

ASSESSING THE BURDEN OF HEPATITIS B IN SOUTH AFRICA, PREDICTING DISEASE PREVALENCE AND MODELLING THE IMPACT OF HEPATITIS B BIRTH DOSE VACCINATION

By

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DECLARATION - PLAGIARISM

I, Shelina Moonsamy, declare that

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Signed:

DEDICATION

I dedicate this thesis to my cherished immediate family:

To my sisters, Keshni Haripersad and Nirvana Ramjiawan,

To my brother, Vinay Manilall,

To my mother, Leelawathie Ramjiawan,

To my son Kioshan Moonsamy,

To my daughter, Darisia Moonsamy,

To my husband, Magesh Moonsamy.

Your collective support and encouragement have contributed in various ways towards the completion of this thesis.

ABSTRACT

In 2016, WHO adopted a resolution to eliminate hepatitis B by 2030, targeted at reducing disease burden. In South Africa, HBV disease burden has largely been estimated from community-based or sentinel studies, thereby limiting its accuracy. Since 2009, the WHO recommended the addition of a birth dose of the HBV vaccine to current vaccine schedules to mitigate the risks of vertical transmission. This intervention is crucial to reduce disease burden, given the increased risks of developing chronic disease if contracted at birth or infancy. Despite the introduction of the HBV vaccine into their EPI schedule in 1995, South Africa is yet to fulfil this recommendation.

In this study, our objective was to assess HBV disease burden in the public health sector of South Africa through meticulous analyses of an extensive national dataset spanning 2015 to 2019. Additionally, we aimed to model the potential impact of a birth dose of the HBV vaccine using country-specific HBV prevalence data obtained from our own testing conducted on women attending antenatal care in 2017.

Over the five years, the national HBV prevalence was 9.02%, declining gradually each year. Overall, males had consistently higher prevalence rates than females. The observed lower infection and higher immunity rates among vaccine-eligible individuals clearly demonstrated the positive impact of the HBV vaccine. Nevertheless, HBV infection among these individuals was quite concerning, highlighting the roll-over effects of suboptimal vaccine coverage rates.

The prevalence of HBsAg among pregnant women was alarmingly high at 11.24%, further compounded by the high HBeAg prevalence among these women. These findings alerted us to the increased probability of vertical transmission, representing a concerning source of disease burden in the country. Among vaccine-eligible women under 19 years old, HBsAg prevalence was

surprisingly high at 8.08%, noting that these women still had approximately 30 more years of potential child-bearing. These findings pose a serious threat to achieving, or even nearing, WHO elimination goals.

Using a deterministic HBV transmission model to simulate the impact of a birth dose of the HBV vaccine, we estimated more than a three-fold reduction in chronic HBV infections and HBV-related deaths, specifically when considering new cases from initiation of our model. In essence, this represents a greater than three-fold reduction in HBV disease burden.

Our findings are unique for South Africa given their national representation and country-specific model inputs. Despite the introduction of the HBV vaccine in 1995, hepatitis B remained highly endemic in South Africa. Adding a birth dose to the current HBV vaccination schedule and achieving optimal vaccine coverage rates will markedly reduce country HBV burden. We therefore recommend prompt implementation of a birth dose of the HBV vaccine, together with increased efforts aimed at improving HBV vaccine coverage rates to optimal levels.

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Sincerely,

LIST OF ABBREVIATIONS

Abbreviation	Full Name
ALT	Alanine Aminotransferase
Anti-HBc	Antibodies against Hepatitis B Core Antigen
Anti-HBcIgM	IgM Antibodies against Hepatitis B Core Antigen
anti-HBcT	Total Antibodies against Hepatitis B Core Antigen
Anti-HBe	Antibodies against Hepatitis B e Antigen
Anti-HBs	Antibodies against Hepatitis B Surface Antigen
cccDNA	Covalently Closed Circular DNA
CDC	Centers for Disease Control and Elimination
CDW	Central Data Warehouse
EPI	Expanded Programme for Immunisation
FOI	Force of Infection
HBcAg	Hepatitis B Core Antigen
HBeAg	Hepatitis B e Antigen
HBsAg	Hepatitis B Surface Antigen
HBV	Hepatitis B Virus
HCC	Hepatocellular Carcinoma
HepB3	Primary vaccination series of three HBV vaccine doses
HIV	Human Immunodeficiency Virus
IU/ml	International Units per milliliter
LSE	Least Squares Estimation
NDoH	National Department of Health
mIU/ml	milli-International Units per milliliter
MLE	Maximum Likelihood Estimation

Abbreviation	Full Name
MMED	Meaningful modelling of epidemiological data
NHLS	National Health Laboratory Service
ODE	Ordinary Differential Equations
pgRNA	Pre-genomic RNA
rcDNA	Relaxed Circular DNA
SEIR	Susceptible-Exposed-Infectious-Recovered
SIR	Susceptible-Infectious-Recovered
SIRS	Susceptible-Infectious-Recovered-Susceptible
SIS	Susceptible-Infectious-Susceptible
UID	Unique Identifier
USA	United States of America
WHO	World Health Organization

CHAPTER ONE: INTRODUCTION

1.1 HEPATITIS B

1.1.1 The pathogen, infection and replication overview

Hepatitis B virus (HBV) is a small, enveloped, partially double-stranded DNA virus of the *Hepadnaviridae* family and *Orthohepadnavirus* genus and ranks among the smallest viruses capable of infecting humans (Liang 2009; Datta, Chatterjee, Veer and Chakravarty 2012; World Health Organisation 2017b). The infectious hepatitis B virion, also known as the Dane particle, has a spherical, double-shelled structure with a diameter of approximately 42 nanometers. The lipid envelope contains hepatitis B surface antigen (HBsAg) that surrounds an inner nucleocapsid (Figure 1.1) (Liang 2009). Figure 1.1 presents the schematic structure of HBV, reproduced from Abu et al (Abu, Mohd Bakhori and Shueb 2023).

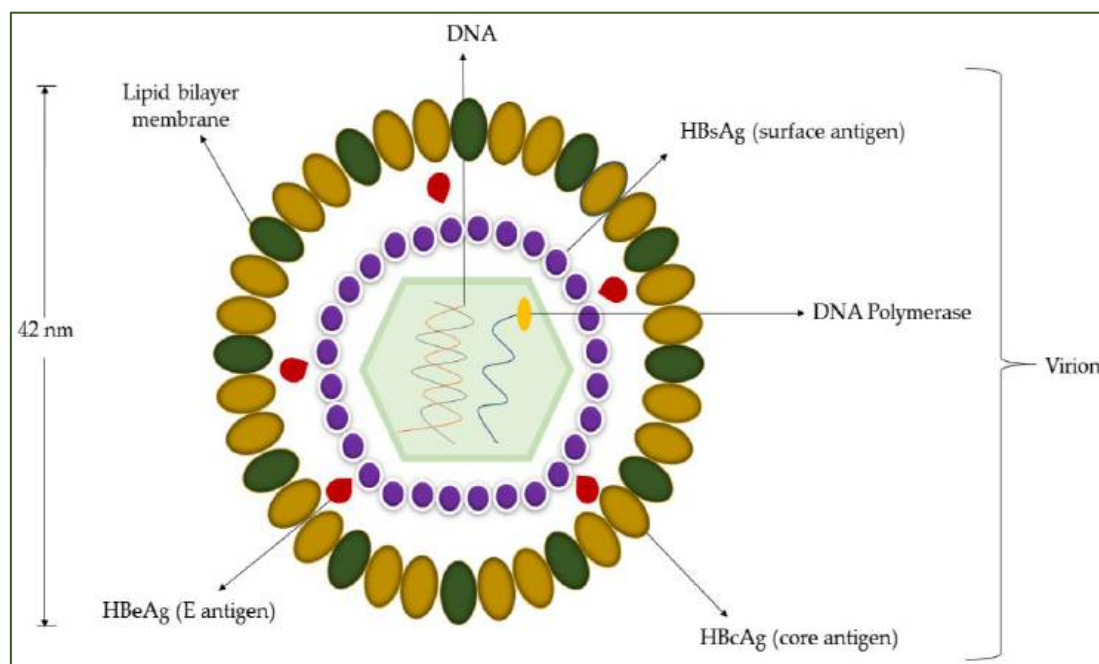


Figure 1.1: Schematic structure of hepatitis B virus

This nucleocapsid is composed of hepatitis B core antigen (HBcAg). Unlike HBsAg and HBcAg, hepatitis B e antigen (HBeAg) is not found in a particulate form and is present as a soluble protein measuring 17 kilodaltons (Dusheiko

2015; Kramvis, Kostaki, Hatzakis and Paraskevis 2018). The genome of HBV is a partially double-stranded circular DNA comprising approximately 3.2 kilobase pairs in length within an icosahedral core particle (World Health Organisation 2017b). This structure is characteristic of HBV and plays a crucial role in its replication and infectivity. There are at least 10 HBV genotypes globally (A to J), and these have been classified based on greater than 8% difference in their genome sequences (Lin and Kao 2011; Kafeero *et al.* 2023).

The initial phase of HBV infection is the attachment of mature virions to host cell membranes (Liang 2009). During this phase, the virus attaches to specific receptors on the surface of host cells, allowing it to initiate the process of infection and entry into the host cell (Liang 2009). This attachment is a critical step in the HBV infection cycle and marks the beginning of the virus's interaction with the host's cellular machinery. The HBV replication pathway involves several intricate steps. These steps are depicted schematically in Figure 1.2, reproduced from Tsukuda and Watashi (Tsukuda and Watashi 2020).

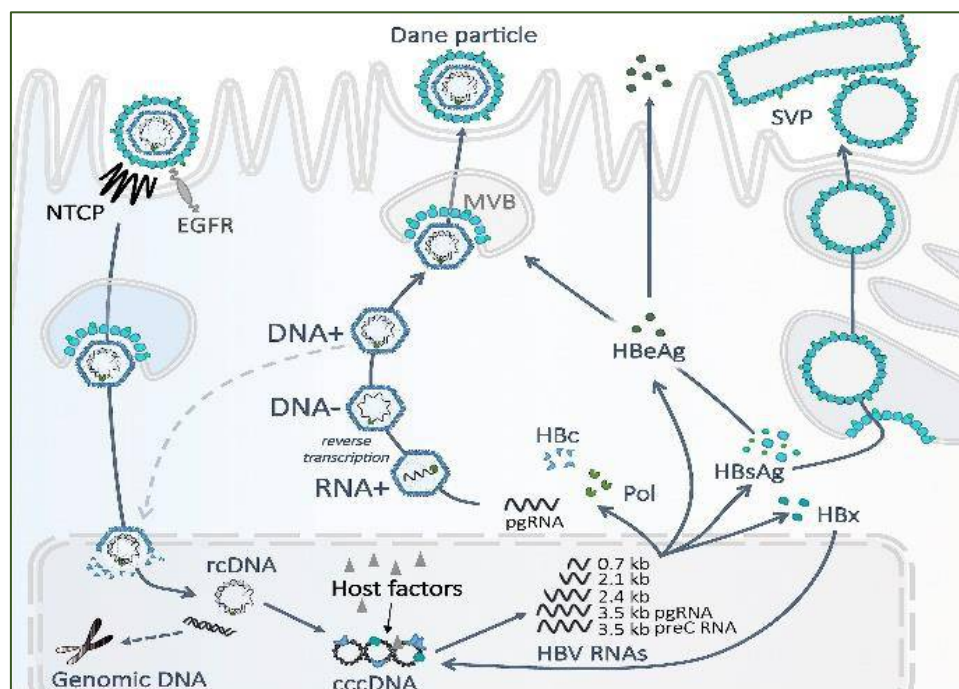


Figure 1.2: Schematic representation of the replication cycle of hepatitis B

Once HBV enters the host cell, the viral envelope fuses with the cellular membrane, releasing the viral genome into the host cell cytoplasm (Liang 2009). Inside the host cell, the virus uses a reverse transcriptase enzyme to convert its RNA genome into a covalently closed circular DNA (cccDNA) form, which is transported to the host cell nucleus (Liang 2009). The cccDNA serves as a template for the transcription of viral mRNA, which, in turn, directs the translation of viral proteins, including HBcAg, HBsAg, and polymerase (Liang 2009). The viral polymerase synthesizes a pregenomic RNA (pgRNA) from the cccDNA template. The pgRNA serves as a template for the reverse transcription of the viral genome, forming relaxed circular DNA (rcDNA) within the viral capsid. New viral genomes, core proteins, and surface proteins are assembled into new virions. The newly formed virions are released from the host cell by budding and during this process acquire a lipid envelope containing HBsAg (Liang 2009). These fully developed virions infect additional host cells and continue the replication cycle.

1.1.2 Hepatitis B disease and transmission

Hepatitis B is a life-threatening viral infection of the liver (Matthews *et al.* 2022; Control and Prevention 2023). Infection with HBV can be either acute or chronic (Busca and Kumar 2014). An acute HBV infection typically develops within the initial six months following exposure to the virus, with an average incubation period of 75 days (Liang 2009; World Health Organisation 2017b; Control and Prevention 2023). Most HBV infections do not exhibit symptoms during the acute phase, although some individuals may experience symptoms that persist for several weeks (Centers for Disease Control Prevention 2022). Symptoms include jaundice, abdominal pain, fatigue, nausea and vomiting (Centers for Disease Control Prevention 2022). The risk of symptomatic acute inflammation following HBV infection increases with age, with rates of around 1% among infants under one year old, 10% among children one to five years old and around 30% among individuals over five years old (World Health Organisation 2017b). Conversely, the risk of transitioning to a chronic condition decreases with age, with rates of approximately 70%-90% among infants under one year old, 30%-50% among

children one to five years old and 1%-10% among adults (Liang 2009; Spearman and Sonderup 2014; Nelson, Easterbrook and McMahon 2016; Centers for Disease Control and Prevention 2021). In some people, chronic HBV infection can remain inactive and not progress to significant liver disease; however, 15%-40% face a lifetime risk of developing cirrhosis, liver failure, or hepatocellular carcinoma (HCC) (Tang, Yau and Yu 2014; WHO Guidelines Approved by the Guidelines Review Committee 2015; Spearman 2018). As a result, infants who acquire HBV infection before the age of six years face an increased risk of developing HBV complications (World Health Organisation 2022, 2023a). HCC is diagnosed in approximately 85% of patients with cirrhosis and is currently the fifth most prevalent type of cancer worldwide (Asafo-Agyei and Samant 2023). Among males, HCC is the second leading cause of cancer-related deaths, following lung cancer (Asafo-Agyei and Samant 2023). Acute liver failure, often referred to as fulminant hepatitis B, occurs rarely in infants and children but develops in 0.5%-1% of adults following HBV infection, with a case fatality rate between 20%-33% (Chang and Lewin 2007; Ichai and Samuel 2019).

Hepatitis B is transmitted primarily via exposure to infected blood and body fluids such as saliva, semen and vaginal secretions (WHO Guidelines Approved by the Guidelines Review Committee 2015; Tripathi and Mousa 2023). Common transmission routes include vertical transmission from mother to child at birth, horizontal transmission in early childhood (especially from child-to-child), sexual transmission, transfusion of blood or blood products, as well as percutaneous exposure (WHO Guidelines Approved by the Guidelines Review Committee 2015; Kim 2016; Sabeena and Ravishankar 2022; World Health Organisation 2023a). Percutaneous exposure includes needle stick injuries, body piercing, traditional scarification, unsafe injection practices, and inadequately sterilized medical equipment (WHO Guidelines Approved by the Guidelines Review Committee 2015). In regions where HBV is highly endemic, vertical transmission is the primary route of transmission, whereas in areas with low HBV endemicity, sexual contact among high-risk adults, e.g. men who have sex with men and heterosexual individuals with multiple sex partners or contact with sex workers,

is more predominant (Diamond *et al.* 2003; Hou, Liu and Gu 2005; Shepard *et al.* 2006; Inoue and Tanaka 2016; Spronk *et al.* 2019).

1.1.3 Diagnosis of HBV infection

Hepatitis B serologic markers play a vital role in diagnosing and monitoring HBV infection. Each marker provides valuable information about the stage of infection, immune response, viral activity and phase of chronic infection (Liang 2009; Guvenir and Arikan 2020). Additional tests include the measurement of alanine aminotransferase (ALT) levels and non-invasive liver fibrosis tests (WHO Guidelines Approved by the Guidelines Review Committee 2015; Guvenir and Arikan 2020).

1.1.3.1 Hepatitis B serological markers

Acute and chronic HBV infection is diagnosed by detecting HBsAg in blood samples (Krajden, McNabb and Petric 2005; Kao 2008). HBsAg is the earliest marker to appear after infection, and its presence in the blood indicates an active HBV infection and signifies that an individual is infectious (Krajden, McNabb and Petric 2005; Kao 2008; Control and Prevention 2018). Hepatitis B surface antibody (Anti-HBs) develops in response to HBsAg exposure, whether through vaccination or recovery from acute infection (Krajden, McNabb and Petric 2005). Its presence typically indicates immunity to hepatitis B. HBeAg is a marker of active viral replication, and its presence indicates high levels of virus in the blood and increased infectivity (Krajden, McNabb and Petric 2005; Alexopoulou and Karayiannis 2014; Chen *et al.* 2017; Al-Sadeq *et al.* 2019; Piermatteo *et al.* 2021). HBeAg typically emerges shortly after the appearance of HBsAg in cases of acute HBV infection but can also be detected in chronic HBV infections (Krajden, McNabb and Petric 2005; Piermatteo *et al.* 2021). The appearance of hepatitis B e antibody (anti-HBe) often indicates a decrease in viral replication and a transition to the inactive phase of chronic hepatitis B. The presence of hepatitis B core antibody (anti-HBc) indicates past or ongoing HBV infection (Krajden, McNabb and Petric 2005). Anti-HBc can be further classed as IgM or IgG (Park *et al.* 2015). High levels of anti-HBcIgM indicate acute HBV infection (Kryger

1985; Park *et al.* 2015). When reactivation of HBV infection or flares among chronic HBV cases occur, low-level anti-HBcIgM positives may be detected (Spearman *et al.* 2013; Park *et al.* 2015). Chronic HBV infection is confirmed when HBsAg remains detectable for at least six months, regardless of whether HBeAg is detectable (Liang 2009; Kwon and Lee 2011; World Health Organisation 2017b). Anti-HBc total (anti-HBcT) is a marker which includes both IgM and IgG antibodies to the core antigen and can help differentiate between acute and chronic infections (Park *et al.* 2015). HBV DNA is a measurement of the viral DNA load in the blood and provides information about the level of viral replication. Hepatitis B serological markers and their interpretation is summarised in Table 1.1 (stage of HBV infection) and Table 1.2 (phase of chronic HBV infection).

Table 1.1: Hepatitis B serological markers linked to stages of HBV infection and vaccination (Krajden, McNabb and Petric 2005; Amorocho, Domínguez and García 2012; Control and Prevention 2023; World Health Organisation 2023a)

Hepatitis B Marker	Acute HBV Infection	Chronic HBV Infection	Cleared HBV Infection	Vaccination
HBsAg	+	+	-	-
HBeAg	+	+/-	-	-
anti-HBs	-	-	+	+
anti-HBe	-	+/-	+/-	-
anti-HBcIgM	+	-	-	-
anti-HBcIgG	-	+	+	-
HBV DNA	High / Low	Low / High	-	-

Table 1.2: Hepatitis B serological markers and phases of chronic HBV infection

Hepatitis B Marker	Immune tolerant	Immune active	Immune control	Immune escape	Reactivation	Occult Infection
HBsAg	+	+	+	+	+	-
HBeAg	+	+	-	-	+/-	+/-
HBV DNA	>200 000 IU/ml	>2000 IU/ml	<2000 IU/ml	>20 000 IU/ml	>20 000 IU/ml	<200 IU/ml
anti-HBe	-	-	+	+	+/-	+/-
Alanine transaminase	Normal	Persistently or intermittently abnormal	Normal	Persistently or intermittently abnormal	Abnormal	Moderate
Other	Seen in many HBeAg-positive children and young adults	HBeAg to anti-HBe seroconversion possible, with normalization of ALT leading to the immune control phase	Risk of developing cirrhosis and HCC reduced. May develop HBeAg-negative disease	Older persons especially at risk for progressive disease (fibrosis / cirrhosis)	Seroreversion to HBeAg positivity can occur if HBeAg negative. High risk of decompensation in presence of cirrhosis	HBsAb and anti-HBcT may or may not be detectable
Reference	(Davison and Strasser 2014; World Health Organization 2015a)	(Davison and Strasser 2014; World Health Organization 2015a)	(Davison and Strasser 2014; World Health Organization 2015a)	(Davison and Strasser 2014; World Health Organization 2015a)	(World Health Organization 2015a)	(Torbenon and Thomas 2002; World Health Organization 2015a)

The serologic course of acute and chronic HBV infection is shown in Figure 1.3, reproduced from Weinbaum et al (Weinbaum *et al.* 2008).

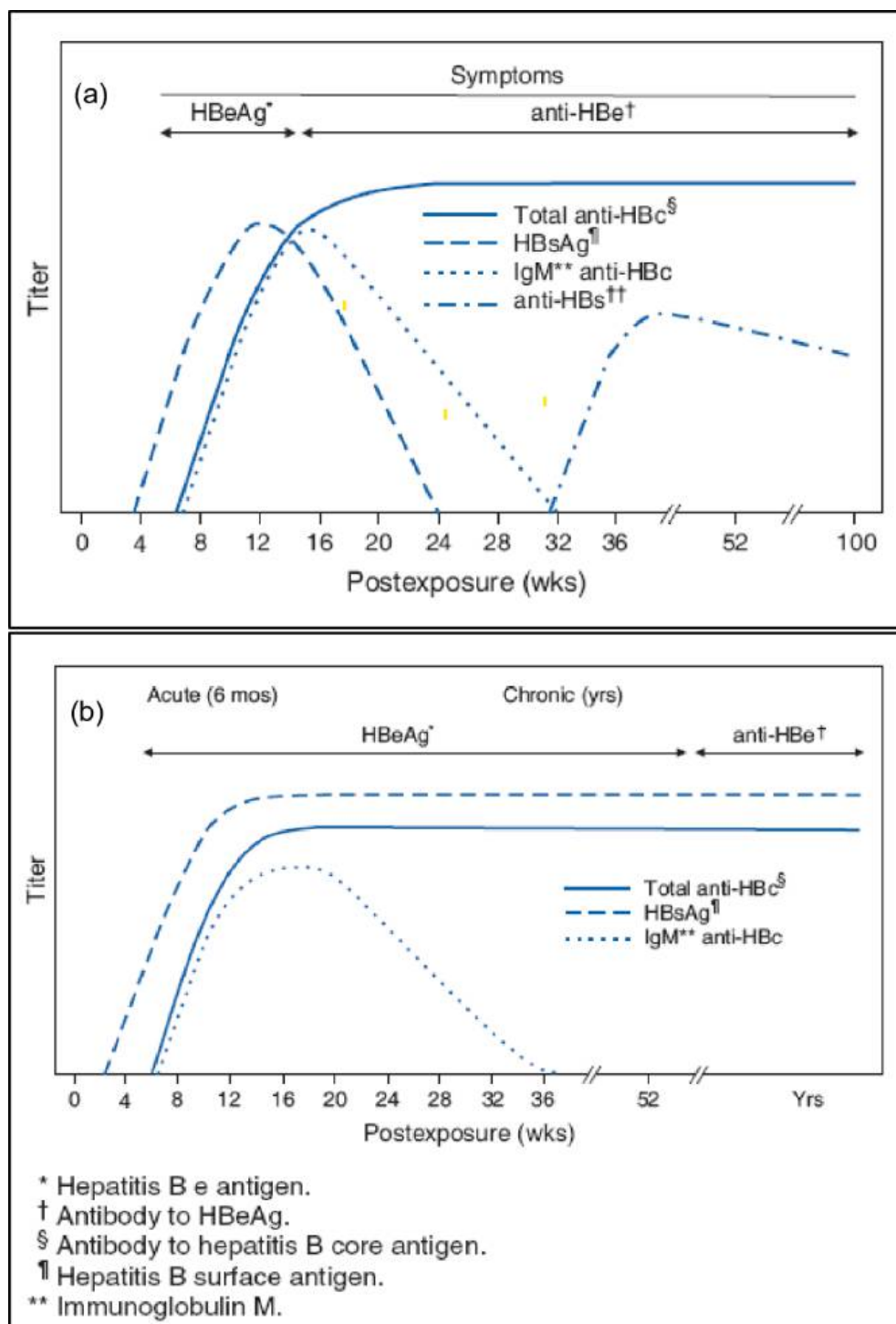


Figure 1.3: Serologic course of hepatitis B infection; a) acute infection with recovery and b) acute infection with progression to chronicity

1.1.4 Hepatitis B vaccination

Hepatitis B is a vaccine-preventable disease (Control and Prevention 2018, 2023; World Health Organisation 2023a). Safe and effective vaccines against hepatitis B were developed in the 1980s, over 30 years ago (Romano and Zanetti 2022). In 1992, the World Health Organisation (WHO) recommended that all countries incorporate hepatitis B vaccines into their routine childhood immunisation schedules (Van Damme 2016). This initiative aimed to improve global efforts to prevent HBV infection, particularly among infants and young children, and to reduce the long-term impact of the disease. The HBV vaccine is effective against all HBV genotypes as it contains the highly immunogenic “a determinant” region of the HBsAg, which is common to all genotypes (WHO Guidelines Approved by the Guidelines Review Committee 2015; Inoue and Tanaka 2020). A protective level of immunity following a complete vaccination series is anti-HBs antibody levels ≥ 10 mIU/mL for (Van Damme *et al.* 2013; Centers for Disease Control and Prevention 2021). While vaccination is crucial for preventing HBV infection, it has been reported that 5% to 10% of vaccinated individuals do not mount an adequate immune response, meaning that they do not develop protective antibodies and therefore remain susceptible to HBV infection (Kubba, Taylor, Graneek and Strobel 2003; Walayat *et al.* 2015). Individuals who fail to develop protective antibody levels following vaccination are commonly referred to as non-responders (Wiedermann, Garner-Spitzer and Wagner 2016).

In April 1995, the HBV vaccine was introduced as a monovalent vaccine into the South African Expanded Programme on Immunisation (EPI) schedule with doses at 6, 10 and 14 weeks of age (Burnett, Kramvis, Dochez and Meheus 2012). Since December 2015, the HBV vaccine has been included as one of the components in the hexavalent combination vaccine in South Africa, which also includes vaccines for diphtheria, tetanus, acellular pertussis, inactivated poliovirus, and *Haemophilus influenza* type B (DTaP-IPV-HIB-HepB) (Romano and Zanetti 2022). Following the recommended doses, this combination vaccine protects against multiple diseases. The current HBV vaccination schedule includes the doses at 6, 10 and 14 weeks of age, with a booster dose scheduled

at 18 months of age (Dlamini and Maja 2016; Prabdia-Sing *et al.* 2019). This and other schedules of a similar pattern induce protective antibody levels in greater than 95% of healthy individuals and are designed to provide effective and long-lasting protection against hepatitis B for at least 20 years (Leuridan and Van Damme 2011; van Leeuwen *et al.* 2021; World Health Organisation 2022). The WHO recommends administering an initial HBV vaccine dose at birth to prevent mother-to-child (vertical) transmission of HBV infection (Spearman *et al.* 2017b; World Health Organisation 2018). The birth dose should be administered as soon as possible after birth and preferably within 24 hours of birth (Lei *et al.* 2022). A birth dose has the additional advantage of reducing the risk of horizontal transmission from household contacts during early infancy (World Health Organisation 2018).

1.1.5 Treatment of hepatitis B

In cases of acute HBV infection, treatment is typically not recommended; instead, the approach involves management of symptoms, providing relief, and offering supportive therapy to alleviate discomfort (WHO Guidelines Approved by the Guidelines Review Committee 2015; World Health Organisation 2017b). Treatment is recommended for specific cases of chronic HBV infections. It is usually lifelong as currently there is no complete cure for chronic HBV infections due to the persistence of cccDNA (WHO Guidelines Approved by the Guidelines Review Committee 2015; Allweiss and Dandri 2017; World Health Organisation 2017b; Xia and Guo 2020). Treatment aims to mitigate the morbidity and mortality risks associated with the advancement of liver disease (WHO Guidelines Approved by the Guidelines Review Committee 2015; World Health Organisation 2017b). Treatment is not recommended for cases with chronic HBV infections if criteria for treatment are not met; however, continued monitoring is recommended to determine if antiviral therapy may potentially be needed to prevent progressive liver disease (WHO Guidelines Approved by the Guidelines Review Committee 2015). WHO recommends using antiviral medications with a high resistance barrier, nucleos(t)ide analogues such as tenofovir or entecavir, as the preferred first-line treatment to circumvent the adverse effects of drug resistance (World

Health Organisation 2017b). Such treatment has demonstrated its ability to hinder or delay the advancement towards cirrhosis, lower the incidence of HCC, and enhance survival by maintaining long-term viral suppression (World Health Organisation 2017b). Furthermore, tenofovir is recommended for HBV-infected pregnant women in their second or third trimester to reduce the risk of vertical transmission (WHO Guidelines Approved by the Guidelines Review Committee 2015; Li *et al.* 2018; Lin *et al.* 2018; Pan 2022; Samadi Kochaksaraei *et al.* 2022). Antiviral therapy is generally effective against all HBV genotypes (WHO Guidelines Approved by the Guidelines Review Committee 2015).

1.2 MODELLING THE TRANSMISSION DYNAMICS OF INFECTIOUS DISEASES

Mathematical analysis and modelling play a crucial role in the field of infectious disease epidemiology (Dietz and Heesterbeek 2002; Heesterbeek 2005; Grassly and Fraser 2008). Mathematical modelling of disease transmission is a powerful tool for understanding and controlling infectious diseases (Grassly and Fraser 2008; Kretzschmar and Wallinga 2010; White and Enright 2010; Siettos and Russo 2013; Li 2018; Nguyen, Mahaffy and Vaidya 2019; Costa, Pires, Resque and Almeida 2021). The utilisation of mathematical models with disease surveillance data is often used to investigate scientific hypotheses and tackle questions related to disease control policies (Grassly and Fraser 2008; Herzog, Blaizot and Hens 2017; Kretzschmar 2020). Mathematical modelling utilises mathematical principles and coding languages to forecast extended patterns in infectious diseases based on estimated data and provides essential insights for guiding public health policies (Zhao, Xu and Lu 2000; Liang, Zu and Zhuang 2018). Infectious disease modelling serves as a valuable tool for investigating the mechanisms of disease transmission, projecting the likely trajectory of a disease under existing strategies, and assessing additional measures to manage and eliminate communicable infections (Thornley, Bullen and Roberts 2008; Christaki 2015). In the 18th century, Daniel Bernoulli developed the first mathematical model for infectious disease transmission to assess how variolation, an early method resembling smallpox vaccination, influenced the mortality data used in

actuarial calculations (Anderson and May 1991; White and Enright 2010). Mathematically formulating models not only enables rigorous analysis but also permits the generation of quantitative predictions regarding disease burden trends and the effectiveness of interventions (McLean and Blumberg 1994; Zhao, Xu and Lu 2000; O'Leary *et al.* 2009; White and Enright 2010; Zou, Zhang and Ruan 2010; Kamyad, Akbari, Heydari and Heydari 2014; Mokaya *et al.* 2019; Wodajo, Gebru and Alemneh 2023). In summary, mathematical models are valuable tools for understanding, predicting, and managing infectious diseases by quantifying the influence of key variables and providing a framework for decision-making and intervention strategies (Grassly and Fraser 2008; Kretzschmar 2020; Panovska-Griffiths, Kerr, Waite and Stuart 2021).

1.2.1 Types of mathematical models used for infectious disease modelling

There are two types of models used to model the transmission dynamics of infectious diseases, stochastic and deterministic compartmental models (Ball 1985; Castillo-Chavez, Fridman and Luo 1993; Trottier and Philippe 2001; GILL 2015; Brauer 2017; Flaig and Houy 2022). Stochastic models incorporate randomness or unpredictability into the data presentation and outcome prediction and take into account the inherent variability or chance events that can influence the results (Castillo-Chavez, Fridman and Luo 1993; Trottier and Philippe 2001; GILL 2015; Brauer 2017; Flaig and Houy 2022). A deterministic model is a mathematical model in which the output is solely determined by the specified input data and the initial conditions, implying that if the same set of input data and initial conditions are applied, the model will consistently produce the same output (Trottier and Philippe 2001; GILL 2015; Brauer 2017; Flaig and Houy 2022). Deterministic compartmental models are mathematical tools that assume nonrandom rate flows to study the spread of infectious diseases within a population (Trottier and Philippe 2001; Batista *et al.* 2021; Costa, Pires, Resque and Almeida 2021). The deterministic compartment model is widely used as an effective tool for assessing the dynamic behaviour of infectious diseases through the use of mathematical simulations aimed at disease control and prevention (Zhao, Xu and Lu 2000; Trottier and Philippe 2001; Thornley, Bullen and Roberts

2008; O'Leary *et al.* 2009; Friedman and Siewe 2018; Liang, Zu and Zhuang 2018; Batista *et al.* 2021). Here, we will introduce the deterministic compartment model as a widely used model for HBV-related modelling. Furthermore, we have also selected the deterministic compartment model to model the impact of a birth dose of the HBV vaccine.

1.2.1.1 Deterministic compartmental models

These compartmental models divide the population into distinct compartments representing disease states and use a set of difference or differential equations to describe how individuals move between these compartments over time using specific time steps (Trottier and Philippe 2001; Dadlani *et al.* 2020; Batista *et al.* 2021). Difference equations represent the number of individuals in each compartment at a specific time, whereas differential equations represent the rate of change of each compartment (Vynnycky and White 2010). The rates at which people move into and out of compartments are referred to as parameters. Deterministic compartmental models are particularly useful for analysing the dynamics of infectious diseases in large populations and for predicting disease spread and control measures (Dadlani *et al.* 2020; Batista *et al.* 2021). Proportions of the population are assigned to compartments with labels, e.g., S, E, I, and R (**S**usceptible, **E**xposed, **I**nfectious/**I**nfective, or **R**ecovered/**R**emoved respectively), representing disease progression. Solid arrows (→) are usually used to show the flow between compartments (Batista *et al.* 2021). Basic model structures are illustrated in Figure 1.4.

SIR	Susceptible → Infectious → Recovered
SEIR	Susceptible → Exposed → Infectious → Recovered
SIS	Susceptible → Infectious
SIRS	Susceptible → Infectious → Recovered

Figure 1.4: Basic structure of SIR, SEIR, SIS and SIRS models

The exposed compartment is included for infections with a latent period, i.e., a period between infection (infected but not yet infectious) and infectiousness (ability to transmit the infection). Therefore, standard deterministic models usually contain compartments of susceptible, exposed, infectious and recovered. However, given that some infections are complex and vaccine-preventable, additional compartments, either different or repeated, are sometimes included, e.g., a compartment for vaccinated (**V**) individuals (Belay, Abonyo and Theuri 2023b). An alternative to adding an additional compartment is to update relevant equations of the model to accommodate the interventions. Additionally, when the age of infection influences disease progression, the model may incorporate age stratification.

1.2.2 Parameter estimations

Parameters play a vital role in modelling the transmission dynamics of infectious diseases as they contribute substantially to the final outcome (Myung 2002). The rates at which people move between compartments following exposure to a virus depend on the average time they spend in each compartment (White and Enright 2010). Parameter estimation aims to determine the values of the model's parameters that best fit the collected data (goodness of fit) (Myung 2002; Lillacci and Khammash 2010). It involves finding the parameter values that minimise the discrepancy between the model's predictions and the observed data (Myung 2002). This process helps ensure that the model accurately represents the real-world phenomena it is meant to describe (Anderson and Darling 1954; Varian

1990). Evaluating the goodness of fit and subsequent parameter estimation are critical steps in the modelling process (Anderson and Darling 1954; D'Agostino 2017).

For well-studied infections, the rates of progression between compartments following exposure may be obtained from literature. The parameter that typically requires estimation is the rate at which a susceptible person transitions to the exposed or infectious compartment following contact with an infectious individual. This parameter is referred to as the incidence risk or force of infection (FOI) and relies on the probability of effective contact (transmission coefficient) and the population size of the infectious compartment (Vynnycky and White 2010). The characteristics of infectious diseases and their ability to spread from person to person result in the dynamic fluctuation of an individual's risk of infection in response to the changing levels of infection within the population (White and Enright 2010). The FOI and population sizes per compartment may be estimated from population-specific seroprevalence data (Varian 1990; Vynnycky and White 2010). In our model, we applied the MLE method to obtain the best fit of the model to our data (Chapter 6).

Estimating population parameters from a seroprevalence sample can be done using two commonly used approaches: the maximum likelihood estimation (MLE) method and the least squares estimation (LSE) method (Varian 1990). The MLE method is a statistical method used to estimate population parameters by finding the values that maximise the likelihood function of the observed data (Varian 1990; Anderson and May 1991). MLE aims to find the parameter values that make the observed data most probable under the assumed model (Varian 1990; Myung 2003). The LSE method aims to minimise the sum of the squared differences between observed data points and the corresponding values predicted by a model (Varian 1990; Myung 2003). The MLE method is more general and can be applied to a broader range of statistical models, while LSE is specialised for linear models (Varian 1990; Myung 2003).

1.2.3 Validating models

Mathematical models represent a model world which requires parameterisation (assigning estimated values to parameters) (Anderson and May 1991). The predictive capability of a model needs to be reliable, and this is often referred to as model credibility (Kuemmel *et al.* 2020). Model validation plays a fundamental role in establishing the credibility of a model and involves comparing the predictions generated by a mathematical model with real-world data (Thacker *et al.* 2004; Sargent 2010; Kuemmel *et al.* 2020). If the model's outputs closely match the observed data, it suggests that the model can accurately represent the underlying mechanisms of the system (Thacker *et al.* 2004; Sargent 2010). Validation helps assess the accuracy and reliability of the model's predictions and serves as a way to check whether the model captures the dynamics of the phenomenon it aims to describe (Thacker *et al.* 2004; Sargent 2010). Through validation, one can identify the limitations and weaknesses of a model, and if significant discrepancies between the model's predictions and actual data are identified, it may indicate that the model oversimplifies certain aspects or fails to account for influential factors (Thacker *et al.* 2004; Sargent 2010). Credibility is crucial, especially when using models to inform decision-making or public policy (Kuemmel *et al.* 2020). If discrepancies are found during validation, these can guide model improvement efforts by adjusting parameters or incorporating additional variables to better align the model with reality (Sargent 2010). Models may need to be refined and validated multiple times to ensure their credibility and applicability (Sargent 2010; Kuemmel *et al.* 2020). Additionally, validation should consider various sources of uncertainty and potential biases in the data, and sensitivity analyses can help explore how different assumptions and parameter values affect the model's outcomes (Thacker *et al.* 2004; Sargent 2010). Sensitivity analyses are often conducted to assess the robustness of the model's predictions to variations and help identify which parameters significantly influence model outcomes and which uncertainties might affect the results (Sargent 2010; Means, Ali, Ho and Heffernan 2020).

1.3 PROBLEM STATEMENT, AIM, OBJECTIVES AND APPROVALS

1.3.1 Problem statement

Hepatitis B infection, a disease targeted for elimination by 2030, is considered endemic in South Africa (National Department of Health 2019). National estimates for the prevalence of hepatitis B in South Africa are unavailable and remain a significant challenge (National Department of Health 2019). Such estimates are crucial for determining the disease burden in the country, which is likely substantial given that morbidity and mortality from chronic HBV infection are silent and neglected (National Department of Health 2019). Furthermore, HBV infection status among pregnant women in South Africa is urgently needed to address significant gaps and provide data-driven recommendations to inform policymaking on prevention and management of hepatitis B in South Africa (Hecht *et al.* 2018). The introduction of the HBV vaccine into South Africa's EPI schedule in 1995 meant that most child-bearing women were not eligible to receive the vaccine during infancy and were born at a time when HBV was highly prevalent in South Africa. Consequently, a significant proportion of these women are likely chronic HBV carriers with a risk of transmitting the virus to their newborns. It is, therefore, critical to model the transmission dynamics of hepatitis B in order to determine the impact of adding a hepatitis B birth dose vaccine to the current South African EPI schedule. Assessing the burden of HBV disease and implementing interventions to reduce the risk of HBV transmission will offer valuable insights into the pursuit of hepatitis B elimination in South Africa.

1.3.2 Overall aim of this study

The main aim of our study was to evaluate the status of HBV infection and immunity in South Africa over a five-year period, and the impact of supplementary interventions targeted at reducing the burden of HBV disease in South Africa.

1.3.3 Specific objectives

- **Objective 1, Chapter 3:** To determine hepatitis B infection status among individuals attending public healthcare facilities in South Africa over a five year period (2015 to 2019) through comprehensive analyses of combined HBsAg and HBeAg serological markers using data obtained from the National Health Laboratory Services (NHLS) Central Data Warehouse (CDW).

Hypothesis: The prevalence of hepatitis B infection, as determined by the presence of HBsAg and HBeAg serological markers, will show significant variation among individuals attending public healthcare facilities in South Africa over the period 2015 to 2019.

- Rationale and novelty
 - o Published literature on HBV infection in South Africa have thus far been from studies on targeted cohorts rather than at a national level. Our study has national coverage and includes all individuals who have had HBV testing at public health facilities in South Africa from 2015 to 2019. Furthermore, while the studies mentioned above focused on point prevalence, this study spans a five-year period.
- Outputs
 - o Manuscript published and attached as Appendix 3.1. The online version of the manuscript can be accessed by clicking on the following link: [Hepatitis B infection status among South Africans attending public health facilities over a five-year period: 2015 to 2019 - PubMed \(nih.gov\).](#)
 - o Poster presentation titled "Hepatitis B Surface Antigen among South Africans in Public Health Facilities, 2015-2019" at the 2022 Conference on Liver Disease in Africa. The poster was selected as one of the top three posters for an oral presentation.

- **Objective 2, Chapter 4:** To determine the annual prevalence and incidence rates of hepatitis B virus infection in the public health sector of South Africa over the period 2015 to 2019 through data analyses of HBsAg and anti-HBcIgM serological markers respectively using the NHLS CDW data.

Hypothesis: The annual prevalence and incidence rates of hepatitis B virus infection in the public health sector of South Africa will demonstrate significant trends and variations over the period from 2015 to 2019, as determined by the analysis of HBsAg and anti-HBcIgM serological markers.

- Rationale and novelty
 - o Published literature on HBV prevalence and incidence in South Africa have thus far been from studies on targeted cohorts or estimated nationally from data obtained from these smaller studies. As indicated above, our study has national coverage and includes all individuals who have had HBV testing at public health facilities in South Africa from 2015 to 2019. Therefore, we were able to observe annual national trends in HBV prevalence and incidence over a five-year period.
- Outputs
 - o Manuscript published and attached as Appendix 4.1. The online version of the manuscript can be accessed by clicking on the following link: [Prevalence and incidence rates of laboratory-confirmed hepatitis B infection in South Africa, 2015 to 2019 - PubMed \(nih.gov\).](#)
 - o Poster presentation titled "Prevalence and Incidence Rates of Laboratory-Confirmed Hepatitis B Infection in South Africa, 2015 to 2019" at the 2021 Pathology Research and Development Congress. The poster was awarded best poster presentation in Public Health (Appendix 4.2).

- **Objective 3, Chapter 5:** To determine hepatitis B immunity and susceptibility status among individuals attending public healthcare facilities in South Africa over a five year period (2015 to 2019) through extensive individual and combined analyses of anti-HBs, anti-HBcT and HBsAg serological markers using data obtained from the NHLS CDW.
- **Hypothesis:** The analysis of anti-HBs, anti-HBcT, and HBsAg serological markers will demonstrate distinct patterns of hepatitis B immunity and susceptibility among individuals attending public healthcare facilities in South Africa over the period 2015 to 2019.
 - Rationale and novelty
 - o As for objective 1 but for HBV immunity rather than HBV infection
 - Output
 - o Thesis chapter
 - o Data input for objective 5.
- **Objective 4, Chapter 6:** To determine hepatitis B infection and immunity status in HIV-uninfected and HIV-infected pregnant women throughout the nine provinces of South Africa by performing hepatitis B serological laboratory testing (HBsAg, HBeAg and anti-HBs) on South Africa's 2017 antenatal HIV seroprevalence surveillance samples.

Hypothesis: Hepatitis B infection status will differ significantly between HIV-uninfected and HIV-infected pregnant women across South Africa, as determined by serological testing (HBsAg, HBeAg, and anti-HBs) of the 2017 antenatal HIV seroprevalence surveillance samples.

 - Rationale and novelty
 - o Vertical transmission of HBV is a transmission route of great concern given the risk of developing chronic HBV disease and adding to HBV disease burden. To our knowledge, there have been

only two studies that reported HBV prevalence among pregnant women and both were in Western Cape Province (Andersson *et al.* 2013; Joseph Davey *et al.* 2022b). Our study has national coverage incorporating pregnant women from all nine provinces of South Africa.

- Output
 - o Publication planned for 2024.

- **Objective 5, Chapter 7:** To develop and apply a mathematical model of hepatitis B virus transmission dynamics to model the impact of adding a birth dose hepatitis B vaccine using data obtained from analysis of the NHLS CDW data and from testing of the 2017 HIV seroprevalence surveillance samples.

Hypothesis: The implementation of a birth dose hepatitis B vaccine will significantly reduce the burden of hepatitis B in South Africa, as predicted by a mathematical model using data from the NHLS CDW and the 2017 HIV seroprevalence surveillance samples.

- Rationale and novelty
 - o To our knowledge, there were no modelling studies that focussed on the risk of vertical transmission and the impact of a birth dose of the HBV vaccine specifically for South Africa. Furthermore, our study uses country-specific data obtained from our analyses of national HBV testing (objective 3) and from our testing of the antenatal samples (objective 4).
- Output
 - o Publication planned for 2024.

1.3.4 Approvals, support and trainings towards achievement of the objectives of this study

- Ethics
 - o Overall ethics approval for the study's ethical considerations was issued by the Institutional Research Ethics Committee at Durban University of Technology, Durban, South Africa on 07 October 2020 (IREC 069/20, Appendix 1.1).
- Access and analysis of the NHLS CDW data
 - o Approval to access and analyse the NHLS CDW data was issued by the NHLS Academic Affairs and Research Management System at NHLS, Johannesburg, South Africa on 20 October 2020 (PR20254, Appendix 1.2).
 - o The NHLS CDW data were used towards achievement of objectives 1, 2, 3, and specific components of objective 5 of this study.
- Access and laboratory testing on South Africa's 2017 antenatal HIV seroprevalence surveillance samples
 - o The National Department of Health of South Africa officially endorsed HBV testing on the country's antenatal HIV seroprevalence surveillance samples on 10 February 2020 (Appendix 1.3). The accompanying letter of support highlighted the significance of obtaining HBV results for South African women attending antenatal care to inform policy.
 - o The United States Department of Health and Human Services, Centers for Disease Control and Prevention, Atlanta, United States of America approved an amendment of the 2017 antenatal HIV seroprevalence surveillance protocol to include HBV testing on the 2017 antenatal samples on 27 July 2022 (Accession Number: CGH/GAPCTRY/AFRS/SOAFR, Appendix 1.4). This approval allowed for the subsequent access to the 2017 antenatal dataset for sample selection, retrieval, testing and analysis towards achievement of objective 4 of this study.
- Workshops on infectious disease modelling

- o Introduction to Infectious Disease Modelling and Its Applications, hosted by The London School of Hygiene & Tropical Medicine and the UK Health Security Agency (formerly Public Health England), 15 June 2020 to 26 June 2020 (Appendix 1.5).
- o Clinic on Meaningful Modelling of Epidemiological Data, hosted by The South African Centre for Epidemiological Modelling and Analysis, Muizenberg, Cape Town, South Africa, 26 June 2020 – 08 July 2023 (Appendix 1.6).
- o These workshops enhanced my knowledge and understanding of infectious disease modelling towards achievement of objective 5 of this study.

CHAPTER TWO: LITERATURE REVIEW

2.1 OVERVIEW

Our literature review aimed to initially emphasise the worldwide public health threat posed by HBV infection and the related elimination targets set by WHO. Subsequently, our focus was to present targeted HBV-related information and reported findings in alignment with our specific objectives to ensure the novelty and significance of our contributions to public health. In conducting this narrative review, literature was searched using Google for relevant keywords. Additionally, databases such as Medline via PubMed and Google Scholar were utilised to ensure comprehensive coverage of the topic. These subsections that follow link the relevant objective/s and provide a brief introduction of the content to follow.

2.2 HEPATITIS B: A GLOBAL PUBLIC HEALTH CONCERN

Hepatitis B infection is a major global public health concern (World Health Organisation 2023a). In 2016, the WHO passed a resolution to eliminate hepatitis B infection by 2030 (World Health Organisation 2016; Amponsah-Dacosta 2021). Elimination goals are to reduce new chronic infections by 90% and reduce HBV-related deaths by 65% (World Health Organisation 2016; Amponsah-Dacosta 2021). To successfully meet these targets, countries need to achieve a minimum of 90% coverage for both timely hepatitis B birth dose vaccine and the completion of the three doses of hepatitis B infant vaccine (World Health Organization 2016). Among children under five years old, an additional target set by WHO for validating elimination at a national level is to achieve an HBsAg prevalence of $\leq 0.1\%$ (World Health Organisation 2021). As per WHO estimates of 2015, approximately 257 million individuals, which equated to 3.5% of the global population, were living with chronic hepatitis B infection, and the majority (68%) resided in the African and Western Pacific regions, indicating the highest disease burden in these areas (World Health Organisation 2017a). In 2019, the WHO estimated that 296 million people were living with chronic HBV infection, marking a 15% increase from the 2015 estimate of 257 million (World Health Organisation 2017a; Easterbrook *et al.* 2021). The number of deaths due to HBV infection in 2019 was estimated at 820,000, mostly from cirrhosis and HCC, with a slight

decrease (7.5%) from the 2015 estimate of 887,000 (World Health Organisation 2017a, 2023a). Globally, in 2013, there were more deaths due to viral hepatitis (1.4 million) than HIV infection (1.3 million) (Murray *et al.* 2014; Stanaway *et al.* 2016). In 2017, it was estimated that 24% of females and 32% of males living with HBV worldwide die from hepatitis B, and 20% of females and 23% of males living with HBV in Southern sub-Saharan Africa contribute to hepatitis B-related deaths (G. B. D. Cirrhosis Collaborators 2020).

2.3 PREVALENCE OF HEPATITIS B

This section relates to objectives 1, 2 and 4 of our study as listed below.

In this section, we match the HBV serological marker used for prevalence estimates and define the different categories of HBV endemicity related to HBV prevalence. At a global level, we report findings on gender differences in HBV prevalence and the impact of HBV vaccination. For South Africa, we report prevalence rates estimated from targeted or community based studies, the primary mode of transmission of HBV at different ages, and HBV prevalence data from regional, community or targeted HBV studies.

2.3.1 General overview

Hepatitis B prevalence is indicated by the serological prevalence of HBsAg (World Health Organisation 2017b). Areas with an HBsAg prevalence of 8% or higher are categorised as highly endemic, whilst prevalence ranging from 5% to 7% are considered high-intermediate endemic areas, 2% to 4% are considered low-intermediate endemic areas and less than 2% is considered as low endemic areas (Hou, Liu and Gu 2005; Weinbaum *et al.* 2008; Ott, Stevens, Groeger and Wiersma 2012; MacLachlan and Cowie 2015; World Health Organisation 2017b). Prevalence of HBV has been seen to be higher among males than women, as reported in studies from Brazil, China, Greece, New Zealand, Nigeria, Pakistan, Taiwan and USA (Blumberg 1979; Koulentaki *et al.* 1999; Odusanya *et al.* 2005; Robinson *et al.* 2005; Baig 2009; Tsay *et al.* 2009b; Kruszon-Moran *et al.* 2020; Rezende *et al.* 2020; Liu *et al.* 2022a; Wang *et al.* 2022). However, a systematic

review and meta-analysis of 22 studies in Sierra Leone from 1997 to 2022 showed that HBV prevalence was higher among women overall (Yendewa *et al.* 2023). Following introduction of the HBV vaccine into routine immunisation schedules, prevalence of HBV infection declined remarkably as demonstrated or reported in several studies or reviews respectively (Chen *et al.* 1987; Hsu *et al.* 1988; Odusanya *et al.* 2005; Zanetti, Van Damme and Shouval 2008; Wasley *et al.* 2010; Hwang and Cheung 2011; Nelson, Easterbrook and McMahon 2016; Centers for Disease Control and Prevention 2021; Pattyn, Hendrickx, Vorsters and Van Damme 2021).

2.3.2 Prevalence of hepatitis B in South Africa

Hepatitis B was highly endemic in South Africa before 1995 when the hepatitis B vaccine was introduced into the EPI schedule (Spearman and Sonderup 2014; Makan, Song, Kinge and Kramvis 2023). Evidence of exposure to hepatitis B in South Africa before 1995 ranged from 5% to 76% (Kiire 1996; Kew 2008; Burnett, Kramvis, Dochez and Meheus 2012; Spearman and Sonderup 2014). It was reported that the primary mode of transmission among children under five years of age was horizontal transmission due to close interaction with infected household contacts and playmates, while among adolescents and young adults, sexual transmission was reported as the primary mode of transmission (Kew 2008; Burnett, Kramvis, Dochez and Meheus 2012; Spearman *et al.* 2017a). In 1995, the overall HBsAg prevalence in South African children under five years old was estimated to be 12.8%, declining to 3% in 2009 (Burnett, Kramvis, Dochez and Meheus 2012; Spearman *et al.* 2017b). In a study conducted on serum samples that were originally collected as part of the measles surveillance programme in 2013, a 0.4% HBsAg prevalence was reported in children under 15 years of age, all of whom would have been vaccine-eligible as infants (Table 2.1) (Prabdi-Sing *et al.* 2019). Further studies conducted post 1995 have also demonstrated the effectiveness of the South African HBV vaccination schedule (Burnett, Kramvis, Dochez and Meheus 2012; Amponsah-Dacosta *et al.* 2014). From the South African studies reviewed from 1995 to 2022, the prevalence of HBsAg ranged from 2.9% in HIV-uninfected women to 20% in HIV-infected

individuals (Table 2.1). In 2014, the South African national prevalence was estimated to be 2.5 million chronic cases (Spearman and Sonderup 2014).

Table 2.1: Summary of findings of eleven Hepatitis B studies in South Africa

No.	Area of South Africa and study cohort	Period of study	No. of participants	HBsAg prevalence	Reference
1.	Eastern Cape Province. Children 0 to 6 years.	July 1995 – April 1996	2,288	10.4% overall, ranging from 8.1% in children aged 0 to 6 months to 15.7% in children aged 61 to 72 months.	(Vardas <i>et al.</i> 1999)
2.	Dr. George Mukhari hospital, Pretoria, South Africa. 167 HIV-positive and 128 HIV-negative patients.	January 1998 to March 2001	295.	16.2% in HIV-infected and 35.2% in HIV-uninfected individuals.	(Mphahlele <i>et al.</i> 2006)
3.	Chris Hani Baragwanath Hospital, Johannesburg, South Africa. HIV-infected participants, 52 males and 48 females aged 16 to 54 years.	May 1999	100	6%	(Lodenyo <i>et al.</i> 2000)
4.	South Africa. HIV-infected individuals attending workplace HIV care programs.	November 2002 to December 2005	133 of 868 participants enrolled in the study	17%	(Hoffmann <i>et al.</i> 2007)
5	Several mining and industrial companies in South Africa. HIV-infected patients enrolled in workplace HIV programmes.	November 2002 to January 2006	537	20%	(Hoffmann <i>et al.</i> 2008)
6	Western Cape Province. Antenatal samples from the 2008	2008	3,089	Overall 3.1%, with a 2.9% prevalence in HIV-	(Andersson <i>et al.</i> 2013)

No.	Area of South Africa and study cohort	Period of study	No. of participants	HBsAg prevalence	Reference
	antenatal sentinel HIV and syphilis prevalence survey.			uninfected women and a 3.4% prevalence in HIV-infected women.	
7	North-eastern South Africa. HIV-infected participants.	2008	380	20%	(Ayuk, Mphahlele and Bessong 2013)
8.	Eastern Cape Province. HIV-infected patients from a rural HIV clinic.	December 2008 to October 2009	1,765	Overall 7.1%, with a 5.5% prevalence in females and 12.1% in males.	(Boyles and Cohen 2011)
9.	Gauteng, North West, Mpumalanga, Limpopo and Northern Cape. Individuals aged 1 to 25 years.	September 2011 to September 2012	1,206	1.4% among individuals born after 1995 and 4.2% among individuals born before 1995.	(Amponsah-Dacosta <i>et al.</i> 2014)
10.	South African children under 15 years old.	2013	450	0.4%	(Prabdhial-Sing <i>et al.</i> 2019)
11	Antenatal care clinic in Cape Town, Western Cape. HIV-uninfected pregnant women.	February 2020 to March 2022	1,194	Overall 0.7%, with a 1.3% prevalence in women born before 1995 and a 0.0% prevalence in women born after 1995.	(Joseph Davey <i>et al.</i> 2022a)

2.4 HEPATITIS B VACCINATION

This section relates to objectives 3 and 5 of our study as listed below.

In this section, we present findings on reported long term and waning vaccine-induced immunity, the latter of particular concern as it suggests non-vaccination rather than waned immunity and categorised as such when analysing immunity status. We review the birth dose of the HBV vaccine in reducing the risk of vertical transmission of HBV, and birth dose implementation rates world-wide. At a national level, we present country and WHO-UNICEF estimates of vaccination coverage rates.

2.4.1 Overview

Vaccination with at least three doses of the HBV vaccine was designed to provide long-lasting protection (World Health Organisation 2022). Bruce *et al.* demonstrated evidence of protective antibody levels in 51% of individuals 30 years after receiving the initial primary series of the HBV vaccine in 1981 (Bruce *et al.* 2016; World Health Organisation 2022). However, immunity has been seen to wane among individuals who received the primary series of HBV vaccine doses over time, as demonstrated by lower or undetectable anti-HBs antibody levels in several studies (Table 2.2). Furthermore, a decrease in the levels of protective immunity (anti-HBs) has been indirectly demonstrated through identification of current or prior HBV infection (through the detection of HBsAg, anti-HBc, and/or HBV DNA) in individuals who had received the initial series of HBV vaccine doses (McMahon *et al.* 2005; Hudu *et al.* 2013; Yao *et al.* 2016; Asadi Mobarkhan *et al.* 2023).

Table 2.2: Summary of studies demonstrating waning of vaccine-induced immunity through serological testing of anti-HBs levels

No.	Period of study	Area	Study cohort	No. of participants	Summary of findings	Reference
1.	1984 to 2004	Clinic of Infectious Diseases, Siena University, Italy	Subjects born to HBsAg-positive mothers, who had received post-exposure prophylaxis.	79	With the population in 5-year age groups, a significant decrease in the anti-HBs geometric mean titre (from 203,65 to 19,36 mIU/ml) was observed five years after the primary vaccination cycle, and a significant decrease in the percentage of protected subjects was observed 20 years after the primary cycle (>90-% to <20%).	(Bracciale <i>et al.</i> 2009)
2.	1988 to 2006	University Hospital Ostrava, Czech Republic	Blood samples from children born to HBsAg positive mothers who received full HBV immunisation (including a birth dose) obtained 1 to 3 months after completing their vaccination schedule at 2 years of age and biennially thereafter.	620	Waning of protective anti-HBs antibodies were detected in 30%, 60% and 75% of children at 5, 10 and 15 years of age respectively. In addition, among children with low anti-HBs levels, waning of anti-HBs levels were observed in 47% and 80% after 5 and 10 years respectively. Among children with high anti-HBs levels, waning of anti-HBs levels were observed in 18% after five years and 49% after 10 years.	(Roznovsky <i>et al.</i> 2010)
3.	May 1999 to July 2000	Israel	Children aged one to eight years who had minor intercurrent diseases vaccinated in a routine vaccination program and visited the	122	Twenty-eight children (22.9%) had undetectable anti-HBs antibody levels (< 10 mIU/ml) (14.6% among children 1 to 2.5 years old, 20% among children 2.5 to five years old	(Gold <i>et al.</i> 2003)

No.	Period of study	Area	Study cohort	No. of participants	Summary of findings	Reference
			emergency room or an outpatient clinic of Dana Children's Hospital of the Tel-Aviv Medical Center.		and 36,1% among children 5 to 8 years old).	
4.	2004 to 2005	Taiwan	High school students (15-21 years old) in the city of Taipei who had been vaccinated with plasma-derived HB vaccine as infants.	6,156	63% of vaccinees had no protective anti-HBs levels (<10 mIU/ml).	(Lu <i>et al.</i> 2008)
5.	2005	Taiwan	1987 birth year cohort of students at a Northern Taiwanese university born in 1987, 18 years after receiving the primary HBV vaccination series.	670	The prevalence of persistent HBV immunity through earlier vaccination was 41.6%.	(Su <i>et al.</i> 2008)
6.	Jun 2006	Pohnpei, Federated States of Micronesia	Adolescents (median age = 15.8 years) born and vaccinated with HBV vaccine during 1989 –1991 who had participated in the Child Health Survey conducted by the Federated States of Micronesia Department of Health Services in 1993.	97	After 15 years of receiving the primary HBV vaccination series, only 7.3% had anti-HBs concentrations ≥ 10 mIU/ml.	(Bialek <i>et al.</i> 2008)
7.	2010	Hong Kong	Medical and nursing school entrants, 17 to 23 years old born after	212	81.1% were anti-HBs negative (<10 mIU/ml)	(Chan <i>et al.</i> 2014)

No.	Period of study	Area	Study cohort	No. of participants	Summary of findings	Reference
			adoption of neonatal immunization in 1988.			
8.	2016	Bangkok, Thailand	First-year medical students between 16 and 20 years of age born after the inclusion of the HBV vaccine into the universal vaccination program on the assumption that approximately 94% of the individuals had received three-dose HBV vaccine within the first year of life based on the national vaccine coverage data for newborns.	291	7% of the individuals possessed anti-HBs titers ≥ 10 mIU/ml whilst 93% had anti-HBs of < 10 mIU/ml.	(Posuwan <i>et al.</i> 2018)
9.	January 2017 to January 2019	Students from University of L'Aquila and doctors from San Salvatore Hospital, Italy	Vaccinated medical students and postgraduates medical doctors, either as infants or at 12 years of age.	239	40,1% of infant vaccinees and 16.5% of individuals vaccinated at 12 years had anti-HBs antibody levels of < 10 mIU/ml.	(Mastrodomenico <i>et al.</i> 2021)
10.	August 2020 to January 2021	Riyadh, the Kingdom of Saudi Arabia	Visitors to primary care centres of the Ministry of Health, including Healthy adults, with mean age of 25 years and who had received full doses of the HBV vaccine in infancy.	400	24,3% had protective anti-HBs antibody levels of ≥ 10 mIU/ml.	(AlAteeq <i>et al.</i> 2022)

No.	Period of study	Area	Study cohort	No. of participants	Summary of findings	Reference
11.	January 2012 to August 2021	Chulabhorn Royal Academy, Thailand	Students and healthcare workers who received their primary HBV vaccination series.	464	Among age groups 16 to 21 years, 21 to 25 years and 26 to 28 years, protective anti-HBs antibody levels of ≥ 10 mIU/ml was observed in 28%, 51.7% and 60% of individuals post-vaccination respectively.	(Phattraprayoon <i>et al.</i> 2022)
12.	2001 to 2009	Review of several studies conducted in Samoa, United Kingdom, China, Italy, Canada, Iran, Gambia, Alaska, Thailand, Taiwan and Germany	Vaccinated populations of infants (HBsAg positive and HBsAg negative mothers), children, adolescents, young adults and the general population.	Ranging from 37 to 6,156	Among children who responded to a primary 3-dose vaccination series with anti-HBs concentrations of ≥ 10 mIU/mL, 15%–50% had low or undetectable concentrations of anti-HBs 5 to 15 years after vaccination. Among adult vaccinees, anti-HBs concentrations declined to < 10 mIU/mL in 7%–50% within five years after vaccination and in 30%–60% within 9–11 years.	(Leuridan and Van Damme 2011; Van Damme 2016)

2.4.2 Hepatitis B birth dose vaccine

The HBV vaccine safeguards both children and adults against HBV infection; however, studies have shown that when administered within 24 hours after birth and followed by a minimum of two additional doses, the vaccine is approximately 90% effective in preventing mother-to-child (vertical) transmission of HBV infection (Plotkin, Orenstein and Offit 2013; World Health Organization 2015b). Protecting newborns is crucial because if they contract HBV infection during this early stage of life, it is considerably more likely to develop into chronic HBV infection, which in turn can lead to premature death (World Health Organization 2015b). In 2009, the WHO emphasised the importance of preventing mother-to-child HBV transmission by recommending that all countries, including those with low HBV prevalence, implement universal hepatitis B birth dose vaccination (World Health Organization 2009, 2015b). South Africa has not yet included a hepatitis B birth dose in its EPI schedule, primarily because the transmission of HBV in young children in the country has been observed to be largely horizontal rather than vertical (Kew 2008; Burnett, Kramvis, Dochez and Meheus 2012; Spearman *et al.* 2017a). In 2016, the African Region had the lowest implementation rate of administering a birth dose of the HBV vaccine among the six WHO regions worldwide, with only 19% of countries in the African region adopting this practice (World Health Organisation 2018). In 2021, 30% of African countries introduced the hepatitis B birth dose into their routine EPI schedule (World Health Organisation 2023b). Some of the key challenges and barriers to implementation of the hepatitis B birth dose vaccination in the African region are related to healthcare infrastructure, cold chain logistics, awareness and education, funding and resources, cultural and social barriers, and policy and political will (Boisson *et al.* 2022; Freeland *et al.* 2023; Solomon-Rakiep, Olivier and Amponsah-Dacosta 2023). The rates of hepatitis B birth dose vaccination have increased in most regions around the world, and by 2021, these rates reached 42% globally; however, hepatitis B birth dose coverage in Africa among newborns was 17% in 2021 (World Health Organization 2021; Flores, Thompson, Ryan and Howell 2022; World Health Organisation 2023b). For the national implementation of a hepatitis B birth dose, it is recommended to establish a clear

national policy mandating universal hepatitis B birth dose vaccination within 24 hours of birth in addition to the current national schedule (World Health Organization 2015b; Boisson *et al.* 2022). Following a systematic review and meta-analysis of 27 studies in sub-Saharan Africa, it was indicated that pentavalent or hexavalent vaccination initiated at 6 to 8 weeks of age could be adequate for averting early horizontal transmission of HBV among infants born to HBsAg-negative mothers (Ansari *et al.* 2023). In addition, a selective birth dose strategy targeted for infants born to HBsAg-positive mothers or mothers with an unknown HBsAg status may be non-inferior to a universal birth dose strategy (Ansari *et al.* 2023). However, universal implementation is recommended as a targeted strategy would add complexity to the guidelines and demand significant efforts to identify infants at risk, potentially resulting in lower immunisation coverage within these vulnerable populations (Børresen *et al.* 2012; Lewis-Ximenez and Peliganga 2023). There could be additional advantages to administering a hepatitis B birth dose vaccine for children who may miss subsequent routine EPI doses (Ansari *et al.* 2023).

The only contraindication to administering the HBV vaccine is the occurrence of an anaphylactic reaction to a prior dose; however, since newborns would not have received a previous dose, there are no verifiable contraindications to the birth dose of the HBV vaccine (World Health Organization 2015b; Opri *et al.* 2018).

2.4.3 Hepatitis B vaccine coverage in South Africa

The Health Systems Trust of South Africa has reported vaccination coverage data for children under one year old who completed their HBV vaccine doses at 6, 10 and 14 weeks of age (HepB3) in South Africa from 2000 to 2019 (Massyn *et al.* 2013a; Massyn *et al.* 2013b; Massyn *et al.* 2014; Massyn *et al.* 2016; Massyn, Day, Ndlovu and Padayachee 2020). The WHO reports administrative and official HepB3 coverage from 2000 to 2022 and WHO/UNICEF coverage estimates (WUENIC) from 1997 to 2022 (World Health Organisation 2023b). Administrative coverage is based on the number of vaccine doses administered versus the

target population (World Health Organisation 2023b). Official coverage is derived from various methods, including administrative data, surveys, or other sources (World Health Organisation 2023b). However, administrative data and survey-based estimates may have inherent biases or inaccuracies (World Health Organisation 2023b). To address some of these limitations, national health authorities can provide their own coverage estimates of what they believe are most accurate and likely (World Health Organisation 2023b). These national estimates can serve as a valuable tool for interpreting administrative data and ensuring a more comprehensive and reliable vaccination coverage assessment (World Health Organisation 2023b). HepB3 vaccine coverage estimates from The Health Systems Trust of South Africa and WHO are indicated in Table 2.3.

Table 2.3: HepB3 vaccination coverage rates for South Africa, 1997 to 2022

Year	Country Estimate (%)	WHO estimates (%)		
	Health Systems Trust of South Africa	Administrative coverage	Official coverage	WHO/UNICEF Estimates of National Immunization Coverage (WUENIC)
2022	-	85.28	85.28	85
2021	-	85.59	85.59	86
2020	-	83.83	83.83	84
2019	82.09	84.95	85	85
2018	80.92	86.07	82.14	82
2017	76.89	83.71	83.8	84
2016	72.37	84.4	84.4	85
2015	80.7	92.8	92.8	85
2014	83.4	97.5	97.53	85
2013	78.22	88.3	88.34	73
2012	78.09	86.1	86.11	70
2011	76.09	93.9	93.92	76
2010	71.7	88.8	88.78	71
2009	79.07	104	104.01	74
2008	78.09	93.1	93.09	76
2007	86.96	99.6	99.58	83
2006	87.2	99.6	99.56	83
2005	83.39	96.2	96.17	79
2004	75.76	71	71	76
2003	70.99	93	94	71
2002	68.06	77	83	72
2001	67.07	80	80	72
2000	71.22	78	88	73
1999	-	-	-	73
1998	-	-	-	74
1997	-	-	-	74

2.5 MODELLING THE TRANSMISSION DYNAMICS OF HEPATITIS B

This section relates to objective 5 of our study as listed below.

In this section, we begin by presenting an overview on the transmission dynamics of HBV modelling. We report on the different model structures, mathematical equations and model parameters applied to HBV modelling. We conclude with a summary of HBV modelling studies which demonstrate their diverse application related to infectious disease modelling.

2.5.1 OVERVIEW

Mathematical models of HBV transmission dynamics are used to simulate the transmission dynamics of HBV disease and evaluate various intervention strategies (Grassly and Fraser 2008; White and Enright 2010; Mann and Roberts 2011; Siettos and Russo 2013; Liang, Zu and Zhuang 2018; McCulloch *et al.* 2020; Costa, Pires, Resque and Almeida 2021; Wodajo, Gebru and Alemneh 2023). As with other modelling exercises, HBV models can provide insights into the potential impact of different interventions on the prevalence of HBV and help guide decision-making (McLean and Blumberg 1994; Zhao, Xu and Lu 2000; Goldstein *et al.* 2005b; O'Leary *et al.* 2009; Zou, Zhang and Ruan 2010; Mann and Roberts 2011; Kamyad, Akbari, Heydari and Heydari 2014; Nayagam *et al.* 2016b; McNaughton *et al.* 2017; Liang, Zu and Zhuang 2018; Mokaya *et al.* 2019; de Villiers *et al.* 2020; Liu *et al.* 2022b; Anley *et al.* 2023; Wang *et al.* 2023; Wodajo, Gebru and Alemneh 2023). Simulation results of published modelling studies suggest that mathematical modelling is highly advantageous to evaluate the impact of vaccination or other intervention strategies (Kretzschmar, Mangen, van de Laar and de Wit 2009; O'Leary *et al.* 2009; Pang, Cui and Zhou 2010; Zou, Zhang and Ruan 2013; Liang, Zu and Zhuang 2018). In the early 1980s, the transmission dynamics model was initially employed to investigate the transmission dynamics of hepatitis B and the effectiveness of control measures (Liang, Zu and Zhuang 2018; Gahamanyi, Banzi and Ntaganda 2021). As the hepatitis B vaccine became available, the primary focus shifted to employing mathematical models to predict the long-term consequences of vaccination on hepatitis B control (Williams, Nokes, Medley and Anderson 1996; Zhao, Xu and

Lu 2000; Goldstein *et al.* 2005b; Liang, Zu and Zhuang 2018; Schillie *et al.* 2018; Gahamanyi, Banzi and Ntaganda 2021). In 1994, McLean and Blumberg introduced a differential equation model for HBV transmission to address questions related to the impact of mass vaccination programs on the prevalence of hepatitis B (McLean and Blumberg 1994). Since then, there have been many studies which have used similar methodologies to examine the transmission dynamics of HBV and evaluate the effects of different vaccination strategies (Nayagam *et al.* 2016b; Liang, Zu and Zhuang 2018; Anley *et al.* 2023). Findings from these studies have provided a quantitative foundation for making informed decisions in public health policy concerning HBV transmission (Nayagam *et al.* 2016b; Liang, Zu and Zhuang 2018). However, variations in the mathematical modelling approaches applied to HBV transmission have been observed and encompass not only differences in the model structures but also variations in parameter estimations (Liang, Zu and Zhuang 2018).

Typically, the process is initiated by the construction of a mathematical model that describes the transmission dynamics of HBV, including compartments that represent the different population groups and parameters that govern HBV disease transmission, progression, and recovery (Liang, Zu and Zhuang 2018). Once the HBV model is constructed, model parameters are adjusted to reproduce historical data on HBV prevalence or incidence as part of the validation process (Zhao, Xu and Lu 2000; Nayagam *et al.* 2016b; Wang *et al.* 2019b; Liu *et al.* 2022b; Yavuz, Özköse, Susam and Kalidass 2023). Based on the model's validation results, policy recommendations are often made, either directly or indirectly, and include prioritising certain interventions and targeted strategies to control and prevent HBV transmission (National Academies of Sciences and Medicine 2017; Anderson *et al.* 2018; McCulloch *et al.* 2020; Matthews *et al.* 2023).

2.5.2 Hepatitis B model structures, equations and parameters

The foundation for constructing mathematical models in the context of HBV infection lies in categorising disease states of HBV infection and vaccination

status (Zhao, Xu and Lu 2000; Liang, Zu and Zhuang 2018; Means, Ali, Ho and Heffernan 2020; Liu *et al.* 2022b). The most commonly used HBV model structures contain five or six compartmental models (Liang, Zu and Zhuang 2018; Anley *et al.* 2023). In the five-compartment models, disease states followed the SEIR structure with an additional “I” compartment to accommodate acutely infected individuals who progress to chronicity as opposed to acutely infected individuals who recover, and therefore “I” was replaced with “A” for acute and “C” for chronic (Liang, Zu and Zhuang 2018). The recovered/removed (R) disease state accommodated successful immunisations following vaccination, and therefore “R” was often replaced with “I”, indicating immune, either through natural infection or vaccination (Liang, Zu and Zhuang 2018). The five-compartment model structure is illustrated in Figure 2.1.



Figure 2.1: Structure of the five-compartment model used in hepatitis B transmission models.

The six-compartment models followed the same pattern as the five-compartment models with an additional “V” compartment for individuals who were successfully vaccinated (Liang, Zu and Zhuang 2018). In these models, “R” for recovered/removed was maintained. These six-compartment models considered waning immunity following vaccination and lifelong immunity following recovery from infection (Liang, Zu and Zhuang 2018). The six-compartment model structure is illustrated in Figure 2.2.

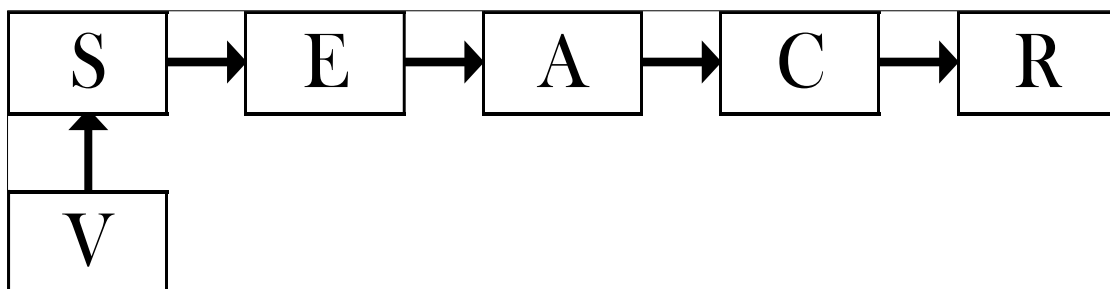


Figure 2.2: Structure of the six-compartment model used in hepatitis B transmission models.

The most frequently applied mathematical expression for modelling the transmission dynamics of HBV was the ordinary differential equation (ODE) (McLean and Blumberg 1994; Williams, Nokes, Medley and Anderson 1996; Zhao, Xu and Lu 2000; Medley, Lindop, Edmunds and Nokes 2001; Thornley, Bullen and Roberts 2008; Kretzschmar, Mangen, van de Laar and de Wit 2009; O'Leary *et al.* 2009; Zou, Ruan and Zhang 2010; Zou, Zhang and Ruan 2010; Mann and Roberts 2011; Zhang and Zhou 2012; Zou, Zhang and Ruan 2013; Kamyad, Akbari, Heydari and Heydari 2014; Liang, Zu and Zhuang 2018). Parameters included in models are described in Table 2.4.

Table 2.4: Summary of model parameters applied to models of HBV transmission dynamics

Parameter Description	Explanation	Comments	References
Force of infection	Rate at which a susceptible individual effectively contacts an infectious individual	Either estimated from population-specific age-stratified seroprevalence data or the transmission coefficient is obtained from literature review.	(McLean and Blumberg 1994; Williams, Nokes, Medley and Anderson 1996; Zhao, Xu and Lu 2000; Medley, Lindop, Edmunds and Nokes 2001; Thornley, Bullen and Roberts 2008; Kretzschmar, Mangen, van de Laar and de Wit 2009; O'Leary <i>et al.</i> 2009; Zou, Ruan and Zhang 2010; Zou, Zhang and Ruan 2010; Mann and Roberts 2011; Zhang and Zhou 2012; Zou, Zhang and Ruan 2013; Kamyad, Akbari, Heydari and Heydari 2014; Nayagam <i>et al.</i> 2016b; Liang, Zu and Zhuang 2018)
Rate at which individuals leave the latent (exposed) compartment	Rate at which an exposed individual becomes infected and is expressed as $1/(\text{average exposure period})$	Well documented in literature.	
Rate at which individuals progress to chronicity	Rates of progression to chronicity is dependent on age of infection.	The rates of age-stratified progression to chronicity is well documented in literature. Most studies use age-stratified rates as reported in published manuscripts.	
Recovery rate of individuals with acute infection	Rate at which an individual with an acute infection recovers $1/(\text{acute infection period})$	Well documented in literature.	
Recovery rate of individuals with chronic infection	Proportion of individuals with chronic HBV infection who recover	Well documented in literature.	
Vertical transmission rate	Mother-to-child transmission of HBV	Where applied, these rates were obtained from literature review. Application; however, was not standard, i.e. a combined estimated rate applied to only acutely infected mothers or chronically infected mothers, or different	

Parameter Description	Explanation	Comments	References
		rates of transmission based on mothers with acute or chronic infections.	
Birth rate	Number of births / total population	Obtained from population-specific birth rates. Some initial and more recent modelling studies often used time-varying birth rates and these are usually applied when population sizes either significantly increase or decrease with time.	
Natural mortality rate	Number of natural deaths / total population	Obtained from population-specific mortality rates. Modelling studies that are age-stratified often use age-stratified mortality rates.	
HBV-related mortality rate	Number of HBV-related deaths / Number of chronic HBV cases	Obtained from literature review or population specific (chronic HBV) data.	
Successful vaccination rate	Proportion of children who develop protective immunity to HBV following vaccination	Estimated based on the proportion of individuals who develop protective immunity to HBV following vaccination and vaccine coverage rates among targeted populations (infant vaccination, vaccination of high-risk groups and vaccination of susceptible individuals).	
Rate of waning vaccine-induced immunity	Period of protection following successful vaccination	Mostly obtained from literature review.	

2.5.3 Review of hepatitis B modelling studies

There have been numerous modelling studies on hepatitis B globally. We conducted a literature review by searching relevant keywords on Google, which guided us to additional databases like Medline via PubMed and Google Scholar, where we accessed the relevant publications. A publication on a literature review of compartmental modelling studies of hepatitis B virus transmission applied to immunisation strategies from 1994 to 2015, published as open access, reported findings of 14 publications (Liang, Zu and Zhuang 2018). A systematic review on hepatitis B seroepidemiology modelling studies in Africa reported findings of 96 studies from 39 African countries (McNaughton *et al.* 2020b). A literature review to determine global prevalence, treatment and prevention of HBV infection in 2016 developed models for 120 countries (McNaughton *et al.* 2020b). Studies published from 2011 to 2023 have reported findings following modelling exercises on HBV transmission dynamics to model interventions to reduce HBV burden, predict vertical transmission of HBV, prevent vertical transmission through treatment interventions, cost effectiveness of interventions to reduce HBV burden, global and national prevalence of HBV, management of HBV infection (through educational campaigns, vaccination, and treatment), expansion of hepatitis B treatment, immune response persistence following a booster vaccination, and the dynamics of hepatitis B across various infection phases and multiple transmission scenarios. Fifteen of these studies are summarised in Table 2.5. These have been selected based on relevance to our modelling exercise (Chapter 7).

Table 2.5: Summary of findings from 15 HBV modelling exercises from 2011 to 2023 by publication year

Year of publication and focus	Manuscript title	Description and summary of findings	Reference
2011, transmission of HBV	Modelling the epidemiology of hepatitis B in New Zealand	In this study, the researchers present a compartmental mathematical model which divides the population into different age groups to analyse the transmission of HBV. They use local data on infection rates and vaccination coverage to estimate the basic reproduction number (R_0). The study finds R_0 for HBV to be 1.53, indicating that the virus has the potential to spread. However, the vaccination campaign in New Zealand had significantly reduced R_0 to a value below one, which implies that the virus's transmission has been effectively reduced. However, considerable number of carriers of HBV still exist in the population, serving as a potential source of infection.	(Mann and Roberts 2011)
2012, transmission of HBV	The analysis and application of an HBV model	The authors developed a mathematical model to depict the transmission of hepatitis B. Their outcomes indicated that the dynamics of the model are primarily influenced by the basic reproductive number (R_0). If R_0 is less than 1, the disease-free equilibrium is established as globally stable. If R_0 exceeds 1, the disease-free equilibrium becomes unstable, and the disease persists uniformly within the population. Additionally, the authors applied the model to examine HBV transmission in China. To achieve this, they estimated the model's parameter values using available HBV epidemic data from China. The simulation results closely approximated the observed HBV epidemic data in China.	(Zhang and Zhou 2012)
2016, interventions to reduce HBV burden and cost effectiveness	Requirements for global elimination of hepatitis B: a modelling study	The model applied here indicated that without the expansion of existing interventions, there will be a cumulative total of 63 million new cases of chronic HBV infection and 17 million HBV-related deaths between 2015 and 2030. This is due to ongoing transmission in certain regions and limited access to treatment for individuals who are already infected. The research suggests that it is possible to achieve set targets by scaling up various	(Nayagam <i>et al.</i> 2016a)

Year of publication and focus	Manuscript title	Description and summary of findings	Reference
		interventions. This could avert an estimated 7.3 million deaths between 2015 and 2030, including 1.5 million cases of cancer-related deaths. It was further demonstrated that in order to meet the WHO global elimination goal, infant vaccination coverage should reach 90%, birth dose vaccination 80%, peripartum antivirals administered to at least 80% of HBeAg positive mothers prior to childbirth, and population-wide testing and treatment to reach 80% of those eligible	
2016, treatment interventions for prevention of vertical transmission	Hepatitis B Virus Disease: A Mathematical Model for Vertical Transmission with Treatment Strategy	This article introduced a mathematical model designed to capture critical insights into the effects of treatment on the vertical transmission of hepatitis B. The study compares the treatment-induced reproduction number with the basic reproduction number to evaluate their potential advantages. The findings suggested that with the implementation of treatment, the transmission of the infection diminishes. Consequently, the number of acute and chronic infections in adult women decreases, resulting in fewer newborn babies being born with the infection.	(Shaban and Manzoza 2016)
2018, estimating global prevalence of HBV	Global prevalence, treatment, and prevention of hepatitis B virus infection in 2016: a modelling study	The authors of the study developed models for a total of 120 countries, out of which 78 had reliable data approved by experts. Global prevalence was estimated to be 3.9% (approximately 291,992,000 infections). Approximately 1.8 million of these infections were found in children aged five years. They estimated that 87% of infants received the three-dose HBV vaccination during their first year of life. Furthermore, 46% received timely birth-dose vaccination, and 13% received hepatitis B immunoglobulin in addition to the full vaccination regimen. Less than 1% of mothers with a high viral load had received antiviral therapy to reduce the risk of mother-to-child transmission of HBV.	(Razavi-Shearer <i>et al.</i> 2018)
2019, transmission dynamics of HBV	A mathematical model of hepatitis B transmission	In this research, the authors introduced and examined a conventional compartment model to represent the transmission dynamics of HBV. Data from the Republic of Turkey Ministry of Health were used to estimate the model's associated parameters and demonstrate its applicability through	(Gölgeli 2019)

Year of publication and focus	Manuscript title	Description and summary of findings	Reference
		suitable simulations. Additionally, the authors calculated the basic reproductive number based on the estimated parameters. Lastly, the authors explored the sensitivity of these parameters and assessed the impact of parameter variations on the disease's transmission dynamics. Based on this research, it appeared that the disease-free state for HBV in Turkey remains stable.	
2019, transmission of HBV	Modeling and qualitative analysis of a hepatitis B epidemic model	Here, the authors constructed a mathematical model to depict the spread of hepatitis B disease. Additionally, the authors determined the model's threshold quantity and conducted a sensitivity analysis to illustrate how various parameters impact the spread of the hepatitis B virus. The authors presented numerical simulations to validate their analytical computations and explore the sensitivity of the model's parameters.	(Khan, Ahmad and Zaman 2019)
2020, prevalence of HBV infection and exposure in Africa	Hepatitis B virus seroepidemiology data for Africa: Modelling intervention strategies based on a systematic review and meta-analysis	The authors investigated the relationship between the prevalence of HBV infection and exposure in Africa through a systematic literature review from 1995 to 2019 and included 96 studies from 39 African countries. The researchers discovered a strong relationship between the prevalence of HBV infection (HBsAg) and HBV exposure (anti-HBc). The authors used a previously developed mathematical model to explore the impact of various interventions in a high-prevalence setting. The most substantial and sustained impact was projected with a testing and treatment strategy, which was predicted to reduce prevalence by 33% after 20 years and by 62% after 50 years. Overall, this research provided valuable insights into the relationship between HBV infection and exposure in Africa, highlighting the importance of tailored intervention strategies to combat HBV prevalence in different regions.	(McNaughton <i>et al.</i> 2020a)
2021, management of HBV infection through educational campaigns, vaccination, and treatment	Mathematical analysis of hepatitis B epidemic model with optimal control	This study focused on the dynamics of hepatitis B virus and how it can be managed through educational campaigns, vaccination, and treatment. The authors considered constant controls and the stability of the model and examined the existence of solutions for disease-free and endemic	(Zada <i>et al.</i> 2021)

Year of publication and focus	Manuscript title	Description and summary of findings	Reference
		equilibria. Time was subsequently included as a variable control which allowed the development of an optimal control strategy aimed at reducing the number of infected individuals and associated costs. The results demonstrated that the most effective approach to controlling HBV infection is to optimise the combination of educational campaigns, treatment, and vaccination.	
2022, expanding hepatitis B treatment and cost effectiveness	Impact of expanding hepatitis B treatment guidelines: A modelling and economic impact analysis	This study estimated that there would be around 1.4 million chronic hepatitis B cases in Korea in 2020 and aimed to assess the impact of broadening the eligibility criteria for treatment on the future burden of the disease. The findings highlighted the significant impact that adjustments to treatment protocols can have in preventing HCC cases and saving lives among individuals with chronic hepatitis B, while also being economically efficient.	(Lim <i>et al.</i> 2022)
2022, HBsAg prevalence estimation over time	Modelling the prevalence of hepatitis B towards eliminating it as a major public health threat in China	The authors used a dynamic compartmental model (age and time stratified) to reflect the natural progression of HBV infection and the historical and current status of hepatitis B control. The model was simulated from 2006 to 2040 to predict the decline in HBsAg prevalence. Under the current systems, HBsAg prevalence was projected to steadily decrease across all age groups. However, it would not reach the WHO's target of achieving a prevalence of 0.1% in children under the age of five years until the year 2037. Introducing Peripartum Antiviral Prophylaxis (PAP) led to a significant reduction in HBsAg prevalence among children under five years old, but still not achieve the 0.1% target by 2030. If current interventions are scaled up to reach a larger portion of the population with PAP introduction, the WHO's 0.1% target could be achieved on time or even earlier.	(Liu <i>et al.</i> 2022b)
2022, immune response persistence following a booster vaccination	Modeling long-term persistence after 8 years of hepatitis B booster vaccination	This study aimed to quantify immune response persistence following a booster vaccination through mathematical modelling. The model's predictions indicated that 99.5% of subjects will continue to have seropositivity ($\geq 10\text{mIU/mL}$) even 20 years after receiving the booster	(Qiu <i>et al.</i> 2022)

Year of publication and focus	Manuscript title	Description and summary of findings	Reference
	in 5- to 15-year-old children	vaccination. However, after 30 years, the seropositivity rates were anticipated to decline to 76.8%. The immunogenicity of the booster vaccination was projected to persist for a minimum of 8 years, and mathematical modelling suggested it may extend up to 30 years of protection.	
2023, HBV prevalence following a two-dose vaccine series	Mathematical Model of Hepatitis B Disease with Optimal Control and Cost-Effectiveness Analysis	In this paper, the authors developed and examined a mathematical model for hepatitis B disease, taking into account a two-dose vaccine series. They demonstrated that the disease-free equilibrium of the model becomes globally asymptotically stable when the basic reproduction number (R_0) is less than one. The model's endemic equilibrium is locally asymptotically stable when R_0 is greater than one. To illustrate the theoretical findings and assess the effectiveness of different strategies, the authors conducted simulation analyses using their model. These simulations indicate that the use of prevention efforts emerges as the most cost-effective strategy.	(Belay, Abonyo and Theuri 2023a)
2023, dynamics of hepatitis B across various infection phases and multiple transmission scenarios	Modelling the dynamics of acute and chronic hepatitis B with optimal control	This manuscript explores the dynamics of hepatitis B across various infection phases and multiple transmission scenarios. The authors constructed an epidemiological model that captures the essential features of the disease. To mitigate the spread of the disease, the authors introduced two control measures (treatment and vaccination). These proved to be highly effective in the management of hepatitis B virus infection.	(Khan, Rihan and Ahmad 2023)
2023, prediction of HBV vertical transmission	Modelling of Hepatitis B Virus vertical transmission dynamics in Ethiopia: a compartmental modelling approach	The authors developed a deterministic model and conducted numerical simulations to create a straightforward model capable of predicting HBV vertical transmission over the next five decades by assuming a fixed population. The model's outcomes revealed that a significant portion of the population would continue to be infected and become carriers over the next 49 years, but with a decreasing trend. Without intervention on vertical transmission, it was projected that 271,719 individuals would succumb to HBV complications. The sensitivity analysis emphasized that the FOI is the most critical parameter affecting the dynamics of hepatitis B vertical	(Anley <i>et al.</i> 2023)

Year of publication and focus	Manuscript title	Description and summary of findings	Reference
		transmission. The introduction of hepatitis B immunoglobulin (HBVIG) and vaccines during childbirth could reduce the FOI by over half, potentially saving 51,892 lives if the intervention is implemented for 50% of deliveries in Ethiopia.	

Modelling the transmission dynamics of HBV infection and simulating vaccine interventions, particularly a birth dose, is urgently needed for South Africa using country-specific analysed national data. Although the hepatitis B vaccine was introduced into the EPI schedule in 1995, no birth dose of the HBV vaccine is administered, and the majority of child-bearing women were born in the pre-vaccination era when hepatitis B was highly endemic (Spearman and Sonderup 2014; Makan, Song, Kinge and Kramvis 2023). This suggests that a substantial proportion of child-bearing women may be HBV-infected and transmit the infection to their babies. Given that modelling has not included country-specific data for South Africa, it is urgently needed to evaluate the prevalence of HBV disease in South Africa, with and without a birth dose of the HBV vaccine. Our findings will be the first for South Africa with input of results obtained from HBV testing of a nationally representative sample of pregnant women.

**CHAPTER THREE (OBJECTIVE 1): HEPATITIS
B INFECTION STATUS AMONG INDIVIDUALS
ATTENDING PUBLIC HEALTHCARE
FACILITIES, 2015 TO 2019**

3.1 INTRODUCTION

Analysis of Hepatitis B serological markers indicative of active HBV infections (HBsAg and HBeAg) are needed for South Africa for purposes of estimating disease burden in the country. In order to estimate HBV disease burden, we analysed results of HBsAg and HBeAg serological markers among cases tested countrywide (refer to Table 1.1 for the interpretation of these serological markers).

Analysing patterns of HBsAg results from 2015 to 2019 allowed us to further identify HBsAg positive cases under five years old, HBsAg positive cases among females of child-bearing age, chronic HBV infections, cases who demonstrated clearance of HBsAg, and cases who supposedly acquired HBV infection. Analysing HBeAg status among HBsAg positive and chronic HBV cases allowed us to identify the proportion of individuals with active HBV infections who had an increased risk of transmitting the infection following contact with a susceptible individual (Krajden, McNabb and Petric 2005; Alexopoulou and Karayiannis 2014).

The key findings from this chapter have been incorporated into a published manuscript, attached as Appendix 3.1. The online version of the manuscript can be accessed by clicking on the following link: [Hepatitis B infection status among South Africans attending public health facilities over a five-year period: 2015 to 2019 - PubMed \(nih.gov\)](#). While some content in this chapter may overlap with the published manuscript, it also includes additional information and insights. Furthermore, this chapter includes online links facilitating access to referenced figures and tables from the aforementioned manuscript.

3.2 METHODOLOGY

3.2.1 Ethics statement

Our study utilised anonymous retrospective data linked to a unique identifier. We received ethics approval from the Faculty of Health Sciences, Institutional Research Ethics Committee (IREC 069/20) at Durban University of Technology, Durban, South Africa. Additionally, we obtained permission to access and analyze the data through the National Health Laboratory Service (NHLS) Academic Affairs and Research Management System (PR20254).

3.2.2 Study population and data source

The data used to create HBsAg and HBeAg registries were obtained from the NHLS CDW from 01 January 2015 to 31 December 2019. NHLS laboratories across the country utilise a laboratory information management system (LIMS) to record test results, which are subsequently integrated into the NHLS CDW. The NHLS CDW functions as the national repository for laboratory data within South Africa's public health sector, covering more than 80% of the country's total population (Ngobeni, Breitenbach and Aye 2020). The NHLS CDW includes various types of other records, such as non-patient related data (e.g., quality assurance samples and project-related records) if laboratories have captured them onto the laboratory information management system in addition to patient results. Non-patient related data were not included in our analyses. It is important to emphasize that this study did not incorporate data from HBV testing conducted in the private healthcare sector.

Laboratory data were obtained for each calendar year, encompassing tests performed annually from 2015 to 2019, as five individual data files. The variables of the HBV dataset are listed and described in Table 3.1.

Table 3.1: Variable names available in the HBV dataset and their description

Number	Variable Name	Description
1.	UNIQUE_PATIENT_ID	Unique identifier
2.	GENDER	Gender
3.	DOB	Date of birth
4.	AGE_TESTED_YEARS	Age at time of testing
5.	YEARS	Age at time of testing in years
6.	MONTHS	Age at time of testing in months
7.	DAYS	Age at time of testing in days
8.	HOSPITAL_ID	Hospital identification number
9.	WARD_NAME	Name of hospital ward
10.	FACILITY_NAME	Name of facility attended by the patient
11.	SUB_DISTRICT_NAME	Sub-district name of facility
12.	DISTRICT_NAME	District name of facility
13.	PROVINCE_NAME	Province name of facility
14.	SPECIMEN_TYPE	Type of specimen
15.	TESTING_LAB	Identification of the laboratory that performed the HBV testing
16.	TAKEN_DATE	Date of sample collection
17.	TESTED_DATE	Date when sample was tested
18.	CLINICAL_DIAGNOSIS	Clinical diagnosis
19.	HEP_B_SURFACE_AG	Qualitative HBsAg results
20.	HEP_B_SURFACE_AG_VALUE	Quantitative HBsAg results
21.	HEPATITIS_B_CORE_IGM	Qualitative IgM anti-HBc results
22.	HEPATITIS_B_CORE_IGM_VALUE	Quantitative IgM anti-HBc results
23.	HEPATITIS_B_E_AG	Qualitative HBeAg results
24.	HEPATITIS_B_E_AG_VALUE	Quantitative HBeAg results
25.	HEPATITIS_B_SURFACE_AB	Qualitative anti-HBs results
26.	HEPATITIS_B_CORE_TOTAL_AB	Qualitative total anti-HBc results

Specifically, for the development of HBsAg and HBeAg registries, we utilised the variables numbered 1-3, 8, 10, 12, 13, 16, 17, 19 and 23, as listed in Table 3.1 above.

3.2.3 Data manipulation to obtain a five-year data file

Data were manipulated in Microsoft Excel (Version 2016, Washington, USA) and Stata IC (Versions 14, 17 and 18, Texas, USA).

Annual data were examined visually to ensure uniformity in data layout between datasets, the availability of all required variables for purposes of our analyses, and the completeness of data as per the relevant annual testing period. This was done to ensure consistency across all HBV data files from 2015 to 2019.

3.2.3.1 Data cleaning

Before we could proceed with data analysis, we cleaned the data to ensure we were working with patient-specific data to enhance the accuracy and reliability of our findings. Data cleaning were performed in Excel to exclude project-related records and records of external quality assurance testing. Following the data cleaning exercise, the Excel files were saved for subsequent importation and data analysis in Stata.

3.2.3.2 Data formatting and appending

Following importation of an Excel dataset into Stata, the variables are either imported as numerical or text variables, including date variables in various formats. In order to execute commands using dates in Stata, date variables needed to be stored as numeric variables with a consistent date format. As a result, following importation of our annual Excel files into Stata, we formatted all date variables according to the dd/mm/yyyy (day/month/year) format. Following this adjustment, we appended the five Stata files, sorted the data by the "TAKEN_DATE" variable and saved a Stata file of all 2015 to 2019 records (herein referred to as the 2015-2019_HepatitisB_All_Records.dta file). The extension .dta refers to a Stata dataset and will be used herein when referring to Stata dataset files. The dataset was sorted by the "TAKEN_DATE" variable to maintain a file with the sample collection date in an ascending order for multiple records of a single case.

3.2.4 Data analysis

Data analyses were performed in Microsoft Excel (Version 2016, Washington, USA) and Stata IC (Versions 14, 17 and 18, Texas, USA).

3.2.4.1 Assigning age groups

Although an age variable (AGE_TESTED_YEARS) was among the existing variables (Table 3.1, number 4), the age reflected here indicated the age at the time of testing, which could be later than the sample collection date. We wanted to assign age groups based on the sample collection date to accurately determine the age group of cases. In order to do this, we used the difference between the "DOB" and "TAKEN_DATE" variables to create a variable named "AGE_TAKEN_DATE_DAYS". We subsequently generated variables named AGE_TAKEN_DATE_DAYS" and "TAKEN_DATE_AGE_GROUP" to assign cases to defined five-year age groups (from 0 to 4 years to 55 to 59 years, and then 60+ years). If either the date of birth or sample collection date (or both) was unknown, the age group was assigned as "99999" and reported as unknown. By performing these steps, we ensured that the age groups were correctly assigned based on the sample collection date, allowing for more accurate analysis and interpretation of the data.

3.2.4.2 Linking districts to provinces

For district specific analyses, we generated an additional variable in the 2015-2019_HepatitisB_All_Records.dta file to link the district name to the province name (labelled as "PROVINCE_DISTRICT"). Given that there are 52 districts spread across nine provinces, this variable streamlined the process of ascertaining the province for each district. We then replaced the saved 2015-2019_HepatitisB_All_Records.dta file with the file that had the "PROVINCE_DISTRICT" variable.

3.2.4.3 Generating variables to identify the year of testing and year of sample collection

To facilitate the tabulation of data per year from the five-year combined dataset, we generated two additional variables. The first was to capture the year component from the "TAKEN_DATE" variable to identify the year when the sample was taken (labelled as "YEAR_TAKEN_DATE"), and the second was to capture the year component from the "TESTED_DATE" variable to identify the year when the sample was TESTED (labelled as "YEAR_TESTED_DATE"). These additional variables facilitated the segregation and analysis of the data based on both the year of sample collection and the year of sample testing.

In comparison to Table 3.1, which originally listed the variables of the hepatitis B data files extracted from the NHLS CDW, the HBV dataset of 2015 to 2019 now contained additional variables as indicated above.

3.2.4.4 Development of a registry of cases who were tested for HBsAg and a registry of HBsAg positive cases

In order to obtain a registry of cases who were tested for HBsAg, we used the 2015-2019_HepatitisB_All_Records.dta file and tabulated the HBsAg result options. We then maintained and saved only those records of valid HBsAg results (equivocal, negative, low positive and positive), and saved a file of these records (herein referred to as the 2015-2019_HBsAg_All_Records.dta file). As this file included repeat and follow-up tests of a single case as separate records, we proceeded to delete duplicate case records by executing two commands in Stata (Table 3.2) to obtain a registry (line list) of cases who were tested for HBsAg from 2015 to 2019. We subsequently saved a file of these records (herein referred to as the 2015-2019_HBsAg_All_cases.dta file) for subsequent use. The registry of cases who were tested for HBsAg over the five years (total number of cases

tested) provided the denominator for the HBsAg test positivity rate (HBsAg positive cases / total cases tested for HBsAg).

Table 3.2: Deduplication commands applied in Stata for deleting duplicate results of a case with multiple records

Duplicate identification Number	Stata command	Stata action	Justification
1.	duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force	Delete duplicate UID except UIDs of "-1".	A UID of "-1" is assigned to new entries into CDW. Following linkage checks, a new UID is generated or an existing UID is allocated based on a linkage match identified. As a result, there may be unique cases with a UID of "-1". If we did not apply the exclusion, we would delete true cases if there were multiple cases with a UID of "-1"
2.	duplicates drop DOB HOSPITAL_ID FACILITY_NAME if UNIQUE_PATIENT_ID ==-1, force	Deletes duplicates if UID is "-1" and duplicates identified by the date of birth, hospital identification number and facility name.	To ensure we do not maintain duplicate records of cases with a UID of "-1"

We then saved a file of the deduplication commands in order to execute them as necessary. Stata command files are saved as .do files so that they can be distinguished from other Stata files (e.g., the .dta file representing Stata datasets).

In order to develop a registry of HBsAg positive cases (cases who tested positive for HBsAg at least once from 2015 to 2019), we returned to the 2015-2019_HBsAg_All_records.dta file and selected records of all positive (including

low positive) HBsAg results. As this file included repeat and follow-up positive tests of a single case as separate records, we first saved this file (herein referred to as 2015-2019_HBsAg_All_Positive.dta file) prior to executing the two deduplication commands as listed in Table 3.2. We then obtained and saved a registry of HBsAg positive cases (herein referred to as 2015-2019_HBsAg_positive_cases.dta file) for further data manipulation and analyses. The registry of positive HBsAg cases (total number of positive cases) provided the numerator for the HBsAg test positivity rate (HBsAg positive cases / total cases tested for HBsAg).

Data analyses were performed on all cases who were tested for HBsAg and cases who tested positive for HBsAg to determine the distribution of cases by gender, age group, province and district at a national level. To provide a more meaningful interpretation of the data, we calculated and illustrated the data as HBsAg test positivity rates (positive cases / total cases tested) by age group, gender and province at a national level.

HBsAg positive cases under five years old

We used the 2015-2019 HBsAg_positive_cases.dta file to extract those cases under five years old who tested positive for HBsAg by selecting all cases that fell within the 0 to 4 year age group and maintained a file of these cases (herein referred to 2015-2019_HBsAg_positive_cases_under_5years.dta file). To be able to determine the HBsAg test positivity rate among cases under five over the combined five-year period (positive cases / total tested), we used the 2015-2019_HBsAg_All_cases.dta file (registry of cases tested for HBsAg) and tabulated the "TAKEN_DATE_AGE_GROUP" variable to identify the number of cases under five who were tested for HBsAg. To be able to determine the HBsAg population positivity rate among children under five over the combined five-year period (positive cases / population size), we used the average population size

among children under five years old from 2015 to 2019 as reported by Statistics South Africa (<https://www.statssa.gov.za/>). We further analysed the 2015-2019_HBsAg_positive_cases_under_5years.dta file to determine the number of cases in one-year age groups. In order to this, we tabulated the variable created to determine the five-year age groups based on the date the sample was taken ("AGE_TAKEN_DATE_YEARS"). In order to identify HBsAg positive cases among children under one year old, we created age groups in weeks by using the "AGE_TAKEN_DATE_DAYS" variable ($\text{AGE\_TAKEN\_DATE\_DAYS} / 7$) and calculated the number of HBsAg positive children 0 to 5 weeks, 6 to 16 weeks and 17 to 52 weeks old.

Data analyses were performed on the registry of HBsAg-positive cases under five years old to further determine the distribution of cases by gender, province and district. To provide a more meaningful interpretation of the data, we calculated and illustrated the data as HBsAg test positivity rates among cases under five years old by age group in one-year intervals, stratified by gender and province.

HBsAg positive cases among females of child-bearing age (15-49 years old)

We used the 2015-2019_HBsAg_positive_cases.dta file to first extract HBsAg positive females using the "GENDER" variable. We then extracted cases of ages 15 to 49 years using the assigned five-year age group variable ("TAKEN_DATE_AGE_GROUP") to obtain a registry of HBsAg positive females of child-bearing age (herein referred to as the 2015-2019_HBsAg_positive_females_15-49years.dta file). To determine HBsAg test positivity rates among females of child-bearing age (positive cases / total tested), we used the 2015-2019_HBsAg_All_cases.dta file (registry of cases tested for HBsAg) to extract and analyse all cases among females of child-bearing age who were tested for HBsAg.

Data analyses were performed to determine the distribution of females of child-bearing age by defined five-year age groups (15 to 49 years old), province and district. To provide a more meaningful interpretation of the data, we calculated and illustrated the data as HBsAg test positivity rates among females of child-bearing age by defined five-year age groups (15 to 49 years old) and province.

3.2.4.5 Development of a registry of chronic hepatitis B cases

To develop a registry of chronic HBV cases (cases who tested positive for HBsAg six months or more apart), we used the 2015-2019_HBsAg_All_Positive.dta file (previously sorted by date of sample collection in an ascending order) and exported the data to an Excel workbook. Subsequent data manipulations were performed in Excel using standard Excel tools and tools available within the Ablebits add-in, downloaded from <https://www.ablebits.com>. Based on the standard duplicate identification criteria (Table 3.2), we proceeded to identify duplicates using the “Duplicate Remover” wizard of the Ablebits add-in and moved duplicates and first occurrences to a separate sheet within the same Excel workbook, naming the sheets according to the duplicate criteria applied for subsequent analysis. We then selected each sheet that contained the duplicates and first occurrences and used the “Merge Duplicates” wizard of the Ablebits add-in to merge the HBsAg and date of sample collection fields (variables labelled as “HEP_B_SURFACE_AG” and “TAKEN_DATE” in Excel respectively). The purpose of merging the HBsAg results field was to verify that all merged results were positive, and the purpose of merging the dates of sample collection field was to determine the time period between sample collection dates and extract those cases who met the chronic HBV case definition. The “Merge Duplicates” wizard combines all duplicate observations into one by merging subsequent data of selected fields (in our case the HBsAg results and date of sample collection fields).

Using the “Text to Columns” wizard within Excel data tools, we separated the combined dates in the “TAKEN_DATE” field into the relevant number of columns adjacent to it. We proceeded to label the original “TAKEN_DATE” field as “TAKEN_DATE_1” and subsequent separated dates of sample collection as “TAKEN_DATE_2”, “TAKEN_DATE_3” and so forth depending on the number of duplicates identified.

As the data were initially sorted by the TAKEN_DATE variable in an ascending order, they were combined and separated accordingly, so “TAKEN_DATE_1” represented the earliest date of sample collection. The Excel file was then saved for importation into Stata and subsequent data manipulations and analyses. In Stata, we examined all date fields and where applicable, formatted them to conform to our standard format of dd/mm/yyyy. We subsequently executed commands in Stata to calculate the time interval in days between the first sample collection dates and subsequent sample collection dates, generating new variables labelled as “TIME_DAYS_1”, “TIME_DAYS_2”, “TIME_DAYS_3” and so forth until all calculations were completed. Missing values (represented by a “.” in Stata) were generated for missing sample collection dates. As missing values are treated as the largest possible numeric value in Stata, we converted all missing values to an arbitrary number of “-99999” in order to exclude these when selecting records with a time interval of equal to or greater than 180 days (equivalent to 6 months and indicative of chronic infection). We then executed commands to identify and keep only those records with a time interval of equal to or greater than 180 days to obtain a dataset of chronic HBV cases (herein referred to as the 2015-2019_HBV_Chronic_Cases.dta file).

Data analyses were performed to determine the distribution of chronic HBV cases by gender, age group, province and district at a national level. To provide a more meaningful interpretation of the data, we used data obtained from analyses of all

HBsAg positive cases to calculate and illustrate the proportion identified as chronic HBV cases per province and age group, both stratified by gender.

3.2.4.6 Development of a registry of cases who cleared HBsAg infection and cases who have transitioned from HBsAg negative to HBsAg positive status

In order to identify cases who demonstrated clearance of HBsAg and cases who might have acquired HBV infection between 2015 and 2019 (the latter was based on cases who had transitioned from HBsAg negative to HBsAg positive status), we needed a dataset of both HBsAg positive and negative records. For this purpose, we used the 2015-2019_HBsAg_All_Records.dta file to maintain all positive (including low positive) and negative HBsAg records by deleting records of equivocal results. We then saved a Stata file of the positive and negative records (herein referred to as the 2015-2019_HBsAg_All_Neg_Pos_Records.dta file). We subsequently executed commands to identify duplicates (based on the duplicate identification criteria as per Table 3.2) and generated two variables to indicate the number of duplicates identified per duplicate identification criteria (named TAG_1 and TAG_2). By tabulating "TAG_1" and "TAG_2", we were able to identify cases who were tested once only over the five years and subsequently deleted these records. We remained with a dataset of records of cases who were tested at least twice for HBsAg over the five years. The dataset was then exported into an Excel workbook to merge duplicate cases by merging the HBsAg results variables using the Ablebits add-in. Using the "Text to Columns" wizard within Excel data tools, we separated the combined results in the "HEP_B_SURFACE_AG" field into the relevant number of columns adjacent to it. We proceeded to label the original "HEP_B_SURFACE_AG" field as "HEP_B_SURFACE_AG _1" and subsequent separated HBsAg results as "HEP_B_SURFACE_AG _2", "HEP_B_SURFACE_AG _3" and so forth depending on the number of duplicates identified. The merged Excel dataset was

then imported into Stata for further data analysis. Commands were executed to: 1) identify cases who tested positive throughout the five years (herein referred to as Group_P), 2) identify cases who tested negative throughout the five years (herein referred to as Group_N) and 3) identify cases who tested positive and negative over the five years (herein referred to as Group_M). Subsequent commands on Group_M were executed to identify the testing patterns within this group. Based on the testing patterns within Group_M, we subsequently determined cases who demonstrated clearance of HBsAg and cases who supposedly acquired HBV infection during the period 2015 to 2019. We analysed the data to determine the distribution of these cases by gender, age group, province, and district. To examine cases who transitioned from HBsAg negative to HBsAg positive more closely, we calculated the percentage of cases per province and age group, both stratified by gender, using the total number of cases tested for HBsAg as the denominator. To examine cases in Group_M more closely, we looked at gender and age group predominance among cases who tested positive initially and negative subsequently, cases who tested positive in-between an initial and last negative test, cases who tested negative initially and positive subsequently, and cases who tested positive throughout the five years.

3.2.4.7 Development of a registry of the total cases tested for HBeAg, HBeAg positive cases and HBeAg cases coupled with HBsAg positive and HBV chronic cases

In order to obtain a registry (line list) of cases who were tested for HBeAg, we used the 2015-2019_HepatitisB_All_Records.dta file and tabulated the HBeAg result options. We selected and maintained only records of valid HBeAg results; i.e., equivocal, negative, and positive (including low positive), and saved a Stata file of these HBeAg records (herein referred to as 2015-2019_HBeAg_Valid_Records.dta file). As this file included repeat and follow-up tests of a single case as separate records, we proceeded to delete duplicate case records by executing

the two deduplications commands (Table 3.2). We subsequently obtained a registry (line list) of cases who were tested for HBeAg from 2015 to 2019 and saved a file of these records (herein referred to as 2015-2019_HBeAg_All_cases.dta file). The registry of cases tested for HBeAg (total number of cases) provided the denominator for the HBeAg test positivity rate (HBeAg positive cases / total cases tested for HBeAg). As HBeAg is a marker of HBV replication and increased infectivity, a positive case registry was subsequently developed based on a positive HBeAg laboratory result (cases who tested positive at least once for HBeAg from 2015 to 2019). For this purpose, we used the 2015-2019_HBeAg_Valid_Records.dta file and selected only records of positive (including low positive) HBeAg results and saved a Stata file of all HBeAg positive records (herein referred to as 2015-2019_HBeAg_All_Positive_Records.dta file). We then proceeded to delete duplicate case records by executing the standard deduplication commands (Table 3.2) to obtain and maintain a registry of HBeAg positive cases (herein referred to as 2015-2019_HBeAg_Positive_Cases.dta file). The registry of HBeAg positive cases provided the numerator for the HBeAg test positivity rate (HBeAg positive cases / total cases tested for HBeAg).

Having already developed registries of HBsAg and HBV chronic cases (2015-2019_HBsAg_positive_cases.dta and 2015-2019_HBV_Chronic_Cases.dta files), we merged these files with the 2015-2019_HBeAg_All_Cases.dta file to link HBsAg and chronic HBV cases to available HBeAg results. We subsequently maintained files that contained only those cases who had HBeAg results available for further analysis (herein referred to as 2015-2019_Positive-HBsAg_merged_HBeAg.dta and 2015-2019_chronic-HBV_merged_HBeAg.dta files). We analysed the merged files to determine the distribution of HBsAg positive cases and HBV chronic cases by age group stratified by gender and HBeAg positive results, as well as by province stratified by gender and all HBeAg results, the latter representing cases who were tested for HBeAg. In order to

assess statistical differences between females and males, we used the test of proportions (with a significance level of $\alpha = 0.05$) among individuals who tested positive for HBsAg and HBeAg, and among chronic HBV infections, by age group and province (Moonsamy, Pillay and Prabdhial-Sing 2023). The test of proportions is a statistical method used to determine whether the proportion of a certain outcome in a sample is significantly different to a known proportion or to the proportion in another sample. Analyses on age groups stratified by gender provided data on HBsAg positivity, HBV chronicity and HBeAg positivity among children under five years old and among females of child-bearing age.

3.3 RESULTS

3.3.1 Appended and annual records of the complete hepatitis b data file, 2015 to 2019

Following data cleaning of the annual data files and appending of all files, the 2015 to 2019 combined data file had a total of 6,315,380 records. Table 3.3 displays the breakdown of records for each year based on the tests conducted in that specific year.

Table 3.3: Annual number of records of the complete hepatitis B data file from 2015 to 2019

Testing Year	Number	Percentage
2015	1,032,718	16.35%
2016	1,305,585	20.67%
2017	1,349,178	21.36%
2018	1,276,410	20.21%
2019	1,351,489	21.40%
Total	6,315,380	100%

3.3.2 Registries of cases who were tested for HBsAg and HBsAg positive cases

From the 2015-2019_HepatitisB_All_Records.dta file, the total number of valid HBsAg records were 2,370,723. On deduplication, we identified 1,957,224 cases who were tested for HBsAg. On selecting the positive HBsAg records from the data file of 2,370,723 records, we obtained 232,551 records of positive results and on deduplication, we obtained a registry of 176,530 HBsAg positive cases. These steps have been included in Figure 1 of the published manuscript: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10519597/figure/pgph.0000992.g001/>. The HBsAg test positivity rate over the combined five-year period was 9.02% (176,530 / 1,957,224).

The Stata log file, which contains a record of the executed commands and their corresponding outputs for creating both the HBsAg registries (total cases tested and total positive cases), is provided as Appendix 3.2, and includes tables on the distribution of cases by gender, province, district and age group.

Looking at the total number of cases tested for HBsAg, we saw that 60.87% were females and 40.80% were from Gauteng. Of the cases from Gauteng, 35.78% were from the City of Johannesburg district, and 75.76% of the cases were among the ages of 20 to 49 years (Appendix 3.2). In all age groups and provinces, more females were tested for HBsAg than males. Looking at the total number of HBsAg positive cases, we saw that 53.64% were males, the majority were from Gauteng (36.87%), and the majority were among the ages of 20 to 49 years (Appendix 3.2).

We used the data obtained on HBsAg positive cases and total cases tested for HBsAg (Appendix 3.2) to calculate the HBsAg test positivity rates per gender, province and age group as illustrated in Figure 3.1.

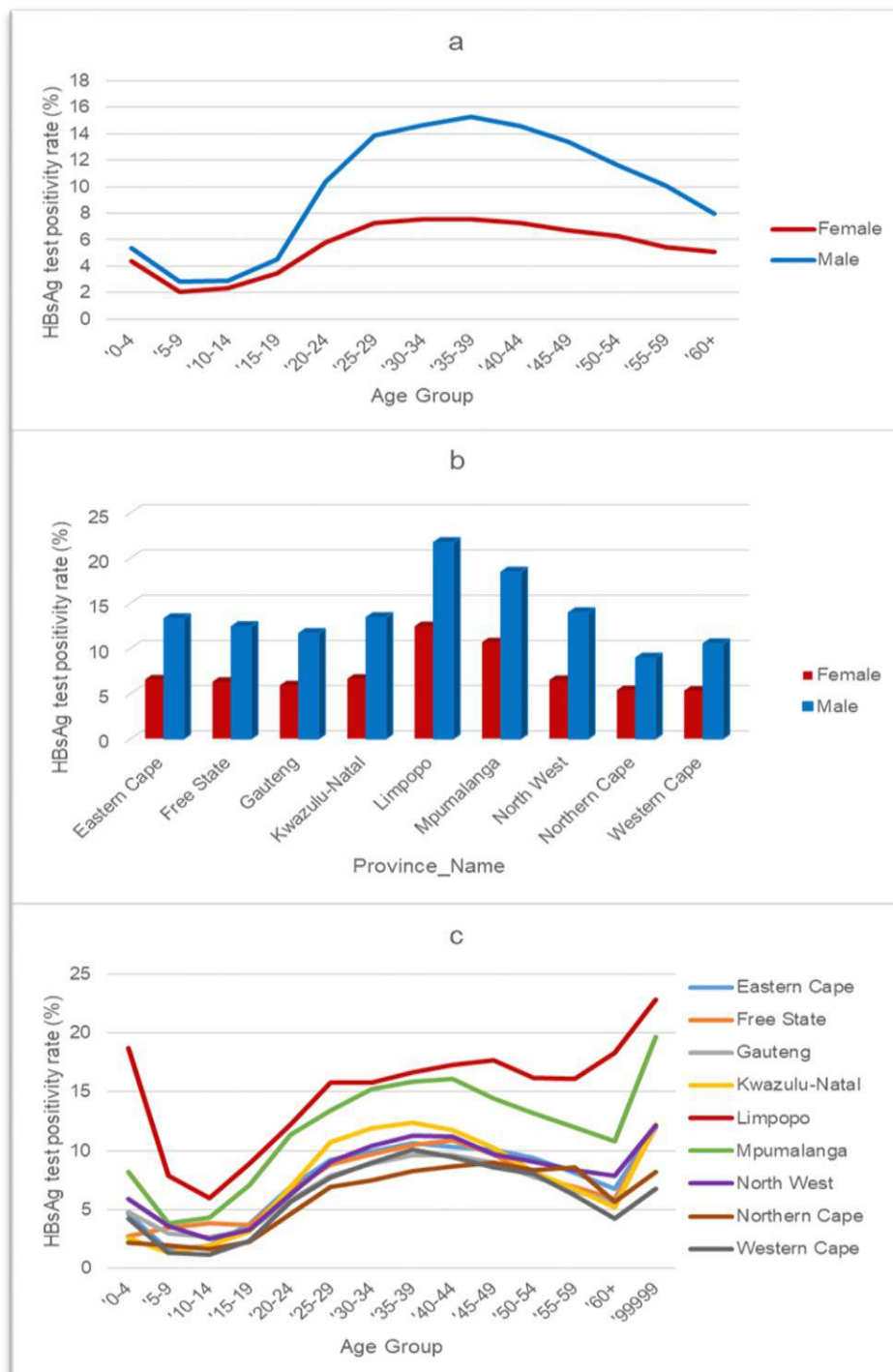


Figure 3.1: National HBsAg test positivity rates: a) by age group per gender, b) by province per gender, and c) by age group per province

The HBsAg test positivity rates among males were higher than females in all age groups, slightly above females at ages 0 to 19 years, almost double the rate in females at ages 20 to 34 years and 45 to 59 years, and just over double the rate in females at ages 35 to 44 years (Figure 3.1a). Provincially, we saw a similar picture, with the HBsAg test positivity rates higher among males in all provinces, almost double the rates in females in Free State, Gauteng, and Western Cape, and just over double the rates in females in Eastern Cape, KwaZulu-Natal and North West Provinces (Figure 3.1b). Among all age groups, the HBsAg test positivity rates were highest in Limpopo Province, followed by Mpumalanga Province (Figure 3.1c).

3.3.2.1 HBsAg positive cases under five years old

These results have been included as Table 3 of the published manuscript: (<https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10519597/table/pgph.0000992.t003/?report=objectonly>). The link to the manuscript is provided in section 3.1.

The Stata log file, which contains a record of the executed commands and their corresponding outputs is provided as Appendix 3.3, and includes tables on the distribution of cases under five years old by gender, province, district and age in one-year intervals. The HBsAg test positivity rates in one-year age intervals, stratified by province and gender are illustrated in Figure 3.2 (a and b).

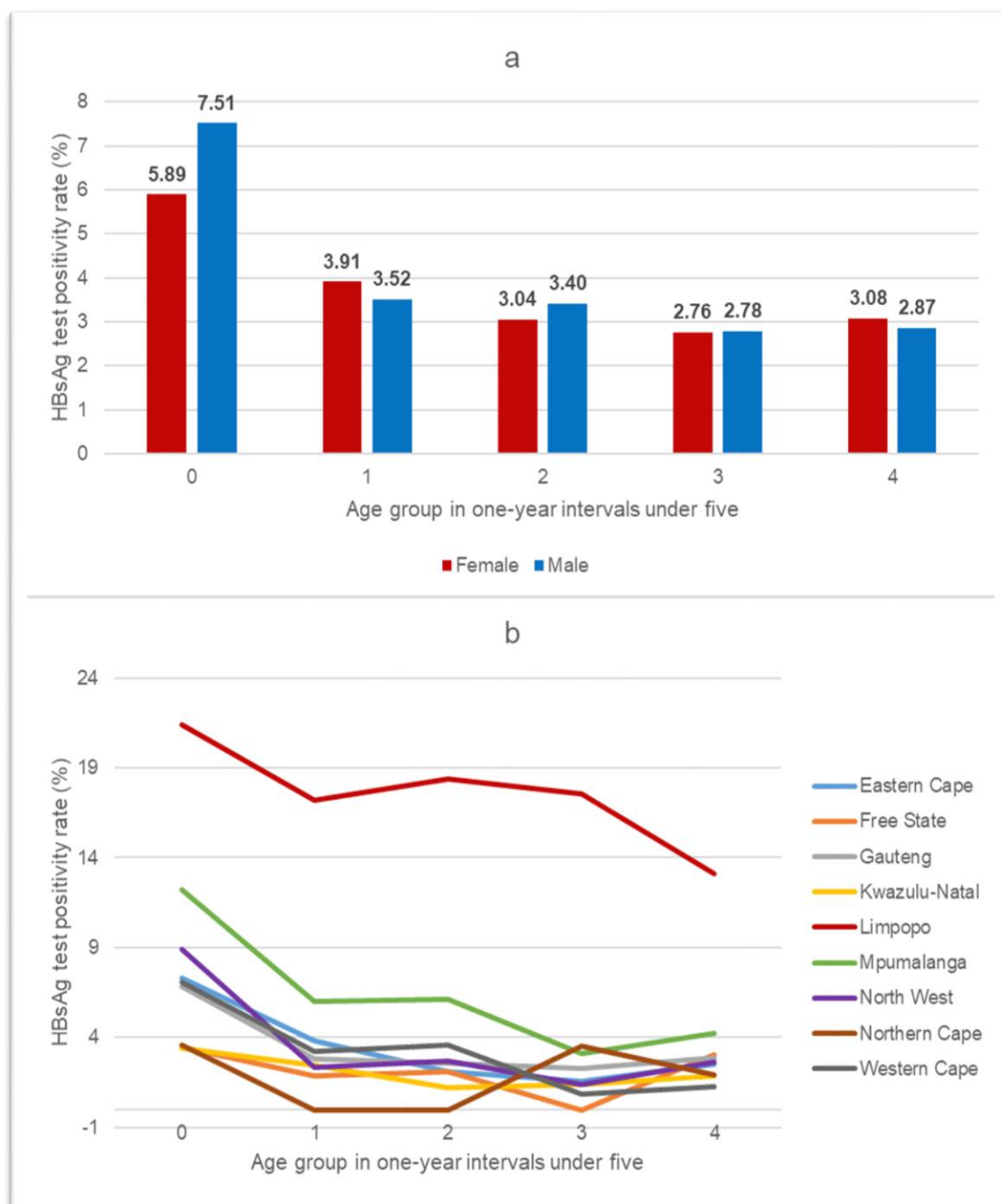


Figure 3.2: HBsAg test positivity rates among children under five years in one-year age intervals: a) by gender and b) by province

Among children under five years old, the HBsAg test positivity rates were higher in males at ages less than one year and two years old, similar between males and females at three years of age and higher among females at ages one year and 4 years old (Figure 3.2a). At a provincial level, the HBsAg test positivity rates were much higher in Limpopo an all children under five years old (Figure 3.2b). After Limpopo, rates were highest in Mpumalanga Province in four of the five age groups, except for children who were three years old, with the second highest in Northern Cape Province Figure 3.2b).

3.3.2.2 HBsAg positive cases among females of child-bearing age (15 to 49 years old)

From the 2015-2019_HBsAg_positive_cases.dta file (176,530 cases), we identified 67,234 females 15 to 49 years old who tested positive for HBsAg (Moonsamy, Pillay and Prabdhial-Sing 2023). From the 2015-2019_HBsAg_All_cases.dta file, we identified 979,421 woman 15 to 49 years old who were tested for HBsAg, giving a test positivity rate of 6.86% among females of child-bearing age.

The Stata log file, which contains a record of the executed commands and their corresponding outputs is provided as Appendix 3.4, and includes tables on the distribution of females of child-bearing age by province, district and five-year age groups. The HBsAg test positivity rates among females of child-bearing age per province and age group in five-year intervals are illustrated in Figure 3.3 (a and b).

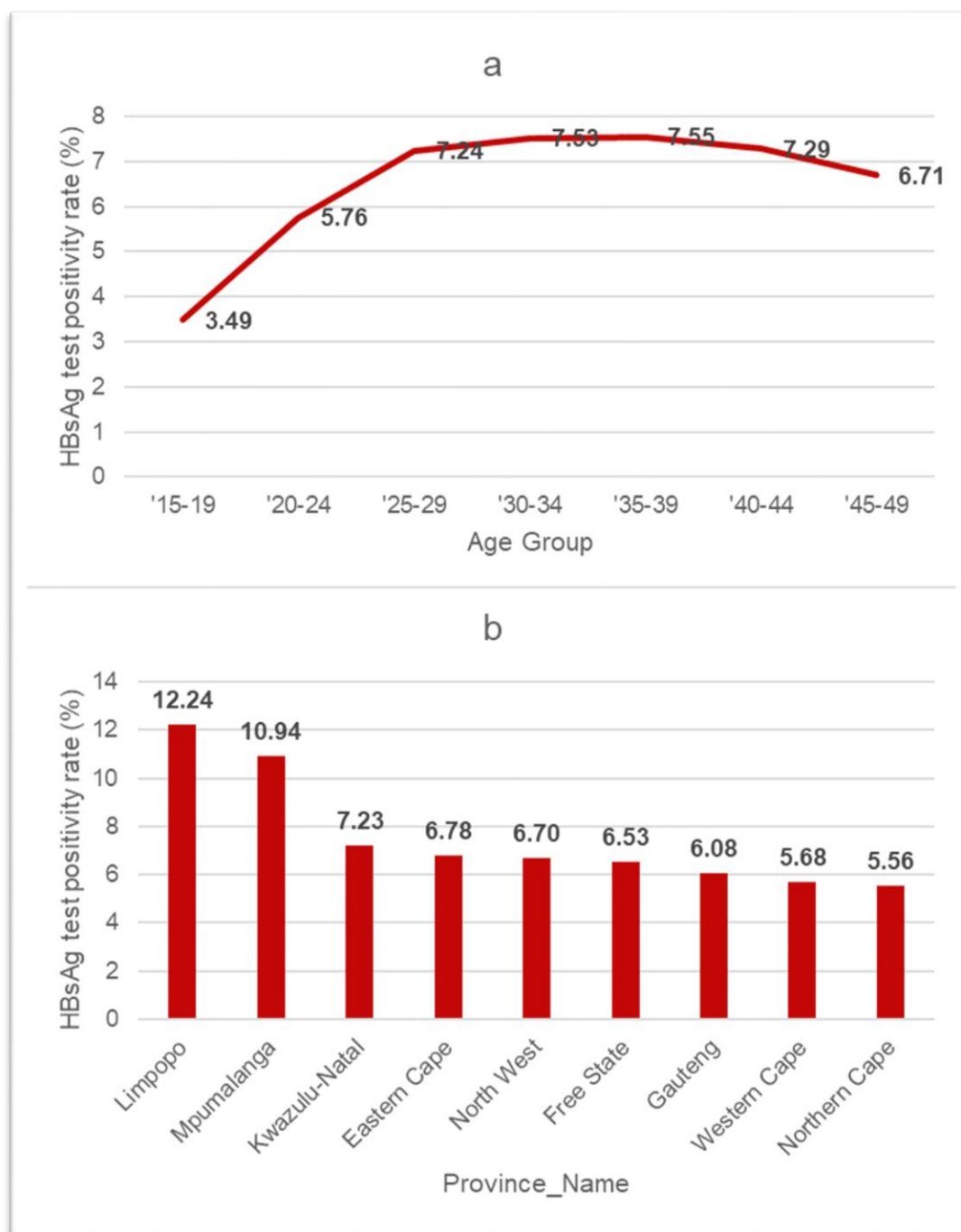


Figure 3.3: HBsAg test positivity rates among females of child-bearing age: a) by defined five-year age groups and b) by province

The HBsAg test positivity rate among females of child-bearing age was highest among females 35 to 39 years old, followed by 30 to 34 years old, 40 to 44 years old and 25 to 29 years old, all above 7.00% (Figure 3.3a). Rates were lowest among females 15 to 19 years old (Figure 3.3a). Provincially, the HBsAg test positivity rate was highest in Limpopo Province followed by Mpumalanga Province, both above 10.00% (Figure 3.3b). The HBsAg test positivity rates in all other provinces were between 5.60% and 7.24% (Figure 3.3b).

3.3.3 Registry of chronic hepatitis B cases

The 2015-2019_HBsAg_All_Positive.dta file contained 232,551 records. Among these, there were 94,450 records of cases with multiple HBsAg positive tests. On merging the duplicate records, we obtained a line list of 38,429 cases with multiple HBsAg positive tests. Following importation of the line list of 38,429 cases into Stata, we identified 11,355 cases who had two positive HBsAg tests with samples collected ≥ 180 days apart. These steps have been included in Figure 1 of the published manuscript, accessible online via the following link: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10519597/figure/pgph.0000992.g001/>. The link to the manuscript is provided in section 3.1.

The Stata log file, which contains a record of the executed commands and their corresponding outputs is provided as Appendix 3.4, and includes tables on the distribution of chronic HBV cases by gender, province, district and age group. The proportion of chronic HBV cases identified among HBsAg positive cases per province and age group, both stratified by gender are illustrated in Figure 3.4 (a and b).

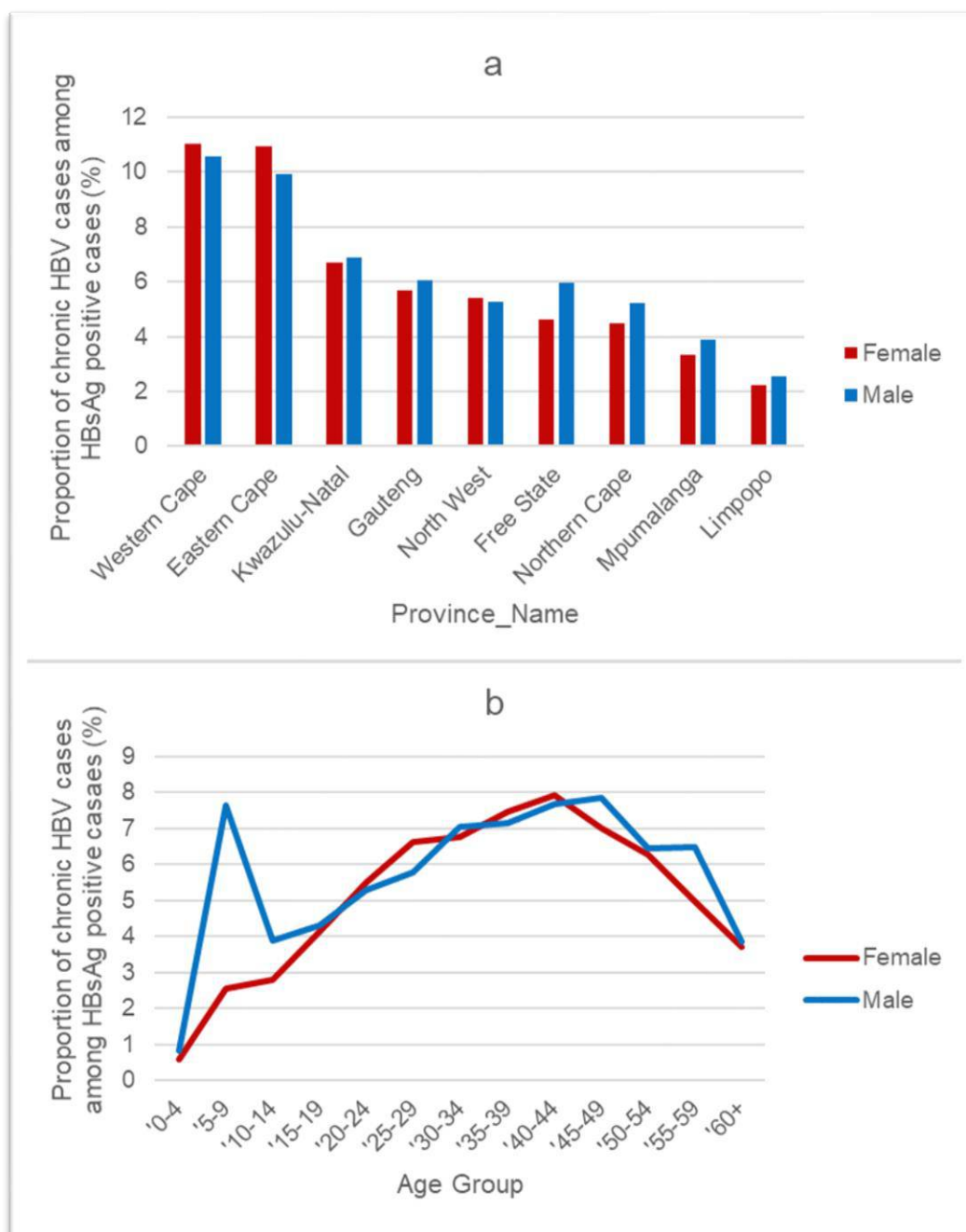


Figure 3.4: Proportion of HBV chronic cases among HBsAg positive cases: a) per province by gender, and b) per age group by gender

The rates of chronic HBV infection among HBsAg positive cases were highest in Western Cape and Eastern Cape Provinces, with higher rates in females in both provinces (Figure 3.4a). Apart from North West Province, the rates of chronic HBV infection among HBsAg positive cases were higher among males in all other provinces (Figure 3.4a). At ages 0 to 19 years, 30 to 34 years, and 45 years and above, the rates of chronic HBV infection among HBsAg positive cases were higher in males compared to females, with rates higher among females at ages 20 to 29 years and 35 to 44 years (Figure 3.4b).

3.3.4 Registries of cases who cleared HBsAg and cases who transitioned from HBsAg negative to HBsAg positive

From the 2015-2019_HBsAg_All_Records.dta file of 2,370,723 records, we deleted 6,211 equivocal records and maintained 2,364,512 records. On tagging UID duplicates, we identified 1,655,468 cases who were tested once only, and on tagging duplicates based on the date of birth, hospital identification and testing facility, we identified 16 cases who were tested once only. On deleting the records of cases who were tested once only, we maintained a dataset of 709,028 records. Following exportation into an Excel file and merging the duplicates, we obtained a dataset of 297,267 cases who had been tested at least twice over the five years. On executing commands to identify cases who tested positive throughout (Group_P), cases who tested negative throughout (Group_N), and cases who tested both positive and negative (Group_M), we identified 36,193 cases in Group_P, 252,429 cases in Group_N and 8,645 cases in Group_M. On executing commands to identify the testing patterns of cases within Group_M, we identified 73 cases who tested HBsAg negative between an initial and last positive test, 3,003 cases with an initial negative and last positive test, and 5,569 cases who tested negative after testing HBsAg positive. Among the 5,569 cases, we identified 4,905 cases with an initial positive and last negative HBsAg test and 664 cases who tested HBsAg positive in-between an initial and last negative test.

These steps have been included in Figure 1 of the published manuscript: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10519597/figure/pgph.0000992.g001/>. The link to the manuscript is provided in section 3.1.

The Stata log file, which contains a record of the executed commands and their corresponding outputs is provided as Appendix 3.5, and includes tables on the distribution of cases in Group_P, Group_N and Group_M by gender, province, district and age group. The proportion of cases who transitioned from HBsAg negative to HBsAg positive, using the total cases tested for HBsAg as the denominator, by province and age group, both stratified by gender, is shown in Figure 3.5 (a and b).

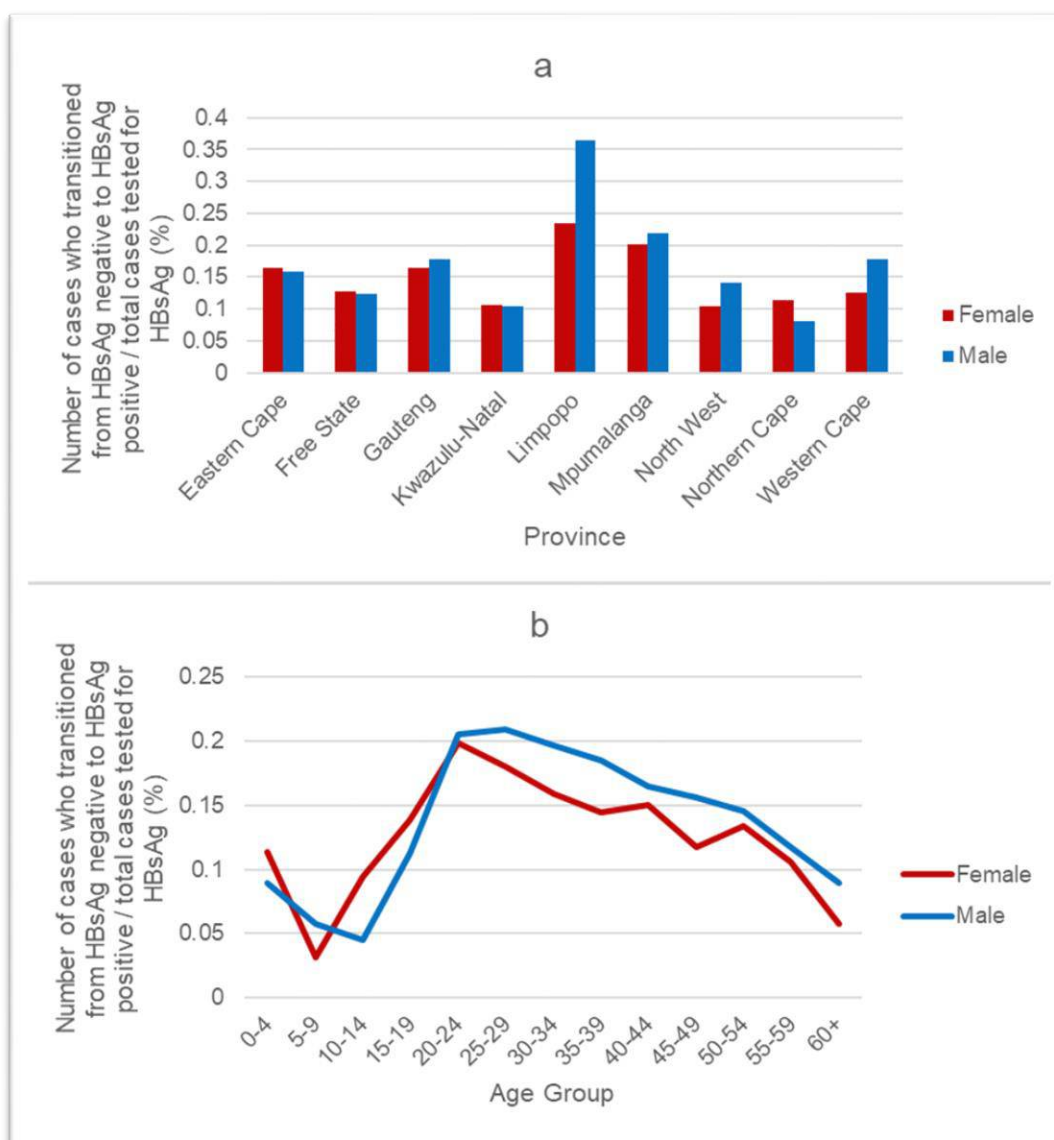


Figure 3.5: Percentage of cases who transitioned from HBsAg negative to HBsAg positive

Among cases who transitioned from HBsAg negative to HBsAg positive, the rates were higher among females in Eastern Cape, Free State, KwaZulu-Natal and Northern Cape Provinces, and higher among males in all other provinces, notably higher in Limpopo province (Figure 3.5a). By age group, we saw higher rates among males at ages five to nine years and 20 years and above (Figure 3.5b).

Table 3.4 shows the gender and age group predominance among testing patterns of cases in Group_M.

Table 3.4: Gender and Age Group predominance among testing patterns of cases who tested positive and negative for HBsAg, 2015 to 2019

Testing Patern	Total Number	Gender		Age Group	
		Predominant	Percentage	Predominant	Percentage
+ → -*	4,905	Females	59.98%	20-44 years	74.41%
- → + → -**	664	Females	62.35%	20-44 years	75.45%
- → +***	3,003	Females	59.01%	20-44 years	77.26%
+ + +****	36,193	Males	51.63%	25-44 years	69.30%
<i>*Cases who tested positive initially and negative subsequently</i> <i>**Cases who tested positive inbetween an initial and last negative test</i> <i>***Cases who tested negative initially and positive subsequently</i> <i>****Cases who tested positive throughout the five years</i>					

3.3.5 Registries of total cases tested for HBeAg, HBeAg positive cases, and HBeAg cases coupled with HBsAg positive and HBV chronic cases

From the 2015-2019_HepatitisB_All_Records.dta file of 6,315,380 records, we identified 107,433 valid HBeAg records. On execution of the deduplication commands, we obtained a dataset of 84,463 cases who were tested for HBeAg. From the 2015-2019_HBeAg_Valid_Records.dta file, there were 34,005 positive HBeAg records and following deduplication, we obtained a dataset of 25,796 HBeAg positive cases, giving an HBeAg test positivity rate of 30.54%. The Stata log file, which contains a record of the executed commands and their corresponding outputs is provided as Appendix 3.6, and includes tables on the distribution of the total cases tested for HBeAg and HBeAg positive cases by gender, province, district and age group.

On merging the total cases tested for HBeAg with the HBsAg positive cases, we identified 65,551 HBsAg positive cases who had been tested for HBeAg. The distribution of HBeAg results among HBsAg positive cases is Figure 2 of the published manuscript, accessible online via the following link: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10519597/figure/pgph.0000992.g002/>. On merging the total cases tested for HBeAg with the chronic HBV dataset, we identified 5,824 chronic HBV cases who had been tested for HBeAg. The distribution of HBeAg results among chronic HBV cases is Figure 4 of the published manuscript, accessible online via the following link: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10519597/figure/pgph.0000992.g004/>.

The Stata log files, which contain a record of the executed commands and their corresponding outputs, on merging the HBeAg results with the HBsAg positive cases and chronic HBV cases, are provided as Appendix 3.7 and Appendix 3.8 respectively. Both appendices include tables on the distribution of the cases by gender, province, district and age group, and results of statistical analyses between males and females. The online link to the manuscript is provided in section 3.1.

HBeAg positivity among HBsAg positive cases and chronic HBV cases with available HBeAg results at a national level is shown in Table 3.5.

Table 3.5: HBeAg positivity among HBsAg positive cases and chronic HBV cases with available HBeAg results

Label	Description	HBsAg positive cases	Chronic HBV cases
A	Total number	176,530	11,355
B	Available HBeAg results	65,551	5,824
C	HBeAg positive results	24,839	2,461
D	Percentage HBeAg positivity (C/B)	37.89%	42.26%

Among the 1,131 cases under one year old who were HBsAg positive, 78 (6.90%) were HBeAg positive, and among the 67,234 females of child-bearing age who were HBsAg positive, 9,229 (13.73%) were HBeAg positive (Moonsamy, Pillay and Prabdhial-Sing 2023).

The HBeAg positivity rates among HBsAg positive cases by gender and age group, and by province and gender are illustrated in Figure 3.6.

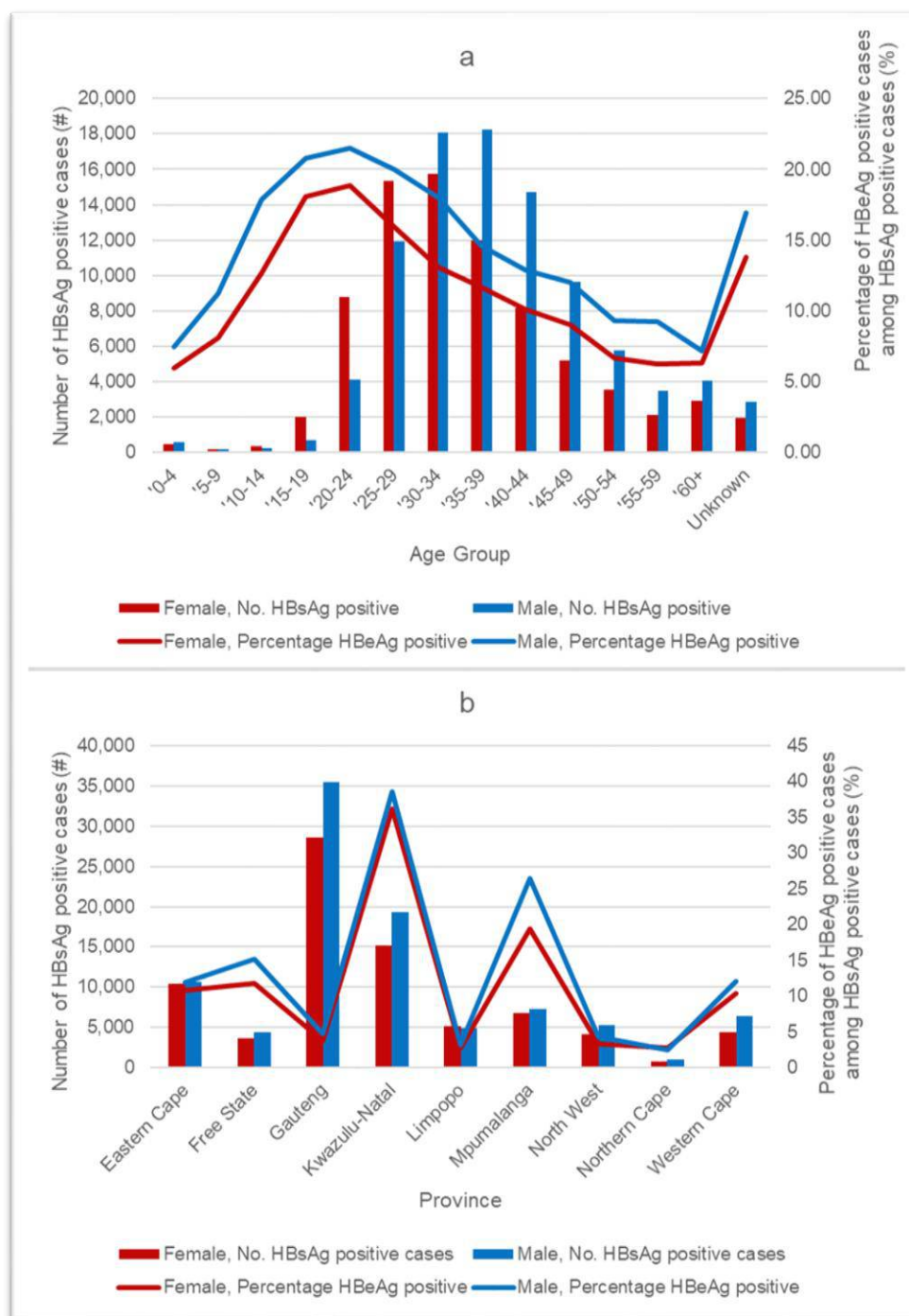


Figure 3.6: HBeAg positivity rate among HBsAg positive cases, 2015 to 2015: a) by age group and gender and b) by province and gender

The distribution of HBsAg and HBeAg positive cases by age group stratified by gender, as well as statistical differences between males and females by age group is illustrated in Figure 3.6a above and provided as Table 1 of the published manuscript, accessible online via the following link: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10519597/table/pgph.0000992.t001/?report=objectonly> (Moonsamy, Pillay and Prabodial-Sing 2023). The distribution of HBsAg and HBeAg positive cases by province is illustrated in Figure 3.6b above and provided as Table 2 of the published manuscript, accessible online via the following link: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10519597/table/pgph.0000992.t002/?report=objectonly> (Moonsamy, Pillay and Prabodial-Sing 2023). The distribution of HBsAg (active HBV infections) and HBeAg positive cases by province stratified by gender, as well as statistical differences between males and females per province is provided as Supplementary Table 2 of the published manuscript, accessible online via the following link: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10519597/bin/pgph.0000992.s002.pdf> (Moonsamy, Pillay and Prabodial-Sing 2023). Active HBV infections per 100,000 province population are illustrated in Figure 3 of the published manuscript, accessible online via the following link: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10519597/figure/pgph.0000992.g003/> (Moonsamy, Pillay and Prabodial-Sing 2023). These results have also been described and discussed in the publication (Moonsamy, Pillay and Prabodial-Sing 2023). The link to the manuscript is provided in section 3.1.

The HBeAg positivity rate among chronic HBV cases by gender and age group, and by province and gender are illustrated in Figure 3.7.

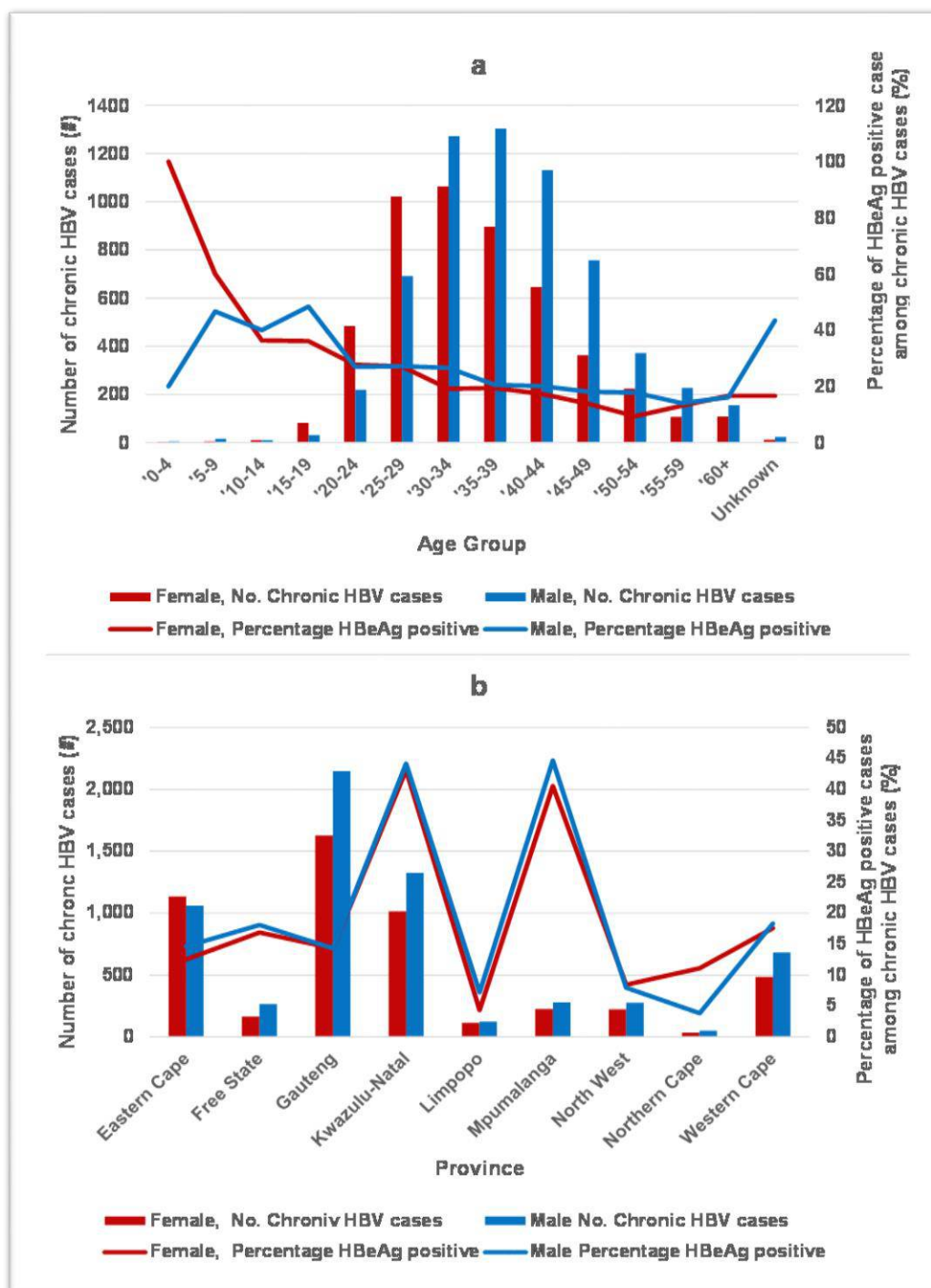


Figure 3.7: HBeAg positivity rate among chronic HBV cases, 2015 to 2015: a) by age group and gender and b) by province and gender

The distribution of chronic HBV cases and HBeAg positive chronic cases by age group stratified by gender, as well as statistical differences between males and females by age group is illustrated in Figure 3.7a above and provided as Table 4 of the published manuscript, accessible online via the following link: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10519597/table/pgph.0000992.t004/?report=objectonly> (Moonsamy, Pillay and Prabdhial-Sing 2023). The distribution of chronic HBV infections and HBeAg positive chronic cases by province stratified by gender, as well as statistical differences between males and females per province is provided as Supplementary Table 3 of the published manuscript, accessible online via the following link: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10519597/bin/pgph.0000992.s003.pdf> (Moonsamy, Pillay and Prabdhial-Sing 2023). Chronic HBV infections per 100,000 province population are illustrated in Figure 5 of the published manuscript, accessible online via the following link: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC10519597/figure/pgph.0000992.g005/> (Moonsamy, Pillay and Prabdhial-Sing 2023). These results have also been described and discussed in the publication (Moonsamy, Pillay and Prabdhial-Sing 2023). The link to the manuscript is provided in section 3.1.

3.4 SUMMARY AND DISCUSSION

We conducted rigorous analysis of nationwide laboratory data on HBsAg and HBeAg on from 2015 to 2019. The primary objective was to identify the number of cases with active HBV infection (HBsAg positive) and assess their HBeAg status. Among all active HBV infections, we went further to identify those individuals with chronic HBV infection and assess their HBeAg status. Over this five-year period, we had a total of 6,315,380 hepatitis B records. These records included 2,370,723 valid HBsAg records and 107,433 valid HBeAg records (Moonsamy, Pillay and Prabdhial-Sing 2023).

The key findings, related discussions and limitations have been addressed in detail in the published manuscript, accessible online via the following link: [Hepatitis B infection status among South Africans attending public health facilities over a five-year period: 2015 to 2019 - PubMed \(nih.gov\)](#). Below, we highlight a additional key observations and limitations.

The HBsAg test positivity rate of 9.02% relates to a high HBV endemicity in South Africa, even after 20 years since the introduction of the HBV vaccine into South Africa's EPI schedule (Hou, Liu and Gu 2005; Weinbaum *et al.* 2008; Ott, Stevens, Groeger and Wiersma 2012; MacLachlan and Cowie 2015; World Health Organisation 2017b).

Our analysis of cases that transitioned from testing HBsAg positive to HBsAg negative, suggesting resolution of HBV infection, revealed a higher prevalence among females, and therefore complements previous studies that have reported a higher probability of females clearing HBV infection in comparison to males (Hyams 1995; Koulentaki *et al.* 1999; Robinson *et al.* 2005; Tsay *et al.* 2009b; Ruggieri, Gagliardi and Anticoli 2018; Msomi *et al.* 2020b; Xu *et al.* 2023).

The finding that the majority of active HBV infections were among individuals born before 1995 was not unexpected as hepatitis B was highly endemic in South Africa then (Burnett, Kramvis, Dochez and Meheus 2012).

Among individuals who were vaccine eligible as infants, we suspect a proportion were vertically infected from their mothers prior to receiving the HBV vaccine.

Over and above the reported limitations on the use of the NHLS CDW data, these data often comes from specific populations such as hospital patients or individuals undergoing routine screening and this can result in a biased sample

that does not accurately represent the general population. Furthermore, laboratory tests for HBV, such as serological assays, vary in sensitivity and specificity and errors or variations in testing may affect the reliability of prevalence and incidence estimates. Laboratory data used for our analyses might have been incomplete or missing for some individuals due to issues like loss to follow-up or errors in data collection and this may influence the data analysis outcomes. We acknowledge that factors such as age, gender, socioeconomic status, and other health conditions can influence HBV infection status and although our data were stratified by age and gender, we did not consider other factors such as socioeconomic status and confounding health conditions. Inconsistent or incomplete documentation of laboratory results can lead to inaccuracies in data analysis. Our data did not include information on HIV status, so we are unable to report separately on HBV prevalence among HIV-uninfected and HIV-infected individuals. In our analysis, we included low reactive (positive) results as true positives, acknowledging that some may have been false positives and could have influenced our overall findings; however, we chose to include them based on levels consistent with recent infection. The limitations outlined here and in the published manuscript are relevant to all chapters of this thesis that use the NHLS CDW data to inform on disease states, where applicable.

Further discussions related to HBV infection status among South Africans in the public health sector considered findings from other chapters within this thesis and are included in Chapter 9 (Concluding Remarks).

**CHAPTER FOUR (OBJECTIVE 2): ANNUAL
PREVALENCE AND INCIDENCE RATES OF
HEPATITIS B VIRUS INFECTION IN THE
PUBLIC HEALTH SECTOR OF SOUTH AFRICA,
2015 TO 2019**

4.1 INTRODUCTION

It is important to identify trends in the prevalence and incidence of a disease over time to be able to identify patterns of disease burden. Such analysis may assist to inform public health policies and be used to develop targeted interventions to reduce the risk of transmission and improve public health.

As we had a five year dataset of hepatitis B (introduced in Chapter 3), which included markers of disease prevalence (HBsAg) and disease incidence (anti-HBcIgM), we used this data to analyse annual HBV prevalence and incidence over the five years. Given that South Africa introduced the HBV vaccine into their EPI schedule in 1995, there should be fewer active HBV infections in individuals who were eligible for vaccination as infants as the majority (approximately 95%) would have been protected against hepatitis B following administration of the scheduled HBV vaccine doses at 6, 10, and 14 weeks of age, even if vaccine coverage rates were suboptimal (Walayat *et al.* 2015). Age group stratification of the data will assist to demonstrate such trends.

The key findings from this chapter have been incorporated into a published manuscript, attached as Appendix 4.1. The manuscript, titled "Prevalence and incidence rates of laboratory-confirmed hepatitis B infection in South Africa, 2015 to 2019," is accessible online through the following link: [Prevalence and incidence rates of laboratory-confirmed hepatitis B infection in South Africa, 2015 to 2019 - PubMed \(nih.gov\)](#). While some content in this chapter may overlap with the published manuscript, it also includes some additional information and insights. Furthermore, this chapter includes online links facilitating access to referenced figures and tables from the aforementioned manuscript.

4.2 METHODOLOGY

In order to determine the annual national and provincial prevalence and incidence for the period 2015 to 2019, we initiated our analysis using the 2015-2019_Hepatitis_B_All_Records.dta file created in Chapter 3 (section 3.2.2.2).

Methods to determine and analyse annual trends in prevalence and incidence over the period 2015 to 2019 have been included in the published manuscript. The online link to the manuscript is provided in section 4.1 and attached as Appendix 4.1. As the same data file utilised in Chapter 3 was used here, additional details can be found in Sections 3.2.1 to 3.2.3.

Regarding ethics approval, please refer to section 3.2.1.

4.3 RESULTS

For the period 2015 to 2019, the annual numbers of cases tested for HBsAg and anti-HBcIgM (referred to as HBCoreIgM in the figure) and the annual number of positive cases for both markers is illustrated in Figure 1 of the published manuscript, accessible online via the following link: <https://bmcpublichealth.biomedcentral.com/articles/10.1186/s12889-021-12391-3/figures/1>. The annual HBsAg test positivity rates per gender, age group and province is illustrated in Figure 2 of the published manuscript, accessible online via the following link: <https://pubmed.ncbi.nlm.nih.gov/34991533/#&gid=article-figures&pid=fig-2-uid-1>. The annual anti-HBcIgM test positivity rates per gender, age group and province is illustrated in Figure 4 of the published manuscript, accessible online via the following link: <https://pubmed.ncbi.nlm.nih.gov/34991533/#&gid=article-figures&pid=fig-4-uid-3>. The online link to the manuscript is provided in section 4.1.

Here, we included additional figures that were not generated for publication; however, the data used to generate these figures have been included as supplementary tables of the published manuscript and online links to these tables have been provided where applicable.

4.3.1 Prevalence of HBV infection 2015 to 2019

4.3.1.1 HBsAg prevalence per 100,000 population by gender, 2015 to 2019

Stratifying the annual HBsAg prevalence by gender, a similar prevalence curve per 100,000 gender population was seen between males and females from 2015 to 2019, consistently higher in males compared to females (Figure 4.1).

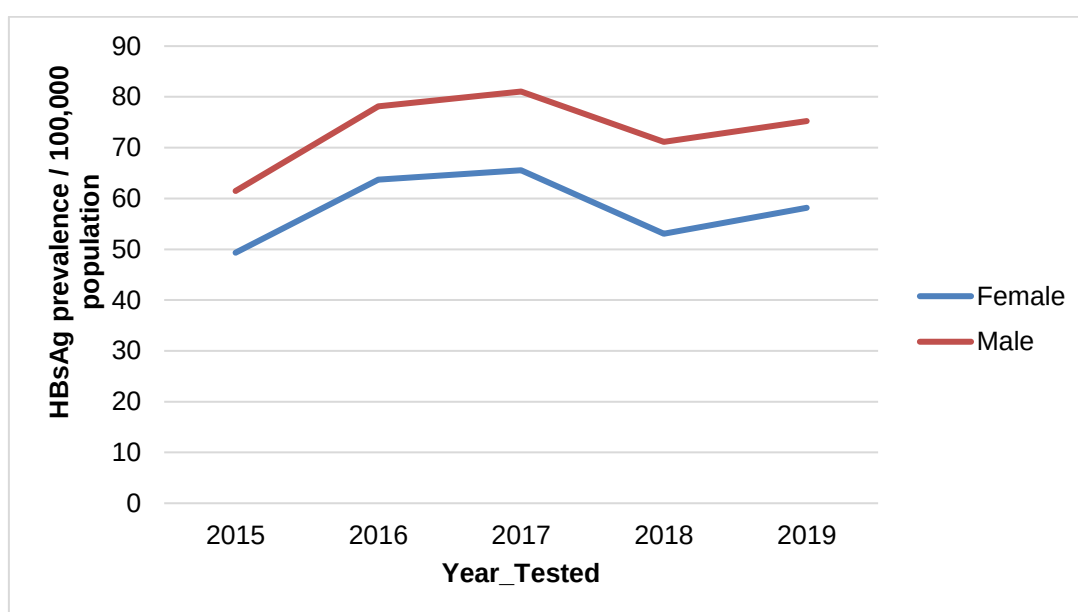


Figure 4.1: Annual prevalence of HBsAg per 100,000 population by gender, 2015 to 2019

This pattern was also observed when we compared the HBsAg test positivity rates between males and females over the five years, provided as Figure 2 of the published manuscript, accessible online via the following link:

<https://pubmed.ncbi.nlm.nih.gov/34991533/#&gid=article-figures&pid=fig-2-uid-1>.

4.3.1.2 HBsAg prevalence per 100,000 population by age group, 2015 to 2019

Stratifying the annual HBsAg prevalence per 100,000 population by age group, we observed the highest rates among individuals aged 35 to 39 years over all five years (Figure 4.2).

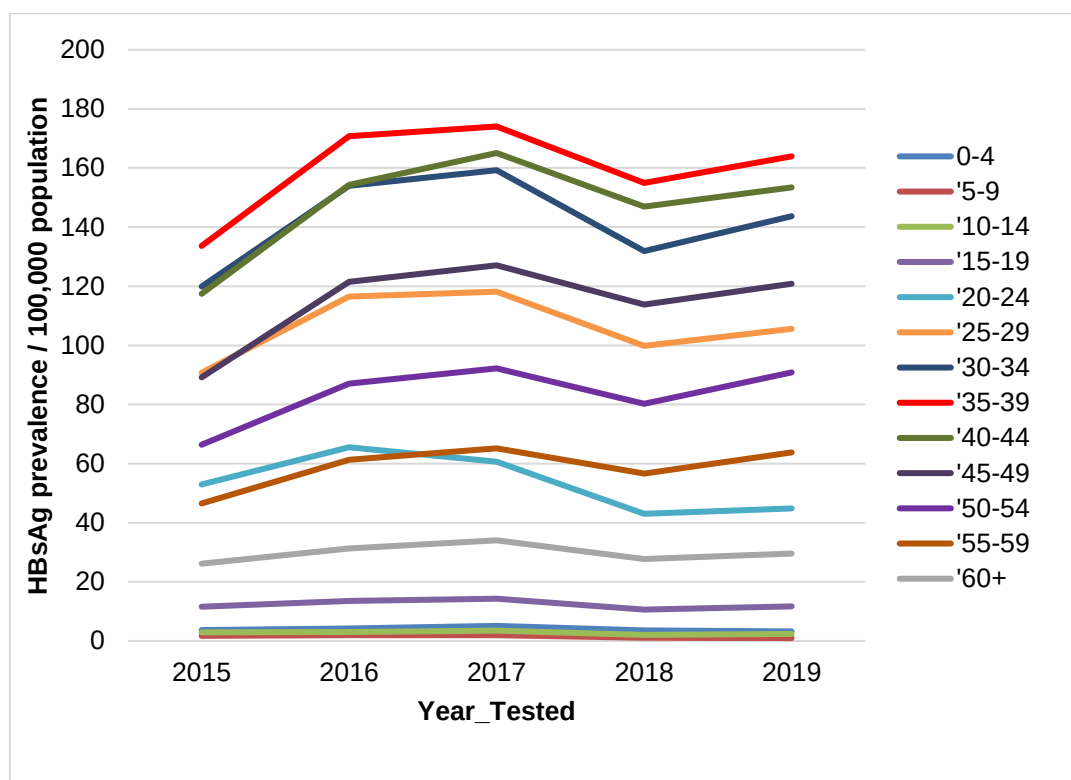


Figure 4.2: Annual prevalence of HBsAg positive cases by age group per 100,000 age-group population, 2015 to 2019

This was followed by individuals aged 30 to 34 years in 2015 and individuals aged 40 to 44 years from 2016 to 2019. From 2015 to 2019, the HBsAg prevalence per 100,000 population was lowest among individuals aged 5 to 9 years, followed by 10 to 14 years and 0 to 4 years (Figure 4.2).

4.3.1.3 HBsAg prevalence by province, 2015 to 2019

Stratifying the annual HBsAg prevalence by province, Gauteng had the highest prevalence from 2015 to 2019, averaging 96.2 / 100,000 population. Annual HBsAg prevalence per 100,000 population in all other provinces were inconsistent over the years (Figure 4.3).

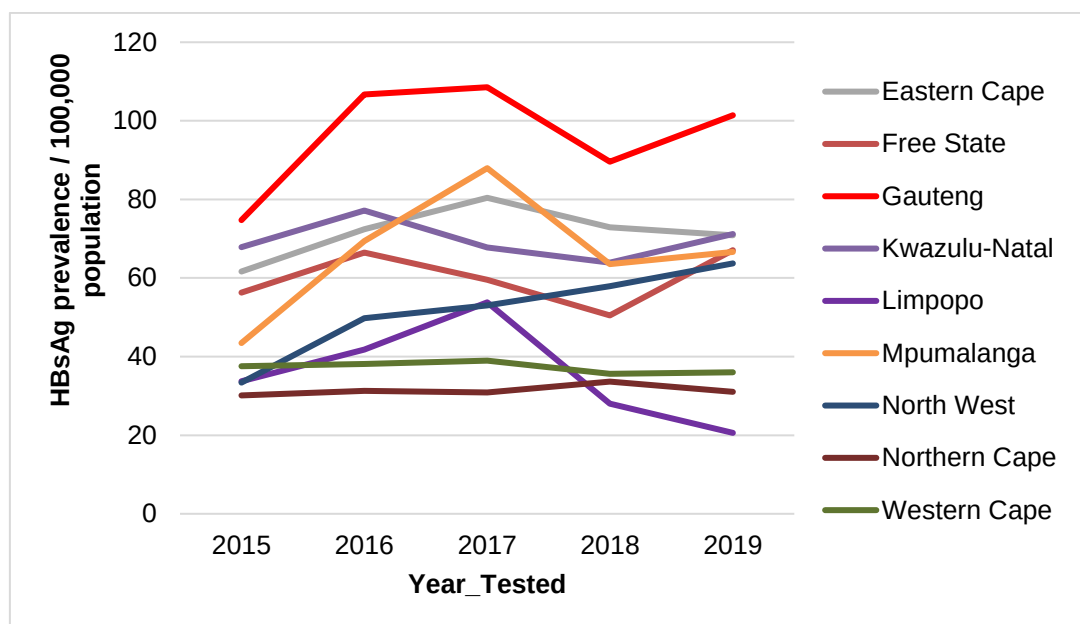


Figure 4.3: Annual HBsAg prevalence per 100,000 province population, 2015 to 2019

4.3.1.4 HBsAg prevalence per 100,000 population by province stratified by gender, 2015 to 2019

Prevalence of HBsAg per 100,000 population from 2015 to 2019 was mostly higher in males than females in all provinces (averaging 63.4 versus 50.8 / 100,000 population respectively), except for Limpopo in 2016 and 2017 where the prevalence among females (42.2 and 53.6 / 100,000 population respectively) was seen to be slightly higher than males (40.7 and 53.1 / 100,000 population respectively) (Figure 4.4).

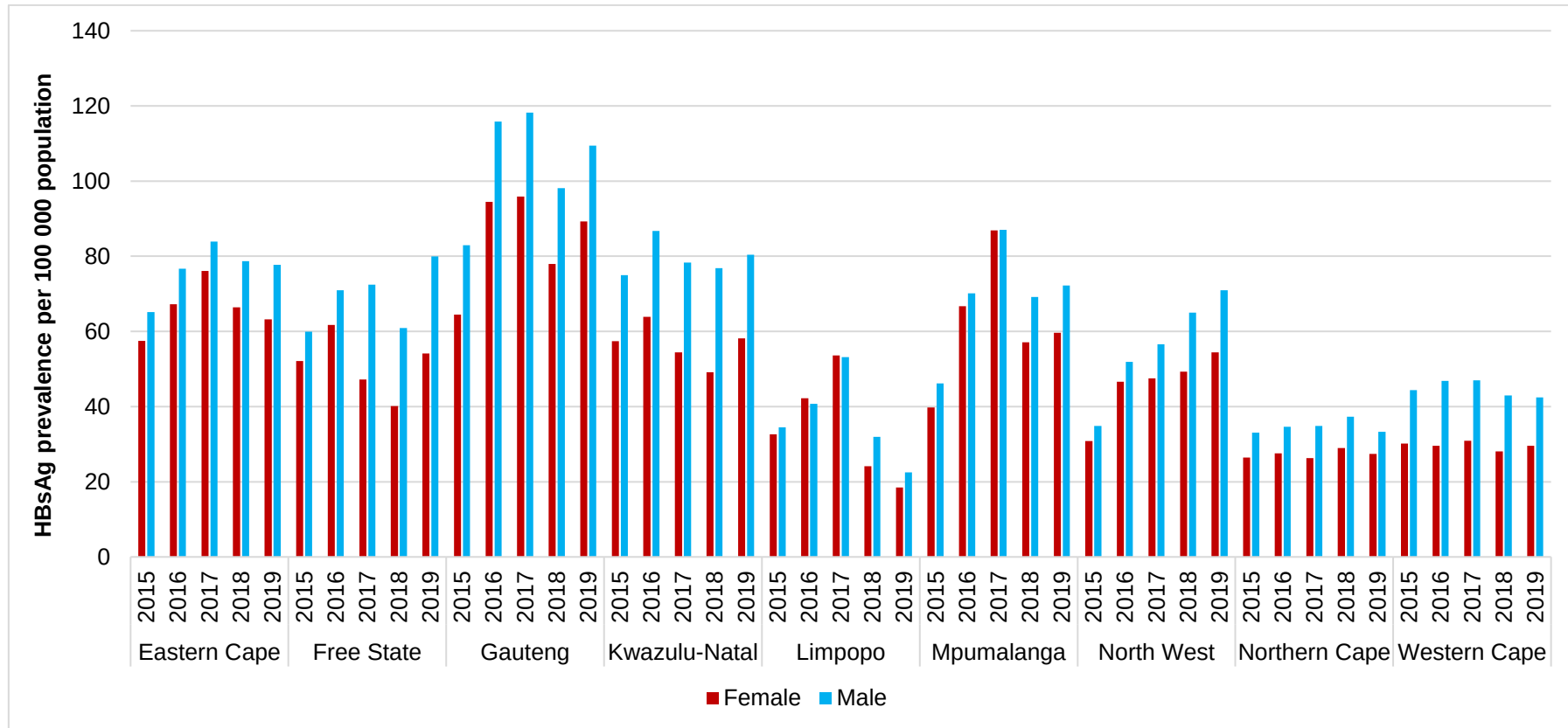


Figure 4.4: Annual HBsAg prevalence per 100,000 population per province stratified by gender, 2015 to 2019

The data used to generate Figures 4.1 to 4.4 are provided as Supplementary Table 2 of the published manuscript, accessible online via the following link: https://static-content.springer.com/esm/art%3A10.1186%2Fs12889-021-12391-3/MediaObjects/12889_2021_12391_MOESM2_ESM.pdf.

The Stata log file, attached as Appendix 4.3, provides a comprehensive record of the executed commands and their corresponding outputs that were used to generate HBV prevalence rates.

4.3.2 Incidence of HBV infection 2015 to 2019

4.3.2.1 HBV incidence per 100,000 population by gender, 2015 to 2019

Stratifying the annual HBV incidence per 100,000 population by gender, females had a higher incidence than males in 2015 (6.3 versus 5.8 / 100,000 population respectively) and 2016 (6.9 versus 6.3 / 100,000 population respectively) (Figure 4.5). In 2017, HBV incidence was similar between females and males at 5.9 and 5.8 / 100,000 population respectively. However, in 2018 and 2019, females had a lower HBV incidence (3.7 and 3.1 / 100,000 population respectively) than males (3.9 and 3.7 / 100,000 population respectively). The overall HBV incidence per 100,000 population for the period 2015 to 2019 was similar between females and males at 5.2 and 5.1 / 100,000 respectively.

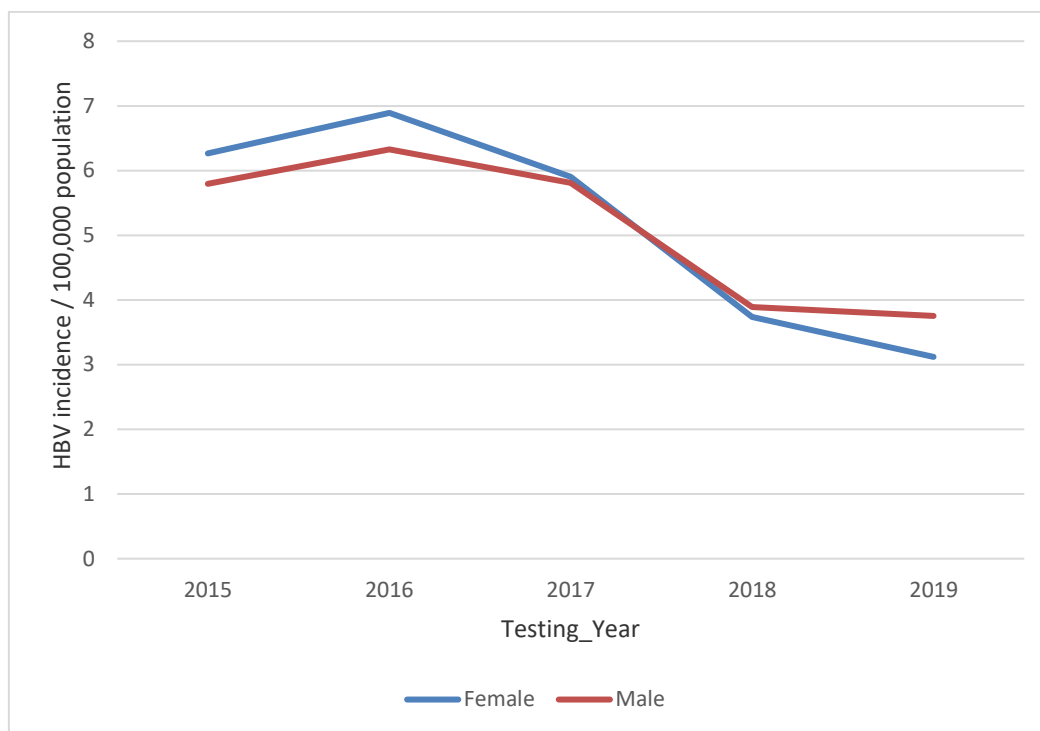


Figure 4.5: Annual HBV incidence per 100,000 population by gender, 2015 to 2019

When we compared HBV incidence per 100,000 population and anti-HBcIgM test positivity rates between males and females, we observed that the HBV incidence per 100,000 population was higher in females in 2015, 2016 and 2017 and higher in males in 2018 and 2019 (Figure 4.5). However, the anti-HBcIgM test positivity rates were consistently higher among males over the five years, as illustrated in Figure 4 of the published manuscript, accessible online via the following link: <https://pubmed.ncbi.nlm.nih.gov/34991533/#&gid=article-figures&pid=fig-4-uid-3>.

4.3.2.2 HBV incidence per 100,000 population by age group, 2015 to 2019

Stratifying the annual HBV incidence per 100,000 population by age group, incidence was highest in individuals aged 25 to 29 years over the five years, at 14.5, 16.3, 15.0, 9.6 and 9.3 / 100,000 population respectively (Figure 4.6).

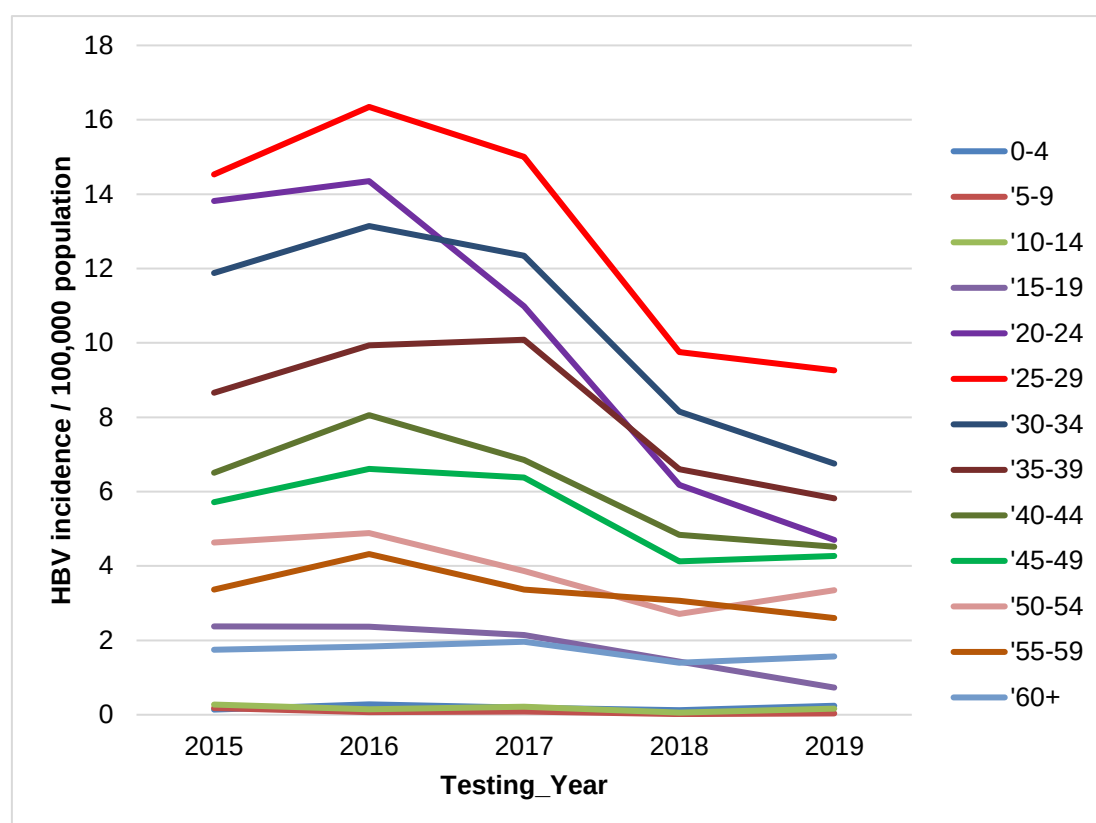


Figure 4.6: Annual HBV incidence by age group per 100,000 age-group population, 2015 to 2019

This was followed by individuals aged 20 to 24 years in 2015 and 2016 at 13.8 and 14.4 / 100,000 population respectively, and individuals aged 30 to 34 years in 2017, 2018 and 2019 at 12.3, 8.1 and 6.6 / 100,000 population respectively. From 2015 to 2019, individuals aged 5 to 9 years had the lowest overall HBV incidence at 0.1 / 100,000 population, followed by individuals aged 10 to 14 years and 0 to 4 years at 0.18 and 0.2 / 100,000 population respectively.

4.3.2.3 HBV incidence per 100,000 population by province, 2015 to 2019

Stratifying the annual HBV incidence by province, Eastern Cape had the highest incidence of HBV cases in 2015, 2016 and 2017 at 8.0, 9.2 and 12.4 / 100,000 population respectively (Figure 4.7). This was followed closely by Free State in 2015 and 2016 at 7.8 and 9.1 / 100,000 population respectively. In 2018 and 2019, HBV incidence was highest in Gauteng (5.8 / 100,000 population) and KwaZulu-Natal (6.2 / 100,000 population) respectively followed by Northern Cape in 2018 at 5.3 / 100,000 population and Gauteng in 2019 at 4.4 / 100,000 population. From 2015 to 2019, HBV incidence was seen to be lowest in Limpopo, followed by Western Cape and North West, averaging 1.6, 2.5 and 3.4 / 100,000 population respectively.

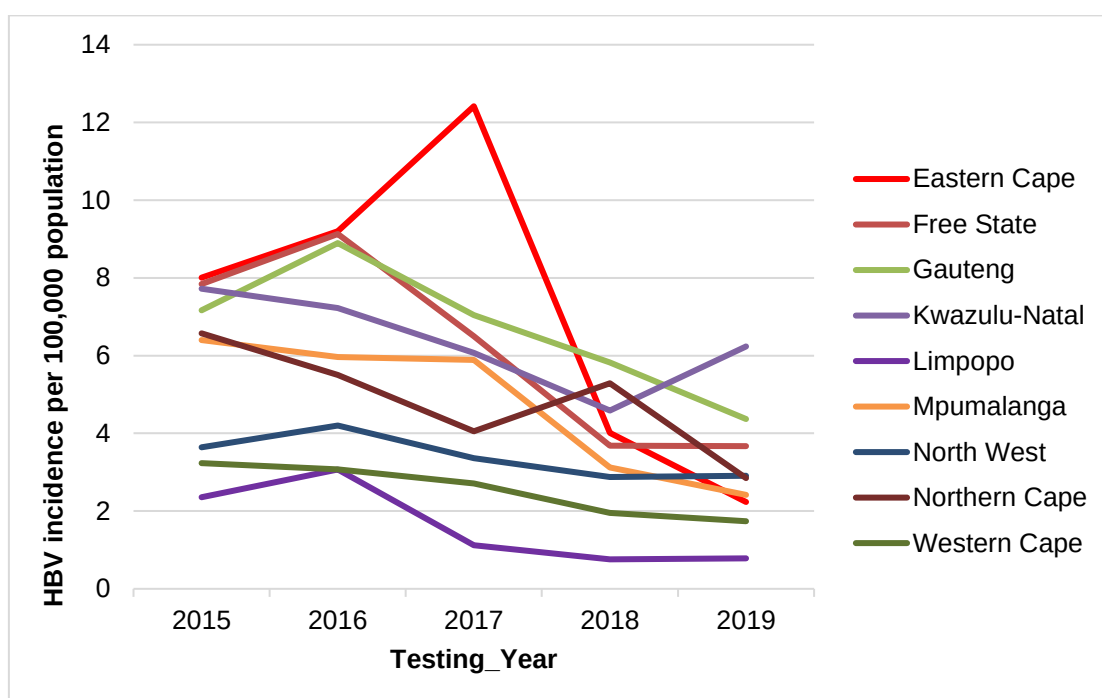


Figure 4.7: Annual HBV incidence per 100,000 per province, 2015 to 2019

4.3.2.4 HBV incidence per 100,000 population by province stratified by gender, 2015 to 2019

In Eastern Cape, Free State, KwaZulu-Natal and Limpopo, the average HBV incidence for the period 2015 to 2019 was higher in females (7.7, 6.6, 6.3 and 1.7 / 100,000 population respectively) than males (6.5, 5.6, 6.0 and 1.5 / 100,000 population respectively) (Figure 4.8). In Gauteng, North West, Northern Cape and Western Cape, males had a higher average HBV incidence (6.8, 3.4, 5.1 and 2.7 / 100,000 population respectively) than females (6.3, 3.3, 4.5 and 2.3 / 100,000 population respectively). The average HBV incidence in Mpumalanga was similar between females and males at 4.7 / 100,000 population.

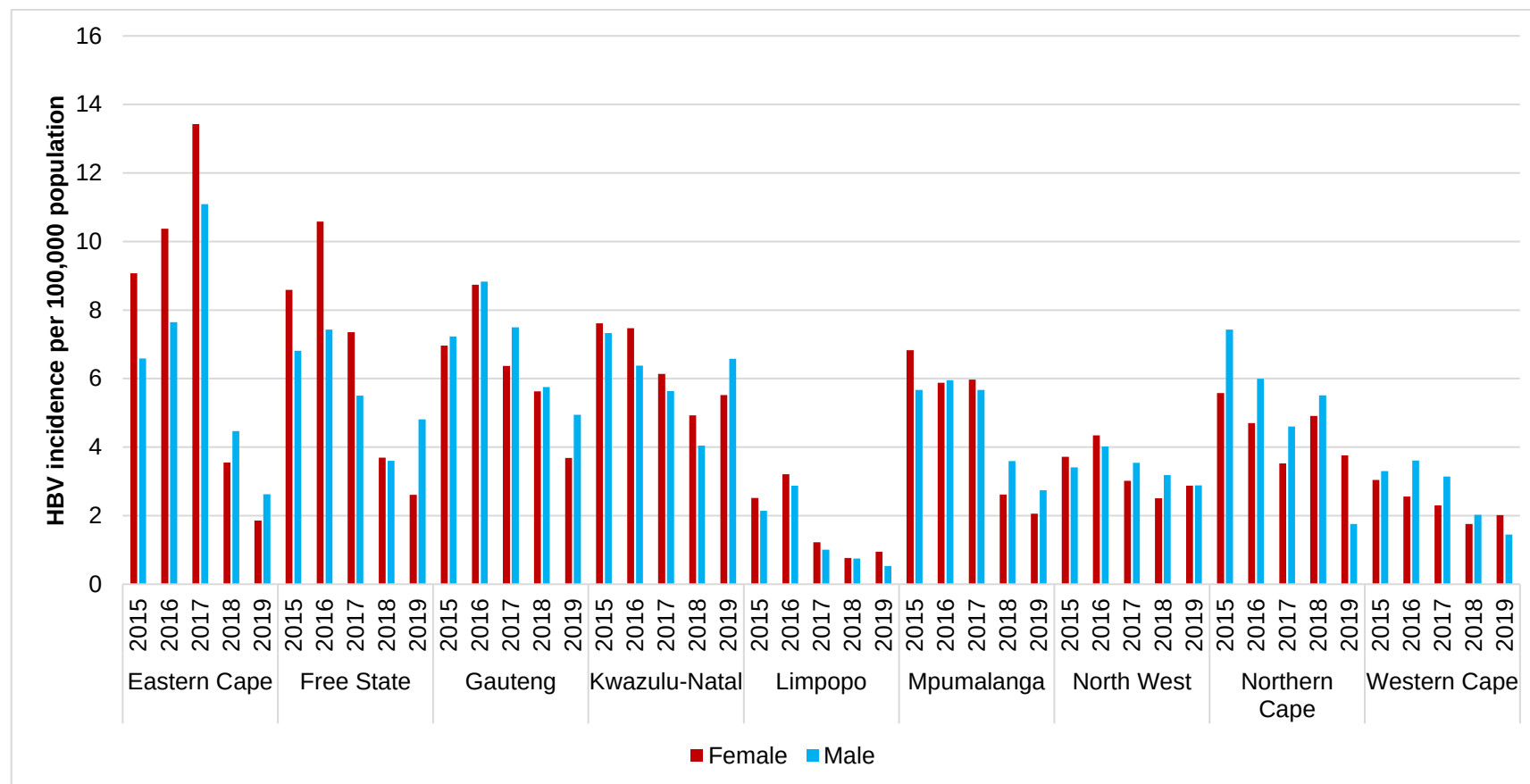


Figure 4.8: Annual HBV incidence per province stratified by gender per 100,000 gender population, 2015 to 2019

The data used to generate Figures 4.5 to 4.8 are provided as Supplementary Table 4 of the published manuscript, accessible online via the following link: https://static-content.springer.com/esm/art%3A10.1186%2Fs12889-021-12391-3/MediaObjects/12889_2021_12391_MOESM4_ESM.pdf.

The Stata log file, attached as Appendix 4.4, provides a comprehensive record of the executed commands and their corresponding outputs that were used to generate HBV incidence rates.

4.4 SUMMARY AND DISCUSSION

The prevalence and incidence rates, overall and stratified by gender, age group and province, have been summarized and discussed in detail in the published manuscript (Appendix 4.1). The online link to the manuscript is provided in section 4.1. Further discussions related to HBV prevalence and incidence rates of South Africa from 2015 to 2019 considered findings from other chapters within this thesis and are included in Chapter 9 (Concluding Remarks).

**CHAPTER FIVE (OBJECTIVE 3): HEPATITIS B
IMMUNITY AND SUSCEPTIBILITY STATUS
AMONG INDIVIDUALS ATTENDING PUBLIC
HEALTHCARE FACILITIES IN SOUTH AFRICA,
2015 TO 2019**

5.1 INTRODUCTION

As South Africa introduced the HBV vaccine into their standard EPI schedule in 1995 and national vaccination coverage data is available from the year 1997 (Table 2.3), evaluating the immunity conferred by the vaccine in individuals who were eligible for vaccination during infancy would provide valuable insights into South Africa's vaccination program. Furthermore, evaluating immunity status before the implementation of routine HBV vaccination would yield insights into the burden of HBV disease prior to 1995. These may be achieved through analyses of the anti-HBs and anti-HBcT serological markers (refer to Table 1.1) (Krajden, McNabb and Petric 2005). Evaluating immunity status also allows for determining susceptible populations, i.e. individuals who remain at risk of HBV infection; however, relying exclusively on anti-HBs and anti-HBcT outcomes may not offer an accurate representation of hepatitis B immunity or susceptibility status. This can be accomplished by incorporating HBsAg analysis alongside the assessment of anti-HBs and anti-HBcT (Table 5.1) (Shah *et al.* 2021). In addition, analyses of these markers will allow for the calculation of specific parameters for purposes of modelling the transmission dynamics of HBV (Chapter 7).

Table 5.1: Interpretation of HBsAg, anti-HBs and anti-HBcT markers to determine susceptibility and immunity status

Markers	Result	Interpretations	Source
HBsAg	-	Non-immune and susceptible to HBV infection.	(Shah <i>et al.</i> 2021)
anti-HBcT	-		
anti-HBs	-		
HBsAg	-	Immunity achieved following naturally acquired HBV infection	
anti-HBcT	+		
anti-HBs	+		
HBsAg	-	Immunity achieved following successful HBV vaccination	
anti-HBcT	-		
anti-HBs	+		

5.2 METHODOLOGY

5.2.1 Ethics statement

Refer to section 3.2.1.

5.2.2 Overview

We first describe analysis of the anti-HBs variable to obtain a dataset of all cases who had been tested for anti-HBs, followed by the same analysis using the anti-HBcT variable. We then merged the datasets of cases who were tested for anti-HBs with the dataset of cases who were tested for anti-HBcT to obtain a dataset of cases who had results available for both markers. We subsequently merged

the combined anti-HBs and anti-HBcT dataset to the 2015-2019_HBsAg_All_cases.dta file (created previously, 3.2.3.4) to obtain a dataset of cases with results available for all three markers. We used this dataset for subsequent analysis. Here, we also referenced some other Stata dataset (.dta) files created for the purposes of developing HBsAg registries (Chapter 3).

5.2.3 Development and analysis of a dataset of anti-HBs results

We initiated our analyses using the 2015-2019_HepatitisB_All_Records.dta file (refer to section 3.2.2.2). We tabulated the anti-HBs results variable and maintained records of all valid anti-HBs results (equivocal, negative, positive and low positive). We subsequently saved a file of these records (herein referred to as the 2015-2019_anti-HBs_Valid_Records_All.dta file). Using this file, we sorted the "TAKEN_DATE" variable in descending order first and then executed the two deduplication commands (Table 3.2) to obtain a file of the line list of cases who were tested for anti-HBs from 2015 to 2019. We saved a file of these cases (herein referred to as the 2015-2019_anti-HBs_All_Cases.dta file). The purpose of sorting the "TAKEN_DATE" variable in descending order prior to execution of the deduplication commands was to ensure we maintain the latest anti-HBs immunity results of a case as deleting duplicates maintains the first occurrence and deletes subsequent occurrences. Also, given that vaccine-induced immunity may wane over time, an individual may test negative for anti-HBs after testing positive at some point earlier and we would want to consider the negative results here when assessing immunity (Farooq and Sherman 2019). We used the 2015-2019_anti-HBs_All_Cases.dta file to select and maintain a file of all positive anti-HBs results (herein referred to as the 2015-2019_anti-HBs_Positive_Cases.dta file), and select and maintain a file of all anti-HBs negative results (herein referred to as the 2015-2019_anti-HBs_Negative_Cases.dta file).

5.2.4 Development and analysis of a dataset of anti-HBcT results

As we did for the anti-HBs variable, we initiated our analyses using the 2015-2019_HepatitisB_All_Records.dta file. We tabulated the anti-HBcT results variable and maintained records of all valid anti-HBcT results (equivocal, negative, positive and low positive). We subsequently saved a file of these records (herein referred to as the 2015-2019_anti-HBcT_Valid_Records_All.dta file). Using this file, we sorted the "TAKEN_DATE" variable in descending order first and then executed the two deduplication commands (Table 3.2) to obtain a file of the line list of cases who were tested for anti-HBcT from 2015 to 2019. We saved a file of these cases (herein referred to as the 2015-2019_anti-HBcT_All_Cases.dta file). The purpose of sorting the "TAKEN_DATE" variable in descending order prior to execution of the deduplication commands was to ensure we maintain the latest anti-HBcT immunity results of a case. Here we wanted to ensure that if an individual was infected and developed anti-HBcT antibodies during the study period, we maintain the positive results. We used the 2015-2019_anti-HBcT_All_Cases.dta file, to select and maintain a file of all positive anti-HBcT results (herein referred to as the 2015-2019_anti-HBcT_Positive_Cases.dta file), and select and maintain a file of all anti-HBs negative results (herein referred to as the 2015-2019_anti-HBcT_Negative_Cases.dta file).

5.2.5 Development of a combined dataset of anti-HBs and anti-HBcT results

On opening the 2015-2019_anti-HBs_All_Cases.dta and 2015-2019_anti-HBcT_All_Cases.dta files separately, we first checked to see if there were any UIDs of "-1" as more than one UID of "-1" in either or both files will generate an error given that it will not be unique. From both these files, we saved the "-1" UIDs separately and maintained files which excluded the "-1" UIDs. We then merged

the anti-HBs and anti-HBcT files which excluded the "-1" UIDs using the UID as the merge key. We did the same for the two files of "-1" UIDs but this time we used the variables of "DOB", "HOSPITAL_ID", and FACILITY_NAME" to merge the data. Once the datasets were merged, we identified cases that appeared in both the anti-HBs and anti-HBcT datasets and maintained two individual files of cases who had results for both tests, one for cases with unique UIDs and one for the cases with all "-1" UIDs.

5.2.6 Development and analysis of a combined dataset of anti-HBs, anti-HBcT and HBsAg results

We used the 2015-2019_HBsAg_All_cases.dta file to check for UIDs of "-1" and maintained a separate file of these UIDs for merging purposes. We subsequently obtained two files of cases with available HBsAg results, one excluding all UIDs of "-1" and one of all "-1" UIDs. We then merged the file of all HBsAg cases with unique UIDs with the file of cases who had available results for anti-HBs and anti-HBcT with unique UIDs, identified cases who had results available for all three markers and saved a dataset of these cases. We did the same for HBsAg cases with UIDs of "-1" and the anti-HBs and anti-HBcT dataset of UIDs of "-1". We then appended these datasets to obtain and save a complete dataset of cases who had results available for HBsAg, anti-HBs and anti-HBcT. As this file included equivocal (inconclusive) results, we subsequently deleted HBsAg, anti-HBs and anti-HBcT equivocal results to maintain a dataset of only positive and negative results as our final dataset for purposes of analysis.

We analysed the data to obtain three additional datasets: 1) cases who tested negative for all three markers, 2) cases who tested negative for HBsAg and positive for anti-HBs and anti-HBcT, and 3) cases who tested positive for anti-HBs and negative for HBsAg and anti-HBcT. We analysed these three datasets

as well as the dataset of all cases with available positive and negative results to determine the distribution of cases per gender, age group, province and district. As numbers alone may be meaningless without a denominator, we used the analysis outputs to calculate susceptibility rates (cases who tested negative for HBsAg, anti-HBs and anti-HBcT / total number of cases with available positive or negative results), vaccine-induced immunity rates (cases who tested negative for HBsAg and anti-HBcT and positive for anti-HBs / total number of cases with available positive or negative results), and infection-induced immunity rates (cases who tested negative for HBsAg and positive for anti-HBs and anti-HBcT / total number of cases with available positive or negative results). We applied the test of proportions, with a significance level set at $\alpha = 0.05$, to assess whether there were statistically significant differences in susceptibility rates, vaccine-induced immunity rates and infection-induced immunity rates between females and males. As described previously (Chapter 3), the test of proportions is a statistical method used to determine whether the proportion of a certain outcome in a sample is significantly different to a known proportion or to the proportion in another sample.

5.3 RESULTS

5.3.1 Development and analysis of a dataset of anti-HBs results

From the 2015-2019_HepatitisB_All_Records.dta file of 6,315,380 records, there were 763,668 valid anti-HBs records. On deduplication, we identified 631,210 cases who were tested for anti-HBs. Of the 631,210 cases, 256,024 tested positive, 373,266 tested negative and 1,920 tested equivocal.

The Stata log file, which contained a record of the executed commands and their corresponding outputs is provided as Appendix 5.1.

5.3.2 Development and analysis of a dataset of anti-HBcT results

From the 2015-2019_HepatitisB_All_Records.dta file of 6,315,380 records, there were 335,006 valid anti-HBcT records. On deduplication, we identified 282,930 cases who were tested for anti-HBcT. Of the 282,930 cases, 132,078 tested positive, 150,713 tested negative and 139 tested equivocal.

The Stata log file, which contained a record of the executed commands and their corresponding outputs is provided as Appendix 5.2.

5.3.3 Development of the merged anti-HBs and anti-HBcT results

Of the 631,210 cases who had anti-HBs results, there were 31 cases with a UID of “-1” and 631,179 cases with unique UIDs. Of the 282,930 cases who had anti-HBcT results, there were 15 cases with a UID of “-1” and 282,915 cases with unique UIDs. On merging the anti-HBs and anti-HBcT variables with unique UIDs, we identified 215,241 cases who had both anti-HBs and anti-HBcT results. On merging the anti-HBs and anti-HBcT variables with UIDs of “-1”, we identified 14 cases who had both anti-HBs and anti-HBcT results.

The Stata log file, which contained a record of the executed commands on merging the anti-HBs and anti-HBcT datasets and their corresponding outputs is provided as Appendix 5.3.

5.3.4 Development and analysis of the merged HBsAg, anti-HBs and anti-HBcT results

From the 2015-2019_HBsAg_All_cases.dta file, we identified 46 cases with UIDs of “-1” and 1,957,178 cases with unique UIDs. On merging the dataset of 1,957,178 HBsAg cases with the dataset of 215,241 combined anti-HBs and anti-HBcT cases, we identified 206,915 cases who had results available for all

markers. On merging the dataset of 46 HBsAg cases to the dataset of 14 combined anti-HBs and anti-HBcT cases, all 14 cases had results available for all markers. On appending the 206, 915 cases to the 14 cases, we obtained a combined dataset of 206,229 cases. We identified 1,352 cases who had equivocal results for either one or more markers and deleted these cases, maintaining a dataset of 205,577 cases who tested positive or negative for all three markers (Table 5.2).

Table 5.2: Pattern of combined anti-HBs and anti-HBcT results

	HBsAg Negative	HBsAg Positive
Anti-HBs Negative		
<i>Anti-HBcT Negative</i>	84,056*	4,426
<i>Anti-HBcT Positive</i>	13,570	28,453
Anti-HBs Positive		
<i>Anti-HBcT Negative</i>	22,502*	635
<i>Anti-HBcT Positive</i>	49,757*	2,178

**Datasets were created for cases with these testing patterns*

Figure 5.1 illustrates the susceptibility rate, vaccine-induced immunity rate and infection-induced immunity rate by age group stratified by gender.

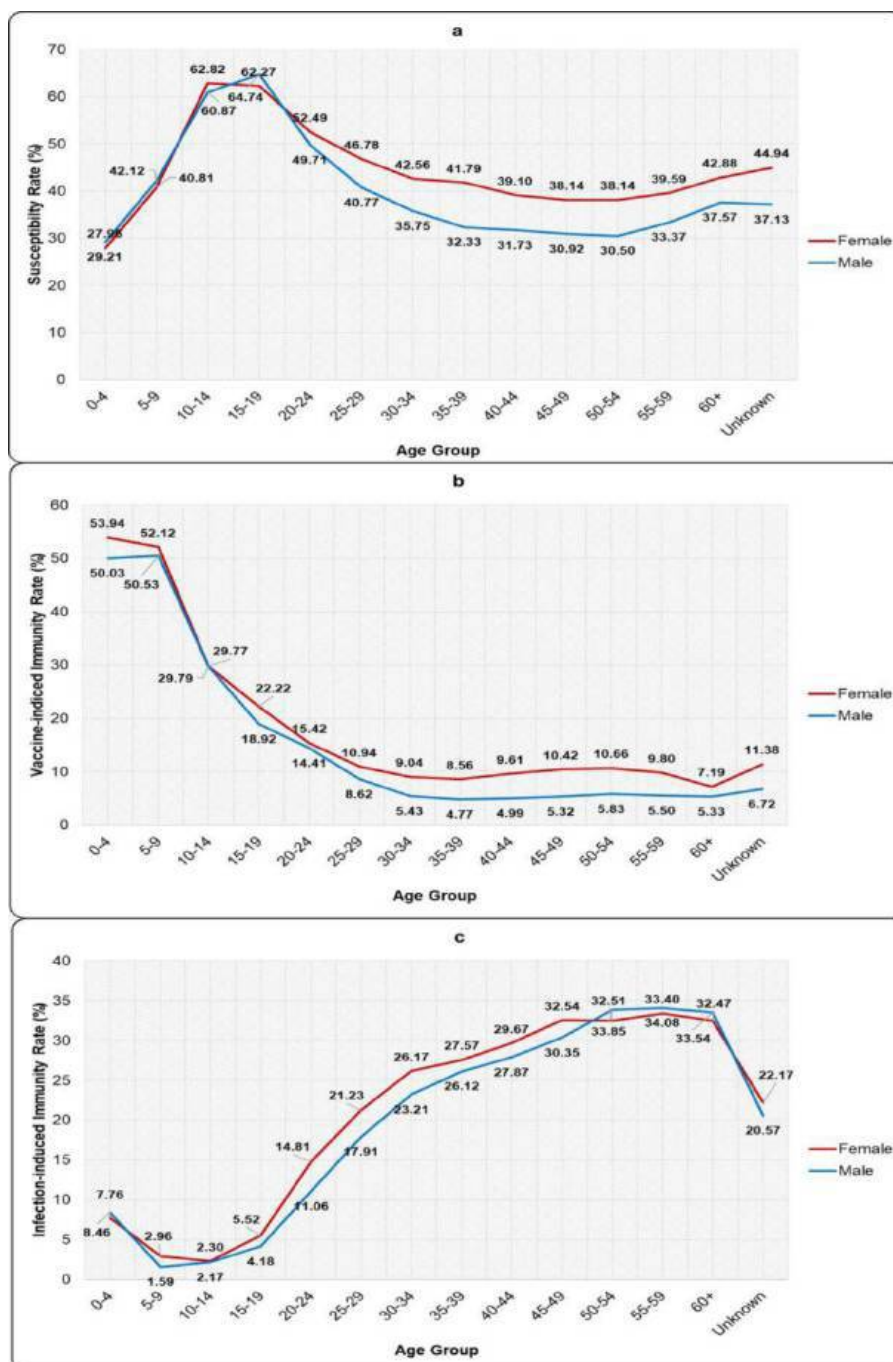


Figure 5.1: Susceptibility rate (a), vaccine-induced immunity rate (b) and infection-induced immunity rate (c) by age group stratified by gender, 2015 to 2019

The Stata log file, which contained a record of the executed commands on merging the HBsAg dataset to the anti-HBs and anti-HBcT datasets and their corresponding outputs is provided as Appendix 5.4. The Stata log file, which contained a record of the statistical analysis between males and females on the susceptibility, vaccine-induced immunity and infection-induced immunity rates and their corresponding outputs is provided as Appendix 5.5.

From analysis of cases who tested negative for HBsAg, anti-HBs, and anti-HBcT, we found that there was no significant difference in susceptibility rates between males and females for those under the age of 25 (with p-values ranging from 0.0631 to 0.7403) (Figure 5.1a and Table 5.3).

Table 5.3: Susceptibility rates by gender stratified by age group

Age Group	Female			Male			P-value*
	HBsAg, anti-HBs and anti-HBcT negative (#)	Total Cases (#)	Susceptibility rate (%)	HBsAg, anti-HBs and anti-HBcT negative (#)	Total Cases (#)	Susceptibility rate (%)	
0-4	508	1,817	27.96	539	1,845	29.21	0.7202
5-9	606	1,485	40.81	476	1,130	42.12	0.7403
10-14	1,477	2,351	62.82	756	1,242	60.87	0.3560
15-19	3,486	5,598	62.27	1,208	1,866	64.74	0.0631
20-24	6,813	12,980	52.49	2,242	4,510	49.71	0.1003
25-29	8,402	17,961	46.78	3,638	8,924	40.77	<0.0001
30-34	7,580	17,811	42.56	4,277	11,964	35.75	<0.0001
35-39	5,936	14,204	41.79	3,791	11,726	32.33	<0.0001
40-44	4,350	11,124	39.10	3,328	10,489	31.73	<0.0001
45-49	3,248	8,516	38.14	2,504	8,099	30.92	<0.0001
50-54	2,690	7,053	38.14	1,884	6,177	30.50	<0.0001
55-59	2,092	5,284	39.59	1,615	4,839	33.37	<0.0001
60+	3,674	8,568	42.88	2,902	7,724	37.57	<0.0001
Unknown	1,753	3,901	44.94	1,343	3,617	37.13	<0.0001
Total	52,615	118,653	44.34	30,503	84,152	36.25	<0.0001

*alpha = 0.05, p-values < 0.05 is considered significant

However, among individuals aged 25 and above, we observed a notably elevated susceptibility rate among females compared to males (p-values of <0.0001) (Figure 5.1a and Table 5.3).

From analysis of cases who tested negative for HBsAg and anti-HBcT and positive for anti-HBs, we saw no difference in vaccine-induced immunity rates between males and females at ages 0 to 29 years old and 55 years and over (with p-values ranging from 0.0591 to >0.9999) (Figure 5.1b and Table 5.4).

Table 5.4: Vaccine-induced immunity rates by gender stratified by age group

Age Group	Female			Male			P-value
	HBsAg negative, anti-HBs positive and anti-HBcT negative (#)	Total Cases (#)	Vaccine-induced Immunity rate (%)	HBsAg negative, anti-HBs positive and anti-HBcT negative (#)	Total Cases (#)	Vaccine-induced Immunity rate (%)	
0-4	980	1,817	53.94	923	1,845	50.03	0.0809
5-9	774	1,485	52.12	571	1,130	50.53	0.7168
10-14	700	2,351	29.77	370	1,242	29.79	>0.9999
15-19	1,244	5,598	22.22	353	1,866	18.92	0.2246
20-24	2,001	12,980	15.42	650	4,510	14.41	0.2246
25-29	1,965	17,961	10.94	769	8,924	8.62	0.1241
30-34	1,611	17,811	9.04	650	11,964	5.43	0.0014
35-39	1,216	14,204	8.56	559	11,726	4.77	0.0034
40-44	1,069	11,124	9.61	523	10,489	4.99	0.0007
45-49	887	8,516	10.42	431	8,099	5.32	0.0021
50-54	752	7,053	10.66	360	6,177	5.83	0.0075
55-59	518	5,284	9.80	266	4,839	5.50	0.0591
60+	616	8,568	7.19	412	7,724	5.33	0.1925
Unknown	444	3,901	11.38	243	3,617	6.72	0.0886
Total	14,777	118,653	12.45	7,080	84,152	8.41	<0.0001
*alpha = 0.05, p-values < 0.05 is considered significant							

However, at ages 30 to 54 years, the vaccine-induced immunity rate was significantly higher in females compared to males (with p-values ranging from 0.0007 to 0.0075) (Figure 5.1b, Table 5.4).

From analysis of cases who tested negative for HBsAg and positive for anti-HBs and anti-HBcT, we saw no difference in infection-induced immunity rates between males and females 0 to 19 years, 35 to 44 years, and 50 years and above (with p-values ranging from 0.0622 to >0.9999) (Figure 5.1c and Table 5.5).

Table 5.5: Infection-induced immunity rates by gender stratified by age group

Age Group	Female			Male			P-value
	HBsAg negative, anti-HBs positive and anti-HBcT negative (#)	Total Cases (#)	Infection-induced Immunity Rate (%)	HBsAg negative, anti-HBs positive and anti-HBcT negative (#)	Total Cases (#)	Infection-induced Immunity Rate (%)	
0-4	141	1,817	0.08	156	1,845	0.08	>0.9999
5-9	44	1,485	0.03	18	1,130	0.02	0.8258
10-14	54	2,351	0.02	27	1,242	0.02	>0.9999
15-19	309	5,598	0.06	78	1,866	0.04	0.4923
20-24	1,922	12,980	0.15	499	4,510	0.11	0.0225
25-29	3,813	17,961	0.21	1,598	8,924	0.18	0.0120
30-34	4,661	17,811	0.26	2,777	11,964	0.23	0.0038
35-39	3,916	14,204	0.28	3,063	11,726	0.26	0.0622
40-44	3,301	11,124	0.30	2,923	10,489	0.28	0.0829
45-49	2,771	8,516	0.33	2,458	8,099	0.30	0.0199
50-54	2,293	7,053	0.33	2,091	6,177	0.34	0.4834
55-59	1,765	5,284	0.33	1,649	4,839	0.34	0.5361
60+	2,782	8,568	0.32	2,591	7,724	0.34	0.1192
Unknown	865	3,901	0.22	744	3,617	0.21	0.6266
Total	28,637	118,653	0.24	20,672	84,152	0.25	0.0108

**alpha = 0.05, p-values < 0.05 is considered significant*

However, at ages 20 to 34 years and 45 to 49 years, the infection-induced immunity rate was significantly higher in females compared to males (with p-values ranging from 0.0038 to >0.0225) (Figure 5.1c and Table 5.5).

5.4 SUMMARY AND DISCUSSION

We analysed the 2015 to 2019 HBV dataset to identify cases who were tested for anti-HBs and cases who were tested for anti-HBcT in order to identify cases who

had results for both markers and merge these cases with available HBsAg results in order to provide a more meaningful representation of hepatitis B immunity or susceptibility status in South Africa.

Following analysis of the anti-HBs variable, we noted that the total number of cases who were tested for anti-HBs was quite high (631,210); however, following analysis of the anti-HBcT variable, the numbers tested were much lower (282,930). Nevertheless, the majority of cases who were tested for anti-HBcT were also tested for anti-HBs (215,255, 76.08%). On merging the dataset of cases who had anti-HBs and anti-HBcT results with the dataset of HBsAg cases, we identified 205,577 cases who had results for all three markers. We subsequently analysed the data to identify cases who tested negative for all three markers, indicating susceptibility to HBV infection, cases who tested positive for anti-HBs but negative for HBsAg and anti-HBcT, indicating vaccine-induced immunity and cases who tested negative for HBsAg but positive for anti-HBs and anti-HBcT, indicating recovery and infection-induced immunity. These analyses provided frequencies of cases by age group stratified by gender; however, assessing frequencies cannot be accurately interpreted on their own and necessitates the use of a denominator. We therefore analysed the dataset of cases with results for all three markers (205,577 records) and applied the total number of cases by age group and gender as the denominator. We subsequently calculated susceptibility rates, vaccine-induced immunity rates and infection-induced immunity rates.

Interestingly, among the 205,577 cases, the majority tested negative for HBsAg, anti-HBs and anti-HBcT, indicating susceptibility to HBV infection. Reasons for testing negative for these three markers include lack of previous exposure to HBV and not having received the HBV vaccine. Another plausible explanation might include individuals who were previously vaccinated but experienced a decrease

in anti-HBs levels to the point of being undetectable (waning immunity), or those who did not induce an immune response following vaccination (non-responders). From analysis of the susceptibility rates, we observed a significantly higher rate among females compared to males overall. These results indicated that there was a higher proportion of susceptible females than males over the study period. When we consider that these individuals were never exposed to HBV and never vaccinated against HBV, our findings suggest that the higher susceptibility rates in females is likely due to higher HBV exposure among males, as there are no justifiable reasons for gender-based differences in vaccination rates. This is also supported by the fact that at ages 0 to 24 years old, noting that all individuals up to 20 years old and a proportion 20 to 24 years old were vaccine eligible as infants, rates were similar between males and females and at ages 25 years and above, rates were significantly higher among females. Previous studies have reported that males may have a higher risk of HBV exposure than females, supporting our findings that among individuals who were not vaccine eligible as infants, HBV exposure was significantly higher among males (Wang, Chen and Yeh 2015; Brown, Goulder and Matthews 2022; Wang *et al.* 2022). Furthermore, apart from our own studies on hepatitis B infection status, and prevalence and incidence rates among individuals in South Africa over the period 2015 to 2019, many other studies have reported higher prevalence rates in males compared to females (Koulentaki *et al.* 1999; Tsay *et al.* 2009a; Coppola *et al.* 2017; Khan *et al.* 2018; Graham, MacLachlan, Gunaratnam and Cowie 2019; Wang *et al.* 2019a; Msomi *et al.* 2020a; Hamilton *et al.* 2022; Moonsamy, Suchard, Pillay and Prabodial-Sing 2022; Moonsamy, Pillay and Prabodial-Sing 2023). What raised particular concern was the observation that susceptibility rates were highest among individuals who were eligible for vaccination during infancy (aged 10 to 19 years). Although we are aware of suboptimal vaccine coverage rates (Table 2.3), we did not expect these findings. However, this observation suggests that among individuals aged 25 years and above, a higher proportion had been exposed to

HBV, and this is plausible considering that hepatitis B was highly endemic in South Africa before the introduction of the HBV vaccine (Spearman and Sonderup 2014; Makan, Song, Kinge and Kramvis 2023).

Among individuals who tested positive for anti-HBs and negative for HBsAg and anti-HBcT, we observed that vaccine-induced immunity rates were higher among individuals 0 to 24 years old, but highest among children under 10 years old. As all individuals under 20 years old and a proportion of individuals 20 to 24 years old were eligible for vaccination as infants given our study period of 2015 to 2019, these findings were anticipated. A contributory factor for the higher rates among children aged 0 to 9 years compared to individuals aged 10 to 24 years may be related to the higher vaccine coverage rates in later years up to 2019 (Table 2.3). Our findings reaffirm the effectiveness of the vaccination program in South Africa, as reported previously (Moonsamy, Suchard, Pillay and Prabdhial-Sing 2022; Moonsamy, Pillay and Prabdhial-Sing 2023). Surprisingly though, we observed positive anti-HBs results and negative HBsAg and anti-HBcT results among individuals 25 years and older. These findings do not correlate with vaccine-induced immunity, as individuals of the public health sector at these ages would not have been vaccine-eligible as infants. Hence, we have reason to believe that a portion of infants who might have initially been vaccinated with the HBV vaccine at private healthcare facilities shortly after birth later sought medical care at public healthcare facilities where they were tested for HBV markers. Reasons may include being born into a private sector family but since moved to the public sector, or exhaustion of medical aid benefits and therefore seeking healthcare at public facilities. Furthermore, it is worth noting that, even though this might explain a very small fraction of cases, some individuals could have been included in public health sector research studies and consequently received the HBV vaccine. It is also important to acknowledge the potential for either of the results to be false positives or false negatives.

When we looked at individuals who tested negative for HBsAg but positive for both anti-HBs and anti-HBcT markers, implying previous exposure to HBV, we observed that infection-induced immunity rates were higher in females compared to males at most ages and significantly higher at ages 20 to 34 years and 45 to 49 years. It has been reported that males have a higher risk of developing chronic HBV infections than females and that females have a higher likelihood of producing anti-HBs compared to males in response to an infection (Blumberg 1979; Tsay *et al.* 2009a; Ruggieri, Gagliardi and Anticoli 2018). Our findings lend support to these observations given the higher rates of infection-induced immunity observed in females. Considering ages alone, infection-induced immunity rates were higher among individuals 20 years or older with much lower rates among individuals 0 to 19 years old. Our findings, demonstrate, once again, the effectiveness of the vaccination programme seeing that they imply lower infection rates among individuals who were eligible for vaccination as infants. Nevertheless, we did observe previous HBV exposure among individuals who were 0 to 19 years old, and within these ages, rates were highest among children under five years old. Several factors could account for this observation, such as, missed vaccination, incomplete vaccine dosage, individuals who failed to develop protective antibodies after vaccination and consequently contracted HBV infection, or individuals who contracted the virus from their mothers during childbirth (vertical transmission). Minimising the risk of vertical transmission requires the administration of a birth dose of the HBV vaccine; however, this has not yet been incorporated into South Africa's routine EPI schedule.

Overall, the impact of introducing HBV vaccine into South Africa's EPI schedule in 1995 is clearly demonstrated when comparing vaccine-induced immunity rates to infection-induced immunity rates.

Here, we present findings based on passive surveillance of anti-HBs and anti-HBcT tests conducted over a fixed five-year period, and we acknowledge that passive surveillance is constrained to detecting laboratory-confirmed cases only. Our analysis focuses on individuals attending public healthcare facilities, with exclusions for those attending private healthcare facilities during the stipulated five-year period. Consequently, the numbers presented represent minimum estimates. While we acknowledge the potential for false results, this consideration was not factored into our analyses. The reported province in our findings reflects the location of the testing facility, not necessarily the place of residence or birth for each case. As a result, observed provincial differences may be attributed to variations in testing practices rather than actual province-specific findings. Data entry errors in patient identification details could impact the NHLS CDW linkage process, potentially assigning a new UID to an existing case. A notable strength of our study, however, lies in the analysis of a substantial dataset comprising 205,577 records of tests conducted within the public health sector of South Africa. This sector serves approximately 85% of the national population, contributing to the robustness of our findings.

**CHAPTER SIX (OBJECTIVE 4): HEPATITIS B
INFECTION AND IMMUNITY STATUS IN HIV-
UNINFECTED AND HIV-INFECTED PREGNANT
WOMEN IN SOUTH AFRICA, 2017**

6.1 INTRODUCTION

We conducted hepatitis B testing on a proportion of study participants from the 2017 antenatal HIV sentinel survey to determine HBV prevalence (HBsAg test positivity rate), HBV infectivity (HBeAg test positivity rate), and HBV immunity (anti-HBs positive and HBsAg negative) among HIV-uninfected and HIV-infected pregnant women in South Africa. HBV prevalence and infectivity data was used to estimate the risk of vertical transmission of hepatitis B given that currently there are no standard measures in place to minimise the risk of mother-to-child transmission, noting that infants infected vertically have the highest risk of developing chronic HBV infection. Data on anti-HBs status is essential for assessing HBV immunity and susceptibility. Anti-HBs positive and HBsAg negative individuals are considered immune to HBV, as they have developed antibodies against the virus and are not infected (Table 1.1). On the other hand, individuals who are anti-HBs negative and HBsAg negative are considered susceptible to HBV, meaning they have not developed immunity and are at risk of infection if exposed to the virus. Such data will be used for purposes of modelling the transmission dynamics of hepatitis B and the impact of adding a birth dose of the HBV vaccine into the routine EPI schedule in South Africa.

6.1.1 Background on the antenatal HIV sentinel survey

Since 1990, antenatal HIV surveys have been conducted for the purpose of HIV surveillance in pregnant women attending antenatal care at public healthcare facilities in South Africa (Woldesenbet *et al.* 2021). The survey primarily aimed to estimate HIV prevalence trends over time among pregnant women attending antenatal care (Woldesenbet *et al.* 2019). From 1990 to 2015, the survey was conducted on an annual basis, and since 2015, it was conducted biennially (Woldesenbet *et al.* 2019). Following testing, antenatal samples are archived for subsequent research purposes with the consent of the participants at the time of

sample collection. Barcodes were assigned to the samples, ensuring that their identities were maintained with strict anonymity (Woldesenbet *et al.* 2019). The request for access to the antenatal samples was initiated in March 2020 and the latest available samples at that time were those from 2017 as the 2019 samples were still under analysis. The 2017 samples were archived at the National Institute for Occupational Health in Johannesburg from where it was retrieved for testing following a traceable retrieval process.

The key findings of the 2017 HIV antenatal survey, which includes the sampling methods, sample size, laboratory testing, and data management and analysis has been published and is available via the following link: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8767461/> (Woldesenbet *et al.* 2021).

6.2 METHODOLOGY

6.2.1 Ethics statement

Our study was conducted using anonymous retrospective samples linked to a unique identifier. We obtained ethics approval from the Faculty of Health Sciences, Institutional Research Ethics Committee (IREC 069/20) at Durban University of Technology, Durban, South Africa. Access to the samples and data was granted through the Academic Affairs and Research Management System (PR20254) of the National Health Laboratory Service (NHLS), Johannesburg, South Africa, and the Centre for Disease Control and Prevention (Accession #: CGH-SOAFR-7/19/22-86d1f), Atlanta, USA.

6.2.2 Study design

This study was conducted as a retrospective cross-sectional study.

6.2.3 Study population

The samples used in our study were from participants who were enrolled as part of the 2017 antenatal HIV sentinel survey (Woldesenbet et al. 2019; Woldesenbet et al. 2021). Samples were randomly selected from all nine provinces of South Africa by HIV status after calculation of the sample size that was needed for our study.

6.2.4 Sample size

In order to obtain the ideal sample size to determine HBV prevalence amongst pregnant women in South Africa, we needed to determine HBV prevalence estimates amongst HIV-uninfected and HIV-infected pregnant women nationally as national estimates were not available. In order to do this, we needed most recent estimates of prevalence of hepatitis B among pregnant women and reference estimates among HIV-infected and HIV-uninfected pregnant women. For the latter, we used previously reported HBsAg prevalence of 2.8% in HIV-uninfected and 3.4% in HIV-infected pregnant women of Western Cape Province, with an overall HBsAg prevalence of 3.1% (Andersson *et al.* 2013). For most recent national estimates, we used HBV prevalence among women of child-bearing age as a proxy for prevalence amongst South African pregnant women. For this, we used the average HBsAg test positivity rates of 2019 in females 15 to 49 years old as reported in five-year age groups in our publication of 2022 (Supplementary Table 3) (Moonsamy, Suchard, Pillay and Prabdhial-Sing 2022). We then estimated the prevalence of HBV in HIV-infected and HIV-uninfected pregnant women and used these estimates in a formula to calculate the sample size for a prevalence study (Pourhoseingholi, Vahedi and Rahimzadeh 2013).

Equation 6.1: Formula for sample size calculation for a prevalence study (n) =

$$Z^2P(1-P) / d^2$$

In Equation 6.1, $Z = 1.96$ and $d = 0.01$ for α of 0.05 (Hajian-Tilaki 2011; Pourhoseingholi, Vahedi and Rahimzadeh 2013).

Once we obtained our sample sizes, we calculated the proportion that will be needed from the 2017 samples and used Stata's built in command (Stata/SE 18.0.) to randomly select samples by HIV status and calculated proportions by province.

6.2.5 Testing methodology

The Abbott Architect i1000SR (Abbott Diagnostics, Illinois, USA) was used as the testing platform for our HBV testing. We used the instrument located in the HIV Sero-Molecular Laboratory at the National Institute for Communicable Diseases in Sandringham, Johannesburg, South Africa. This instrument has been validated for HBsAg, anti-HBs and HBeAg testing by the Centre for Vaccines and Immunology at the National Institute for Communicable Diseases. Reagents, calibrators, controls and all necessary consumables required for HBsAg, anti-HBs and HBeAg were sponsored by Abbott Laboratories, USA, facilitated by The Task Force for Global Health, CDC, USA. The assays for each of the markers were performed according to manufacturer's instructions and we followed all calibration and quality control criteria to ensure reliable and accurate results.

The Abbott Architect system performs sample quality checks to ensure that the sample quality meets the necessary standards for accurate and reliable testing results. These include volume measurement to ensure sufficiency as insufficient sample volumes can affect test results, and checks for haemolysis and turbidity, which can interfere with test accuracy. When the quality check fails, the system alerts the operator with an error message or notification indicating that the quality

check has failed and the sample will not proceed to analysis until the issue is resolved.

6.2.6 Data analysis

Results of completed test runs were exported from the Architect instrument to a rewritable compact disc (CD-RW) for purposes of data analysis. Files were exported as text files, opened using Windows Notepad, copied and pasted into Excel. On completion of testing, individual Excel files were combined to create a single excel file containing all HBsAg, anti-HBs and HBeAg test results for importation and data analysis in Stata/SE 18.0 (Texas, USA). A positive test result is reported as "Reactive" and a negative test result is reported as "Nonreactive" on the Abbott Architect. Apart from the HBV data obtained following testing of the 2017 HIV antenatal samples, all other data used for analyses were obtained from the 2017 HIV antenatal dataset collected between 01 October and 15 November 2017. For all statistical inferences, we applied the test of proportions with a significance level (α) of 0.05. As described previously (Chapter 3), the test of proportions is a statistical method used to determine whether the proportion of a certain outcome in a sample is significantly different to a known proportion or to the proportion in another sample.

6.2.6.1 HBsAg

Data were analysed to determine the overall HBsAg prevalence (HBsAg test positivity rate), and prevalence by five-year age groups and province. Further analysis was conducted to determine if there were significant differences in HBsAg positivity between HIV-uninfected and HIV-infected individuals by five-year age groups and province.

6.2.6.2 HBeAg

Data were initially analysed to determine how many HBsAg positive cases had available HBeAg results to determine the overall HBeAg test positivity rate. We subsequently calculated HBeAg positivity among HIV-uninfected and HIV-infected individuals to determine if these were significantly different.

6.2.6.3 Anti-HBs

Data were initially analysed to obtain a two-way table of anti-HBs and HBsAg results in order to identify if there were any individuals who tested positive for both markers and individuals who tested negative for anti-HBs and positive for HBsAg. For purposes of HBV immunity, we excluded individuals who tested positive for both markers from further analysis given the HBsAg positive result. For purposes of identifying cases who were susceptible to HBV infection, we excluded individuals who tested negative for anti-HBs and positive for HBsAg. Data were analysed to determine the overall anti-HBs test positivity rate, HBV immunity rate (number of cases who tested positive for anti-HBs and negative for HBsAg / total number of cases tested) and HBV susceptibility rate (number of cases who tested negative for anti-HBs and HBsAg / total number of cases tested) by five-year age groups. Further analysis was conducted to determine if there were significant differences in HBV immunity and HBV susceptibility between HIV-uninfected and HIV-infected individuals by five-year age groups.

6.3 RESULTS

6.3.1 Sample size

In 2019, HBsAg test positivity rates were calculated to be 2.11%, 3.73%, 6.13%, 6.85%, 7.19%, 7.20% and 6.69% among females aged 15 to 19, 20 to 24, 25 to 29, 30 to 34, 35 to 39, 40 to 44 and 45 to 49 years old respectively (Moonsamy,

Suchard, Pillay and Prabdhial-Sing 2022). The average HBsAg test positivity rate was therefore 5.70%. Based on the reported HBsAg prevalence of 3.10% overall, 2.80% among HIV-uninfected pregnant women and 3.40% among HIV-infected pregnant women in 2008, we estimated HBsAg prevalence to be 5.10% and 6.30% among HIV-uninfected and HIV-infected pregnant women respectively (Andersson *et al.* 2013) (Table 6.1).

Table 6.1: Estimated prevalence of HBsAg in 2017

HBsAg Prevalence	Year	
	2008 (Reported)	2017 (Estimated)
Overall	3.10	5.70
HIV-uninfected	2.80	5.10
HIV-infected	3.40	6.30

The total sample size for HIV-uninfected pregnant women was calculated to be $\approx 1,860$ ($1.96^2 \cdot 0.051 (1-0.051) / 0.01^2$), and the total sample size for HIV-infected pregnant women was calculated to be $\approx 2,268$ ($1.96^2 \cdot 0.063 (1-0.063) / 0.01^2$) (Equation 6.1).

The 2017 HIV antenatal dataset consisted of 32,716 samples, with 22,358 HIV negative results and 10,358 positive results (Woldesenbet *et al.* 2020; Woldesenbet *et al.* 2021). Our sample size for HIV-uninfected individuals was 1,860 which is 8.32% of 22,358, and our sample size for HIV-infected individuals

was 2,268 which is 21.90% of 10,358. On executing the commands in Stata using these percentages, we obtained the sample numbers per province required for HBV testing. Table 6.2 shows the sample numbers required, the sample numbers tested and a comparison between the two, and Table 6.3 shows the sample numbers tested by HIV status and five-year age groups.

Table 6.2: Sample numbers required following random selection by HIV status and province, the actual sample numbers tested, and a comparison based on the required numbers versus tested numbers

Province	Sample size by province required			Sample size by province tested			Comparison		
	HIV negative	HIV positive	Total	HIV negative	HIV positive	Total	HIV negative	HIV positive	Total
Eastern Cape	223	298	521	223	300	523	Same	Tested 2 more	Tested 2 more
Free State	153	196	349	153	197	350	Same	Tested 1 more	Tested 1 more
Gauteng	273	341	614	294	342	636	Tested 21 more	Tested 1 more	Tested 22 more
KwaZulu-Natal	404	742	1146	403	746	1149	Tested 1 less	Tested 4 more	Tested 3 more
Limpopo	169	136	305	172	138	310	Tested 3 more	Tested 2 more	Tested 5 more
Mpumalanga	150	234	384	177	243	420	Tested 27 more	Tested 9 more	Tested 36 more
North West	136	137	273	136	136	272	Same	Tested 1 less	Tested 1 less
Northern Cape	103	59	162	103	84	187	Same	Tested 25 more	Tested 25 more
Western Cape	250	124	374	281	126	407	Tested 31 more	Tested 2 more	Tested 33 more
Total	1861	2267	4128	1942	2312	4254	Tested 81 more	Tested 45 more	Tested 126 more

Table 6.3: The number of samples tested by HIV status by five-year age groups

Age Group	HIV Results (#)		
	Negative	Positive	Total
'15-19	330	113	443
'20-24	573	462	1,035
'25-29	449	658	1,107
'30-34	279	546	825
'35-39	120	308	428
'40-44	29	71	100
'45-49	1	3	4
Unknown	161	151	312
Total	1,942	2,312	4,254

Majority of the cases were from KwaZulu-Natal (1,149, 27.01%) and among the ages of 20 to 34 years (2,967, 69.75%). There were only four cases 45 to 49 years old and this was expected given that there were only 32 women among this age group of the total of 32,716 antenatal samples of 2017. The majority of the 32,716 samples were also from KwaZulu-Natal (Woldesenbet *et al.* 2021).

6.3.2 HBsAg prevalence

Of the total of 4,254 samples tested for HBsAg, 478 tested positive, with an overall HBsAg prevalence (HBsAg test positivity rate) of 11.24%. The HBsAg test positivity rate by five-year age groups and by province is illustrated in Figure 6.1.

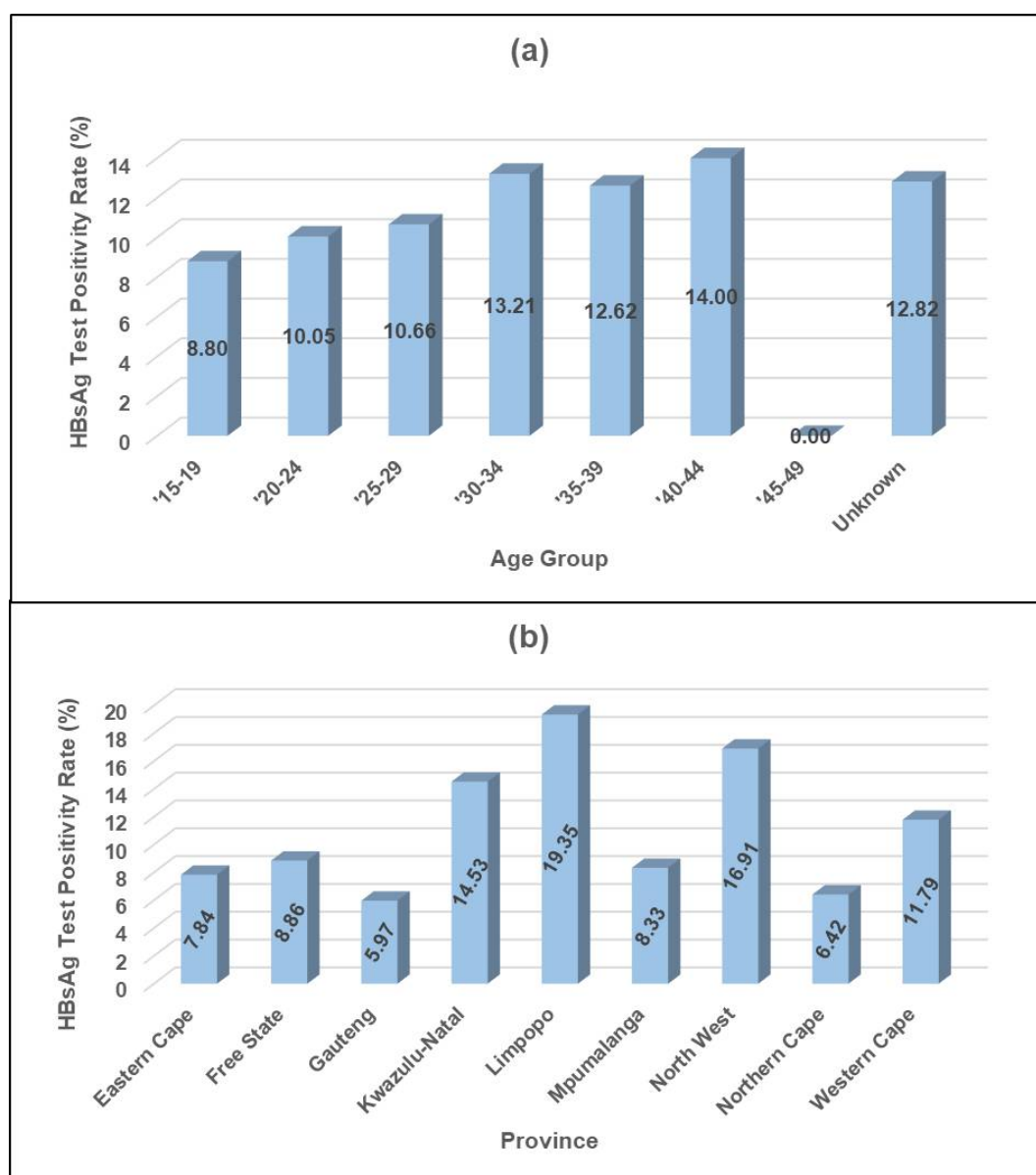


Figure 6.1: HBsAg test positivity rate among pregnant women in 2017 by; a) five-year age groups, and b) province

The HBsAg test positivity rate was highest among females aged 40 to 44 years (14.00%), although also high (>10%) in females 20 to 39 years old (Figure 6.1a). In the 15 to 19 year age group, the HBsAg test positivity rate was 8.80%. We saw

the highest HBsAg test positivity rates in Limpopo Province, followed by North West and KwaZulu-Natal Provinces, and the lowest rate in Gauteng Province (Figure 6.1b).

The frequency of positive and negative HBsAg results and the proportion of positive HBsAg results (HBsAg positivity) by HIV status in five-year age groups and by province is displayed in Table 6.4.

Table 6.4: HBsAg results and proportion of HBsAg positive cases among HIV-uninfected and HIV-infected pregnant women in 2017 by; a) five-year age groups, and b) province

(a)									
Age Group	HIV Negative (#)			HIV Positive (#)			Proportion HBsAg positive among HIV-uninfected individuals	Proportion HBsAg positive among HIV-infected individuals	P-Value
	HBsAg results			HBsAg results					
	Negative (#)	Positive (#)	Total (#)	Negative (#)	Positive (#)	Total (#)			
'15-19	309	21	330	95	18	113	0.06	0.16	0.3122
'20-24	541	32	573	390	72	462	0.06	0.16	0.1606
'25-29	425	24	449	564	94	658	0.05	0.14	0.2287
'30-34	261	18	279	455	91	546	0.06	0.17	0.2347
'35-39	116	4	120	258	50	308	0.03	0.16	0.4840
'40-44	27	2	29	59	12	71	0.07	0.17	0.7188
'45-49	1	0	1	3	0	3	0.00	0.00	**
Unknown	150	11	161	122	29	151	0.07	0.19	0.3516
Total	1830	112	1942	1946	366	2312	0.06	0.16	0.0070
(b)									
Province	HIV Negative (#)			HIV Positive (#)			Proportion HBsAg positive among HIV-uninfected individuals	Proportion HBsAg positive among HIV-infected individuals	P-Value
	HBsAg results			HBsAg results					
	Negative (#)	Positive (#)	Total (#)	Negative (#)	Positive (#)	Total (#)			
Eastern Cape	215	8	223	267	33	300	0.04	0.11	0.5472
Free State	146	7	153	173	24	197	0.05	0.12	0.5938
Gauteng	284	10	294	314	28	342	0.03	0.08	0.5868
Kwazulu-Natal	376	27	403	606	140	746	0.07	0.19	0.1291
Limpopo	149	23	172	101	37	138	0.13	0.27	0.2004
Mpumalanga	163	14	177	222	21	243	0.08	0.09	0.9177
North West	124	12	136	102	34	136	0.09	0.25	0.2406
Northern Cape	100	3	103	75	9	84	0.03	0.11	0.6750
Western Cape	273	8	281	86	40	126	0.03	0.32	0.0923
Total	1830	112	1942	1946	366	2312	0.06	0.16	0.0070

*P-Value generated from the test of proportions between HIV-uninfected HBsAg positive individuals versus HIV-infected HBsAg positive individuals, alpha = 0.05

**Insufficient observations to generate a P-Value

Overall, the HBsAg positivity was significantly higher among HIV-infected females (15.83%) compared to HIV-uninfected females (5.77%, $p = 0.0070$) (Table 6.4). By age group and province, there were no significant differences in HBsAg positivity between HIV-infected versus HIV-uninfected pregnant women, although consistently higher among HIV-infected individuals (Table 6.4).

6.3.3 HBeAg prevalence among HBsAg positive pregnant women

Of the 478 HBsAg positive samples, 14 were insufficient for HBeAg testing. Of the 464 samples tested for HBeAg, 44 (9.48%) tested positive.

Table 6.5: HBeAg results on HBsAg positive samples stratified by HIV status

HIV Results	HBeAg Results			Proportion HBeAg Positive	P-Value*
	Negative	Positive	Total		
Negative	101	8	109	0.07	0.7931
Positive	319	36	355	0.10	
Total	420	44	464	0.09	-
*P-Value generated from the test of proportions between HIV-uninfected HBsAg positive individuals versus HIV-infected HBsAg positive individuals, $\alpha = 0.05$					

No significant difference was observed in HBeAg positivity between HIV-infected versus HIV-uninfected pregnant women (Table 6.5).

6.3.4 Anti-HBs status

Of the 4,254 samples, 992 tested positive for anti-HBs, with an overall anti-HBs test positivity rate of 23.32%. Of the 992 positive anti-HBs samples, 36 had also tested positive for HBsAg and therefore the overall HBV immunity rate was calculated to be 22.47% (956 / 4,254). Of the 4,254 samples, 3,262 tested negative for anti-HBs, with an overall anti-HBs test negativity rate of 76.68%. Of the 3,262 negative anti-HBs samples, 442 had tested positive for HBsAg and

therefore the overall HBV susceptibility rate was calculated to be 53.60% (2,280 / 4,254). Table 6.6 shows a two-way table of anti-HBs and HBsAg results.

Table 6.6: Two-way table of anti-HBs results and HBsAg results

Anti-HBs Results (#)	HBsAg Results (#)		
	Negative	Positive	Total
Negative	2,280	442	3,262
Positive	956	36	992
Total	3,776	478	4,254

Figure 6.2 illustrates the HBV susceptibility and immunity rates by five-year age groups.

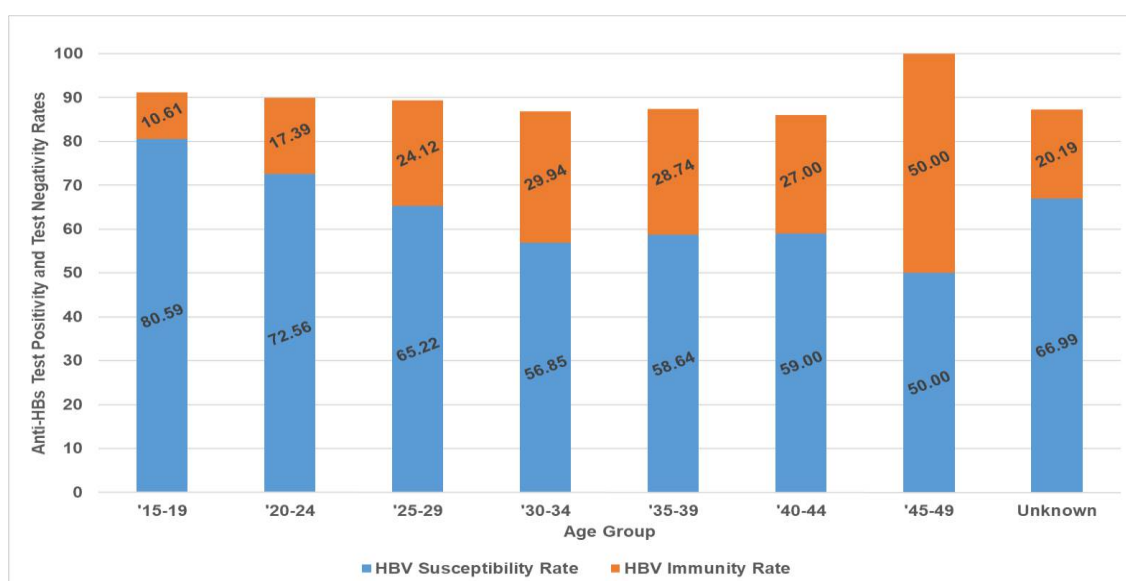


Figure 6.2: HBV susceptibility and immunity rates by five-year age groups among pregnant women in 2017

As there were only four cases among the ages 45 to 49 years, we excluded this age group when examining HBV susceptibility and immunity rates. The HBV immunity rate was therefore highest among females aged 30 to 34 years, followed by 35 to 39 years, 40 to 44 years, 25 to 29 years, 20 to 24 years and lastly 15 to 19 years (Figure 6.2). The reverse was observed for HBV susceptibility rates (Figure 6.2).

Table 6.7 shows the number of HBV susceptible and immune individuals and the proportion of susceptible and immune individuals by HIV status in five-year age groups.

Table 6.7: Number of HBV susceptible and immune individuals and the proportion of susceptible and immune individuals by HIV status in five-year age groups among pregnant women in 2017

(a)						
Age Group	HIV Results					
	Negative (#)			Positive (#)		
	Susceptible	Immune	Total Tested (#)	Susceptible	Immune	Total Tested (#)
'15-19	282	27	330	75	20	113
'20-24	473	68	573	278	112	462
'25-29	353	72	449	369	195	658
'30-34	195	66	279	274	181	546
'35-39	92	24	120	159	99	308
'40-44	22	5	29	37	22	71
'45-49	1	0	1	1	2	3
Unknown	124	26	161	85	37	151
Total	1,542	288	1,942	1,278	668	2,312
(b)						
Age Group	Proportion of HBV Susceptible and HBV Immune among HIV-uninfected and HIV-infected individuals					
	Proportion HBV susceptible among HIV-uninfected individuals	Proportion HBV susceptible among HIV-infected individuals	P-Value*	Proportion HBV immune among HIV-uninfected individuals	Proportion HBV immune among HIV-infected individuals	P-Value*
'15-19	0.85	0.66	0.0002	0.08	0.18	0.3013
'20-24	0.83	0.60	<0.0001	0.12	0.24	0.0487
'25-29	0.79	0.56	<0.0001	0.16	0.30	0.0210
'30-34	0.70	0.50	<0.0001	0.24	0.33	0.1744
'35-39	0.77	0.52	0.0001	0.20	0.32	0.2482
'40-44	0.76	0.52	0.0677	0.17	0.31	0.5309
'45-49	1.00	0.33	**	0.00	0.67	**
Unknown	0.77	0.56	0.0013	0.16	0.25	0.3902
Total	0.79	0.55	<0.0001	0.15	0.29	<0.0001
*P-Value generated from the test of proportions between HIV-uninfected HBsAg positive individuals versus HIV-infected HBsAg positive individuals, alpha = 0.05						
**Insufficient observations to generate a P-Value						

Overall, there were significantly more susceptible individuals that were HIV-uninfected compared to susceptible individuals that were HIV-infected, and significantly more immune individuals that were HIV-infected compared to immune individuals that were HIV-uninfected ($p = < 0.0001$) (Table 6.7b). By age group, there were significantly higher HBV susceptible individuals among HIV-uninfected individuals 15 to 39 years old ($p = < 0.0001$ to 0.0002), and significantly higher HBV immune individuals among HIV-infected individuals 20 to 29 years old ($p = 0.0210$ to 0.0487) (Table 6.7b).

6.4 SUMMARY AND DISCUSSION

We performed HBV testing on 13.00% of samples from the HIV antenatal sentinel survey of 2017. These samples were from women who attended public healthcare facilities for antenatal care in 2017. From the samples tested for HBV, HBsAg prevalence was notably high at 11.24%, significantly higher among HIV-infected women (15.83%) compared to HIV-uninfected women (5.77%). The higher rates in HIV-infected women was expected given that HIV-infection and HBV infection share common routes of transmission (Liu *et al.* 2014; Sharma, Ramachandran, Mogha and Bharadwaj 2018; Control and Prevention 2022). This high HBsAg prevalence, not described before, indicates that vertical transmission remains a concern for transmission and warrants national or targeted interventions to reduce or eliminate the associated risks. This is corroborated by the notable HBeAg positivity among women who tested positive for HBsAg in our study, suggesting a much higher risk of vertical transmission in this group of women. A national intervention to reduce the risk of vertical transmission of HBV is the administration of a birth dose of the HBV vaccine in addition to the scheduled EPI doses, and a targeted intervention involves routine screening of pregnant women for HBV infection during antenatal care visits with administration

of hepatitis B immunoglobulin and a birth dose of the HBV vaccine to infants born to HBV positive mothers (Matthews *et al.* 2023).

Across the various age groups, HBsAg prevalence was highest among women 40 to 44 years, although still considered high (>10%) from ages 20 years and above. Note that all women aged 25 years and above and a proportion of women 20 to 24 years old were born prior to the introduction of the HBV vaccine into South Africa's EPI schedule in 1995 and at a time when hepatitis B was highly endemic in South Africa (Spearman and Sonderup 2014; Makan, Song, Kinge and Kramvis 2023). Our findings here indicate that these women acquired HBV infection at some point in their lives and likely transmission routes include vertical transmission from their mothers during childbirth, horizontal transmission in early childhood, or sexual transmission in adulthood. Although slightly lower, HBsAg test positivity rates, again indicating acquired HBV infection, were quite concerning among women 15 to 19 years old, given that all of these women would have been eligible for vaccination when they were born. However, while we recognise that vaccine-coverage rates were suboptimal, which may account for why some of these women may not have received vaccinations and subsequently became infected, it's important to consider that even if these women received vaccinations as infants, there is a possibility that they were vertically infected at birth. Additionally, since the first HBV vaccine dose has traditionally been administered at six weeks of age in South Africa, they would not have benefitted from having received the vaccine. In order to reduce the risks of vertical transmission of HBV, it is recommended to administer the HBV vaccine as a birth dose within the first 24 hours after birth (World Health Organization 2015b; Boisson *et al.* 2022).

Regarding provincial HBsAg test positivity rates, we observed concerning high rates in Limpopo, North West, KwaZulu-Natal and Western Cape Provinces.

Referring to our observations on the annual HBV prevalence from 2015 to 2019 in South Africa, we noted that in 2017 we reported a 19.52% HBsAg test positivity rate in Limpopo Province, comparable to our findings among pregnant women in Limpopo Province in 2017 (19.35%) (Moonsamy, Suchard, Pillay and Prabdhial-Sing 2022). We also noted in our previous publications that to better understand the reasons for provincial differences, thorough investigations are needed (Moonsamy, Suchard, Pillay and Prabdhial-Sing 2022; Moonsamy, Pillay and Prabdhial-Sing 2023).

When we analysed anti-HBs results to determine the proportion of women who were immune or were still vulnerable to HBV infection, we excluded cases who tested positive for HBsAg. Individuals who tested negative for anti-HBs and positive for HBsAg would indicate an acute or chronic infection (Krajden, McNabb and Petric 2005; Control and Prevention 2023). Individuals who tested positive for anti-HBs and HBsAg, although a rare occurrence, would suggest a chronic infection (Lada, Benhamou, Poynard and Thibault 2006; Jiang, Chang, Yan and Wang 2021). These individuals will therefore not meet the criteria of being immune or susceptible to HBV infection. After excluding women aged 45 to 49 years because of the very small numbers, we saw the highest HBV immunity rate among women aged 30 to 34 years old and lowest among individuals aged 15 to 19 years old. Initially, we found this odd given that individuals aged 15 to 19 years old were vaccine-eligible as infants. However, the higher immunity rates among women who were not vaccine-eligible as infants indicated recovery following HBV infection and we therefore attribute this to higher infection rates among these women, which is not unexpected but concerning. In addition, among individuals who were eligible for vaccination, susceptibility may be a result of missed HBV vaccination, incomplete dosage, non-response to the HBV vaccine or waning of anti-HBs levels following vaccination. Our findings among susceptible women 15 to 19 years old indicate a lower HBV infection rate (8.80%) among this age group

compared to other age groups. However, there is a possibility that some of these individuals may acquire HBV infection at a later stage in life, although they have a 90% chance of full recovery (Liang 2009; Spearman and Sonderup 2014; Nelson, Easterbrook and McMahon 2016).

The data on HBsAg and HBeAg prevalence, susceptibility and immunity by five-year age groups will be used to estimate the FOI for modelling the impact of the addition of a HBV birth dose to the current HBV vaccination schedule in South Africa. The data will also assist to estimate the proportion of births that will be susceptible to HBV infection, exposed to HBV infection and successfully vaccinated against HBV infection.

Our observations pertain specifically to pregnant women attending antenatal visits at public healthcare facilities in 2017, and excludes pregnant women attending antenatal visits at private healthcare facilities during this period. We used data on women of reproductive age as a proxy for estimating sample sizes. Our study focussed on HBsAg, HBeAg and anti-HBs testing; however, additional testing among pregnant women may have assisted to further corroborate our findings, and these include anti-HBcT and HBV viral load. Furthermore, we acknowledge that the inclusion of anti-HBcT testing might have influenced our findings on the proportion of pregnant women who were susceptible where anti-HBs levels may have dropped to below detectable levels following HBV infection and recovery. In our analysis, we included low positive results as true positives, acknowledging that some may have been false positives and could have influenced our overall findings; however, we chose to include them based on levels consistent with recent infection or recent recovery. Despite these limitations, we present findings from a nationwide HBV testing initiative targeting pregnant women, marking the first such endeavour in South Africa. Therefore,

this study addresses a gap in existing research and contributes valuable insights to the understanding of HBV prevalence among pregnant women in the country.

6.5 CONCLUSION

Our findings demonstrate that a high proportion of antenatal women were HBV infected, but also that a high proportion were susceptible to HBV infection. HBV infectivity remained high regardless of HIV infection. Therefore, we conclude that vertical transmission of HBV remains a threat to achieving WHO elimination targets and South Africa needs to consider implementation of a birth dose of the HBV vaccine in addition to doses at 6, 10, and 14 weeks of age. Furthermore, raising awareness of HBV transmission routes and the consequences of acquiring HBV infection at an early age may assist in reducing the HBV disease burden overall, not only in South Africa but also in other countries with a high HBV disease burden.

**CHAPTER SEVEN (OBJECTIVE 5):
DEVELOPMENT AND APPLICATION OF A
DETERMINISTIC MATHEMATICAL MODEL OF
HEPATITIS B VIRUS TRANSMISSION
DYNAMICS TO MODEL THE IMPACT OF A
BIRTH DOSE HEPATITIS B VACCINE**

7.1 INTRODUCTION

A critical step in modelling the transmission dynamics of any disease is country-specific parameterisation, one being the average annual FOI (Anderson and May 1991). Seroprevalence data of a disease before the implementation of any intervention that would impact transmission, such as vaccination, may be used for this purpose (Vynnycky and White 2010). Such data allow for the estimation of population-specific rates and proportions required for modelling disease dynamics and provides insights on exposure patterns (Murray and Lopez 1996). These include the average annual FOI, the proportion of the population that is susceptible, the median age of infection and the basic reproduction number. As the pathogenesis of hepatitis B has been thoroughly investigated, values assigned to parameters that represent the transition between the different stages of HBV infection following exposure to the virus are usually obtained from literature references (Grob 1998; Zhang, Zhang and Ye 2006; Baumert, Thimme and von Weizsäcker 2007; Nguyen, Ludgate and Hu 2008; Chisari, Isogawa and Wieland 2010; Iannacone and Guidotti 2022). Infection with HBV and progression to chronicity may be unnoticed and as a result may not be diagnosed, but the risk of transmitting the virus to a susceptible person following effective contact still exists (Shepard *et al.* 2006; Seto, Lo, Pawlotsky and Yuen 2018).

Many modelling exercises rely on seroprevalence data obtained from previously published studies. In this context, our objective was to use country-wide data collected from our HBV testing among women attending antenatal care in 2017 (Chapter 6) and from data obtained from the NHLS CDW (Chapter 5 and additional data subsequently received). All these data were from the public health sector of South Africa and were used to model the impact of a birth dose of the HBV vaccine into South Africa's EPI schedule. Furthermore, an existing tailored

model will provide an adaptable framework that can be easily adjusted to accommodate other public health interventions.

7.2 METHODS

We used HBV exposure data for the period 1997 to 2014 obtained from the NHLS CDW to estimate the proportion of individuals who were exposed to HBV, susceptible to HBV infection, the average annual FOI, the basic reproduction number (R_0), and the median age of infection at a national level. We used the data obtained from our HBV testing to estimate susceptibility among pregnant women in 2017 and the number of infants who would have been exposed to HBV at birth. We therefore used country-specific data to model the impact of a birth dose of the HBV vaccine over a period of time. To do this, we first setup a deterministic compartmental mathematical model with no birth dose vaccine and modified this model to subsequently include birth dose vaccination. Given that our data on pregnant women were from 2017, we chose to use 2017 as our starting time point.

We used Microsoft Excel (Version 2016, Washington, USA) for estimates calculated from the 1997 to 2014 NHLS CDW data, and the flowchart option of Berkeley Madonna 10.6.1 (University of California, Berkeley) for modelling the impact of a birth dose of the HBV vaccine. Berkeley Madonna is a modelling tool that is used for simulating and analysing mathematical models of dynamic systems and can be setup using a flowchart, which includes the mathematical equations, or with just the mathematical equations (Marcoline *et al.* 2022). We chose the flowchart option to be able to present the model diagrammatically.

7.2.1 Creating a model structure for modelling the impact of a birth dose of the HBV vaccine

We created a deterministic compartment model of six state variables (compartments); vaccinated (V), susceptible (S), exposed (E), acute infections (Ia), chronic infections (Ic), and recovered (R). Figure 7.1 illustrates the basic model structure.

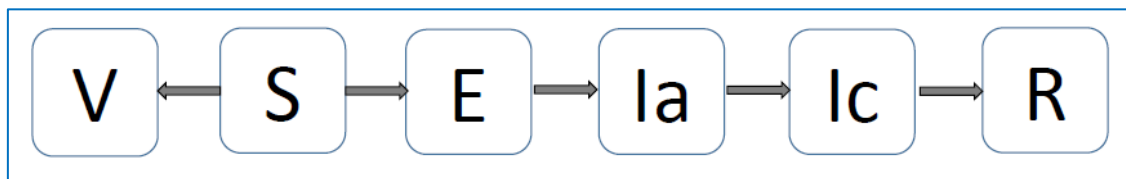


Figure 7.1: Diagrammatic representation of the model structure created for modelling the impact of a birth dose of the HBV vaccine

Figure 7.1 shows that movement out of the susceptible compartment will be following vaccination or following exposure to HBV leading to HBV infection.

Figures 7.2 and 7.3 are diagrammatic representations of our flowchart model structure, created in Berkeley Madonna, which shows the transitions between compartments, births and deaths, and represents a model without and with a birth dose of the HBV vaccine respectively.

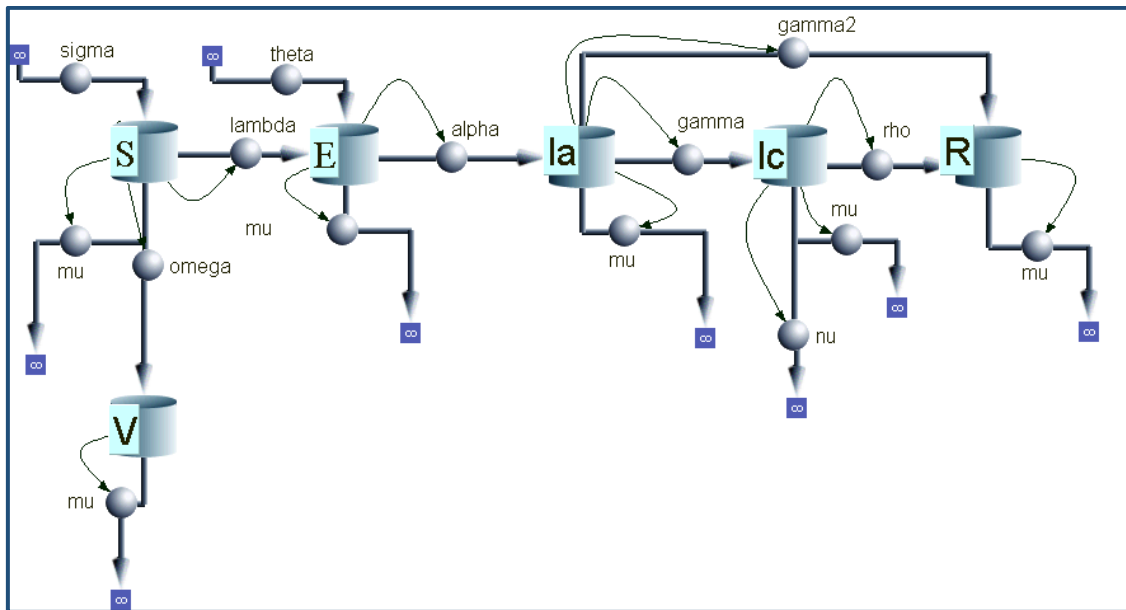


Figure 7.2: The model structure without a birth dose of the hepatitis B vaccine

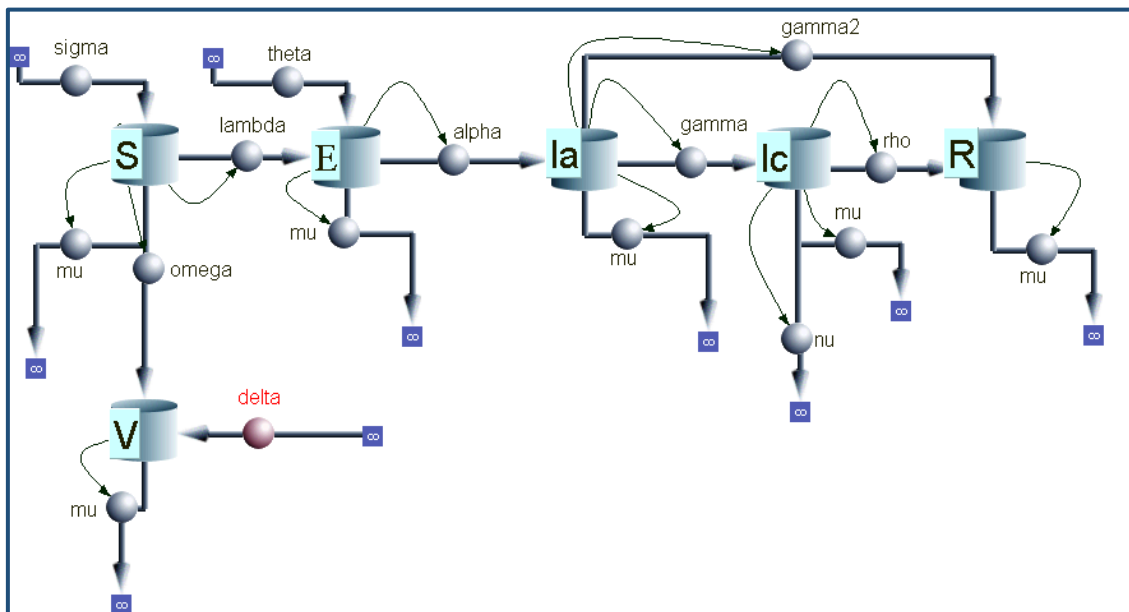


Figure 7.3: The model structure inclusive of a birth dose of the hepatitis B vaccine

The major difference between Figures 7.2 and 7.3 is the addition of a flow arrow into the "V" compartment (referred to as delta in Figure 7.3), which takes into account the administration and efficacy of the birth dose of the HBV vaccine. Table 7.1 describes the terms used in our model.

Table 7.1: Description and symbols of the terms used in our model

Term	Symbol	Description
sigma	σ	Susceptible births. These are infants born from HBsAg negative mothers and a proportion of HBsAg positive mothers.
theta	θ	Exposed births. These are infants born from a proportion of HBsAg positive mothers.
mu	μ	Natural mortality rate.
nu	ν	HBV-related deaths.
lambda	λ	Force of HBV infection, i.e. the rate at which a susceptible individual comes into effective contact with an infectious individual.
alpha	α	Transition from the exposed compartment to the acute infectious compartment.
gamma	γ	Transition from the acute infectious compartment to the chronic infectious compartment.
gamma2	γ_2	Transition from the acute infectious compartment to the recovered compartment.
rho	ρ	Transition from the chronic infectious compartment to the recovered compartment.
omega	ω	The proportion of susceptible individuals who develop protective antibodies after vaccinations at 6, 10 and 14 weeks of age
delta	δ	Immune births. These are a proportion of infants who were vaccinated at birth and developed protective antibodies.

7.2.2 Differential equations

The differential equations used in our model for each of the six compartments are as follows:

- I. The rate of change in the number of individuals in the "S" compartment:

$$\text{Equation 7.1: } dS/dt = + \sigma - \lambda * S - \mu * S - \omega * S$$

- II. The rate of change in the number of individuals in the "E" compartment:

$$\text{Equation 7.2: } dE/dt = + \theta + \lambda * S - \alpha * E - \mu * E$$

- III. The rate of change in the number of individuals in the "Ia" compartment:

$$\text{Equation 7.3: } dIa/dt = + \alpha * E - \gamma * Ia - \mu * Ia - \gamma 2 * Ia$$

- IV. The rate of change in the number of individuals in the "Ic" compartment:

$$\text{Equation 7.4: } dIc/dt = + \gamma * Ia - \mu * Ic - \rho * Ic - v * Ic$$

- V. The rate of change in the number of individuals in the "R" compartment:

$$\text{Equation 7.5: } dR/dt = + \rho * Ic + \gamma 2 * Ia - \mu * R$$

- VI. The rate of change in the number of individuals in the "V" compartment:

- a. Without a birth dose of the HBV vaccine:

$$\text{Equation 7.6: } dV/dt = + \omega * S - \mu * V$$

- b. With a birth dose of the HBV vaccine:

$$\text{Equation 7.7: } dV/dt = + \delta + \omega * S - \mu * V$$

7.2.3 Parameter and proportion estimates using the NHLS CDW data

As the data from NHLS CDW spanned 1997 to 2014, we had HBV exposure data for ages three years and above before the introduction of the vaccine in South Africa. For estimate calculations, we used the anti-HBcT variable as it is considered a lifelong marker following exposure to HBV (Holtkamp, Fiedler, Dittmer and Anastasiou 2022; Control and Prevention 2023).

7.2.3.1 Proportion of the population who were exposed to HBV or susceptible to HBV infection

We analysed the HBV exposure data to identify the total number of individuals who were tested for anti-HBcT and the number of individuals who either tested positive or negative for anti-HBcT. Equations 7.8 and 7.9 represent the equations used to calculate the proportion exposed and susceptible respectively.

Equation 7.8: Proportion exposed = (number of individuals who tested positive for anti-HBcT) / (total number of individuals tested for anti-HBcT)

Equation 7.9: Proportion susceptible = (number of individuals who tested negative for anti-HBcT) / (total number of individuals tested for anti-HBcT)

7.2.3.2 Estimating the basic reproduction number

We estimated the basic reproduction number (R_0) using the proportion of the total population that were susceptible (Vynnycky and White 2010) (Equation 7.10).

Equation 7.10: $R_0 = 1 / (\text{proportion of the population that is susceptible})$

This is a simplified method to express R_0 with respect to disease spread and suggests that R_0 is inversely proportional to the proportion of the population that is susceptible (Vynnycky and White 2010). Intuitively, R_0 increases as the

proportion of individuals who are susceptible decreases, indicating a higher rate of disease transmission within the population thereby reducing the number of susceptible individuals.

7.2.3.3 Graphical check to determine if the average annual force of infection was age dependent

To determine whether the average annual FOI varied with age in our population, we created a plot of the negative natural log of the proportion susceptible ($-\ln(\text{proportion susceptible})$) by age in years against the age midpoints (Vynnycky and White 2010). Here, we aimed to examine whether the observed pattern followed a linear trend, which would indicate that the average annual FOI was constant among all ages and therefore not age dependent (Vynnycky and White 2010). If the pattern resembled more than one linear trend, then the average annual FOI must be assumed to be different for ages that represented each linear trend and estimated for those specific age groups. Although the average annual FOI should not be assumed to be the same if the plot resembled more than one linear trend, it can subsequently be calculated to be similar or even identical.

7.2.3.4 Estimating the average annual force of infection for different age groups

To estimate the average annual FOI, we applied a formula to calculate the average annual risk of infection (Equation 7.11) and the average annual FOI (Equation 7.12) per age group that appeared to have different rates of the average annual FOI (Vynnycky and White 2010).

Equation 7.11: Average annual risk of infection =

$$1 - (\text{proportion negative for anti-HBcT})^{(1/(\text{age midpoint}))}$$

Equation 7.12: Average annual FOI =

-natural log(1-average annual risk of infection)

7.2.3.5 Fitting the model to data (model calibration)

After estimating the average annual FOI, we used a model created in Microsoft Excel (Version 2016, Washington, USA) to predict the proportion of individuals who were previously exposed (referred to as ever infected in the Excel model) by age mid-points of selected age groups using Equation 7.13.

$$\text{Equation 7.13: Proportion ever infected} = 1 - e^{-(\text{FOI} \times \text{age mid-point})}$$

These predictions were solely based on the estimated average annual FOI and age mid-points without inclusion of any additional data. We plotted the predicted proportions to show the predicted data based on the estimated average annual FOI. We then added our observed anti-HBcT data (positive, negative and total) to our model in Microsoft Excel at the same age midpoints, calculated the proportion positive (positive / total) and included a plot of the observed proportions alongside the plot of the predicted proportions. The term "fitting the model to data" refers to adjusting one or more parameters of the model so that it aligns as closely as possible to the observed data points. It was finding the best fit of the predicted data to the observed data. The goal was to create a model that accurately represented the observed data by changing an estimated value or values that allowed for better predictions or insights. In our case, we wanted to adjust the estimated average annual FOI to be able to use the fitted FOI when modelling the impact of a birth dose of the HBV vaccine.

To find the best fit of the predicted data to the observed data, we applied the Maximum Likelihood Estimation (MLE) method to formally estimate the average annual FOI (Haynes 2013). Simply, the MLE method measures the difference between the model prediction and observed data points (goodness of fit statistic)

and provides an adjusted value (in our case the FOI) based on the best fit of the predicted data to the observed data. A good comparison between the original FOI and MLE estimated FOI would suggest that the calculations used to estimate the original FOI were correctly applied. We used the estimated MLE average annual FOI for modelling the impact of a birth dose of the HBV vaccine.

7.2.3.6 Model validation

Here, we used the NHLS CDW HBV exposure data pre-introduction of any intervention from 2015 to 2019 to validate our model, i.e. to provide assurance that the model predictions are able to accurately represent real-life observations. The data used for model validation must be data that was not used for model calibration and for the latter, we used data from 1997 to 2014.

7.2.3.7 Estimating the median age of infection

The median age of infection represents the age at which 50% of a population (proportion of 0.5) had been infected with a disease. A quick and crude method of estimating the median age at infection is to use a plot of the proportion of individuals who were exposed to a disease and locate the point where 50% of the population tested positive. Equation 7.14 was a more formal way of estimating the median age of infection.

$$\text{Equation 7.14: } A = S \cdot L$$

In Equation 7.14, "A" is the median age of infection, "S" is the proportion of the population that is susceptible, and "L" is the average life expectancy. We applied a life expectancy of 63 years, as reported for 2017 (United Nations 2023). For modelling purposes, it is preferred to use Equation 7.14 to calculate the median age at infection. However, it is good to have both estimates and compare their

outputs to see how well the crude estimate aligns with the formal calculated estimate.

7.2.4 Estimation of exposed, susceptible and immunised births

For these estimations, we needed population, birth rate and infant mortality rate estimates for South Africa. For our purposes, we excluded infant deaths from the births to factor in only infants who will age beyond infancy. For immunised births following a birth dose of the HBV vaccine, we needed to factor in birth dose coverage and birth dose efficacy. For estimations of the proportions of infants exposed to HBV or susceptible to HBV infection, we used our HBsAg and HBeAg data obtained from testing of the antenatal samples of 2017 (Chapter 6). Table 7.2 shows the estimates used in our model and their source.

Table 7.2: Terms and estimates applied to our model

Estimates required	Terms applied in our model equations	Estimates used in our model	Source
Country population estimate for South Africa in 2017	pop	56,641,209	(United Nations 2023)
Live birth estimate for South Africa in 2017	l_births	0.0211	
Infant mortality rate for South Africa in 2017	infant_m_rate	0.0284	
Live births excluding infant deaths for South Africa in 2017	b_rate	$l\_births * (1 - infant\_m\_rate)$	
Proportion of pregnant women who were HBsAg positive	hbsagpos	0.1124	Chapter 6
Proportion of pregnant women who were HBsAg positive	hbsagneg	0.8876 (1 - 0.1124)	Chapter 6
Proportion of HBsAg pregnant women who were HBeAg positive	hbeagpos	0.0948	Chapter 6
Proportion of HBsAg pregnant women who were HBeAg negative	hbeagneg	0.9052 (1 - 0.0948)	Chapter 6
Proportion of HBeAg positive mothers who will give birth to HBV exposed infants	hbeagpos_exp_rate	0.8	(CDC 1988; Nelson, Jamieson and Murphy 2014)
Proportion of HBeAg negative mothers who will give birth to HBV exposed infants	hbeagneg_exp_rate	0.2	
Vaccinated infants at birth	hepbddcov	0.8	Assumed
Efficacy of the birth dose	hepbddeff	0.9	(Meireles, Marinho and Van Damme 2015; Kim, Loucks and Shah 2023)

7.2.4.1 The model without a birth dose of the HBV vaccine

In this model, births would either be born into the "S" compartment or the "E" compartment. All HBsAg negative mothers would give birth to infants who are susceptible to HBV infection. Some HBsAg positive mothers would give birth to infants who were exposed to HBV and others would give birth to infants who were susceptible to HBV infection. Our estimations were based on literature references of vertical transmission rates among HBsAg and HBeAg positive mothers, and among HBsAg positive and HBeAg negative mothers. We used the reported HBeAg estimates to calculate the weighted proportion among HBsAg positive mothers who would give birth to infants exposed to HBV. We used Equation 7.15 to calculate the estimated weighted proportion (referred to as the "exp_rate" in our model).

$$\text{Equation 7.15: } \text{exp\_rate} = ((p1 \times n1) + (p2 \times n2)) / (n1+n2)$$

In Equation 7.15, p1 refers to the estimated proportion of HBeAg positive mothers who would give birth to HBV exposed infants and n1 is the number of HBeAg positive mothers, and p2 is the estimated proportion of HBeAg negative mothers who would give birth to HBV exposed infants and n2 is the number of HBeAg negative mothers. We used the weighted proportion of HBsAg positive mothers who would give birth to HBV exposed infants as the rate of births into the exposed compartment (Equation 7.16). The remaining births were born into the susceptible compartment (Equation 7.17).

$$\begin{aligned} \text{Equation 7.16: The number of infants born into the "E" compartment (theta)} \\ = \text{hbsagpos} \times \text{exp\_rate} \times \text{b\_rate} \times \text{pop} \end{aligned}$$

$$\begin{aligned} \text{Equation 7.17: The number of infants born into the "S" compartment (sigma) =} \\ (\text{hbsagneg} \times \text{b\_rate} \times \text{pop}) + (\text{hbsagpos} \times (1 - \text{exp\_rate}) \times \text{b\_rate} \times \text{pop}) \end{aligned}$$

Intuitively, a proportion of one (1) represents 100%. Therefore, if we estimated the proportion of births exposed to HBV at birth to be X , then the complementary proportion $(1 - X)$ would represent the proportion of births who were not exposed to HBV at birth. As an illustrative example for Equations 7.16 and 7.17, considering the exposure rate (exp_rate), if the total number of births is 100 and the proportion of HBsAg positive pregnant women is 0.1 (10 out of 100), then applying the $\text{exp\_rate} = 0.2$, the expression $0.2 \times 0.1 \times 100$ would represent the number of babies exposed to HBV at birth. Similarly, $(1 - 0.2) \times 0.1 \times 100$ would represent the number of babies born from HBsAg positive mothers but not exposed to HBV at birth. In this example, the calculation yields 2 and 8 respectively, and the sum of these values $(8 + 2)$ equals the total number of births from HBsAg positive mothers (10).

7.2.4.2 The model with a birth dose of the HBV vaccine

In this model, there will be births into the "S", "E" and "V" compartments. We first used Equation 7.18 to calculate the number of infants who would be born into the "V" compartment, followed by Equation 7.19 to calculate number of infants who would be born into the "E" compartment, and lastly Equation 7.20 to calculate the number of infants who would be born into the "S" compartment.

Equation 7.18: The number of infants born into the "V" compartment (δ) =

$$\text{hepbddcov} \times \text{hepbddeff} \times \text{pop} \times \text{b\_rate}$$

Intuitively, if the efficacy of the birth dose vaccine (hepbddeff) is 90% and 80% of the population (births in our model) was vaccinated (hepbddcov), then 90% of 80% (72% in total or a proportion of 0.72) would be protected. Here, this applied to all births irrespective of the HBsAg status of the mother.

Equation 7.19: The number of infants born into the "E" compartment (θ) =

$$(hbsagpos * exp\_rate * b\_rate * pop * (1 - hepbbdcov)) + (hbsagpos * exp\_rate * b\_rate * pop * hepbbdcov * (1 - hepbbdeff))$$

Intuitively, only births from HBsAg positive mothers can be born into the "E" compartment. In Equation 7.19, $(hbsagpos * exp\_rate * b\_rate * pop * (1 - hepbbdcov))$ represents the number of infants exposed to HBV at birth who did not receive the birth dose of the HBV vaccine $(1 - hepbbdcov)$, and $(hbsagpos * exp\_rate * b\_rate * pop * hepbbdcov * (1 - hepbbdeff))$ represents the number of infants exposed to HBV at birth who received the birth dose of the HBV vaccine but did not develop protective antibodies $(1 - hepbbdeff)$.

Equation 7.20: The number of infants born into the "S" compartment (σ) =

$$(b\_rate * pop) - (hepbbdcov * hepbbdeff * pop * b\_rate) - ((hbsagpos * exp\_rate * b\_rate * pop * (1 - hepbbdcov)) + (hbsagpos * exp\_rate * b\_rate * pop * hepbbdcov * (1 - hepbbdeff)))$$

Intuitively, if we consider all the births $(b\_rate * pop)$, and exclude those born into the "V" compartment $(hepbbdcov * hepbbdeff * pop * b\_rate)$ and those born into the "E" compartment $((hbsagpos * exp\_rate * b\_rate * pop * (1 - hepbbdcov)) + (hbsagpos * exp\_rate * b\_rate * pop * hepbbdcov * (1 - hepbbdeff)))$, then the remaining births will be born into the "S" compartment.

7.2.5 Parameter and proportion estimates based on literature references

Before we could run our model, we needed to ensure that estimates obtained from literature references were assigned accordingly. Table 7.3 shows the estimates required, the symbols used to represent these estimates, their values and their source.

Table 7.3: Estimates assigned to parameters and proportions based on existing literature

Estimates required	Terms applied in our model equations	Estimates used in our model	Source
Mu	μ	0.0097	(United Nations 2023)
Nu	ν	0.2	(Anley <i>et al.</i> 2023)
Alpha	α	Exposure period of 75 days on average	(Liang 2009; Jindal, Kumar and Sarin 2013; Takata <i>et al.</i> 2020; Control and Prevention 2023)
Gamma	γ	0.9	(Control and Prevention 2023)
Gamma2	γ_2	0.1	(Control and Prevention 2023)
Rho	ρ	0.015	(Chu and Liaw 2010; Liu <i>et al.</i> 2010)

7.2.6 Model assumptions

In our model, we used the birth and mortality rates (natural and HBV-related) as published for 2017 and these were assumed to be constant over the modelled period (United Nations 2023). We assumed vaccine coverage rates (births and vaccinations at 6, 10 and 14 weeks of age) were 80% for all vaccinations, and assumed the rate to be constant for the modelled period. This assumption, specifically for vaccinations at 6, 10 and 14 weeks of age, was realistic given the reported vaccine coverage rates from 2017 (Table 2.3).

7.2.7 Modelling the impact of a birth dose of the HBV vaccine

We used the values as obtained from literature references or as estimated through our own calculations from the NHLS CDW data and from testing of the antenatal samples to run the model under two scenarios; 1) births without a birth dose of the HBV vaccine, and 2) births with a birth dose of the HBV vaccine. We ran the model for a period of 30 years, tracking the cumulative proportion of individuals within each of the compartments on a yearly basis. The rationale for a cumulative proportion was based on identifying the total number of births from initiation in 2017 that were estimated to have progressed to chronic HBV disease or were estimated to have succumbed to HBV infection within a 30-year timeframe.

7.3 RESULTS

7.3.1 Proportion of the population that were exposed and susceptible to HBV infection

Analysis of the anti-HBcT marker on individuals who were not vaccine eligible as infants showed that half of the population were either exposed to HBV or susceptible to HBV infection (Table 7.4)

Table 7.4: Proportions of individuals who were exposed to HBV or susceptible to HBV infection

Anti-HBcT Negative (Susceptible)	
No.	Proportion
278,435	0.50
Anti-HBcT Positive (Exposed)	
No.	Proportion
282,384	0.50
Anti-HBcT Total	551,772

7.3.2 Estimation of the basic reproduction number

Applying Equation 7.10 and using the proportion susceptible of 0.5, we calculated R_0 to be 2 ($1/0.5$).

7.3.3 Graphical check of the force of infection

After plotting the negative natural log of the proportion susceptible by age mid-points in years, we observed that the average annual FOI may vary for three age groups, as indicated by three trend lines; under 15 years, 15 to 29 years and 30 years and above (Figure 7.4).

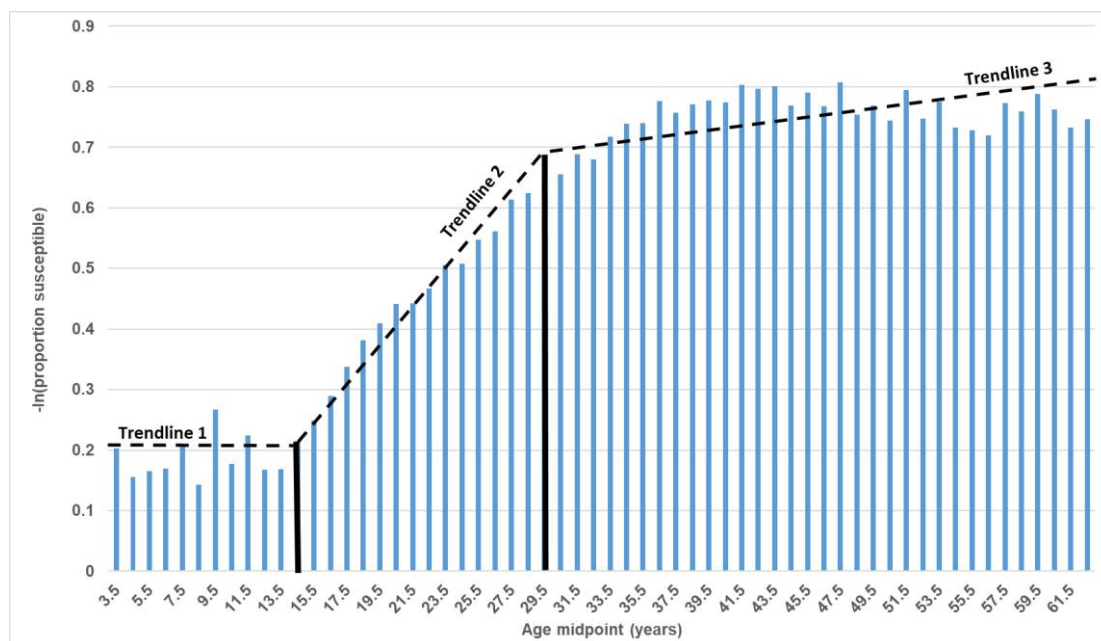


Figure 7.4: Plot of the negative natural log of the proportion susceptible by age mid-points in years as a graphical check for a constant FOI

Given these observations, we further analysed the data to obtain anti-HBcT results for age groups under 15 years, 15 to 29 years and 30 years and above to estimate the average annual FOI for these three age groups.

7.3.4 Estimation of the average annual force of infection

The proportion susceptible, average annual risk of infection and average annual FOI among age groups under 15 years, 15 to 29 years and 30 years and above is shown in Table 7.5.

Table 7.5: Calculation of the proportion susceptible, average annual risk of infection and average annual force of infection among age groups under 15 years, 15 to 29 years and 30 years and above

Calculation of proportion susceptible, average annual risk of infection and average annual force of infection								
Age Group	Age Group Midpoint	Anti-HBcT Results			Proportion Susceptible (Negative / Total)	Average annual risk of infection (Equation 7.4)	Average annual force of infection (Equation 7.5)	Average annual force of infection, rounded to 2 decimal points
		Negative	Positive	Total				
<15	7.5	3,443	695	4,138	0.832044466	0.024217845	0.024515919	0.02
15-29	22	90,354	61,143	151,497	0.59640785	0.023218501	0.023492297	0.02
30+	46.5	184,638	220,546	396,137	0.466096325	0.015942353	0.016070799	0.02

On calculating the average annual FOI for the three age groups, we noted that they were all comparable. When rounded to two decimal points, they were identical and therefore, this suggested that the average annual FOI was constant among all ages.

7.3.5 Model calibration (fitting the model to data)

Based on our FOI of 0.02 and age midpoints of selected age groups, Figure 7.5 shows the predicted proportions ever infected against the age group midpoints.

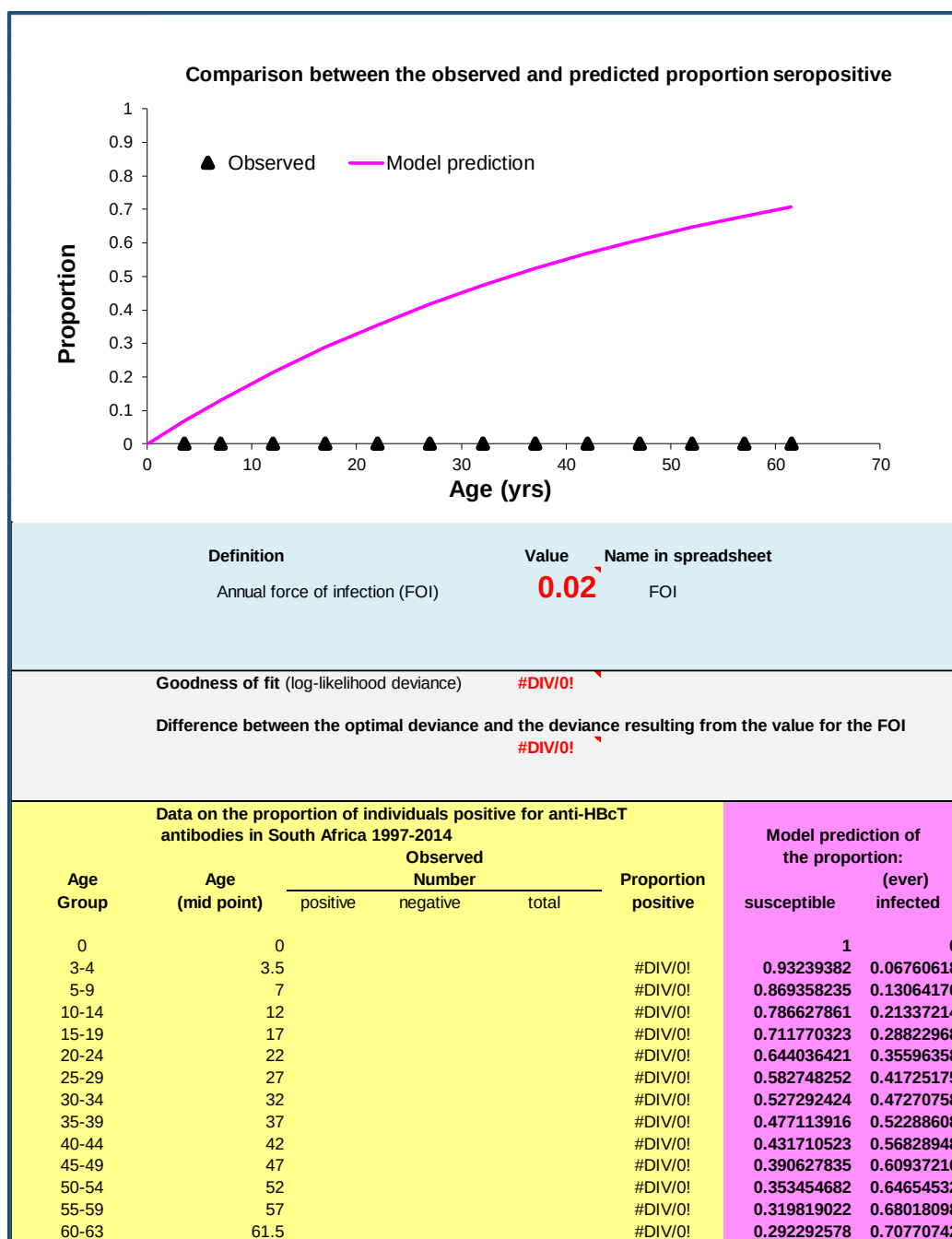


Figure 7.5: Predicted proportions ever infected with hepatitis B against age midpoints

After adding our anti-HBcT data to the model with the FOI of 0.02, the proportion positive (observed data), the goodness of fit statistic and the difference between the model prediction and observed data is shown in Figure 7.6.

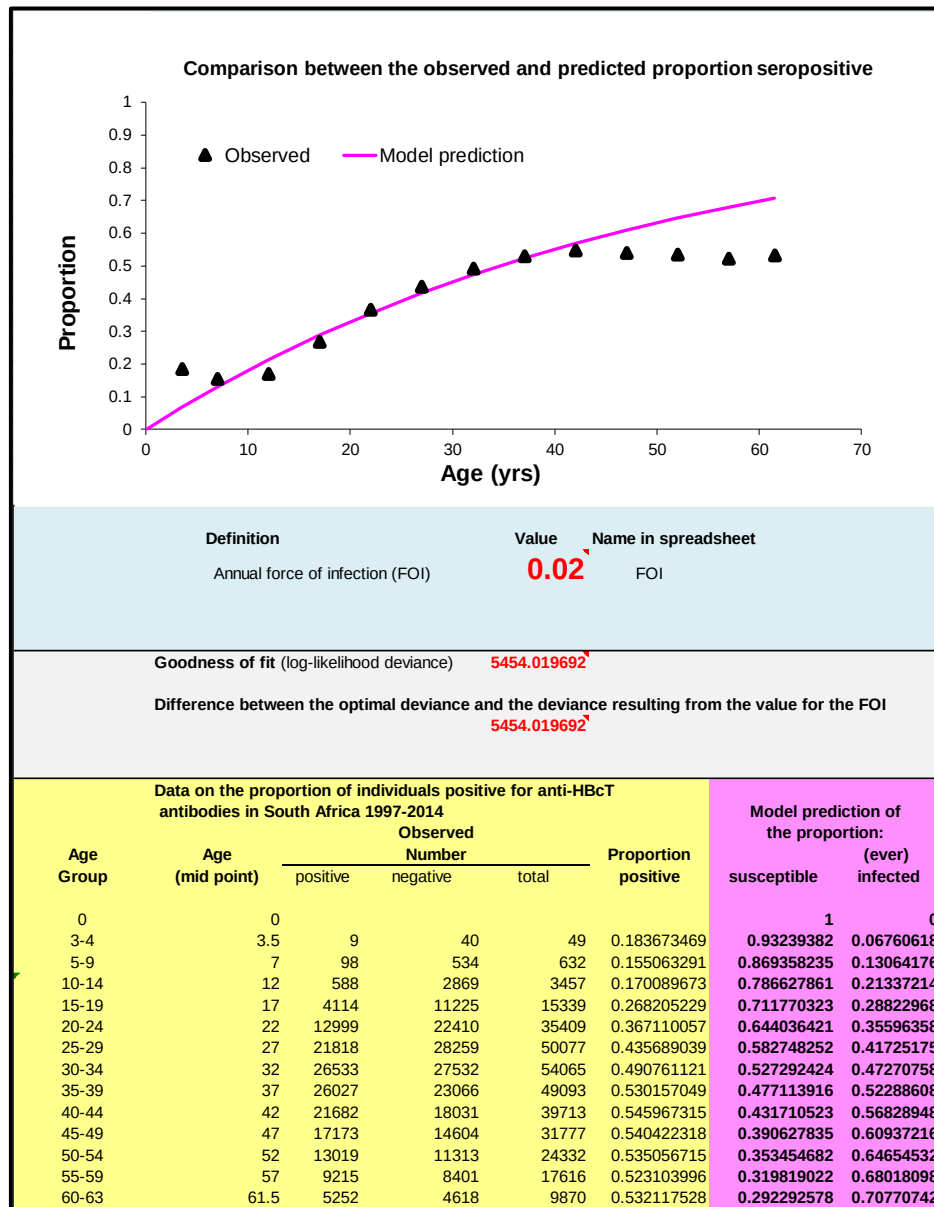


Figure 7.6: Deviance between model predictions of individuals who were ever infected with HBV versus data on HBV exposure

Graphically, we see that the predicted proportions fit the observed proportions well and therefore suggest that the true FOI is similar to our calculated FOI of 0.02. The goodness of fit statistic was calculated to be 5454.02, and given that at this point we did not apply the MLE method, the difference between the optimal deviance and the deviance that resulted from the value for the FOI was the same as the goodness of fit statistic (Figure 7.6).

On minimising the goodness of fit statistic by adjusting the FOI to obtain the best fit of the predicted proportions to the observed proportions, the goodness of fit statistic dropped to 4310.18 and the average annual FOI adjusted to 0.019 (95% CI: 0.008 – 0.028) (Figure 7.7).

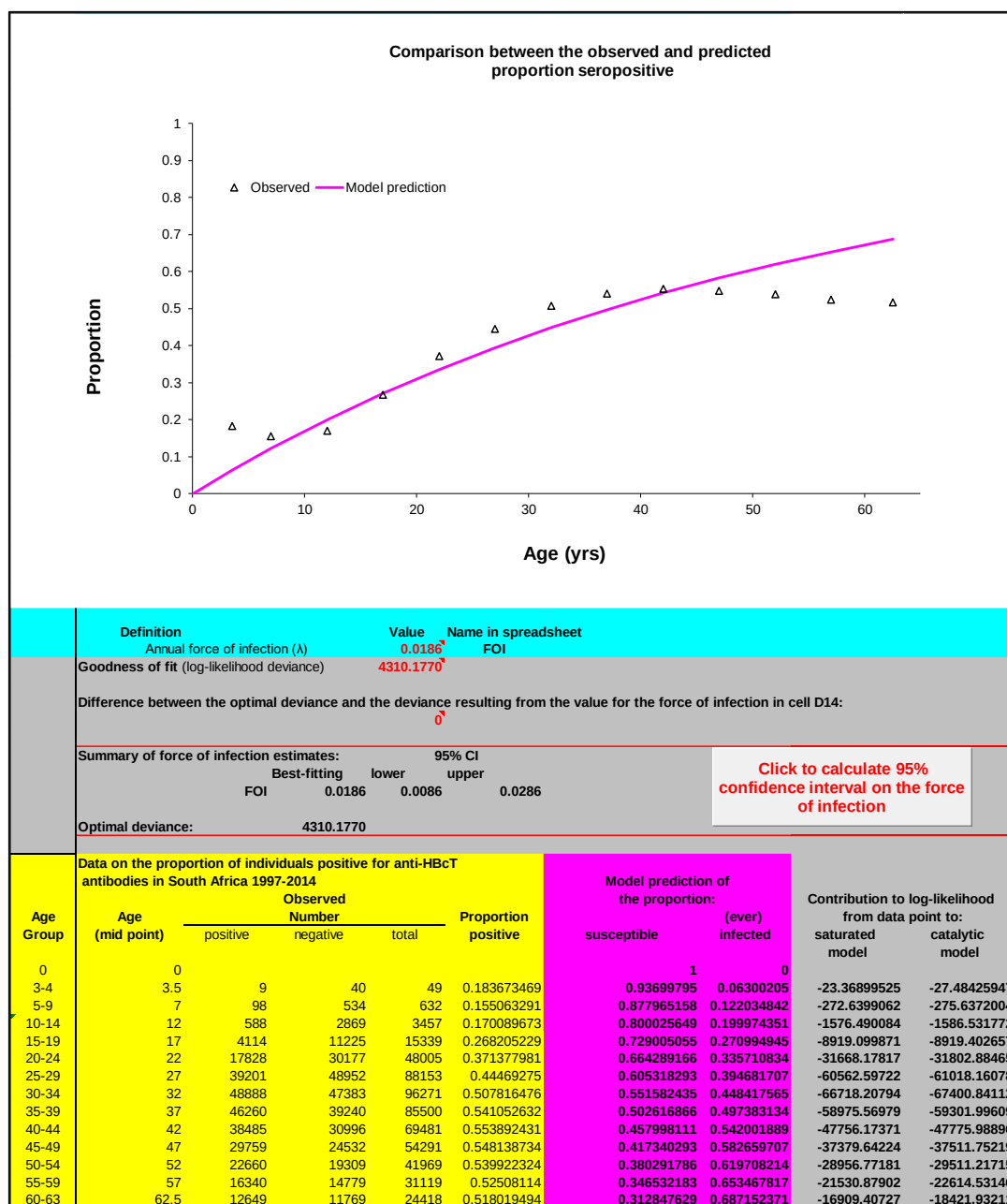


Figure 7.7: Maximum likelihood estimation of the force of infection

Here, you will notice that the difference between the optimal deviance and the deviance resulting from the value for the FOI is now 0, indicating an optimal fit

(Figure 7.7). When rounded to two decimal points, the adjusted FOI was identical to our input FOI of 0.02.

7.3.6 Model validation

Using the HBV exposure data from 2015 to 2019 pre-introduction of any intervention, we observed that the model predictions accurately represented our data, thereby validating our parameter estimation (FOI) and providing assurance that our model world mimics the real world (Figure 7.8).

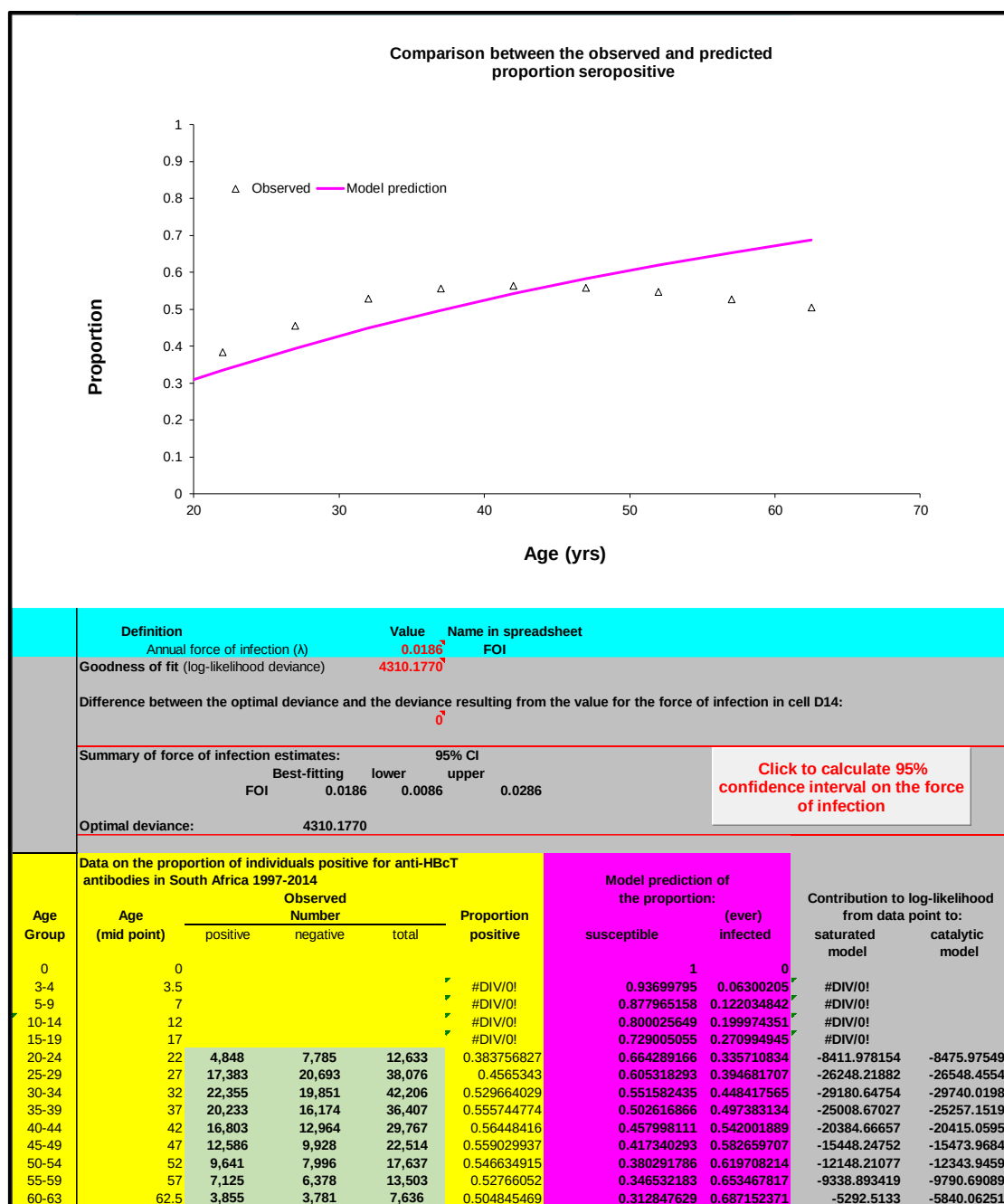


Figure 7.8: Validation of the model using HBV exposure data from 2015 to 2019

Note that the data used for the validation process was from 2015 and therefore only individuals 21 years and older were born before introduction of the HBV

vaccine into the routine EPI schedule. Therefore, exposure data for individuals 19 years old and younger were not included for validation purposes and the x-axis range was adjusted to exclude individuals under 20 years old (Figure 7.8).

7.3.7 Estimating the median age of infection

Using a plot of the proportion of individuals who were exposed to HBV infection, we estimated the median age of infection to be approximately 31.5 years (Figure 7.9).

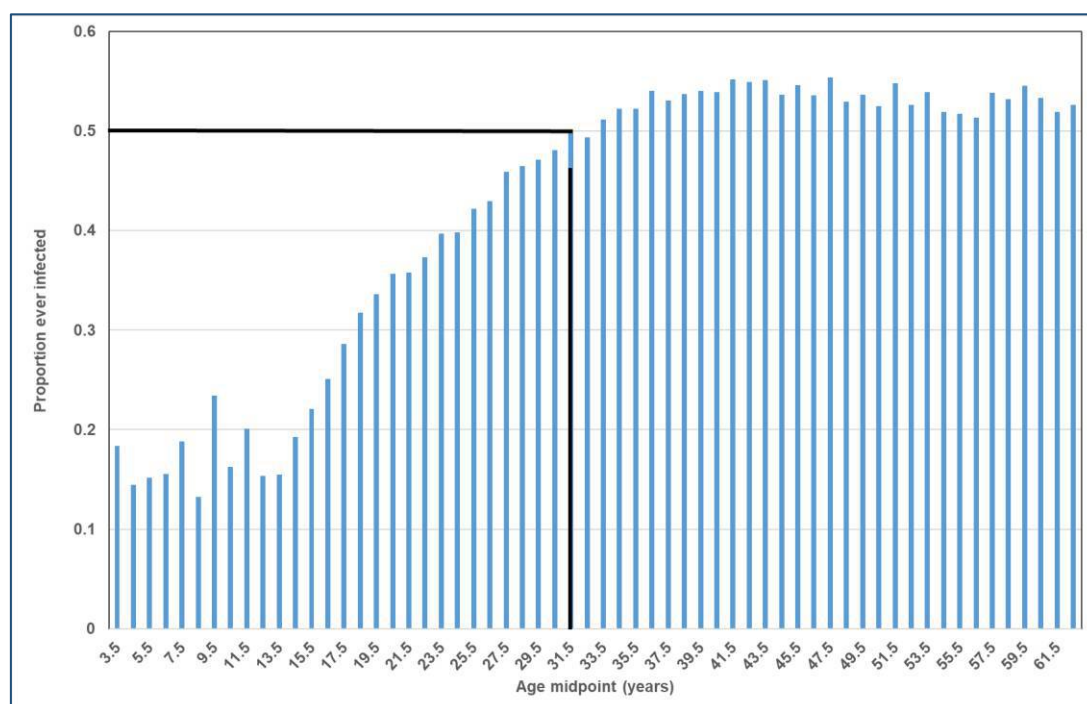


Figure 7.9: Estimation of the median age of HBV infection from a plot of the proportion of individuals who were exposed to HBV

Applying Equation 7.14 and using 0.5 (refer to 7.3.1) as the proportion of the population that was susceptible, the median age of infection was estimated to be 31.5 years (0.5×63). This showed that our crude method, which was 31.5 years, was identical to our calculated method of estimating the median age of infection.

7.3.8 Estimation of exposed, susceptible and immunised births

7.3.8.1 The model without a birth dose of the HBV vaccine

From out HBV testing among pregnant women in 2017, 478 / 4,254 (0.1124) tested positive for HBsAg. Of the 478, there were HBeAg results for 464 samples of which 44 tested positive and 420 tested negative for HBeAg. Applying Equation 7.15 to calculate the estimated weighted proportion of HBsAg positive mothers who would give birth to exposed infants, we obtained an exp_rate of 0.26.

$$\text{exp\_rate} = ((p1 \times n1) + (p2 \times n2)) / n1 + n2 =$$

$$((0.8 \times 44) + (0.2 \times 420)) / (44 + 420) = 0.26$$

7.3.9 Modelling the impact of a birth dose of the HBV vaccine

Tables 7.6 and 7.7 represent the model outputs (cumulative number of individuals in each compartment) without and with a birth dose of the HBV vaccine respectively.

Table 7.6: Model output without a birth dose of the HBV vaccine from 2017 over a period of 30 years

Time (years)	Susceptible	Exposed	Acute Infectious	Chronic Infectious	Recovered	Vaccinated
0	0	0	0	0	0	0
1	783,317	30,533	2,434	666	84	338,487
2	1,147,671	55,159	6,769	4,227	566	1,085,107
3	1,317,148	75,020	11,147	10,674	1,562	2,015,881
4	1,395,980	91,038	15,006	19,161	3,074	3,026,679
5	1,432,647	103,957	18,240	28,792	5,061	4,069,123
6	1,449,703	114,376	20,893	38,846	7,469	5,120,761
7	1,457,637	122,779	23,050	48,802	10,242	6,171,206
8	1,461,327	129,557	24,796	58,315	13,327	7,215,678
9	1,463,043	135,023	26,206	67,177	16,676	8,252,005
10	1,463,842	139,431	27,345	75,274	20,246	9,279,230
11	1,464,213	142,986	28,263	82,564	23,999	10,296,958
12	1,464,386	145,854	29,004	89,051	27,900	11,305,058
13	1,464,466	148,167	29,602	94,767	31,921	12,303,516
14	1,464,503	150,032	30,084	99,765	36,036	13,292,379
15	1,464,521	151,536	30,472	104,105	40,225	14,271,715
16	1,464,529	152,749	30,786	107,852	44,468	15,241,607
17	1,464,533	153,728	31,039	111,072	48,750	16,202,141
18	1,464,534	154,517	31,243	113,826	53,058	17,153,405
19	1,464,535	155,154	31,407	116,173	57,381	18,095,487
20	1,464,536	155,667	31,540	118,167	61,709	19,028,475
21	1,464,536	156,081	31,647	119,856	66,034	19,952,458
22	1,464,536	156,415	31,733	121,281	70,351	20,867,521
23	1,464,536	156,684	31,802	122,483	74,653	21,773,751
24	1,464,536	156,901	31,859	123,492	78,936	22,671,233
25	1,464,536	157,076	31,904	124,340	83,197	23,560,051
26	1,464,536	157,218	31,940	125,049	87,432	24,440,290
27	1,464,536	157,332	31,970	125,642	91,639	25,312,032
28	1,464,536	157,424	31,994	126,137	95,817	26,175,358
29	1,464,536	157,498	32,013	126,549	99,963	27,030,351
30	1,464,536	157,557	32,028	126,892	104,076	27,877,091

Table 7.7: Model output with a birth dose of the HBV vaccine from 2017 over a period of 30 years

Time (years)	Susceptible	Exposed	Acute Infectious	Chronic Infectious	Recovered	Vaccinated
0	0	0	0	0	0	0
1	219,329	8,549	682	187	24	926,790
2	321,348	15,445	1,895	1,184	158	1,959,825
3	368,802	21,006	3,121	2,989	437	3,036,470
4	390,874	25,491	4,202	5,365	861	4,127,644
5	401,141	29,108	5,107	8,062	1,417	5,219,878
6	405,917	32,025	5,850	10,877	2,091	6,306,961
7	408,138	34,378	6,454	13,664	2,868	7,386,058
8	409,171	36,276	6,943	16,328	3,732	8,455,905
9	409,652	37,806	7,338	18,809	4,669	9,515,967
10	409,876	39,041	7,657	21,077	5,669	10,566,049
11	409,980	40,036	7,914	23,118	6,720	11,606,112
12	410,028	40,839	8,121	24,934	7,812	12,636,189
13	410,050	41,487	8,288	26,535	8,938	13,656,349
14	410,061	42,009	8,423	27,934	10,090	14,666,672
15	410,066	42,430	8,532	29,149	11,263	15,667,249
16	410,068	42,770	8,620	30,199	12,451	16,658,169
17	410,069	43,044	8,691	31,100	13,650	17,639,525
18	410,070	43,265	8,748	31,871	14,856	18,611,408
19	410,070	43,443	8,794	32,529	16,067	19,573,910
20	410,070	43,587	8,831	33,087	17,278	20,527,121
21	410,070	43,703	8,861	33,560	18,490	21,471,130
22	410,070	43,796	8,885	33,959	19,698	22,406,027
23	410,070	43,872	8,905	34,295	20,903	23,331,899
24	410,070	43,932	8,920	34,578	22,102	24,248,834
25	410,070	43,981	8,933	34,815	23,295	25,156,918
26	410,070	44,021	8,943	35,014	24,481	26,056,235
27	410,070	44,053	8,952	35,180	25,659	26,946,872
28	410,070	44,079	8,958	35,318	26,829	27,828,911
29	410,070	44,099	8,964	35,434	27,990	28,702,435
30	410,070	44,116	8,968	35,530	29,141	29,567,528

In order to distinctly illustrate the outcomes with and without the administration of a birth dose of the HBV vaccine, we created plots showing the cumulative numbers of individuals within the susceptible, acute infectious, exposed, and recovered compartments (Figure 7.10).

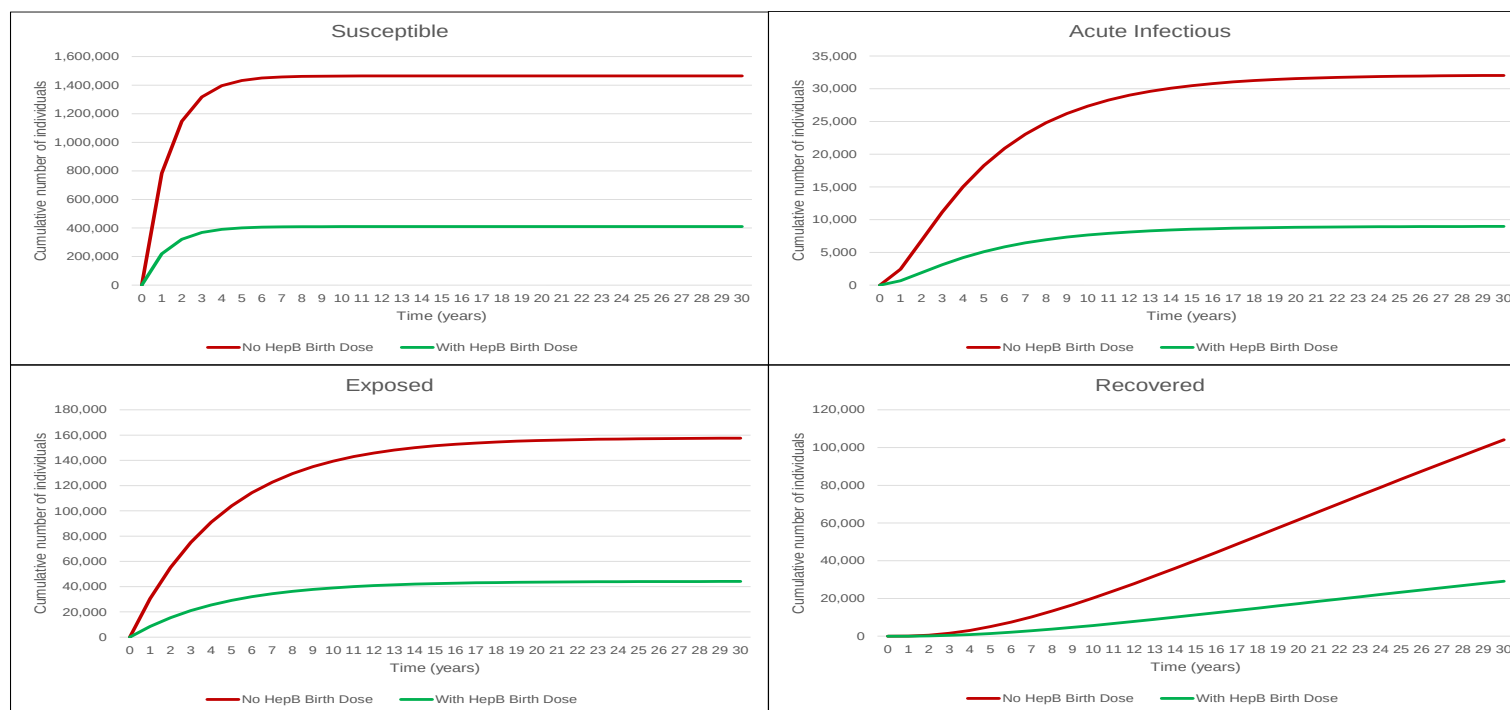


Figure 7.10: Illustration of the cumulative number of individuals in the susceptible, exposed, acute infectious and recovered compartments, comparing scenarios with and without the inclusion of a birth dose of the HBV vaccine from 2017 over a period of 30 years.

Based on the observations from Figure 7.10, it is evident that the cumulative numbers of individuals in the susceptible, exposed, acute infectious, and recovered compartments are over three times higher without a birth dose of the HBV vaccine, as compared to the cumulative numbers with the inclusion of a birth dose of the HBV vaccine.

In light of the significant burden posed by HBV disease, we opted to present a dedicated figure illustrating the cumulative number of individuals in the chronic infectious compartment and the cumulative number of HBV-related deaths under both model scenarios. (Figure 7.11).

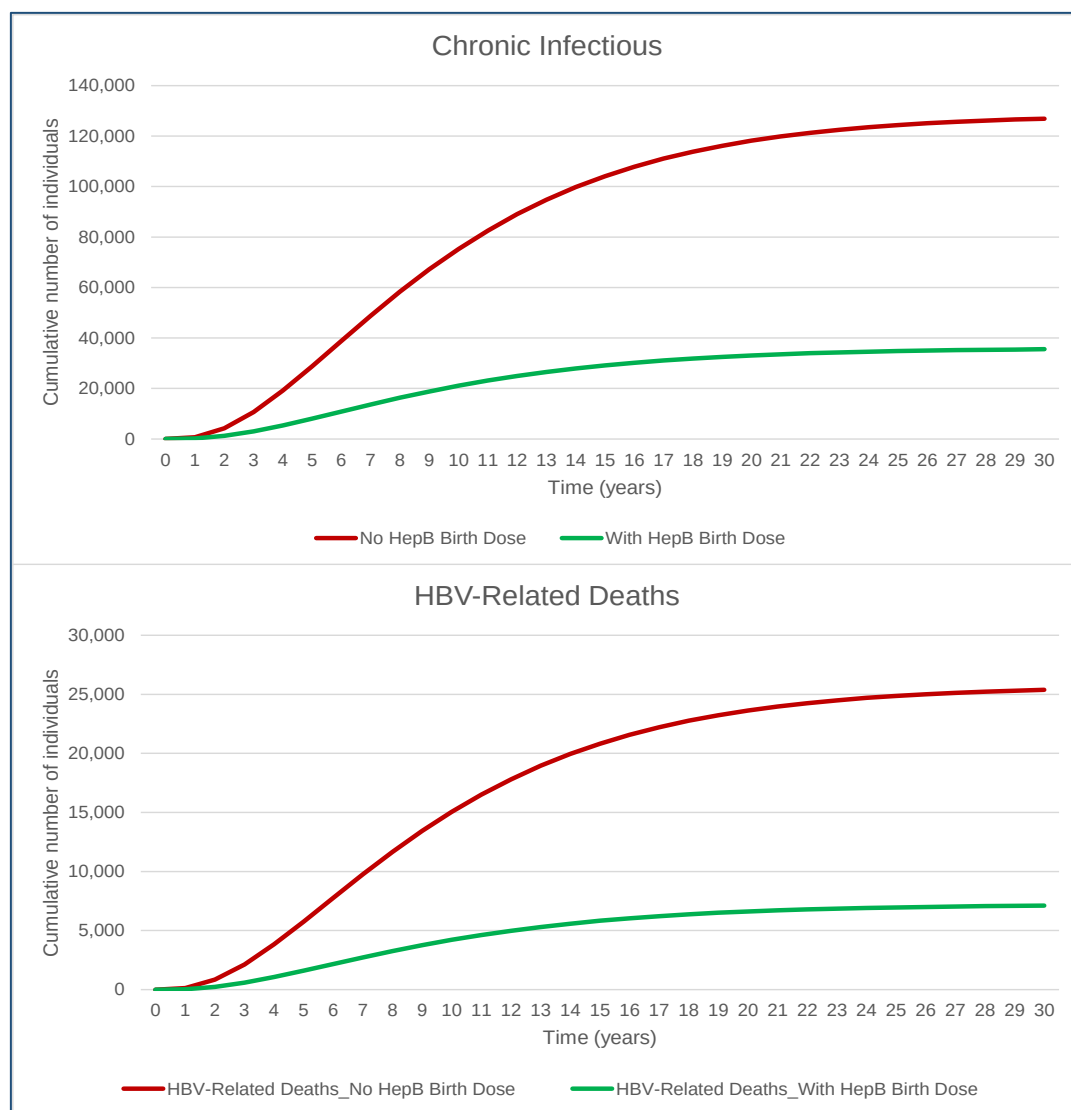


Figure 7.11: Illustration of the cumulative number of individuals in the chronic infectious compartment and the cumulative number of HBV-related deaths, both with and without the inclusion of a birth dose of the HBV vaccine from 2017 over a period of 30 years.

Referring to Figure 7.11, a comparable trend was observed between the cumulative number of individuals in the chronic infectious compartment and the cumulative number of individuals who succumbed to HBV infection, i.e. a

representation exceeding three times higher without a birth dose of the HBV vaccine.

7.4 SUMMARY AND DISCUSSION

For purposes of modelling the transmission dynamics of HBV, we needed to estimate the FOI using exposure data prior to introduction of the vaccine into South Africa's EPI schedule in 1995. Initially, this was done by calculations based on the proportion of the population that were susceptible to HBV infection, and subsequently by fitting a model of the predicted data to the observed data (model calibration), and finally by using new data to validate the model predictions. We found that our original estimation of the FOI, when rounded off to two decimal points, was identical to the fitted FOI. We also noted that our crude estimate of the median age of infection was comparable to our formal estimate. Although not a required input for our model, the median age of infection provided insights into the demographic patterns of HBV infection among the South Africa population prior to introduction of the vaccine into the EPI schedule. These findings confirmed that our initial estimations based on the exposure data were equivalent to formal estimations that were subsequently calculated, providing assurance of the reliability of the data.

Our model was set up to show the cumulative numbers of individuals from 2017 to 2047 (30 years from the starting time point of 2017) prior to and post implementation of a birth dose of the HBV vaccine. Given our focus on the impact of the birth dose on vertical transmission of HBV, our model incorporated infant-specific parameters to provide a more realistic output, especially the risk of progression to chronic infection among infants who contracted HBV through vertical transmission. Even though we saw much higher numbers of recovered individuals under the scenario of no birth dose of the HBV vaccine, which may be

deceiving, we must note that this was related to the higher numbers of acute infectious and chronic infectious individuals under the scenario of no birth dose of the HBV vaccine. Basically, recoveries are directly proportional to HBV infections, and therefore higher numbers of recoveries are due to higher number of HBV infections.

These results unmistakably demonstrated the favorable impact of administering a birth dose of the HBV vaccine, given that we observed a burden that was more than three times lower than the scenario without a birth dose of the HBV vaccine. Our findings were comparable to other modelling studies which demonstrated the reduction in chronic HBV cases with implementation of a birth dose of the HBV vaccine or scaling up the HBV birth dose vaccine coverage (Goldstein *et al.* 2005a; de Villiers, Nayagam and Hallett 2021; Anley *et al.* 2023; Belay, Abonyo and Theuri 2023b).

Limitations of our model were the assumptions that the birth rates, natural mortality rates and routine vaccine coverage rates remained constant over the 30-year period, although these rates were seen to vary in previous years (United Nations 2023; World Health Organisation 2023c). This assumption likely introduced a degree of inaccuracy into the model, which may have led to either an underestimation or overestimation of HBV transmission and the overall disease burden over the 30-year period. However, we used a static model with constant rates to allow for a more straightforward analysis, focusing on specific aspects of the problem without the added complexity of constantly changing variables. Moreover, a static model helps to establish basic relationships and identify key drivers of the disease burden, which can then inform the development of a more detailed dynamic model if needed for future purposes. The potential influence of maternally derived antibodies on resulting HBV infections was not accounted for in our model. This exclusion may have skewed the results towards

a higher perceived risk of HBV infection in infants, as it does not consider the protective role these antibodies might play in infancy. Since our model focused exclusively on infants with vertically transmitted HBV, we did not account for other transmission routes, such as horizontal, sexual, or through sharing contaminated needles, which may have influenced our overall assessment of HBV disease burden. A major strength of this study is that we used country-specific data on HBV infection among pregnant women to estimate the proportion of births who would have been born into the susceptible, exposed and recovered compartments.

Unlike other modeling studies that explored various HBV transmission routes beyond vertical transmission, our focus was specifically on vertical transmission and the consequential development of chronic HBV infections, leading to subsequent HBV-related deaths. In light of our findings, the implementation of a birth dose of the HBV vaccine was seen to be an intervention that would significantly reduce the burden of HBV disease. Of course, this has financial implications, but although it may seem exorbitant on implementation, there may be lower costs long term given the effects of a birth dose administration in our model, resulting in fewer and fewer cases needing healthcare at public health facilities. The cost-effectiveness of implementation of a birth dose of the HBV vaccine has been demonstrated from various modelling studies (Klingler, Thoumi and Mrithinjayam 2012; Scott *et al.* 2018; Reardon *et al.* 2019; Memirie *et al.* 2020; Gosset *et al.* 2021; Njuguna *et al.* 2022; Biondi *et al.* 2023).

CHAPTER EIGHT: SUMMARY OF KEY FINDINGS, DISCUSSIONS AND LIMITATIONS

8.1 OVERVIEW

Here, we highlight key observations derived from our comprehensive and rigorous country-wide data analyses, HBV laboratory testing of a nationally representative sample of pregnant women, and modelling of a birth dose HBV vaccine intervention in line with our objectives.

Below, we provide a recap of our objectives as initially outlined in Chapter 1, Section 1.3.2:

- **Objective 1:** To determine hepatitis B infection status among individuals attending public healthcare facilities in South Africa over a five year period (2015 to 2019) through comprehensive analyses of combined HBsAg and HBeAg serological markers using data obtained from the NHLS CDW.
- **Objective 2:** To determine the annual prevalence and incidence rates of hepatitis B virus infection in the public health sector of South Africa over the period 2015 to 2019 through data analyses of HBsAg and anti-HBcIgM serological markers respectively using the NHLS CDW data.
- **Objective 3:** To determine hepatitis B immunity and susceptibility status among individuals attending public healthcare facilities in South Africa over a five year period (2015 to 2019) through extensive individual and combined analyses of anti-HBs, anti-HBcT and HBsAg serological markers using data obtained from the NHLS CDW
- **Objective 4:** To determine hepatitis B infection and immunity status in HIV-uninfected and HIV-infected pregnant women throughout the nine provinces of South Africa by performing hepatitis B serological laboratory testing (HBsAg, HBeAg and anti-HBs) on South Africa's 2017 antenatal HIV seroprevalence surveillance samples.

- **Objective 5:** To develop and apply a mathematical model of HBV transmission dynamics to model the impact of adding a birth dose hepatitis B vaccine using data obtained from analysis of the NHLS CDW data and from testing of the 2017 HIV seroprevalence surveillance samples.

8.2 HBV DISEASE BURDEN IN SOUTH AFRICA

In this section, we highlight the key findings on HBV disease burden related to objectives 1, 2 and 4 of this study.

8.2.1 National

Nationally, from 2015 to 2019, the HBsAg test positivity rate was 9.02%. Of the individuals who had at least two positive HBsAg tests, analyses showed that 6.43% were chronically infected. Where HBeAg results were available, HBeAg test positivity rates were 37.89% among HBsAg positive individuals and 42.26% among chronically infected individuals. Annually from 2015 to 2019, we observed a gradual decline in HBsAg prevalence from 9.77% to 8.09% respectively. From a population perspective, prevalence of HBsAg per 100,000 population fluctuated over the five years. Our analysis of the anti-HBcIgM serological marker to determine the trends in incidence rates (suggestive of acute HBV infections) over the five years, showed a gradual decline in incidence per 100,000 population; however, anti-HBcIgM test positivity rates declined from 2015 to 2017 but increased in 2018 and 2019.

8.2.2 Gender and age group stratification

Over the five years, HBsAg test positivity rates and chronic HBV infections were higher among males overall compared to females. Comparing incidence rates per 100,000 population and anti-HBcIgM test positivity rates, these were similar between males and females.

Age group analyses showed that HBsAg prevalence was predominant among individuals born prior to 1995, a period when the HBV vaccine had not yet been introduced in South Africa. By gender, HBsAg test positivity rates were higher among females at ages 10 to 29 years compared to males at these ages. HBV incidence was seen to predominate among individuals 15 to 39 years old. Among children under five year's old, we identified 1,131 children who tested positive for HBsAg over the five years, with a test positivity rate of 4.83%. Of the 1,131 children, 65.78% were less than one year old. Further analysis showed that 53.63% of children under one year old who tested positive for HBsAg were at ages at which transient HBsAg positivity following vaccination would not apply if the vaccine was administered at 6, 10 and 14 weeks of age. Analysis of HBeAg results among children under five year's old showed a 6.90% prevalence among HBsAg positive children.

From our NHLS CDW data analysis of women of child-bearing ages (15 to 49 year's old), we observed an HBsAg test positivity rate of 6.86%. Among these women, HBeAg results were available for 35.90%, with an HBeAg test positivity rate of 38.23%. From the total number of HBsAg positive cases among women 15 to 49 year's old, HBeAg prevalence was 13.73% overall. From our testing and analysis of pregnant women who attended public healthcare facilities for antenatal care in 2017, the HBsAg test positivity rate was 11.24%; however, close to three times higher among HIV-infected women (15.83%) compared to HIV-uninfected women (5.77%). Here, we also observed an HBeAg test positivity rate of 9.48% overall. Furthermore, the HBsAg test positivity rate among females 15 to 19 years old (vaccine eligible ages), was 8.80%.

8.2.3 Province stratification

We observed the highest HBsAg test positivity rate in Limpopo Province over the five years. Regarding HBV chronicity, the rate was highest in Eastern Cape Province (33 per 100,000 population). With respect to incidence rates per 100,000 population and anti-HBcIgM test positivity rates over the five years, we saw the highest rates in Mpumalanga and KwaZulu-Natal Provinces. In Mpumalanga, these rates declined over time, while in Eastern Cape, there was an increase in rates over time. Analysis of HBeAg tests over the five years showed that the majority of positive tests (53.67%) were from KwaZulu-Natal Province; however, of all available HBeAg tests, 51.60% were conducted in KwaZulu-Natal Province. From our testing and analysis of pregnant women in 2017, the overall HBsAg test positivity rate was highest in Limpopo Province (19.35%), followed by North West (16.91%) and KwaZulu-Natal (14.53%) Provinces. Among HIV-infected women, the HBsAg test positivity rate was highest in Western Cape Province (31.75%), followed by Limpopo (26.81%) and North West (25.00%) Provinces.

8.3 HBV IMMUNITY AND SUSCEPTIBILITY IN SOUTH AFRICA

In this section, we highlight the key findings on HBV immunity and susceptibility related to objectives 3 and 4 of this study.

8.3.1 National

From our 2015 to 2019 NHLS CDW dataset, 205,577 cases had results for anti-HBs, anti-HBcT and HBsAg. Majority (51.83%) of these cases demonstrated susceptibility to HBV infection, and 41.75% demonstrated immunity to HBV infection, either vaccine-induced or infection-induced. Based on test positivity of anti-HBs and anti-HBcT among HBsAg negative individuals, 73.78% of cases

who demonstrated immunity to HBV infection were infection-induced and the remaining (26.22%) were vaccine-induced. From our testing and analysis of pregnant women in 2017, the observed HBV immunity rate was 22.47% and observed HBV susceptibility rate was 53.60%.

8.3.2 Gender and age group stratification

From analyses of the NHLS CDW data, susceptibility rates were higher among females compared to males overall, and similar between males and females 0 to 24 years old. Susceptibility rates were highest among individuals 10 to 19 years old compared to other age groups. Overall, infection-induced immunity rates were higher in females compared to males, and higher among individuals 20 years and older compared to individuals 0 to 19 years old. From our testing and analysis of pregnant women in 2017, the HBV susceptibility rate was highest among women 15 to 19 years old. Excluding women 45 to 49 years old, the HBV immunity rate was highest among pregnant women 30 to 34 years old. Stratified by HIV status, HBV susceptibility rates were higher among HIV-uninfected pregnant women, and HBV immunity rates were higher among HIV-infected pregnant women.

8.4 MODELLING THE IMPACT OF A BIRTH DOSE OF THE HBV VACCINE

In this section, we highlight the key findings related to objective 5 of this study.

8.4.1 Data used to inform parameter or proportion estimates

From analysis of the NHLS CDW data over the period 1997 to 2014 (anti-HBcT serological marker) among individuals born before the introduction of the HBV vaccine into the EPI schedule in 1995, 50% of individuals demonstrated prior exposure to HBV. Therefore, the proportion of the population estimated to be susceptible was 0.5, and the estimated R_0 was 2. The average annual FOI was

calculated to be 0.02 and this determination was confirmed by fitting the predicted proportions of the population previously exposed to HBV to the observed exposure patterns.

We used HBsAg and HBeAg test positivity rates among pregnant women in 2017 to estimate the proportion of infants who would have been exposed at birth. Without a birth dose of the HBV vaccine, infants who were not exposed at birth were assumed to be born susceptible. To estimate the proportion of the births who would have escaped HBV exposure and infection following administration of the HBV vaccine at birth, we factored in a constant vaccine coverage rate of 80% and vaccine efficacy of 90%.

8.4.2 Modelling outputs

The cumulative number of chronically infected individuals were more than three-fold lower after 30 years with administration of the HBV birth dose to 80% of all births. Our findings demonstrated that the HBV birth dose vaccine was highly effective in reducing the burden of chronic HBV disease, with an incremental impact year on year.

In conclusion, through the rigorous application of data analyses, laboratory testing and mathematical modelling, the results presented in this research and summarised above demonstrate that each objective has been successfully met. In light of these accomplishments, it can be concluded that our findings have contributed valuable insights into the burden of HBV disease in South Africa.

CHAPTER NINE: OVERALL CONCLUDING REMARKS

Twenty-five years after the HBV vaccine was introduced into the country's EPI schedule in 1995, hepatitis B remained highly endemic in South Africa with an observed HBV prevalence of 9.02% over the period 2015 to 2019 (Hou, Liu and Gu 2005; Weinbaum *et al.* 2008; Ott, Stevens, Groeger and Wiersma 2012; MacLachlan and Cowie 2015; World Health Organisation 2017b). However, at this time, the majority of our studied population were born outside the vaccine-eligible era, and therefore our observations are likely linked to HBV endemicity in South Africa pre-1995.

Factoring in the introduction of the HBV vaccine in 1995, our findings on HBV infection rates and vaccine-induced immunity rates clearly demonstrated the positive impact of the HBV vaccine, even though vaccine coverage rates were suboptimal for South Africa from 1997 onwards (Table 2.3). Increased efforts are needed to improve vaccine coverage rates to optimal levels, and this requires, at a minimum, enhanced public awareness, efficient distribution systems, and collaborative initiatives among healthcare providers and communities. Given the demonstrated effectiveness of the HBV vaccination schedule of South Africa and the reported effectiveness of HBV vaccination, these efforts will have an incremental impact in reducing HBV infections in childhood and older years, mostly acquired through horizontal transmission and sexual transmission respectively, (Chen *et al.* 1987; Hsu *et al.* 1988; Odusanya *et al.* 2005; Kew 2008; Zanetti, Van Damme and Shouval 2008; Wasley *et al.* 2010; Hwang and Cheung 2011; Burnett, Kramvis, Dochez and Meheus 2012; Amponsah-Dacosta *et al.* 2014; Nelson, Easterbrook and McMahon 2016; Spearman *et al.* 2017b; Centers for Disease Control and Prevention 2021; Pattyn, Hendrickx, Vorsters and Van Damme 2021). We also acknowledge here that optimal HBV vaccine coverage would not only decrease the burden of HBV but also offer protection against other debilitating vaccine-preventable diseases as the HBV vaccine is administered as a hexavalent vaccine in South Africa.

The burden of HBV disease can also be reduced through timely HBV treatment interventions targeted for chronic infections. Early identification of HBV chronicity is crucial in mitigating the risk of liver cirrhosis and hepatocellular carcinoma through timely initiation of appropriate treatment. This goal can be achieved by leveraging real-time data analysis and disseminating relevant information for effective public health interventions. This will require timely diagnosis, and real-time analysis of HBV testing data may prove to be a useful tool to identify individuals who are chronically infected. Passive surveillance can therefore play a significant role in decision-making.

From a gender perspective, our observations on HBV infection and susceptibility rates are consistent with the general trend of higher HBV prevalence among males, also due to their heightened risk of persistent HBV infection (Koulentaki *et al.* 1999; Robinson *et al.* 2005; Tsay *et al.* 2009a; Coppola *et al.* 2017; Khan *et al.* 2018; Graham, MacLachlan, Gunaratnam and Cowie 2019; Wang *et al.* 2019a; Msomi *et al.* 2020a; Hamilton *et al.* 2022). This is evident from our study through comparable rates of acute HBV infection between males and females but notably higher rates of HBsAg prevalence in males, as well as higher recovery rates among females, identified by the seroconversion from HBsAg positive to HBsAg negative. With a higher overall rate of HBsAg testing conducted among women, our findings are consistent with the general observation that women tend to exhibit a greater health-seeking tendency than males, possibly influenced by factors such as antenatal visits and their increased risk of symptomatic acute HBV infections compared to males. We believe that adopting a comprehensive approach, that combines vaccination, education, and national interventions, has the potential to decrease HBV disease prevalence in males, consequently leading to a direct impact on the overall disease burden of the country.

We have established that immunisation is pivotal in mitigating the burden of HBV infection. HBV infections found in individuals eligible for vaccination during infancy, albeit at lower rates than older individuals, suggest that these individuals acquired the infection because they were not protected, indicating their susceptibility to HBV infection prior to disease acquisition. These findings immediately suggested missed vaccinations, but given the number of cases, alternative reasoning may be associated with infection at birth, thereby negating the effects of subsequent scheduled doses of the HBV vaccine. This is plausible as infection at birth and early ages are subclinical, leading to diagnosis much later in life when vertical transmission is likely a rare consideration as a possible transmission route. Additionally, waning vaccine-induced immunity may have contributed to HBV infection at later ages, and if this is indeed the case, the potential for a booster dose of the HBV vaccine needs to be considered. Evidence of waning vaccine-induced immunity may require country-specific research studies on the durability of protection conferred by the vaccine over time; however, many studies have reported various degrees on waning vaccine-induced immunity and these may be used in support of a booster dose (Table 2.2).

On the other hand, from both datasets analysed (NHLS CDW and antenatal datasets), a notable cause for concern was the observation that individuals who were vaccine eligible as infants had the highest susceptibility rates. Given that these datasets are independent of each other, it enhances the credibility of this observation. Of greater concern here is the heightened risk of HBV infection for these individuals, with a substantial proportion likely to acquire the infection at later ages. Once again, we see justifiable reasons for administering a booster dose of the HBV vaccine, serving as an intervention to mitigate the associated risks of subsequent HBV acquisition.

The large number of children under five years old who tested positive for HBsAg, especially those under one year old at ages not associated with transient HBsAg positivity following vaccination, alerted us that these infants were most likely infected from their mothers (Rysgaard *et al.* 2012; Corsini Campioli *et al.* 2021). The high HBsAg prevalence and HBeAg positivity observed in pregnant women of 2017 and among women of child-bearing ages supports this and indicates that vertical transmission remains a great concern, more so due to the lack of preventive interventions in South Africa (Spearman and Sonderup 2014; Spearman *et al.* 2017a; National Department of Health 2019). Furthermore, using country-specific data to simulate the impact that infants infected from their mothers will have on HBV disease burden in the country, we saw that without interventions, the disease burden is projected to triple within 30 years. It's important to note here that this estimation only takes newborns into consideration, and therefore the disease burden is likely to be higher 30 years later. As a country, we are yet to intervene to try and prevent these infections, the majority of which will be life-long. Our findings emphasise the imperative for an intervention to mitigate lifelong infections in infants, thereby alleviating the burden of hepatitis B in the country. One which has proven successful and recommended by WHO since 2009 is the universal implementation of a birth dose of the HBV vaccine to prevent mother-to-child HBV transmission (World Health Organization 2009, 2015b; Boisson *et al.* 2022). The birth dose should be in addition to the country's current schedule, and for South Africa, this would be in addition to doses at 6, 10 and 14 weeks of age (World Health Organization 2009, 2015b). This intervention could be national or targeted given that targeted interventions have proven to be non-inferior to national interventions (Ansari *et al.* 2023). Targeted interventions, however, have been seen to be less cost-effective than national interventions, as they involve routine screening of pregnant women for HBV infection during antenatal care visits with administration of hepatitis B immunoglobulin and a birth dose of the HBV vaccine to infants born to HBV

positive mothers (Reardon *et al.* 2019; Matthews *et al.* 2023). Therefore, it is crucial to carefully consider which intervention to implement, rather than deliberating on whether to implement an intervention at all. Administration of a hepatitis B birth dose vaccine provides an additional advantage for children at risk of missing subsequent routine EPI doses (Ansari *et al.* 2023).

Our provincial-level findings reveal variations and disparities in public health infrastructure across South African provinces, consistent with prior reports (Ndwandwe, Nnaji and Wiysonge 2020). Investigating these disparities, especially in public health policies and district-level practices, may uncover root causes, informing targeted interventions to mitigate health risks, not only for hepatitis B but also other diseases of concern.

Despite the limitations highlighted in relevant chapters, our study reports findings from rigorous analyses of extensive national public health datasets, and from our own laboratory testing of pregnant women. These country-specific data were used to inform our model inputs, thereby enhancing the accuracy and relevance of our predictions. Our study therefore contributes valuable insights on HBV disease burden and HBV disease elimination in South Africa, and offer a solid foundation for further investigation and refinement of public health policies.

Overall, we advocate for prompt integration of a birth dose of the HBV vaccine into the existing South African EPI schedule, alongside doses administered at 6, 10, and 14 weeks of age. Additionally, sustained and intensified efforts are crucial to enhance and uphold optimal vaccine coverage rates. Implementing these measures will place South Africa in a more advantageous position in light of the WHO elimination goals of 2030.

CHAPTER 10: REFERENCE LIST

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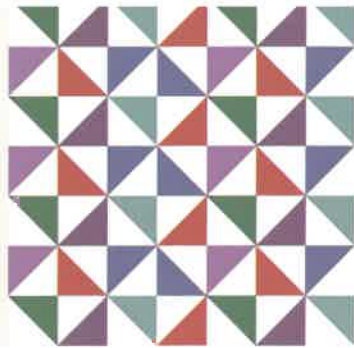
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7 October 2020

Mrs S Moonsamy
15 Henius Street
Edenglen
1609

Dear Mrs Moonsamy

Assessing the burden of hepatitis B infection in South Africa to determine disease control and elimination strategies.

Ethical Clearance Number IREC 069/20

The Institutional Research Ethics Committee acknowledges receipt of your gatekeeper permission letter.

Please note that **FULL APPROVAL** is granted to your research proposal. You may proceed with data collection.

Any adverse events [serious or minor] which occur in connection with this study and/or which may alter its ethical consideration must be reported to the IREC according to the IREC Standard Operating Procedures (SOP's).

Please note that any deviations from the approved proposal require the approval of the IREC as outlined in the IREC SOP's.

Yours Sincerely

Prof J K Adam
Chairperson: IREC



Appendix 1.2: Approval to access and analyse the NHLS CDW data

Shelina Moonsamy

From: noreply@nhls.ac.za
Sent: 20 October 2020 19:01
To: Shelina Moonsamy
Subject: Research Project Status

Importance: High

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Shelina,

Application Type: Request for Data, Request for Samples

Project Title: Assessing the burden of hepatitis B infection in South Africa to determine disease control and elimination strategies.

Thank you for submitting your application for consideration by the NHLS Academic Affairs and Research office. This email serves to inform you that your application titled 'Assessing the burden of hepatitis B infection in South Africa to determine disease control and elimination strategies.' has been finalised. The final outcome is reflected below:

Final Review Outcome: "Approved"

Kindly find below "Review Outcome Comments":

Approved.

Submission Date Applicant: 14-08-2020

Submission Date Supervisor: N/A

Submission Date Administrator: 18-08-2020

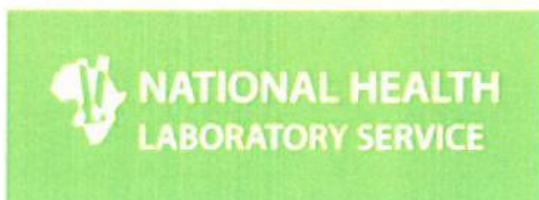
Submission Date Review: 04-10-2020

Final Review Outcome Date: 20-10-2020

A formal letter communicating the above and additional information will be sent to you.

Kind Regards,

Academic Affairs and Research
National Health Laboratory Service



Appendix 1.3: Letter of support issued by the NDoH, South Africa



health
Department:
Health
REPUBLIC OF SOUTH AFRICA

06 February 2020

RE: Support for HEPATITIS B SEROPREVALENCE AND HBsAg STATUS IN ANTENATAL WOMEN study by the Centre for Vaccines and Immunology, NICD, Sandringham.

To whom it may concern:

The National Department of Health (NDoH) recognises the need to increase the provision of and access to hepatitis services in South Africa. South Africa has adopted the World Health Organization's goal to eliminate viral hepatitis by 2030. To achieve this, the National Health Council approved the National Viral Hepatitis Management guidelines in 2018.

Hepatitis B infection can be mild with discrete or no clinical signs, or it can be severe causing acute liver failure that often carries a high mortality rate. The Centre for Vaccines and Immunology (CVI) at the National Institute for Communicable Disease (NICD) is mandated to carry out Hepatitis B surveillance in South Africa. There is currently no surveillance system in place that entails routine testing of the general population, so the approach that has been adopted entails estimation of the burden of Hepatitis B in specific subsets of the population like pregnant women. Putting all these different estimates together will provide a measure of the burden in the general population.

Sub-Saharan Africa is an area of high endemicity for hepatitis B (>8%). In the HIV era, vertical transmission of HBV from mother to child may be on the increase as immune control was shown to decrease in HIV co-infected mothers, leading to increased HBV viral load. Although vaccine effectiveness is high in South Africa, with reduced HBsAg carriage in vaccinated versus unvaccinated infants, anti-HBs antibody titres were shown to be lower in HIV-infected children. In light of natural as well as vaccine-induced immunity waning with HIV co-infection, the acquisition of passively acquired maternal antibodies in the newborn is affected.

It was shown recently that 1 in 6 HBV-positive mothers are HBeAg-seropositive, and together with higher HBV replication and viral load due to HIV immunosuppression; the risk of perinatal transmission to their babies is greatly increased. In South Africa, pregnant women and their babies are not routinely screened for HBV and hepatitis B immunoglobulin (HBIG) is expensive and not provided in the public sector to babies of HIV-HBV co-infected mothers.

It may well be that, if significant infection does take place in either intrauterine or perinatal stages, the dosing schedule may need to be adjusted to provide for a neonatal dose of HepB vaccine.

There is a need to monitor the prevalence of HBV in the antenatal cohorts as HIV is highly prevalent in this group and this may reverse the gains made with immunizations. The aims of the study are to determine whether hepatitis B antibody status is affected by HIV co-infection and whether antigen positivity is higher in HIV infected compared to HIV-uninfected antenatal women.

The impact of this study would be to understand perinatal transmission of HBV in South Africa in the HIV era and imply a change in the current HepB vaccine schedule, suggest HBV testing on high-risk antenatal women and provision of HBIG to newborns, born to HBV-infected mothers.

Blood Samples are collected from pregnant women in all districts of the country for antenatal HIV testing. Although this represents a selective population, estimates obtained from these samples will approximate the national burden of Hepatitis B in this sub-population.

Therefore, the NDoh sees the value of the planned study as it will inform future policy and programming— a significant step towards the elimination of hepatitis by 2030.

Yours sincerely

DR YG PILLAY
DEPUTY DIRECTOR-GENERAL: COMMUNICABLE AND NON
COMMUNICABLE DISEASES
NATIONAL DEPARTMENT OF HEALTH

DATE: 10/12/2020



Shelina Moonsamy

From: Cheyip, Mireille (CDC/DDPHSIS/CGH/DGHT) <uwt8@cdc.gov>
Sent: 27 July 2022 09:07
To: Shelina Moonsamy
Cc: Selamawit Woldesenbet; Adrian Puren
Subject: FW: eClearance - Project In Progress requested for PROTOCOL FOR IMPLEMENTING ENHANCED ANTENATAL HIV SENTINEL SURVEY (ANCHSS) IN SOUTH AFRICA (Amendment)
Attachments: project-summary-0900f3eb81f86d1f-7-27-2022-8_48_32.pdf
Follow Up Flag: Follow up
Flag Status: Flagged

Dear Shelina,

Congratulations! Your amendment has been approved! Attached is the signed project determination for your records.

Thanks,

Mireille

From: Publishing HD (CDC) <PublishingHD@cdc.gov>
Sent: Tuesday, July 26, 2022 8:05 PM
To: Van Wyk, Marelize (CDC/DDPHSIS/CGH/DGHT) <yco5@cdc.gov>
Subject: eClearance - Project In Progress requested for PROTOCOL FOR IMPLEMENTING ENHANCED ANTENATAL HIV SENTINEL SURVEY (ANCHSS) IN SOUTH AFRICA (Amendment)

All of the reviews have been completed for your project. You may now work on this project.



Title: [PROTOCOL FOR IMPLEMENTING ENHANCED ANTENATAL HIV SENTINEL SURVEY \(ANCHSS\) IN SOUTH AFRICA \(Amendment\)](#)
Task Type: Project In Progress
Intended Use: Project Determination
Priority: Standard
Project Contact: Van Wyk_Marelize (yco5)
Initiator Comments:
Project ID: 0900f3eb81f86d1f
Accession #: CGH-SOAFR-7/19/22-86d1f

Date Received: 7/26/2022

Description: This surveillance/survey project aims to conduct linked confidential testing (LCT) ?based antenatal HSS to provide HIV and syphilis prevalence information needed for monitoring and programme

Please do not reply to this email. For questions or issues, please contact your CIO's [eClearance administrator](#).



U.S. Department of
Health and Human Services
Centers for Disease
Control and Prevention

Print Date: 7/27/22

Title: PROTOCOL FOR IMPLEMENTING ENHANCED ANTENATAL HIV SENTINEL SURVEY (ANCHSS) IN SOUTH AFRICA (Amendment)

Project Id: 0900f3eb81f86d1f

Accession #: CGH-SOAFR-7/19/22-86d1f

Project Contact: Marelize Van Wyk

Organization: CGH/GAPCTRY/AFRS/SOAFR

Status: **Project In Progress**

Intended Use: **Project Determination**

Estimated Start Date: 10/01/2021

Estimated Completion Date: 06/30/2022

CDC/ATSDR HRPO/IRB Protocol #:

OMB Control #:

Determinations

Determination	Justification	Completed	Entered By & Role
HSC: Does NOT Require HRPO Review	Research that involves de-identified/unlinkable data or biospecimens, but not involving FDA investigational products 45 CFR 46.102(e)	7/24/22	Alexander_Lorraine N. (Ifa9) CIO HSC
PRA:	Exclusion: Information collection not conducted or		Alexander_Lorraine N. (Ifa9)

PRA does not apply	sponsored by Federal government <i>Justification:</i> CDC provides technical assistance	7/24/22	OMB / PRA
ICRO: Concur		7/26/22	Zirger_Jeffrey (wtj5) ICRO Reviewer

Description & Funding

Description

Priority: Standard

Determination Start Date: 07/19/22

Description: This surveillance/survey project aims to conduct linked confidential testing (LCT)-based antenatal HSS to provide HIV and syphilis prevalence information needed for monitoring and programme

IMS/CIO/Epi-Aid/Lab-Aid/Chemical Exposure Submission: No

IMS Activation Name: Not selected

Primary Priority of the Project: Not selected

Secondary Priority(s) of the Project: Not selected

Task Force Associated with the Response: Not selected

CIO Emergency Response Name: Not selected

Epi-Aid Name: Not selected

Lab-Aid Name: Not selected

Assessment of Chemical Exposure Name: Not selected

Goals/Purpose The main aim of this antenatal HSS is to provide empirical data over time for national, provincial and district level epidemiological estimates and extrapolation of HIV infections for future projections that will inform the process of policy planning, strategic implementation of interventions and impact evaluation of programmes and activities aimed at the prevention and control of HIV and AIDS.

Objective: Primary Objectives ? To determine the geographical distribution and pattern of HIV sero-prevalence among 15-49 years old pregnant women attending ANC clinics at national, provincial and district level in South Africa ? To monitor HIV prevalence trends over time among pregnant women attending ANC clinics in the following three domains: - (a) 15-49 years old pregnant women at national and provincial level - (b) 15-24 years old pregnant women at national level - (c) in urban and rural geo-types at national level Secondary objectives ? To describe HIV prevalence distribution by age, gravidity, parity, and education among 15-49 years old pregnant women attending ANC clinics. ? To determine the proportion of 15-49 years old pregnant women attending ANC clinics with recent HIV sero-conversions (new infections within one year) ? To determine the proportion of 15-49 years old HIV-positive pregnant women attending ANC clinics who know their HIV status (1st 90 # HIV status knowledge). ? To determine the proportion of 15-49 years old known HIV-positive pregnant women receiving antiretroviral treatment (2nd 90 # ARV coverage) . ? To estimate the

proportion of 15-49 years old HIV-positive pregnant women receiving ARV treatment who are virally suppressed (<1,000 copies per millilitre (cps/mL)) (3rd 90# viral suppression) . ? To estimate the proportion of 15-49 years old HIV-positive pregnant women whose infants are at high risk of mother-to-child transmission (MTCT) (viral load level >1000 cps/mL) . ? To assess the level of agreement in HIV test results between routine clinic-based rapid test and laboratory-based enzyme immunoassays (EIA) testing . ? To describe and monitor syphilis prevalence among 15-49 years old pregnant women attending antenatal clinics at national, provincial and district level. ? To evaluate implementation of viral load monitoring during pregnancy. ? To measure the magnitude of unplanned pregnancy. ? To measure the association between unplanned pregnancy and timing of ART initiation and viral suppression. ? To generate data for use in estimation and projection of HIV sero-prevalence trends in the general population.

Does this project include interventions, services, or policy change work aimed at improving the health of groups who have been excluded or marginalized and/or decreasing disparities?:

No

Project does not incorporate elements of health equity science:

Yes

Measuring Disparities:

Not Selected

Studying Social Determinants of Health (SDOH):

Not Selected

Assessing Impact:

Not Selected

Methods to Improve Health Equity Research and Practice:

Not Selected

Other:

Not Selected

Activities or Tasks:

New Collection of Information, Data, or Biospecimens ; Secondary Data or Specimen Analysis

Target Populations to be Included/Represented:

Fetuses ; Neonates ; Pregnant Women

Tags/Keywords:

HIV ; Surveys and Questionnaires ; South Africa

CDC's Role:

Activity originated and designed by non-CDC staff (awardee or external collaborator) ; CDC provides technical assistance but does not specifically request or approve study design or data collection

Method Categories:

Biomonitoring; Prevalence (Cross-sectional) Surveys; Secondary Data Analysis

Methods:

This will be a cross-sectional, linked-confidential antenatal survey involving HIV screening of all pregnant women aged 15-49 years attending public facilities for any antenatal service during the current pregnancy. Thirty-six thousand fifteen (36,015) pregnant women from 1,589 public facilities will be included. Sample size was calculated to provide district level HIV point prevalence estimate with a maximum margin of error range of 3-5%. In addition, the sample size will monitor HIV prevalence trend change over time in the following three domains: (a) 15-49 years old pregnant women at national and provincial level (b) 15-24 years old pregnant women at national level and (c) in urban and rural geo-types at national level. Sentinel sites within each stratum were selected using Probability Proportional to Size (PPS) sampling method. Consecutive sampling at facility level will be used to enrol pregnant women in the survey.

The survey will be conducted from 1st of October to 2nd week of November, every other year. The survey will include a brief interview, medical record review and blood specimen collection which will be performed by currently employed nurses working in the antenatal clinics at the sampled facilities. The following demographic and clinical information will be collected through interview and/or medical record review: age of the woman, race of the woman, level of education, marital status, gravidity, parity, type of

Collection of Info, Data or Biospecimen:

antenatal visit, whether the pregnancy was planned, and gestational age. In addition, to estimate HIV incidence, the 90-90-90 UNAIDS indicators and syphilis service coverage, the following data will be collected by reviewing medical records or through interviewing of participants: routine HIV testing uptake, routine HIV test result, antiretroviral treatment (ART) uptake, time since ART initiation, routine viral load testing and documentation of result, planning of pregnancy, maternal syphilis screening and uptake of syphilis treatment if diagnosed with syphilis. Blood specimen (8.5ml of blood,) will be collected from each participant and this will be transported to the designated National Health Laboratory Service (NHLS) and National Institute for Communicable Diseases (NICD) laboratories where testing will be done for HIV. Remaining blood will be sent to the HIV reference laboratory at NICD for HIV recent infection, viral load, antiretroviral (ARV) drug exposure and syphilis tests. Laboratory tests The HIV testing strategy will follow the national HIV testing guideline. Both screening (Enzyme immunoassay #EIA-1) and confirmatory (EIA-2) tests will be performed to confirm HIV status. The incidence-testing will be based on the Limiting-Antigen Avidity Assay (LAG-Avidity EIA) in combination with additional information on ARV treatment exposure and HIV viral load. The presence of ARVs in HIV-positive samples will be determined by means of High Performance Liquid Chromatography (HPLC) coupled to Tandem Mass Spectrometry. HIV viral load testing on all confirmed HIV positive specimens will be carried out using the Abbott m2000 HIV Real-Time System, Abbott Molecular Inc, Des Plaines, Illinois, USA. All specimens will be screened for syphilis infection. Treponema pallidum (Siemens Advia Centaur Syphilis or Roche Cobas Elecsys Syphilis) will be used as a screening test. Reactive serum on Treponema pallidum will be tested by a manual non-treponemal assay (e.g. Macro-Vue# RPR or Immutrep# Omega Diagnostics)[1].

Expected Use of Findings/Results and their impact:

Returning of results HIV test results will be returned to participants through the clinic. The survey is conducted in parallel with routine antenatal voluntary counselling and testing service which has high uptake (>95%) in South Africa[2]. Participants who accept routine antenatal testing will receive their antenatal HIV test result from routine voluntary counselling and testing/ANC service at the day of the survey or in prior ANC visits. The antenatal survey will return results of participants who missed HIV testing in the routine service and to participants with discordant result (i.e. discordant result between the routine clinic test result and the laboratory test result) # these results will be immediately returned to the clinic using the routine system. ANC attendees who refuse routine antenatal service testing will be offered the opportunity to receive the laboratory results of the survey and will be included in the analysis if they agree to participate in the survey and receive results. Results will be returned for these participants through the routine courier service and reminders will be sent to participants. ANC attendees who refuse to provide blood samples or refuse to learn their HIV test results will be given an option to participate in the interview only. Data analysis The primary outcome of this cross-sectional survey will be the determination of HIV prevalence defined as the proportion of eligible pregnant women that participated in the survey with a positive HIV EIA1 test. Analysis will take into account the study design and weighting for the total number of pregnant women attending first ANC visits in the different provinces and for sample size realization. Descriptive analysis will provide HIV prevalence nationally and HIV prevalence at province, district, geographical location (rural vs. urban vs. semi-urban), by age group (5 year age groupings) and HIV prevalence trend overtime. In addition, the following outcome indicators will be reported: HIV incidence estimates, proportion aware of their HIV positive status, proportion on ART, ART initiation prior to pregnancy and after pregnancy , proportion virally suppressed, median viral load level, proportion at high risk of transmitting HIV to their infants, proportion receiving routine viral load test and proportion viral load result is documented, syphilis prevalence, number of RPR positive women treated for syphilis. The specificity and sensitivity of routine rapid test will be calculated using the ANC survey EIA test as a gold standard. HIV prevalence and HIV testing uptake will be compared between the routine rapid test and the antenatal survey to assess differences in HIV prevalence estimates and HIV testing uptake between the antenatal survey and the PMTCT programme.

Could Individuals potentially be identified based on Information Collected? No

Funding

Funding Type	Funding Title	Funding #	Original Budget Yr	# Years Award	Budget Amount
CDC Cooperative Agreement	PEPFAR	GH002381	2021	5	500000.00

HSC Review

Additional Ethical Considerations

CDC is not engaged.

Regulation and Policy

Do you anticipate this project will be submitted to the IRB office ☐ No

Estimated number of study participants

Population - Children

Protocol Page #:

Population - Minors

Protocol Page #:

Population - Prisoners

Protocol Page #:

Population - Pregnant Women

Protocol Page #:

Population - Emancipated Minors

Protocol Page #:

Suggested level of risk to subjects

Do you anticipate this project will be exempt research or non-exempt research

Requested consent process wavers

Informed consent for adults ☐ No Selection

Children capable of providing assent	No Selection
Parental permission	No Selection
Alteration of authorization under HIPPA Privacy Rule	No Selection

Requested Waivers of Documentation of Informed Consent

Informed consent for adults	No Selection
Children capable of providing assent	No Selection
Parental permission	No Selection

Consent process shown in an understandable language

Reading level has been estimated	No Selection
Comprehension tool is provided	No Selection
Short form is provided	No Selection
Translation planned or performed	No Selection
Certified translation / translator	No Selection
Translation and back-translation to/from target language(s)	No Selection
Other method	No Selection

Clinical Trial

Involves human participants	No Selection
Assigned to an intervention	No Selection
Evaluate the effect of the intervention	No Selection
Evaluation of a health related biomedical or behavioral outcome	No Selection
Registerable clinical trial	No Selection

Other Considerations

Exception is requested to PHS informing those bested about HIV serostatus	No Selection
Human genetic testing is planned now or in the	No Selection

future

Involves long-term storage of identifiable biological specimens No Selection

Involves a drug, biologic, or device No Selection

Conducted under an Investigational New Drug exemption or Investigational Device Exemption No Selection

Institutions & Staff

Institutions

Name	FWA #	FWA Exp Date	IRB Title	IRB Exp Date	Funding #
University of the Witwatersrand, Johannesburg	FWA00000715	03/07/24	U of the Witwatersand IRB #1	03/08/22	GH002381

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Staff Member	SIQT Exp. Date	CITI Biomedical Exp. Date	CITI Social & Behavioral Exp. Date	CITI Good Clinical Practice Exp. Date	Staff Role	Email	Phone	Organization
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Yogan Pillay	n/a	n/a	n/a	n/a	Co-Investigator	yoganp@health.gov.za		University of the Witwatersrand, Johannesburg

Data

DMP

Proposed Data Collection Start Date: 10/1/21

Proposed Data Collection End Date: 12/31/21

Proposed Public Access Level: Public

Public Access Justification: Country/Jurisdiction owns the data with protections under their laws and regulations

How Access Will Be Provided for Data: Memorandum of Understanding

Plans for Archival and Long Term Preservation:

Spatiality

Country	State/Province	County/Region
Republic of South Africa		

Dataset

Dataset Title	Dataset Description	Data Publisher /Owner	Public Access Level	Public Access Justification	External Access URL	Download URL	Type of Data Released	Collection Start Date	Collection End Date
Dataset yet to be added...									

Supporting Info

Current	CDC Staff Member and Role	Date Added	Description	Supporting Info Type	Supporting Info
Current	Van Wyk_Marelize (yco5) Project Contact	07/19/2022	Extended DUT approval	IRB Approval Letter	Attachment 4_Extended DUT_Full Ethics Approval.pdf
Current	Van Wyk_Marelize (yco5)	07/19/2022	Initial DUT approval	IRB Approval Letter	Attachment 3_DUT_Original Full Ethics Approval.pdf

	Project Contact				
Current	Van Wyk_Marelize (yc05) Project Contact	07/19/2022	AARMS approval	IRB Approval Letter	Attachment 2_AARMS approval.pdf
Current	Van Wyk_Marelize (yc05) Project Contact	07/19/2022	NDOH approval letter	Other-NDOH approval	Attachment 1_NDoH Letter of Support.pdf
Current	Van Wyk_Marelize (yc05) Project Contact	07/19/2022	List of changes - amendments	Other-Amendment list	Additions to the 2017 antenatal seroprevalence survey amendment list_S Moonsamy 090522.docx
Current	Van Wyk_Marelize (yc05) Project Contact	07/19/2022	Tracked changes version of protocol	Protocol	PR-2021-395_2017 ANSUR protocol_tracked_v6.0 S Moonsamy230622.doc
Current	Van Wyk_Marelize (yc05) Project Contact	07/19/2022	Clean version of Protocol	Protocol	PR-2021-395_2017 ANSUR protocol_clean_v6.0 S Moonsamy230622.doc
Current	Van Wyk_Marelize (yc05) Project Contact	07/19/2022	Project determination	Other-Enter new type	ANC amendment PD SA ADS signed_CS Signed_7.18.22. pdf



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26 June 2020

TO WHOM IT MAY CONCERN

Shelina Moonsamy

This is to certify that the above named was registered at the London School of Hygiene & Tropical Medicine as follows:

Student Number	1810686
Date of Birth:	7 June 1970
Course of Study:	Introduction to Infectious Disease Modelling and Its Applications
Mode of Study:	part-time
Start Date:	15 June 2020
Finish Date:	26 June 2020

Helena Kopecka
Head of Registry



Shelina Moonsamy

From: Bruce, Faikah [faikah@sun.ac.za] <faikah@sun.ac.za>
Sent: 05 May 2023 15:02
To: Beeka, BC, Mrs [berylbeeka@sun.ac.za]; Shelina Moonsamy
Cc: admin@ici3d.org
Subject: MMED 2023: Travel arrangements for Shelina Moonsamy

Follow Up Flag: Follow up
Flag Status: Flagged

Dear Beryl,

Shelina Moonsamy is a participant for MMED and requires travel (CC R1775 Project MM23). She is a recipient of the SACEMA scholarship which includes course fees (covering accommodation, meals, airport transfers and excursions) and an economy class return flight JHB – CT.

@Shelina Moonsamy Please send Beryl a copy of your passport/ID, a contact number (WhatsApp number if you cannot receive SMS during travel) and airport of departure. I am sure she would request additional information.

Kind regards | Ngemibuliso emihle | Vriendelike groete

Faikah Bruce MSc (Stellenbosch University)

Training Coordinator | Opleidingskoördineerder

[DSL-NRF Centre of Excellence in Epidemiological Modelling and Analysis SACEMA | DWT-NNS Sentrum vir Uitnemendheid in Epidemiologiese modellering en analise](#)

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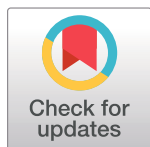
RESEARCH ARTICLE

Hepatitis B infection status among South Africans attending public health facilities over a five-year period: 2015 to 2019

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Abstract

Hepatitis B, a potentially life-threatening viral infection of the liver, remains a global public health concern despite the availability of effective vaccines for over three decades. The aim of our study was to provide national data on active hepatitis B infections in the public health sector of South Africa. We conducted retrospective analyses on national laboratory data over the period 2015 to 2019. We identified 176,530 cases who tested positive for HBsAg (active infection) with a test positivity rate of 9.02%. Of these active infections, 11,355 (6.43%) were found to be chronically infected. We linked 24,839 (14.07%) and 2,461 (21.67%) HBeAg positive results to all active HBV infections and identified chronic infections respectively. Clearance of HBsAg was observed in 5,569 cases, inclusive of clearance in 135 chronic cases. Active HBV infections were significantly higher in men than women over the five years ($p < 0.0001$). Among individuals who were vaccine-eligible as infants (0 to 19 years old), we observed 4,981 active HBV infections, including 1,131 infections under five years old, majority of which (65.78%) were under one year old. In the under five-year age group, the HBsAg population positivity rate was 0.02% and test positivity rate was 4.83%. Among all women with active HBV infections (78,935), 85.17% were of reproductive age and of these, 13.73% were HBeAg positive. Without a birth dose of the HBV vaccine, lack of routine HBsAg screening at antenatal care, and HBsAg and HBeAg prevalence among women of reproductive age, it is likely that the majority of cases under five years old were vertically infected. Optimal HBV vaccine coverage, inclusive of a birth dose, is key to eliminating horizontal and vertical transmission of HBV. Early identification of HBV chronicity through real time data analysis is fundamental in reducing the risk of liver cirrhosis and hepatocellular carcinoma.

OPEN ACCESS

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Data Availability Statement: Data used for this study have been uploaded as [Supporting Information](#) files.

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Competing interests: The authors have declared that no competing interests exist.

1 Introduction

Hepatitis B, a potentially life-threatening viral infection of the liver, remains a global public health concern despite the availability of effective vaccines for over three decades [1–3]. It occurs following infection with the hepatitis B virus (HBV) and common transmission routes are sexual contact, intravenous drug use and vertical transmission from mother to child [4]. Infection with HBV can cause acute and chronic disease. The risk of progression to chronicity decreases with age, ranging from around 70–90% among infants less than a year old to 1–10% among individuals over 20 years old [5–7]. Resolved HBV infection usually results in hepatitis B immunity that prevents disease following re-exposure, however HBV reactivation or reinfection, as identified by the reappearance of detectable HBsAg levels, has been reported in individuals infected with HIV-1 [8]. Chronically infected individuals have a 15–40% lifetime risk of cirrhosis, liver failure or hepatocellular carcinoma [9,10]. Presently, there is no complete cure for chronic HBV infection as this requires the clearance of HBsAg and all forms of HBV DNA, including intranuclear covalently closed circular DNA (cccDNA) [11,12]. In South Africa, hepatitis B disease progression may be managed with various treatment options as highlighted in the National Guidelines for the Management of Viral Hepatitis [9,10,13–15]. HBsAg clearance may occur at an annual rate of around 1–2% of chronically infected individuals, either naturally or following treatment interventions [13,15–17]. This is considered as an optimal endpoint (functional cure) following antiviral treatment [16,18,19]. In 2019, The World Health Organisation (WHO) estimated that 296 million people were living with chronic HBV infection, a 15% increase from the 2015 estimate of 257 million [20,21]. In June 2016, the World Health Assembly adopted a resolution to eliminate viral hepatitis as a major public health problem by 2030 [1]. Elimination is targeted at reducing new chronic infections by 90% and HBV related deaths by 65% [1]. In addition, one of the WHO impact targets for measuring elimination is $\leq 0.1\%$ HBsAg prevalence in children under five years old [22].

HBV infection is diagnosed following laboratory detection of HBsAg, which is the first serological biomarker to appear following HBV infection and indicates active infection [23,24]. If HBsAg is not cleared within 6 months of first detection, HBV infection is classified as chronic [1,23,25,26]. The existence of HBsAg indicates that a person is infectious [27]. Transient HBsAg positivity may be observed up to two weeks following HBV vaccination [27,28]. HBeAg appears shortly after HBsAg appearance in acute infection and can be detected in chronic HBV infections as well [24,29]. The presence of HBeAg indicates high levels of viral replication and is a biomarker of increased infectivity [24,29–32]. In South Africa, as per the national guidelines, HBeAg testing follows a positive HBsAg test [15]. Pregnant women who are HBeAg positive are at increased risk of transmitting HBV to their infants [33–35].

Hepatitis B was highly endemic in South Africa before April 1995 when the HBV vaccine was introduced as a monovalent dose into the South African expanded programme on immunisation (EPI) schedule [36]. Since December 2015, the HBV vaccine is one of the vaccines among the hexavalent combination vaccine of diphtheria, tetanus, acellular pertussis, inactivated poliovirus, Haemophilus influenza type B and hepatitis B (DTaP-IPV-HIB-HepB). The current HBV vaccination schedule consists of doses at 6, 10 and 14 weeks of age (primary series), and a booster dose at 18 months of age [37,38]. Although recommended to minimise the risk of mother to child transmission of HBV, a birth dose of the HBV vaccine is yet to be included in the EPI schedule of South Africa [39,40]. Vaccination coverage for South Africa among children under one year old who have completed their primary course of immunisation has been reported from 2000 to 2019 by the Health Systems Trust of South Africa using data obtained from the District Health Information System [41–45]. Over the 20-year period,

the average vaccination coverage rate by province ranged from 67.20% in North West to 85.57% in Northern Cape ([S1 Table](#)).

In South Africa, chronic HBV prevalence has been estimated at 2.5 million cases, reported in 2014 [6]. Based on the population size of South Africa in 2014 at just over 54 million, this would translate to a HBsAg prevalence of 4.6%, indicative of intermediate HBV endemicity (2 to 7% HBsAg prevalence) [36,46–48]. A major transmission route in South Africa was reported to be unexplainable horizontal transmission in children under five years of age, whilst sexual transmission was reported to be the major transmission route among adolescents and young adults [36]. Over the five years, 2015 to 2019, the average population of South Africa, as reported by Statistics South Africa was just under 57 million [49]. Overall, there were higher numbers of women than men, although in Gauteng and North West, there were slightly more men than women. Provincially, the smallest province of South Africa (Gauteng), housed the majority of South Africans, whilst the largest province (Northern Cape, just over 20-fold larger) housed the least number of South Africans at more than 10-fold lower than Gauteng [50].

Most HBV studies that have been conducted in South Africa targeted distinct cohorts [36,38,39,51–56]. Our first study on prevalence and incidence rates of laboratory-confirmed hepatitis B infection in South Africa, 2015 to 2019 focused on trend analysis of the proportion of HBsAg and anti-HBc IgM positive cases versus all cases tested per marker and per 100,000 population per calendar year [57]. The aim of this study was to determine the proportion of South Africans in the public health sector who had active hepatitis B infection nationally over a five-year period, including children under five years old and women of reproductive age.

2 Methods

2.1 Ethics statement

Our study was conducted on anonymous retrospective data linked to a unique identifier. Ethics approval was obtained from the Faculty of Health Sciences, Institutional Research Ethics Committee (IREC 069/20) of the Durban University of Technology, Durban, South Africa. Approval to access and analyse the data was obtained via the National Health Laboratory Service (NHLS) Academic Affairs and Research Management System (PR20254).

2.2 Study population and data source

We conducted a cross-sectional study on HBsAg and HBeAg tests obtained from the National Health Laboratory Service (NHLS) Central Data Warehouse (CDW) for tests performed nationally during the period 2015 to 2019. The NHLS CDW is the national repository for laboratory data from the public health sector of South Africa, serving over 80% of the country's population [58]. Records included duplicate entries of a case if the same test was conducted multiple times over the study period. Each entry into the repository was allocated a unique identification number (UID) which was duplicated if a link to an existing record was identified. Criteria for inclusion in our study were records of all valid HBsAg and HBeAg test results.

2.3 Data analyses

Data analyses were performed in Stata/SE (Version 17.0, Texas, USA) and Microsoft Excel (Version 16, USA).

Data were obtained per year from 2015 to 2019 and were appended to maintain two separate datasets; one of all HBsAg test records and the other of all HBeAg test records. Cases were assigned to defined five-year age groups based on the time interval between the sample

collection date (first if there were multiple records) and date of birth. All analyses were performed on the appended five-year data files.

Initial analyses were performed to: 1) obtain denominators for HBsAg and HBeAg test positivity rates (line list of total number of cases tested); 2) identify cases with multiple HBsAg tests and their testing patterns; and 3) develop registries of all active HBV infections and chronic HBV infections coupled with HBeAg results. HBsAg records of equivocal (inconclusive) results were maintained initially (for purposes of obtaining denominators) but removed prior to analysis of multiple HBsAg tests as our focus here was solely on positive and negative results. The registries were used to calculate the proportion of cases who were tested for HBeAg over the study period and the proportion with positive HBeAg results. Data were subsequently analysed to determine the distribution of cases by age group and province, both stratified by gender, and to determine the number of active HBV infections per 100,000 province population. We used the average population over the five years as reported by Statistics South Africa [49]. We applied the test of proportions to determine statistical differences ($\alpha = 0.05$) between women compared to men by age group and by province.

Additional analyses focussed on age group 0 to 4 years and women of reproductive age (15 to 49 years) [50]. Among children 0 to 4 years old, we calculated HBsAg test positivity rate (HBsAg positive cases / total cases 0 to 4 years old tested for HBsAg), HBsAg population positivity rate (HBsAg positive cases / average population size 0 to 4 years old 2015 to 2019), age in one-year intervals, and age in one-week intervals among infants under one year old.

3 Results

Following development of the appended 2015 to 2019 HBsAg and HBeAg data files, the HBsAg dataset consisted of a total of 2,370,723 records and the HBeAg dataset consisted of a total of 107,433 records [57]. Deduplication of the HBsAg dataset resulted in a line list of 1,957,224 cases (Fig 1A). Deduplication of the HBeAg dataset resulted in a line list of 84,463 cases; 25,796 with positive results (test positivity rate of 30.54%), 58,219 with negative results, and 448 with equivocal results.

From the HBsAg dataset of 2,370,723 records, 6,211 records with equivocal results were removed, leaving 2,364,512 records of positive and negative HBsAg results, of which 1,655,484 cases had been tested once only and the remaining 709,028 cases had at least two tests during the five-year period (Fig 1B). From the 709,028 records, we identified 297,267 cases with duplicate records; 252,429 cases who tested negative for HBsAg throughout, 8,645 cases who had both positive and negative HBsAg results, and 36,193 cases who tested positive for HBsAg throughout (Fig 1B). Of the 8,645 cases who tested positive and negative for HBsAg, 5,569 cases tested negative after a positive test, 3,003 cases tested positive after a negative test, and 73 cases tested negative in between an initial and last positive test (Fig 1B). Of the 5,569 cases who tested negative after a positive test, 4,905 cases tested positive initially and negative subsequently and 664 cases tested positive in between an initial and last negative test (Fig 1B).

3.1 Development of a registry and analyses of all active HBV infections coupled with HBeAg results, 2015 to 2019

From the HBsAg dataset of 2,364,512 records, we identified and extracted 232,551 records of positive HBsAg results (Fig 1C). Deduplication of cases resulted in a line list of 176,530 cases who had tested positive for HBsAg at least once during the five-year period (active HBV infection), with a test positivity rate of 9.02% (176,530 / 1,957,224) (Fig 1A and 1C).

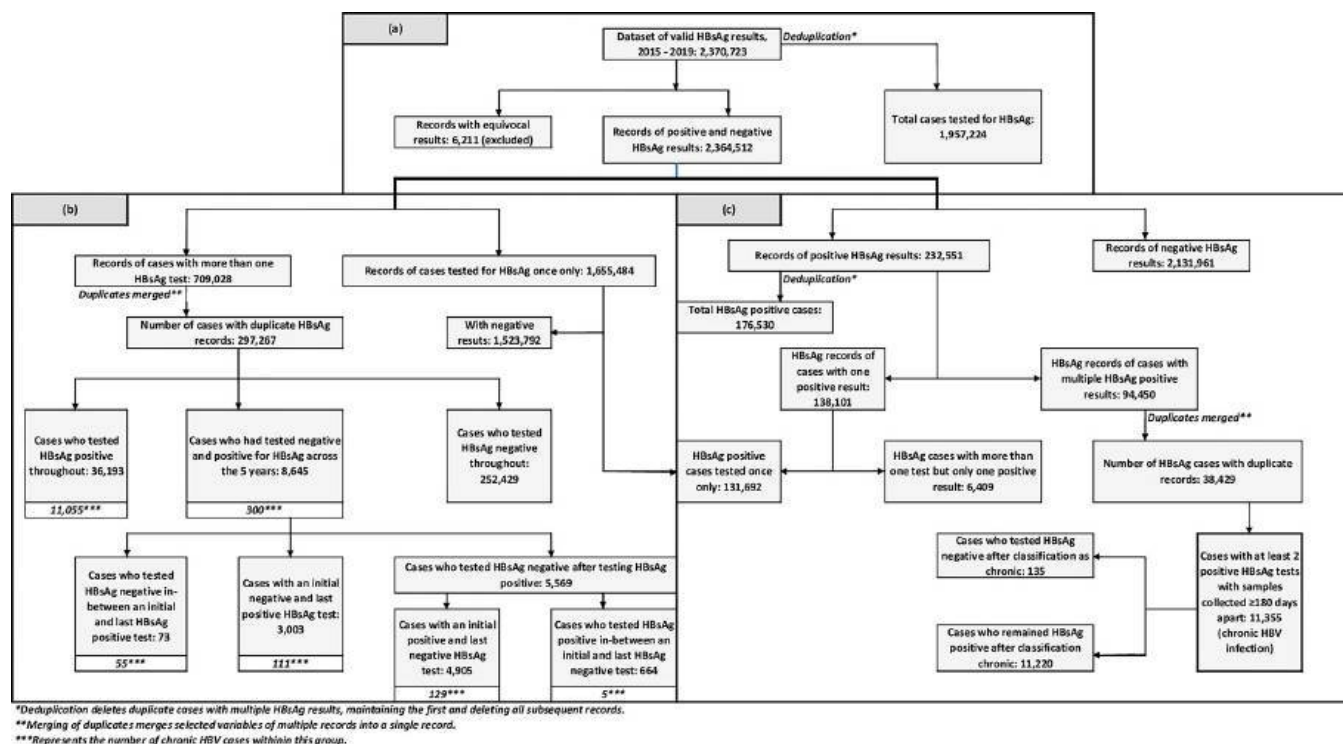


Fig 1. Flow of HBsAg valid records from 2015 to 2019; to obtain a dataset of all positive and negative records (a), to obtain datasets of cases who tested positive throughout, negative throughout, or both positive and negative over the five years (b), and to obtain a dataset of chronic HBV infections (c).

<https://doi.org/10.1371/journal.pgph.0000992.g001>

Of the 176,530 active infections, we linked 65,551 (37.13%) cases to a HBeAg result (Table 1). The number of active infections with available HBeAg results per province is shown in Table 2 and actual HBeAg results is illustrated in Fig 2.

Of the total active HBV infections and those that were HBeAg positive (176,530 and 24,839 respectively), significantly more men tested positive than women ($p < 0.0001$) (Table 1). Individuals aged 20 to 49 years old had the highest proportion of active infections (144,068, 81.61%) and HBeAg positivity (21,536, 86.70%) (Table 1).

There were 4,981 active HBV infections 0 to 19 years old, of which 1,131 (22.71%) were under five years old (Table 1). In the under five-year age group, the HBsAg test positivity rate was 4.83%, and the HBsAg population positivity rate was 0.02% (Table 3A).

Among children under five years old, 65.78% of active infections were in children less than one year old, significantly higher than active infections among children 1 to 4 years old combined (34.22%, $p < 0.0001$) (Table 3B). Among infants under one year old, 34.54% of cases were 0 to 5 weeks old, 46.37% were 6 to 16 weeks old, and 19.09% were 18 to 52 weeks old (Table 3C).

Among all women with active HBV infection (78,935) and those who were HBeAg positive (10,156), 85.17% (67,234) and 90.87% (9,229) were of reproductive age respectively, a 13.73% HBeAg positivity among women of reproductive age (Table 1).

At a provincial level, of the 176,530 active HBV infections, Gauteng had the highest proportion of cases (65,085, 36.86%), followed by Kwazulu-Natal (35,532, 20.13%) and Eastern Cape (21,280, 12.05%), with the lowest proportion in the Northern Cape (1,827, 1.03%) (Fig 3). Of the 24,839 active infections with HBeAg positive results, individuals from Kwazulu-Natal accounted for more than 50% of the cases (13,332, 53.67%), individuals from Mpumalanga,

Table 1. Distribution of active HBV infections by age group stratified by gender and HBsAg results, 2015 to 2019.

Age group	Gender	HBsAg		HBsAg				Age group	Gender	HBsAg		HBsAg			
		No.	P-value ^e	With results ^b		Positive ^c				No.	P-value ^e	With results ^b		Positive ^c	
				No	%	No	%					No	%	No	%
0-4	Women	502	0.0029	146	29.08	30	5.98	40-44	Women ^d	8,152	<0.0001	2,695	33.06	824	10.11
	Men	603		141	23.38	45	7.46		Men	14,720		5,249	35.66	1,900	12.91
	Unknown	26		7	26.92	3	11.54		Unknown	312		138	44.23	43	13.78
	Total	1,131	294	25.99	78	6.9	Total		23,184	8,082	34.86	2,767	11.93		
	5-9	Women	197	>0.9999	54	27.41	16		8.12	45-49	Women ^d	5,182	<0.0001	1,772	34.2
Men	196	63	32.14	22	11.22	Men	9,631	3,387	35.17		1,159	12.03			
Unknown	14	5	35.71	2	14.29	Unknown	196	97	49.49		33	16.84			
Total	407	122	29.98	40	9.83	Total	15,009	5,256	35.02		1,662	11.07			
10-14	Women	394	<0.0001	127	32.23	50	12.69	50-54	Women		3,568	<0.0001	1,293	36.24	239
Men	258	112		43.41	46	17.83	Men		5,759	1,992	34.59		538	9.34	
Unknown	12	8		66.67	3	25	Unknown		106	47	44.34		11	10.38	
15-19	Total	664	247	37.2	99	14.91	Total		9,433	3,332	35.32	788	8.35		
15-19	Women ^d	2,017	<0.0001	788	39.07	365	18.1		55-59	Women	2,143	<0.0001	786	36.68	134
	Men	722		290	40.17	150	20.78	Men		3,494	1,243		35.58	322	9.22
	Unknown	40		22	55	13	32.5	Unknown		66	29		43.94	5	7.58
	Total	2,779	1,100	39.58	528	19	Total	5,703		2,058	36.09	461	8.08		
	20-24	Women ^d	8,797	<0.0001	3,543	40.28	1,659	18.86		60+	Women	2,918	<0.0001	1,145	39.24
Men	4,146	1,721	41.51		890	21.47	Men	4,043	1,491		36.88	290		7.17	
Unknown	211	126	59.72		58	27.49	Unknown	98	57		58.16	10		10.2	
25-29	Total	13,154	5,390	40.98	2,607	19.82	Total	7,059	2,693		38.15	485	6.87		
25-29	Women ^d	15,365	<0.0001	5,817	37.86	2,445	15.91	Unknown	Women		1,979	<0.0001	741	37.44	273
	Men	11,938		5,020	42.05	2,387	19.99		Men	2,858	1,163		40.69	485	16.97
	Unknown	453		242	53.42	112	24.72		Unknown	449	163		36.3	66	14.7
	Total	27,756	11,079	39.92	4,944	17.81	Total		5,286	2,067	39.1	824	15.59		
	30-34	Women ^d	15,747	<0.0001	5,517	35.04	2,068		13.13	Total	Women	78,935	<0.0001	28,432	36.02
Men	18,077	7,212	39.9		3,259	18.03	Men	94,699	35,751		37.75	14,157		14.95	
Unknown	496	225	45.36		98	19.76	Unknown	2,896	1,368		47.24	526		18.16	
35-39	Total	34,320	12,954	37.74	5,425	15.81	Total	176,530	65,551		37.13	24,839	14.07		
35-39	Women ^d	11,974	<0.0001	4,008	33.47	1,398	11.68	<0.0001	Women		78,935	<0.0001	28,432	36.02	10,156
	Men	18,254		6,667	36.52	2,664	14.59		Men	94,699	35,751		37.75	14,157	14.95
	Unknown	417		202	48.44	69	16.55		Unknown	2,896	1,368		47.24	526	18.16
	Total	30,645	10,877	35.49	4,131	13.48	Total		176,530	65,551	37.13	24,839	14.07		

^aP-value generated from the test of proportions between women and men, per age group and total^bNumber and percentage of active HBV infections with available HBsAg results^cNumber and percentage of active HBV infections with positive HBsAg results^dWomen of reproductive age (15–49 years).<https://doi.org/10.1371/journal.pgph.0000992.t001>

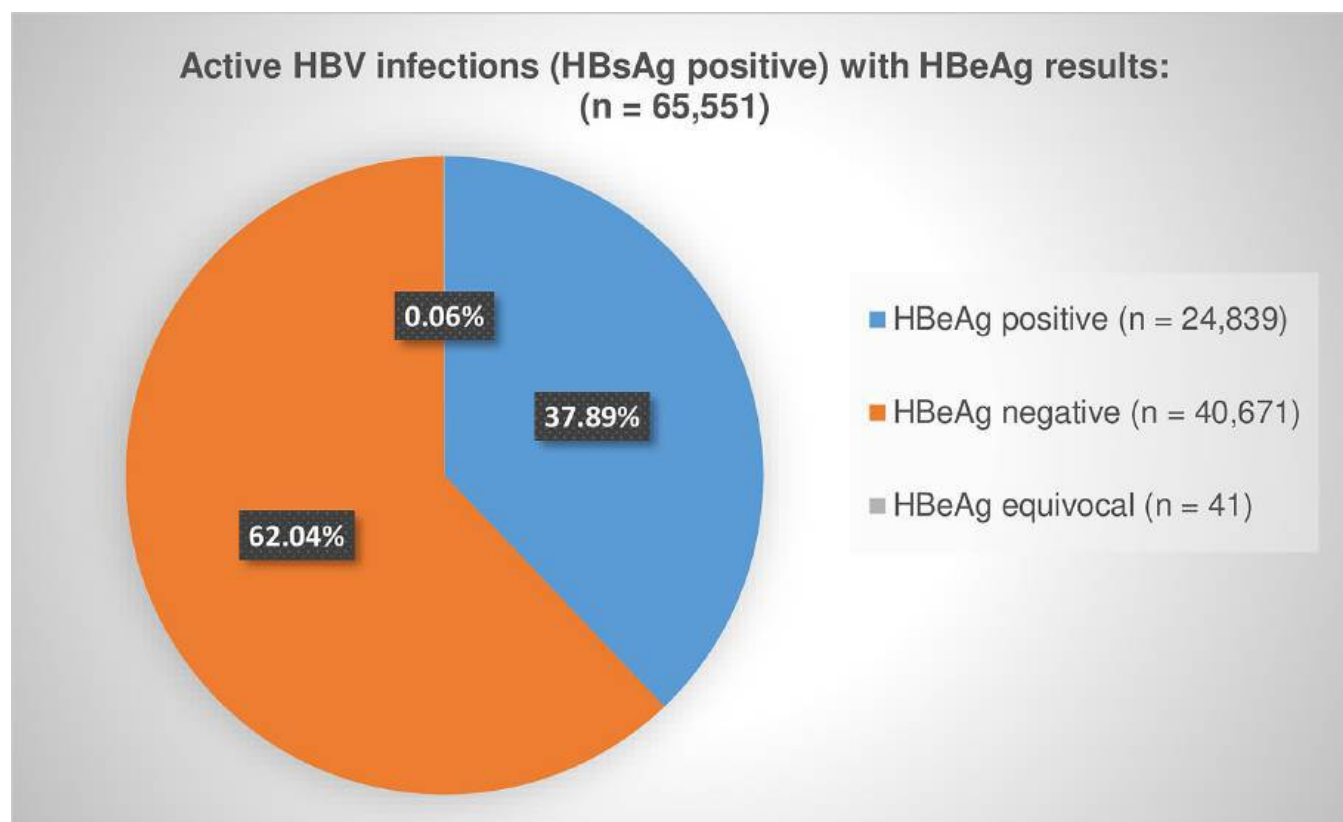
Table 2. Number of active HBV infections with available HBeAg results per province, 2015 to 2019.

Province	Active HBV infections			
	HBsAg+	HBeAg results available		% of HBsAg with HBeAg results available
	No.	No.	% of total HBeAg results	
Eastern Cape	21,280	7,473	11.40	35.12
Free State	8,087	1,967	3.00	24.32
Gauteng	65,085	6,468	9.87	9.94
Kwazulu-Natal	35,532	33,824	51.60	95.19
Limpopo	10,122	819	1.25	8.09
Mpumalanga	14,176	9,999	15.25	70.53
North West	9,540	907	1.38	9.51
Northern Cape	1,827	156	0.24	8.54
Western Cape	10,881	3,938	6.01	36.19
Total	176,530	65,551	100	37.13

<https://doi.org/10.1371/journal.pgph.0000992.t002>

Gauteng, Eastern Cape, Western Cape and Free State together accounted for 43.46% (10,794) of the cases, and the remaining 2.87% of the cases (713) were from North West, Limpopo and Northern Cape (Fig 3).

The number of active HBV infections per 100,000 population was highest in Gauteng (450/100,000), comparable between Kwazulu-Natal (322/100,000), Mpumalanga (319/100,000) and Eastern Cape (318/100,000), and least in Northern Cape (148/100,000) (Fig 3). In Limpopo,

**Fig 2. Proportion of active HBV infections with positive, negative and equivocal HBeAg results, 2015 to 2019.**

<https://doi.org/10.1371/journal.pgph.0000992.g002>

Table 3. HBV infection among children under five years old, 2015 to 2019; test positivity and population positivity rates a); age in one-year intervals b), and age in weeks among infants under one year old c).

(3a)		
No. of active HBV infections in children under five years old	1,131	
No. of cases under 5 years old tested for HBsAg	23,395	
HBsAg test positivity rate amongst children under five years old (1,131/23,395)	4.83%	
Average population size amongst children under five years old, 2015 to 2019	5,679,585	
HBsAg population positivity rate amongst children under five years old (1,131/5,679,585)	0.02%	
(3b)		
Age in years	# HBsAg positive cases	Percentage of total
<1	744	65.80%
1	119	387 34.20%
2	92	
3	80	
4	96	
Total	1,131	100%
(3c)		
Age in weeks	# HBsAg positive cases / Percentage of total	Comments
0-5	257 / 34.54	Before administration of the first scheduled HBV vaccine dose at 6 weeks of age
6-16	345 / 46.37	From initiation of the scheduled primary vaccine series at 6 weeks of age to 2 weeks after the scheduled third dose at 14 weeks of age. Possibility of transient positivity following vaccination
17-52	142 / 19.09	From three weeks post administration of the scheduled third HBV vaccine dose at 14 weeks of age. Post period of transient positivity following vaccination
Total	744 / 100	

<https://doi.org/10.1371/journal.pgph.0000992.t003>

North West and Free State, there was a decline in actual numbers of active HBV infections respectively; however, when we factored in population sizes of these provinces we saw an incline in the number cases respectively (Fig 3).

By gender, the number of active HBV infections in men were significantly higher than women in eight of the nine provinces ($p \leq 0.0306$), except for Limpopo with a significantly higher proportion in women ($p = 0.0103$) (S2 Table). HBeAg positive men were higher than women in all nine provinces, significantly higher in seven of the nine provinces ($p \leq 0.0016$), except for Limpopo and Northern Cape. (S2 Table).

3.2 Development of a registry and analyses of chronic HBV infections coupled with HBeAg results, 2015 to 2019

Of the positive HBsAg dataset of 232,551 records, we identified 138,101 cases who had only a single positive test over the five-year period and 94,450 records of cases who had multiple positive HBsAg tests (Fig 1C). The 94,450 records were from 38,429 cases with at least two positive HBsAg tests, from which we identified 11,355 cases with samples collected 6 months or more apart (chronic HBV infections) (Fig 1C). One hundred and thirty five (135) cases tested

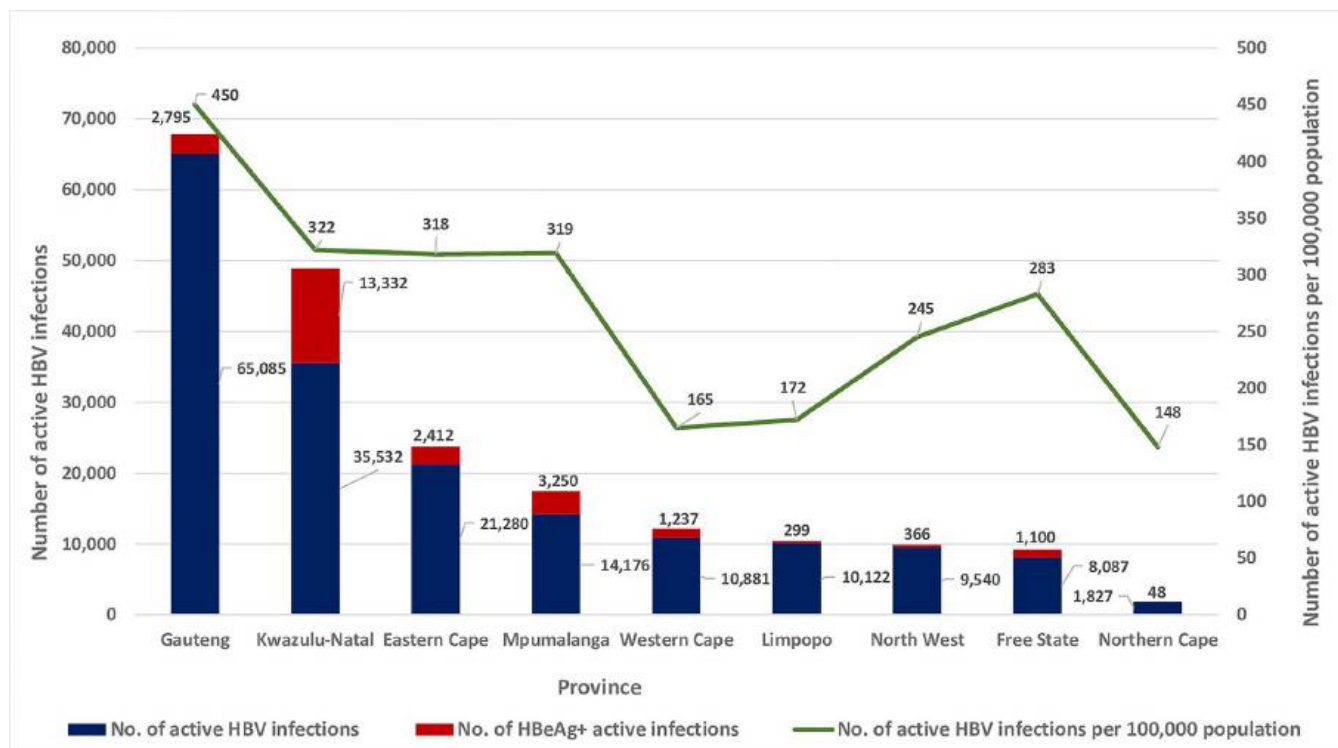


Fig 3. Provincial distribution of active HBV infections, those that were HBeAg positive, and active infections per 100,000 province population, 2015 to 2019.

<https://doi.org/10.1371/journal.pgph.0000992.g003>

HBsAg negative after being classified as chronic, whilst the majority (11,220) remained HBsAg positive up until the end of the study period (Fig 1C). Of the 11,355 chronic HBV infections, we linked 5,824 (51.29%) cases who had been tested for HBeAg (Table 4) with results illustrated in Fig 4.

Of the total active HBV infections identified during the five-year period, 6.43% (11,355/176,530) were chronically infected. Of the total chronic HBV infections and those that were HBeAg positive, significantly more men tested positive than women ($p < 0.0001$), although at ages 15 to 29 years significantly more women tested positive than men ($p \leq 0.0339$) (Table 4). Majority of the chronic HBV infections were among individuals aged 25 to 49 years old (9,230 / 11,355, 81.28%), and the majority of HBeAg positive chronic cases were among individuals aged 20 to 49 years old (2,204 / 2,461, 89.56%) (Table 4).

Among the 5,027 women with chronic HBV infection, 1,046 (20.81%) were HBeAg positive, and 4,557 (90.65%) and 981 (93.78%) were of reproductive age respectively. HBeAg positivity among chronic HBV infections in women of reproductive age was 21.53% (981/4,557) (Table 4).

At a provincial level, chronic HBV infection was highest in Gauteng (3,811, 33.56%), followed by Kwazulu-Natal (2,398, 21.12%) and Eastern Cape (2,198, 19.36%), with the lowest proportion in the Northern Cape (89, 0.78%) (Fig 5). Of the 2,461 HBeAg positive chronic cases, individuals from Kwazulu-Natal accounted for 42.83% of the cases ($n = 1,054$), individuals from Mpumalanga, Gauteng, Eastern Cape, Western Cape and Free State together accounted for 54.65% ($n = 1,345$) of the cases, and the remaining 2.52% of the cases ($n = 62$) were from North West, Limpopo and Northern Cape (Fig 5).

Table 4. Distribution of chronic HBV infections by age group stratified by gender and HBeAg results, 2015 to 2019.

Age group	Gender	Chronic HBV		HBeAg					Age group	Gender	Chronic HBV		HBeAg				
		Positive		With results ^b		Positive ^c					Positive		With results ^b		Positive ^c		
		No.	P-value ^a	No	%	No	%	P-value ^a			No.	P-value ^a	No	%	No	%	P-value ^a
0-4	Women	3	0.4924	3	100	3	100	0.3711	40-44	Women ^d	646	<0.0001	331	51.24	112	17.34	<0.0001
	Men	5		1	20.00	1	20.00			Men	1,131		546	48.28	228	20.16	
	Unknown	0		0	-	0	-			Unknown	14		5	35.71	4	28.57	
	Total	8	4	50.00	4	50.00	Total	1,791		882	49.25	344	19.21				
5-9	Women	5	0.0640	4	80.00	3	60.00	0.2827	45-49	Women ^d	363	<0.0001	189	52.07	50	13.77	<0.0001
	Men	15		9	60.00	7	46.67			Men	757		381	50.33	137	18.10	
	Unknown	1		1	100	1	100			Unknown	13		10	76.92	4	30.77	
	Total	21	14	66.67	11	52.38	Total	1,133		580	51.19	191	16.86				
10-14	Women	11	0.8547	7	63.64	4	36.36	>0.9999	50-54	Women	224	<0.0001	125	55.80	21	9.38	<0.0001
	Men	10		7	70.00	4	40.00			Men	372		208	55.91	66	17.74	
	Unknown	0		0	-	0	-			Unknown	6		2	33.33	0	0.00	
	Total	21	14	66.67	8	38.10	Total	602		335	55.65	87	14.45				
15-19	Women ^d	83	<0.0001	42	50.60	30	36.14	0.0304	55-59	Women	107	<0.0001	58	54.21	14	13.08	0.0115
	Men	31		23	74.19	15	48.39			Men	227		116	51.10	32	14.10	
	Unknown	0		0	-	0	-			Unknown	2		0	0.00	0	0.00	
	Total	114	65	57.02	45	39.47	Total	336		174	51.79	46	13.69				
20-24	Women ^d	484	<0.0001	265	54.75	134	27.69	<0.0001	60+	Women	108	0.0041	76	70.37	18	16.67	0.3006
	Men	219		116	52.97	59	26.94			Men	155		92	59.35	25	16.13	
	Unknown	15		14	93.33	11	73.33			Unknown	5		2	40.00	1	20.00	
	Total	718	395	55.01	204	28.41	Total	268		170	63.43	44	16.42				
25-29	Women ^d	1,021	<0.0001	501	49.07	277	27.13	0.0001	Unknown	Women	12	0.0918	9	75.00	2	16.67	0.0577
	Men	691		367	53.11	188	27.21			Men	23		18	78.26	10	43.48	
	Unknown	12		9	75.00	3	25.00			Unknown	2		0	0.00	0	0.00	
	Total	1,724	877	50.87	468	27.15	Total	37		27	72.97	12	32.43				
30-34	Women ^d	1,064	<0.0001	475	44.64	204	19.17	<0.0001	Total	Women	5,027	<0.0001	2,527	50.27	1,046	20.81	<0.0001
	Men	1,272		683	53.69	338	26.57			Men	6,211		3,228	51.97	1,378	22.19	
	Unknown	23		11	47.83	8	34.78			Unknown	117		69	58.97	37	31.62	
	Total	2,359	1,169	49.55	550	23.31	Total	11,355		5,824	51.29	2,461	21.67				
35-39	Women ^d	896	<0.0001	442	49.33	174	19.42	<0.0001									
	Men	1,303		661	50.73	268	20.57										
	Unknown	24		15	62.50	5	20.83										
	Total	2,223	1,118	50.29	447	20.11											

^aP-value generated from the test of proportions between women and men, per age group and total^bNumber and percentage of chronic HBV infections with available HBeAg results^cNumber and percentage of chronic HBV infections with positive HBeAg results^dWomen of reproductive age (15–49 years).<https://doi.org/10.1371/journal.pgph.0000992.t004>

Chronic HBV infections per 100,000 province population was highest in Eastern Cape (33/100,000), followed by Gauteng (26/100,000) and Kwazulu-Natal (22/100,000), and least in Limpopo (4/100,000) (Fig 5).

By gender, chronicity was significantly more prevalent in men than women in six of the nine provinces ($p \leq 0.0254$) (S3 Table), and HBeAg positivity among men was significantly higher than women in five of the nine provinces ($p \leq 0.0275$) (S3 Table). In Eastern Cape, HBeAg positivity was higher in chronically infected men yet more women were found to have

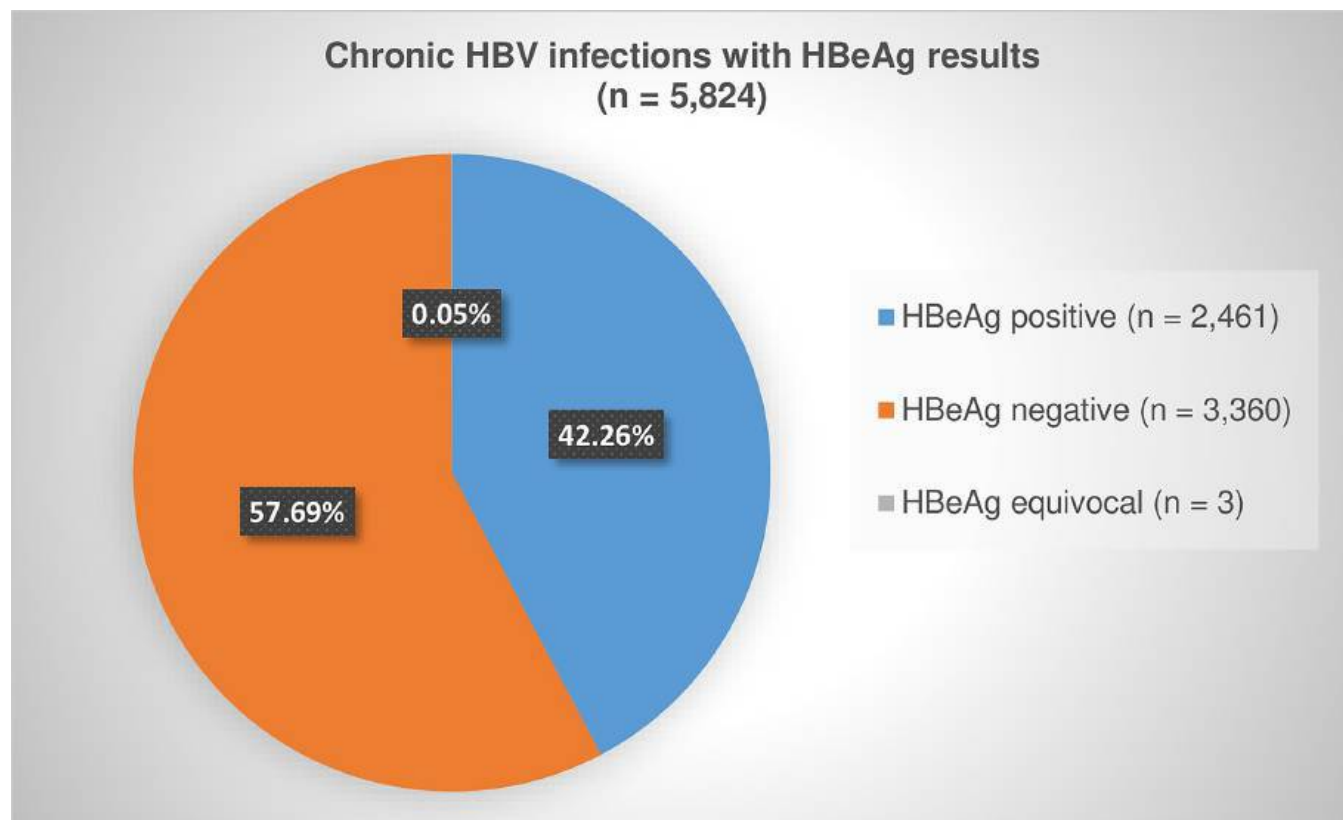


Fig 4. Proportion of chronic HBV infections with positive, negative and equivocal HBeAg results, 2015 to 2019.

<https://doi.org/10.1371/journal.pgph.0000992.g004>

chronic infections. Contrarily, in Northern Cape, although numbers were low, HBeAg positivity was higher in chronically infected women yet more men were found to have chronic infections (S3 Table).

4 Summary and discussion

We analysed countrywide HBsAg and HBeAg laboratory data from 2015 to 2019 to determine the number of cases who had active HBV infection, including prolonged (chronic) infection, and their HBeAg status. Over the five years, the HBsAg test positivity rate was 9.02%, of which 6.43% were found to have chronic HBV infection. HBeAg test results were available for 37.13% of active infections and 51.29% among those with chronic infections, with test positivity rates of 37.89% and 42.26% respectively, indicating high levels of viral replication in these individuals, increased risk of HBV transmission, and an increased risk of progression to cirrhosis among those with chronic infections [24,30]. Despite the unavailability of HBeAg status for more than 60% of all active HBV infections and just under 50% of chronic infections, the positivity rate was surprisingly high at 14.07% and 21.67% respectively. The lack of HBeAg results may be due to patient loss to follow up, unawareness of or non-adherence to the testing algorithm, or HBeAg tests conducted outside of the study period.

We noted that the majority of active HBV infections were among cases who were born pre-1995, outside the vaccine-eligible era and therefore foreseeable. Active infections were considerably lower among individuals who were vaccine-eligible as infants (0 to 19 years), demonstrating effective vaccination in these groups. As vaccination is key to prevention of HBV

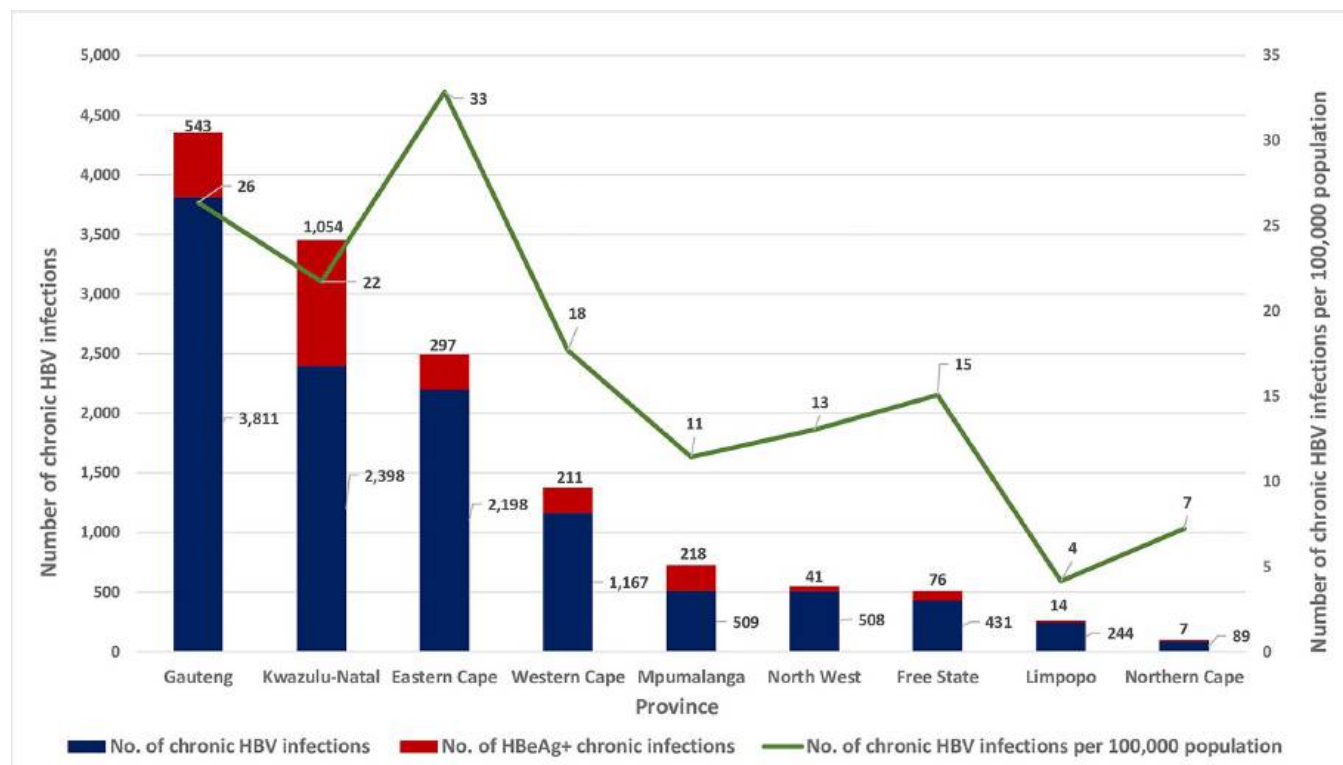


Fig 5. Provincial distribution of chronic HBV infections, those that were HBeAg positive, and chronic infections per 100,000 province population, 2015 to 2019.

<https://doi.org/10.1371/journal.pgph.0000992.g005>

infection, active HBV infections among vaccine-eligible individuals is likely due to the suboptimal vaccine coverage rates reported for South Africa from 2000 to 2019 [41–45]. Suboptimal vaccine coverage rates may have largely been due to the challenges that faced EPI activities in South Africa, highlighted by EPI managers as being insufficient knowledge of vaccines and EPI practices among staff, financial constraints, staff shortages and high staff turn-over [59].

HBV infection was seen to be more prevalent in men overall; however, at ages 10 to 29 years more women were infected. The higher rate among men overall is compounded by the fact that the average population size over the five years was higher in women. The higher rates observed in women 10 to 29 years old are likely due to their increased risk of symptomatic infection following viral infections, coupled with higher health seeking tendency including antenatal visits at these ages [60]. The higher rates in men overall and at later ages are likely due to their increased risk of persistent HBV infection resulting in their increased risk of HBV chronicity [61,62]. This is in keeping with studies conducted in Taiwan, Greece and New Zealand, where it was reported that women were less likely to develop chronic HBV infection [62–64]. In a study on sex differences in response to HBV infection, Blumberg reports that the prevalence of chronic infection among men is higher than women in most human populations [65].

In children under five years old, we noted a sizeable number of active HBV infections over the five years (1,131). Although horizontal transmission has been reported as a major transmission route between children in South Africa, justifiable reasons are lacking [36,66]. Looking closer into these children, 65.78% were less than one year old. With no birth dose of the HBV vaccine administered to these children and no routine screening for HBV infection at antenatal care, we suspect a considerable proportion were infected from their mothers given the increased risk with no preventative interventions [6,15,39,40]. Additionally, 6.90% (78)

were HBeAg positive. Honing in, we saw that 34.54% of children under one year old were at ages below the first scheduled HBV vaccine dose at 6 weeks of age and 19.09% were at ages post two weeks after the third scheduled HBV vaccine dose at 14 weeks of age, eliminating transient HBsAg positivity following vaccination if the vaccine was administered as per the EPI schedule at 6, 10 and 14 weeks of age [67]. Furthermore, our analyses of women alone showed that of the total with active HBV infections, 85.17% were of reproductive age with an HBeAg prevalence of 13.73%, indicative of an increased risk of mother-to-child transmission [33,34]. Considering the WHO impact target of $\leq 0.1\%$ HBsAg prevalence for measuring elimination in children under five years old and the South African HBsAg population positivity rate in this age group (population prevalence), South Africa is well below the target over 2015 to 2019 at 0.02% [22]. However, the data presented are only from children tested in public healthcare facilities and it is likely that a substantial proportion of children under five years old were not HBV diagnosed given their low risk of symptomatic infection [1]. Substituting the denominator with the total number of cases under five years old who were tested for HBsAg, the HBsAg test positivity rate (test prevalence) was 4.83%, well above the WHO impact target of $\leq 0.1\%$.

Provincially, we noted that the majority of active HBV infections were in Gauteng, followed by Kwazulu-Natal and Eastern Cape and lowest in the Northern Cape, not surprising given that the average population size of these four provinces from 2015 to 2019 followed the same pattern. In addition, the findings in Gauteng and Northern Cape may also be related to the land size of these provinces versus their population sizes [68]. Furthermore, Northern Cape boasted the highest average vaccine coverage rate from 2000 to 2019 (85.57%) (S1 Table). Focussing on HBeAg positivity, we saw that more than 50% of cases were from Kwazulu-Natal. Similarly, we noted that of all HBeAg results available, 51.60% were from Kwazulu-Natal (Table 2). This finding suggests that in Kwazulu-Natal, follow up testing was considerably more prevalent than in other provinces over the study period, likely related to the testing facility and testing practises. Taking into consideration the population size per province, Eastern Cape was seen to have the highest number of chronic HBV infections in the country (33/100,000), in keeping with one of the poorest vaccine coverage rates averaging 69.54% from 2000 to 2019 (S1 Table). Surprisingly, however, there were more chronic infections in women in Eastern Cape, despite significantly higher active infections in men. Regarding gender distribution, we saw that active HBV infections were significantly higher in women in Limpopo province, yet more men were chronically infected. We link this finding in Limpopo to the increased risk of symptomatic infection following viral infections in women together with the increased risk of persistent HBV infection in men [60–62]. Although reasons are unclear, we are cognisant of provincial public health disparities within South Africa and suboptimal vaccine coverage rates (S1 Table) [69]. Therefore, provincial investigations, including community awareness, HBV testing and follow up practises, social practises, and vaccination policies would provide insight into provincial HBV burden.

From analyses of cases who had both positive and negative HBsAg results over the five years, we saw that 64.42% (5,569/8,645) of cases tested negative after a positive test, suggesting HBsAg clearance and resolution of HBV infection. Analyses of testing patterns showed that among the cases who tested negative after a positive test, 11.92% (664/5,569) of cases tested negative before testing positive, suggesting that in these individuals HBV infection was likely acquired during the study period and likely among those individuals who did not receive or complete their primary course of vaccinations. Similarly for cases who tested HBsAg negative initially and positive subsequently (3,003/8,645, 34.74%). We also observed a small proportion (73/8,645, 0.84%) of cases who tested HBsAg negative between two positive tests, suggesting HBsAg clearance after acquiring HBV infection followed by reactivation of HBV disease or

HBV reinfection, a phenomenon seen among HIV-1 infected individuals [8]. Among the 11,355 chronic HBV infections, we report a last negative HBsAg test in 1.19% of cases following classification as chronic, in line with reported statistics of HBsAg clearance observed in 1–2% of chronic infections following the natural course of disease or treatment interventions [13,14].

A limitation of this study is that we report findings restricted to passive surveillance of HBsAg and HBeAg tests conducted over a five-year fixed period. Population prevalence rates include South Africa's total population as the denominator and our findings are from individuals attending only public healthcare facilities. HBeAg results were available for less than 50% of active infections. We noted a large number of cases who tested positive for HBsAg repeatedly but sample collection dates fell short of 6 months apart. Our numbers, therefore, represent minimum estimates. We analysed data on women of reproductive age as a proxy of pregnant women. HBsAg positivity among children 6 to 16 weeks of age may be associated with transient positivity following vaccination rather than active HBV infection, although reasons for testing in this age group are unclear and vaccination data was not available. Although we are cognisant of the possibility of false results, we did not factor this in during our analyses. Our data were not linked to HIV status and we therefore cannot report on HBV and HIV co-infection or relate our findings to other studies reporting HBV prevalence and chronicity in HIV-infected individuals.

A strength of our study, however, is the interrogation of a robust nationally representative public health dataset comprising over 2,3 million HBsAg records and 100 000 HBeAg records.

5 Conclusion

Prevention of HBV infection through infant vaccination, with implementation of a birth dose, is key to eliminating HBV infection. Given that the HBV vaccine is administered as a hexavalent vaccine in South Africa, optimal (3-dose) HBV vaccine coverage would not only reduce HBV burden, but would provide protection from other debilitating vaccine-preventable diseases. Routine screening of pregnant women attending antenatal clinics for HBV and appropriate maternal antiviral therapy would further reduce mother-to-child transmission. Actual data on the national prevalence of HBV in pregnant women is needed to inform policy. Early identification of HBV chronicity is fundamental in reducing the risk of liver cirrhosis and hepatocellular carcinoma through appropriate treatment initiation, and can be achieved through real-time data analysis and dissemination of the relevant information for public health interventions.

Supporting information

S1 Table. Vaccination coverage among children under one year who have completed their primary course of immunisation in South Africa.

(PDF)

S2 Table. Active HBV infections by province stratified by gender and HBeAg results, 2015 to 2019.

(PDF)

S3 Table. Chronic HBV infections by province stratified by gender and HBeAg results, 2015 to 2019.

(PDF)

S1 Dataset.

(ZIP)

S2 Dataset.

(ZIP)

S3 Dataset.

(ZIP)

S4 Dataset.

(ZIP)

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Appendix 3.2: Stata Log file of HBsAg total tested and positive registries

```
. use "2015-2019_HepatitisB_All_Records.dta",replace
```

```
. count
```

```
6,315,380
```

```
. tab HEP_B_SURFACE_AG
```

HEP_B_SURFACE_AG	Freq.	Percent	Cum.
-----+-----			
EQUIVOCAL	6,211	0.10	0.10
LOW POSITIVE	5,805	0.09	0.19
NEGATIVE	2,131,961	33.76	33.95
NULL	3,944,612	62.46	96.41
POSITIVE	226,746	3.59	100.00
UNKNOWN	45	0.00	100.00
-----+-----			
Total	6,315,380	100.00	

```
. keep if HEP_B_SURFACE_AG=="LOW POSITIVE" | HEP_B_SURFACE_AG=="POSITIVE" |  
HEP_B_SURFACE_AG=="EQUIVOCAL" | HEP_B_SURFACE_AG=="NEGATIVE"
```

```
(3,944,657 observations deleted)
```

```
. keep if HEP_B_SURFACE_AG=="LOW POSITIVE" | HEP_B_SURFACE_AG=="POSITIVE" |  
HEP_B_SURFACE_AG=="EQUIVOCAL" | HEP_B_SURFACE_AG=="NEGATIVE"
```

```
(0 observations deleted)tab
```

```
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBsAg_All_Records.dta",  
replace
```

```
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBsAg_All_Records.dta saved
```

```
. do "Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD  
Output files_SM081020\Files_Chapter3\26-09-23\Deduplication_Commands.do"
```



```
. capture noisily duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force
```

Duplicates in terms of UNIQUE_PATIENT_ID

(413,448 observations deleted)

```
. capture noisily duplicates drop DOB HOSPITAL_ID FACILITY_NAME if UNIQUE_PATIENT_ID ==-1, force
```

Duplicates in terms of DOB HOSPITAL_ID FACILITY_NAME

(51 observations deleted)

```
.
```

end of do-file

```
. tab GENDER
```

GENDER	Freq.	Percent	Cum.
-----+-----			
F	1,191,342	60.87	60.87
M	735,946	37.60	98.47
U	29,936	1.53	100.00
-----+-----			
Total	1,957,224	100.00	

```
. tab PROVINCE_NAME
```

PROVINCE_NAME	Freq.	Percent	Cum.
-----+-----			
EASTERN CAPE	240,699	12.30	12.30
FREE STATE	93,063	4.75	17.05

GAUTENG	798,591	40.80	57.86
KWAZULU-NATAL	383,581	19.60	77.45
LIMPOPO	64,305	3.29	80.74
MPUMALANGA	103,573	5.29	86.03
NORTH WEST	102,686	5.25	91.28
NORTHERN CAPE	26,436	1.35	92.63
WESTERN CAPE	144,290	7.37	100.00

-----+-----

Total | 1,957,224 100.00

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	Freq.	Percent	Cum.
-----+-----			
EASTERN CAPE_ALFRED NZO	8,797	0.45	0.45
EASTERN CAPE_AMATHOLE	22,640	1.16	1.61
EASTERN CAPE_BUFFALO CITY METRO	63,163	3.23	4.83
EASTERN CAPE_CHRIS HANI	9,564	0.49	5.32
EASTERN CAPE_JOE GQABI	5,874	0.30	5.62
EASTERN CAPE_NELSON MANDELA BAY METRO	56,973	2.91	8.53
EASTERN CAPE_NOT APPLICABLE	6	0.00	8.53
EASTERN CAPE_O R TAMBO	55,669	2.84	11.38
EASTERN CAPE_SARAH BAARTMAN	17,299	0.88	12.26
EASTERN CAPE_UNKNOWN	714	0.04	12.30
FREE STATE_FEZILE DABI	10,175	0.52	12.82
FREE STATE_LEJWELEPUTSWA	20,188	1.03	13.85
FREE STATE_MANGAUNG METRO	49,025	2.50	16.35
FREE STATE_NOT APPLICABLE	1	0.00	16.35
FREE STATE_THABO MOFUTSANYANA	8,752	0.45	16.80
FREE STATE_UNKNOWN	57	0.00	16.80
FREE STATE_XHARIEP	4,865	0.25	17.05
GAUTENG_CITY OF JOHANNESBURG METRO	286,509	14.64	31.69

GAUTENG_CITY OF TSHWANE METRO	197,086	10.07	41.76
GAUTENG_EKURHULENI METRO	270,469	13.82	55.58
GAUTENG_SEDIBENG	26,647	1.36	56.94
GAUTENG_UNKNOWN	1,514	0.08	57.02
GAUTENG_WEST RAND	16,366	0.84	57.86
KWAZULU-NATAL_AMAJUBA	9,222	0.47	58.33
KWAZULU-NATAL_ETHEKWINI METRO	176,836	9.04	67.36
KWAZULU-NATAL_HARRY GWALA	4,559	0.23	67.59
KWAZULU-NATAL_ILEMBE	11,873	0.61	68.20
KWAZULU-NATAL_KING CETSHWAYO	9,291	0.47	68.68
KWAZULU-NATAL_UGU	40,630	2.08	70.75
KWAZULU-NATAL_UMGUNGUNDLOVU	93,252	4.76	75.52
KWAZULU-NATAL_UMKHANYAKUDE	9,934	0.51	76.02
KWAZULU-NATAL_UMZINYATHI	7,733	0.40	76.42
KWAZULU-NATAL_UNKNOWN	39	0.00	76.42
KWAZULU-NATAL_UTHUKELA	4,937	0.25	76.67
KWAZULU-NATAL_UTHUNGULU	5,905	0.30	76.97
KWAZULU-NATAL_ZULULAND	9,370	0.48	77.45
LIMPOPO_CAPRICORN	23,485	1.20	78.65
LIMPOPO_GREATER SEKHUKHUNE	11,417	0.58	79.24
LIMPOPO_MOPANI	9,876	0.50	79.74
LIMPOPO_UNKNOWN	33	0.00	79.74
LIMPOPO_VHEMBE	10,812	0.55	80.30
LIMPOPO_WATERBERG	8,682	0.44	80.74
MPUMALANGA_EHLANZENI	41,425	2.12	82.86
MPUMALANGA_GERT SIBANDE	39,053	2.00	84.85
MPUMALANGA_NKANGALA	23,054	1.18	86.03
MPUMALANGA_UNKNOWN	41	0.00	86.03
NORTH WEST_BOJANALA PLATINUM	40,036	2.05	88.08
NORTH WEST_DR KENNETH KAUNDA	31,027	1.59	89.66
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	8,727	0.45	90.11
NORTH WEST_NGAKA MODIRI MOLEMA	22,889	1.17	91.28

NORTH WEST_UNKNOWN	7	0.00	91.28
NORTHERN CAPE_FRANCES BAARD	16,765	0.86	92.13
NORTHERN CAPE_JOHN TAOLO GAETSEWE	1,263	0.06	92.20
NORTHERN CAPE_NAMAKWA	2,063	0.11	92.30
NORTHERN CAPE_PIXLEY KA SEME	1,723	0.09	92.39
NORTHERN CAPE_UNKNOWN	7	0.00	92.39
NORTHERN CAPE_ZF MGCAWU	4,615	0.24	92.63
WESTERN CAPE_CAPE WINELANDS	14,812	0.76	93.38
WESTERN CAPE_CENTRAL KAROO	1,128	0.06	93.44
WESTERN CAPE_CITY OF CAPE TOWN METRO	103,866	5.31	98.75
WESTERN CAPE_GARDEN ROUTE	11,325	0.58	99.33
WESTERN CAPE_NOT APPLICABLE	48	0.00	99.33
WESTERN CAPE_OVERBERG	6,577	0.34	99.67
WESTERN CAPE_UNKNOWN	1,676	0.09	99.75
WESTERN CAPE_WEST COAST	4,858	0.25	100.00
-----+-----			
Total	1,957,224	100.00	

. tab TAKEN_DATE_AGE_GROUP

RECODE of			
AGE_TAKEN_D			
ATE_YEARS	Freq.	Percent	Cum.
-----+-----			
'0-4	23,395	1.20	1.20
'5-9	16,734	0.85	2.05
'10-14	26,246	1.34	3.39
'15-19	75,106	3.84	7.23
'20-24	195,649	10.00	17.22
'25-29	302,414	15.45	32.68
'30-34	336,922	17.21	49.89
'35-39	281,733	14.39	64.28

'40-44	215,298	11.00	75.29
'45-49	150,822	7.71	82.99
'50-54	107,625	5.50	88.49
'55-59	75,120	3.84	92.33
'60+	109,478	5.59	97.92
'99999	40,682	2.08	100.00

-----+-----

Total	1,957,224	100.00

.

. count

1,957,224

. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBsAg_All_cases.dta",
replace

file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBsAg_All_cases.dta saved

. use "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBsAg_All_Records.dta"

. count

2,370,723

. tab HEP_B_SURFACE_AG

HEP_B_SURFACE_AG	Freq.	Percent	Cum.

-----+-----

EQUIVOCAL	6,211	0.26	0.26
LOW POSITIVE	5,805	0.24	0.51
NEGATIVE	2,131,961	89.93	90.44
POSITIVE	226,746	9.56	100.00

-----+-----

Total	2,370,723	100.00

```
. keep if HEP_B_SURFACE_AG=="LOW POSITIVE" | HEP_B_SURFACE_AG=="POSITIVE"
```

```
(2,138,172 observations deleted)
```

```
. count
```

```
232,551
```

```
. do "Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD  
Output files_SM081020\Files_Chapter3\26-09-23\Deduplication_Commands.do"
```

```
. capture noisily duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force
```

```
Duplicates in terms of UNIQUE_PATIENT_ID
```

```
(56,021 observations deleted)
```

```
. capture noisily duplicates drop DOB HOSPITAL_ID FACILITY_NAME if UNIQUE_PATIENT_ID ==-1,  
force
```

```
Duplicates in terms of DOB HOSPITAL_ID FACILITY_NAME
```

```
(0 observations are duplicates)
```

```
.
```

```
end of do-file
```

```
. count
```

```
176,530
```

```
. tab GENDER
```

GENDER	Freq.	Percent	Cum.
-----+-----			
F	78,935	44.71	44.71
M	94,699	53.64	98.36
U	2,896	1.64	100.00
-----+-----			
Total	176,530	100.00	

. tab PROVINCE_NAME

PROVINCE_NAME	Freq.	Percent	Cum.
-----+-----			
EASTERN CAPE	21,280	12.05	12.05
FREE STATE	8,087	4.58	16.64
GAUTENG	65,085	36.87	53.50
KWAZULU-NATAL	35,532	20.13	73.63
LIMPOPO	10,122	5.73	79.37
MPUMALANGA	14,176	8.03	87.40
NORTH WEST	9,540	5.40	92.80
NORTHERN CAPE	1,827	1.03	93.84
WESTERN CAPE	10,881	6.16	100.00
-----+-----			
Total	176,530	100.00	

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	Freq.	Percent	Cum.
-----+-----			
EASTERN CAPE_ALFRED NZO	751	0.43	0.43
EASTERN CAPE_AMATHOLE	2,163	1.23	1.65
EASTERN CAPE_BUFFALO CITY METRO	5,399	3.06	4.71
EASTERN CAPE_CHRIS HANI	1,013	0.57	5.28

EASTERN CAPE_JOE GQABI	676	0.38	5.67
EASTERN CAPE_NELSON MANDELA BAY METRO	4,741	2.69	8.35
EASTERN CAPE_O R TAMBO	4,928	2.79	11.14
EASTERN CAPE_SARAH BAARTMAN	1,538	0.87	12.01
EASTERN CAPE_UNKNOWN	71	0.04	12.05
FREE STATE_FEZILE DABI	1,083	0.61	12.67
FREE STATE_LEJWELEPUTSWA	2,038	1.15	13.82
FREE STATE_MANGAUNG METRO	3,753	2.13	15.95
FREE STATE_THABO MOFUTSANYANA	903	0.51	16.46
FREE STATE_UNKNOWN	4	0.00	16.46
FREE STATE_XHARIEP	306	0.17	16.64
GAUTENG_CITY OF JOHANNESBURG METRO	25,026	14.18	30.81
GAUTENG_CITY OF TSHWANE METRO	12,916	7.32	38.13
GAUTENG_EKURHULENI METRO	23,329	13.22	51.34
GAUTENG_SEDIBENG	1,930	1.09	52.44
GAUTENG_UNKNOWN	83	0.05	52.48
GAUTENG_WEST RAND	1,801	1.02	53.50
KWAZULU-NATAL_AMAJUBA	1,005	0.57	54.07
KWAZULU-NATAL_ETHEKWINI METRO	15,990	9.06	63.13
KWAZULU-NATAL_HARRY GWALA	571	0.32	63.46
KWAZULU-NATAL_ILEMBE	1,282	0.73	64.18
KWAZULU-NATAL_KING CETSHWAYO	912	0.52	64.70
KWAZULU-NATAL_UGU	3,970	2.25	66.95
KWAZULU-NATAL_UMGUNGUNDLOVU	7,219	4.09	71.04
KWAZULU-NATAL_UMKHANYAKUDE	1,450	0.82	71.86
KWAZULU-NATAL_UMZINYATHI	679	0.38	72.24
KWAZULU-NATAL_UNKNOWN	5	0.00	72.25
KWAZULU-NATAL_UTHUKELA	509	0.29	72.53
KWAZULU-NATAL_UTHUNGULU	652	0.37	72.90
KWAZULU-NATAL_ZULULAND	1,288	0.73	73.63
LIMPOPO_CAPRICORN	3,868	2.19	75.82
LIMPOPO_GREATER SEKHUKHUNE	1,380	0.78	76.61

LIMPOPO_MOPANI	1,556	0.88	77.49
LIMPOPO_UNKNOWN	2	0.00	77.49
LIMPOPO_VHEMBE	1,705	0.97	78.45
LIMPOPO_WATERBERG	1,611	0.91	79.37
MPUMALANGA_EHLANZENI	6,648	3.77	83.13
MPUMALANGA_GERT SIBANDE	3,883	2.20	85.33
MPUMALANGA_NKANGALA	3,641	2.06	87.39
MPUMALANGA_UNKNOWN	4	0.00	87.40
NORTH WEST_BOJANALA PLATINUM	4,163	2.36	89.76
NORTH WEST_DR KENNETH KAUNDA	3,170	1.80	91.55
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	657	0.37	91.92
NORTH WEST_NGAKA MODIRI MOLEMA	1,550	0.88	92.80
NORTHERN CAPE_FRANCES BAARD	934	0.53	93.33
NORTHERN CAPE_JOHN TAOLO GAETSEWE	166	0.09	93.42
NORTHERN CAPE_NAMAKWA	111	0.06	93.49
NORTHERN CAPE_PIXLEY KA SEME	133	0.08	93.56
NORTHERN CAPE_ZF MGCAWU	483	0.27	93.84
WESTERN CAPE_CAPE WINELANDS	1,126	0.64	94.47
WESTERN CAPE_CENTRAL KAROO	97	0.05	94.53
WESTERN CAPE_CITY OF CAPE TOWN METRO	7,527	4.26	98.79
WESTERN CAPE_GARDEN ROUTE	1,201	0.68	99.47
WESTERN CAPE_NOT APPLICABLE	12	0.01	99.48
WESTERN CAPE_OVERBERG	450	0.25	99.73
WESTERN CAPE_UNKNOWN	38	0.02	99.76
WESTERN CAPE_WEST COAST	430	0.24	100.00
-----+-----			
Total	176,530	100.00	

. tab TAKEN_DATE_AGE_GROUP

RECODE of |
AGE_TAKEN_D |

ATE_YEARS	Freq.	Percent	Cum.
-----+-----			
'0-4	1,131	0.64	0.64
'5-9	407	0.23	0.87
'10-14	664	0.38	1.25
'15-19	2,779	1.57	2.82
'20-24	13,154	7.45	10.27
'25-29	27,756	15.72	26.00
'30-34	34,320	19.44	45.44
'35-39	30,645	17.36	62.80
'40-44	23,184	13.13	75.93
'45-49	15,009	8.50	84.43
'50-54	9,433	5.34	89.78
'55-59	5,703	3.23	93.01
'60+	7,059	4.00	97.01
'99999	5,286	2.99	100.00
-----+-----			
Total	176,530	100.00	

. tab TAKEN_DATE_AGE_GROUP GENDER, row col

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+-----+
| Key      |
|-----|
| frequency |
| row percentage |
| column percentage |
+-----+

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RECODE of |
AGE_TAKEN_ |      GENDER
DATE_YEARS |      F      M      U | Total

```

-----+-----+-----				
'0-4	502	603	26	1,131
	44.39	53.32	2.30	100.00
	0.64	0.64	0.90	0.64
-----+-----+-----				
'5-9	197	196	14	407
	48.40	48.16	3.44	100.00
	0.25	0.21	0.48	0.23
-----+-----+-----				
'10-14	394	258	12	664
	59.34	38.86	1.81	100.00
	0.50	0.27	0.41	0.38
-----+-----+-----				
'15-19	2,017	722	40	2,779
	72.58	25.98	1.44	100.00
	2.56	0.76	1.38	1.57
-----+-----+-----				
'20-24	8,797	4,146	211	13,154
	66.88	31.52	1.60	100.00
	11.14	4.38	7.29	7.45
-----+-----+-----				
'25-29	15,365	11,938	453	27,756
	55.36	43.01	1.63	100.00
	19.47	12.61	15.64	15.72
-----+-----+-----				
'30-34	15,747	18,077	496	34,320
	45.88	52.67	1.45	100.00
	19.95	19.09	17.13	19.44
-----+-----+-----				
'35-39	11,974	18,254	417	30,645
	39.07	59.57	1.36	100.00
	15.17	19.28	14.40	17.36

-----+-----+-----				
'40-44	8,152	14,720	312	23,184
	35.16	63.49	1.35	100.00
	10.33	15.54	10.77	13.13
-----+-----+-----				
'45-49	5,182	9,631	196	15,009
	34.53	64.17	1.31	100.00
	6.56	10.17	6.77	8.50
-----+-----+-----				
'50-54	3,568	5,759	106	9,433
	37.82	61.05	1.12	100.00
	4.52	6.08	3.66	5.34
-----+-----+-----				
'55-59	2,143	3,494	66	5,703
	37.58	61.27	1.16	100.00
	2.71	3.69	2.28	3.23
-----+-----+-----				
'60+	2,918	4,043	98	7,059
	41.34	57.27	1.39	100.00
	3.70	4.27	3.38	4.00
-----+-----+-----				
'99999	1,979	2,858	449	5,286
	37.44	54.07	8.49	100.00
	2.51	3.02	15.50	2.99
-----+-----+-----				
Total	78,935	94,699	2,896	176,530
	44.71	53.64	1.64	100.00
	100.00	100.00	100.00	100.00

. tab PROVINCE_NAME GENDER, row col

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| Key          |
|-----|
| frequency    |
| row percentage |
| column percentage |
+-----+

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	GENDER			
PROVINCE_NAME	F	M	U	Total
-----+-----+-----				
EASTERN CAPE	10,368	10,686	226	21,280
48.72	50.22	1.06	100.00	
13.13	11.28	7.80	12.05	
-----+-----+-----				
FREE STATE	3,593	4,447	47	8,087
44.43	54.99	0.58	100.00	
4.55	4.70	1.62	4.58	
-----+-----+-----				
GAUTENG	28,548	35,481	1,056	65,085
43.86	54.51	1.62	100.00	
36.17	37.47	36.46	36.87	
-----+-----+-----				
KWAZULU-NATAL	15,165	19,262	1,105	35,532
42.68	54.21	3.11	100.00	
19.21	20.34	38.16	20.13	
-----+-----+-----				
LIMPOPO	5,153	4,894	75	10,122
50.91	48.35	0.74	100.00	
6.53	5.17	2.59	5.73	
-----+-----+-----				
MPUMALANGA	6,768	7,235	173	14,176
47.74	51.04	1.22	100.00	

		8.57	7.64	5.97		8.03
-----+-----+-----						
NORTH WEST		4,153	5,255	132		9,540
		43.53	55.08	1.38		100.00
		5.26	5.55	4.56		5.40
-----+-----+-----						
NORTHERN CAPE		806	993	28		1,827
		44.12	54.35	1.53		100.00
		1.02	1.05	0.97		1.03
-----+-----+-----						
WESTERN CAPE		4,381	6,446	54		10,881
		40.26	59.24	0.50		100.00
		5.55	6.81	1.86		6.16
-----+-----+-----						
Total		78,935	94,699	2,896		176,530
		44.71	53.64	1.64		100.00
		100.00	100.00	100.00		100.00

. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME, row col

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+-----+
| Key      |
|-----|
| frequency |
| row percentage |
| column percentage |
+-----+

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RECODE of |
AGE_TAKEN_ |          PROVINCE_NAME
DATE_YEARS | EASTERN.. FREE ST.. GAUTENG KWAZULU.. LIMPOPO MPUMALA.. NORTH W..
NORTHER.. | Total
-----+-----+-----

```

'0-4	107	21	303	199	256	92	39	15	1,131
	9.46	1.86	26.79	17.60	22.63	8.13	3.45	1.33	100.00
	0.50	0.26	0.47	0.56	2.53	0.65	0.41	0.82	0.64
-----+									
'5-9	31	19	122	68	72	42	20	11	407
	7.62	4.67	29.98	16.71	17.69	10.32	4.91	2.70	100.00
	0.15	0.23	0.19	0.19	0.71	0.30	0.21	0.60	0.23
-----+									
'10-14	61	36	199	139	90	76	28	11	664
	9.19	5.42	29.97	20.93	13.55	11.45	4.22	1.66	100.00
	0.29	0.45	0.31	0.39	0.89	0.54	0.29	0.60	0.38
-----+									
'15-19	416	123	773	598	281	318	121	23	2,779
	14.97	4.43	27.82	21.52	10.11	11.44	4.35	0.83	100.00
	1.95	1.52	1.19	1.68	2.78	2.24	1.27	1.26	1.57
-----+									
'20-24	1,842	615	4,318	3,161	654	1,190	557	97	13,154
	14.00	4.68	32.83	24.03	4.97	9.05	4.23	0.74	100.00
	8.66	7.60	6.63	8.90	6.46	8.39	5.84	5.31	7.45
-----+									
'25-29	3,430	1,310	9,870	6,565	1,191	2,220	1,378	228	27,756
	12.36	4.72	35.56	23.65	4.29	8.00	4.96	0.82	100.00
	16.12	16.20	15.16	18.48	11.77	15.66	14.44	12.48	15.72
-----+									
'30-34	4,049	1,551	13,066	7,407	1,361	2,750	1,816	258	34,320
	11.80	4.52	38.07	21.58	3.97	8.01	5.29	0.75	100.00
	19.03	19.18	20.08	20.85	13.45	19.40	19.04	14.12	19.44
-----+									
'35-39	3,559	1,445	12,029	5,891	1,379	2,310	1,777	280	30,645
	11.61	4.72	39.25	19.22	4.50	7.54	5.80	0.91	100.00
	16.72	17.87	18.48	16.58	13.62	16.30	18.63	15.33	17.36
-----+									

'40-44	2,666	1,155	9,062	4,153	1,285	1,747	1,407	250	23,184
	11.50	4.98	39.09	17.91	5.54	7.54	6.07	1.08	100.00
	12.53	14.28	13.92	11.69	12.70	12.32	14.75	13.68	13.13
-----+-----+-----									
'45-49	1,835	778	5,670	2,487	977	1,091	899	219	15,009
	12.23	5.18	37.78	16.57	6.51	7.27	5.99	1.46	100.00
	8.62	9.62	8.71	7.00	9.65	7.70	9.42	11.99	8.50
-----+-----+-----									
'50-54	1,233	450	3,314	1,532	708	701	581	151	9,433
	13.07	4.77	35.13	16.24	7.51	7.43	6.16	1.60	100.00
	5.79	5.56	5.09	4.31	6.99	4.94	6.09	8.26	5.34
-----+-----+-----									
'55-59	779	272	1,825	958	502	418	377	120	5,703
	13.66	4.77	32.00	16.80	8.80	7.33	6.61	2.10	100.00
	3.66	3.36	2.80	2.70	4.96	2.95	3.95	6.57	3.23
-----+-----+-----									
'60+	918	277	1,915	1,391	1,016	487	428	124	7,059
	13.00	3.92	27.13	19.71	14.39	6.90	6.06	1.76	100.00
	4.31	3.43	2.94	3.91	10.04	3.44	4.49	6.79	4.00
-----+-----+-----									
'99999	354	35	2,619	983	350	734	112	40	5,286
	6.70	0.66	49.55	18.60	6.62	13.89	2.12	0.76	100.00
	1.66	0.43	4.02	2.77	3.46	5.18	1.17	2.19	2.99
-----+-----+-----									
Total	21,280	8,087	65,085	35,532	10,122	14,176	9,540	1,827	176,530
	12.05	4.58	36.87	20.13	5.73	8.03	5.40	1.03	100.00
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

RECODE of | PROVINCE_N

AGE_TAKEN_ | AME

DATE_YEARS | WESTERN.. | Total

-----+-----+-----

'0-4	99	1,131
	8.75	100.00
	0.91	0.64
-----+-----+-----		
'5-9	22	407
	5.41	100.00
	0.20	0.23
-----+-----+-----		
'10-14	24	664
	3.61	100.00
	0.22	0.38
-----+-----+-----		
'15-19	126	2,779
	4.53	100.00
	1.16	1.57
-----+-----+-----		
'20-24	720	13,154
	5.47	100.00
	6.62	7.45
-----+-----+-----		
'25-29	1,564	27,756
	5.63	100.00
	14.37	15.72
-----+-----+-----		
'30-34	2,062	34,320
	6.01	100.00
	18.95	19.44
-----+-----+-----		
'35-39	1,975	30,645
	6.44	100.00
	18.15	17.36
-----+-----+-----		

'40-44		1,459		23,184
		6.29		100.00
		13.41		13.13
-----+-----+-----				
'45-49		1,053		15,009
		7.02		100.00
		9.68		8.50
-----+-----+-----				
'50-54		763		9,433
		8.09		100.00
		7.01		5.34
-----+-----+-----				
'55-59		452		5,703
		7.93		100.00
		4.15		3.23
-----+-----+-----				
'60+		503		7,059
		7.13		100.00
		4.62		4.00
-----+-----+-----				
'99999		59		5,286
		1.12		100.00
		0.54		2.99
-----+-----+-----				
Total		10,881		176,530
		6.16		100.00
		100.00		100.00

Appendix 3.3: Stata Log file of HBsAg Cases Under five years old

```
. use "2015-2019 HBsAg_positive_cases.dta",clear
```

```
. tab TAKEN_DATE_AGE_GROUP
```

```
RECODE of |  
AGE_TAKEN_D |  
ATE_YEARS |   Freq.   Percent   Cum.  
-----+-----  
    '0-4 |    1,131     0.64     0.64  
    '5-9 |     407     0.23     0.87  
   '10-14 |     664     0.38     1.25  
   '15-19 |    2,779     1.57     2.82  
   '20-24 |   13,154     7.45    10.27  
   '25-29 |   27,756    15.72    26.00  
   '30-34 |   34,320    19.44    45.44  
   '35-39 |   30,645    17.36    62.80  
   '40-44 |   23,184    13.13    75.93  
   '45-49 |   15,009     8.50    84.43  
   '50-54 |    9,433     5.34    89.78  
   '55-59 |    5,703     3.23    93.01  
    '60+ |    7,059     4.00    97.01  
   '99999 |    5,286     2.99   100.00  
-----+-----  
    Total |  176,530   100.00
```

```
. codebook TAKEN_DATE_AGE_GROUP
```

Type: Numeric (int)

Label: TAKEN_DATE_AGE_GROUP

Range: [1,14]

Units: 1

Unique values: 14

Missing .: 0/176,530

Examples: 6 '25-29

7 '30-34

8 '35-39

10 '45-49

```
. keep if TAKEN_DATE_AGE_GROUP
```

(0 observations deleted)

```
. keep if TAKEN_DATE_AGE_GROUP==1
```

(175,399 observations deleted)

```
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBsAg_positive_cases_under_5years.dta", replace
```

file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBsAg_positive_cases_under_5years.dta saved

```
. use "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBsAg_All_cases.dta"
```

```
. tab TAKEN_DATE_AGE_GROUP
```

RECODE of |

AGE_TAKEN_D |

ATE_YEARS	Freq.	Percent	Cum.

-----+-----

'0-4	23,395	1.20	1.20

'5-9	16,734	0.85	2.05

'10-14	26,246	1.34	3.39

'15-19	75,106	3.84	7.23

'20-24	195,649	10.00	17.22
'25-29	302,414	15.45	32.68
'30-34	336,922	17.21	49.89
'35-39	281,733	14.39	64.28
'40-44	215,298	11.00	75.29
'45-49	150,822	7.71	82.99
'50-54	107,625	5.50	88.49
'55-59	75,120	3.84	92.33
'60+	109,478	5.59	97.92
'99999	40,682	2.08	100.00

-----+-----

Total	1,957,224	100.00

. codebook TAKEN_DATE_AGE_GROUP

TAKEN_DATE_AGE_GROUP
AGE_TAKEN_DATE_YEARS

RECODE of

Type: Numeric (long)

Label: TAKEN_DATE_AGE_GROUP, but 1 nonmissing value is not labeled

Range: [1,99999]

Units: 1

Unique values: 14

Missing .: 0/1,957,224

Examples: 6 '25-29

7 '30-34

8 '35-39

10 '45-49

. keep if TAKEN_DATE_AGE_GROUP==1

(1,933,905 observations deleted)

```
. tab TAKEN_DATE_AGE_GROUP
```

```
RECODE of |
AGE_TAKEN_D |
ATE_YEARS |   Freq.   Percent   Cum.
-----+-----
'0-4 |    23,395    100.00    100.00
-----+-----
Total |    23,395    100.00
```

```
. tab GENDER
```

```
GENDER |   Freq.   Percent   Cum.
-----+-----
F |    11,474    49.04    49.04
M |    11,201    47.88    96.92
U |       720     3.08   100.00
-----+-----
Total |    23,395   100.00
```

```
. tab PROVINCE_NAME
```

```
-----+-----
EASTERN CAPE |    2,330     9.96    9.96
FREE STATE |     782     3.34   13.30
GAUTENG |    6,347    27.13   40.43
KWAZULU-NATAL |   7,708    32.95   73.38
LIMPOPO |    1,369     5.85   79.23
```

MPUMALANGA	1,129	4.83	84.06
NORTH WEST	666	2.85	86.90
NORTHERN CAPE	695	2.97	89.87
WESTERN CAPE	2,369	10.13	100.00
-----+-----			
Total	23,395	100.00	

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	Freq.	Percent	Cum.
-----+-----			
EASTERN CAPE_ALFRED NZO	206	0.88	0.88
EASTERN CAPE_AMATHOLE	111	0.47	1.35
EASTERN CAPE_BUFFALO CITY METRO	487	2.08	3.44
EASTERN CAPE_CHRIS HANI	82	0.35	3.79
EASTERN CAPE_JOE GQABI	26	0.11	3.90
EASTERN CAPE_NELSON MANDELA BAY METRO	414	1.77	5.67
EASTERN CAPE_O R TAMBO	924	3.95	9.62
EASTERN CAPE_SARAH BAARTMAN	68	0.29	9.91
EASTERN CAPE_UNKNOWN	12	0.05	9.96
FREE STATE_FEZILE DABI	52	0.22	10.18
FREE STATE_LEJWELEPUTSWA	57	0.24	10.43
FREE STATE_MANGAUNG METRO	619	2.65	13.07
FREE STATE_THABO MOFUTSANYANA	39	0.17	13.24
FREE STATE_XHARIEP	15	0.06	13.30
GAUTENG_CITY OF JOHANNESBURG METRO	2,369	10.13	23.43
GAUTENG_CITY OF TSHWANE METRO	2,198	9.40	32.82
GAUTENG_EKURHULENI METRO	1,351	5.77	38.60
GAUTENG_SEDIBENG	213	0.91	39.51
GAUTENG_UNKNOWN	2	0.01	39.52

GAUTENG_WEST RAND	214	0.91	40.43
KWAZULU-NATAL_AMAJUBA	481	2.06	42.49
KWAZULU-NATAL_ETHEKWINI METRO	2,989	12.78	55.26
KWAZULU-NATAL_HARRY GWALA	161	0.69	55.95
KWAZULU-NATAL_ILEMBE	351	1.50	57.45
KWAZULU-NATAL_KING CETSHWAYO	207	0.88	58.34
KWAZULU-NATAL_UGU	392	1.68	60.01
KWAZULU-NATAL_UMGUNGUNDLOVU	1,702	7.28	67.29
KWAZULU-NATAL_UMKHANYAKUDE	345	1.47	68.76
KWAZULU-NATAL_UMZINYATHI	301	1.29	70.05
KWAZULU-NATAL_UNKNOWN	1	0.00	70.05
KWAZULU-NATAL_UTHUKELA	218	0.93	70.99
KWAZULU-NATAL_UTHUNGULU	211	0.90	71.89
KWAZULU-NATAL_ZULULAND	349	1.49	73.38
LIMPOPO_CAPRICORN	575	2.46	75.84
LIMPOPO_GREATER SEKHUKHUNE	217	0.93	76.76
LIMPOPO_MOPANI	145	0.62	77.38
LIMPOPO_VHEMBE	243	1.04	78.42
LIMPOPO_WATERBERG	189	0.81	79.23
MPUMALANGA_EHLANZENI	512	2.19	81.42
MPUMALANGA_GERT SIBANDE	356	1.52	82.94
MPUMALANGA_NKANGALA	261	1.12	84.06
NORTH WEST_BOJANALA PLATINUM	151	0.65	84.70
NORTH WEST_DR KENNETH KAUNDA	184	0.79	85.49
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	45	0.19	85.68
NORTH WEST_NGAKA MODIRI MOLEMA	286	1.22	86.90
NORTHERN CAPE_FRANCES BAARD	576	2.46	89.37
NORTHERN CAPE_JOHN TAOLO GAETSEWE	17	0.07	89.44
NORTHERN CAPE_NAMAKWA	29	0.12	89.56
NORTHERN CAPE_PIXLEY KA SEME	19	0.08	89.64
NORTHERN CAPE_ZF MGCAWU	54	0.23	89.87
WESTERN CAPE_CAPE WINELANDS	248	1.06	90.93

WESTERN CAPE_CENTRAL KAROO	27	0.12	91.05
WESTERN CAPE_CITY OF CAPE TOWN METRO	1,862	7.96	99.01
WESTERN CAPE_GARDEN ROUTE	106	0.45	99.46
WESTERN CAPE_OVERBERG	67	0.29	99.75
WESTERN CAPE_UNKNOWN	9	0.04	99.79
WESTERN CAPE_WEST COAST	50	0.21	100.00
-----+-----			
Total	23,395	100.00	

. tab PROVINCE_NAME AGE_TAKEN_DATE_YEARS

AGE_TAKEN_DATE_YEARS						
PROVINCE_NAME	0	1	2	3	4	Total
-----+-----+-----						
EASTERN CAPE	1,008	313	332	321	356	2,330
FREE STATE	401	107	95	81	98	782
GAUTENG	3,214	880	742	751	760	6,347
KWAZULU-NATAL	3,790	1,058	910	939	1,011	7,708
LIMPOPO	621	180	174	188	206	1,369
MPUMALANGA	507	166	130	160	166	1,129
NORTH WEST	359	86	74	71	76	666
NORTHERN CAPE	281	120	105	85	104	695
WESTERN CAPE	972	342	305	360	390	2,369
-----+-----+-----						
Total	11,153	3,252	2,867	2,956	3,167	23,395

. tab AGE_TAKEN_DATE_YEARS GENDER

AGE_TAKEN_	GENDER			
DATE_YEARS	F	M	U	Total

-----+-----+-----				
0	5,042	5,711	400	11,153
1	1,536	1,620	96	3,252
2	1,480	1,322	65	2,867
3	1,628	1,257	71	2,956
4	1,788	1,291	88	3,167
-----+-----+-----				
Total	11,474	11,201	720	23,395

```
. use "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBsAg_positive_cases_under_5years.dta"
```

```
. tab AGE_TAKEN_DATE_YEARS
```

AGE_TAKEN_D			
ATE_YEARS	Freq.	Percent	Cum.
-----+-----			
0	744	65.78	65.78
1	119	10.52	76.30
2	92	8.13	84.44
3	80	7.07	91.51
4	96	8.49	100.00
-----+-----			
Total	1,131	100.00	

```
. gen AGE_TAKEN_DATE_WEEKS= AGE_TAKEN_DATE_DAYS/7
```

```
. keep if AGE_TAKEN_DATE_YEARS<1
(387 observations deleted)
```

```
. tab AGE_TAKEN_DATE_WEEKS
```

AGE_TAKEN_D |

ATE_WEEKS | Freq. Percent Cum.

-----+-----

0	141	18.95	18.95
1	27	3.63	22.58
2	27	3.63	26.21
3	19	2.55	28.76
4	21	2.82	31.59
5	22	2.96	34.54
6	129	17.34	51.88
7	59	7.93	59.81
8	27	3.63	63.44
9	17	2.28	65.73
10	38	5.11	70.83
11	34	4.57	75.40
12	9	1.21	76.61
13	10	1.34	77.96
14	10	1.34	79.30
15	5	0.67	79.97
16	7	0.94	80.91
17	5	0.67	81.59
18	9	1.21	82.80
19	7	0.94	83.74
20	5	0.67	84.41
21	2	0.27	84.68
22	8	1.08	85.75
23	3	0.40	86.16
24	7	0.94	87.10
25	1	0.13	87.23
26	3	0.40	87.63
27	6	0.81	88.44

28	5	0.67	89.11
29	4	0.54	89.65
30	4	0.54	90.19
31	5	0.67	90.86
32	4	0.54	91.40
33	7	0.94	92.34
34	1	0.13	92.47
35	4	0.54	93.01
36	4	0.54	93.55
37	4	0.54	94.09
38	4	0.54	94.62
39	4	0.54	95.16
40	3	0.40	95.56
41	5	0.67	96.24
43	4	0.54	96.77
44	4	0.54	97.31
45	2	0.27	97.58
46	3	0.40	97.98
47	2	0.27	98.25
48	1	0.13	98.39
49	4	0.54	98.92
50	3	0.40	99.33
51	3	0.40	99.73
52	2	0.27	100.00

-----+-----

Total	744	100.00

. count if AGE_TAKEN_DATE_WEEKS<6

257

. count if AGE_TAKEN_DATE_WEEKS>5 & AGE_TAKEN_DATE_WEEKS<17

345

```
. count if AGE_TAKEN_DATE_WEEKS>16
```

```
142
```

```
. tab GENDER
```

GENDER	Freq.	Percent	Cum.
-----+-----			
F	297	39.92	39.92
M	429	57.66	97.58
U	18	2.42	100.00
-----+-----			
Total	744	100.00	

```
.
```

```
. tab PROVINCE_NAME
```

PROVINCE_NAME	Freq.	Percent	Cum.
-----+-----			
EASTERN CAPE	74	9.95	9.95
FREE STATE	14	1.88	11.83
GAUTENG	220	29.57	41.40
KWAZULU-NATAL	130	17.47	58.87
LIMPOPO	133	17.88	76.75
MPUMALANGA	62	8.33	85.08
NORTH WEST	32	4.30	89.38
NORTHERN CAPE	10	1.34	90.73
WESTERN CAPE	69	9.27	100.00
-----+-----			
Total	744	100.00	

```
.
```

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	Freq.	Percent	Cum.	
-----+-----				
EASTERN CAPE_ALFRED NZO	6	0.81	0.81	
EASTERN CAPE_AMATHOLE	3	0.40	1.21	
EASTERN CAPE_BUFFALO CITY METRO	19	2.55	3.76	
EASTERN CAPE_CHRIS HANI	4	0.54	4.30	
EASTERN CAPE_JOE GQABI	3	0.40	4.70	
EASTERN CAPE_NELSON MANDELA BAY METRO	16	2.15	6.85	
EASTERN CAPE_O R TAMBO	20	2.69	9.54	
EASTERN CAPE_SARAH BAARTMAN	2	0.27	9.81	
EASTERN CAPE_UNKNOWN	1	0.13	9.95	
FREE STATE_FEZILE DABI	2	0.27	10.22	
FREE STATE_LEJWELEPUTSWA	3	0.40	10.62	
FREE STATE_MANGAUNG METRO	9	1.21	11.83	
GAUTENG_CITY OF JOHANNESBURG METRO	89	11.96	23.79	
GAUTENG_CITY OF TSHWANE METRO	55	7.39	31.18	
GAUTENG_EKURHULENI METRO	64	8.60	39.78	
GAUTENG_SEDIBENG	3	0.40	40.19	
GAUTENG_WEST RAND	9	1.21	41.40	
KWAZULU-NATAL_AMAJUBA	9	1.21	42.61	
KWAZULU-NATAL_ETHEKWINI METRO	50	6.72	49.33	
KWAZULU-NATAL_HARRY GWALA	4	0.54	49.87	
KWAZULU-NATAL_ILEMBE	4	0.54	50.40	
KWAZULU-NATAL_KING CETSHWAYO	4	0.54	50.94	
KWAZULU-NATAL_UGU	6	0.81	51.75	
KWAZULU-NATAL_UMGUNGUNDLOVU	22	2.96	54.70	
KWAZULU-NATAL_UMKHANYAKUDE	9	1.21	55.91	
KWAZULU-NATAL_UMZINYATHI	5	0.67	56.59	
KWAZULU-NATAL_UTHUKELA	3	0.40	56.99	
KWAZULU-NATAL_UTHUNGULU	5	0.67	57.66	

KWAZULU-NATAL_ZULULAND	9	1.21	58.87
LIMPOPO_CAPRICORN	68	9.14	68.01
LIMPOPO_GREATER SEKHUKHUNE	10	1.34	69.35
LIMPOPO_MOPANI	10	1.34	70.70
LIMPOPO_VHEMBE	26	3.49	74.19
LIMPOPO_WATERBERG	19	2.55	76.75
MPUMALANGA_EHLANZENI	30	4.03	80.78
MPUMALANGA_GERT SIBANDE	15	2.02	82.80
MPUMALANGA_NKANGALA	17	2.28	85.08
NORTH WEST_BOJANALA PLATINUM	6	0.81	85.89
NORTH WEST_DR KENNETH KAUNDA	15	2.02	87.90
NORTH WEST_NGAKA MODIRI MOLEMA	11	1.48	89.38
NORTHERN CAPE_FRANCES BAARD	10	1.34	90.73
WESTERN CAPE_CAPE WINELANDS	2	0.27	90.99
WESTERN CAPE_CENTRAL KAROO	1	0.13	91.13
WESTERN CAPE_CITY OF CAPE TOWN METRO	54	7.26	98.39
WESTERN CAPE_GARDEN ROUTE	11	1.48	99.87
WESTERN CAPE_OVERBERG	1	0.13	100.00
-----+-----			
Total	744	100.00	

.

. tab TAKEN_DATE_AGE_GROUP

RECODE of			
AGE_TAKEN_D			
ATE_YEARS	Freq.	Percent	Cum.
-----+-----			
'0-4	744	100.00	100.00
-----+-----			
Total	744	100.00	

```
.
. tab TAKEN_DATE_AGE_GROUP GENDER, row col
```

```
+-----+
| Key      |
|-----|
| frequency |
| row percentage |
| column percentage |
+-----+
```

RECODE of				
AGE_TAKEN_	GENDER			
DATE_YEARS	F	M	U	Total
-----+-----+-----				
'0-4	297	429	18	744
	39.92	57.66	2.42	100.00
	100.00	100.00	100.00	100.00
-----+-----+-----				
Total	297	429	18	744
	39.92	57.66	2.42	100.00
	100.00	100.00	100.00	100.00

```
.
. tab PROVINCE_NAME GENDER, row col
```

```
+-----+
| Key      |
|-----|
| frequency |
| row percentage |
| column percentage |
```


+-----+				
	GENDER			
PROVINCE_NAME	F	M	U	Total
-----+				
EASTERN CAPE	31	43	0	74
41.89	58.11	0.00	100.00	
10.44	10.02	0.00	9.95	
-----+				
FREE STATE	8	6	0	14
57.14	42.86	0.00	100.00	
2.69	1.40	0.00	1.88	
-----+				
GAUTENG	84	131	5	220
38.18	59.55	2.27	100.00	
28.28	30.54	27.78	29.57	
-----+				
KWAZULU-NATAL	51	71	8	130
39.23	54.62	6.15	100.00	
17.17	16.55	44.44	17.47	
-----+				
LIMPOPO	47	84	2	133
35.34	63.16	1.50	100.00	
15.82	19.58	11.11	17.88	
-----+				
MPUMALANGA	23	37	2	62
37.10	59.68	3.23	100.00	
7.74	8.62	11.11	8.33	
-----+				
NORTH WEST	13	19	0	32
40.62	59.38	0.00	100.00	
4.38	4.43	0.00	4.30	

-----+-----+-----				
NORTHERN CAPE	4	5	1	10
40.00	50.00	10.00	100.00	
1.35	1.17	5.56	1.34	

```
. tab TAKEN DATE AGE GROUP PROVINCE NAME, row col
```

RECODE of	AGE_TAKEN_	PROVINCE_NAME
DATE_YEARS EASTERN..	FREE ST..	GAUTENG KWAZULU..
NORTHER..	WESTERN..	LIMPOPO MPUMALA..
	Total	NORTH W..

```

-----+-----
Total |    74    14   220   130   133    62    32    10    69 |   744
      |    9.95   1.88  29.57  17.47  17.88   8.33   4.30   1.34   9.27 |  100.00
      |  100.00  100.00  100.00  100.00  100.00  100.00  100.00  100.00  100.00 |
100.00

```

```

. use "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-
2019_HBsAg_positive_cases_under_5years.dta", clear

```

```

. tab GENDER

```

```

GENDER |   Freq.   Percent   Cum.
-----+-----
F |    502   44.39   44.39
M |    603   53.32   97.70
U |     26    2.30  100.00
-----+-----
Total |   1,131  100.00

```

```

. tab PROVINCE_NAME

```

```

PROVINCE_NAME |   Freq.   Percent   Cum.
-----+-----
EASTERN CAPE |    107    9.46    9.46
FREE STATE |     21    1.86   11.32
GAUTENG |    303   26.79   38.11
KWAZULU-NATAL |    199   17.60   55.70
LIMPOPO |    256   22.63   78.34
MPUMALANGA |     92    8.13   86.47
NORTH WEST |     39    3.45   89.92
NORTHERN CAPE |     15    1.33   91.25
WESTERN CAPE |     99    8.75  100.00
-----+-----

```

Total | 1,131 100.00

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	Freq.	Percent	Cum.
-----+-----			
EASTERN CAPE_ALFRED NZO	9	0.80	0.80
EASTERN CAPE_AMATHOLE	5	0.44	1.24
EASTERN CAPE_BUFFALO CITY METRO	27	2.39	3.63
EASTERN CAPE_CHRIS HANI	7	0.62	4.24
EASTERN CAPE_JOE GQABI	3	0.27	4.51
EASTERN CAPE_NELSON MANDELA BAY METRO	19	1.68	6.19
EASTERN CAPE_O R TAMBO	34	3.01	9.20
EASTERN CAPE_SARAH BAARTMAN	2	0.18	9.37
EASTERN CAPE_UNKNOWN	1	0.09	9.46
FREE STATE_FEZILE DABI	3	0.27	9.73
FREE STATE_LEJWELEPUTSWA	5	0.44	10.17
FREE STATE_MANGAUNG METRO	10	0.88	11.05
FREE STATE_THABO MOFUTSANYANA	1	0.09	11.14
FREE STATE_XHARIEP	2	0.18	11.32
GAUTENG_CITY OF JOHANNESBURG METRO	117	10.34	21.66
GAUTENG_CITY OF TSHWANE METRO	80	7.07	28.74
GAUTENG_EKURHULENI METRO	88	7.78	36.52
GAUTENG_SEDIBENG	5	0.44	36.96
GAUTENG_WEST RAND	13	1.15	38.11
KWAZULU-NATAL_AMAJUBA	15	1.33	39.43
KWAZULU-NATAL_ETHEKWINI METRO	77	6.81	46.24
KWAZULU-NATAL_HARRY GWALA	5	0.44	46.68
KWAZULU-NATAL_ILEMBE	6	0.53	47.21
KWAZULU-NATAL_KING CETSHWAYO	4	0.35	47.57
KWAZULU-NATAL_UGU	12	1.06	48.63
KWAZULU-NATAL_UMGUNGUNDLOVU	38	3.36	51.99

KWAZULU-NATAL_UMKHANYAKUDE	10	0.88	52.87
KWAZULU-NATAL_UMZINYATHI	8	0.71	53.58
KWAZULU-NATAL_UTHUKELA	3	0.27	53.85
KWAZULU-NATAL_UTHUNGULU	5	0.44	54.29
KWAZULU-NATAL_ZULULAND	16	1.41	55.70
LIMPOPO_CAPRICORN	135	11.94	67.64
LIMPOPO_GREATER SEKHUKHUNE	22	1.95	69.58
LIMPOPO_MOPANI	24	2.12	71.71
LIMPOPO_VHEMBE	42	3.71	75.42
LIMPOPO_WATERBERG	33	2.92	78.34
MPUMALANGA_EHLANZENI	43	3.80	82.14
MPUMALANGA_GERT SIBANDE	27	2.39	84.53
MPUMALANGA_NKANGALA	22	1.95	86.47
NORTH WEST_BOJANALA PLATINUM	7	0.62	87.09
NORTH WEST_DR KENNETH KAUNDA	19	1.68	88.77
NORTH WEST_NGAKA MODIRI MOLEMA	13	1.15	89.92
NORTHERN CAPE_FRANCES BAARD	14	1.24	91.16
NORTHERN CAPE_ZF MGCAWU	1	0.09	91.25
WESTERN CAPE_CAPE WINELANDS	3	0.27	91.51
WESTERN CAPE_CENTRAL KAROO	2	0.18	91.69
WESTERN CAPE_CITY OF CAPE TOWN METRO	69	6.10	97.79
WESTERN CAPE_GARDEN ROUTE	23	2.03	99.82
WESTERN CAPE_OVERBERG	2	0.18	100.00
-----+-----			
Total	1,131	100.00	

. tab TAKEN_DATE_AGE_GROUP

RECODE of |
AGE_TAKEN_D |
ATE_YEARS | Freq. Percent Cum.
-----+-----

'0-4	1,131	100.00	100.00
-----+-----			
Total	1,131	100.00	

. tab TAKEN_DATE_AGE_GROUP GENDER, row col

+-----+			
Key			

frequency			
row percentage			
column percentage			
+-----+			

RECODE of				
AGE_TAKEN_	GENDER			
DATE_YEARS	F	M	U	Total
-----+-----				
'0-4	502	603	26	1,131
	44.39	53.32	2.30	100.00
	100.00	100.00	100.00	100.00
-----+-----				
Total	502	603	26	1,131
	44.39	53.32	2.30	100.00
	100.00	100.00	100.00	100.00

. tab PROVINCE_NAME GENDER, row col

+-----+			
Key			

frequency			

| row percentage |

| column percentage |

+-----+

GENDER				
PROVINCE_NAME	F	M	U	Total
-----+				
EASTERN CAPE	51	55	1	107
	47.66	51.40	0.93	100.00
	10.16	9.12	3.85	9.46
-----+				
FREE STATE	12	9	0	21
	57.14	42.86	0.00	100.00
	2.39	1.49	0.00	1.86
-----+				
GAUTENG	125	172	6	303
	41.25	56.77	1.98	100.00
	24.90	28.52	23.08	26.79
-----+				
KWAZULU-NATAL	92	97	10	199
	46.23	48.74	5.03	100.00
	18.33	16.09	38.46	17.60
-----+				
LIMPOPO	112	139	5	256
	43.75	54.30	1.95	100.00
	22.31	23.05	19.23	22.63
-----+				
MPUMALANGA	39	51	2	92
	42.39	55.43	2.17	100.00
	7.77	8.46	7.69	8.13
-----+				
NORTH WEST	16	22	1	39

		41.03	56.41	2.56		100.00
		3.19	3.65	3.85		3.45
-----+-----+-----						
NORTHERN CAPE		5	9	1		15
		33.33	60.00	6.67		100.00
		1.00	1.49	3.85		1.33
-----+-----+-----						
WESTERN CAPE		50	49	0		99
		50.51	49.49	0.00		100.00
		9.96	8.13	0.00		8.75
-----+-----+-----						
Total		502	603	26		1,131
		44.39	53.32	2.30		100.00
		100.00	100.00	100.00		100.00

. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME, row col

+-----+	
Key	

frequency	
row percentage	
column percentage	
+-----+	

RECODE of										
AGE_TAKEN_					PROVINCE_NAME					
DATE_YEARS	EASTERN..	FREE ST..	GAUTENG	KWAZULU..	LIMPOPO	MPUMALA..	NORTH W..			
NORTHER..	WESTERN..		Total							
-----+-----+-----										
'0-4	107	21	303	199	256	92	39	15	99	1,131
	9.46	1.86	26.79	17.60	22.63	8.13	3.45	1.33	8.75	100.00

		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
100.00											
-----+-----											
Total		107	21	303	199	256	92	39	15	99	1,131
		9.46	1.86	26.79	17.60	22.63	8.13	3.45	1.33	8.75	100.00
		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
100.00											

. tab GENDER

GENDER		Freq.	Percent	Cum.
-----+-----				
F		502	44.39	44.39
M		603	53.32	97.70
U		26	2.30	100.00
-----+-----				
Total		1,131	100.00	

.

. tab PROVINCE_NAME

PROVINCE_NAME		Freq.	Percent	Cum.
-----+-----				
EASTERN CAPE		107	9.46	9.46
FREE STATE		21	1.86	11.32
GAUTENG		303	26.79	38.11
KWAZULU-NATAL		199	17.60	55.70
LIMPOPO		256	22.63	78.34
MPUMALANGA		92	8.13	86.47
NORTH WEST		39	3.45	89.92
NORTHERN CAPE		15	1.33	91.25
WESTERN CAPE		99	8.75	100.00
-----+-----				

Total | 1,131 100.00

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	Freq.	Percent	Cum.
-----+-----			
EASTERN CAPE_ALFRED NZO	9	0.80	0.80
EASTERN CAPE_AMATHOLE	5	0.44	1.24
EASTERN CAPE_BUFFALO CITY METRO	27	2.39	3.63
EASTERN CAPE_CHRIS HANI	7	0.62	4.24
EASTERN CAPE_JOE GQABI	3	0.27	4.51
EASTERN CAPE_NELSON MANDELA BAY METRO	19	1.68	6.19
EASTERN CAPE_O R TAMBO	34	3.01	9.20
EASTERN CAPE_SARAH BAARTMAN	2	0.18	9.37
EASTERN CAPE_UNKNOWN	1	0.09	9.46
FREE STATE_FEZILE DABI	3	0.27	9.73
FREE STATE_LEJWELEPUTSWA	5	0.44	10.17
FREE STATE_MANGAUNG METRO	10	0.88	11.05
FREE STATE_THABO MOFUTSANYANA	1	0.09	11.14
FREE STATE_XHARIEP	2	0.18	11.32
GAUTENG_CITY OF JOHANNESBURG METRO	117	10.34	21.66
GAUTENG_CITY OF TSHWANE METRO	80	7.07	28.74
GAUTENG_EKURHULENI METRO	88	7.78	36.52
GAUTENG_SEDIBENG	5	0.44	36.96
GAUTENG_WEST RAND	13	1.15	38.11
KWAZULU-NATAL_AMAJUBA	15	1.33	39.43
KWAZULU-NATAL_ETHEKWINI METRO	77	6.81	46.24
KWAZULU-NATAL_HARRY GWALA	5	0.44	46.68
KWAZULU-NATAL_ILEMBE	6	0.53	47.21
KWAZULU-NATAL_KING CETSHWAYO	4	0.35	47.57
KWAZULU-NATAL_UGU	12	1.06	48.63

KWAZULU-NATAL_UMGUNGUNDLOVU	38	3.36	51.99
KWAZULU-NATAL_UMKHANYAKUDE	10	0.88	52.87
KWAZULU-NATAL_UMZINYATHI	8	0.71	53.58
KWAZULU-NATAL_UTHUKELA	3	0.27	53.85
KWAZULU-NATAL_UTHUNGULU	5	0.44	54.29
KWAZULU-NATAL_ZULULAND	16	1.41	55.70
LIMPOPO_CAPRICORN	135	11.94	67.64
LIMPOPO_GREATER SEKHUKHUNE	22	1.95	69.58
LIMPOPO_MOPANI	24	2.12	71.71
LIMPOPO_VHEMBE	42	3.71	75.42
LIMPOPO_WATERBERG	33	2.92	78.34
MPUMALANGA_EHLANZENI	43	3.80	82.14
MPUMALANGA_GERT SIBANDE	27	2.39	84.53
MPUMALANGA_NKANGALA	22	1.95	86.47
NORTH WEST_BOJANALA PLATINUM	7	0.62	87.09
NORTH WEST_DR KENNETH KAUNDA	19	1.68	88.77
NORTH WEST_NGAKA MODIRI MOLEMA	13	1.15	89.92
NORTHERN CAPE_FRANCES BAARD	14	1.24	91.16
NORTHERN CAPE_ZF MGCAWU	1	0.09	91.25
WESTERN CAPE_CAPE WINELANDS	3	0.27	91.51
WESTERN CAPE_CENTRAL KAROO	2	0.18	91.69
WESTERN CAPE_CITY OF CAPE TOWN METRO	69	6.10	97.79
WESTERN CAPE_GARDEN ROUTE	23	2.03	99.82
WESTERN CAPE_OVERBERG	2	0.18	100.00

-----+-----
Total | 1,131 100.00

.
.tab AGE_TAKEN_DATE_YEARS

AGE_TAKEN_D |
ATE_YEARS | Freq. Percent Cum.

0	744	65.78	65.78
1	119	10.52	76.30
2	92	8.13	84.44
3	80	7.07	91.51
4	96	8.49	100.00
Total	1,131	100.00	

```
.
. tab AGE_TAKEN_DATE_YEARS GENDER, row col
```

+-----+				
Key				

frequency				
row percentage				
column percentage				
+-----+				
AGE_TAKEN_		GENDER		
DATE_YEARS		F	M	U Total
+-----+				
0	297	429	18	744
	39.92	57.66	2.42	100.00
	59.16	71.14	69.23	65.78
+-----+				
1	60	57	2	119
	50.42	47.90	1.68	100.00
	11.95	9.45	7.69	10.52
+-----+				
2	45	45	2	92

		48.91	48.91	2.17		100.00
		8.96	7.46	7.69		8.13
-----+-----+-----						
3		45	35	0		80
		56.25	43.75	0.00		100.00
		8.96	5.80	0.00		7.07
-----+-----+-----						
4		55	37	4		96
		57.29	38.54	4.17		100.00
		10.96	6.14	15.38		8.49
-----+-----+-----						
Total		502	603	26		1,131
		44.39	53.32	2.30		100.00
		100.00	100.00	100.00		100.00

.

. tab PROVINCE_NAME GENDER, row col

+-----+	
Key	

frequency	
row percentage	
column percentage	
+-----+	

		GENDER			
PROVINCE_NAME		F	M	U	Total
-----+-----+-----					
EASTERN CAPE		51	55	1	107
		47.66	51.40	0.93	100.00
		10.16	9.12	3.85	9.46

-----+-----+-----				
FREE STATE	12	9	0	21
	57.14	42.86	0.00	100.00
	2.39	1.49	0.00	1.86
-----+-----+-----				
GAUTENG	125	172	6	303
	41.25	56.77	1.98	100.00
	24.90	28.52	23.08	26.79
-----+-----+-----				
KWAZULU-NATAL	92	97	10	199
	46.23	48.74	5.03	100.00
	18.33	16.09	38.46	17.60
-----+-----+-----				
LIMPOPO	112	139	5	256
	43.75	54.30	1.95	100.00
	22.31	23.05	19.23	22.63
-----+-----+-----				
MPUMALANGA	39	51	2	92
	42.39	55.43	2.17	100.00
	7.77	8.46	7.69	8.13
-----+-----+-----				
NORTH WEST	16	22	1	39
	41.03	56.41	2.56	100.00
	3.19	3.65	3.85	3.45
-----+-----+-----				
NORTHERN CAPE	5	9	1	15
	33.33	60.00	6.67	100.00
	1.00	1.49	3.85	1.33
-----+-----+-----				
WESTERN CAPE	50	49	0	99
	50.51	49.49	0.00	100.00
	9.96	8.13	0.00	8.75

+-----+				
Total	502	603	26	1,131
	44.39	53.32	2.30	100.00
	100.00	100.00	100.00	100.00

.
.tab AGE_TAKEN_DATE_YEARS PROVINCE_NAME, row col

+-----+	
Key	

frequency	
row percentage	
column percentage	
+-----+	

AGE_TAKEN_ | PROVINCE_NAME
DATE_YEARS | EASTERN.. FREE ST.. GAUTENG KWAZULU.. LIMPOPO MPUMALA.. NORTH W..
NORTHER.. WESTERN.. | Total

+-----+										
0	74	14	220	130	133	62	32	10	69	744
	9.95	1.88	29.57	17.47	17.88	8.33	4.30	1.34	9.27	100.00
	69.16	66.67	72.61	65.33	51.95	67.39	82.05	66.67	69.70	65.78
+-----+										
1	12	2	25	26	31	10	2	0	11	119
	10.08	1.68	21.01	21.85	26.05	8.40	1.68	0.00	9.24	100.00
	11.21	9.52	8.25	13.07	12.11	10.87	5.13	0.00	11.11	10.52
+-----+										
2	7	2	19	11	32	8	2	0	11	92
	7.61	2.17	20.65	11.96	34.78	8.70	2.17	0.00	11.96	100.00
	6.54	9.52	6.27	5.53	12.50	8.70	5.13	0.00	11.11	8.13
+-----+										
3	5	0	17	13	33	5	1	3	3	80

		6.25	0.00	21.25	16.25	41.25	6.25	1.25	3.75	3.75		100.00
		4.67	0.00	5.61	6.53	12.89	5.43	2.56	20.00	3.03		7.07
-----+-----												
4		9	3	22	19	27	7	2	2	5		96
		9.38	3.12	22.92	19.79	28.12	7.29	2.08	2.08	5.21		100.00
		8.41	14.29	7.26	9.55	10.55	7.61	5.13	13.33	5.05		8.49
-----+-----												
Total		107	21	303	199	256	92	39	15	99		1,131
		9.46	1.86	26.79	17.60	22.63	8.13	3.45	1.33	8.75		100.00
		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00

.

```
. count
1,131
```

```
. tab GENDER
```

GENDER		Freq.	Percent	Cum.
-----+-----				
F		502	44.39	44.39
M		603	53.32	97.70
U		26	2.30	100.00
-----+-----				
Total		1,131	100.00	

```
. tab PROVINCE_NAME
```

PROVINCE_NAME		Freq.	Percent	Cum.
-----+-----				
EASTERN CAPE		107	9.46	9.46
FREE STATE		21	1.86	11.32

GAUTENG	303	26.79	38.11
KWAZULU-NATAL	199	17.60	55.70
LIMPOPO	256	22.63	78.34
MPUMALANGA	92	8.13	86.47
NORTH WEST	39	3.45	89.92
NORTHERN CAPE	15	1.33	91.25
WESTERN CAPE	99	8.75	100.00

-----+-----

Total | 1,131 100.00

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	Freq.	Percent	Cum.
-----+-----			
EASTERN CAPE_ALFRED NZO	9	0.80	0.80
EASTERN CAPE_AMATHOLE	5	0.44	1.24
EASTERN CAPE_BUFFALO CITY METRO	27	2.39	3.63
EASTERN CAPE_CHRIS HANI	7	0.62	4.24
EASTERN CAPE_JOE GQABI	3	0.27	4.51
EASTERN CAPE_NELSON MANDELA BAY METRO	19	1.68	6.19
EASTERN CAPE_O R TAMBO	34	3.01	9.20
EASTERN CAPE_SARAH BAARTMAN	2	0.18	9.37
EASTERN CAPE_UNKNOWN	1	0.09	9.46
FREE STATE_FEZILE DABI	3	0.27	9.73
FREE STATE_LEJWELEPUTSWA	5	0.44	10.17
FREE STATE_MANGAUNG METRO	10	0.88	11.05
FREE STATE_THABO MOFUTSANYANA	1	0.09	11.14
FREE STATE_XHARIEP	2	0.18	11.32
GAUTENG_CITY OF JOHANNESBURG METRO	117	10.34	21.66
GAUTENG_CITY OF TSHWANE METRO	80	7.07	28.74
GAUTENG_EKURHULENI METRO	88	7.78	36.52
GAUTENG_SEDIBENG	5	0.44	36.96

GAUTENG_WEST RAND	13	1.15	38.11
KWAZULU-NATAL_AMAJUBA	15	1.33	39.43
KWAZULU-NATAL_ETHEKWINI METRO	77	6.81	46.24
KWAZULU-NATAL_HARRY GWALA	5	0.44	46.68
KWAZULU-NATAL_ILEMBE	6	0.53	47.21
KWAZULU-NATAL_KING CETSHWAYO	4	0.35	47.57
KWAZULU-NATAL_UGU	12	1.06	48.63
KWAZULU-NATAL_UMGUNGUNDLOVU	38	3.36	51.99
KWAZULU-NATAL_UMKHANYAKUDE	10	0.88	52.87
KWAZULU-NATAL_UMZINYATHI	8	0.71	53.58
KWAZULU-NATAL_UTHUKELA	3	0.27	53.85
KWAZULU-NATAL_UTHUNGULU	5	0.44	54.29
KWAZULU-NATAL_ZULULAND	16	1.41	55.70
LIMPOPO_CAPRICORN	135	11.94	67.64
LIMPOPO_GREATER SEKHUKHUNE	22	1.95	69.58
LIMPOPO_MOPANI	24	2.12	71.71
LIMPOPO_VHEMBE	42	3.71	75.42
LIMPOPO_WATERBERG	33	2.92	78.34
MPUMALANGA_EHLANZENI	43	3.80	82.14
MPUMALANGA_GERT SIBANDE	27	2.39	84.53
MPUMALANGA_NKANGALA	22	1.95	86.47
NORTH WEST_BOJANALA PLATINUM	7	0.62	87.09
NORTH WEST_DR KENNETH KAUNDA	19	1.68	88.77
NORTH WEST_NGAKA MODIRI MOLEMA	13	1.15	89.92
NORTHERN CAPE_FRANCES BAARD	14	1.24	91.16
NORTHERN CAPE_ZF MGCAWU	1	0.09	91.25
WESTERN CAPE_CAPE WINELANDS	3	0.27	91.51
WESTERN CAPE_CENTRAL KAROO	2	0.18	91.69
WESTERN CAPE_CITY OF CAPE TOWN METRO	69	6.10	97.79
WESTERN CAPE_GARDEN ROUTE	23	2.03	99.82
WESTERN CAPE_OVERBERG	2	0.18	100.00

-----+-----

Total | 1,131 100.00

.

.

. tab PROVINCE_NAME AGE_TAKEN_DATE_YEARS

AGE_TAKEN_DATE_YEARS						
PROVINCE_NAME	0	1	2	3	4	Total
-----+-----+-----						
EASTERN CAPE	74	12	7	5	9	107
FREE STATE	14	2	2	0	3	21
GAUTENG	220	25	19	17	22	303
KWAZULU-NATAL	130	26	11	13	19	199
LIMPOPO	133	31	32	33	27	256
MPUMALANGA	62	10	8	5	7	92
NORTH WEST	32	2	2	1	2	39
NORTHERN CAPE	10	0	0	3	2	15
WESTERN CAPE	69	11	11	3	5	99
-----+-----+-----						
Total	744	119	92	80	96	1,131

. tab AGE_TAKEN_DATE_YEARS GENDER

AGE_TAKEN_ GENDER				
DATE_YEARS	F	M	U	Total
-----+-----+-----				
0	297	429	18	744
1	60	57	2	119
2	45	45	2	92
3	45	35	0	80
4	55	37	4	96
-----+-----+-----				

Total	502	603	26	1,131

Appendix 3.4: Stata Log file of HBsAg women 15-49 years old

```
. use "2015-2019 HBsAg_positive_cases.dta",replace
```

```
. tab1 TAKEN_DATE_AGE_GROUP GENDER
```

-> tabulation of TAKEN_DATE_AGE_GROUP

```
RECODE of |
AGE_TAKEN_D |
ATE_YEARS |   Freq.   Percent   Cum.
-----+-----
'0-4 |    1,131    0.64    0.64
'5-9 |     407    0.23    0.87
'10-14 |    664    0.38    1.25
'15-19 |   2,779    1.57    2.82
'20-24 |  13,154    7.45   10.27
'25-29 |  27,756   15.72   26.00
'30-34 |  34,320   19.44   45.44
'35-39 |  30,645   17.36   62.80
'40-44 |  23,184   13.13   75.93
'45-49 |  15,009    8.50   84.43
'50-54 |   9,433    5.34   89.78
'55-59 |   5,703    3.23   93.01
'60+ |   7,059    4.00   97.01
'99999 |   5,286    2.99  100.00
-----+-----
Total |  176,530  100.00
```

-> tabulation of GENDER

GENDER	Freq.	Percent	Cum.
-----+-----			
F	78,935	44.71	44.71
M	94,699	53.64	98.36
U	2,896	1.64	100.00
-----+-----			
Total	176,530	100.00	

. tab TAKEN_DATE_AGE_GROUP GENDER

RECODE of				
AGE_TAKEN_	GENDER			
DATE_YEARS	F	M	U	Total
-----+-----+-----				
'0-4	502	603	26	1,131
'5-9	197	196	14	407
'10-14	394	258	12	664
'15-19	2,017	722	40	2,779
'20-24	8,797	4,146	211	13,154
'25-29	15,365	11,938	453	27,756
'30-34	15,747	18,077	496	34,320
'35-39	11,974	18,254	417	30,645
'40-44	8,152	14,720	312	23,184
'45-49	5,182	9,631	196	15,009
'50-54	3,568	5,759	106	9,433
'55-59	2,143	3,494	66	5,703
'60+	2,918	4,043	98	7,059
'99999	1,979	2,858	449	5,286
-----+-----+-----				
Total	78,935	94,699	2,896	176,530

```
. keep if GENDER=="F" & TAKEN_DATE_AGE_GROUP>3 & TAKEN_DATE_AGE_GROUP<11
(109,296 observations deleted)
```

```
. tab TAKEN_DATE_AGE_GROUP GENDER
```

```
RECODE of |
AGE_TAKEN_ | GENDER
DATE_YEARS |    F |  Total
-----+-----+-----
'15-19 |    2,017 |    2,017
'20-24 |    8,797 |    8,797
'25-29 |   15,365 |   15,365
'30-34 |   15,747 |   15,747
'35-39 |   11,974 |   11,974
'40-44 |    8,152 |    8,152
'45-49 |    5,182 |    5,182
-----+-----+-----
Total |   67,234 |   67,234
```

```
. tab GENDER
```

```
GENDER |    Freq.  Percent   Cum.
-----+-----
F |    67,234   100.00  100.00
-----+-----
Total |    67,234   100.00
```

```
. tab PROVINCE_NAME
```

```
PROVINCE_NAME |    Freq.  Percent   Cum.
```

-----+-----			
EASTERN CAPE	8,916	13.26	13.26
FREE STATE	3,124	4.65	17.91
GAUTENG	24,782	36.86	54.77
KWAZULU-NATAL	13,058	19.42	74.19
LIMPOPO	3,829	5.70	79.88
MPUMALANGA	5,707	8.49	88.37
NORTH WEST	3,579	5.32	93.70
NORTHERN CAPE	616	0.92	94.61
WESTERN CAPE	3,623	5.39	100.00
-----+-----			
Total	67,234	100.00	

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	Freq.	Percent	Cum.	
-----+-----				
EASTERN CAPE_ALFRED NZO	287	0.43	0.43	
EASTERN CAPE_AMATHOLE	973	1.45	1.87	
EASTERN CAPE_BUFFALO CITY METRO	2,337	3.48	5.35	
EASTERN CAPE_CHRIS HANI	378	0.56	5.91	
EASTERN CAPE_JOE GQABI	250	0.37	6.28	
EASTERN CAPE_NELSON MANDELA BAY METRO	1,907	2.84	9.12	
EASTERN CAPE_O R TAMBO	2,177	3.24	12.36	
EASTERN CAPE_SARAH BAARTMAN	591	0.88	13.24	
EASTERN CAPE_UNKNOWN	16	0.02	13.26	
FREE STATE_FEZILE DABI	396	0.59	13.85	
FREE STATE_LEJWELEPUTSWA	807	1.20	15.05	
FREE STATE_MANGAUNG METRO	1,467	2.18	17.23	
FREE STATE_THABO MOFUTSANYANA	328	0.49	17.72	
FREE STATE_XHARIEP	126	0.19	17.91	

GAUTENG_CITY OF JOHANNESBURG METRO	9,044	13.45	31.36
GAUTENG_CITY OF TSHWANE METRO	4,671	6.95	38.31
GAUTENG_EKURHULENI METRO	9,901	14.73	53.03
GAUTENG_SEDIBENG	586	0.87	53.90
GAUTENG_UNKNOWN	23	0.03	53.94
GAUTENG_WEST RAND	557	0.83	54.77
KWAZULU-NATAL_AMAJUBA	346	0.51	55.28
KWAZULU-NATAL_ETHEKWINI METRO	5,937	8.83	64.11
KWAZULU-NATAL_HARRY GWALA	197	0.29	64.40
KWAZULU-NATAL_ILEMBE	432	0.64	65.05
KWAZULU-NATAL_KING CETSHWAYO	232	0.35	65.39
KWAZULU-NATAL_UGU	1,603	2.38	67.78
KWAZULU-NATAL_UMGUNGUNDLOVU	2,656	3.95	71.73
KWAZULU-NATAL_UMKHANYAKUDE	495	0.74	72.46
KWAZULU-NATAL_UMZINYATHI	238	0.35	72.82
KWAZULU-NATAL_UNKNOWN	2	0.00	72.82
KWAZULU-NATAL_UTHUKELA	184	0.27	73.09
KWAZULU-NATAL_UTHUNGULU	233	0.35	73.44
KWAZULU-NATAL_ZULULAND	503	0.75	74.19
LIMPOPO_CAPRICORN	1,505	2.24	76.43
LIMPOPO_GREATER SEKHUKHUNE	545	0.81	77.24
LIMPOPO_MOPANI	629	0.94	78.17
LIMPOPO_UNKNOWN	1	0.00	78.17
LIMPOPO_VHEMBE	596	0.89	79.06
LIMPOPO_WATERBERG	553	0.82	79.88
MPUMALANGA_EHLANZENI	2,716	4.04	83.92
MPUMALANGA_GERT SIBANDE	1,437	2.14	86.06
MPUMALANGA_NKANGALA	1,554	2.31	88.37
NORTH WEST_BOJANALA PLATINUM	1,696	2.52	90.89
NORTH WEST_DR KENNETH KAUNDA	1,038	1.54	92.44
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	254	0.38	92.82

NORTH WEST_NGAKA MODIRI MOLEMA	591	0.88	93.70
NORTHERN CAPE_FRANCES BAARD	290	0.43	94.13
NORTHERN CAPE_JOHN TAOLO GAETSEWE	54	0.08	94.21
NORTHERN CAPE_NAMAKWA	37	0.06	94.26
NORTHERN CAPE_PIXLEY KA SEME	59	0.09	94.35
NORTHERN CAPE_ZF MGCAWU	176	0.26	94.61
WESTERN CAPE_CAPE WINELANDS	391	0.58	95.19
WESTERN CAPE_CENTRAL KAROO	36	0.05	95.25
WESTERN CAPE_CITY OF CAPE TOWN METRO	2,446	3.64	98.88
WESTERN CAPE_GARDEN ROUTE	441	0.66	99.54
WESTERN CAPE_OVERBERG	164	0.24	99.78
WESTERN CAPE_UNKNOWN	30	0.04	99.83
WESTERN CAPE_WEST COAST	115	0.17	100.00
-----+-----			
Total	67,234	100.00	

. tab TAKEN_DATE_AGE_GROUP

RECODE of			
AGE_TAKEN_D			
ATE_YEARS	Freq.	Percent	Cum.
-----+-----			
'15-19	2,017	3.00	3.00
'20-24	8,797	13.08	16.08
'25-29	15,365	22.85	38.94
'30-34	15,747	23.42	62.36
'35-39	11,974	17.81	80.17
'40-44	8,152	12.12	92.29
'45-49	5,182	7.71	100.00
-----+-----			
Total	67,234	100.00	

```
. tab TAKEN_DATE_AGE_GROUP GENDER, row col
```

```
+-----+
```

```
| Key      |
```

```
|-----|
```

```
| frequency |
```

```
| row percentage |
```

```
| column percentage |
```

```
+-----+
```

```
RECODE of |
```

```
AGE_TAKEN_ | GENDER
```

```
DATE_YEARS | F | Total
```

```
-----+-----+-----
```

```
'15-19 | 2,017 | 2,017
```

```
| 100.00 | 100.00
```

```
| 3.00 | 3.00
```

```
-----+-----+-----
```

```
'20-24 | 8,797 | 8,797
```

```
| 100.00 | 100.00
```

```
| 13.08 | 13.08
```

```
-----+-----+-----
```

```
'25-29 | 15,365 | 15,365
```

```
| 100.00 | 100.00
```

```
| 22.85 | 22.85
```

```
-----+-----+-----
```

```
'30-34 | 15,747 | 15,747
```

```
| 100.00 | 100.00
```

```
| 23.42 | 23.42
```

```
-----+-----+-----
```

'35-39		11,974		11,974
		100.00		100.00
		17.81		17.81
-----+-----+-----				
'40-44		8,152		8,152
		100.00		100.00
		12.12		12.12
-----+-----+-----				
'45-49		5,182		5,182
		100.00		100.00
		7.71		7.71
-----+-----+-----				
Total		67,234		67,234
		100.00		100.00
		100.00		100.00

. tab PROVINCE_NAME GENDER, row col

+-----+				
Key				

frequency				
row percentage				
column percentage				
+-----+				
		GENDER		
PROVINCE_NAME		F		Total
-----+-----+-----				
EASTERN CAPE		8,916		8,916
		100.00		100.00

		13.26		13.26
-----+-----+-----				
FREE STATE		3,124		3,124
		100.00		100.00
		4.65		4.65
-----+-----+-----				
GAUTENG		24,782		24,782
		100.00		100.00
		36.86		36.86
-----+-----+-----				
KWAZULU-NATAL		13,058		13,058
		100.00		100.00
		19.42		19.42
-----+-----+-----				
LIMPOPO		3,829		3,829
		100.00		100.00
		5.70		5.70
-----+-----+-----				
MPUMALANGA		5,707		5,707
		100.00		100.00
		8.49		8.49
-----+-----+-----				
NORTH WEST		3,579		3,579
		100.00		100.00
		5.32		5.32
-----+-----+-----				
NORTHERN CAPE		616		616
		100.00		100.00
		0.92		0.92
-----+-----+-----				
WESTERN CAPE		3,623		3,623

		100.00		100.00
		5.39		5.39
-----+-----+-----				
Total		67,234		67,234
		100.00		100.00
		100.00		100.00

. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME, row col

+-----+	
Key	

frequency	
row percentage	
column percentage	
+-----+	

RECODE of |

AGE_TAKEN_ | PROVINCE_NAME

DATE_YEARS | EASTERN.. FREE ST.. GAUTENG KWAZULU.. LIMPOPO MPUMALA.. NORTH W..
NORTHER.. WESTERN.. | Total

-----+-----+-----										
'15-19		302	88	540	428	211	253	90	15	90 2,017
		14.97	4.36	26.77	21.22	10.46	12.54	4.46	0.74	4.46 100.00
		3.39	2.82	2.18	3.28	5.51	4.43	2.51	2.44	2.48 3.00
-----+-----+-----										
'20-24		1,307	407	2,837	2,109	460	839	366	64	408 8,797
		14.86	4.63	32.25	23.97	5.23	9.54	4.16	0.73	4.64 100.00
		14.66	13.03	11.45	16.15	12.01	14.70	10.23	10.39	11.26 13.08
-----+-----+-----										
'25-29		2,047	697	5,545	3,316	750	1,358	758	115	779 15,365

		13.32	4.54	36.09	21.58	4.88	8.84	4.93	0.75	5.07		100.00
		22.96	22.31	22.38	25.39	19.59	23.80	21.18	18.67	21.50		22.85
-----+-----												
'30-34		1,987	696	6,121	3,031	780	1,301	873	119	839		15,747
		12.62	4.42	38.87	19.25	4.95	8.26	5.54	0.76	5.33		100.00
		22.29	22.28	24.70	23.21	20.37	22.80	24.39	19.32	23.16		23.42
-----+-----												
'35-39		1,543	534	4,761	2,039	673	903	687	126	708		11,974
		12.89	4.46	39.76	17.03	5.62	7.54	5.74	1.05	5.91		100.00
		17.31	17.09	19.21	15.61	17.58	15.82	19.20	20.45	19.54		17.81
-----+-----												
'40-44		1,021	431	3,118	1,293	568	669	487	100	465		8,152
		12.52	5.29	38.25	15.86	6.97	8.21	5.97	1.23	5.70		100.00
		11.45	13.80	12.58	9.90	14.83	11.72	13.61	16.23	12.83		12.12
-----+-----												
'45-49		709	271	1,860	842	387	384	318	77	334		5,182
		13.68	5.23	35.89	16.25	7.47	7.41	6.14	1.49	6.45		100.00
		7.95	8.67	7.51	6.45	10.11	6.73	8.89	12.50	9.22		7.71
-----+-----												
Total		8,916	3,124	24,782	13,058	3,829	5,707	3,579	616	3,623		67,234
		13.26	4.65	36.86	19.42	5.70	8.49	5.32	0.92	5.39		100.00
		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00

```
. use "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBsAg_All_cases.dta"
```

```
. keep if GENDER=="F" & TAKEN_DATE_AGE_GROUP>3 & TAKEN_DATE_AGE_GROUP<11
```

```
(978,668 observations deleted)
```

```
. tab GENDER TAKEN_DATE_AGE_GROUP
```

	RECODE of AGE_TAKEN_DATE_YEARS							
GENDER	'15-19	'20-24	'25-29	'30-34	'35-39	'40-44	'45-49	Total
-----+-----+-----								
F	57,773	152,668	212,119	209,258	158,538	111,828	77,237	979,421
-----+-----+-----								
Total	57,773	152,668	212,119	209,258	158,538	111,828	77,237	979,421

Appendix 3.5: Stata Log file of chronic HBV cases

```
use "2015-2019_HBsAg_All_Positive.dta",
```

```
clear
```

```
. sort TAKEN_DATE
```

```
. count
```

```
232,551
```

```
. export excel using C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBsAg_All_
```

```
> Positive.xlsx", firstrow(variables) replace
```

```
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBsAg_All_Positive.dta"
```

```
> \HBsAg All pos 232551 records for developm> ent of chronic registry.xlsx saved
```

```
. import excel C:\Users\shelinam\Documents\StataFiles_Chapter3\38429 duplicate HBsAg
```

```
> positives.xlsx", sheet
```

```
> ("38429") firstrow clear
```

```
. format %tdDD/NN/CCYY DOB
```

```
. format %tdDD/NN/CCYY TESTED_DATE
```

```
. format %tdDD/NN/CCYY TAKEN_DATE_1 TAKEN_DATE_2 TAKEN_DATE_3 TAKEN_DATE_4  
TAKEN_DATE_5
```

```
> TAKEN_DATE_6 TAKEN_DATE_7 TAKEN_DATE_8 TAKEN_DATE_9 TAKEN_DATE_10  
TAKEN_DATE_11 TAKE
```

```
> N_DATE_12 TAKEN_DATE_13 TAKEN_DATE_14 TAKEN_DATE_15 TAKEN_DATE_16  
TAKEN_DATE_17 TAKEN
```

```
> _DATE_18 TAKEN_DATE_19 TAKEN_DATE_20 TAKEN_DATE_21 TAKEN_DATE_22 TAKEN_DATE_23  
TAKEN_
```

```
> DATE_24 TAKEN_DATE_25 TAKEN_DATE_26
```

```
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBV_Chronic_Cases.dta"
```

```
>,replace
```

```
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBV_Chronic_Cases.dta saved
```

```
. gen TIME_DAYS_1 = TAKEN_DATE_2- TAKEN_DATE_1
```

```
. gen TIME_DAYS_2 = TAKEN_DATE_3- TAKEN_DATE_1
```

```
(29,293 missing values generated)
```

```
. gen TIME_DAYS_3 = TAKEN_DATE_4- TAKEN_DATE_1
```

```
(33,718 missing values generated)
```

```
. gen TIME_DAYS_4 = TAKEN_DATE_5- TAKEN_DATE_1
```

```
(36,819 missing values generated)
```

```
. gen TIME_DAYS_5 = TAKEN_DATE_6- TAKEN_DATE_1
```

```
(37,430 missing values generated)
```

```
. gen TIME_DAYS_6 = TAKEN_DATE_7- TAKEN_DATE_1
```

```
(37,997 missing values generated)
```

```
. gen TIME_DAYS_7 = TAKEN_DATE_8- TAKEN_DATE_1
```

```
(38,151 missing values generated)
```

```
. gen TIME_DAYS_8 = TAKEN_DATE_9- TAKEN_DATE_1
```

```
(38,289 missing values generated)
```

```
. gen TIME_DAYS_9= TAKEN_DATE_10- TAKEN_DATE_1
```

```
(38,331 missing values generated)
```

```
. gen TIME_DAYS_10= TAKEN_DATE_11- TAKEN_DATE_1
```

```
(38,381 missing values generated)
```

```
. gen TIME_DAYS_11= TAKEN_DATE_12- TAKEN_DATE_1  
(38,397 missing values generated)
```

```
. gen TIME_DAYS_12= TAKEN_DATE_13- TAKEN_DATE_1  
(38,407 missing values generated)
```

```
. gen TIME_DAYS_13= TAKEN_DATE_14- TAKEN_DATE_1  
(38,409 missing values generated)
```

```
. gen TIME_DAYS_14= TAKEN_DATE_15- TAKEN_DATE_1  
(38,415 missing values generated)
```

```
. gen TIME_DAYS_15= TAKEN_DATE_16- TAKEN_DATE_1  
(38,418 missing values generated)
```

```
. gen TIME_DAYS_16= TAKEN_DATE_17- TAKEN_DATE_1  
(38,421 missing values generated)
```

```
. gen TIME_DAYS_17= TAKEN_DATE_18- TAKEN_DATE_1  
(38,422 missing values generated)
```

```
. gen TIME_DAYS_18= TAKEN_DATE_19- TAKEN_DATE_1  
(38,422 missing values generated)
```

```
. gen TIME_DAYS_19= TAKEN_DATE_20- TAKEN_DATE_1  
(38,424 missing values generated)
```

```
. gen TIME_DAYS_20= TAKEN_DATE_21- TAKEN_DATE_1  
(38,425 missing values generated)
```

```
. gen TIME_DAYS_21= TAKEN_DATE_22- TAKEN_DATE_1
```

(38,426 missing values generated)

```
. gen TIME_DAYS_22= TAKEN_DATE_23- TAKEN_DATE_1
```

(38,427 missing values generated)

```
. gen TIME_DAYS_23= TAKEN_DATE_24- TAKEN_DATE_1
```

(38,427 missing values generated)

```
. gen TIME_DAYS_24= TAKEN_DATE_25- TAKEN_DATE_1
```

(38,427 missing values generated)

```
. gen TIME_DAYS_25= TAKEN_DATE_26- TAKEN_DATE_1
```

(38,428 missing values generated)

```
. mvencode TIME_DAYS_25 TIME_DAYS_24 TIME_DAYS_23 TIME_DAYS_22 TIME_DAYS_21  
TIME_DAYS_2
```

```
> 0 TIME_DAYS_19 TIME_DAYS_18 TIME_DAYS_17 TIME_DAYS_16 TIME_DAYS_15 TIME_DAYS_14  
TIME_
```

```
> DAYS_13 TIME_DAYS_12 TIME_DAYS_11 TIME_DAYS_10 TIME_DAYS_9 TIME_DAYS_8  
TIME_DAYS_7 TI
```

```
> ME_DAYS_6 TIME_DAYS_5 TIME_DAYS_4 TIME_DAYS_3 TIME_DAYS_2 TIME_DAYS_1, mv(-99999)
```

TIME_DAYS_25: 38428 missing values recoded

TIME_DAYS_24: 38427 missing values recoded

TIME_DAYS_23: 38427 missing values recoded

TIME_DAYS_22: 38427 missing values recoded

TIME_DAYS_21: 38426 missing values recoded

TIME_DAYS_20: 38425 missing values recoded

TIME_DAYS_19: 38424 missing values recoded

TIME_DAYS_18: 38422 missing values recoded

TIME_DAYS_17: 38422 missing values recoded

TIME_DAYS_16: 38421 missing values recoded

TIME_DAYS_15: 38418 missing values recoded

TIME_DAYS_14: 38415 missing values recoded

TIME_DAYS_13: 38409 missing values recoded

TIME_DAYS_12: 38407 missing values recoded
TIME_DAYS_11: 38397 missing values recoded
TIME_DAYS_10: 38381 missing values recoded
TIME_DAYS_9: 38331 missing values recoded
TIME_DAYS_8: 38289 missing values recoded
TIME_DAYS_7: 38151 missing values recoded
TIME_DAYS_6: 37997 missing values recoded
TIME_DAYS_5: 37430 missing values recoded
TIME_DAYS_4: 36819 missing values recoded
TIME_DAYS_3: 33718 missing values recoded
TIME_DAYS_2: 29293 missing values recoded

```
. keep if TIME_DAYS_1>=180 | TIME_DAYS_2>=180 | TIME_DAYS_3>=180 | TIME_DAYS_4>=180 | T  
> IME_DAYS_5>=180 | TIME_DAYS_6>=180 | TIME_DAYS_7>=180 | TIME_DAYS_8>=180 |  
TIME_DAYS_  
> 9>=180 | TIME_DAYS_10>=180 | TIME_DAYS_11>=180 | TIME_DAYS_12>=180 |  
TIME_DAYS_13>=18  
> 0 | TIME_DAYS_14>=180 | TIME_DAYS_15>=180 | TIME_DAYS_16>=180 | TIME_DAYS_17>=180 |  
T  
> IME_DAYS_18>=180 | TIME_DAYS_19>=180 | TIME_DAYS_20>=180 | TIME_DAYS_21>=180 |  
TIME_D  
> AYS_22>=180 | TIME_DAYS_23>=180 | TIME_DAYS_24>=180 | TIME_DAYS_25>=180  
(27,074 observations deleted)
```

```
. count  
  
11,355
```

```
tab GENDER_2
```

GENDER	Freq.	Percent	Cum.
F	5,027	44.27	44.27
M	6,211	54.70	98.97
U	117	1.03	100.00

```
-----+-----
Total |  11,355  100.00
```

```
.
.
. tab PROVINCE_NAME
```

```

      PROVINCE_NAME |   Freq.   Percent   Cum.
-----+-----
      EASTERN CAPE |    2,198    19.36    19.36
      FREE STATE  |     431     3.80    23.15
      GAUTENG     |    3,811    33.56    56.72
      KWAZULU-NATAL |    2,398    21.12    77.83
      LIMPOPO     |     244     2.15    79.98
      MPUMALANGA  |     509     4.48    84.46
      NORTH WEST  |     508     4.47    88.94
      NORTHERN CAPE |      89     0.78    89.72
      WESTERN CAPE |    1,167    10.28   100.00
-----+-----
      Total |   11,355   100.00
```

```
.
. tab PROVINCE_DISTRICT
variable PROVINCE_DISTRICT not found
r(111);
```

```
.
. tab TAKEN_DATE_AGE_GROUP_ALL
```

```

RECODE of |
AGE_TAKEN_D |
ATE_YEARS1 |   Freq.   Percent   Cum.
-----+-----
```

'0-4	4	0.07	0.07
'5-9	21	0.18	0.26
'10-14	21	0.18	0.44
'15-19	114	1.00	1.44
'20-24	718	6.32	7.77
'25-29	1,724	15.18	22.95
'30-34	2,359	20.77	43.73
'35-39	2,223	19.58	63.30
'40-44	1,791	15.77	79.08
'45-49	1,133	9.98	89.05
'50-54	602	5.30	94.35
'55-59	336	2.96	97.31
'60+	268	2.36	99.67
'99999	37	0.33	100.00
-----+-----			
Total	11,355	100.00	

```
.
. tab TAKEN_DATE_AGE_GROUP_ALL GENDER_2 , row col
```

```
+-----+
| Key      |
|-----|
| frequency |
| row percentage |
| column percentage |
+-----+
```

```
RECODE of |
AGE_TAKEN_ |
DATE_YEARS |      GENDER
1 |      F      M      U | Total
```

-----+-----+-----				
'0-4	3	5	0	8
	25.00	75.00	0.00	100.00
	0.06	0.08	0.00	0.04
-----+-----+-----				
'5-9	5	15	1	21
	23.81	71.43	4.76	100.00
	0.10	0.24	0.85	0.18
-----+-----+-----				
'10-14	11	10	0	21
	52.38	47.62	0.00	100.00
	0.22	0.16	0.00	0.18
-----+-----+-----				
'15-19	83	31	0	114
	72.81	27.19	0.00	100.00
	1.65	0.50	0.00	1.00
-----+-----+-----				
'20-24	484	219	15	718
	67.41	30.50	2.09	100.00
	9.63	3.53	12.82	6.32
-----+-----+-----				
'25-29	1,021	691	12	1,724
	59.22	40.08	0.70	100.00
	20.31	11.13	10.26	15.18
-----+-----+-----				
'30-34	1,064	1,272	23	2,359
	45.10	53.92	0.97	100.00
	21.17	20.48	19.66	20.77
-----+-----+-----				
'35-39	896	1,303	24	2,223
	40.31	58.61	1.08	100.00
	17.82	20.98	20.51	19.58

-----+-----+-----				
'40-44	646	1,131	14	1,791
	36.07	63.15	0.78	100.00
	12.85	18.21	11.97	15.77
-----+-----+-----				
'45-49	363	757	13	1,133
	32.04	66.81	1.15	100.00
	7.22	12.19	11.11	9.98
-----+-----+-----				
'50-54	224	372	6	602
	37.21	61.79	1.00	100.00
	4.46	5.99	5.13	5.30
-----+-----+-----				
'55-59	107	227	2	336
	31.85	67.56	0.60	100.00
	2.13	3.65	1.71	2.96
-----+-----+-----				
'60+	108	155	5	268
	40.30	57.84	1.87	100.00
	2.15	2.50	4.27	2.36
-----+-----+-----				
'99999	12	23	2	37
	32.43	62.16	5.41	100.00
	0.24	0.37	1.71	0.33
-----+-----+-----				
Total	5,027	6,211	117	11,355
	44.27	54.70	1.03	100.00
	100.00	100.00	100.00	100.00

.

. tab PROVINCE_NAME GENDER_2 , row col

```

+-----+
| Key      |
+-----+
| frequency |
| row percentage |
| column percentage |
+-----+

```

	GENDER			
PROVINCE_NAME	F	M	U	Total
-----+-----+-----				
EASTERN CAPE	1,133	1,060	5	2,198
	51.55	48.23	0.23	100.00
	22.54	17.07	4.27	19.36
-----+-----+-----				
FREE STATE	166	265	0	431
	38.52	61.48	0.00	100.00
	3.30	4.27	0.00	3.80
-----+-----+-----				
GAUTENG	1,626	2,146	39	3,811
	42.67	56.31	1.02	100.00
	32.35	34.55	33.33	33.56
-----+-----+-----				
KWAZULU-NATAL	1,016	1,325	57	2,398
	42.37	55.25	2.38	100.00
	20.21	21.33	48.72	21.12
-----+-----+-----				
LIMPOPO	115	125	4	244
	47.13	51.23	1.64	100.00
	2.29	2.01	3.42	2.15
-----+-----+-----				
MPUMALANGA	227	280	2	509

		44.60	55.01	0.39		100.00
		4.52	4.51	1.71		4.48
-----+-----+-----						
NORTH WEST		225	276	7		508
		44.29	54.33	1.38		100.00
		4.48	4.44	5.98		4.47
-----+-----+-----						
NORTHERN CAPE		36	52	1		89
		40.45	58.43	1.12		100.00
		0.72	0.84	0.85		0.78
-----+-----+-----						
WESTERN CAPE		483	682	2		1,167
		41.39	58.44	0.17		100.00
		9.61	10.98	1.71		10.28
-----+-----+-----						
Total		5,027	6,211	117		11,355
		44.27	54.70	1.03		100.00
		100.00	100.00	100.00		100.00

. tab PROVINCE_DISTRICT GENDER_2

		GENDER			
PROVINCE_DISTRICT		F	M	U	Total
-----+-----+-----					
EASTERN CAPE_ALFRED..		8	5	0	13
EASTERN CAPE_AMATHOLE		54	46	1	101
EASTERN CAPE_Alfred..		8	1	0	9
EASTERN CAPE_Amathole		63	50	0	113
EASTERN CAPE_BUFFAL..		217	169	2	388

EASTERN CAPE_Buffal..	193	159	1	353
EASTERN CAPE_CHRIS ..	12	12	0	24
EASTERN CAPE_Chris ..	19	11	0	30
EASTERN CAPE_JOE GQ..	12	17	0	29
EASTERN CAPE_Joe Gq..	12	17	0	29
EASTERN CAPE_NELSON..	132	168	0	300
EASTERN CAPE_Nelson..	141	154	0	295
EASTERN CAPE_O R TA..	84	71	1	156
EASTERN CAPE_O R Ta..	111	87	0	198
EASTERN CAPE_SARAH ..	30	42	0	72
EASTERN CAPE_Sarah ..	37	51	0	88
FREE STATE_FEZILE D..	13	11	0	24
FREE STATE_Fezile D..	8	22	0	30
FREE STATE_LEJWELEP..	20	23	0	43
FREE STATE_Lejwelep..	13	26	0	39
FREE STATE_MANGAUNG..	57	67	0	124
FREE STATE_Mangaung..	41	87	0	128
FREE STATE_THABO MO..	2	10	0	12
FREE STATE_Thabo Mo..	5	13	0	18
FREE STATE_XHARIEP	6	3	0	9
FREE STATE_Xhariep	1	3	0	4
GAUTENG_CITY OF JOH..	328	447	10	785
GAUTENG_CITY OF TSH..	179	259	1	439
GAUTENG_City Of Joh..	348	467	8	823
GAUTENG_City Of Tsh..	222	266	2	490
GAUTENG_EKURHULENI ..	236	298	9	543
GAUTENG_Ekurhuleni ..	265	314	7	586
GAUTENG_SEDIBENG	20	23	1	44
GAUTENG_Sedibeng	10	26	0	36
GAUTENG_UNKNOWN	0	1	0	1
GAUTENG_WEST RAND	7	15	0	22
GAUTENG_West Rand	11	30	1	42

KWAZULU-NATAL_AMAJUBA	9	9	0	18
KWAZULU-NATAL_Amajuba	6	6	0	12
KWAZULU-NATAL_ETHEK..	251	314	11	576
KWAZULU-NATAL_Ethek..	240	308	11	559
KWAZULU-NATAL_HARRY..	2	8	0	10
KWAZULU-NATAL_Harry..	2	4	0	6
KWAZULU-NATAL_ILEMBE	15	15	1	31
KWAZULU-NATAL_Ilembe	7	14	2	23
KWAZULU-NATAL_KING ..	1	7	0	8
KWAZULU-NATAL_King ..	4	6	1	11
KWAZULU-NATAL_UGU	71	93	3	167
KWAZULU-NATAL_UMGUN..	139	186	13	338
KWAZULU-NATAL_UMKHA..	16	21	0	37
KWAZULU-NATAL_UMZIN..	7	4	0	11
KWAZULU-NATAL_UTHUK..	4	3	0	7
KWAZULU-NATAL_UTHUN..	6	4	0	10
KWAZULU-NATAL_Ugu	67	82	1	150
KWAZULU-NATAL_Umgun..	134	175	13	322
KWAZULU-NATAL_Umkha..	11	21	0	32
KWAZULU-NATAL_Umzin..	3	11	0	14
KWAZULU-NATAL_Uthuk..	6	6	0	12
KWAZULU-NATAL_Uthun..	4	5	0	9
KWAZULU-NATAL_ZULUL..	7	13	0	20
KWAZULU-NATAL_Zulul..	4	10	1	15
LIMPOPO_CAPRICORN	23	19	1	43
LIMPOPO_Capricorn	12	24	1	37
LIMPOPO_GREATER SEK..	13	10	0	23
LIMPOPO_Greater Sek..	14	9	1	24
LIMPOPO_MOPANI	10	11	1	22
LIMPOPO_Mopani	7	15	0	22
LIMPOPO_VHEMBE	11	10	0	21
LIMPOPO_Vhembe	12	17	0	29

LIMPOPO_WATERBERG	7	7	0	14
LIMPOPO_Waterberg	6	3	0	9
MPUMALANGA_EHLANZENI	44	65	0	109
MPUMALANGA_Ehlanzeni	56	51	1	108
MPUMALANGA_GERT SIB..	51	59	0	110
MPUMALANGA_Gert Sib..	41	57	1	99
MPUMALANGA_NKANGALA	12	28	0	40
MPUMALANGA_Nkangala	23	20	0	43
NORTH WEST_BOJANALA..	49	52	0	101
NORTH WEST_Bojanala..	39	53	2	94
NORTH WEST_DR KENNE..	39	62	2	103
NORTH WEST_DR RUTH ..	20	10	0	30
NORTH WEST_Dr Kenne..	43	58	3	104
NORTH WEST_Dr Ruth ..	12	9	0	21
NORTH WEST_NGAKA MO..	9	16	0	25
NORTH WEST_Ngaka Mo..	14	16	0	30
NORTHERN CAPE_FRANC..	6	15	1	22
NORTHERN CAPE_Franc..	3	16	0	19
NORTHERN CAPE_John ..	1	0	0	1
NORTHERN CAPE_NAMAKWA	1	2	0	3
NORTHERN CAPE_Namakwa	0	2	0	2
NORTHERN CAPE_PIXLE..	5	3	0	8
NORTHERN CAPE_Pixle..	5	4	0	9
NORTHERN CAPE_ZF MG..	8	4	0	12
NORTHERN CAPE_Zf Mg..	7	6	0	13
WESTERN CAPE_CAPE W..	22	32	0	54
WESTERN CAPE_CITY O..	176	253	0	429
WESTERN CAPE_Cape W..	24	37	0	61
WESTERN CAPE_Centra..	1	2	0	3
WESTERN CAPE_City O..	188	245	1	434
WESTERN CAPE_GARDEN..	21	22	0	43
WESTERN CAPE_Garden..	19	28	0	47

WESTERN CAPE_OVERBERG	11	14	0	25

WESTERN CAPE_Overberg	6	18	0	24

WESTERN CAPE_WEST C..	12	17	1	30

WESTERN CAPE_West C..	3	14	0	17

-----+-----+-----

Total	5,027	6,211	117	11,355

Appendix 3.6: Stata Log file of HBsAg Clearance and Transition from HBsAg negative to HBsAg positive

```
. use "2015-2019_HBsAg_All_Records.dta"
```

```
. count
```

```
2,370,723
```

```
. tab HEP_B_SURFACE_AG
```

HEP_B_SURFACE_AG	Freq.	Percent	Cum.
-----+-----			
EQUIVOCAL	6,211	0.26	0.26
LOW POSITIVE	5,805	0.24	0.51
NEGATIVE	2,131,961	89.93	90.44
POSITIVE	226,746	9.56	100.00
-----+-----			
Total	2,370,723	100.00	

```
. drop if HEP_B_SURFACE_AG=="EQUIVOCAL"
```

```
(6,211 observations deleted)
```

```
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-  
2019_HBsAg_All_Neg_Pos_Records.dta" saved
```

```
. duplicates tag UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, generate(TAG_1)
```

Duplicates in terms of UNIQUE_PATIENT_ID

```
. duplicates tag DOB HOSPITAL_ID FACILITY_NAME if UNIQUE_PATIENT_ID ==-1, generate(TAG_2)
```

Duplicates in terms of DOB HOSPITAL_ID FACILITY_NAME

. tab HEP_B_SURFACE_AG

HEP_B_SURFACE_AG	Freq.	Percent	Cum.
-----+-----			
LOW POSITIVE	5,805	0.25	0.25
NEGATIVE	2,131,961	90.16	90.41
POSITIVE	226,746	9.59	100.00
-----+-----			
Total	2,364,512	100.00	

. tab1 TAG_1 TAG_2

-> tabulation of TAG_1

TAG_1	Freq.	Percent	Cum.
-----+-----			
0	1,655,468	70.02	70.02
1	457,266	19.34	89.36
2	134,055	5.67	95.03
3	59,528	2.52	97.54
4	22,725	0.96	98.50
5	12,684	0.54	99.04
6	5,607	0.24	99.28
7	3,936	0.17	99.44
8	2,583	0.11	99.55
9	2,150	0.09	99.64
10	1,507	0.06	99.71
11	1,128	0.05	99.76
12	988	0.04	99.80
13	700	0.03	99.83
14	750	0.03	99.86

15	672	0.03	99.89
16	646	0.03	99.91
17	540	0.02	99.94
18	437	0.02	99.96
19	320	0.01	99.97
20	210	0.01	99.98
21	154	0.01	99.98
22	115	0.00	99.99
23	48	0.00	99.99
24	25	0.00	99.99
25	26	0.00	99.99
146	147	0.01	100.00
-----+-----			
Total	2,364,415	100.00	

-> tabulation of TAG_2

TAG_2	Freq.	Percent	Cum.
-----+-----			
0	16	16.49	16.49
1	32	32.99	49.48
2	30	30.93	80.41
3	12	12.37	92.78
6	7	7.22	100.00
-----+-----			
Total	97	100.00	

```
. drop if TAG_1==0 | TAG_2==0
(1,655,484 observations deleted)
```

```
. tab1 TAG_1 TAG_2
```

-> tabulation of TAG_1

TAG_1	Freq.	Percent	Cum.
-----+-----			
1	457,266	64.50	64.50
2	134,055	18.91	83.41
3	59,528	8.40	91.81
4	22,725	3.21	95.01
5	12,684	1.79	96.80
6	5,607	0.79	97.59
7	3,936	0.56	98.15
8	2,583	0.36	98.51
9	2,150	0.30	98.81
10	1,507	0.21	99.03
11	1,128	0.16	99.18
12	988	0.14	99.32
13	700	0.10	99.42
14	750	0.11	99.53
15	672	0.09	99.62
16	646	0.09	99.71
17	540	0.08	99.79
18	437	0.06	99.85
19	320	0.05	99.90
20	210	0.03	99.93
21	154	0.02	99.95
22	115	0.02	99.97
23	48	0.01	99.97
24	25	0.00	99.98
25	26	0.00	99.98
146	147	0.02	100.00
-----+-----			
Total	708,947	100.00	

-> tabulation of TAG_2

TAG_2	Freq.	Percent	Cum.
-----+-----			
1	32	39.51	39.51
2	30	37.04	76.54
3	12	14.81	91.36
6	7	8.64	100.00
-----+-----			
Total	81	100.00	

```
. count
```

709,028

```
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-  
2019_HBsAg_positive_and_negative_cases_with_duplicate_records.dta saved
```

```
. export delimited using "C:\Users\shelinam\Documents\StataFiles_Chapter3\HBsAg positive and  
negative records_All_709028.csv saved
```

```
. import delimited "C:\Users\shelinam\Documents\StataFiles_Chapter3\297237 for import into  
stata.csv", varnames(1) case(upper)
```

(encoding automatically selected: ISO-8859-1)

(85 vars, 297,237 obs)

```
. count
```

297,267

```
. count if (HEP_B_SURFACE_AG_1=="POSITIVE" | HEP_B_SURFACE_AG_1=="") &  
(HEP_B_SURFACE_AG_2=="POSITIVE" | HEP_B_  
> SURFACE_AG_2=="") & (HEP_B_SURFACE_AG_3=="POSITIVE" | HEP_B_SURFACE_AG_3=="") &  
(HEP_B_SURFACE_AG_4=="POSITIV  
> E" | HEP_B_SURFACE_AG_4=="") & (HEP_B_SURFACE_AG_5=="POSITIVE" |  
HEP_B_SURFACE_AG_5=="") & (HEP_B_SURFACE_AG_
```

```

> 6=="POSITIVE" | HEP_B_SURFACE_AG_6=="") & (HEP_B_SURFACE_AG_7=="POSITIVE" |
HEP_B_SURFACE_AG_7=="") & (HEP_B_

> SURFACE_AG_8=="POSITIVE" | HEP_B_SURFACE_AG_8=="") &
(HEP_B_SURFACE_AG_9=="POSITIVE" | HEP_B_SURFACE_AG_9=="")

> ) & (HEP_B_SURFACE_AG_10=="POSITIVE" | HEP_B_SURFACE_AG_10=="") &
(HEP_B_SURFACE_AG_11=="POSITIVE" | HEP_B_SU

> RFACE_AG_11=="") & (HEP_B_SURFACE_AG_12=="POSITIVE" | HEP_B_SURFACE_AG_12=="") &
(HEP_B_SURFACE_AG_13=="POSIT

> IVE" | HEP_B_SURFACE_AG_13=="") & (HEP_B_SURFACE_AG_14=="POSITIVE" |
HEP_B_SURFACE_AG_14=="") & (HEP_B_SURFAC

> E_AG_15=="POSITIVE" | HEP_B_SURFACE_AG_15=="") & (HEP_B_SURFACE_AG_16=="POSITIVE" |
HEP_B_SURFACE_AG_16=="")

> & (HEP_B_SURFACE_AG_17=="POSITIVE" | HEP_B_SURFACE_AG_17=="") &
(HEP_B_SURFACE_AG_18=="POSITIVE" | HEP_B_SURF

> ACE_AG_18=="") & (HEP_B_SURFACE_AG_19=="POSITIVE" | HEP_B_SURFACE_AG_19=="") &
(HEP_B_SURFACE_AG_20=="POSITIV

> E" | HEP_B_SURFACE_AG_20=="") & (HEP_B_SURFACE_AG_21=="POSITIVE" |
HEP_B_SURFACE_AG_21=="") & (HEP_B_SURFACE_

> AG_22=="POSITIVE" | HEP_B_SURFACE_AG_22=="") & (HEP_B_SURFACE_AG_23=="POSITIVE" |
HEP_B_SURFACE_AG_23=="") &

> (HEP_B_SURFACE_AG_24=="POSITIVE" | HEP_B_SURFACE_AG_24=="") &
(HEP_B_SURFACE_AG_25=="POSITIVE" | HEP_B_SURFAC

> E_AG_25=="") & (HEP_B_SURFACE_AG_26=="POSITIVE" | HEP_B_SURFACE_AG_26=="") &
(HEP_B_SURFACE_AG_27=="POSITIVE"

> | HEP_B_SURFACE_AG_27=="") & (HEP_B_SURFACE_AG_28=="POSITIVE" |
HEP_B_SURFACE_AG_28=="") & (HEP_B_SURFACE_AG

> _29=="POSITIVE" | HEP_B_SURFACE_AG_29=="") & (HEP_B_SURFACE_AG_30=="POSITIVE" |
HEP_B_SURFACE_AG_30=="") & (H

> EP_B_SURFACE_AG_31=="POSITIVE" | HEP_B_SURFACE_AG_31=="") &
(HEP_B_SURFACE_AG_32=="POSITIVE" | HEP_B_SURFACE_

> AG_32=="") & (HEP_B_SURFACE_AG_33=="POSITIVE" | HEP_B_SURFACE_AG_33=="") &
(HEP_B_SURFACE_AG_34=="POSITIVE" |

> HEP_B_SURFACE_AG_34=="") & (HEP_B_SURFACE_AG_35=="POSITIVE" |
HEP_B_SURFACE_AG_35=="") & (HEP_B_SURFACE_AG_3

> 6=="POSITIVE" | HEP_B_SURFACE_AG_36=="") & (HEP_B_SURFACE_AG_37=="POSITIVE" |
HEP_B_SURFACE_AG_37=="") & (HEP

> _B_SURFACE_AG_38=="POSITIVE" | HEP_B_SURFACE_AG_38=="") &
(HEP_B_SURFACE_AG_105=="POSITIVE" | HEP_B_SURFACE_A

> G_105=="") & (HEP_B_SURFACE_AG_147=="POSITIVE" | HEP_B_SURFACE_AG_147=="")

```

```
. count
```

```
36,193
```

```
. tab GENDER
```

GENDER	Freq.	Percent	Cum.
-----+-----			
Female	17,070	47.16	47.16
Male	18,685	51.63	98.79
Unknown	438	1.21	100.00
-----+-----			
Total	36,193	100.00	

```
.
```

```
. tab PROVINCE_NAME
```

PROVINCE_NAME	Freq.	Percent	Cum.
-----+-----			
Eastern Cape	6,422	17.74	17.74
Free State	1,680	4.64	22.39
Gauteng	10,220	28.24	50.62
Kwazulu-Natal	7,527	20.80	71.42
Limpopo	1,570	4.34	75.76
Mpumalanga	2,722	7.52	83.28
North West	2,400	6.63	89.91
Northern Cape	423	1.17	91.08
Western Cape	3,229	8.92	100.00
-----+-----			
Total	36,193	100.00	

```
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. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	Freq.	Percent	Cum.
-----+-----			
Eastern Cape_Alfred Nzo	121	0.33	0.33
Eastern Cape_Amathole	588	1.62	1.96
Eastern Cape_Buffalo City Metro	1,985	5.48	7.44
Eastern Cape_Chris Hani	363	1.00	8.45
Eastern Cape_Joe Gqabi	234	0.65	9.09
Eastern Cape_Nelson Mandela Bay Metro	1,870	5.17	14.26
Eastern Cape_O R Tambo	716	1.98	16.24
Eastern Cape_Sarah Baartman	545	1.51	17.74
Free State_Fezile Dabi	297	0.82	18.56
Free State_Lejweleputswa	502	1.39	19.95
Free State_Mangaung Metro	623	1.72	21.67
Free State_Thabo Mofutsanyana	212	0.59	22.26
Free State_Xhariep	46	0.13	22.39
Gauteng_City Of Johannesburg Metro	4,814	13.30	35.69
Gauteng_City Of Tshwane Metro	2,080	5.75	41.43
Gauteng_Ekurhuleni Metro	2,762	7.63	49.06
Gauteng_Sedibeng	230	0.64	49.70
Gauteng_Unknown	16	0.04	49.74
Gauteng_West Rand	318	0.88	50.62
Kwazulu-Natal_Amajuba	208	0.57	51.20
Kwazulu-Natal_Ethekwini Metro	3,541	9.78	60.98
Kwazulu-Natal_Harry Gwala	109	0.30	61.28
Kwazulu-Natal_Ilembe	249	0.69	61.97
Kwazulu-Natal_King Cetshwayo	77	0.21	62.18
Kwazulu-Natal_Ugu	1,060	2.93	65.11
Kwazulu-Natal_Umgungundlovu	1,628	4.50	69.61
Kwazulu-Natal_Umkhanyakude	239	0.66	70.27
Kwazulu-Natal_Umzinyathi	74	0.20	70.47

Kwazulu-Natal_Uthukela	73	0.20	70.68
Kwazulu-Natal_Uthungulu	101	0.28	70.96
Kwazulu-Natal_Zululand	168	0.46	71.42
Limpopo_Capricorn	446	1.23	72.65
Limpopo_Greater Sekhukhune	190	0.52	73.18
Limpopo_Mopani	373	1.03	74.21
Limpopo_Vhembe	334	0.92	75.13
Limpopo_Waterberg	227	0.63	75.76
Mpumalanga_Ehlanzeni	1,476	4.08	79.84
Mpumalanga_Gert Sibande	697	1.93	81.76
Mpumalanga_Nkangala	548	1.51	83.28
Mpumalanga_Unknown	1	0.00	83.28
North West_Bojanala Platinum	986	2.72	86.00
North West_Dr Kenneth Kaunda	942	2.60	88.61
North West_Dr Ruth Segomotsi Mompati	230	0.64	89.24
North West_Ngaka Modiri Molema	242	0.67	89.91
Northern Cape_Frances Baard	152	0.42	90.33
Northern Cape_John Taolo Gaetsewe	24	0.07	90.40
Northern Cape_Namakwa	39	0.11	90.50
Northern Cape_Pixley Ka Seme	33	0.09	90.59
Northern Cape_Zf Mgcawu	175	0.48	91.08
Western Cape_Cape Winelands	405	1.12	92.20
Western Cape_Central Karoo	30	0.08	92.28
Western Cape_City Of Cape Town Metro	2,234	6.17	98.45
Western Cape_Garden Route	302	0.83	99.29
Western Cape_Not Applicable	1	0.00	99.29
Western Cape_Overberg	98	0.27	99.56
Western Cape_Unknown	5	0.01	99.57
Western Cape_West Coast	154	0.43	100.00
-----+-----			
Total	36,193	100.00	

.

. tab TAKEN_DATE_AGE_GROUP

TAKEN_DATE_ |

AGE_GROUP | Freq. Percent Cum.

-----+-----			
0-4	55	0.15	0.15
10-14	90	0.25	0.40
15-19	357	0.99	1.39
20-24	2,283	6.31	7.69
25-29	5,408	14.94	22.64
30-34	7,244	20.01	42.65
35-39	6,966	19.25	61.90
40-44	5,522	15.26	77.16
45-49	3,569	9.86	87.02
5-9	62	0.17	87.19
50-54	2,165	5.98	93.17
55-59	1,209	3.34	96.51
60+	1,180	3.26	99.77
99999	83	0.23	100.00
-----+-----			
Total	36,193	100.00	

.

. tab TAKEN_DATE_AGE_GROUP GENDER, row col

+-----+

Key	

frequency	
row percentage	
column percentage	

+-----+

TAKEN_DATE	GENDER			
_AGE_GROUP	Female	Male	Unknown	Total

-----+-----+

0-4	27	28	0	55
	49.09	50.91	0.00	100.00
	0.16	0.15	0.00	0.15

-----+-----+

10-14	50	39	1	90
	55.56	43.33	1.11	100.00
	0.29	0.21	0.23	0.25

-----+-----+

15-19	229	123	5	357
	64.15	34.45	1.40	100.00
	1.34	0.66	1.14	0.99

-----+-----+

20-24	1,568	682	33	2,283
	68.68	29.87	1.45	100.00
	9.19	3.65	7.53	6.31

-----+-----+

25-29	3,326	1,998	84	5,408
	61.50	36.95	1.55	100.00
	19.48	10.69	19.18	14.94

-----+-----+

30-34	3,708	3,449	87	7,244
	51.19	47.61	1.20	100.00
	21.72	18.46	19.86	20.01

-----+-----+

35-39	3,025	3,870	71	6,966
	43.43	55.56	1.02	100.00
	17.72	20.71	16.21	19.25

-----+-----+-----				
40-44	2,109	3,352	61	5,522
	38.19	60.70	1.10	100.00
	12.36	17.94	13.93	15.26
-----+-----+-----				
45-49	1,234	2,299	36	3,569
	34.58	64.42	1.01	100.00
	7.23	12.30	8.22	9.86
-----+-----+-----				
5-9	22	35	5	62
	35.48	56.45	8.06	100.00
	0.13	0.19	1.14	0.17
-----+-----+-----				
50-54	830	1,314	21	2,165
	38.34	60.69	0.97	100.00
	4.86	7.03	4.79	5.98
-----+-----+-----				
55-59	429	775	5	1,209
	35.48	64.10	0.41	100.00
	2.51	4.15	1.14	3.34
-----+-----+-----				
60+	481	679	20	1,180
	40.76	57.54	1.69	100.00
	2.82	3.63	4.57	3.26
-----+-----+-----				
99999	32	42	9	83
	38.55	50.60	10.84	100.00
	0.19	0.22	2.05	0.23
-----+-----+-----				
Total	17,070	18,685	438	36,193
	47.16	51.63	1.21	100.00
	100.00	100.00	100.00	100.00

.

. tab PROVINCE_NAME GENDER, row col

+-----+

| Key |

|-----|

| frequency |

| row percentage |

| column percentage |

+-----+

	GENDER			
PROVINCE_NAME	Female	Male	Unknown	Total

-----+-----+-----

Eastern Cape	3,398	2,989	35	6,422

	52.91	46.54	0.55	100.00

	19.91	16.00	7.99	17.74

-----+-----+-----

Free State	767	909	4	1,680

	45.65	54.11	0.24	100.00

	4.49	4.86	0.91	4.64

-----+-----+-----

Gauteng	4,570	5,519	131	10,220

	44.72	54.00	1.28	100.00

	26.77	29.54	29.91	28.24

-----+-----+-----

Kwazulu-Natal	3,436	3,897	194	7,527

	45.65	51.77	2.58	100.00

	20.13	20.86	44.29	20.80

-----+-----+-----

Limpopo	844	716	10	1,570

		53.76	45.61	0.64		100.00
		4.94	3.83	2.28		4.34
-----+-----+-----						
Mpumalanga		1,421	1,280	21		2,722
		52.20	47.02	0.77		100.00
		8.32	6.85	4.79		7.52
-----+-----+-----						
North West		1,110	1,259	31		2,400
		46.25	52.46	1.29		100.00
		6.50	6.74	7.08		6.63
-----+-----+-----						
Northern Cape		200	218	5		423
		47.28	51.54	1.18		100.00
		1.17	1.17	1.14		1.17
-----+-----+-----						
Western Cape		1,324	1,898	7		3,229
		41.00	58.78	0.22		100.00
		7.76	10.16	1.60		8.92
-----+-----+-----						
Total		17,070	18,685	438		36,193
		47.16	51.63	1.21		100.00
		100.00	100.00	100.00		100.00

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.
. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME, row col

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+-----+	
Key	

frequency	
row percentage	
column percentage	

+-----+

TAKEN_DATE | PROVINCE_NAME
_AGE_GROUP | Eastern.. Free St.. Gauteng Kwazulu.. Limpopo Mpumala.. North W.. Norther..
Western.. | Total

+-----+										
0-4	11	1	19	4	8	0	2	0	10	55
	20.00	1.82	34.55	7.27	14.55	0.00	3.64	0.00	18.18	100.00
	0.17	0.06	0.19	0.05	0.51	0.00	0.08	0.00	0.31	0.15
+-----+										
10-14	10	9	25	19	8	8	2	2	7	90
	11.11	10.00	27.78	21.11	8.89	8.89	2.22	2.22	7.78	100.00
	0.16	0.54	0.24	0.25	0.51	0.29	0.08	0.47	0.22	0.25
+-----+										
15-19	87	18	74	98	18	26	16	3	17	357
	24.37	5.04	20.73	27.45	5.04	7.28	4.48	0.84	4.76	100.00
	1.35	1.07	0.72	1.30	1.15	0.96	0.67	0.71	0.53	0.99
+-----+										
20-24	460	97	535	672	83	161	94	14	167	2,283
	20.15	4.25	23.43	29.43	3.64	7.05	4.12	0.61	7.31	100.00
	7.16	5.77	5.23	8.93	5.29	5.91	3.92	3.31	5.17	6.31
+-----+										
25-29	956	261	1,442	1,392	176	396	318	45	422	5,408
	17.68	4.83	26.66	25.74	3.25	7.32	5.88	0.83	7.80	100.00
	14.89	15.54	14.11	18.49	11.21	14.55	13.25	10.64	13.07	14.94
+-----+										
30-34	1,308	326	2,048	1,604	229	607	428	67	627	7,244
	18.06	4.50	28.27	22.14	3.16	8.38	5.91	0.92	8.66	100.00
	20.37	19.40	20.04	21.31	14.59	22.30	17.83	15.84	19.42	20.01
+-----+										
35-39	1,186	316	2,070	1,393	278	532	500	70	621	6,966
	17.03	4.54	29.72	20.00	3.99	7.64	7.18	1.00	8.91	100.00
	18.47	18.81	20.25	18.51	17.71	19.54	20.83	16.55	19.23	19.25

40-44	947	259	1,662	1,001	269	422	391	72	499	5,522	
	17.15	4.69	30.10	18.13	4.87	7.64	7.08	1.30	9.04	100.00	
	14.75	15.42	16.26	13.30	17.13	15.50	16.29	17.02	15.45	15.26	
-----+											
45-49	651	163	1,054	566	191	257	281	53	353	3,569	
	18.24	4.57	29.53	15.86	5.35	7.20	7.87	1.49	9.89	100.00	
	10.14	9.70	10.31	7.52	12.17	9.44	11.71	12.53	10.93	9.86	
-----+											
5-9	8	1	24	9	9	4	3	3	1	62	
	12.90	1.61	38.71	14.52	14.52	6.45	4.84	4.84	1.61	100.00	
	0.12	0.06	0.23	0.12	0.57	0.15	0.12	0.71	0.03	0.17	
-----+											
50-54	374	119	599	334	132	152	177	45	233	2,165	
	17.27	5.50	27.67	15.43	6.10	7.02	8.18	2.08	10.76	100.00	
	5.82	7.08	5.86	4.44	8.41	5.58	7.38	10.64	7.22	5.98	
-----+											
55-59	226	54	321	187	72	76	101	23	149	1,209	
	18.69	4.47	26.55	15.47	5.96	6.29	8.35	1.90	12.32	100.00	
	3.52	3.21	3.14	2.48	4.59	2.79	4.21	5.44	4.61	3.34	
-----+											
60+	198	56	264	248	97	81	87	26	123	1,180	
	16.78	4.75	22.37	21.02	8.22	6.86	7.37	2.20	10.42	100.00	
	3.08	3.33	2.58	3.29	6.18	2.98	3.62	6.15	3.81	3.26	
-----+											
99999	0	0	83	0	0	0	0	0	0	83	
	0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	
	0.00	0.00	0.81	0.00	0.00	0.00	0.00	0.00	0.00	0.23	
-----+											
Total	6,422	1,680	10,220	7,527	1,570	2,722	2,400	423	3,229	36,193	
	17.74	4.64	28.24	20.80	4.34	7.52	6.63	1.17	8.92	100.00	
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	
100.00											

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(HEP_B_SURFACE_AG_2=="NEGATIVE" | HEP_B_

> SURFACE_AG_2=="") & (HEP_B_SURFACE_AG_3=="NEGATIVE" | HEP_B_SURFACE_AG_3=="") &
(HEP_B_SURFACE_AG_4=="NEGATIV

> E" | HEP_B_SURFACE_AG_4=="") & (HEP_B_SURFACE_AG_5=="NEGATIVE" |
HEP_B_SURFACE_AG_5=="") & (HEP_B_SURFACE_AG_

> 6=="NEGATIVE" | HEP_B_SURFACE_AG_6=="") & (HEP_B_SURFACE_AG_7=="NEGATIVE" |
HEP_B_SURFACE_AG_7=="") & (HEP_B_

> SURFACE_AG_8=="NEGATIVE" | HEP_B_SURFACE_AG_8=="") &
(HEP_B_SURFACE_AG_9=="NEGATIVE" | HEP_B_SURFACE_AG_9=="")

> ) & (HEP_B_SURFACE_AG_10=="NEGATIVE" | HEP_B_SURFACE_AG_10=="") &
(HEP_B_SURFACE_AG_11=="NEGATIVE" | HEP_B_SU

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(HEP_B_SURFACE_AG_13=="NEGAT

> IVE" | HEP_B_SURFACE_AG_13=="") & (HEP_B_SURFACE_AG_14=="NEGATIVE" |
HEP_B_SURFACE_AG_14=="") & (HEP_B_SURFAC

> E_AG_15=="NEGATIVE" | HEP_B_SURFACE_AG_15=="") & (HEP_B_SURFACE_AG_16=="NEGATIVE"
| HEP_B_SURFACE_AG_16=="")

> & (HEP_B_SURFACE_AG_17=="NEGATIVE" | HEP_B_SURFACE_AG_17=="") &
(HEP_B_SURFACE_AG_18=="NEGATIVE" | HEP_B_SURF

> ACE_AG_18=="") & (HEP_B_SURFACE_AG_19=="NEGATIVE" | HEP_B_SURFACE_AG_19=="") &
(HEP_B_SURFACE_AG_20=="NEGATIV

> E" | HEP_B_SURFACE_AG_20=="") & (HEP_B_SURFACE_AG_21=="NEGATIVE" |
HEP_B_SURFACE_AG_21=="") & (HEP_B_SURFACE_

> AG_22=="NEGATIVE" | HEP_B_SURFACE_AG_22=="") & (HEP_B_SURFACE_AG_23=="NEGATIVE" |
HEP_B_SURFACE_AG_23=="") &

> (HEP_B_SURFACE_AG_24=="NEGATIVE" | HEP_B_SURFACE_AG_24=="") &
(HEP_B_SURFACE_AG_25=="NEGATIVE" | HEP_B_SURFAC

> E_AG_25=="") & (HEP_B_SURFACE_AG_26=="NEGATIVE" | HEP_B_SURFACE_AG_26=="") &
(HEP_B_SURFACE_AG_27=="NEGATIVE"

> | HEP_B_SURFACE_AG_27=="") & (HEP_B_SURFACE_AG_28=="NEGATIVE" |
HEP_B_SURFACE_AG_28=="") & (HEP_B_SURFACE_AG

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HEP_B_SURFACE_AG_30=="") & (H

> EP_B_SURFACE_AG_31=="NEGATIVE" | HEP_B_SURFACE_AG_31=="") &
(HEP_B_SURFACE_AG_32=="NEGATIVE" | HEP_B_SURFACE_

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(HEP_B_SURFACE_AG_34=="NEGATIVE" |

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(HEP_B_SURFACE_AG_105=="NEGATIVE" | HEP_B_SURFACE_A
> G_105=="") & (HEP_B_SURFACE_AG_147=="NEGATIVE" | HEP_B_SURFACE_AG_147=="")
252,429

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. count
252,429

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. rename*,upper

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. tab GENDER

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GENDER	Freq.	Percent	Cum.
Female	165,477	65.55	65.55
Male	84,308	33.40	98.95
Unknown	2,644	1.05	100.00
Total	252,429	100.00	

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. tab PROVINCE_NAME

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PROVINCE_NAME	Freq.	Percent	Cum.
Eastern Cape	45,263	17.93	17.93
Free State	10,640	4.22	22.15
Gauteng	87,363	34.61	56.75
Kwazulu-Natal	48,534	19.23	75.98
Limpopo	6,646	2.63	78.61

Mpumalanga	11,623	4.60	83.22
North West	16,477	6.53	89.75
Northern Cape	3,451	1.37	91.11
Western Cape	22,432	8.89	100.00

-----+-----

Total | 252,429 100.00

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. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	Freq.	Percent	Cum.
-----+-----			
Eastern Cape_Alfred Nzo	728	0.29	0.29
Eastern Cape_Amathole	3,548	1.41	1.69
Eastern Cape_Buffalo City Metro	14,768	5.85	7.54
Eastern Cape_Chris Hani	1,927	0.76	8.31
Eastern Cape_Joe Gqabi	1,208	0.48	8.79
Eastern Cape_Nelson Mandela Bay Metro	12,742	5.05	13.83
Eastern Cape_Not Applicable	2	0.00	13.83
Eastern Cape_O R Tambo	6,816	2.70	16.53
Eastern Cape_Sarah Baartman	3,516	1.39	17.93
Eastern Cape_Unknown	8	0.00	17.93
Free State_Fezile Dabi	1,434	0.57	18.50
Free State_Lejweleputswa	2,985	1.18	19.68
Free State_Mangaung Metro	4,768	1.89	21.57
Free State_Not Applicable	1	0.00	21.57
Free State_Thabo Mofutsanyana	922	0.37	21.94
Free State_Unknown	4	0.00	21.94
Free State_Xhariep	526	0.21	22.15
Gauteng_City Of Johannesburg Metro	32,677	12.95	35.09
Gauteng_City Of Tshwane Metro	23,984	9.50	44.59
Gauteng_Ekurhuleni Metro	26,912	10.66	55.25

Gauteng_Sedibeng	2,081	0.82	56.08
Gauteng_Unknown	61	0.02	56.10
Gauteng_West Rand	1,648	0.65	56.75
Kwazulu-Natal_Amajuba	1,141	0.45	57.21
Kwazulu-Natal_Ethekwini Metro	22,878	9.06	66.27
Kwazulu-Natal_Harry Gwala	432	0.17	66.44
Kwazulu-Natal_Ilembe	1,186	0.47	66.91
Kwazulu-Natal_King Cetshwayo	611	0.24	67.15
Kwazulu-Natal_Ugu	7,325	2.90	70.05
Kwazulu-Natal_Umgungundlovu	11,775	4.66	74.72
Kwazulu-Natal_Umkhanyakude	920	0.36	75.08
Kwazulu-Natal_Umzinyathi	675	0.27	75.35
Kwazulu-Natal_Unknown	1	0.00	75.35
Kwazulu-Natal_Uthukela	321	0.13	75.48
Kwazulu-Natal_Uthungulu	528	0.21	75.69
Kwazulu-Natal_Zululand	741	0.29	75.98
Limpopo_Capricorn	1,976	0.78	76.76
Limpopo_Greater Sekhukhune	1,398	0.55	77.32
Limpopo_Mopani	1,326	0.53	77.84
Limpopo_Unknown	10	0.00	77.85
Limpopo_Vhembe	1,158	0.46	78.31
Limpopo_Waterberg	778	0.31	78.61
Mpumalanga_Ehlanzeni	4,902	1.94	80.56
Mpumalanga_Gert Sibande	4,323	1.71	82.27
Mpumalanga_Nkangala	2,388	0.95	83.22
Mpumalanga_Unknown	10	0.00	83.22
North West_Bojanala Platinum	6,537	2.59	85.81
North West_Dr Kenneth Kaunda	5,620	2.23	88.04
North West_Dr Ruth Segomotsi Mompati	1,996	0.79	88.83
North West_Ngaka Modiri Molema	2,323	0.92	89.75
North West_Unknown	1	0.00	89.75
Northern Cape_Frances Baard	1,824	0.72	90.47

Northern Cape_John Taolo Gaetsewe	120	0.05	90.52
Northern Cape_Namakwa	379	0.15	90.67
Northern Cape_Pixley Ka Seme	282	0.11	90.78
Northern Cape_Zf Mgcawu	846	0.34	91.11
Western Cape_Cape Winelands	2,368	0.94	92.05
Western Cape_Central Karoo	160	0.06	92.12
Western Cape_City Of Cape Town Metro	16,126	6.39	98.50
Western Cape_Garden Route	1,921	0.76	99.26
Western Cape_Not Applicable	3	0.00	99.27
Western Cape_Overberg	883	0.35	99.62
Western Cape_Unknown	102	0.04	99.66
Western Cape_West Coast	869	0.34	100.00
-----+-----			
Total	252,429	100.00	

.

. tab TAKEN_DATE_AGE_GROUP

TAKEN_DATE_			
AGE_GROUP	Freq.	Percent	Cum.
-----+-----			
0-4	1,347	0.53	0.53
10-14	2,806	1.11	1.65
15-19	8,508	3.37	5.02
20-24	24,171	9.58	14.59
25-29	41,478	16.43	31.02
30-34	46,639	18.48	49.50
35-39	38,851	15.39	64.89
40-44	30,123	11.93	76.82
45-49	21,024	8.33	85.15
5-9	1,411	0.56	85.71
50-54	14,889	5.90	91.61

55-59	9,586	3.80	95.41
60+	11,268	4.46	99.87
99999	328	0.13	100.00
-----+-----			
Total	252,429	100.00	

```

.
. tab TAKEN_DATE_AGE_GROUP GENDER, row col

```

+-----+			
Key			

frequency			
row percentage			
column percentage			
+-----+			

TAKEN_DATE	GENDER			
_AGE_GROUP	Female	Male	Unknown	Total
-----+-----+-----				
0-4	654	667	26	1,347
	48.55	49.52	1.93	100.00
	0.40	0.79	0.98	0.53
-----+-----+-----				
10-14	1,650	1,117	39	2,806
	58.80	39.81	1.39	100.00
	1.00	1.32	1.48	1.11
-----+-----+-----				
15-19	6,304	2,078	126	8,508
	74.09	24.42	1.48	100.00
	3.81	2.46	4.77	3.37
-----+-----+-----				

-----+-----+

-----+-----+

-----+-----+

55-59		5,235	4,259	92		9,586
		54.61	44.43	0.96		100.00
		3.16	5.05	3.48		3.80
-----+-----+-----						
60+		6,042	5,121	105		11,268
		53.62	45.45	0.93		100.00
		3.65	6.07	3.97		4.46
-----+-----+-----						
99999		175	129	24		328
		53.35	39.33	7.32		100.00
		0.11	0.15	0.91		0.13
-----+-----+-----						
Total		165,477	84,308	2,644		252,429
		65.55	33.40	1.05		100.00
		100.00	100.00	100.00		100.00

.

. tab PROVINCE_NAME GENDER, row col

+-----+						
	Key					

	frequency					
	row percentage					
	column percentage					
+-----+						
		GENDER				
PROVINCE_NAME		Female	Male	Unknown		Total
-----+-----+-----						
Eastern Cape		32,358	12,689	216		45,263
		71.49	28.03	0.48		100.00

		19.55	15.05	8.17		17.93
-----+-----+-----						
Free State		6,945	3,667	28		10,640
		65.27	34.46	0.26		100.00
		4.20	4.35	1.06		4.22
-----+-----+-----						
Gauteng		55,953	30,549	861		87,363
		64.05	34.97	0.99		100.00
		33.81	36.23	32.56		34.61
-----+-----+-----						
Kwazulu-Natal		31,214	16,105	1,215		48,534
		64.31	33.18	2.50		100.00
		18.86	19.10	45.95		19.23
-----+-----+-----						
Limpopo		4,701	1,902	43		6,646
		70.73	28.62	0.65		100.00
		2.84	2.26	1.63		2.63
-----+-----+-----						
Mpumalanga		7,802	3,754	67		11,623
		67.13	32.30	0.58		100.00
		4.71	4.45	2.53		4.60
-----+-----+-----						
North West		11,238	5,102	137		16,477
		68.20	30.96	0.83		100.00
		6.79	6.05	5.18		6.53
-----+-----+-----						
Northern Cape		2,009	1,408	34		3,451
		58.22	40.80	0.99		100.00
		1.21	1.67	1.29		1.37
-----+-----+-----						
Western Cape		13,257	9,132	43		22,432
		59.10	40.71	0.19		100.00

20-24	4,454	1,024	8,112	5,615	503	1,100	1,351	250	1,762	24,171
	18.43	4.24	33.56	23.23	2.08	4.55	5.59	1.03	7.29	100.00
	9.84	9.62	9.29	11.57	7.57	9.46	8.20	7.24	7.85	9.58
-----+										
25-29	7,798	1,793	14,211	8,544	862	1,977	2,485	446	3,362	41,478
	18.80	4.32	34.26	20.60	2.08	4.77	5.99	1.08	8.11	100.00
	17.23	16.85	16.27	17.60	12.97	17.01	15.08	12.92	14.99	16.43
-----+										
30-34	8,788	1,812	16,678	8,771	1,006	2,190	2,971	465	3,958	46,639
	18.84	3.89	35.76	18.81	2.16	4.70	6.37	1.00	8.49	100.00
	19.42	17.03	19.09	18.07	15.14	18.84	18.03	13.47	17.64	18.48
-----+										
35-39	7,301	1,653	14,016	6,577	990	1,772	2,658	478	3,406	38,851
	18.79	4.25	36.08	16.93	2.55	4.56	6.84	1.23	8.77	100.00
	16.13	15.54	16.04	13.55	14.90	15.25	16.13	13.85	15.18	15.39
-----+										
40-44	5,410	1,284	10,953	4,884	884	1,335	2,195	444	2,734	30,123
	17.96	4.26	36.36	16.21	2.93	4.43	7.29	1.47	9.08	100.00
	11.95	12.07	12.54	10.06	13.30	11.49	13.32	12.87	12.19	11.93
-----+										
45-49	3,614	973	7,369	3,311	673	965	1,586	366	2,167	21,024
	17.19	4.63	35.05	15.75	3.20	4.59	7.54	1.74	10.31	100.00
	7.98	9.14	8.43	6.82	10.13	8.30	9.63	10.61	9.66	8.33
-----+										
5-9	186	36	351	414	72	80	55	89	128	1,411
	13.18	2.55	24.88	29.34	5.10	5.67	3.90	6.31	9.07	100.00
	0.41	0.34	0.40	0.85	1.08	0.69	0.33	2.58	0.57	0.56
-----+										
50-54	2,420	652	5,193	2,585	476	672	1,109	288	1,494	14,889
	16.25	4.38	34.88	17.36	3.20	4.51	7.45	1.93	10.03	100.00
	5.35	6.13	5.94	5.33	7.16	5.78	6.73	8.35	6.66	5.90
-----+										

55-59	1,541	457	3,179	1,772	302	382	728	167	1,058	9,586
	16.08	4.77	33.16	18.49	3.15	3.98	7.59	1.74	11.04	100.00
	3.40	4.30	3.64	3.65	4.54	3.29	4.42	4.84	4.72	3.80
-----+-----										
60+	1,684	389	3,323	2,720	426	429	718	196	1,383	11,268
	14.94	3.45	29.49	24.14	3.78	3.81	6.37	1.74	12.27	100.00
	3.72	3.66	3.80	5.60	6.41	3.69	4.36	5.68	6.17	4.46
-----+-----										
99999	3	0	323	1	1	0	0	0	0	328
	0.91	0.00	98.48	0.30	0.30	0.00	0.00	0.00	0.00	100.00
	0.01	0.00	0.37	0.00	0.02	0.00	0.00	0.00	0.00	0.13
-----+-----										
Total	45,263	10,640	87,363	48,534	6,646	11,623	16,477	3,451	22,432	252,429
	17.93	4.22	34.61	19.23	2.63	4.60	6.53	1.37	8.89	100.00
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

. preserve

```
. keep if (HEP_B_SURFACE_AG_1=="POSITIVE" | HEP_B_SURFACE_AG_1=="") &
(HEP_B_SURFACE_AG_2=="POSITIVE" | HEP_B_S
> URFACE_AG_2=="") & (HEP_B_SURFACE_AG_3=="POSITIVE" | HEP_B_SURFACE_AG_3=="") &
(HEP_B_SURFACE_AG_4=="POSITIVE
> " | HEP_B_SURFACE_AG_4=="") & (HEP_B_SURFACE_AG_5=="POSITIVE" |
HEP_B_SURFACE_AG_5=="") & (HEP_B_SURFACE_AG_6
> == "POSITIVE" | HEP_B_SURFACE_AG_6=="") & (HEP_B_SURFACE_AG_7=="POSITIVE" |
HEP_B_SURFACE_AG_7=="") & (HEP_B_S
> URFACE_AG_8=="POSITIVE" | HEP_B_SURFACE_AG_8=="") &
(HEP_B_SURFACE_AG_9=="POSITIVE" | HEP_B_SURFACE_AG_9=="")
> & (HEP_B_SURFACE_AG_10=="POSITIVE" | HEP_B_SURFACE_AG_10=="") &
(HEP_B_SURFACE_AG_11=="POSITIVE" | HEP_B_SUR
> FACE_AG_11=="") & (HEP_B_SURFACE_AG_12=="POSITIVE" | HEP_B_SURFACE_AG_12=="") &
(HEP_B_SURFACE_AG_13=="POSITI
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> VE" | HEP_B_SURFACE_AG_13=="") & (HEP_B_SURFACE_AG_14=="POSITIVE" |
HEP_B_SURFACE_AG_14=="") & (HEP_B_SURFACE
> _AG_15=="POSITIVE" | HEP_B_SURFACE_AG_15=="") & (HEP_B_SURFACE_AG_16=="POSITIVE" |
HEP_B_SURFACE_AG_16=="") &
> (HEP_B_SURFACE_AG_17=="POSITIVE" | HEP_B_SURFACE_AG_17=="") &
(HEP_B_SURFACE_AG_18=="POSITIVE" | HEP_B_SURFA
> CE_AG_18=="") & (HEP_B_SURFACE_AG_19=="POSITIVE" | HEP_B_SURFACE_AG_19=="") &
(HEP_B_SURFACE_AG_20=="POSITIVE
> " | HEP_B_SURFACE_AG_20=="") & (HEP_B_SURFACE_AG_21=="POSITIVE" |
HEP_B_SURFACE_AG_21=="") & (HEP_B_SURFACE_A
> G_22=="POSITIVE" | HEP_B_SURFACE_AG_22=="") & (HEP_B_SURFACE_AG_23=="POSITIVE" |
HEP_B_SURFACE_AG_23=="") & (
> HEP_B_SURFACE_AG_24=="POSITIVE" | HEP_B_SURFACE_AG_24=="") &
(HEP_B_SURFACE_AG_25=="POSITIVE" | HEP_B_SURFACE
> _AG_25=="") & (HEP_B_SURFACE_AG_26=="POSITIVE" | HEP_B_SURFACE_AG_26=="") &
(HEP_B_SURFACE_AG_27=="POSITIVE"
> | HEP_B_SURFACE_AG_27=="") & (HEP_B_SURFACE_AG_28=="POSITIVE" |
HEP_B_SURFACE_AG_28=="") & (HEP_B_SURFACE_AG_
> 29=="POSITIVE" | HEP_B_SURFACE_AG_29=="") & (HEP_B_SURFACE_AG_30=="POSITIVE" |
HEP_B_SURFACE_AG_30=="") & (HE
> P_B_SURFACE_AG_31=="POSITIVE" | HEP_B_SURFACE_AG_31=="") &
(HEP_B_SURFACE_AG_32=="POSITIVE" | HEP_B_SURFACE_A
> G_32=="") & (HEP_B_SURFACE_AG_33=="POSITIVE" | HEP_B_SURFACE_AG_33=="") &
(HEP_B_SURFACE_AG_34=="POSITIVE" |
> HEP_B_SURFACE_AG_34=="") & (HEP_B_SURFACE_AG_35=="POSITIVE" |
HEP_B_SURFACE_AG_35=="") & (HEP_B_SURFACE_AG_36
> =="POSITIVE" | HEP_B_SURFACE_AG_36=="") & (HEP_B_SURFACE_AG_37=="POSITIVE" |
HEP_B_SURFACE_AG_37=="") & (HEP_
> B_SURFACE_AG_38=="POSITIVE" | HEP_B_SURFACE_AG_38=="") &
(HEP_B_SURFACE_AG_105=="POSITIVE" | HEP_B_SURFACE_AG
> _105=="") & (HEP_B_SURFACE_AG_147=="POSITIVE" | HEP_B_SURFACE_AG_147=="")
(261,074 observations deleted)

```

```

. save "Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD
Output files_SM08102

```

```

> 0\Files_Chapter3\Stata files\36193 from 297237.dta", replace

```

```

file Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD Output
files_SM081020\F

```

```

> iles_Chapter3\Stata files\36193 from 297237.dta saved

```

. restore

. preserve

```
. keep if (HEP_B_SURFACE_AG_1=="NEGATIVE" | HEP_B_SURFACE_AG_1=="") &
(HEP_B_SURFACE_AG_2=="NEGATIVE" | HEP_B_S
> URFACE_AG_2=="") & (HEP_B_SURFACE_AG_3=="NEGATIVE" | HEP_B_SURFACE_AG_3=="") &
(HEP_B_SURFACE_AG_4=="NEGATIVE
> " | HEP_B_SURFACE_AG_4=="") & (HEP_B_SURFACE_AG_5=="NEGATIVE" |
HEP_B_SURFACE_AG_5=="") & (HEP_B_SURFACE_AG_6
> == "NEGATIVE" | HEP_B_SURFACE_AG_6=="") & (HEP_B_SURFACE_AG_7=="NEGATIVE" |
HEP_B_SURFACE_AG_7=="") & (HEP_B_S
> URFACE_AG_8=="NEGATIVE" | HEP_B_SURFACE_AG_8=="") &
(HEP_B_SURFACE_AG_9=="NEGATIVE" | HEP_B_SURFACE_AG_9=="")
> & (HEP_B_SURFACE_AG_10=="NEGATIVE" | HEP_B_SURFACE_AG_10=="") &
(HEP_B_SURFACE_AG_11=="NEGATIVE" | HEP_B_SUR
> FACE_AG_11=="") & (HEP_B_SURFACE_AG_12=="NEGATIVE" | HEP_B_SURFACE_AG_12=="") &
(HEP_B_SURFACE_AG_13=="NEGATI
> VE" | HEP_B_SURFACE_AG_13=="") & (HEP_B_SURFACE_AG_14=="NEGATIVE" |
HEP_B_SURFACE_AG_14=="") & (HEP_B_SURFACE
> _AG_15=="NEGATIVE" | HEP_B_SURFACE_AG_15=="") & (HEP_B_SURFACE_AG_16=="NEGATIVE"
| HEP_B_SURFACE_AG_16=="") &
> (HEP_B_SURFACE_AG_17=="NEGATIVE" | HEP_B_SURFACE_AG_17=="") &
(HEP_B_SURFACE_AG_18=="NEGATIVE" | HEP_B_SURFA
> CE_AG_18=="") & (HEP_B_SURFACE_AG_19=="NEGATIVE" | HEP_B_SURFACE_AG_19=="") &
(HEP_B_SURFACE_AG_20=="NEGATIVE
> " | HEP_B_SURFACE_AG_20=="") & (HEP_B_SURFACE_AG_21=="NEGATIVE" |
HEP_B_SURFACE_AG_21=="") & (HEP_B_SURFACE_A
> G_22=="NEGATIVE" | HEP_B_SURFACE_AG_22=="") & (HEP_B_SURFACE_AG_23=="NEGATIVE" |
HEP_B_SURFACE_AG_23=="") & (
> HEP_B_SURFACE_AG_24=="NEGATIVE" | HEP_B_SURFACE_AG_24=="") &
(HEP_B_SURFACE_AG_25=="NEGATIVE" | HEP_B_SURFACE
> _AG_25=="") & (HEP_B_SURFACE_AG_26=="NEGATIVE" | HEP_B_SURFACE_AG_26=="") &
(HEP_B_SURFACE_AG_27=="NEGATIVE"
> | HEP_B_SURFACE_AG_27=="") & (HEP_B_SURFACE_AG_28=="NEGATIVE" |
HEP_B_SURFACE_AG_28=="") & (HEP_B_SURFACE_AG_
> 29=="NEGATIVE" | HEP_B_SURFACE_AG_29=="") & (HEP_B_SURFACE_AG_30=="NEGATIVE" |
HEP_B_SURFACE_AG_30=="") & (HE
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> P_B_SURFACE_AG_31=="NEGATIVE" | HEP_B_SURFACE_AG_31=="") &
(HEP_B_SURFACE_AG_32=="NEGATIVE" | HEP_B_SURFACE_A
> G_32=="") & (HEP_B_SURFACE_AG_33=="NEGATIVE" | HEP_B_SURFACE_AG_33=="") &
(HEP_B_SURFACE_AG_34=="NEGATIVE" |
> HEP_B_SURFACE_AG_34=="") & (HEP_B_SURFACE_AG_35=="NEGATIVE" |
HEP_B_SURFACE_AG_35=="") & (HEP_B_SURFACE_AG_36
> == "NEGATIVE" | HEP_B_SURFACE_AG_36=="") & (HEP_B_SURFACE_AG_37=="NEGATIVE" |
HEP_B_SURFACE_AG_37=="") & (HEP_
> B_SURFACE_AG_38=="NEGATIVE" | HEP_B_SURFACE_AG_38=="") &
(HEP_B_SURFACE_AG_105=="NEGATIVE" | HEP_B_SURFACE_AG
> _105=="") & (HEP_B_SURFACE_AG_147=="NEGATIVE" | HEP_B_SURFACE_AG_147=="")
(44,838 observations deleted)

```

```

. save "Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD
Output files_SM08102

```

```

> 0\Files_Chapter3\Stata files\252429 from 297267.dta"

```

```

file Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD Output
files_SM081020\F

```

```

> iles_Chapter3\Stata files\252429 from 297267.dta saved

```

```

. restore

```

```

. drop if (HEP_B_SURFACE_AG_1=="POSITIVE" | HEP_B_SURFACE_AG_1=="") &
(HEP_B_SURFACE_AG_2=="POSITIVE" | HEP_B_S
> URFACE_AG_2=="") & (HEP_B_SURFACE_AG_3=="POSITIVE" | HEP_B_SURFACE_AG_3=="") &
(HEP_B_SURFACE_AG_4=="POSITIVE
> " | HEP_B_SURFACE_AG_4=="") & (HEP_B_SURFACE_AG_5=="POSITIVE" |
HEP_B_SURFACE_AG_5=="") & (HEP_B_SURFACE_AG_6
> == "POSITIVE" | HEP_B_SURFACE_AG_6=="") & (HEP_B_SURFACE_AG_7=="POSITIVE" |
HEP_B_SURFACE_AG_7=="") & (HEP_B_S
> URFACE_AG_8=="POSITIVE" | HEP_B_SURFACE_AG_8=="") &
(HEP_B_SURFACE_AG_9=="POSITIVE" | HEP_B_SURFACE_AG_9=="")
> & (HEP_B_SURFACE_AG_10=="POSITIVE" | HEP_B_SURFACE_AG_10=="") &
(HEP_B_SURFACE_AG_11=="POSITIVE" | HEP_B_SUR
> FACE_AG_11=="") & (HEP_B_SURFACE_AG_12=="POSITIVE" | HEP_B_SURFACE_AG_12=="") &
(HEP_B_SURFACE_AG_13=="POSITI
> VE" | HEP_B_SURFACE_AG_13=="") & (HEP_B_SURFACE_AG_14=="POSITIVE" |
HEP_B_SURFACE_AG_14=="") & (HEP_B_SURFACE

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> _AG_15=="POSITIVE" | HEP_B_SURFACE_AG_15=="") & (HEP_B_SURFACE_AG_16=="POSITIVE" |
HEP_B_SURFACE_AG_16=="") &

> (HEP_B_SURFACE_AG_17=="POSITIVE" | HEP_B_SURFACE_AG_17=="") &
(HEP_B_SURFACE_AG_18=="POSITIVE" | HEP_B_SURFA

> CE_AG_18=="") & (HEP_B_SURFACE_AG_19=="POSITIVE" | HEP_B_SURFACE_AG_19=="") &
(HEP_B_SURFACE_AG_20=="POSITIVE

> " | HEP_B_SURFACE_AG_20=="") & (HEP_B_SURFACE_AG_21=="POSITIVE" |
HEP_B_SURFACE_AG_21=="") & (HEP_B_SURFACE_A

> G_22=="POSITIVE" | HEP_B_SURFACE_AG_22=="") & (HEP_B_SURFACE_AG_23=="POSITIVE" |
HEP_B_SURFACE_AG_23=="") & (

> HEP_B_SURFACE_AG_24=="POSITIVE" | HEP_B_SURFACE_AG_24=="") &
(HEP_B_SURFACE_AG_25=="POSITIVE" | HEP_B_SURFACE

> _AG_25=="") & (HEP_B_SURFACE_AG_26=="POSITIVE" | HEP_B_SURFACE_AG_26=="") &
(HEP_B_SURFACE_AG_27=="POSITIVE"

> | HEP_B_SURFACE_AG_27=="") & (HEP_B_SURFACE_AG_28=="POSITIVE" |
HEP_B_SURFACE_AG_28=="") & (HEP_B_SURFACE_AG_

> 29=="POSITIVE" | HEP_B_SURFACE_AG_29=="") & (HEP_B_SURFACE_AG_30=="POSITIVE" |
HEP_B_SURFACE_AG_30=="") & (HE

> P_B_SURFACE_AG_31=="POSITIVE" | HEP_B_SURFACE_AG_31=="") &
(HEP_B_SURFACE_AG_32=="POSITIVE" | HEP_B_SURFACE_A

> G_32=="") & (HEP_B_SURFACE_AG_33=="POSITIVE" | HEP_B_SURFACE_AG_33=="") &
(HEP_B_SURFACE_AG_34=="POSITIVE" |

> HEP_B_SURFACE_AG_34=="") & (HEP_B_SURFACE_AG_35=="POSITIVE" |
HEP_B_SURFACE_AG_35=="") & (HEP_B_SURFACE_AG_36

> =="POSITIVE" | HEP_B_SURFACE_AG_36=="") & (HEP_B_SURFACE_AG_37=="POSITIVE" |
HEP_B_SURFACE_AG_37=="") & (HEP_

> B_SURFACE_AG_38=="POSITIVE" | HEP_B_SURFACE_AG_38=="") &
(HEP_B_SURFACE_AG_105=="POSITIVE" | HEP_B_SURFACE_AG

> _105=="") & (HEP_B_SURFACE_AG_147=="POSITIVE" | HEP_B_SURFACE_AG_147=="")

(36,193 observations deleted)

```

```

. drop if (HEP_B_SURFACE_AG_1=="NEGATIVE" | HEP_B_SURFACE_AG_1=="") &
(HEP_B_SURFACE_AG_2=="NEGATIVE" | HEP_B_S

> URFACE_AG_2=="") & (HEP_B_SURFACE_AG_3=="NEGATIVE" | HEP_B_SURFACE_AG_3=="") &
(HEP_B_SURFACE_AG_4=="NEGATIVE

> " | HEP_B_SURFACE_AG_4=="") & (HEP_B_SURFACE_AG_5=="NEGATIVE" |
HEP_B_SURFACE_AG_5=="") & (HEP_B_SURFACE_AG_6

> =="NEGATIVE" | HEP_B_SURFACE_AG_6=="") & (HEP_B_SURFACE_AG_7=="NEGATIVE" |
HEP_B_SURFACE_AG_7=="") & (HEP_B_S

```

```

> URFACE_AG_8=="NEGATIVE" | HEP_B_SURFACE_AG_8=="") &
(HEP_B_SURFACE_AG_9=="NEGATIVE" | HEP_B_SURFACE_AG_9=="")

> & (HEP_B_SURFACE_AG_10=="NEGATIVE" | HEP_B_SURFACE_AG_10=="") &
(HEP_B_SURFACE_AG_11=="NEGATIVE" | HEP_B_SUR

> FACE_AG_11=="") & (HEP_B_SURFACE_AG_12=="NEGATIVE" | HEP_B_SURFACE_AG_12=="") &
(HEP_B_SURFACE_AG_13=="NEGATI

> VE" | HEP_B_SURFACE_AG_13=="") & (HEP_B_SURFACE_AG_14=="NEGATIVE" |
HEP_B_SURFACE_AG_14=="") & (HEP_B_SURFACE

> _AG_15=="NEGATIVE" | HEP_B_SURFACE_AG_15=="") & (HEP_B_SURFACE_AG_16=="NEGATIVE"
| HEP_B_SURFACE_AG_16=="") &

> (HEP_B_SURFACE_AG_17=="NEGATIVE" | HEP_B_SURFACE_AG_17=="") &
(HEP_B_SURFACE_AG_18=="NEGATIVE" | HEP_B_SURFA

> CE_AG_18=="") & (HEP_B_SURFACE_AG_19=="NEGATIVE" | HEP_B_SURFACE_AG_19=="") &
(HEP_B_SURFACE_AG_20=="NEGATIVE

> " | HEP_B_SURFACE_AG_20=="") & (HEP_B_SURFACE_AG_21=="NEGATIVE" |
HEP_B_SURFACE_AG_21=="") & (HEP_B_SURFACE_A

> G_22=="NEGATIVE" | HEP_B_SURFACE_AG_22=="") & (HEP_B_SURFACE_AG_23=="NEGATIVE" |
HEP_B_SURFACE_AG_23=="") & (

> HEP_B_SURFACE_AG_24=="NEGATIVE" | HEP_B_SURFACE_AG_24=="") &
(HEP_B_SURFACE_AG_25=="NEGATIVE" | HEP_B_SURFACE

> _AG_25=="") & (HEP_B_SURFACE_AG_26=="NEGATIVE" | HEP_B_SURFACE_AG_26=="") &
(HEP_B_SURFACE_AG_27=="NEGATIVE"

> | HEP_B_SURFACE_AG_27=="") & (HEP_B_SURFACE_AG_28=="NEGATIVE" |
HEP_B_SURFACE_AG_28=="") & (HEP_B_SURFACE_AG_

> 29=="NEGATIVE" | HEP_B_SURFACE_AG_29=="") & (HEP_B_SURFACE_AG_30=="NEGATIVE" |
HEP_B_SURFACE_AG_30=="") & (HE

> P_B_SURFACE_AG_31=="NEGATIVE" | HEP_B_SURFACE_AG_31=="") &
(HEP_B_SURFACE_AG_32=="NEGATIVE" | HEP_B_SURFACE_A

> G_32=="") & (HEP_B_SURFACE_AG_33=="NEGATIVE" | HEP_B_SURFACE_AG_33=="") &
(HEP_B_SURFACE_AG_34=="NEGATIVE" |

> HEP_B_SURFACE_AG_34=="") & (HEP_B_SURFACE_AG_35=="NEGATIVE" |
HEP_B_SURFACE_AG_35=="") & (HEP_B_SURFACE_AG_36

> == "NEGATIVE" | HEP_B_SURFACE_AG_36=="") & (HEP_B_SURFACE_AG_37=="NEGATIVE" |
HEP_B_SURFACE_AG_37=="") & (HEP_

> B_SURFACE_AG_38=="NEGATIVE" | HEP_B_SURFACE_AG_38=="") &
(HEP_B_SURFACE_AG_105=="NEGATIVE" | HEP_B_SURFACE_AG

> _105=="") & (HEP_B_SURFACE_AG_147=="NEGATIVE" | HEP_B_SURFACE_AG_147=="")

(252,429 observations deleted)

```



```
. count
```

```
8,645
```

```
. save "Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD  
Output files_SM08102
```

```
> 0\Files_Chapter3\Stata files\group M 8645 from 297267.dta"
```

```
file Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD Output  
files_SM081020\F
```

```
> iles_Chapter3\Stata files\group M 8645 from 297267.dta saved
```

```
. count if HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_2=="NEGATIVE" &  
HEP_B_SURFACE_AG_3=="
```

```
2,924
```

```
. count if HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_2=="POSITIVE" &  
HEP_B_SURFACE_AG_3=="
```

```
1,884
```

```
. count if HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_2=="NEGATIVE" &  
HEP_B_SURFACE_AG_3=="
```

```
2,924
```

```
.
```

```
. count if HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_2=="POSITIVE" &  
HEP_B_SURFACE_AG_3=="
```

```
1,884
```

```
.
```

```
. drop if HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_2=="NEGATIVE" &  
HEP_B_SURFACE_AG_3=="
```

```
(2,924 observations deleted)
```

```
.
```

```
. drop if HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_2=="POSITIVE" &  
HEP_B_SURFACE_AG_3=="
```

(1,884 observations deleted)

.

```
. count if HEP_B_SURFACE_AG_4=="
```

2,315

.

```
. count if HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_2=="NEGATIVE" &  
HEP_B_SURFACE_AG_3=="POSITIVE" & H
```

```
> EP_B_SURFACE_AG_4=="
```

282

.

```
. count if HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_2=="POSITIVE" &  
HEP_B_SURFACE_AG_3=="POSITIVE" & H
```

```
> EP_B_SURFACE_AG_4=="
```

473

.

```
. count if HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_2=="POSITIVE" &  
HEP_B_SURFACE_AG_3=="NEGATIVE" & H
```

```
> EP_B_SURFACE_AG_4=="
```

274

.

```
. count if HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_2=="POSITIVE" &  
HEP_B_SURFACE_AG_3=="NEGATIVE" & H
```

```
> EP_B_SURFACE_AG_4=="
```

730

.

```
. count if HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_2=="NEGATIVE" &  
HEP_B_SURFACE_AG_3=="NEGATIVE" & H
```

```
> EP_B_SURFACE_AG_4=="
```

```

.
. count if HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_2=="NEGATIVE" &
HEP_B_SURFACE_AG_3=="POSITIVE" & H
> EP_B_SURFACE_AG_4=="
30

.
. drop if HEP_B_SURFACE_AG_4=="
(2,315 observations deleted)

. count if (HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_4=="NEGATIVE" &
HEP_B_SURFACE_AG_5=="") | (HEP_B_
> SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_5=="NEGATIVE" &
HEP_B_SURFACE_AG_6=="") | (HEP_B_SURFACE_AG_1=="N
> EGATIVE" & HEP_B_SURFACE_AG_6=="NEGATIVE" & HEP_B_SURFACE_AG_7=="") |
(HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B
> _SURFACE_AG_7=="NEGATIVE" & HEP_B_SURFACE_AG_8=="") |
(HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_8=="
> NEGATIVE" & HEP_B_SURFACE_AG_9=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_9=="NEGATIVE" & HEP_
> B_SURFACE_AG_10=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_10=="NEGATIVE" & HEP_B_SURFACE_AG_1
> 1=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_11=="NEGATIVE" &
HEP_B_SURFACE_AG_12=="") | (HEP_
> B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_12=="NEGATIVE" &
HEP_B_SURFACE_AG_13=="") | (HEP_B_SURFACE_AG_1
> == "NEGATIVE" & HEP_B_SURFACE_AG_13=="NEGATIVE" & HEP_B_SURFACE_AG_14=="") |
(HEP_B_SURFACE_AG_1=="NEGATIVE" &
> HEP_B_SURFACE_AG_14=="NEGATIVE" & HEP_B_SURFACE_AG_15=="") |
(HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE
> _AG_15=="NEGATIVE" & HEP_B_SURFACE_AG_16=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_16=="NEGAT
> IVE" & HEP_B_SURFACE_AG_17=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_17=="NEGATIVE" & HEP_B_S
> URFACE_AG_18=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_18=="NEGATIVE" & HEP_B_SURFACE_AG_19==

```

```

> "" ) | (HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_19=="NEGATIVE" &
HEP_B_SURFACE_AG_20=="") | (HEP_B_S
> URFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_20=="NEGATIVE" &
HEP_B_SURFACE_AG_21=="") | (HEP_B_SURFACE_AG_1=="
> NEGATIVE" & HEP_B_SURFACE_AG_21=="NEGATIVE" & HEP_B_SURFACE_AG_22=="") |
(HEP_B_SURFACE_AG_1=="NEGATIVE" & HE
> P_B_SURFACE_AG_22=="NEGATIVE" & HEP_B_SURFACE_AG_23=="") |
(HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG
> _23=="NEGATIVE" & HEP_B_SURFACE_AG_24=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_24=="NEGATIVE
> " & HEP_B_SURFACE_AG_25=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_25=="NEGATIVE" & HEP_B_SURF
> ACE_AG_26=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_26=="NEGATIVE" & HEP_B_SURFACE_AG_27=="")
> | (HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_27=="NEGATIVE" &
HEP_B_SURFACE_AG_28=="") | (HEP_B_SURF
> ACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_28=="NEGATIVE" &
HEP_B_SURFACE_AG_29=="") | (HEP_B_SURFACE_AG_1=="NEG
> ATIVE" & HEP_B_SURFACE_AG_29=="NEGATIVE" & HEP_B_SURFACE_AG_30=="") |
(HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B
> _SURFACE_AG_30=="NEGATIVE" & HEP_B_SURFACE_AG_31=="") |
(HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_31
> =="NEGATIVE" & HEP_B_SURFACE_AG_32=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_32=="NEGATIVE" &
> HEP_B_SURFACE_AG_33=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_33=="NEGATIVE" & HEP_B_SURFACE
> _AG_34=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_34=="NEGATIVE" &
HEP_B_SURFACE_AG_35=="") |
> (HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_35=="NEGATIVE" &
HEP_B_SURFACE_AG_36=="") | (HEP_B_SURFACE
> _AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_36=="NEGATIVE" & HEP_B_SURFACE_AG_37=="") |
(HEP_B_SURFACE_AG_1=="NEGATI
> VE" & HEP_B_SURFACE_AG_37=="NEGATIVE" & HEP_B_SURFACE_AG_38=="") |
(HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SU
> RFACE_AG_38=="NEGATIVE" & HEP_B_SURFACE_AG_105=="") |
(HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_105=
> ="NEGATIVE" & HEP_B_SURFACE_AG_147=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_147=="NEGATIVE")

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. count if (HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_4=="POSITIVE" &
HEP_B_SURFACE_AG_5=="") | (HEP_B_

> SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_5=="POSITIVE" &
HEP_B_SURFACE_AG_6=="") | (HEP_B_SURFACE_AG_1=="P

> OSITIVE" & HEP_B_SURFACE_AG_6=="POSITIVE" & HEP_B_SURFACE_AG_7=="") |
(HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B

> _SURFACE_AG_7=="POSITIVE" & HEP_B_SURFACE_AG_8=="") |
(HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_8=="

> POSITIVE" & HEP_B_SURFACE_AG_9=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &
HEP_B_SURFACE_AG_9=="POSITIVE" & HEP_

> B_SURFACE_AG_10=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &
HEP_B_SURFACE_AG_10=="POSITIVE" & HEP_B_SURFACE_AG_1

> 1=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_11=="POSITIVE" &
HEP_B_SURFACE_AG_12=="") | (HEP_

> B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_12=="POSITIVE" &
HEP_B_SURFACE_AG_13=="") | (HEP_B_SURFACE_AG_1

> == "POSITIVE" & HEP_B_SURFACE_AG_13=="POSITIVE" & HEP_B_SURFACE_AG_14=="") |
(HEP_B_SURFACE_AG_1=="POSITIVE" &

> HEP_B_SURFACE_AG_14=="POSITIVE" & HEP_B_SURFACE_AG_15=="") |
(HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE

> _AG_15=="POSITIVE" & HEP_B_SURFACE_AG_16=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &
HEP_B_SURFACE_AG_16=="POSIT

> IVE" & HEP_B_SURFACE_AG_17=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &
HEP_B_SURFACE_AG_17=="POSITIVE" & HEP_B_S

> URFACE_AG_18=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &
HEP_B_SURFACE_AG_18=="POSITIVE" & HEP_B_SURFACE_AG_19=="

> ") | (HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_19=="POSITIVE" &
HEP_B_SURFACE_AG_20=="") | (HEP_B_S

> URFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_20=="POSITIVE" &
HEP_B_SURFACE_AG_21=="") | (HEP_B_SURFACE_AG_1=="

> POSITIVE" & HEP_B_SURFACE_AG_21=="POSITIVE" & HEP_B_SURFACE_AG_22=="") |
(HEP_B_SURFACE_AG_1=="POSITIVE" & HE

> P_B_SURFACE_AG_22=="POSITIVE" & HEP_B_SURFACE_AG_23=="") |
(HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG

> _23=="POSITIVE" & HEP_B_SURFACE_AG_24=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &
HEP_B_SURFACE_AG_24=="POSITIVE

> " & HEP_B_SURFACE_AG_25=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &
HEP_B_SURFACE_AG_25=="POSITIVE" & HEP_B_SURF

```

```

> ACE_AG_26=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_26=="POSITIVE"
& HEP_B_SURFACE_AG_27=="")

> | (HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_27=="POSITIVE" &
HEP_B_SURFACE_AG_28=="") | (HEP_B_SURF

> ACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_28=="POSITIVE" & HEP_B_SURFACE_AG_29=="")
| (HEP_B_SURFACE_AG_1=="POS

> ITIVE" & HEP_B_SURFACE_AG_29=="POSITIVE" & HEP_B_SURFACE_AG_30=="") |
(HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B

> _SURFACE_AG_30=="POSITIVE" & HEP_B_SURFACE_AG_31=="") |
(HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_31

> =="POSITIVE" & HEP_B_SURFACE_AG_32=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &
HEP_B_SURFACE_AG_32=="POSITIVE" &

> HEP_B_SURFACE_AG_33=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &
HEP_B_SURFACE_AG_33=="POSITIVE" & HEP_B_SURFACE

> _AG_34=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_34=="POSITIVE" &
HEP_B_SURFACE_AG_35=="") |

> (HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_35=="POSITIVE" &
HEP_B_SURFACE_AG_36=="") | (HEP_B_SURFACE

> _AG_1=="POSITIVE" & HEP_B_SURFACE_AG_36=="POSITIVE" & HEP_B_SURFACE_AG_37=="") |
(HEP_B_SURFACE_AG_1=="POSITI

> VE" & HEP_B_SURFACE_AG_37=="POSITIVE" & HEP_B_SURFACE_AG_38=="") |
(HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SU

> RFACE_AG_38=="POSITIVE" & HEP_B_SURFACE_AG_105=="") |
(HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_105=

> ="POSITIVE" & HEP_B_SURFACE_AG_147=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &
HEP_B_SURFACE_AG_147=="POSITIVE")

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43

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.
. count if (HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_4=="POSITIVE" &
HEP_B_SURFACE_AG_5=="") | (HEP_B_

> SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_5=="POSITIVE" &
HEP_B_SURFACE_AG_6=="") | (HEP_B_SURFACE_AG_1=="N

> EGATIVE" & HEP_B_SURFACE_AG_6=="POSITIVE" & HEP_B_SURFACE_AG_7=="") |
(HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B

> _SURFACE_AG_7=="POSITIVE" & HEP_B_SURFACE_AG_8=="") |
(HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_8=="

> POSITIVE" & HEP_B_SURFACE_AG_9=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_9=="POSITIVE" & HEP_

```

```

> B_SURFACE_AG_10=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_10=="POSITIVE" & HEP_B_SURFACE_AG_1

> 1=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_11=="POSITIVE" &
HEP_B_SURFACE_AG_12=="") | (HEP_

> B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_12=="POSITIVE" &
HEP_B_SURFACE_AG_13=="") | (HEP_B_SURFACE_AG_1

> == "NEGATIVE" & HEP_B_SURFACE_AG_13=="POSITIVE" & HEP_B_SURFACE_AG_14=="") |
(HEP_B_SURFACE_AG_1=="NEGATIVE" &

> HEP_B_SURFACE_AG_14=="POSITIVE" & HEP_B_SURFACE_AG_15=="") |
(HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE

> _AG_15=="POSITIVE" & HEP_B_SURFACE_AG_16=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_16=="POSIT

> IVE" & HEP_B_SURFACE_AG_17=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_17=="POSITIVE" & HEP_B_S

> URFACE_AG_18=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_18=="POSITIVE" & HEP_B_SURFACE_AG_19=="

> ") | (HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_19=="POSITIVE" &
HEP_B_SURFACE_AG_20=="") | (HEP_B_S

> URFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_20=="POSITIVE" &
HEP_B_SURFACE_AG_21=="") | (HEP_B_SURFACE_AG_1=="

> NEGATIVE" & HEP_B_SURFACE_AG_21=="POSITIVE" & HEP_B_SURFACE_AG_22=="") |
(HEP_B_SURFACE_AG_1=="NEGATIVE" & HE

> P_B_SURFACE_AG_22=="POSITIVE" & HEP_B_SURFACE_AG_23=="") |
(HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG

> _23=="POSITIVE" & HEP_B_SURFACE_AG_24=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_24=="POSITIVE

> " & HEP_B_SURFACE_AG_25=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_25=="POSITIVE" & HEP_B_SURF

> ACE_AG_26=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_26=="POSITIVE" & HEP_B_SURFACE_AG_27=="")

> | (HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_27=="POSITIVE" &
HEP_B_SURFACE_AG_28=="") | (HEP_B_SURF

> ACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_28=="POSITIVE" & HEP_B_SURFACE_AG_29=="")
| (HEP_B_SURFACE_AG_1=="NEG

> ATIVE" & HEP_B_SURFACE_AG_29=="POSITIVE" & HEP_B_SURFACE_AG_30=="") |
(HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B

> _SURFACE_AG_30=="POSITIVE" & HEP_B_SURFACE_AG_31=="") |
(HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_31

> == "POSITIVE" & HEP_B_SURFACE_AG_32=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_32=="POSITIVE" &

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> HEP_B_SURFACE_AG_33=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_33=="POSITIVE" & HEP_B_SURFACE
> _AG_34=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_34=="POSITIVE" &
HEP_B_SURFACE_AG_35=="") |
> (HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_35=="POSITIVE" &
HEP_B_SURFACE_AG_36=="") | (HEP_B_SURFACE
> _AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_36=="POSITIVE" & HEP_B_SURFACE_AG_37=="") |
(HEP_B_SURFACE_AG_1=="NEGATI
> VE" & HEP_B_SURFACE_AG_37=="POSITIVE" & HEP_B_SURFACE_AG_38=="") |
(HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SU
> RFACE_AG_38=="POSITIVE" & HEP_B_SURFACE_AG_105=="") |
(HEP_B_SURFACE_AG_1=="NEGATIVE" & HEP_B_SURFACE_AG_105=
> ="POSITIVE" & HEP_B_SURFACE_AG_147=="") | (HEP_B_SURFACE_AG_1=="NEGATIVE" &
HEP_B_SURFACE_AG_147=="POSITIVE")

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.
. count if (HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_4=="NEGATIVE" &
HEP_B_SURFACE_AG_5=="") | (HEP_B_
> SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_5=="NEGATIVE" &
HEP_B_SURFACE_AG_6=="") | (HEP_B_SURFACE_AG_1=="P
> OSITIVE" & HEP_B_SURFACE_AG_6=="NEGATIVE" & HEP_B_SURFACE_AG_7=="") |
(HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B
> _SURFACE_AG_7=="NEGATIVE" & HEP_B_SURFACE_AG_8=="") |
(HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_8=="
> NEGATIVE" & HEP_B_SURFACE_AG_9=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &
HEP_B_SURFACE_AG_9=="NEGATIVE" & HEP_
> B_SURFACE_AG_10=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &
HEP_B_SURFACE_AG_10=="NEGATIVE" & HEP_B_SURFACE_AG_1
> 1=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_11=="NEGATIVE" &
HEP_B_SURFACE_AG_12=="") | (HEP_
> B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_12=="NEGATIVE" &
HEP_B_SURFACE_AG_13=="") | (HEP_B_SURFACE_AG_1
> == "POSITIVE" & HEP_B_SURFACE_AG_13=="NEGATIVE" & HEP_B_SURFACE_AG_14=="") |
(HEP_B_SURFACE_AG_1=="POSITIVE" &
> HEP_B_SURFACE_AG_14=="NEGATIVE" & HEP_B_SURFACE_AG_15=="") |
(HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE
> _AG_15=="NEGATIVE" & HEP_B_SURFACE_AG_16=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &
HEP_B_SURFACE_AG_16=="NEGAT

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> IVE" & HEP_B_SURFACE_AG_17=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &
 HEP_B_SURFACE_AG_17=="NEGATIVE" & HEP_B_S

 > URFACE_AG_18=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &
 HEP_B_SURFACE_AG_18=="NEGATIVE" & HEP_B_SURFACE_AG_19==

 > """) | (HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_19=="NEGATIVE" &
 HEP_B_SURFACE_AG_20=="") | (HEP_B_S

 > URFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_20=="NEGATIVE" &
 HEP_B_SURFACE_AG_21=="") | (HEP_B_SURFACE_AG_1=="

 > POSITIVE" & HEP_B_SURFACE_AG_21=="NEGATIVE" & HEP_B_SURFACE_AG_22=="") |
 (HEP_B_SURFACE_AG_1=="POSITIVE" & HE

 > P_B_SURFACE_AG_22=="NEGATIVE" & HEP_B_SURFACE_AG_23=="") |
 (HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG

 > _23=="NEGATIVE" & HEP_B_SURFACE_AG_24=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &
 HEP_B_SURFACE_AG_24=="NEGATIVE

 > " & HEP_B_SURFACE_AG_25=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &
 HEP_B_SURFACE_AG_25=="NEGATIVE" & HEP_B_SURF

 > ACE_AG_26=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &
 HEP_B_SURFACE_AG_26=="NEGATIVE" & HEP_B_SURFACE_AG_27=="")

 > | (HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_27=="NEGATIVE" &
 HEP_B_SURFACE_AG_28=="") | (HEP_B_SURF

 > ACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_28=="NEGATIVE" & HEP_B_SURFACE_AG_29=="")
 | (HEP_B_SURFACE_AG_1=="POS

 > ITIVE" & HEP_B_SURFACE_AG_29=="NEGATIVE" & HEP_B_SURFACE_AG_30=="") |
 (HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B

 > _SURFACE_AG_30=="NEGATIVE" & HEP_B_SURFACE_AG_31=="") |
 (HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_31

 > == "NEGATIVE" & HEP_B_SURFACE_AG_32=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &
 HEP_B_SURFACE_AG_32=="NEGATIVE" &

 > HEP_B_SURFACE_AG_33=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &
 HEP_B_SURFACE_AG_33=="NEGATIVE" & HEP_B_SURFACE

 > _AG_34=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_34=="NEGATIVE" &
 HEP_B_SURFACE_AG_35=="") |

 > (HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_35=="NEGATIVE" &
 HEP_B_SURFACE_AG_36=="") | (HEP_B_SURFACE

 > _AG_1=="POSITIVE" & HEP_B_SURFACE_AG_36=="NEGATIVE" & HEP_B_SURFACE_AG_37=="") |
 (HEP_B_SURFACE_AG_1=="POSITI

 > VE" & HEP_B_SURFACE_AG_37=="NEGATIVE" & HEP_B_SURFACE_AG_38=="") |
 (HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SU

 > RFACE_AG_38=="NEGATIVE" & HEP_B_SURFACE_AG_105=="") |
 (HEP_B_SURFACE_AG_1=="POSITIVE" & HEP_B_SURFACE_AG_105=

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> ="NEGATIVE" & HEP_B_SURFACE_AG_147=="") | (HEP_B_SURFACE_AG_1=="POSITIVE" &  
HEP_B_SURFACE_AG_147=="NEGATIVE")
```

725

*POSITIVE-NEGATIVE-POSITIVE = 274 + 390 = 664

*NEGATIVE-POSITIVE-NEGATIVE = 43 + 30 = 73

*FIRST POSITIVE AND LAST NEGATIVE = 2924 + 730 + 725 + 526 = 4905

FIRST NEGATIVE AND LAST POSITIVE = 1884 + 282 + 473 + 364 = 3003

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. count
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4,905

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. tab GENDER
```

GENDER	Freq.	Percent	Cum.
-----+-----			
Female	2,942	59.98	59.98
Male	1,906	38.86	98.84
Unknown	57	1.16	100.00
-----+-----			
Total	4,905	100.00	

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. tab PROVINCE_NAME
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PROVINCE_NAME	Freq.	Percent	Cum.
-----+-----			
Eastern Cape	542	11.05	11.05
Free State	179	3.65	14.70
Gauteng	2,024	41.26	55.96
Kwazulu-Natal	639	13.03	68.99

Limpopo	304	6.20	75.19
Mpumalanga	369	7.52	82.71
North West	221	4.51	87.22
Northern Cape	77	1.57	88.79
Western Cape	550	11.21	100.00

-----+-----

Total	4,905	100.00

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	Freq.	Percent	Cum.

-----+-----

Eastern Cape_Alfred Nzo	15	0.31	0.31
Eastern Cape_Amathole	38	0.77	1.08
Eastern Cape_Buffalo City Metro	140	2.85	3.93
Eastern Cape_Chris Hani	16	0.33	4.26
Eastern Cape_Joe Gqabi	7	0.14	4.40
Eastern Cape_Nelson Mandela Bay Metro	111	2.26	6.67
Eastern Cape_O R Tambo	187	3.81	10.48
Eastern Cape_Sarah Baartman	27	0.55	11.03
Eastern Cape_Unknown	1	0.02	11.05
Free State_Fezile Dabi	15	0.31	11.36
Free State_Lejweleputswa	36	0.73	12.09
Free State_Mangaung Metro	97	1.98	14.07
Free State_Thabo Mofutsanyana	17	0.35	14.41
Free State_Xhariep	14	0.29	14.70
Gauteng_City Of Johannesburg Metro	715	14.58	29.28
Gauteng_City Of Tshwane Metro	450	9.17	38.45
Gauteng_Ekurhuleni Metro	757	15.43	53.88
Gauteng_Sedibeng	49	1.00	54.88
Gauteng_West Rand	53	1.08	55.96
Kwazulu-Natal_Amajuba	24	0.49	56.45

Kwazulu-Natal_EtheKwini Metro	266	5.42	61.88
Kwazulu-Natal_Harry Gwala	10	0.20	62.08
Kwazulu-Natal_Ilembe	25	0.51	62.59
Kwazulu-Natal_King Cetshwayo	12	0.24	62.83
Kwazulu-Natal_Ugu	82	1.67	64.51
Kwazulu-Natal_Umgungundlovu	134	2.73	67.24
Kwazulu-Natal_Umkhanyakude	30	0.61	67.85
Kwazulu-Natal_Umzinyathi	17	0.35	68.20
Kwazulu-Natal_Uthukela	7	0.14	68.34
Kwazulu-Natal_Uthungulu	9	0.18	68.52
Kwazulu-Natal_Zululand	23	0.47	68.99
Limpopo_Capricorn	128	2.61	71.60
Limpopo_Greater Sekhukhune	51	1.04	72.64
Limpopo_Mopani	34	0.69	73.33
Limpopo_Vhembe	33	0.67	74.01
Limpopo_Waterberg	58	1.18	75.19
Mpumalanga_Ehlanzeni	154	3.14	78.33
Mpumalanga_Gert Sibande	110	2.24	80.57
Mpumalanga_Nkangala	105	2.14	82.71
North West_Bojanala Platinum	72	1.47	84.18
North West_Dr Kenneth Kaunda	55	1.12	85.30
North West_Dr Ruth Segomotsi Mompati	8	0.16	85.46
North West_Ngaka Modiri Molema	86	1.75	87.22
Northern Cape_Frances Baard	46	0.94	88.15
Northern Cape_John Taolo Gaetsewe	2	0.04	88.20
Northern Cape_Namakwa	8	0.16	88.36
Northern Cape_Pixley Ka Seme	4	0.08	88.44
Northern Cape_Zf Mgcau	17	0.35	88.79
Western Cape_Cape Winelands	36	0.73	89.52
Western Cape_Central Karoo	7	0.14	89.66
Western Cape_City Of Cape Town Metro	377	7.69	97.35
Western Cape_Garden Route	87	1.77	99.12

Western Cape_Overberg	31	0.63	99.76
Western Cape_Unknown	3	0.06	99.82
Western Cape_West Coast	9	0.18	100.00
-----+-----			
Total	4,905	100.00	

. tab TAKEN_DATE_AGE_GROUP

TAKEN_DATE_			
AGE_GROUP	Freq.	Percent	Cum.
-----+-----			
0-4	122	2.49	2.49
10-14	45	0.92	3.40
15-19	137	2.79	6.20
20-24	612	12.48	18.67
25-29	905	18.45	37.13
30-34	963	19.63	56.76
35-39	688	14.03	70.78
40-44	509	10.38	81.16
45-49	333	6.79	87.95
5-9	27	0.55	88.50
50-54	237	4.83	93.33
55-59	134	2.73	96.07
60+	182	3.71	99.78
99999	11	0.22	100.00
-----+-----			
Total	4,905	100.00	

. tab TAKEN_DATE_AGE_GROUP GENDER, row col

+-----+

| Key |

|-----|
| frequency |
| row percentage |
| column percentage |
+-----+

TAKEN_DATE	GENDER			
_AGE_GROUP	Female	Male	Unknown	Total
-----+-----+-----				
0-4	54	65	3	122
	44.26	53.28	2.46	100.00
	1.84	3.41	5.26	2.49
-----+-----+-----				
10-14	25	20	0	45
	55.56	44.44	0.00	100.00
	0.85	1.05	0.00	0.92
-----+-----+-----				
15-19	104	32	1	137
	75.91	23.36	0.73	100.00
	3.54	1.68	1.75	2.79
-----+-----+-----				
20-24	478	124	10	612
	78.10	20.26	1.63	100.00
	16.25	6.51	17.54	12.48
-----+-----+-----				
25-29	605	287	13	905
	66.85	31.71	1.44	100.00
	20.56	15.06	22.81	18.45
-----+-----+-----				
30-34	611	347	5	963
	63.45	36.03	0.52	100.00
	20.77	18.21	8.77	19.63

-----+-----+-----				
35-39	363	317	8	688
	52.76	46.08	1.16	100.00
	12.34	16.63	14.04	14.03
-----+-----+-----				
40-44	245	259	5	509
	48.13	50.88	0.98	100.00
	8.33	13.59	8.77	10.38
-----+-----+-----				
45-49	159	171	3	333
	47.75	51.35	0.90	100.00
	5.40	8.97	5.26	6.79
-----+-----+-----				
5-9	13	12	2	27
	48.15	44.44	7.41	100.00
	0.44	0.63	3.51	0.55
-----+-----+-----				
50-54	115	120	2	237
	48.52	50.63	0.84	100.00
	3.91	6.30	3.51	4.83
-----+-----+-----				
55-59	70	63	1	134
	52.24	47.01	0.75	100.00
	2.38	3.31	1.75	2.73
-----+-----+-----				
60+	91	87	4	182
	50.00	47.80	2.20	100.00
	3.09	4.56	7.02	3.71
-----+-----+-----				
99999	9	2	0	11
	81.82	18.18	0.00	100.00
	0.31	0.10	0.00	0.22

+-----+				
Total	2,942	1,906	57	4,905
	59.98	38.86	1.16	100.00
	100.00	100.00	100.00	100.00

. tab PROVINCE_NAME GENDER, row col

+-----+	
Key	

frequency	
row percentage	
column percentage	
+-----+	

	GENDER			
PROVINCE_NAME	Female	Male	Unknown	Total
+-----+				
Eastern Cape	369	169	4	542
	68.08	31.18	0.74	100.00
	12.54	8.87	7.02	11.05
+-----+				
Free State	110	68	1	179
	61.45	37.99	0.56	100.00
	3.74	3.57	1.75	3.65
+-----+				
Gauteng	1,158	840	26	2,024
	57.21	41.50	1.28	100.00
	39.36	44.07	45.61	41.26
+-----+				
Kwazulu-Natal	375	249	15	639
	58.69	38.97	2.35	100.00

		12.75	13.06	26.32		13.03
-----+-----+-----						
Limpopo		203	99	2		304
		66.78	32.57	0.66		100.00
		6.90	5.19	3.51		6.20
-----+-----+-----						
Mpumalanga		240	126	3		369
		65.04	34.15	0.81		100.00
		8.16	6.61	5.26		7.52
-----+-----+-----						
North West		127	92	2		221
		57.47	41.63	0.90		100.00
		4.32	4.83	3.51		4.51
-----+-----+-----						
Northern Cape		44	30	3		77
		57.14	38.96	3.90		100.00
		1.50	1.57	5.26		1.57
-----+-----+-----						
Western Cape		316	233	1		550
		57.45	42.36	0.18		100.00
		10.74	12.22	1.75		11.21
-----+-----+-----						
Total		2,942	1,906	57		4,905
		59.98	38.86	1.16		100.00
		100.00	100.00	100.00		100.00

. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME, row col

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+-----+
| Key      |
|-----|
| frequency |

```

| row percentage |

| column percentage |

+-----+

TAKEN_DATE | PROVINCE_NAME
_AGE_GROUP | Eastern.. Free St.. Gauteng Kwazulu.. Limpopo Mpumala.. North W.. Norther..
Western.. | Total

+-----+

0-4	6	2	23	24	15	12	6	6	28	122
	4.92	1.64	18.85	19.67	12.30	9.84	4.92	4.92	22.95	100.00
	1.11	1.12	1.14	3.76	4.93	3.25	2.71	7.79	5.09	2.49

+-----+

10-14	4	1	14	9	4	7	0	2	4	45
	8.89	2.22	31.11	20.00	8.89	15.56	0.00	4.44	8.89	100.00
	0.74	0.56	0.69	1.41	1.32	1.90	0.00	2.60	0.73	0.92

+-----+

15-19	13	6	44	23	11	15	7	1	17	137
	9.49	4.38	32.12	16.79	8.03	10.95	5.11	0.73	12.41	100.00
	2.40	3.35	2.17	3.60	3.62	4.07	3.17	1.30	3.09	2.79

+-----+

20-24	77	25	220	122	41	45	20	4	58	612
	12.58	4.08	35.95	19.93	6.70	7.35	3.27	0.65	9.48	100.00
	14.21	13.97	10.87	19.09	13.49	12.20	9.05	5.19	10.55	12.48

+-----+

25-29	115	36	389	121	42	68	40	13	81	905
	12.71	3.98	42.98	13.37	4.64	7.51	4.42	1.44	8.95	100.00
	21.22	20.11	19.22	18.94	13.82	18.43	18.10	16.88	14.73	18.45

+-----+

30-34	104	37	425	120	50	64	47	10	106	963
	10.80	3.84	44.13	12.46	5.19	6.65	4.88	1.04	11.01	100.00
	19.19	20.67	21.00	18.78	16.45	17.34	21.27	12.99	19.27	19.63

+-----+

35-39	82	24	300	70	27	55	32	14	84	688

		11.92	3.49	43.60	10.17	3.92	7.99	4.65	2.03	12.21		100.00
		15.13	13.41	14.82	10.95	8.88	14.91	14.48	18.18	15.27		14.03
-----+-----												
40-44		65	14	216	57	30	47	25	5	50		509
		12.77	2.75	42.44	11.20	5.89	9.23	4.91	0.98	9.82		100.00
		11.99	7.82	10.67	8.92	9.87	12.74	11.31	6.49	9.09		10.38
-----+-----												
45-49		33	14	155	28	22	22	15	7	37		333
		9.91	4.20	46.55	8.41	6.61	6.61	4.50	2.10	11.11		100.00
		6.09	7.82	7.66	4.38	7.24	5.96	6.79	9.09	6.73		6.79
-----+-----												
5-9		1	2	8	1	5	1	1	3	5		27
		3.70	7.41	29.63	3.70	18.52	3.70	3.70	11.11	18.52		100.00
		0.18	1.12	0.40	0.16	1.64	0.27	0.45	3.90	0.91		0.55
-----+-----												
50-54		21	11	99	22	22	13	11	5	33		237
		8.86	4.64	41.77	9.28	9.28	5.49	4.64	2.11	13.92		100.00
		3.87	6.15	4.89	3.44	7.24	3.52	4.98	6.49	6.00		4.83
-----+-----												
55-59		9	2	56	12	14	10	7	3	21		134
		6.72	1.49	41.79	8.96	10.45	7.46	5.22	2.24	15.67		100.00
		1.66	1.12	2.77	1.88	4.61	2.71	3.17	3.90	3.82		2.73
-----+-----												
60+		12	5	64	30	21	10	10	4	26		182
		6.59	2.75	35.16	16.48	11.54	5.49	5.49	2.20	14.29		100.00
		2.21	2.79	3.16	4.69	6.91	2.71	4.52	5.19	4.73		3.71
-----+-----												
99999		0	0	11	0	0	0	0	0	0		11
		0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00		100.00
		0.00	0.00	0.54	0.00	0.00	0.00	0.00	0.00	0.00		0.22
-----+-----												
Total		542	179	2,024	639	304	369	221	77	550		4,905

		11.05	3.65	41.26	13.03	6.20	7.52	4.51	1.57	11.21		100.00
		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00

```
. count
3,003
```

```
. tab GENDER
```

GENDER	Freq.	Percent	Cum.
-----+-----			
Female	1,772	59.01	59.01
Male	1,199	39.93	98.93
Unknown	32	1.07	100.00
-----+-----			
Total	3,003	100.00	

```
. tab PROVINCE_NAME
```

PROVINCE_NAME	Freq.	Percent	Cum.
-----+-----			
Eastern Cape	389	12.95	12.95
Free State	117	3.90	16.85
Gauteng	1,346	44.82	61.67
Kwazulu-Natal	400	13.32	74.99
Limpopo	180	5.99	80.99
Mpumalanga	213	7.09	88.08
North West	119	3.96	92.04
Northern Cape	26	0.87	92.91
Western Cape	213	7.09	100.00
-----+-----			
Total	3,003	100.00	

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	Freq.	Percent	Cum.
-----+-----			
Eastern Cape_Alfred Nzo	5	0.17	0.17
Eastern Cape_Amathole	26	0.87	1.03
Eastern Cape_Buffalo City Metro	108	3.60	4.63
Eastern Cape_Chris Hani	10	0.33	4.96
Eastern Cape_Joe Gqabi	5	0.17	5.13
Eastern Cape_Nelson Mandela Bay Metro	99	3.30	8.42
Eastern Cape_O R Tambo	120	4.00	12.42
Eastern Cape_Sarah Baartman	16	0.53	12.95
Free State_Fezile Dabi	11	0.37	13.32
Free State_Lejweleputswa	29	0.97	14.29
Free State_Mangaung Metro	63	2.10	16.38
Free State_Thabo Mofutsanyana	5	0.17	16.55
Free State_Xhariep	9	0.30	16.85
Gauteng_City Of Johannesburg Metro	382	12.72	29.57
Gauteng_City Of Tshwane Metro	288	9.59	39.16
Gauteng_Ekurhuleni Metro	625	20.81	59.97
Gauteng_Sedibeng	28	0.93	60.91
Gauteng_Unknown	2	0.07	60.97
Gauteng_West Rand	21	0.70	61.67
Kwazulu-Natal_Amajuba	9	0.30	61.97
Kwazulu-Natal_Ethekewini Metro	173	5.76	67.73
Kwazulu-Natal_Harry Gwala	3	0.10	67.83
Kwazulu-Natal_Ilembe	6	0.20	68.03
Kwazulu-Natal_King Cetshwayo	5	0.17	68.20
Kwazulu-Natal_Ugu	60	2.00	70.20
Kwazulu-Natal_Umgungundlovu	110	3.66	73.86
Kwazulu-Natal_Umkhanyakude	8	0.27	74.13

Kwazulu-Natal_Umzinyathi	7	0.23	74.36
Kwazulu-Natal_Uthukela	6	0.20	74.56
Kwazulu-Natal_Uthungulu	3	0.10	74.66
Kwazulu-Natal_Zululand	10	0.33	74.99
Limpopo_Capricorn	61	2.03	77.02
Limpopo_Greater Sekhukhune	31	1.03	78.06
Limpopo_Mopani	21	0.70	78.75
Limpopo_Vhembe	32	1.07	79.82
Limpopo_Waterberg	35	1.17	80.99
Mpumalanga_Ehlanzeni	83	2.76	83.75
Mpumalanga_Gert Sibande	89	2.96	86.71
Mpumalanga_Nkangala	41	1.37	88.08
North West_Bojanala Platinum	38	1.27	89.34
North West_Dr Kenneth Kaunda	40	1.33	90.68
North West_Dr Ruth Segomotsi Mompati	7	0.23	90.91
North West_Ngaka Modiri Molema	34	1.13	92.04
Northern Cape_Frances Baard	15	0.50	92.54
Northern Cape_John Taolo Gaetsewe	1	0.03	92.57
Northern Cape_Namakwa	1	0.03	92.61
Northern Cape_Pixley Ka Seme	2	0.07	92.67
Northern Cape_Zf Mgcawu	7	0.23	92.91
Western Cape_Cape Winelands	21	0.70	93.61
Western Cape_Central Karoo	3	0.10	93.71
Western Cape_City Of Cape Town Metro	134	4.46	98.17
Western Cape_Garden Route	38	1.27	99.43
Western Cape_Overberg	8	0.27	99.70
Western Cape_West Coast	9	0.30	100.00

-----+-----
Total | 3,003 100.00

. tab TAKEN_DATE_AGE_GROUP

TAKEN_DATE_	AGE_GROUP	Freq.	Percent	Cum.

-----+-----				
0-4	23	0.77	0.77	
10-14	21	0.70	1.47	
15-19	102	3.40	4.86	
20-24	386	12.85	17.72	
25-29	568	18.91	36.63	
30-34	581	19.35	55.98	
35-39	455	15.15	71.13	
40-44	337	11.22	82.35	
45-49	204	6.79	89.14	
5-9	7	0.23	89.38	
50-54	152	5.06	94.44	
55-59	84	2.80	97.24	
60+	80	2.66	99.90	
99999	3	0.10	100.00	
-----+-----				
Total	3,003	100.00		

```
. tab TAKEN_DATE_AGE_GROUP GENDER, row col
```

```
+-----+
| Key      |
|-----|
| frequency |
| row percentage |
| column percentage |
+-----+
```

TAKEN_DATE	GENDER			
_AGE_GROUP	Female	Male	Unknown	Total

-----+-----+-----				
0-4	13	10	0	23
	56.52	43.48	0.00	100.00
	0.73	0.83	0.00	0.77
-----+-----+-----				
10-14	16	4	1	21
	76.19	19.05	4.76	100.00
	0.90	0.33	3.12	0.70
-----+-----+-----				
15-19	80	18	4	102
	78.43	17.65	3.92	100.00
	4.51	1.50	12.50	3.40
-----+-----+-----				
20-24	303	82	1	386
	78.50	21.24	0.26	100.00
	17.10	6.84	3.12	12.85
-----+-----+-----				
25-29	382	180	6	568
	67.25	31.69	1.06	100.00
	21.56	15.01	18.75	18.91
-----+-----+-----				
30-34	333	243	5	581
	57.31	41.82	0.86	100.00
	18.79	20.27	15.62	19.35
-----+-----+-----				
35-39	229	222	4	455
	50.33	48.79	0.88	100.00
	12.92	18.52	12.50	15.15
-----+-----+-----				
40-44	168	166	3	337
	49.85	49.26	0.89	100.00
	9.48	13.84	9.38	11.22

+-----+				
45-49	91	112	1	204
	44.61	54.90	0.49	100.00
	5.14	9.34	3.12	6.79
+-----+				
5-9	3	4	0	7
	42.86	57.14	0.00	100.00
	0.17	0.33	0.00	0.23
+-----+				
50-54	76	72	4	152
	50.00	47.37	2.63	100.00
	4.29	6.01	12.50	5.06
+-----+				
55-59	42	41	1	84
	50.00	48.81	1.19	100.00
	2.37	3.42	3.12	2.80
+-----+				
60+	33	45	2	80
	41.25	56.25	2.50	100.00
	1.86	3.75	6.25	2.66
+-----+				
99999	3	0	0	3
	100.00	0.00	0.00	100.00
	0.17	0.00	0.00	0.10
+-----+				
Total	1,772	1,199	32	3,003
	59.01	39.93	1.07	100.00
	100.00	100.00	100.00	100.00

. tab PROVINCE_NAME GENDER, row col

+-----+

```

| Key          |
|-----|
| frequency    |
| row percentage |
| column percentage |
+-----+

```

	GENDER			
PROVINCE_NAME	Female	Male	Unknown	Total
-----+				
Eastern Cape	260	128	1	389
	66.84	32.90	0.26	100.00
	14.67	10.68	3.12	12.95
-----+				
Free State	72	44	1	117
	61.54	37.61	0.85	100.00
	4.06	3.67	3.12	3.90
-----+				
Gauteng	790	539	17	1,346
	58.69	40.04	1.26	100.00
	44.58	44.95	53.12	44.82
-----+				
Kwazulu-Natal	240	149	11	400
	60.00	37.25	2.75	100.00
	13.54	12.43	34.38	13.32
-----+				
Limpopo	97	82	1	180
	53.89	45.56	0.56	100.00
	5.47	6.84	3.12	5.99
-----+				
Mpumalanga	127	86	0	213
	59.62	40.38	0.00	100.00

		7.17	7.17	0.00		7.09
-----+						
North West		66	53	0		119
		55.46	44.54	0.00		100.00
		3.72	4.42	0.00		3.96
-----+						
Northern Cape		17	9	0		26
		65.38	34.62	0.00		100.00
		0.96	0.75	0.00		0.87
-----+						
Western Cape		103	109	1		213
		48.36	51.17	0.47		100.00
		5.81	9.09	3.12		7.09
-----+						
Total		1,772	1,199	32		3,003
		59.01	39.93	1.07		100.00
		100.00	100.00	100.00		100.00

```
. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME, row col
```

+-----+	
	Key

	frequency
	row percentage
	column percentage
+-----+	

TAKEN_DATE	PROVINCE_NAME									
_AGE_GROUP	Eastern..	Free St..	Gauteng	Kwazulu..	Limpopo	Mpumala..	North W..	Norther..		
Western..	Total									
-----+-----+										
0-4	2	1	4	2	8	2	1	1	2	23

		8.70	4.35	17.39	8.70	34.78	8.70	4.35	4.35	8.70		100.00
		0.51	0.85	0.30	0.50	4.44	0.94	0.84	3.85	0.94		0.77
-----+-----												
10-14		0	1	8	7	1	2	0	1	1		21
		0.00	4.76	38.10	33.33	4.76	9.52	0.00	4.76	4.76		100.00
		0.00	0.85	0.59	1.75	0.56	0.94	0.00	3.85	0.47		0.70
-----+-----												
15-19		16	6	38	20	7	3	7	1	4		102
		15.69	5.88	37.25	19.61	6.86	2.94	6.86	0.98	3.92		100.00
		4.11	5.13	2.82	5.00	3.89	1.41	5.88	3.85	1.88		3.40
-----+-----												
20-24		68	20	165	64	10	29	8	3	19		386
		17.62	5.18	42.75	16.58	2.59	7.51	2.07	0.78	4.92		100.00
		17.48	17.09	12.26	16.00	5.56	13.62	6.72	11.54	8.92		12.85
-----+-----												
25-29		73	20	247	89	28	43	25	6	37		568
		12.85	3.52	43.49	15.67	4.93	7.57	4.40	1.06	6.51		100.00
		18.77	17.09	18.35	22.25	15.56	20.19	21.01	23.08	17.37		18.91
-----+-----												
30-34		73	21	270	71	29	49	28	5	35		581
		12.56	3.61	46.47	12.22	4.99	8.43	4.82	0.86	6.02		100.00
		18.77	17.95	20.06	17.75	16.11	23.00	23.53	19.23	16.43		19.35
-----+-----												
35-39		63	22	203	38	29	29	19	5	47		455
		13.85	4.84	44.62	8.35	6.37	6.37	4.18	1.10	10.33		100.00
		16.20	18.80	15.08	9.50	16.11	13.62	15.97	19.23	22.07		15.15
-----+-----												
40-44		48	12	159	39	16	18	15	2	28		337
		14.24	3.56	47.18	11.57	4.75	5.34	4.45	0.59	8.31		100.00
		12.34	10.26	11.81	9.75	8.89	8.45	12.61	7.69	13.15		11.22
-----+-----												
45-49		21	2	96	29	14	16	7	0	19		204

		10.29	0.98	47.06	14.22	6.86	7.84	3.43	0.00	9.31		100.00
		5.40	1.71	7.13	7.25	7.78	7.51	5.88	0.00	8.92		6.79
-----+-----												
5-9		0	0	3	1	1	2	0	0	0		7
		0.00	0.00	42.86	14.29	14.29	28.57	0.00	0.00	0.00		100.00
		0.00	0.00	0.22	0.25	0.56	0.94	0.00	0.00	0.00		0.23
-----+-----												
50-54		15	3	69	20	14	13	7	1	10		152
		9.87	1.97	45.39	13.16	9.21	8.55	4.61	0.66	6.58		100.00
		3.86	2.56	5.13	5.00	7.78	6.10	5.88	3.85	4.69		5.06
-----+-----												
55-59		6	6	42	8	11	5	2	1	3		84
		7.14	7.14	50.00	9.52	13.10	5.95	2.38	1.19	3.57		100.00
		1.54	5.13	3.12	2.00	6.11	2.35	1.68	3.85	1.41		2.80
-----+-----												
60+		4	3	39	12	12	2	0	0	8		80
		5.00	3.75	48.75	15.00	15.00	2.50	0.00	0.00	10.00		100.00
		1.03	2.56	2.90	3.00	6.67	0.94	0.00	0.00	3.76		2.66
-----+-----												
99999		0	0	3	0	0	0	0	0	0		3
		0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00		100.00
		0.00	0.00	0.22	0.00	0.00	0.00	0.00	0.00	0.00		0.10
-----+-----												
Total		389	117	1,346	400	180	213	119	26	213		3,003
		12.95	3.90	44.82	13.32	5.99	7.09	3.96	0.87	7.09		100.00
		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00

. count

664

. tab GENDER

GENDER	Freq.	Percent	Cum.
-----+-----			
Female	414	62.35	62.35
Male	245	36.90	99.25
Unknown	5	0.75	100.00
-----+-----			
Total	664	100.00	

. tab PROVINCE_NAME

PROVINCE_NAME	Freq.	Percent	Cum.
-----+-----			
Eastern Cape	113	17.02	17.02
Free State	17	2.56	19.58
Gauteng	284	42.77	62.35
Kwazulu-Natal	71	10.69	73.04
Limpopo	50	7.53	80.57
Mpumalanga	40	6.02	86.60
North West	20	3.01	89.61
Northern Cape	8	1.20	90.81
Western Cape	61	9.19	100.00
-----+-----			
Total	664	100.00	

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	Freq.	Percent	Cum.
-----+-----			
Eastern Cape_Alfred Nzo	1	0.15	0.15
Eastern Cape_Amathole	8	1.20	1.36
Eastern Cape_Buffalo City Metro	30	4.52	5.87

Eastern Cape_Nelson Mandela Bay Metro	16	2.41	8.28
Eastern Cape_O R Tambo	53	7.98	16.27
Eastern Cape_Sarah Baartman	5	0.75	17.02
Free State_Fezile Dabi	1	0.15	17.17
Free State_Lejweleputswa	8	1.20	18.37
Free State_Mangaung Metro	6	0.90	19.28
Free State_Thabo Mofutsanyana	1	0.15	19.43
Free State_Xhariep	1	0.15	19.58
Gauteng_City Of Johannesburg Metro	92	13.86	33.43
Gauteng_City Of Tshwane Metro	66	9.94	43.37
Gauteng_Ekurhuleni Metro	118	17.77	61.14
Gauteng_Sedibeng	3	0.45	61.60
Gauteng_West Rand	5	0.75	62.35
Kwazulu-Natal_Amajuba	1	0.15	62.50
Kwazulu-Natal_Ethekwini Metro	37	5.57	68.07
Kwazulu-Natal_Harry Gwala	1	0.15	68.22
Kwazulu-Natal_Ilembe	1	0.15	68.37
Kwazulu-Natal_Ugu	11	1.66	70.03
Kwazulu-Natal_Umgungundlovu	18	2.71	72.74
Kwazulu-Natal_Umzinyathi	1	0.15	72.89
Kwazulu-Natal_Zululand	1	0.15	73.04
Limpopo_Capricorn	32	4.82	77.86
Limpopo_Greater Sekhukhune	7	1.05	78.92
Limpopo_Mopani	4	0.60	79.52
Limpopo_Vhembe	5	0.75	80.27
Limpopo_Waterberg	2	0.30	80.57
Mpumalanga_Ehlanzeni	18	2.71	83.28
Mpumalanga_Gert Sibande	12	1.81	85.09
Mpumalanga_Nkangala	10	1.51	86.60
North West_Bojanala Platinum	4	0.60	87.20
North West_Dr Kenneth Kaunda	7	1.05	88.25
North West_Dr Ruth Segomotsi Mompati	1	0.15	88.40

North West_Ngaka Modiri Molema	8	1.20	89.61
Northern Cape_Frances Baard	6	0.90	90.51
Northern Cape_Pixley Ka Seme	1	0.15	90.66
Northern Cape_Zf Mgcawu	1	0.15	90.81
Western Cape_Cape Winelands	5	0.75	91.57
Western Cape_Central Karoo	1	0.15	91.72
Western Cape_City Of Cape Town Metro	42	6.33	98.04
Western Cape_Garden Route	10	1.51	99.55
Western Cape_Overberg	2	0.30	99.85
Western Cape_West Coast	1	0.15	100.00
-----+-----			
Total	664	100.00	

. tab TAKEN_DATE_AGE_GROUP

TAKEN_DATE_			
AGE_GROUP	Freq.	Percent	Cum.
-----+-----			
0-4	9	1.36	1.36
10-14	5	0.75	2.11
15-19	28	4.22	6.33
20-24	90	13.55	19.88
25-29	108	16.27	36.14
30-34	129	19.43	55.57
35-39	100	15.06	70.63
40-44	75	11.30	81.93
45-49	52	7.83	89.76
5-9	1	0.15	89.91
50-54	28	4.22	94.13
55-59	16	2.41	96.54
60+	23	3.46	100.00
-----+-----			

Total | 664 100.00

. tab TAKEN_DATE_AGE_GROUP GENDER, row col

+-----+
Key
frequency
row percentage
column percentage
+-----+

TAKEN_DATE	GENDER			
_AGE_GROUP	Female	Male	Unknown	Total
-----+-----+-----				
0-4	4	5	0	9
	44.44	55.56	0.00	100.00
	0.97	2.04	0.00	1.36
-----+-----+-----				
10-14	2	3	0	5
	40.00	60.00	0.00	100.00
	0.48	1.22	0.00	0.75
-----+-----+-----				
15-19	22	6	0	28
	78.57	21.43	0.00	100.00
	5.31	2.45	0.00	4.22
-----+-----+-----				
20-24	71	18	1	90
	78.89	20.00	1.11	100.00
	17.15	7.35	20.00	13.55
-----+-----+-----				
25-29	79	29	0	108

		73.15	26.85	0.00		100.00
		19.08	11.84	0.00		16.27
-----+-----+-----						
30-34		82	45	2		129
		63.57	34.88	1.55		100.00
		19.81	18.37	40.00		19.43
-----+-----+-----						
35-39		53	47	0		100
		53.00	47.00	0.00		100.00
		12.80	19.18	0.00		15.06
-----+-----+-----						
40-44		45	29	1		75
		60.00	38.67	1.33		100.00
		10.87	11.84	20.00		11.30
-----+-----+-----						
45-49		21	30	1		52
		40.38	57.69	1.92		100.00
		5.07	12.24	20.00		7.83
-----+-----+-----						
5-9		1	0	0		1
		100.00	0.00	0.00		100.00
		0.24	0.00	0.00		0.15
-----+-----+-----						
50-54		13	15	0		28
		46.43	53.57	0.00		100.00
		3.14	6.12	0.00		4.22
-----+-----+-----						
55-59		8	8	0		16
		50.00	50.00	0.00		100.00
		1.93	3.27	0.00		2.41
-----+-----+-----						
60+		13	10	0		23

		56.52	43.48	0.00		100.00
		3.14	4.08	0.00		3.46
-----+-----+-----						
Total		414	245	5		664
		62.35	36.90	0.75		100.00
		100.00	100.00	100.00		100.00

. tab PROVINCE_NAME GENDER, row col

```

+-----+
| Key      |
|-----|
| frequency |
| row percentage |
| column percentage |
+-----+

```

		GENDER			
PROVINCE_NAME		Female	Male	Unknown	Total
-----+-----+-----					
Eastern Cape		84	28	1	113
		74.34	24.78	0.88	100.00
		20.29	11.43	20.00	17.02
-----+-----+-----					
Free State		9	8	0	17
		52.94	47.06	0.00	100.00
		2.17	3.27	0.00	2.56
-----+-----+-----					
Gauteng		175	107	2	284
		61.62	37.68	0.70	100.00
		42.27	43.67	40.00	42.77
-----+-----+-----					

Kwazulu-Natal		40	29	2		71
		56.34	40.85	2.82		100.00
		9.66	11.84	40.00		10.69
-----+-----+-----						
Limpopo		28	22	0		50
		56.00	44.00	0.00		100.00
		6.76	8.98	0.00		7.53
-----+-----+-----						
Mpumalanga		28	12	0		40
		70.00	30.00	0.00		100.00
		6.76	4.90	0.00		6.02
-----+-----+-----						
North West		11	9	0		20
		55.00	45.00	0.00		100.00
		2.66	3.67	0.00		3.01
-----+-----+-----						
Northern Cape		4	4	0		8
		50.00	50.00	0.00		100.00
		0.97	1.63	0.00		1.20
-----+-----+-----						
Western Cape		35	26	0		61
		57.38	42.62	0.00		100.00
		8.45	10.61	0.00		9.19
-----+-----+-----						
Total		414	245	5		664
		62.35	36.90	0.75		100.00
		100.00	100.00	100.00		100.00

. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME, row col

+-----+

| Key |

```

|-----|
| frequency |
| row percentage |
| column percentage |
+-----+

```

```

TAKEN_DATE | PROVINCE_NAME
_AGE_GROUP | Eastern.. Free St.. Gauteng Kwazulu.. Limpopo Mpumala.. North W.. Norther..
Western.. | Total

```

0-4	0	0	4	1	1	2	0	1	0	9	
	0.00	0.00	44.44	11.11	11.11	22.22	0.00	11.11	0.00	100.00	
	0.00	0.00	1.41	1.41	2.00	5.00	0.00	12.50	0.00	1.36	
10-14	1	0	3	1	0	0	0	0	0	5	
	20.00	0.00	60.00	20.00	0.00	0.00	0.00	0.00	0.00	100.00	
	0.88	0.00	1.06	1.41	0.00	0.00	0.00	0.00	0.00	0.75	
15-19	4	2	13	4	2	2	0	1	0	28	
	14.29	7.14	46.43	14.29	7.14	7.14	0.00	3.57	0.00	100.00	
	3.54	11.76	4.58	5.63	4.00	5.00	0.00	12.50	0.00	4.22	
20-24	20	4	35	8	11	6	0	0	6	90	
	22.22	4.44	38.89	8.89	12.22	6.67	0.00	0.00	6.67	100.00	
	17.70	23.53	12.32	11.27	22.00	15.00	0.00	0.00	9.84	13.55	
25-29	24	2	39	14	5	6	3	1	14	108	
	22.22	1.85	36.11	12.96	4.63	5.56	2.78	0.93	12.96	100.00	
	21.24	11.76	13.73	19.72	10.00	15.00	15.00	12.50	22.95	16.27	
30-34	25	2	56	19	7	5	2	1	12	129	
	19.38	1.55	43.41	14.73	5.43	3.88	1.55	0.78	9.30	100.00	
	22.12	11.76	19.72	26.76	14.00	12.50	10.00	12.50	19.67	19.43	

35-39	18	2	51	5	5	6	7	0	6	100
	18.00	2.00	51.00	5.00	5.00	6.00	7.00	0.00	6.00	100.00
	15.93	11.76	17.96	7.04	10.00	15.00	35.00	0.00	9.84	15.06
40-44	10	2	32	7	6	5	3	1	9	75
	13.33	2.67	42.67	9.33	8.00	6.67	4.00	1.33	12.00	100.00
	8.85	11.76	11.27	9.86	12.00	12.50	15.00	12.50	14.75	11.30
45-49	5	2	19	3	6	4	3	1	9	52
	9.62	3.85	36.54	5.77	11.54	7.69	5.77	1.92	17.31	100.00
	4.42	11.76	6.69	4.23	12.00	10.00	15.00	12.50	14.75	7.83
5-9	0	0	0	0	0	1	0	0	0	1
	0.00	0.00	0.00	0.00	0.00	100.00	0.00	0.00	0.00	100.00
	0.00	0.00	0.00	0.00	0.00	2.50	0.00	0.00	0.00	0.15
50-54	2	1	15	2	0	3	1	1	3	28
	7.14	3.57	53.57	7.14	0.00	10.71	3.57	3.57	10.71	100.00
	1.77	5.88	5.28	2.82	0.00	7.50	5.00	12.50	4.92	4.22
55-59	2	0	6	4	2	0	0	1	1	16
	12.50	0.00	37.50	25.00	12.50	0.00	0.00	6.25	6.25	100.00
	1.77	0.00	2.11	5.63	4.00	0.00	0.00	12.50	1.64	2.41
60+	2	0	11	3	5	0	1	0	1	23
	8.70	0.00	47.83	13.04	21.74	0.00	4.35	0.00	4.35	100.00
	1.77	0.00	3.87	4.23	10.00	0.00	5.00	0.00	1.64	3.46
Total	113	17	284	71	50	40	20	8	61	664
	17.02	2.56	42.77	10.69	7.53	6.02	3.01	1.20	9.19	100.00
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

100.00

```
. count
```

```
73
```

```
. tab GENDER
```

GENDER	Freq.	Percent	Cum.
-----+-----			
Female	42	57.53	57.53
Male	31	42.47	100.00
-----+-----			
Total	73	100.00	

```
. tab PROVINCE_NAME
```

PROVINCE_NAME	Freq.	Percent	Cum.
-----+-----			
Eastern Cape	11	15.07	15.07
Free State	1	1.37	16.44
Gauteng	30	41.10	57.53
Kwazulu-Natal	10	13.70	71.23
Limpopo	7	9.59	80.82
Mpumalanga	2	2.74	83.56
North West	1	1.37	84.93
Northern Cape	1	1.37	86.30
Western Cape	10	13.70	100.00
-----+-----			
Total	73	100.00	

```
. tab PROVINCE_DISTRICT
```

PROVINCE_DISTRICT	Freq.	Percent	Cum.
-----+-----			
Eastern Cape_Amathole	2	2.74	2.74
Eastern Cape_Buffalo City Metro	2	2.74	5.48
Eastern Cape_Nelson Mandela Bay Metro	3	4.11	9.59
Eastern Cape_O R Tambo	4	5.48	15.07
Free State_Fezile Dabi	1	1.37	16.44
Gauteng_City Of Johannesburg Metro	13	17.81	34.25
Gauteng_City Of Tshwane Metro	7	9.59	43.84
Gauteng_Ekurhuleni Metro	6	8.22	52.05
Gauteng_Sedibeng	3	4.11	56.16
Gauteng_West Rand	1	1.37	57.53
Kwazulu-Natal_Ethekwini Metro	7	9.59	67.12
Kwazulu-Natal_Ugu	2	2.74	69.86
Kwazulu-Natal_Umgungundlovu	1	1.37	71.23
Limpopo_Capricorn	1	1.37	72.60
Limpopo_Greater Sekhukhune	3	4.11	76.71
Limpopo_Mopani	2	2.74	79.45
Limpopo_Waterberg	1	1.37	80.82
Mpumalanga_Ehlanzeni	2	2.74	83.56
North West_Ngaka Modiri Molema	1	1.37	84.93
Northern Cape_Frances Baard	1	1.37	86.30
Western Cape_Cape Winelands	2	2.74	89.04
Western Cape_City Of Cape Town Metro	6	8.22	97.26
Western Cape_Garden Route	2	2.74	100.00
-----+-----			
Total	73	100.00	

. tab TAKEN_DATE_AGE_GROUP

TAKEN_DATE_ |

AGE_GROUP | Freq. Percent Cum.

+-----+			
15-19	1	1.37	1.37
20-24	8	10.96	12.33
25-29	13	17.81	30.14
30-34	13	17.81	47.95
35-39	13	17.81	65.75
40-44	11	15.07	80.82
45-49	4	5.48	86.30
5-9	1	1.37	87.67
50-54	5	6.85	94.52
55-59	2	2.74	97.26
60+	2	2.74	100.00
+-----+			
Total	73	100.00	

. tab TAKEN_DATE_AGE_GROUP GENDER, row col

```
+-----+
| Key      |
|-----|
| frequency |
| row percentage |
| column percentage |
+-----+
```

TAKEN_DATE	GENDER		
_AGE_GROUP	Female	Male	Total
+-----+			
15-19	1	0	1
	100.00	0.00	100.00
	2.38	0.00	1.37
+-----+			

20-24		5	3		8
		62.50	37.50		100.00
		11.90	9.68		10.96
-----+-----+-----					
25-29		10	3		13
		76.92	23.08		100.00
		23.81	9.68		17.81
-----+-----+-----					
30-34		9	4		13
		69.23	30.77		100.00
		21.43	12.90		17.81
-----+-----+-----					
35-39		5	8		13
		38.46	61.54		100.00
		11.90	25.81		17.81
-----+-----+-----					
40-44		4	7		11
		36.36	63.64		100.00
		9.52	22.58		15.07
-----+-----+-----					
45-49		3	1		4
		75.00	25.00		100.00
		7.14	3.23		5.48
-----+-----+-----					
5-9		1	0		1
		100.00	0.00		100.00
		2.38	0.00		1.37
-----+-----+-----					
50-54		2	3		5
		40.00	60.00		100.00
		4.76	9.68		6.85
-----+-----+-----					

55-59		1	1		2
		50.00	50.00		100.00
		2.38	3.23		2.74
-----+-----+-----					
60+		1	1		2
		50.00	50.00		100.00
		2.38	3.23		2.74
-----+-----+-----					
Total		42	31		73
		57.53	42.47		100.00
		100.00	100.00		100.00

```
. tab PROVINCE_NAME GENDER, row col
```

+-----+					
	Key				

	frequency				
	row percentage				
	column percentage				
+-----+					
		GENDER			
PROVINCE_NAME		Female	Male		Total
-----+-----+-----					
Eastern Cape		7	4		11
		63.64	36.36		100.00
		16.67	12.90		15.07
-----+-----+-----					
Free State		1	0		1
		100.00	0.00		100.00
		2.38	0.00		1.37

-----+-----+-----			
Gauteng	18	12	30
	60.00	40.00	100.00
	42.86	38.71	41.10
-----+-----+-----			
Kwazulu-Natal	5	5	10
	50.00	50.00	100.00
	11.90	16.13	13.70
-----+-----+-----			
Limpopo	5	2	7
	71.43	28.57	100.00
	11.90	6.45	9.59
-----+-----+-----			
Mpumalanga	2	0	2
	100.00	0.00	100.00
	4.76	0.00	2.74
-----+-----+-----			
North West	0	1	1
	0.00	100.00	100.00
	0.00	3.23	1.37
-----+-----+-----			
Northern Cape	0	1	1
	0.00	100.00	100.00
	0.00	3.23	1.37
-----+-----+-----			
Western Cape	4	6	10
	40.00	60.00	100.00
	9.52	19.35	13.70
-----+-----+-----			
Total	42	31	73
	57.53	42.47	100.00
	100.00	100.00	100.00

```
. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME, row col
```

```
+-----+
| Key      |
|-----|
| frequency |
| row percentage |
| column percentage |
+-----+
```

```
TAKEN_DATE | PROVINCE_NAME
_AGE_GROUP | Eastern.. Free St.. Gauteng Kwazulu.. Limpopo Mpumala.. North W.. Norther..
Western.. | Total
```

```
-----+-----+
15-19 | 0 0 0 0 0 0 0 0 0 1 | 1
      | 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 100.00 | 100.00
      | 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 0.00 10.00 | 1.37
-----+-----+
20-24 | 3 0 2 2 0 0 0 0 0 1 | 8
      | 37.50 0.00 25.00 25.00 0.00 0.00 0.00 0.00 0.00 12.50 | 100.00
      | 27.27 0.00 6.67 20.00 0.00 0.00 0.00 0.00 0.00 10.00 | 10.96
-----+-----+
25-29 | 2 0 3 4 2 1 0 0 0 1 | 13
      | 15.38 0.00 23.08 30.77 15.38 7.69 0.00 0.00 0.00 7.69 | 100.00
      | 18.18 0.00 10.00 40.00 28.57 50.00 0.00 0.00 0.00 10.00 | 17.81
-----+-----+
30-34 | 0 0 9 0 1 1 0 0 0 2 | 13
      | 0.00 0.00 69.23 0.00 7.69 7.69 0.00 0.00 0.00 15.38 | 100.00
      | 0.00 0.00 30.00 0.00 14.29 50.00 0.00 0.00 0.00 20.00 | 17.81
-----+-----+
35-39 | 2 0 7 2 1 0 1 0 0 0 | 13
      | 15.38 0.00 53.85 15.38 7.69 0.00 7.69 0.00 0.00 0.00 | 100.00
```

		18.18	0.00	23.33	20.00	14.29	0.00	100.00	0.00	0.00		17.81
-----+-----												
40-44		3	0	3	1	2	0	0	0	2		11
		27.27	0.00	27.27	9.09	18.18	0.00	0.00	0.00	18.18		100.00
		27.27	0.00	10.00	10.00	28.57	0.00	0.00	0.00	20.00		15.07
-----+-----												
45-49		1	0	3	0	0	0	0	0	0		4
		25.00	0.00	75.00	0.00	0.00	0.00	0.00	0.00	0.00		100.00
		9.09	0.00	10.00	0.00	0.00	0.00	0.00	0.00	0.00		5.48
-----+-----												
5-9		0	0	1	0	0	0	0	0	0		1
		0.00	0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00		100.00
		0.00	0.00	3.33	0.00	0.00	0.00	0.00	0.00	0.00		1.37
-----+-----												
50-54		0	0	2	1	0	0	0	1	1		5
		0.00	0.00	40.00	20.00	0.00	0.00	0.00	20.00	20.00		100.00
		0.00	0.00	6.67	10.00	0.00	0.00	0.00	100.00	10.00		6.85
-----+-----												
55-59		0	1	0	0	0	0	0	0	1		2
		0.00	50.00	0.00	0.00	0.00	0.00	0.00	0.00	50.00		100.00
		0.00	100.00	0.00	0.00	0.00	0.00	0.00	0.00	10.00		2.74
-----+-----												
60+		0	0	0	0	1	0	0	0	1		2
		0.00	0.00	0.00	0.00	50.00	0.00	0.00	0.00	50.00		100.00
		0.00	0.00	0.00	0.00	14.29	0.00	0.00	0.00	10.00		2.74
-----+-----												
Total		11	1	30	10	7	2	1	1	10		73
		15.07	1.37	41.10	13.70	9.59	2.74	1.37	1.37	13.70		100.00
		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00

100.00

Appendix 3.7: Stata log file of HBeAg Total Tested and Positive Registries

```
. use "2015-2019_HepatitisB_All_Records.dta",clear
```

```
. count
```

```
6,315,380
```

```
. tab HEPATITIS_B_E_AG
```

```
HEPATITIS_B_ |
```

E_AG	Freq.	Percent	Cum.
-----+-----			
EQUIVOCAL	647	0.01	0.01
LOW POSITIVE	10	0.00	0.01
NEGATIVE	72,781	1.15	1.16
NULL	6,207,946	98.30	99.46
POSITIVE	33,995	0.54	100.00
UNKNOWN	1	0.00	100.00
-----+-----			
Total	6,315,380	100.00	

```
. keep if HEPATITIS_B_E_AG=="EQUIVOCAL" | HEPATITIS_B_E_AG=="LOW POSITIVE" |  
HEPATITIS_B_E_AG=="POSITIVE" | HEPATITIS_B_E_AG=="NEGATIVE"
```

```
(6,207,947 observations deleted)
```

```
. tab HEPATITIS_B_E_AG
```

```
HEPATITIS_B_ |
```

E_AG	Freq.	Percent	Cum.
-----+-----			
EQUIVOCAL	647	0.60	0.60
LOW POSITIVE	10	0.01	0.61

NEGATIVE	72,781	67.75	68.36

POSITIVE	33,995	31.64	100.00

-----+-----

Total	107,433	100.00	

. preserve

. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBeAg_Valid_Records.dta"

file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBeAg_Valid_Records.dta saved

. do "Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD
Output files_SM081020\Files_Chapter3\26-09-23\Deduplication_Commands.do"

. capture noisily duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force

Duplicates in terms of UNIQUE_PATIENT_ID

(22,970 observations deleted)

. capture noisily duplicates drop DOB HOSPITAL_ID FACILITY_NAME if UNIQUE_PATIENT_ID ==-1,
force

no observations

end of do-file

. count

84,463

. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBeAg_All_cases.dta"

file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBeAg_All_cases.dta saved

. use "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBeAg_Valid_Records.dta"


```
. keep if HEPATITIS_B_E_AG=="LOW POSITIVE" | HEPATITIS_B_E_AG=="POSITIVE"
(73,428 observations deleted)
```

```
. tab HEPATITIS_B_E_AG
```

```
HEPATITIS_B_ |
  E_AG |   Freq.   Percent   Cum.
-----+-----
LOW POSITIVE |     10     0.03     0.03
  POSITIVE |  33,995    99.97   100.00
-----+-----
      Total |  34,005   100.00
```

```
. do "Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD
Output files_SM081020\Files_Chapter3\26-09-23\Deduplication_Commands.do"
```

```
. capture noisily duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force
```

```
Duplicates in terms of UNIQUE_PATIENT_ID
```

```
(8,209 observations deleted)
```

```
. capture noisily duplicates drop DOB HOSPITAL_ID FACILITY_NAME if UNIQUE_PATIENT_ID ==-1,
force
```

```
no observations
```

```
.
```

```
end of do-file
```

```
. count
```

```
25,796
```

```
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBeAg_Positive_Cases.dta"
```

```
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBeAg_Positive_Cases.dta  
saved
```

```
. use "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBeAg_All_cases.dta"
```

```
. tab GENDER
```

GENDER	Freq.	Percent	Cum.
-----+-----			
F	38,910	46.07	46.07
M	43,856	51.92	97.99
U	1,697	2.01	100.00
-----+-----			
Total	84,463	100.00	

```
.
```

```
. tab PROVINCE_NAME
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PROVINCE_NAME	Freq.	Percent	Cum.
-----+-----			
EASTERN CAPE	9,171	10.86	10.86
FREE STATE	2,137	2.53	13.39
GAUTENG	14,457	17.12	30.50
KWAZULU-NATAL	39,667	46.96	77.47
LIMPOPO	1,216	1.44	78.91
MPUMALANGA	10,546	12.49	91.39
NORTH WEST	2,225	2.63	94.03
NORTHERN CAPE	201	0.24	94.27
WESTERN CAPE	4,843	5.73	100.00
-----+-----			
Total	84,463	100.00	

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	Freq.	Percent	Cum.	
-----+-----				
EASTERN CAPE_ALFRED NZO	851	1.01	1.01	
EASTERN CAPE_AMATHOLE	1,003	1.19	2.20	
EASTERN CAPE_BUFFALO CITY METRO	153	0.18	2.38	
EASTERN CAPE_CHRIS HANI	400	0.47	2.85	
EASTERN CAPE_JOE GQABI	129	0.15	3.00	
EASTERN CAPE_NELSON MANDELA BAY METRO	1,959	2.32	5.32	
EASTERN CAPE_NOT APPLICABLE	1	0.00	5.32	
EASTERN CAPE_O R TAMBO	4,055	4.80	10.12	
EASTERN CAPE_SARAH BAARTMAN	620	0.73	10.86	
FREE STATE_FEZILE DABI	802	0.95	11.81	
FREE STATE_LEJWELEPUTSWA	334	0.40	12.20	
FREE STATE_MANGAUNG METRO	877	1.04	13.24	
FREE STATE_THABO MOFUTSANYANA	111	0.13	13.37	
FREE STATE_UNKNOWN	1	0.00	13.37	
FREE STATE_XHARIEP	12	0.01	13.39	
GAUTENG_CITY OF JOHANNESBURG METRO	7,065	8.36	21.75	
GAUTENG_CITY OF TSHWANE METRO	4,229	5.01	26.76	
GAUTENG_EKURHULENI METRO	2,478	2.93	29.69	
GAUTENG_SEDIBENG	262	0.31	30.00	
GAUTENG_UNKNOWN	10	0.01	30.02	
GAUTENG_WEST RAND	413	0.49	30.50	
KWAZULU-NATAL_AMAJUBA	1,072	1.27	31.77	
KWAZULU-NATAL_ETHEKWINI METRO	18,271	21.63	53.41	
KWAZULU-NATAL_HARRY GWALA	611	0.72	54.13	
KWAZULU-NATAL_ILEMBE	1,259	1.49	55.62	
KWAZULU-NATAL_KING CETSHWAYO	922	1.09	56.71	
KWAZULU-NATAL_UGU	4,192	4.96	61.67	

KWAZULU-NATAL_UMGUNGUNDLOVU	7,977	9.44	71.12
KWAZULU-NATAL_UMKHANYAKUDE	2,002	2.37	73.49
KWAZULU-NATAL_UMZINYATHI	743	0.88	74.37
KWAZULU-NATAL_UNKNOWN	5	0.01	74.37
KWAZULU-NATAL_UTHUKELA	587	0.69	75.07
KWAZULU-NATAL_UTHUNGULU	695	0.82	75.89
KWAZULU-NATAL_ZULULAND	1,331	1.58	77.47
LIMPOPO_CAPRICORN	205	0.24	77.71
LIMPOPO_GREATER SEKHUKHUNE	368	0.44	78.15
LIMPOPO_MOPANI	46	0.05	78.20
LIMPOPO_VHEMBE	293	0.35	78.55
LIMPOPO_WATERBERG	304	0.36	78.91
MPUMALANGA_EHLANZENI	3,520	4.17	83.08
MPUMALANGA_GERT SIBANDE	3,803	4.50	87.58
MPUMALANGA_NKANGALA	3,223	3.82	91.39
NORTH WEST_BOJANALA PLATINUM	282	0.33	91.73
NORTH WEST_DR KENNETH KAUNDA	1,159	1.37	93.10
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	382	0.45	93.55
NORTH WEST_NGAKA MODIRI MOLEMA	402	0.48	94.03
NORTHERN CAPE_FRANCES BAARD	96	0.11	94.14
NORTHERN CAPE_JOHN TAOLO GAETSEWE	4	0.00	94.15
NORTHERN CAPE_NAMAKWA	32	0.04	94.18
NORTHERN CAPE_PIXLEY KA SEME	10	0.01	94.20
NORTHERN CAPE_ZF MGCAWU	59	0.07	94.27
WESTERN CAPE_CAPE WINELANDS	499	0.59	94.86
WESTERN CAPE_CENTRAL KAROO	5	0.01	94.86
WESTERN CAPE_CITY OF CAPE TOWN METRO	3,971	4.70	99.56
WESTERN CAPE_GARDEN ROUTE	118	0.14	99.70
WESTERN CAPE_NOT APPLICABLE	16	0.02	99.72
WESTERN CAPE_OVERBERG	78	0.09	99.82
WESTERN CAPE_UNKNOWN	3	0.00	99.82
WESTERN CAPE_WEST COAST	153	0.18	100.00

-----+-----			
Total	84,463	100.00	

.

. tab TAKEN_DATE_AGE_GROUP

RECODE of |

AGE_TAKEN_D |

ATE_YEARS | Freq. Percent Cum.

-----+-----			
'0-4	744	0.88	0.88
'5-9	342	0.40	1.29
'10-14	554	0.66	1.94
'15-19	1,763	2.09	4.03
'20-24	6,841	8.10	12.13
'25-29	13,287	15.73	27.86
'30-34	15,524	18.38	46.24
'35-39	13,175	15.60	61.84
'40-44	10,008	11.85	73.69
'45-49	6,739	7.98	81.67
'50-54	4,518	5.35	87.01
'55-59	3,085	3.65	90.67
'60+	4,401	5.21	95.88
99999	3,482	4.12	100.00
-----+-----			
Total	84,463	100.00	

.

. tab TAKEN_DATE_AGE_GROUP GENDER, row col

+-----+

| Key |

|-----|
| frequency |
| row percentage |
| column percentage |
+-----+

RECODE of				
AGE_TAKEN_		GENDER		
DATE_YEARS	F	M	U	Total
-----+-----+				
'0-4	351	366	27	744
	47.18	49.19	3.63	100.00
	0.90	0.83	1.59	0.88
-----+-----+				
'5-9	170	157	15	342
	49.71	45.91	4.39	100.00
	0.44	0.36	0.88	0.40
-----+-----+				
'10-14	310	224	20	554
	55.96	40.43	3.61	100.00
	0.80	0.51	1.18	0.66
-----+-----+				
'15-19	1,255	473	35	1,763
	71.19	26.83	1.99	100.00
	3.23	1.08	2.06	2.09
-----+-----+				
'20-24	4,564	2,130	147	6,841
	66.72	31.14	2.15	100.00
	11.73	4.86	8.66	8.10
-----+-----+				
'25-29	7,279	5,746	262	13,287
	54.78	43.25	1.97	100.00

		18.71	13.10	15.44		15.73
-----+-----+-----						
'30-34		6,988	8,284	252		15,524
		45.01	53.36	1.62		100.00
		17.96	18.89	14.85		18.38
-----+-----+-----						
'35-39		5,200	7,757	218		13,175
		39.47	58.88	1.65		100.00
		13.36	17.69	12.85		15.60
-----+-----+-----						
'40-44		3,688	6,169	151		10,008
		36.85	61.64	1.51		100.00
		9.48	14.07	8.90		11.85
-----+-----+-----						
'45-49		2,496	4,127	116		6,739
		37.04	61.24	1.72		100.00
		6.41	9.41	6.84		7.98
-----+-----+-----						
'50-54		1,896	2,559	63		4,518
		41.97	56.64	1.39		100.00
		4.87	5.84	3.71		5.35
-----+-----+-----						
'55-59		1,272	1,766	47		3,085
		41.23	57.24	1.52		100.00
		3.27	4.03	2.77		3.65
-----+-----+-----						
'60+		2,027	2,298	76		4,401
		46.06	52.22	1.73		100.00
		5.21	5.24	4.48		5.21
-----+-----+-----						
99999		1,414	1,800	268		3,482
		40.61	51.69	7.70		100.00

		3.63	4.10	15.79		4.12
-----+						
Total		38,910	43,856	1,697		84,463
		46.07	51.92	2.01		100.00
		100.00	100.00	100.00		100.00

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.
. tab PROVINCE_NAME GENDER, row col

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+-----+	
Key	

frequency	
row percentage	
column percentage	
+-----+	

		GENDER			
PROVINCE_NAME		F	M	U	Total
-----+					
EASTERN CAPE		4,570	4,510	91	9,171
		49.83	49.18	0.99	100.00
		11.75	10.28	5.36	10.86
-----+					
FREE STATE		888	1,244	5	2,137
		41.55	58.21	0.23	100.00
		2.28	2.84	0.29	2.53
-----+					
GAUTENG		7,030	7,212	215	14,457
		48.63	49.89	1.49	100.00
		18.07	16.44	12.67	17.12
-----+					

KWAZULU-NATAL		17,555	20,907	1,205		39,667
		44.26	52.71	3.04		100.00
		45.12	47.67	71.01		46.96
-----+-----+-----						
LIMPOPO		601	606	9		1,216
		49.42	49.84	0.74		100.00
		1.54	1.38	0.53		1.44
-----+-----+-----						
MPUMALANGA		5,104	5,322	120		10,546
		48.40	50.46	1.14		100.00
		13.12	12.14	7.07		12.49
-----+-----+-----						
NORTH WEST		1,146	1,061	18		2,225
		51.51	47.69	0.81		100.00
		2.95	2.42	1.06		2.63
-----+-----+-----						
NORTHERN CAPE		95	104	2		201
		47.26	51.74	1.00		100.00
		0.24	0.24	0.12		0.24
-----+-----+-----						
WESTERN CAPE		1,921	2,890	32		4,843
		39.67	59.67	0.66		100.00
		4.94	6.59	1.89		5.73
-----+-----+-----						
Total		38,910	43,856	1,697		84,463
		46.07	51.92	2.01		100.00
		100.00	100.00	100.00		100.00

.

. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME, row col

+-----+

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| Key          |
|-----|
| frequency    |
| row percentage |
| column percentage |
+-----+

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RECODE of |

AGE_TAKEN_ | PROVINCE_NAME

DATE_YEARS | EASTERN.. FREE ST.. GAUTENG KWAZULU.. LIMPOPO MPUMALA.. NORTH W..
NORTHER.. WESTERN.. | Total

'0-4	52	6	165	389	9	55	18	3	47	744	
	6.99	0.81	22.18	52.28	1.21	7.39	2.42	0.40	6.32	100.00	
	0.57	0.28	1.14	0.98	0.74	0.52	0.81	1.49	0.97	0.88	
'5-9	16	7	92	168	2	32	13	1	11	342	
	4.68	2.05	26.90	49.12	0.58	9.36	3.80	0.29	3.22	100.00	
	0.17	0.33	0.64	0.42	0.16	0.30	0.58	0.50	0.23	0.40	
'10-14	34	4	114	294	6	65	20	1	16	554	
	6.14	0.72	20.58	53.07	1.08	11.73	3.61	0.18	2.89	100.00	
	0.37	0.19	0.79	0.74	0.49	0.62	0.90	0.50	0.33	0.66	
'15-19	209	23	258	867	21	247	79	5	54	1,763	
	11.85	1.30	14.63	49.18	1.19	14.01	4.48	0.28	3.06	100.00	
	2.28	1.08	1.78	2.19	1.73	2.34	3.55	2.49	1.12	2.09	
'20-24	843	139	848	3,533	72	936	151	16	303	6,841	
	12.32	2.03	12.40	51.64	1.05	13.68	2.21	0.23	4.43	100.00	
	9.19	6.50	5.87	8.91	5.92	8.88	6.79	7.96	6.26	8.10	
'25-29	1,443	311	1,730	7,063	158	1,706	264	21	591	13,287	

		10.86	2.34	13.02	53.16	1.19	12.84	1.99	0.16	4.45		100.00
		15.73	14.55	11.97	17.81	12.99	16.18	11.87	10.45	12.20		15.73
-----+-----												
'30-34		1,641	386	2,106	7,965	173	2,071	335	30	817		15,524
		10.57	2.49	13.57	51.31	1.11	13.34	2.16	0.19	5.26		100.00
		17.89	18.06	14.57	20.08	14.23	19.64	15.06	14.93	16.87		18.38
-----+-----												
'35-39		1,375	368	2,051	6,346	170	1,696	330	22	817		13,175
		10.44	2.79	15.57	48.17	1.29	12.87	2.50	0.17	6.20		100.00
		14.99	17.22	14.19	16.00	13.98	16.08	14.83	10.95	16.87		15.60
-----+-----												
'40-44		1,064	320	1,721	4,526	172	1,246	294	26	639		10,008
		10.63	3.20	17.20	45.22	1.72	12.45	2.94	0.26	6.38		100.00
		11.60	14.97	11.90	11.41	14.14	11.81	13.21	12.94	13.19		11.85
-----+-----												
'45-49		742	237	1,364	2,741	141	773	218	28	495		6,739
		11.01	3.52	20.24	40.67	2.09	11.47	3.23	0.42	7.35		100.00
		8.09	11.09	9.43	6.91	11.60	7.33	9.80	13.93	10.22		7.98
-----+-----												
'50-54		545	143	893	1,772	86	525	167	17	370		4,518
		12.06	3.17	19.77	39.22	1.90	11.62	3.70	0.38	8.19		100.00
		5.94	6.69	6.18	4.47	7.07	4.98	7.51	8.46	7.64		5.35
-----+-----												
'55-59		372	90	665	1,148	76	312	130	10	282		3,085
		12.06	2.92	21.56	37.21	2.46	10.11	4.21	0.32	9.14		100.00
		4.06	4.21	4.60	2.89	6.25	2.96	5.84	4.98	5.82		3.65
-----+-----												
'60+		617	96	954	1,829	104	321	174	17	289		4,401
		14.02	2.18	21.68	41.56	2.36	7.29	3.95	0.39	6.57		100.00
		6.73	4.49	6.60	4.61	8.55	3.04	7.82	8.46	5.97		5.21
-----+-----												
99999		218	7	1,496	1,026	26	561	32	4	112		3,482

		6.26	0.20	42.96	29.47	0.75	16.11	0.92	0.11	3.22		100.00
		2.38	0.33	10.35	2.59	2.14	5.32	1.44	1.99	2.31		4.12
-----+-----												
Total		9,171	2,137	14,457	39,667	1,216	10,546	2,225	201	4,843		
		84,463										
		10.86	2.53	17.12	46.96	1.44	12.49	2.63	0.24	5.73		100.00
		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00
		100.00										

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. use "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_HBeAg_Positive_Cases.dta"
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. tab GENDER
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GENDER		Freq.	Percent	Cum.
-----+-----				
F		10,554	40.91	40.91
M		14,712	57.03	97.95
U		530	2.05	100.00
-----+-----				
Total		25,796	100.00	

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.
. tab PROVINCE_NAME
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PROVINCE_NAME		Freq.	Percent	Cum.
-----+-----				
EASTERN CAPE		2,458	9.53	9.53
FREE STATE		1,110	4.30	13.83
GAUTENG		3,170	12.29	26.12
KWAZULU-NATAL		13,738	53.26	79.38
LIMPOPO		303	1.17	80.55
MPUMALANGA		3,278	12.71	93.26
NORTH WEST		396	1.54	94.79

NORTHERN CAPE	48	0.19	94.98	
WESTERN CAPE	1,295	5.02	100.00	
-----+-----				
Total	25,796	100.00		
.				
. tab PROVINCE_DISTRICT				
PROVINCE_DISTRICT	Freq.	Percent	Cum.	
-----+-----				
EASTERN CAPE_ALFRED NZO	211	0.82	0.82	
EASTERN CAPE_AMATHOLE	326	1.26	2.08	
EASTERN CAPE_BUFFALO CITY METRO	49	0.19	2.27	
EASTERN CAPE_CHRIS HANI	105	0.41	2.68	
EASTERN CAPE_JOE GQABI	42	0.16	2.84	
EASTERN CAPE_NELSON MANDELA BAY METRO	610	2.36	5.21	
EASTERN CAPE_O R TAMBO	952	3.69	8.90	
EASTERN CAPE_SARAH BAARTMAN	163	0.63	9.53	
FREE STATE_FEZILE DABI	459	1.78	11.31	
FREE STATE_LEJWELEPUTSWA	184	0.71	12.02	
FREE STATE_MANGAUNG METRO	392	1.52	13.54	
FREE STATE_THABO MOFUTSANYANA	72	0.28	13.82	
FREE STATE_XHARIEP	3	0.01	13.83	
GAUTENG_CITY OF JOHANNESBURG METRO	1,556	6.03	19.86	
GAUTENG_CITY OF TSHWANE METRO	1,378	5.34	25.21	
GAUTENG_EKURHULENI METRO	158	0.61	25.82	
GAUTENG_SEDIBENG	22	0.09	25.90	
GAUTENG_UNKNOWN	1	0.00	25.91	
GAUTENG_WEST RAND	55	0.21	26.12	
KWAZULU-NATAL_AMAJUBA	484	1.88	28.00	
KWAZULU-NATAL_ETHEKWINI METRO	6,178	23.95	51.95	
KWAZULU-NATAL_HARRY GWALA	248	0.96	52.91	

KWAZULU-NATAL_ILEMBE	500	1.94	54.85
KWAZULU-NATAL_KING CETSHWAYO	295	1.14	55.99
KWAZULU-NATAL_UGU	1,359	5.27	61.26
KWAZULU-NATAL_UMGUNGUNDLOVU	3,101	12.02	73.28
KWAZULU-NATAL_UMKHANYAKUDE	425	1.65	74.93
KWAZULU-NATAL_UMZINYATHI	230	0.89	75.82
KWAZULU-NATAL_UNKNOWN	3	0.01	75.83
KWAZULU-NATAL_UTHUKELA	253	0.98	76.81
KWAZULU-NATAL_UTHUNGULU	229	0.89	77.70
KWAZULU-NATAL_ZULULAND	433	1.68	79.38
LIMPOPO_CAPRICORN	46	0.18	79.55
LIMPOPO_GREATER SEKHUKHUNE	100	0.39	79.94
LIMPOPO_MOPANI	12	0.05	79.99
LIMPOPO_VHEMBE	61	0.24	80.23
LIMPOPO_WATERBERG	84	0.33	80.55
MPUMALANGA_EHLANZENI	889	3.45	84.00
MPUMALANGA_GERT SIBANDE	1,529	5.93	89.92
MPUMALANGA_NKANGALA	860	3.33	93.26
NORTH WEST_BOJANALA PLATINUM	66	0.26	93.51
NORTH WEST_DR KENNETH KAUNDA	193	0.75	94.26
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	100	0.39	94.65
NORTH WEST_NGAKA MODIRI MOLEMA	37	0.14	94.79
NORTHERN CAPE_FRANCES BAARD	20	0.08	94.87
NORTHERN CAPE_NAMAKWA	11	0.04	94.91
NORTHERN CAPE_PIXLEY KA SEME	2	0.01	94.92
NORTHERN CAPE_ZF MGCAWU	15	0.06	94.98
WESTERN CAPE_CAPE WINELANDS	153	0.59	95.57
WESTERN CAPE_CENTRAL KAROO	1	0.00	95.58
WESTERN CAPE_CITY OF CAPE TOWN METRO	1,048	4.06	99.64
WESTERN CAPE_GARDEN ROUTE	17	0.07	99.71
WESTERN CAPE_NOT APPLICABLE	6	0.02	99.73
WESTERN CAPE_OVERBERG	29	0.11	99.84

WESTERN CAPE_ WEST COAST	41	0.16	100.00
-----+-----			
Total	25,796	100.00	

.
.tab TAKEN_DATE_AGE_GROUP

RECODE of			
AGE_TAKEN_D			
ATE_YEARS	Freq.	Percent	Cum.
-----+-----			
'0-4	85	0.33	0.33
'5-9	42	0.16	0.49
'10-14	108	0.42	0.91
'15-19	539	2.09	3.00
'20-24	2,636	10.22	13.22
'25-29	5,044	19.55	32.77
'30-34	5,615	21.77	54.54
'35-39	4,293	16.64	71.18
'40-44	2,902	11.25	82.43
'45-49	1,747	6.77	89.20
'50-54	844	3.27	92.48
'55-59	501	1.94	94.42
'60+	517	2.00	96.42
99999	923	3.58	100.00
-----+-----			
Total	25,796	100.00	

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.tab TAKEN_DATE_AGE_GROUP GENDER, row col

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| Key          |
|-----|
| frequency    |
| row percentage |
| column percentage |
+-----+

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RECODE of				
AGE_TAKEN_		GENDER		
DATE_YEARS	F	M	U	Total
-----+-----+-----				
'0-4	38	44	3	85
	44.71	51.76	3.53	100.00
	0.36	0.30	0.57	0.33
-----+-----+-----				
'5-9	22	19	1	42
	52.38	45.24	2.38	100.00
	0.21	0.13	0.19	0.16
-----+-----+-----				
'10-14	53	52	3	108
	49.07	48.15	2.78	100.00
	0.50	0.35	0.57	0.42
-----+-----+-----				
'15-19	373	154	12	539
	69.20	28.57	2.23	100.00
	3.53	1.05	2.26	2.09
-----+-----+-----				
'20-24	1,676	909	51	2,636
	63.58	34.48	1.93	100.00
	15.88	6.18	9.62	10.22
-----+-----+-----				
'25-29	2,495	2,439	110	5,044

		49.46	48.35	2.18		100.00
		23.64	16.58	20.75		19.55
-----+-----+-----						
'30-34		2,174	3,340	101		5,615
		38.72	59.48	1.80		100.00
		20.60	22.70	19.06		21.77
-----+-----+-----						
'35-39		1,460	2,765	68		4,293
		34.01	64.41	1.58		100.00
		13.83	18.79	12.83		16.64
-----+-----+-----						
'40-44		865	1,993	44		2,902
		29.81	68.68	1.52		100.00
		8.20	13.55	8.30		11.25
-----+-----+-----						
'45-49		495	1,218	34		1,747
		28.33	69.72	1.95		100.00
		4.69	8.28	6.42		6.77
-----+-----+-----						
'50-54		253	577	14		844
		29.98	68.36	1.66		100.00
		2.40	3.92	2.64		3.27
-----+-----+-----						
'55-59		146	349	6		501
		29.14	69.66	1.20		100.00
		1.38	2.37	1.13		1.94
-----+-----+-----						
'60+		198	307	12		517
		38.30	59.38	2.32		100.00
		1.88	2.09	2.26		2.00
-----+-----+-----						
99999		306	546	71		923

		33.15	59.15	7.69		100.00
		2.90	3.71	13.40		3.58
-----+-----+-----						
Total		10,554	14,712	530		25,796
		40.91	57.03	2.05		100.00
		100.00	100.00	100.00		100.00

```

.
. tab PROVINCE_NAME GENDER, row col

```

+-----+	
Key	

frequency	
row percentage	
column percentage	
+-----+	

		GENDER			
PROVINCE_NAME		F	M	U	Total
-----+-----+-----					
EASTERN CAPE		1,140	1,297	21	2,458
		46.38	52.77	0.85	100.00
		10.80	8.82	3.96	9.53
-----+-----+-----					
FREE STATE		425	682	3	1,110
		38.29	61.44	0.27	100.00
		4.03	4.64	0.57	4.30
-----+-----+-----					
GAUTENG		1,218	1,905	47	3,170
		38.42	60.09	1.48	100.00
		11.54	12.95	8.87	12.29

-----+-----+-----				
KWAZULU-NATAL		5,668	7,655	415 13,738
		41.26	55.72	3.02 100.00
		53.70	52.03	78.30 53.26
-----+-----+-----				
LIMPOPO		146	153	4 303
		48.18	50.50	1.32 100.00
		1.38	1.04	0.75 1.17
-----+-----+-----				
MPUMALANGA		1,317	1,930	31 3,278
		40.18	58.88	0.95 100.00
		12.48	13.12	5.85 12.71
-----+-----+-----				
NORTH WEST		153	242	1 396
		38.64	61.11	0.25 100.00
		1.45	1.64	0.19 1.54
-----+-----+-----				
NORTHERN CAPE		20	28	0 48
		41.67	58.33	0.00 100.00
		0.19	0.19	0.00 0.19
-----+-----+-----				
WESTERN CAPE		467	820	8 1,295
		36.06	63.32	0.62 100.00
		4.42	5.57	1.51 5.02
-----+-----+-----				
Total		10,554	14,712	530 25,796
		40.91	57.03	2.05 100.00
		100.00	100.00	100.00 100.00

.

. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME, row col

```

+-----+
| Key      |
|-----|
| frequency |
| row percentage |
| column percentage |
+-----+

```

```

RECODE of |
AGE_TAKEN_ |          PROVINCE_NAME
DATE_YEARS | EASTERN.. FREE ST.. GAUTENG KWAZULU.. LIMPOPO MPUMALA.. NORTH W..
NORTHER.. WESTERN.. | Total

```

'0-4	8	1	13	43	1	10	0	0	9	85	
	9.41	1.18	15.29	50.59	1.18	11.76	0.00	0.00	10.59	100.00	
	0.33	0.09	0.41	0.31	0.33	0.31	0.00	0.00	0.69	0.33	
'5-9	5	0	9	22	0	2	0	0	4	42	
	11.90	0.00	21.43	52.38	0.00	4.76	0.00	0.00	9.52	100.00	
	0.20	0.00	0.28	0.16	0.00	0.06	0.00	0.00	0.31	0.16	
'10-14	10	4	15	62	1	9	1	0	6	108	
	9.26	3.70	13.89	57.41	0.93	8.33	0.93	0.00	5.56	100.00	
	0.41	0.36	0.47	0.45	0.33	0.27	0.25	0.00	0.46	0.42	
'15-19	82	12	31	327	6	53	8	1	19	539	
	15.21	2.23	5.75	60.67	1.11	9.83	1.48	0.19	3.53	100.00	
	3.34	1.08	0.98	2.38	1.98	1.62	2.02	2.08	1.47	2.09	
'20-24	310	78	182	1,570	29	295	29	7	136	2,636	
	11.76	2.96	6.90	59.56	1.10	11.19	1.10	0.27	5.16	100.00	
	12.61	7.03	5.74	11.43	9.57	9.00	7.32	14.58	10.50	10.22	

'25-29	532	179	525	2,869	53	583	70	7	226	5,044
	10.55	3.55	10.41	56.88	1.05	11.56	1.39	0.14	4.48	100.00
	21.64	16.13	16.56	20.88	17.49	17.79	17.68	14.58	17.45	19.55
-----+										
'30-34	529	236	559	3,112	66	757	82	8	266	5,615
	9.42	4.20	9.96	55.42	1.18	13.48	1.46	0.14	4.74	100.00
	21.52	21.26	17.63	22.65	21.78	23.09	20.71	16.67	20.54	21.77
-----+										
'35-39	374	212	522	2,267	52	556	60	7	243	4,293
	8.71	4.94	12.16	52.81	1.21	12.95	1.40	0.16	5.66	100.00
	15.22	19.10	16.47	16.50	17.16	16.96	15.15	14.58	18.76	16.64
-----+										
'40-44	253	163	377	1,472	37	378	53	6	163	2,902
	8.72	5.62	12.99	50.72	1.27	13.03	1.83	0.21	5.62	100.00
	10.29	14.68	11.89	10.71	12.21	11.53	13.38	12.50	12.59	11.25
-----+										
'45-49	145	103	312	795	18	234	27	5	108	1,747
	8.30	5.90	17.86	45.51	1.03	13.39	1.55	0.29	6.18	100.00
	5.90	9.28	9.84	5.79	5.94	7.14	6.82	10.42	8.34	6.77
-----+										
'50-54	80	59	174	361	10	97	25	2	36	844
	9.48	6.99	20.62	42.77	1.18	11.49	2.96	0.24	4.27	100.00
	3.25	5.32	5.49	2.63	3.30	2.96	6.31	4.17	2.78	3.27
-----+										
'55-59	37	28	88	210	13	71	17	3	34	501
	7.39	5.59	17.56	41.92	2.59	14.17	3.39	0.60	6.79	100.00
	1.51	2.52	2.78	1.53	4.29	2.17	4.29	6.25	2.63	1.94
-----+										
'60+	52	32	86	232	11	50	17	2	35	517
	10.06	6.19	16.63	44.87	2.13	9.67	3.29	0.39	6.77	100.00
	2.12	2.88	2.71	1.69	3.63	1.53	4.29	4.17	2.70	2.00
-----+										

99999	41	3	277	396	6	183	7	0	10	923
	4.44	0.33	30.01	42.90	0.65	19.83	0.76	0.00	1.08	100.00
	1.67	0.27	8.74	2.88	1.98	5.58	1.77	0.00	0.77	3.58
-----+-----										
Total	2,458	1,110	3,170	13,738	303	3,278	396	48	1,295	25,796
	9.53	4.30	12.29	53.26	1.17	12.71	1.54	0.19	5.02	100.00
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

.

Appendix 3.8: Stata Log file of merging HBsAg positive cases with all cases tested for HBeAg

```
. use "2015-2019_HBsAg_Positive_Cases.dta", clear
```

```
. merge 1:1 UNIQUE_PATIENT_ID using "Z:\Centre for Vaccines and  
Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD Output  
files_SM081020\Files_Chapter3\Final for PhD 061023\HBsAg and HBV Chronic for m
```

```
> erging with HBeAg\2015-2019_HBeAg_All_Cases.dta"
```

```
(label TAKEN_DATE_AGE_GROUP already defined)
```

Result	Number of obs

Not matched	129,891
from master	110,979 (_merge==1)
from using	18,912 (_merge==2)
Matched	65,551 (_merge==3)

```
. keep if _merge==3
```

```
(129,891 observations deleted)
```

```
. tab HEP_B_SURFACE_AG HEPATITIS_B_E_AG if _merge==3
```

		HEPATITIS_B_E_AG			
HEP_B_SURFACE_AG		EQUIVOCAL	NEGATIVE	POSITIVE	Total
-----+-----+-----					
POSITIVE		41	40,671	24,839	65,551
-----+-----+-----					
Total		41	40,671	24,839	65,551

. tab TAKEN_DATE_AGE_GROUP GENDER if HEPATITIS_B_E_AG == "POSITIVE"

RECODE of				
AGE_TAKEN_	GENDER			
DATE_YEARS	F	M	U	Total
-----+-----+-----				
'0-4	30	45	3	78
'5-9	16	22	2	40
'10-14	50	46	3	99
'15-19	365	150	13	528
'20-24	1,659	890	58	2,607
'25-29	2,445	2,387	112	4,944
'30-34	2,068	3,259	98	5,425
'35-39	1,398	2,664	69	4,131
'40-44	824	1,900	43	2,767
'45-49	470	1,159	33	1,662
'50-54	239	538	11	788
'55-59	134	322	5	461
'60+	185	290	10	485
'99999	273	485	66	824
-----+-----+-----				
Total	10,156	14,157	526	24,839

. tab TAKEN_DATE_AGE_GROUP GENDER if HEPATITIS_B_E_AG == "NEGATIVE"

RECODE of				
AGE_TAKEN_	GENDER			
DATE_YEARS	F	M	U	Total
-----+-----+-----				
'0-4	115	96	4	215
'5-9	38	41	3	82
'10-14	77	66	5	148

'15-19	422	140	9	571
'20-24	1,882	830	68	2,780
'25-29	3,370	2,629	130	6,129
'30-34	3,446	3,948	127	7,521
'35-39	2,604	4,002	133	6,739
'40-44	1,869	3,347	95	5,311
'45-49	1,302	2,224	64	3,590
'50-54	1,053	1,452	36	2,541
'55-59	652	920	24	1,596
'60+	958	1,201	47	2,206
'99999	468	677	97	1,242
-----+-----+-----				
Total	18,256	21,573	842	40,671

. tab TAKEN_DATE_AGE_GROUP GENDER if HEPATITIS_B_E_AG == "EQUIVOCAL"

RECODE of			
AGE_TAKEN_	GENDER		
DATE_YEARS	F	M	Total
-----+-----+-----			
'0-4	1	0	1
'15-19	1	0	1
'20-24	2	1	3
'25-29	2	4	6
'30-34	3	5	8
'35-39	6	1	7
'40-44	2	2	4
'45-49	0	4	4
'50-54	1	2	3
'55-59	0	1	1
'60+	2	0	2
'99999	0	1	1

-----+-----+-----				
Total	20	21	41	

. table TAKEN_DATE_AGE_GROUP GENDER HEPATITIS_B_E_AG

		HEPATITIS_B_E_AG		
		EQUIVOCAL	NEGATIVE	POSITIVE
		Total		

-----+-----

RECODE of AGE_TAKEN_DATE_YEARS |

'0-4					
GENDER					
F		1	115	30	146
M			96	45	141
U			4	3	7
Total		1	215	78	294
'5-9					
GENDER					
F			38	16	54
M			41	22	63
U			3	2	5
Total			82	40	122
'10-14					
GENDER					
F			77	50	127
M			66	46	112
U			5	3	8
Total			148	99	247
'15-19					
GENDER					
F		1	422	365	788
M			140	150	290

U		9	13	22
Total		1	571	528 1,100
'20-24				
GENDER				
F		2	1,882	1,659 3,543
M		1	830	890 1,721
U		68	58	126
Total		3	2,780	2,607 5,390
'25-29				
GENDER				
F		2	3,370	2,445 5,817
M		4	2,629	2,387 5,020
U		130	112	242
Total		6	6,129	4,944 11,079
'30-34				
GENDER				
F		3	3,446	2,068 5,517
M		5	3,948	3,259 7,212
U		127	98	225
Total		8	7,521	5,425 12,954
'35-39				
GENDER				
F		6	2,604	1,398 4,008
M		1	4,002	2,664 6,667
U		133	69	202
Total		7	6,739	4,131 10,877
'40-44				
GENDER				
F		2	1,869	824 2,695
M		2	3,347	1,900 5,249
U		95	43	138
Total		4	5,311	2,767 8,082

'45-49					
GENDER					
F			1,302	470	1,772
M		4	2,224	1,159	3,387
U			64	33	97
Total		4	3,590	1,662	5,256
'50-54					
GENDER					
F		1	1,053	239	1,293
M		2	1,452	538	1,992
U			36	11	47
Total		3	2,541	788	3,332
'55-59					
GENDER					
F			652	134	786
M		1	920	322	1,243
U			24	5	29
Total		1	1,596	461	2,058
'60+					
GENDER					
F		2	958	185	1,145
M			1,201	290	1,491
U			47	10	57
Total		2	2,206	485	2,693
'99999					
GENDER					
F			468	273	741
M		1	677	485	1,163
U			97	66	163
Total		1	1,242	824	2,067
Total					
GENDER					

F		20	18,256	10,156	28,432
M		21	21,573	14,157	35,751
U			842	526	1,368
Total		41	40,671	24,839	65,551

. tab PROVINCE_NAME GENDER if HEPATITIS_B_E_AG == "POSITIVE"

		GENDER			
PROVINCE_NAME		F	M	U	Total
-----+-----+-----					
EASTERN CAPE		1,116	1,272	24	2,412
FREE STATE		425	672	3	1,100
GAUTENG		1,067	1,676	52	2,795
KWAZULU-NATAL		5,485	7,440	407	13,332
LIMPOPO		142	153	4	299
MPUMALANGA		1,309	1,909	32	3,250
NORTH WEST		137	228	1	366
NORTHERN CAPE		22	25	1	48
WESTERN CAPE		453	782	2	1,237
-----+-----+-----					
Total		10,156	14,157	526	24,839

. tab PROVINCE_NAME GENDER if HEPATITIS_B_E_AG == "NEGATIVE"

		GENDER			
PROVINCE_NAME		F	M	U	Total
-----+-----+-----					
EASTERN CAPE		2,476	2,540	45	5,061
FREE STATE		370	482	2	854
GAUTENG		1,546	2,069	57	3,672
KWAZULU-NATAL		8,813	11,019	643	20,475

LIMPOPO		242	276	2		520
MPUMALANGA		3,466	3,198	85		6,749
NORTH WEST		256	278	4		538
NORTHERN CAPE		45	62	0		107
WESTERN CAPE		1,042	1,649	4		2,695
-----+-----+-----						
Total		18,256	21,573	842		40,671

```
. tab PROVINCE_NAME GENDER if HEPATITIS_B_E_AG=="EQUIVOCAL"
```

		GENDER			
PROVINCE_NAME		F	M		Total
-----+-----+-----					
FREE STATE		4	9		13
GAUTENG		1	0		1
KWAZULU-NATAL		11	6		17
NORTH WEST		2	1		3
NORTHERN CAPE		0	1		1
WESTERN CAPE		2	4		6
-----+-----+-----					
Total		20	21		41

```
. table PROVINCE_NAME GENDER HEPATITIS_B_E_AG
```

		HEPATITIS_B_E_AG			
		EQUIVOCAL	NEGATIVE	POSITIVE	Total
-----+-----					
PROVINCE_NAME					
EASTERN CAPE					
GENDER					
F		2,476	1,116	3,592	

M		2,540	1,272	3,812
U		45	24	69
Total		5,061	2,412	7,473

FREE STATE |

GENDER				
F		4	370	425 799
M		9	482	672 1,163
U		2	3	5
Total		13	854	1,100 1,967

GAUTENG |

GENDER				
F		1	1,546	1,067 2,614
M			2,069	1,676 3,745
U			57	52 109
Total		1	3,672	2,795 6,468

KWAZULU-NATAL |

GENDER				
F		11	8,813	5,485 14,309
M		6	11,019	7,440 18,465
U			643	407 1,050
Total		17	20,475	13,332 33,824

LIMPOPO |

GENDER				
F			242	142 384
M			276	153 429
U			2	4 6
Total			520	299 819

MPUMALANGA |

GENDER				
F			3,466	1,309 4,775
M			3,198	1,909 5,107
U			85	32 117

Total		6,749	3,250	9,999

NORTH WEST |

GENDER					

F		2	256	137	395

M		1	278	228	507

U			4	1	5

Total		3	538	366	907

NORTHERN CAPE |

GENDER					

F			45	22	67

M		1	62	25	88

U				1	1

Total		1	107	48	156

WESTERN CAPE |

GENDER					

F		2	1,042	453	1,497

M		4	1,649	782	2,435

U			4	2	6

Total		6	2,695	1,237	3,938

Total |

GENDER					

F		20	18,256	10,156	28,432

M		21	21,573	14,157	35,751

U			842	526	1,368

Total		41	40,671	24,839	65,551

. table PROVINCE_DISTRICT GENDER HEPATITIS_B_E_AG

		HEPATITIS_B_E_AG			
		EQUIVOCAL	NEGATIVE	POSITIVE	Total

-----+-----				
PROVINCE_DISTRICT				
EASTERN CAPE_ALFRED NZO				
GENDER				
F		168	87	255
M		152	117	269
U		8	6	14
Total		328	210	538
EASTERN CAPE_AMATHOLE				
GENDER				
F		309	167	476
M		267	148	415
U		5	5	10
Total		581	320	901
EASTERN CAPE_BUFFALO CITY METRO				
GENDER				
F		39	16	55
M		40	26	66
U		2	2	
Total		81	42	123
EASTERN CAPE_CHRIS HANI				
GENDER				
F		76	45	121
M		78	59	137
U		3	1	4
Total		157	105	262
EASTERN CAPE_JOE GQABI				
GENDER				
F		20	18	38
M		28	22	50
Total		48	40	88
EASTERN CAPE_NELSON MANDELA BAY METRO				

GENDER				
F		528	256	784
M		727	325	1,052
U		4	4	8
Total		1,259	585	1,844

EASTERN CAPE_O R TAMBO

GENDER				
F		1,157	460	1,617
M		1,046	472	1,518
U		21	8	29
Total		2,224	940	3,164

EASTERN CAPE_SARAH BAARTMAN

GENDER				
F		179	67	246
M		202	103	305
U		2	2	
Total		383	170	553

FREE STATE_FEZILE DABI

GENDER				
F	1	146	174	321
M	2	178	283	463
U		1	1	2
Total	3	325	458	786

FREE STATE_LEJWELEPUTSWA

GENDER				
F		71	86	157
M	2	70	102	174
U			1	1
Total	2	141	189	332

FREE STATE_MANGAUNG METRO

GENDER				
F	2	138	143	283

M		4	208	234	446
U			1	1	2
Total		6	347	378	731

FREE STATE_THABO MOFUTSANYANA |

GENDER					
F		1	11	22	34
M		1	21	50	72
Total		2	32	72	106

FREE STATE_UNKNOWN |

GENDER					
M			1		1
Total			1		1

FREE STATE_XHARIEP |

GENDER					
F			4		4
M			4	3	7
Total			8	3	11

GAUTENG_CITY OF JOHANNESBURG METRO |

GENDER					
F			633	482	1,115
M			935	740	1,675
U			44	39	83
Total			1,612	1,261	2,873

GAUTENG_CITY OF TSHWANE METRO |

GENDER					
F			809	505	1,314
M			960	806	1,766
U			11	10	21
Total			1,780	1,321	3,101

GAUTENG_EKURHULENI METRO |

GENDER					
F		1	84	63	148

M		121	86	207
U		1	1	2
Total		1	206	150 357
GAUTENG_SEDIBENG				
GENDER				
F		7	9	16
M		16	11	27
Total		23	20	43
GAUTENG_UNKNOWN				
GENDER				
F		1	1	
M		2	2	
U		1	1	2
Total		4	1	5
GAUTENG_WEST RAND				
GENDER				
F		12	8	20
M		35	33	68
U			1	1
Total		47	42	89
KWAZULU-NATAL_AMAJUBA				
GENDER				
F		1	219	177 397
M			229	283 512
U			16	10 26
Total		1	464	470 935
KWAZULU-NATAL_ETHEKWINI METRO				
GENDER				
F		7	3,943	2,466 6,416
M		2	5,000	3,373 8,375
U			248	169 417
Total		9	9,191	6,008 15,208

KWAZULU-NATAL_HARRY GWALA |

GENDER					
F			111	107	218
M		1	177	128	306
U			12	6	18
Total		1	300	241	542

KWAZULU-NATAL_ILEMBE |

GENDER					
F			275	204	479
M			404	269	673
U			37	23	60
Total			716	496	1,212

KWAZULU-NATAL_KING CETSHWAYO |

GENDER					
F			212	103	315
M			326	174	500
U			27	9	36
Total			565	286	851

KWAZULU-NATAL_UGU |

GENDER					
F		1	1,087	564	1,652
M			1,302	730	2,032
U			43	32	75
Total		1	2,432	1,326	3,759

KWAZULU-NATAL_UMGUNGUNDLOVU |

GENDER					
F		1	1,658	1,238	2,897
M		2	2,065	1,636	3,703
U			210	130	340
Total		3	3,933	3,004	6,940

KWAZULU-NATAL_UMKHANYAKUDE |

GENDER					

F		408	160	568
M		527	235	762
U		17	8	25
Total		952	403	1,355

KWAZULU-NATAL_UMZINYATHI |

GENDER				
F		190	87	277
M		1 237	125	363
U		4	5	9
Total		1 431	217	649

KWAZULU-NATAL_UNKNOWN |

GENDER				
F		1	1	2
M			2	2
U		1		1
Total		2	3	5

KWAZULU-NATAL_UTHUKELA |

GENDER				
F		121	97	218
M		128	140	268
U		2	4	6
Total		251	241	492

KWAZULU-NATAL_UTHUNGULU |

GENDER				
F		1 184	90	275
M		212	128	340
U		8	3	11
Total		1 404	221	626

KWAZULU-NATAL_ZULULAND |

GENDER				
F		404	191	595
M		412	217	629

U		18	8	26
Total		834	416	1,250
LIMPOPO_CAPRICORN				
GENDER				
F		41	15	56
M		49	23	72
Total		90	38	128
LIMPOPO_GREATER SEKHUKHUNE				
GENDER				
F		82	58	140
M		65	44	109
U			1	1
Total		147	103	250
LIMPOPO_MOPANI				
GENDER				
F		14	7	21
M		8	6	14
Total		22	13	35
LIMPOPO_VHEMBE				
GENDER				
F		59	24	83
M		90	37	127
Total		149	61	210
LIMPOPO_WATERBERG				
GENDER				
F		46	38	84
M		64	43	107
U		2	3	5
Total		112	84	196
MPUMALANGA_EHLANZENI				
GENDER				
F		1,337	364	1,701

M		1,167	498	1,665	
U		15	10	25	
Total		2,519	872	3,391	
MPUMALANGA_GERT SIBANDE					
GENDER					
F		907	575	1,482	
M		1,051	934	1,985	
U		21	10	31	
Total		1,979	1,519	3,498	
MPUMALANGA_NKANGALA					
GENDER					
F		1,222	370	1,592	
M		980	477	1,457	
U		49	12	61	
Total		2,251	859	3,110	
NORTH WEST_BOJANALA PLATINUM					
GENDER					
F		53	30	83	
M		30	37	67	
Total		83	67	150	
NORTH WEST_DR KENNETH KAUNDA					
GENDER					
F		82	50	132	
M		109	112	221	
U		3	1	4	
Total		194	163	357	
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI					
GENDER					
F		2	87	46	135
M		1	99	54	154
Total		3	186	100	289
NORTH WEST_NGAKA MODIRI MOLEMA					

GENDER				
F		34	11	45
M		40	25	65
U		1		1
Total		75	36	111

NORTHERN CAPE_FRANCES BAARD |

GENDER				
F		18	6	24
M		23	11	34
U			1	1
Total		41	18	59

NORTHERN CAPE_JOHN TAOLO GAETSEWE |

GENDER				
F		1		1
M		2		2
Total		3		3

NORTHERN CAPE_NAMAKWA |

GENDER				
F		3	8	11
M		14	3	17
Total		17	11	28

NORTHERN CAPE_PIXLEY KA SEME |

GENDER				
F		2	2	4
M		4	2	6
Total		6	4	10

NORTHERN CAPE_ZF MGCAWU |

GENDER				
F		21	6	27
M	1	19	9	29
Total	1	40	15	56

WESTERN CAPE_CAPE WINELANDS |

GENDER				
F		116	64	180
M		198	84	282
U		1	1	
Total		315	148	463

WESTERN CAPE_CENTRAL KAROO |

GENDER				
F		5	5	
M			1	1
Total		5	1	6

WESTERN CAPE_CITY OF CAPE TOWN METRO |

GENDER				
F	2	836	355	1,193
M	4	1,302	632	1,938
U		1	2	3
Total	6	2,139	989	3,134

WESTERN CAPE_GARDEN ROUTE |

GENDER				
F		28	5	33
M		46	15	61
Total		74	20	94

WESTERN CAPE_NOT APPLICABLE |

GENDER				
M		1	1	
Total		1	1	

WESTERN CAPE_OVERBERG |

GENDER				
F		18	15	33
M		36	21	57
Total		54	36	90

WESTERN CAPE_UNKNOWN |

GENDER				


```

      y |      .5332 .0203166          .4933801 .5730199
-----+-----
diff |   -.0893  .030075          -.1482459 -.0303541
      | under H0:  .030206 -2.96  0.003
-----+-----

diff = prop(x) - prop(y)          z = -2.9564
H0: diff = 0

Ha: diff < 0          Ha: diff != 0          Ha: diff > 0
Pr(Z < z) = 0.0016    Pr(|Z| > |z|) = 0.0031    Pr(Z > z) = 0.9984

.
. prtesti 197 .4840 196 .4816

```

```

Two-sample test of proportions          x: Number of obs =   197
                                     y: Number of obs =   196
-----+-----
      |   Mean  Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
x |   .484  .0356053          .4142149 .5537851
y |   .4816 .0356901          .4116487 .5515513
-----+-----
diff |   .0024 .0504135          -.0964086 .1012086
      | under H0:  .0504136  0.05  0.962
-----+-----

diff = prop(x) - prop(y)          z =  0.0476
H0: diff = 0

Ha: diff < 0          Ha: diff != 0          Ha: diff > 0
Pr(Z < z) = 0.5190    Pr(|Z| > |z|) = 0.9620    Pr(Z > z) = 0.4810

.

```

```
. prtesti 394 .5934 258 .3886
```

Two-sample test of proportions x: Number of obs = 394

 y: Number of obs = 258

```
-----
      |   Mean  Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
    x |   .5934   .0247462           .5448982   .6419018
    y |   .3886   .0303462           .3291225   .4480775
-----+-----
diff |   .2048   .039157           .1280537   .2815463
      | under H0:   .0400316   5.12   0.000
-----
```

```
diff = prop(x) - prop(y)                      z =  5.1160
H0: diff = 0
```

```
Ha: diff < 0              Ha: diff != 0              Ha: diff > 0
Pr(Z < z) = 1.0000      Pr(|Z| > |z|) = 0.0000      Pr(Z > z) = 0.0000
```

```
.
. prtesti 2017 .7261 722 .2595
```

Two-sample test of proportions x: Number of obs = 2017

 y: Number of obs = 722

```
-----
      |   Mean  Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
    x |   .7261   .0099298           .7066379   .7455621
    y |   .2595   .0163141           .227525   .291475
-----+-----
diff |   .4666   .0190984           .4291677   .5040323
      | under H0:   .0212182  21.99   0.000
-----
```

```
y: Number of obs = 11938
```

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.5535	.0040105			.5456395 .5613605
y	.4301	.0045313			.4212189 .4389811
diff	.1234	.0060512			.1115399 .1352601
under H0: .0061002 20.23 0.000					

. prtesti 15747 .4588 18077 .5267

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.4588	.0039709			.4510171 .4665829
y	.5267	.0037135			.5194216 .5339784
diff	-.0679	.0054368			-.0785559 -.0572441
	under H0:	.00545	-12.46	0.000	

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
 Pr(Z < z) = 0.0000 Pr(|Z| > |z|) = 0.0000 Pr(Z > z) = 1.0000

.
 . prtesti 11974 .3907 18254 .5957

Two-sample test of proportions x: Number of obs = 11974
 y: Number of obs = 18254

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.3907	.0044588			.3819609 .3994391
y	.5957	.0036323			.5885807 .6028193
diff	-.205	.0057511			-.2162719 -.1937281
under H0:	.0058775		-34.88	0.000	

diff = prop(x) - prop(y) z = -34.8787
 H0: diff = 0

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
 Pr(Z < z) = 0.0000 Pr(|Z| > |z|) = 0.0000 Pr(Z > z) = 1.0000

.
 . prtesti 8152 .3516 14720 .6349

Two-sample test of proportions x: Number of obs = 8152
 y: Number of obs = 14720

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.3516	.0052883			.3412352 .3619648


```

y | .6349 .0039683 .6271223 .6426777
-----+-----
diff | -.2833 .0066116 -.2962585 -.2703415
      | under H0: .0068871 -41.14 0.000
-----+-----

diff = prop(x) - prop(y)          z = -41.1351
H0: diff = 0

Ha: diff < 0      Ha: diff != 0      Ha: diff > 0
Pr(Z < z) = 0.0000  Pr(|Z| > |z|) = 0.0000  Pr(Z > z) = 1.0000

.
. prtesti 5182 .3453 9631 .6416

```

Two-sample test of proportions x: Number of obs = 5182
 y: Number of obs = 9631

```

-----+-----
      | Mean Std. err. z P>|z| [95% conf. interval]
-----+-----
x | .3453 .006605 .3323545 .3582455
y | .6416 .0048863 .632023 .651177
-----+-----

diff | -.2963 .0082159 -.3124029 -.2801971
      | under H0: .0085892 -34.50 0.000
-----+-----

diff = prop(x) - prop(y)          z = -34.4968
H0: diff = 0

```

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
 Pr(Z < z) = 0.0000 Pr(|Z| > |z|) = 0.0000 Pr(Z > z) = 1.0000

.

```
. prtesti 3568 .3782 5759 .6106
```

Two-sample test of proportions x: Number of obs = 3568

 y: Number of obs = 5759

```
-----
      |   Mean  Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
    x |   .3782   .0081185           .3622881   .3941119
    y |   .6106   .0064254           .5980064   .6231936
-----+-----
diff |   -.2324   .0103535           -.2526926   -.2121074
      | under H0:   .0106426  -21.84   0.000
-----
```

```
diff = prop(x) - prop(y)                      z = -21.8369
H0: diff = 0
```

```
Ha: diff < 0              Ha: diff != 0              Ha: diff > 0
Pr(Z < z) = 0.0000        Pr(|Z| > |z|) = 0.0000        Pr(Z > z) = 1.0000
```

```
.
. prtesti 2143 .3758 3494 .6127
```

Two-sample test of proportions x: Number of obs = 2143

 y: Number of obs = 3494

```
-----
      |   Mean  Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
    x |   .3758   .0104623           .3552942   .3963058
    y |   .6127   .0082411           .5965477   .6288523
-----+-----
diff |   -.2369   .0133183           -.2630034   -.2107966
      | under H0:   .0137049  -17.29   0.000
-----
```

y: Number of obs = 3494

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.3758	.0104623			.3552942 .3963058
y	.6127	.0082411			.5965477 .6288523
diff	-.2369	.0133183			-.2630034 -.2107966
	under H0:	.0137049	-17.29	0.000	

$$\text{diff} = \text{prop}(x) - \text{prop}(y) \quad z = -17.2858$$
$$H_0: \text{diff} = 0$$
$$H_a: \text{diff} < 0$$

Ha: $\text{diff} \neq 0$

$$H_a: \text{diff} > 0$$
$$\Pr(Z < z) = 0.0000$$
$$\Pr(|Z| > |z|) = 0.0000$$
$$\Pr(Z > z) = 1.0000$$

•

```
. prtesti 1979 .3744 2858 .5407
```

Two-sample test of proportions x: Number of obs = 1979

y: Number of obs = 2858

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.3744	.0108791			.3530773 .3957227
y	.5407	.0093217			.5224298 .5589702
diff	-.1663	.0143265			-.1943795 -.1382205
under H0:	.0146	-11.39	0.000		

$$\text{diff} = \text{prop}(x) - \text{prop}(y) \qquad z = -11.3904$$

H0: $\text{diff} = 0$

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(Z < z) = 0.0000 Pr(|Z| > |z|) = 0.0000 Pr(Z > z) = 1.0000

.
. prtesti 78935 .4471 94699 .5364

Two-sample test of proportions x: Number of obs = 78935
y: Number of obs = 94699

```
-----
      |   Mean   Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
      x |   .4471   .0017697           .4436315   .4505685
      y |   .5364   .0016205           .5332239   .5395761
-----+-----
diff |   -.0893   .0023995           -.094003   -.084597
      | under H0:   .0024097  -37.06   0.000
-----
```

diff = prop(x) - prop(y) z = -37.0584
H0: diff = 0

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(Z < z) = 0.0000 Pr(|Z| > |z|) = 0.0000 Pr(Z > z) = 1.0000

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. ***INFERENTIAL STATS OF HBEAG POS BY AGEGROUP AND GENDER

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.
. prtesti 30 .38 45 .58

```

-----+-----
diff |    -0.15  0.1620185          -0.4675505  0.1675505
      | under H0: 0.1642253 -0.91  0.361

```

```

diff = prop(x) - prop(y)          z = -0.9134
H0: diff = 0

Ha: diff < 0      Ha: diff != 0      Ha: diff > 0
Pr(Z < z) = 0.1805  Pr(|Z| > |z|) = 0.3610  Pr(Z > z) = 0.8195

.
. prtesti 50 .51 46 .46

```

```

Two-sample test of proportions      x: Number of obs =   50
                                   y: Number of obs =   46

```

```

-----
      |   Mean   Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
x |   .51   .0706965           .3714373   .6485627
y |   .46   .0734847           .3159726   .6040274
-----+-----
diff |   .05   .1019706        -.1498587   .2498587
      | under H0:   .102111   0.49  0.624
-----

```

```

diff = prop(x) - prop(y)          z =  0.4897
H0: diff = 0

Ha: diff < 0      Ha: diff != 0      Ha: diff > 0
Pr(Z < z) = 0.6878  Pr(|Z| > |z|) = 0.6244  Pr(Z > z) = 0.3122

.
. prtesti 365 .69 150 .28

```

```

Two-sample test of proportions      x: Number of obs =  365
                                   y: Number of obs =  150

```

```

-----

```

```
y |      .28  .0366606      .2081465  .3518535
```

```
| under H0: .0480077    8.54  0.000
```

H0: diff = 0

. prtesti 1659 .64 890 .34

y	.34	.0158788	.3088782	.3711218

```
| under H0: .0207231 14.48 0.000
```

$$H_0: \text{diff} = 0$$

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

$\Pr(Z < z) = 1.0000$ $\Pr(|Z| > |z|) = 0.0000$ $\Pr(Z > z) = 0.0000$

.

. prtesti 2445 .49 2387 .48

Two-sample test of proportions x: Number of obs = 2445
y: Number of obs = 2387

	Mean	Std. err.	z	P> z	[95% conf. interval]
-----+-----					
x	.49	.0101098		.4701851	.5098149
y	.48	.0102258		.4599579	.5000421
-----+-----					
diff	.01	.0143797		-.0181836	.0381836
	under H0: .0143805		0.70	0.487	

diff = prop(x) - prop(y) z = 0.6954
H0: diff = 0

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
 $\Pr(Z < z) = 0.7566$ $\Pr(|Z| > |z|) = 0.4868$ $\Pr(Z > z) = 0.2434$

.

. prtesti 2068 .38 3259 .60

Two-sample test of proportions x: Number of obs = 2068
y: Number of obs = 3259

	Mean	Std. err.	z	P> z	[95% conf. interval]
-----+-----					
x	.38	.0106736		.3590801	.4009199
y	.6	.0085815		.5831806	.6168194

| under H0: .0270007 -15.56 0.000

```

diff = prop(x) - prop(y)                z = -15.5551
H0: diff = 0

Ha: diff < 0          Ha: diff != 0       Ha: diff > 0
Pr(Z < z) = 0.0000    Pr(|Z| > |z|) = 0.0000    Pr(Z > z) = 1.0000

.
. prtesti 239 .30 538 .68

```

```

Two-sample test of proportions          x: Number of obs =   239
                                     y: Number of obs =   538

```

```

-----
      |   Mean   Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
x |    .3   .0296422           .2419023   .3580977
y |    .68   .0201112           .6405827   .7194173
-----+-----
diff |   -.38   .0358207          -.4502073   -.3097927
      | under H0:   .0385569   -9.86   0.000
-----

```

```

diff = prop(x) - prop(y)                z = -9.8556
H0: diff = 0

Ha: diff < 0          Ha: diff != 0       Ha: diff > 0
Pr(Z < z) = 0.0000    Pr(|Z| > |z|) = 0.0000    Pr(Z > z) = 1.0000

.
. prtesti 134 .29 322 .70

```

```

Two-sample test of proportions          x: Number of obs =   134
                                     y: Number of obs =   322

```

```

-----

```

Two-sample test of proportions x: Number of obs = 185
y: Number of obs = 290

$\Pr(Z < z) = 0.0000$ $\Pr(|Z| > |z|) = 0.0000$ $\Pr(Z > z) = 1.0000$

.

. prtesti 273 .33 485 .59

Two-sample test of proportions x: Number of obs = 273

 y: Number of obs = 485

	Mean	Std. err.	z	P> z	[95% conf. interval]
-----+-----					
x	.33	.0284586		.2742222	.3857778
y	.59	.022333		.5462281	.6337719
-----+-----					
diff	-.26	.0361753		-.3309023	-.1890977
	under H0:	.0378304	-6.87	0.000	

diff = prop(x) - prop(y) z = -6.8728

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

$\Pr(Z < z) = 0.0000$ $\Pr(|Z| > |z|) = 0.0000$ $\Pr(Z > z) = 1.0000$

.

. prtesti 10156 .41 14157 .57

Two-sample test of proportions x: Number of obs = 10156

 y: Number of obs = 14157

	Mean	Std. err.	z	P> z	[95% conf. interval]
-----+-----					
x	.41	.0048804		.4004346	.4195654
y	.57	.0041609		.5618448	.5781552

```

-----+-----
diff |   -16 .0064134          -.17257  -.14743
    | under H0: .0065018 -24.61  0.000
-----+-----

diff = prop(x) - prop(y)          z = -24.6086
H0: diff = 0

Ha: diff < 0          Ha: diff != 0          Ha: diff > 0
Pr(Z < z) = 0.0000    Pr(|Z| > |z|) = 0.0000    Pr(Z > z) = 1.0000

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. ***INFERENTIAL STATS OF HBSAG POS BY PROVINCE AND GENDER
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.
. prtesti 10368 .4872 10685 .5021

Two-sample test of proportions          x: Number of obs = 10368
                                     y: Number of obs = 10685
-----+-----
    |   Mean Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
x |   .4872 .0049089          .4775788  .4968212
y |   .5021 .004837          .4926196  .5115804
-----+-----

diff |   -.0149 .0068916          -.0284072  -.0013928
    | under H0: .0068924 -2.16  0.031
-----+-----

diff = prop(x) - prop(y)          z = -2.1618

```

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.0153

Pr(|Z| > |z|) = 0.0306

Pr(Z > z) = 0.9847

.

. prtesti 3593 .4443 4447 .5499

Two-sample test of proportions

x: Number of obs = 3593

y: Number of obs = 4447

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.4443	.0082895		.4280528	.4605472
y	.5499	.0074604		.5352779	.5645221
diff	-.1056	.0111523		-.1274581	-.0837419
under H0:	.0112158		-9.42	0.000	

diff = prop(x) - prop(y)

z = -9.4153

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.0000

Pr(|Z| > |z|) = 0.0000

Pr(Z > z) = 1.0000

.

. prtesti 28547 .4386 35481 .5451

Two-sample test of proportions

x: Number of obs = 28547

y: Number of obs = 35481

	Mean	Std. err.	z	P> z	[95% conf. interval]

-----+-----				
x	.4386	.0029369	.4328438	.4443562
y	.5451	.0026436	.5399186	.5502814
-----+-----				
diff	-.1065	.0039515	-.1142447	-.0987553
under H0:	.0039753	-26.79	0.000	

diff = prop(x) - prop(y) z = -26.7903
H0: diff = 0

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
Pr(Z < z) = 0.0000	Pr(Z > z) = 0.0000	Pr(Z > z) = 1.0000

. prtesti 15165 .4268 19262 .5421

Two-sample test of proportions x: Number of obs = 15165
y: Number of obs = 19262

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.4268	.0040165			.4189279 .4346721
y	.5421	.0035898			.5350641 .5491359
diff	-.1153	.0053869			-.1258582 -.1047418
	under H0:	.0054273	-21.24	0.000	

diff = prop(x) - prop(y) z = -21.2445
H0: diff = 0

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
Pr(Z < z) = 0.0000	Pr(Z > z) = 0.0000	Pr(Z > z) = 1.0000

Two-sample test of proportions x: Number of obs = 5153
y: Number of obs = 4894

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.5091	.0069641			.4954505 .5227495
y	.4835	.0071433			.4694993 .4975007
diff	.0256	.0099763			.0060468 .0451532
	under H0:	.0099797	2.57	0.010	

diff = prop(x) - prop(y) z = 2.5652
H0: diff = 0

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
Pr(Z < z) = 0.9948	Pr(Z > z) = 0.0103	Pr(Z > z) = 0.0052

```
. prtesti 6768 .4774 7235 .5104
```

Two-sample test of proportions x: Number of obs = 6768
y: Number of obs = 7235

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.4774	.0060715			.4655001 .4892999
y	.5104	.005877			.4988813 .5219187

```

diff |   -.033   .00845           -.0495617  -.0164383
    | under H0: .0084548  -3.90  0.000
-----

diff = prop(x) - prop(y)           z = -3.9031
H0: diff = 0

Ha: diff < 0           Ha: diff != 0           Ha: diff > 0
Pr(Z < z) = 0.0000     Pr(|Z| > |z|) = 0.0001     Pr(Z > z) = 1.0000

.
. prtesti 4153 .4353 5255 .5508

```

```

Two-sample test of proportions           x: Number of obs =   4153
                                         y: Number of obs =   5255

```

```

-----
    |   Mean  Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
x |   .4353   .0076935           .4202211   .4503789
y |   .5508   .0068617           .5373514   .5642486
-----+-----

diff |   -.1155   .0103088           -.135705   -.095295
    | under H0: .0103813  -11.13  0.000
-----

diff = prop(x) - prop(y)           z = -11.1258
H0: diff = 0

Ha: diff < 0           Ha: diff != 0           Ha: diff > 0
Pr(Z < z) = 0.0000     Pr(|Z| > |z|) = 0.0000     Pr(Z > z) = 1.0000

.
. prtesti 806 .4412 993 .5435

```

x: Number of obs = 806

y: Number of obs = 993

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.4412	.0174895			.4069211 .4754789
y	.5435	.0158069			.5125191 .5744809
diff	-.1023	.0235742			-.1485045 -.0560955
	under H0:	.0237049	-4.32	0.000	

$$\text{diff} = \text{prop}(x) - \text{prop}(y) \quad z = -4.3156$$

H0: diff = 0

$$H_a: \text{diff} < 0$$

Ha: $\text{diff} \neq 0$

$$H_a: \text{diff} > 0$$
$$\Pr(Z < z) = 0.0000$$
$$\Pr(|Z| > |z|) = 0.0000$$
$$\Pr(Z > z) = 1.0000$$

```

.
. prtesti 4381 .4026 6446 .5924

```

x: Number of obs = 4381

y: Number of obs = 6446

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.4026	.0074094			.3880778 .4171222
y	.5924	.0061204			.5804042 .6043958
diff	-.1898	.0096103			-.2086359 -.1709641
	under H0:	.0097855	-19.40	0.000	

diff = prop(x) - prop(y) z = -19.3961

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.0000

Pr(|Z| > |z|) = 0.0000

Pr(Z > z) = 1.0000

.

. prtesti 78935 .4471 94699 .5364

Two-sample test of proportions

x: Number of obs = 78935

y: Number of obs = 94699

	Mean	Std. err.	z	P> z	[95% conf. interval]
-----+-----					
x	.4471	.0017697			.4436315 .4505685
y	.5364	.0016205			.5332239 .5395761
-----+-----					
diff	-.0893	.0023995			-.094003 -.084597
	under H0:	.0024097	-37.06	0.000	

diff = prop(x) - prop(y)

z = -37.0584

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.0000

Pr(|Z| > |z|) = 0.0000

Pr(Z > z) = 1.0000

.

.

.

. ***INFERENTIAL STATS OF HBEAG POS BY PROVINCE AND GENDER

.

.

| under H0: .0309526 -7.25 0.000

diff = prop(x) - prop(y) z = -7.2530

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.0000

Pr(|Z| > |z|) = 0.0000

Pr(Z > z) = 1.0000

. prtesti 1067 0.3818 1676 0.5996

Two-sample test of proportions

x: Number of obs = 1067

y: Number of obs = 1676

| Mean Std. err. z P>|z| [95% conf. interval]

x | .3818 .0148731 .3526493 .4109507

y | .5996 .0119685 .5761421 .6230579

diff | -.2178 .0190907 -.255217 -.180383

| under H0: .0195736 -11.13 0.000

diff = prop(x) - prop(y) z = -11.1272

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.0000

Pr(|Z| > |z|) = 0.0000

Pr(Z > z) = 1.0000

. prtesti 5485 0.4114 7440 0.5581

Two-sample test of proportions

x: Number of obs = 5485

y: Number of obs = 7440

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.4114	.0066444		.3983773	.4244227
y	.5581	.0057575		.5468156	.5693844
diff	-.1467	.0087918		-.1639317	-.1294683
under H0:	.0088981	-16.49	0.000		

diff = prop(x) - prop(y) z = -16.4867

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.0000

Pr(|Z| > |z|) = 0.0000

Pr(Z > z) = 1.0000

. prtesti 142 0.4749 153 0.5117

Two-sample test of proportions x: Number of obs = 142

y: Number of obs = 153

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.4749	.0419062		.3927654	.5570346
y	.5117	.0404115		.4324948	.5909052
diff	-.0368	.058217		-.1509032	.0773032
under H0:	.0582586	-0.63	0.528		

diff = prop(x) - prop(y) z = -0.6317

H0: diff = 0

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
 Pr(Z < z) = 0.2638 Pr(|Z| > |z|) = 0.5276 Pr(Z > z) = 0.7362

.
. prtesti 1309 0.4028 1909 0.5874

Two-sample test of proportions x: Number of obs = 1309
y: Number of obs = 1909

```

-----
      |   Mean   Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
x |   .4028   .0135561           .3762305   .4293695
y |   .5874   .0112675           .5653161   .6094839
-----+-----
diff |   -.1846   .0176274           -.2191491   -.1500509
      | under H0:   .0179374  -10.29   0.000
-----

```

diff = prop(x) - prop(y) z = -10.2914
 H0: diff = 0

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
 Pr(Z < z) = 0.0000 Pr(|Z| > |z|) = 0.0000 Pr(Z > z) = 1.0000

.
. prtesti 137 0.3743 228 0.6230

Two-sample test of proportions x: Number of obs = 137
y: Number of obs = 228

```

-----
      |   Mean   Std. err.   z   P>|z|   [95% conf. interval]
-----+-----

```


	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.4089	.0048784			.3993385 .4184615
y	.57	.0041609			.5618448 .5781552
diff	-.1611	.0064118			-.173667 -.148533

| under H0: .0065018 -24.78 0.000

diff = prop(x) - prop(y)

z = -24.7776

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.0000

Pr(|Z| > |z|) = 0.0000

Pr(Z > z) = 1.0000

Appendix 3.9: Stata Log file of merging HBV chronic cases with all cases tested for HBeAg

```
. use "2015-2019_HBV Chronic Cases.dta",clear
```

```
. merge 1:1 UNIQUE_PATIENT_ID using "Z:\Centre for Vaccines and  
Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD Output  
files_SM081020\Files_Chapter3\Final for PhD 061023\HBsAg and HBV Chronic for
```

```
> merging with HBeAg\2015-2019_HBeAg_All_Cases.dta"
```

```
(label TAKEN_DATE_AGE_GROUP already defined)
```

Result	Number of obs

Not matched	84,170
from master	5,531 (_merge==1)
from using	78,639 (_merge==2)
 Matched	 5,824 (_merge==3)

```
.
```

```
. keep if _merge==3
```

```
(84,170 observations deleted)
```

```
.
```

```
. tab HEPATITIS_B_E_AG
```

HEPATITIS_B_			
E_AG	Freq.	Percent	Cum.
-----+-----			
EQUIVOCAL	3	0.05	0.05
NEGATIVE	3,360	57.69	57.74

POSITIVE	2,461	42.26	100.00

-----+-----

Total	5,824	100.00

.

. table Taken_Date_Age_Group Gender if HEPATITIS_B_E_AG == "POSITIVE"

		GENDER			
		F	M	U	Total

-----+-----

RECODE of AGE_TAKEN_DATE_YEARS1 |

'0-4		3	1		4
'5-9		3	7	1	11
'10-14		4	4		8
'15-19		30	15		45
'20-24		134	59	11	204
'25-29		277	188	3	468
'30-34		204	338	8	550
'35-39		174	268	5	447
'40-44		112	228	4	344
'45-49		50	137	4	191
'50-54		21	66		87
'55-59		14	32		46
'60+		18	25	1	44
'99999		2	10		12
Total		1,046	1,378	37	2,461

.

. table Taken_Date_Age_Group Gender if HEPATITIS_B_E_AG == "NEGATIVE"

		GENDER			
		F	M	U	Total
-----+-----					
RECODE of AGE_TAKEN_DATE_YEARS1					
'5-9		1	2	3	
'10-14		3	3	6	
'15-19		12	8	20	
'20-24		130	57	3	190
'25-29		224	179	6	409
'30-34		271	344	3	618
'35-39		268	393	10	671
'40-44		219	318	1	538
'45-49		139	244	6	389
'50-54		104	141	2	247
'55-59		44	84		128
'60+		58	67	1	126
'99999		7	8		15
Total		1,480	1,848	32	3,360

.

. table Taken_Date_Age_Group Gender if HEPATITIS_B_E_AG == "EQUIVOCAL"

		GENDER		
		F	M	Total
-----+-----				
RECODE of AGE_TAKEN_DATE_YEARS1				
'20-24		1	1	
'30-34		1	1	
'50-54		1	1	

Total		1	2	3

.

. table Taken_Date_Age_Group Gender HEPATITIS_B_E_AG

		HEPATITIS_B_E_AG		
		EQUIVOCAL	NEGATIVE	POSITIVE
		Total		

RECODE of AGE_TAKEN_DATE_YEARS1 |

'0-4				
GENDER				
F			3	3
M			1	1
Total			4	4
'5-9				
GENDER				
F		1	3	4
M		2	7	9
U			1	1
Total		3	11	14
'10-14				
GENDER				
F		3	4	7
M		3	4	7
Total		6	8	14
'15-19				
GENDER				
F		12	30	42
M		8	15	23
Total		20	45	65

'20-24					
GENDER					
F		1	130	134	265
M			57	59	116
U			3	11	14
Total		1	190	204	395
'25-29					
GENDER					
F			224	277	501
M			179	188	367
U			6	3	9
Total			409	468	877
'30-34					
GENDER					
F			271	204	475
M		1	344	338	683
U			3	8	11
Total		1	618	550	1,169
'35-39					
GENDER					
F			268	174	442
M			393	268	661
U			10	5	15
Total			671	447	1,118
'40-44					
GENDER					
F			219	112	331
M			318	228	546
U			1	4	5
Total			538	344	882
'45-49					
GENDER					

F			139	50	189
M			244	137	381
U			6	4	10
Total			389	191	580
'50-54					
GENDER					
F			104	21	125
M		1	141	66	208
U			2	2	
Total		1	247	87	335
'55-59					
GENDER					
F			44	14	58
M			84	32	116
Total			128	46	174
'60+					
GENDER					
F			58	18	76
M			67	25	92
U			1	1	2
Total			126	44	170
'99999					
GENDER					
F			7	2	9
M			8	10	18
Total			15	12	27
Total					
GENDER					
F		1	1,480	1,046	2,527
M		2	1,848	1,378	3,228
U			32	37	69
Total		3	3,360	2,461	5,824

•

Two-sample test of proportions x: Number of obs = 3
y: Number of obs = 1

	Mean	Std. err.	z	P> z	[95% conf. interval]

x	.75	.25	.260009	1.239991

y | .25 . . .

-----+

diff	.5	.5	-.479982	1.479982

```
| under H0: .559017  0.89  0.371
```

$$\text{diff} = \text{prop}(x) - \text{prop}(y) \quad z = 0.8944$$
$$H_0: \text{diff} = 0$$

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

$$\Pr(Z < z) = 0.8145 \quad \Pr(|Z| > |z|) = 0.3711 \quad \Pr(Z > z) = 0.1855$$

•

```
. prtesti 3 .27 7 .64
```

Two-sample test of proportions x: Number of obs = 3

y: Number of obs = 7

	Mean	Std. err.	z	P> z	[95% conf. interval]

```

x |      .27 .2563201      -.2323782 .7723782
y |      .64 .1814229      .2844176 .9955824
-----+-----
diff |    -.37 .3140291      -.9854858 .2454858
    | under H0: .3444519 -1.07 0.283
-----+-----

diff = prop(x) - prop(y)          z = -1.0742
H0: diff = 0

Ha: diff < 0      Ha: diff != 0      Ha: diff > 0
Pr(Z < z) = 0.1414  Pr(|Z| > |z|) = 0.2827  Pr(Z > z) = 0.8586

.
. prtesti 4 .50 4 .50

```

Two-sample test of proportions x: Number of obs = 4
 y: Number of obs = 4

```

    |   Mean   Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
x |    .5    .25          .010009   .989991
y |    .5    .25          .010009   .989991
-----+-----

diff |    0 .3535534      -.6929519 .6929519
    | under H0: .3535534  0.00 1.000
-----+-----

diff = prop(x) - prop(y)          z = 0.0000
H0: diff = 0

Ha: diff < 0      Ha: diff != 0      Ha: diff > 0
Pr(Z < z) = 0.5000  Pr(|Z| > |z|) = 1.0000  Pr(Z > z) = 0.5000

```

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.66	.0409222		.579794	.740206
y	.29	.0590748		.1742155	.4057845
diff	.37	.0718642		.2291488	.5108512

| under H0: .0777771 4.76 0.000

diff = prop(x) - prop(y) z = 4.7572

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 1.0000

Pr(|Z| > |z|) = 0.0000

Pr(Z > z) = 0.0000

. prtesti 277 .59 188 .40

Two-sample test of proportions

x: Number of obs = 277

y: Number of obs = 188

| Mean Std. err. z P>|z| [95% conf. interval]

x | .59 .0295514 .5320803 .6479197

y | .4 .0357295 .3299715 .4700285

diff | .19 .0463668 .0991227 .2808773

| under H0: .0472309 4.02 0.000

diff = prop(x) - prop(y) z = 4.0228

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 1.0000

Pr(|Z| > |z|) = 0.0001

Pr(Z > z) = 0.0000

. prtesti 204 .37 338 .61

Two-sample test of proportions

x: Number of obs = 204

y: Number of obs = 338

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.37	.0338031		.3037472	.4362528
y	.61	.0265301		.558002	.661998
diff	-.24	.0429708		-.3242213	-.1557787
under H0:	.0442955	-5.42	0.000		

diff = prop(x) - prop(y) z = -5.4182

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.0000

Pr(|Z| > |z|) = 0.0000

Pr(Z > z) = 1.0000

. prtesti 174 .39 268 .60

Two-sample test of proportions

x: Number of obs = 174

y: Number of obs = 268

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.39	.0369762		.3175279	.4624721
y	.6	.0299253		.5413475	.6586525
diff	-.21	.0475685		-.3032326	-.1167674
under H0:	.0486495	-4.32	0.000		

diff = prop(x) - prop(y) z = -4.3166

H0: diff = 0

```

Ha: diff < 0      Ha: diff != 0      Ha: diff > 0
Pr(Z < z) = 0.0000  Pr(|Z| > |z|) = 0.0000  Pr(Z > z) = 1.0000

.

. prtesti 112 .33 228 .66

```

```

Two-sample test of proportions      x: Number of obs =   112
                                   y: Number of obs =   228

```

```

-----
|   Mean  Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
x |   .33   .0444309           .242917   .417083
y |   .66   .0313721           .5985118   .7214882
-----+-----
diff |   -.33   .0543904           -.4366033   -.2233967
      | under H0: .0573899   -5.75   0.000

```

```

-----
diff = prop(x) - prop(y)          z = -5.7501
H0: diff = 0

```

```

Ha: diff < 0      Ha: diff != 0      Ha: diff > 0
Pr(Z < z) = 0.0000  Pr(|Z| > |z|) = 0.0000  Pr(Z > z) = 1.0000

.

. prtesti 50 .26 137 .72

```

```

Two-sample test of proportions      x: Number of obs =   50
                                   y: Number of obs =  137

```

```

-----
|   Mean  Std. err.   z   P>|z|   [95% conf. interval]
-----+-----

```


	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.41	.1159262		.1827888	.6372112
y	.57	.0990152		.3759339	.7640661
diff	-.16	.1524562		-.4588086	.1388086

| under H0: .1545575 -1.04 0.301

diff = prop(x) - prop(y) z = -1.0352

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.1503

Pr(|Z| > |z|) = 0.3006

Pr(Z > z) = 0.8497

.

. prtesti 2 .17 10 .83

Two-sample test of proportions

x: Number of obs = 2

y: Number of obs = 10

| Mean Std. err. z P>|z| [95% conf. interval]

x | .17 .2656125 -.3505909 .6905909

y | .83 .1187855 .5971847 1.062815

diff | -.66 .2909639 -1.230279 -.0897212

| under H0: .347793 -1.90 0.058

diff = prop(x) - prop(y) z = -1.8977

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.0289

Pr(|Z| > |z|) = 0.0577

Pr(Z > z) = 0.9711

.

.

.

. ***FOR INFERENTIAL STATS BY AGE GROUP AND GENDER_HBV CHRONIC CASES

```
. prtesti 3 .38 5 .63
```

Two-sample test of proportions x: Number of obs = 3

y: Number of obs = 5

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.38	.280238			
y	.63	.2159167			
diff	-.25	.3537702			
under H0: .3641875 -0.69 0.492					

$$\text{diff} = \text{prop}(x) - \text{prop}(y) \quad z = -0.6865$$

H0: diff = 0

$$H_a: \text{diff} < 0$$

Ha: $\text{diff} \neq 0$

$$H_a: \text{diff} > 0$$
$$\Pr(Z < z) = 0.2462$$
$$\Pr(|Z| > |z|) = 0.4924$$
$$\Pr(Z > z) = 0.7538$$

.

. prtesti 5 .24 15 .71

Two-sample test of proportions x: Number of obs = 5

y: Number of obs = 15

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.24	.1909974			
y	.71	.1171609			

```

diff |    -.47 .2240684          -.9091661  -.0308339
    | under H0: .253742  -1.85  0.064
-----

diff = prop(x) - prop(y)          z = -1.8523
H0: diff = 0

Ha: diff < 0          Ha: diff != 0          Ha: diff > 0
Pr(Z < z) = 0.0320    Pr(|Z| > |z|) = 0.0640    Pr(Z > z) = 0.9680

.
. prtesti 11 .52 10 .48

```

```

Two-sample test of proportions          x: Number of obs =   11
                                     y: Number of obs =   10

```

```

-----
      |   Mean   Std. err.    z   P>|z|   [95% conf. interval]
-----+-----
x |   .52   .150635          .2247608   .8152392
y |   .48   .1579873          .1703505   .7896495
-----+-----

diff |   .04   .2182909          -.3878423   .4678423
    | under H0: .2184653   0.18  0.855
-----

diff = prop(x) - prop(y)          z =  0.1831
H0: diff = 0

Ha: diff < 0          Ha: diff != 0          Ha: diff > 0
Pr(Z < z) = 0.5726    Pr(|Z| > |z|) = 0.8547    Pr(Z > z) = 0.4274

.
. prtesti 83 .73 31 .27

```

x: Number of obs = 83

y: Number of obs = 31

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.73	.0487309			.6344892 .8255108
y	.27	.0797375			.1137174 .4262826
diff	.46	.0934493			.2768428 .6431572
	under H0:	.1029024	4.47	0.000	

$$\text{diff} = \text{prop}(x) - \text{prop}(y) \quad z = 4.4703$$

H0: diff = 0

$$H_a: \text{diff} < 0$$

Ha: $\text{diff} \neq 0$

$$H_a: \text{diff} > 0$$
$$\Pr(Z < z) = 1.0000$$
$$\Pr(|Z| > |z|) = 0.0000$$
$$\Pr(Z > z) = 0.0000$$

•

```
. prtesti 484 .67 219 .31
```

x: Number of obs = 484

y: Number of obs = 219

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.67	.0213733			.6281091 .7118909
y	.31	.0312524			.2487464 .3712536
diff	.36	.037862			.2857919 .4342081
under H0: .0404461 8.90 0.000					

$$\text{diff} = \text{prop}(x) - \text{prop}(y) \quad z = 8.9007$$

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 1.0000

Pr(|Z| > |z|) = 0.0000

Pr(Z > z) = 0.0000

.

. prtesti 1021 .59 691 .40

Two-sample test of proportions

x: Number of obs = 1021

y: Number of obs = 691

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.59	.0153924		.5598315	.6201685
y	.4	.0186366		.3634729	.4365271
diff	.19	.0241712		.1426253	.2373747
	under H0: .0246216 7.72 0.000				

diff = prop(x) - prop(y)

z = 7.7168

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 1.0000

Pr(|Z| > |z|) = 0.0000

Pr(Z > z) = 0.0000

.

. prtesti 1064 .45 1272 .54

Two-sample test of proportions

x: Number of obs = 1064

y: Number of obs = 1272

	Mean	Std. err.	z	P> z	[95% conf. interval]

-----+-----				
x	.45	.0152516	.4201073	.4798927
y	.54	.0139744	.5126107	.5673893
-----+-----				
diff	-.09	.0206856	-.1305431	-.0494569
under H0:	.0207726	-4.33	0.000	

```
diff = prop(x) - prop(y)          z = -4.3326
H0: diff = 0
```

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
Pr(Z < z) = 0.0000	Pr(Z > z) = 0.0000	Pr(Z > z) = 1.0000

.prtesti 896 .40 1303 .59

Two-sample test of proportions x: Number of obs = 896
y: Number of obs = 1303

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.4	.0163663		.3679226	.4320774
y	.59	.0136253		.5632949	.6167051
diff	-.19	.0212957		-.2317388	-.1482612
	under H0:	.021693	-8.76	0.000	

diff = prop(x) - prop(y) z = -8.7586
H0: diff = 0

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
Pr(Z < z) = 0.0000	Pr(Z > z) = 0.0000	Pr(Z > z) = 1.0000

Two-sample test of proportions x: Number of obs = 646
y: Number of obs = 1131

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.36	.0188853			.3229854 .3970146
y	.63	.0143562			.6018623 .6581377
diff	-.27	.0237225			-.3164953 -.2235047
under H0: .0246084 -10.97 0.000					

diff = prop(x) - prop(y) z = -10.9719
H0: diff = 0

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
Pr(Z < z) = 0.0000	Pr(Z > z) = 0.0000	Pr(Z > z) = 1.0000

. prtesti 363 .32 757 .67

Two-sample test of proportions x: Number of obs = 363
y: Number of obs = 757

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.32	.0244836		.2720129	.3679871
y	.67	.0170902		.6365039	.7034961

.....

. prtesti 224 .37 372 .62

. prtesti 107 .32 227 .68

x: Number of obs = 107

y: Number of obs = 227

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.32	.045096			.2316136 .4083864
y	.68	.0309611			.6193173 .7406827
diff	-.36	.0547013			-.4672126 -.2527874
	under H0:	.05814	-6.19	0.000	

$$\text{diff} = \text{prop}(x) - \text{prop}(y) \quad z = -6.1920$$

H0: diff = 0

$$H_a: \text{diff} < 0$$

Ha: $\text{diff} \neq 0$

$$H_a: \text{diff} > 0$$
$$\Pr(Z < z) = 0.0000$$
$$\Pr(|Z| > |z|) = 0.0000$$
$$\Pr(Z > z) = 1.0000$$

•

```
. prtesti 108 .40 155 .58
```

x: Number of obs = 108

y: Number of obs = 155

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.4	.0471405			.3076064 .4923936
y	.58	.0396436			.5023 .6577
diff	-.18	.0615941			-.3007222 -.0592778
	under H0:	.0626669	-2.87	0.004	

$$\text{diff} = \text{prop}(x) - \text{prop}(y) \quad z = -2.8723$$

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.0020

Pr(|Z| > |z|) = 0.0041

Pr(Z > z) = 0.9980

.

. prtesti 12 .32 23 .62

Two-sample test of proportions

x: Number of obs = 12

y: Number of obs = 23

	Mean	Std. err.	z	P> z	[95% conf. interval]
-----+-----					
x	.32	.1346601		.0560711	.5839289
y	.62	.1012101		.4216319	.8183681
-----+-----					
diff	-.3	.1684542		-.6301641	.0301641
under H0:	.1779484		-1.69	0.092	

diff = prop(x) - prop(y)

z = -1.6859

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.0459

Pr(|Z| > |z|) = 0.0918

Pr(Z > z) = 0.9541

.

. prtesti 5027 .44 6211 .55

Two-sample test of proportions

x: Number of obs = 5027

y: Number of obs = 6211

	Mean	Std. err.	z	P> z	[95% conf. interval]

```

-----+-----
      x |   .44 .0070011          .4262781 .4537219
      y |   .55 .0063126          .5376276 .5623724
-----+-----

      diff |   -11 .0094268          -1.1284761 -.0915239
          | under H0: .0094859 -11.60 0.000
-----+-----

      diff = prop(x) - prop(y)          z = -11.5962
H0: diff = 0

      Ha: diff < 0          Ha: diff != 0          Ha: diff > 0
Pr(Z < z) = 0.0000      Pr(|Z| > |z|) = 0.0000      Pr(Z > z) = 1.0000

.
. table PROVINCE_NAME Gender if HEPATITIS_B_E_AG == "POSITIVE"

```

```

-----+-----
      |      GENDER
      |  F    M  U Total
-----+-----

PROVINCE_NAME |
EASTERN CAPE | 142 155    297
FREE STATE   |  28  48    76
GAUTENG      | 233 307  3  543
KWAZULU-NATAL | 438 585 31 1,054
LIMPOPO      |   5   9   14
MPUMALANGA   |  92 125  1  218
NORTH WEST   |  19  22   41
NORTHERN CAPE |   4   2   1   7
WESTERN CAPE |  85 125  1  211
Total        | 1,046 1,378 37 2,461
-----+-----

```

.

. table PROVINCE_NAME Gender if HEPATITIS_B_E_AG=="NEGATIVE"

	GENDER				
	F	M	U	Total	
-----+					
PROVINCE_NAME					
EASTERN CAPE	280	249	1	530	
FREE STATE	30	56		86	
GAUTENG	243	349	4	596	
KWAZULU-NATAL	572	735	26	1,333	
LIMPOPO	18	25		43	
MPUMALANGA	115	127		242	
NORTH WEST	29	28	1	58	
NORTHERN CAPE	5	8		13	
WESTERN CAPE	188	271		459	
Total	1,480	1,848	32	3,360	

.

. table PROVINCE_NAME Gender if HEPATITIS_B_E_AG=="EQUIVOCAL"

	GENDER		
	F	M	Total
-----+			
PROVINCE_NAME			
FREE STATE	1		1
KWAZULU-NATAL	1	1	2
Total	1	2	3

.

. table PROVINCE_NAME Gender HEPATITIS_B_E_AG

		HEPATITIS_B_E_AG			
		EQUIVOCAL	NEGATIVE	POSITIVE	Total

-----+

PROVINCE_NAME |

EASTERN CAPE |

GENDER |

F			280	142	422
M			249	155	404
U			1	1	
Total			530	297	827

FREE STATE |

GENDER |

F			30	28	58
M		1	56	48	105
Total		1	86	76	163

GAUTENG |

GENDER |

F			243	233	476
M			349	307	656
U			4	3	7
Total			596	543	1,139

KWAZULU-NATAL |

GENDER |

F		1	572	438	1,011
M		1	735	585	1,321
U			26	31	57

Total		2	1,333	1,054	2,389

LIMPOPO |

GENDER					

F		18	5	23

M		25	9	34

Total		43	14	57

MPUMALANGA |

GENDER					

F		115	92	207

M		127	125	252

U			1	1

Total		242	218	460

NORTH WEST |

GENDER					

F		29	19	48

M		28	22	50

U		1		1

Total		58	41	99

NORTHERN CAPE |

GENDER					

F		5	4	9

M		8	2	10

U			1	1

Total		13	7	20

WESTERN CAPE |

GENDER					

F		188	85	273

M		271	125	396

U			1	1

Total		459	211	670

Total |

GENDER					

F		1	1,480	1,046	2,527
M		2	1,848	1,378	3,228
U			32	37	69
Total		3	3,360	2,461	5,824

. table PROVINCE_DISTRICT Gender HEPATITIS_B_E_AG

		HEPATITIS_B_E_AG			
		EQUIVOCAL	NEGATIVE	POSITIVE	Total

PROVINCE_DISTRICT				
Eastern Cape_Alfred Nzo				
GENDER				
F		9	6	15
M		3	4	7
Total		12	10	22

Eastern Cape_Amathole				
GENDER				
F		32	27	59
M		26	22	48
Total		58	49	107

Eastern Cape_Buffalo City Metro				
GENDER				
F		12	4	16
M		5	8	13
U		1		1
Total		18	12	30

Eastern Cape_Chris Hani				
GENDER				

F		7	2	9
M		1	2	3
Total		8	4	12
Eastern Cape_Joe Gqabi				
GENDER				
F		1		1
M		4		4
Total		5		5
Eastern Cape_Nelson Mandela Bay Metro				
GENDER				
F		89	45	134
M		99	70	169
Total		188	115	303
Eastern Cape_O R Tambo				
GENDER				
F		104	67	171
M		100	42	142
U			1	1
Total		204	110	314
Eastern Cape_Sarah Baartman				
GENDER				
F		22	2	24
M		18	9	27
Total		40	11	51
Free State_Fezile Dabi				
GENDER				
F		9	10	19
M		12	22	34
Total		21	32	53
Free State_Lejweleputswa				
GENDER				
F		6	4	10

M		3	8	11
Total		9	12	21

Free State_Mangaung Metro |

GENDER				
F		16	12	28
M		40	18	58
Total		56	30	86

Free State_Thabo Mofutsanyana |

GENDER				
F			1	1
M		1	1	2
Total		1	1	3

Free State_Unknown |

GENDER				
M		1		1
Total		1		1

Free State_Xhariep |

GENDER				
F		1	1	2
M		1		1
Total		2	1	3

Gauteng_City Of Johannesburg Metro |

GENDER				
F		123	109	232
M		175	156	331
U		3	2	5
Total		301	267	568

Gauteng_City Of Tshwane Metro |

GENDER				
F		103	99	202
M		137	123	260
U		1	1	2

Total		241	223	464
Gauteng_Ekurhuleni Metro				
GENDER				
F		3	4	7
M		8	7	15
Total		11	11	22
Gauteng_Sedibeng				
GENDER				
M		2	2	
Total		2	2	
Gauteng_West Rand				
GENDER				
F			1	1
M		4	3	7
Total		4	4	8
Kwazulu-Natal_Amajuba				
GENDER				
F		14	5	19
M		11	7	18
Total		25	12	37
Kwazulu-Natal_Ethekwini Metro				
GENDER				
F		1	277	222 500
M			352	283 635
U			10	14 24
Total		1	639	519 1,159
Kwazulu-Natal_Harry Gwala				
GENDER				
F		4	3	7
M		5	6	11
Total		9	9	18
Kwazulu-Natal_Ilembe				

GENDER				
F		16	6	22
M		17	13	30
U		2	2	
Total		35	19	54

Kwazulu-Natal_King Cetshwayo |

GENDER				
F		6	2	8
M		10	1	11
U		1	1	
Total		17	3	20

Kwazulu-Natal_Ugu |

GENDER				
F		89	52	141
M		101	65	166
U		1	2	3
Total		191	119	310

Kwazulu-Natal_Umgungundlovu |

GENDER				
F		129	147	276
M	1	185	174	360
U		11	13	24
Total	1	325	334	660

Kwazulu-Natal_Umkhanyakude |

GENDER				
F		19	5	24
M		30	14	44
Total		49	19	68

Kwazulu-Natal_Umzinyathi |

GENDER				
F		9	4	13
M		7	12	19

Total		16	16	32
Kwazulu-Natal_Uthukela				
GENDER				
F		8	3	11
M		8	5	13
Total		16	8	24
Kwazulu-Natal_Uthungulu				
GENDER				
F		8	1	9
M		6	4	10
U			1	1
Total		14	6	20
Kwazulu-Natal_Zululand				
GENDER				
F		11	3	14
M		15	10	25
U		1		1
Total		27	13	40
Limpopo_Capricorn				
GENDER				
M		4		4
Total		4		4
Limpopo_Greater Sekhukhune				
GENDER				
F		9	2	11
M		6	4	10
Total		15	6	21
Limpopo_Mopani				
GENDER				
M		2		2
Total		2		2
Limpopo_Vhembe				

GENDER				
F		4	4	
M		11	2	13
Total		15	2	17

Limpopo_Waterberg |

GENDER				
F		3	3	6
M		2	3	5
Total		5	6	11

Mpumalanga_Ehlanzeni |

GENDER				
F		58	26	84
M		59	36	95
Total		117	62	179

Mpumalanga_Gert Sibande |

GENDER				
F		36	53	89
M		47	74	121
U			1	1
Total		83	128	211

Mpumalanga_Nkangala |

GENDER				
F		24	16	40
M		27	22	49
Total		51	38	89

North West_Bojanala Platinum |

GENDER				
F		3	1	4
M		3		3
Total		6	1	7

North West_Dr Kenneth Kaunda |

GENDER				

F		4	8	12
M		10	10	20
U		1		1
Total		15	18	33

North West_Dr Ruth Segomotsi Mompati |

GENDER				
F		18	6	24
M		7	7	14
Total		25	13	38

North West_Ngaka Modiri Molema |

GENDER				
F		2	1	3
M		7	2	9
Total		9	3	12

Northern Cape_Frances Baard |

GENDER				
F		1	1	2
M		4		4
U			1	1
Total		5	2	7

Northern Cape_Namakwa |

GENDER				
F		1		1
Total		1		1

Northern Cape_Pixley Ka Seme |

GENDER				
F		1		1
M			1	1
Total		1	1	2

Northern Cape_Zf Mgcawu |

GENDER				
F		2		2

M		1	1	2
Total		3	1	4
Western Cape_Cape Winelands				
GENDER				
F		19	6	25
M		26	9	35
Total		45	15	60
Western Cape_City Of Cape Town Metro				
GENDER				
F		149	72	221
M		230	108	338
U			1	1
Total		379	181	560
Western Cape_Garden Route				
GENDER				
F		9		9
M		7	1	8
Total		16	1	17
Western Cape_Overberg				
GENDER				
F		4	1	5
M		3	2	5
Total		7	3	10
Western Cape_West Coast				
GENDER				
F		6	3	9
M		5	6	11
Total		11	9	20
Total				
GENDER				
F		1	1,480	1,046 2,527
M		2	1,848	1,378 3,228

x: Number of obs = 28

y: Number of obs = 48

	Mean	Std. err.	z	P> z	[95% conf. interval]

x	.3684	.0911595	.1897307	.5470693

y	.6316	.0696242	.4951391	.7680609

```
diff | -0.2632 0.1147065 -0.4880206 -0.0383794
```

```
| under H0: .1186132  -2.22  0.026
```

$$\text{diff} = \text{prop}(x) - \text{prop}(y) \quad z = -2.2190$$

H0: diff = 0

$$H_a: \text{diff} < 0$$

Ha: $\text{diff} \neq 0$

$$H_a: \text{diff} > 0$$
$$\Pr(Z < z) = 0.0132$$
$$\Pr(|Z| > |z|) = 0.0265$$
$$\Pr(Z > z) = 0.9868$$

```
. prtesti 233 0.4291 307 0.5654
```

x: Number of obs = 233

y: Number of obs = 307

	Mean	Std. err.	z	P> z	[95% conf. interval]

x	.4291	.0324251	.365548	.492652

y	.5654	.0282913	.50995	.62085

```
diff |    -.1363 .0430324          -.2206419 -.0519581
```

```
| under H0: .0434392  -3.14  0.002
```

$$\text{diff} = \text{prop}(x) - \text{prop}(y) \quad z = -3.1377$$

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.0009

Pr(|Z| > |z|) = 0.0017

Pr(Z > z) = 0.9991

.

. prtesti 438 0.4156 585 0.5550

Two-sample test of proportions

x: Number of obs = 438

y: Number of obs = 585

	Mean	Std. err.	z	P> z	[95% conf. interval]
-----+-----					
x	.4156	.0235481		.3694466	.4617534
y	.555	.020547		.5147286	.5952714
-----+-----					
diff	-.1394	.0312521		-.2006529	-.0781471
under H0:	.0315918	-4.41	0.000		

diff = prop(x) - prop(y)

z = -4.4125

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.0000

Pr(|Z| > |z|) = 0.0000

Pr(Z > z) = 1.0000

.

. prtesti 5 0.3571 9 0.6429

Two-sample test of proportions

x: Number of obs = 5

y: Number of obs = 9

	Mean	Std. err.	z	P> z	[95% conf. interval]

Two-sample test of proportions x: Number of obs = 19
y: Number of obs = 22

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.4634	.1144001			.2391798 .6876202
y	.5366	.1063144			.3282276 .7449724
diff	-.0732	.1561734			-.3792943 .2328943
	under H0:	.1565913	-0.47	0.640	

diff = prop(x) - prop(y) z = -0.4675
H0: diff = 0

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
Pr(Z < z) = 0.3201	Pr(Z > z) = 0.6402	Pr(Z > z) = 0.6799

```
. prtesti 4 0.5714 2 0.2857
```

Two-sample test of proportions x: Number of obs = 4
y: Number of obs = 2

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.5714	.2474379		.0864306	1.056369
y	.2857	.3194335		-.3403781	.9117781

```

diff |   .2857   .4040585           -.5062401   1.07764
    | under H0: .4325205   0.66   0.509
-----
diff = prop(x) - prop(y)           z =   0.6605
H0: diff = 0

Ha: diff < 0           Ha: diff != 0           Ha: diff > 0
Pr(Z < z) = 0.7455     Pr(|Z| > |z|) = 0.5089     Pr(Z > z) = 0.2545

.
. prtesti 85 0.4028 125 0.5924

```

```

Two-sample test of proportions           x: Number of obs =   85
                                     y: Number of obs =   125

```

```

-----
    |   Mean   Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
x |   .4028   .053198           .2985339   .5070661
y |   .5924   .0439511           .5062575   .6785425
-----+-----
diff |   -.1896   .0690052           -.3248478   -.0543522
    | under H0: .070259   -2.70   0.007
-----

```

```

diff = prop(x) - prop(y)           z =  -2.6986
H0: diff = 0

Ha: diff < 0           Ha: diff != 0           Ha: diff > 0
Pr(Z < z) = 0.0035     Pr(|Z| > |z|) = 0.0070     Pr(Z > z) = 0.9965

.
. prtesti 1046 0.4250 1378 0.5599

```

x: Number of obs = 1046

y: Number of obs = 1378

	Mean	Std. err.	z	P> z	[95% conf. interval]

x	.425	.0152849	.3950422	.4549578

```
y |      .5599 .0133723      .5336908 .5861092
```

diff | -.1349 .0203088 -.1747045 -.0950955

```
| under H0: .0205042  -6.58  0.000
```

$$\text{diff} = \text{prop}(x) - \text{prop}(y) \quad z = -6.5791$$

H0: diff = 0

$$H_a: \text{diff} < 0$$

Ha: $\text{diff} \neq 0$

$$H_a: \text{diff} > 0$$
$$\Pr(Z < z) = 0.0000$$
$$\Pr(|Z| > |z|) = 0.0000$$
$$\Pr(Z > z) = 1.0000$$

•

•

•

. ***FOR INFERENCE STATS BY PROVINCE AND GENDER_HBV CHRONIC CASES

•

```
. prtesti 1133 .52 1060 .48
```

x: Number of obs = 1133

y: Number of obs = 1060

	Mean	Std. err.	z	P> z	[95% conf. interval]

x	.52	.0148425	.4909092	.5490908

```
y |      .48 .0153451      .4499242 .5100758
```


y: Number of obs = 2146

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.43	.0122775			.4059365 .4540635
y	.56	.0107153			.5389983 .5810017
diff	-.13	.0162959			-.1619394 -.0980606
under H0: .0164387 -7.91 0.000					

diff = prop(x) - prop(y) z = -7.9082
H0: diff = 0

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
Pr(Z < z) = 0.0000	Pr(Z > z) = 0.0000	Pr(Z > z) = 1.0000

```

.
. prtesti 1016 .42 1325 .55

```

y: Number of obs = 1325

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.42	.0154843			.3896513 .4503487
y	.55	.0136672			.5232128 .5767872
diff	-.13	.0206532			-.1704796 -.0895204
	under H0:	.0208488	-6.24	0.000	

diff = prop(x) - prop(y) z = -6.2354

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.0000

Pr(|Z| > |z|) = 0.0000

Pr(Z > z) = 1.0000

.

. prtesti 115 .47 125 .51

Two-sample test of proportions x: Number of obs = 115

y: Number of obs = 125

	Mean	Std. err.	z	P> z	[95% conf. interval]
-----+-----					
x	.47	.0465412		.3787808	.5612192
y	.51	.0447124		.4223653	.5976347
-----+-----					
diff	-.04	.064539		-.1664942	.0864942
under H0:	.064595		-0.62	0.536	

diff = prop(x) - prop(y) z = -0.6192

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.2679

Pr(|Z| > |z|) = 0.5358

Pr(Z > z) = 0.7321

.

. prtesti 227 .45 280 .55

Two-sample test of proportions x: Number of obs = 227

y: Number of obs = 280

```

|      Mean  Std. err.      z    P>|z|    [95% conf. interval]
-----+-----
x |      .45   .0330198                .3852823   .5147177
y |      .55   .0297309                .4917284   .6082716
-----+-----
diff |      -.1   .0444324                -.1870859   -.0129141
      | under H0:  .0446538   -2.24   0.025
-----+-----

diff = prop(x) - prop(y)                z = -2.2395
H0: diff = 0

Ha: diff < 0                Ha: diff != 0                Ha: diff > 0
Pr(Z < z) = 0.0126          Pr(|Z| > |z|) = 0.0251          Pr(Z > z) = 0.9874
.
. prtesti 225 .44 276 .54

```

$\Pr(Z < z) = 0.0130$ $\Pr(|Z| > |z|) = 0.0260$ $\Pr(Z > z) = 0.9870$

.

. prtesti 36 .40 52 .58

Two-sample test of proportions x: Number of obs = 36
y: Number of obs = 52

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.4	.0816497		.2399696	.5600304
y	.58	.0684443		.4458517	.7141483
diff	-.18	.1065424		-.3888193	.0288193
under H0:	.1083985		-1.66	0.097	

diff = prop(x) - prop(y) z = -1.6605

H0: diff = 0

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

$\Pr(Z < z) = 0.0484$ $\Pr(|Z| > |z|) = 0.0968$ $\Pr(Z > z) = 0.9516$

.

. prtesti 483 .41 682 .58

Two-sample test of proportions x: Number of obs = 483
y: Number of obs = 682

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.41	.0223792		.3661376	.4538624
y	.58	.0188993		.542958	.617042

RESEARCH

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Prevalence and incidence rates of laboratory-confirmed hepatitis B infection in South Africa, 2015 to 2019

Shelina Moonsamy^{1,2*}, Melinda Suchard^{1,3}, Pavitra Pillay² and Nishi Prabhdial-Sing^{1,4}

Abstract

Background: Hepatitis B virus (HBV), a global public health threat, is targeted for elimination by 2030. As national HBV prevalence and incidence is lacking for South Africa, our study aimed to provide such data in the public health sector.

Methods: We analysed laboratory-confirmed HBV data from 2015 to 2019 to determine annual prevalence and incidence rates of HBV infection per 100,000 population, HBsAg and anti-HBc IgM test positivity rates, and HBsAg and anti-HBc IgM testing rates per 100,000 population. Time trend and statistical analyses were performed on HBsAg and anti-HBc IgM test positivity rates.

Results: The national prevalence rate of HBV infection per 100,000 population increased from 56.14 in 2015 to 67.76 in 2019. Over the five years, the prevalence rate was higher in males than females, highest amongst individuals 25 to 49 years old and highest in Gauteng province. The HBsAg test positivity rate dropped from 9.77% in 2015 to 8.09% in 2019. Over the five years, the HBsAg test positivity rate was higher in males than females, amongst individuals 25 to 49 years old and amongst individuals of Limpopo province. Amongst HBsAg positive children under 5 years old, the majority (65.7%) were less than a year old. HBsAg testing rates per 100,000 population were higher in females under 45 years of age and in males 45 years and above. The national incidence rate of acute HBV infection per 100,000 population dropped from 3.17 in 2015 to 1.69 in 2019. Over the five-year period, incidence rates were similar between males and females, highest amongst individuals 20 to 39 years old and highest in Mpumalanga province. Amongst individuals 20 to 24 years old, there was a substantial decline in the incidence and anti-HBc IgM test positivity rates over time. Anti-HBc IgM testing rates per 100,000 population were higher in females under 40 years of age and in males 40 years and above.

Conclusion: Critical to hepatitis B elimination is strengthened infant vaccination coverage and interruption of vertical transmission. Transmission of HBV infection in adults may be reduced through heightened awareness of transmission routes and prevention measures.

Keywords: Hepatitis B, Prevalence, Incidence, Acute, HBsAg, Anti-HBc IgM, Test positivity rates

Background

Hepatitis B, a global public health threat, is a potentially life-threatening viral infection of the liver caused by the hepatitis B virus (HBV) [1]. Transmission of HBV infection is through contact with blood or other body fluids of an infected person, mainly via vertical transmission

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from mother to child, sexual contact and the sharing of equipment between intravenous drug users [2]. In 2015, the World Health Organisation (WHO) estimated that 257 million people were living with chronic HBV infection, with the greatest burden in the African and Western Pacific Regions [3]. Chronic HBV infection has no known cure, with a 15–40% lifetime risk of cirrhosis, liver failure or hepatocellular carcinoma [4]. Globally, in 2013, there were more deaths due to viral hepatitis (1.4 million) than HIV infection (1.3 million) [5, 6]. More recent estimates from 2017 show that HBV accounted for 24% of cirrhosis-related deaths in females and 32% of cirrhosis-related deaths in males globally, and 20% of cirrhosis-related deaths in females and 23% of cirrhosis-related deaths in males in Southern sub-Saharan Africa [7]. In 2016, the WHO adopted a resolution to eliminate HBV infection by 2030, with the aim of reducing new chronic infections by 90% and reducing HBV related deaths by 65% [8]. South Africa has embraced this resolution, with subsequent development and approval of the national guidelines for the management of viral hepatitis [9].

A diagnosis of HBV infection requires laboratory confirmation by detection of HBV surface antigen (HBsAg), a marker of active HBV infection [10, 11]. The persistence of HBsAg for six months or more is indicative of a chronic infection [12–14]. Acute HBV infection occurs within the first six months following exposure to the virus and is defined by the presence of high levels of IgM antibody to the core antigen (anti-HBc IgM). Low-level anti-HBc IgM antibodies are usually associated with reactivation of HBV infection or flares amongst chronic carriers [15, 16].

The HBV vaccine is the backbone of prevention of HBV infection. South Africa introduced the vaccine into the expanded programme on immunisation (EPI) schedule in April 1995, administered as a monovalent dose at 6, 10 and 14 weeks of age (HepB3) [17]. Since December 2015, the HBV vaccine has been administered as a component of the hexavalent vaccine (DTaP-IPV-HIB-HepB), with an additional booster dose administered at 18 months of age [18, 19]. HepB3 reportedly induces protective antibody levels in approximately 95% of individuals [20]. It was further demonstrated that 51% of individuals who responded to the primary vaccination series had protective antibody levels 30 years later [21].

HepB3 coverage in South Africa, as per the District Health Information System (DHIS) and published by the Health Systems Trust of South Africa, averaged 76.6% for the period 2000 to 2018; with the lowest in 2001 at 67.0% and highest in 2006 at 85.5% [22–26]. The WHO-UNICEF estimates for South Africa for the period 2000 to 2018 averaged 76.1%, with the lowest in 2003 and 2010 at 71.0% and highest in 2014 and 2015 at 85.0% [27].

The WHO recommends a birth dose of the HBV vaccine (HepB_{BD}) to combat vertical transmission of HBV infection [28, 29]. Globally, by 2015, HepB_{BD} had significantly reduced the number of new chronic infections [8]. Although planned, South Africa is yet to implement HepB_{BD}, as transmission under five years of age was largely horizontal prior to vaccine introduction [17, 30]. Infants infected from their mothers have the highest risk of developing chronic HBV disease (70 to 90%). The risk decreases to between 20 to 60% in individuals who acquire infection between the ages of 1 and 6 years, 5 to 10% in individuals who acquire infection between the ages of 6 and 20 years, and 1 to 5% in individuals who acquire infection above the age of 20 years [31, 32]. On the contrary, the risk of developing symptoms in the acute phase of HBV infection increases with age. The risk of symptomatic HBV is around 1% in infants infected from their mothers, 10% in children 1 to 5 years of age and 30% in individuals over 5 years of age [12]. Antenatal HBV screening, recommended but not routinely performed in South Africa, would help assess and minimise the risk of vertical transmission through appropriate interventions [9].

Prior to vaccine introduction, hepatitis B was highly endemic in South Africa [19]. Following vaccine introduction, several sentinel studies reported HBsAg prevalence ranging from 2.9% in HIV-uninfected pregnant women in the Western Cape province in 2008 to 20.0% in HIV-infected individuals enrolled in workplace antiretroviral treatment programmes in 2002 and in HIV-infected individuals from North Eastern South Africa in 2008 [10, 33–37]. In children under 5 years of age, the overall HBsAg prevalence declined from 12.8% prior to vaccine introduction to 3.0% in 2009 [17, 28, 37]. In a study to determine HBV sero-prevalence in a convenience sample of children under 15 years of age, HBsAg prevalence was reported as 0.4% [19]. Data generated from some of these South African sentinel prevalence studies were used to develop a 5-year national hepatitis action plan using an investment case approach [38]. With the 2030 hepatitis B elimination goal fast approaching, our study aims to provide data on laboratory-diagnosed HBV infection in the public health sector at a national level.

Methods

Study population and data source

This was a retrospective quantitative cross-sectional study on routine HBV laboratory data obtained from the National Health Laboratory Service (NHLS) Central Data Warehouse (CDW) from 2015 to 2019. The NHLS CDW is the national repository for laboratory data from the public health sector of South Africa, serving around 85% of the population. HBV data were extracted by the

“Tested_Date” variable for the period 2015 to 2019. Other variables within the HBV dataset included qualitative and quantitative HBsAg and anti-HBc IgM results, gender, date of birth, age, province of testing facility and a CDW allocated unique identification number (UID). A probabilistic linkage algorithm, based on the surname, first name and date of birth or national identification number, was applied to each new entry into the CDW database. If a link to a previous record was identified, the UID was duplicated, otherwise a new UID was generated. Criteria for inclusion in our study were valid HBsAg and anti-HBc IgM qualitative results.

Data cleaning and deduplication

Data were initially cleaned in Microsoft Excel (Version 2016, Washington, USA) by identification, confirmation and deletion of quality assurance (non-patient related) records and records of research study participants to maintain a database restricted to patient records. Data were then imported into Stata IC (Version 14.1, Texas, USA) for deduplication purposes to exclude test results with duplicate UID records. Deduplication was performed per year from 2015 to 2019. If a patient UID had multiple tests in a specific year, deduplication ensured that a patient appeared only once in that year, providing a more accurate analysis of the data and eliminating risks of over- and under-estimation. Deduplication per year was performed on the complete dataset when determining the total number of cases tested for a specific marker in that year. When determining the total number of cases who tested positive for a specific marker per year, deduplication was performed only after the selection of all positive results for that year, thereby ensuring the inclusion of all cases who tested positive at any point in that year irrespective of testing negative either before and/or after the positive test.

Statistical analysis

Data were analysed for each year from 2015 to 2019 in Stata IC (version 14.1, Texas, USA) to determine the total number of laboratory-confirmed HBsAg and anti-HBc IgM positive cases by year, and the total number of HBsAg and anti-HBc IgM laboratory tests conducted by year. To prevent over-estimation of anti-HBc IgM positive cases, we excluded anti-HBc IgM values below recommended thresholds for each testing platform in consultation with the NHLS Virology Expert Committee (Supplementary Table 1). Values below the established thresholds were more likely to represent reactivation of HBV infection or chronic flares rather than acute HBV infection [15, 16]. We subsequently calculated the prevalence rates of HBV infection (HBsAg positive cases) per 100,000 population, the incidence

rates of acute HBV infection (anti-HBc IgM positive results) per 100,000 population, HBsAg and anti-HBc IgM testing rates per 100,000 population, and HBsAg and anti-HBc IgM test positivity rates. The prevalence rate of HBV infection was calculated as (the number of cases who tested positive for HBsAg $\times$ 100,000) / the population estimate. The incidence rate of acute HBV infection was calculated as (the number of cases who tested positive for anti-HBc IgM $\times$ 100,000) / the population estimate. HBsAg testing rate was calculated as (the total number of cases tested for HBsAg $\times$ 100,000) / the population estimate. Anti-HBc IgM testing rate was calculated as (the total number of cases tested for anti-HBc IgM $\times$ 100,000) / the population estimate. HBsAg test positivity rate was calculated as the percentage of HBsAg positive cases over the total number of cases tested for HBsAg. Anti-HBc IgM test positivity rate was calculated as the percentage of anti-HBc IgM positive cases over the total number of cases tested for anti-HBc IgM. Our analysis of HBsAg may reflect a mixture of acute and chronic HBV cases, and amongst those acutely infected, a proportion may have subsequently cleared viral infection.

For prevalence, incidence and testing rates, we used mid-year population estimates as published by Statistics South Africa [39]. Data were analysed per province, gender and age group. Cases with unknown province, gender or age group were included in national totals, however excluded in province-specific, gender-specific and age group-specific analyses respectively.

Statistical analyses were performed on HBsAg and anti-HBc IgM test positivity rates. To analyse trends over time from 2015 to 2019, we used the Kendall's rank correlation test for time series analysis in Stata IC (Version 14.1, Texas, USA). The Kendall's rank correlation test generates a correlation coefficient (tau) ranging from -1 to $+1$, where -0.8 to -1 is indicative of a strong negative association over time and a $+0.8$ to $+1$ is indicative of a strong positive association over time. As the correlation coefficient approaches zero, the association weakens. In our study, a negative association indicated a decline in test positivity rates overall from 2015 to 2019, whilst a positive association indicated an increase in test positivity rates overall from 2015 to 2019. To analyse statistical differences between age groups from 2015 to 2019, we used the Mann-Whitney and Kruskal-Wallis tests in GraphPad Prism (Version 9.0.0, California, USA). For all analyses, p -values less than 0.05 were considered significant (α level of 0.05). Where the Kruskal-Wallis test resulted in a p -value of less than 0.05, the Dunn's multiple comparison post-hoc test was applied, generating an adjusted p -value based on the number of comparisons.

Ethics

Ethics approval was obtained from the Institutional Research Ethics Committee (IREC 069/20) of the Durban University of Technology, Durban, South Africa. Approval to obtain the NHLS CDW data was obtained via the NHLS Academic Affairs and Research Management System (PR20254).

Results

For the period 2015 to 2019, the HBV dataset consisted of a total of 2,889,687 records; 2,370,723 valid HBsAg records and 518,964 valid anti-HBc IgM records. Sample numbers per year of total tests performed and total positives for each marker (HBsAg and anti-HBc IgM) prior to and post de-duplication are illustrated in Fig. 1.

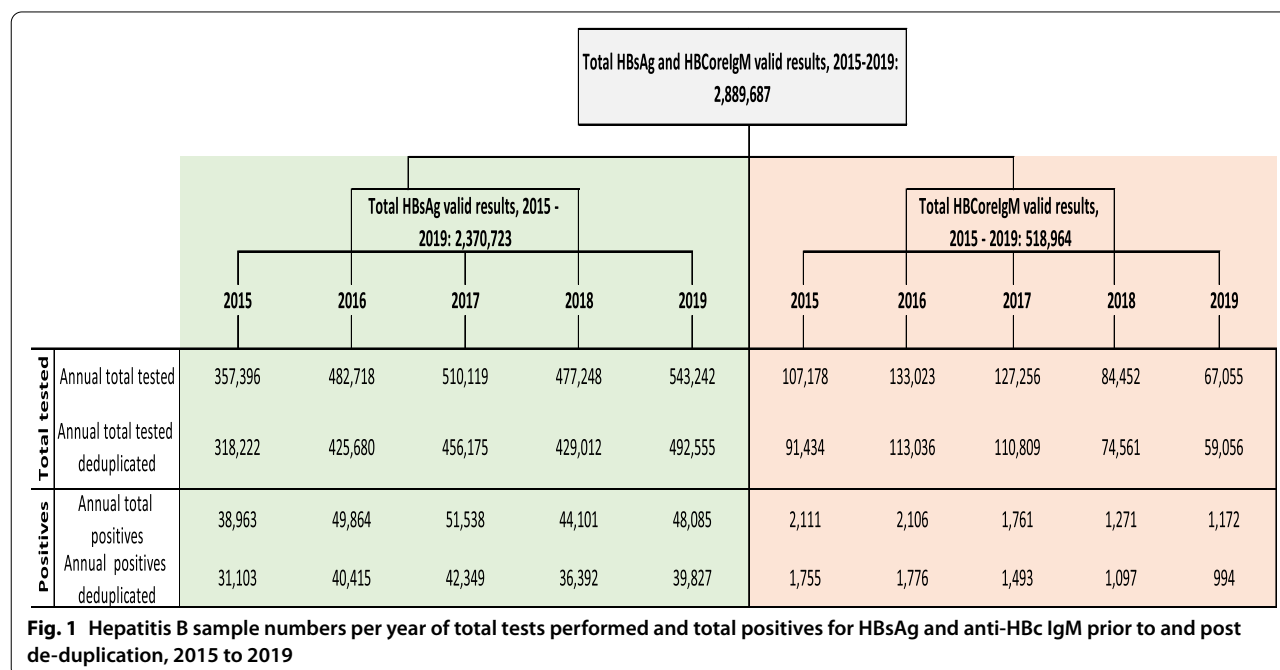
Prevalence of HBV infection

The annual national HBV prevalence rate (HBsAg positive cases per 100,000 population) increased from 56.14 in 2015 to 74.17 in 2017, decreased to 62.81 in 2018 but increased again to 67.76 in 2019 (Supplementary Table 2). This trend was mirrored amongst females and males, with consistently higher prevalence rates in males (Supplementary Table 2). Individuals aged 25 to 49 years had the highest HBV prevalence rates over the 5 year period, with higher rates in males than females (Supplementary Table 2). Amongst individuals 15 to 24 years old, the HBV prevalence rate was substantially lower in individuals 15 to 19 years versus 20 to 24 years, with higher rates in females than males (Supplementary Table 2). Amongst

individuals under 15 years of age, the HBV prevalence rate was highest in age group 0 to 4 years, followed by 10 to 14 years and 5 to 9 years, with higher rates in males aged 0 to 4 years, and in females aged 5 to 14 years (Supplementary Table 2). Amongst individuals 50 years and older, HBV prevalence rates decreased by age group, with higher rates in males than females (Supplementary Table 2). Provincially, over the five-year period, the HBV prevalence rate was highest in Gauteng, followed by Eastern Cape and Kwazulu-Natal, and lowest in Northern Cape (Supplementary Table 2).

HBsAg testing rates

The annual national HBsAg testing rates (total HBsAg tests per 100,000 population) fluctuated over the years, ranging from 574.34 in 2015 to 838.03 in 2019 (Supplementary Table 2). Over the five-year period, individuals aged 20 to 54 years had the highest HBsAg testing rates, higher in females at ages 20 to 44 years, and higher in males at ages 45 to 54 years (Supplementary Table 2). Amongst individuals under 20 years of age, the HBsAg testing rate was highest in age group 15 to 19 years, followed by 10 to 14 years, 0 to 4 years and 5 to 9 years, with higher rates in females than males (Supplementary Table 2). Amongst individuals 55 years and older, the HBsAg testing rate was higher in individuals aged 55 to 59 years than individuals 60 years and older, with higher rates in males than females (Supplementary Table 2). Provincially, over the five-year period, the HBsAg testing rate was highest in Gauteng, followed by Eastern Cape



and Kwazulu-Natal, and lowest in Limpopo (Supplementary Table 2).

HBsAg test positivity rate

The national HBsAg test positivity rate (percentage of HBsAg positive cases over the total HBsAg tests) declined annually, from 9.77% in 2015 to 8.09% in 2019, with a significant strong negative association over time ($\tau = -1.0$, $p = 0.0275$), a trend mirrored amongst males and females (Fig. 2a, Supplementary Table 3). Annually, over the five-year period, the HBsAg test positivity rate was significantly higher in males (annual median = 13.09, 95% CI: 11.95 – 13.90) than females (annual median = 6.90, 95% CI: 5.78 – 7.23) ($p = 0.0079$) (Fig. 2a, Supplementary Table 3).

Individuals aged 25 to 49 years had the highest HBsAg test positivity rates (Fig. 2b, Supplementary Table 3). Amongst individuals 50 years and older, the HBsAg test positivity rate decreased by age group (Supplementary Table 3). Amongst individuals 15 to 24 years old, the HBsAg test positivity rate was lower in individuals 15 to 19 years (annual median = 4.25, 95% CI: 2.39–5.04) than 20 to 24 years (annual median = 7.20, 95% CI: 4.17–9.18) (Supplementary Table 3). In children under 15 years of age, the HBsAg test positivity rate was significantly higher in children aged 0 to 4 years (annual median = 4.60, 95% CI: 3.82 – 6.16) than children aged 5 to 9 years (annual median = 2.72, 95% CI: 1.67 – 3.08) and 10 to 14 years (annual median = 2.71, 95% CI: 1.94 – 3.08, $p = 0.0104$ and 0.0240 respectively). In children under 5 years of age who tested positive for HBsAg ($n = 1131$), 65.7% (743) were under 1 year old (Table 1). The majority of cases under 1 year old were from Gauteng (221/743, 29.74%), followed by Limpopo (133/743, 17.90%) and Kwazulu-Natal (129/743, 17.36%) (Table 1).

The HBsAg test positivity rate was higher in males in all age groups than females, significantly higher in males than females 25 years and older ($p = 0.0079$) (Supplementary Table 3). Trend analysis over time showed a significant strong negative association in age groups 15 to 19 years, 20 to 24 years, 25 to 29 years and 35 to 39 years ($\tau = -1.0$, $p = 0.0275$), and a strong negative association in age group 30 to 34 years ($\tau = -0.8$, $p = 0.0864$) (Supplementary Table 3).

Amongst females of child-bearing age (15 to 49 years) over the five years, the median HBsAg test positivity rate was 7.18%, declining from 7.63% in 2015 to 6.69% in 2019 (Supplementary Table 3). Provincially, over the five years, the HBsAg test positivity rate was notably higher in Limpopo and Mpumalanga, and lowest in Northern Cape (Fig. 2c, Supplementary Table 3). The HBsAg test positivity rate in Limpopo dropped markedly in 2018 and in 2019, with a moderate negative association over time

($\tau = -0.6$, $p = 0.2207$). Trend analysis of the HBsAg test positivity rates over time showed a significant strong negative association in Gauteng and Kwazulu-Natal provinces ($\tau = -1.0$, $p = 0.0275$), and a strong negative association in Mpumalanga province ($\tau = -0.8$, $p = 0.0864$) (Fig. 2c, Supplementary Table 3).

Incidence of acute HBV infection

The annual national incidence rate of acute HBV infection (anti-HBc IgM positive cases per 100,000 population) dropped from 3.17 in 2015 to 1.69 in 2019 (Supplementary Table 4). This decline was largely influenced by the decline in incidence rates amongst individuals 20 to 24 years old, from 8.04 per 100,000 population in 2015 to 2.38 per 100,000 population in 2019 (Fig. 3). In males, there was a decline in the incidence rates over the years; however, in females the rate peaked at 3.35 per 100,000 population in 2016, declining thereafter (Supplementary Table 4). Individuals 20 to 39 years old had the highest incidence rates over the five years, higher in females at ages 20 to 29 years and higher in males at ages 30 to 39 years (Supplementary Table 4). Amongst individuals under 20 years of age, the incidence rate was higher amongst individuals aged 15 to 19 years than individuals aged 0 to 14 years, higher in females 15 to 19 years old and similar between males and females 0 to 14 years old (Supplementary Table 4). Amongst individuals 40 years and older, incidence rates decreased by age group, with higher rates in males than females (Supplementary Table 4).

Provincially, over the five years, the incidence rate of acute HBV infection was highest in Mpumalanga, followed by Kwazulu-Natal and Gauteng, and lowest in Limpopo (Supplementary Table 4). We saw noteworthy declines in the incidence rates per 100,000 population in Eastern Cape province from 2.58 in 2015 to 1.06 in 2019, and in Mpumalanga province from 3.99 in 2015 to 1.11 in 2019 (Supplementary Table 4).

Anti-HBc IgM testing rate

The anti-HBc IgM testing rate (total anti-HBc IgM tests per 100,000 population) peaked in 2016, but dropped thereafter (Supplementary Table 4). Over the five years, individuals aged 25 to 54 years had the highest anti-HBc IgM testing rates, higher in females at ages 25 to 39 years and higher in males at ages 40 to 54 years (Supplementary Table 4). Amongst individuals 15 to 24 years of age, the anti-HBc IgM testing rate was substantially higher in individuals aged 20 to 24 years than individuals aged 15 to 19 years, with higher rates in females than males (Supplementary Table 4). Amongst individuals under 15 years of age, the anti-HBc IgM testing rate was highest in age group 10 to 14 years, followed by age group 0

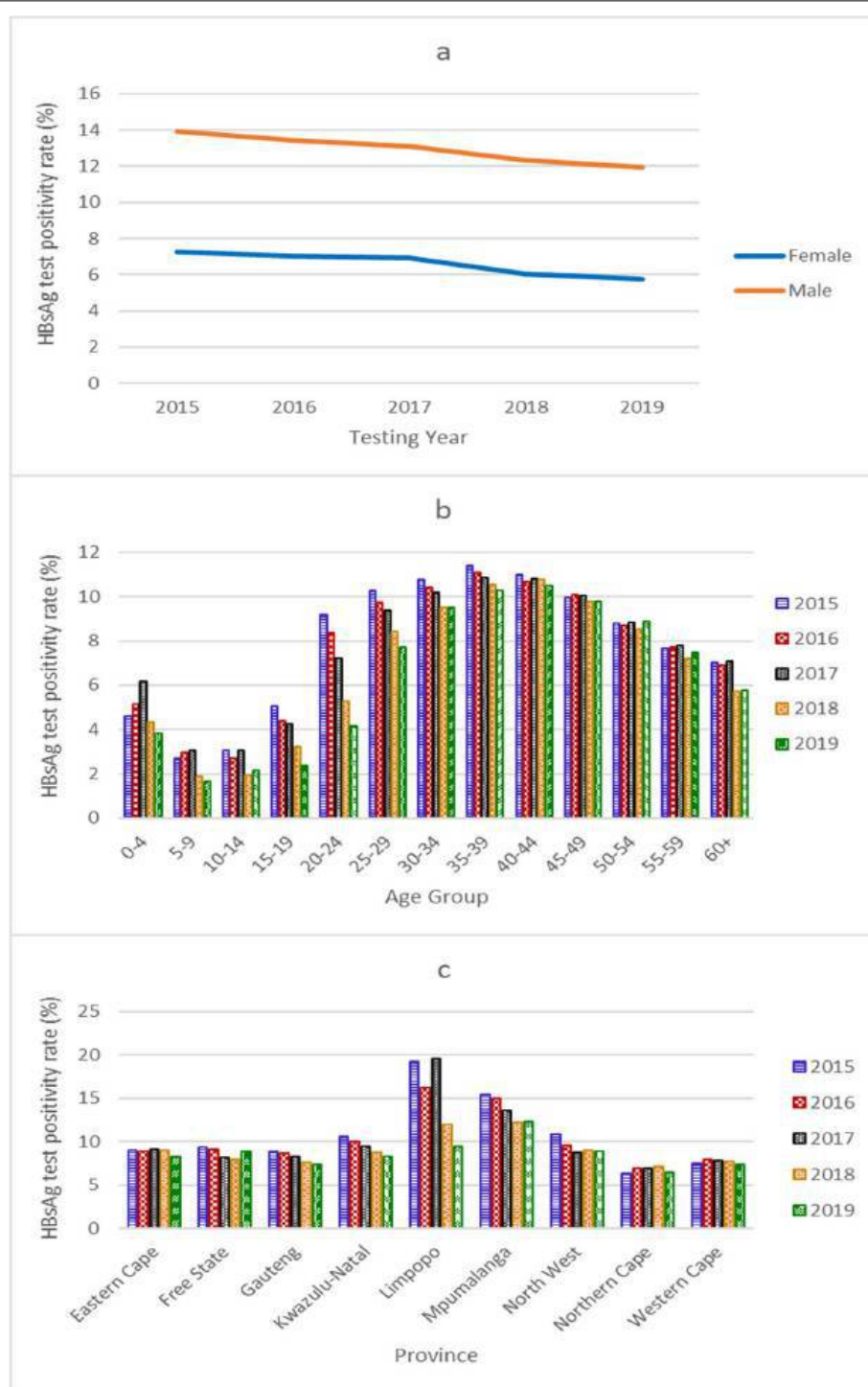


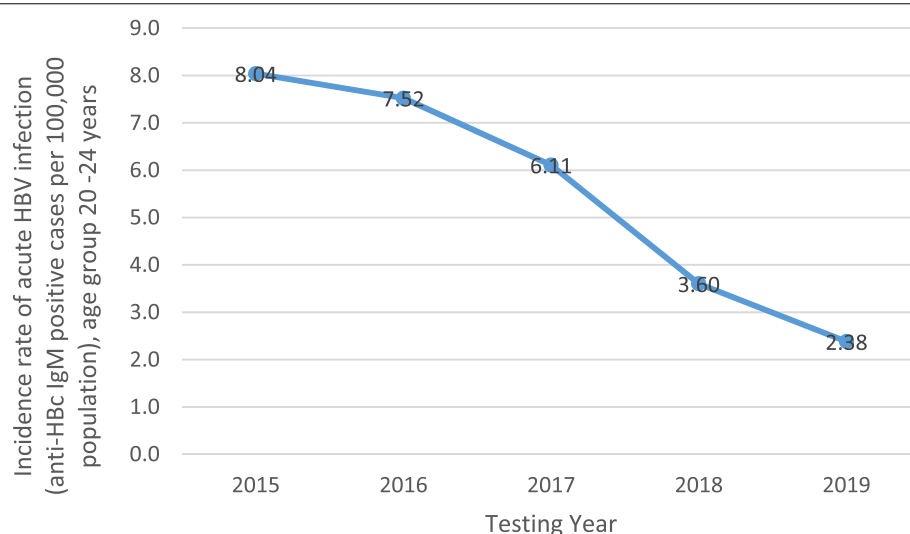
Fig. 2 HBsAg test positivity rate 2015 to 2019 by gender (a), age group (b), and province (c). HBsAg test positivity rate was calculated as the percentage of HBsAg positive tests over the total number of HBsAg tests per year

to 4 years and age group 5 to 9 years, with higher rates in females than males (Supplementary Table 4). Amongst individuals 55 years and older, the anti-HBc IgM testing

rate was higher in age group 55 to 59 years than individuals 60 years and older, higher in males than females (Supplementary Table 4). Provincially, over the five years,

Table 1 Age distribution of HBsAg positive cases under 5 years old by province, 2015 to 2019

Province	Age in years					Total (No)	Percent of Total (%)
	0	1	2	3	4		
Eastern Cape	74	12	7	5	9	107	9.46
Free State	13	3	2	0	3	21	1.86
Gauteng	221	24	20	16	22	303	26.79
Kwazulu-Natal	129	27	11	12	20	199	17.60
Limpopo	133	31	31	34	27	256	22.63
Mpumalanga	62	10	8	6	6	92	8.13
North West	32	2	2	1	2	39	3.45
Northern Cape	10	0	0	3	2	15	1.33
Western Cape	69	11	11	3	5	99	8.75
Total	743	120	92	80	96	1131	100

**Fig. 3** National incidence rate of acute HBV infection per 100,000 population amongst individuals 20 to 24 years old, 2015 to 2019. Incidence rate was calculated as (the number of cases who tested positive for anti-HBc IgM × 100,000) / the population estimate per year

the anti-HBc IgM testing rate was highest in Northern Cape, followed by Eastern Cape and Free State, and lowest in Mpumalanga (Supplementary Table 4). We noted a substantial decline in the anti-HBc IgM testing rate per 100,000 population in Eastern Cape province from 329.25 in 2015 to 24.36 in 2019 (Supplementary Table 4).

Anti-HBc IgM test positivity rate

The national anti-HBc IgM test positivity rate (percentage of anti-HBc IgM positive cases over the total anti-HBc IgM tests) reached a low point of 1.35% in 2017, subsequently increasing to 1.68% in 2019 (Fig. 4a, Supplementary Table 5). Trend analysis showed a weak negative association in the national and gender-specific anti-HBc IgM test positivity rate over time ($\tau = -0.2$,

$p = 0.8065$, Supplementary Table 5). There was no difference between males and females in the anti-HBc IgM test positivity rates over the five years (Supplementary Table 5). Individuals aged 15 to 39 years had the highest anti-HBc IgM test positivity rates, significantly higher in females 15 to 19 years old and in males 20 to 24 years, 25 to 29 years, and 30 to 34 years old (Fig. 4b, Supplementary Table 5).

Amongst individuals under 15 years of age, the anti-HBc IgM test positivity rate was similar in age groups 0 to 4 years (annual median = 0.25, 95% CI: 0.15–0.38), 5 to 9 years (annual median = 0.24, 95% CI: 0.00–0.38) and 10 to 14 years (annual median = 0.26, 95% CI: 0.17–0.30, overall $p = 0.9803$), and slightly higher in males (Supplementary Table 5). Amongst individuals 40 years and

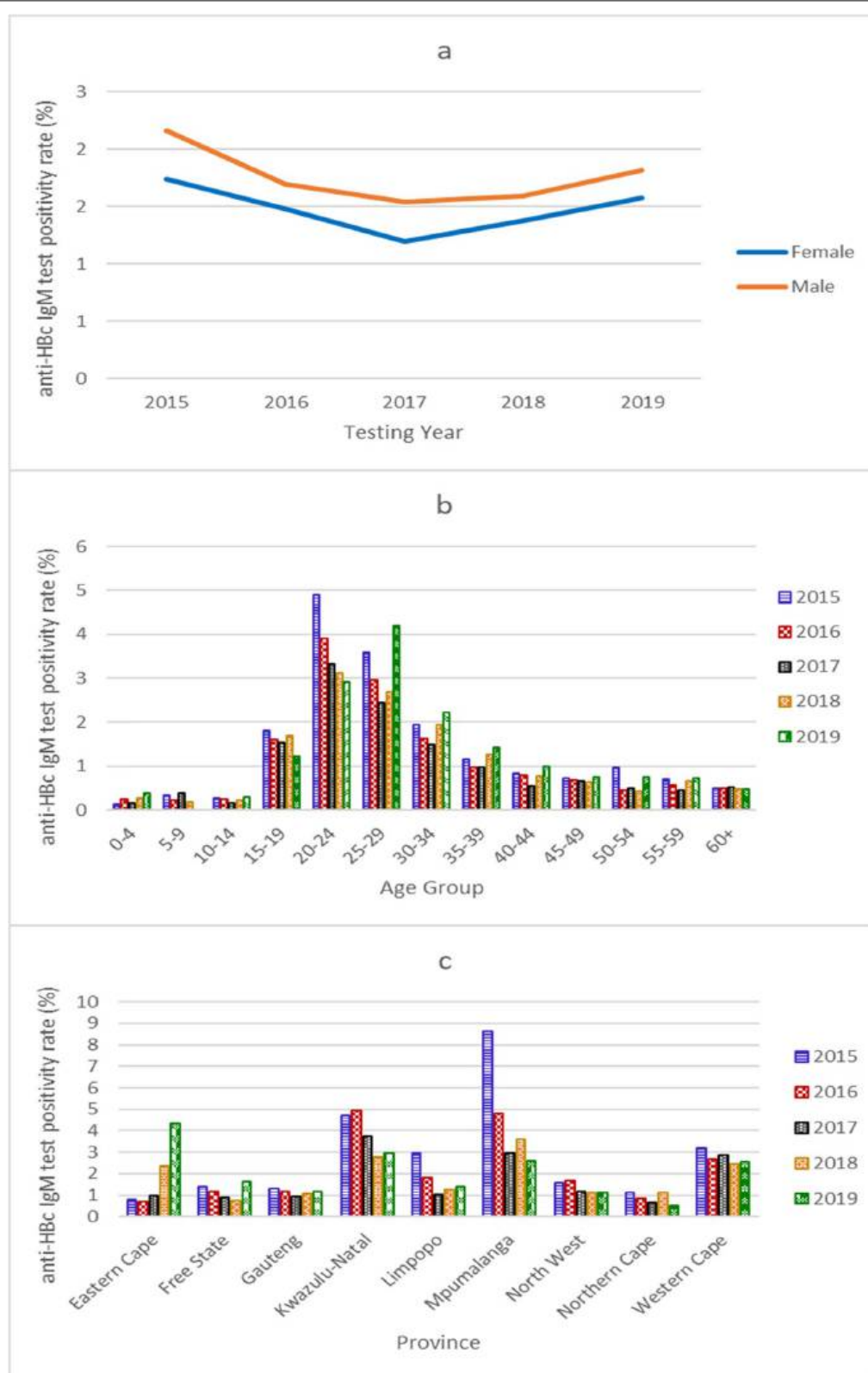


Fig. 4 Anti-HBc IgM test positivity rate 2015 to 2019 by gender (a), age group (b), and province (c). Anti-HBc IgM test positivity rate was calculated as the percentage of anti-HBc IgM positive cases over the total anti-HBc IgM tests

older, the anti-HBc IgM test positivity rates were similar amongst all age groups, as well as between females and males (Supplementary Table 5). Trend analysis of the anti-HBc IgM test positivity rates in all age groups over time showed a significant negative association in age group 20 to 24 years ($\tau = -1.0$, $p = 0.0275$) (Supplementary Table 5). Provincially, over the five years, the anti-HBc IgM test positivity rate was highest in KwaZulu-Natal, followed by Mpumalanga and Western Cape, and lowest in Northern Cape (Supplementary Table 5, Fig. 4c). We saw a noteworthy drop in the anti-HBc IgM test positivity rate in Mpumalanga province from 8.62% in 2015 to 2.57% in 2019, with a strong negative association over time ($\tau = -0.8$, $p = 0.0864$). On the contrary, we noted a concerning rise in the anti-HBc IgM test positivity rate in Eastern Cape province, from 0.79% in 2015 to 4.34% in 2019, with a strong positive association over time ($\tau = +0.8$, $p = 0.0864$) (Supplementary Table 5, Fig. 4c).

Discussion

We analysed countrywide hepatitis B prevalence, incidence and test positivity rates annually for five years from 2015 to 2019 from laboratory-confirmed HBV tests conducted in the NHLS. The national HBV prevalence and HBsAg testing rates per 100,000 population fluctuated over the years; however, the HBsAg test positivity rate showed a consistent downward trend. Similarly, there was a decline in the national incidence rate of acute HBV infection per 100,000 population over the years. The downward trend in the national HBsAg test positivity rates and the incidence rates of acute HBV infection are most likely attributed to the inclusion of the HBV vaccine into the routine EPI schedule in 1995, and suggest that although HBV transmission is ongoing, HBV disease prevalence and incidence is slowly declining. A decline in the HBsAg seroprevalence from 12.8% in 1995 to 3.0% in 2009 has previously been reported amongst children under five years old in South Africa [17, 28]. Globally, reductions in the HBV incidence rates and HBsAg seroprevalence rates have also been reported in many other countries and regions of the world following the initiation of universal HBV vaccination [28, 32, 40].

The HBV prevalence and HBsAg test positivity rates were substantially higher in males. However, incidence rates of acute HBV infection and anti-HBc IgM test positivity rates were comparable between males and females. A plausible explanation is that despite similar rates of acute HBV infections, more males progress to chronic disease, consistent with reviews of gender differences in response to HBV infection and with findings of studies conducted in Greece, New Zealand and Taiwan [41–44]. With regards to testing rates, females had higher rates

overall, however testing patterns varied with age. Whilst females had substantially higher rates at earlier ages, males had higher rates at older ages. The higher testing rates in females at earlier ages are likely due to the higher probability of symptomatic infection in females due to their more intense inflammatory responses to viral infections, coupled with more frequent healthcare seeking behaviour, including visits during pregnancy and childcare visits [45, 46]. As a result, there may be a considerable proportion of undiagnosed acute HBV infection in males. The higher testing rates in males at older ages is likely due to their increased risk of persistent HBV infection and progression to chronicity, with subsequent reactivation of infection or chronic flares warranting healthcare seeking behaviour at these ages [41–43, 45].

HBV prevalence and HBsAg test positivity rates were highest amongst individuals aged 25 to 49 years, which is not surprising as persons above 24 years would not have been eligible for the HBV vaccination programme as infants. Although our cross-sectional approach did not distinguish between transiently positive HBsAg results and results that remained positive for more than six months, it is likely that a substantial proportion of individuals positive for HBsAg are/were chronic carriers and therefore a possible source of HBV transmission [19]. Regarding acute HBV infections, we saw that individuals 20 to 39 years old had the highest incidence rates per 100,000 population, and individuals 15 to 39 years old had the highest anti-HBc IgM test positivity rates. These distributions suggest risky lifestyle habits amongst individuals 15 to 39 years old, including multiple sexual partners, unprotected sex and/or intravenous drug use, resulting in increased HBV infection rates at these ages [47–50]. In individuals 20 to 24 years old, a striking observation was the substantial decline in the incidence rates of acute HBV infection, HBsAg and anti-HBc IgM test positivity rates over the years. In 2015, only individuals aged 20 years were vaccine eligible as infants, while by 2019 all individuals within the age group of 20 to 24 years were vaccine eligible as infants. The decline in the annual incidence rates of acute HBV infection amongst individuals 20 to 24 years old demonstrates the positive impact of the HBV vaccination programme, even with suboptimal vaccine coverage rates [51]. Interestingly, we also noted declining HBsAg test positivity rates in age groups 25 to 29, 30 to 34 and 35 to 39 years, which suggest reduction in transmission of HBV amongst individuals who were not vaccine eligible, possibly due to reduced transmission in the community overall.

The HBV prevalence and HBsAg test positivity rates amongst individuals 50 years and older may be linked to the higher probability of symptomatic chronic HBV infection at these ages, leading to healthcare-seeking

behaviour. However, incidence rates of acute HBV infection and anti-HBc IgM test positivity rates observed amongst individuals 50 years and older indicate ongoing transmission of HBV infection at these older ages.

Amongst children under 15 years of age, ages least likely to be associated with sexual behavior and intravenous drug use, the HBV prevalence and HBsAg test positivity rates were higher in children 0 to 4 years old versus age groups of 5 to 9 years and 10 to 14 years. Further analysis of the number of HBsAg positive cases under 5 years old showed that the bulk of the cases were under 1 year old. As South Africa has not yet implemented a birth dose of the HBV vaccine into its routine EPI schedule, and a considerable proportion of females of child-bearing age tested positive for HBsAg, HBV infection in infants is more likely associated with vertical rather than horizontal transmission. Also, although HBV testing in pregnancy is recommended by the South African national Hepatitis B guidelines, it is not widely implemented. A possible confounder of HBsAg positivity in cases under 1 year old may be attributed to transient HBsAg positivity following HBV vaccination [52]. However, as hepatitis B is usually described as subclinical in infants and young individuals, the reasons for HBsAg testing in at these ages are uncertain and cannot be determined without access to their or their mother's clinical histories. Reasons for testing may include symptomatic cases, infants admitted for other medical conditions in which HBV screening was performed, or screening of infants born to mothers known to be HBV infected. Infants infected from their mothers may also be diagnosed with HBV infection at much later ages [53]. Vertical transmission may be significantly reduced with inclusion of a HepB_BD into the current EPI schedule, subsequently minimising the national burden of chronic HBV infection [54]. Amongst individuals 5 to 14 years old, the low HBV prevalence and HBsAg test positivity rates may reflect the subclinical phase of HBV infection at these ages and/or effective vaccination within this group. However, HBV infection in children and teenagers can still occur where there is suboptimal vaccine coverage, resulting in continued transmission in these populations. Suboptimal vaccine efficacy in risk groups, such as HIV-infected children, may also be a contributing factor [55].

HBV prevalence and HBsAg testing rates were substantially higher in Gauteng province compared with other provinces. Gauteng is the economic hub of South Africa with numerous excellent health facilities. Individuals may have travelled from other provinces to Gauteng for healthcare purposes. The HBsAg test positivity rate, however, was highest in Limpopo province, declining markedly over time, while the HBV prevalence rate in Limpopo was quite low in comparison to other provinces.

The reasons for high HBsAg test positivity rates may therefore reflect HBsAg testing practices, although test positivity rates may reflect disease burden [56, 57]. We therefore regard the high HBsAg test positivity rate in Limpopo province as indicative of a particularly high disease burden which declined over time. Regarding incidence rates of acute HBV infection and anti-HBc IgM test positivity rates over the five years, the two provinces with the highest rates were Mpumalanga and Kwazulu-Natal. In Mpumalanga, there was a substantial decline in the incidence and anti-HBc IgM test positivity rates from 2015 to 2019. In Eastern Cape, there was a substantial increase in the anti-HBc IgM test positivity rate from 2015 to 2019, with a substantial decrease in the incidence rates of acute HBV infection and anti-HBc IgM testing rates. Changes to the anti-HBc IgM testing practices, particularly in Mpumalanga and Eastern Cape provinces, may have contributed to the change in rates over time. Given these findings and provincial disparities within South Africa, further investigations to better understand risk behaviour, testing practices and vaccination coverage, are warranted in Limpopo, Mpumalanga, Eastern Cape and Kwazulu-Natal provinces [58]. Where applicable, targeted provincial interventions would subsequently decrease countrywide incidence of HBV infection.

Passive surveillance has the limitation of only detecting laboratory-confirmed cases, and we cannot extrapolate our data to estimate community prevalence or incidence of undiagnosed HBV infection. Such estimation would require random sampling of households with blood draws. We did not use estimates of health seeking behaviour to estimate numbers of undiagnosed cases. The reported province reflects the location of the testing facility and not necessarily the place of residence or birth for each case. People may have travelled to preferred facilities or as referrals for enhanced care and management. In addition, due to limited availability of diagnostic testing amongst public health facilities in South Africa, and variation in access and utilization of testing by province, the numbers in provincial differences presented here may represent differences in testing practices rather than disease burden. As testing for anti-HBc IgM is usually associated with symptomatic manifestations of HBV infection, an increased anti-HBc IgM test positivity rate may suggest that more clinically suspected acute HBV infections were laboratory confirmed rather than an increase in the acute infection rate, however experience with other diseases has shown the value of monitoring trends in test positivity rates over time. By excluding anti-HBc IgM positive results with values below an established threshold, we may have excluded a proportion of true acute HBV infections in our analyses. Data entry errors in patient

identification details may have affected the NHLS CDW linkage process, allocating a new UID to an existing case. Deduplication exercises were performed per year and not collectively over the five-year period. We therefore did not exclude individuals who were tested in multiple years and have reported our data as annual rates, an approach that is reproducible over time. A strength of our study, however, is analyses of a mega dataset of 2,889,687 records of tests conducted in the public health sector of South Africa, which serves around 85% of the national population.

Conclusion

We conclude that thorough interrogation of passive laboratory data, not exclusive to HBV, is an informative resource and may be valuable for planning public health programmes or serve as evidence or a reference point for long-term public health interventions. Optimal vaccination coverage at 6, 10, and 14 week visits and interruption of vertical transmission is critical to hepatitis B elimination. Tools to minimise vertical transmission of HBV are inclusion of HepB_{BD} vaccine into the routine EPI schedule of South Africa, or nation-wide implementation of screening of mothers for HBV to mitigate associated risks. As new generations of vaccinated infants and children reach adulthood, hepatitis B incidence and prevalence should shift to older age groups, subsequently declining in younger individuals, including women of reproductive age. Without vaccination programmes in adults, hepatitis B incidence may be reduced through heightened awareness of transmission routes and prevention measures.

Abbreviations

HBV: Hepatitis B virus; HBsAg: Hepatitis B surface antigen; anti-HBc IgM: IgM antibody to the hepatitis B core antigen; WHO: World Health Organisation; EPI: Expanded Programme on Immunisation; HepB3: Hepatitis B vaccine administered at 6, 10 and 14 weeks of age; HepB_{BD}: Birth dose of the hepatitis B vaccine; NHLS: National Health Laboratory Service; CDW: Central Data Warehouse; UID: Unique identification.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12889-021-12391-3>.

Additional file 1.
Additional file 2.
Additional file 3.
Additional file 4.
Additional file 5.

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Authors' contributions

Shelina Moonsamy wrote the main manuscript with preparation of all main and supplementary tables and figures. Melinda Suchard reviewed the manuscript. Pavitra Pillay reviewed the manuscript. Nishi Prabdial-Sing reviewed the manuscript.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate

All methods were carried out in accordance with relevant guidelines and regulations. Ethics approval, including a waiver of informed consent for use of the data, was obtained from the Institutional Research Ethics Committee of the Durban University of Technology, Durban, South Africa (Ethical Clearance Number: IREC 069/20). Consent to participate is not applicable as this study is based on data analyses of laboratory tests conducted in the public health sector of South Africa (NHLS) and datasets excluded patient identification. Approval to obtain the NHLS data was obtained via the NHLS Academic Affairs and Research Management System (PR20254).

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests that might be perceived to influence the results and/or discussion reported in this paper.

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held virtually
from 19 August to 22 August 2021

Dr Zivanai Cuthbert Chapanduka
Chairperson Scientific Committee

Dr Babatyi Malope-Kgokong
Chairperson Organising Committee

Date issued: 22 August 2021

Appendix 4.3: Stata Log file of annual HBV prevalence

```
. use "\\6315380 final file to use for prevalence and incidence.dta", clear
```

```
. tab YEAR_TESTED_DATE
```

```
YEAR_TESTED |  
  _DATE |   Freq.   Percent   Cum.  
-----+-----  
    2015 |   357,396    15.08    15.08  
    2016 |   482,718    20.36    35.44  
    2017 |   510,119    21.52    56.95  
    2018 |   477,248    20.13    77.09  
    2019 |   543,242    22.91   100.00  
-----+-----  
      Total | 2,370,723   100.00
```

```
. restore
```

```
. preserve
```

```
. keep if YEAR_TESTED_DATE==2015
```

```
(5,282,669 observations deleted)
```

```
. count
```

```
1,032,718
```

```
. keep if HEP_B_SURFACE_AG=="POSITIVE" | HEP_B_SURFACE_AG=="LOW POSITIVE"
```

```
(993,755 observations deleted)
```

```
. count
```

```
38,963
```

```
. duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force
```

Duplicates in terms of UNIQUE_PATIENT_ID

(7,860 observations deleted)

```
. count
```

31,103

```
. tab PROVINCE_NAME
```

PROVINCE_NAME No.

EASTERN CAPE 4,103.0

FREE STATE 1,594.0

GAUTENG 10,260.0

KWAZULU-NATAL 7,325.0

LIMPOPO 1,948.0

MPUMALANGA 1,874.0

NORTH WEST 1,257.0

NORTHERN CAPE 362.0

WESTERN CAPE 2,380.0

Total 31,103.0

```
. tab PROVINCE_DISTRICT
```

PROVINCE_DISTRICT No.

EASTERN CAPE_ALFRED NZO 178.0

EASTERN CAPE_AMATHOLE 499.0

EASTERN CAPE_BUFFALO CITY METRO 1,188.0

EASTERN CAPE_CHRIS HANI 291.0

EASTERN CAPE_JOE GQABI 152.0

EASTERN CAPE_NELSON MANDELA BAY METRO 786.0
EASTERN CAPE_O R TAMBO 728.0
EASTERN CAPE_SARAH BAARTMAN 281.0
FREE STATE_FEZILE DABI 255.0
FREE STATE_LEJWELEPUTSWA 380.0
FREE STATE_MANGAUNG METRO 688.0
FREE STATE_THABO MOFUTSANYANA 207.0
FREE STATE_UNKNOWN 1.0
FREE STATE_XHARIEP 63.0
GAUTENG_CITY OF JOHANNESBURG METRO 4,229.0
GAUTENG_CITY OF TSHWANE METRO 1,913.0
GAUTENG_EKURHULENI METRO 3,360.0
GAUTENG_SEDIBENG 364.0
GAUTENG_UNKNOWN 6.0
GAUTENG_WEST RAND 388.0
KWAZULU-NATAL_AMAJUBA 172.0
KWAZULU-NATAL_ETHEKWINI METRO 3,544.0
KWAZULU-NATAL_HARRY GWALA 105.0
KWAZULU-NATAL_ILEMBE 310.0
KWAZULU-NATAL_KING CETSHWAYO 266.0
KWAZULU-NATAL_UGU 911.0
KWAZULU-NATAL_UMGUNGUNDLOVU 1,283.0
KWAZULU-NATAL_UMKHANYAKUDE 349.0
KWAZULU-NATAL_UMZINYATHI 90.0
KWAZULU-NATAL_UTHUKELA 59.0
KWAZULU-NATAL_UTHUNGULU 78.0
KWAZULU-NATAL_ZULULAND 158.0
LIMPOPO_CAPRICORN 884.0
LIMPOPO_GREATER SEKHUKHUNE 173.0
LIMPOPO_MOPANI 243.0
LIMPOPO_VHEMBE 295.0
LIMPOPO_WATERBERG 353.0

MPUMALANGA_EHLANZENI	851.0
MPUMALANGA_GERT SIBANDE	622.0
MPUMALANGA_NKANGALA	401.0
NORTH WEST_BOJANALA PLATINUM	454.0
NORTH WEST_DR KENNETH KAUNDA	444.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	117.0
NORTH WEST_NGAKA MODIRI MOLEMA	242.0
NORTHERN CAPE_FRANCES BAARD	220.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	28.0
NORTHERN CAPE_NAMAKWA	8.0
NORTHERN CAPE_PIXLEY KA SEME	26.0
NORTHERN CAPE_ZF MGCAWU	80.0
WESTERN CAPE_CAPE WINELANDS	216.0
WESTERN CAPE_CENTRAL KAROO	19.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	1,666.0
WESTERN CAPE_GARDEN ROUTE	290.0
WESTERN CAPE_NOT APPLICABLE	12.0
WESTERN CAPE_OVERBERG	93.0
WESTERN CAPE_UNKNOWN	2.0
WESTERN CAPE_WEST COAST	82.0
Total	31,103.0

. tab GENDER

GENDER No.

F	14,033.0
M	16,573.0
U	497.0
Total	31,103.0

. tab PROVINCE_DISTRICT GENDER

GENDER

PROVINCE_DISTRICT	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE_ALFRED NZO	86.0	87.0	5.0	178.0
EASTERN CAPE_AMATHOLE	269.0	223.0	7.0	499.0
EASTERN CAPE_BUFFALO CITY METRO	595.0	579.0	14.0	1,188.0
EASTERN CAPE_CHRIS HANI	143.0	144.0	4.0	291.0
EASTERN CAPE_JOE GQABI	66.0	86.0	0.0	152.0
EASTERN CAPE_NELSON MANDELA BAY METRO	373.0	411.0	2.0	786.0
EASTERN CAPE_O R TAMBO	373.0	349.0	6.0	728.0
EASTERN CAPE_SARAH BAARTMAN	124.0	157.0	0.0	281.0
FREE STATE_FEZILE DABI	120.0	134.0	1.0	255.0
FREE STATE_LEJWELEPUTSWA	191.0	186.0	3.0	380.0
FREE STATE_MANGAUNG METRO	329.0	352.0	7.0	688.0
FREE STATE_THABO MOFUTSANYANA	92.0	115.0	0.0	207.0
FREE STATE_UNKNOWN	0.0	1.0	0.0	1.0
FREE STATE_XHARIEP	32.0	31.0	0.0	63.0
GAUTENG_CITY OF JOHANNESBURG METRO	1,831.0	2,321.0	77.0	4,229.0
GAUTENG_CITY OF TSHWANE METRO	805.0	1,096.0	12.0	1,913.0
GAUTENG_EKURHULENI METRO	1,470.0	1,854.0	36.0	3,360.0
GAUTENG_SEDIBENG	152.0	206.0	6.0	364.0
GAUTENG_UNKNOWN	0.0	2.0	4.0	6.0
GAUTENG_WEST RAND	147.0	237.0	4.0	388.0
KWAZULU-NATAL_AMAJUBA	75.0	95.0	2.0	172.0
KWAZULU-NATAL_ETHEKWINI METRO	1,528.0	1,896.0	120.0	3,544.0
KWAZULU-NATAL_HARRY GWALA	50.0	53.0	2.0	105.0
KWAZULU-NATAL_ILEMBE	135.0	166.0	9.0	310.0
KWAZULU-NATAL_KING CETSHWAYO	121.0	141.0	4.0	266.0
KWAZULU-NATAL_UGU	443.0	448.0	20.0	911.0
KWAZULU-NATAL_UMGUNGUNDLOVU	582.0	646.0	55.0	1,283.0

KWAZULU-NATAL_UMKHANYAKUDE	145.0	198.0	6.0	349.0
KWAZULU-NATAL_UMZINYATHI	40.0	50.0	0.0	90.0
KWAZULU-NATAL_UTHUKELA	24.0	34.0	1.0	59.0
KWAZULU-NATAL_UTHUNGULU	39.0	38.0	1.0	78.0
KWAZULU-NATAL_ZULULAND	74.0	81.0	3.0	158.0
LIMPOPO_CAPRICORN	480.0	399.0	5.0	884.0
LIMPOPO_GREATER SEKHUKHUNE	99.0	73.0	1.0	173.0
LIMPOPO_MOPANI	116.0	127.0	0.0	243.0
LIMPOPO_VHEMBE	126.0	167.0	2.0	295.0
LIMPOPO_WATERBERG	178.0	168.0	7.0	353.0
MPUMALANGA_EHLANZENI	419.0	419.0	13.0	851.0
MPUMALANGA_GERT SIBANDE	254.0	362.0	6.0	622.0
MPUMALANGA_NKANGALA	201.0	195.0	5.0	401.0
NORTH WEST_BOJANALA PLATINUM	221.0	224.0	9.0	454.0
NORTH WEST_DR KENNETH KAUNDA	169.0	268.0	7.0	444.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	57.0	60.0	0.0	117.0
NORTH WEST_NGAKA MODIRI MOLEMA	126.0	113.0	3.0	242.0
NORTHERN CAPE_FRANCES BAARD	98.0	118.0	4.0	220.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	15.0	12.0	1.0	28.0
NORTHERN CAPE_NAMAKWA	6.0	2.0	0.0	8.0
NORTHERN CAPE_PIXLEY KA SEME	9.0	17.0	0.0	26.0
NORTHERN CAPE_ZF MGCAWU	33.0	47.0	0.0	80.0
WESTERN CAPE_CAPE WINELANDS	82.0	132.0	2.0	216.0
WESTERN CAPE_CENTRAL KAROO	9.0	10.0	0.0	19.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	672.0	985.0	9.0	1,666.0
WESTERN CAPE_GARDEN ROUTE	150.0	140.0	0.0	290.0
WESTERN CAPE_NOT APPLICABLE	0.0	2.0	10.0	12.0
WESTERN CAPE_OVERBERG	33.0	59.0	1.0	93.0
WESTERN CAPE_UNKNOWN	0.0	2.0	0.0	2.0
WESTERN CAPE_WEST COAST	26.0	55.0	1.0	82.0
Total	14,033.0	16,573.0	497.0	31,103.0

```
. restore
```

```
. preserve
```

```
. keep if YEAR_TESTED_DATE==2015
```

```
(5,282,669 observations deleted)
```

```
. count
```

```
1,032,718
```

```
. drop if HEP_B_SURFACE_AG=="NULL" | HEP_B_SURFACE_AG=="UNKNOWN" | HEP_B_SURFACE_A
```

```
> G=="INSUFFICIENT FOR FURTHER TESTS"
```

```
(675,322 observations deleted)
```

```
. count
```

```
357,396
```

```
. duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force
```

```
Duplicates in terms of UNIQUE_PATIENT_ID
```

```
(39,174 observations deleted)
```

```
. count
```

```
318,222
```

```
. tab PROVINCE_NAME
```

```
PROVINCE_NAME  No.
```

```
EASTERN CAPE  45,869.0
```

FREE STATE 17,083.0
 GAUTENG 115,150.0
 KWAZULU-NATAL 68,760.0
 LIMPOPO 10,119.0
 MPUMALANGA 12,163.0
 NORTH WEST 11,618.0
 NORTHERN CAPE 5,663.0
 WESTERN CAPE 31,797.0
 Total 318,222.0

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	No.
EASTERN CAPE_ALFRED NZO	2,291.0
EASTERN CAPE_AMATHOLE	5,927.0
EASTERN CAPE_BUFFALO CITY METRO	13,317.0
EASTERN CAPE_CHRIS HANI	2,747.0
EASTERN CAPE_JOE GQABI	1,337.0
EASTERN CAPE_NELSON MANDELA BAY METRO	9,005.0
EASTERN CAPE_NOT APPLICABLE	1.0
EASTERN CAPE_O R TAMBO	8,106.0
EASTERN CAPE_SARAH BAARTMAN	3,137.0
EASTERN CAPE_UNKNOWN	1.0
FREE STATE_FEZILE DABI	2,270.0
FREE STATE_LEJWELEPUTSWA	3,645.0
FREE STATE_MANGAUNG METRO	8,706.0
FREE STATE_THABO MOFUTSANYANA	1,468.0
FREE STATE_UNKNOWN	2.0
FREE STATE_XHARIEP	992.0
GAUTENG_CITY OF JOHANNESBURG METRO	37,874.0
GAUTENG_CITY OF TSHWANE METRO	28,064.0
GAUTENG_EKURHULENI METRO	41,396.0

GAUTENG_SEDIBENG 4,546.0
GAUTENG_UNKNOWN 522.0
GAUTENG_WEST RAND 2,748.0
KWAZULU-NATAL_AMAJUBA 1,370.0
KWAZULU-NATAL_ETHEKWINI METRO 34,996.0
KWAZULU-NATAL_HARRY GWALA 679.0
KWAZULU-NATAL_ILEMBE 2,172.0
KWAZULU-NATAL_KING CETSHWAYO 2,425.0
KWAZULU-NATAL_UGU 8,093.0
KWAZULU-NATAL_UMGUNGUNDLOVU 13,437.0
KWAZULU-NATAL_UMKHANYAKUDE 2,499.0
KWAZULU-NATAL_UMZINYATHI 934.0
KWAZULU-NATAL_UNKNOWN 2.0
KWAZULU-NATAL_UTHUKELA 519.0
KWAZULU-NATAL_UTHUNGULU 634.0
KWAZULU-NATAL_ZULULAND 1,000.0
LIMPOPO_CAPRICORN 3,823.0
LIMPOPO_GREATER SEKHUKHUNE 1,733.0
LIMPOPO_MOPANI 1,416.0
LIMPOPO_UNKNOWN 8.0
LIMPOPO_VHEMBE 1,516.0
LIMPOPO_WATERBERG 1,623.0
MPUMALANGA_EHLANZENI 4,830.0
MPUMALANGA_GERT SIBANDE 5,172.0
MPUMALANGA_NKANGALA 2,152.0
MPUMALANGA_UNKNOWN 9.0
NORTH WEST_BOJANALA PLATINUM 3,860.0
NORTH WEST_DR KENNETH KAUNDA 3,289.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI 1,286.0
NORTH WEST_NGAKA MODIRI MOLEMA 3,180.0
NORTH WEST_UNKNOWN 3.0
NORTHERN CAPE_FRANCES BAARD 3,992.0

NORTHERN CAPE_JOHN TAOLO GAETSEWE	167.0
NORTHERN CAPE_NAMAKWA	473.0
NORTHERN CAPE_PIXLEY KA SEME	349.0
NORTHERN CAPE_UNKNOWN	2.0
NORTHERN CAPE_ZF MGCAWU	680.0
WESTERN CAPE_CAPE WINELANDS	2,841.0
WESTERN CAPE_CENTRAL KAROO	221.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	22,826.0
WESTERN CAPE_GARDEN ROUTE	3,181.0
WESTERN CAPE_NOT APPLICABLE	48.0
WESTERN CAPE_OVERBERG	1,569.0
WESTERN CAPE_UNKNOWN	26.0
WESTERN CAPE_WEST COAST	1,085.0
Total	318,222.0

. tab GENDER

GENDER No.

F	194,046.0
M	119,235.0
U	4,941.0
Total	318,222.0

. tab PROVINCE_NAME GENDER

GENDER

PROVINCE_NAME	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE	30,629.0	14,866.0	374.0	45,869.0
FREE STATE	10,935.0	6,042.0	106.0	17,083.0

GAUTENG	69,006.0	44,463.0	1,681.0	115,150.0
KWAZULU-NATAL	41,348.0	25,208.0	2,204.0	68,760.0
LIMPOPO	6,323.0	3,737.0	59.0	10,119.0
MPUMALANGA	7,523.0	4,565.0	75.0	12,163.0
NORTH WEST	7,315.0	4,168.0	135.0	11,618.0
NORTHERN CAPE	3,206.0	2,389.0	68.0	5,663.0
WESTERN CAPE	17,761.0	13,797.0	239.0	31,797.0
Total	194,046.0	119,235.0	4,941.0	318,222.0

. tab PROVINCE_DISTRICT GENDER

GENDER

PROVINCE_DISTRICT	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE_ALFRED NZO	1,558.0	679.0	54.0	2,291.0
EASTERN CAPE_AMATHOLE	4,030.0	1,855.0	42.0	5,927.0
EASTERN CAPE_BUFFALO CITY METRO	9,067.0	4,107.0	143.0	13,317.0
EASTERN CAPE_CHRIS HANI	1,827.0	889.0	31.0	2,747.0
EASTERN CAPE_JOE GQABI	844.0	485.0	8.0	1,337.0
EASTERN CAPE_NELSON MANDELA BAY METRO	5,865.0	3,124.0	16.0	9,005.0
EASTERN CAPE_NOT APPLICABLE	1.0	0.0	0.0	1.0
EASTERN CAPE_O R TAMBO	5,442.0	2,593.0	71.0	8,106.0
EASTERN CAPE_SARAH BAARTMAN	1,995.0	1,133.0	9.0	3,137.0
EASTERN CAPE_UNKNOWN	0.0	1.0	0.0	1.0
FREE STATE_FEZILE DABI	1,460.0	808.0	2.0	2,270.0
FREE STATE_LEJWELEPUTSWA	2,511.0	1,123.0	11.0	3,645.0
FREE STATE_MANGAUNG METRO	5,335.0	3,285.0	86.0	8,706.0
FREE STATE_THABO MOFUTSANYANA	967.0	495.0	6.0	1,468.0
FREE STATE_UNKNOWN	0.0	2.0	0.0	2.0
FREE STATE_XHARIEP	662.0	329.0	1.0	992.0
GAUTENG_CITY OF JOHANNESBURG METRO	22,323.0	14,966.0	585.0	37,874.0

GAUTENG_CITY OF TSHWANE METRO	16,873.0	11,016.0	175.0	28,064.0
GAUTENG_EKURHULENI METRO	25,601.0	15,421.0	374.0	41,396.0
GAUTENG_SEDIBENG	2,684.0	1,799.0	63.0	4,546.0
GAUTENG_UNKNOWN	59.0	13.0	450.0	522.0
GAUTENG_WEST RAND	1,466.0	1,248.0	34.0	2,748.0
KWAZULU-NATAL_AMAJUBA	822.0	518.0	30.0	1,370.0
KWAZULU-NATAL_ETHEKWINI METRO	20,760.0	13,163.0	1,073.0	34,996.0
KWAZULU-NATAL_HARRY GWALA	370.0	294.0	15.0	679.0
KWAZULU-NATAL_ILEMBE	1,302.0	809.0	61.0	2,172.0
KWAZULU-NATAL_KING CETSHWAYO	1,434.0	933.0	58.0	2,425.0
KWAZULU-NATAL_UGU	5,361.0	2,544.0	188.0	8,093.0
KWAZULU-NATAL_UMGUNGUNDLOVU	8,113.0	4,685.0	639.0	13,437.0
KWAZULU-NATAL_UMKHANYAKUDE	1,372.0	1,057.0	70.0	2,499.0
KWAZULU-NATAL_UMZINYATHI	568.0	344.0	22.0	934.0
KWAZULU-NATAL_UNKNOWN	0.0	2.0	0.0	2.0
KWAZULU-NATAL_UTHUKELA	298.0	212.0	9.0	519.0
KWAZULU-NATAL_UTHUNGULU	398.0	224.0	12.0	634.0
KWAZULU-NATAL_ZULULAND	550.0	423.0	27.0	1,000.0
LIMPOPO_CAPRICORN	2,346.0	1,458.0	19.0	3,823.0
LIMPOPO_GREATER SEKHUKHUNE	1,146.0	577.0	10.0	1,733.0
LIMPOPO_MOPANI	914.0	498.0	4.0	1,416.0
LIMPOPO_UNKNOWN	6.0	2.0	0.0	8.0
LIMPOPO_VHEMBE	926.0	576.0	14.0	1,516.0
LIMPOPO_WATERBERG	985.0	626.0	12.0	1,623.0
MPUMALANGA_EHLANZENI	3,041.0	1,757.0	32.0	4,830.0
MPUMALANGA_GERT SIBANDE	3,076.0	2,087.0	9.0	5,172.0
MPUMALANGA_NKANGALA	1,400.0	718.0	34.0	2,152.0
MPUMALANGA_UNKNOWN	6.0	3.0	0.0	9.0
NORTH WEST_BOJANALA PLATINUM	2,509.0	1,296.0	55.0	3,860.0
NORTH WEST_DR KENNETH KAUNDA	1,893.0	1,349.0	47.0	3,289.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	909.0	366.0	11.0	1,286.0
NORTH WEST_NGAKA MODIRI MOLEMA	2,003.0	1,155.0	22.0	3,180.0

NORTH WEST_UNKNOWN	1.0	2.0	0.0	3.0
NORTHERN CAPE_FRANCES BAARD	2,155.0	1,780.0	57.0	3,992.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	115.0	49.0	3.0	167.0
NORTHERN CAPE_NAMAKWA	318.0	151.0	4.0	473.0
NORTHERN CAPE_PIXLEY KA SEME	234.0	113.0	2.0	349.0
NORTHERN CAPE_UNKNOWN	2.0	0.0	0.0	2.0
NORTHERN CAPE_ZF MGCAWU	382.0	296.0	2.0	680.0
WESTERN CAPE_CAPE WINELANDS	1,457.0	1,309.0	75.0	2,841.0
WESTERN CAPE_CENTRAL KAROO	126.0	95.0	0.0	221.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	12,740.0	9,969.0	117.0	22,826.0
WESTERN CAPE_GARDEN ROUTE	2,000.0	1,176.0	5.0	3,181.0
WESTERN CAPE_NOT APPLICABLE	16.0	13.0	19.0	48.0
WESTERN CAPE_OVERBERG	914.0	641.0	14.0	1,569.0
WESTERN CAPE_UNKNOWN	9.0	14.0	3.0	26.0
WESTERN CAPE_WEST COAST	499.0	580.0	6.0	1,085.0
Total	194,046.0	119,235.0	4,941.0	318,222.0

. restore

. preserve

. keep if YEAR_TESTED_DATE==2016

(5,009,798 observations deleted)

. count

1,305,589

. keep if HEP_B_SURFACE_AG=="POSITIVE" | HEP_B_SURFACE_AG=="LOW POSITIVE"

(1,255,725 observations deleted)

. count

49,864

```
. duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force
```

Duplicates in terms of UNIQUE_PATIENT_ID

(9,449 observations deleted)

```
. count  
40,415
```

```
. tab PROVINCE_NAME
```

PROVINCE_NAME	No.
EASTERN CAPE	4,832.0
FREE STATE	1,894.0
GAUTENG	15,036.0
KWAZULU-NATAL	8,424.0
LIMPOPO	2,434.0
MPUMALANGA	3,039.0
NORTH WEST	1,908.0
NORTHERN CAPE	381.0
WESTERN CAPE	2,467.0
Total	40,415.0

```
. tab PROVINCE_DISTRICT
```

PROVINCE_DISTRICT	No.
EASTERN CAPE_ALFRED NZO	163.0
EASTERN CAPE_AMATHOLE	542.0
EASTERN CAPE_BUFFALO CITY METRO	1,398.0
EASTERN CAPE_CHRIS HANI	303.0
EASTERN CAPE_JOE GQABI	131.0

EASTERN CAPE_NELSON MANDELA BAY METRO 1,065.0
EASTERN CAPE_O R TAMBO 828.0
EASTERN CAPE_SARAH BAARTMAN 332.0
EASTERN CAPE_UNKNOWN 70.0
FREE STATE_FEZILE DABI 234.0
FREE STATE_LEJWELEPUTSWA 499.0
FREE STATE_MANGAUNG METRO 943.0
FREE STATE_THABO MOFUTSANYANA 145.0
FREE STATE_XHARIEP 73.0
GAUTENG_CITY OF JOHANNESBURG METRO 5,596.0
GAUTENG_CITY OF TSHWANE METRO 3,025.0
GAUTENG_EKURHULENI METRO 5,570.0
GAUTENG_SEDIBENG 476.0
GAUTENG_UNKNOWN 5.0
GAUTENG_WEST RAND 364.0
KWAZULU-NATAL_AMAJUBA 251.0
KWAZULU-NATAL_ETHEKWINI METRO 3,735.0
KWAZULU-NATAL_HARRY GWALA 138.0
KWAZULU-NATAL_ILEMBE 274.0
KWAZULU-NATAL_KING CETSHWAYO 218.0
KWAZULU-NATAL_UGU 1,137.0
KWAZULU-NATAL_UMGUNGUNDLOVU 1,574.0
KWAZULU-NATAL_UMKHANYAKUDE 421.0
KWAZULU-NATAL_UMZINYATHI 136.0
KWAZULU-NATAL_UNKNOWN 1.0
KWAZULU-NATAL_UTHUKELA 89.0
KWAZULU-NATAL_UTHUNGULU 167.0
KWAZULU-NATAL_ZULULAND 283.0
LIMPOPO_CAPRICORN 904.0
LIMPOPO_GREATER SEKHUKHUNE 341.0
LIMPOPO_MOPANI 380.0
LIMPOPO_VHEMBE 398.0

LIMPOPO_WATERBERG	411.0
MPUMALANGA_EHLANZENI	1,335.0
MPUMALANGA_GERT SIBANDE	862.0
MPUMALANGA_NKANGALA	842.0
NORTH WEST_BOJANALA PLATINUM	875.0
NORTH WEST_DR KENNETH KAUNDA	534.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	134.0
NORTH WEST_NGAKA MODIRI MOLEMA	365.0
NORTHERN CAPE_FRANCES BAARD	218.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	27.0
NORTHERN CAPE_NAMAKWA	20.0
NORTHERN CAPE_PIXLEY KA SEME	21.0
NORTHERN CAPE_ZF MGCAWU	95.0
WESTERN CAPE_CAPE WINELANDS	244.0
WESTERN CAPE_CENTRAL KAROO	13.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	1,757.0
WESTERN CAPE_GARDEN ROUTE	227.0
WESTERN CAPE_OVERBERG	116.0
WESTERN CAPE_WEST COAST	110.0
Total	40,415.0

. tab GENDER

GENDER No.

F	18,382.0
M	21,404.0
U	629.0
Total	40,415.0

. tab PROVINCE_NAME GENDER

GENDER

PROVINCE_NAME	F	M	U	Total

No.	No.	No.	No.

EASTERN CAPE	2,378.0	2,406.0	48.0	4,832.0

FREE STATE	910.0	975.0	9.0	1,894.0

GAUTENG	6,626.0	8,186.0	224.0	15,036.0

KWAZULU-NATAL	3,658.0	4,502.0	264.0	8,424.0

LIMPOPO	1,302.0	1,117.0	15.0	2,434.0

MPUMALANGA	1,486.0	1,509.0	44.0	3,039.0

NORTH WEST	881.0	1,009.0	18.0	1,908.0

NORTHERN CAPE	170.0	208.0	3.0	381.0

WESTERN CAPE	971.0	1,492.0	4.0	2,467.0

Total	18,382.0	21,404.0	629.0	40,415.0

. tab PROVINCE_DISTRICT GENDER

GENDER

PROVINCE_DISTRICT	F	M	U	Total

No.	No.	No.	No.

EASTERN CAPE_ALFRED NZO	87.0	74.0	2.0	163.0

EASTERN CAPE_AMATHOLE	283.0	250.0	9.0	542.0

EASTERN CAPE_BUFFALO CITY METRO	715.0	669.0	14.0	1,398.0

EASTERN CAPE_CHRIS HANI	136.0	161.0	6.0	303.0

EASTERN CAPE_JOE GQABI	58.0	71.0	2.0	131.0

EASTERN CAPE_NELSON MANDELA BAY METRO	521.0	539.0	5.0	1,065.0

EASTERN CAPE_O R TAMBO	413.0	409.0	6.0	828.0

EASTERN CAPE_SARAH BAARTMAN	139.0	190.0	3.0	332.0

EASTERN CAPE_UNKNOWN	26.0	43.0	1.0	70.0

FREE STATE_FEZILE DABI	119.0	114.0	1.0	234.0

FREE STATE_LEJWELEPUTSWA	223.0	274.0	2.0	499.0

FREE STATE_MANGAUNG METRO	459.0	478.0	6.0	943.0

FREE STATE_THABO MOFUTSANYANA	69.0	76.0	0.0	145.0
FREE STATE_XHARIEP	40.0	33.0	0.0	73.0
GAUTENG_CITY OF JOHANNESBURG METRO	2,356.0	3,109.0	131.0	5,596.0
GAUTENG_CITY OF TSHWANE METRO	1,347.0	1,653.0	25.0	3,025.0
GAUTENG_EKURHULENI METRO	2,596.0	2,913.0	61.0	5,570.0
GAUTENG_SEDIBENG	182.0	289.0	5.0	476.0
GAUTENG_UNKNOWN	2.0	3.0	0.0	5.0
GAUTENG_WEST RAND	143.0	219.0	2.0	364.0
KWAZULU-NATAL_AMAJUBA	105.0	143.0	3.0	251.0
KWAZULU-NATAL_ETHEKWINI METRO	1,615.0	2,023.0	97.0	3,735.0
KWAZULU-NATAL_HARRY GWALA	60.0	76.0	2.0	138.0
KWAZULU-NATAL_ILEMBE	108.0	154.0	12.0	274.0
KWAZULU-NATAL_KING CETSHWAYO	81.0	133.0	4.0	218.0
KWAZULU-NATAL_UGU	506.0	596.0	35.0	1,137.0
KWAZULU-NATAL_UMGUNGUNDLOVU	676.0	806.0	92.0	1,574.0
KWAZULU-NATAL_UMKHANYAKUDE	187.0	223.0	11.0	421.0
KWAZULU-NATAL_UMZINYATHI	59.0	76.0	1.0	136.0
KWAZULU-NATAL_UNKNOWN	1.0	0.0	0.0	1.0
KWAZULU-NATAL_UTHUKELA	36.0	52.0	1.0	89.0
KWAZULU-NATAL_UTHUNGULU	85.0	80.0	2.0	167.0
KWAZULU-NATAL_ZULULAND	139.0	140.0	4.0	283.0
LIMPOPO_CAPRICORN	529.0	370.0	5.0	904.0
LIMPOPO_GREATER SEKHUKHUNE	185.0	154.0	2.0	341.0
LIMPOPO_MOPANI	204.0	172.0	4.0	380.0
LIMPOPO_VHEMBE	176.0	221.0	1.0	398.0
LIMPOPO_WATERBERG	208.0	200.0	3.0	411.0
MPUMALANGA_EHLANZENI	644.0	681.0	10.0	1,335.0
MPUMALANGA_GERT SIBANDE	366.0	483.0	13.0	862.0
MPUMALANGA_NKANGALA	476.0	345.0	21.0	842.0
NORTH WEST_BOJANALA PLATINUM	413.0	454.0	8.0	875.0
NORTH WEST_DR KENNETH KAUNDA	211.0	316.0	7.0	534.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	64.0	70.0	0.0	134.0

NORTH WEST_NGAKA MODIRI MOLEMA	193.0	169.0	3.0	365.0
NORTHERN CAPE_FRANCES BAARD	92.0	123.0	3.0	218.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	13.0	14.0	0.0	27.0
NORTHERN CAPE_NAMAKWA	8.0	12.0	0.0	20.0
NORTHERN CAPE_PIXLEY KA SEME	13.0	8.0	0.0	21.0
NORTHERN CAPE_ZF MGCAWU	44.0	51.0	0.0	95.0
WESTERN CAPE_CAPE WINELANDS	104.0	140.0	0.0	244.0
WESTERN CAPE_CENTRAL KAROO	6.0	7.0	0.0	13.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	692.0	1,061.0	4.0	1,757.0
WESTERN CAPE_GARDEN ROUTE	93.0	134.0	0.0	227.0
WESTERN CAPE_OVERBERG	40.0	76.0	0.0	116.0
WESTERN CAPE_WEST COAST	36.0	74.0	0.0	110.0
Total	18,382.0	21,404.0	629.0	40,415.0

```
. restore
```

```
. preserve
```

```
. keep if YEAR_TESTED_DATE==2016
```

```
(5,009,798 observations deleted)
```

```
. count
```

```
1,305,589
```

```
. drop if HEP_B_SURFACE_AG=="NULL" | HEP_B_SURFACE_AG=="UNKNOWN" | HEP_B_SURFACE_A  
> G=="INSUFFICIENT FOR FURTHER TESTS"
```

```
(822,871 observations deleted)
```

```
. count
```

```
482,718
```

```
. duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force
```

Duplicates in terms of UNIQUE_PATIENT_ID

(57,038 observations deleted)

. count

425,680

. tab PROVINCE_NAME

PROVINCE_NAME No.

EASTERN CAPE 54,288.0

FREE STATE 20,917.0

GAUTENG 174,249.0

KWAZULU-NATAL 84,491.0

LIMPOPO 14,965.0

MPUMALANGA 20,362.0

NORTH WEST 20,069.0

NORTHERN CAPE 5,512.0

WESTERN CAPE 30,827.0

Total 425,680.0

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT No.

EASTERN CAPE_ALFRED NZO 1,754.0

EASTERN CAPE_AMATHOLE 5,769.0

EASTERN CAPE_BUFFALO CITY METRO 16,445.0

EASTERN CAPE_CHRIS HANI 3,089.0

EASTERN CAPE_JOE GQABI 1,139.0

EASTERN CAPE_NELSON MANDELA BAY METRO 13,139.0

EASTERN CAPE_O R TAMBO 8,838.0

EASTERN CAPE_SARAH BAARTMAN 3,476.0
EASTERN CAPE_UNKNOWN 639.0
FREE STATE_FEZILE DABI 2,425.0
FREE STATE_LEJWELEPUTSWA 4,491.0
FREE STATE_MANGAUNG METRO 12,106.0
FREE STATE_THABO MOFUTSANYANA 1,110.0
FREE STATE_UNKNOWN 3.0
FREE STATE_XHARIEP 782.0
GAUTENG_CITY OF JOHANNESBURG METRO 57,577.0
GAUTENG_CITY OF TSHWANE METRO 42,354.0
GAUTENG_EKURHULENI METRO 65,043.0
GAUTENG_SEDIBENG 6,197.0
GAUTENG_UNKNOWN 103.0
GAUTENG_WEST RAND 2,975.0
KWAZULU-NATAL_AMAJUBA 2,009.0
KWAZULU-NATAL_ETHEKWINI METRO 39,269.0
KWAZULU-NATAL_HARRY GWALA 1,179.0
KWAZULU-NATAL_ILEMBE 2,161.0
KWAZULU-NATAL_KING CETSHWAYO 2,437.0
KWAZULU-NATAL_UGU 11,085.0
KWAZULU-NATAL_UMGUNGUNDLOVU 19,279.0
KWAZULU-NATAL_UMKHANYAKUDE 2,227.0
KWAZULU-NATAL_UMZINYATHI 1,265.0
KWAZULU-NATAL_UNKNOWN 6.0
KWAZULU-NATAL_UTHUKELA 860.0
KWAZULU-NATAL_UTHUNGULU 960.0
KWAZULU-NATAL_ZULULAND 1,754.0
LIMPOPO_CAPRICORN 5,013.0
LIMPOPO_GREATER SEKHUKHUNE 3,035.0
LIMPOPO_MOPANI 2,385.0
LIMPOPO_UNKNOWN 8.0
LIMPOPO_VHEMBE 2,452.0

LIMPOPO_WATERBERG	2,072.0
MPUMALANGA_EHLANZENI	7,898.0
MPUMALANGA_GERT SIBANDE	7,782.0
MPUMALANGA_NKANGALA	4,676.0
MPUMALANGA_UNKNOWN	6.0
NORTH WEST_BOJANALA PLATINUM	8,664.0
NORTH WEST_DR KENNETH KAUNDA	6,083.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	1,642.0
NORTH WEST_NGAKA MODIRI MOLEMA	3,680.0
NORTHERN CAPE_FRANCES BAARD	3,983.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	146.0
NORTHERN CAPE_NAMAKWA	349.0
NORTHERN CAPE_PIXLEY KA SEME	296.0
NORTHERN CAPE_UNKNOWN	1.0
NORTHERN CAPE_ZF MGCAWU	737.0
WESTERN CAPE_CAPE WINELANDS	2,938.0
WESTERN CAPE_CENTRAL KAROO	246.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	22,352.0
WESTERN CAPE_GARDEN ROUTE	2,611.0
WESTERN CAPE_OVERBERG	1,562.0
WESTERN CAPE_UNKNOWN	16.0
WESTERN CAPE_WEST COAST	1,102.0
Total	425,680.0

. tab GENDER

GENDER No.

F 260,405.0

M 159,653.0

U 5,622.0

Total 425,680.0

. tab PROVINCE_NAME GENDER

GENDER

PROVINCE_NAME	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE	35,792.0	18,102.0	394.0	54,288.0
FREE STATE	13,042.0	7,783.0	92.0	20,917.0
GAUTENG	105,538.0	66,835.0	1,876.0	174,249.0
KWAZULU-NATAL	50,733.0	31,166.0	2,592.0	84,491.0
LIMPOPO	9,686.0	5,202.0	77.0	14,965.0
MPUMALANGA	12,497.0	7,659.0	206.0	20,362.0
NORTH WEST	12,534.0	7,329.0	206.0	20,069.0
NORTHERN CAPE	3,029.0	2,408.0	75.0	5,512.0
WESTERN CAPE	17,554.0	13,169.0	104.0	30,827.0
Total	260,405.0	159,653.0	5,622.0	425,680.0

. tab PROVINCE_DISTRICT GENDER

GENDER

PROVINCE_DISTRICT	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE_ALFRED NZO	1,198.0	525.0	31.0	1,754.0
EASTERN CAPE_AMATHOLE	3,870.0	1,867.0	32.0	5,769.0
EASTERN CAPE_BUFFALO CITY METRO	11,215.0	5,112.0	118.0	16,445.0
EASTERN CAPE_CHRIS HANI	2,002.0	1,054.0	33.0	3,089.0
EASTERN CAPE_JOE GQABI	685.0	449.0	5.0	1,139.0
EASTERN CAPE_NELSON MANDELA BAY METRO	8,447.0	4,653.0	39.0	13,139.0
EASTERN CAPE_O R TAMBO	5,891.0	2,850.0	97.0	8,838.0
EASTERN CAPE_SARAH BAARTMAN	2,188.0	1,277.0	11.0	3,476.0
EASTERN CAPE_UNKNOWN	296.0	315.0	28.0	639.0
FREE STATE_FEZILE DABI	1,483.0	932.0	10.0	2,425.0
FREE STATE_LEJWELEPUTSWA	2,948.0	1,521.0	22.0	4,491.0

FREE STATE_MANGAUNG METRO	7,436.0	4,619.0	51.0	12,106.0
FREE STATE_THABO MOFUTSANYANA	684.0	421.0	5.0	1,110.0
FREE STATE_UNKNOWN	3.0	0.0	0.0	3.0
FREE STATE_XHARIEP	488.0	290.0	4.0	782.0
GAUTENG_CITY OF JOHANNESBURG METRO	34,060.0	22,551.0	966.0	57
>,577.0				
GAUTENG_CITY OF TSHWANE METRO	26,259.0	15,820.0	275.0	42,354.0
GAUTENG_EKURHULENI METRO	40,098.0	24,413.0	532.0	65,043.0
GAUTENG_SEDIBENG	3,485.0	2,645.0	67.0	6,197.0
GAUTENG_UNKNOWN	74.0	29.0	0.0	103.0
GAUTENG_WEST RAND	1,562.0	1,377.0	36.0	2,975.0
KWAZULU-NATAL_AMAJUBA	1,222.0	726.0	61.0	2,009.0
KWAZULU-NATAL_ETHEKWINI METRO	23,433.0	14,831.0	1,005.0	39,269.0
KWAZULU-NATAL_HARRY GWALA	671.0	498.0	10.0	1,179.0
KWAZULU-NATAL_ILEMBE	1,236.0	838.0	87.0	2,161.0
KWAZULU-NATAL_KING CETSHWAYO	1,393.0	982.0	62.0	2,437.0
KWAZULU-NATAL_UGU	7,086.0	3,813.0	186.0	11,085.0
KWAZULU-NATAL_UMGUNGUNDLOVU	11,727.0	6,490.0	1,062.0	19,279.0
KWAZULU-NATAL_UMKHANYAKUDE	1,218.0	970.0	39.0	2,227.0
KWAZULU-NATAL_UMZINYATHI	696.0	554.0	15.0	1,265.0
KWAZULU-NATAL_UNKNOWN	6.0	0.0	0.0	6.0
KWAZULU-NATAL_UTHUKELA	511.0	331.0	18.0	860.0
KWAZULU-NATAL_UTHUNGULU	550.0	395.0	15.0	960.0
KWAZULU-NATAL_ZULULAND	984.0	738.0	32.0	1,754.0
LIMPOPO_CAPRICORN	3,172.0	1,815.0	26.0	5,013.0
LIMPOPO_GREATER SEKHUKHUNE	2,040.0	979.0	16.0	3,035.0
LIMPOPO_MOPANI	1,604.0	772.0	9.0	2,385.0
LIMPOPO_UNKNOWN	5.0	3.0	0.0	8.0
LIMPOPO_VHEMBE	1,573.0	866.0	13.0	2,452.0
LIMPOPO_WATERBERG	1,292.0	767.0	13.0	2,072.0
MPUMALANGA_EHLANZENI	4,908.0	2,928.0	62.0	7,898.0
MPUMALANGA_GERT SIBANDE	4,527.0	3,206.0	49.0	7,782.0

MPUMALANGA_NKANGALA	3,058.0	1,523.0	95.0	4,676.0
MPUMALANGA_UNKNOWN	4.0	2.0	0.0	6.0
NORTH WEST_BOJANALA PLATINUM	5,665.0	2,913.0	86.0	8,664.0
NORTH WEST_DR KENNETH KAUNDA	3,603.0	2,383.0	97.0	6,083.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	1,100.0	534.0	8.0	1,642.0
NORTH WEST_NGAKA MODIRI MOLEMA	2,166.0	1,499.0	15.0	3,680.0
NORTHERN CAPE_FRANCES BAARD	2,108.0	1,818.0	57.0	3,983.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	87.0	56.0	3.0	146.0
NORTHERN CAPE_NAMAKWA	213.0	136.0	0.0	349.0
NORTHERN CAPE_PIXLEY KA SEME	194.0	100.0	2.0	296.0
NORTHERN CAPE_UNKNOWN	0.0	1.0	0.0	1.0
NORTHERN CAPE_ZF MGCAWU	427.0	297.0	13.0	737.0
WESTERN CAPE_CAPE WINELANDS	1,671.0	1,240.0	27.0	2,938.0
WESTERN CAPE_CENTRAL KAROO	144.0	102.0	0.0	246.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	12,756.0	9,527.0	69.0	22,352.0
WESTERN CAPE_GARDEN ROUTE	1,556.0	1,053.0	2.0	2,611.0
WESTERN CAPE_OVERBERG	891.0	668.0	3.0	1,562.0
WESTERN CAPE_UNKNOWN	12.0	4.0	0.0	16.0
WESTERN CAPE_WEST COAST	524.0	575.0	3.0	1,102.0
Total	260,405.0	159,653.0	5,622.0	425,680.0

. restore

. preserve

. keep if YEAR_TESTED_DATE==2017

(4,966,207 observations deleted)

. count

1,349,180

. keep if HEP_B_SURFACE_AG=="POSITIVE" | HEP_B_SURFACE_AG=="LOW POSITIVE"

(1,297,642 observations deleted)

```
. count
```

51,538

```
. duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force
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Duplicates in terms of UNIQUE_PATIENT_ID

(9,189 observations deleted)

```
. count
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42,349

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. tab PROVINCE_NAME
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PROVINCE_NAME No.

EASTERN CAPE 5,382.0

FREE STATE 1,704.0

GAUTENG 15,682.0

KWAZULU-NATAL 7,484.0

LIMPOPO 3,166.0

MPUMALANGA 3,913.0

NORTH WEST 2,066.0

NORTHERN CAPE 381.0

WESTERN CAPE 2,571.0

Total 42,349.0

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. tab PROVINCE_DISTRICT
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PROVINCE_DISTRICT No.

EASTERN CAPE_ALFRED NZO 112.0

EASTERN CAPE_AMATHOLE 564.0
EASTERN CAPE_BUFFALO CITY METRO 1,248.0
EASTERN CAPE_CHRIS HANI 269.0
EASTERN CAPE_JOE GQABI 122.0
EASTERN CAPE_NELSON MANDELA BAY METRO 1,200.0
EASTERN CAPE_O R TAMBO 1,471.0
EASTERN CAPE_SARAH BAARTMAN 396.0
FREE STATE_FEZILE DABI 246.0
FREE STATE_LEJWELEPUTSWA 410.0
FREE STATE_MANGAUNG METRO 857.0
FREE STATE_THABO MOFUTSANYANA 132.0
FREE STATE_XHARIEP 59.0
GAUTENG_CITY OF JOHANNESBURG METRO 6,041.0
GAUTENG_CITY OF TSHWANE METRO 3,214.0
GAUTENG_EKURHULENI METRO 5,580.0
GAUTENG_SEDIBENG 464.0
GAUTENG_UNKNOWN 1.0
GAUTENG_WEST RAND 382.0
KWAZULU-NATAL_AMAJUBA 150.0
KWAZULU-NATAL_ETHEKWINI METRO 3,396.0
KWAZULU-NATAL_HARRY GWALA 114.0
KWAZULU-NATAL_ILEMBE 247.0
KWAZULU-NATAL_KING CETSHWAYO 145.0
KWAZULU-NATAL_UGU 960.0
KWAZULU-NATAL_UMGUNGUNDLOVU 1,405.0
KWAZULU-NATAL_UMKHANYAKUDE 295.0
KWAZULU-NATAL_UMZINYATHI 201.0
KWAZULU-NATAL_UTHUKELA 117.0
KWAZULU-NATAL_UTHUNGULU 126.0
KWAZULU-NATAL_ZULULAND 328.0
LIMPOPO_CAPRICORN 1,325.0
LIMPOPO_GREATER SEKHUKHUNE 481.0

LIMPOPO_MOPANI	414.0
LIMPOPO_UNKNOWN	2.0
LIMPOPO_VHEMBE	448.0
LIMPOPO_WATERBERG	496.0
MPUMALANGA_EHLANZENI	1,813.0
MPUMALANGA_GERT SIBANDE	926.0
MPUMALANGA_NKANGALA	1,172.0
MPUMALANGA_UNKNOWN	2.0
NORTH WEST_BOJANALA PLATINUM	970.0
NORTH WEST_DR KENNETH KAUNDA	693.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	123.0
NORTH WEST_NGAKA MODIRI MOLEMA	280.0
NORTHERN CAPE_FRANCES BAARD	195.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	17.0
NORTHERN CAPE_NAMAKWA	26.0
NORTHERN CAPE_PIXLEY KA SEME	23.0
NORTHERN CAPE_ZF MGCAWU	120.0
WESTERN CAPE_CAPE WINELANDS	262.0
WESTERN CAPE_CENTRAL KAROO	27.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	1,762.0
WESTERN CAPE_GARDEN ROUTE	291.0
WESTERN CAPE_OVERBERG	128.0
WESTERN CAPE_UNKNOWN	1.0
WESTERN CAPE_WEST COAST	100.0
Total	42,349.0

. tab GENDER

GENDER No.

F	19,193.0
M	22,551.0
U	605.0

Total 42,349.0

. tab PROVINCE_NAME GENDER

GENDER

PROVINCE_NAME	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE	2,697.0	2,640.0	45.0	5,382.0
FREE STATE	700.0	1,000.0	4.0	1,704.0
GAUTENG	6,907.0	8,564.0	211.0	15,682.0
KWAZULU-NATAL	3,147.0	4,113.0	224.0	7,484.0
LIMPOPO	1,668.0	1,474.0	24.0	3,166.0
MPUMALANGA	1,964.0	1,904.0	45.0	3,913.0
NORTH WEST	912.0	1,118.0	36.0	2,066.0
NORTHERN CAPE	164.0	212.0	5.0	381.0
WESTERN CAPE	1,034.0	1,526.0	11.0	2,571.0
Total	19,193.0	22,551.0	605.0	42,349.0

. tab PROVINCE_DISTRICT GENDER

GENDER

PROVINCE_DISTRICT	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE_ALFRED NZO	57.0	54.0	1.0	112.0
EASTERN CAPE_AMATHOLE	296.0	264.0	4.0	564.0
EASTERN CAPE_BUFFALO CITY METRO	641.0	591.0	16.0	1,248.0
EASTERN CAPE_CHRIS HANI	132.0	133.0	4.0	269.0
EASTERN CAPE_JOE GQABI	55.0	67.0	0.0	122.0
EASTERN CAPE_NELSON MANDELA BAY METRO	565.0	630.0	5.0	1,200.0
EASTERN CAPE_O R TAMBO	782.0	674.0	15.0	1,471.0

EASTERN CAPE_SARAH BAARTMAN	169.0	227.0	0.0	396.0
FREE STATE_FEZILE DABI	91.0	153.0	2.0	246.0
FREE STATE_LEJWELEPUTSWA	175.0	234.0	1.0	410.0
FREE STATE_MANGAUNG METRO	356.0	500.0	1.0	857.0
FREE STATE_THABO MOFUTSANYANA	55.0	77.0	0.0	132.0
FREE STATE_XHARIEP	23.0	36.0	0.0	59.0
GAUTENG_CITY OF JOHANNESBURG METRO	2,631.0	3,286.0	124.0	6,041.0
GAUTENG_CITY OF TSHWANE METRO	1,358.0	1,834.0	22.0	3,214.0
GAUTENG_EKURHULENI METRO	2,627.0	2,898.0	55.0	5,580.0
GAUTENG_SEDIBENG	174.0	286.0	4.0	464.0
GAUTENG_UNKNOWN	1.0	0.0	0.0	1.0
GAUTENG_WEST RAND	116.0	260.0	6.0	382.0
KWAZULU-NATAL_AMAJUBA	71.0	77.0	2.0	150.0
KWAZULU-NATAL_ETHEKWINI METRO	1,442.0	1,878.0	76.0	3,396.0
KWAZULU-NATAL_HARRY GWALA	41.0	64.0	9.0	114.0
KWAZULU-NATAL_ILEMBE	91.0	140.0	16.0	247.0
KWAZULU-NATAL_KING CETSHWAYO	50.0	81.0	14.0	145.0
KWAZULU-NATAL_UGU	403.0	544.0	13.0	960.0
KWAZULU-NATAL_UMGUNGUNDLOVU	580.0	755.0	70.0	1,405.0
KWAZULU-NATAL_UMKHANYAKUDE	114.0	175.0	6.0	295.0
KWAZULU-NATAL_UMZINYATHI	104.0	93.0	4.0	201.0
KWAZULU-NATAL_UTHUKELA	46.0	68.0	3.0	117.0
KWAZULU-NATAL_UTHUNGULU	49.0	76.0	1.0	126.0
KWAZULU-NATAL_ZULULAND	156.0	162.0	10.0	328.0
LIMPOPO_CAPRICORN	744.0	571.0	10.0	1,325.0
LIMPOPO_GREATER SEKHUKHUNE	245.0	232.0	4.0	481.0
LIMPOPO_MOPANI	235.0	177.0	2.0	414.0
LIMPOPO_UNKNOWN	2.0	0.0	0.0	2.0
LIMPOPO_VHEMBE	216.0	228.0	4.0	448.0
LIMPOPO_WATERBERG	226.0	266.0	4.0	496.0
MPUMALANGA_EHLANZENI	939.0	861.0	13.0	1,813.0
MPUMALANGA_GERT SIBANDE	392.0	527.0	7.0	926.0

MPUMALANGA_NKANGALA	631.0	516.0	25.0	1,172.0
MPUMALANGA_UNKNOWN	2.0	0.0	0.0	2.0
NORTH WEST_BOJANALA PLATINUM	455.0	502.0	13.0	970.0
NORTH WEST_DR KENNETH KAUNDA	274.0	400.0	19.0	693.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	61.0	61.0	1.0	123.0
NORTH WEST_NGAKA MODIRI MOLEMA	122.0	155.0	3.0	280.0
NORTHERN CAPE_FRANCES BAARD	75.0	117.0	3.0	195.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	8.0	9.0	0.0	17.0
NORTHERN CAPE_NAMAKWA	10.0	16.0	0.0	26.0
NORTHERN CAPE_PIXLEY KA SEME	13.0	10.0	0.0	23.0
NORTHERN CAPE_ZF MGCAWU	58.0	60.0	2.0	120.0
WESTERN CAPE_CAPE WINELANDS	109.0	150.0	3.0	262.0
WESTERN CAPE_CENTRAL KAROO	16.0	11.0	0.0	27.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	695.0	1,059.0	8.0	1,762.0
WESTERN CAPE_GARDEN ROUTE	133.0	158.0	0.0	291.0
WESTERN CAPE_OVERBERG	53.0	75.0	0.0	128.0
WESTERN CAPE_UNKNOWN	1.0	0.0	0.0	1.0
WESTERN CAPE_WEST COAST	27.0	73.0	0.0	100.0
Total	19,193.0	22,551.0	605.0	42,349.0

```
. restore
```

```
. preserve
```

```
. keep if YEAR_TESTED_DATE==2017
```

```
(4,966,207 observations deleted)
```

```
. count
```

```
1,349,180
```

```
. drop if HEP_B_SURFACE_AG=="NULL" | HEP_B_SURFACE_AG=="UNKNOWN" | HEP_B_SURFACE_A
> G=="INSUFFICIENT FOR FURTHER TESTS"
```

(839,061 observations deleted)

```
. count
```

510,119

```
. duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force
```

Duplicates in terms of UNIQUE_PATIENT_ID

(53,944 observations deleted)

```
. count
```

456,175

```
. tab PROVINCE_NAME
```

PROVINCE_NAME No.

EASTERN CAPE 58,991.0

FREE STATE 20,934.0

GAUTENG 189,823.0

KWAZULU-NATAL 79,479.0

LIMPOPO 16,218.0

MPUMALANGA 28,851.0

NORTH WEST 23,501.0

NORTHERN CAPE 5,507.0

WESTERN CAPE 32,871.0

Total 456,175.0

```
. tab PROVINCE_DISTRICT
```

PROVINCE_DISTRICT No.

EASTERN CAPE_ALFRED NZO 1,377.0

EASTERN CAPE_AMATHOLE 5,166.0
EASTERN CAPE_BUFFALO CITY METRO 15,513.0
EASTERN CAPE_CHRIS HANI 2,637.0
EASTERN CAPE_JOE GQABI 1,278.0
EASTERN CAPE_NELSON MANDELA BAY METRO 13,785.0
EASTERN CAPE_NOT APPLICABLE 2.0
EASTERN CAPE_O R TAMBO 14,909.0
EASTERN CAPE_SARAH BAARTMAN 4,323.0
EASTERN CAPE_UNKNOWN 1.0
FREE STATE_FEZILE DABI 2,276.0
FREE STATE_LEJWELEPUTSWA 4,922.0
FREE STATE_MANGAUNG METRO 11,175.0
FREE STATE_NOT APPLICABLE 1.0
FREE STATE_THABO MOFUTSANYANA 1,404.0
FREE STATE_UNKNOWN 5.0
FREE STATE_XHARIEP 1,151.0
GAUTENG_CITY OF JOHANNESBURG METRO 65,588.0
GAUTENG_CITY OF TSHWANE METRO 50,168.0
GAUTENG_EKURHULENI METRO 64,177.0
GAUTENG_SEDIBENG 6,604.0
GAUTENG_UNKNOWN 62.0
GAUTENG_WEST RAND 3,224.0
KWAZULU-NATAL_AMAJUBA 1,799.0
KWAZULU-NATAL_ETHEKWINI METRO 35,853.0
KWAZULU-NATAL_HARRY GWALA 1,038.0
KWAZULU-NATAL_ILEMBE 2,314.0
KWAZULU-NATAL_KING CETSHWAYO 1,641.0
KWAZULU-NATAL_UGU 10,650.0
KWAZULU-NATAL_UMGUNGUNDLOVU 17,905.0
KWAZULU-NATAL_UMKHANYAKUDE 2,208.0
KWAZULU-NATAL_UMZINYATHI 2,090.0
KWAZULU-NATAL_UNKNOWN 1.0

KWAZULU-NATAL_UTHUKELA 913.0
KWAZULU-NATAL_UTHUNGULU 1,136.0
KWAZULU-NATAL_ZULULAND 1,931.0
LIMPOPO_CAPRICORN 5,936.0
LIMPOPO_GREATER SEKHUKHUNE 3,217.0
LIMPOPO_MOPANI 2,462.0
LIMPOPO_UNKNOWN 7.0
LIMPOPO_VHEMBE 2,445.0
LIMPOPO_WATERBERG 2,151.0
MPUMALANGA_EHLANZENI 11,015.0
MPUMALANGA_GERT SIBANDE 10,184.0
MPUMALANGA_NKANGALA 7,646.0
MPUMALANGA_UNKNOWN 6.0
NORTH WEST_BOJANALA PLATINUM 9,982.0
NORTH WEST_DR KENNETH KAUNDA 7,456.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI 1,765.0
NORTH WEST_NGAKA MODIRI MOLEMA 4,298.0
NORTHERN CAPE_FRANCES BAARD 3,397.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE 96.0
NORTHERN CAPE_NAMAKWA 437.0
NORTHERN CAPE_PIXLEY KA SEME 377.0
NORTHERN CAPE_UNKNOWN 4.0
NORTHERN CAPE_ZF MGCAWU 1,196.0
WESTERN CAPE_CAPE WINELANDS 3,481.0
WESTERN CAPE_CENTRAL KAROO 254.0
WESTERN CAPE_CITY OF CAPE TOWN METRO 23,903.0
WESTERN CAPE_GARDEN ROUTE 2,505.0
WESTERN CAPE_OVERBERG 1,582.0
WESTERN CAPE_UNKNOWN 16.0
WESTERN CAPE_WEST COAST 1,130.0
Total 456,175.0

. tab GENDER

GENDER No.

F 278,205.0

M 172,307.0

U 5,663.0

Total 456,175.0

. tab PROVINCE_NAME GENDER

GENDER

PROVINCE_NAME F M U Total

No. No. No. No.

EASTERN CAPE 39,233.0 19,337.0 421.0 58,991.0

FREE STATE 12,691.0 8,192.0 51.0 20,934.0

GAUTENG 115,265.0 72,288.0 2,270.0 189,823.0

KWAZULU-NATAL 47,019.0 30,339.0 2,121.0 79,479.0

LIMPOPO 10,401.0 5,717.0 100.0 16,218.0

MPUMALANGA 17,692.0 10,903.0 256.0 28,851.0

NORTH WEST 14,566.0 8,708.0 227.0 23,501.0

NORTHERN CAPE 3,135.0 2,296.0 76.0 5,507.0

WESTERN CAPE 18,203.0 14,527.0 141.0 32,871.0

Total 278,205.0 172,307.0 5,663.0 456,175.0

. tab PROVINCE_DISTRICT GENDER

GENDER

PROVINCE_DISTRICT F M U Total

No. No. No. No.

EASTERN CAPE_ALFRED NZO 893.0 469.0 15.0 1,377.0

EASTERN CAPE_AMATHOLE 3,526.0 1,614.0 26.0 5,166.0

EASTERN CAPE_BUFFERALO CITY METRO	10,691.0	4,705.0	117.0	15,513.0
EASTERN CAPE_CHRIS HANI	1,738.0	876.0	23.0	2,637.0
EASTERN CAPE_JOE GQABI	747.0	520.0	11.0	1,278.0
EASTERN CAPE_NELSON MANDELA BAY METRO	8,841.0	4,912.0	32.0	13,785.0
EASTERN CAPE_NOT APPLICABLE	1.0	1.0	0.0	2.0
EASTERN CAPE_OR TAMBO	10,120.0	4,605.0	184.0	14,909.0
EASTERN CAPE_SARAH BAARTMAN	2,675.0	1,635.0	13.0	4,323.0
EASTERN CAPE_UNKNOWN	1.0	0.0	0.0	1.0
FREE STATE_FEZILE DABI	1,293.0	970.0	13.0	2,276.0
FREE STATE_LEJWELEPUTSWA	3,284.0	1,622.0	16.0	4,922.0
FREE STATE_MANGAUNG METRO	6,574.0	4,582.0	19.0	11,175.0
FREE STATE_NOT APPLICABLE	1.0	0.0	0.0	1.0
FREE STATE_THABO MOFUTSANYANA	865.0	538.0	1.0	1,404.0
FREE STATE_UNKNOWN	5.0	0.0	0.0	5.0
FREE STATE_XHARIEP	669.0	480.0	2.0	1,151.0
GAUTENG_CITY OF JOHANNESBURG METRO	38,518.0	25,858.0	1,212.0	65,588.0
GAUTENG_CITY OF TSHWANE METRO	31,494.0	18,316.0	358.0	50,168.0
GAUTENG_EKURHULENI METRO	39,709.0	23,876.0	592.0	64,177.0
GAUTENG_SEDIBENG	3,780.0	2,748.0	76.0	6,604.0
GAUTENG_UNKNOWN	51.0	9.0	2.0	62.0
GAUTENG_WEST RAND	1,713.0	1,481.0	30.0	3,224.0
KWAZULU-NATAL_AMAJUBA	1,137.0	588.0	74.0	1,799.0
KWAZULU-NATAL_ETHEKWINI METRO	21,137.0	14,003.0	713.0	35,853.0
KWAZULU-NATAL_HARRY GWALA	538.0	449.0	51.0	1,038.0
KWAZULU-NATAL_ILEMBE	1,394.0	746.0	174.0	2,314.0
KWAZULU-NATAL_KING CETSHWAYO	871.0	670.0	100.0	1,641.0
KWAZULU-NATAL_UGU	6,603.0	3,918.0	129.0	10,650.0
KWAZULU-NATAL_UMGUNGUNDLOVU	10,695.0	6,472.0	738.0	17,905.0
KWAZULU-NATAL_UMKHANYAKUDE	1,143.0	1,028.0	37.0	2,208.0
KWAZULU-NATAL_UMZINYATHI	1,361.0	698.0	31.0	2,090.0
KWAZULU-NATAL_UNKNOWN	0.0	1.0	0.0	1.0

KWAZULU-NATAL_UTHUKELA	483.0	408.0	22.0	913.0	
KWAZULU-NATAL_UTHUNGULU	591.0	530.0	15.0	1,136.0	
KWAZULU-NATAL_ZULULAND	1,066.0	828.0	37.0	1,931.0	
LIMPOPO_CAPRICORN	3,758.0	2,136.0	42.0	5,936.0	
LIMPOPO_GREATER SEKHUKHUNE	2,111.0	1,077.0	29.0	3,217.0	
LIMPOPO_MOPANI	1,691.0	762.0	9.0	2,462.0	
LIMPOPO_UNKNOWN	7.0	0.0	0.0	7.0	
LIMPOPO_VHEMBE	1,626.0	805.0	14.0	2,445.0	
LIMPOPO_WATERBERG	1,208.0	937.0	6.0	2,151.0	
MPUMALANGA_EHLANZENI	6,869.0	4,069.0	77.0	11,015.0	
MPUMALANGA_GERT SIBANDE	6,073.0	4,066.0	45.0	10,184.0	
MPUMALANGA_NKANGALA	4,745.0	2,768.0	133.0	7,646.0	
MPUMALANGA_UNKNOWN	5.0	0.0	1.0	6.0	
NORTH WEST_BOJANALA PLATINUM	6,436.0	3,454.0	92.0	9,982.0	
NORTH WEST_DR KENNETH KAUNDA	4,377.0	2,974.0	105.0	7,456.0	
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	1,191.0	565.0	9.0	1,765.0	
NORTH WEST_NGAKA MODIRI MOLEMA	2,562.0	1,715.0	21.0	4,298.0	
NORTHERN CAPE_FRANCES BAARD	1,821.0	1,522.0	54.0	3,397.0	
NORTHERN CAPE_JOHN TAOLO GAETSEWE	68.0	28.0	0.0	96.0	
NORTHERN CAPE_NAMAKWA	271.0	165.0	1.0	437.0	
NORTHERN CAPE_PIXLEY KA SEME	243.0	129.0	5.0	377.0	
NORTHERN CAPE_UNKNOWN	4.0	0.0	0.0	4.0	
NORTHERN CAPE_ZF MGCAWU	728.0	452.0	16.0	1,196.0	
WESTERN CAPE_CAPE WINELANDS	2,044.0	1,368.0	69.0	3,481.0	
WESTERN CAPE_CENTRAL KAROO	160.0	94.0	0.0	254.0	
WESTERN CAPE_CITY OF CAPE TOWN METRO	13,140.0	10,699.0	64.0	23	
	> ,903.0				
WESTERN CAPE_GARDEN ROUTE	1,389.0	1,116.0	0.0	2,505.0	
WESTERN CAPE_OVERBERG	897.0	683.0	2.0	1,582.0	
WESTERN CAPE_UNKNOWN	12.0	4.0	0.0	16.0	
WESTERN CAPE_WEST COAST	561.0	563.0	6.0	1,130.0	
Total	278,205.0	172,307.0	5,663.0	456,175.0	

```
. restore
```

```
. preserve
```

```
. keep if YEAR_TESTED_DATE==2018  
(5,038,976 observations deleted)
```

```
. count  
1,276,411
```

```
. keep if HEP_B_SURFACE_AG=="POSITIVE" | HEP_B_SURFACE_AG=="LOW POSITIVE"  
(1,232,310 observations deleted)
```

```
. count  
44,101
```

```
. duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force
```

Duplicates in terms of UNIQUE_PATIENT_ID

```
(7,709 observations deleted)
```

```
. count  
36,392
```

```
. tab PROVINCE_NAME
```

```
PROVINCE_NAME  No.  
EASTERN CAPE   4,888.0  
FREE STATE     1,452.0  
GAUTENG        13,273.0
```

KWAZULU-NATAL 7,134.0

LIMPOPO 1,662.0

MPUMALANGA 2,873.0

NORTH WEST 2,296.0

NORTHERN CAPE 420.0

WESTERN CAPE 2,394.0

Total 36,392.0

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT No.

EASTERN CAPE_ALFRED NZO 147.0

EASTERN CAPE_AMATHOLE 408.0

EASTERN CAPE_BUFFALO CITY METRO 1,255.0

EASTERN CAPE_CHRIS HANI 116.0

EASTERN CAPE_JOE GQABI 147.0

EASTERN CAPE_NELSON MANDELA BAY METRO 1,193.0

EASTERN CAPE_O R TAMBO 1,262.0

EASTERN CAPE_SARAH BAARTMAN 360.0

FREE STATE_FEZILE DABI 189.0

FREE STATE_LEJWELEPUTSWA 308.0

FREE STATE_MANGAUNG METRO 754.0

FREE STATE_THABO MOFUTSANYANA 134.0

FREE STATE_XHARIEP 67.0

GAUTENG_CITY OF JOHANNESBURG METRO 5,055.0

GAUTENG_CITY OF TSHWANE METRO 2,922.0

GAUTENG_EKURHULENI METRO 4,541.0

GAUTENG_SEDIBENG 395.0

GAUTENG_UNKNOWN 2.0

GAUTENG_WEST RAND 358.0

KWAZULU-NATAL_AMAJUBA 185.0

KWAZULU-NATAL_ETHEKWINI METRO 3,136.0

KWAZULU-NATAL_HARRY GWALA 128.0
KWAZULU-NATAL_ILEMBE 226.0
KWAZULU-NATAL_KING CETSHWAYO 133.0
KWAZULU-NATAL_UGU 622.0
KWAZULU-NATAL_UMGUNGUNDLOVU 1,766.0
KWAZULU-NATAL_UMKHANYAKUDE 270.0
KWAZULU-NATAL_UMZINYATHI 141.0
KWAZULU-NATAL_UNKNOWN 1.0
KWAZULU-NATAL_UTHUKELA 106.0
KWAZULU-NATAL_UTHUNGULU 158.0
KWAZULU-NATAL_ZULULAND 262.0
LIMPOPO_CAPRICORN 488.0
LIMPOPO_GREATER SEKHUKHUNE 277.0
LIMPOPO_MOPANI 345.0
LIMPOPO_VHEMBE 325.0
LIMPOPO_WATERBERG 227.0
MPUMALANGA_EHLANZENI 1,309.0
MPUMALANGA_GERT SIBANDE 903.0
MPUMALANGA_NKANGALA 657.0
MPUMALANGA_UNKNOWN 4.0
NORTH WEST_BOJANALA PLATINUM 1,019.0
NORTH WEST_DR KENNETH KAUNDA 765.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI 138.0
NORTH WEST_NGAKA MODIRI MOLEMA 374.0
NORTHERN CAPE_FRANCES BAARD 196.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE 42.0
NORTHERN CAPE_NAMAKWA 37.0
NORTHERN CAPE_PIXLEY KA SEME 31.0
NORTHERN CAPE_ZF MGCAWU 114.0
WESTERN CAPE_CAPE WINELANDS 251.0
WESTERN CAPE_CENTRAL KAROO 20.0
WESTERN CAPE_CITY OF CAPE TOWN METRO 1,692.0

WESTERN CAPE_GARDEN ROUTE 243.0
 WESTERN CAPE_OVERBERG 87.0
 WESTERN CAPE_UNKNOWN 7.0
 WESTERN CAPE_WEST COAST 94.0
 Total 36,392.0

. tab GENDER

GENDER No.

F 15,756.0
 M 20,090.0
 U 546.0
 Total 36,392.0

. tab PROVINCE_NAME GENDER

GENDER

PROVINCE_NAME	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE	2,357.0	2,481.0	50.0	4,888.0
FREE STATE	598.0	845.0	9.0	1,452.0
GAUTENG	5,758.0	7,287.0	228.0	13,273.0
KWAZULU-NATAL	2,873.0	4,082.0	179.0	7,134.0
LIMPOPO	756.0	896.0	10.0	1,662.0
MPUMALANGA	1,310.0	1,539.0	24.0	2,873.0
NORTH WEST	963.0	1,306.0	27.0	2,296.0
NORTHERN CAPE	183.0	230.0	7.0	420.0
WESTERN CAPE	958.0	1,424.0	12.0	2,394.0
Total	15,756.0	20,090.0	546.0	36,392.0

. tab PROVINCE_DISTRICT GENDER

GENDER

PROVINCE_DISTRICT	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE_ALFRED NZO	66.0	75.0	6.0	147.0
EASTERN CAPE_AMATHOLE	196.0	211.0	1.0	408.0
EASTERN CAPE_BUFFALO CITY METRO	623.0	617.0	15.0	1,255.0
EASTERN CAPE_CHRIS HANI	57.0	56.0	3.0	116.0
EASTERN CAPE_JOE GQABI	64.0	82.0	1.0	147.0
EASTERN CAPE_NELSON MANDELA BAY METRO	520.0	667.0	6.0	1,193.0
EASTERN CAPE_O R TAMBO	662.0	585.0	15.0	1,262.0
EASTERN CAPE_SARAH BAARTMAN	169.0	188.0	3.0	360.0
FREE STATE_FEZILE DABI	63.0	125.0	1.0	189.0
FREE STATE_LEJWELEPUTSWA	137.0	169.0	2.0	308.0
FREE STATE_MANGAUNG METRO	316.0	433.0	5.0	754.0
FREE STATE_THABO MOFUTSANYANA	56.0	77.0	1.0	134.0
FREE STATE_XHARIEP	26.0	41.0	0.0	67.0
GAUTENG_CITY OF JOHANNESBURG METRO	2,100.0	2,827.0	128.0	5,055.0
GAUTENG_CITY OF TSHWANE METRO	1,210.0	1,672.0	40.0	2,922.0
GAUTENG_EKURHULENI METRO	2,155.0	2,337.0	49.0	4,541.0
GAUTENG_SEDIBENG	143.0	246.0	6.0	395.0
GAUTENG_UNKNOWN	1.0	1.0	0.0	2.0
GAUTENG_WEST RAND	149.0	204.0	5.0	358.0
KWAZULU-NATAL_AMAJUBA	79.0	103.0	3.0	185.0
KWAZULU-NATAL_ETHEKWINI METRO	1,250.0	1,811.0	75.0	3,136.0
KWAZULU-NATAL_HARRY GWALA	49.0	78.0	1.0	128.0
KWAZULU-NATAL_ILEMBE	91.0	124.0	11.0	226.0
KWAZULU-NATAL_KING CETSHWAYO	48.0	78.0	7.0	133.0
KWAZULU-NATAL_UGU	257.0	360.0	5.0	622.0
KWAZULU-NATAL_UMGUNGUNDLOVU	704.0	1,000.0	62.0	1,766.0
KWAZULU-NATAL_UMKHANYAKUDE	113.0	155.0	2.0	270.0
KWAZULU-NATAL_UMZINYATHI	50.0	86.0	5.0	141.0
KWAZULU-NATAL_UNKNOWN	1.0	0.0	0.0	1.0

KWAZULU-NATAL_UTHUKELA	51.0	55.0	0.0	106.0
KWAZULU-NATAL_UTHUNGULU	62.0	93.0	3.0	158.0
KWAZULU-NATAL_ZULULAND	118.0	139.0	5.0	262.0
LIMPOPO_CAPRICORN	219.0	265.0	4.0	488.0
LIMPOPO_GREATER SEKHUKHUNE	132.0	141.0	4.0	277.0
LIMPOPO_MOPANI	162.0	183.0	0.0	345.0
LIMPOPO_VHEMBE	152.0	172.0	1.0	325.0
LIMPOPO_WATERBERG	91.0	135.0	1.0	227.0
MPUMALANGA_EHLANZENI	603.0	694.0	12.0	1,309.0
MPUMALANGA_GERT SIBANDE	397.0	503.0	3.0	903.0
MPUMALANGA_NKANGALA	309.0	339.0	9.0	657.0
MPUMALANGA_UNKNOWN	1.0	3.0	0.0	4.0
NORTH WEST_BOJANALA PLATINUM	437.0	569.0	13.0	1,019.0
NORTH WEST_DR KENNETH KAUNDA	308.0	444.0	13.0	765.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	67.0	71.0	0.0	138.0
NORTH WEST_NGAKA MODIRI MOLEMA	151.0	222.0	1.0	374.0
NORTHERN CAPE_FRANCES BAARD	69.0	123.0	4.0	196.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	17.0	24.0	1.0	42.0
NORTHERN CAPE_NAMAKWA	19.0	17.0	1.0	37.0
NORTHERN CAPE_PIXLEY KA SEME	20.0	10.0	1.0	31.0
NORTHERN CAPE_ZF MGCAWU	58.0	56.0	0.0	114.0
WESTERN CAPE_CAPE WINELANDS	105.0	145.0	1.0	251.0
WESTERN CAPE_CENTRAL KAROO	8.0	12.0	0.0	20.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	659.0	1,026.0	7.0	1,692.0
WESTERN CAPE_GARDEN ROUTE	112.0	131.0	0.0	243.0
WESTERN CAPE_OVERBERG	44.0	42.0	1.0	87.0
WESTERN CAPE_UNKNOWN	3.0	1.0	3.0	7.0
WESTERN CAPE_WEST COAST	27.0	67.0	0.0	94.0
Total	15,756.0	20,090.0	546.0	36,392.0

. restore

```
. preserve
```

```
. keep if YEAR_TESTED_DATE==2018
```

```
(5,038,976 observations deleted)
```

```
. count
```

```
1,276,411
```

```
. drop if HEP_B_SURFACE_AG=="NULL" | HEP_B_SURFACE_AG=="UNKNOWN" | HEP_B_SURFACE_A
```

```
> G=="INSUFFICIENT FOR FURTHER TESTS"
```

```
(799,163 observations deleted)
```

```
. count
```

```
477,248
```

```
. duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force
```

```
Duplicates in terms of UNIQUE_PATIENT_ID
```

```
(48,236 observations deleted)
```

```
. count
```

```
429,012
```

```
. tab PROVINCE_NAME
```

```
PROVINCE_NAME  No.
```

```
EASTERN CAPE  54,565.0
```

```
FREE STATE    18,292.0
```

```
GAUTENG 174,093.0
```

```
KWAZULU-NATAL 81,947.0
```

```
LIMPOPO 13,936.0
```


MPUMALANGA 23,475.0
NORTH WEST 25,639.0
NORTHERN CAPE 5,836.0
WESTERN CAPE 31,229.0
Total 429,012.0

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	No.
EASTERN CAPE_ALFRED NZO	1,621.0
EASTERN CAPE_AMATHOLE	4,108.0
EASTERN CAPE_BUFFALO CITY METRO	14,178.0
EASTERN CAPE_CHRIS HANI	885.0
EASTERN CAPE_JOE GQABI	1,182.0
EASTERN CAPE_NELSON MANDELA BAY METRO	13,853.0
EASTERN CAPE_NOT APPLICABLE	2.0
EASTERN CAPE_O R TAMBO	14,695.0
EASTERN CAPE_SARAH BAARTMAN	4,040.0
EASTERN CAPE_UNKNOWN	1.0
FREE STATE_FEZILE DABI	1,883.0
FREE STATE_LEJWELEPUTSWA	3,597.0
FREE STATE_MANGAUNG METRO	10,368.0
FREE STATE_THABO MOFUTSANYANA	1,199.0
FREE STATE_UNKNOWN	1.0
FREE STATE_XHARIEP	1,244.0
GAUTENG_CITY OF JOHANNESBURG METRO	62,632.0
GAUTENG_CITY OF TSHWANE METRO	46,666.0
GAUTENG_EKURHULENI METRO	55,150.0
GAUTENG_SEDIBENG	5,683.0
GAUTENG_UNKNOWN	45.0
GAUTENG_WEST RAND	3,917.0
KWAZULU-NATAL_AMAJUBA	1,636.0

KWAZULU-NATAL_ETHEKWINI METRO 35,454.0
KWAZULU-NATAL_HARRY GWALA 1,075.0
KWAZULU-NATAL_ILEMBE 2,635.0
KWAZULU-NATAL_KING CETSHWAYO 1,568.0
KWAZULU-NATAL_UGU 7,703.0
KWAZULU-NATAL_UMGUNGUNDLOVU 22,840.0
KWAZULU-NATAL_UMKHANYAKUDE 1,891.0
KWAZULU-NATAL_UMZINYATHI 1,936.0
KWAZULU-NATAL_UNKNOWN 10.0
KWAZULU-NATAL_UTHUKELA 1,075.0
KWAZULU-NATAL_UTHUNGULU 1,908.0
KWAZULU-NATAL_ZULULAND 2,216.0
LIMPOPO_CAPRICORN 5,443.0
LIMPOPO_GREATER SEKHUKHUNE 2,570.0
LIMPOPO_MOPANI 2,159.0
LIMPOPO_UNKNOWN 4.0
LIMPOPO_VHEMBE 2,129.0
LIMPOPO_WATERBERG 1,631.0
MPUMALANGA_EHLANZENI 9,045.0
MPUMALANGA_GERT SIBANDE 9,487.0
MPUMALANGA_NKANGALA 4,928.0
MPUMALANGA_UNKNOWN 15.0
NORTH WEST_BOJANALA PLATINUM 9,877.0
NORTH WEST_DR KENNETH KAUNDA 7,157.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI 2,178.0
NORTH WEST_NGAKA MODIRI MOLEMA 6,427.0
NORTHERN CAPE_FRANCES BAARD 3,344.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE 285.0
NORTHERN CAPE_NAMAKWA 620.0
NORTHERN CAPE_PIXLEY KA SEME 414.0
NORTHERN CAPE_UNKNOWN 1.0
NORTHERN CAPE_ZF MGCAWU 1,172.0

WESTERN CAPE_CAPE WINELANDS 3,368.0
 WESTERN CAPE_CENTRAL KAROO 267.0
 WESTERN CAPE_CITY OF CAPE TOWN METRO 23,050.0
 WESTERN CAPE_GARDEN ROUTE 2,095.0
 WESTERN CAPE_OVERBERG 1,277.0
 WESTERN CAPE_UNKNOWN 170.0
 WESTERN CAPE_WEST COAST 1,002.0
 Total 429,012.0

. tab GENDER

GENDER No.
 F 259,972.0
 M 162,993.0
 U 6,047.0
 Total 429,012.0

. tab PROVINCE_NAME GENDER

GENDER				
PROVINCE_NAME	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE	35,800.0	18,273.0	492.0	54,565.0
FREE STATE	10,748.0	7,517.0	27.0	18,292.0
GAUTENG	105,736.0	65,918.0	2,439.0	174,093.0
KWAZULU-NATAL	47,896.0	31,848.0	2,203.0	81,947.0
LIMPOPO	8,833.0	4,987.0	116.0	13,936.0
MPUMALANGA	14,248.0	9,021.0	206.0	23,475.0
NORTH WEST	15,757.0	9,595.0	287.0	25,639.0
NORTHERN CAPE	3,291.0	2,467.0	78.0	5,836.0
WESTERN CAPE	17,663.0	13,367.0	199.0	31,229.0

Total 259,972.0 162,993.0 6,047.0 429,012.0

. tab PROVINCE_DISTRICT GENDER

GENDER

PROVINCE_DISTRICT F M U Total

No. No. No. No.

EASTERN CAPE_ALFRED NZO 1,044.0 548.0 29.0 1,621.0

EASTERN CAPE_AMATHOLE 2,689.0 1,395.0 24.0 4,108.0

EASTERN CAPE_BUFFALO CITY METRO 9,677.0 4,325.0 176.0 14,178.0

EASTERN CAPE_CHRIS HANI 550.0 331.0 4.0 885.0

EASTERN CAPE_JOE GQABI 731.0 446.0 5.0 1,182.0

EASTERN CAPE_NELSON MANDELA BAY METRO 8,783.0 5,000.0 70.0 13,853.0

EASTERN CAPE_NOT APPLICABLE 1.0 1.0 0.0 2.0

EASTERN CAPE_O R TAMBO 9,755.0 4,774.0 166.0 14,695.0

EASTERN CAPE_SARAH BAARTMAN 2,569.0 1,453.0 18.0 4,040.0

EASTERN CAPE_UNKNOWN 1.0 0.0 0.0 1.0

FREE STATE_FEZILE DABI 1,053.0 824.0 6.0 1,883.0

FREE STATE_LEJWELEPUTSWA 2,381.0 1,209.0 7.0 3,597.0

FREE STATE_MANGAUNG METRO 5,846.0 4,509.0 13.0 10,368.0

FREE STATE_THABO MOFUTSANYANA 749.0 449.0 1.0 1,199.0

FREE STATE_UNKNOWN 1.0 0.0 0.0 1.0

FREE STATE_XHARIEP 718.0 526.0 0.0 1,244.0

GAUTENG_CITY OF JOHANNESBURG METRO 36,897.0 24,300.0 1,435.0 62

>,632.0

GAUTENG_CITY OF TSHWANE METRO 28,687.0 17,587.0 392.0 46,666.0

GAUTENG_EKURHULENI METRO 34,604.0 20,050.0 496.0 55,150.0

GAUTENG_SEDIBENG 3,260.0 2,357.0 66.0 5,683.0

GAUTENG_UNKNOWN 31.0 9.0 5.0 45.0

GAUTENG_WEST RAND 2,257.0 1,615.0 45.0 3,917.0

KWAZULU-NATAL_AMAJUBA 928.0 643.0 65.0 1,636.0

KWAZULU-NATAL_ETHEKWINI METRO 20,625.0 14,045.0 784.0 35,454.0

KWAZULU-NATAL_HARRY GWALA	621.0	437.0	17.0	1,075.0
KWAZULU-NATAL_ILEMBE	1,574.0	903.0	158.0	2,635.0
KWAZULU-NATAL_KING CETSHWAYO	855.0	619.0	94.0	1,568.0
KWAZULU-NATAL_UGU	4,671.0	2,930.0	102.0	7,703.0
KWAZULU-NATAL_UMGUNGUNDLOVU	13,486.0	8,569.0	785.0	22,840.0
KWAZULU-NATAL_UMKHANYAKUDE	1,049.0	819.0	23.0	1,891.0
KWAZULU-NATAL_UMZINYATHI	1,110.0	799.0	27.0	1,936.0
KWAZULU-NATAL_UNKNOWN	7.0	3.0	0.0	10.0
KWAZULU-NATAL_UTHUKELA	623.0	437.0	15.0	1,075.0
KWAZULU-NATAL_UTHUNGULU	1,104.0	747.0	57.0	1,908.0
KWAZULU-NATAL_ZULULAND	1,243.0	897.0	76.0	2,216.0
LIMPOPO_CAPRICORN	3,423.0	1,975.0	45.0	5,443.0
LIMPOPO_GREATER SEKHUKHUNE	1,714.0	834.0	22.0	2,570.0
LIMPOPO_MOPANI	1,383.0	762.0	14.0	2,159.0
LIMPOPO_UNKNOWN	3.0	1.0	0.0	4.0
LIMPOPO_VHEMBE	1,352.0	759.0	18.0	2,129.0
LIMPOPO_WATERBERG	958.0	656.0	17.0	1,631.0
MPUMALANGA_EHLANZENI	5,452.0	3,496.0	97.0	9,045.0
MPUMALANGA_GERT SIBANDE	5,776.0	3,678.0	33.0	9,487.0
MPUMALANGA_NKANGALA	3,012.0	1,840.0	76.0	4,928.0
MPUMALANGA_UNKNOWN	8.0	7.0	0.0	15.0
NORTH WEST_BOJANALA PLATINUM	6,146.0	3,583.0	148.0	9,877.0
NORTH WEST_DR KENNETH KAUNDA	4,133.0	2,940.0	84.0	7,157.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	1,478.0	691.0	9.0	2,178.0
NORTH WEST_NGAKA MODIRI MOLEMA	4,000.0	2,381.0	46.0	6,427.0
NORTHERN CAPE_FRANCES BAARD	1,771.0	1,510.0	63.0	3,344.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	177.0	107.0	1.0	285.0
NORTHERN CAPE_NAMAKWA	374.0	244.0	2.0	620.0
NORTHERN CAPE_PIXLEY KA SEME	270.0	142.0	2.0	414.0
NORTHERN CAPE_UNKNOWN	1.0	0.0	0.0	1.0
NORTHERN CAPE_ZF MGCAWU	698.0	464.0	10.0	1,172.0
WESTERN CAPE_CAPE WINELANDS	2,004.0	1,319.0	45.0	3,368.0

WESTERN CAPE_CENTRAL KAROO	167.0	100.0	0.0	267.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	12,868.0	10,104.0	78.0	23
>,050.0				
WESTERN CAPE_GARDEN ROUTE	1,236.0	858.0	1.0	2,095.0
WESTERN CAPE_OVERBERG	764.0	507.0	6.0	1,277.0
WESTERN CAPE_UNKNOWN	99.0	6.0	65.0	170.0
WESTERN CAPE_WEST COAST	525.0	473.0	4.0	1,002.0
Total	259,972.0	162,993.0	6,047.0	429,012.0

. restore

. preserve

. keep if YEAR_TESTED_DATE==2019

(4,963,898 observations deleted)

. count

1,351,489

. keep if HEP_B_SURFACE_AG=="POSITIVE" | HEP_B_SURFACE_AG=="LOW POSITIVE"

(1,303,404 observations deleted)

. count

48,085

. duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force

Duplicates in terms of UNIQUE_PATIENT_ID

(8,258 observations deleted)

. count

39,827

. tab PROVINCE_NAME

PROVINCE_NAME No.

EASTERN CAPE 4,756.0

FREE STATE 1,937.0

GAUTENG 15,388.0

KWAZULU-NATAL 8,033.0

LIMPOPO 1,232.0

MPUMALANGA 3,059.0

NORTH WEST 2,566.0

NORTHERN CAPE 392.0

WESTERN CAPE 2,464.0

Total 39,827.0

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT No.

EASTERN CAPE_ALFRED NZO 181.0

EASTERN CAPE_AMATHOLE 400.0

EASTERN CAPE_BUFFALO CITY METRO 1,220.0

EASTERN CAPE_CHRIS HANI 91.0

EASTERN CAPE_JOE GQABI 200.0

EASTERN CAPE_NELSON MANDELA BAY METRO 1,238.0

EASTERN CAPE_O R TAMBO 1,070.0

EASTERN CAPE_SARAH BAARTMAN 355.0

EASTERN CAPE_UNKNOWN 1.0

FREE STATE_FEZILE DABI 213.0

FREE STATE_LEJWELEPUTSWA 537.0

FREE STATE_MANGAUNG METRO 799.0

FREE STATE_THABO MOFUTSANYANA 321.0

FREE STATE_UNKNOWN 4.0
FREE STATE_XHARIEP 63.0
GAUTENG_CITY OF JOHANNESBURG METRO 6,059.0
GAUTENG_CITY OF TSHWANE METRO 3,070.0
GAUTENG_EKURHULENI METRO 5,500.0
GAUTENG_SEDIBENG 314.0
GAUTENG_UNKNOWN 70.0
GAUTENG_WEST RAND 375.0
KWAZULU-NATAL_AMAJUBA 298.0
KWAZULU-NATAL_ETHEKWINI METRO 3,536.0
KWAZULU-NATAL_HARRY GWALA 106.0
KWAZULU-NATAL_ILEMBE 286.0
KWAZULU-NATAL_KING CETSHWAYO 168.0
KWAZULU-NATAL_UGU 686.0
KWAZULU-NATAL_UMGUNGUNDLOVU 2,004.0
KWAZULU-NATAL_UMKHANYAKUDE 203.0
KWAZULU-NATAL_UMZINYATHI 147.0
KWAZULU-NATAL_UNKNOWN 3.0
KWAZULU-NATAL_UTHUKELA 158.0
KWAZULU-NATAL_UTHUNGULU 143.0
KWAZULU-NATAL_ZULULAND 295.0
LIMPOPO_CAPRICORN 373.0
LIMPOPO_GREATER SEKHUKHUNE 179.0
LIMPOPO_MOPANI 230.0
LIMPOPO_VHEMBE 298.0
LIMPOPO_WATERBERG 152.0
MPUMALANGA_EHLANZENI 1,599.0
MPUMALANGA_GERT SIBANDE 792.0
MPUMALANGA_NKANGALA 668.0
NORTH WEST_BOJANALA PLATINUM 1,051.0
NORTH WEST_DR KENNETH KAUNDA 960.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI 200.0

NORTH WEST_NGAKA MODIRI MOLEMA	355.0
NORTHERN CAPE_FRANCES BAARD	160.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	56.0
NORTHERN CAPE_NAMAKWA	25.0
NORTHERN CAPE_PIXLEY KA SEME	49.0
NORTHERN CAPE_ZF MGCAWU	102.0
WESTERN CAPE_CAPE WINELANDS	275.0
WESTERN CAPE_CENTRAL KAROO	24.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	1,715.0
WESTERN CAPE_GARDEN ROUTE	249.0
WESTERN CAPE_OVERBERG	72.0
WESTERN CAPE_UNKNOWN	29.0
WESTERN CAPE_WEST COAST	100.0
Total	39,827.0

. tab GENDER

GENDER No.	
F	17,501.0
M	21,579.0
U	747.0
Total	39,827.0

. tab PROVINCE_NAME GENDER

GENDER				
PROVINCE_NAME	F	M	U	Total
	No.	No.	No.	No.
EASTERN CAPE	2,246.0	2,454.0	56.0	4,756.0
FREE STATE	809.0	1,113.0	15.0	1,937.0
GAUTENG	6,763.0	8,322.0	303.0	15,388.0

KWAZULU-NATAL	3,433.0	4,328.0	272.0	8,033.0
LIMPOPO	582.0	636.0	14.0	1,232.0
MPUMALANGA	1,388.0	1,635.0	36.0	3,059.0
NORTH WEST	1,080.0	1,450.0	36.0	2,566.0
NORTHERN CAPE	175.0	208.0	9.0	392.0
WESTERN CAPE	1,025.0	1,433.0	6.0	2,464.0
Total	17,501.0	21,579.0	747.0	39,827.0

. tab PROVINCE_DISTRICT GENDER

GENDER				
PROVINCE_DISTRICT	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE_ALFRED NZO	79.0	100.0	2.0	181.0
EASTERN CAPE_AMATHOLE	204.0	193.0	3.0	400.0
EASTERN CAPE_BUFFALO CITY METRO	604.0	590.0	26.0	1,220.0
EASTERN CAPE_CHRIS HANI	36.0	54.0	1.0	91.0
EASTERN CAPE_JOE GQABI	84.0	115.0	1.0	200.0
EASTERN CAPE_NELSON MANDELA BAY METRO	556.0	676.0	6.0	1,238.0
EASTERN CAPE_O R TAMBO	531.0	524.0	15.0	1,070.0
EASTERN CAPE_SARAH BAARTMAN	151.0	202.0	2.0	355.0
EASTERN CAPE_UNKNOWN	1.0	0.0	0.0	1.0
FREE STATE_FEZILE DABI	89.0	124.0	0.0	213.0
FREE STATE_LEJWELEPUTSWA	248.0	280.0	9.0	537.0
FREE STATE_MANGAUNG METRO	326.0	470.0	3.0	799.0
FREE STATE_THABO MOFUTSANYANA	116.0	205.0	0.0	321.0
FREE STATE_UNKNOWN	0.0	1.0	3.0	4.0
FREE STATE_XHARIEP	30.0	33.0	0.0	63.0
GAUTENG_CITY OF JOHANNESBURG METRO	2,608.0	3,276.0	175.0	6,059.0
GAUTENG_CITY OF TSHWANE METRO	1,260.0	1,787.0	23.0	3,070.0
GAUTENG_EKURHULENI METRO	2,615.0	2,800.0	85.0	5,500.0

GAUTENG_SEDIBENG	102.0	203.0	9.0	314.0
GAUTENG_UNKNOWN	23.0	40.0	7.0	70.0
GAUTENG_WEST RAND	155.0	216.0	4.0	375.0
KWAZULU-NATAL_AMAJUBA	124.0	154.0	20.0	298.0
KWAZULU-NATAL_ETHEKWINI METRO	1,557.0	1,892.0	87.0	3,536.0
KWAZULU-NATAL_HARRY GWALA	39.0	63.0	4.0	106.0
KWAZULU-NATAL_ILEMBE	113.0	156.0	17.0	286.0
KWAZULU-NATAL_KING CETSHWAYO	53.0	106.0	9.0	168.0
KWAZULU-NATAL_UGU	293.0	383.0	10.0	686.0
KWAZULU-NATAL_UMGUNGUNDLOVU	825.0	1,067.0	112.0	2,004.0
KWAZULU-NATAL_UMKHANYAKUDE	81.0	120.0	2.0	203.0
KWAZULU-NATAL_UMZINYATHI	55.0	92.0	0.0	147.0
KWAZULU-NATAL_UNKNOWN	0.0	2.0	1.0	3.0
KWAZULU-NATAL_UTHUKELA	81.0	76.0	1.0	158.0
KWAZULU-NATAL_UTHUNGULU	66.0	73.0	4.0	143.0
KWAZULU-NATAL_ZULULAND	146.0	144.0	5.0	295.0
LIMPOPO_CAPRICORN	160.0	206.0	7.0	373.0
LIMPOPO_GREATER SEKHUKHUNE	86.0	91.0	2.0	179.0
LIMPOPO_MOPANI	113.0	117.0	0.0	230.0
LIMPOPO_VHEMBE	152.0	141.0	5.0	298.0
LIMPOPO_WATERBERG	71.0	81.0	0.0	152.0
MPUMALANGA_EHLANZENI	721.0	856.0	22.0	1,599.0
MPUMALANGA_GERT SIBANDE	365.0	421.0	6.0	792.0
MPUMALANGA_NKANGALA	302.0	358.0	8.0	668.0
NORTH WEST_BOJANALA PLATINUM	468.0	560.0	23.0	1,051.0
NORTH WEST_DR KENNETH KAUNDA	372.0	581.0	7.0	960.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	92.0	106.0	2.0	200.0
NORTH WEST_NGAKA MODIRI MOLEMA	148.0	203.0	4.0	355.0
NORTHERN CAPE_FRANCES BAARD	70.0	84.0	6.0	160.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	26.0	29.0	1.0	56.0
NORTHERN CAPE_NAMAKWA	7.0	18.0	0.0	25.0
NORTHERN CAPE_PIXLEY KA SEME	22.0	26.0	1.0	49.0

NORTHERN CAPE_ZF MGCAWU	50.0	51.0	1.0	102.0
WESTERN CAPE_CAPE WINELANDS	106.0	169.0	0.0	275.0
WESTERN CAPE_CENTRAL KAROO	14.0	10.0	0.0	24.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	693.0	1,016.0	6.0	1,715.0
WESTERN CAPE_GARDEN ROUTE	119.0	130.0	0.0	249.0
WESTERN CAPE_OVERBERG	32.0	40.0	0.0	72.0
WESTERN CAPE_UNKNOWN	27.0	2.0	0.0	29.0
WESTERN CAPE_WEST COAST	34.0	66.0	0.0	100.0
Total	17,501.0	21,579.0	747.0	39,827.0

. restore

. preserve

. keep if YEAR_TESTED_DATE==2019

(4,963,898 observations deleted)

. count

1,351,489

. drop if HEP_B_SURFACE_AG=="NULL" | HEP_B_SURFACE_AG=="UNKNOWN" | HEP_B_SURFACE_A
> G=="INSUFFICIENT FOR FURTHER TESTS"

(808,247 observations deleted)

. count

543,242

. duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force

Duplicates in terms of UNIQUE_PATIENT_ID

(50,687 observations deleted)

. count

492,555

. tab PROVINCE_NAME

PROVINCE_NAME No.

EASTERN CAPE 57,661.0

FREE STATE 21,970.0

GAUTENG 209,689.0

KWAZULU-NATAL 97,016.0

LIMPOPO 12,969.0

MPUMALANGA 24,721.0

NORTH WEST 28,972.0

NORTHERN CAPE 6,110.0

WESTERN CAPE 33,447.0

Total 492,555.0

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT No.

EASTERN CAPE_ALFRED NZO 2,118.0

EASTERN CAPE_AMATHOLE 3,657.0

EASTERN CAPE_BUFFALO CITY METRO 14,323.0

EASTERN CAPE_CHRIS HANI 787.0

EASTERN CAPE_JOE GQABI 1,633.0

EASTERN CAPE_NELSON MANDELA BAY METRO 15,401.0

EASTERN CAPE_NOT APPLICABLE 1.0

EASTERN CAPE_O R TAMBO 15,384.0

EASTERN CAPE_SARAH BAARTMAN 4,276.0

EASTERN CAPE_UNKNOWN 81.0

FREE STATE_FEZILE DABI 1,898.0

FREE STATE_LEJWELEPUTSWA 4,933.0
FREE STATE_MANGAUNG METRO 10,118.0
FREE STATE_THABO MOFUTSANYANA 3,916.0
FREE STATE_UNKNOWN 49.0
FREE STATE_XHARIEP 1,056.0
GAUTENG_CITY OF JOHANNESBURG METRO 83,468.0
GAUTENG_CITY OF TSHWANE METRO 51,255.0
GAUTENG_EKURHULENI METRO 64,920.0
GAUTENG_SEDIBENG 4,943.0
GAUTENG_UNKNOWN 839.0
GAUTENG_WEST RAND 4,264.0
KWAZULU-NATAL_AMAJUBA 2,905.0
KWAZULU-NATAL_ETHEKWINI METRO 44,022.0
KWAZULU-NATAL_HARRY GWALA 763.0
KWAZULU-NATAL_ILEMBE 3,086.0
KWAZULU-NATAL_KING CETSHWAYO 1,550.0
KWAZULU-NATAL_UGU 6,955.0
KWAZULU-NATAL_UMGUNGUNDLOVU 28,207.0
KWAZULU-NATAL_UMKHANYAKUDE 1,621.0
KWAZULU-NATAL_UMZINYATHI 1,958.0
KWAZULU-NATAL_UNKNOWN 23.0
KWAZULU-NATAL_UTHUKELA 1,720.0
KWAZULU-NATAL_UTHUNGULU 1,455.0
KWAZULU-NATAL_ZULULAND 2,751.0
LIMPOPO_CAPRICORN 4,791.0
LIMPOPO_GREATER SEKHUKHUNE 2,146.0
LIMPOPO_MOPANI 1,873.0
LIMPOPO_UNKNOWN 8.0
LIMPOPO_VHEMBE 2,631.0
LIMPOPO_WATERBERG 1,520.0
MPUMALANGA_EHLANZENI 10,716.0
MPUMALANGA_GERT SIBANDE 9,107.0

MPUMALANGA_NKANGALA	4,889.0
MPUMALANGA_UNKNOWN	9.0
NORTH WEST_BOJANALA PLATINUM	10,290.0
NORTH WEST_DR KENNETH KAUNDA	9,309.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	2,851.0
NORTH WEST_NGAKA MODIRI MOLEMA	6,518.0
NORTH WEST_UNKNOWN	4.0
NORTHERN CAPE_FRANCES BAARD	3,342.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	601.0
NORTHERN CAPE_NAMAKWA	362.0
NORTHERN CAPE_PIXLEY KA SEME	590.0
NORTHERN CAPE_ZF MGCAWU	1,215.0
WESTERN CAPE_CAPE WINELANDS	3,387.0
WESTERN CAPE_CENTRAL KAROO	205.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	23,913.0
WESTERN CAPE_GARDEN ROUTE	2,290.0
WESTERN CAPE_OVERBERG	1,152.0
WESTERN CAPE_UNKNOWN	1,467.0
WESTERN CAPE_WEST COAST	1,033.0
Total	492,555.0

. tab GENDER

GENDER No.

F	302,788.0
M	180,568.0
U	9,199.0
Total	492,555.0

. tab PROVINCE_NAME GENDER

GENDER

PROVINCE_NAME	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE	37,905.0	18,897.0	859.0	57,661.0
FREE STATE	13,244.0	8,643.0	83.0	21,970.0
GAUTENG	127,542.0	78,383.0	3,764.0	209,689.0
KWAZULU-NATAL	58,637.0	34,976.0	3,403.0	97,016.0
LIMPOPO	8,652.0	4,220.0	97.0	12,969.0
MPUMALANGA	15,245.0	9,220.0	256.0	24,721.0
NORTH WEST	18,230.0	10,343.0	399.0	28,972.0
NORTHERN CAPE	3,493.0	2,517.0	100.0	6,110.0
WESTERN CAPE	19,840.0	13,369.0	238.0	33,447.0
Total	302,788.0	180,568.0	9,199.0	492,555.0

. tab PROVINCE_DISTRICT GENDER

GENDER

PROVINCE_DISTRICT	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE_ALFRED NZO	1,380.0	716.0	22.0	2,118.0
EASTERN CAPE_AMATHOLE	2,317.0	1,313.0	27.0	3,657.0
EASTERN CAPE_BUFFALO CITY METRO	9,546.0	4,332.0	445.0	14,323.0
EASTERN CAPE_CHRIS HANI	465.0	307.0	15.0	787.0
EASTERN CAPE_JOE GQABI	1,044.0	568.0	21.0	1,633.0
EASTERN CAPE_NELSON MANDELA BAY METRO	9,973.0	5,360.0	68.0	15,401.0
EASTERN CAPE_NOT APPLICABLE	1.0	0.0	0.0	1.0
EASTERN CAPE_O R TAMBO	10,491.0	4,654.0	239.0	15,384.0
EASTERN CAPE_SARAH BAARTMAN	2,631.0	1,624.0	21.0	4,276.0
EASTERN CAPE_UNKNOWN	57.0	23.0	1.0	81.0
FREE STATE_FEZILE DABI	1,094.0	801.0	3.0	1,898.0

FREE STATE_LEJWELEPUTSWA	3,123.0	1,762.0	48.0	4,933.0
FREE STATE_MANGAUNG METRO	5,878.0	4,219.0	21.0	10,118.0
FREE STATE_THABO MOFUTSANYANA	2,501.0	1,411.0	4.0	3,916.0
FREE STATE_UNKNOWN	35.0	9.0	5.0	49.0
FREE STATE_XHARIEP	613.0	441.0	2.0	1,056.0
GAUTENG_CITY OF JOHANNESBURG METRO	49,734.0	31,554.0	2,180.0	83
	>,468.0			
GAUTENG_CITY OF TSHWANE METRO	31,115.0	19,592.0	548.0	51,255.0
GAUTENG_EKURHULENI METRO	41,120.0	22,911.0	889.0	64,920.0
GAUTENG_SEDIBENG	2,713.0	2,148.0	82.0	4,943.0
GAUTENG_UNKNOWN	480.0	335.0	24.0	839.0
GAUTENG_WEST RAND	2,380.0	1,843.0	41.0	4,264.0
KWAZULU-NATAL_AMAJUBA	1,723.0	1,033.0	149.0	2,905.0
KWAZULU-NATAL_ETHEKWINI METRO	27,012.0	16,054.0	956.0	44,022.0
KWAZULU-NATAL_HARRY GWALA	392.0	331.0	40.0	763.0
KWAZULU-NATAL_ILEMBE	1,751.0	1,103.0	232.0	3,086.0
KWAZULU-NATAL_KING CETSHWAYO	785.0	700.0	65.0	1,550.0
KWAZULU-NATAL_UGU	4,185.0	2,701.0	69.0	6,955.0
KWAZULU-NATAL_UMGUNGUNDLOVU	17,075.0	9,428.0	1,704.0	28,207.0
KWAZULU-NATAL_UMKHANYAKUDE	931.0	667.0	23.0	1,621.0
KWAZULU-NATAL_UMZINYATHI	1,071.0	850.0	37.0	1,958.0
KWAZULU-NATAL_UNKNOWN	16.0	6.0	1.0	23.0
KWAZULU-NATAL_UTHUKELA	1,209.0	481.0	30.0	1,720.0
KWAZULU-NATAL_UTHUNGULU	843.0	590.0	22.0	1,455.0
KWAZULU-NATAL_ZULULAND	1,644.0	1,032.0	75.0	2,751.0
LIMPOPO_CAPRICORN	3,049.0	1,711.0	31.0	4,791.0
LIMPOPO_GREATER SEKHUKHUNE	1,462.0	672.0	12.0	2,146.0
LIMPOPO_MOPANI	1,255.0	613.0	5.0	1,873.0
LIMPOPO_UNKNOWN	6.0	2.0	0.0	8.0
LIMPOPO_VHEMBE	1,942.0	651.0	38.0	2,631.0
LIMPOPO_WATERBERG	938.0	571.0	11.0	1,520.0
MPUMALANGA_EHLANZENI	6,567.0	3,994.0	155.0	10,716.0

MPUMALANGA_GERT SIBANDE	5,569.0	3,511.0	27.0	9,107.0
MPUMALANGA_NKANGALA	3,102.0	1,713.0	74.0	4,889.0
MPUMALANGA_UNKNOWN	7.0	2.0	0.0	9.0
NORTH WEST_BOJANALA PLATINUM	6,619.0	3,467.0	204.0	10,290.0
NORTH WEST_DR KENNETH KAUNDA	5,627.0	3,585.0	97.0	9,309.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	1,963.0	859.0	29.0	2,851.0
NORTH WEST_NGAKA MODIRI MOLEMA	4,020.0	2,429.0	69.0	6,518.0
NORTH WEST_UNKNOWN	1.0	3.0	0.0	4.0
NORTHERN CAPE_FRANCES BAARD	1,845.0	1,433.0	64.0	3,342.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	366.0	229.0	6.0	601.0
NORTHERN CAPE_NAMAKWA	212.0	149.0	1.0	362.0
NORTHERN CAPE_PIXLEY KA SEME	389.0	187.0	14.0	590.0
NORTHERN CAPE_ZF MGCAWU	681.0	519.0	15.0	1,215.0
WESTERN CAPE_CAPE WINELANDS	2,075.0	1,283.0	29.0	3,387.0
WESTERN CAPE_CENTRAL KAROO	130.0	75.0	0.0	205.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	13,646.0	10,109.0	158.0	23
	>,913.0			
WESTERN CAPE_GARDEN ROUTE	1,350.0	938.0	2.0	2,290.0
WESTERN CAPE_OVERBERG	697.0	452.0	3.0	1,152.0
WESTERN CAPE_UNKNOWN	1,390.0	34.0	43.0	1,467.0
WESTERN CAPE_WEST COAST	552.0	478.0	3.0	1,033.0
Total	302,788.0	180,568.0	9,199.0	492,555.0

. restore

Appendix 4.4: Stata Log file of annual HBV incidence

```
. use "\\6315380 final file to use for prevalence and incidence.dta", clear
```

```
. tab YEAR_TESTED_DATE
```

```
YEAR_TESTED |  
  _DATE |   Freq.   Percent   Cum.  
-----+-----  
    2015 |  107,178   20.65   20.65  
    2016 |  133,023   25.63   46.28  
    2017 |  127,256   24.52   70.81  
    2018 |   84,452   16.27   87.08  
    2019 |   67,055   12.92  100.00  
-----+-----  
      Total |  518,964  100.00
```

```
. keep if YEAR_TESTED_DATE==2015
```

```
(5,282,669 observations deleted)
```

```
. keep if HEPATITIS_B_CORE_IGM=="LOW POSITIVE" | HEPATITIS_B_CORE_IGM==  
> "POSITIVE"
```

```
(1,028,561 observations deleted)
```

```
.
```

```
. tab TESTING_LAB
```

```
TESTING_LAB |   Freq.   Percent   Cum.
```

-----+-----			
BRAAMFONTEIN CENTRAL LABORATORY	450	10.83	10.83
CECILIA MAKIWANE LABORATORY	29	0.70	11.52
CHARLOTTE MAXEKE JOHANNESBURG ACADEMI..	117	2.81	14.34
CHRIS HANI BARAGWANATH LABORATORY	168	4.04	18.38
DORA NGINZA LABORATORY	1	0.02	18.40
DR GEORGE MUKHARI LABORATORY	208	5.00	23.41
EAST LONDON LABORATORY	361	8.68	32.09
ERMELO LABORATORY	152	3.66	35.75
GEORGE LABORATORY	26	0.63	36.37
GROOTE SCHUUR LABORATORY	86	2.07	38.44
HELEN JOSEPH LABORATORY	87	2.09	40.53
INKOSI ALBERT LUTHULI CENTRAL HOSPITAL	1,015	24.42	64.95
KIMBERLEY LABORATORY	83	2.00	66.95
LERATONG LABORATORY	54	1.30	68.25
LETABA LABORATORY	1	0.02	68.27
MAFIKENG LABORATORY	6	0.14	68.41
NELSON MANDELA ACADEMIC LABORATORY	194	4.67	73.08
PELONOMI LABORATORY	114	2.74	75.82
POLOKWANE LABORATORY	43	1.03	76.86
PORT ELIZABETH LABORATORY	94	2.26	79.12
ROB FERREIRA LABORATORY	65	1.56	80.68
TAMBO MEMORIAL LABORATORY	171	4.11	84.80
THUSONG LABORATORY	1	0.02	84.82
TSHEPONG LABORATORY	57	1.37	86.19
TSHWANE ACADEMIC LABORATORY	413	9.94	96.13
TYGERBERG LABORATORY	161	3.87	100.00
-----+-----			
Total	4,157	100.00	

. destring HEPATITIS_B_CORE_IGM_VALUE, generate(COREIGM_VALUE) force

HEPATITIS_B_CORE_IGM_VALUE contains nonnumeric characters; COREIGM_VALUE generated as double

(722 missing values generated)

```
. keep if ((TESTING_LAB=="BRAAMFONTEIN CENTRAL LABORATORY" | TESTING_LAB=="DORA
NGINZA LABORATORY" | TESTING
> _LAB=="CECILIA MAKIWANE LABORATORY" | TESTING_LAB=="LERATONG LABORATORY" |
TESTING_LAB=="MAFIKENG LABORATO
> RY" | TESTING_LAB=="MANKWENG LABORATORY" | TESTING_LAB=="PORT SHEPSTONE
LABORATORY" | TESTING_LAB=="THUSON
> G LABORATORY" | TESTING_LAB=="EAST LONDON LABORATORY" | TESTING_LAB=="INKOSI
ALBERT LUTHULI CENTRAL HOSPIT
> AL" | TESTING_LAB=="NELSON MANDELA ACADEMIC LABORATORY" | TESTING_LAB=="PORT
ELIZABETH LABORATORY" | TESTI
> NG_LAB=="CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL" | TESTING_LAB=="CHRIS
HANI BARAGWANATH LABORATOR
> Y" | TESTING_LAB=="DR GEORGE MUKHARI LABORATORY" | TESTING_LAB=="ERMELO
LABORATORY" | TESTING_LAB=="GROOTE
> SCHUUR LABORATORY" | TESTING_LAB=="LETABA LABORATORY" | TESTING_LAB=="TSHEPONG
LABORATORY" | TESTING_LAB=
> ="TYGERBERG LABORATORY" | TESTING_LAB=="TSHWANE ACADEMIC LABORATORY" |
TESTING_LAB=="UNIVERSITAS ACADEMIC
> LABORATORY") & (COREIGM_VALUE>=20 & COREIGM_VALUE<.) | ((TESTING_LAB=="GEORGE
LABORATORY" | TESTING_LAB==
> "POLOKWANE LABORATORY" | TESTING_LAB=="ROB FERREIRA LABORATORY") &
(COREIGM_VALUE>=5 & COREIGM_VALUE<.) |
> (HEPATITIS_B_CORE_IGM_VALUE==">9" | HEPATITIS_B_CORE_IGM_VALUE==">9.00" |
HEPATITIS_B_CORE_IGM_VALUE==">1
> 5" | HEPATITIS_B_CORE_IGM_VALUE==">15.00" | HEPATITIS_B_CORE_IGM_VALUE==">1000" |
HEPATITIS_B_CORE_IGM_VAL
> UE=="UNKNOWN")
```

(2,046 observations deleted)

.

```
. tab TESTING_LAB
```

TESTING_LAB	Freq.	Percent	Cum.

-----+-----			
BRAAMFONTEIN CENTRAL LABORATORY	181	8.57	8.57
CECILIA MAKIWANE LABORATORY	5	0.24	8.81
CHARLOTTE MAXEKE JOHANNESBURG ACADEMI..	66	3.13	11.94
CHRIS HANI BARAGWANATH LABORATORY	98	4.64	16.58
DORA NGINZA LABORATORY	1	0.05	16.63
DR GEORGE MUKHARI LABORATORY	114	5.40	22.03
EAST LONDON LABORATORY	97	4.59	26.62
ERMELO LABORATORY	87	4.12	30.74
GEORGE LABORATORY	22	1.04	31.79
GROOTE SCHUUR LABORATORY	43	2.04	33.82
HELEN JOSEPH LABORATORY	47	2.23	36.05
INKOSI ALBERT LUTHULI CENTRAL HOSPITAL	629	29.80	65.85
KIMBERLEY LABORATORY	49	2.32	68.17
LERATONG LABORATORY	27	1.28	69.45
MAFIKENG LABORATORY	1	0.05	69.49
NELSON MANDELA ACADEMIC LABORATORY	73	3.46	72.95
PELONOMI LABORATORY	75	3.55	76.50
POLOKWANE LABORATORY	36	1.71	78.21
PORT ELIZABETH LABORATORY	47	2.23	80.44
ROB FERREIRA LABORATORY	50	2.37	82.80
TSHEPONG LABORATORY	19	0.90	83.70
TSHWANE ACADEMIC LABORATORY	213	10.09	93.79
TYGERBERG LABORATORY	131	6.21	100.00
-----+-----			
Total	2,111	100.00	

. count

2,111

.

```
. duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force
```

Duplicates in terms of UNIQUE_PATIENT_ID

(356 observations deleted)

```
.  
. count  
1,755
```

```
.  
. tab HEPATITIS_B_CORE_IGM
```

HEPATITIS_B_CORE_IGM	Freq.	Percent	Cum.
-----+-----			
POSITIVE	1,755	100.00	100.00
-----+-----			
Total	1,755	100.00	

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. tab PROVINCE_NAME
```

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PROVINCE_NAME  No.  
EASTERN CAPE   172.0  
FREE STATE     108.0  
GAUTENG        430.0  
KWAZULU-NATAL  521.0  
LIMPOPO        84.0  
MPUMALANGA     172.0  
NORTH WEST     67.0  
NORTHERN CAPE  46.0  
WESTERN CAPE   155.0
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Total 1,755.0

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. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	No.
EASTERN CAPE_ALFRED NZO	11.0
EASTERN CAPE_AMATHOLE	16.0
EASTERN CAPE_BUFFALO CITY METRO	31.0
EASTERN CAPE_CHRIS HANI	22.0
EASTERN CAPE_JOE GQABI	14.0
EASTERN CAPE_NELSON MANDELA BAY METRO	30.0
EASTERN CAPE_O R TAMBO	40.0
EASTERN CAPE_SARAH BAARTMAN	8.0
FREE STATE_FEZILE DABI	13.0
FREE STATE_LEJWELEPUTSWA	25.0
FREE STATE_MANGAUNG METRO	47.0
FREE STATE_THABO MOFUTSANYANA	22.0
FREE STATE_XHARIEP	1.0
GAUTENG_CITY OF JOHANNESBURG METRO	202.0
GAUTENG_CITY OF TSHWANE METRO	119.0
GAUTENG_EKURHULENI METRO	55.0
GAUTENG_SEDIBENG	30.0
GAUTENG_WEST RAND	24.0
KWAZULU-NATAL_AMAJUBA	28.0
KWAZULU-NATAL_ETHEKWINI METRO	227.0
KWAZULU-NATAL_HARRY GWALA	13.0
KWAZULU-NATAL_ILEMBE	31.0
KWAZULU-NATAL_KING CETSHWAYO	33.0
KWAZULU-NATAL_UGU	23.0
KWAZULU-NATAL_UMGUNGUNDLOVU	61.0
KWAZULU-NATAL_UMKHANYAKUDE	23.0

KWAZULU-NATAL_UMZINYATHI	24.0
KWAZULU-NATAL_UTHUKELA	18.0
KWAZULU-NATAL_UTHUNGULU	9.0
KWAZULU-NATAL_ZULULAND	31.0
LIMPOPO_CAPRICORN	33.0
LIMPOPO_GREATER SEKHUKHUNE	17.0
LIMPOPO_MOPANI	3.0
LIMPOPO_VHEMBE	16.0
LIMPOPO_WATERBERG	15.0
MPUMALANGA_EHLANZENI	60.0
MPUMALANGA_GERT SIBANDE	55.0
MPUMALANGA_NKANGALA	57.0
NORTH WEST_BOJANALA PLATINUM	30.0
NORTH WEST_DR KENNETH KAUNDA	24.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	4.0
NORTH WEST_NGAKA MODIRI MOLEMA	9.0
NORTHERN CAPE_FRANCES BAARD	28.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	12.0
NORTHERN CAPE_NAMAKWA	3.0
NORTHERN CAPE_PIXLEY KA SEME	2.0
NORTHERN CAPE_ZF MGCAWU	1.0
WESTERN CAPE_CAPE WINELANDS	30.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	101.0
WESTERN CAPE_GARDEN ROUTE	16.0
WESTERN CAPE_OVERBERG	3.0
WESTERN CAPE_WEST COAST	5.0
Total	1,755.0

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. tab GENDER

GENDER No.

F	926.0
M	798.0
U	31.0
Total	1,755.0

. tab PROVINCE_NAME GENDER

GENDER				
PROVINCE_NAME	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE	114.0	55.0	3.0	172.0
FREE STATE	53.0	54.0	1.0	108.0
GAUTENG	196.0	230.0	4.0	430.0
KWAZULU-NATAL	287.0	218.0	16.0	521.0
LIMPOPO	49.0	34.0	1.0	84.0
MPUMALANGA	96.0	72.0	4.0	172.0
NORTH WEST	32.0	34.0	1.0	67.0
NORTHERN CAPE	17.0	28.0	1.0	46.0
WESTERN CAPE	82.0	73.0	0.0	155.0
Total	926.0	798.0	31.0	1,755.0

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. tab PROVINCE_DISTRICT GENDER

GENDER				
PROVINCE_DISTRICT	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE_ALFRED NZO	7.0	3.0	1.0	11.0
EASTERN CAPE_AMATHOLE	11.0	5.0	0.0	16.0
EASTERN CAPE_BUFFALO CITY METRO	22.0	9.0	0.0	31.0

EASTERN CAPE_CHRIS HANI	15.0	7.0	0.0	22.0
EASTERN CAPE_JOE GQABI	10.0	4.0	0.0	14.0
EASTERN CAPE_NELSON MANDELA BAY METRO	19.0	11.0	0.0	30.0
EASTERN CAPE_O R TAMBO	28.0	10.0	2.0	40.0
EASTERN CAPE_SARAH BAARTMAN	2.0	6.0	0.0	8.0
FREE STATE_FEZILE DABI	5.0	8.0	0.0	13.0
FREE STATE_LEJWELEPUTSWA	9.0	16.0	0.0	25.0
FREE STATE_MANGAUNG METRO	29.0	17.0	1.0	47.0
FREE STATE_THABO MOFUTSANYANA	9.0	13.0	0.0	22.0
FREE STATE_XHARIEP	1.0	0.0	0.0	1.0
GAUTENG_CITY OF JOHANNESBURG METRO	101.0	98.0	3.0	202.0
GAUTENG_CITY OF TSHWANE METRO	47.0	72.0	0.0	119.0
GAUTENG_EKURHULENI METRO	25.0	30.0	0.0	55.0
GAUTENG_SEDIBENG	15.0	14.0	1.0	30.0
GAUTENG_WEST RAND	8.0	16.0	0.0	24.0
KWAZULU-NATAL_AMAJUBA	15.0	13.0	0.0	28.0
KWAZULU-NATAL_ETHEKWINI METRO	115.0	106.0	6.0	227.0
KWAZULU-NATAL_HARRY GWALA	7.0	6.0	0.0	13.0
KWAZULU-NATAL_ILEMBE	14.0	16.0	1.0	31.0
KWAZULU-NATAL_KING CETSHWAYO	18.0	15.0	0.0	33.0
KWAZULU-NATAL_UGU	18.0	5.0	0.0	23.0
KWAZULU-NATAL_UMGUNGUNDLOVU	35.0	20.0	6.0	61.0
KWAZULU-NATAL_UMKHANYAKUDE	15.0	7.0	1.0	23.0
KWAZULU-NATAL_UMZINYATHI	15.0	9.0	0.0	24.0
KWAZULU-NATAL_UTHUKELA	11.0	6.0	1.0	18.0
KWAZULU-NATAL_UTHUNGULU	6.0	3.0	0.0	9.0
KWAZULU-NATAL_ZULULAND	18.0	12.0	1.0	31.0
LIMPOPO_CAPRICORN	18.0	15.0	0.0	33.0
LIMPOPO_GREATER SEKHUKHUNE	14.0	3.0	0.0	17.0
LIMPOPO_MOPANI	2.0	1.0	0.0	3.0
LIMPOPO_VHEMBE	8.0	8.0	0.0	16.0
LIMPOPO_WATERBERG	7.0	7.0	1.0	15.0

MPUMALANGA_EHLANZENI	39.0	20.0	1.0	60.0
MPUMALANGA_GERT SIBANDE	28.0	25.0	2.0	55.0
MPUMALANGA_NKANGALA	29.0	27.0	1.0	57.0
NORTH WEST_BOJANALA PLATINUM	17.0	13.0	0.0	30.0
NORTH WEST_DR KENNETH KAUNDA	9.0	14.0	1.0	24.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	1.0	3.0	0.0	4.0
NORTH WEST_NGAKA MODIRI MOLEMA	5.0	4.0	0.0	9.0
NORTHERN CAPE_FRANCES BAARD	12.0	16.0	0.0	28.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	2.0	9.0	1.0	12.0
NORTHERN CAPE_NAMAKWA	2.0	1.0	0.0	3.0
NORTHERN CAPE_PIXLEY KA SEME	1.0	1.0	0.0	2.0
NORTHERN CAPE_ZF MGCAWU	0.0	1.0	0.0	1.0
WESTERN CAPE_CAPE WINELANDS	17.0	13.0	0.0	30.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	51.0	50.0	0.0	101.0
WESTERN CAPE_GARDEN ROUTE	10.0	6.0	0.0	16.0
WESTERN CAPE_OVERBERG	2.0	1.0	0.0	3.0
WESTERN CAPE_WEST COAST	2.0	3.0	0.0	5.0
Total	926.0	798.0	31.0	1,755.0

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. restore
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. preserve
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. keep if YEAR_TESTED_DATE==2015
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(5,282,669 observations deleted)
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. drop if HEPATITIS_B_CORE_IGM=="NULL" | HEPATITIS_B_CORE_IGM=="UNKNOWN" |  
HEPATITIS_B_CORE_IGM=="INSUFFICIE
```

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> NT FOR FURTHER TESTS" | HEPATITIS_B_CORE_IGM=="." | HEPATITIS_B_CORE_IGM=="
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(925,540 observations deleted)

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. count

107,178

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. duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force

Duplicates in terms of UNIQUE_PATIENT_ID

(15,740 observations deleted)

.

. count

91,438

.

. duplicates drop GENDER DOB HOSPITAL_ID FACILITY_NAME if UNIQUE_PATIENT_ID ==-1, force

Duplicates in terms of GENDER DOB HOSPITAL_ID FACILITY_NAME

(4 observations deleted)

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. count

91,434

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. tab HEPATITIS_B_CORE_IGM

HEPATITIS_B_CORE_IGM	Freq.	Percent	Cum.

-----+-----			
EQUIVOCAL	78	0.09	0.09
LOW POSITIVE	15	0.02	0.10
NEGATIVE	87,960	96.20	96.30
POSITIVE	3,381	3.70	100.00
-----+-----			
Total	91,434	100.00	

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. tab PROVINCE_NAME u

PROVINCE_NAME No.

EASTERN CAPE 21,908.0

FREE STATE 7,720.0

GAUTENG 32,762.0

KWAZULU-NATAL 11,033.0

LIMPOPO 2,823.0

MPUMALANGA 1,995.0

NORTH WEST 4,298.0

NORTHERN CAPE 4,041.0

WESTERN CAPE 4,854.0

Total 91,434.0

.

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT No.

EASTERN CAPE_ALFRED NZO 297.0

EASTERN CAPE_AMATHOLE 3,466.0

EASTERN CAPE_BUFFALO CITY METRO 13,433.0

EASTERN CAPE_CHRIS HANI 1,923.0

EASTERN CAPE_JOE GQABI 1,153.0

EASTERN CAPE_NELSON MANDELA BAY METRO 364.0
EASTERN CAPE_O R TAMBO 1,108.0
EASTERN CAPE_SARAH BAARTMAN 164.0
FREE STATE_FEZILE DABI 181.0
FREE STATE_LEJWELEPUTSWA 4,938.0
FREE STATE_MANGAUNG METRO 2,001.0
FREE STATE_THABO MOFUTSANYANA 469.0
FREE STATE_XHARIEP 131.0
GAUTENG_CITY OF JOHANNESBURG METRO 14,204.0
GAUTENG_CITY OF TSHWANE METRO 2,082.0
GAUTENG_EKURHULENI METRO 13,570.0
GAUTENG_SEDIBENG 1,592.0
GAUTENG_UNKNOWN 22.0
GAUTENG_WEST RAND 1,292.0
KWAZULU-NATAL_AMAJUBA 184.0
KWAZULU-NATAL_ETHEKWINI METRO 4,474.0
KWAZULU-NATAL_HARRY GWALA 105.0
KWAZULU-NATAL_ILEMBE 264.0
KWAZULU-NATAL_KING CETSHWAYO 271.0
KWAZULU-NATAL_UGU 1,657.0
KWAZULU-NATAL_UMGUNGUNDLOVU 1,948.0
KWAZULU-NATAL_UMKHANYAKUDE 593.0
KWAZULU-NATAL_UMZINYATHI 259.0
KWAZULU-NATAL_UTHUKELA 70.0
KWAZULU-NATAL_UTHUNGULU 87.0
KWAZULU-NATAL_ZULULAND 1,121.0
LIMPOPO_CAPRICORN 2,085.0
LIMPOPO_GREATER SEKHUKHUNE 193.0
LIMPOPO_MOPANI 18.0
LIMPOPO_VHEMBE 391.0
LIMPOPO_WATERBERG 136.0
MPUMALANGA_EHLANZENI 822.0

MPUMALANGA_GERT SIBANDE	686.0
MPUMALANGA_NKANGALA	487.0
NORTH WEST_BOJANALA PLATINUM	438.0
NORTH WEST_DR KENNETH KAUNDA	3,176.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	120.0
NORTH WEST_NGAKA MODIRI MOLEMA	563.0
NORTH WEST_UNKNOWN	1.0
NORTHERN CAPE_FRANCES BAARD	3,004.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	272.0
NORTHERN CAPE_NAMAKWA	22.0
NORTHERN CAPE_PIXLEY KA SEME	546.0
NORTHERN CAPE_UNKNOWN	2.0
NORTHERN CAPE_ZF MGCAWU	195.0
WESTERN CAPE_CAPE WINELANDS	146.0
WESTERN CAPE_CENTRAL KAROO	95.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	3,465.0
WESTERN CAPE_GARDEN ROUTE	1,059.0
WESTERN CAPE_NOT APPLICABLE	20.0
WESTERN CAPE_OVERBERG	27.0
WESTERN CAPE_WEST COAST	42.0
Total	91,434.0

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. tab GENDER

GENDER No.

F 53,147.0

M 36,990.0

U 1,297.0

Total 91,434.0

. tab PROVINCE_NAME GENDER

GENDER

PROVINCE_NAME	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE	14,349.0	7,345.0	214.0	21,908.0
FREE STATE	5,165.0	2,481.0	74.0	7,720.0
GAUTENG	18,366.0	13,935.0	461.0	32,762.0
KWAZULU-NATAL	5,473.0	5,177.0	383.0	11,033.0
LIMPOPO	1,541.0	1,267.0	15.0	2,823.0
MPUMALANGA	978.0	996.0	21.0	1,995.0
NORTH WEST	2,474.0	1,770.0	54.0	4,298.0
NORTHERN CAPE	2,252.0	1,752.0	37.0	4,041.0
WESTERN CAPE	2,549.0	2,267.0	38.0	4,854.0
Total	53,147.0	36,990.0	1,297.0	91,434.0

. tab PROVINCE_DISTRICT GENDER

GENDER

PROVINCE_DISTRICT	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE_ALFRED NZO	157.0	132.0	8.0	297.0
EASTERN CAPE_AMATHOLE	2,251.0	1,195.0	20.0	3,466.0
EASTERN CAPE_BUFFALO CITY METRO	9,140.0	4,150.0	143.0	13,433.0
EASTERN CAPE_CHRIS HANI	1,256.0	642.0	25.0	1,923.0
EASTERN CAPE_JOE GQABI	725.0	421.0	7.0	1,153.0
EASTERN CAPE_NELSON MANDELA BAY METRO	155.0	209.0	0.0	364.0
EASTERN CAPE_O R TAMBO	587.0	510.0	11.0	1,108.0
EASTERN CAPE_SARAH BAARTMAN	78.0	86.0	0.0	164.0
FREE STATE_FEZILE DABI	109.0	70.0	2.0	181.0

FREE STATE_LEJWELEPUTSWA	3,460.0	1,434.0	44.0	4,938.0
FREE STATE_MANGAUNG METRO	1,226.0	750.0	25.0	2,001.0
FREE STATE_THABO MOFUTSANYANA	280.0	186.0	3.0	469.0
FREE STATE_XHARIEP	90.0	41.0	0.0	131.0
GAUTENG_CITY OF JOHANNESBURG METRO	7,760.0	6,190.0	254.0	14,204.0
GAUTENG_CITY OF TSHWANE METRO	921.0	1,150.0	11.0	2,082.0
GAUTENG_EKURHULENI METRO	8,167.0	5,253.0	150.0	13,570.0
GAUTENG_SEDIBENG	848.0	719.0	25.0	1,592.0
GAUTENG_UNKNOWN	17.0	5.0	0.0	22.0
GAUTENG_WEST RAND	653.0	618.0	21.0	1,292.0
KWAZULU-NATAL_AMAJUBA	91.0	87.0	6.0	184.0
KWAZULU-NATAL_ETHEKWINI METRO	2,066.0	2,271.0	137.0	4,474.0
KWAZULU-NATAL_HARRY GWALA	51.0	52.0	2.0	105.0
KWAZULU-NATAL_ILEMBE	105.0	150.0	9.0	264.0
KWAZULU-NATAL_KING CETSHWAYO	124.0	143.0	4.0	271.0
KWAZULU-NATAL_UGU	941.0	665.0	51.0	1,657.0
KWAZULU-NATAL_UMGUNGUNDLOVU	1,012.0	817.0	119.0	1,948.0
KWAZULU-NATAL_UMKHANYAKUDE	261.0	315.0	17.0	593.0
KWAZULU-NATAL_UMZINYATHI	143.0	114.0	2.0	259.0
KWAZULU-NATAL_UTHUKELA	36.0	33.0	1.0	70.0
KWAZULU-NATAL_UTHUNGULU	47.0	38.0	2.0	87.0
KWAZULU-NATAL_ZULULAND	596.0	492.0	33.0	1,121.0
LIMPOPO_CAPRICORN	1,172.0	907.0	6.0	2,085.0
LIMPOPO_GREATER SEKHUKHUNE	111.0	80.0	2.0	193.0
LIMPOPO_MOPANI	13.0	5.0	0.0	18.0
LIMPOPO_VHEMBE	181.0	208.0	2.0	391.0
LIMPOPO_WATERBERG	64.0	67.0	5.0	136.0
MPUMALANGA_EHLANZENI	408.0	407.0	7.0	822.0
MPUMALANGA_GERT SIBANDE	293.0	387.0	6.0	686.0
MPUMALANGA_NKANGALA	277.0	202.0	8.0	487.0
NORTH WEST_BOJANALA PLATINUM	223.0	207.0	8.0	438.0
NORTH WEST_DR KENNETH KAUNDA	1,861.0	1,275.0	40.0	3,176.0

NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	76.0	43.0	1.0	120.0
NORTH WEST_NGAKA MODIRI MOLEMA	314.0	244.0	5.0	563.0
NORTH WEST_UNKNOWN	0.0	1.0	0.0	1.0
NORTHERN CAPE_FRANCES BAARD	1,634.0	1,346.0	24.0	3,004.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	151.0	113.0	8.0	272.0
NORTHERN CAPE_NAMAKWA	13.0	8.0	1.0	22.0
NORTHERN CAPE_PIXLEY KA SEME	346.0	197.0	3.0	546.0
NORTHERN CAPE_UNKNOWN	1.0	1.0	0.0	2.0
NORTHERN CAPE_ZF MGCAWU	107.0	87.0	1.0	195.0
WESTERN CAPE_CAPE WINELANDS	56.0	89.0	1.0	146.0
WESTERN CAPE_CENTRAL KAROO	50.0	45.0	0.0	95.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	1,802.0	1,642.0	21.0	3,465.0
WESTERN CAPE_GARDEN ROUTE	613.0	446.0	0.0	1,059.0
WESTERN CAPE_NOT APPLICABLE	1.0	3.0	16.0	20.0
WESTERN CAPE_OVERBERG	11.0	16.0	0.0	27.0
WESTERN CAPE_WEST COAST	16.0	26.0	0.0	42.0
Total	53,147.0	36,990.0	1,297.0	91,434.0

. restore

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. preserve

.

. keep if YEAR_TESTED_DATE==2016

(5,009,798 observations deleted)

.

. keep if HEPATITIS_B_CORE_IGM=="LOW POSITIVE" | HEPATITIS_B_CORE_IGM==
> "POSITIVE"

(1,300,997 observations deleted)

.

. tab TESTING_LAB

TESTING_LAB	Freq.	Percent	Cum.
-----+-----			
BRAAMFONTEIN CENTRAL LABORATORY	506	11.02	11.02
CHARLOTTE MAXEKE JOHANNESBURG ACADEMI..	116	2.53	13.55
CHRIS HANI BARAGWANATH LABORATORY	195	4.25	17.79
DR GEORGE MUKHARI LABORATORY	248	5.40	23.19
EAST LONDON LABORATORY	443	9.65	32.84
ERMELO LABORATORY	187	4.07	36.91
GEORGE LABORATORY	33	0.72	37.63
GROOTE SCHUUR LABORATORY	72	1.57	39.20
HELEN JOSEPH LABORATORY	159	3.46	42.66
INKOSI ALBERT LUTHULI CENTRAL HOSPITAL	983	21.41	64.07
KIMBERLEY LABORATORY	73	1.59	65.66
LERATONG LABORATORY	78	1.70	67.36
LETABA LABORATORY	30	0.65	68.01
MAFIKENG LABORATORY	6	0.13	68.14
NELSON MANDELA ACADEMIC LABORATORY	219	4.77	72.91
PELONOMI LABORATORY	122	2.66	75.57
POLOKWANE LABORATORY	58	1.26	76.83
PORT ELIZABETH LABORATORY	126	2.74	79.57
ROB FERREIRA LABORATORY	96	2.09	81.66
TAMBO MEMORIAL LABORATORY	217	4.73	86.39
TSHEPONG LABORATORY	88	1.92	88.31
TSHWANE ACADEMIC LABORATORY	385	8.38	96.69
TYGERBERG LABORATORY	152	3.31	100.00
-----+-----			
Total	4,592	100.00	

.

. destring HEPATITIS_B_CORE_IGM_VALUE, generate(COREIGM_VALUE) force

HEPATITIS_B_CORE_IGM_VALUE contains nonnumeric characters; COREIGM_VALUE generated as double

(281 missing values generated)

.

. keep if ((TESTING_LAB=="BRAAMFONTEIN CENTRAL LABORATORY" | TESTING_LAB=="DORA NGINZA LABORATORY" | TESTING

> _LAB=="CECILIA MAKIWANE LABORATORY" | TESTING_LAB=="LERATONG LABORATORY" | TESTING_LAB=="MAFIKENG LABORATO

> RY" | TESTING_LAB=="MANKWENG LABORATORY" | TESTING_LAB=="PORT SHEPSTONE LABORATORY" | TESTING_LAB=="THUSON

> G LABORATORY" | TESTING_LAB=="EAST LONDON LABORATORY" | TESTING_LAB=="INKOSI ALBERT LUTHULI CENTRAL HOSPIT

> AL" | TESTING_LAB=="NELSON MANDELA ACADEMIC LABORATORY" | TESTING_LAB=="PORT ELIZABETH LABORATORY" | TESTI

> NG_LAB=="CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL" | TESTING_LAB=="CHRIS HANI BARAGWANATH LABORATOR

> Y" | TESTING_LAB=="DR GEORGE MUKHARI LABORATORY" | TESTING_LAB=="ERMELO LABORATORY" | TESTING_LAB=="GROOTE

> SCHUUR LABORATORY" | TESTING_LAB=="LETABA LABORATORY" | TESTING_LAB=="TSHEPONG LABORATORY" | TESTING_LAB=

> ="TYGERBERG LABORATORY" | TESTING_LAB=="TSHWANE ACADEMIC LABORATORY" | TESTING_LAB=="UNIVERSITAS ACADEMIC

> LABORATORY") & (COREIGM_VALUE>=20 & COREIGM_VALUE<.) | ((TESTING_LAB=="GEORGE LABORATORY" | TESTING_LAB==

> "POLOKWANE LABORATORY" | TESTING_LAB=="ROB FERREIRA LABORATORY") & (COREIGM_VALUE>=5 & COREIGM_VALUE<.) |

> (HEPATITIS_B_CORE_IGM_VALUE==">9" | HEPATITIS_B_CORE_IGM_VALUE==">9.00" | HEPATITIS_B_CORE_IGM_VALUE==">1

> 5" | HEPATITIS_B_CORE_IGM_VALUE==">15.00" | HEPATITIS_B_CORE_IGM_VALUE==">1000" | HEPATITIS_B_CORE_IGM_VAL

> UE=="UNKNOWN")

(2,486 observations deleted)

. tab TESTING_LAB

TESTING_LAB	Freq.	Percent	Cum.
-----+-----			
BRAAMFONTEIN CENTRAL LABORATORY	192	9.12	9.12
CHARLOTTE MAXEKE JOHANNESBURG ACADEMI..	54	2.56	11.68
CHRIS HANI BARAGWANATH LABORATORY	82	3.89	15.57
DR GEORGE MUKHARI LABORATORY	143	6.79	22.36
EAST LONDON LABORATORY	85	4.04	26.40
ERMELO LABORATORY	111	5.27	31.67
GEORGE LABORATORY	24	1.14	32.81
GROOTE SCHUUR LABORATORY	40	1.90	34.71
HELEN JOSEPH LABORATORY	88	4.18	38.89
INKOSI ALBERT LUTHULI CENTRAL HOSPITAL	531	25.21	64.10
KIMBERLEY LABORATORY	37	1.76	65.86
LERATONG LABORATORY	36	1.71	67.57
MAFIKENG LABORATORY	1	0.05	67.62
NELSON MANDELA ACADEMIC LABORATORY	95	4.51	72.13
PELONOMI LABORATORY	92	4.37	76.50
POLOKWANE LABORATORY	38	1.80	78.30
PORT ELIZABETH LABORATORY	53	2.52	80.82
ROB FERREIRA LABORATORY	71	3.37	84.19
TAMBO MEMORIAL LABORATORY	19	0.90	85.09
TSHEPONG LABORATORY	42	1.99	87.08
TSHWANE ACADEMIC LABORATORY	187	8.88	95.96
TYGERBERG LABORATORY	85	4.04	100.00
-----+-----			
Total	2,106	100.00	

. tab HEPATITIS_B_CORE_IGM

HEPATITIS_B_CORE_IGM	Freq.	Percent	Cum.
-----+-----			
POSITIVE	2,106	100.00	100.00
-----+-----			
Total	2,106	100.00	

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. count
2,106
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. duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force
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Duplicates in terms of UNIQUE_PATIENT_ID

(330 observations deleted)

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. count
1,776
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. tab HEPATITIS_B_CORE_IGM
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HEPATITIS_B_CORE_IGM	Freq.	Percent	Cum.
-----+-----			
POSITIVE	1,776	100.00	100.00
-----+-----			
Total	1,776	100.00	

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. tab PROVINCE_NAME

PROVINCE_NAME	No.
EASTERN CAPE	188.0
FREE STATE	114.0
GAUTENG	540.0
KWAZULU-NATAL	437.0
LIMPOPO	83.0
MPUMALANGA	175.0
NORTH WEST	82.0
NORTHERN CAPE	36.0
WESTERN CAPE	121.0
Total	1,776.0

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. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	No.
EASTERN CAPE_ALFRED NZO	17.0
EASTERN CAPE_AMATHOLE	18.0
EASTERN CAPE_BUFFALO CITY METRO	40.0
EASTERN CAPE_CHRIS HANI	19.0
EASTERN CAPE_JOE GQABI	8.0
EASTERN CAPE_NELSON MANDELA BAY METRO	25.0
EASTERN CAPE_O R TAMBO	53.0
EASTERN CAPE_SARAH BAARTMAN	8.0
FREE STATE_FEZILE DABI	13.0
FREE STATE_LEJWELEPUTSWA	29.0
FREE STATE_MANGAUNG METRO	42.0
FREE STATE_THABO MOFUTSANYANA	26.0
FREE STATE_XHARIEP	4.0
GAUTENG_CITY OF JOHANNESBURG METRO	199.0

GAUTENG_CITY OF TSHWANE METRO 171.0
GAUTENG_EKURHULENI METRO 98.0
GAUTENG_SEDIBENG 38.0
GAUTENG_WEST RAND 34.0
KWAZULU-NATAL_AMAJUBA 33.0
KWAZULU-NATAL_ETHEKWINI METRO 190.0
KWAZULU-NATAL_HARRY GWALA 7.0
KWAZULU-NATAL_ILEMBE 25.0
KWAZULU-NATAL_KING CETSHWAYO 17.0
KWAZULU-NATAL_UGU 31.0
KWAZULU-NATAL_UMGUNGUNDLOVU 45.0
KWAZULU-NATAL_UMKHANYAKUDE 25.0
KWAZULU-NATAL_UMZINYATHI 9.0
KWAZULU-NATAL_UTHUKELA 13.0
KWAZULU-NATAL_UTHUNGULU 8.0
KWAZULU-NATAL_ZULULAND 34.0
LIMPOPO_CAPRICORN 32.0
LIMPOPO_GREATER SEKHUKHUNE 31.0
LIMPOPO_MOPANI 2.0
LIMPOPO_VHEMBE 7.0
LIMPOPO_WATERBERG 11.0
MPUMALANGA_EHLANZENI 66.0
MPUMALANGA_GERT SIBANDE 57.0
MPUMALANGA_NKANGALA 52.0
NORTH WEST_BOJANALA PLATINUM 35.0
NORTH WEST_DR KENNETH KAUNDA 38.0
NORTH WEST_NGAKA MODIRI MOLEMA 9.0
NORTHERN CAPE_FRANCES BAARD 18.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE 12.0
NORTHERN CAPE_NAMAKWA 1.0
NORTHERN CAPE_PIXLEY KA SEME 3.0
NORTHERN CAPE_ZF MGCAWU 2.0

WESTERN CAPE_CAPE WINELANDS 18.0
 WESTERN CAPE_CITY OF CAPE TOWN METRO 73.0
 WESTERN CAPE_GARDEN ROUTE 19.0
 WESTERN CAPE_OVERBERG 3.0
 WESTERN CAPE_WEST COAST 8.0
 Total 1,776.0

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. tab GENDER

GENDER No.

F 968.0
 M 784.0
 U 24.0
 Total 1,776.0

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. tab PROVINCE_NAME GENDER

GENDER				
PROVINCE_NAME	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE	125.0	60.0	3.0	188.0
FREE STATE	57.0	57.0	0.0	114.0
GAUTENG	268.0	267.0	5.0	540.0
KWAZULU-NATAL	255.0	168.0	14.0	437.0
LIMPOPO	50.0	33.0	0.0	83.0
MPUMALANGA	94.0	81.0	0.0	175.0
NORTH WEST	49.0	32.0	1.0	82.0
NORTHERN CAPE	16.0	19.0	1.0	36.0
WESTERN CAPE	54.0	67.0	0.0	121.0

Total 968.0 784.0 24.0 1,776.0

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. tab PROVINCE_DISTRICT GENDER

> .xls

GENDER

PROVINCE_DISTRICT	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE_ALFRED NZO	14.0	3.0	0.0	17.0
EASTERN CAPE_AMATHOLE	14.0	2.0	2.0	18.0
EASTERN CAPE_BUFFALO CITY METRO	25.0	15.0	0.0	40.0
EASTERN CAPE_CHRIS HANI	12.0	7.0	0.0	19.0
EASTERN CAPE_JOE GQABI	6.0	2.0	0.0	8.0
EASTERN CAPE_NELSON MANDELA BAY METRO	16.0	9.0	0.0	25.0
EASTERN CAPE_O R TAMBO	32.0	20.0	1.0	53.0
EASTERN CAPE_SARAH BAARTMAN	6.0	2.0	0.0	8.0
FREE STATE_FEZILE DABI	7.0	6.0	0.0	13.0
FREE STATE_LEJWELEPUTSWA	16.0	13.0	0.0	29.0
FREE STATE_MANGAUNG METRO	21.0	21.0	0.0	42.0
FREE STATE_THABO MOFUTSANYANA	11.0	15.0	0.0	26.0
FREE STATE_XHARIEP	2.0	2.0	0.0	4.0
GAUTENG_CITY OF JOHANNESBURG METRO	94.0	101.0	4.0	199.0
GAUTENG_CITY OF TSHWANE METRO	80.0	91.0	0.0	171.0
GAUTENG_EKURHULENI METRO	50.0	47.0	1.0	98.0
GAUTENG_SEDIBENG	25.0	13.0	0.0	38.0
GAUTENG_WEST RAND	19.0	15.0	0.0	34.0
KWAZULU-NATAL_AMAJUBA	19.0	14.0	0.0	33.0
KWAZULU-NATAL_ETHEKWINI METRO	107.0	74.0	9.0	190.0
KWAZULU-NATAL_HARRY GWALA	7.0	0.0	0.0	7.0
KWAZULU-NATAL_ILEMBE	12.0	12.0	1.0	25.0
KWAZULU-NATAL_KING CETSHWAYO	10.0	7.0	0.0	17.0

KWAZULU-NATAL_UGU	22.0	9.0	0.0	31.0
KWAZULU-NATAL_UMGUNGUNDLOVU	23.0	19.0	3.0	45.0
KWAZULU-NATAL_UMKHANYAKUDE	15.0	10.0	0.0	25.0
KWAZULU-NATAL_UMZINYATHI	6.0	3.0	0.0	9.0
KWAZULU-NATAL_UTHUKELA	6.0	7.0	0.0	13.0
KWAZULU-NATAL_UTHUNGULU	3.0	4.0	1.0	8.0
KWAZULU-NATAL_ZULULAND	25.0	9.0	0.0	34.0
LIMPOPO_CAPRICORN	13.0	19.0	0.0	32.0
LIMPOPO_GREATER SEKHUKHUNE	23.0	8.0	0.0	31.0
LIMPOPO_MOPANI	2.0	0.0	0.0	2.0
LIMPOPO_VHEMBE	6.0	1.0	0.0	7.0
LIMPOPO_WATERBERG	6.0	5.0	0.0	11.0
MPUMALANGA_EHLANZENI	37.0	29.0	0.0	66.0
MPUMALANGA_GERT SIBANDE	29.0	28.0	0.0	57.0
MPUMALANGA_NKANGALA	28.0	24.0	0.0	52.0
NORTH WEST_BOJANALA PLATINUM	18.0	17.0	0.0	35.0
NORTH WEST_DR KENNETH KAUNDA	24.0	13.0	1.0	38.0
NORTH WEST_NGAKA MODIRI MOLEMA	7.0	2.0	0.0	9.0
NORTHERN CAPE_FRANCES BAARD	5.0	12.0	1.0	18.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	6.0	6.0	0.0	12.0
NORTHERN CAPE_NAMAKWA	1.0	0.0	0.0	1.0
NORTHERN CAPE_PIXLEY KA SEME	3.0	0.0	0.0	3.0
NORTHERN CAPE_ZF MGCAWU	1.0	1.0	0.0	2.0
WESTERN CAPE_CAPE WINELANDS	10.0	8.0	0.0	18.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	28.0	45.0	0.0	73.0
WESTERN CAPE_GARDEN ROUTE	11.0	8.0	0.0	19.0
WESTERN CAPE_OVERBERG	1.0	2.0	0.0	3.0
WESTERN CAPE_WEST COAST	4.0	4.0	0.0	8.0
Total	968.0	784.0	24.0	1,776.0

. restore

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. preserve

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. keep if YEAR_TESTED_DATE==2016

(5,009,798 observations deleted)

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. count

133,023

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. duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force

Duplicates in terms of UNIQUE_PATIENT_ID

(19,983 observations deleted)

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. count

113,040

.

. duplicates drop GENDER DOB HOSPITAL_ID FACILITY_NAME if UNIQUE_PATIENT_ID ==-1, force

Duplicates in terms of GENDER DOB HOSPITAL_ID FACILITY_NAME

(4 observations deleted)

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. count

113,036

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. tab HEPATITIS_B_CORE_IGM

HEPATITIS_B_CORE_IGM	Freq.	Percent	Cum.
-----+-----			
EQUIVOCAL	50	0.04	0.04
LOW POSITIVE	11	0.01	0.05
NEGATIVE	109,237	96.64	96.69
POSITIVE	3,738	3.31	100.00
-----+-----			
Total	113,036	100.00	

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. tab PROVINCE_NAME

PROVINCE_NAME	No.
EASTERN CAPE	25,868.0
FREE STATE	9,788.0
GAUTENG	46,686.0
KWAZULU-NATAL	8,809.0
LIMPOPO	4,611.0
MPUMALANGA	3,636.0
NORTH WEST	4,944.0
NORTHERN CAPE	4,187.0
WESTERN CAPE	4,507.0
Total	113,036.0

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. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	No.
EASTERN CAPE_ALFRED NZO	296.0
EASTERN CAPE_AMATHOLE	3,438.0
EASTERN CAPE_BUFFALO CITY METRO	16,498.0
EASTERN CAPE_CHRIS HANI	2,299.0
EASTERN CAPE_JOE GQABI	1,000.0
EASTERN CAPE_NELSON MANDELA BAY METRO	434.0
EASTERN CAPE_O R TAMBO	1,125.0
EASTERN CAPE_SARAH BAARTMAN	137.0
EASTERN CAPE_UNKNOWN	641.0
FREE STATE_FEZILE DABI	256.0
FREE STATE_LEJWELEPUTSWA	7,322.0
FREE STATE_MANGAUNG METRO	1,658.0
FREE STATE_THABO MOFUTSANYANA	467.0
FREE STATE_UNKNOWN	1.0
FREE STATE_XHARIEP	84.0
GAUTENG_CITY OF JOHANNESBURG METRO	17,682.0
GAUTENG_CITY OF TSHWANE METRO	2,967.0
GAUTENG_EKURHULENI METRO	21,827.0
GAUTENG_SEDIBENG	2,482.0
GAUTENG_UNKNOWN	19.0
GAUTENG_WEST RAND	1,709.0
KWAZULU-NATAL_AMAJUBA	247.0
KWAZULU-NATAL_ETHEKWINI METRO	3,783.0
KWAZULU-NATAL_HARRY GWALA	128.0
KWAZULU-NATAL_ILEMBE	251.0
KWAZULU-NATAL_KING CETSHWAYO	211.0
KWAZULU-NATAL_UGU	1,182.0
KWAZULU-NATAL_UMGUNGUNDLOVU	1,566.0
KWAZULU-NATAL_UMKHANYAKUDE	478.0
KWAZULU-NATAL_UMZINYATHI	170.0
KWAZULU-NATAL_UNKNOWN	1.0

KWAZULU-NATAL_UTHUKELA	89.0
KWAZULU-NATAL_UTHUNGULU	158.0
KWAZULU-NATAL_ZULULAND	545.0
LIMPOPO_CAPRICORN	3,333.0
LIMPOPO_GREATER SEKHUKHUNE	595.0
LIMPOPO_MOPANI	49.0
LIMPOPO_UNKNOWN	2.0
LIMPOPO_VHEMBE	440.0
LIMPOPO_WATERBERG	192.0
MPUMALANGA_EHLANZENI	1,344.0
MPUMALANGA_GERT SIBANDE	924.0
MPUMALANGA_NKANGALA	1,368.0
NORTH WEST_BOJANALA PLATINUM	712.0
NORTH WEST_DR KENNETH KAUNDA	3,620.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	76.0
NORTH WEST_NGAKA MODIRI MOLEMA	536.0
NORTHERN CAPE_FRANCES BAARD	3,218.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	287.0
NORTHERN CAPE_NAMAKWA	14.0
NORTHERN CAPE_PIXLEY KA SEME	450.0
NORTHERN CAPE_ZF MGCAWU	218.0
WESTERN CAPE_CAPE WINELANDS	122.0
WESTERN CAPE_CENTRAL KAROO	47.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	3,671.0
WESTERN CAPE_GARDEN ROUTE	593.0
WESTERN CAPE_OVERBERG	22.0
WESTERN CAPE_UNKNOWN	4.0
WESTERN CAPE_WEST COAST	48.0
Total	113,036.0

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. tab GENDER

GENDER No.

F 65,471.0

M 46,132.0

U 1,433.0

Total 113,036.0

. tab PROVINCE_NAME GENDER

GENDER

PROVINCE_NAME	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE	16,848.0	8,794.0	226.0	25,868.0
FREE STATE	6,351.0	3,374.0	63.0	9,788.0
GAUTENG	26,366.0	19,677.0	643.0	46,686.0
KWAZULU-NATAL	3,917.0	4,620.0	272.0	8,809.0
LIMPOPO	2,735.0	1,850.0	26.0	4,611.0
MPUMALANGA	1,981.0	1,596.0	59.0	3,636.0
NORTH WEST	2,599.0	2,270.0	75.0	4,944.0
NORTHERN CAPE	2,305.0	1,833.0	49.0	4,187.0
WESTERN CAPE	2,369.0	2,118.0	20.0	4,507.0
Total	65,471.0	46,132.0	1,433.0	113,036.0

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. tab PROVINCE_DISTRICT GENDER

GENDER

PROVINCE_DISTRICT	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE_ALFRED NZO	171.0	120.0	5.0	296.0

EASTERN CAPE_AMATHOLE	2,205.0	1,207.0	26.0	3,438.0
EASTERN CAPE_BUFFALO CITY METRO	11,247.0	5,135.0	116.0	16,498.0
EASTERN CAPE_CHRIS HANI	1,464.0	805.0	30.0	2,299.0
EASTERN CAPE_JOE GQABI	602.0	394.0	4.0	1,000.0
EASTERN CAPE_NELSON MANDELA BAY METRO	199.0	231.0	4.0	434.0
EASTERN CAPE_O R TAMBO	598.0	515.0	12.0	1,125.0
EASTERN CAPE_SARAH BAARTMAN	67.0	69.0	1.0	137.0
EASTERN CAPE_UNKNOWN	295.0	318.0	28.0	641.0
FREE STATE_FEZILE DABI	149.0	104.0	3.0	256.0
FREE STATE_LEJWELEPUTSWA	4,908.0	2,368.0	46.0	7,322.0
FREE STATE_MANGAUNG METRO	970.0	677.0	11.0	1,658.0
FREE STATE_THABO MOFUTSANYANA	273.0	191.0	3.0	467.0
FREE STATE_UNKNOWN	0.0	1.0	0.0	1.0
FREE STATE_XHARIEP	51.0	33.0	0.0	84.0
GAUTENG_CITY OF JOHANNESBURG METRO	9,809.0	7,543.0	330.0	17,682.0
GAUTENG_CITY OF TSHWANE METRO	1,329.0	1,616.0	22.0	2,967.0
GAUTENG_EKURHULENI METRO	13,081.0	8,510.0	236.0	21,827.0
GAUTENG_SEDIBENG	1,289.0	1,161.0	32.0	2,482.0
GAUTENG_UNKNOWN	13.0	6.0	0.0	19.0
GAUTENG_WEST RAND	845.0	841.0	23.0	1,709.0
KWAZULU-NATAL_AMAJUBA	104.0	140.0	3.0	247.0
KWAZULU-NATAL_ETHEKWINI METRO	1,653.0	2,035.0	95.0	3,783.0
KWAZULU-NATAL_HARRY GWALA	56.0	70.0	2.0	128.0
KWAZULU-NATAL_ILEMBE	101.0	139.0	11.0	251.0
KWAZULU-NATAL_KING CETSHWAYO	79.0	128.0	4.0	211.0
KWAZULU-NATAL_UGU	539.0	606.0	37.0	1,182.0
KWAZULU-NATAL_UMGUNGUNDLOVU	685.0	793.0	88.0	1,566.0
KWAZULU-NATAL_UMKHANYAKUDE	217.0	246.0	15.0	478.0
KWAZULU-NATAL_UMZINYATHI	75.0	94.0	1.0	170.0
KWAZULU-NATAL_UNKNOWN	1.0	0.0	0.0	1.0
KWAZULU-NATAL_UTHUKELA	36.0	52.0	1.0	89.0
KWAZULU-NATAL_UTHUNGULU	80.0	76.0	2.0	158.0

KWAZULU-NATAL_ZULULAND	291.0	241.0	13.0	545.0
LIMPOPO_CAPRICORN	2,001.0	1,316.0	16.0	3,333.0
LIMPOPO_GREATER SEKHUKHUNE	380.0	211.0	4.0	595.0
LIMPOPO_MOPANI	34.0	15.0	0.0	49.0
LIMPOPO_UNKNOWN	2.0	0.0	0.0	2.0
LIMPOPO_VHEMBE	233.0	203.0	4.0	440.0
LIMPOPO_WATERBERG	85.0	105.0	2.0	192.0
MPUMALANGA_EHLANZENI	706.0	630.0	8.0	1,344.0
MPUMALANGA_GERT SIBANDE	393.0	519.0	12.0	924.0
MPUMALANGA_NKANGALA	882.0	447.0	39.0	1,368.0
NORTH WEST_BOJANALA PLATINUM	319.0	385.0	8.0	712.0
NORTH WEST_DR KENNETH KAUNDA	1,922.0	1,633.0	65.0	3,620.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	47.0	29.0	0.0	76.0
NORTH WEST_NGAKA MODIRI MOLEMA	311.0	223.0	2.0	536.0
NORTHERN CAPE_FRANCES BAARD	1,710.0	1,465.0	43.0	3,218.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	195.0	89.0	3.0	287.0
NORTHERN CAPE_NAMAKWA	8.0	6.0	0.0	14.0
NORTHERN CAPE_PIXLEY KA SEME	271.0	176.0	3.0	450.0
NORTHERN CAPE_ZF MGCAWU	121.0	97.0	0.0	218.0
WESTERN CAPE_CAPE WINELANDS	53.0	69.0	0.0	122.0
WESTERN CAPE_CENTRAL KAROO	30.0	17.0	0.0	47.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	1,952.0	1,699.0	20.0	3,671.0
WESTERN CAPE_GARDEN ROUTE	304.0	289.0	0.0	593.0
WESTERN CAPE_OVERBERG	7.0	15.0	0.0	22.0
WESTERN CAPE_UNKNOWN	3.0	1.0	0.0	4.0
WESTERN CAPE_WEST COAST	20.0	28.0	0.0	48.0
Total	65,471.0	46,132.0	1,433.0	113,036.0

. restore

.

```
. preserve
```

```
.
```

```
. keep if YEAR_TESTED_DATE==2017
```

```
(4,966,207 observations deleted)
```

```
.
```

```
. keep if HEPATITIS_B_CORE_IGM=="LOW POSITIVE" | HEPATITIS_B_CORE_IGM==  
> "POSITIVE"
```

```
(1,345,135 observations deleted)
```

```
.
```

```
. tab TESTING_LAB
```

TESTING_LAB	Freq.	Percent	Cum.
-----+-----			
BRAAMFONTEIN CENTRAL LABORATORY	468	11.57	11.57
CHARLOTTE MAXEKE JOHANNESBURG ACADEMI..	83	2.05	13.62
CHRIS HANI BARAGWANATH LABORATORY	230	5.69	19.31
DR GEORGE MUKHARI LABORATORY	219	5.41	24.72
EAST LONDON LABORATORY	318	7.86	32.58
ERMELO LABORATORY	193	4.77	37.35
GEORGE LABORATORY	62	1.53	38.89
GROOTE SCHUUR LABORATORY	61	1.51	40.40
HELEN JOSEPH LABORATORY	112	2.77	43.16
INKOSI ALBERT LUTHULI CENTRAL HOSPITAL	804	19.88	63.04
KIMBERLEY LABORATORY	53	1.31	64.35
LERATONG LABORATORY	39	0.96	65.32
LETABA LABORATORY	2	0.05	65.36
MANKWENG LABORATORY	1	0.02	65.39

NELSON MANDELA ACADEMIC LABORATORY	563	13.92	79.31
PELONOMI LABORATORY	155	3.83	83.14
POLOKWANE LABORATORY	55	1.36	84.50
PORT ELIZABETH LABORATORY	97	2.40	86.90
ROB FERREIRA LABORATORY	111	2.74	89.64
TAMBO MEMORIAL LABORATORY	219	5.41	95.06
TSHEPONG LABORATORY	57	1.41	96.46
TSHWANE ACADEMIC LABORATORY	13	0.32	96.79
TYGERBERG LABORATORY	128	3.16	99.95
UNIVERSITAS ACADEMIC LABORATORY	2	0.05	100.00

-----+-----

Total | 4,045 100.00

.

. destring HEPATITIS_B_CORE_IGM_VALUE, generate(COREIGM_VALUE) force

HEPATITIS_B_CORE_IGM_VALUE contains nonnumeric characters; COREIGM_VALUE generated as double

(270 missing values generated)

.

. keep if ((TESTING_LAB=="BRAAMFONTEIN CENTRAL LABORATORY" | TESTING_LAB=="DORA NGINZA LABORATORY" | TESTING

> _LAB=="CECILIA MAKIWANE LABORATORY" | TESTING_LAB=="LERATONG LABORATORY" | TESTING_LAB=="MAFIKENG LABORATO

> RY" | TESTING_LAB=="MANKWENG LABORATORY" | TESTING_LAB=="PORT SHEPSTONE LABORATORY" | TESTING_LAB=="THUSON

> G LABORATORY" | TESTING_LAB=="EAST LONDON LABORATORY" | TESTING_LAB=="INKOSI ALBERT LUTHULI CENTRAL HOSPIT

> AL" | TESTING_LAB=="NELSON MANDELA ACADEMIC LABORATORY" | TESTING_LAB=="PORT ELIZABETH LABORATORY" | TESTI

> NG_LAB=="CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL" | TESTING_LAB=="CHRIS HANI BARAGWANATH LABORATOR

> Y" | TESTING_LAB=="DR GEORGE MUKHARI LABORATORY" | TESTING_LAB=="ERMELO LABORATORY" | TESTING_LAB=="GROOTE

```

> SCHUUR LABORATORY" | TESTING_LAB=="LETABA LABORATORY" | TESTING_LAB=="TSHEPONG
LABORATORY" | TESTING_LAB=

> ="TYGERBERG LABORATORY" | TESTING_LAB=="TSHWANE ACADEMIC LABORATORY" |
TESTING_LAB=="UNIVERSITAS ACADEMIC

> LABORATORY") & (COREIGM_VALUE>=20 & COREIGM_VALUE<.) | ((TESTING_LAB=="GEORGE
LABORATORY" | TESTING_LAB==

> "POLOKWANE LABORATORY" | TESTING_LAB=="ROB FERREIRA LABORATORY") &
(COREIGM_VALUE>=5 & COREIGM_VALUE<.) |

> (HEPATITIS_B_CORE_IGM_VALUE==">9" | HEPATITIS_B_CORE_IGM_VALUE==">9.00" |
HEPATITIS_B_CORE_IGM_VALUE==">1

> 5" | HEPATITIS_B_CORE_IGM_VALUE==">15.00" | HEPATITIS_B_CORE_IGM_VALUE==">1000" |
HEPATITIS_B_CORE_IGM_VAL

> UE=="UNKNOWN")

(2,284 observations deleted)

```

```

. tab TESTING_LAB

```

TESTING_LAB	Freq.	Percent	Cum.
-----+-----			
BRAAMFONTEIN CENTRAL LABORATORY	159	9.03	9.03
CHARLOTTE MAXEKE JOHANNESBURG ACADEMI..	34	1.93	10.96
CHRIS HANI BARAGWANATH LABORATORY	127	7.21	18.17
DR GEORGE MUKHARI LABORATORY	100	5.68	23.85
EAST LONDON LABORATORY	54	3.07	26.92
ERMELO LABORATORY	99	5.62	32.54
GEORGE LABORATORY	40	2.27	34.81
GROOTE SCHUUR LABORATORY	41	2.33	37.14
HELEN JOSEPH LABORATORY	71	4.03	41.17
INKOSI ALBERT LUTHULI CENTRAL HOSPITAL	432	24.53	65.70
KIMBERLEY LABORATORY	30	1.70	67.40
LERATONG LABORATORY	18	1.02	68.43
NELSON MANDELA ACADEMIC LABORATORY	115	6.53	74.96
PELONOMI LABORATORY	80	4.54	79.50
POLOKWANE LABORATORY	40	2.27	81.77

PORT ELIZABETH LABORATORY	56	3.18	84.95
ROB FERREIRA LABORATORY	73	4.15	89.10
TAMBO MEMORIAL LABORATORY	88	5.00	94.09
TSHEPONG LABORATORY	24	1.36	95.46
TSHWANE ACADEMIC LABORATORY	2	0.11	95.57
TYGERBERG LABORATORY	78	4.43	100.00
-----+-----			
Total	1,761	100.00	

```
. tab HEPATITIS_B_CORE_IGM
```

HEPATITIS_B_CORE_IGM	Freq.	Percent	Cum.
-----+-----			
POSITIVE	1,761	100.00	100.00
-----+-----			
Total	1,761	100.00	

```
. count
1,761
```

```
. duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force
```

Duplicates in terms of UNIQUE_PATIENT_ID

(268 observations deleted)

```
. count
1,493
```

.

. tab HEPATITIS_B_CORE_IGM

HEPATITIS_B_CORE_IGM	Freq.	Percent	Cum.
-----+-----			
POSITIVE	1,493	100.00	100.00
-----+-----			
Total	1,493	100.00	

.

. tab PROVINCE_NAME

PROVINCE_NAME	No.
EASTERN CAPE	191.0
FREE STATE	84.0
GAUTENG	459.0
KWAZULU-NATAL	362.0
LIMPOPO	41.0
MPUMALANGA	156.0
NORTH WEST	56.0
NORTHERN CAPE	26.0
WESTERN CAPE	118.0
Total	1,493.0

.

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	No.
EASTERN CAPE_ALFRED NZO	17.0
EASTERN CAPE_AMATHOLE	16.0
EASTERN CAPE_BUFFALO CITY METRO	26.0

EASTERN CAPE_CHRIS HANI 16.0
EASTERN CAPE_JOE GQABI 6.0
EASTERN CAPE_NELSON MANDELA BAY METRO 30.0
EASTERN CAPE_O R TAMBO 68.0
EASTERN CAPE_SARAH BAARTMAN 12.0
FREE STATE_FEZILE DABI 15.0
FREE STATE_LEJWELEPUTSWA 24.0
FREE STATE_MANGAUNG METRO 21.0
FREE STATE_THABO MOFUTSANYANA 24.0
GAUTENG_CITY OF JOHANNESBURG METRO 207.0
GAUTENG_CITY OF TSHWANE METRO 48.0
GAUTENG_EKURHULENI METRO 133.0
GAUTENG_SEDIBENG 37.0
GAUTENG_WEST RAND 34.0
KWAZULU-NATAL_AMAJUBA 23.0
KWAZULU-NATAL_ETHEKWINI METRO 140.0
KWAZULU-NATAL_HARRY GWALA 12.0
KWAZULU-NATAL_ILEMBE 14.0
KWAZULU-NATAL_KING CETSHWAYO 11.0
KWAZULU-NATAL_UGU 23.0
KWAZULU-NATAL_UMGUNGUNDLOVU 55.0
KWAZULU-NATAL_UMKHANYAKUDE 20.0
KWAZULU-NATAL_UMZINYATHI 12.0
KWAZULU-NATAL_UTHUKELA 14.0
KWAZULU-NATAL_UTHUNGULU 11.0
KWAZULU-NATAL_ZULULAND 27.0
LIMPOPO_CAPRICORN 27.0
LIMPOPO_GREATER SEKHUKHUNE 9.0
LIMPOPO_VHEMBE 5.0
MPUMALANGA_EHLANZENI 62.0
MPUMALANGA_GERT SIBANDE 43.0
MPUMALANGA_NKANGALA 51.0

NORTH WEST_BOJANALA PLATINUM	21.0
NORTH WEST_DR KENNETH KAUNDA	28.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	2.0
NORTH WEST_NGAKA MODIRI MOLEMA	5.0
NORTHERN CAPE_FRANCES BAARD	14.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	7.0
NORTHERN CAPE_PIXLEY KA SEME	4.0
NORTHERN CAPE_ZF MGCAWU	1.0
WESTERN CAPE_CAPE WINELANDS	10.0
WESTERN CAPE_CENTRAL KAROO	1.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	76.0
WESTERN CAPE_GARDEN ROUTE	25.0
WESTERN CAPE_OVERBERG	3.0
WESTERN CAPE_WEST COAST	3.0
Total	1,493.0

.

. tab GENDER

GENDER No.

F 765.0

M 702.0

U 26.0

Total 1,493.0

. tab PROVINCE_NAME GENDER

GENDER

PROVINCE_NAME	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE	108.0	79.0	4.0	191.0

FREE STATE	40.0	43.0	1.0	84.0
GAUTENG	202.0	248.0	9.0	459.0
KWAZULU-NATAL	209.0	144.0	9.0	362.0
LIMPOPO	28.0	13.0	0.0	41.0
MPUMALANGA	78.0	76.0	2.0	156.0
NORTH WEST	33.0	22.0	1.0	56.0
NORTHERN CAPE	14.0	12.0	0.0	26.0
WESTERN CAPE	53.0	65.0	0.0	118.0
Total	765.0	702.0	26.0	1,493.0

.

. tab PROVINCE_DISTRICT GENDER u

GENDER

PROVINCE_DISTRICT	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE_ALFRED NZO	8.0	8.0	1.0	17.0
EASTERN CAPE_AMATHOLE	8.0	8.0	0.0	16.0
EASTERN CAPE_BUFFALO CITY METRO	18.0	8.0	0.0	26.0
EASTERN CAPE_CHRIS HANI	10.0	5.0	1.0	16.0
EASTERN CAPE_JOE GQABI	3.0	3.0	0.0	6.0
EASTERN CAPE_NELSON MANDELA BAY METRO	13.0	16.0	1.0	30.0
EASTERN CAPE_O R TAMBO	42.0	25.0	1.0	68.0
EASTERN CAPE_SARAH BAARTMAN	6.0	6.0	0.0	12.0
FREE STATE_FEZILE DABI	7.0	7.0	1.0	15.0
FREE STATE_LEJWELEPUTSWA	13.0	11.0	0.0	24.0
FREE STATE_MANGAUNG METRO	11.0	10.0	0.0	21.0
FREE STATE_THABO MOFUTSANYANA	9.0	15.0	0.0	24.0
GAUTENG_CITY OF JOHANNESBURG METRO	98.0	103.0	6.0	207.0
GAUTENG_CITY OF TSHWANE METRO	24.0	23.0	1.0	48.0
GAUTENG_EKURHULENI METRO	57.0	75.0	1.0	133.0
GAUTENG_SEDIBENG	14.0	23.0	0.0	37.0

GAUTENG_WEST RAND	9.0	24.0	1.0	34.0
KWAZULU-NATAL_AMAJUBA	14.0	9.0	0.0	23.0
KWAZULU-NATAL_ETHEKWINI METRO	73.0	64.0	3.0	140.0
KWAZULU-NATAL_HARRY GWALA	7.0	4.0	1.0	12.0
KWAZULU-NATAL_ILEMBE	4.0	9.0	1.0	14.0
KWAZULU-NATAL_KING CETSHWAYO	7.0	4.0	0.0	11.0
KWAZULU-NATAL_UGU	13.0	10.0	0.0	23.0
KWAZULU-NATAL_UMGUNGUNDLOVU	36.0	17.0	2.0	55.0
KWAZULU-NATAL_UMKHANYAKUDE	11.0	9.0	0.0	20.0
KWAZULU-NATAL_UMZINYATHI	10.0	2.0	0.0	12.0
KWAZULU-NATAL_UTHUKELA	7.0	7.0	0.0	14.0
KWAZULU-NATAL_UTHUNGULU	9.0	2.0	0.0	11.0
KWAZULU-NATAL_ZULULAND	18.0	7.0	2.0	27.0
LIMPOPO_CAPRICORN	17.0	10.0	0.0	27.0
LIMPOPO_GREATER SEKHUKHUNE	7.0	2.0	0.0	9.0
LIMPOPO_VHEMBE	4.0	1.0	0.0	5.0
MPUMALANGA_EHLANZENI	31.0	30.0	1.0	62.0
MPUMALANGA_GERT SIBANDE	20.0	23.0	0.0	43.0
MPUMALANGA_NKANGALA	27.0	23.0	1.0	51.0
NORTH WEST_BOJANALA PLATINUM	14.0	6.0	1.0	21.0
NORTH WEST_DR KENNETH KAUNDA	16.0	12.0	0.0	28.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	2.0	0.0	0.0	2.0
NORTH WEST_NGAKA MODIRI MOLEMA	1.0	4.0	0.0	5.0
NORTHERN CAPE_FRANCES BAARD	9.0	5.0	0.0	14.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	2.0	5.0	0.0	7.0
NORTHERN CAPE_PIXLEY KA SEME	3.0	1.0	0.0	4.0
NORTHERN CAPE_ZF MGCAWU	0.0	1.0	0.0	1.0
WESTERN CAPE_CAPE WINELANDS	6.0	4.0	0.0	10.0
WESTERN CAPE_CENTRAL KAROO	0.0	1.0	0.0	1.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	36.0	40.0	0.0	76.0
WESTERN CAPE_GARDEN ROUTE	10.0	15.0	0.0	25.0
WESTERN CAPE_OVERBERG	1.0	2.0	0.0	3.0

WESTERN CAPE_WEST COAST 0.0 3.0 0.0 3.0

Total 765.0 702.0 26.0 1,493.0

. restore

.

. preserve

.

. keep if YEAR_TESTED_DATE==2017

(4,966,207 observations deleted)

.

.

. drop if HEPATITIS_B_CORE_IGM=="NULL" | HEPATITIS_B_CORE_IGM=="UNKNOWN" |
HEPATITIS_B_CORE_IGM=="INSUFFICIENT"

> NT FOR FURTHER TESTS" | HEPATITIS_B_CORE_IGM=="." | HEPATITIS_B_CORE_IGM=="

(1,221,924 observations deleted)

.

. count

127,256

.

. duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force

Duplicates in terms of UNIQUE_PATIENT_ID

(16,446 observations deleted)

.

```
. count
```

```
110,810
```

```
.
```

```
. duplicates drop GENDER DOB HOSPITAL_ID FACILITY_NAME if UNIQUE_PATIENT_ID ==-1, force
```

Duplicates in terms of GENDER DOB HOSPITAL_ID FACILITY_NAME

(1 observation deleted)

```
.
```

```
. count
```

```
110,809
```

```
.
```

```
. tab HEPATITIS_B_CORE_IGM
```

HEPATITIS_B_CORE_IGM	Freq.	Percent	Cum.
-----+-----			
EQUIVOCAL	124	0.11	0.11
LOW POSITIVE	11	0.01	0.12
NEGATIVE	107,305	96.84	96.96
POSITIVE	3,369	3.04	100.00
-----+-----			
Total	110,809	100.00	

```
.
```

```
. tab PROVINCE_NAME
```

PROVINCE_NAME No.

EASTERN CAPE 19,837.0

FREE STATE 9,213.0

GAUTENG 49,976.0
 KWAZULU-NATAL 9,679.0
 LIMPOPO 3,928.0
 MPUMALANGA 5,238.0
 NORTH WEST 4,764.0
 NORTHERN CAPE 4,040.0
 WESTERN CAPE 4,134.0
 Total 110,809.0

.

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT No.

EASTERN CAPE_ALFRED NZO 158.0
 EASTERN CAPE_AMATHOLE 2,563.0
 EASTERN CAPE_BUFFALO CITY METRO 12,748.0
 EASTERN CAPE_CHRIS HANI 1,641.0
 EASTERN CAPE_JOE GQABI 952.0
 EASTERN CAPE_NELSON MANDELA BAY METRO 430.0
 EASTERN CAPE_NOT APPLICABLE 1.0
 EASTERN CAPE_O R TAMBO 1,231.0
 EASTERN CAPE_SARAH BAARTMAN 113.0
 FREE STATE_FEZILE DABI 317.0
 FREE STATE_LEJWELEPUTSWA 6,744.0
 FREE STATE_MANGAUNG METRO 1,305.0
 FREE STATE_NOT APPLICABLE 1.0
 FREE STATE_THABO MOFUTSANYANA 697.0
 FREE STATE_UNKNOWN 2.0
 FREE STATE_XHARIEP 147.0
 GAUTENG_CITY OF JOHANNESBURG METRO 19,931.0
 GAUTENG_CITY OF TSHWANE METRO 1,003.0
 GAUTENG_EKURHULENI METRO 24,445.0

GAUTENG_SEDIBENG 2,772.0
GAUTENG_UNKNOWN 8.0
GAUTENG_WEST RAND 1,817.0
KWAZULU-NATAL_AMAJUBA 167.0
KWAZULU-NATAL_ETHEKWINI METRO 4,382.0
KWAZULU-NATAL_HARRY GWALA 146.0
KWAZULU-NATAL_ILEMBE 248.0
KWAZULU-NATAL_KING CETSHWAYO 169.0
KWAZULU-NATAL_UGU 1,498.0
KWAZULU-NATAL_UMGUNGUNDLOVU 1,520.0
KWAZULU-NATAL_UMKHANYAKUDE 523.0
KWAZULU-NATAL_UMZINYATHI 262.0
KWAZULU-NATAL_UTHUKELA 180.0
KWAZULU-NATAL_UTHUNGULU 143.0
KWAZULU-NATAL_ZULULAND 441.0
LIMPOPO_CAPRICORN 3,360.0
LIMPOPO_GREATER SEKHUKHUNE 262.0
LIMPOPO_MOPANI 17.0
LIMPOPO_UNKNOWN 2.0
LIMPOPO_VHEMBE 266.0
LIMPOPO_WATERBERG 21.0
MPUMALANGA_EHLANZENI 1,704.0
MPUMALANGA_GERT SIBANDE 1,087.0
MPUMALANGA_NKANGALA 2,447.0
NORTH WEST_BOJANALA PLATINUM 770.0
NORTH WEST_DR KENNETH KAUNDA 3,635.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI 60.0
NORTH WEST_NGAKA MODIRI MOLEMA 299.0
NORTHERN CAPE_FRANCES BAARD 3,121.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE 208.0
NORTHERN CAPE_NAMAKWA 19.0
NORTHERN CAPE_PIXLEY KA SEME 527.0

NORTHERN CAPE_UNKNOWN 2.0
 NORTHERN CAPE_ZF MGCAWU 163.0
 WESTERN CAPE_CAPE WINELANDS 118.0
 WESTERN CAPE_CENTRAL KAROO 62.0
 WESTERN CAPE_CITY OF CAPE TOWN METRO 3,140.0
 WESTERN CAPE_GARDEN ROUTE 749.0
 WESTERN CAPE_OVERBERG 20.0
 WESTERN CAPE_UNKNOWN 2.0
 WESTERN CAPE_WEST COAST 43.0
 Total 110,809.0

.
 . tab GENDER

GENDER No.
 F 63,912.0
 M 45,493.0
 U 1,404.0
 Total 110,809.0

.
 . tab PROVINCE_NAME GENDER

GENDER				
PROVINCE_NAME	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE	13,070.0	6,631.0	136.0	19,837.0
FREE STATE	5,812.0	3,373.0	28.0	9,213.0
GAUTENG	28,700.0	20,553.0	723.0	49,976.0
KWAZULU-NATAL	4,401.0	5,022.0	256.0	9,679.0
LIMPOPO	2,366.0	1,530.0	32.0	3,928.0

MPUMALANGA	2,818.0	2,338.0	82.0	5,238.0
NORTH WEST	2,430.0	2,257.0	77.0	4,764.0
NORTHERN CAPE	2,200.0	1,787.0	53.0	4,040.0
WESTERN CAPE	2,115.0	2,002.0	17.0	4,134.0
Total	63,912.0	45,493.0	1,404.0	110,809.0

. tab PROVINCE_DISTRICT GENDER

> xls

GENDER

PROVINCE_DISTRICT	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE_ALFRED NZO	88.0	69.0	1.0	158.0
EASTERN CAPE_AMATHOLE	1,707.0	847.0	9.0	2,563.0
EASTERN CAPE_BUFFALO CITY METRO	8,745.0	3,911.0	92.0	12,748.0
EASTERN CAPE_CHRIS HANI	1,072.0	554.0	15.0	1,641.0
EASTERN CAPE_JOE GQABI	561.0	384.0	7.0	952.0
EASTERN CAPE_NELSON MANDELA BAY METRO	189.0	239.0	2.0	430.0
EASTERN CAPE_NOT APPLICABLE	0.0	1.0	0.0	1.0
EASTERN CAPE_O R TAMBO	657.0	564.0	10.0	1,231.0
EASTERN CAPE_SARAH BAARTMAN	51.0	62.0	0.0	113.0
FREE STATE_FEZILE DABI	186.0	125.0	6.0	317.0
FREE STATE_LEJWELEPUTSWA	4,390.0	2,333.0	21.0	6,744.0
FREE STATE_MANGAUNG METRO	723.0	582.0	0.0	1,305.0
FREE STATE_NOT APPLICABLE	1.0	0.0	0.0	1.0
FREE STATE_THABO MOFUTSANYANA	439.0	258.0	0.0	697.0
FREE STATE_UNKNOWN	2.0	0.0	0.0	2.0
FREE STATE_XHARIEP	71.0	75.0	1.0	147.0
GAUTENG_CITY OF JOHANNESBURG METRO	11,082.0	8,485.0	364.0	19,931.0
GAUTENG_CITY OF TSHWANE METRO	416.0	582.0	5.0	1,003.0
GAUTENG_EKURHULENI METRO	14,758.0	9,386.0	301.0	24,445.0

GAUTENG_SEDIBENG	1,501.0	1,233.0	38.0	2,772.0
GAUTENG_UNKNOWN	8.0	0.0	0.0	8.0
GAUTENG_WEST RAND	935.0	867.0	15.0	1,817.0
KWAZULU-NATAL_AMAJUBA	82.0	81.0	4.0	167.0
KWAZULU-NATAL_ETHEKWINI METRO	1,981.0	2,320.0	81.0	4,382.0
KWAZULU-NATAL_HARRY GWALA	57.0	79.0	10.0	146.0
KWAZULU-NATAL_ILEMBE	93.0	138.0	17.0	248.0
KWAZULU-NATAL_KING CETSHWAYO	65.0	89.0	15.0	169.0
KWAZULU-NATAL_UGU	728.0	747.0	23.0	1,498.0
KWAZULU-NATAL_UMGUNGUNDLOVU	651.0	794.0	75.0	1,520.0
KWAZULU-NATAL_UMKHANYAKUDE	244.0	273.0	6.0	523.0
KWAZULU-NATAL_UMZINYATHI	134.0	124.0	4.0	262.0
KWAZULU-NATAL_UTHUKELA	84.0	92.0	4.0	180.0
KWAZULU-NATAL_UTHUNGULU	60.0	82.0	1.0	143.0
KWAZULU-NATAL_ZULULAND	222.0	203.0	16.0	441.0
LIMPOPO_CAPRICORN	2,027.0	1,309.0	24.0	3,360.0
LIMPOPO_GREATER SEKHUKHUNE	155.0	103.0	4.0	262.0
LIMPOPO_MOPANI	12.0	5.0	0.0	17.0
LIMPOPO_UNKNOWN	2.0	0.0	0.0	2.0
LIMPOPO_VHEMBE	160.0	102.0	4.0	266.0
LIMPOPO_WATERBERG	10.0	11.0	0.0	21.0
MPUMALANGA_EHLANZENI	911.0	783.0	10.0	1,704.0
MPUMALANGA_GERT SIBANDE	487.0	591.0	9.0	1,087.0
MPUMALANGA_NKANGALA	1,420.0	964.0	63.0	2,447.0
NORTH WEST_BOJANALA PLATINUM	361.0	398.0	11.0	770.0
NORTH WEST_DR KENNETH KAUNDA	1,874.0	1,696.0	65.0	3,635.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	28.0	32.0	0.0	60.0
NORTH WEST_NGAKA MODIRI MOLEMA	167.0	131.0	1.0	299.0
NORTHERN CAPE_FRANCES BAARD	1,646.0	1,424.0	51.0	3,121.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	144.0	64.0	0.0	208.0
NORTHERN CAPE_NAMAKWA	9.0	10.0	0.0	19.0
NORTHERN CAPE_PIXLEY KA SEME	310.0	215.0	2.0	527.0

NORTHERN CAPE_UNKNOWN	2.0	0.0	0.0	2.0
NORTHERN CAPE_ZF MGCAWU	89.0	74.0	0.0	163.0
WESTERN CAPE_CAPE WINELANDS	50.0	68.0	0.0	118.0
WESTERN CAPE_CENTRAL KAROO	39.0	23.0	0.0	62.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	1,596.0	1,527.0	17.0	3,140.0
WESTERN CAPE_GARDEN ROUTE	403.0	346.0	0.0	749.0
WESTERN CAPE_OVERBERG	7.0	13.0	0.0	20.0
WESTERN CAPE_UNKNOWN	2.0	0.0	0.0	2.0
WESTERN CAPE_WEST COAST	18.0	25.0	0.0	43.0
Total	63,912.0	45,493.0	1,404.0	110,809.0

```
. restore
```

```
.
```

```
. preserve
```

```
.
```

```
. keep if YEAR_TESTED_DATE==2018
```

```
(5,038,976 observations deleted)
```

```
.
```

```
. keep if HEPATITIS_B_CORE_IGM=="LOW POSITIVE" | HEPATITIS_B_CORE_IGM==  
> "POSITIVE"
```

```
(1,273,773 observations deleted)
```

```
.
```

```
. tab TESTING_LAB
```

TESTING_LAB	Freq.	Percent	Cum.

-----+-----

BRAAMFONTEIN CENTRAL LABORATORY	412	15.62	15.62
CHARLOTTE MAXEKE JOHANNESBURG ACADEMI..	47	1.78	17.40
CHRIS HANI BARAGWANATH LABORATORY	153	5.80	23.20
DR GEORGE MUKHARI LABORATORY	189	7.16	30.36
EAST LONDON LABORATORY	75	2.84	33.21
ERMELO LABORATORY	136	5.16	38.36
GEORGE LABORATORY	35	1.33	39.69
GROOTE SCHUUR LABORATORY	70	2.65	42.34
HELEN JOSEPH LABORATORY	84	3.18	45.53
INKOSI ALBERT LUTHULI CENTRAL HOSPITAL	620	23.50	69.03
KIMBERLEY LABORATORY	75	2.84	71.87
NELSON MANDELA ACADEMIC LABORATORY	155	5.88	77.75
PELONOMI LABORATORY	117	4.44	82.18
POLOKWANE LABORATORY	45	1.71	83.89
PORT ELIZABETH LABORATORY	103	3.90	87.79
ROB FERREIRA LABORATORY	1	0.04	87.83
TAMBO MEMORIAL LABORATORY	133	5.04	92.87
TSHEPONG LABORATORY	61	2.31	95.19
TSHWANE ACADEMIC LABORATORY	63	2.39	97.57
TYGERBERG LABORATORY	64	2.43	100.00

-----+-----

Total | 2,638 100.00

.

. destring HEPATITIS_B_CORE_IGM_VALUE, generate(COREIGM_VALUE) force

HEPATITIS_B_CORE_IGM_VALUE contains nonnumeric characters; COREIGM_VALUE generated as double

(206 missing values generated)

.

. keep if ((TESTING_LAB=="BRAAMFONTEIN CENTRAL LABORATORY" | TESTING_LAB=="DORA NGINZA LABORATORY" | TESTING

```

> _LAB=="CECILIA MAKIWANE LABORATORY" | TESTING_LAB=="LERATONG LABORATORY" |
TESTING_LAB=="MAFIKENG LABORATO

> RY" | TESTING_LAB=="MANKWENG LABORATORY" | TESTING_LAB=="PORT SHEPSTONE
LABORATORY" | TESTING_LAB=="THUSON

> G LABORATORY" | TESTING_LAB=="EAST LONDON LABORATORY" | TESTING_LAB=="INKOSI
ALBERT LUTHULI CENTRAL HOSPIT

> AL" | TESTING_LAB=="NELSON MANDELA ACADEMIC LABORATORY" | TESTING_LAB=="PORT
ELIZABETH LABORATORY" | TESTI

> NG_LAB=="CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL" | TESTING_LAB=="CHRIS
HANI BARAGWANATH LABORATOR

> Y" | TESTING_LAB=="DR GEORGE MUKHARI LABORATORY" | TESTING_LAB=="ERMELO
LABORATORY" | TESTING_LAB=="GROOTE

> SCHUUR LABORATORY" | TESTING_LAB=="LETABA LABORATORY" | TESTING_LAB=="TSHEPONG
LABORATORY" | TESTING_LAB=

> ="TYGERBERG LABORATORY" | TESTING_LAB=="TSHWANE ACADEMIC LABORATORY" |
TESTING_LAB=="UNIVERSITAS ACADEMIC

> LABORATORY") & (COREIGM_VALUE>=20 & COREIGM_VALUE<.) | ((TESTING_LAB=="GEORGE
LABORATORY" | TESTING_LAB==

> "POLOKWANE LABORATORY" | TESTING_LAB=="ROB FERREIRA LABORATORY") &
(COREIGM_VALUE>=5 & COREIGM_VALUE<.) |

> (HEPATITIS_B_CORE_IGM_VALUE==">9" | HEPATITIS_B_CORE_IGM_VALUE==">9.00" |
HEPATITIS_B_CORE_IGM_VALUE==">1

> 5" | HEPATITIS_B_CORE_IGM_VALUE==">15.00" | HEPATITIS_B_CORE_IGM_VALUE==">1000" |
HEPATITIS_B_CORE_IGM_VAL

> UE=="UNKNOWN")

(1,367 observations deleted)

```

```

.
. tab TESTING_LAB

```

TESTING_LAB	Freq.	Percent	Cum.
-----+-----			
BRAAMFONTEIN CENTRAL LABORATORY	200	15.74	15.74
CHARLOTTE MAXEKE JOHANNESBURG ACADEMI..	19	1.49	17.23
CHRIS HANI BARAGWANATH LABORATORY	73	5.74	22.97
DR GEORGE MUKHARI LABORATORY	84	6.61	29.58
EAST LONDON LABORATORY	25	1.97	31.55

ERMELO LABORATORY	63	4.96	36.51
GEORGE LABORATORY	22	1.73	38.24
GROOTE SCHUUR LABORATORY	45	3.54	41.78
HELEN JOSEPH LABORATORY	44	3.46	45.24
INKOSI ALBERT LUTHULI CENTRAL HOSPITAL	292	22.97	68.21
KIMBERLEY LABORATORY	49	3.86	72.07
NELSON MANDELA ACADEMIC LABORATORY	70	5.51	77.58
PELONOMI LABORATORY	57	4.48	82.06
POLOKWANE LABORATORY	36	2.83	84.89
PORT ELIZABETH LABORATORY	41	3.23	88.12
ROB FERREIRA LABORATORY	1	0.08	88.20
TAMBO MEMORIAL LABORATORY	56	4.41	92.60
TSHEPONG LABORATORY	23	1.81	94.41
TSHWANE ACADEMIC LABORATORY	35	2.75	97.17
TYGERBERG LABORATORY	36	2.83	100.00

-----+-----
Total | 1,271 100.00

.
.tab HEPATITIS_B_CORE_IGM

HEPATITIS_B_CORE_IGM	Freq.	Percent	Cum.
-----+-----			
POSITIVE	1,271	100.00	100.00
-----+-----			
Total	1,271	100.00	

.
.count
1,271

.

```
. duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force
```

Duplicates in terms of UNIQUE_PATIENT_ID

(174 observations deleted)

```
.  
. count  
1,097
```

```
.  
. tab HEPATITIS_B_CORE_IGM
```

HEPATITIS_B_CORE_IGM	Freq.	Percent	Cum.
-----+-----			
POSITIVE	1,097	100.00	100.00
-----+-----			
Total	1,097	100.00	

```
.  
. tab PROVINCE_NAME
```

```
PROVINCE_NAME  No.  
EASTERN CAPE   112.0  
FREE STATE     52.0  
GAUTENG        403.0  
KWAZULU-NATAL  250.0  
LIMPOPO        35.0  
MPUMALANGA     71.0  
NORTH WEST     46.0  
NORTHERN CAPE  45.0  
WESTERN CAPE   83.0
```


Total 1,097.0

.

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	No.
EASTERN CAPE_ALFRED NZO	11.0
EASTERN CAPE_AMATHOLE	8.0
EASTERN CAPE_BUFFALO CITY METRO	10.0
EASTERN CAPE_CHRIS HANI	8.0
EASTERN CAPE_JOE GQABI	7.0
EASTERN CAPE_NELSON MANDELA BAY METRO	20.0
EASTERN CAPE_O R TAMBO	40.0
EASTERN CAPE_SARAH BAARTMAN	8.0
FREE STATE_FEZILE DABI	5.0
FREE STATE_LEJWELEPUTSWA	19.0
FREE STATE_MANGAUNG METRO	13.0
FREE STATE_THABO MOFUTSANYANA	9.0
FREE STATE_XHARIEP	6.0
GAUTENG_CITY OF JOHANNESBURG METRO	136.0
GAUTENG_CITY OF TSHWANE METRO	65.0
GAUTENG_EKURHULENI METRO	138.0
GAUTENG_SEDIBENG	41.0
GAUTENG_WEST RAND	23.0
KWAZULU-NATAL_AMAJUBA	13.0
KWAZULU-NATAL_ETHEKWINI METRO	105.0
KWAZULU-NATAL_HARRY GWALA	10.0
KWAZULU-NATAL_ILEMBE	9.0
KWAZULU-NATAL_KING CETSHWAYO	7.0
KWAZULU-NATAL_UGU	18.0
KWAZULU-NATAL_UMGUNGUNDLOVU	38.0
KWAZULU-NATAL_UMKHANYAKUDE	12.0

KWAZULU-NATAL_UMZINYATHI	9.0
KWAZULU-NATAL_UTHUKELA	9.0
KWAZULU-NATAL_UTHUNGULU	6.0
KWAZULU-NATAL_ZULULAND	14.0
LIMPOPO_CAPRICORN	17.0
LIMPOPO_GREATER SEKHUKHUNE	16.0
LIMPOPO_VHEMBE	1.0
LIMPOPO_WATERBERG	1.0
MPUMALANGA_EHLANZENI	12.0
MPUMALANGA_GERT SIBANDE	33.0
MPUMALANGA_NKANGALA	26.0
NORTH WEST_BOJANALA PLATINUM	20.0
NORTH WEST_DR KENNETH KAUNDA	22.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	1.0
NORTH WEST_NGAKA MODIRI MOLEMA	3.0
NORTHERN CAPE_FRANCES BAARD	21.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	19.0
NORTHERN CAPE_PIXLEY KA SEME	3.0
NORTHERN CAPE_ZF MGCAWU	2.0
WESTERN CAPE_CAPE WINELANDS	5.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	60.0
WESTERN CAPE_GARDEN ROUTE	14.0
WESTERN CAPE_OVERBERG	1.0
WESTERN CAPE_WEST COAST	3.0
Total	1,097.0

.

. tab GENDER

GENDER No.

F 558.0

M 524.0

U 15.0
Total 1,097.0

. tab PROVINCE_NAME GENDER

GENDER				
PROVINCE_NAME	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE	60.0	52.0	0.0	112.0
FREE STATE	26.0	25.0	1.0	52.0
GAUTENG	187.0	208.0	8.0	403.0
KWAZULU-NATAL	153.0	92.0	5.0	250.0
LIMPOPO	21.0	14.0	0.0	35.0
MPUMALANGA	27.0	43.0	1.0	71.0
NORTH WEST	20.0	26.0	0.0	46.0
NORTHERN CAPE	19.0	26.0	0.0	45.0
WESTERN CAPE	45.0	38.0	0.0	83.0
Total	558.0	524.0	15.0	1,097.0

.

. tab PROVINCE_DISTRICT GENDER

GENDER				
PROVINCE_DISTRICT	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE_ALFRED NZO	6.0	5.0	0.0	11.0
EASTERN CAPE_AMATHOLE	3.0	5.0	0.0	8.0
EASTERN CAPE_BUFFALO CITY METRO	4.0	6.0	0.0	10.0
EASTERN CAPE_CHRIS HANI	6.0	2.0	0.0	8.0

EASTERN CAPE_JOE GQABI	3.0	4.0	0.0	7.0
EASTERN CAPE_NELSON MANDELA BAY METRO	11.0	9.0	0.0	20.0
EASTERN CAPE_O R TAMBO	25.0	15.0	0.0	40.0
EASTERN CAPE_SARAH BAARTMAN	2.0	6.0	0.0	8.0
FREE STATE_FEZILE DABI	3.0	1.0	1.0	5.0
FREE STATE_LEJWELEPUTSWA	8.0	11.0	0.0	19.0
FREE STATE_MANGAUNG METRO	6.0	7.0	0.0	13.0
FREE STATE_THABO MOFUTSANYANA	6.0	3.0	0.0	9.0
FREE STATE_XHARIEP	3.0	3.0	0.0	6.0
GAUTENG_CITY OF JOHANNESBURG METRO	65.0	66.0	5.0	136.0
GAUTENG_CITY OF TSHWANE METRO	36.0	29.0	0.0	65.0
GAUTENG_EKURHULENI METRO	61.0	75.0	2.0	138.0
GAUTENG_SEDIBENG	13.0	27.0	1.0	41.0
GAUTENG_WEST RAND	12.0	11.0	0.0	23.0
KWAZULU-NATAL_AMAJUBA	11.0	2.0	0.0	13.0
KWAZULU-NATAL_ETHEKWINI METRO	65.0	38.0	2.0	105.0
KWAZULU-NATAL_HARRY GWALA	7.0	3.0	0.0	10.0
KWAZULU-NATAL_ILEMBE	7.0	2.0	0.0	9.0
KWAZULU-NATAL_KING CETSHWAYO	3.0	4.0	0.0	7.0
KWAZULU-NATAL_UGU	12.0	6.0	0.0	18.0
KWAZULU-NATAL_UMGUNGUNDLOVU	22.0	14.0	2.0	38.0
KWAZULU-NATAL_UMKHANYAKUDE	8.0	3.0	1.0	12.0
KWAZULU-NATAL_UMZINYATHI	5.0	4.0	0.0	9.0
KWAZULU-NATAL_UTHUKELA	4.0	5.0	0.0	9.0
KWAZULU-NATAL_UTHUNGULU	4.0	2.0	0.0	6.0
KWAZULU-NATAL_ZULULAND	5.0	9.0	0.0	14.0
LIMPOPO_CAPRICORN	11.0	6.0	0.0	17.0
LIMPOPO_GREATER SEKHUKHUNE	8.0	8.0	0.0	16.0
LIMPOPO_VHEMBE	1.0	0.0	0.0	1.0
LIMPOPO_WATERBERG	1.0	0.0	0.0	1.0
MPUMALANGA_EHLANZENI	6.0	5.0	1.0	12.0
MPUMALANGA_GERT SIBANDE	9.0	24.0	0.0	33.0

MPUMALANGA_NKANGALA	12.0	14.0	0.0	26.0
NORTH WEST_BOJANALA PLATINUM	8.0	12.0	0.0	20.0
NORTH WEST_DR KENNETH KAUNDA	10.0	12.0	0.0	22.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	1.0	0.0	0.0	1.0
NORTH WEST_NGAKA MODIRI MOLEMA	1.0	2.0	0.0	3.0
NORTHERN CAPE_FRANCES BAARD	7.0	14.0	0.0	21.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	8.0	11.0	0.0	19.0
NORTHERN CAPE_PIXLEY KA SEME	2.0	1.0	0.0	3.0
NORTHERN CAPE_ZF MGCAWU	2.0	0.0	0.0	2.0
WESTERN CAPE_CAPE WINELANDS	5.0	0.0	0.0	5.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	27.0	33.0	0.0	60.0
WESTERN CAPE_GARDEN ROUTE	12.0	2.0	0.0	14.0
WESTERN CAPE_OVERBERG	1.0	0.0	0.0	1.0
WESTERN CAPE_WEST COAST	0.0	3.0	0.0	3.0
Total	558.0	524.0	15.0	1,097.0

```
. restore
```

```
.
```

```
. preserve
```

```
.
```

```
. keep if YEAR_TESTED_DATE==2018
```

```
(5,038,976 observations deleted)
```

```
.
```

```
. drop if HEPATITIS_B_CORE_IGM=="NULL" | HEPATITIS_B_CORE_IGM=="UNKNOWN" |  
HEPATITIS_B_CORE_IGM=="INSUFFICIE
```

```
> NT FOR FURTHER TESTS" | HEPATITIS_B_CORE_IGM=="." | HEPATITIS_B_CORE_IGM=="
```

```
(1,191,959 observations deleted)
```

```
.
```

```
. count
```

84,452

.

. duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force

Duplicates in terms of UNIQUE_PATIENT_ID

(9,883 observations deleted)

.

. count

74,569

.

. duplicates drop GENDER DOB HOSPITAL_ID FACILITY_NAME if UNIQUE_PATIENT_ID ==-1, force

Duplicates in terms of GENDER DOB HOSPITAL_ID FACILITY_NAME

(8 observations deleted)

.

. count

74,561

.

. tab HEPATITIS_B_CORE_IGM

HEPATITIS_B_CORE_IGM	Freq.	Percent	Cum.
-----+-----			
EQUIVOCAL	72	0.10	0.10
LOW POSITIVE	7	0.01	0.11
NEGATIVE	72,248	96.90	97.00

POSITIVE	2,234	3.00	100.00

-----+-----

Total	74,561	100.00

.

. tab PROVINCE_NAME

PROVINCE_NAME	No.

EASTERN CAPE	4,734.0

FREE STATE	7,126.0

GAUTENG	37,336.0

KWAZULU-NATAL	9,069.0

LIMPOPO	2,777.0

MPUMALANGA	1,979.0

NORTH WEST	4,150.0

NORTHERN CAPE	4,002.0

WESTERN CAPE	3,388.0

Total	74,561.0

.

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	No.

EASTERN CAPE_ALFRED NZO	125.0

EASTERN CAPE_AMATHOLE	552.0

EASTERN CAPE_BUFFALO CITY METRO	2,332.0

EASTERN CAPE_CHRIS HANI	295.0

EASTERN CAPE_JOE GQABI	234.0

EASTERN CAPE_NELSON MANDELA BAY METRO	411.0

EASTERN CAPE_O R TAMBO	667.0

EASTERN CAPE_SARAH BAARTMAN	118.0

FREE STATE_FEZILE DABI	249.0

FREE STATE_LEJWELEPUTSWA 4,977.0
FREE STATE_MANGAUNG METRO 1,295.0
FREE STATE_THABO MOFUTSANYANA 464.0
FREE STATE_XHARIEP 141.0
GAUTENG_CITY OF JOHANNESBURG METRO 17,308.0
GAUTENG_CITY OF TSHWANE METRO 1,197.0
GAUTENG_EKURHULENI METRO 14,291.0
GAUTENG_SEDIBENG 2,364.0
GAUTENG_UNKNOWN 6.0
GAUTENG_WEST RAND 2,170.0
KWAZULU-NATAL_AMAJUBA 215.0
KWAZULU-NATAL_ETHEKWINI METRO 4,161.0
KWAZULU-NATAL_HARRY GWALA 156.0
KWAZULU-NATAL_ILEMBE 243.0
KWAZULU-NATAL_KING CETSHWAYO 169.0
KWAZULU-NATAL_UGU 1,013.0
KWAZULU-NATAL_UMGUNGUNDLOVU 1,913.0
KWAZULU-NATAL_UMKHANYAKUDE 306.0
KWAZULU-NATAL_UMZINYATHI 206.0
KWAZULU-NATAL_UNKNOWN 1.0
KWAZULU-NATAL_UTHUKELA 125.0
KWAZULU-NATAL_UTHUNGULU 188.0
KWAZULU-NATAL_ZULULAND 373.0
LIMPOPO_CAPRICORN 2,150.0
LIMPOPO_GREATER SEKHUKHUNE 318.0
LIMPOPO_MOPANI 18.0
LIMPOPO_UNKNOWN 3.0
LIMPOPO_VHEMBE 262.0
LIMPOPO_WATERBERG 26.0
MPUMALANGA_EHLANZENI 167.0
MPUMALANGA_GERT SIBANDE 972.0
MPUMALANGA_NKANGALA 840.0

NORTH WEST_BOJANALA PLATINUM	760.0
NORTH WEST_DR KENNETH KAUNDA	3,188.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	96.0
NORTH WEST_NGAKA MODIRI MOLEMA	106.0
NORTHERN CAPE_FRANCES BAARD	2,880.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	276.0
NORTHERN CAPE_NAMAKWA	14.0
NORTHERN CAPE_PIXLEY KA SEME	600.0
NORTHERN CAPE_ZF MGCAWU	232.0
WESTERN CAPE_CAPE WINELANDS	71.0
WESTERN CAPE_CENTRAL KAROO	42.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	2,583.0
WESTERN CAPE_GARDEN ROUTE	556.0
WESTERN CAPE_OVERBERG	14.0
WESTERN CAPE_UNKNOWN	16.0
WESTERN CAPE_WEST COAST	106.0
Total	74,561.0

.

. tab GENDER

GENDER No.

F 40,581.0

M 32,958.0

U 1,022.0

Total 74,561.0

.

. tab PROVINCE_NAME GENDER

GENDER

PROVINCE_NAME	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE	2,639.0	2,050.0	45.0	4,734.0
FREE STATE	4,345.0	2,765.0	16.0	7,126.0
GAUTENG	21,058.0	15,732.0	546.0	37,336.0
KWAZULU-NATAL	3,921.0	4,924.0	224.0	9,069.0
LIMPOPO	1,598.0	1,156.0	23.0	2,777.0
MPUMALANGA	957.0	1,001.0	21.0	1,979.0
NORTH WEST	2,165.0	1,933.0	52.0	4,150.0
NORTHERN CAPE	2,144.0	1,796.0	62.0	4,002.0
WESTERN CAPE	1,754.0	1,601.0	33.0	3,388.0
Total	40,581.0	32,958.0	1,022.0	74,561.0

.

. tab PROVINCE_DISTRICT GENDER

GENDER

PROVINCE_DISTRICT	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE_ALFRED NZO	59.0	61.0	5.0	125.0
EASTERN CAPE_AMATHOLE	313.0	238.0	1.0	552.0
EASTERN CAPE_BUFFALO CITY METRO	1,415.0	891.0	26.0	2,332.0
EASTERN CAPE_CHRIS HANI	159.0	135.0	1.0	295.0
EASTERN CAPE_JOE GQABI	142.0	92.0	0.0	234.0
EASTERN CAPE_NELSON MANDELA BAY METRO	159.0	250.0	2.0	411.0
EASTERN CAPE_O R TAMBO	336.0	321.0	10.0	667.0
EASTERN CAPE_SARAH BAARTMAN	56.0	62.0	0.0	118.0
FREE STATE_FEZILE DABI	126.0	121.0	2.0	249.0
FREE STATE_LEJWELEPUTSWA	3,139.0	1,825.0	13.0	4,977.0
FREE STATE_MANGAUNG METRO	727.0	567.0	1.0	1,295.0

FREE STATE_THABO MOFUTSANYANA	268.0	196.0	0.0	464.0
FREE STATE_XHARIEP	85.0	56.0	0.0	141.0
GAUTENG_CITY OF JOHANNESBURG METRO	9,574.0	7,407.0	327.0	17,308.0
GAUTENG_CITY OF TSHWANE METRO	515.0	663.0	19.0	1,197.0
GAUTENG_EKURHULENI METRO	8,508.0	5,646.0	137.0	14,291.0
GAUTENG_SEDIBENG	1,279.0	1,053.0	32.0	2,364.0
GAUTENG_UNKNOWN	5.0	0.0	1.0	6.0
GAUTENG_WEST RAND	1,177.0	963.0	30.0	2,170.0
KWAZULU-NATAL_AMAJUBA	95.0	114.0	6.0	215.0
KWAZULU-NATAL_ETHEKWINI METRO	1,808.0	2,264.0	89.0	4,161.0
KWAZULU-NATAL_HARRY GWALA	62.0	93.0	1.0	156.0
KWAZULU-NATAL_ILEMBE	102.0	131.0	10.0	243.0
KWAZULU-NATAL_KING CETSHWAYO	70.0	91.0	8.0	169.0
KWAZULU-NATAL_UGU	475.0	523.0	15.0	1,013.0
KWAZULU-NATAL_UMGUNGUNDLOVU	776.0	1,070.0	67.0	1,913.0
KWAZULU-NATAL_UMKHANYAKUDE	139.0	165.0	2.0	306.0
KWAZULU-NATAL_UMZINYATHI	75.0	125.0	6.0	206.0
KWAZULU-NATAL_UNKNOWN	1.0	0.0	0.0	1.0
KWAZULU-NATAL_UTHUKELA	61.0	64.0	0.0	125.0
KWAZULU-NATAL_UTHUNGULU	81.0	104.0	3.0	188.0
KWAZULU-NATAL_ZULULAND	176.0	180.0	17.0	373.0
LIMPOPO_CAPRICORN	1,233.0	896.0	21.0	2,150.0
LIMPOPO_GREATER SEKHUKHUNE	195.0	123.0	0.0	318.0
LIMPOPO_MOPANI	15.0	3.0	0.0	18.0
LIMPOPO_UNKNOWN	2.0	1.0	0.0	3.0
LIMPOPO_VHEMBE	139.0	121.0	2.0	262.0
LIMPOPO_WATERBERG	14.0	12.0	0.0	26.0
MPUMALANGA_EHLANZENI	79.0	86.0	2.0	167.0
MPUMALANGA_GERT SIBANDE	447.0	522.0	3.0	972.0
MPUMALANGA_NKANGALA	431.0	393.0	16.0	840.0
NORTH WEST_BOJANALA PLATINUM	348.0	403.0	9.0	760.0
NORTH WEST_DR KENNETH KAUNDA	1,700.0	1,446.0	42.0	3,188.0

NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	56.0	40.0	0.0	96.0
NORTH WEST_NGAKA MODIRI MOLEMA	61.0	44.0	1.0	106.0
NORTHERN CAPE_FRANCES BAARD	1,482.0	1,343.0	55.0	2,880.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	169.0	106.0	1.0	276.0
NORTHERN CAPE_NAMAKWA	8.0	6.0	0.0	14.0
NORTHERN CAPE_PIXLEY KA SEME	372.0	223.0	5.0	600.0
NORTHERN CAPE_ZF MGCAWU	113.0	118.0	1.0	232.0
WESTERN CAPE_CAPE WINELANDS	27.0	44.0	0.0	71.0
WESTERN CAPE_CENTRAL KAROO	18.0	24.0	0.0	42.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	1,347.0	1,215.0	21.0	2,583.0
WESTERN CAPE_GARDEN ROUTE	293.0	262.0	1.0	556.0
WESTERN CAPE_OVERBERG	8.0	6.0	0.0	14.0
WESTERN CAPE_UNKNOWN	3.0	2.0	11.0	16.0
WESTERN CAPE_WEST COAST	58.0	48.0	0.0	106.0
Total	40,581.0	32,958.0	1,022.0	74,561.0

. restore

.

. preserve

.

. keep if YEAR_TESTED_DATE==2019

(4,963,898 observations deleted)

.

. keep if HEPATITIS_B_CORE_IGM=="LOW POSITIVE" | HEPATITIS_B_CORE_IGM==
> "POSITIVE"

(1,349,040 observations deleted)

.

. tab TESTING_LAB

TESTING_LAB	Freq.	Percent	Cum.
-----+-----			
BRAAMFONTEIN CENTRAL LABORATORY	309	12.62	12.62
CHARLOTTE MAXEKE JOHANNESBURG ACADEMI..	51	2.08	14.70
CHRIS HANI BARAGWANATH LABORATORY	150	6.12	20.82
DR GEORGE MUKHARI LABORATORY	163	6.66	27.48
EAST LONDON LABORATORY	78	3.18	30.67
ERMELO LABORATORY	95	3.88	34.54
GEORGE LABORATORY	24	0.98	35.52
GROOTE SCHUUR LABORATORY	83	3.39	38.91
HELEN JOSEPH LABORATORY	74	3.02	41.94
INKOSI ALBERT LUTHULI CENTRAL HOSPITAL	844	34.46	76.40
KIMBERLEY LABORATORY	43	1.76	78.15
LETABA LABORATORY	9	0.37	78.52
NELSON MANDELA ACADEMIC LABORATORY	42	1.71	80.24
PELONOMI LABORATORY	90	3.67	83.91
POLOKWANE LABORATORY	33	1.35	85.26
PORT ELIZABETH LABORATORY	80	3.27	88.53
TAMBO MEMORIAL LABORATORY	87	3.55	92.08
TSHEPONG LABORATORY	77	3.14	95.22
TSHWANE ACADEMIC LABORATORY	26	1.06	96.28
TYGERBERG LABORATORY	65	2.65	98.94
UNIVERSITAS ACADEMIC LABORATORY	26	1.06	100.00
-----+-----			
Total	2,449	100.00	

.

. destring HEPATITIS_B_CORE_IGM_VALUE, generate(COREIGM_VALUE) force

HEPATITIS_B_CORE_IGM_VALUE contains nonnumeric characters; COREIGM_VALUE generated as double

(167 missing values generated)

```
. keep if ((TESTING_LAB=="BRAAMFONTEIN CENTRAL LABORATORY" | TESTING_LAB=="DORA
NGINZA LABORATORY" | TESTING

> _LAB=="CECILIA MAKIWANE LABORATORY" | TESTING_LAB=="LERATONG LABORATORY" |
TESTING_LAB=="MAFIKENG LABORATO

> RY" | TESTING_LAB=="MANKWENG LABORATORY" | TESTING_LAB=="PORT SHEPSTONE
LABORATORY" | TESTING_LAB=="THUSON

> G LABORATORY" | TESTING_LAB=="EAST LONDON LABORATORY" | TESTING_LAB=="INKOSI
ALBERT LUTHULI CENTRAL HOSPIT

> AL" | TESTING_LAB=="NELSON MANDELA ACADEMIC LABORATORY" | TESTING_LAB=="PORT
ELIZABETH LABORATORY" | TESTI

> NG_LAB=="CHARLOTTE MAXEKE JOHANNESBURG ACADEMIC HOSPITAL" | TESTING_LAB=="CHRIS
HANI BARAGWANATH LABORATOR

> Y" | TESTING_LAB=="DR GEORGE MUKHARI LABORATORY" | TESTING_LAB=="ERMELO
LABORATORY" | TESTING_LAB=="GROOTE

> SCHUUR LABORATORY" | TESTING_LAB=="LETABA LABORATORY" | TESTING_LAB=="TSHEPONG
LABORATORY" | TESTING_LAB=

> ="TYGERBERG LABORATORY" | TESTING_LAB=="TSHWANE ACADEMIC LABORATORY" |
TESTING_LAB=="UNIVERSITAS ACADEMIC

> LABORATORY") & (COREIGM_VALUE>=20 & COREIGM_VALUE<.) | ((TESTING_LAB=="GEORGE
LABORATORY" | TESTING_LAB==

> "POLOKWANE LABORATORY" | TESTING_LAB=="ROB FERREIRA LABORATORY") &
(COREIGM_VALUE>=5 & COREIGM_VALUE<.) |

> (HEPATITIS_B_CORE_IGM_VALUE==">9" | HEPATITIS_B_CORE_IGM_VALUE==">9.00" |
HEPATITIS_B_CORE_IGM_VALUE==">1

> 5" | HEPATITIS_B_CORE_IGM_VALUE==">15.00" | HEPATITIS_B_CORE_IGM_VALUE==">1000" |
HEPATITIS_B_CORE_IGM_VAL

> UE=="UNKNOWN")

(1,277 observations deleted)
```

```
.
. tab TESTING_LAB
```

TESTING_LAB	Freq.	Percent	Cum.
-----+-----			
BRAAMFONTEIN CENTRAL LABORATORY	160	13.65	13.65

CHARLOTTE MAXEKE JOHANNESBURG ACADEMI..	25	2.13	15.78
CHRIS HANI BARAGWANATH LABORATORY	74	6.31	22.10
DR GEORGE MUKHARI LABORATORY	76	6.48	28.58
EAST LONDON LABORATORY	29	2.47	31.06
ERMELO LABORATORY	39	3.33	34.39
GEORGE LABORATORY	17	1.45	35.84
GROOTE SCHUUR LABORATORY	45	3.84	39.68
HELEN JOSEPH LABORATORY	33	2.82	42.49
INKOSI ALBERT LUTHULI CENTRAL HOSPITAL	359	30.63	73.12
KIMBERLEY LABORATORY	19	1.62	74.74
NELSON MANDELA ACADEMIC LABORATORY	24	2.05	76.79
PELONOMI LABORATORY	59	5.03	81.83
POLOKWANE LABORATORY	27	2.30	84.13
PORT ELIZABETH LABORATORY	31	2.65	86.77
TAMBO MEMORIAL LABORATORY	48	4.10	90.87
TSHEPONG LABORATORY	41	3.50	94.37
TSHWANE ACADEMIC LABORATORY	16	1.37	95.73
TYGERBERG LABORATORY	42	3.58	99.32
UNIVERSITAS ACADEMIC LABORATORY	8	0.68	100.00

-----+-----

Total | 1,172 100.00

.

. tab HEPATITIS_B_CORE_IGM

HEPATITIS_B_CORE_IGM	Freq.	Percent	Cum.
-----+-----			
LOW POSITIVE	3	0.26	0.26
POSITIVE	1,169	99.74	100.00
-----+-----			
Total	1,172	100.00	

```
.  
. count  
1,172
```

```
.  
. duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force
```

Duplicates in terms of UNIQUE_PATIENT_ID

(178 observations deleted)

```
.  
. count  
994
```

```
.  
. tab HEPATITIS_B_CORE_IGM
```

HEPATITIS_B_CORE_IGM	Freq.	Percent	Cum.
-----+-----			
LOW POSITIVE	2	0.20	0.20
POSITIVE	992	99.80	100.00
-----+-----			
Total	994	100.00	

```
.  
. tab PROVINCE_NAME
```

```
PROVINCE_NAME  No.  
EASTERN CAPE   71.0  
FREE STATE     63.0  
GAUTENG        323.0
```


KWAZULU-NATAL 297.0

LIMPOPO 30.0

MPUMALANGA 51.0

NORTH WEST 55.0

NORTHERN CAPE 18.0

WESTERN CAPE 86.0

Total 994.0

.

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT No.

EASTERN CAPE_ALFRED NZO 5.0

EASTERN CAPE_AMATHOLE 4.0

EASTERN CAPE_BUFFALO CITY METRO 9.0

EASTERN CAPE_CHRIS HANI 6.0

EASTERN CAPE_JOE GQABI 8.0

EASTERN CAPE_NELSON MANDELA BAY METRO 19.0

EASTERN CAPE_O R TAMBO 16.0

EASTERN CAPE_SARAH BAARTMAN 4.0

FREE STATE_FEZILE DABI 15.0

FREE STATE_LEJWELEPUTSWA 12.0

FREE STATE_MANGAUNG METRO 21.0

FREE STATE_THABO MOFUTSANYANA 14.0

FREE STATE_XHARIEP 1.0

GAUTENG_CITY OF JOHANNESBURG METRO 129.0

GAUTENG_CITY OF TSHWANE METRO 41.0

GAUTENG_EKURHULENI METRO 102.0

GAUTENG_SEDIBENG 36.0

GAUTENG_WEST RAND 15.0

KWAZULU-NATAL_AMAJUBA 21.0

KWAZULU-NATAL_ETHEKWINI METRO 112.0

KWAZULU-NATAL_HARRY GWALA	12.0
KWAZULU-NATAL_ILEMBE	16.0
KWAZULU-NATAL_KING CETSHWAYO	9.0
KWAZULU-NATAL_UGU	23.0
KWAZULU-NATAL_UMGUNGUNDLOVU	42.0
KWAZULU-NATAL_UMKHANYAKUDE	14.0
KWAZULU-NATAL_UMZINYATHI	4.0
KWAZULU-NATAL_UTHUKELA	14.0
KWAZULU-NATAL_UTHUNGULU	10.0
KWAZULU-NATAL_ZULULAND	20.0
LIMPOPO_CAPRICORN	17.0
LIMPOPO_GREATER SEKHUKHUNE	4.0
LIMPOPO_UNKNOWN	1.0
LIMPOPO_VHEMBE	6.0
LIMPOPO_WATERBERG	2.0
MPUMALANGA_EHLANZENI	12.0
MPUMALANGA_GERT SIBANDE	22.0
MPUMALANGA_NKANGALA	17.0
NORTH WEST_BOJANALA PLATINUM	15.0
NORTH WEST_DR KENNETH KAUNDA	24.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	12.0
NORTH WEST_NGAKA MODIRI MOLEMA	4.0
NORTHERN CAPE_FRANCES BAARD	16.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	2.0
WESTERN CAPE_CAPE WINELANDS	2.0
WESTERN CAPE_CENTRAL KAROO	2.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	68.0
WESTERN CAPE_GARDEN ROUTE	10.0
WESTERN CAPE_OVERBERG	2.0
WESTERN CAPE_WEST COAST	2.0
Total	994.0

.

. tab GENDER

GENDER No.

F 489.0

M 488.0

U 17.0

Total 994.0

.

. tab PROVINCE_NAME GENDER

GENDER

PROVINCE_NAME F M U Total

No. No. No. No.

EASTERN CAPE 42.0 28.0 1.0 71.0

FREE STATE 25.0 38.0 0.0 63.0

GAUTENG 139.0 181.0 3.0 323.0

KWAZULU-NATAL 154.0 133.0 10.0 297.0

LIMPOPO 17.0 12.0 1.0 30.0

MPUMALANGA 22.0 28.0 1.0 51.0

NORTH WEST 31.0 24.0 0.0 55.0

NORTHERN CAPE 10.0 7.0 1.0 18.0

WESTERN CAPE 49.0 37.0 0.0 86.0

Total 489.0 488.0 17.0 994.0

.

. tab PROVINCE_DISTRICT GENDER

GENDER

PROVINCE_DISTRICT F M U Total

No.	No.	No.	No.	
EASTERN CAPE	_ALFRED NZO	4.0	1.0	0.0 5.0
EASTERN CAPE	_AMATHOLE	0.0	4.0	0.0 4.0
EASTERN CAPE	_BUFFALO CITY METRO	5.0	3.0	1.0 9.0
EASTERN CAPE	_CHRIS HANI	3.0	3.0	0.0 6.0
EASTERN CAPE	_JOE GQABI	4.0	4.0	0.0 8.0
EASTERN CAPE	_NELSON MANDELA BAY METRO	13.0	6.0	0.0 19.0
EASTERN CAPE	_O R TAMBO	11.0	5.0	0.0 16.0
EASTERN CAPE	_SARAH BAARTMAN	2.0	2.0	0.0 4.0
FREE STATE	_FEZILE DABI	9.0	6.0	0.0 15.0
FREE STATE	_LEJWELEPUTSWA	3.0	9.0	0.0 12.0
FREE STATE	_MANGAUNG METRO	7.0	14.0	0.0 21.0
FREE STATE	_THABO MOFUTSANYANA	6.0	8.0	0.0 14.0
FREE STATE	_XHARIEP	0.0	1.0	0.0 1.0
GAUTENG	_CITY OF JOHANNESBURG METRO	66.0	62.0	1.0 129.0
GAUTENG	_CITY OF TSHWANE METRO	14.0	27.0	0.0 41.0
GAUTENG	_EKURHULENI METRO	41.0	61.0	0.0 102.0
GAUTENG	_SEDIBENG	11.0	23.0	2.0 36.0
GAUTENG	_WEST RAND	7.0	8.0	0.0 15.0
KWAZULU-NATAL	_AMAJUBA	15.0	6.0	0.0 21.0
KWAZULU-NATAL	_ETHEKWINI METRO	59.0	48.0	5.0 112.0
KWAZULU-NATAL	_HARRY GWALA	4.0	8.0	0.0 12.0
KWAZULU-NATAL	_ILEMBE	7.0	9.0	0.0 16.0
KWAZULU-NATAL	_KING CETSHWAYO	4.0	4.0	1.0 9.0
KWAZULU-NATAL	_UGU	9.0	13.0	1.0 23.0
KWAZULU-NATAL	_UMGUNGUNDLOVU	16.0	24.0	2.0 42.0
KWAZULU-NATAL	_UMKHANYAKUDE	9.0	5.0	0.0 14.0
KWAZULU-NATAL	_UMZINYATHI	3.0	1.0	0.0 4.0
KWAZULU-NATAL	_UTHUKELA	4.0	9.0	1.0 14.0
KWAZULU-NATAL	_UTHUNGULU	8.0	2.0	0.0 10.0
KWAZULU-NATAL	_ZULULAND	16.0	4.0	0.0 20.0
LIMPOPO	_CAPRICORN	11.0	5.0	1.0 17.0

LIMPOPO_GREATER SEKHUKHUNE	3.0	1.0	0.0	4.0
LIMPOPO_UNKNOWN	0.0	1.0	0.0	1.0
LIMPOPO_VHEMBE	2.0	4.0	0.0	6.0
LIMPOPO_WATERBERG	1.0	1.0	0.0	2.0
MPUMALANGA_EHLANZENI	8.0	4.0	0.0	12.0
MPUMALANGA_GERT SIBANDE	6.0	16.0	0.0	22.0
MPUMALANGA_NKANGALA	8.0	8.0	1.0	17.0
NORTH WEST_BOJANALA PLATINUM	7.0	8.0	0.0	15.0
NORTH WEST_DR KENNETH KAUNDA	13.0	11.0	0.0	24.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	8.0	4.0	0.0	12.0
NORTH WEST_NGAKA MODIRI MOLEMA	3.0	1.0	0.0	4.0
NORTHERN CAPE_FRANCES BAARD	9.0	6.0	1.0	16.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	1.0	1.0	0.0	2.0
WESTERN CAPE_CAPE WINELANDS	1.0	1.0	0.0	2.0
WESTERN CAPE_CENTRAL KAROO	2.0	0.0	0.0	2.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	41.0	27.0	0.0	68.0
WESTERN CAPE_GARDEN ROUTE	3.0	7.0	0.0	10.0
WESTERN CAPE_OVERBERG	1.0	1.0	0.0	2.0
WESTERN CAPE_WEST COAST	1.0	1.0	0.0	2.0
Total	489.0	488.0	17.0	994.0

. restore

.

. preserve

.

. keep if YEAR_TESTED_DATE==2019

(4,963,898 observations deleted)

.

```
. drop if HEPATITIS_B_CORE_IGM=="NULL" | HEPATITIS_B_CORE_IGM=="UNKNOWN" |  
HEPATITIS_B_CORE_IGM=="INSUFFICIE  
> NT FOR FURTHER TESTS" | HEPATITIS_B_CORE_IGM=="." | HEPATITIS_B_CORE_IGM==""  
(1,284,434 observations deleted)
```

```
.  
. count  
67,055
```

```
. duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force
```

Duplicates in terms of UNIQUE_PATIENT_ID

(7,992 observations deleted)

```
.  
. count  
59,063
```

```
. duplicates drop GENDER DOB HOSPITAL_ID FACILITY_NAME if UNIQUE_PATIENT_ID ==-1, force
```

Duplicates in terms of GENDER DOB HOSPITAL_ID FACILITY_NAME

(7 observations deleted)

```
.  
. count  
59,056
```

```
. tab HEPATITIS_B_CORE_IGM
```

HEPATITIS_B_CORE_IGM	Freq.	Percent	Cum.
-----+-----			
EQUIVOCAL	69	0.12	0.12
LOW POSITIVE	39	0.07	0.18
NEGATIVE	56,921	96.38	96.57
POSITIVE	2,027	3.43	100.00
-----+-----			
Total	59,056	100.00	

.

. tab PROVINCE_NAME u

PROVINCE_NAME	No.
EASTERN CAPE	1,635.0
FREE STATE	3,927.0
GAUTENG	27,642.0
KWAZULU-NATAL	10,011.0
LIMPOPO	2,147.0
MPUMALANGA	1,982.0
NORTH WEST	4,999.0
NORTHERN CAPE	3,318.0
WESTERN CAPE	3,395.0
Total	59,056.0

.

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	No.
EASTERN CAPE_ALFRED NZO	52.0
EASTERN CAPE_AMATHOLE	130.0
EASTERN CAPE_BUFFALO CITY METRO	589.0

EASTERN CAPE_CHRIS HANI 103.0
EASTERN CAPE_JOE GQABI 90.0
EASTERN CAPE_NELSON MANDELA BAY METRO 386.0
EASTERN CAPE_O R TAMBO 201.0
EASTERN CAPE_SARAH BAARTMAN 84.0
FREE STATE_FEZILE DABI 143.0
FREE STATE_LEJWELEPUTSWA 1,675.0
FREE STATE_MANGAUNG METRO 1,250.0
FREE STATE_THABO MOFUTSANYANA 706.0
FREE STATE_UNKNOWN 1.0
FREE STATE_XHARIEP 152.0
GAUTENG_CITY OF JOHANNESBURG METRO 16,559.0
GAUTENG_CITY OF TSHWANE METRO 1,018.0
GAUTENG_EKURHULENI METRO 5,818.0
GAUTENG_SEDIBENG 2,024.0
GAUTENG_UNKNOWN 23.0
GAUTENG_WEST RAND 2,200.0
KWAZULU-NATAL_AMAJUBA 313.0
KWAZULU-NATAL_ETHEKWINI METRO 4,619.0
KWAZULU-NATAL_HARRY GWALA 109.0
KWAZULU-NATAL_ILEMBE 312.0
KWAZULU-NATAL_KING CETSHWAYO 203.0
KWAZULU-NATAL_UGU 1,151.0
KWAZULU-NATAL_UMGUNGUNDLOVU 2,130.0
KWAZULU-NATAL_UMKHANYAKUDE 216.0
KWAZULU-NATAL_UMZINYATHI 170.0
KWAZULU-NATAL_UNKNOWN 3.0
KWAZULU-NATAL_UTHUKELA 170.0
KWAZULU-NATAL_UTHUNGULU 174.0
KWAZULU-NATAL_ZULULAND 441.0
LIMPOPO_CAPRICORN 1,642.0
LIMPOPO_GREATER SEKHUKHUNE 215.0

LIMPOPO_MOPANI	8.0
LIMPOPO_UNKNOWN	3.0
LIMPOPO_VHEMBE	240.0
LIMPOPO_WATERBERG	39.0
MPUMALANGA_EHLANZENI	200.0
MPUMALANGA_GERT SIBANDE	902.0
MPUMALANGA_NKANGALA	880.0
NORTH WEST_BOJANALA PLATINUM	863.0
NORTH WEST_DR KENNETH KAUNDA	3,766.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	226.0
NORTH WEST_NGAKA MODIRI MOLEMA	142.0
NORTH WEST_UNKNOWN	2.0
NORTHERN CAPE_FRANCES BAARD	2,697.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	27.0
NORTHERN CAPE_NAMAKWA	3.0
NORTHERN CAPE_PIXLEY KA SEME	544.0
NORTHERN CAPE_ZF MGCAWU	47.0
WESTERN CAPE_CAPE WINELANDS	58.0
WESTERN CAPE_CENTRAL KAROO	51.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	2,677.0
WESTERN CAPE_GARDEN ROUTE	524.0
WESTERN CAPE_OVERBERG	14.0
WESTERN CAPE_UNKNOWN	6.0
WESTERN CAPE_WEST COAST	65.0
Total	59,056.0

.

. tab GENDER

GENDER No.

F 31,114.0

M 26,870.0

U 1,072.0
Total 59,056.0

.

. tab PROVINCE_NAME GENDER

GENDER

PROVINCE_NAME	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE	773.0	851.0	11.0	1,635.0
FREE STATE	2,289.0	1,616.0	22.0	3,927.0
GAUTENG	15,041.0	12,049.0	552.0	27,642.0
KWAZULU-NATAL	4,560.0	5,139.0	312.0	10,011.0
LIMPOPO	1,241.0	886.0	20.0	2,147.0
MPUMALANGA	1,001.0	962.0	19.0	1,982.0
NORTH WEST	2,583.0	2,356.0	60.0	4,999.0
NORTHERN CAPE	1,822.0	1,440.0	56.0	3,318.0
WESTERN CAPE	1,804.0	1,571.0	20.0	3,395.0
Total	31,114.0	26,870.0	1,072.0	59,056.0

.

. tab PROVINCE_DISTRICT GENDER

GENDER

PROVINCE_DISTRICT	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE_ALFRED NZO	16.0	35.0	1.0	52.0
EASTERN CAPE_AMATHOLE	62.0	68.0	0.0	130.0
EASTERN CAPE_BUFFALO CITY METRO	322.0	261.0	6.0	589.0
EASTERN CAPE_CHRIS HANI	52.0	50.0	1.0	103.0
EASTERN CAPE_JOE GQABI	31.0	59.0	0.0	90.0
EASTERN CAPE_NELSON MANDELA BAY METRO	164.0	221.0	1.0	386.0

EASTERN CAPE_ORTAMBO	96.0	104.0	1.0	201.0
EASTERN CAPE_SARAH BAARTMAN	30.0	53.0	1.0	84.0
FREE STATE_FEZILE DABI	82.0	60.0	1.0	143.0
FREE STATE_LEJWELEPUTSWA	1,004.0	654.0	17.0	1,675.0
FREE STATE_MANGAUNG METRO	712.0	534.0	4.0	1,250.0
FREE STATE_THABO MOFUTSANYANA	409.0	297.0	0.0	706.0
FREE STATE_UNKNOWN	1.0	0.0	0.0	1.0
FREE STATE_XHARIEP	81.0	71.0	0.0	152.0
GAUTENG_CITY OF JOHANNESBURG METRO	9,033.0	7,131.0	395.0	16,559.0
GAUTENG_CITY OF TSHWANE METRO	423.0	581.0	14.0	1,018.0
GAUTENG_EKURHULENI METRO	3,313.0	2,416.0	89.0	5,818.0
GAUTENG_SEDIBENG	1,073.0	925.0	26.0	2,024.0
GAUTENG_UNKNOWN	15.0	5.0	3.0	23.0
GAUTENG_WEST RAND	1,184.0	991.0	25.0	2,200.0
KWAZULU-NATAL_AMAJUBA	133.0	160.0	20.0	313.0
KWAZULU-NATAL_ETHEKWINI METRO	2,176.0	2,342.0	101.0	4,619.0
KWAZULU-NATAL_HARRY GWALA	42.0	63.0	4.0	109.0
KWAZULU-NATAL_ILEMBE	126.0	168.0	18.0	312.0
KWAZULU-NATAL_KING CETSHWAYO	71.0	121.0	11.0	203.0
KWAZULU-NATAL_UGU	562.0	569.0	20.0	1,151.0
KWAZULU-NATAL_UMGUNGUNDLOVU	895.0	1,120.0	115.0	2,130.0
KWAZULU-NATAL_UMKHANYAKUDE	88.0	126.0	2.0	216.0
KWAZULU-NATAL_UMZINYATHI	66.0	102.0	2.0	170.0
KWAZULU-NATAL_UNKNOWN	0.0	2.0	1.0	3.0
KWAZULU-NATAL_UTHUKELA	86.0	82.0	2.0	170.0
KWAZULU-NATAL_UTHUNGULU	82.0	87.0	5.0	174.0
KWAZULU-NATAL_ZULULAND	233.0	197.0	11.0	441.0
LIMPOPO_CAPRICORN	932.0	697.0	13.0	1,642.0
LIMPOPO_GREATER SEKHUKHUNE	127.0	86.0	2.0	215.0
LIMPOPO_MOPANI	6.0	2.0	0.0	8.0
LIMPOPO_UNKNOWN	2.0	1.0	0.0	3.0
LIMPOPO_VHEMBE	148.0	88.0	4.0	240.0

LIMPOPO_WATERBERG	26.0	12.0	1.0	39.0
MPUMALANGA_EHLANZENI	114.0	85.0	1.0	200.0
MPUMALANGA_GERT SIBANDE	427.0	469.0	6.0	902.0
MPUMALANGA_NKANGALA	460.0	408.0	12.0	880.0
NORTH WEST_BOJANALA PLATINUM	389.0	458.0	16.0	863.0
NORTH WEST_DR KENNETH KAUNDA	2,008.0	1,717.0	41.0	3,766.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	107.0	117.0	2.0	226.0
NORTH WEST_NGAKA MODIRI MOLEMA	79.0	62.0	1.0	142.0
NORTH WEST_UNKNOWN	0.0	2.0	0.0	2.0
NORTHERN CAPE_FRANCES BAARD	1,448.0	1,200.0	49.0	2,697.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	19.0	8.0	0.0	27.0
NORTHERN CAPE_NAMAKWA	1.0	2.0	0.0	3.0
NORTHERN CAPE_PIXLEY KA SEME	332.0	205.0	7.0	544.0
NORTHERN CAPE_ZF MGCAWU	22.0	25.0	0.0	47.0
WESTERN CAPE_CAPE WINELANDS	26.0	32.0	0.0	58.0
WESTERN CAPE_CENTRAL KAROO	27.0	24.0	0.0	51.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	1,422.0	1,235.0	20.0	2,677.0
WESTERN CAPE_GARDEN ROUTE	275.0	249.0	0.0	524.0
WESTERN CAPE_OVERBERG	8.0	6.0	0.0	14.0
WESTERN CAPE_UNKNOWN	3.0	3.0	0.0	6.0
WESTERN CAPE_WEST COAST	43.0	22.0	0.0	65.0
Total	31,114.0	26,870.0	1,072.0	59,056.0

. restore

Appendix 5.1: Stata Log file of anti-HBs results and analysis

```
. use "2015-2019_HepatitisB_All_Records.dta"
```

```
. count
```

```
6,315,380
```

```
.
```

```
. tab HEPATITIS_B_SURFACE_AB
```

HEPATITIS_B_SURFACE_AB	Freq.	Percent	Cum.
-----+-----			
EQUIVOCAL	2,701	0.04	0.04
LOW POSITIVE	305	0.00	0.05
NEGATIVE	445,808	7.06	7.11
NULL	5,551,697	87.91	95.01
POSITIVE	314,854	4.99	100.00
UNKNOWN	15	0.00	100.00
-----+-----			
Total	6,315,380	100.00	

```
. count
```

```
6,315,380
```

```
.
```

```
. drop if HEPATITIS_B_SURFACE_AB=="NULL" | HEPATITIS_B_SURFACE_AB=="UNKNOWN"  
(5,551,712 observations deleted)
```

```
.
```

```
. count
```

763,668

.

```
. tab HEPATITIS_B_SURFACE_AB
```

HEPATITIS_B_SURFACE_AB	Freq.	Percent	Cum.
-----+-----			
EQUIVOCAL	2,701	0.35	0.35
LOW POSITIVE	305	0.04	0.39
NEGATIVE	445,808	58.38	58.77
POSITIVE	314,854	41.23	100.00
-----+-----			
Total	763,668	100.00	

.

```
. count
```

763,668

```
. gsort- TAKEN_DATE
```

.

```
. do "Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD  
Output files_SM081020\Files_Chapter3\26-09-23\Deduplication_Commands.do"
```

```
. capture noisily duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force
```

Duplicates in terms of UNIQUE_PATIENT_ID

(132,420 observations deleted)

```
. capture noisily duplicates drop DOB HOSPITAL_ID FACILITY_NAME if UNIQUE_PATIENT_ID ==-1,  
force
```

Duplicates in terms of DOB HOSPITAL_ID FACILITY_NAME

(38 observations deleted)

.

end of do-file

. count

631,210

. tab GENDER

GENDER	Freq.	Percent	Cum.
-----+-----			
F	377,617	59.82	59.82
M	243,809	38.63	98.45
U	9,784	1.55	100.00
-----+-----			
Total	631,210	100.00	

.

. tab PROVINCE_NAME

PROVINCE_NAME	Freq.	Percent	Cum.
-----+-----			
EASTERN CAPE	42,292	6.70	6.70
FREE STATE	38,777	6.14	12.84
GAUTENG	158,686	25.14	37.98
KWAZULU-NATAL	150,138	23.79	61.77
LIMPOPO	45,014	7.13	68.90
MPUMALANGA	58,568	9.28	78.18
NORTH WEST	47,102	7.46	85.64

NORTHERN CAPE	23,159	3.67	89.31	
WESTERN CAPE	67,474	10.69	100.00	
-----+-----				
Total	631,210	100.00		
.				
. tab PROVINCE_DISTRICT				
PROVINCE_DISTRICT	Freq.	Percent	Cum.	
-----+-----				
EASTERN CAPE_ALFRED NZO	3,993	0.63	0.63	
EASTERN CAPE_AMATHOLE	2,407	0.38	1.01	
EASTERN CAPE_BUFFALO CITY METRO	3,918	0.62	1.63	
EASTERN CAPE_CHRIS HANI	2,726	0.43	2.07	
EASTERN CAPE_JOE GQABI	1,468	0.23	2.30	
EASTERN CAPE_NELSON MANDELA BAY METRO	11,046	1.75	4.05	
EASTERN CAPE_NOT APPLICABLE	2	0.00	4.05	
EASTERN CAPE_O R TAMBO	13,137	2.08	6.13	
EASTERN CAPE_SARAH BAARTMAN	3,590	0.57	6.70	
EASTERN CAPE_UNKNOWN	5	0.00	6.70	
FREE STATE_FEZILE DABI	2,909	0.46	7.16	
FREE STATE_LEJWELEPUTSWA	6,313	1.00	8.16	
FREE STATE_MANGAUNG METRO	21,925	3.47	11.63	
FREE STATE_NOT APPLICABLE	1	0.00	11.63	
FREE STATE_THABO MOFUTSANYANA	6,236	0.99	12.62	
FREE STATE_UNKNOWN	267	0.04	12.67	
FREE STATE_XHARIEP	1,126	0.18	12.84	
GAUTENG_CITY OF JOHANNESBURG METRO	75,851	12.02	24.86	
GAUTENG_CITY OF TSHWANE METRO	41,642	6.60	31.46	
GAUTENG_EKURHULENI METRO	24,048	3.81	35.27	
GAUTENG_SEDIBENG	8,276	1.31	36.58	
GAUTENG_UNKNOWN	1,913	0.30	36.88	

GAUTENG_WEST RAND	6,956	1.10	37.98
KWAZULU-NATAL_AMAJUBA	5,696	0.90	38.89
KWAZULU-NATAL_ETHEKWINI METRO	60,667	9.61	48.50
KWAZULU-NATAL_HARRY GWALA	3,799	0.60	49.10
KWAZULU-NATAL_ILEMBE	7,950	1.26	50.36
KWAZULU-NATAL_KING CETSHWAYO	3,824	0.61	50.96
KWAZULU-NATAL_UGU	19,542	3.10	54.06
KWAZULU-NATAL_UMGUNGUNDLOVU	32,988	5.23	59.29
KWAZULU-NATAL_UMKHANYAKUDE	2,379	0.38	59.66
KWAZULU-NATAL_UMZINYATHI	5,535	0.88	60.54
KWAZULU-NATAL_UNKNOWN	15	0.00	60.54
KWAZULU-NATAL_UTHUKELA	3,833	0.61	61.15
KWAZULU-NATAL_UTHUNGULU	1,516	0.24	61.39
KWAZULU-NATAL_ZULULAND	2,394	0.38	61.77
LIMPOPO_CAPRICORN	20,445	3.24	65.01
LIMPOPO_GREATER SEKHUKHUNE	5,404	0.86	65.86
LIMPOPO_MOPANI	7,339	1.16	67.03
LIMPOPO_UNKNOWN	16	0.00	67.03
LIMPOPO_VHEMBE	6,686	1.06	68.09
LIMPOPO_WATERBERG	5,124	0.81	68.90
MPUMALANGA_EHLANZENI	22,569	3.58	72.48
MPUMALANGA_GERT SIBANDE	24,896	3.94	76.42
MPUMALANGA_NKANGALA	11,044	1.75	78.17
MPUMALANGA_UNKNOWN	59	0.01	78.18
NORTH WEST_BOJANALA PLATINUM	32,009	5.07	83.25
NORTH WEST_DR KENNETH KAUNDA	4,517	0.72	83.97
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	4,995	0.79	84.76
NORTH WEST_NGAKA MODIRI MOLEMA	5,580	0.88	85.64
NORTH WEST_UNKNOWN	1	0.00	85.64
NORTHERN CAPE_FRANCES BAARD	14,473	2.29	87.93
NORTHERN CAPE_JOHN TAOLO GAETSEWE	889	0.14	88.08
NORTHERN CAPE_NAMAKWA	1,685	0.27	88.34

NORTHERN CAPE_PIXLEY KA SEME	1,371	0.22	88.56
NORTHERN CAPE_UNKNOWN	88	0.01	88.57
NORTHERN CAPE_ZF MGCAWU	4,653	0.74	89.31
WESTERN CAPE_CAPE WINELANDS	9,723	1.54	90.85
WESTERN CAPE_CENTRAL KAROO	871	0.14	90.99
WESTERN CAPE_CITY OF CAPE TOWN METRO	45,435	7.20	98.19
WESTERN CAPE_GARDEN ROUTE	6,847	1.08	99.27
WESTERN CAPE_NOT APPLICABLE	26	0.00	99.28
WESTERN CAPE_OVERBERG	1,881	0.30	99.57
WESTERN CAPE_UNKNOWN	563	0.09	99.66
WESTERN CAPE_WEST COAST	2,128	0.34	100.00

-----+-----

Total | 631,210 100.00

.

. tab TAKEN_DATE_AGE_GROUP

RECODE of |

AGE_TAKEN_D |

ATE_YEARS | Freq. Percent Cum.

-----+-----

'0-4	13,617	2.16	2.16
'5-9	8,938	1.42	3.57
'10-14	12,061	1.91	5.48
'15-19	24,927	3.95	9.43
'20-24	60,068	9.52	18.95
'25-29	85,764	13.59	32.54
'30-34	90,657	14.36	46.90
'35-39	78,025	12.36	59.26
'40-44	64,554	10.23	69.49
'45-49	49,734	7.88	77.37
'50-54	39,413	6.24	83.61

'55-59	30,874	4.89	88.50
'60+	50,892	8.06	96.56
99999	21,686	3.44	100.00
-----+			
Total	631,210	100.00	

.

```
. tab TAKEN_DATE_AGE_GROUP GENDER, row col
```

+-----+				
Key				

frequency				
row percentage				
column percentage				
+-----+				

RECODE of |

AGE_TAKEN_	GENDER			
DATE_YEARS	F	M	U	Total
-----+				
'0-4	6,572	6,641	404	13,617
	48.26	48.77	2.97	100.00
	1.74	2.72	4.13	2.16
-----+				
'5-9	5,082	3,633	223	8,938
	56.86	40.65	2.49	100.00
	1.35	1.49	2.28	1.42
-----+				
'10-14	8,048	3,825	188	12,061
	66.73	31.71	1.56	100.00
	2.13	1.57	1.92	1.91

-----+-----+-----				
'15-19	18,703	5,936	288	24,927
	75.03	23.81	1.16	100.00
	4.95	2.43	2.94	3.95
-----+-----+-----				
'20-24	44,556	14,738	774	60,068
	74.18	24.54	1.29	100.00
	11.80	6.04	7.91	9.52
-----+-----+-----				
'25-29	57,838	26,896	1,030	85,764
	67.44	31.36	1.20	100.00
	15.32	11.03	10.53	13.59
-----+-----+-----				
'30-34	55,269	34,343	1,045	90,657
	60.96	37.88	1.15	100.00
	14.64	14.09	10.68	14.36
-----+-----+-----				
'35-39	44,250	32,931	844	78,025
	56.71	42.21	1.08	100.00
	11.72	13.51	8.63	12.36
-----+-----+-----				
'40-44	34,667	29,243	644	64,554
	53.70	45.30	1.00	100.00
	9.18	11.99	6.58	10.23
-----+-----+-----				
'45-49	26,562	22,632	540	49,734
	53.41	45.51	1.09	100.00
	7.03	9.28	5.52	7.88
-----+-----+-----				
'50-54	21,739	17,289	385	39,413
	55.16	43.87	0.98	100.00
	5.76	7.09	3.93	6.24

-----+-----+-----				
'55-59	16,889	13,670	315	30,874
	54.70	44.28	1.02	100.00
	4.47	5.61	3.22	4.89
-----+-----+-----				
'60+	26,979	23,368	545	50,892
	53.01	45.92	1.07	100.00
	7.14	9.58	5.57	8.06
-----+-----+-----				
99999	10,463	8,664	2,559	21,686
	48.25	39.95	11.80	100.00
	2.77	3.55	26.15	3.44
-----+-----+-----				
Total	377,617	243,809	9,784	631,210
	59.82	38.63	1.55	100.00
	100.00	100.00	100.00	100.00

```
.
. tab PROVINCE_NAME GENDER, row col
```

+-----+				
Key				

frequency				
row percentage				
column percentage				
+-----+				
		GENDER		
PROVINCE_NAME	F	M	U	Total
-----+-----+-----				
EASTERN CAPE	27,279	14,649	364	42,292

		64.50	34.64	0.86		100.00
		7.22	6.01	3.72		6.70
-----+-----+-----						
FREE STATE		23,194	15,394	189		38,777
		59.81	39.70	0.49		100.00
		6.14	6.31	1.93		6.14
-----+-----+-----						
GAUTENG		91,055	64,744	2,887		158,686
		57.38	40.80	1.82		100.00
		24.11	26.56	29.51		25.14
-----+-----+-----						
KWAZULU-NATAL		90,646	55,415	4,077		150,138
		60.38	36.91	2.72		100.00
		24.00	22.73	41.67		23.79
-----+-----+-----						
LIMPOPO		28,382	16,345	287		45,014
		63.05	36.31	0.64		100.00
		7.52	6.70	2.93		7.13
-----+-----+-----						
MPUMALANGA		35,307	22,738	523		58,568
		60.28	38.82	0.89		100.00
		9.35	9.33	5.35		9.28
-----+-----+-----						
NORTH WEST		29,422	17,197	483		47,102
		62.46	36.51	1.03		100.00
		7.79	7.05	4.94		7.46
-----+-----+-----						
NORTHERN CAPE		13,168	9,644	347		23,159
		56.86	41.64	1.50		100.00
		3.49	3.96	3.55		3.67
-----+-----+-----						
WESTERN CAPE		39,164	27,683	627		67,474

		58.04	41.03	0.93		100.00
		10.37	11.35	6.41		10.69
-----+-----+-----						
Total		377,617	243,809	9,784		631,210
		59.82	38.63	1.55		100.00
		100.00	100.00	100.00		100.00

.
.tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME, row col

+-----+	
Key	

frequency	
row percentage	
column percentage	
+-----+	

RECODE of |
AGE_TAKEN_ | PROVINCE_NAME
DATE_YEARS | EASTERN.. FREE ST.. GAUTENG KWAZULU.. LIMPOPO MPUMALA.. NORTH W..
NORTHER.. WESTERN.. | Total

-----+-----+-----											
'0-4		629	565	3,228	4,283	1,255	958	425	463	1,811	13,617
		4.62	4.15	23.71	31.45	9.22	7.04	3.12	3.40	13.30	100.00
		1.49	1.46	2.03	2.85	2.79	1.64	0.90	2.00	2.68	2.16
-----+-----+-----											
'5-9		393	267	1,782	2,861	734	848	324	295	1,434	8,938
		4.40	2.99	19.94	32.01	8.21	9.49	3.62	3.30	16.04	100.00
		0.93	0.69	1.12	1.91	1.63	1.45	0.69	1.27	2.13	1.42
-----+-----+-----											
'10-14		423	397	2,565	3,686	1,198	1,191	594	380	1,627	12,061
		3.51	3.29	21.27	30.56	9.93	9.87	4.92	3.15	13.49	100.00

		1.00	1.02	1.62	2.46	2.66	2.03	1.26	1.64	2.41		1.91
-----+-----												
'15-19		1,342	1,397	4,863	7,395	2,380	2,654	1,642	839	2,415		24,927
		5.38	5.60	19.51	29.67	9.55	10.65	6.59	3.37	9.69		100.00
		3.17	3.60	3.06	4.93	5.29	4.53	3.49	3.62	3.58		3.95
-----+-----												
'20-24		3,869	3,729	13,058	17,391	3,828	5,809	4,427	1,857	6,100		60,068
		6.44	6.21	21.74	28.95	6.37	9.67	7.37	3.09	10.16		100.00
		9.15	9.62	8.23	11.58	8.50	9.92	9.40	8.02	9.04		9.52
-----+-----												
'25-29		5,678	5,538	19,798	21,701	5,131	8,872	7,393	2,915	8,738		85,764
		6.62	6.46	23.08	25.30	5.98	10.34	8.62	3.40	10.19		100.00
		13.43	14.28	12.48	14.45	11.40	15.15	15.70	12.59	12.95		13.59
-----+-----												
'30-34		6,003	5,696	22,031	21,530	5,639	9,434	7,936	3,153	9,235		90,657
		6.62	6.28	24.30	23.75	6.22	10.41	8.75	3.48	10.19		100.00
		14.19	14.69	13.88	14.34	12.53	16.11	16.85	13.61	13.69		14.36
-----+-----												
'35-39		5,398	4,958	19,919	17,156	5,509	7,574	6,839	3,040	7,632		78,025
		6.92	6.35	25.53	21.99	7.06	9.71	8.77	3.90	9.78		100.00
		12.76	12.79	12.55	11.43	12.24	12.93	14.52	13.13	11.31		12.36
-----+-----												
'40-44		4,634	4,311	16,794	13,432	4,913	5,967	5,428	2,649	6,426		64,554
		7.18	6.68	26.02	20.81	7.61	9.24	8.41	4.10	9.95		100.00
		10.96	11.12	10.58	8.95	10.91	10.19	11.52	11.44	9.52		10.23
-----+-----												
'45-49		3,568	3,591	12,993	9,622	3,718	4,273	3,951	2,209	5,809		49,734
		7.17	7.22	26.12	19.35	7.48	8.59	7.94	4.44	11.68		100.00
		8.44	9.26	8.19	6.41	8.26	7.30	8.39	9.54	8.61		7.88

-----+-----										
'50-54	3,182	2,830	9,890	7,945	3,020	3,083	2,781	1,632	5,050	39,413
	8.07	7.18	25.09	20.16	7.66	7.82	7.06	4.14	12.81	100.00
	7.52	7.30	6.23	5.29	6.71	5.26	5.90	7.05	7.48	6.24
-----+-----										
'55-59	2,674	2,223	7,794	6,337	2,277	2,183	2,047	1,263	4,076	30,874
	8.66	7.20	25.24	20.53	7.38	7.07	6.63	4.09	13.20	100.00
	6.32	5.73	4.91	4.22	5.06	3.73	4.35	5.45	6.04	4.89
-----+-----										
'60+	3,606	3,007	13,505	12,501	4,202	2,977	2,665	2,009	6,420	50,892
	7.09	5.91	26.54	24.56	8.26	5.85	5.24	3.95	12.61	100.00
	8.53	7.75	8.51	8.33	9.33	5.08	5.66	8.67	9.51	8.06
-----+-----										
99999	893	268	10,466	4,298	1,210	2,745	650	455	701	21,686
	4.12	1.24	48.26	19.82	5.58	12.66	3.00	2.10	3.23	100.00
	2.11	0.69	6.60	2.86	2.69	4.69	1.38	1.96	1.04	3.44
-----+-----										
Total	42,292	38,777	158,686	150,138	45,014	58,568	47,102	23,159	67,474	631,210
	6.70	6.14	25.14	23.79	7.13	9.28	7.46	3.67	10.69	100.00
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

.

. preserve

. tab HEPATITIS_B_SURFACE_AB

HEPATITIS_B_SURFACE_AB	Freq.	Percent	Cum.
-----+-----			
EQUIVOCAL	1,920	0.30	0.30
LOW POSITIVE	269	0.04	0.35
NEGATIVE	373,266	59.13	59.48
POSITIVE	255,755	40.52	100.00

```
-----+-----
Total | 631,210 100.00
```

```
.
. count
631,210
```

```
.
. keep if HEPATITIS_B_SURFACE_AB=="LOW POSITIVE" | HEPATITIS_B_SURFACE_AB=="POSITIVE"
(375,186 observations deleted)
```

```
.
. count
256,024
```

```
.
. tab HEPATITIS_B_SURFACE_AB
```

HEPATITIS_B_SURFACE_AB	Freq.	Percent	Cum.
-----+-----			
LOW POSITIVE	269	0.11	0.11
POSITIVE	255,755	99.89	100.00
-----+-----			
Total	256,024	100.00	

```
. tab GENDER
```

GENDER	Freq.	Percent	Cum.
-----+-----			
F	157,868	61.66	61.66
M	93,843	36.65	98.32
U	4,313	1.68	100.00

```
-----+-----
Total | 256,024 100.00
```

```
.
.
. tab PROVINCE_NAME
```

```

PROVINCE_NAME | Freq. Percent Cum.
-----+-----
EASTERN CAPE | 23,316 9.11 9.11
FREE STATE | 17,169 6.71 15.81
GAUTENG | 58,639 22.90 38.72
KWAZULU-NATAL | 65,067 25.41 64.13
LIMPOPO | 16,341 6.38 70.51
MPUMALANGA | 21,204 8.28 78.80
NORTH WEST | 16,224 6.34 85.13
NORTHERN CAPE | 7,866 3.07 88.21
WESTERN CAPE | 30,198 11.79 100.00
-----+-----
Total | 256,024 100.00
```

```
.
.
. tab PROVINCE_DISTRICT
```

```

PROVINCE_DISTRICT | Freq. Percent Cum.
-----+-----
EASTERN CAPE_ALFRED NZO | 1,589 0.62 0.62
EASTERN CAPE_AMATHOLE | 1,219 0.48 1.10
EASTERN CAPE_BUFFALO CITY METRO | 1,867 0.73 1.83
EASTERN CAPE_CHRIS HANI | 1,245 0.49 2.31
EASTERN CAPE_JOE GQABI | 608 0.24 2.55
EASTERN CAPE_NELSON MANDELA BAY METRO | 8,413 3.29 5.84
EASTERN CAPE_NOT APPLICABLE | 1 0.00 5.84
```

EASTERN CAPE_O R TAMBO	5,833	2.28	8.11
EASTERN CAPE_SARAH BAARTMAN	2,539	0.99	9.11
EASTERN CAPE_UNKNOWN	2	0.00	9.11
FREE STATE_FEZILE DABI	1,231	0.48	9.59
FREE STATE_LEJWELEPUTSWA	2,586	1.01	10.60
FREE STATE_MANGAUNG METRO	9,833	3.84	14.44
FREE STATE_THABO MOFUTSANYANA	2,770	1.08	15.52
FREE STATE_UNKNOWN	240	0.09	15.61
FREE STATE_XHARIEP	509	0.20	15.81
GAUTENG_CITY OF JOHANNESBURG METRO	28,722	11.22	27.03
GAUTENG_CITY OF TSHWANE METRO	14,788	5.78	32.81
GAUTENG_EKURHULENI METRO	8,484	3.31	36.12
GAUTENG_SEDIBENG	2,653	1.04	37.16
GAUTENG_UNKNOWN	1,489	0.58	37.74
GAUTENG_WEST RAND	2,503	0.98	38.72
KWAZULU-NATAL_AMAJUBA	2,890	1.13	39.85
KWAZULU-NATAL_ETHEKWINI METRO	25,407	9.92	49.77
KWAZULU-NATAL_HARRY GWALA	1,598	0.62	50.39
KWAZULU-NATAL_ILEMBE	3,450	1.35	51.74
KWAZULU-NATAL_KING CETSHWAYO	1,863	0.73	52.47
KWAZULU-NATAL_UGU	8,311	3.25	55.71
KWAZULU-NATAL_UMGUNGUNDLOVU	13,896	5.43	61.14
KWAZULU-NATAL_UMKHANYAKUDE	1,267	0.49	61.64
KWAZULU-NATAL_UMZINYATHI	2,763	1.08	62.72
KWAZULU-NATAL_UNKNOWN	3	0.00	62.72
KWAZULU-NATAL_UTHUKELA	1,720	0.67	63.39
KWAZULU-NATAL_UTHUNGULU	769	0.30	63.69
KWAZULU-NATAL_ZULULAND	1,130	0.44	64.13
LIMPOPO_CAPRICORN	7,506	2.93	67.06
LIMPOPO_GREATER SEKHUKHUNE	1,781	0.70	67.76
LIMPOPO_MOPANI	2,744	1.07	68.83
LIMPOPO_UNKNOWN	9	0.00	68.83

LIMPOPO_VHEMBE	2,469	0.96	69.80
LIMPOPO_WATERBERG	1,832	0.72	70.51
MPUMALANGA_EHLANZENI	8,369	3.27	73.78
MPUMALANGA_GERT SIBANDE	8,591	3.36	77.14
MPUMALANGA_NKANGALA	4,196	1.64	78.78
MPUMALANGA_UNKNOWN	48	0.02	78.80
NORTH WEST_BOJANALA PLATINUM	10,163	3.97	82.77
NORTH WEST_DR KENNETH KAUNDA	1,675	0.65	83.42
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	1,948	0.76	84.18
NORTH WEST_NGAKA MODIRI MOLEMA	2,438	0.95	85.13
NORTHERN CAPE_FRANCES BAARD	4,614	1.80	86.93
NORTHERN CAPE_JOHN TAOLO GAETSEWE	316	0.12	87.06
NORTHERN CAPE_NAMAKWA	558	0.22	87.28
NORTHERN CAPE_PIXLEY KA SEME	524	0.20	87.48
NORTHERN CAPE_UNKNOWN	75	0.03	87.51
NORTHERN CAPE_ZF MGCAWU	1,779	0.69	88.21
WESTERN CAPE_CAPE WINELANDS	4,177	1.63	89.84
WESTERN CAPE_CENTRAL KAROO	352	0.14	89.97
WESTERN CAPE_CITY OF CAPE TOWN METRO	20,562	8.03	98.01
WESTERN CAPE_GARDEN ROUTE	3,027	1.18	99.19
WESTERN CAPE_NOT APPLICABLE	17	0.01	99.19
WESTERN CAPE_OVERBERG	744	0.29	99.48
WESTERN CAPE_UNKNOWN	462	0.18	99.67
WESTERN CAPE_WEST COAST	857	0.33	100.00

-----+-----
Total | 256,024 100.00

.
.tab TAKEN_DATE_AGE_GROUP

RECODE of |
AGE_TAKEN_D |

ATE_YEARS | Freq. Percent Cum.

+-----+			
'0-4	8,499	3.32	3.32
'5-9	5,031	1.97	5.28
'10-14	3,962	1.55	6.83
'15-19	7,344	2.87	9.70
'20-24	21,790	8.51	18.21
'25-29	32,723	12.78	30.99
'30-34	35,495	13.86	44.86
'35-39	31,589	12.34	57.20
'40-44	27,122	10.59	67.79
'45-49	21,784	8.51	76.30
'50-54	17,864	6.98	83.27
'55-59	13,783	5.38	88.66
'60+	20,431	7.98	96.64
99999	8,607	3.36	100.00
+-----+			
Total	256,024	100.00	

.
. tab TAKEN_DATE_AGE_GROUP GENDER, row col

+-----+
Key
frequency
row percentage
column percentage
+-----+

RECODE of |
AGE_TAKEN_ | GENDER

DATE_YEARS	F	M	U	Total
-----+-----+-----				
'0-4	4,224	4,027	248	8,499
	49.70	47.38	2.92	100.00
	2.68	4.29	5.75	3.32
-----+-----+-----				
'5-9	2,879	2,030	122	5,031
	57.23	40.35	2.42	100.00
	1.82	2.16	2.83	1.97
-----+-----+-----				
'10-14	2,596	1,313	53	3,962
	65.52	33.14	1.34	100.00
	1.64	1.40	1.23	1.55
-----+-----+-----				
'15-19	5,637	1,626	81	7,344
	76.76	22.14	1.10	100.00
	3.57	1.73	1.88	2.87
-----+-----+-----				
'20-24	16,490	5,035	265	21,790
	75.68	23.11	1.22	100.00
	10.45	5.37	6.14	8.51
-----+-----+-----				
'25-29	22,688	9,649	386	32,723
	69.33	29.49	1.18	100.00
	14.37	10.28	8.95	12.78
-----+-----+-----				
'30-34	22,503	12,575	417	35,495
	63.40	35.43	1.17	100.00
	14.25	13.40	9.67	13.86
-----+-----+-----				
'35-39	18,815	12,424	350	31,589
	59.56	39.33	1.11	100.00

		11.92	13.24	8.12		12.34
-----+-----+-----						
'40-44		15,619	11,227	276		27,122
		57.59	41.39	1.02		100.00
		9.89	11.96	6.40		10.59
-----+-----+-----						
'45-49		12,593	8,953	238		21,784
		57.81	41.10	1.09		100.00
		7.98	9.54	5.52		8.51
-----+-----+-----						
'50-54		10,528	7,141	195		17,864
		58.93	39.97	1.09		100.00
		6.67	7.61	4.52		6.98
-----+-----+-----						
'55-59		8,038	5,626	119		13,783
		58.32	40.82	0.86		100.00
		5.09	6.00	2.76		5.38
-----+-----+-----						
'60+		11,056	9,143	232		20,431
		54.11	44.75	1.14		100.00
		7.00	9.74	5.38		7.98
-----+-----+-----						
99999		4,202	3,074	1,331		8,607
		48.82	35.72	15.46		100.00
		2.66	3.28	30.86		3.36
-----+-----+-----						
Total		157,868	93,843	4,313		256,024
		61.66	36.65	1.68		100.00
		100.00	100.00	100.00		100.00

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. tab PROVINCE_NAME GENDER, row col


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+-----+
| Key      |
|-----|
| frequency |
| row percentage |
| column percentage |
+-----+

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	GENDER			
PROVINCE_NAME	F	M	U	Total
-----+-----+-----				
EASTERN CAPE	15,044	8,091	181	23,316
	64.52	34.70	0.78	100.00
	9.53	8.62	4.20	9.11
-----+-----+-----				
FREE STATE	10,827	6,247	95	17,169
	63.06	36.39	0.55	100.00
	6.86	6.66	2.20	6.71
-----+-----+-----				
GAUTENG	35,125	22,288	1,226	58,639
	59.90	38.01	2.09	100.00
	22.25	23.75	28.43	22.90
-----+-----+-----				
KWAZULU-NATAL	40,540	22,782	1,745	65,067
	62.31	35.01	2.68	100.00
	25.68	24.28	40.46	25.41
-----+-----+-----				
LIMPOPO	10,036	6,199	106	16,341
	61.42	37.94	0.65	100.00
	6.36	6.61	2.46	6.38
-----+-----+-----				

MPUMALANGA		13,241	7,777	186		21,204
		62.45	36.68	0.88		100.00
		8.39	8.29	4.31		8.28
-----+-----+-----						
NORTH WEST		10,453	5,592	179		16,224
		64.43	34.47	1.10		100.00
		6.62	5.96	4.15		6.34
-----+-----+-----						
NORTHERN CAPE		4,559	3,180	127		7,866
		57.96	40.43	1.61		100.00
		2.89	3.39	2.94		3.07
-----+-----+-----						
WESTERN CAPE		18,043	11,687	468		30,198
		59.75	38.70	1.55		100.00
		11.43	12.45	10.85		11.79
-----+-----+-----						
Total		157,868	93,843	4,313		256,024
		61.66	36.65	1.68		100.00
		100.00	100.00	100.00		100.00

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.
. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME, row col

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+-----+	
Key	

frequency	
row percentage	
column percentage	
+-----+	

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RECODE of |

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AGE_TAKEN_	PROVINCE_NAME									
DATE_YEARS	EASTERN..	FREE ST..	GAUTENG	KWAZULU..	LIMPOPO	MPUMALA..	NORTH W..	NORTHER..	WESTERN..	Total
'0-4	375	331	2,008	2,660	800	578	238	260	1,249	8,499
	4.41	3.89	23.63	31.30	9.41	6.80	2.80	3.06	14.70	100.00
	1.61	1.93	3.42	4.09	4.90	2.73	1.47	3.31	4.14	3.32
'5-9	182	129	1,046	1,539	451	449	176	128	931	5,031
	3.62	2.56	20.79	30.59	8.96	8.92	3.50	2.54	18.51	100.00
	0.78	0.75	1.78	2.37	2.76	2.12	1.08	1.63	3.08	1.97
'10-14	106	131	994	1,037	430	310	182	117	655	3,962
	2.68	3.31	25.09	26.17	10.85	7.82	4.59	2.95	16.53	100.00
	0.45	0.76	1.70	1.59	2.63	1.46	1.12	1.49	2.17	1.55
'15-19	368	542	1,681	1,929	727	660	472	210	755	7,344
	5.01	7.38	22.89	26.27	9.90	8.99	6.43	2.86	10.28	100.00
	1.58	3.16	2.87	2.96	4.45	3.11	2.91	2.67	2.50	2.87
'20-24	1,563	1,613	5,099	6,182	1,049	1,717	1,372	556	2,639	21,790
	7.17	7.40	23.40	28.37	4.81	7.88	6.30	2.55	12.11	100.00
	6.70	9.39	8.70	9.50	6.42	8.10	8.46	7.07	8.74	8.51
'25-29	2,772	2,300	7,058	9,156	1,476	2,839	2,401	937	3,784	32,723
	8.47	7.03	21.57	27.98	4.51	8.68	7.34	2.86	11.56	100.00
	11.89	13.40	12.04	14.07	9.03	13.39	14.80	11.91	12.53	12.78
'30-34	3,179	2,503	7,652	9,785	1,755	3,204	2,589	939	3,889	35,495
	8.96	7.05	21.56	27.57	4.94	9.03	7.29	2.65	10.96	100.00
	13.63	14.58	13.05	15.04	10.74	15.11	15.96	11.94	12.88	13.86
'35-39	2,988	2,177	7,074	8,100	1,819	2,820	2,360	987	3,264	31,589

[illegible]

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. tab HEPATITIS_B_SURFACE_AB

HEPATITIS_B_SURFACE_AB	Freq.	Percent	Cum.
-----+-----			
LOW POSITIVE	269	0.11	0.11
POSITIVE	255,755	99.89	100.00
-----+-----			
Total	256,024	100.00	

.

. count

256,024

.

. restore

.

. tab HEPATITIS_B_SURFACE_AB

HEPATITIS_B_SURFACE_AB	Freq.	Percent	Cum.
-----+-----			
EQUIVOCAL	1,920	0.30	0.30
LOW POSITIVE	269	0.04	0.35
NEGATIVE	373,266	59.13	59.48
POSITIVE	255,755	40.52	100.00
-----+-----			
Total	631,210	100.00	

.

. keep if HEPATITIS_B_SURFACE_AB == "NEGATIVE"

(257,944 observations deleted)

.

. count

373,266

.

. tab GENDER

GENDER	Freq.	Percent	Cum.
-----+-----			
F	218,608	58.57	58.57
M	149,199	39.97	98.54
U	5,459	1.46	100.00
-----+-----			
Total	373,266	100.00	

.

. tab PROVINCE_NAME

PROVINCE_NAME	Freq.	Percent	Cum.
-----+-----			
EASTERN CAPE	18,975	5.08	5.08
FREE STATE	20,605	5.52	10.60
GAUTENG	100,045	26.80	37.41
KWAZULU-NATAL	85,067	22.79	60.20
LIMPOPO	28,670	7.68	67.88
MPUMALANGA	37,241	9.98	77.85
NORTH WEST	30,727	8.23	86.09
NORTHERN CAPE	14,660	3.93	90.01
WESTERN CAPE	37,276	9.99	100.00
-----+-----			

Total | 373,266 100.00

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	Freq.	Percent	Cum.
-----+-----			
EASTERN CAPE_ALFRED NZO	2,404	0.64	0.64
EASTERN CAPE_AMATHOLE	1,188	0.32	0.96
EASTERN CAPE_BUFFALO CITY METRO	2,050	0.55	1.51
EASTERN CAPE_CHRIS HANI	1,481	0.40	1.91
EASTERN CAPE_JOE GQABI	860	0.23	2.14
EASTERN CAPE_NELSON MANDELA BAY METRO	2,633	0.71	2.84
EASTERN CAPE_NOT APPLICABLE	1	0.00	2.84
EASTERN CAPE_O R TAMBO	7,304	1.96	4.80
EASTERN CAPE_SARAH BAARTMAN	1,051	0.28	5.08
EASTERN CAPE_UNKNOWN	3	0.00	5.08
FREE STATE_FEZILE DABI	1,601	0.43	5.51
FREE STATE_LEJWELEPUTSWA	3,545	0.95	6.46
FREE STATE_MANGAUNG METRO	11,561	3.10	9.56
FREE STATE_NOT APPLICABLE	1	0.00	9.56
FREE STATE_THABO MOFUTSANYANA	3,291	0.88	10.44
FREE STATE_UNKNOWN	25	0.01	10.45
FREE STATE_XHARIEP	581	0.16	10.60
GAUTENG_CITY OF JOHANNESBURG METRO	47,127	12.63	23.23
GAUTENG_CITY OF TSHWANE METRO	26,854	7.19	30.42
GAUTENG_EKURHULENI METRO	15,564	4.17	34.59
GAUTENG_SEDIBENG	5,623	1.51	36.10
GAUTENG_UNKNOWN	424	0.11	36.21
GAUTENG_WEST RAND	4,453	1.19	37.41
KWAZULU-NATAL_AMAJUBA	2,806	0.75	38.16
KWAZULU-NATAL_ETHEKWINI METRO	35,257	9.45	47.60

KWAZULU-NATAL_HARRY GWALA	2,201	0.59	48.19
KWAZULU-NATAL_ILEMBE	4,500	1.21	49.40
KWAZULU-NATAL_KING CETSHWAYO	1,961	0.53	49.92
KWAZULU-NATAL_UGU	11,231	3.01	52.93
KWAZULU-NATAL_UMGUNGUNDLOVU	19,091	5.11	58.05
KWAZULU-NATAL_UMKHANYAKUDE	1,112	0.30	58.35
KWAZULU-NATAL_UMZINYATHI	2,772	0.74	59.09
KWAZULU-NATAL_UNKNOWN	12	0.00	59.09
KWAZULU-NATAL_UTHUKELA	2,113	0.57	59.66
KWAZULU-NATAL_UTHUNGULU	747	0.20	59.86
KWAZULU-NATAL_ZULULAND	1,264	0.34	60.20
LIMPOPO_CAPRICORN	12,939	3.47	63.66
LIMPOPO_GREATER SEKHUKHUNE	3,623	0.97	64.63
LIMPOPO_MOPANI	4,593	1.23	65.86
LIMPOPO_UNKNOWN	7	0.00	65.87
LIMPOPO_VHEMBE	4,216	1.13	67.00
LIMPOPO_WATERBERG	3,292	0.88	67.88
MPUMALANGA_EHLANZENI	14,084	3.77	71.65
MPUMALANGA_GERT SIBANDE	16,299	4.37	76.02
MPUMALANGA_NKANGALA	6,847	1.83	77.85
MPUMALANGA_UNKNOWN	11	0.00	77.85
NORTH WEST_BOJANALA PLATINUM	21,846	5.85	83.71
NORTH WEST_DR KENNETH KAUNDA	2,842	0.76	84.47
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	2,898	0.78	85.24
NORTH WEST_NGAKA MODIRI MOLEMA	3,140	0.84	86.09
NORTH WEST_UNKNOWN	1	0.00	86.09
NORTHERN CAPE_FRANCES BAARD	9,488	2.54	88.63
NORTHERN CAPE_JOHN TAOLO GAETSEWE	545	0.15	88.77
NORTHERN CAPE_NAMAKWA	1,120	0.30	89.07
NORTHERN CAPE_PIXLEY KA SEME	804	0.22	89.29
NORTHERN CAPE_UNKNOWN	11	0.00	89.29
NORTHERN CAPE_ZF MGCAWU	2,692	0.72	90.01

WESTERN CAPE_CAPE WINELANDS	5,546	1.49	91.50
WESTERN CAPE_CENTRAL KAROO	519	0.14	91.64
WESTERN CAPE_CITY OF CAPE TOWN METRO	24,873	6.66	98.30
WESTERN CAPE_GARDEN ROUTE	3,820	1.02	99.33
WESTERN CAPE_NOT APPLICABLE	9	0.00	99.33
WESTERN CAPE_OVERBERG	1,137	0.30	99.63
WESTERN CAPE_UNKNOWN	101	0.03	99.66
WESTERN CAPE_WEST COAST	1,271	0.34	100.00
-----+-----			
Total	373,266	100.00	

.

. tab TAKEN_DATE_AGE_GROUP

RECODE of			
AGE_TAKEN_D			
ATE_YEARS	Freq.	Percent	Cum.
-----+-----			
'0-4	5,085	1.36	1.36
'5-9	3,863	1.03	2.40
'10-14	8,030	2.15	4.55
'15-19	17,444	4.67	9.22
'20-24	38,083	10.20	19.42
'25-29	52,840	14.16	33.58
'30-34	54,928	14.72	48.30
'35-39	46,239	12.39	60.68
'40-44	37,209	9.97	70.65
'45-49	27,778	7.44	78.09
'50-54	21,421	5.74	83.83
'55-59	16,991	4.55	88.38
'60+	30,301	8.12	96.50
99999	13,054	3.50	100.00

```
-----+-----
Total | 373,266 100.00

.
.
. tab TAKEN_DATE_AGE_GROUP GENDER, row col
```

```
+-----+
| Key      |
|-----|
| frequency |
| row percentage |
| column percentage |
+-----+
```

RECODE of				
AGE_TAKEN_		GENDER		
DATE_YEARS	F	M	U	Total
-----+-----				
'0-4	2,334	2,595	156	5,085
	45.90	51.03	3.07	100.00
	1.07	1.74	2.86	1.36
-----+-----				
'5-9	2,175	1,588	100	3,863
	56.30	41.11	2.59	100.00
	0.99	1.06	1.83	1.03
-----+-----				
'10-14	5,402	2,494	134	8,030
	67.27	31.06	1.67	100.00
	2.47	1.67	2.45	2.15
-----+-----				
'15-19	12,967	4,272	205	17,444
	74.34	24.49	1.18	100.00

		5.93	2.86	3.76		4.67
-----+-----+-----						
'20-24		27,921	9,653	509		38,083
		73.32	25.35	1.34		100.00
		12.77	6.47	9.32		10.20
-----+-----+-----						
'25-29		35,012	17,184	644		52,840
		66.26	32.52	1.22		100.00
		16.02	11.52	11.80		14.16
-----+-----+-----						
'30-34		32,620	21,682	626		54,928
		59.39	39.47	1.14		100.00
		14.92	14.53	11.47		14.72
-----+-----+-----						
'35-39		25,327	20,420	492		46,239
		54.77	44.16	1.06		100.00
		11.59	13.69	9.01		12.39
-----+-----+-----						
'40-44		18,935	17,906	368		37,209
		50.89	48.12	0.99		100.00
		8.66	12.00	6.74		9.97
-----+-----+-----						
'45-49		13,876	13,600	302		27,778
		49.95	48.96	1.09		100.00
		6.35	9.12	5.53		7.44
-----+-----+-----						
'50-54		11,139	10,092	190		21,421
		52.00	47.11	0.89		100.00
		5.10	6.76	3.48		5.74
-----+-----+-----						
'55-59		8,801	7,995	195		16,991
		51.80	47.05	1.15		100.00

		4.03	5.36	3.57		4.55
-----+						
'60+		15,852	14,136	313		30,301
		52.32	46.65	1.03		100.00
		7.25	9.47	5.73		8.12
-----+						
99999		6,247	5,582	1,225		13,054
		47.86	42.76	9.38		100.00
		2.86	3.74	22.44		3.50
-----+						
Total		218,608	149,199	5,459		373,266
		58.57	39.97	1.46		100.00
		100.00	100.00	100.00		100.00

.

. tab PROVINCE_NAME GENDER, row col

+-----+	
Key	

frequency	
row percentage	
column percentage	
+-----+	

		GENDER			
PROVINCE_NAME		F	M	U	Total
-----+					
EASTERN CAPE		12,235	6,557	183	18,975
		64.48	34.56	0.96	100.00
		5.60	4.39	3.35	5.08
-----+					

FREE STATE | 11,790 8,724 91 | 20,605

	57.22	42.34	0.44		100.00

| 5.39 5.85 | 1.67 | 5.52

GAUTENG | 55,928 42,456 1,661 | 100,045

	55.90	42.44	1.66		100.00

	25.58	28.46	30.43		26.80

KWAZULU-NATAL | 50,103 32,632 2,332 | 85,067

	58.90	38.36	2.74		100.00

| 22.92 21.87 42.72 | 22.79

LIMPOPO | 18,344 10,145 181 | 28,670

	63.98	35.39	0.63		100.00

| 8.39 6.80 3.32 | 7.68

MPUMALANGA	21,984	14,921	336	37,241

	59.03	40.07	0.90		100.00

| 10.06 10.00 6.15 | 9.98

NORTH WEST	18,863	11,561	303	30,727

	61.39	37.62	0.99		100.00

| 8.63 7.75 | 5.55 | 8.23

NORTHERN CAPE | 8,240 6,207 213 | 14,660

	56.21	42.34	1.45		100.00

| 3.77 4.16 3.90 | 3.93

-----+-----+

WESTERN CAPE | 21,121 15,996 159 | 37,276

	56.66	42.91	0.43		100.00

	9.66	10.72	2.91		9.99

Total | 218,608 149,199 5,459 | 373,266

| 58.57 39.97 1.46 | 100.00

| 100.00 100.00 100.00 | 100.00

.

. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME, row col

+-----+

| Key |

|-----|

| frequency |

| row percentage |

| column percentage |

+-----+

RECODE of |

AGE_TAKEN_ | PROVINCE_NAME

DATE_YEARS | EASTERN.. FREE ST.. GAUTENG KWAZULU.. LIMPOPO MPUMALA.. NORTH W..
NORTHER.. WESTERN.. | Total

-----+

'0-4 | 254 221 1,220 1,623 455 376 186 188 562 | 5,085
| 5.00 4.35 23.99 31.92 8.95 7.39 3.66 3.70 11.05 | 100.00
| 1.34 1.07 1.22 1.91 1.59 1.01 0.61 1.28 1.51 | 1.36

-----+

'5-9 | 211 124 736 1,322 283 395 142 147 503 | 3,863
| 5.46 3.21 19.05 34.22 7.33 10.23 3.68 3.81 13.02 | 100.00
| 1.11 0.60 0.74 1.55 0.99 1.06 0.46 1.00 1.35 | 1.03

-----+

'10-14 | 317 235 1,571 2,649 767 872 403 244 972 | 8,030
| 3.95 2.93 19.56 32.99 9.55 10.86 5.02 3.04 12.10 | 100.00
| 1.67 1.14 1.57 3.11 2.68 2.34 1.31 1.66 2.61 | 2.15

-----+

'15-19 | 974 785 3,182 5,465 1,652 1,985 1,149 592 1,660 | 17,444

		5.58	4.50	18.24	31.33	9.47	11.38	6.59	3.39	9.52		100.00
		5.13	3.81	3.18	6.42	5.76	5.33	3.74	4.04	4.45		4.67
-----+-----+-----												
'20-24		2,306	2,015	7,957	11,209	2,779	4,082	3,037	1,237	3,461		38,083
		6.06	5.29	20.89	29.43	7.30	10.72	7.97	3.25	9.09		100.00
		12.15	9.78	7.95	13.18	9.69	10.96	9.88	8.44	9.28		10.20
-----+-----+-----												
'25-29		2,906	3,123	12,740	12,544	3,655	6,023	4,975	1,920	4,954		52,840
		5.50	5.91	24.11	23.74	6.92	11.40	9.42	3.63	9.38		100.00
		15.31	15.16	12.73	14.75	12.75	16.17	16.19	13.10	13.29		14.16
-----+-----+-----												
'30-34		2,824	3,068	14,379	11,744	3,884	6,214	5,329	2,140	5,346		54,928
		5.14	5.59	26.18	21.38	7.07	11.31	9.70	3.90	9.73		100.00
		14.88	14.89	14.37	13.81	13.55	16.69	17.34	14.60	14.34		14.72
-----+-----+-----												
'35-39		2,410	2,661	12,845	9,056	3,690	4,745	4,465	1,999	4,368		46,239
		5.21	5.75	27.78	19.59	7.98	10.26	9.66	4.32	9.45		100.00
		12.70	12.91	12.84	10.65	12.87	12.74	14.53	13.64	11.72		12.39
-----+-----+-----												
'40-44		1,883	2,194	10,760	6,986	3,186	3,621	3,451	1,673	3,455		37,209
		5.06	5.90	28.92	18.78	8.56	9.73	9.27	4.50	9.29		100.00
		9.92	10.65	10.76	8.21	11.11	9.72	11.23	11.41	9.27		9.97
-----+-----+-----												
'45-49		1,302	1,704	8,157	5,043	2,271	2,512	2,465	1,323	3,001		27,778
		4.69	6.13	29.36	18.15	8.18	9.04	8.87	4.76	10.80		100.00
		6.86	8.27	8.15	5.93	7.92	6.75	8.02	9.02	8.05		7.44
-----+-----+-----												
'50-54		1,045	1,328	6,097	4,146	1,755	1,794	1,736	962	2,558		21,421
		4.88	6.20	28.46	19.35	8.19	8.37	8.10	4.49	11.94		100.00

		5.51	6.45	6.09	4.87	6.12	4.82	5.65	6.56	6.86		5.74
-----+-----												
'55-59		836	1,135	4,913	3,439	1,267	1,212	1,273	727	2,189		16,991
		4.92	6.68	28.92	20.24	7.46	7.13	7.49	4.28	12.88		100.00
		4.41	5.51	4.91	4.04	4.42	3.25	4.14	4.96	5.87		4.55
-----+-----												
'60+		1,250	1,861	8,947	7,290	2,296	1,654	1,691	1,237	4,075		30,301
		4.13	6.14	29.53	24.06	7.58	5.46	5.58	4.08	13.45		100.00
		6.59	9.03	8.94	8.57	8.01	4.44	5.50	8.44	10.93		8.12
-----+-----												
99999		457	151	6,541	2,551	730	1,756	425	271	172		13,054
		3.50	1.16	50.11	19.54	5.59	13.45	3.26	2.08	1.32		100.00
		2.41	0.73	6.54	3.00	2.55	4.72	1.38	1.85	0.46		3.50
-----+-----												
Total		18,975	20,605	100,045	85,067	28,670	37,241	30,727	14,660	37,276		373,266
		5.08	5.52	26.80	22.79	7.68	9.98	8.23	3.93	9.99		100.00
		100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00		100.00

```
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-
HBs_Negative_Cases.dta",replace
```

```
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBs_Negative_Cases.dta
saved
```

```
. use "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBs_All_Cases.dta",clear
```

```
. count if UNIQUE_PATIENT_ID== -1
```

```
31
```

```
. preserve
```



```
. keep if UNIQUE_PATIENT_ID==1
```

```
(631,179 observations deleted)
```

```
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBs_minus1-31.dta",replace
```

```
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBs_minus1-31.dta saved
```

```
. restore
```

```
. drop if UNIQUE_PATIENT_ID==1
```

```
(31 observations deleted)
```

```
. count
```

```
631,179
```

```
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBs_nominus1-631179.dta",replace
```

```
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBs_nominus1-631179.dta saved
```

Appendix 5.2: Stata Log file of anti-HBcT results and analysis

```
. use "2015-2019_HepatitisB_All_Records.dta"
```

```
. count
```

```
6,315,380
```

```
.
```

```
. tab HEPATITIS_B_CORE_TOTAL_AB
```

```
HEPATITIS_B_ |
```

```
CORE_TOTAL_A |
```

B	Freq.	Percent	Cum.
-----+-----			
EQUIVOCAL	172	0.00	0.00
LOW POSITIVE	201	0.00	0.01
NEGATIVE	173,782	2.75	2.76
NULL	5,980,355	94.70	97.45
POSITIVE	160,851	2.55	100.00
UNKNOWN	19	0.00	100.00
-----+-----			
Total	6,315,380	100.00	

```
.
```

```
. drop if HEPATITIS_B_CORE_TOTAL_AB=="NULL" | HEPATITIS_B_CORE_TOTAL_AB=="UNKNOWN"  
(5,980,374 observations deleted)
```

```
.
```

```
. tab HEPATITIS_B_CORE_TOTAL_AB
```

```
HEPATITIS_B_ |
```

```
CORE_TOTAL_A |
```

B	Freq.	Percent	Cum.
-----+-----			
EQUIVOCAL	172	0.05	0.05
LOW POSITIVE	201	0.06	0.11
NEGATIVE	173,782	51.87	51.99
POSITIVE	160,851	48.01	100.00
-----+-----			
Total	335,006	100.00	

```
.
. count
335,006

.

. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-
HBcT_Valid_Records_All.dta",replace

file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-
HBcT_Valid_Records_All.dta saved

.

. gsort- TAKEN_DATE

.

. do "Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD
Output files_SM081020\Files_Chapter3\26-09-23\Deduplication_Commands.do"

. capture noisily duplicates drop UNIQUE_PATIENT_ID if UNIQUE_PATIENT_ID !=-1, force

Duplicates in terms of UNIQUE_PATIENT_ID

(52,045 observations deleted)

. capture noisily duplicates drop DOB HOSPITAL_ID FACILITY_NAME if UNIQUE_PATIENT_ID ==-1,
force
```

Duplicates in terms of DOB HOSPITAL_ID FACILITY_NAME

(31 observations deleted)

.

end of do-file

.

. count

282,930

. tab GENDER

GENDER	Freq.	Percent	Cum.
-----+-----			
F	160,206	56.62	56.62
M	118,744	41.97	98.59
U	3,980	1.41	100.00
-----+-----			
Total	282,930	100.00	

.

. tab PROVINCE_NAME

PROVINCE_NAME	Freq.	Percent	Cum.
-----+-----			
EASTERN CAPE	49,114	17.36	17.36
FREE STATE	402	0.14	17.50
GAUTENG	66,195	23.40	40.90
KWAZULU-NATAL	40,377	14.27	55.17
LIMPOPO	22,719	8.03	63.20

MPUMALANGA	51,879	18.34	81.53
NORTH WEST	2,860	1.01	82.55
NORTHERN CAPE	5,470	1.93	84.48
WESTERN CAPE	43,914	15.52	100.00
-----+-----			
Total	282,930	100.00	

.

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	Freq.	Percent	Cum.
-----+-----			
EASTERN CAPE_ALFRED NZO	2,716	0.96	0.96
EASTERN CAPE_AMATHOLE	2,222	0.79	1.75
EASTERN CAPE_BUFFALO CITY METRO	5,210	1.84	3.59
EASTERN CAPE_CHRIS HANI	2,168	0.77	4.35
EASTERN CAPE_JOE GQABI	1,019	0.36	4.71
EASTERN CAPE_NELSON MANDELA BAY METRO	22,203	7.85	12.56
EASTERN CAPE_NOT APPLICABLE	6	0.00	12.56
EASTERN CAPE_O R TAMBO	8,220	2.91	15.47
EASTERN CAPE_SARAH BAARTMAN	5,341	1.89	17.36
EASTERN CAPE_UNKNOWN	9	0.00	17.36
FREE STATE_FEZILE DABI	10	0.00	17.36
FREE STATE_LEJWELEPUTSWA	139	0.05	17.41
FREE STATE_MANGAUNG METRO	216	0.08	17.49
FREE STATE_THABO MOFUTSANYANA	23	0.01	17.50
FREE STATE_UNKNOWN	2	0.00	17.50
FREE STATE_XHARIEP	12	0.00	17.50
GAUTENG_CITY OF JOHANNESBURG METRO	29,789	10.53	28.03
GAUTENG_CITY OF TSHWANE METRO	21,607	7.64	35.67
GAUTENG_EKURHULENI METRO	9,616	3.40	39.07
GAUTENG_SEDIBENG	1,261	0.45	39.51

GAUTENG_UNKNOWN	658	0.23	39.74
GAUTENG_WEST RAND	3,264	1.15	40.90
KWAZULU-NATAL_AMAJUBA	1,047	0.37	41.27
KWAZULU-NATAL_ETHEKWINI METRO	18,701	6.61	47.88
KWAZULU-NATAL_HARRY GWALA	606	0.21	48.09
KWAZULU-NATAL_ILEMBE	1,259	0.44	48.54
KWAZULU-NATAL_KING CETSHWAYO	924	0.33	48.86
KWAZULU-NATAL_UGU	4,188	1.48	50.34
KWAZULU-NATAL_UMGUNGUNDLOVU	8,330	2.94	53.29
KWAZULU-NATAL_UMKHANYAKUDE	1,964	0.69	53.98
KWAZULU-NATAL_UMZINYATHI	751	0.27	54.25
KWAZULU-NATAL_UNKNOWN	5	0.00	54.25
KWAZULU-NATAL_UTHUKELA	555	0.20	54.44
KWAZULU-NATAL_UTHUNGULU	688	0.24	54.69
KWAZULU-NATAL_ZULULAND	1,359	0.48	55.17
LIMPOPO_CAPRICORN	6,888	2.43	57.60
LIMPOPO_GREATER SEKHUKHUNE	2,704	0.96	58.56
LIMPOPO_MOPANI	6,919	2.45	61.00
LIMPOPO_UNKNOWN	3	0.00	61.01
LIMPOPO_VHEMBE	4,790	1.69	62.70
LIMPOPO_WATERBERG	1,415	0.50	63.20
MPUMALANGA_EHLANZENI	18,540	6.55	69.75
MPUMALANGA_GERT SIBANDE	24,458	8.64	78.40
MPUMALANGA_NKANGALA	8,844	3.13	81.52
MPUMALANGA_UNKNOWN	37	0.01	81.53
NORTH WEST_BOJANALA PLATINUM	1,322	0.47	82.00
NORTH WEST_DR KENNETH KAUNDA	372	0.13	82.13
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	266	0.09	82.23
NORTH WEST_NGAKA MODIRI MOLEMA	900	0.32	82.55
NORTHERN CAPE_FRANCES BAARD	88	0.03	82.58
NORTHERN CAPE_JOHN TAOLO GAETSEWE	29	0.01	82.59
NORTHERN CAPE_NAMAKWA	1,384	0.49	83.08

NORTHERN CAPE_PIXLEY KA SEME	21	0.01	83.08
NORTHERN CAPE_ZF MGCAWU	3,948	1.40	84.48
WESTERN CAPE_CAPE WINELANDS	7,178	2.54	87.02
WESTERN CAPE_CENTRAL KAROO	618	0.22	87.23
WESTERN CAPE_CITY OF CAPE TOWN METRO	26,806	9.47	96.71
WESTERN CAPE_GARDEN ROUTE	6,344	2.24	98.95
WESTERN CAPE_NOT APPLICABLE	25	0.01	98.96
WESTERN CAPE_OVERBERG	1,264	0.45	99.41
WESTERN CAPE_UNKNOWN	87	0.03	99.44
WESTERN CAPE_WEST COAST	1,592	0.56	100.00
-----+-----			
Total	282,930	100.00	

.

. tab TAKEN_DATE_AGE_GROUP

RECODE of			
AGE_TAKEN_D			
ATE_YEARS	Freq.	Percent	Cum.
-----+-----			
'0-4	5,382	1.90	1.90
'5-9	3,820	1.35	3.25
'10-14	5,172	1.83	5.08
'15-19	10,514	3.72	8.80
'20-24	24,097	8.52	17.31
'25-29	38,020	13.44	30.75
'30-34	42,189	14.91	45.66
'35-39	36,470	12.89	58.55
'40-44	29,824	10.54	69.09
'45-49	22,568	7.98	77.07
'50-54	17,694	6.25	83.32
'55-59	13,568	4.80	88.12

'60+	22,502	7.95	96.07
99999	11,110	3.93	100.00
-----+			
Total	282,930	100.00	

. tab TAKEN_DATE_AGE_GROUP GENDER, row col

+-----+			
Key			

frequency			
row percentage			
column percentage			
+-----+			

RECODE of				
AGE_TAKEN_	GENDER			
DATE_YEARS	F	M	U	Total
-----+				
'0-4	2,656	2,655	71	5,382
	49.35	49.33	1.32	100.00
	1.66	2.24	1.78	1.90
-----+				
'5-9	2,133	1,643	44	3,820
	55.84	43.01	1.15	100.00
	1.33	1.38	1.11	1.35
-----+				
'10-14	3,362	1,761	49	5,172
	65.00	34.05	0.95	100.00
	2.10	1.48	1.23	1.83
-----+				

'15-19		7,823	2,609	82		10,514
		74.41	24.81	0.78		100.00
		4.88	2.20	2.06		3.72

-----+-----+-----

'20-24		17,614	6,260	223		24,097
		73.10	25.98	0.93		100.00
		10.99	5.27	5.60		8.52

-----+-----+-----

'25-29		24,637	12,990	393		38,020
		64.80	34.17	1.03		100.00
		15.38	10.94	9.87		13.44

-----+-----+-----

'30-34		24,120	17,664	405		42,189
		57.17	41.87	0.96		100.00
		15.06	14.88	10.18		14.91

-----+-----+-----

'35-39		19,030	17,076	364		36,470
		52.18	46.82	1.00		100.00
		11.88	14.38	9.15		12.89

-----+-----+-----

'40-44		14,755	14,796	273		29,824
		49.47	49.61	0.92		100.00
		9.21	12.46	6.86		10.54

-----+-----+-----

'45-49		11,193	11,162	213		22,568
		49.60	49.46	0.94		100.00
		6.99	9.40	5.35		7.98

-----+-----+-----

'50-54		9,193	8,372	129		17,694
		51.96	47.32	0.73		100.00
		5.74	7.05	3.24		6.25

-----+-----+-----

'55-59		6,951	6,520	97		13,568
		51.23	48.05	0.71		100.00
		4.34	5.49	2.44		4.80
-----+-----+-----						
'60+		11,775	10,561	166		22,502
		52.33	46.93	0.74		100.00
		7.35	8.89	4.17		7.95
-----+-----+-----						
99999		4,964	4,675	1,471		11,110
		44.68	42.08	13.24		100.00
		3.10	3.94	36.96		3.93
-----+-----+-----						
Total		160,206	118,744	3,980		282,930
		56.62	41.97	1.41		100.00
		100.00	100.00	100.00		100.00

.

. tab PROVINCE_NAME GENDER, row col

+-----+						
	Key					

	frequency					
	row percentage					
	column percentage					
+-----+						
		GENDER				
	PROVINCE_NAME		F	M	U	Total
-----+-----+-----						
	EASTERN CAPE		29,995	18,820	299	49,114
			61.07	38.32	0.61	100.00

		18.72	15.85	7.51		17.36
-----+-----+-----						
FREE STATE		203	194	5		402
		50.50	48.26	1.24		100.00
		0.13	0.16	0.13		0.14
-----+-----+-----						
GAUTENG		36,389	28,300	1,506		66,195
		54.97	42.75	2.28		100.00
		22.71	23.83	37.84		23.40
-----+-----+-----						
KWAZULU-NATAL		18,107	21,059	1,211		40,377
		44.84	52.16	3.00		100.00
		11.30	17.73	30.43		14.27
-----+-----+-----						
LIMPOPO		14,759	7,829	131		22,719
		64.96	34.46	0.58		100.00
		9.21	6.59	3.29		8.03
-----+-----+-----						
MPUMALANGA		30,954	20,499	426		51,879
		59.67	39.51	0.82		100.00
		19.32	17.26	10.70		18.34
-----+-----+-----						
NORTH WEST		1,688	1,151	21		2,860
		59.02	40.24	0.73		100.00
		1.05	0.97	0.53		1.01
-----+-----+-----						
NORTHERN CAPE		3,286	2,121	63		5,470
		60.07	38.78	1.15		100.00
		2.05	1.79	1.58		1.93
-----+-----+-----						
WESTERN CAPE		24,825	18,771	318		43,914
		56.53	42.74	0.72		100.00

		15.50	15.81	7.99		15.52	
-----+-----+-----							
Total		160,206	118,744	3,980		282,930	
		56.62	41.97	1.41		100.00	
		100.00	100.00	100.00		100.00	

```
.
. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME, row col
```

+-----+	
Key	

frequency	
row percentage	
column percentage	
+-----+	

```
RECODE of |
AGE_TAKEN_ | PROVINCE_NAME
DATE_YEARS | EASTERN.. FREE ST.. GAUTENG KWAZULU.. LIMPOPO MPUMALA.. NORTH W..
NORTHER.. WESTERN.. | Total
```

-----+-----+-----											
'0-4		940	6	1,256	451	582	842	35	88	1,182	5,382
		17.47	0.11	23.34	8.38	10.81	15.64	0.65	1.64	21.96	100.00
		1.91	1.49	1.90	1.12	2.56	1.62	1.22	1.61	2.69	1.90
-----+-----+-----											
'5-9		825	2	685	191	352	764	29	75	897	3,820
		21.60	0.05	17.93	5.00	9.21	20.00	0.76	1.96	23.48	100.00
		1.68	0.50	1.03	0.47	1.55	1.47	1.01	1.37	2.04	1.35
-----+-----+-----											
'10-14		1,102	4	912	347	583	1,047	48	80	1,049	5,172
		21.31	0.08	17.63	6.71	11.27	20.24	0.93	1.55	20.28	100.00
		2.24	1.00	1.38	0.86	2.57	2.02	1.68	1.46	2.39	1.83

'15-19	2,186	11	1,858	919	1,233	2,323	116	188	1,680	10,514
	20.79	0.10	17.67	8.74	11.73	22.09	1.10	1.79	15.98	100.00
	4.45	2.74	2.81	2.28	5.43	4.48	4.06	3.44	3.83	3.72
'20-24	4,325	23	4,834	3,546	1,938	5,183	233	482	3,533	24,097
	17.95	0.10	20.06	14.72	8.04	21.51	0.97	2.00	14.66	100.00
	8.81	5.72	7.30	8.78	8.53	9.99	8.15	8.81	8.05	8.52
'25-29	6,268	53	7,830	7,085	2,515	7,912	355	729	5,273	38,020
	16.49	0.14	20.59	18.63	6.61	20.81	0.93	1.92	13.87	100.00
	12.76	13.18	11.83	17.55	11.07	15.25	12.41	13.33	12.01	13.44
'30-34	6,651	51	9,016	8,032	2,973	8,399	417	811	5,839	42,189
	15.76	0.12	21.37	19.04	7.05	19.91	0.99	1.92	13.84	100.00
	13.54	12.69	13.62	19.89	13.09	16.19	14.58	14.83	13.30	14.91
'35-39	5,921	69	8,357	6,395	2,855	6,679	432	779	4,983	36,470
	16.24	0.19	22.91	17.53	7.83	18.31	1.18	2.14	13.66	100.00
	12.06	17.16	12.62	15.84	12.57	12.87	15.10	14.24	11.35	12.89
'40-44	4,937	47	7,149	4,613	2,517	5,224	359	657	4,321	29,824
	16.55	0.16	23.97	15.47	8.44	17.52	1.20	2.20	14.49	100.00
	10.05	11.69	10.80	11.42	11.08	10.07	12.55	12.01	9.84	10.54
'45-49	3,960	41	5,402	2,830	1,871	3,746	236	537	3,945	22,568
	17.55	0.18	23.94	12.54	8.29	16.60	1.05	2.38	17.48	100.00
	8.06	10.20	8.16	7.01	8.24	7.22	8.25	9.82	8.98	7.98
'50-54	3,408	31	4,181	1,820	1,553	2,725	162	410	3,404	17,694
	19.26	0.18	23.63	10.29	8.78	15.40	0.92	2.32	19.24	100.00
	6.94	7.71	6.32	4.51	6.84	5.25	5.66	7.50	7.75	6.25

-----+-----										
'55-59	2,793	23	3,376	1,199	1,079	1,896	148	264	2,790	13,568
	20.59	0.17	24.88	8.84	7.95	13.97	1.09	1.95	20.56	100.00
	5.69	5.72	5.10	2.97	4.75	3.65	5.17	4.83	6.35	4.80
-----+-----										
'60+	5,041	35	5,614	1,915	2,052	2,581	256	282	4,726	22,502
	22.40	0.16	24.95	8.51	9.12	11.47	1.14	1.25	21.00	100.00
	10.26	8.71	8.48	4.74	9.03	4.98	8.95	5.16	10.76	7.95
-----+-----										
99999	757	6	5,725	1,034	616	2,558	34	88	292	11,110
	6.81	0.05	51.53	9.31	5.54	23.02	0.31	0.79	2.63	100.00
	1.54	1.49	8.65	2.56	2.71	4.93	1.19	1.61	0.66	3.93
-----+-----										
Total	49,114	402	66,195	40,377	22,719	51,879	2,860	5,470	43,914	282,930
	17.36	0.14	23.40	14.27	8.03	18.34	1.01	1.93	15.52	100.00
	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

```
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-
HBcT_All_Cases.dta",replace
```

```
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBcT_All_Cases.dta saved
```

```
.
```

```
. tab HEPATITIS_B_CORE_TOTAL_AB
```

HEPATITIS_B_			
CORE_TOTAL_A			
B	Freq.	Percent	Cum.
-----+-----			
EQUIVOCAL	139	0.05	0.05
LOW POSITIVE	142	0.05	0.10
NEGATIVE	150,713	53.27	53.37
POSITIVE	131,936	46.63	100.00

```
-----+-----
Total | 282,930 100.00
```

```
.
```

```
. preserve
```

```
.
```

```
. keep if HEPATITIS_B_CORE_TOTAL_AB=="LOW POSITIVE" | HEPATITIS_B_CORE_TOTAL_AB=="POSITIVE"
```

```
(150,852 observations deleted)
```

```
.
```

```
. count
```

```
132,078
```

```
.
```

```
. tab HEPATITIS_B_CORE_TOTAL_AB
```

```
HEPATITIS_B_ |
```

```
CORE_TOTAL_A |
```

```
      B |   Freq.   Percent   Cum.
-----+-----
LOW POSITIVE |    142     0.11    0.11
  POSITIVE | 131,936    99.89   100.00
-----+-----
Total | 132,078   100.00
```

```
.
```

```
. tab GENDER
```

```
  GENDER |   Freq.   Percent   Cum.
-----+-----
      F |  65,493    49.59    49.59
```

M	64,581	48.90	98.48
U	2,004	1.52	100.00
-----+-----			
Total	132,078	100.00	

.

. tab PROVINCE_NAME

PROVINCE_NAME	Freq.	Percent	Cum.
-----+-----			
EASTERN CAPE	21,662	16.40	16.40
FREE STATE	264	0.20	16.60
GAUTENG	25,448	19.27	35.87
KWAZULU-NATAL	33,856	25.63	61.50
LIMPOPO	8,578	6.49	68.00
MPUMALANGA	22,987	17.40	85.40
NORTH WEST	982	0.74	86.14
NORTHERN CAPE	1,974	1.49	87.64
WESTERN CAPE	16,327	12.36	100.00
-----+-----			
Total	132,078	100.00	

.

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	Freq.	Percent	Cum.
-----+-----			
EASTERN CAPE_ALFRED NZO	1,183	0.90	0.90
EASTERN CAPE_AMATHOLE	1,066	0.81	1.70
EASTERN CAPE_BUFFALO CITY METRO	2,013	1.52	3.23
EASTERN CAPE_CHRIS HANI	1,017	0.77	4.00
EASTERN CAPE_JOE GQABI	474	0.36	4.36

EASTERN CAPE_NELSON MANDELA BAY METRO	9,612	7.28	11.63
EASTERN CAPE_NOT APPLICABLE	2	0.00	11.63
EASTERN CAPE_O R TAMBO	3,847	2.91	14.55
EASTERN CAPE_SARAH BAARTMAN	2,445	1.85	16.40
EASTERN CAPE_UNKNOWN	3	0.00	16.40
FREE STATE_FEZILE DABI	6	0.00	16.41
FREE STATE_LEJWELEPUTSWA	106	0.08	16.49
FREE STATE_MANGAUNG METRO	135	0.10	16.59
FREE STATE_THABO MOFUTSANYANA	13	0.01	16.60
FREE STATE_XHARIEP	4	0.00	16.60
GAUTENG_CITY OF JOHANNESBURG METRO	11,608	8.79	25.39
GAUTENG_CITY OF TSHWANE METRO	7,719	5.84	31.23
GAUTENG_EKURHULENI METRO	3,989	3.02	34.25
GAUTENG_SEDIBENG	640	0.48	34.74
GAUTENG_UNKNOWN	37	0.03	34.77
GAUTENG_WEST RAND	1,455	1.10	35.87
KWAZULU-NATAL_AMAJUBA	875	0.66	36.53
KWAZULU-NATAL_ETHEKWINI METRO	15,404	11.66	48.19
KWAZULU-NATAL_HARRY GWALA	518	0.39	48.59
KWAZULU-NATAL_ILEMBE	1,162	0.88	49.47
KWAZULU-NATAL_KING CETSHWAYO	828	0.63	50.09
KWAZULU-NATAL_UGU	3,670	2.78	52.87
KWAZULU-NATAL_UMGUNGUNDLOVU	6,833	5.17	58.04
KWAZULU-NATAL_UMKHANYAKUDE	1,622	1.23	59.27
KWAZULU-NATAL_UMZINYATHI	644	0.49	59.76
KWAZULU-NATAL_UNKNOWN	5	0.00	59.76
KWAZULU-NATAL_UTHUKELA	479	0.36	60.13
KWAZULU-NATAL_UTHUNGULU	613	0.46	60.59
KWAZULU-NATAL_ZULULAND	1,203	0.91	61.50
LIMPOPO_CAPRICORN	2,116	1.60	63.10
LIMPOPO_GREATER SEKHUKHUNE	943	0.71	63.82
LIMPOPO_MOPANI	3,085	2.34	66.15

LIMPOPO_UNKNOWN	2	0.00	66.15
LIMPOPO_VHEMBE	1,863	1.41	67.57
LIMPOPO_WATERBERG	569	0.43	68.00
MPUMALANGA_EHLANZENI	9,570	7.25	75.24
MPUMALANGA_GERT SIBANDE	10,288	7.79	83.03
MPUMALANGA_NKANGALA	3,116	2.36	85.39
MPUMALANGA_UNKNOWN	13	0.01	85.40
NORTH WEST_BOJANALA PLATINUM	470	0.36	85.76
NORTH WEST_DR KENNETH KAUNDA	203	0.15	85.91
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	75	0.06	85.97
NORTH WEST_NGAKA MODIRI MOLEMA	234	0.18	86.14
NORTHERN CAPE_FRANCES BAARD	35	0.03	86.17
NORTHERN CAPE_JOHN TAOLO GAETSEWE	9	0.01	86.18
NORTHERN CAPE_NAMAKWA	360	0.27	86.45
NORTHERN CAPE_PIXLEY KA SEME	7	0.01	86.45
NORTHERN CAPE_ZF MGCAWU	1,563	1.18	87.64
WESTERN CAPE_CAPE WINELANDS	2,784	2.11	89.75
WESTERN CAPE_CENTRAL KAROO	188	0.14	89.89
WESTERN CAPE_CITY OF CAPE TOWN METRO	10,319	7.81	97.70
WESTERN CAPE_GARDEN ROUTE	1,884	1.43	99.13
WESTERN CAPE_NOT APPLICABLE	11	0.01	99.14
WESTERN CAPE_OVERBERG	464	0.35	99.49
WESTERN CAPE_UNKNOWN	27	0.02	99.51
WESTERN CAPE_WEST COAST	650	0.49	100.00

-----+-----
Total | 132,078 100.00

.
.tab TAKEN_DATE_AGE_GROUP

RECODE of |
AGE_TAKEN_D |

ATE_YEARS | Freq. Percent Cum.

+-----+			
'0-4	745	0.56	0.56
'5-9	168	0.13	0.69
'10-14	272	0.21	0.90
'15-19	1,372	1.04	1.94
'20-24	7,580	5.74	7.68
'25-29	17,256	13.07	20.74
'30-34	22,270	16.86	37.60
'35-39	20,192	15.29	52.89
'40-44	16,788	12.71	65.60
'45-49	12,588	9.53	75.13
'50-54	9,644	7.30	82.43
'55-59	7,144	5.41	87.84
'60+	11,093	8.40	96.24
99999	4,966	3.76	100.00
+-----+			
Total	132,078	100.00	

.
. tab TAKEN_DATE_AGE_GROUP GENDER, row col

+-----+
Key
frequency
row percentage
column percentage
+-----+

RECODE of |
AGE_TAKEN_ | GENDER

DATE_YEARS	F	M	U	Total
-----+-----+-----				
'0-4	336	392	17	745
	45.10	52.62	2.28	100.00
	0.51	0.61	0.85	0.56
-----+-----+-----				
'5-9	93	71	4	168
	55.36	42.26	2.38	100.00
	0.14	0.11	0.20	0.13
-----+-----+-----				
'10-14	158	107	7	272
	58.09	39.34	2.57	100.00
	0.24	0.17	0.35	0.21
-----+-----+-----				
'15-19	971	381	20	1,372
	70.77	27.77	1.46	100.00
	1.48	0.59	1.00	1.04
-----+-----+-----				
'20-24	5,296	2,173	111	7,580
	69.87	28.67	1.46	100.00
	8.09	3.36	5.54	5.74
-----+-----+-----				
'25-29	10,183	6,799	274	17,256
	59.01	39.40	1.59	100.00
	15.55	10.53	13.67	13.07
-----+-----+-----				
'30-34	11,428	10,565	277	22,270
	51.32	47.44	1.24	100.00
	17.45	16.36	13.82	16.86
-----+-----+-----				
'35-39	9,212	10,721	259	20,192
	45.62	53.10	1.28	100.00

		14.07	16.60	12.92		15.29
-----+-----+-----						
'40-44		7,233	9,356	199		16,788
		43.08	55.73	1.19		100.00
		11.04	14.49	9.93		12.71
-----+-----+-----						
'45-49		5,488	6,951	149		12,588
		43.60	55.22	1.18		100.00
		8.38	10.76	7.44		9.53
-----+-----+-----						
'50-54		4,458	5,101	85		9,644
		46.23	52.89	0.88		100.00
		6.81	7.90	4.24		7.30
-----+-----+-----						
'55-59		3,265	3,818	61		7,144
		45.70	53.44	0.85		100.00
		4.99	5.91	3.04		5.41
-----+-----+-----						
'60+		5,361	5,638	94		11,093
		48.33	50.82	0.85		100.00
		8.19	8.73	4.69		8.40
-----+-----+-----						
99999		2,011	2,508	447		4,966
		40.50	50.50	9.00		100.00
		3.07	3.88	22.31		3.76
-----+-----+-----						
Total		65,493	64,581	2,004		132,078
		49.59	48.90	1.52		100.00
		100.00	100.00	100.00		100.00

.

. tab PROVINCE_NAME GENDER, row col

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+-----+
| Key      |
|-----|
| frequency |
| row percentage |
| column percentage |
+-----+
```

GENDER				
PROVINCE_NAME	F	M	U	Total
-----+-----+-----				
EASTERN CAPE	12,014	9,515	133	21,662
	55.46	43.92	0.61	100.00
	18.34	14.73	6.64	16.40
-----+-----+-----				
FREE STATE	121	140	3	264
	45.83	53.03	1.14	100.00
	0.18	0.22	0.15	0.20
-----+-----+-----				
GAUTENG	12,048	12,928	472	25,448
	47.34	50.80	1.85	100.00
	18.40	20.02	23.55	19.27
-----+-----+-----				
KWAZULU-NATAL	14,356	18,450	1,050	33,856
	42.40	54.50	3.10	100.00
	21.92	28.57	52.40	25.63
-----+-----+-----				
LIMPOPO	4,814	3,716	48	8,578
	56.12	43.32	0.56	100.00
	7.35	5.75	2.40	6.49
-----+-----+-----				

MPUMALANGA		12,373	10,428	186		22,987
		53.83	45.36	0.81		100.00
		18.89	16.15	9.28		17.40
-----+-----+-----						
NORTH WEST		511	466	5		982
		52.04	47.45	0.51		100.00
		0.78	0.72	0.25		0.74
-----+-----+-----						
NORTHERN CAPE		1,061	884	29		1,974
		53.75	44.78	1.47		100.00
		1.62	1.37	1.45		1.49
-----+-----+-----						
WESTERN CAPE		8,195	8,054	78		16,327
		50.19	49.33	0.48		100.00
		12.51	12.47	3.89		12.36
-----+-----+-----						
Total		65,493	64,581	2,004		132,078
		49.59	48.90	1.52		100.00
		100.00	100.00	100.00		100.00

```
.
. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME, row col
```

```
+-----+
| Key      |
|-----|
| frequency |
| row percentage |
| column percentage |
+-----+
```

```
RECODE of |
```

AGE_TAKEN_	PROVINCE_NAME									
DATE_YEARS	EASTERN..	FREE ST..	GAUTENG	KWAZULU..	LIMPOPO	MPUMALA..	NORTH W..	NORTHER..	WESTERN..	Total

-----+-----+-----										
'0-4	94	0	177	120	78	140	3	7	126	745
	12.62	0.00	23.76	16.11	10.47	18.79	0.40	0.94	16.91	100.00
	0.43	0.00	0.70	0.35	0.91	0.61	0.31	0.35	0.77	0.56
-----+-----+-----										
'5-9	18	0	44	29	6	48	1	2	20	168
	10.71	0.00	26.19	17.26	3.57	28.57	0.60	1.19	11.90	100.00
	0.08	0.00	0.17	0.09	0.07	0.21	0.10	0.10	0.12	0.13
-----+-----+-----										
'10-14	35	1	54	74	27	59	2	3	17	272
	12.87	0.37	19.85	27.21	9.93	21.69	0.74	1.10	6.25	100.00
	0.16	0.38	0.21	0.22	0.31	0.26	0.20	0.15	0.10	0.21
-----+-----+-----										
'15-19	218	2	189	451	71	321	6	9	105	1,372
	15.89	0.15	13.78	32.87	5.17	23.40	0.44	0.66	7.65	100.00
	1.01	0.76	0.74	1.33	0.83	1.40	0.61	0.46	0.64	1.04
-----+-----+-----										
'20-24	1,144	9	1,100	2,715	354	1,422	42	84	710	7,580
	15.09	0.12	14.51	35.82	4.67	18.76	0.55	1.11	9.37	100.00
	5.28	3.41	4.32	8.02	4.13	6.19	4.28	4.26	4.35	5.74
-----+-----+-----										
'25-29	2,465	39	2,764	6,125	720	3,168	114	198	1,663	17,256
	14.28	0.23	16.02	35.49	4.17	18.36	0.66	1.15	9.64	100.00
	11.38	14.77	10.86	18.09	8.39	13.78	11.61	10.03	10.19	13.07
-----+-----+-----										
'30-34	3,156	32	3,847	7,122	1,127	4,145	167	317	2,357	22,270
	14.17	0.14	17.27	31.98	5.06	18.61	0.75	1.42	10.58	100.00
	14.57	12.12	15.12	21.04	13.14	18.03	17.01	16.06	14.44	16.86
-----+-----+-----										
'35-39	3,007	48	3,848	5,683	1,239	3,569	165	329	2,304	20,192

[illegible]

```
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-  
HBcT_Positive_Cases.dta",replace
```

```
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBcT_Positive_Cases.dta  
saved
```

```
.  
. restore
```

```
.  
. tab HEPATITIS_B_CORE_TOTAL_AB
```

```
HEPATITIS_B_ |  
CORE_TOTAL_A |  
      B |   Freq.   Percent   Cum.  
-----+-----  
EQUIVOCAL |     139     0.05     0.05  
LOW POSITIVE |    142     0.05     0.10  
NEGATIVE |  150,713   53.27   53.37  
POSITIVE |  131,936   46.63  100.00  
-----+-----  
Total |   282,930  100.00
```

```
.  
. keep if HEPATITIS_B_CORE_TOTAL_AB == "NEGATIVE"  
(132,217 observations deleted)
```

```
.  
. count  
150,713
```

```
.  
. tab GENDER
```

GENDER	Freq.	Percent	Cum.
-----+-----			
F	94,644	62.80	62.80
M	54,093	35.89	98.69
U	1,976	1.31	100.00
-----+-----			
Total	150,713	100.00	

.

. tab PROVINCE_NAME

PROVINCE_NAME	Freq.	Percent	Cum.
-----+-----			
EASTERN CAPE	27,452	18.21	18.21
FREE STATE	136	0.09	18.30
GAUTENG	40,746	27.04	45.34
KWAZULU-NATAL	6,503	4.31	49.66
LIMPOPO	14,131	9.38	59.03
MPUMALANGA	28,862	19.15	78.18
NORTH WEST	1,878	1.25	79.43
NORTHERN CAPE	3,421	2.27	81.70
WESTERN CAPE	27,584	18.30	100.00
-----+-----			
Total	150,713	100.00	

.

. tab PROVINCE_DISTRICT

PROVINCE_DISTRICT	Freq.	Percent	Cum.
-----+-----			
EASTERN CAPE_ALFRED NZO	1,533	1.02	1.02
EASTERN CAPE_AMATHOLE	1,156	0.77	1.78

EASTERN CAPE_BUFFERALO CITY METRO	3,197	2.12	3.91
EASTERN CAPE_CHRIS HANI	1,151	0.76	4.67
EASTERN CAPE_JOE GQABI	545	0.36	5.03
EASTERN CAPE_NELSON MANDELA BAY METRO	12,591	8.35	13.39
EASTERN CAPE_NOT APPLICABLE	4	0.00	13.39
EASTERN CAPE_O R TAMBO	4,373	2.90	16.29
EASTERN CAPE_SARAH BAARTMAN	2,896	1.92	18.21
EASTERN CAPE_UNKNOWN	6	0.00	18.21
FREE STATE_FEZILE DABI	4	0.00	18.22
FREE STATE_LEJWELEPUTSWA	33	0.02	18.24
FREE STATE_MANGAUNG METRO	79	0.05	18.29
FREE STATE_THABO MOFUTSANYANA	10	0.01	18.30
FREE STATE_UNKNOWN	2	0.00	18.30
FREE STATE_XHARIEP	8	0.01	18.30
GAUTENG_CITY OF JOHANNESBURG METRO	18,181	12.06	30.37
GAUTENG_CITY OF TSHWANE METRO	13,887	9.21	39.58
GAUTENG_EKURHULENI METRO	5,627	3.73	43.32
GAUTENG_SEDIBENG	621	0.41	43.73
GAUTENG_UNKNOWN	621	0.41	44.14
GAUTENG_WEST RAND	1,809	1.20	45.34
KWAZULU-NATAL_AMAJUBA	172	0.11	45.45
KWAZULU-NATAL_ETHEKWINI METRO	3,286	2.18	47.63
KWAZULU-NATAL_HARRY GWALA	88	0.06	47.69
KWAZULU-NATAL_ILEMBE	96	0.06	47.76
KWAZULU-NATAL_KING CETSHWAYO	96	0.06	47.82
KWAZULU-NATAL_UGU	517	0.34	48.16
KWAZULU-NATAL_UMGUNGUNDLOVU	1,492	0.99	49.15
KWAZULU-NATAL_UMKHANYAKUDE	342	0.23	49.38
KWAZULU-NATAL_UMZINYATHI	107	0.07	49.45
KWAZULU-NATAL_UTHUKELA	76	0.05	49.50
KWAZULU-NATAL_UTHUNGULU	75	0.05	49.55
KWAZULU-NATAL_ZULULAND	156	0.10	49.66

LIMPOPO_CAPRICORN	4,769	3.16	52.82
LIMPOPO_GREATER SEKHUKHUNE	1,760	1.17	53.99
LIMPOPO_MOPANI	3,829	2.54	56.53
LIMPOPO_UNKNOWN	1	0.00	56.53
LIMPOPO_VHEMBE	2,926	1.94	58.47
LIMPOPO_WATERBERG	846	0.56	59.03
MPUMALANGA_EHLANZENI	8,952	5.94	64.97
MPUMALANGA_GERT SIBANDE	14,161	9.40	74.37
MPUMALANGA_NKANGALA	5,725	3.80	78.17
MPUMALANGA_UNKNOWN	24	0.02	78.18
NORTH WEST_BOJANALA PLATINUM	852	0.57	78.75
NORTH WEST_DR KENNETH KAUNDA	169	0.11	78.86
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	191	0.13	78.99
NORTH WEST_NGAKA MODIRI MOLEMA	666	0.44	79.43
NORTHERN CAPE_FRANCES BAARD	53	0.04	79.46
NORTHERN CAPE_JOHN TAOLO GAETSEWE	20	0.01	79.48
NORTHERN CAPE_NAMAKWA	1,021	0.68	80.15
NORTHERN CAPE_PIXLEY KA SEME	14	0.01	80.16
NORTHERN CAPE_ZF MGCAWU	2,313	1.53	81.70
WESTERN CAPE_CAPE WINELANDS	4,394	2.92	84.61
WESTERN CAPE_CENTRAL KAROO	429	0.28	84.90
WESTERN CAPE_CITY OF CAPE TOWN METRO	16,487	10.94	95.84
WESTERN CAPE_GARDEN ROUTE	4,458	2.96	98.80
WESTERN CAPE_NOT APPLICABLE	14	0.01	98.80
WESTERN CAPE_OVERBERG	800	0.53	99.34
WESTERN CAPE_UNKNOWN	60	0.04	99.37
WESTERN CAPE_WEST COAST	942	0.63	100.00

-----+-----

Total | 150,713 100.00

.

. tab TAKEN_DATE_AGE_GROUP

```

RECODE of |
AGE_TAKEN_D |
ATE_YEARS |   Freq.   Percent   Cum.

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```

'0-4	4,637	3.08	3.08
'5-9	3,651	2.42	5.50
'10-14	4,900	3.25	8.75
'15-19	9,139	6.06	14.81
'20-24	16,514	10.96	25.77
'25-29	20,744	13.76	39.54
'30-34	19,898	13.20	52.74
'35-39	16,261	10.79	63.53
'40-44	13,017	8.64	72.16
'45-49	9,963	6.61	78.77
'50-54	8,038	5.33	84.11
'55-59	6,416	4.26	88.37
'60+	11,393	7.56	95.92
99999	6,142	4.08	100.00

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Total	150,713	100.00	

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.
. tab TAKEN_DATE_AGE_GROUP GENDER, row col

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+-----+
| Key      |
|-----|
| frequency |
| row percentage |
| column percentage |
+-----+

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RECODE of |

AGE_TAKEN_ |

GENDER

DATE_YEARS | F M U | Total

-----+-----+-----

'0-4 | 2,320 2,263 54 | 4,637

 | 50.03 48.80 1.16 | 100.00

 | 2.45 4.18 2.73 | 3.08

-----+-----+-----

'5-9 | 2,039 1,572 40 | 3,651

 | 55.85 43.06 1.10 | 100.00

 | 2.15 2.91 2.02 | 2.42

-----+-----+-----

'10-14 | 3,204 1,654 42 | 4,900

 | 65.39 33.76 0.86 | 100.00

 | 3.39 3.06 2.13 | 3.25

-----+-----+-----

'15-19 | 6,849 2,228 62 | 9,139

 | 74.94 24.38 0.68 | 100.00

 | 7.24 4.12 3.14 | 6.06

-----+-----+-----

'20-24 | 12,315 4,087 112 | 16,514

 | 74.57 24.75 0.68 | 100.00

 | 13.01 7.56 5.67 | 10.96

-----+-----+-----

'25-29 | 14,442 6,183 119 | 20,744

 | 69.62 29.81 0.57 | 100.00

 | 15.26 11.43 6.02 | 13.76

-----+-----+-----

'30-34 | 12,681 7,089 128 | 19,898

 | 63.73 35.63 0.64 | 100.00

 | 13.40 13.11 6.48 | 13.20

-----+-----+-----				
'35-39	9,811	6,345	105	16,261
	60.33	39.02	0.65	100.00
	10.37	11.73	5.31	10.79
-----+-----+-----				
'40-44	7,515	5,428	74	13,017
	57.73	41.70	0.57	100.00
	7.94	10.03	3.74	8.64
-----+-----+-----				
'45-49	5,696	4,203	64	9,963
	57.17	42.19	0.64	100.00
	6.02	7.77	3.24	6.61
-----+-----+-----				
'50-54	4,731	3,263	44	8,038
	58.86	40.59	0.55	100.00
	5.00	6.03	2.23	5.33
-----+-----+-----				
'55-59	3,682	2,698	36	6,416
	57.39	42.05	0.56	100.00
	3.89	4.99	1.82	4.26
-----+-----+-----				
'60+	6,406	4,915	72	11,393
	56.23	43.14	0.63	100.00
	6.77	9.09	3.64	7.56
-----+-----+-----				
99999	2,953	2,165	1,024	6,142
	48.08	35.25	16.67	100.00
	3.12	4.00	51.82	4.08
-----+-----+-----				
Total	94,644	54,093	1,976	150,713
	62.80	35.89	1.31	100.00
	100.00	100.00	100.00	100.00

.

. tab PROVINCE_NAME GENDER, row col

+-----+

| Key |

|-----|

| frequency |

| row percentage |

| column percentage |

+-----+

	GENDER			
PROVINCE_NAME	F	M	U	Total
-----+-----+-----				
EASTERN CAPE	17,981	9,305	166	27,452
	65.50	33.90	0.60	100.00
	19.00	17.20	8.40	18.21
-----+-----+-----				
FREE STATE	82	52	2	136
	60.29	38.24	1.47	100.00
	0.09	0.10	0.10	0.09
-----+-----+-----				
GAUTENG	24,341	15,371	1,034	40,746
	59.74	37.72	2.54	100.00
	25.72	28.42	52.33	27.04
-----+-----+-----				
KWAZULU-NATAL	3,737	2,605	161	6,503
	57.47	40.06	2.48	100.00
	3.95	4.82	8.15	4.31
-----+-----+-----				
LIMPOPO	9,941	4,107	83	14,131

		70.35	29.06	0.59		100.00
		10.50	7.59	4.20		9.38
+-----+						
MPUMALANGA		18,571	10,051	240		28,862
		64.34	34.82	0.83		100.00
		19.62	18.58	12.15		19.15
+-----+						
NORTH WEST		1,177	685	16		1,878
		62.67	36.47	0.85		100.00
		1.24	1.27	0.81		1.25
+-----+						
NORTHERN CAPE		2,185	1,202	34		3,421
		63.87	35.14	0.99		100.00
		2.31	2.22	1.72		2.27
+-----+						
WESTERN CAPE		16,629	10,715	240		27,584
		60.28	38.84	0.87		100.00
		17.57	19.81	12.15		18.30
+-----+						
Total		94,644	54,093	1,976		150,713
		62.80	35.89	1.31		100.00
		100.00	100.00	100.00		100.00

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.
. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME, row col

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+-----+	
Key	

frequency	
row percentage	
column percentage	

+-----+

RECODE of |

AGE_TAKEN_ | PROVINCE_NAME

DATE_YEARS | EASTERN.. FREE ST.. GAUTENG KWAZULU.. LIMPOPO MPUMALA.. NORTH W..
NORTHER.. WESTERN.. | Total

+-----+

'0-4	846	6	1,079	331	504	702	32	81	1,056	4,637
	18.24	0.13	23.27	7.14	10.87	15.14	0.69	1.75	22.77	100.00
	3.08	4.41	2.65	5.09	3.57	2.43	1.70	2.37	3.83	3.08

+-----+

'5-9	807	2	641	161	346	716	28	73	877	3,651
	22.10	0.05	17.56	4.41	9.48	19.61	0.77	2.00	24.02	100.00
	2.94	1.47	1.57	2.48	2.45	2.48	1.49	2.13	3.18	2.42

+-----+

'10-14	1,067	3	858	273	556	988	46	77	1,032	4,900
	21.78	0.06	17.51	5.57	11.35	20.16	0.94	1.57	21.06	100.00
	3.89	2.21	2.11	4.20	3.93	3.42	2.45	2.25	3.74	3.25

+-----+

'15-19	1,968	9	1,669	466	1,162	2,001	110	179	1,575	9,139
	21.53	0.10	18.26	5.10	12.71	21.90	1.20	1.96	17.23	100.00
	7.17	6.62	4.10	7.17	8.22	6.93	5.86	5.23	5.71	6.06

+-----+

'20-24	3,181	14	3,734	830	1,584	3,760	191	398	2,822	16,514
	19.26	0.08	22.61	5.03	9.59	22.77	1.16	2.41	17.09	100.00
	11.59	10.29	9.16	12.76	11.21	13.03	10.17	11.63	10.23	10.96

+-----+

'25-29	3,803	13	5,066	957	1,794	4,740	241	520	3,610	20,744
	18.33	0.06	24.42	4.61	8.65	22.85	1.16	2.51	17.40	100.00
	13.85	9.56	12.43	14.72	12.70	16.42	12.83	15.20	13.09	13.76

+-----+

'30-34	3,495	19	5,168	905	1,846	4,252	250	481	3,482	19,898
	17.56	0.10	25.97	4.55	9.28	21.37	1.26	2.42	17.50	100.00

		12.73	13.97	12.68	13.92	13.06	14.73	13.31	14.06	12.62		13.20
-----+-----												
'35-39		2,914	20	4,509	711	1,615	3,105	267	441	2,679		16,261
		17.92	0.12	27.73	4.37	9.93	19.09	1.64	2.71	16.48		100.00
		10.61	14.71	11.07	10.93	11.43	10.76	14.22	12.89	9.71		10.79
-----+-----												
'40-44		2,257	10	3,819	495	1,316	2,334	199	357	2,230		13,017
		17.34	0.08	29.34	3.80	10.11	17.93	1.53	2.74	17.13		100.00
		8.22	7.35	9.37	7.61	9.31	8.09	10.60	10.44	8.08		8.64
-----+-----												
'45-49		1,741	10	2,881	349	869	1,688	151	278	1,996		9,963
		17.47	0.10	28.92	3.50	8.72	16.94	1.52	2.79	20.03		100.00
		6.34	7.35	7.07	5.37	6.15	5.85	8.04	8.13	7.24		6.61
-----+-----												
'50-54		1,442	6	2,333	272	748	1,233	95	203	1,706		8,038
		17.94	0.07	29.02	3.38	9.31	15.34	1.18	2.53	21.22		100.00
		5.25	4.41	5.73	4.18	5.29	4.27	5.06	5.93	6.18		5.33
-----+-----												
'55-59		1,218	6	1,966	194	489	818	87	135	1,503		6,416
		18.98	0.09	30.64	3.02	7.62	12.75	1.36	2.10	23.43		100.00
		4.44	4.41	4.83	2.98	3.46	2.83	4.63	3.95	5.45		4.26
-----+-----												
'60+		2,306	13	3,469	428	947	1,118	159	147	2,806		11,393
		20.24	0.11	30.45	3.76	8.31	9.81	1.40	1.29	24.63		100.00
		8.40	9.56	8.51	6.58	6.70	3.87	8.47	4.30	10.17		7.56
-----+-----												
99999		407	5	3,554	131	355	1,407	22	51	210		6,142
		6.63	0.08	57.86	2.13	5.78	22.91	0.36	0.83	3.42		100.00
		1.48	3.68	8.72	2.01	2.51	4.87	1.17	1.49	0.76		4.08
-----+-----												
Total		27,452	136	40,746	6,503	14,131	28,862	1,878	3,421	27,584		150,713
		18.21	0.09	27.04	4.31	9.38	19.15	1.25	2.27	18.30		100.00

```
      | 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 100.00 |
100.00
```

```
. use "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-
HBcT_All_Cases.dta",clear
```

```
.
```

```
. count if UNIQUE_PATIENT_ID==1
```

```
15
```

```
.
```

```
. preserve
```

```
.
```

```
. keep if UNIQUE_PATIENT_ID==1
```

```
(282,915 observations deleted)
```

```
.
```

```
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBcT_minus1-
15.dta",replace
```

```
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBcT_minus1-15.dta saved
```

```
.
```

```
. restore
```

```
. drop if UNIQUE_PATIENT_ID==1
```

```
(15 observations deleted)
```

```
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBcT_nominus1-
282915.dta",replace
```

```
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBcT_nominus1-
282915.dta saved
```

```
.
```

Appendix 5.3: Stata Log file of anti-HBs and anti-HBcT merge and analysis

```
. use "2015-2019_anti-HBs_nominus1-631179.dta", clear
```

```
.
```

```
. merge 1:1 UNIQUE_PATIENT_ID using "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBcT_nominus1-282915.dta", generate(_merge_antiHBs_antiHBcT) force
```

```
(label TAKEN_DATE_AGE_GROUP already defined)
```

Result	Number of obs

Not matched	483,612
from master	415,938 (_merge_antiHBs_antiHBcT==1)
from using	67,674 (_merge_antiHBs_antiHBcT==2)
Matched	215,241 (_merge_antiHBs_antiHBcT==3)

```
.
```

```
. tab HEPATITIS_B_SURFACE_AB HEPATITIS_B_CORE_TOTAL_AB
```

HEPATITIS_B_SURFACE_A		HEPATITIS_B_CORE_TOTAL_AB				
B		EQUIVOCAL	LOW POS..	NEGATIVE	POSITIVE	Total
-----+-----+-----						
EQUIVOCAL	3	1	125	145	274	
LOW POSITIVE	0	0	102	97	199	
NEGATIVE	35	44	92,797	42,899	135,775	
POSITIVE	71	87	25,023	53,812	78,993	
-----+-----+-----						
Total	109	132	118,047	96,953	215,241	

```
.  
. preserve  
  
.   
. keep if _merge_antiHBs_antiHBcT==3  
(483,612 observations deleted)  
  
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT merged  
215241.dta",replace  
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT merged  
215241.dta saved  
  
.   
. restore  
  
.   
. preserve  
  
.   
. keep if _merge_antiHBs_antiHBcT==1  
(282,915 observations deleted)  
  
.   
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT  
mergedUnique_anti-HBs 415939.dta",replace  
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT  
mergedUnique_anti-HBs 415939.dta saved  
  
.   
. restore  
  
.   
. preserve
```

```
. keep if _merge_antiHBs_antiHBcT==2
```

```
(631,179 observations deleted)
```

```
.
```

```
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT  
mergedUnique_anti-HBcT 67674.dta",replace
```

```
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT  
mergedUnique_anti-HBcT 67674.dta saved
```

```
.
```

```
. restore
```

```
.
```

```
. use "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBs_minus1-31.dta",  
clear
```

```
.
```

```
. drop HEP_B_SURFACE_AG HEP_B_SURFACE_AG_value HEPATITIS_B_CORE_IGM  
HEPATITIS_B_CORE_IGM_VALUE HEPATITIS_B_E_AG HEPATITIS_B_E_AG_VALUE  
HEPATITIS_B_CORE_TOTAL_AB
```

```
.
```

```
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBs_minus1-31.dta",  
replace
```

```
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBs_minus1-31.dta saved
```

```
.
```

```
. use "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBcT_minus1-  
15.dta",clear
```

```
.
```

```
. drop HEP_B_SURFACE_AG HEP_B_SURFACE_AG_value HEPATITIS_B_CORE_IGM  
HEPATITIS_B_CORE_IGM_VALUE HEPATITIS_B_E_AG HEPATITIS_B_E_AG_VALUE  
HEPATITIS_B_SURFACE_AB
```

```
.
```



```
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBcT_minus1-15.dta",
replace
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBcT_minus1-15.dta saved
```

```
.
. use "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBs_minus1-
31.dta",clear
.
. merge 1:1 DOB HOSPITAL_ID FACILITY_NAME using
"C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019_anti-HBcT_minus1-15.dta",
generate(_merge_antiHBs_antiBcT2) force
(label TAKEN_DATE_AGE_GROUP already defined)
```

Result	Number of obs

Not matched	18
from master	17 (_merge_antiHBs_antiBcT2==1)
from using	1 (_merge_antiHBs_antiBcT2==2)
Matched	14 (_merge_antiHBs_antiBcT2==3)

```
.
. tab _merge_antiHBs_antiBcT2
```

Matching result from				
merge	Freq.	Percent	Cum.	
-----+-----				
Master only (1)	17	53.12	53.12	
Using only (2)	1	3.12	56.25	
Matched (3)	14	43.75	100.00	
-----+-----				
Total	32	100.00		

```

.
. preserve

.
. keep if _merge_antiHBs_antiHBcT2==3
(18 observations deleted)

.
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT merged-1_14.dta",replace
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT merged-1_14.dta saved

.
. restore

.
. preserve

.
. keep if _merge_antiHBs_antiHBcT2==1
(15 observations deleted)

.
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT mergedUnique_anti-HBs-1_17.dta",replace
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT mergedUnique_anti-HBs-1_17.dta saved

.
. restore

.

```

```
. keep if _merge_antiHBs_antiHBcT2==2
```

```
(31 observations deleted)
```

```
.
```

```
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT  
mergedUnique_anti-HBcT-1_1.dta",replace
```

```
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT  
mergedUnique_anti-HBcT-1_1.dta saved
```

```
.
```

```
. use "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT merged  
215241.dta",clear
```

```
.
```

```
. append using "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT  
merged-1_14.dta", force
```

```
(label _merge already defined)
```

```
(label TAKEN_DATE_AGE_GROUP already defined)
```

```
.
```

```
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT  
mergedappended 215255.dta",replace
```

```
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT  
mergedappended 215255.dta saved
```

```
.
```

```
. use "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT  
mergedUnique_anti-HBs 415939.dta", clear
```

```
.
```

```
. append using "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT  
mergedUnique_anti-HBs-1_17.dta", force
```

```
(label TAKEN_DATE_AGE_GROUP already defined)
```

```
(label _merge already defined)
```

```
.
. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT
mergedUniqueAppended_anti-HBs_415956.dta",replace
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT
mergedUniqueAppended_anti-HBs_415956.dta saved

.

. use "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT
mergedUnique_anti-HBcT 67674.dta", clear

.

. append using "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT
mergedUnique_anti-HBcT-1_1.dta", force
(label _merge already defined)
(label TAKEN_DATE_AGE_GROUP already defined)

.

. save "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT
mergedUniqueAppended_anti-HBcT 67675.dta",replace
file C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT
mergedUniqueAppended_anti-HBcT 67675.dta saved

.

. use "C:\Users\shelinam\Documents\StataFiles_Chapter3\2015-2019 antiHBs_anti-HBcT
mergedappended 215255.dta"
```

```
. tab HEPATITIS_B_SURFACE_AB HEPATITIS_B_CORE_TOTAL_AB
```

HEPATITIS_B_SURFACE_A		HEPATITIS_B_CORE_TOTAL_AB			
B EQUIVOCAL		LOW POS..	NEGATIVE	POSITIVE	Total
-----+-----+-----					
EQUIVOCAL	3	1	125	145	274
LOW POSITIVE	0	0	102	97	199
NEGATIVE	35	44	92,805	42,901	135,785

POSITIVE	71	87	25,025	53,814	78,997
-----+-----+-----					
Total	109	132	118,057	96,957	215,255
.					
. tab HEPATITIS_B_SURFACE_AB HEPATITIS_B_CORE_TOTAL_AB,row col					

+-----+	
Key	

frequency	
row percentage	
column percentage	
+-----+	

HEPATITIS_B_SURFACE_A	HEPATITIS_B_CORE_TOTAL_AB				
B	EQUIVOCAL	LOW POS..	NEGATIVE	POSITIVE	Total
-----+-----+-----					
EQUIVOCAL	3	1	125	145	274
	1.09	0.36	45.62	52.92	100.00
	2.75	0.76	0.11	0.15	0.13
-----+-----+-----					
LOW POSITIVE	0	0	102	97	199
	0.00	0.00	51.26	48.74	100.00
	0.00	0.00	0.09	0.10	0.09
-----+-----+-----					
NEGATIVE	35	44	92,805	42,901	135,785
	0.03	0.03	68.35	31.59	100.00
	32.11	33.33	78.61	44.25	63.08
-----+-----+-----					
POSITIVE	71	87	25,025	53,814	78,997
	0.09	0.11	31.68	68.12	100.00

		65.14	65.91	21.20	55.50		36.70
-----+-----+-----							
Total		109	132	118,057	96,957		215,255
		0.05	0.06	54.85	45.04		100.00
		100.00	100.00	100.00	100.00		100.00

. replace HEPATITIS_B_SURFACE_AB="POSITIVE" if HEPATITIS_B_SURFACE_AB=="LOW POSITIVE"

(199 real changes made)

. replace HEPATITIS_B_CORE_TOTAL_AB ="POSITIVE" if HEPATITIS_B_CORE_TOTAL_AB =="LOW POSITIVE"

(132 real changes made)

. tab HEPATITIS_B_SURFACE_AB HEPATITIS_B_CORE_TOTAL_AB,row col

```

+-----+
| Key      |
|-----|
| frequency |
| row percentage |
| column percentage |
+-----+

```

HEPATITIS_B_SURFACE_A | HEPATITIS_B_CORE_TOTAL_AB

	B		EQUIVOCAL	NEGATIVE	POSITIVE		Total
-----+-----+-----							
EQUIVOCAL		3	125	146		274	
		1.09	45.62	53.28		100.00	
		2.75	0.11	0.15		0.13	
-----+-----+-----							
NEGATIVE		35	92,805	42,945		135,785	
		0.03	68.35	31.63		100.00	

		32.11	78.61	44.23		63.08
-----+-----+-----						
POSITIVE		71	25,127	53,998		79,196
		0.09	31.73	68.18		100.00
		65.14	21.28	55.62		36.79
-----+-----+-----						
Total		109	118,057	97,089		215,255
		0.05	54.85	45.10		100.00
		100.00	100.00	100.00		100.00

Appendix 5.4: Stata log file of merging HBsAg All cases to cases with anti-HBs and anti-HBcT results

```
. use "2015-2019_HBsAg_All_cases.dta",clear
```

```
. count if UNIQUE_PATIENT_ID==1
```

```
46
```

```
. preserve
```

```
. keep if UNIQUE_PATIENT_ID==1
```

```
(1,957,178 observations deleted)
```

```
. save "Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD  
Output files_SM081020\Files_Chapter3\Final for PhD 061023\StataFiles\2015-  
2019_HBsAg_All_cases-1_46.dta",replace
```

```
file Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD Output  
files_SM081020\Files_Chapter3\Final for PhD 061023\StataFiles\2015-2019_HBsAg_All_cases-  
1_46.dta saved
```

```
. restore
```

```
. drop if UNIQUE_PATIENT_ID==1
```

```
(46 observations deleted)
```

```
. save "Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD  
Output files_SM081020\Files_Chapter3\Final for PhD 061023\StataFiles\2015-  
2019_HBsAg_All_cases_no-1_1957178.dta",r
```

```
> eplace
```

```
file Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD Output  
files_SM081020\Files_Chapter3\Final for PhD 061023\StataFiles\2015-2019_HBsAg_All_cases_no-  
1_1957178.dta
```

```
saved
```



```
. merge 1:1 UNIQUE_PATIENT_ID using "Z:\Centre for Vaccines and
Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD Output
files_SM081020\Files_Chapter3\Final for PhD 061023\StataFiles\2015-2019 antiHB
> s_anti-HBcT merged 215241-2.dta", generate(_mergeAllsAg_no_1_215241_New) force
(variable TAKEN_DATE_AGE_GROUP was int, now long to accommodate using data's values)
(label TAKEN_DATE_AGE_GROUP already defined)
```

Result	Number of obs

Not matched	1,758,589
from master	1,750,263 (_mergeAllsAg_no_1_215241_New==1)
from using	8,326 (_mergeAllsAg_no_1_215241_New==2)
Matched	206,915 (_mergeAllsAg_no_1_215241_New==3)

```
. preserve

. keep if _mergeAllsAg_no_1_215241==3
(1,758,589 observations deleted)

. save "Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD
Output files_SM081020\Files_Chapter3\Final for PhD 061023\StataFiles\2015-2019_All_HBsAg_no-
1_Merged_215241_206915
> .dta",replace

file Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD Output
files_SM081020\Files_Chapter3\Final for PhD
061023\StataFiles\2015-2019_All_HBsAg_no-1_Merged_215241_206915.dta saved

. restore

. preserve

. keep if _mergeAllsAg_no_1_215241==2
```

(1,957,178 observations deleted)

```
. save "Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD  
Output files_SM081020\Files_Chapter3\Final for PhD 061023\StataFiles\2015-2019_All_HBsAg_no-  
1_NotMerged_215241_832
```

```
> 6.dta",replace
```

```
file Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD Output  
files_SM081020\Files_Chapter3\Final for PhD
```

```
061023\StataFiles\2015-2019_All_HBsAg_no-1_NotMerged_215241_8326.dta saved
```

```
. restore
```

```
. use "Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD  
Output files_SM081020\Files_Chapter3\Final for PhD 061023\StataFiles\2015-  
2019_HBsAg_All_cases-1_46.dta", clear
```

```
. merge m:1 DOB HOSPITAL_ID FACILITY_NAME using "Z:\Centre for Vaccines and  
Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD Output  
files_SM081020\Files_Chapter3\Final for PhD 061023\StataFiles\2015
```

```
> -2019 antiHBs_anti-HBcT merged-1_14-2.dta", generate(_mergeAllsAg_nminus_1_14_New) force  
(variable TAKEN_DATE_AGE_GROUP was int, now long to accommodate using data's values)  
(label TAKEN_DATE_AGE_GROUP already defined)
```

Result	Number of obs

Not matched	32
from master	32 (_mergeAllsAg_nminus_1_14_New==1)
from using	0 (_mergeAllsAg_nminus_1_14_New==2)
Matched	14 (_mergeAllsAg_nminus_1_14_New==3)

```
. keep if _mergeAllsAg_nminus_1_14==3
```

(32 observations deleted)

```
. save "Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD
Output files_SM081020\Files_Chapter3\Final for PhD 061023\StataFiles\2015-2019_All_HBsAg_-
1_Merged_14_14.dta",repl
```

```
> ace
```

```
file Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD Output
files_SM081020\Files_Chapter3\Final for PhD 061023\StataFiles\2015-2019_All_HBsAg_-
1_Merged_14_14.dta saved
```

```
. append using "Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis
B\PhD\PHD Output files_SM081020\Files_Chapter3\Final for PhD 061023\StataFiles\2015-
2019_All_HBsAg_no-1_Merged_21524
```

```
> 1_206915.dta", force
```

```
(label _merge already defined)
```

```
(label TAKEN_DATE_AGE_GROUP already defined)
```

```
. save "Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD
Output files_SM081020\Files_Chapter3\Final for PhD 061023\StataFiles\2015-
2019_Available_HBsAg_anti-HBcT_anti-HBs_
```

```
> 206929.dta",replace
```

```
file Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD Output
files_SM081020\Files_Chapter3\Final for PhD
```

```
061023\StataFiles\2015-2019_Available_HBsAg_anti-HBcT_anti-HBs_206929.dta saved
```

```
. table (HEP_B_SURFACE_AG HEPATITIS_B_SURFACE_AB) HEPATITIS_B_CORE_TOTAL_AB
```

		HEPATITIS_B_CORE_TOTAL_AB				
		EQUIVOCAL	LOW POSITIVE	NEGATIVE	POSITIVE	Total
-----+-----						
HEP_B_SURFACE_AG						
EQUIVOCAL						
HEPATITIS_B_SURFACE_AB						
EQUIVOCAL			1		1	
LOW POSITIVE			2		2	
NEGATIVE		1	587	121	709	
POSITIVE		2	2	112	184	300

Total		3	2	702	305	1,012
LOW POSITIVE						
HEPATITIS_B_SURFACE_AB						
EQUIVOCAL				1		1
NEGATIVE			1	360	193	554
POSITIVE		1	9	99	170	279
Total		1	10	460	363	834
NEGATIVE						
HEPATITIS_B_SURFACE_AB						
EQUIVOCAL		3	1	99	113	216
LOW POSITIVE				86	83	169
NEGATIVE		29	35	84,056	13,535	97,655
POSITIVE		60	58	22,416	49,616	72,150
Total		92	94	106,657	63,347	170,190
POSITIVE						
HEPATITIS_B_SURFACE_AB						
EQUIVOCAL				6	19	25
LOW POSITIVE				4	9	13
NEGATIVE		3	2	4,066	28,257	32,328
POSITIVE		5	1	532	1,989	2,527
Total		8	3	4,608	30,274	34,893
Total						
HEPATITIS_B_SURFACE_AB						
EQUIVOCAL		3	1	107	132	243
LOW POSITIVE				92	92	184
NEGATIVE		33	38	89,069	42,106	131,246
POSITIVE		68	70	23,159	51,959	75,256
Total		104	109	112,427	94,289	206,929

. replace HEPATITIS_B_CORE_TOTAL_AB="POSITIVE" if HEPATITIS_B_CORE_TOTAL_AB=="LOW POSITIVE"

(109 real changes made)

```
. replace HEP_B_SURFACE_AG ="POSITIVE" if HEP_B_SURFACE_AG == "LOW POSITIVE"
```

(834 real changes made)

```
. replace HEPATITIS_B_SURFACE_AB ="POSITIVE" if HEPATITIS_B_SURFACE_AB == "LOW POSITIVE"
```

(184 real changes made)

```
. save "Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD  
Output files_SM081020\Files_Chapter3\Final for PhD 061023\StataFiles\2015-  
2019_Available_HBsAg_anti-HBcT_anti-HBs_
```

```
> 206929.dta", replace
```

```
file Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD Output  
files_SM081020\Files_Chapter3\Final for PhD
```

```
061023\StataFiles\2015-2019_Available_HBsAg_anti-HBcT_anti-HBs_206929.dta saved
```

```
. ***using the same file for analysis
```

```
. table (HEP_B_SURFACE_AG HEPATITIS_B_SURFACE_AB) HEPATITIS_B_CORE_TOTAL_AB
```

		HEPATITIS_B_CORE_TOTAL_AB			
		EQUIVOCAL	NEGATIVE	POSITIVE	Total
HEP_B_SURFACE_AG					
EQUIVOCAL					
HEPATITIS_B_SURFACE_AB					
EQUIVOCAL		1		1	
NEGATIVE		1	587	121	709
POSITIVE		2	114	186	302
Total		3	702	307	1,012
NEGATIVE					
HEPATITIS_B_SURFACE_AB					
EQUIVOCAL		3	99	114	216
NEGATIVE		29	84,056	13,570	97,655

POSITIVE		60	22,502	49,757	72,319

Total		92	106,657	63,441	170,190

POSITIVE	

HEPATITIS_B_SURFACE_AB	

EQUIVOCAL		7	19	26

NEGATIVE		3	4,426	28,453	32,882

POSITIVE		6	635	2,178	2,819

Total		9	5,068	30,650	35,727

Total	

HEPATITIS_B_SURFACE_AB	

EQUIVOCAL		3	107	133	243

NEGATIVE		33	89,069	42,144	131,246

POSITIVE		68	23,251	52,121	75,440

Total		104	112,427	94,398	206,929

```
. drop if HEP_B_SURFACE_AG=="EQUIVOCAL" | HEPATITIS_B_SURFACE_AB=="EQUIVOCAL" |  
HEPATITIS_B_CORE_TOTAL_AB=="EQUIVOCAL"
```

(1,352 observations deleted)

```
. table (HEP_B_SURFACE_AG HEPATITIS_B_SURFACE_AB) HEPATITIS_B_CORE_TOTAL_AB
```

		HEPATITIS_B_CORE_TOTAL_AB

		NEGATIVE	POSITIVE	Total

-----+-----

HEP_B_SURFACE_AG	

NEGATIVE	

HEPATITIS_B_SURFACE_AB	

NEGATIVE		84,056	13,570	97,626

POSITIVE		22,502	49,757	72,259

Total		106,558	63,327	169,885

POSITIVE	

HEPATITIS_B_SURFACE_AB				
NEGATIVE		4,426	28,453	32,879
POSITIVE		635	2,178	2,813
Total		5,061	30,631	35,692
Total				
HEPATITIS_B_SURFACE_AB				
NEGATIVE		88,482	42,023	130,505
POSITIVE		23,137	51,935	75,072
Total		111,619	93,958	205,577

. preserve

. keep if HEP_B_SURFACE_AG=="NEGATIVE" & HEPATITIS_B_SURFACE_AB=="NEGATIVE" &
HEPATITIS_B_CORE_TOTAL_AB=="NEGATIVE"

(121,521 observations deleted)

. tab TAKEN_DATE_AGE_GROUP GENDER

RECODE of				
AGE_TAKEN_ GENDER				
DATE_YEARS	F	M	U	Total
-----+-----+-----				
'0-4	508	539	16	1,063
'5-9	606	476	9	1,091
'10-14	1,477	756	23	2,256
'15-19	3,486	1,208	27	4,721
'20-24	6,813	2,242	56	9,111
'25-29	8,402	3,638	70	12,110
'30-34	7,580	4,277	66	11,923
'35-39	5,936	3,791	60	9,787
'40-44	4,350	3,328	44	7,722
'45-49	3,248	2,504	36	5,788

'50-54	2,690	1,884	31	4,605
'55-59	2,092	1,615	21	3,728
'60+	3,674	2,902	36	6,612
'99999	1,753	1,343	443	3,539
-----+-----+-----				
Total	52,615	30,503	938	84,056

. tab PROVINCE_NAME GENDER

	GENDER			
PROVINCE_NAME	F	M	U	Total
-----+-----+-----				
EASTERN CAPE	4,311	1,938	69	6,318
FREE STATE	28	21	0	49
GAUTENG	15,076	9,805	542	25,423
KWAZULU-NATAL	951	630	41	1,622
LIMPOPO	6,413	2,428	42	8,883
MPUMALANGA	12,591	7,155	150	19,896
NORTH WEST	709	436	10	1,155
NORTHERN CAPE	1,284	659	17	1,960
WESTERN CAPE	11,252	7,431	67	18,750
-----+-----+-----				
Total	52,615	30,503	938	84,056

. tab PROVINCE_DISTRICT GENDER

	GENDER			
PROVINCE_DISTRICT	F	M	U	Total
-----+-----+-----				
EASTERN CAPE_ALFRED..	843	306	26	1,175
EASTERN CAPE_AMATHOLE	276	98	2	376
EASTERN CAPE_BUFFAL..	247	101	4	352

EASTERN CAPE_CHRIS ..		223	108	4		335
EASTERN CAPE_JOE GQ..		87	58	1		146
EASTERN CAPE_NELSON..		309	212	2		523
EASTERN CAPE_NOT AP..		1	0	0		1
EASTERN CAPE_O R TA..		2,188	1,000	30		3,218
EASTERN CAPE_SARAH ..		94	41	0		135
EASTERN CAPE_UNKNOWN		0	1	0		1
FREE STATE_FEZILE D..		0	1	0		1
FREE STATE_LEJWELEP..		1	2	0		3
FREE STATE_MANGAUNG..		16	20	0		36
FREE STATE_THABO MO..		2	1	0		3
GAUTENG_CITY OF JOH..		7,022	4,693	352		12,067
GAUTENG_CITY OF TSH..		4,736	3,207	21		7,964
GAUTENG_EKURHULENI ..		2,173	1,285	21		3,479
GAUTENG_SEDIBENG		226	164	11		401
GAUTENG_UNKNOWN		8	1	132		141
GAUTENG_WEST RAND		858	440	4		1,302
KWAZULU-NATAL_AMAJUBA		6	4	0		10
KWAZULU-NATAL_ETHEK..		471	364	6		841
KWAZULU-NATAL_HARRY..		3	3	0		6
KWAZULU-NATAL_IEMBE		11	5	0		16
KWAZULU-NATAL_KING ..		7	9	0		16
KWAZULU-NATAL_UGU		100	56	7		163
KWAZULU-NATAL_UMGUN..		262	128	27		417
KWAZULU-NATAL_UMKHA..		54	38	0		92
KWAZULU-NATAL_UMZIN..		3	4	0		7
KWAZULU-NATAL_UTHUK..		5	1	0		6
KWAZULU-NATAL_UTHUN..		1	3	0		4
KWAZULU-NATAL_ZULUL..		12	4	0		16
LIMPOPO_CAPRICORN		2,249	961	16		3,226
LIMPOPO_GREATER SEK..		941	343	5		1,289
LIMPOPO_MOPANI		1,537	654	7		2,198

LIMPOPO_VHEMBE	1,355	292	11	1,658
LIMPOPO_WATERBERG	349	192	3	544
MPUMALANGA_EHLANZENI	3,713	1,778	46	5,537
MPUMALANGA_GERT SIB..	6,827	4,148	36	11,011
MPUMALANGA_NKANGALA	2,096	1,241	70	3,407
MPUMALANGA_UNKNOWN	2	2	0	4
NORTH WEST_BOJANALA..	335	205	5	545
NORTH WEST_DR KENNE..	65	17	2	84
NORTH WEST_DR RUTH ..	42	22	1	65
NORTH WEST_NGAKA MO..	271	189	2	462
NORTHERN CAPE_FRANC..	12	9	0	21
NORTHERN CAPE_JOHN ..	6	1	0	7
NORTHERN CAPE_NAMAKWA	471	243	1	715
NORTHERN CAPE_PIXLE..	6	0	0	6
NORTHERN CAPE_ZF MG..	791	412	16	1,219
WESTERN CAPE_CAPE W..	1,931	1,131	23	3,085
WESTERN CAPE_CENTRA..	183	93	0	276
WESTERN CAPE_CITY O..	7,042	4,897	21	11,960
WESTERN CAPE_GARDEN..	1,427	775	3	2,205
WESTERN CAPE_OVERBERG	309	276	2	587
WESTERN CAPE_UNKNOWN	8	3	14	25
WESTERN CAPE_WEST C..	402	261	4	667

-----+-----+-----
Total 52,615 30,503 938 84,056

. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME

RECODE of	AGE_TAKEN_	PROVINCE_NAME
DATE_YEARS	EASTERN..	FREE ST..
	GAUTENG	KWAZULU..
	LIMPOPO	MPUMALA..
	NORTH W..	
Total		

-----+-----+-----
'0-4 126 0 264 32 115 216 5 1,063

'5-9	132	1	228	33	112	281	9	1,091
'10-14	183	0	417	76	284	668	23	2,256
'15-19	491	4	925	118	649	1,358	53	4,721
'20-24	937	7	2,119	190	1,020	2,577	110	9,111
'25-29	1,049	5	3,127	205	1,228	3,408	144	12,110
'30-34	853	6	3,396	193	1,310	3,162	163	11,923
'35-39	709	6	3,117	151	1,125	2,268	178	9,787
'40-44	487	4	2,609	127	887	1,660	133	7,722
'45-49	325	4	1,926	100	585	1,197	93	5,788
'50-54	262	3	1,536	95	502	842	64	4,605
'55-59	221	4	1,328	72	301	571	57	3,728
'60+	355	5	2,253	207	579	814	112	6,612
'99999	188	0	2,178	23	186	874	11	3,539
-----+-----+-----								
Total	6,318	49	25,423	1,622	8,883	19,896	1,155	84,056

RECODE of |

AGE_TAKEN_ | PROVINCE_NAME

DATE_YEARS | NORTHER.. WESTERN.. | Total

-----+-----+-----				
'0-4	13	292	1,063	
'5-9	25	270	1,091	
'10-14	38	567	2,256	
'15-19	86	1,037	4,721	
'20-24	243	1,908	9,111	
'25-29	323	2,621	12,110	
'30-34	281	2,559	11,923	
'35-39	281	1,952	9,787	
'40-44	219	1,596	7,722	
'45-49	152	1,406	5,788	
'50-54	115	1,186	4,605	

'55-59	77	1,097	3,728
'60+	87	2,200	6,612
'99999	20	59	3,539
-----+-----+-----			
Total	1,960	18,750	84,056

. tabout TAKEN_DATE_AGE_GROUP GENDER using
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\Susceptible84056AgeGen.xls
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found)

Table output written to:
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\Susceptible84056AgeGen.xls

GENDER				
RECODE of AGE_TAKEN_DATE_YEARS	F	M	U	Total
No. No. No. No.				
'0-4	508.0	539.0	16.0	1,063.0
'5-9	606.0	476.0	9.0	1,091.0
'10-14	1,477.0	756.0	23.0	2,256.0
'15-19	3,486.0	1,208.0	27.0	4,721.0
'20-24	6,813.0	2,242.0	56.0	9,111.0
'25-29	8,402.0	3,638.0	70.0	12,110.0
'30-34	7,580.0	4,277.0	66.0	11,923.0
'35-39	5,936.0	3,791.0	60.0	9,787.0
'40-44	4,350.0	3,328.0	44.0	7,722.0
'45-49	3,248.0	2,504.0	36.0	5,788.0
'50-54	2,690.0	1,884.0	31.0	4,605.0
'55-59	2,092.0	1,615.0	21.0	3,728.0
'60+	3,674.0	2,902.0	36.0	6,612.0
'99999	1,753.0	1,343.0	443.0	3,539.0
Total	52,615.0	30,503.0	938.0	84,056.0

. tabout PROVINCE_NAME GENDER using

C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\Susceptible84056ProvGen.xls

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Table output written to:

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GENDER

PROVINCE_NAME	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE	4,311.0	1,938.0	69.0	6,318.0
FREE STATE	28.0	21.0	0.0	49.0
GAUTENG	15,076.0	9,805.0	542.0	25,423.0
KWAZULU-NATAL	951.0	630.0	41.0	1,622.0
LIMPOPO	6,413.0	2,428.0	42.0	8,883.0
MPUMALANGA	12,591.0	7,155.0	150.0	19,896.0
NORTH WEST	709.0	436.0	10.0	1,155.0
NORTHERN CAPE	1,284.0	659.0	17.0	1,960.0
WESTERN CAPE	11,252.0	7,431.0	67.0	18,750.0
Total	52,615.0	30,503.0	938.0	84,056.0

. tabout PROVINCE_DISTRICT GENDER using

C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\Susceptible84056DistGen.xls

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Table output written to:

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GENDER

PROVINCE_DISTRICT	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE_ALFRED NZO	843.0	306.0	26.0	1,175.0
EASTERN CAPE_AMATHOLE	276.0	98.0	2.0	376.0

EASTERN CAPE_BUFFERALO CITY METRO	247.0	101.0	4.0	352.0
EASTERN CAPE_CHRIS HANI	223.0	108.0	4.0	335.0
EASTERN CAPE_JOE GQABI	87.0	58.0	1.0	146.0
EASTERN CAPE_NELSON MANDELA BAY METRO	309.0	212.0	2.0	523.0
EASTERN CAPE_NOT APPLICABLE	1.0	0.0	0.0	1.0
EASTERN CAPE_OR TAMBO	2,188.0	1,000.0	30.0	3,218.0
EASTERN CAPE_SARAH BAARTMAN	94.0	41.0	0.0	135.0
EASTERN CAPE_UNKNOWN	0.0	1.0	0.0	1.0
FREE STATE_FEZILE DABI	0.0	1.0	0.0	1.0
FREE STATE_LEJWELEPUTSWA	1.0	2.0	0.0	3.0
FREE STATE_MANGAUNG METRO	16.0	20.0	0.0	36.0
FREE STATE_THABO MOFUTSANYANA	2.0	1.0	0.0	3.0
GAUTENG_CITY OF JOHANNESBURG METRO	7,022.0	4,693.0	352.0	12,067.0
GAUTENG_CITY OF TSHWANE METRO	4,736.0	3,207.0	21.0	7,964.0
GAUTENG_EKURHULENI METRO	2,173.0	1,285.0	21.0	3,479.0
GAUTENG_SEDIBENG	226.0	164.0	11.0	401.0
GAUTENG_UNKNOWN	8.0	1.0	132.0	141.0
GAUTENG_WEST RAND	858.0	440.0	4.0	1,302.0
KWAZULU-NATAL_AMAJUBA	6.0	4.0	0.0	10.0
KWAZULU-NATAL_ETHEKWINI METRO	471.0	364.0	6.0	841.0
KWAZULU-NATAL_HARRY GWALA	3.0	3.0	0.0	6.0
KWAZULU-NATAL_ILEMBE	11.0	5.0	0.0	16.0
KWAZULU-NATAL_KING CETSHWAYO	7.0	9.0	0.0	16.0
KWAZULU-NATAL_UGU	100.0	56.0	7.0	163.0
KWAZULU-NATAL_UMGUNGUNDLOVU	262.0	128.0	27.0	417.0
KWAZULU-NATAL_UMKHANYAKUDE	54.0	38.0	0.0	92.0
KWAZULU-NATAL_UMZINYATHI	3.0	4.0	0.0	7.0
KWAZULU-NATAL_UTHUKELA	5.0	1.0	0.0	6.0
KWAZULU-NATAL_UTHUNGULU	1.0	3.0	0.0	4.0
KWAZULU-NATAL_ZULULAND	12.0	4.0	0.0	16.0
LIMPOPO_CAPRICORN	2,249.0	961.0	16.0	3,226.0
LIMPOPO_GREATER SEKHUKHUNE	941.0	343.0	5.0	1,289.0

LIMPOPO_MOPANI	1,537.0	654.0	7.0	2,198.0
LIMPOPO_VHEMBE	1,355.0	292.0	11.0	1,658.0
LIMPOPO_WATERBERG	349.0	192.0	3.0	544.0
MPUMALANGA_EHLANZENI	3,713.0	1,778.0	46.0	5,537.0
MPUMALANGA_GERT SIBANDE	6,827.0	4,148.0	36.0	11,011.0
MPUMALANGA_NKANGALA	2,096.0	1,241.0	70.0	3,407.0
MPUMALANGA_UNKNOWN	2.0	2.0	0.0	4.0
NORTH WEST_BOJANALA PLATINUM	335.0	205.0	5.0	545.0
NORTH WEST_DR KENNETH KAUNDA	65.0	17.0	2.0	84.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	42.0	22.0	1.0	65.0
NORTH WEST_NGAKA MODIRI MOLEMA	271.0	189.0	2.0	462.0
NORTHERN CAPE_FRANCES BAARD	12.0	9.0	0.0	21.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	6.0	1.0	0.0	7.0
NORTHERN CAPE_NAMAKWA	471.0	243.0	1.0	715.0
NORTHERN CAPE_PIXLEY KA SEME	6.0	0.0	0.0	6.0
NORTHERN CAPE_ZF MGCAWU	791.0	412.0	16.0	1,219.0
WESTERN CAPE_CAPE WINELANDS	1,931.0	1,131.0	23.0	3,085.0
WESTERN CAPE_CENTRAL KAROO	183.0	93.0	0.0	276.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	7,042.0	4,897.0	21.0	11,960.0
WESTERN CAPE_GARDEN ROUTE	1,427.0	775.0	3.0	2,205.0
WESTERN CAPE_OVERBERG	309.0	276.0	2.0	587.0
WESTERN CAPE_UNKNOWN	8.0	3.0	14.0	25.0
WESTERN CAPE_WEST COAST	402.0	261.0	4.0	667.0
Total	52,615.0	30,503.0	938.0	84,056.0

. tabout TAKEN_DATE_AGE_GROUP PROVINCE_NAME using

C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\Susceptible84056AgeProv.xls

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Table output written to:

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PROVINCE_NAME

RECODE of AGE_TAKEN_DATE_YEARS EASTERN CAPE FREE STATE GAUTENG KWAZULU-NATAL
 LIMPOPO MPUMALANGA NORTH WEST NORTHERN CAPE WESTERN CAPE Total

	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	
'0-4	126.0	0.0	264.0	32.0	115.0	216.0	5.0	13.0	292.0	1,063.0	
'5-9	132.0	1.0	228.0	33.0	112.0	281.0	9.0	25.0	270.0	1,091.0	
'10-14	183.0	0.0	417.0	76.0	284.0	668.0	23.0	38.0	567.0	2,256.0	
'15-19	491.0	4.0	925.0	118.0	649.0	1,358.0	53.0	86.0	1,037.0	4,721.0	
'20-24	937.0	7.0	2,119.0	190.0	1,020.0	2,577.0	110.0	243.0	1,908.0	9,111.0	
'25-29	1,049.0	5.0	3,127.0	205.0	1,228.0	3,408.0	144.0	323.0	2,621.0	12,110.0	
'30-34	853.0	6.0	3,396.0	193.0	1,310.0	3,162.0	163.0	281.0	2,559.0	11,923.0	
'35-39	709.0	6.0	3,117.0	151.0	1,125.0	2,268.0	178.0	281.0	1,952.0	9,787.0	
'40-44	487.0	4.0	2,609.0	127.0	887.0	1,660.0	133.0	219.0	1,596.0	7,722.0	
'45-49	325.0	4.0	1,926.0	100.0	585.0	1,197.0	93.0	152.0	1,406.0	5,788.0	
'50-54	262.0	3.0	1,536.0	95.0	502.0	842.0	64.0	115.0	1,186.0	4,605.0	
'55-59	221.0	4.0	1,328.0	72.0	301.0	571.0	57.0	77.0	1,097.0	3,728.0	
'60+	355.0	5.0	2,253.0	207.0	579.0	814.0	112.0	87.0	2,200.0	6,612.0	
'99999	188.0	0.0	2,178.0	23.0	186.0	874.0	11.0	20.0	59.0	3,539.0	
Total	6,318.0	49.0	25,423.0		1,622.0	8,883.0	19,896.0		1,155.0	1,960.0	18,750.0
	84,056.0										

. restore

. preserve

. keep if HEP_B_SURFACE_AG=="NEGATIVE" & HEPATITIS_B_SURFACE_AB=="POSITIVE" &
 HEPATITIS_B_CORE_TOTAL_AB=="NEGATIVE"

(183,075 observations deleted)

. tab TAKEN_DATE_AGE_GROUP GENDER

RECODE of |
 AGE_TAKEN_ | GENDER
 DATE_YEARS | F M U | Total
 -----+-----+-----

'0-4	980	923	22	1,925
'5-9	774	571	16	1,361
'10-14	700	370	3	1,073
'15-19	1,244	353	9	1,606
'20-24	2,001	650	20	2,671
'25-29	1,965	769	19	2,753
'30-34	1,611	650	16	2,277
'35-39	1,216	559	14	1,789
'40-44	1,069	523	9	1,601
'45-49	887	431	13	1,331
'50-54	752	360	9	1,121
'55-59	518	266	6	790
'60+	616	412	11	1,039
'99999	444	243	478	1,165
-----+-----+-----				
Total	14,777	7,080	645	22,502

```
. tab PROVINCE_NAME GENDER
```

	GENDER			
PROVINCE_NAME	F	M	U	Total
-----+-----+-----				
EASTERN CAPE	1,464	667	23	2,154
FREE STATE	15	9	0	24
GAUTENG	4,146	1,995	382	6,523
KWAZULU-NATAL	407	197	21	625
LIMPOPO	1,439	583	12	2,034
MPUMALANGA	3,346	1,265	46	4,657
NORTH WEST	187	84	3	274
NORTHERN CAPE	469	238	6	713
WESTERN CAPE	3,304	2,042	152	5,498
-----+-----+-----				

Total | 14,777 7,080 645 | 22,502

. tab PROVINCE_DISTRICT GENDER

	GENDER			
PROVINCE_DISTRICT	F	M	U	Total
-----+-----+-----				
EASTERN CAPE_ALFRED..	181	58	9	248
EASTERN CAPE_AMATHOLE	47	10	1	58
EASTERN CAPE_BUFFAL..	156	65	1	222
EASTERN CAPE_CHRIS ..	66	27	2	95
EASTERN CAPE_JOE GQ..	19	10	1	30
EASTERN CAPE_NELSON..	328	183	0	511
EASTERN CAPE_O R TA..	563	281	6	850
EASTERN CAPE_SARAH ..	84	22	2	108
FREE STATE_FEZILE D..	1	0	0	1
FREE STATE_MANGAUNG..	9	7	0	16
FREE STATE_THABO MO..	3	0	0	3
FREE STATE_XHARIEP	1	1	0	2
GAUTENG_CITY OF JOH..	2,040	956	66	3,062
GAUTENG_CITY OF TSH..	1,296	705	9	2,010
GAUTENG_EKURHULENI ..	483	210	6	699
GAUTENG_SEDIBENG	47	33	0	80
GAUTENG_UNKNOWN	35	10	299	344
GAUTENG_WEST RAND	252	91	2	345
KWAZULU-NATAL_AMAJUBA	11	3	1	15
KWAZULU-NATAL_ETHEK..	192	126	3	321
KWAZULU-NATAL_HARRY..	1	0	0	1
KWAZULU-NATAL_ILEMBE	1	3	0	4
KWAZULU-NATAL_KING ..	4	3	0	7
KWAZULU-NATAL_UGU	26	12	0	38
KWAZULU-NATAL_UMGUN..	118	38	16	172

KWAZULU-NATAL_UMKHA..	20	9	0	29
KWAZULU-NATAL_UMZIN..	7	2	0	9
KWAZULU-NATAL_UTHUK..	2	1	0	3
KWAZULU-NATAL_UTHUN..	0	0	1	1
KWAZULU-NATAL_ZULUL..	9	0	0	9
LIMPOPO_CAPRICORN	496	231	4	731
LIMPOPO_GREATER SEK..	145	58	1	204
LIMPOPO_MOPANI	394	156	3	553
LIMPOPO_VHEMBE	299	94	3	396
LIMPOPO_WATERBERG	106	40	1	147
MPUMALANGA_EHLANZENI	1,150	435	9	1,594
MPUMALANGA_GERT SIB..	1,229	482	10	1,721
MPUMALANGA_NKANGALA	957	337	27	1,321
MPUMALANGA_UNKNOWN	16	3	0	19
NORTH WEST_BOJANALA..	50	29	2	81
NORTH WEST_DR KENNE..	24	7	1	32
NORTH WEST_DR RUTH ..	30	9	0	39
NORTH WEST_NGAKA MO..	85	40	0	125
NORTHERN CAPE_FRANC..	11	13	1	25
NORTHERN CAPE_JOHN ..	1	0	0	1
NORTHERN CAPE_NAMAKWA	154	60	1	215
NORTHERN CAPE_PIXLE..	6	1	0	7
NORTHERN CAPE_ZF MG..	297	159	4	460
WESTERN CAPE_CAPE W..	652	335	124	1,111
WESTERN CAPE_CENTRA..	64	33	0	97
WESTERN CAPE_CITY O..	1,708	1,259	10	2,977
WESTERN CAPE_GARDEN..	635	299	0	934
WESTERN CAPE_NOT AP..	2	2	0	4
WESTERN CAPE_OVERBERG	118	63	2	183
WESTERN CAPE_UNKNOWN	13	7	15	35
WESTERN CAPE_WEST C..	133	62	2	197

-----+-----+-----

Total | 14,777 7,080 645 | 22,502

. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME

RECODE of |

AGE_TAKEN_ | PROVINCE_NAME

DATE_YEARS | EASTERN.. FREE ST.. GAUTENG KWAZULU.. LIMPOPO MPUMALA.. NORTH W.. |
Total

-----+-----+-----								
'0-4	188	1	485	81	191	356	13	1,925
'5-9	93	1	264	29	140	325	12	1,361
'10-14	52	1	272	23	136	219	5	1,073
'15-19	120	1	398	44	244	386	17	1,606
'20-24	196	6	875	69	217	619	27	2,671
'25-29	267	5	861	96	193	639	43	2,753
'30-34	267	3	695	62	165	461	34	2,277
'35-39	209	3	480	62	156	386	29	1,789
'40-44	187	0	409	47	161	311	30	1,601
'45-49	132	1	346	27	116	264	23	1,331
'50-54	136	1	282	35	99	204	17	1,121
'55-59	108	1	200	17	78	113	10	790
'60+	128	0	289	27	99	139	11	1,039
'99999	71	0	667	6	39	235	3	1,165
-----+-----+-----								
Total	2,154	24	6,523	625	2,034	4,657	274	22,502

RECODE of |

AGE_TAKEN_ | PROVINCE_NAME

DATE_YEARS | NORTHER.. WESTERN.. | Total

-----+-----+-----			
'0-4	27	583	1,925
'5-9	32	465	1,361

'10-14	21	344	1,073
'15-19	35	361	1,606
'20-24	63	599	2,671
'25-29	90	559	2,753
'30-34	89	501	2,277
'35-39	76	388	1,789
'40-44	77	379	1,601
'45-49	74	348	1,331
'50-54	59	288	1,121
'55-59	39	224	790
'60+	23	323	1,039
'99999	8	136	1,165
-----+-----+-----			
Total	713	5,498	22,502

```
. tabout TAKEN_DATE_AGE_GROUP GENDER using
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\VaccineInducedImmunity22502AgeGen
.xls
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.xls not found)
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Table output written to:
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\VaccineInducedImmunity22502AgeGen
.xls
```

GENDER				
RECODE of AGE_TAKEN_DATE_YEARS F M U Total				
No.	No.	No.	No.	
'0-4	980.0	923.0	22.0	1,925.0
'5-9	774.0	571.0	16.0	1,361.0
'10-14	700.0	370.0	3.0	1,073.0
'15-19	1,244.0	353.0	9.0	1,606.0
'20-24	2,001.0	650.0	20.0	2,671.0
'25-29	1,965.0	769.0	19.0	2,753.0

'30-34	1,611.0	650.0	16.0	2,277.0
'35-39	1,216.0	559.0	14.0	1,789.0
'40-44	1,069.0	523.0	9.0	1,601.0
'45-49	887.0	431.0	13.0	1,331.0
'50-54	752.0	360.0	9.0	1,121.0
'55-59	518.0	266.0	6.0	790.0
'60+	616.0	412.0	11.0	1,039.0
'99999	444.0	243.0	478.0	1,165.0
Total	14,777.0	7,080.0	645.0	22,502.0

. tabout PROVINCE_NAME GENDER using

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Table output written to:

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GENDER

PROVINCE_NAME	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE	1,464.0	667.0	23.0	2,154.0
FREE STATE	15.0	9.0	0.0	24.0
GAUTENG	4,146.0	1,995.0	382.0	6,523.0
KWAZULU-NATAL	407.0	197.0	21.0	625.0
LIMPOPO	1,439.0	583.0	12.0	2,034.0
MPUMALANGA	3,346.0	1,265.0	46.0	4,657.0
NORTH WEST	187.0	84.0	3.0	274.0
NORTHERN CAPE	469.0	238.0	6.0	713.0
WESTERN CAPE	3,304.0	2,042.0	152.0	5,498.0
Total	14,777.0	7,080.0	645.0	22,502.0

. tabout PROVINCE_DISTRICT GENDER using

C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\VaccineInducedImmunity22502DistGen.xls

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Table output written to:

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GENDER

PROVINCE_DISTRICT	F	M	U	Total

No.	No.	No.	No.

EASTERN CAPE_ALFRED NZO	181.0	58.0	9.0	248.0

EASTERN CAPE_AMATHOLE	47.0	10.0	1.0	58.0

EASTERN CAPE_BUFFALO CITY METRO	156.0	65.0	1.0	222.0

EASTERN CAPE_CHRIS HANI	66.0	27.0	2.0	95.0

EASTERN CAPE_JOE GQABI	19.0	10.0	1.0	30.0

EASTERN CAPE_NELSON MANDELA BAY METRO	328.0	183.0	0.0	511.0

EASTERN CAPE_O R TAMBO	563.0	281.0	6.0	850.0

EASTERN CAPE_SARAH BAARTMAN	84.0	22.0	2.0	108.0

FREE STATE_FEZILE DABI	1.0	0.0	0.0	1.0

FREE STATE_MANGAUNG METRO	9.0	7.0	0.0	16.0

FREE STATE_THABO MOFUTSANYANA	3.0	0.0	0.0	3.0

FREE STATE_XHARIEP	1.0	1.0	0.0	2.0

GAUTENG_CITY OF JOHANNESBURG METRO	2,040.0	956.0	66.0	3,062.0

GAUTENG_CITY OF TSHWANE METRO	1,296.0	705.0	9.0	2,010.0

GAUTENG_EKURHULENI METRO	483.0	210.0	6.0	699.0

GAUTENG_SEDIBENG	47.0	33.0	0.0	80.0

GAUTENG_UNKNOWN	35.0	10.0	299.0	344.0

GAUTENG_WEST RAND	252.0	91.0	2.0	345.0

KWAZULU-NATAL_AMAJUBA	11.0	3.0	1.0	15.0

KWAZULU-NATAL_ETHEKWINI METRO	192.0	126.0	3.0	321.0

KWAZULU-NATAL_HARRY GWALA	1.0	0.0	0.0	1.0

KWAZULU-NATAL_ILEMBE	1.0	3.0	0.0	4.0
KWAZULU-NATAL_KING CETSHWAYO	4.0	3.0	0.0	7.0
KWAZULU-NATAL_UGU	26.0	12.0	0.0	38.0
KWAZULU-NATAL_UMGUNGUNDLOVU	118.0	38.0	16.0	172.0
KWAZULU-NATAL_UMKHANYAKUDE	20.0	9.0	0.0	29.0
KWAZULU-NATAL_UMZINYATHI	7.0	2.0	0.0	9.0
KWAZULU-NATAL_UTHUKELA	2.0	1.0	0.0	3.0
KWAZULU-NATAL_UTHUNGULU	0.0	0.0	1.0	1.0
KWAZULU-NATAL_ZULULAND	9.0	0.0	0.0	9.0
LIMPOPO_CAPRICORN	496.0	231.0	4.0	731.0
LIMPOPO_GREATER SEKHUKHUNE	145.0	58.0	1.0	204.0
LIMPOPO_MOPANI	394.0	156.0	3.0	553.0
LIMPOPO_VHEMBE	299.0	94.0	3.0	396.0
LIMPOPO_WATERBERG	106.0	40.0	1.0	147.0
MPUMALANGA_EHLANZENI	1,150.0	435.0	9.0	1,594.0
MPUMALANGA_GERT SIBANDE	1,229.0	482.0	10.0	1,721.0
MPUMALANGA_NKANGALA	957.0	337.0	27.0	1,321.0
MPUMALANGA_UNKNOWN	16.0	3.0	0.0	19.0
NORTH WEST_BOJANALA PLATINUM	50.0	29.0	2.0	81.0
NORTH WEST_DR KENNETH KAUNDA	24.0	7.0	1.0	32.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	30.0	9.0	0.0	39.0
NORTH WEST_NGAKA MODIRI MOLEMA	85.0	40.0	0.0	125.0
NORTHERN CAPE_FRANCES BAARD	11.0	13.0	1.0	25.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	1.0	0.0	0.0	1.0
NORTHERN CAPE_NAMAKWA	154.0	60.0	1.0	215.0
NORTHERN CAPE_PIXLEY KA SEME	6.0	1.0	0.0	7.0
NORTHERN CAPE_ZF MGCAWU	297.0	159.0	4.0	460.0
WESTERN CAPE_CAPE WINELANDS	652.0	335.0	124.0	1,111.0
WESTERN CAPE_CENTRAL KAROO	64.0	33.0	0.0	97.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	1,708.0	1,259.0	10.0	2,977.0
WESTERN CAPE_GARDEN ROUTE	635.0	299.0	0.0	934.0
WESTERN CAPE_NOT APPLICABLE	2.0	2.0	0.0	4.0

WESTERN CAPE_OVERBERG	118.0	63.0	2.0	183.0
WESTERN CAPE_UNKNOWN	13.0	7.0	15.0	35.0
WESTERN CAPE_WEST COAST	133.0	62.0	2.0	197.0
Total	14,777.0	7,080.0	645.0	22,502.0

. tabout TAKEN_DATE_AGE_GROUP PROVINCE_NAME using
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.xls

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Table output written to:
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.xls

	PROVINCE_NAME									
	RECODE of AGE_TAKEN_DATE_YEARS									
	EASTERN CAPE	FREE STATE	GAUTENG	KWAZULU-NATAL	LIMPOPO	MPUMALANGA	NORTH WEST	NORTHERN CAPE	WESTERN CAPE	Total
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
'0-4	188.0	1.0	485.0	81.0	191.0	356.0	13.0	27.0	583.0	1,925.0
'5-9	93.0	1.0	264.0	29.0	140.0	325.0	12.0	32.0	465.0	1,361.0
'10-14	52.0	1.0	272.0	23.0	136.0	219.0	5.0	21.0	344.0	1,073.0
'15-19	120.0	1.0	398.0	44.0	244.0	386.0	17.0	35.0	361.0	1,606.0
'20-24	196.0	6.0	875.0	69.0	217.0	619.0	27.0	63.0	599.0	2,671.0
'25-29	267.0	5.0	861.0	96.0	193.0	639.0	43.0	90.0	559.0	2,753.0
'30-34	267.0	3.0	695.0	62.0	165.0	461.0	34.0	89.0	501.0	2,277.0
'35-39	209.0	3.0	480.0	62.0	156.0	386.0	29.0	76.0	388.0	1,789.0
'40-44	187.0	0.0	409.0	47.0	161.0	311.0	30.0	77.0	379.0	1,601.0
'45-49	132.0	1.0	346.0	27.0	116.0	264.0	23.0	74.0	348.0	1,331.0
'50-54	136.0	1.0	282.0	35.0	99.0	204.0	17.0	59.0	288.0	1,121.0
'55-59	108.0	1.0	200.0	17.0	78.0	113.0	10.0	39.0	224.0	790.0
'60+	128.0	0.0	289.0	27.0	99.0	139.0	11.0	23.0	323.0	1,039.0
'99999	71.0	0.0	667.0	6.0	39.0	235.0	3.0	8.0	136.0	1,165.0
Total	2,154.0	24.0	6,523.0	625.0	2,034.0	4,657.0	274.0	713.0	5,498.0	22,502.0

```
. restore
```

```
. preserve
```

```
. keep if HEP_B_SURFACE_AG=="POSITIVE" & HEPATITIS_B_SURFACE_AB=="NEGATIVE" &  
HEPATITIS_B_CORE_TOTAL_AB=="POSITIVE"
```

```
(177,124 observations deleted)
```

```
. tab TAKEN_DATE_AGE_GROUP GENDER
```

```
RECODE of |  
AGE_TAKEN_ |      GENDER  
DATE_YEARS |      F      M      U |  Total  
-----+-----+-----  
    '0-4 |    33    50     2 |    85  
    '5-9 |    16    22     2 |    40  
   '10-14 |    24    34     2 |    60  
   '15-19 |   229   115     1 |   345  
   '20-24 |  1,210   775    46 |  2,031  
   '25-29 |  2,163  2,081    77 |  4,321  
   '30-34 |  2,214  2,998    69 |  5,281  
   '35-39 |  1,654  2,955    54 |  4,663  
   '40-44 |  1,188  2,449    45 |  3,682  
   '45-49 |    777  1,699    39 |  2,515  
   '50-54 |    588  1,056    15 |  1,659  
   '55-59 |    368    662    12 |  1,042  
    '60+ |    524    763    19 |  1,306  
   '99999 |    458    854   111 |  1,423  
-----+-----+-----  
    Total | 11,446 16,513   494 | 28,453
```

```
. tab PROVINCE_NAME GENDER
```

	GENDER			
PROVINCE_NAME	F	M	U	Total
-----+-----+-----				
EASTERN CAPE	652	751	17	1,420
FREE STATE	71	91	1	163
GAUTENG	2,480	3,931	125	6,536
KWAZULU-NATAL	3,772	5,298	268	9,338
LIMPOPO	806	1,051	12	1,869
MPUMALANGA	2,333	3,151	60	5,544
NORTH WEST	128	195	2	325
NORTHERN CAPE	143	188	2	333
WESTERN CAPE	1,061	1,857	7	2,925
-----+-----+-----				
Total	11,446	16,513	494	28,453

. tab PROVINCE_DISTRICT GENDER

	GENDER			
PROVINCE_DISTRICT	F	M	U	Total
-----+-----+-----				
EASTERN CAPE_ALFRED..	94	111	6	211
EASTERN CAPE_AMATHOLE	33	38	1	72
EASTERN CAPE_BUFFAL..	46	32	0	78
EASTERN CAPE_CHRIS ..	63	62	2	127
EASTERN CAPE_JOE GQ..	14	18	0	32
EASTERN CAPE_NELSON..	72	102	0	174
EASTERN CAPE_O R TA..	306	351	5	662
EASTERN CAPE_SARAH ..	19	29	1	49
FREE STATE_FEZILE D..	1	1	0	2
FREE STATE_LEJWELEP..	30	40	1	71
FREE STATE_MANGAUNG..	35	46	0	81

FREE STATE_THABO MO..		3	3	0		6
FREE STATE_XHARIEP		1	0	0		1
GAUTENG_CITY OF JOH..		1,019	1,663	89		2,771
GAUTENG_CITY OF TSH..		934	1,450	17		2,401
GAUTENG_EKURHULENI ..		317	545	10		872
GAUTENG_SEDIBENG		49	92	3		144
GAUTENG_UNKNOWN		1	2	4		7
GAUTENG_WEST RAND		152	157	2		311
KWAZULU-NATAL_AMAJUBA		153	176	9		338
KWAZULU-NATAL_ETHEK..		1,531	2,146	57		3,734
KWAZULU-NATAL_HARRY..		55	78	14		147
KWAZULU-NATAL_IEMBE		211	300	25		536
KWAZULU-NATAL_KING ..		110	137	10		257
KWAZULU-NATAL_UGU		506	710	31		1,247
KWAZULU-NATAL_UMGUN..		753	1,113	107		1,973
KWAZULU-NATAL_UMKHA..		93	127	1		221
KWAZULU-NATAL_UMZIN..		133	207	4		344
KWAZULU-NATAL_UNKNOWN		0	1	0		1
KWAZULU-NATAL_UTHUK..		104	141	3		248
KWAZULU-NATAL_UTHUN..		36	50	4		90
KWAZULU-NATAL_ZULUL..		95	116	4		215
LIMPOPO_CAPRICORN		153	210	1		364
LIMPOPO_GREATER SEK..		111	106	1		218
LIMPOPO_MOPANI		292	361	0		653
LIMPOPO_VHEMBE		186	279	5		470
LIMPOPO_WATERBERG		67	107	5		179
MPUMALANGA_EHLANZENI		1,290	1,629	31		2,950
MPUMALANGA_GERT SIB..		735	1,074	11		1,820
MPUMALANGA_NKANGALA		302	462	18		782
MPUMALANGA_UNKNOWN		1	2	0		3
NORTH WEST_BOJANALA..		58	86	1		145
NORTH WEST_DR KENNE..		29	52	0		81

NORTH WEST_DR RUTH ..	8	5	0		13
NORTH WEST_NGAKA MO..	34	44	1		79
NORTHERN CAPE_FRANC..	7	10	1		18
NORTHERN CAPE_JOHN ..	3	2	0		5
NORTHERN CAPE_NAMAKWA	22	25	0		47
NORTHERN CAPE_PIXLE..	1	4	0		5
NORTHERN CAPE_ZF MG..	113	150	2		265
WESTERN CAPE_CAPE W..	173	300	3		476
WESTERN CAPE_CENTRA..	13	16	0		29
WESTERN CAPE_CITY O..	671	1,210	2		1,883
WESTERN CAPE_GARDEN..	140	195	0		335
WESTERN CAPE_NOT AP..	0	1	0		1
WESTERN CAPE_OVERBERG	28	50	0		78
WESTERN CAPE_UNKNOWN	0	1	2		3
WESTERN CAPE_WEST C..	40	88	0		128

-----+-----+-----					
Total	11,446	16,513	494		28,453

. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME

RECODE of |

AGE_TAKEN_ | PROVINCE_NAME

DATE_YEARS | EASTERN.. FREE ST.. GAUTENG KWAZULU.. LIMPOPO MPUMALA.. NORTH W.. |
Total

-----+-----+-----									
'0-4	3	0	21	25	6	21	0		85
'5-9	2	0	20	10	0	4	0		40
'10-14	2	1	15	22	3	10	1		60
'15-19	32	2	50	130	18	84	4		345
'20-24	152	9	349	782	98	395	13		2,031
'25-29	245	26	897	1,680	204	813	40		4,321
'30-34	245	17	1,134	1,825	285	1,106	60		5,281
'35-39	187	33	1,105	1,501	293	929	63		4,663

'40-44	161	27	877	1,147	299	693	55	3,682
'45-49	105	17	655	680	233	445	20	2,515
'50-54	96	15	343	458	139	315	25	1,659
'55-59	55	6	223	295	95	180	16	1,042
'60+	82	10	247	446	136	197	23	1,306
'99999	53	0	600	337	60	352	5	1,423
-----+-----+-----								
Total	1,420	163	6,536	9,338	1,869	5,544	325	28,453

RECODE of |

AGE_TAKEN_ | PROVINCE_NAME

DATE_YEARS | NORTHER.. WESTERN.. | Total

-----+-----+-----				
'0-4	0	9	85	
'5-9	0	4	40	
'10-14	1	5	60	
'15-19	1	24	345	
'20-24	17	216	2,031	
'25-29	40	376	4,321	
'30-34	64	545	5,281	
'35-39	38	514	4,663	
'40-44	47	376	3,682	
'45-49	46	314	2,515	
'50-54	34	234	1,659	
'55-59	25	147	1,042	
'60+	12	153	1,306	
'99999	8	8	1,423	
-----+-----+-----				
Total	333	2,925	28,453	

. tabout TAKEN_DATE_AGE_GROUP GENDER using

C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\AcuteChronicInfection28453AgeGen.xls

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not found)

Table output written to:
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\AcuteChronicInfection28453AgeGen.xls

GENDER				
RECODE of AGE_TAKEN_DATE_YEARS	F	M	U	Total
No. No. No. No.				
'0-4	33.0	50.0	2.0	85.0
'5-9	16.0	22.0	2.0	40.0
'10-14	24.0	34.0	2.0	60.0
'15-19	229.0	115.0	1.0	345.0
'20-24	1,210.0	775.0	46.0	2,031.0
'25-29	2,163.0	2,081.0	77.0	4,321.0
'30-34	2,214.0	2,998.0	69.0	5,281.0
'35-39	1,654.0	2,955.0	54.0	4,663.0
'40-44	1,188.0	2,449.0	45.0	3,682.0
'45-49	777.0	1,699.0	39.0	2,515.0
'50-54	588.0	1,056.0	15.0	1,659.0
'55-59	368.0	662.0	12.0	1,042.0
'60+	524.0	763.0	19.0	1,306.0
'99999	458.0	854.0	111.0	1,423.0
Total	11,446.0	16,513.0	494.0	28,453.0

. tabout PROVINCE_NAME GENDER using
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\AcuteChronicInfection28453ProvGen.xls

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Table output written to:
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GENDER

PROVINCE_NAME	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE	652.0	751.0	17.0	1,420.0
FREE STATE	71.0	91.0	1.0	163.0
GAUTENG	2,480.0	3,931.0	125.0	6,536.0
KWAZULU-NATAL	3,772.0	5,298.0	268.0	9,338.0
LIMPOPO	806.0	1,051.0	12.0	1,869.0
MPUMALANGA	2,333.0	3,151.0	60.0	5,544.0
NORTH WEST	128.0	195.0	2.0	325.0
NORTHERN CAPE	143.0	188.0	2.0	333.0
WESTERN CAPE	1,061.0	1,857.0	7.0	2,925.0
Total	11,446.0	16,513.0	494.0	28,453.0

. tabout PROVINCE_DISTRICT GENDER using

C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\AcuteChronicInfection28453DistGen.xls
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not found)

Table output written to:

C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\AcuteChronicInfection28453DistGen.xls

GENDER

PROVINCE_DISTRICT	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE_ALFRED NZO	94.0	111.0	6.0	211.0
EASTERN CAPE_AMATHOLE	33.0	38.0	1.0	72.0
EASTERN CAPE_BUFFALO CITY METRO	46.0	32.0	0.0	78.0
EASTERN CAPE_CHRIS HANI	63.0	62.0	2.0	127.0
EASTERN CAPE_JOE GQABI	14.0	18.0	0.0	32.0
EASTERN CAPE_NELSON MANDELA BAY METRO	72.0	102.0	0.0	174.0
EASTERN CAPE_O R TAMBO	306.0	351.0	5.0	662.0

EASTERN CAPE_SARAH BAARTMAN	19.0	29.0	1.0	49.0
FREE STATE_FEZILE DABI	1.0	1.0	0.0	2.0
FREE STATE_LEJWELEPUTSWA	30.0	40.0	1.0	71.0
FREE STATE_MANGAUNG METRO	35.0	46.0	0.0	81.0
FREE STATE_THABO MOFUTSANYANA	3.0	3.0	0.0	6.0
FREE STATE_XHARIEP	1.0	0.0	0.0	1.0
GAUTENG_CITY OF JOHANNESBURG METRO	1,019.0	1,663.0	89.0	2,771.0
GAUTENG_CITY OF TSHWANE METRO	934.0	1,450.0	17.0	2,401.0
GAUTENG_EKURHULENI METRO	317.0	545.0	10.0	872.0
GAUTENG_SEDIBENG	49.0	92.0	3.0	144.0
GAUTENG_UNKNOWN	1.0	2.0	4.0	7.0
GAUTENG_WEST RAND	152.0	157.0	2.0	311.0
KWAZULU-NATAL_AMAJUBA	153.0	176.0	9.0	338.0
KWAZULU-NATAL_ETHEKWINI METRO	1,531.0	2,146.0	57.0	3,734.0
KWAZULU-NATAL_HARRY GWALA	55.0	78.0	14.0	147.0
KWAZULU-NATAL_ILEMBE	211.0	300.0	25.0	536.0
KWAZULU-NATAL_KING CETSHWAYO	110.0	137.0	10.0	257.0
KWAZULU-NATAL_UGU	506.0	710.0	31.0	1,247.0
KWAZULU-NATAL_UMGUNGUNDLOVU	753.0	1,113.0	107.0	1,973.0
KWAZULU-NATAL_UMKHANYAKUDE	93.0	127.0	1.0	221.0
KWAZULU-NATAL_UMZINYATHI	133.0	207.0	4.0	344.0
KWAZULU-NATAL_UNKNOWN	0.0	1.0	0.0	1.0
KWAZULU-NATAL_UTHUKELA	104.0	141.0	3.0	248.0
KWAZULU-NATAL_UTHUNGULU	36.0	50.0	4.0	90.0
KWAZULU-NATAL_ZULULAND	95.0	116.0	4.0	215.0
LIMPOPO_CAPRICORN	153.0	210.0	1.0	364.0
LIMPOPO_GREATER SEKHUKHUNE	111.0	106.0	1.0	218.0
LIMPOPO_MOPANI	292.0	361.0	0.0	653.0
LIMPOPO_VHEMBE	186.0	279.0	5.0	470.0
LIMPOPO_WATERBERG	67.0	107.0	5.0	179.0
MPUMALANGA_EHLANZENI	1,290.0	1,629.0	31.0	2,950.0
MPUMALANGA_GERT SIBANDE	735.0	1,074.0	11.0	1,820.0

MPUMALANGA_NKANGALA	302.0	462.0	18.0	782.0
MPUMALANGA_UNKNOWN	1.0	2.0	0.0	3.0
NORTH WEST_BOJANALA PLATINUM	58.0	86.0	1.0	145.0
NORTH WEST_DR KENNETH KAUNDA	29.0	52.0	0.0	81.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	8.0	5.0	0.0	13.0
NORTH WEST_NGAKA MODIRI MOLEMA	34.0	44.0	1.0	79.0
NORTHERN CAPE_FRANCES BAARD	7.0	10.0	1.0	18.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	3.0	2.0	0.0	5.0
NORTHERN CAPE_NAMAKWA	22.0	25.0	0.0	47.0
NORTHERN CAPE_PIXLEY KA SEME	1.0	4.0	0.0	5.0
NORTHERN CAPE_ZF MGCAWU	113.0	150.0	2.0	265.0
WESTERN CAPE_CAPE WINELANDS	173.0	300.0	3.0	476.0
WESTERN CAPE_CENTRAL KAROO	13.0	16.0	0.0	29.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	671.0	1,210.0	2.0	1,883.0
WESTERN CAPE_GARDEN ROUTE	140.0	195.0	0.0	335.0
WESTERN CAPE_NOT APPLICABLE	0.0	1.0	0.0	1.0
WESTERN CAPE_OVERBERG	28.0	50.0	0.0	78.0
WESTERN CAPE_UNKNOWN	0.0	1.0	2.0	3.0
WESTERN CAPE_WEST COAST	40.0	88.0	0.0	128.0
Total	11,446.0	16,513.0	494.0	28,453.0

. tabout TAKEN_DATE_AGE_GROUP PROVINCE_NAME using
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\AcuteChronicInfection28453AgeProv.xls

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Table output written to:
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PROVINCE_NAME

RECODE of AGE_TAKEN_DATE_YEARS EASTERN CAPE FREE STATE GAUTENG KWAZULU-NATAL
LIMPOPO MPUMALANGA NORTH WEST NORTHERN CAPE WESTERN CAPE Total

	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
'0-4	3.0	0.0	21.0	25.0	6.0	21.0	0.0	0.0	9.0	85.0	
'5-9	2.0	0.0	20.0	10.0	0.0	4.0	0.0	0.0	4.0	40.0	
'10-14	2.0	1.0	15.0	22.0	3.0	10.0	1.0	1.0	5.0	60.0	
'15-19	32.0	2.0	50.0	130.0	18.0	84.0	4.0	1.0	24.0	345.0	
'20-24	152.0	9.0	349.0	782.0	98.0	395.0	13.0	17.0	216.0	2,031.0	
'25-29	245.0	26.0	897.0	1,680.0	204.0	813.0	40.0	40.0	376.0	4,321.0	
'30-34	245.0	17.0	1,134.0	1,825.0	285.0	1,106.0	60.0	64.0	545.0	5,281.0	
'35-39	187.0	33.0	1,105.0	1,501.0	293.0	929.0	63.0	38.0	514.0	4,663.0	
'40-44	161.0	27.0	877.0	1,147.0	299.0	693.0	55.0	47.0	376.0	3,682.0	
'45-49	105.0	17.0	655.0	680.0	233.0	445.0	20.0	46.0	314.0	2,515.0	
'50-54	96.0	15.0	343.0	458.0	139.0	315.0	25.0	34.0	234.0	1,659.0	
'55-59	55.0	6.0	223.0	295.0	95.0	180.0	16.0	25.0	147.0	1,042.0	
'60+	82.0	10.0	247.0	446.0	136.0	197.0	23.0	12.0	153.0	1,306.0	
'99999	53.0	0.0	600.0	337.0	60.0	352.0	5.0	8.0	8.0	1,423.0	
Total	1,420.0	163.0	6,536.0	9,338.0	1,869.0	5,544.0	325.0	333.0	2,925.0	28,453.0	

. restore

. preserve

. keep if HEP_B_SURFACE_AG=="NEGATIVE" & HEPATITIS_B_SURFACE_AB=="POSITIVE" &
HEPATITIS_B_CORE_TOTAL_AB=="POSITIVE"

(155,820 observations deleted)

. tabout TAKEN_DATE_AGE_GROUP PROVINCE_NAME using
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\InfectionInducedImmunity49757AgePro
v.xls

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Table output written to:

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v.xls

PROVINCE_NAME											
RECODE of AGE_TAKEN_DATE_YEARS	EASTERN CAPE	FREE STATE	GAUTENG	KWAZULU-NATAL	LIMPOPO	MPUMALANGA	NORTH WEST	NORTHERN CAPE	WESTERN CAPE	Total	
No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	
'0-4	42.0	0.0	75.0	13.0	34.0	69.0	1.0	1.0	67.0	302.0	
'5-9	10.0	0.0	18.0	3.0	3.0	19.0	1.0	0.0	8.0	62.0	
'10-14	15.0	0.0	18.0	6.0	6.0	27.0	0.0	0.0	9.0	81.0	
'15-19	101.0	0.0	75.0	9.0	23.0	134.0	0.0	3.0	46.0	391.0	
'20-24	636.0	2.0	468.0	72.0	142.0	696.0	24.0	38.0	353.0	2,431.0	
'25-29	1,328.0	1.0	1,050.0	150.0	319.0	1,585.0	38.0	96.0	883.0	5,450.0	
'30-34	1,672.0	4.0	1,616.0	166.0	526.0	2,025.0	56.0	138.0	1,264.0	7,467.0	
'35-39	1,516.0	3.0	1,592.0	145.0	562.0	1,745.0	51.0	160.0	1,244.0	7,018.0	
'40-44	1,439.0	2.0	1,405.0	130.0	520.0	1,451.0	54.0	126.0	1,133.0	6,260.0	
'45-49	1,207.0	4.0	1,138.0	94.0	432.0	1,087.0	36.0	108.0	1,154.0	5,260.0	
'50-54	1,138.0	3.0	915.0	79.0	395.0	775.0	23.0	94.0	987.0	4,409.0	
'55-59	918.0	2.0	724.0	80.0	287.0	585.0	28.0	51.0	754.0	3,429.0	
'60+	1,581.0	5.0	1,085.0	135.0	519.0	810.0	44.0	58.0	1,164.0	5,401.0	
'99999	168.0	0.0	928.0	19.0	106.0	502.0	1.0	13.0	59.0	1,796.0	
Total	11,771.0		26.0	11,107.0		1,101.0	3,874.0	11,510.0	357.0	886.0	9,125.0 49,757.0

. tab TAKEN_DATE_AGE_GROUP GENDER

RECODE of					
AGE_TAKEN_					
DATE_YEARS	F	M	U	Total	
-----+-----+-----					
'0-4	141	156	5	302	
'5-9	44	18	0	62	
'10-14	54	27	0	81	
'15-19	309	78	4	391	
'20-24	1,922	499	10	2,431	
'25-29	3,813	1,598	39	5,450	

'30-34	4,661	2,777	29	7,467
'35-39	3,916	3,063	39	7,018
'40-44	3,301	2,923	36	6,260
'45-49	2,771	2,458	31	5,260
'50-54	2,293	2,091	25	4,409
'55-59	1,765	1,649	15	3,429
'60+	2,782	2,591	28	5,401
'99999	865	744	187	1,796
-----+-----+-----				
Total	28,637	20,672	448	49,757

. tab PROVINCE_NAME GENDER

	GENDER			
PROVINCE_NAME	F	M	U	Total
-----+-----+-----				
EASTERN CAPE	7,030	4,685	56	11,771
FREE STATE	12	14	0	26
GAUTENG	5,984	4,926	197	11,107
KWAZULU-NATAL	623	455	23	1,101
LIMPOPO	2,408	1,445	21	3,874
MPUMALANGA	6,834	4,598	78	11,510
NORTH WEST	228	126	3	357
NORTHERN CAPE	530	340	16	886
WESTERN CAPE	4,988	4,083	54	9,125
-----+-----+-----				
Total	28,637	20,672	448	49,757

. tab PROVINCE_DISTRICT GENDER

	GENDER			
PROVINCE_DISTRICT	F	M	U	Total

-----+-----+-----				
EASTERN CAPE_ALFRED..	479	222	17	718
EASTERN CAPE_AMATHOLE	350	188	4	542
EASTERN CAPE_BUFFAL..	135	64	0	199
EASTERN CAPE_CHRIS ..	303	190	5	498
EASTERN CAPE_JOE GQ..	66	47	0	113
EASTERN CAPE_NELSON..	3,324	2,429	9	5,762
EASTERN CAPE_NOT AP..	0	1	0	1
EASTERN CAPE_O R TA..	1,539	859	16	2,414
EASTERN CAPE_SARAH ..	817	674	5	1,496
EASTERN CAPE_UNKNOWN	0	1	0	1
FREE STATE_FEZILE D..	1	0	0	1
FREE STATE_LEJWELEP..	1	1	0	2
FREE STATE_MANGAUNG..	8	11	0	19
FREE STATE_THABO MO..	1	0	0	1
FREE STATE_XHARIEP	1	0	0	1
GAUTENG_CITY OF JOH..	3,024	2,498	166	5,688
GAUTENG_CITY OF TSH..	1,473	1,416	9	2,898
GAUTENG_EKURHULENI ..	850	704	8	1,562
GAUTENG_SEDIBENG	77	65	5	147
GAUTENG_UNKNOWN	11	2	4	17
GAUTENG_WEST RAND	518	212	3	733
KWAZULU-NATAL_AMAJUBA	6	1	0	7
KWAZULU-NATAL_ETHEK..	315	263	6	584
KWAZULU-NATAL_HARRY..	6	4	0	10
KWAZULU-NATAL_ILEMBE	3	2	0	5
KWAZULU-NATAL_KING ..	4	2	1	7
KWAZULU-NATAL_UGU	56	50	1	107
KWAZULU-NATAL_UMGUN..	145	75	14	234
KWAZULU-NATAL_UMKHA..	61	45	2	108
KWAZULU-NATAL_UMZIN..	6	3	0	9
KWAZULU-NATAL_UTHUK..	4	4	0	8

KWAZULU-NATAL_UTHUN..		0	1	0		1
KWAZULU-NATAL_ZULUL..		5	5	0		10
LIMPOPO_CAPRICORN		652	461	4		1,117
LIMPOPO_GREATER SEK..		293	183	4		480
LIMPOPO_MOPANI		835	465	4		1,304
LIMPOPO_UNKNOWN		1	0	0		1
LIMPOPO_VHEMBE		517	250	8		775
LIMPOPO_WATERBERG		123	97	1		221
MPUMALANGA_EHLANZENI		2,384	1,629	31		4,044
MPUMALANGA_GERT SIB..		3,519	2,356	13		5,888
MPUMALANGA_NKANGALA		959	632	34		1,625
MPUMALANGA_UNKNOWN		5	4	1		10
NORTH WEST_BOJANALA..		114	62	1		177
NORTH WEST_DR KENNE..		39	9	2		50
NORTH WEST_DR RUTH ..		18	12	0		30
NORTH WEST_NGAKA MO..		55	41	0		96
NORTHERN CAPE_FRANC..		7	2	0		9
NORTHERN CAPE_JOHN ..		1	0	0		1
NORTHERN CAPE_NAMAKWA		116	86	1		203
NORTHERN CAPE_PIXLE..		2	1	0		3
NORTHERN CAPE_ZF MG..		406	253	15		674
WESTERN CAPE_CAPE W..		1,005	689	34		1,728
WESTERN CAPE_CENTRA..		53	47	0		100
WESTERN CAPE_CITY O..		3,138	2,697	8		5,843
WESTERN CAPE_GARDEN..		456	361	0		817
WESTERN CAPE_NOT AP..		0	2	4		6
WESTERN CAPE_OVERBERG		146	131	1		278
WESTERN CAPE_UNKNOWN		3	2	7		12
WESTERN CAPE_WEST C..		201	161	0		362
-----+-----+-----						
Total		28,637	20,672	448		49,757

. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME

RECODE of |

AGE_TAKEN_ | PROVINCE_NAME

DATE_YEARS | EASTERN.. FREE ST.. GAUTENG KWAZULU.. LIMPOPO MPUMALA.. NORTH W.. |
Total

-----+-----+-----									
'0-4	42	0	75	13	34	69	1	302	
'5-9	10	0	18	3	3	19	1	62	
'10-14	15	0	18	6	6	27	0	81	
'15-19	101	0	75	9	23	134	0	391	
'20-24	636	2	468	72	142	696	24	2,431	
'25-29	1,328	1	1,050	150	319	1,585	38	5,450	
'30-34	1,672	4	1,616	166	526	2,025	56	7,467	
'35-39	1,516	3	1,592	145	562	1,745	51	7,018	
'40-44	1,439	2	1,405	130	520	1,451	54	6,260	
'45-49	1,207	4	1,138	94	432	1,087	36	5,260	
'50-54	1,138	3	915	79	395	775	23	4,409	
'55-59	918	2	724	80	287	585	28	3,429	
'60+	1,581	5	1,085	135	519	810	44	5,401	
'99999	168	0	928	19	106	502	1	1,796	
-----+-----+-----									
Total	11,771	26	11,107	1,101	3,874	11,510	357	49,757	

RECODE of |

AGE_TAKEN_ | PROVINCE_NAME

DATE_YEARS | NORTHER.. WESTERN.. | Total

-----+-----+-----			
'0-4	1	67	302
'5-9	0	8	62
'10-14	0	9	81
'15-19	3	46	391

'20-24	38	353	2,431
'25-29	96	883	5,450
'30-34	138	1,264	7,467
'35-39	160	1,244	7,018
'40-44	126	1,133	6,260
'45-49	108	1,154	5,260
'50-54	94	987	4,409
'55-59	51	754	3,429
'60+	58	1,164	5,401
'99999	13	59	1,796
-----+-----+-----			
Total	886	9,125	49,757

. tabout TAKEN_DATE_AGE_GROUP GENDER using
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\InfectionInducedImmunity49757AgeGe
n.xls

(file
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n.xls not found)

Table output written to:
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\InfectionInducedImmunity49757AgeGe
n.xls

GENDER				
RECODE of AGE_TAKEN_DATE_YEARS F M U Total				
	No.	No.	No.	No.
'0-4	141.0	156.0	5.0	302.0
'5-9	44.0	18.0	0.0	62.0
'10-14	54.0	27.0	0.0	81.0
'15-19	309.0	78.0	4.0	391.0
'20-24	1,922.0	499.0	10.0	2,431.0
'25-29	3,813.0	1,598.0	39.0	5,450.0
'30-34	4,661.0	2,777.0	29.0	7,467.0
'35-39	3,916.0	3,063.0	39.0	7,018.0

'40-44	3,301.0	2,923.0	36.0	6,260.0
'45-49	2,771.0	2,458.0	31.0	5,260.0
'50-54	2,293.0	2,091.0	25.0	4,409.0
'55-59	1,765.0	1,649.0	15.0	3,429.0
'60+	2,782.0	2,591.0	28.0	5,401.0
'99999	865.0	744.0	187.0	1,796.0
Total	28,637.0	20,672.0	448.0	49,757.0

. tabout PROVINCE_NAME GENDER using
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\InfectionInducedImmunity49757ProvG
en.xls

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en.xls not found)

Table output written to:
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en.xls

GENDER				
PROVINCE_NAME	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE	7,030.0	4,685.0	56.0	11,771.0
FREE STATE	12.0	14.0	0.0	26.0
GAUTENG	5,984.0	4,926.0	197.0	11,107.0
KWAZULU-NATAL	623.0	455.0	23.0	1,101.0
LIMPOPO	2,408.0	1,445.0	21.0	3,874.0
MPUMALANGA	6,834.0	4,598.0	78.0	11,510.0
NORTH WEST	228.0	126.0	3.0	357.0
NORTHERN CAPE	530.0	340.0	16.0	886.0
WESTERN CAPE	4,988.0	4,083.0	54.0	9,125.0
Total	28,637.0	20,672.0	448.0	49,757.0

. tabout PROVINCE_DISTRICT GENDER using

C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\InfectionInducedImmunity49757DistGe
n.xls

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n.xls not found)

Table output written to:

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n.xls

GENDER

PROVINCE_DISTRICT	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE_ALFRED NZO	479.0	222.0	17.0	718.0
EASTERN CAPE_AMATHOLE	350.0	188.0	4.0	542.0
EASTERN CAPE_BUFFALO CITY METRO	135.0	64.0	0.0	199.0
EASTERN CAPE_CHRIS HANI	303.0	190.0	5.0	498.0
EASTERN CAPE_JOE GQABI	66.0	47.0	0.0	113.0
EASTERN CAPE_NELSON MANDELA BAY METRO	3,324.0	2,429.0	9.0	5,762.0
EASTERN CAPE_NOT APPLICABLE	0.0	1.0	0.0	1.0
EASTERN CAPE_O R TAMBO	1,539.0	859.0	16.0	2,414.0
EASTERN CAPE_SARAH BAARTMAN	817.0	674.0	5.0	1,496.0
EASTERN CAPE_UNKNOWN	0.0	1.0	0.0	1.0
FREE STATE_FEZILE DABI	1.0	0.0	0.0	1.0
FREE STATE_LEJWELEPUTSWA	1.0	1.0	0.0	2.0
FREE STATE_MANGAUNG METRO	8.0	11.0	0.0	19.0
FREE STATE_THABO MOFUTSANYANA	1.0	0.0	0.0	1.0
FREE STATE_XHARIEP	1.0	0.0	0.0	1.0
GAUTENG_CITY OF JOHANNESBURG METRO	3,024.0	2,498.0	166.0	5,688.0
GAUTENG_CITY OF TSHWANE METRO	1,473.0	1,416.0	9.0	2,898.0
GAUTENG_EKURHULENI METRO	850.0	704.0	8.0	1,562.0
GAUTENG_SEDIBENG	77.0	65.0	5.0	147.0
GAUTENG_UNKNOWN	11.0	2.0	4.0	17.0
GAUTENG_WEST RAND	518.0	212.0	3.0	733.0

KWAZULU-NATAL_AMAJUBA	6.0	1.0	0.0	7.0
KWAZULU-NATAL_ETHEKWINI METRO	315.0	263.0	6.0	584.0
KWAZULU-NATAL_HARRY GWALA	6.0	4.0	0.0	10.0
KWAZULU-NATAL_ILEMBE	3.0	2.0	0.0	5.0
KWAZULU-NATAL_KING CETSHWAYO	4.0	2.0	1.0	7.0
KWAZULU-NATAL_UGU	56.0	50.0	1.0	107.0
KWAZULU-NATAL_UMGUNGUNDLOVU	145.0	75.0	14.0	234.0
KWAZULU-NATAL_UMKHANYAKUDE	61.0	45.0	2.0	108.0
KWAZULU-NATAL_UMZINYATHI	6.0	3.0	0.0	9.0
KWAZULU-NATAL_UTHUKELA	4.0	4.0	0.0	8.0
KWAZULU-NATAL_UTHUNGULU	0.0	1.0	0.0	1.0
KWAZULU-NATAL_ZULULAND	5.0	5.0	0.0	10.0
LIMPOPO_CAPRICORN	652.0	461.0	4.0	1,117.0
LIMPOPO_GREATER SEKHUKHUNE	293.0	183.0	4.0	480.0
LIMPOPO_MOPANI	835.0	465.0	4.0	1,304.0
LIMPOPO_UNKNOWN	1.0	0.0	0.0	1.0
LIMPOPO_VHEMBE	517.0	250.0	8.0	775.0
LIMPOPO_WATERBERG	123.0	97.0	1.0	221.0
MPUMALANGA_EHLANZENI	2,384.0	1,629.0	31.0	4,044.0
MPUMALANGA_GERT SIBANDE	3,519.0	2,356.0	13.0	5,888.0
MPUMALANGA_NKANGALA	959.0	632.0	34.0	1,625.0
MPUMALANGA_UNKNOWN	5.0	4.0	1.0	10.0
NORTH WEST_BOJANALA PLATINUM	114.0	62.0	1.0	177.0
NORTH WEST_DR KENNETH KAUNDA	39.0	9.0	2.0	50.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	18.0	12.0	0.0	30.0
NORTH WEST_NGAKA MODIRI MOLEMA	55.0	41.0	0.0	96.0
NORTHERN CAPE_FRANCES BAARD	7.0	2.0	0.0	9.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	1.0	0.0	0.0	1.0
NORTHERN CAPE_NAMAKWA	116.0	86.0	1.0	203.0
NORTHERN CAPE_PIXLEY KA SEME	2.0	1.0	0.0	3.0
NORTHERN CAPE_ZF MGCAWU	406.0	253.0	15.0	674.0
WESTERN CAPE_CAPE WINELANDS	1,005.0	689.0	34.0	1,728.0

WESTERN CAPE_CENTRAL KAROO	53.0	47.0	0.0	100.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	3,138.0	2,697.0	8.0	5,843.0
WESTERN CAPE_GARDEN ROUTE	456.0	361.0	0.0	817.0
WESTERN CAPE_NOT APPLICABLE	0.0	2.0	4.0	6.0
WESTERN CAPE_OVERBERG	146.0	131.0	1.0	278.0
WESTERN CAPE_UNKNOWN	3.0	2.0	7.0	12.0
WESTERN CAPE_WEST COAST	201.0	161.0	0.0	362.0
Total	28,637.0	20,672.0	448.0	49,757.0

```
. tabout TAKEN_DATE_AGE_GROUP PROVINCE_NAME using
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\InfectionInducedImmunity49757AgePro
v.xls
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The file
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\InfectionInducedImmunity49757AgePro
v.xls already exists, but you haven't

used either the replace or append option. Please change
the file name or include replace or append.

```
. restore
```

```
. preserve
```

```
. keep if HEP_B_SURFACE_AG=="POSITIVE" & HEPATITIS_B_SURFACE_AB=="NEGATIVE" &
HEPATITIS_B_CORE_TOTAL_AB=="NEGATIVE"
```

(201,151 observations deleted)

```
. tab TAKEN_DATE_AGE_GROUP GENDER
```

```
RECODE of |
AGE_TAKEN_ |      GENDER
DATE_YEARS |      F      M      U | Total
-----+-----+-----
```

'0-4	61	66	1	128
'5-9	12	18	3	33
'10-14	46	26	0	72
'15-19	149	44	1	194
'20-24	365	131	8	504
'25-29	450	249	6	705
'30-34	409	307	4	720
'35-39	284	294	5	583
'40-44	214	206	5	425
'45-49	124	150	5	279
'50-54	88	97	0	185
'55-59	56	62	1	119
'60+	112	103	2	217
'99999	114	119	29	262
-----+-----+-----				
Total	2,484	1,872	70	4,426

. tab PROVINCE_NAME GENDER

	GENDER			
PROVINCE_NAME	F	M	U	Total
-----+-----+-----				
EASTERN CAPE	67	51	0	118
FREE STATE	30	17	2	49
GAUTENG	586	546	31	1,163
KWAZULU-NATAL	258	264	9	531
LIMPOPO	327	167	1	495
MPUMALANGA	967	621	20	1,608
NORTH WEST	23	33	0	56
NORTHERN CAPE	37	22	0	59
WESTERN CAPE	189	151	7	347
-----+-----+-----				

Total | 2,484 1,872 70 | 4,426

. tab PROVINCE_DISTRICT GENDER

	GENDER			
PROVINCE_DISTRICT	F	M	U	Total
-----+-----+-----				
EASTERN CAPE_ALFRED..	11	6	0	17
EASTERN CAPE_AMATHOLE	1	6	0	7
EASTERN CAPE_BUFFAL..	7	4	0	11
EASTERN CAPE_CHRIS ..	8	5	0	13
EASTERN CAPE_JOE GQ..	2	4	0	6
EASTERN CAPE_NELSON..	9	3	0	12
EASTERN CAPE_O R TA..	32	20	0	52
EASTERN CAPE_SARAH ..	0	2	0	2
FREE STATE_FEZILE D..	1	0	0	1
FREE STATE_LEJWELEP..	11	6	0	17
FREE STATE_MANGAUNG..	12	11	2	25
FREE STATE_THABO MO..	2	0	0	2
FREE STATE_XHARIEP	3	0	0	3
GAUTENG_CITY OF JOH..	243	238	27	508
GAUTENG_CITY OF TSH..	240	202	2	444
GAUTENG_EKURHULENI ..	73	60	1	134
GAUTENG_SEDIBENG	9	24	1	34
GAUTENG_WEST RAND	21	21	0	42
KWAZULU-NATAL_AMAJUBA	10	17	0	27
KWAZULU-NATAL_ETHEK..	99	99	3	201
KWAZULU-NATAL_HARRY..	3	3	0	6
KWAZULU-NATAL_ILEMBE	9	12	0	21
KWAZULU-NATAL_KING ..	3	6	0	9
KWAZULU-NATAL_UGU	38	29	0	67
KWAZULU-NATAL_UMGUN..	63	77	5	145

KWAZULU-NATAL_UMKHA..		2	6	1		9
KWAZULU-NATAL_UMZIN..		8	6	0		14
KWAZULU-NATAL_UTHUK..		9	4	0		13
KWAZULU-NATAL_UTHUN..		3	2	0		5
KWAZULU-NATAL_ZULUL..		4	4	0		8
LIMPOPO_CAPRICORN		129	57	0		186
LIMPOPO_GREATER SEK..		22	15	1		38
LIMPOPO_MOPANI		119	65	0		184
LIMPOPO_VHEMBE		41	20	0		61
LIMPOPO_WATERBERG		16	10	0		26
MPUMALANGA_EHLANZENI		502	299	6		807
MPUMALANGA_GERT SIB..		257	187	4		448
MPUMALANGA_NKANGALA		210	138	10		358
NORTH WEST_BOJANALA..		12	9	0		21
NORTH WEST_DR KENNE..		5	10	0		15
NORTH WEST_DR RUTH ..		0	1	0		1
NORTH WEST_NGAKA MO..		8	12	0		20
NORTHERN CAPE_FRANC..		2	2	0		4
NORTHERN CAPE_NAMAKWA		4	2	0		6
NORTHERN CAPE_ZF MG..		32	18	0		50
WESTERN CAPE_CAPE W..		20	20	0		40
WESTERN CAPE_CENTRA..		8	7	0		15
WESTERN CAPE_CITY O..		82	72	1		155
WESTERN CAPE_GARDEN..		72	43	0		115
WESTERN CAPE_NOT AP..		0	0	6		6
WESTERN CAPE_OVERBERG		2	5	0		7
WESTERN CAPE_WEST C..		5	3	0		8

-----+-----+-----						
Total		2,484	1,872	70		4,426

. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME

RECODE of |

AGE_TAKEN_ | PROVINCE_NAME

DATE_YEARS | EASTERN.. FREE ST.. GAUTENG KWAZULU.. LIMPOPO MPUMALA.. NORTH W.. |
Total

-----+-----+-----									
'0-4	5	3	23	22	24	30	1	128	
'5-9	2	0	5	6	4	11	0	33	
'10-14	2	1	12	12	10	30	0	72	
'15-19	16	2	24	19	32	89	1	194	
'20-24	17	7	102	60	58	211	1	504	
'25-29	13	5	163	97	64	306	3	705	
'30-34	24	10	185	85	69	256	13	720	
'35-39	16	10	161	71	64	186	15	583	
'40-44	6	3	130	54	45	151	7	425	
'45-49	3	3	92	33	29	82	8	279	
'50-54	4	0	56	17	25	66	3	185	
'55-59	2	0	44	7	8	44	0	119	
'60+	4	5	55	21	47	50	3	217	
'99999	4	0	111	27	16	96	1	262	
-----+-----+-----									
Total	118	49	1,163	531	495	1,608	56	4,426	

RECODE of |

AGE_TAKEN_ | PROVINCE_NAME

DATE_YEARS | NORTHERN.. WESTERN.. | Total

-----+-----+-----			
'0-4	1	19	128
'5-9	1	4	33
'10-14	0	5	72
'15-19	1	10	194
'20-24	5	43	504
'25-29	9	45	705

'30-34	13	65	720
'35-39	10	50	583
'40-44	6	23	425
'45-49	2	27	279
'50-54	0	14	185
'55-59	3	11	119
'60+	7	25	217
'99999	1	6	262
-----+-----+-----			
Total	59	347	4,426

. tabout TAKEN_DATE_AGE_GROUP GENDER using
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\HBsAgPos_antiHBsNeg_antiHBcTNeg44
26AgeGen.xls

(file
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\HBsAgPos_antiHBsNeg_antiHBcTNeg44
26AgeGen.xls not found)

Table output written to:
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\HBsAgPos_antiHBsNeg_antiHBcTNeg44
26AgeGen.xls

GENDER				
RECODE of AGE_TAKEN_DATE_YEARS F M U Total				
	No.	No.	No.	No.
'0-4	61.0	66.0	1.0	128.0
'5-9	12.0	18.0	3.0	33.0
'10-14	46.0	26.0	0.0	72.0
'15-19	149.0	44.0	1.0	194.0
'20-24	365.0	131.0	8.0	504.0
'25-29	450.0	249.0	6.0	705.0
'30-34	409.0	307.0	4.0	720.0
'35-39	284.0	294.0	5.0	583.0
'40-44	214.0	206.0	5.0	425.0
'45-49	124.0	150.0	5.0	279.0

'50-54	88.0	97.0	0.0	185.0
'55-59	56.0	62.0	1.0	119.0
'60+	112.0	103.0	2.0	217.0
'99999	114.0	119.0	29.0	262.0
Total	2,484.0	1,872.0	70.0	4,426.0

```
. tabout PROVINCE_NAME GENDER using
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\HBsAgPos_antiHBsNeg_antiHBcTNeg44
26ProvGen.xls
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(file
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\HBsAgPos_antiHBsNeg_antiHBcTNeg44
26ProvGen.xls not found)
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Table output written to:
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\HBsAgPos_antiHBsNeg_antiHBcTNeg44
26ProvGen.xls
```

GENDER				
PROVINCE_NAME	F	M	U	Total
No.	No.	No.	No.	
EASTERN CAPE	67.0	51.0	0.0	118.0
FREE STATE	30.0	17.0	2.0	49.0
GAUTENG	586.0	546.0	31.0	1,163.0
KWAZULU-NATAL	258.0	264.0	9.0	531.0
LIMPOPO	327.0	167.0	1.0	495.0
MPUMALANGA	967.0	621.0	20.0	1,608.0
NORTH WEST	23.0	33.0	0.0	56.0
NORTHERN CAPE	37.0	22.0	0.0	59.0
WESTERN CAPE	189.0	151.0	7.0	347.0
Total	2,484.0	1,872.0	70.0	4,426.0

```
. tabout PROVINCE_DISTRICT GENDER using
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\HBsAgPos_antiHBsNeg_antiHBcTNeg44
26DistGen.xls
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C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\HBsAgPos_antiHBsNeg_antiHBcTNeg44
26DistGen.xls not found)

Table output written to:

C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\HBsAgPos_antiHBsNeg_antiHBcTNeg44
26DistGen.xls

GENDER

PROVINCE_DISTRICT	F	M	U	Total
No. No. No. No.				
EASTERN CAPE_ALFRED NZO	11.0	6.0	0.0	17.0
EASTERN CAPE_AMATHOLE	1.0	6.0	0.0	7.0
EASTERN CAPE_BUFFALO CITY METRO	7.0	4.0	0.0	11.0
EASTERN CAPE_CHRIS HANI	8.0	5.0	0.0	13.0
EASTERN CAPE_JOE GQABI	2.0	4.0	0.0	6.0
EASTERN CAPE_NELSON MANDELA BAY METRO	9.0	3.0	0.0	12.0
EASTERN CAPE_O R TAMBO	32.0	20.0	0.0	52.0
EASTERN CAPE_SARAH BAARTMAN	0.0	2.0	0.0	2.0
FREE STATE_FEZILE DABI	1.0	0.0	0.0	1.0
FREE STATE_LEJWELEPUTSWA	11.0	6.0	0.0	17.0
FREE STATE_MANGAUNG METRO	12.0	11.0	2.0	25.0
FREE STATE_THABO MOFUTSANYANA	2.0	0.0	0.0	2.0
FREE STATE_XHARIEP	3.0	0.0	0.0	3.0
GAUTENG_CITY OF JOHANNESBURG METRO	243.0	238.0	27.0	508.0
GAUTENG_CITY OF TSHWANE METRO	240.0	202.0	2.0	444.0
GAUTENG_EKURHULENI METRO	73.0	60.0	1.0	134.0
GAUTENG_SEDIBENG	9.0	24.0	1.0	34.0
GAUTENG_WEST RAND	21.0	21.0	0.0	42.0
KWAZULU-NATAL_AMAJUBA	10.0	17.0	0.0	27.0
KWAZULU-NATAL_ETHEKWINI METRO	99.0	99.0	3.0	201.0
KWAZULU-NATAL_HARRY GWALA	3.0	3.0	0.0	6.0
KWAZULU-NATAL_ILEMBE	9.0	12.0	0.0	21.0
KWAZULU-NATAL_KING CETSHWAYO	3.0	6.0	0.0	9.0

KWAZULU-NATAL_UGU	38.0	29.0	0.0	67.0
KWAZULU-NATAL_UMGUNGUNDLOVU	63.0	77.0	5.0	145.0
KWAZULU-NATAL_UMKHANYAKUDE	2.0	6.0	1.0	9.0
KWAZULU-NATAL_UMZINYATHI	8.0	6.0	0.0	14.0
KWAZULU-NATAL_UTHUKELA	9.0	4.0	0.0	13.0
KWAZULU-NATAL_UTHUNGULU	3.0	2.0	0.0	5.0
KWAZULU-NATAL_ZULULAND	4.0	4.0	0.0	8.0
LIMPOPO_CAPRICORN	129.0	57.0	0.0	186.0
LIMPOPO_GREATER SEKHUKHUNE	22.0	15.0	1.0	38.0
LIMPOPO_MOPANI	119.0	65.0	0.0	184.0
LIMPOPO_VHEMBE	41.0	20.0	0.0	61.0
LIMPOPO_WATERBERG	16.0	10.0	0.0	26.0
MPUMALANGA_EHLANZENI	502.0	299.0	6.0	807.0
MPUMALANGA_GERT SIBANDE	257.0	187.0	4.0	448.0
MPUMALANGA_NKANGALA	210.0	138.0	10.0	358.0
NORTH WEST_BOJANALA PLATINUM	12.0	9.0	0.0	21.0
NORTH WEST_DR KENNETH KAUNDA	5.0	10.0	0.0	15.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	0.0	1.0	0.0	1.0
NORTH WEST_NGAKA MODIRI MOLEMA	8.0	12.0	0.0	20.0
NORTHERN CAPE_FRANCES BAARD	2.0	2.0	0.0	4.0
NORTHERN CAPE_NAMAKWA	4.0	2.0	0.0	6.0
NORTHERN CAPE_ZF MGCAWU	32.0	18.0	0.0	50.0
WESTERN CAPE_CAPE WINELANDS	20.0	20.0	0.0	40.0
WESTERN CAPE_CENTRAL KAROO	8.0	7.0	0.0	15.0
WESTERN CAPE_CITY OF CAPE TOWN METRO	82.0	72.0	1.0	155.0
WESTERN CAPE_GARDEN ROUTE	72.0	43.0	0.0	115.0
WESTERN CAPE_NOT APPLICABLE	0.0	0.0	6.0	6.0
WESTERN CAPE_OVERBERG	2.0	5.0	0.0	7.0
WESTERN CAPE_WEST COAST	5.0	3.0	0.0	8.0
Total	2,484.0	1,872.0	70.0	4,426.0

```
. tabout TAKEN_DATE_AGE_GROUP PROVINCE_NAME using
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\HBsAgPos_antiHBsNeg_antiHBcTNeg44
26AgeProv.xls
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(file
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26AgeProv.xls not found)
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Table output written to:
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\HBsAgPos_antiHBsNeg_antiHBcTNeg44
26AgeProv.xls
```

	PROVINCE_NAME									
RECODE of AGE_TAKEN_DATE_YEARS	EASTERN CAPE	FREE STATE	GAUTENG	KWAZULU-NATAL	LIMPOPO	MPUMALANGA	NORTH WEST	NORTHERN CAPE	WESTERN CAPE	Total
No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
'0-4	5.0	3.0	23.0	22.0	24.0	30.0	1.0	1.0	19.0	128.0
'5-9	2.0	0.0	5.0	6.0	4.0	11.0	0.0	1.0	4.0	33.0
'10-14	2.0	1.0	12.0	12.0	10.0	30.0	0.0	0.0	5.0	72.0
'15-19	16.0	2.0	24.0	19.0	32.0	89.0	1.0	1.0	10.0	194.0
'20-24	17.0	7.0	102.0	60.0	58.0	211.0	1.0	5.0	43.0	504.0
'25-29	13.0	5.0	163.0	97.0	64.0	306.0	3.0	9.0	45.0	705.0
'30-34	24.0	10.0	185.0	85.0	69.0	256.0	13.0	13.0	65.0	720.0
'35-39	16.0	10.0	161.0	71.0	64.0	186.0	15.0	10.0	50.0	583.0
'40-44	6.0	3.0	130.0	54.0	45.0	151.0	7.0	6.0	23.0	425.0
'45-49	3.0	3.0	92.0	33.0	29.0	82.0	8.0	2.0	27.0	279.0
'50-54	4.0	0.0	56.0	17.0	25.0	66.0	3.0	0.0	14.0	185.0
'55-59	2.0	0.0	44.0	7.0	8.0	44.0	0.0	3.0	11.0	119.0
'60+	4.0	5.0	55.0	21.0	47.0	50.0	3.0	7.0	25.0	217.0
'99999	4.0	0.0	111.0	27.0	16.0	96.0	1.0	1.0	6.0	262.0
Total	118.0	49.0	1,163.0	531.0	495.0	1,608.0	56.0	59.0	347.0	4,426.0

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. clear ado
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. log close
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name: <unnamed>
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Output files_SM081020\Files_Chapter3\Final for PhD 061023\Log Files\Merging HBsAg All cases to
cases with ant

> i-HBs and anti-HBcT results.smcl

log type: smcl

closed on: 19 Oct 2023, 12:17:54

name: <unnamed>

log: Z:\Centre for Vaccines and Immunology\2020\2019\AFP\ShelinaAll\Hepatitis B\PhD\PHD
Output files_SM081020\Files_Chapter3\Final for PhD 061023\Log Files\Merging HBsAg All cases to
cases with ant

> i-HBs and anti-HBcT results.smcl

log type: smcl

opened on: 19 Oct 2023, 12:19:55

. tab TAKEN_DATE_AGE_GROUP GENDER

RECODE of				
AGE_TAKEN_		GENDER		
DATE_YEARS	F	M	U	Total
-----+-----+-----				
'0-4	1,817	1,845	51	3,713
'5-9	1,485	1,130	31	2,646
'10-14	2,351	1,242	28	3,621
'15-19	5,598	1,866	44	7,508
'20-24	12,980	4,510	153	17,643
'25-29	17,961	8,924	222	27,107
'30-34	17,811	11,964	205	29,980
'35-39	14,204	11,726	186	26,116
'40-44	11,124	10,489	152	21,765
'45-49	8,516	8,099	138	16,753
'50-54	7,053	6,177	87	13,317

'55-59	5,284	4,839	66	10,189
'60+	8,568	7,724	106	16,398
'99999	3,901	3,617	1,303	8,821
-----+-----+-----				
Total	118,653	84,152	2,772	205,577

. tab PROVINCE_NAME GENDER

	GENDER			
PROVINCE_NAME	F	M	U	Total
-----+-----+-----				
EASTERN CAPE	15,112	9,310	184	24,606
FREE STATE	174	169	3	346
GAUTENG	29,764	22,797	1,358	53,919
KWAZULU-NATAL	6,402	7,186	385	13,973
LIMPOPO	12,394	6,378	99	18,871
MPUMALANGA	28,516	18,738	385	47,639
NORTH WEST	1,339	938	18	2,295
NORTHERN CAPE	2,666	1,626	46	4,338
WESTERN CAPE	22,286	17,010	294	39,590
-----+-----+-----				
Total	118,653	84,152	2,772	205,577

. tab PROVINCE_DISTRICT GENDER

	GENDER			
PROVINCE_DISTRICT	F	M	U	Total
-----+-----+-----				
EASTERN CAPE_ALFRED..	1,730	781	63	2,574
EASTERN CAPE_AMATHOLE	786	400	8	1,194
EASTERN CAPE_BUFFAL..	609	281	6	896
EASTERN CAPE_CHRIS ..	733	435	13	1,181

EASTERN CAPE_JOE GQ..		208	145	2		355
EASTERN CAPE_NELSON..		4,799	3,535	14		8,348
EASTERN CAPE_NOT AP..		1	1	0		2
EASTERN CAPE_O R TA..		4,960	2,763	66		7,789
EASTERN CAPE_SARAH ..		1,210	922	10		2,142
EASTERN CAPE_UNKNOWN		0	3	0		3
FREE STATE_FEZILE D..		4	3	0		7
FREE STATE_LEJWELEP..		51	55	1		107
FREE STATE_MANGAUNG..		89	102	2		193
FREE STATE_THABO MO..		11	5	0		16
FREE STATE_XHARIEP		7	2	0		9
GAUTENG_CITY OF JOH..		14,120	10,858	759		25,737
GAUTENG_CITY OF TSH..		9,070	7,416	62		16,548
GAUTENG_EKURHULENI ..		4,084	3,037	51		7,172
GAUTENG_SEDIBENG		424	402	21		847
GAUTENG_UNKNOWN		55	16	448		519
GAUTENG_WEST RAND		1,904	995	13		2,912
KWAZULU-NATAL_AMAJUBA		199	211	10		420
KWAZULU-NATAL_ETHEK..		2,769	3,141	80		5,990
KWAZULU-NATAL_HARRY..		74	94	14		182
KWAZULU-NATAL_ILEMBE		250	328	27		605
KWAZULU-NATAL_KING ..		131	160	12		303
KWAZULU-NATAL_UGU		771	909	42		1,722
KWAZULU-NATAL_UMGUN..		1,442	1,511	180		3,133
KWAZULU-NATAL_UMKHA..		247	248	4		499
KWAZULU-NATAL_UMZIN..		170	233	4		407
KWAZULU-NATAL_UNKNOWN		0	1	0		1
KWAZULU-NATAL_UTHUK..		136	155	4		295
KWAZULU-NATAL_UTHUN..		40	58	5		103
KWAZULU-NATAL_ZULUL..		130	135	4		269
LIMPOPO_CAPRICORN		3,937	2,154	25		6,116
LIMPOPO_GREATER SEK..		1,602	760	12		2,374

LIMPOPO_MOPANI	3,616	1,961	21	5,598
LIMPOPO_UNKNOWN	1	0	0	1
LIMPOPO_VHEMBE	2,554	1,044	31	3,629
LIMPOPO_WATERBERG	719	494	10	1,223
MPUMALANGA_EHLANZENI	10,104	6,607	138	16,849
MPUMALANGA_GERT SIB..	13,677	9,148	82	22,907
MPUMALANGA_NKANGALA	4,811	3,030	167	8,008
MPUMALANGA_UNKNOWN	25	12	1	38
NORTH WEST_BOJANALA..	609	420	9	1,038
NORTH WEST_DR KENNE..	168	101	5	274
NORTH WEST_DR RUTH ..	103	55	1	159
NORTH WEST_NGAKA MO..	468	346	3	817
NORTHERN CAPE_FRANC..	44	40	3	87
NORTHERN CAPE_JOHN ..	12	3	0	15
NORTHERN CAPE_NAMAKWA	811	458	5	1,274
NORTHERN CAPE_PIXLE..	16	6	0	22
NORTHERN CAPE_ZF MG..	1,792	1,125	39	2,956
WESTERN CAPE_CAPE W..	4,046	2,702	186	6,934
WESTERN CAPE_CENTRA..	352	213	0	565
WESTERN CAPE_CITY O..	13,473	10,999	43	24,515
WESTERN CAPE_GARDEN..	2,975	1,912	3	4,890
WESTERN CAPE_NOT AP..	3	5	10	18
WESTERN CAPE_OVERBERG	655	567	5	1,227
WESTERN CAPE_UNKNOWN	25	13	42	80
WESTERN CAPE_WEST C..	841	636	6	1,483
-----+-----+-----				
Total	118,653	84,152	2,772	205,577

. tab TAKEN_DATE_AGE_GROUP PROVINCE_NAME

RECODE of |

AGE_TAKEN_ | PROVINCE_NAME

DATE_YEARS | EASTERN.. FREE ST.. GAUTENG KWAZULU.. LIMPOPO MPUMALA.. NORTH W.. |
Total

-----+-----+-----									
'0-4	380	5	908	192	413	730	22	3,713	
'5-9	243	2	543	88	267	663	22	2,646	
'10-14	262	3	751	144	456	980	29	3,621	
'15-19	792	9	1,502	337	1,000	2,151	76	7,508	
'20-24	2,080	35	4,034	1,267	1,619	4,802	184	17,643	
'25-29	3,172	43	6,445	2,357	2,130	7,348	278	27,107	
'30-34	3,438	43	7,453	2,443	2,525	7,754	347	29,980	
'35-39	3,037	58	6,897	2,025	2,437	6,164	359	26,116	
'40-44	2,637	42	5,861	1,575	2,142	4,813	300	21,765	
'45-49	2,045	33	4,449	984	1,600	3,452	188	16,753	
'50-54	1,886	26	3,374	722	1,308	2,497	140	13,317	
'55-59	1,530	19	2,709	495	892	1,701	120	10,189	
'60+	2,566	27	4,208	914	1,635	2,318	207	16,398	
'99999	538	1	4,785	430	447	2,266	23	8,821	
-----+-----+-----									
Total	24,606	346	53,919	13,973	18,871	47,639	2,295	205,577	

RECODE of |

AGE_TAKEN_ | PROVINCE_NAME

DATE_YEARS | NORTHER.. WESTERN.. | Total

-----+-----+-----				
'0-4	45	1,018	3,713	
'5-9	59	759	2,646	
'10-14	61	935	3,621	
'15-19	128	1,513	7,508	
'20-24	375	3,247	17,643	
'25-29	593	4,741	27,107	
'30-34	641	5,336	29,980	
'35-39	629	4,510	26,116	

'40-44	537	3,858	21,765
'45-49	437	3,565	16,753
'50-54	337	3,027	13,317
'55-59	215	2,508	10,189
'60+	224	4,299	16,398
'99999	57	274	8,821

-----+-----+-----

Total	4,338	39,590	205,577

. tabout TAKEN_DATE_AGE_GROUP GENDER using
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\MergedHBsAg_antiHBs_antiHBcT20557
7AgeGen.xls

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Table output written to:
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7AgeGen.xls

GENDER

RECODE of AGE_TAKEN_DATE_YEARS F M U Total

No. No. No. No.

'0-4	1,817.0	1,845.0	51.0	3,713.0
'5-9	1,485.0	1,130.0	31.0	2,646.0
'10-14	2,351.0	1,242.0	28.0	3,621.0
'15-19	5,598.0	1,866.0	44.0	7,508.0
'20-24	12,980.0	4,510.0	153.0	17,643.0
'25-29	17,961.0	8,924.0	222.0	27,107.0
'30-34	17,811.0	11,964.0	205.0	29,980.0
'35-39	14,204.0	11,726.0	186.0	26,116.0
'40-44	11,124.0	10,489.0	152.0	21,765.0
'45-49	8,516.0	8,099.0	138.0	16,753.0
'50-54	7,053.0	6,177.0	87.0	13,317.0
'55-59	5,284.0	4,839.0	66.0	10,189.0

```
'60+ 8,568.0 7,724.0 106.0 16,398.0
'99999 3,901.0 3,617.0 1,303.0 8,821.0
Total 118,653.0 84,152.0 2,772.0 205,577.0
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.
. tabout PROVINCE_NAME GENDER using
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\MergedHBsAg_antiHBs_antiHBcT20557
7ProvGen.xls

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Table output written to:
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7ProvGen.xls
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GENDER
PROVINCE_NAME F M U Total
No. No. No. No.
EASTERN CAPE 15,112.0 9,310.0 184.0 24,606.0
FREE STATE 174.0 169.0 3.0 346.0
GAUTENG 29,764.0 22,797.0 1,358.0 53,919.0
KWAZULU-NATAL 6,402.0 7,186.0 385.0 13,973.0
LIMPOPO 12,394.0 6,378.0 99.0 18,871.0
MPUMALANGA 28,516.0 18,738.0 385.0 47,639.0
NORTH WEST 1,339.0 938.0 18.0 2,295.0
NORTHERN CAPE 2,666.0 1,626.0 46.0 4,338.0
WESTERN CAPE 22,286.0 17,010.0 294.0 39,590.0
Total 118,653.0 84,152.0 2,772.0 205,577.0
```

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.
. tabout PROVINCE_DISTRICT GENDER using
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\MergedHBsAg_antiHBs_antiHBcT20557
7DistGen.xls
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7DistGen.xls

GENDER

PROVINCE_DISTRICT	F	M	U	Total

No.	No.	No.	No.

EASTERN CAPE_ALFRED NZO	1,730.0	781.0	63.0	2,574.0

EASTERN CAPE_AMATHOLE	786.0	400.0	8.0	1,194.0

EASTERN CAPE_BUFFALO CITY METRO	609.0	281.0	6.0	896.0

EASTERN CAPE_CHRIS HANI	733.0	435.0	13.0	1,181.0

EASTERN CAPE_JOE GQABI	208.0	145.0	2.0	355.0

EASTERN CAPE_NELSON MANDELA BAY METRO	4,799.0	3,535.0	14.0	8,348.0

EASTERN CAPE_NOT APPLICABLE	1.0	1.0	0.0	2.0

EASTERN CAPE_O R TAMBO	4,960.0	2,763.0	66.0	7,789.0

EASTERN CAPE_SARAH BAARTMAN	1,210.0	922.0	10.0	2,142.0

EASTERN CAPE_UNKNOWN	0.0	3.0	0.0	3.0

FREE STATE_FEZILE DABI	4.0	3.0	0.0	7.0

FREE STATE_LEJWELEPUTSWA	51.0	55.0	1.0	107.0

FREE STATE_MANGAUNG METRO	89.0	102.0	2.0	193.0

FREE STATE_THABO MOFUTSANYANA	11.0	5.0	0.0	16.0

FREE STATE_XHARIEP	7.0	2.0	0.0	9.0

GAUTENG_CITY OF JOHANNESBURG METRO	14,120.0	10,858.0	759.0	25,737.0

GAUTENG_CITY OF TSHWANE METRO	9,070.0	7,416.0	62.0	16,548.0

GAUTENG_EKURHULENI METRO	4,084.0	3,037.0	51.0	7,172.0

GAUTENG_SEDIBENG	424.0	402.0	21.0	847.0

GAUTENG_UNKNOWN	55.0	16.0	448.0	519.0

GAUTENG_WEST RAND	1,904.0	995.0	13.0	2,912.0

KWAZULU-NATAL_AMAJUBA	199.0	211.0	10.0	420.0

KWAZULU-NATAL_ETHEKWINI METRO	2,769.0	3,141.0	80.0	5,990.0

KWAZULU-NATAL_HARRY GWALA	74.0	94.0	14.0	182.0
KWAZULU-NATAL_ILEMBE	250.0	328.0	27.0	605.0
KWAZULU-NATAL_KING CETSHWAYO	131.0	160.0	12.0	303.0
KWAZULU-NATAL_UGU	771.0	909.0	42.0	1,722.0
KWAZULU-NATAL_UMGUNGUNDLOVU	1,442.0	1,511.0	180.0	3,133.0
KWAZULU-NATAL_UMKHANYAKUDE	247.0	248.0	4.0	499.0
KWAZULU-NATAL_UMZINYATHI	170.0	233.0	4.0	407.0
KWAZULU-NATAL_UNKNOWN	0.0	1.0	0.0	1.0
KWAZULU-NATAL_UTHUKELA	136.0	155.0	4.0	295.0
KWAZULU-NATAL_UTHUNGULU	40.0	58.0	5.0	103.0
KWAZULU-NATAL_ZULULAND	130.0	135.0	4.0	269.0
LIMPOPO_CAPRICORN	3,937.0	2,154.0	25.0	6,116.0
LIMPOPO_GREATER SEKHUKHUNE	1,602.0	760.0	12.0	2,374.0
LIMPOPO_MOPANI	3,616.0	1,961.0	21.0	5,598.0
LIMPOPO_UNKNOWN	1.0	0.0	0.0	1.0
LIMPOPO_VHEMBE	2,554.0	1,044.0	31.0	3,629.0
LIMPOPO_WATERBERG	719.0	494.0	10.0	1,223.0
MPUMALANGA_EHLANZENI	10,104.0	6,607.0	138.0	16,849.0
MPUMALANGA_GERT SIBANDE	13,677.0	9,148.0	82.0	22,907.0
MPUMALANGA_NKANGALA	4,811.0	3,030.0	167.0	8,008.0
MPUMALANGA_UNKNOWN	25.0	12.0	1.0	38.0
NORTH WEST_BOJANALA PLATINUM	609.0	420.0	9.0	1,038.0
NORTH WEST_DR KENNETH KAUNDA	168.0	101.0	5.0	274.0
NORTH WEST_DR RUTH SEGOMOTSI MOMPATI	103.0	55.0	1.0	159.0
NORTH WEST_NGAKA MODIRI MOLEMA	468.0	346.0	3.0	817.0
NORTHERN CAPE_FRANCES BAARD	44.0	40.0	3.0	87.0
NORTHERN CAPE_JOHN TAOLO GAETSEWE	12.0	3.0	0.0	15.0
NORTHERN CAPE_NAMAKWA	811.0	458.0	5.0	1,274.0
NORTHERN CAPE_PIXLEY KA SEME	16.0	6.0	0.0	22.0
NORTHERN CAPE_ZF MGCAWU	1,792.0	1,125.0	39.0	2,956.0
WESTERN CAPE_CAPE WINELANDS	4,046.0	2,702.0	186.0	6,934.0
WESTERN CAPE_CENTRAL KAROO	352.0	213.0	0.0	565.0

WESTERN CAPE_CITY OF CAPE TOWN METRO	13,473.0	10,999.0	43.0	24,515.0
WESTERN CAPE_GARDEN ROUTE	2,975.0	1,912.0	3.0	4,890.0
WESTERN CAPE_NOT APPLICABLE	3.0	5.0	10.0	18.0
WESTERN CAPE_OVERBERG	655.0	567.0	5.0	1,227.0
WESTERN CAPE_UNKNOWN	25.0	13.0	42.0	80.0
WESTERN CAPE_WEST COAST	841.0	636.0	6.0	1,483.0
Total	118,653.0	84,152.0	2,772.0	205,577.0

. tabout TAKEN_DATE_AGE_GROUP PROVINCE_NAME using
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\MergedHBsAg_antiHBs_antiHBcT20557
7AgeProv.xls

(file
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\MergedHBsAg_antiHBs_antiHBcT20557
7AgeProv.xls not found)

Table output written to:
C:\Users\shelinam\Documents\StataFiles_Chapter3\Tabout\MergedHBsAg_antiHBs_antiHBcT20557
7AgeProv.xls

	PROVINCE_NAME									
	RECODE of AGE_TAKEN_DATE_YEARS EASTERN CAPE FREE STATE GAUTENG KWAZULU-NATAL LIMPOPO MPUMALANGA NORTH WEST NORTHERN CAPE WESTERN CAPE Total									
	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
'0-4	380.0	5.0	908.0	192.0	413.0	730.0	22.0	45.0	1,018.0	3,713.0
'5-9	243.0	2.0	543.0	88.0	267.0	663.0	22.0	59.0	759.0	2,646.0
'10-14	262.0	3.0	751.0	144.0	456.0	980.0	29.0	61.0	935.0	3,621.0
'15-19	792.0	9.0	1,502.0	337.0	1,000.0	2,151.0	76.0	128.0	1,513.0	7,508.0
'20-24	2,080.0	35.0	4,034.0	1,267.0	1,619.0	4,802.0	184.0	375.0	3,247.0	17,643.0
'25-29	3,172.0	43.0	6,445.0	2,357.0	2,130.0	7,348.0	278.0	593.0	4,741.0	27,107.0
'30-34	3,438.0	43.0	7,453.0	2,443.0	2,525.0	7,754.0	347.0	641.0	5,336.0	29,980.0
'35-39	3,037.0	58.0	6,897.0	2,025.0	2,437.0	6,164.0	359.0	629.0	4,510.0	26,116.0
'40-44	2,637.0	42.0	5,861.0	1,575.0	2,142.0	4,813.0	300.0	537.0	3,858.0	21,765.0
'45-49	2,045.0	33.0	4,449.0	984.0	1,600.0	3,452.0	188.0	437.0	3,565.0	16,753.0
'50-54	1,886.0	26.0	3,374.0	722.0	1,308.0	2,497.0	140.0	337.0	3,027.0	13,317.0

'55-59	1,530.0	19.0	2,709.0	495.0	892.0	1,701.0	120.0	215.0	2,508.0	10,189.0
'60+	2,566.0	27.0	4,208.0	914.0	1,635.0	2,318.0	207.0	224.0	4,299.0	16,398.0
'99999	538.0	1.0	4,785.0	430.0	447.0	2,266.0	23.0	57.0	274.0	8,821.0
Total	24,606.0		346.0	53,919.0		13,973.0		18,871.0	47,639.0	2,295.0 4,338.0
	39,590.0		205,577.0							

Appendix 5.5: Stata Log file of the statistical analysis of HBV susceptible and immune cases

```
. prtesti 980 .54 923 .50
```

Two-sample test of proportions x: Number of obs = 980

 y: Number of obs = 923

```
-----
      |   Mean   Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
      x |   .54   .0159207           .508796   .571204
      y |   .5   .0164577           .4677435   .5322565
-----+-----
diff |   .04   .0228982           -.0048796   .0848796
      | under H0: .0229143   1.75   0.081
-----
```

diff = prop(x) - prop(y) z = 1.7456

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.9596

Pr(|Z| > |z|) = 0.0809

Pr(Z > z) = 0.0404

```
.
```

```
. prtesti 774 .52 571 .51
```

Two-sample test of proportions x: Number of obs = 774

 y: Number of obs = 571

```
-----
      |   Mean   Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
      x |   .52   .0179577           .4848035   .5551965
      y |   .51   .0209202           .4689972   .5510028
-----+-----
```

```

diff |      .01 .0275705          -.0440372 .0640372
    | under H0: .0275694  0.36 0.717
-----

diff = prop(x) - prop(y)          z =  0.3627
H0: diff = 0

Ha: diff < 0          Ha: diff != 0          Ha: diff > 0
Pr(Z < z) = 0.6416    Pr(|Z| > |z|) = 0.7168    Pr(Z > z) = 0.3584

.
. prtesti 700 .30 370 .30

```

```

Two-sample test of proportions          x: Number of obs =   700
                                     y: Number of obs =   370

```

```

-----
    |   Mean  Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
x |   .3   .0173205          .2660524   .3339476
y |   .3   .0238237          .2533065   .3466935
-----+-----

diff |      0 .0294545          -.0577298 .0577298
    | under H0: .0294545  0.00 1.000
-----

diff = prop(x) - prop(y)          z =  0.0000
H0: diff = 0

Ha: diff < 0          Ha: diff != 0          Ha: diff > 0
Pr(Z < z) = 0.5000    Pr(|Z| > |z|) = 1.0000    Pr(Z > z) = 0.5000

.
. prtesti 1244 .22 353 .19

```


H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.7339

Pr(|Z| > |z|) = 0.5323

Pr(Z > z) = 0.2661

.

. prtesti 1965 .11 769 .09

Two-sample test of proportions

x: Number of obs = 1965

y: Number of obs = 769

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.11	.0070585		.0961657	.1238343
y	.09	.01032		.0697732	.1102268
diff	.02	.012503		-.0045053	.0445053
under H0:	.0130051		1.54	0.124	

diff = prop(x) - prop(y)

z = 1.5379

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.9380

Pr(|Z| > |z|) = 0.1241

Pr(Z > z) = 0.0620

.

. prtesti 1611 .09 650 .05

Two-sample test of proportions

x: Number of obs = 1611

y: Number of obs = 650

	Mean	Std. err.	z	P> z	[95% conf. interval]

```

-----+-----
diff |      .04 .0111317              .0181823 .0618177
      | under H0: .0124977  3.20 0.001

```

diff = prop(x) - prop(y) z = 3.2006

H0: diff = 0

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
Pr(Z < z) = 0.9993	Pr(Z > z) = 0.0014	Pr(Z > z) = 0.0007

```

.
. prtesti 1216 .09 559 .05

```

Two-sample test of proportions x: Number of obs = 1216
y: Number of obs = 559

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.09	.0082068			.0739149 .1060851
y	.05	.0092181			.0319329 .0680671
diff	.04	.012342			.0158101 .0641899
	under H0:	.0136556	2.93	0.003	

```
diff = prop(x) - prop(y)          z =  2.9292
H0: diff = 0
```

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
Pr(Z < z) = 0.9983	Pr(Z > z) = 0.0034	Pr(Z > z) = 0.0017

•

Two-sample test of proportions x: Number of obs = 1069
y: Number of obs = 523

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.1	.0091756			.0820162 .1179838
y	.05	.0095301			.0313214 .0686786
diff	.05	.0132292			.0240711 .0759289
under H0: .0147678 3.39 0.001					

```
diff = prop(x) - prop(y)          z =  3.3857
H0: diff = 0
```

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
Pr(Z < z) = 0.9996	Pr(Z > z) = 0.0007	Pr(Z > z) = 0.0004

•

Two-sample test of proportions x: Number of obs = 887
y: Number of obs = 431

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.1	.010073		.0802573	.1197427
y	.05	.010498		.0294242	.0705758

```

diff |      .05  .014549          .0214844  .0785156
    | under H0:  .0162562   3.08  0.002
-----

diff = prop(x) - prop(y)          z =  3.0757
H0: diff = 0

Ha: diff < 0          Ha: diff != 0          Ha: diff > 0
Pr(Z < z) = 0.9990    Pr(|Z| > |z|) = 0.0021    Pr(Z > z) = 0.0010

.
. prtesti 752 .11 360 .06

```

```

Two-sample test of proportions          x: Number of obs =   752
                                     y: Number of obs =   360

```

```

-----
    |   Mean  Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
x |   .11  .0114099          .087637   .132363
y |   .06  .0125167          .0354678   .0845322
-----+-----

diff |   .05  .0169367          .0168046   .0831954
    | under H0:  .0186867   2.68  0.007
-----

diff = prop(x) - prop(y)          z =  2.6757
H0: diff = 0

Ha: diff < 0          Ha: diff != 0          Ha: diff > 0
Pr(Z < z) = 0.9963    Pr(|Z| > |z|) = 0.0075    Pr(Z > z) = 0.0037

.
. prtesti 518 .10 266 .06

```


x: Number of obs = 518

y: Number of obs = 266

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.1	.0131812		.0741652	.1258348
y	.06	.0145613		.0314605	.0885395
diff	.04	.0196412		.001504	.078496
under H0: .0211959 1.89 0.059					

$$\text{diff} = \text{prop}(x) - \text{prop}(y) \quad z = 1.8872$$

H0: diff = 0

$$H_a: \text{diff} < 0$$

Ha: $\text{diff} \neq 0$

$$H_a: \text{diff} > 0$$
$$\Pr(Z < z) = 0.9704$$
$$\Pr(|Z| > |z|) = 0.0591$$
$$\Pr(Z > z) = 0.0296$$

```

.
. prtesti 616 .07 412 .05

```

x: Number of obs = 616

y: Number of obs = 412

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.07	.0102802			.0498512 .0901488
y	.05	.0107374			.0289551 .0710449
diff	.02	.0148652			-.0091352 .0491352
	under H0:	.0153463	1.30	0.192	

$$\text{diff} = \text{prop}(x) - \text{prop}(y) \quad z = 1.3032$$

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.9038

Pr(|Z| > |z|) = 0.1925

Pr(Z > z) = 0.0962

.

. prtesti 444 .11 243 .07

Two-sample test of proportions

x: Number of obs = 444

y: Number of obs = 243

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.11	.0148491		.0808963	.1391037
y	.07	.0163677		.0379199	.1020801
diff	.04	.0220997		-.0033146	.0833146
under H0:	.0234911		1.70	0.089	

diff = prop(x) - prop(y)

z = 1.7028

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

Pr(Z < z) = 0.9557

Pr(|Z| > |z|) = 0.0886

Pr(Z > z) = 0.0443

.

. prtesti 14777 .12 7080 .08

Two-sample test of proportions

x: Number of obs = 14777

y: Number of obs = 7080

	Mean	Std. err.	z	P> z	[95% conf. interval]

```

-----+-----
      x |      .12 .0026732          .1147605 .1252395
      y |      .08 .0032242          .0736807 .0863193
-----+-----

      diff |      .04 .0041883          .0317911 .0482089
          | under H0: .0044687  8.95 0.000
-----+-----

      diff = prop(x) - prop(y)          z =  8.9512
H0: diff = 0

      Ha: diff < 0          Ha: diff != 0          Ha: diff > 0
Pr(Z < z) = 1.0000      Pr(|Z| > |z|) = 0.0000      Pr(Z > z) = 0.0000

.
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.
. prtesti 508 .28 539 .29

Two-sample test of proportions          x: Number of obs =  508
                                     y: Number of obs =  539
-----+-----
      |      Mean Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
      x |      .28 .0199211          .2409554 .3190446
      y |      .29 .0195449          .2516927 .3283073
-----+-----

      diff |      -.01 .027908          -.0646986 .0446986
          | under H0: .0279184 -0.36 0.720
-----+-----

```

```

diff = prop(x) - prop(y)          z = -0.3582
H0: diff = 0

Ha: diff < 0      Ha: diff != 0      Ha: diff > 0
Pr(Z < z) = 0.3601  Pr(|Z| > |z|) = 0.7202  Pr(Z > z) = 0.6399

.
. prtesti 606 .41 476 .42

```

```

Two-sample test of proportions      x: Number of obs = 606
                                   y: Number of obs = 476

```

```

-----
|   Mean   Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
x |   .41   .0199794           .3708412   .4491588
y |   .42   .0226222           .3756613   .4643387
-----+-----
diff |   -.01   .0301818       -.0691552   .0491552
      | under H0: .0301706   -0.33   0.740
-----

```

```

diff = prop(x) - prop(y)          z = -0.3314
H0: diff = 0

Ha: diff < 0      Ha: diff != 0      Ha: diff > 0
Pr(Z < z) = 0.3702  Pr(|Z| > |z|) = 0.7403  Pr(Z > z) = 0.6298

.
. prtesti 1477 .63 756 .61

```

```

Two-sample test of proportions      x: Number of obs = 1477
                                   y: Number of obs = 756

```

```

-----

```

	Mean	Std. err.	z	P> z	[95% conf. interval]
-----+					
x	.63	.0125626			.6053777 .6546223
y	.61	.0177393			.5752316 .6447684
-----+					
diff	.02	.0217371			-.022604 .062604
under H0:	.0216698	0.92	0.356		

diff = prop(x) - prop(y)			z = 0.9229		
H0: diff = 0					
Ha: diff < 0		Ha: diff != 0		Ha: diff > 0	
Pr(Z < z) = 0.8220		Pr(Z > z) = 0.3560		Pr(Z > z) = 0.1780	

$\Pr(Z < z) = 0.0315$ $\Pr(|Z| > |z|) = 0.0631$ $\Pr(Z > z) = 0.9685$

.

. prtesti 6813 .52 2242 .50

Two-sample test of proportions x: Number of obs = 6813

y: Number of obs = 2242

	Mean	Std. err.	z	P> z	[95% conf. interval]
-----+-----					
x	.52	.0060528		.5081368	.5318632
y	.5	.0105597		.4793033	.5206967
-----+-----					
diff	.02	.0121714		-.0038555	.0438555
	under H0:	.0121683	1.64	0.100	

diff = prop(x) - prop(y) z = 1.6436

H0: diff = 0

Ha: diff < 0

Ha: diff != 0

Ha: diff > 0

$\Pr(Z < z) = 0.9499$ $\Pr(|Z| > |z|) = 0.1003$ $\Pr(Z > z) = 0.0501$

.

. prtesti 8402 .47 3638 .41

Two-sample test of proportions x: Number of obs = 8402

y: Number of obs = 3638

	Mean	Std. err.	z	P> z	[95% conf. interval]
-----+-----					
x	.47	.005445		.4593281	.4806719
y	.41	.0081543		.3940179	.4259821

y: Number of obs = 3791

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.42	.0064061			.4074443 .4325557
y	.32	.0075762			.3051509 .3348491
diff	.1	.0099215			.0805542 .1194458
	under H0:	.0100967	9.90	0.000	

H0: diff = 0

$$\Pr(Z < z) = 1.0000 \quad \Pr(|Z| > |z|) = 0.0000 \quad \Pr(Z > z) = 0.0000$$

. prtesti 4350 .39 3328 .32

y: Number of obs = 3328

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.39	.0073952			.3755056 .4044944
y	.32	.0080861			.3041516 .3358484
diff	.07	.0109578			.048523 .091477
	under H0:	.0110519	6.33	0.000	


```

diff = prop(x) - prop(y)          z =  6.3337
H0: diff = 0

Ha: diff < 0          Ha: diff != 0          Ha: diff > 0
Pr(Z < z) = 1.0000    Pr(|Z| > |z|) = 0.0000    Pr(Z > z) = 0.0000

.
. prtesti 3248 .38 2504 .31

```

```

Two-sample test of proportions          x: Number of obs =  3248
                                     y: Number of obs =  2504

```

```

-----
      |   Mean   Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
x |   .38   .0085169           .3633073   .3966927
y |   .31   .0092425           .2918851   .3281149
-----+-----
diff |   .07   .0125682           .0453667   .0946333
      | under H0:   .0126806   5.52   0.000
-----

```

```

diff = prop(x) - prop(y)          z =  5.5202
H0: diff = 0

Ha: diff < 0          Ha: diff != 0          Ha: diff > 0
Pr(Z < z) = 1.0000    Pr(|Z| > |z|) = 0.0000    Pr(Z > z) = 0.0000

.
. prtesti 2690 .38 1884 .31

```

```

Two-sample test of proportions          x: Number of obs =  2690
                                     y: Number of obs =  1884

```

```

-----

```

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.38	.0093586			.3616575 .3983425
y	.31	.0106553			.289116 .330884
diff	.07	.0141816			.0422045 .0977955
	under H0:	.0143402	4.88	0.000	

$$\text{diff} = \text{prop}(x) - \text{prop}(y) \quad z = 4.8814$$

H0: diff = 0

$$H_a: \text{diff} < 0$$

Ha: $\text{diff} \neq 0$

$$H_a: \text{diff} > 0$$
$$\Pr(Z < z) = 1.0000$$
$$\Pr(|Z| > |z|) = 0.0000$$
$$\Pr(Z > z) = 0.0000$$

.
prtesti 2092 .40 1615 .33

Two-sample test of proportions x: Number of obs = 2092

```
y: Number of obs = 1615
```

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.4	.0107109			.3790071 .4209929
y	.33	.0117006			.3070672 .3529328
diff	.07	.0158627			.0389096 .1010904
	under H0:	.015988	4.38	0.000	

$$\text{diff} = \text{prop}(x) - \text{prop}(y) \quad z = 4.3783$$
$$H_0: \text{diff} = 0$$
$$H_a: \text{diff} < 0$$

Ha: $\text{diff} \neq 0$

$$H_a: \text{diff} > 0$$

$\Pr(Z < z) = 1.0000$ $\Pr(|Z| > |z|) = 0.0000$ $\Pr(Z > z) = 0.0000$

.

. prtesti 3674 .43 2902 .38

Two-sample test of proportions x: Number of obs = 3674
y: Number of obs = 2902

	Mean	Std. err.	z	P> z	[95% conf. interval]
-----+-----					
x	.43	.0081677		.4139915	.4460085
y	.38	.0090103		.3623401	.3976599
-----+-----					
diff	.05	.0121613		.0261643	.0738357
	under H0:	.0122051	4.10	0.000	

diff = prop(x) - prop(y) z = 4.0966
H0: diff = 0

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
 $\Pr(Z < z) = 1.0000$ $\Pr(|Z| > |z|) = 0.0000$ $\Pr(Z > z) = 0.0000$

.

. prtesti 1753 .45 1343 .37

Two-sample test of proportions x: Number of obs = 1753
y: Number of obs = 1343

	Mean	Std. err.	z	P> z	[95% conf. interval]
-----+-----					
x	.45	.0118822		.4267113	.4732887
y	.37	.0131745		.3441785	.3958215

```

-----+-----
diff |    .08 .0177413          .0452277 .1147723
    | under H0: .0178698  4.48 0.000
-----+-----

diff = prop(x) - prop(y)          z =  4.4768
H0: diff = 0

Ha: diff < 0          Ha: diff != 0          Ha: diff > 0
Pr(Z < z) = 1.0000    Pr(|Z| > |z|) = 0.0000    Pr(Z > z) = 0.0000

.
. prtesti 52615 .44 30503 .36

```

```

Two-sample test of proportions          x: Number of obs =  52615
                                     y: Number of obs =  30503

```

```

-----+-----
    |   Mean   Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
x |   .44   .002164          .4357586   .4442414
y |   .36   .0027483          .3546134   .3653866
-----+-----

diff |    .08 .0034981          .0731439 .0868561
    | under H0: .0035403 22.60 0.000
-----+-----

diff = prop(x) - prop(y)          z = 22.5968
H0: diff = 0

Ha: diff < 0          Ha: diff != 0          Ha: diff > 0
Pr(Z < z) = 1.0000    Pr(|Z| > |z|) = 0.0000    Pr(Z > z) = 0.0000

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. cls

```

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. prtesti 141 .08 156 .08

Two-sample test of proportions x: Number of obs = 141
y: Number of obs = 156

Table with 6 columns: Variable, Mean, Std. err., z, P>|z|, [95% conf. interval]. Rows include x, y, and diff (difference between proportions).

diff = prop(x) - prop(y) z = 0.0000
H0: diff = 0

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(Z < z) = 0.5000 Pr(|Z| > |z|) = 1.0000 Pr(Z > z) = 0.5000

.

. prtesti 44 .03 18 .02

Two-sample test of proportions x: Number of obs = 44
y: Number of obs = 18

Table with 6 columns: Variable, Mean, Std. err., z, P>|z|, [95% conf. interval]. Row includes x.

```

      y |      .02  .0329983          -.0446755  .0846755
-----+-----
      diff |      .01  .041836          -.0719971  .0919971
          | under H0:  .0454283   0.22  0.826
-----+-----

      diff = prop(x) - prop(y)          z =  0.2201
H0: diff = 0

      Ha: diff < 0          Ha: diff != 0          Ha: diff > 0
Pr(Z < z) = 0.5871      Pr(|Z| > |z|) = 0.8258      Pr(Z > z) = 0.4129

.
. prtesti 54 .02 27 .02

```

```

Two-sample test of proportions          x: Number of obs =   54
                                     y: Number of obs =   27
-----+-----
      |   Mean  Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
      x |   .02  .0190516          -.0173404  .0573404
      y |   .02  .026943          -.0328073  .0728073
-----+-----
      diff |      0  .0329983          -.0646755  .0646755
          | under H0:  .0329983   0.00  1.000
-----+-----

      diff = prop(x) - prop(y)          z =  0.0000
H0: diff = 0

      Ha: diff < 0          Ha: diff != 0          Ha: diff > 0
Pr(Z < z) = 0.5000      Pr(|Z| > |z|) = 1.0000      Pr(Z > z) = 0.5000

.

```

Two-sample test of proportions x: Number of obs = 309
y: Number of obs = 78

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.06	.0135102			.0335206 .0864794
y	.04	.022188			-.0034877 .0834877
diff	.02	.0259775			-.030915 .070915
under H0: .029127 0.69 0.492					

diff = prop(x) - prop(y) z = 0.6866
H0: diff = 0

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
Pr(Z < z) = 0.7538	Pr(Z > z) = 0.4923	Pr(Z > z) = 0.2462

. prtesti 1922 .15 499 .11

Two-sample test of proportions x: Number of obs = 1922
y: Number of obs = 499

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.15	.0081448			.1340366 .1659634
y	.11	.0140069			.082547 .137453
diff	.04	.0162028			.0082432 .0717568
under H0: .0175245 2.28 0.022					

y: Number of obs = 2777

y	.23	.0079859		.214348	.245652

```
| under H0: .0103634    2.89  0.004
```

H0: diff = 0

$$H_a: \text{diff} > 0$$
$$\Pr(Z > z) = 0.0019$$

•

```
. prtesti 3916 .28 3063 .26
```

y: Number of obs = 3063

-----+

y	.26	.0079255		.2444662	.2755338

-----+

```
| under H0: .0107241    1.86  0.062
```

H0: diff = 0

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(Z < z) = 0.9689 Pr(|Z| > |z|) = 0.0622 Pr(Z > z) = 0.0311

.

. prtesti 3301 .30 2923 .28

Two-sample test of proportions x: Number of obs = 3301
y: Number of obs = 2923

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.3	.007976		.2843673	.3156327
y	.28	.0083048		.2637228	.2962772
diff	.02	.0115147		-.0025683	.0425683
under H0:	.0115317		1.73	0.083	

diff = prop(x) - prop(y) z = 1.7343
H0: diff = 0

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0
Pr(Z < z) = 0.9586 Pr(|Z| > |z|) = 0.0829 Pr(Z > z) = 0.0414

.

. prtesti 2771 .33 2458 .30

Two-sample test of proportions x: Number of obs = 2771
y: Number of obs = 2458

	Mean	Std. err.	z	P> z	[95% conf. interval]
x	.33	.0089326		.3124925	.3475075


```
. prtesti 1765 .33 1649 .34
```

Two-sample test of proportions x: Number of obs = 1765

 y: Number of obs = 1649

```
-----
      |   Mean  Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
    x |   .33  .0111924           .3080634   .3519366
    y |   .34  .0116654           .3171362   .3628638
-----+-----
diff |   -.01  .0161664       -.0416855   .0216855
      | under H0:  .0161632  -0.62  0.536
-----
```

```
diff = prop(x) - prop(y)                      z = -0.6187
H0: diff = 0
```

```
Ha: diff < 0              Ha: diff != 0              Ha: diff > 0
Pr(Z < z) = 0.2681      Pr(|Z| > |z|) = 0.5361      Pr(Z > z) = 0.7319
```

.

```
. prtesti 2782 .32 2591 .34
```

Two-sample test of proportions x: Number of obs = 2782

 y: Number of obs = 2591

```
-----
      |   Mean  Std. err.   z   P>|z|   [95% conf. interval]
-----+-----
    x |   .32  .008844           .302666   .337334
    y |   .34  .0093063          .32176   .35824
-----+-----
diff |   -.02  .0128384       -.0451628   .0051628
      | under H0:  .0128343  -1.56  0.119
-----
```

$$\text{diff} = \text{prop}(x) - \text{prop}(y) \quad z = -1.5583$$
$$H_0: \text{diff} = 0$$

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

$$\Pr(Z < z) = 0.0596 \quad \Pr(|Z| > |z|) = 0.1192 \quad \Pr(Z > z) = 0.9404$$

. prtesti 865 .22 744 .21

Two-sample test of proportions x: Number of obs = 865

y: Number of obs = 744

	Mean	Std. err.	z	P> z	[95% conf. interval]

x	.22	.0140848	.1923943	.2476057

y	.21	.0149326	.1807326	.2392674

diff	.01	.0205272		-.0302325	.0502325

```
| under H0: .0205548    0.49  0.627
```

$$\text{diff} = \text{prop}(x) - \text{prop}(y) \quad z = 0.4865$$

H0: diff = 0

Ha: diff < 0 Ha: diff != 0 Ha: diff > 0

$$\Pr(Z < z) = 0.6867 \quad \Pr(|Z| > |z|) = 0.6266 \quad \Pr(Z > z) = 0.3133$$

```
. prtesti 28637 .24 20672 .25
```

Two-sample test of proportions x: Number of obs = 28637

y: Number of obs = 20672

	Mean	Std. err.	z	P> z	[95% conf. interval]

x	.24	.0025238		.2350535	.2449465
y	.25	.0030117		.2440972	.2559028

diff	-.01	.0039293		-.0177013	-.0022987
	under H0: .0039208 -2.55 0.011				

diff = prop(x) - prop(y) z = -2.5505

H0: diff = 0

Ha: diff < 0	Ha: diff != 0	Ha: diff > 0
Pr(Z < z) = 0.0054	Pr(Z > z) = 0.0108	Pr(Z > z) = 0.9946