The Knowledge, Attitudes and Practices of Health Care Workers regarding the Occupational Exposure to Blood and Bodily Fluids in a Public Hospital, KwaZulu-Natal.

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DECLARATION

I, Nakita Govender, hereby declare that the contents of this dissertation has been composed solely by myself and is representative of my own unaided original work, except where stated otherwise, by reference or acknowledgment. I declare that this thesis has not been submitted, in whole or in part, in any previous application for a degree at the Durban University of Technology (DUT) or any other University.

N. Govender (21520416) Date

DEDICATION

This dissertation is wholeheartedly dedicated to my beloved family, whose words of encouragement and drive for tenacity propelled me forward in the most strenuous of times.

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This dissertation is the fruit of countless and arduous sacrifice.

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ABSTRACT

The risk of exposure to BBF amongst health care professionals may be considered a consequential yet vastly unexplored field of study in the medical setting, particularly in the developing world. In South Africa, knowledge and practices to safeguard health care workers (HCWs) from blood borne infections (BBI) proved substandard in necessitous health care facilities. Ideally, hospital management should be provided with data to guide and inform procedures for prevention and control for potential infections arising in the work environment. An extensive review of South African literature showcased finite research data published on blood and bodily fluid (BBF) exposures and factors affecting infection prevention and control (IPC). In the KwaZulu-Natal province, knowledge, attitude and practices (KAP) of HCWs, regarding occupational exposure to BBF, as well as the HCWs perceptions on the barriers to IPC, in a public hospital, has yet to be studied, with no recently published research encountered thus far, in South Africa. This study aimed to evaluate the KAP of HCWs regarding occupational exposure to BBF in a public hospital of KwaZulu-Natal. An institutional based, observational-descriptive cross-sectional study with a quantitative approach was conducted, in order to determine the association between the knowledge and attitudes of HCWs and behavioral risks for occupational exposure, as well as the perceptions of HCWs, on the barriers to IPC in a public hospital of KwaZulu-Natal. This study utilised a simple-random sampling technique from a total number of 199 HCWs. The minimum sample size was calculated at 166, by a statistician, in which the margin of error is set at 5%. This study found a correlation between profession as well as work department and risk of exposure to BBF. Level of education was found to play a significant role in HCW knowledge of PEP. Work practices were found to greatly influence the likelihood of an NSI. Post exposure prophylaxis amongst a substantial amount of HCWs who did experience an accidental exposure, was distressingly low. Underreporting seemed to have been associated with profession. The age of the respondents did play a significant role in terms of the needle recapping practices of HCWs, with the middle age category between 36 to 40 years most often engaged in needle recapping behaviour. As per the active belief of the HCWs themselves, lack of knowledge, feedback on monitoring and training on IPC, as well as lack of availability of infection prevention and control guidelines were considered to be barriers to IPC in the hospital. Respondnets in this study also displayed a potential

lack of awareness on the infrequent or absence of regular infection prevention and control committee meetings. Additionally, more than half of the total sample exhibited complete ignorance in terms of cost requirements for IPC interventions as a likely impedance of IPC. A disquieting amount of HCWs were found to have received training more than 24 months ago which deviated from the recommended annual refresher training as per the Occupational Health and Safety Act (No. 85 of 1993).

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DEFINITIONS

Occupational exposure to blood and bodily fluids: The accidental exposure of health care workers to blood or bodily fluids during the performance of their duties in a medical setting.

Mucocutaneous injury: This is an injury that occurs when blood or bodily fluids enter the mouth, eyes, nose or non-intact skin.

Needlestick injuries: These are injuries that result from the accidental puncture of the skin by a needle.

HIV Post-exposure prophylaxis: This is a short course of medication taken for the prevention of HIV following a subsequent exposure to the pathogen.

ABBREVIATIONS

BBF	:Blood and Bodily Fluid
HIV	:Human Immunodeficiency Virus
HBV	:Hepatitis B Virus
HCV	:Hepatitis C Virus
HCW	:Health Care Worker
BBI	:Blood Borne Infection
IM	:Intramuscular
IV	:Intravenous
WHO	:World Health Organization
CDC	:Centre For Disease Control And Prevention
NSI	:Needle Stick Injury
KAP	:Knowledge, Attitude And Practices
PEP	:Post-Exposure Prophylaxis

CHAPTER ONE
INTRODUCTION

1.1 INTRODUCTION

Occupational exposure to blood and bodily fluids (BBF) may be considered the most significant route of entry of blood-borne pathogens such as human immunodeficiency virus (HIV), hepatitis B (HBV) and hepatitis C (HCV) into the body (Karani *et al.* 2011: 462). It was suggested that approximately 2.6%, 5.9%, and 0.5% of health care workers (HCWs) were exposed to HCV, HBV and HIV respectively, via a workplace exposure (Karani *et al.* 2011: 462). This amounts to an estimated 16,000, 66,000 and 1000 of HCV, HBV and HIV infections, sequentially (Abere 2020: 2). An occupational exposure to BBF is characterised as an accidental exposure, through a percutaneous injury (via contaminated sharp medical devices or a needlestick), a mucocutaneous injury, or direct contact of infected blood, tissue or any other bodily fluid (blood, urine, faeces, sputum) with non-intact skin (Karani *et al.* 2011: 462). A considerable amount of research has equated percutaneous injuries, via needlestick and sharps, as the typical route of occupational injuries of HCWs (Marković-Denić *et al.* 2014: 789).

The administration of recently introduced therapeutic techniques, the consistent use of invasive procedures, an increased number of individuals acquiring blood-borne infections (BBI) (HIV, HBV and HCV) and the extended life expectancy of those infected, renders occupational exposure of HCWs a suitable field of study, of contemporary interest (Marković-Denić *et al.* 2014: 789). An excess of twenty blood-borne infections presently exist (Calver 1997: 363). However, HIV, HBV and HCV are pathogens that pose the greatest risk to HCWs (Abere 2020: 2). Activities during which HCWs are particularly vulnerable to an exposure include, drawing of blood samples, intravenous line insertion, procedures such as intramuscular (IM) injections, assisting in surgical procedures, emergency surgeries, overfilled sharps containers, needle disposal, needle recapping, blood collection (i.e., drawing of blood samples), transferring blood into a specimen bottle, emergency surgeries, amniotic fluid splash, elective surgeries, conducting labour, cleaning contaminated instruments (e.g. sharps), cleaning contaminated cloths and procedures such as biopsies, suturing, and dressing of wounds (Mohamed *et al.* 2016: 3, Atlaw 2013: 76, Zaidi *et al.* 2012: 211, Gebremariyam 2019: 19, Haile *et al.* 2017: 1, Bekele *et al.* 2018: 1, CDC 2020, Aluko *et al.* 2016: 71, Ngatu *et al.* 2012: 69). Such clinical activities place HCWs at consequent risk of acquiring occupationally related diseases via BBF exposure (Prüss-Üstün et al 2003: 1, Gebremariyam 2019: 19 and World Health Organization (WHO) 2013: 36). Despite the formulation of universal guidelines and protocols established by the Centre for Disease Control and Prevention (CDC) for protection against BBF exposure, conformity to standard precautions remain unsatisfactory and irregular, amongst HCWs throughout (CDC 2020 and Gebresilassie *et al.* 2014: 286). Lack of compliance to standard precautions may owe to the gravity of the hazard being severely trivialised, by the health workforce (Rajkumari 2014: 1470). Additionally, the absence of symptoms associated with blood-borne infections create a significant threat to HCWs. As such standard medical practice requires all HCWs to handle BBF as potentially infectious (Saskatchewan Dental Assistants Association 2020).

Despite the coherence of standard precautions, adherence to policy remains in adequate. This issue is particularly prevalent in low resource settings (Sahiledengle 2018: 173). A systematic review performed in twenty-one African countries revealed a total cumulative prevalence of 48% of occupational exposure to BBF, over a twelve-month period (Auta *et al.* 2017: 831). Similarly, an Iranian study declared a 79% prevalence rate of occupational exposure to BBF amongst HCWs. The implications of exposure to BBF compromises the health and welfare of HCWs and places the standard of healthcare delivery under severe strain (Amoran and Onwube 2013: 156, Yenesew and Fekadu 2014: 17 and Cooke and Stephens 2017: 227). Occupational exposure to BBF is among the leading causes of workplace protest and associated grievances in healthcare settings, in the developing world (Russo *et al.* 2019: 460). The foremost problem arising from an occupational exposure to BBF include acute psychological complications such as anxiety, depression and post-traumatic stress-often experienced post-exposure. Additionally, an immense encumbrance is placed on society, with respect to the assessment and treatment of BBIs, which consequently give rise to associated costs for treatment, absenteeism from the workplace, as well as distress, from the burden of disease (Nouetchognou *et al.* 2016: 2). Such exposures have been associated with HCW burnout, and low employee morale, which may potentially give rise to reduced productivity (Kruse *et al.* 2009: 1).

1.2 HIV PREVALENCE AMONGST HEALTH CARE WORKERS

The incessant occupational exposure of HCWs in their line of duty has resulted in a relatively high prevalence of HIV/AIDS, amongst this population group, both in the public and private sector (Shisana *et al.* 2004: 846). Although several strategies and policies have been employed for the control of HIV, this infection remains globally exponential (UN AIDS 2019). Reports have indicated a global prevalence of 37.9 million individuals presently infected with this malady (UN AIDS 2019). In the same regard, an estimated 7.7 million individuals presently live with HIV in South Africa, what is expected to be the greatest prevalence, in a globally context (Joint United Nations Programme on HIV/AIDS 2014: 2). Under those circumstances South African HCWs may be considered particularly vulnerable, due to their constant contact with HIV infected individuals Kabotho and Chivese (2020: 2). Although there has been a significant advancement in the treatment for HIV amongst patients, HCWs are at a continued risk of occupational exposure (Western Cape Government Health 2016: 4). The likelihood of exposure is unsettling, particularly in a South African health system, that is already severely strained by stressors such as bearing the brunt of greatest HIV morbidity rate, worldwide (Western Cape Government Health 2016: 4).

Prior research presents a compelling case in favour of the effectiveness of HIV post exposure prophylaxis (PEP) with a highly active antiretroviral treatment (HAART) in protection against acquiring HIV, if administered efficiently for the recommended period of 28 days (Western Cape Government Health 2016: 4). Post exposure prophylaxis remains widely available amongst the South African health care setting. However, in order to maximise the capabilities of PEP, HCWs need to be adequately informed on HIV PEP, so as to positively influence HCW line of action, following an occupational exposure. It is imperative that high risk categories of employees, particularly HCWs are equipped with adequate knowledge pertaining to HIV prevention (Mashsoto *et al.* 2015: 29). Factors affecting HIV prevention has been poorly delineated. However, Mossburg *et al.* (2019: 1) suggested that determinants such as improper knowledge, attitude and the absence of appropriate protocols and an adequate reporting system are factors that may be associated with its increased prevalence. The protection of HCWs from BBF exposure, as well as subsequent BBIs remains ineffective in South Africa (Nkoko *et al.* 2014: 382). Pitfalls in knowledge and practices form an integral component in exposure to BBF, particularly in low-income settings of South Africa (Nkoko *et al.* 2014: 382).

A study performed amongst nurses in Cameroon revealed a poor state of knowledge on HIV PEP, amongst this category of workers, with 73% of the research population displaying a dismal state of knowledge (Aminde *et al.* 2015: 2). This revelation further highlights a gap in knowledge, in low resource environments, thus reinforcing the fundamental role that knowledge plays, in HIV prevention, amongst HCWs (Aminde *et al.* 2015: 2). Prior research suggested that nurses are among the most highly exposed cadre of HCWs, and are at greatest risk of exposure to HIV (Kaweti and Abegaz 2016: 1). A study performed in Ethiopia revealed a 58.2% rate of occupational exposure amongst nurses, the greatest, excluding medical doctors in comparison to laboratory personnel (30.8%) and other miscellaneous professions in the health care setting (Mekonnin *et al.* 2018: 1). By the same token, a higher prevalence of percutaneous injuries was reported amongst nurses and midwives (81% and 91.7% respectively) than medical doctors (77.8%) in South West Ethiopia (Mekonnin *et al.* 2018: 1). However, despite the difference in figures, the statistics between all cadres of health care professionals- nurses and doctors alike remains substantially high, instituting an endemic of paramount importance. Further adding to the susceptibility of local HCWs, a significant proportion of hospital beds within South Africa were reportedly occupied by HIV-positive patients (46%). As such, South African HCWs are therefore rendered vulnerable to occupational exposure to HIV, within a healthcare setting (Vardas *et al.* 2002: 6).

Several studies performed within South Africa revealed an HIV prevalence of 20%, 12% and 16% within Cape Town, Gauteng and South Africa as a whole, respectively (Kranzer *et al.*2010: 224, Connelly *et al.* 2007: 115 and Shisana *et al.* 2004: 846). Furthermore, the findings illustrated by Connelly *et al.* (2007: 115) were greatly reinforced in a statement brought forth by Shisana *et al.* (2004: 846). Shisana *et al.* (2004: 846) stated that the study performed by Connelly *et al.* (2007: 115) was the second verifiable South African study to denote HIV infection amongst HCWs as a significant epidemic that demands immediate attention. The results of a South African study conducted within four provinces of South Africa revealed an approximate rate of 16.3% prevalence of HIV amongst public sector HCWs. However, there was no significant difference between the rate of HIV for individuals employed in public hospitals and primary health care facilities (Shisana *et al.* 2004: 846). Whilst a significant proportion of HCWs are directly affected by the HIV epidemic owing to occupational exposure, a study conducted by Tatsilong *et al.* (2016: 706) has indicated that the incidence of Hepatitis B Virus (HBV) among HCWs is four times greater than the general adult population.

Literature in the past thirty years has emphasized the burden of Hepatitis B Virus (HBV) on Public health (Burnett *et al.* 2011: 4293). Prior research suggests a higher chronic carriage of HBV amongst black South Africans, as compared to individuals of mixed ethnicity (Burnett *et al.* 2011: 4293). Additionally, a study performed by Kew (1996: 6) revealed a higher HBsAg (Hepatitis B surface antigen) chronic carriage amongst rural black populations (15.5% in a rural region of Eastern Cape) in relation to urban black populations in Soweto, Gauteng (1.3%). According to De Villiers (2007: 14) the risk of transmission of HBV is allegedly one hundred times greater than HIV, yet HCWs place greater emphasis on the latter, and rarely test for HBV infection following an occupational exposure.

1.3 HBV PREVALENCE AMONGST HEALTH CARE WORKERS

Hepatitis B is deemed a significant occupational health hazard amongst health care professionals – who play an integral role in the relay of infection (Muljono *et al.* 2018: 88). A median review produced by the National Department of Health (2018: 2) stated that the exact prevalence of HBV amongst South African HCWs was currently unknown. However, the prevalence was estimated to resemble that of the general population (HBV infection prevalence = 0.2% - 16%). This range may gravitate toward the higher region and should thus be considered impermissible in the health care setting, and warrant immediate intervention strategies, to safeguard the wellbeing of HCWs. In a like manner, a recent study conducted in two provinces of South Africa focussed on occult HBV (Sondlane *et al.* 2016: 1). The result of this study revealed high rates of HBV infection as well as suboptimal protection against HBV in HCWs (9.6%). Despite the South African National Department of Health advocating for vaccination of all HCWs against HBV – this mandate has not been necessitated in the form of a national policy (Vardas *et al.* 2002: 6). A study performed by Stroffolini *et al.* (2008: 275) amongst Italian HCWs described an association between knowledge and vaccination uptake. An educational programmed aimed at increasing vaccination coverage yielded favourable results, with a drastic increase in vaccination utilisation from 64.5% to 85.3% between 1996 and 2006 (Stroffolini *et al.* 2008: 275). However, the implementation of a national policy for HBV vaccination of HCWs should not be independent of continuous monitoring and evaluation. Throughout the public and private sector of Gauteng HBV vaccinations have been made vastly available (Mureithi 2010: 47). According to Mureithi (2010: 47) the economic sector played a statistically significant role in vaccination uptake, with higher vaccination rates presented in the private sector. This may owe to the level of enforcement and monitoring policies implemented in the private sector hospitals, as opposed to hospitals hailing from the public sector. As such, viral hepatitis may be considered a significant public health issue prevailing endemically across the globe (Krastova *et al.* 2008: 38).

1.4 HCV PREVALENCE AMONGST HEALTH CARE WORKERS

The likelihood of contracting viral hepatitis C increases six fold per needles stick injury, in comparison with risk of HIV infection (1.8% vs. 0.3%) (Greyling 2014: 35). Prior research conducted by Lazarus *et al.* (2012:1) and Botha *et al.* (2010: 20) suggested that the prevalence of HCV in South Africa was inconclusive but may approximately lay between 0.1% and 0.7%. By the same token, the National Department of Health (2018: 2) reiterated the findings described by Lazarus *et al.* (2012:1) and Botha *et al.* (2010: 20) by similarly indicating that the exact prevalence of HCV amongst HCWs in South Africa could not be established. However, according to a medical review by National Department of Health (2018: 2) the prevalence of HCV amongst HCWs closely mimics that of the general South African population (2.4%). An earlier study conducted by Vardons *et al.* (2002: 10) illustrated the prevalence of HCV amongst HCWs. The results of the study found that the prevalence of HCV amongst this risk group was greater than that of the general South African population (1.8% prevalence amongst HCWs, 0.4% - 1.7% prevalence amongst the general South African population). Over time, not only did the prevalence between the HCWs and the general South African population equalise thus minimising the prevalence rate of one another, but it additionally increased to a rate of 2.4% (Vardons *et al.* 2002: 10 and National Department of Health 2018: 2). An extensive review of literature across Africa, and within South Africa specifically, indicated a significant gap in neoteric research pertaining to the prevalence of HCV amongst HCWs in these regions. Although HBV is considered a significant cause of occupationally acquired hepatitis amongst HCWs, HCV has contributed to a substantial number of occupational infections prevalent amongst HCWs (Polish *et al.* 1993: 196 and Centre for Disease Control and Prevention 1997: 1). As a result, the prevalence of HCV within health care settings should be considered a promising line of research within these regions, in order to further investigate the extent of exposure and associated burden of disease among this risk group.

1.5 RISK FACTORS FOR OCCUPATIONAL EXPOSURE TO BBF

Occupational exposure to blood and body fluids is a notable pathway for the relay of blood-borne pathogens including HIV, HBV and HCV (Karani *et al.* 2011: 462). Health care workers, particularly emergency nurses, physicians as well as other emergency personnel are at risk of exposure to various infectious transmissions, as a result of increased risk of occupational exposure to BBF (Farsi *et al.* 2012: 656). According to Sabbah *et al.* (2013: 1) occupational exposure to BBF presents a significant danger to the lives of HCWs. A cross-sectional study executed by Matsubara *et al.* (2017:582) within a tertiary hospital in Vientiane, Lao People’s Democratic Republic revealed that amongst a study population of nine hundred and thirty-two, one hundred and six needle stick injuries (NSI) were discovered. Risk factors such as percutaneous procedures accounted for 17.9% of such injuries with suturing needles, insertion of intravenous lines, the replacement of needle caps and disposal, accounting for 17.0%, 17.0%, 13.2% and 10% respectively, with the remaining 24.5% owing to other incidents not specified in the study (Matsubara *et al.* 2017: 582). Data revealed a statistically significant association between the lack of availability of needles, syringes and sharp equipment and needle stick injuries in the past six months (Matsubara *et al.* 2017:582). Similarly, a study conducted by Mbaisi *et al.* (2013: 1) within a Kenyan-based hospital, equated withdrawal, insertion and manipulation of needles, as a common percutaneous source of injuries. Two hospital-based studies performed in Ethiopia aimed to determine the factors associated with occupational exposure to BBF (Yimechew *et al.* 2013: 19, Gebermariyam *et al.* 2013: 19). Both studies revealed a statistically significant correlation between work experience and occupational exposure to BBF (AOR = 3.9).

The occupational risks of HCWs to BBF are an imperative, yet understudied area of research, particularly in developing countries of the world such as South Africa

(Roussow *et al.* 2014: 732). According to Roussow *et al.* (2014: 732) junior doctors as well as medical and dental students were found to be at a higher risk of occupational exposure due to developing skills, constant exposure to invasive procedures and extensive duration of work shifts. A study performed by Nkoko *et al.* (2014:83) focused on blood and bodily fluid exposure risk factors. This study revealed a statistically significant correlation between years of experience and the occurrence of incidents. Studies conducted among HCWs in the Free State and Gauteng province of South Africa revealed that the majority of exposure to BBF were found to occur most frequently amongst the maternity, casualty, male and obstetrics and gynaecology wards. This finding thereby indicated a probable association between department of work and risk of occupational exposure to BBF (Nkoko *et al.* 2014:83, Aboding *et al.* 2019: 4). Another risk factor that may increase an individual's susceptibility to developing infectious disease is the lack of knowledge regarding occupational exposure to blood or bodily fluid amongst HCWs (Markovic-Denic 2012: 73).

1.6 KNOWLEDGE OF HCWS REGARDING BBF

The foundation for an efficient health promotion or disease prevention programme lay in the coherence between health information and knowledge, and knowledge and practice (Zaidi *et al.* 2012: 211). A study performed in Georgia found that 29% of HCWs were knowledgeable on factors such as proper disposal of needles, whereas 23% of the study population thought that the needles should be recapped (Butsashvilli *et al.* 2012: 662). Another 28% of participants assumed that the used needles should be disinfected (Butsashvilli *et al.* 2012: 662). A total of 18% of the population claimed to be unaware of how to correctly handle contaminated needles (Butsashvilli *et al.* 2012: 662). Another study performed in Georgia found that the general knowledge of dental HCWs on blood borne infections (BBI) was alarmingly low, with majority of HCWs having a flawed understanding of the Hepatitis B Virus (HBV), Hepatitis C Virus (HCV) and Human Immunodeficiency Virus (HIV) prevalence (Kochlamazashvili *et al.* 2018: 867). Half of the study participants considerably overestimated the likelihood of the transmission of blood borne infections following an isolated needle stick injury, with such estimates falling in the range of 50-70% (Kochlamazashvili *et al.* 2018: 867). Correspondingly, research performed in Southeast Ethiopia revealed 53.7% of the study population lacked knowledge on infection prevention. Factors such as sex, profession, service year and the presence of an infection prevention committee and training were significantly associated with knowledge of infection prevention (Gebermariyam *et al.* 2018: 6). The study mirrored results of similar studies performed in Ethiopia and Egypt alike (Biniyam *et al.* 2018: 177, Gebermariyam *et al.* 2018: 2, Teshager *et al.* 2015: 4 and Eskander *et al.* 2013: 9).

A study initiated by Nkoko *et al.* (2014:83) aimed to identify the gap in knowledge of HCWs in rural hospitals of South Africa with regard to BBF. According to Public Health Ontario (2020) the recapping of needles in a health care setting is interdicted. However, approximately, only half of the respondents in the study displayed an understanding of such statement. Additionally, the study revealed a statistically significant association between knowledge of recapping needles and blood and bodily fluid exposure. Additionally, Nkoko *et al.* (2014: 382) concluded that equipping occupational health nurses in resource constrained settings with adequate knowledge may be considered advantageous in encouraging them to head small-scale initiatives to evaluate the KAP of staff and implement subsequent interventions as may be required. A study conducted by Zungu *et al.* (2008: 56) revealed that paucity in knowledge and experiences regarding procedures performed, and lack of experiential learning, were a few factors that students declared strongly associated with the likelihood of the occurrence of needle stick injuries. A review of literature has uncovered several gaps and misconceptions in the knowledge of HCWs with regards to BBF, that are in need of significant reform. All literature reviewed on the domain indicate the need for improved knowledge on prevention, so as to reduce the incidence of BBF exposure amongst HCWs. According to Permana and Hidayah (2017: 1) the application of standard precautions is greatly influenced by knowledge, attitude and compliance, with attitude displaying the greatest impact.

1.7 ATTITUDE OF HCWS TO BLOOD AND BODILY FLUID EXPOSURE

The cornerstone to the prevention of BBI lay in an appropriate attitude toward such infections (Mansour-Ghanaei *et al.* 2013: 197). A study performed in Dubai revealed that the study participants were aware of the significance of blood tests, not only for themselves but also the source patient (Zaidi *et al.* 2012: 211). However, a significant proportion of HCWs claimed to bypass testing and commence treatment without conducting a formal risk assessment beforehand – possibly owing to the HCWs attitudes that risk may have been considered so serious that testing would actually add no value to treatment of the patient at the particular time (Zaidi *et al.* 2012: 211). A hypothetical scenario whereby participants were given a choice on whether or not to report any of the three infections (HBV, HCV and HIV) following a needle stick injury was evaluated by Saleem *et al.* (2010: 152). Precisely, 55% of respondents chose not to report HIV related needle stick injuries due to the fear of stigma by peers (Saleem *et al* 2010: 152). A study based in Nigeria aimed to investigate the attitude of HCWs on occupational exposure to BBF (Aluko *et al.* 2016: 6). In the study, 99.4% of respondents believed that recognition of occupational hazards should take precedence and should be considered part of the conducive work provisions in health care facilities. Additionally, 99% of participants considered staff training and the provision of personal protective equipment as imperative in minimizing employee risk of exposure to occupational hazards in a health care setting (Aluko *et al.* 2016: 6). A study performed in Sudan revealed a propitious attitude among 86.4% of respondents toward the observation of precautionary measures for HBV (Mursy and Mohamed 2019: 3). Such precautionary measures include sterilization of instruments, use of gloves, HBV vaccination and PEP (Mursy and Mohamed 2019: 3). Although a favourable attitude was presented by respondents to preventative measures to HBV infection, the gap in knowledge in awareness of the importance of PEP continues to present itself among the study population (Mursy and Mohamed 2019: 1597). A study conducted in a dental training site within South Africa highlighted that a major cause of the underreporting of incidents may have been attributed to the perception of the injury being too small to be considered significant (Moodley and Naidoo 2015: 337). Similarly, a study conducted by Nkoko *et al.* (2014: 83) illustrated HCWs attitudes toward risk exposure. This study revealed that only 62.5% of the study population deemed it necessary to visit the occupational health clinic following an exposure to BBF. Additionally, 25% of participants displayed a degree of ignorance regarding the importance of PEP, for each subsequent exposure (Nkoko *et al.* 2014: 83). The shortcomings in attitude identified in the literature reviewed, present a serious consequence to HCWs, and may compromise the integrity of health care services delivered to patients alike in health care facilities. In hopes of reducing the morbidity of HCWs, hospital management should place emphasis on strengthening health education, which in turn has proven to improve attitude, which is directly linked to safer practices when handling BBF (Atlam *et al.* 2016: 749).

1.8 PRACTICES OF HCWS IN RELATION TO BLOOD AND BODILY FLUID EXPOSURE

Data illustrating the occupational exposure of nurses to HIV, in South Africa is few and far between (Kabotho and Chivese 2020: 9). A cross-sectional study performed in Western Cape South Africa revealed that only 58.2% of the respondents who had experienced an occupational exposure had reported the incident and sought out appropriate care (see figure 1) (Kabotho and Chivese 2020: 9). Despite favourable behaviour towards reporting of incidents and seeking treatment, only 60% of those who sought treatment completed the course, as such a dropout rate of 40% was observed (Kabotho and Chivese 2020: 9). The discontinuation of treatment reportedly owed to the adverse side-effects experienced by HCWs on the medication, as well as the HCWs perceiving treatment as enough, before the course could be fully completed (Kabotho and Chivese 2020: 9). These findings corroborate those illustrated in a 2016 Botswana study, where less than three quarters of 69% of participants completed treatment (Kassa *et al.* 2016: 880). In support of the findings by Kabotho and Chivese (2020: 2) Kassa *et al.* (2016: 880) found that a portion of participants alike, discontinued treatment, due to its associated side effects. However, despite inconsistent utilisation of PEP, majority of the study population (94.97%) successfully made use of PPE when expected to encounter a BBF exposure (Kabotho and Chivese 2020: 9). A significant proportion of respondents reportedly discard use sharps in the relevant container, with 76.47% of participants claiming to never recap a needle (Kabotho and Chivese 2020: 9). Only 60.78% of participants reportedly sealed the sharps disposal container when it has reached the required capacity mark as required by the FDA (2018) and NHS (2019: 6).

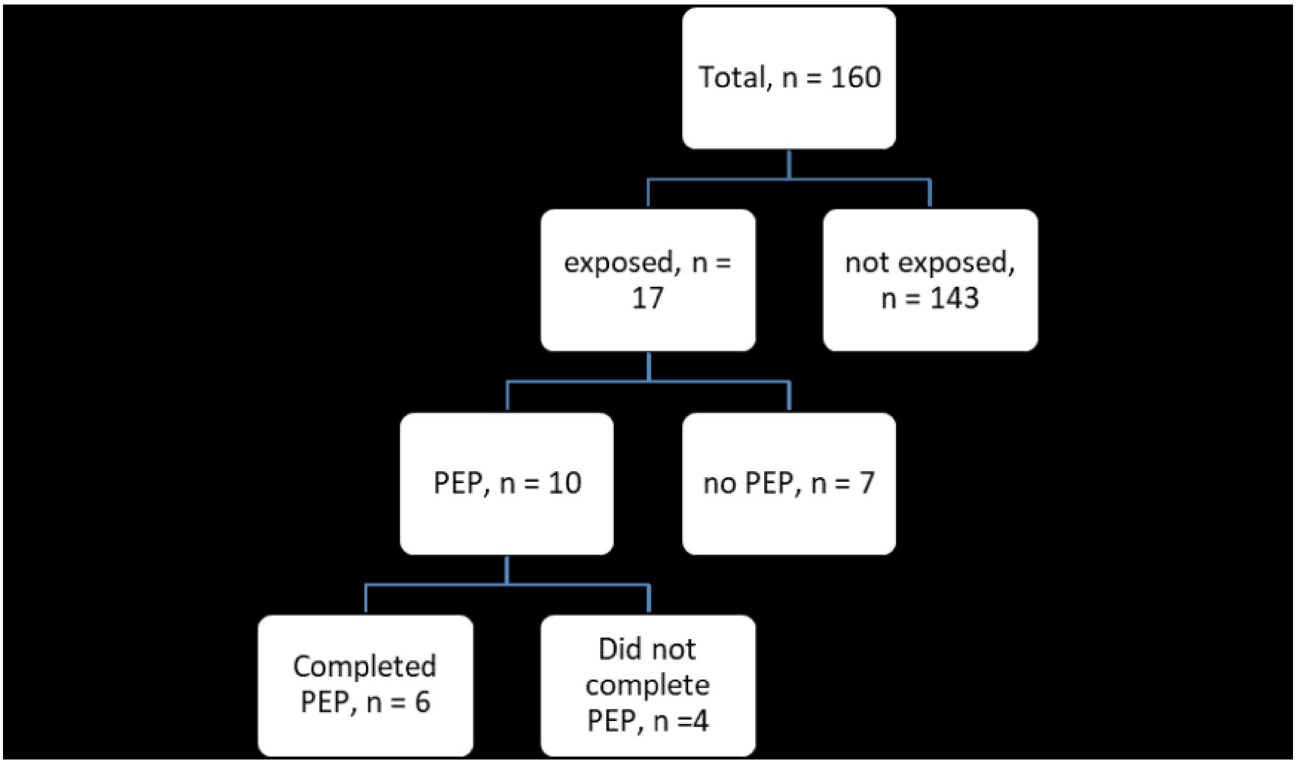

Figure 1: Diagram depicting occupational exposure to HIV and the utilisation and completion of PEP (Kabotho and Chivese 2020: 7).

Approximately 83% of the study population presented with adequate infection-control practices, with only 3% displaying "poor" IPC. Interestingly, (Kabotho and Chivese 2020: 2) failed to establish a statistically significant association between occupational exposure to HIV and infection-control practice scores. The study revealed that one out of nine nurses employed within the study site at Western Cape had experienced an occupational exposure, with NSIs responsible for approximately two thirds of exposure. The trend of exposure within the Western Cape study mirrored those described in a 2015 Tanzanian study and 2011 Nigerian study, where NSIs accounted for 62.9% and 63.6% of injuries, respectively. In conjunction with the findings of the South African study, a study performed in Southeast Ethiopia revealed a report rate of 59% (versus Western Cape 58.82%) (Bekele *et al.* 2015: 3). Researchers Bekele *et al.* (2015: 3) proposed that factors such as lack of time, sharps by which an incident was caused was not contaminated by an infected patient, and lack of sufficient knowledge on reporting as probable elements that inhibited the reporting of injuries. The lack of reporting is accompanied by grave consequences. Exposures that go underreported may inevitably result in the emergence of new HIV-related cases – as lack of reporting may impede HCWs receipt of PEP (Kabotho and Chivese 2020: 9). The analysis by Kabotho and Chivese (2020: 9) provided much incite on the practices of HCWs relating to reporting and optimisation (or lack thereof) of HIV treatment provided by the health facility.

Default in treatment transcends type of infection. In Gauteng a mere 19.9% of 29.5% of respondents who had been vaccinated had completed all three doses of HBV vaccination (Burnett *et al.* 2011: 4293). This finding was lower than those established in similar studies performed globally (Dannetun et al. 2006: 202, Mengal et al 2008: 48 and Hatipoglu 2007- 200). In Sweden, Pakistan and Turkey, 38.7%, 37.2% and 55.8% of the study population had completed all three doses, respectively (Dannetun et al. 2006: 202, Mengal et al 2008: 48 and Hatipoglu 2007: 200). However, the study experienced several shortcomings- the most prominent being that nurses and doctors were primarily surveyed – with doctors comprising only 9.7% (70/725) of the study population. As such allied HCWs at an increased risk of exposure such as: laboratory personnel were not included in the study. Therefore, the results of the study cannot be generalised to all HCWs in Gauteng. This highlights the need for additional all-inclusive research to be conducted in the domain, such that data may be extrapolated to all HCWs who may come into contact with BBF during their work shift. A plethora of research conducted in South Africa focused on preventative practices (such as the use of PEP and HBV vaccination coverage) and reporting or under reporting practices of HCWs. However, few to none reported on associated high-risk practices that increase the risk of exposure of HCWs to BBF during a normal work shift (Mbah *et al.* 2011: 4, Kabotho and Chivese 2020: 5, Burnett *et al.* 2011: 4295 and Sondlane *et al.* 2016: 3858). A more systematic and theoretical analysis is required to determine practices of HCWs that render them vulnerable to BBF exposure.

1.9 FACTORS AFFECTING INFECTION PREVENTION AND CONTROL

Nosocomial infections as well as its prevention and control are a global challenge (Alp *et al.* 2011: 10). A qualitative study conducted in Mongolia aimed to investigate the challenges and barriers to infection control and prevention (IPC), as perceived by HCWs (Ider *et al.* 2012: 6). The study participants revealed that the lack of adequate statistics and evidence, regarding the impact of IPC played a significant role in the lack of improvement of infection control thereof (Ider *et al.* 2012: 6). Alternatively, a qualitative study performed in India, aimed to assess the barriers to infection control in a hospital setting (Barker *et al.* 2017: 35). This study highlighted a potential for alternate deterrents to infection control and prevention. In respect of barriers such as tools and technology, hospital staff reported that a sufficient supply of contact precautionary equipment was easily accessible when required. With regards to organizational factors, the turnover of nursing staff was identified as a significant barrier to infection control, which in turn resulted in new and inexperienced nurses entering the environment, directly from nursing school (Barker 2017: 35). Additionally, several participants identified the language barrier as a key challenge in communicating effectively with patients and staff (Barker 2017: 35). A study conducted in Southeast Ethiopia revealed that the knowledge of infection prevention amongst the study population was significantly associated with factors such as sex, year of service, profession, the existence of an infection prevention guideline and receipt of training on infection prevention (Gebermariyam *et al.* 2018: 5). To support the results established in the above study, a similar study performed by Chalya *et al.* (2016: 5) revealed that sex, job category, work experience and previous training on universal precautions are significantly associated with knowledge of universal precautions. An additional contributing factor to IPC in the health care setting was revealed by a Congolese study (Ngatu *et al.* 2012: 69). This study found that a significant proportion of Congolese HCWs were not immunized against viral hepatitis – due in part to a lack of PEP policies in the hospital under study (Ngatu *et al.* 2012: 69). Such incidents reflected substandard safety conditions to which HCWs are subjected to (Ngatu *et al.* 2012: 69). A review of the above literature highlighted the evidently unsatisfactory conditions that HCWs are expected to operate in.

A study performed by Magadze *et al.* (2016: 4) illustrated a positive effect of knowledge and training of standard precautions on nurses' decision making and actions, when applying precautionary measures for infection prevention. Another key theme that presented itself in the study was the lack of availability to physical and human resources (Magadze *et al.* (2016: 4). The participants believed that the direct involvement of hospital management in IPC could significantly reduce and prevent the advancement of infections, throughout the hospital (Magadze *et al.* (2016: 4). According to Mohamed *et al.* (2017:1) shortcomings in infection-control practices is at the forefront of outbreaks of health care acquired infections (HCAI). Institutions often make use of checklists and audits to monitor compliance with infection control policies (Mohamed *et al.* 2017:1). In low- and middle-income countries (LMIC) the infection control assessment tool (ICAT) is a is methodical approach to extensively review infection-control in health institutions (Mohamed *et al.* 2017:1). A study performed in three public hospitals of the Free State denoted a significant association between adhering to safe practices and faith in management to provide a low to risk-free work environment ($p<0.05$) (Engelbrecht *et al.* 2015: 26). Additionally, the study revealed that a significant proportion of HCWs at the sites under study demonstrated a lack of trust in hospital management, to provide a safe working environment (Engelbrecht *et al.* 2015: 26).

A study performed in Indonesia found that HCWs with both poor knowledge or poor adherence to standard precautions was 70.4%, while HCWs presenting with bad knowledge and proper adherence to standard precautions was 29.6% (Permana and Hidayah 2017: 4). Additionally, HCWs with both adequate knowledge and good precautionary measures was 64.4% (Permana and Hidayah 2017: 4). Hence, a statistically significant association between knowledge and compliance with standard precautions was observed. Adequate knowledge of HCWs was believed to influence the application of precautionary measures (Permana and Hidayah 2017: 4). Additional factors suspected to impact adherence of HCWs to precautions involved education, and length of work (Fahmi 2012:1). Non-compliance to standard precautionary measures may owe to an array of factors. The likelihood of a HCW to employ safe precautions lay in the health belief of the HCW to identify the risk of injury or illness, taking into account benefit and cost. According to Permana and Hidayah (2017: 4) if immediate threat increases, so shall the prevention practices of HCW. Similarly, Henderson (2001: 71) suggested that compliance with standard precautions and guidelines is more probable when HCWs feel at risk of infection. Additionally, time constraints appeared to be another contributing factor to lack of compliance (Sahara 2011: 1).

Researchers Henderson *et al.* (2010: 213) believed that upon confirmation of infection with a BBI in South Africa, the medical fraternity should offer immediate support to the infected HCWs. Such support may be offered by experts in the field or specialist review panels in the facility or department. This way designated specialists may provide support and assistance to infected professionals. This in turn may contribute to the mitigation of risk of spread, and disease progression- by imparting knowledge on suitable treatment and infection control and prevention practices. Several countries throughout the globe have established prevention, control and management guidelines, strategies, and protocols to successfully combat the transmission of blood borne viruses, amongst HCWs (Rossouw 2014: 732). Regrettably however, discrepancy in the burden of disease, work practices and health management resources create a complex situation for South Africa, in adopting international guidelines (Rossouw 2014: 732). Health care facilities are plagued by several challenges arising from the HIV/AIDS pandemic (United Nations AIDS Special Analysis (2016: 1). As such, WHO Guidelines (2013) along with the South African National Department of Health (2016) have developed standard precautions which consist of standardised procedures, strategies, and interventions to be implemented, ensuring the protection against and prevention of BBF exposure in a health care setting. These guidelines urge HCWs to make use of resources provided for protection and treatment recommended through HIV PEP, in the case of accidental exposures. According to Moorhouse (2015: 2) post-exposure prophylaxis measures to prevent HIV infection in the South African health care setting do exist and would ideally include the following intervention mechanisms: HIV counselling, the administration of first aid measures, risk assessment, investigation of blood samples of exposed individuals and sources as well as the supply of antiretroviral treatment within 2-72 hours of exposure, over a period of 28 days.

1.10 BACKGROUND OF THE STUDY

According to the eThekwini District Health Plan 2015/16 (2016) district hospitals are situated at a lengthy geographic distance from each other. Apart from being at a relative distance from one another, district hospitals are scarce in number in comparison to the populous communities in need of health services. The eThekwini District Health Plan 2015/16 (2016) described Osindisweni Hospital as a prime example of a public sector facility that is tasked with serving a geographically dispersed populace, in the far North. Irregular nurse-patient ratio is fast becoming the foremost challenge experienced around the world (Democratic Nursing Association of

South Africa 2020). As such this domain is that of widespread debate (Democratic Nursing Association of South Africa 2020). A nurse-patient ratio refers to the number of patients and patient care that each nurse is accountable for within a nursing unit (Long 2020). A positive correlation was observed between the quality of care administered by the nursing population and the quantity of nurses delivering such care. An overburdened health system strained by an inordinate workload, disproportionate ratio of HCWs to patients and consequential burnout, were found to be probable factors associated with an increased risk of occupational blood exposures (OBE) (Lee *et al.* 2017: 830). Researchers Adams and Kennedy (2006: 23) justifiably argue that HCWs, in addition to patients, are placed at an increased risk of acquiring nosocomial infections, throughout the world. In a like manner, Adams and Kennedy (2006: 23) equated excessive workload and inadequate nurse-patient ratio as significant contributing factors to the vulnerability of HCWs to an occupational exposure.

According to the American Nurses Association (2020) federal regulation deemed it necessary that all hospitals in America have a sufficient quantity of licensed registered nursing staff providing care to patients, as needed.

The South African health system is notorious for several pitfalls in health service delivery. However, the plummeting number of nurses in relation to the exponential growth in disease burden, in several developing nations, is one that cannot be overlooked (Democratic Nursing Association of South Africa 2020). In South Africa, the staffing norms in relation to disease burden and the demand for health care services is not contextually regulated (Democratic Nursing Association of South Africa 2020). Despite the present absence of a health-policy established workforce plan, in South Africa, Uys and Klopper (2013: 3) endorsed the necessity for a greater number of qualified nurses and midwives, so as to ensure advancements in the provision of health services and favourable national health outcomes. In relation to the regulation of staffing ratios amongst the private sector in additional countries, the correspondence between the number of HCWs and patients is substantially irregular within the South African public health sector (Democratic Nursing Association of South Africa 2020).

The study site was based at a district hospital on the North Coast of KwaZulu-Natal. The research site is responsible for rendering health care services to communities surrounding the North Coast area, namely: Osindisweni, Hazelmere, Ndwedwe, Waterloo, Tongaat, Verulam and Amaoti. The district hospital is situated at an approximate distance of 10km inland from a town named, Verulam. A single district hospital was noted to serve this region, Osindisweni Hospital. The surrounding city, Verulam consists of a population of 37 273. Majority of the public lay between the working-age population of 15-64 years (73.1%). Additionally, the medical sector contributes to 3.6% of jobs in contribution to the GDP inward in the area (IYER 2010: 22). Additionally, the Greater Inanda/Tongaat region has the second lowest ratio of clinics to population, behind the Outer West sub district, with a ratio of 0.22 clinics per 10 000 populations (eThekwini District Health Plan 2015/16 2016). It can therefore be deduced that the single district hospital may be in a situation of severe strain, as high reliance may be placed on these public sector services, offered by Osindisweni Hospital.

Despite a decrease in HIV prevalence within the district, as reported by the eThekwini District Health Plan 2015/16 (2016), high prevalence rates were noted in the sub-district, Greater Inanda/Tongaat (Verulam and Tongaat). In light of this evidence, it can be assumed that HCWs may in turn be at an exceptional risk of exposure, arising from possibly managing or treating potentially infected patients, emerging from the surrounding region, to which the district hospital provides health services.

This nearest town of Osindisweni Hospital constitutes a large population of black South Africans (98.8%). Prior research suggests a higher chronic carriage of HBV amongst black South Africans, as compared to individuals of associated ethnicity (Burnett *et al.* 2011: 4293). Additionally, a study performed by Kew (1996: 6) revealed a higher HBsAg (Hepatitis B surface antigen) chronic carriage amongst rural black populations (15.5% in a rural region of Eastern Cape) in relation to urban black populations in Soweto, Gauteng (1.3%). From the given evidence it can be anecdotally assumed that HCWs employed within the research site may be at a potential risk of exposure to blood and bodily fluids and its associated infections. As such this study therefore aims to establish factors associated with such exposures, with particular reference to the KAP of HCWs.

1.11 PROBLEM STATEMENT

The risk of exposure to BBF amongst health care professionals may be considered a consequential yet vastly unexplored field of study in the medical setting, particularly in the developing world. In South Africa, knowledge and practices to safeguard HCWs from blood borne infections proved substandard in necessitous health care facilities. Ideally, hospital management should be provided with data to guide and inform procedures for prevention and control for potential infections arising in the work environment, in order to address the knowledge and attitude shortfalls in relation to HCWs behaviour and practices, when working with BBF. This is in hopes of reducing the rate of BBF exposures and its associated burden. Furthermore, once the perceptions of HCWs on factors that may adversely influence IPC within the hospital are identified, hospital management can be actively aware of the shortfalls in IPC from the perspective of the HCWs, and thus appropriately implement effective intervention strategies. Occupational exposure to BBF presents a significant problem. The foundation which determines successful health promotion or disease prevention lies in unwavering coherence between health awareness and knowledge as well as knowledge and practices. Not only are HCWs at an increased risk of acquiring such infections, but once infected, patients are in turn at risk of exposure. This introduces critical policy implications and gives rise to profound ethical challenges. Health care workers in developing countries, more specifically, South Africa, are at risk of an occupational exposure due to the relatively high prevalence of BBI such as HIV and HBV and significant cases of HCV in comparison to the developed world. Extraordinary effort needs to be made to protect HCWs who are vulnerable to exceptional risks in the workplace, due in part to inadequate KAP and poor IPC, and the existing burden of infectious diseases, in South Africa.

1.12 SIGNIFICANCE OF STUDY

The substandard level of knowledge and practices within low-income settings of South Africa places HCWs at an increased risk of contracting BBIs (Kabotho and Chivese 2020: 2). Despite the existence of several viral pathogens related to occupational exposure, three viral pathogens in particular were observed to present the most severe risk namely- HIV, HBV and HCV (Deuffic-Burban *et al.* 2011: 4). Occupational exposure to BBF presents a significant problem. Not only are HCWs at an increased risk of acquiring such infections, but once infected, patients are in turn at risk of exposure. This introduces critical policy implications and gives rise to profound ethical challenges (Rossouw *et al.* 2014: 732). Health care workers in developing countries, more specifically, South Africa, are at risk of an occupational exposure due to the relatively high prevalence of BBI such as HIV and HBV in comparison to the developed world (Rossouw *et al.* 2014: 732). Extraordinary effort needs to be made to protect HCWs who are vulnerable to exceptional risks in the workplace, due in part to poor IPC practices, and the existing burden of infectious diseases, in South Africa (Rossouw *et al.* 2014: 732). An extensive review of South African literature showcased finite research data published on BBF exposures and factors affecting IPC. The foundation which determines successful health promotion or disease prevention lies in unwavering coherence between health awareness and knowledge as well as knowledge and practices (Zaidi *et al.* 2012: 209). In South Africa, knowledge, and practices to safeguard HCWs from BBIs proved substandard, in necessitous health care facilities (Kabotho and Chivese 2020: 2). In the KwaZulu-Natal province, the knowledge, attitudes and practices of HCWs regarding occupational exposure to BBFs, and the HCWs perceptions on the barriers to IPC in a public hospital, has yet to be studied, with no recently published studies encountered thus far, in South Africa. Additionally, a study conducted in Western Cape, South Africa highlighted the need for better infection control training, amongst nurses, with Kabotho and Chivese (2020: 2) noting a significant gap in BBI control training, amongst participants in the study setting.

Moreover, following an extensive review of literature, a paucity of research was available within South Africa, specifically district level hospitals of KwaZulu-Natal, regarding the firsthand impressions and perceptions of HCWs (at all levels within a hospital) on the barriers to IPC. An unexplored area of research, describing how the level of knowledge, and extent of attitude influences the likelihood of HCWs encountering a BBF exposure, currently exists. Recent studies have indicated that health-related conduct of HCWs is influenced considerably by their knowledge, attitude and practice (KAP) (Klett-tammen *et al.* 2016: 3 and Higuera-Mendieta *et al.* 2016: 1). Knowledge, attitude and practice studies play a fundamental role in gathering information regarding the comprehension, belief and behaviour of participants, in relation to a topic of interest (Klett-tammen *et al.* 2016: 3, Higuera-Mendieta *et al.*

2016: 1, Haq *et al.* 2013: 448 and WHO 2008). A 2020 study performed in the Gauteng province of South Africa aimed to determine occupational exposures and uptake of HIV PEP amongst nursing staff primarily (Rasweswe and Peu 2020: 1). This study assessed occupational exposure to a very limited extent. Furthermore, this paper emphasized the need for future research in other health care settings around South Africa, that encompasses a larger sample size of HCWs (> 94 HCWs) as well as a broader category of health personnel. A study previously conducted by Nkoko *et al.* (2014: 382) assessed the KAP of HCWs to BFF, only to a very limited extent, and described too few variables pertaining to KAP. There are key questions and notions that remain undiscussed in the literature. Additionally, the study suffers from certain weaknesses such as a small sample size, consequently compromising the strength of the study, to reliably identify additional relationships relating to KAP of HCWs on BFF exposure, and factors affecting IPC in a healthcare setting. Moreover, this study only scantly described the relationship between KAP and BBF exposure, representing a mere fragment of the KAP gap amongst HCWs.

Although the research to date has briefly illuminated knowledge variables (surrounding recapping of needles, status of the source patient, reporting of incidents and use of gloves); attitude variables (such as importance of PEP); and practice variables (such as acquiring a NSI, reporting of incidents and vaccination receipt)- no study to date has examined the following variables: knowledge (regrading PEP, discarding of used needles, factors that place HCWs at an increased risk of BBF exposure, type of practices that may lead to an exposure, awareness of precautionary measures to be adopted, infection prevention principles and Hazardous Biological Agents (HBA) Regulations); attitude (regarding the importance of safety precautions, perceptions on PPE usage, willingness to be vaccinated and concerns associated with acquiring a BBI) and practices (such as uptake of PEP following and exposure, reporting of exposures, measures taken following and exposure, use of PPE and protection of open wounds (a potential route of entry) at work) of HWCs. All of which are presently preeminent elements in this particular field of study (Mohamed *et al.* 2016: 3, Wondwossen 2013: 76, Zaidi *et al.* 2012: 211, Gebremariyam 2019: 19, Haile *et al.* 2017: 1, Bekele *et al.* 2018: 1, CDC 2020, Aluko *et al.* 2016: 71, Ngatu *et al.* 2012: 69). This study is one of the few (only one other conducted by Nkoko *et al.* (2014: 382) to be conducted in South Africa- and the first to extensively evaluate the KAP and factors affecting IPC amongst HCWs, to be facilitated in the KwaZulu-Natal province. This study differs greatly from other studies in that it aims to explore variables that have not yet been investigated. Furthermore, the study proposes to address the gaps relating to KAP of HCWs on BFF exposure, by identifying additional relationships, in order to provide a more comprehensive understanding of the tenets of KAP and BBF exposure and HCWs perceptions on the barriers to IPC in a health care setting, situated in a low-income region of KZN. The results of the study are expected to guide and inform procedures for prevention and control of potential infections arising in the work environment. The intent of the study is to provide hospital management with data to address the knowledge and attitude shortfalls in relation to HCWs behaviour and practices, when working with BBF, in hopes of reducing the rate of BBF exposures, and its associated burden. Furthermore, this study aims to determine how HCWs perceive factors that may adversely influence IPC within the hospital. Once the perceptions of HCWs have been identified, hospital management shall be actively aware of the shortfalls in IPC from the perspective of the HCWs, and thus appropriately implement effective intervention strategies to combat this affliction.

1.13 AIM

To evaluate the knowledge, attitudes and practices of HCWs regarding occupational exposure to BBF in a public hospital, KwaZulu-Natal.

1.14 OBJECTIVES

In order to achieve this aim, the following objectives have been stipulated:

1. To evaluate an association between the knowledge of HCWs and their likelihood of engaging in unsafe behaviour and practices, regarding occupational exposure to BBF in a public hospital, KwaZulu-Natal.
2. To evaluate an association between the attitude of HCWs and their likelihood of engaging in unsafe behaviour and practices, regarding occupational exposure to BBF in a public hospital, KwaZulu-Natal.
3. To investigate the practices of HCWs regarding occupational exposure to BBF in a public hospital, KwaZulu-Natal.
4. To assess HCWs perceptions on the barriers to IPC in a public hospital, KwaZulu-Natal.

1.15 CONCLUSION

This chapter provided a brief overview of the proposed study and presented a background to the research. The problem statement was highlighted, along with the significance and objectives of the study. The second chapter provides an extensive review of relevant literature pertaining to the related study.

CHAPTER TWO

LITERATURE REVIEW

2.1 INTRODUCTION

For the purpose of this study the literature reviewed will focus on presenting information pertaining to the research topic of this dissertation: The KAP of HCWs regarding occupational exposure to BBF. Additionally, a brief overview of the most commonly occurring blood borne diseases (HIV, HBV and HCV) that may arise from a BBF exposure, as well as the risk factors for such exposures will be provided. Primarily, the prevalence of HIV, HBV and HCV amongst HCWs, the KAP of HCWs in relation to BBF exposure and the perceptions of HCWs on factors affecting IPC will be discussed. The review of literature, for all articles related to the KAP of HCWs, regarding occupational exposure to BBF was facilitated by the following databases: Sabinet, which provided access to African and South African journals, EbscoHost, ProQuest, PUBMED, ScienceDirect, Scopus, SpringerLink and Google Scholar. In order to filter the most relevant literature, the search strategy employed to all indices included obvious keywords and terms, such as ‘knowledge’, ‘attitude’, ‘practices’, ‘occupational exposure’, ‘blood and bodily fluids’, ‘health care workers’, ‘HIV’ ‘hepatitis B’, ‘hepatitis C’, ‘occupational exposure determinants’ and ‘prevalence of HIV, HBV and HCV’. The initial search was conducted and updated on a monthly basis from April 2020 through to December 2020. The reference list of pivotal articles was dissected, unearthing apposite articles of study. In order to confirm an articles suitability for inclusion in the literature review, titles as well as abstracts were scrutinized.

2.2 HIV PREVALENCE AMONGST HEALTH CARE WORKERS

The incessant occupational exposure of HCWs in their line of duty has resulted in a relatively high prevalence of HIV/AIDS amongst this population group both in the public and private sector (Shisana *et al.* 2004: 846). According to Joyce *et al.* (2015: 1245) occupational transmission of HIV maybe considered rare. At most, 58 confirmed cases and 150 possible cases of occupational HIV transmission amongst HCWs over a 28-year span have been reported to the Centre for Disease Control (CDC) (Joyce *et al.* 2015: 1245). The recording of occupationally acquired HIV infections amongst HCWs is rare in USA, with scarce confirmed cases being documented since the late

1990's. Additionally, Joyce *et al.* (2015: 1245) highlighted that the paucity of HIV infection in HCWs could possibly be a result of underreporting. These findings established within an economically developed country like United States of America (USA) contrast greatly with the findings established in an emerging nation like Cameroon.

Upon application of the prevalence rate on the overall population of staff employed in the health sector, in Cameroon, it was indicative that between 496 and 1758 of 38207 HCWs were infected with HIV, in 2011 alone as compared to a case prevalence of 58 over a 28-year period in USA (Domkam *et al.* 2018: 3 and Joyce *et al.* 2015: 1245). A cross-sectional study conducted in both public and private hospitals within Cameroon revealed a HIV prevalence of 2.61% amongst HCWs (Domkam *et al.* 2018: 3). Furthermore, HCWs in the private health institution presented with a higher rate of infection, in relation to HCWs in the public health institution (5% versus 1.4% (p = 0.028); OR = 3.7 (95% CI: 1.01 – 12.90) (Domkam *et al.* 2018: 3). Similarly, a national survey conducted in Burkina Faso reported, for the first time, a prevalence of HIV infection in a large representative sample of HCWs in West Africa. This study yields a likewise crude HIV prevalence rate of 3.5% (95% CI: 2.3 – 4.6) in HCWs. However, a scarcity of reports on HIV prevalence in HCWs in Africa still remains.

Several studies performed within South Africa revealed an HIV prevalence of 20%, 12% and 16% within Cape Town, Gauteng, and South Africa as a whole, respectively (Kranzer *et al.*2010: 224, Connelly *et al.* 2007: 115 and Shisana *et al.* 2004: 846). Furthermore, the findings illustrated by Connelly *et al.* (2007: 115) were greatly reinforced in a statement brought forth by Shisana *et al.* (2004: 846). Shisana *et al.* (2004: 846) stated that the study performed by Connelly *et al.* (2007: 115) was the second verifiable South African study to denote HIV infection amongst HCWs as a significant epidemic that demands immediate attention. The results of a South African study conducted within four provinces of South Africa revealed an approximate rate of 16.3% prevalence of HIV amongst public sector HCWs. However, there was no significant difference between the rate of HIV for individuals employed in public hospitals and primary health care facilities (Shisana *et al.* 2004: 846).

Whilst a significant proportion of HCWs are directly affected by the HIV epidemic owing to occupational exposure, a study conducted by Tatsilong *et al.* (2016: 706) has indicated that the incidence of Hepatitis B Virus (HBV) among HCWs is four times greater than the general adult population.

2.3 HBV PREVALENCE AMONGST HEALTH CARE WORKERS

Hepatitis B is deemed a significant occupational health hazard amongst health care professionals – who play an integral role in the relay of infection (Muljono *et al.* 2018: 88). According to Schweitzer *et al.* (2015: 1546) and Franco *et al.* (2012: 74) Sub-Saharan African and Western pacific regions present the highest HBV infection prevalence and may be considered 'high-intermediate' to 'high-endemicity' countries. According to a report by the World Health Organisation (2017) such regions presented a Hepatitis B surface antigen (HbsAg) prevalence of 5% to ≥ 8%. Whereas Eastern Mediterranean and European regions are considered 'low-intermediate' areas of HBV infection prevalence (2% - 4.99%). Areas of the globe which have been classified as low endemicity regions include the Western Europe and the Americas, which display an HBsAg prevalence that is predominantly less than 2% (Schweitzer *et al.* 2015: 1546 and Franco *et al.* 2012: 74). Studies conducted in Peshawar, Pakistan and Korea revealed and HBsAg prevalence of 2.18% and 2.4%, respectively (Ataullah *et al.* 2011: 275 and Shin *et al.* 2006: 58). Although significantly lower than the prevalence described in a Lagos study (27.7%) by Bello (2000: 283), the findings established in Ataullah *et al.* (2011: 275) and Shin *et al.* (2006: 58) study corresponded greatly with the HBsAg prevalence (1.5%) found in South-Western Nigeria (Abiola *et al.* 2016: 3). According to (Abiola *et al.* 2016: 3) the considerably low prevalence of HBsAg amongst the HCWs of the Southwestern Nigeria study may have been attributed to a greater understanding of viral Hepatitis B infection as well as a high HBV vaccination rate amongst HCWs. A recent cross-sectional hospital-based pilot study was conducted, to determine the prevalence of HBV amongst Congolese HCWs (Lungosi *et al.* 2019: 622). The results of the study revealed an astonishing HBV infection prevalence rate of 56.7% amongst the Congolese HCWs. This figure indicated that exposure to this infection is rampant amongst HCWs, of the study hospital in Congo (Lungosi *et al.* 2019: 622). Due to the above study being a baseline, conducted recently within Congo, the results of the study could not be critically collated with similar research performed in the region. A closer look at literature from related studies revealed comparatively alike, or a marginally higher prevalence of HBV to that established in preceding studies, which described a greater burden of such infection that existed in HCWs within Sub-Saharan Africa (Pellisier *et al.* 2012: 3, Qin *et al.* 2018: 2 and Lungosi *et al.* 2019: 622). For instance, a 2009 study conducted in Niger revealed a HbsAg of 15.3% amongst HCWs, which slightly contrasted with the HBsAg prevalence established in the Congolese study (18.6%) (Pellisier *et al.* 2012: 3 and Lungosi *et al.* 2019: 622). However, a study performed in Sierra Leone, which included 211 study participants resulted in 10% of the study population testing positive for HBsAg (Qin *et al.* 2018: 2). Similarly, the study performed in Congo with a study population of 97, displayed a slightly higher HBsAg (18.6%) despite the substantially greater difference between the sample sizes.

A median review produced by the National Department of Health (2018: 2) stated that the exact prevalence of HBV amongst South African HCWs was currently unknown. However, the prevalence was estimated to resemble that of the general population (HBV infection prevalence = 0.2% - 16%). This range may gravitate toward the higher region and should thus be considered impermissible in the health care setting and warrant immediate intervention strategies to safeguard the wellbeing of HCWs. In a like manner, a recent study conducted in two provinces of South Africa focussed on occult HBV (Amponsah-Dacosta et al. 2016: 12). The result of this study revealed high rates of HBV infection as well as suboptimal protection against HBV in HCWs (9.6%). The results of HBV infection amongst HCWs described in the above literature, particularly in, Lagos, Congo and Niger which are considered high prevalence rates as described earlier by Nelson *et al.* (2016: 1) should thus be considered impermissible in the health care setting and warrant immediate intervention strategies to safeguard the wellbeing of HCWs (Bello 200: 283, Lungosi *et al.* 2019: 622 and Pellisier *et al.* 2012: 3).

2.4 HCV PREVALENCE AMONGST HEALTH CARE WORKERS

Viral hepatitis may be considered a significant public health issue prevailing endemically across the globe (Nejad *et al.* 2011: 662). A study conducted in Rishikesh, India aimed to evaluate the prevalence of HCV infection amongst HCWs (Chandan *et al.* 2020: 3081). The results of the above-mentioned study indicated an overall prevalence of 1.5%. Prior seroprevalence based studies, conducted in health care settings in western countries, have depicted an HCV rate similar to or less than those approximated to exist in the general population (0.5%). In a like manner, a similar observational cross-sectional facility-based study performed in Betiah, India aimed to evaluate the prevalence of HCV infection amongst HCWs (Kumar and Prasad 2019: 99). This study conducted by Kumar and Prasad (2019: 99) comprised of a sample population (109) comparable to the Rishikesh study (135). Both studies performed in India by contrasting authors, yielded an HCV prevalence rate that corresponded greatly with one another (1.5% - Rishikesh and 1.8% - Betiah) (Chandan *et al.* 2020: 3081 and Kumar and Prasad 2019: 99). A study conducted by Abdelrheem *et al.* (2020: 58) in Aswan, Egypt identified a prevalence of 6.8% HCV infection rate amongst HCWs. According to Abdelrheem *et al.* (2020: 58) this prevalence rate may be considered alarmingly high. According to Virabhak *et al.* (2016: 1) the prevalence of occupationally acquired hepatitis C virus is greater than the general population. A study conducted in five primary hospitals of eastern Libya aimed to investigate the frequency of hepatitis B and C transmission to HCWs (Elzouki *et al.* 2014: 534). The results of the study illustrated 2% (12 HCWs of 601) positivity of Anti-HCV antibodies which closely mirrored the findings described in a large-scale population-based study, that estimated an HCV prevalence of 1.3% amongst the general Libyan population (Elzouki *et al.* 2013: 589). However, by way of contrast, the results of similar studies in Cameroon and Egypt appeared to differ significantly, with the findings established in eastern Libya (Frtizsche *et al.* 2013: 158 and Abdelwahab *et al.* 2012: 98). Research facilitated by Frtizsche *et al.* (2013: 158) and Abdelwahab *et al.* (2012: 98) found an HCV infection prevalence of 16% and 16.6% amongst HCWs in Cameroon and Egypt, respectively. Upon analysis of research conducted by Frtizsche *et al.* (2013: 158) in Cameroon, low testing frequency for HCV and lack of awareness on this non-vaccine preventable infection may greatly predispose HCWs to infection with HCV. This in turn may consequently result in a high rate of HCV amongst HCWs Frtizsche *et al.* (2013: 163).

The likelihood of contracting HCV increases six fold per needles stick injury, in comparison with risk of HIV infection (1.8% vs. 0.3%) (Greyling 2014: 35). Prior research conducted by Lazarus *et al.* (2012:1) and Botha *et al.* (2010: 20) suggested that the prevalence of HCV in South Africa was inconclusive but may approximately lay between 0.1% and 0.7%. By the same token, the National Department of Health (2018: 2) reiterated the findings described by Lazarus *et al.* (2012:1) and Botha *et al.* (2010: 20) by similarly indicated that the exact prevalence of HCV amongst HCWs in

South Africa could not be established. However, according to a medical review by National Department of Health (2018: 2) the prevalence of HCV amongst HCWs closely mimicked that of the general South African population (2.4%). An earlier study conducted by Vardons *et al.* (2002: 10) illustrated the prevalence of HCV amongst HCWs. The results of the study found that the prevalence of HCV amongst this risk group was greater than that of the general South African population (1.8% prevalence amongst HCWs, 0.4% - 1.7% prevalence amongst the general South African population). Over time, not only did the prevalence between the HCWs and the general South African population equalise, thus minimising the prevalence rate of one another, but it additionally increased to a rate of 2.4% (Vardons *et al.* 2002: 10 and National Department of Health 2018: 2). An extensive review of literature across Africa, and within South Africa precisely, indicated a significant gap in neoteric research pertaining to the prevalence of HCV amongst HCWs in these regions. Although HBV is considered a significant cause of occupationally acquired hepatitis amongst HCWs, HCV has contributed to a substantial amount of occupational infections prevalent amongst HCWs (Polish *et al.* 1993: 196 and Smith *et al.* (2012: 817). As a result, the prevalence of HCV within health care settings should be considered a promising line of research within these regions, in order to further investigate the extent of exposure and associated burden of disease amongst this risk group.

2.5 RISK FACTORS FOR OCCUPATIONAL EXPOSURE TO HIV

A significant proportion of HCWs are at the forefront of the HIV/AIDS epidemic, owing to their occupational exposure to BBF (Kirakoya-Samadoulougou *et al.* 2014: 662). The risk of occupational exposure to BBI is exacerbated by several factors (Kermode *et al.* 2005: 36). One such blood borne infection presents a significant danger to human survival: HIV (Akuph *et al.* 2020: 1). A study performed by Marković-Denić (2011: 23) aimed to investigate the epidemiology of occupational accidents amongst Serbian HCWs. The results of the study revealed a statistically significant association between hospital type ($p < 0{,}001$) and department type ($p = 0{,}003$) and occurrence of accidents (Marković-Denić 2011: 23). Within this study, accidents reportedly occurred more frequently within clinical centres ($p < 0{,}001$) than clinical hospitals, clinical hospital centres and hospitals, and intensive care units and operating theatres ($p = 0{,}003$). Thus, it can be concluded that continuation of duties within these previously mentioned areas may significantly increase the likelihood of exposure to blood borne infections

(Marković-Denić 2011: 23). Alternatively, an earlier study performed by De Graaf *et al.* (1998: 441) examined the occupational risks of HIV infection amongst expat Dutch HCWs at selected medical centres. The results of this study revealed alternate risk factors associated with exposure to occupationally acquired HIV infection. This study revealed the following as potential causes for accidents: carelessness when handling needles before and after subsequent use, use of poor equipment, unsatisfactory working conditions (poor lighting) and the lack of experience or complexity of medical procedures. Alternatively, Kermode *et al.* (2005: 36) identified a different avenue of risk to BBF exposure among rural North Indian HCWs: language. Upon control of covariates, the study established an association between mucocutaneous and percutaneous exposures and language, with a greater incidence of blood exposures observed amongst non-English speaking HCWs. Additionally, job category and age ($p < 0{,}01$) were also significantly associated with blood exposure over a working lifetime. That being said, the risk of occupational exposure to BBF among rural north Indian HCWs is undeniably great and the control of risk amongst these rural populations is of urgent need. Similarly, the prevalence of People Living with HIV (PLHIV) in Sub-Saharan Africa may be considered disconcerting at the least.

Occupational exposure to blood and bodily fluids constitutes a significant risk factor for HCWs (Domkam *et al.* 2018: 3). The findings of a Cameroonian cross-sectional study performed by Domkam *et al.* (2018: 3) support the notion that individuals who have not undertaken HIV testing presented a greater rate of infection as compared to those who have received testing. This study revealed a statistically significant correlation between the history of HIV screening and HIV status ($p = 0{,}017$). As a result, the lack of awareness on HIV status may therefore be considered a probable risk factor for HIV infection amongst HCWs (Domkam *et al.* 2018: 3). A national survey was conducted within four provinces of Burkina Faso to determine the prevalence of HIV amongst HCWs. (Kirakoya-Samadoulougou *et al.* 2014: 662). The authors of both of the above studies argued that a significant difference between HIV prevalence and job categories did not exist (Domkam *et al.* 2018: 3 and Kirakoya-Samadoulougou *et al.* 2014: 662). The study performed by Kirakoya-Samadoulougou *et al.* (2014: 662) highlighted another significant risk factor that was found to be associated with a greater HIV prevalence: sex. The results of the study performed in Burkina Faso denoted a higher rate of HIV amongst female HCWs as compared to male

HCWs. Although a statistically significant difference between male and female healthcare workers was not present (*p* = 0,13), the greater rate of HIV amongst females was confounding, considering that females were found to be less mobile and were exposed to a similar prevention programme as males. An additional variable that influenced the prevalence of HIV amongst HCWs in the study was marital status. According to Shisana *et al.* (2004: 846) the relationship between HIV and marital status is convoluted. The results of the study performed in Burkina Faso found a higher prevalence of HIV amongst married HCWs in relation to unmarried HCWs (Kirakoya-Samadoulougou *et al.* 2014: 662). This finding could possibly owe to unsafe sexual practices performed by those who are married. A possible reason for this occurrence could be due to prolonged separation of HCWs from respective partners, which may consequently create an opportunity for partners to seek new sexual relationships, thereby placing their subsequent partners at risk of developing HIV.

A facility-based cross-sectional study performed in public and privately owned facilities in Nigeria aimed to assess the determinants of exposure to HIV within the workplace, amongst HCWs (Akpuh *et al.* (2020: 1) The results of the study indicated a higher HIV prevalence amongst HCWs in the private facilities than public. This finding was not unique as similar results were concluded in a closely related study performed in 2018, in Cameroon (Domkam *et al.* 2018: 3). Although no significant association between the established HIV prevalence of the study and, age, sex, number of sexual partners and socio-professional category existed, type of health facility was found to greatly influence the prevalence of HIV. Health care workers who hailed from the privately owned health institutions were found to be more infected than HCWs from the public facility (OR = 3.71 (0,1 to 12,9). Researchers Tesfay and Habtewold (2014: 1) provided much relevant information on organisational risk factors for HIV transmission amongst HCWs, in Ethiopia. This study indicated that the working department constituted a significant contributing factor to risk of exposure to HIV ($p < 0,05$) within the outpatient department (23%), delivery room (20%) and emergency room (16%) presenting high risks of exposure. Whereas, the results of a similar study performed in Tigray Region, Ethiopia revealed contrasting results, with high exposures present in the delivery room (80% vs. 20%) and the gynaecological ward (75%). Such discrepancies in the findings of both studies could possibly owe to variations in services rendered by the institutions. Additionally, a distinct association between time of PPE use and occupational exposure status was present. (*p* = 0,001). This could possibly be a result of use at the inappropriate time, or inconsistency in the quality of PPE used (Tesfay and Habtewold 2014: 1).

A recent study performed amongst nurses within the Limpopo province aimed to determine the knowledge and receipt of occupational PEP amongst this population group (Makhado and Davhana-Maselesele 2016: 5). The results of the abovementioned study revealed that 40% of nurses were unaware of what HIV-PEP was, with more than half (54%) of the nurses that were aware (29%) not receiving PEP when it was primarily required (Makhado and Davhana-Maselesele 2016: 5). This thereby illustrated that lack of awareness plays an integral role in the transmission of HIV amongst HCWs. A South African study performed by Connelly *et al.* (2007: 115) supported the claim by Kirakoya-Samadoulougou *et al.* (2014: 662) that women were more likely to be infected than men (12.0% versus 7.9%), despite the association lacking statistical significance (*p* = 0.10). As previously mentioned by (Domkam *et al.* 2018: 3) in the Cameroonian study, a statistically significant association between HIV prevalence and socio-professional category did not exist (*p* = 0.769). However, according to Moodley & Naidoo (2015: 336), dental professionals had a greater likelihood of experiencing a percutaneous injury as opposed to other cadres of HCWs in the facility. While a compelling discourse was presented by Moodley and Naidoo (2015:336), the argument that a greater likelihood of sustaining a percutaneous injury existed amongst dental personnel as compared to other categories of HCWs is not entirely valid. Reason being, Moodley and Naidoo (2015:336) performed only descriptive analyses of the data. The accuracy of results could have been enhanced through the use inferential statistics in order to determine whether a statistically significant association existed between job category, (dental personnel and other health professionals in the hospital) and percutaneous injuries. An extensive body of literature was available globally on the risk factors for HIV amongst HCWs. However, a significant gap in neoteric research surrounding the risk factors of HIV exposure amongst HCWs in Africa, more specifically South Africa was observed, thereby beseeching further research in this field of study.

2.6 RISK FACTORS FOR OCCUPATIONAL EXPOSURE TO HBV

Hepatitis B virus has been at the forefront of occupationally acquired BBIs within the global health care setting (Ciorlia *et al.* 2007: 229, Prüss-Ustün *et al.* 2005: 482 and Kashyap *et al.* 2018: 30). Several exposure groups have been earmarked as distinctive populations who have a significant likelihood of acquiring HBV infection (Muljono *et al.* 2018:88). Amongst these specific populations are HCWs who are at an increased risk of occupational exposure (Muljono *et al.* 2018: 88). Two separate Indonesian studies by the same authors were defined in order to characterise the risk of HBV exposure amongst HCWs (Wijayadi *et al.* 2017 and Wijayadi *et al.* 2018: 6). The study conducted among 644 Indonesian HCWs in 2017 aimed to investigate the risk factors for HBV in HCWs (Muljono *et al.* 2018: 88). The results depicted a greater rate of HBV exposure amongst older HCWs as compared to younger HCWs (P<0,001). Such observation corresponded to findings discussed at the sixth Eijkman International Conference 2017 (Wijayadi *et al.* 2017). Additionally, type of work was another fundamental element that was associated with increased prevalence of HBV infection in HCWs, with laboratory staff, surgeons, dentists and gynaecologists considered exposure prone professions (Lewis *et al.* 2015: 488 and Wijayadi *et al.* 2017). As a consequence of length of employment, it appeared that age and category of work alone were not the only causative factors of HBV infection in HCWs (Wijayadi *et al.* 2017). The risk of exposure to HBV infection for duration of employment exceeding ten years was significant at the $p = 0.02$ level versus length of service between 5-9 years (Wijayadi *et al.* 2017). Minimal variation existed in the collected outcomes of either investigations as both studies displayed relatively similar findings.

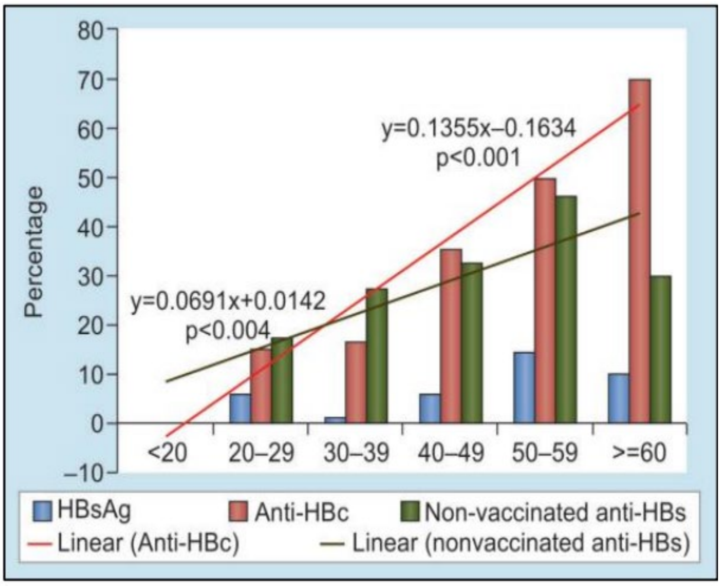

Figure 2: The significant increasing trends of HBsAg, anti-HBc, and anti-HBs prevalence with age (Wijayadi *et al.* 2017: 3).

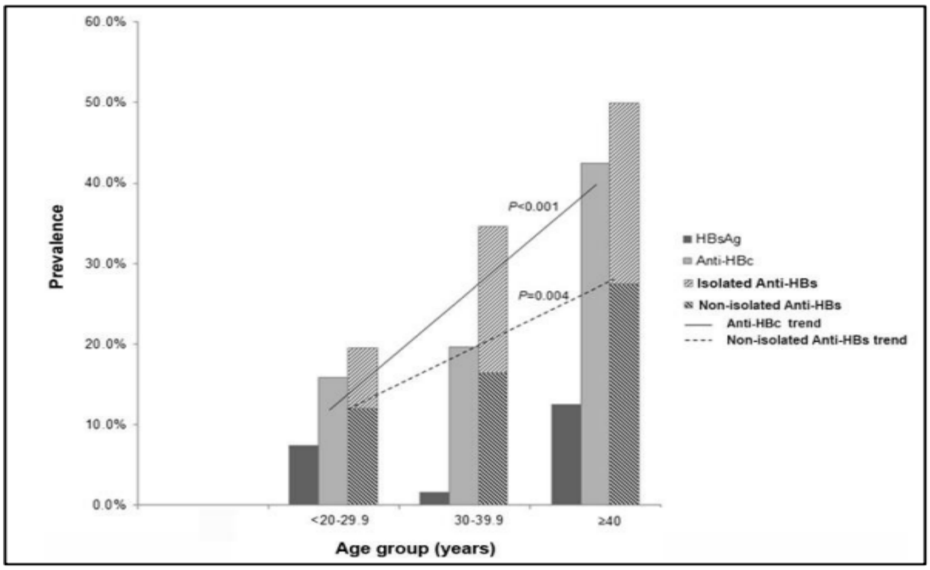

Figure 3: The significant increasing trends of HBsAg, anti-HBc, and anti-HBs prevalence with age (Wijayadi *et al.* 2018: 6).

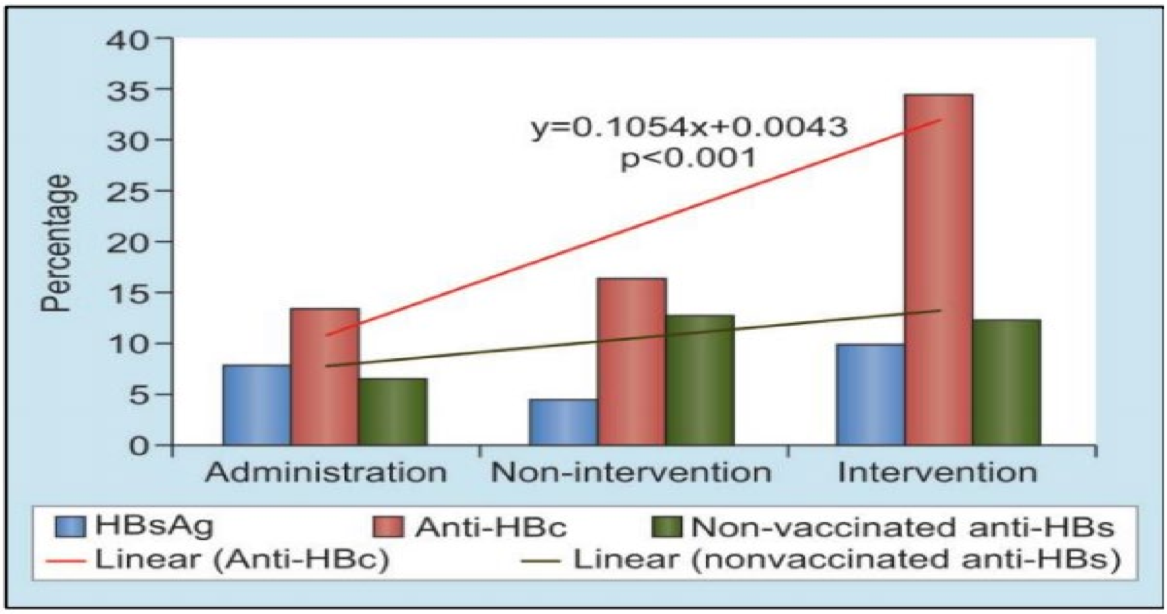

Figure 4: The prevalence of HBsAg, anti-HBc, and anti-HBs among 644 HCWs according to types of work (Wijayadi *et al.* 2017: 3).

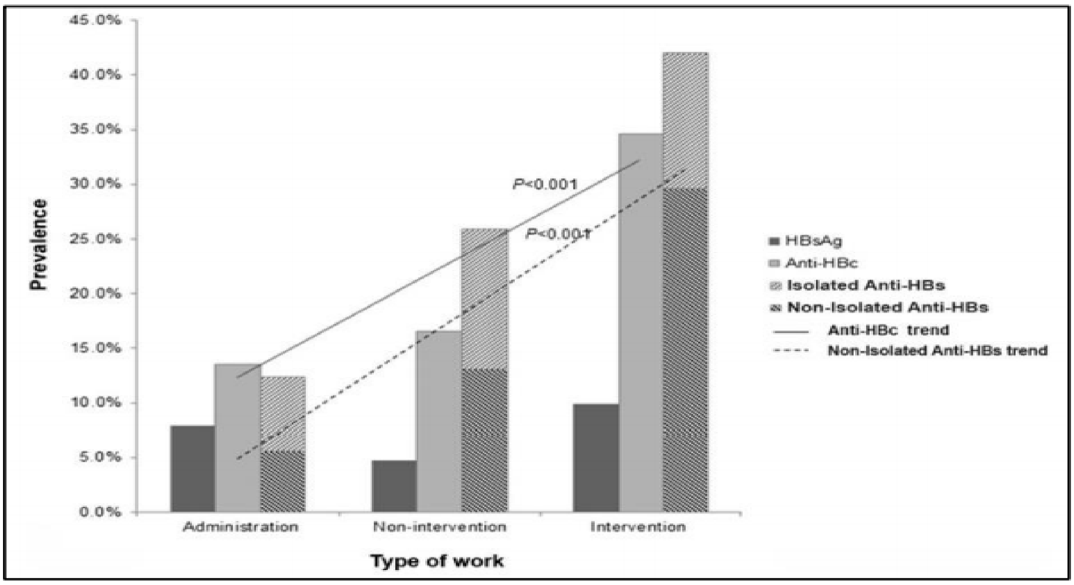

Figure 5: The prevalence of HBsAg, anti-HBc, and anti-HBs among 644 HCWs according to types of work (Wijayadi *et al.* 2018: 6).

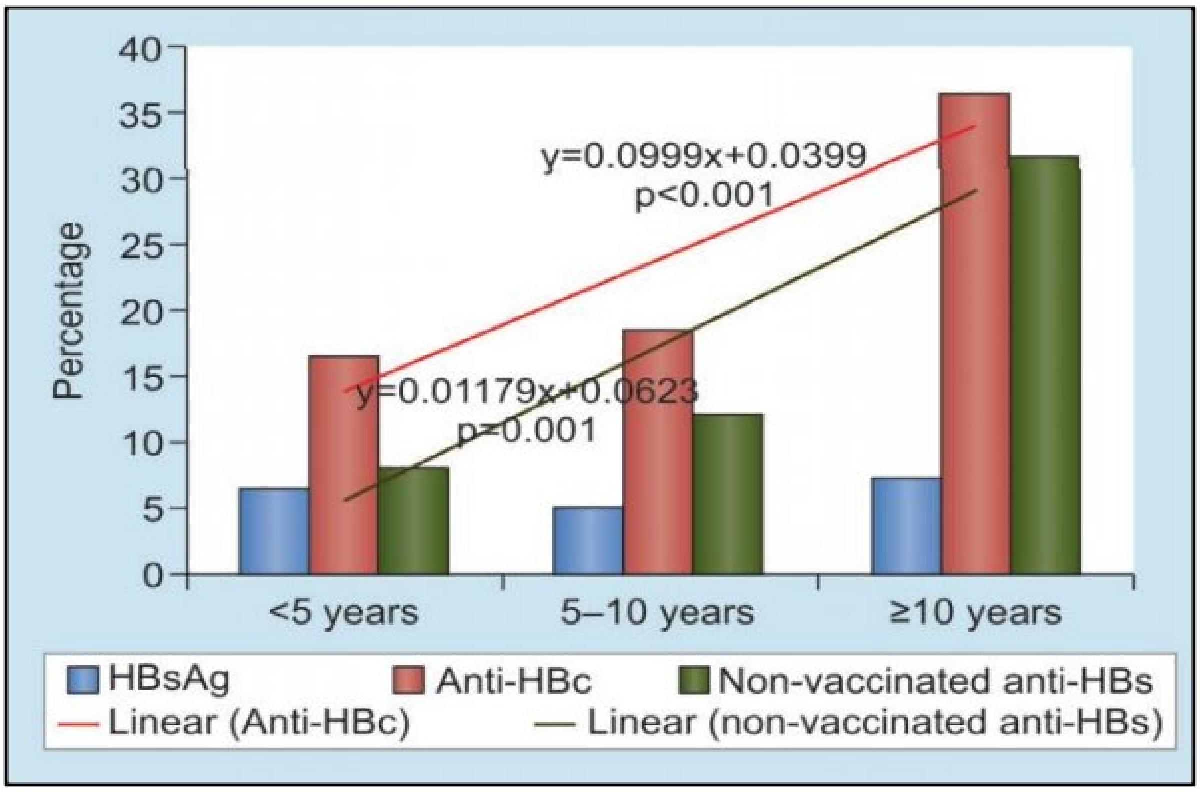

Figure 6: The prevalence of HBsAg, anti-HBc, and anti-HBs among 644 HCWs according to length of service period (Wijayadi *et al.* 2017: 4).

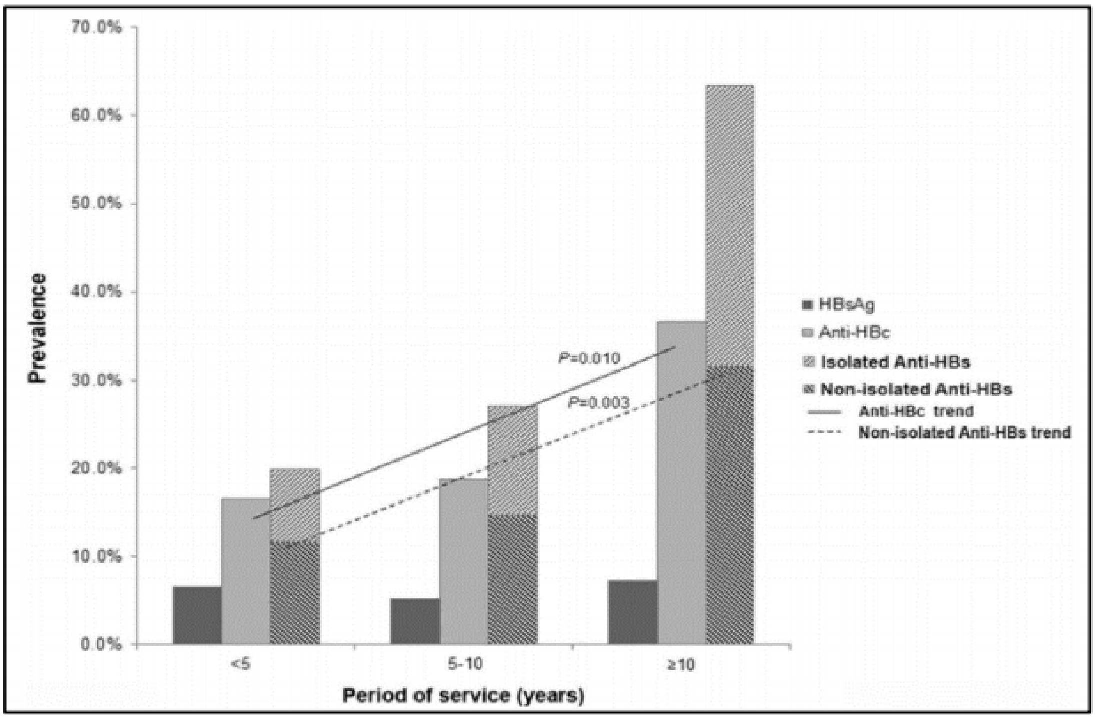

Figure 7: The prevalence of HBsAg, anti-HBc, and anti-HBs among 644 HCWs according to length of service period (Wijayadi *et al.* 2018: 6).

Similarities in the results of both studies were expected as the study group and region of study were interchangeable. While the studies performed by Wijayadi *et al.* (2017) and Wijayadi *et al.* (2018: 6) provided much relevant information, a level of sameness presented itself between the studies. Perhaps the most serious disadvantage of this approach is that both studies were confined to a single province in Indonesia. As such, not only are the results not an accurate representation of all HCWs in Indonesia at large, but the results obtained in the studies cannot be generalised to the larger HCW population of Indonesia. The study executed in 2018 by Wijayadi *et al.* (2018: 6) could have significantly supplemented the findings of the earlier study should it have expanded to surrounding provinces of Indonesia. Furthermore, the inclusion of additional variables would have benefitted the research of Wijayadi by adding control for confounding elements which could have improved the practical significance of the research. Not much variation existed in the collected outcomes as both studies displayed relatively similar findings. The results of the studies may have been expected as similar study populations and regions of study were under observation in both studies (Wijayadi *et al.* 2017 and Wijayadi *et al.* 2018: 6). Two different provinces or regions may have indicated different results which could've been used as a trigger to conduct a wider study on the potential differences in subsequent results, which in turn pave the way for additional risk factors such as socioeconomic risk factors to be introduced. However, an independent study performed in Poland corroborated the findings established in both of the Indonesian studies, thereby suggesting increased occupational risk of HBV infection with an increase in age and length of employment (Ganczak *et al.* 2019: 298). A Polish cross-sectional sero-survey conducted by Ganczak *et al.* (2019: 298) aimed to investigate the factors associated with HBV prevalence amongst HCWs. The results of this study concurred with the findings described earlier by Lewis *et al.* (2015: 488) and Wijayadi *et al.* (2017).

When comparing Hepatitis B core antibody (anti-HBC) cases amongst HCWs, a higher proportion of positive cases were found in older age groups (>45 years) than younger age groups (p = 0,005) (Ganczak *et al.* 2019: 298). It is clear that an unambiguous relationship between length of service and HBV prevalence exists. A higher rate of anti-HBC postive cases were observed amongst HCWs with a longer history of employment as compared to those with a shorter length of employment (14.9% vs. 4.8%) (p = 0.03) (Ganczak *et al.* 2019: 298). Furthermore, vaccination status played an integral role in the prevalence, or lack thereof, of HBV. In addition to the contributing factors described by researchers: Muljono *et al.* (2018: 88), Lewis *et al.* (2015: 488) and Wijayadi *et al.* (2017)- several interesting factors supplementing the risk of infection were described by Ganczak *et al.* (2019: 298). Department was a notable factor in acquiring HBV, with majority of anti-HBC cases observed in the emergency (21.4%) and internal medicine (17.9%), which were closely followed by surgical (15.5%) and intensive care unit (ICU) (14.8%) departments. Interestingly, the lowest rate of HBV prevalence was observed within the operating room (5.6%). In spite of the above risk factors, a significant association was not established between anti-HBC positive cases and hospital departments ($p > 0.08$) as well as job categories ($p > 0{,}89$), gender ($p = 0.85$) and working hours per week ($p = 0.59$). However, the observation of anti-HBC increasing with age and length of employment was in line with findings highlighted in earlier studies performed in Albania, Mexico, Saudi Arabia and Poland (Kondili *et al.* 2007: 94, Méndez-Sánchez *et al.* 2006: 246, Daw and Dau 2012: 1 and Ganczak *et al.* 2010: 3972). The study conducted by Ganczak *et al.* (2019: 298) was constrained to a cross-sectional study design, thereby inhibiting the assessment of temporal associations. Although Ganczak *et al.* (2019: 298) extensively described a range of risk factors that may be aligned with acquiring HBV infection, the findings can be contested as the recollection of information on risk factors by HCWs introduced a recall bias.

Whereas Ganczak *et al.* (2019: 298) argues against gender being a contributing factor for HBV infection in Poland, Wijayadi *et al.* (2018: 279) presented a case that illustrated a significantly greater anti-HBC infection in male than in female HCWs in Indonesia ($p = 0.016$). The dissimilarities illustrated in the above studies may owe to variability in sample sizes, contrast between study areas or variation in economic development of the nations. In the same manner, a study performed in North India found that majority of HCWs exposed to percutaneous injuries and consequently HBV were male (Goel *et al.* 2017: 23). However, this observation may be disputed as a statistically significant association between gender and exposure did not exist. An uneven distribution in the gender of HCWs involved in the study may have resulted in the skewing of data. In order to fit the skewed distribution into a Gaussian distribution the data could have been transformed into normally distributed data. This could have been achieved via a transformation best suited for the statistical characteristics of the data, thus enabling trends to be uncovered, thereby ensuring the functionality of the data. Additionally, the prospective study design utilised by Goel *et al.* (2017: 23) was one of the more practical ways of avoiding an error. However, Goel *et al.* (2017: 23) also relied on the use of a self-administered questionnaire. One major drawback of this approach is the potential for systematic error introduced via an information bias. More specifically, a recall bias. On one hand, the prospective approach and the use of a structured standardised questionnaire reduced the risk of poor recall presented through the study participants answering retrospective questions. However, on the other hand, the fear of victimisation in their place of work could potentially influence the level of honesty of the HCWs when answering the posed questions, consequently resulting in underreporting of factual events that are necessary for the validity and reliability of the study. In order to mitigate the likelihood of such bias the researchers would have had to ensure that the research questions were carefully selected and structured.

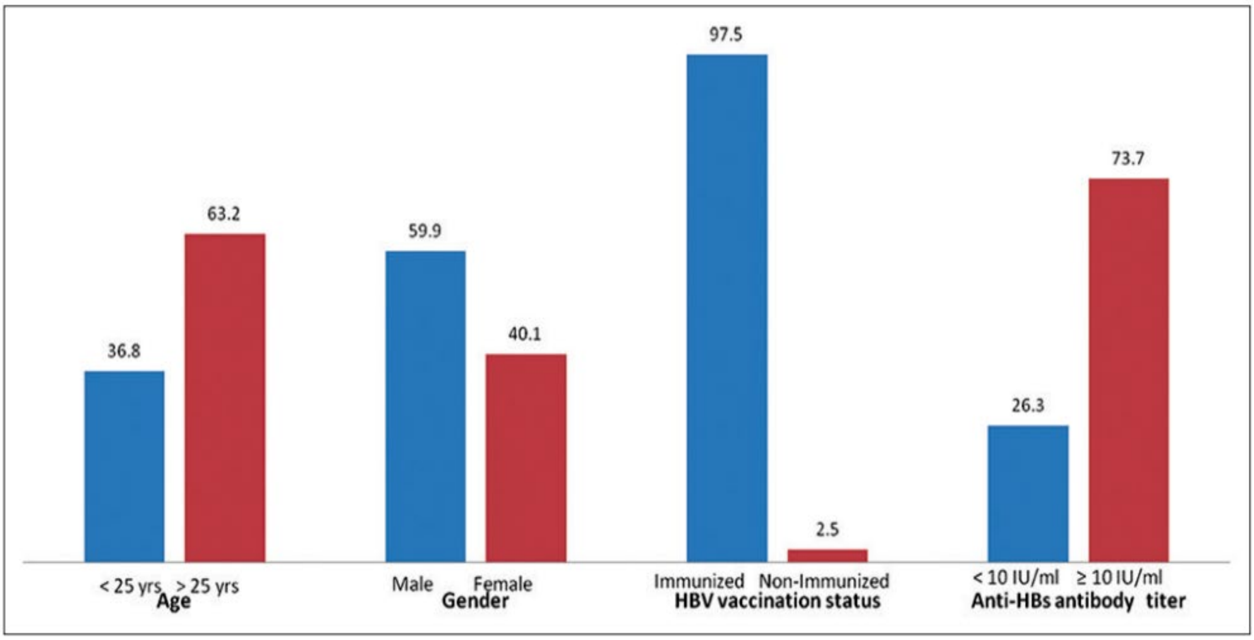

Figure 8: The general characteristics and immune status (%) of health-care workers of AIIMS, New Delhi, who reported for healthcare-related injuries (Goel *et al.* 2017: 23).

A series of recent studies conducted in Africa, specifically Uganda and Tanzania support global evidence that presented age as a contributing factor for HBV exposure amongst HCWs (Muljono *et al.* 2018: 88, Ziraba *et al.* 2010: 6 and Mueller *et al.* 2015:

386). This finding was in line with those established in a Cameroonian study whereby age was observed to be a significant risk factor for HBV exposure (Fritzsche *et al.* 2013: 157). The findings established by Fritzsche *et al.* (2013: 157) supported the results described in the Ugandan and Tanzanian study, in that a greater rate of exposure was denoted in older HCWs than in younger HCWs. As deduced by Mueller *et al.* (2015: 386) the above occurrence may be rationalised by the constant risk of exposure of HCWs that existed throughout a working lifetime, the consequence of such resulting in hepatitis B prevalence increasing with age. Contrary to the findings established in recent studies, the presence of HBV in a tertiary health institute in Nigeria was found to be more endemic in low risk hospital staff (administrative staff) who did not have direct contact with patients (60% of positive cases) as compared to those who did have regular contact with patients (Orji *et al.* 2020: 23). Although this compelling observation was deduced, Orji *et al.* (2020: 23) failed to explicate the relationship between low risk hospital staff and the relatively high prevalence of HBV. As such, there were key questions and notions that were not discussed in the literature. This unexpected finding does however signal the need for additional studies to better understand this unanticipated result. Additionally, these findings contrasted with those described in a South American study that exhibited no significant variation in HBV serology between clinical and non-clinical staff (Black *et al.* 2015: 1). In conjunction with the results established by Black *et al.* (2015: 1) a Brazilian study reported a higher HBV prevalence amongst HCWs who worked in sectors of greatest risk (Ciorlia *et al.* 2005: 384). Similarly, the highest rate of exposure was noted among the following cadre of HCWs: nurses, nurse aides, and HCWs employed in obstetric wards, isolation rooms, dialysis units and dentist units in eastern Libya (Elzouki *et al.* 2014: 536).

The low prevalence amongst high risk sectors in Nigeria could potentially be due to the effectiveness of hospital protocol on IPC, which may have invariably reduced possible transmission from positive patients and vice versa. A cross-sectional study performed by Shao *et al.* (2018: 1) aimed to assess the HBV prevalence amongst HCWs in northern Tanzania, as well as associated factors. The results of the subsequent study identified medical doctors, followed by nurses and thereafter laboratory personnel among those who displayed the greatest seropositivity. By way of contrast, the study in Uganda performed by Ziraba *et al.* (2010: 6) depicted nursing students, followed by laboratory technicians as displaying the greater prevalence of HBV infection. The varying extent of likelihood of exposure to probable hazards in the environment could potentially validate the above discrepancies in HBV prevalence and work type between the different studies. Additionally, the study performed in northern Tanzania found a higher rate of HBV infection among older employees than in younger ones, as similarly suggested by studies performed in Uganda, Tanzania and Cameroon (Ziraba *et al.* 2010:6, Mueller *et al.* 2015: 386 and Fritzsche *et al.* 2013: 157). Evidently, several years in practice appeared to supplement occupational exposure in a clinical setting, which consequently increased the likelihood of developing HBV infection. With regards to profession, nurses were expected to display a greater rate of infection when compared to physicians- as the latter is presumed to possess an adequate level of awareness on transmission of HBV (Shindano *et al.* 2017: 400). Additionally, nurses were found to experience a higher proportion of percutaneous injuries than physicians in the Congo DR (Ngatu *et al.* 2012: 68). In spite of this, the study performed by Lungosi *et al.* (2019: 623) in Kisantu, Congo, DR revealed contrasting results. This may be due to the relatively small sample size utilised in the study (97 vs. 977 HCWs) performed by Ngatu *et al.* (2012: 68), the prevalence of auxiliary avenues for infections by physicians, or confounding factors that may have influenced the study, such as multiple sexual partners. An additional inference for the high rate of HBV is concerned with sexual intercourse. The rationale behind this logic is associated with the excessive exposure of HBV in HCWs who disclosed engaging in unprotected sex with numerous partners (Lungosi *et al.* 2019: 625). The above literature extensively highlighted the epidemiology of HBV infection in several developing countries in Africa. In the past thirty years, epidemiological research performed in Sub-Saharan Africa has indicated a highly endemic presence of HBV thereby presenting a serious public health concern (Ayoola 1998: 161, Kew 1996: 31, Kiire 1996: 5 and Burnett 2005: 201). However, previous studies in Africa revealed a particularly high HBV infection exposure among HCWs in South Africa (approximately 10%) (Qin *et al.* 2018: 2). A paucity in literature was identified in South Africa regarding the risk factors for HBV infection amongst HCWs. However, a common theme that was identified between studies was the vaccination status of HCWs and its influence on the prevalence of HBV infection amongst this risk category.

According to De Villiers *et al.* (2007: 4) HBV reportedly presented a one hundred times greater infection rate than HIV. Despite this critical revelation, HCWs continue to place greater emphasis on HIV and rarely test for the presence of HBV infection following a percutaneous injury or miscellaneous occupational exposure (Khan and Ross 2013: 4). A retrospective study performed in an academic hospital in Limpopo aimed to investigate the prevalence of HBV present in the stored sera of HIV positive South African patients (Lukhwareni *et al.* 2009: 406). The results of the subsequent study revealed that 63% of HIV/AIDS infected patients presented with serological markers for past or present HBV infection. Additionally, 40.6% displayed active HBV infection, and were therefore considered highly infectious (Lukhwareni *et al.* 2009: 406). As a result of these findings it could be concluded that HCWs are at a significant risk for occupational exposure to HBV. Nevertheless, a study performed in Gauteng revealed that approximately 30.6% of HCWs were protected (through subsequent immunity developed from a previous infection or from vaccination). Additionally, only a minute proportion (21.2%) of HCWs were able to recall being vaccinated (Vardas *et al.* 2002: 6). The results of the above study performed by Vardas *et al.* (2002: 6) revealed that HCWs with a history of HBV vaccination coverage presented a tenfold likelihood of possessing protective levels of Hepatitis B surface antibodies (anti-HBs), in comparison with unvaccinated risk groups (OR 16.0, 95% CI 7.2-35.4). The findings established by Vardas *et al.* (2002: 6) therefore suggested that the lack of immunisation of HCWs against HBV infection may result in the eventual exposure of this risk group to HBV. As a result, the lack of vaccination may be considered a probable risk factor for acquiring HBV infection amongst South African HCWs. Similarly, a study performed in three health care settings across the Gauteng province aimed to investigate the vaccination status of HCWs against HBV (Burnett *et al.* 2011: 4203).

In contrast with the findings established in the 2002 study, described above, 67.9% of HCWs received at least a single dose of vaccine which varied with the proportion of 21.2% of HCWs in the earlier study, who recollected receiving a vaccine (Burnett *et al.* 2011: 4203 and Vardas *et al.* 2002: 6). Despite the persistent lack of implementation of a national South African policy, enforcing compulsory vaccination coverage amongst HCWs by the National department of Health (NDoH), anecdotal evidence equated this increase in vaccination coverage with frequent vaccinations offered by majority of health care facilities (Burnett *et al.* 2011: 4203). In support of the evidence denoted by Burnett *et al.* (2011: 4203) above, reports by Mureithi (2010: 29) found that vaccination against HBV at certain hospitals in Tshwane Metro, were reportedly compulsory for HCWs employed in a working capacity at these health care settings. Upon review of the above research executed in South Africa, it was evident that vaccination uptake within these health care settings played an integral role in adequately safeguarding HCWs from consequential exposure to HBV, that may arise from their day-to-day work activities. Furthermore, the current body of research highlighted the need for the South Africa NDoH to adopt a set of national guidelines or policy that deem hepatitis B vaccination coverage mandatory for HCWs. An equally important finding saw a greater rate of exposure and HBV infection in rural settings than in urban settings as described in prior studies performed on the general population of South Africa (Msomi *et al.* 2020: 5 and Kane *et al.* 2000: 207). These findings were corroborated by a study performed in two provinces of South Africa (Sondlane *et al.* 2016: 3835). Results revealed that overall, 29% of HCWs who participate in the study were exposed to HBV across the three hospitals involved in the study. However, of the 29% of HCWs exposed across all three hospitals, 15.3% derived from the greatly urbanised Gauteng province, whilst 51.3% originated from the primarily rural Mpumalanga province. The findings instituted in the abovementioned studies thus indicated a probable association between sociodemographic factors such as resource constrained health facilities and a greater likelihood of acquiring HBV infection, in comparison with hospitals located in more urbanised regions. This thereby illustrated a greater risk of HCWs in rural hospitals potentially acquiring HBV as compared to HCWs in urbanised hospitals.

A copious amount of research presently exists, regarding the effect HBV vaccination has on HBV exposure amongst HCWs. However, a gap in alternate risk factors for HBV amongst South African HCWs was identified, and thus necessitates further research in this particular branch of study in the South African health care setting.

2.7 RISK FACTORS FOR OCCUPATIONAL EXPOSURE TO HCV

Hepatitis C continues to be a significant public health problem worldwide (Kumar and Prasad 2019: 1). HCWs are at risk of infection with severe blood borne pathogens via occupational exposure to BBF. An observational institutional-based cross-sectional study was performed in Bettiah, India (Kumar and Prasad 2019: 1). This study attempted to investigate the risk factors of HCV infection amongst HCWs. The variability in the prevalence of HCV between the different genders presented a controversial yet compelling argument (Kumar and Prasad 2019: 1). A few general population-based studies have been published on the disproportionate relationship between HCV cases between men and women. The HCV antibody prevalence in men was twofold greater than that observed in women in the United States (2.1% vs. 1.1% in women) (Armstrong *et al.* 2006: 705). Likewise, similar observations were noted in Europe (Rantala 2008: 1). A meta-analysis of crude odds ratio (OR) found that males have a statistically significantly greater chance of developing HCV than females (OR 2.01; 95% CI 1.16-3.20) (Ayano *et al.* 2018: 4). However, variability in the population group under study (general population vs psychiatric populace) in each case may have substantially influenced the inconsistency in results (Armstrong *et al.* 2006: 705, Rantala 2008: 1 and Ayano *et al.* 2018: 4). However, the study performed in India by Kumar and Prasad (2019: 1) found a higher HCV prevalence amongst female HCWs in relation to their male counterparts. The findings of Ahsan *et al.* (2019: 4) further support the notion brought forth by Kumar and Prasad (2019: 1). The results established in the Punjab province of Pakistan illustrated the significantly higher HCV seroprevalence in females than in males and transgender individuals.

Additionally, a pattern in HCV seropositivity in relation to age was observed. The results of the study revealed a greater seropositivity amongst the older age group. A finding that was not unique to the study as similar findings were confirmed by Mindolli *et al.* (2015: 956). A study conducted in Aswan aimed to critically evaluate the determinants for HCV seropositivity amongst HCWs (Abdelrheem 2020: 58). A cross-sectional study was performed among 206 randomly selected HCWs through proportional distribution. Results of the study indicated a higher HCV-Ab prevalence amongst cleaning staff (21.7%) than among laboratory technicians (16.5%) with the lowest prevalence illustrated in physicians (2.5%). Furthering, a statistically significant increase between the older age group and HCV-Ab seropositivity was established ($p = 0.002$). Interestingly, populations such as males and individuals with a history of marriage presented a significantly higher prevalence than females and unmarried groups ($p = 0.041$ and $p < 0.001$ respectively). A greater occurrence of HCV-Ab positivity was found in HCWs employed for more than five-years, hence a statistically significant association between extended employment and HCV-Ab seropositivity was evident (*p* < 0.001). Other risk factors that were highlighted in the study included prior history of exposure to NSI, a positive family history of subsequent infection, previous blood transfusion or intravenous drug abuse. On the other hand, however, preceding education and training on occupation exposure to BBF did not seem to influence the prevalence of HCV infection (Abdelrheem 2020: 58).

A case control study performed in Pakistan aimed to evaluate the risk factors for the high prevalence of blood-borne virus hepatitis reported amongst HCWs (Gorar *et al.* 2014: 1). HCWs operating in surgeries were at a 1.7 times greater risk of developing HCV (CI 95 0.62–5). Despite period of service known to be associated with hepatitis prevalence, this was not found in the subsequent study. Additionally, level of education appeared to be positively associated with reduced prevalence of hepatitis C amongst HCWs. This idea was supported by evidence that proved the protective effects against HCW infection when formal education exceeded 10 years (OR = 0.25; CI 95 0.07-0.8) (Gorar *et al.* 2014: 1). The design of the study enabled the simultaneous evaluation of several risk factors under investigation. However, the number of participants involved in the study may be considered relatively small. As such, non-significant associations for these critical risk factors under study may have presented itself. That being said, a similar study performed in Pakistan by Yousufzai *et al.* (2015: 388) corroborated the findings by Gorar *et al.* (2014: 1). The Pakistani study performed by Yousufzai *et al.* (2015: 570) also found years of education to have influenced the occurrence of sharps injury. Such findings could potentially be due in part to heightened vigilance of high-risk procedures and academic criteria associated with hiring a particular cadre of staff (Gorar *et al.* 2014: 1).

Exposure to HCV in an occupational setting comprises of 40% of the total HCV infected cases (Abdelwahab *et al.* 2012: 98). A study performed in Benha University Hospital and Benha Teaching Hospital aimed to investigate the acquisition of HCV infection in relation to specific risk factors and period of employment (Ameen *et al.* 2020: 477). The findings described by Ameen *et al.* (2020: 477) found that 53.7% of HCWs enrolled in the study were exposed to NSIs, with 80% of positive HCV cases associated with an NSI. Additionally, a statistically significant risk factor for HCV prevalence in this study was found to be sex (p< 0.001). The results of the study performed by Ameen *et al.* (2020: 477) found that male participants had a statically significantly greater likelihood of acquiring HCV infection in relation to their female counterpart (13.9% vs. 7.9%). A higher incidence of hepatitis C related NSIs were discovered in general workers in the hospital (74%), and nurses (61.02%) than in doctors (27.34%). A study performed in Egypt aimed to evaluate the risk factors for hepatitis C amongst 842 Egyptian HCWs (Abdelwahab *et al.* 2011: 1). The findings of the study found a substantially greater prevalence of HCV antibodies amongst male participants than the females (24.0% vs. 10.5% respectively; $p < 0.001$). The likelihood of HCWs having anti-HCV antibodies, and residing in a rural area was more than two-fold greater than the risk of such occurrence presenting itself in HCWs living in urban areas (21.4% vs 9.7%; $p < 0.001$) was noted. Crude analysis revealed a lower HCV seroprevalence in physicians (5.6%) than in housekeeping personnel (30.6%) (however the adjusted *p*-value indicated a lack in significant difference between occupation ($p = 0.133$). Additionally, a statistically significant association between antiHCV prevalence and length of employment was established (as employment duration increased, as did antiHCV prevalence, $p < 0.001$). Challenging the findings established by several other scholars in the field, this study found no association between needle sticks and an increased prevalence of anti HCV. In conclusion, Abdelwahab *et al.* (2011: 1) found age (p <0.001), male sex ($p < 0.002$) and rural residence ($p < 0.001$) as the only notable predictors associated with anti HCV positivity.

Alternative risk factors such as occupation ($p = 0.133$), length of employment ($p = 0.272$) and being positive for schistosomal antibodies (p =0.152) were not prominent risk factors for HCV infection. The risk factors established among the HCWs in this study were similar to those described earlier in Egyptian communities (Abdel-Aziz *et al.* 2000: 111, Habib *et al.* 2001: 248, Frank *et al.* 2000: 887). The findings established by Abdelwahab *et al.* (2011: 1) support the notion that the prevalence of HCV infection was comparatively, more a result of community than hospital exposure. The highest prevalence of HCV infection was found to exists amongst HCWs with a low socioeconomic level, such as administrative staff and housekeeping personnel who were expected to reside in the surrounding rural areas- with a proven high infection rate (Abdel-Aziz *et al.* 2000: 111 and Habib *et al.* 2001: 248). Additional significant risk factors for HCV seropositivity included extended employment periods and positive family history of HCV infection ($p = 0.013$ and 0 = 0.011). Coinciding epidemiological studies performed across Egypt found a directly proportional relationship between the seroprevalence of HCV and an increase in age (El-Melligy *et al.* 2016: 14, Okasha *et al.* 2015: 199 and Zayet *et al.* 2015: 85).

To support the findings of Abdelwahab *et al.* (2011: 1) that noted male sex as a significant contributing factor to risk of exposure, a meta-analysis performed by Westermann *et al.* (2015: 883) between the period of 1989 and 2014 suggested that males were two times more likely of displaying HCV-Ab positivity. However, the risk of HCV transmission in relation to sex presented a controversial argument. A rationale for this subsequent occurrence amongst this subset of HCWs may be equated to the generalisation that males are more exposed to blood borne risk factors such as use of drugs or disquieting sexual practices as compared to females (Gabb and Fink 2015: 970). Similarly, alike studies performed in Egypt found that professional categories seemed to have influenced the prevalence of HCV seropositivity, with cleaning staff presenting with a greater prevalence (Abdelwahab *et al.* 2012: 98, Okasha *et al.* 2015: 199 and Zayed *et al.* 2017: 720). A probable basis for this finding may be due to the increased exposure presented during the continual handling of potentially infected sources. Moreover, majority of this risk category were found to possess an inadequate level of education and training (EU-OSHA – European Agency for Safety and Health at Work 2009). Contrasting, Elzouki *et al.* (2013: 589), Seida *et al.* (2018: 265) and Sani *et al.* (2018: 1) proved that technicians and nurses were among the most highly affected risk groups. This disparity between studies may be attributed to variability in the nature and period of exposure among the different study environments as well as dissimilarities in sample size and demographic profile of the populations. Evidently, HCWs whose employment duration exceeded ten years presented with a higher rate of HCV-Ab prevalence as opposed to employees employed within a shorter timeframe. The notion that the risk of acquiring subsequent infection increased with prolonged period of exposure may be supported by similar studies performed in Ethiopia and upper Egypt (Kebede 2012: 1094 and Zayet 2015: 85). A large proportion of HCV-Ab negative HCWs were found to engage in safe hand hygiene practices following an occupational exposure to BBF (Abdelrheem *et al.* 2020: 63). These findings were consistent with those established in another Egyptian study where frequent hand washing post-exposure yielded a significantly low HCV-Ab prevalence amongst HCW (Munier *et al.* 2013: 4).

A significant gap on risk factors contributing to HCV prevalence presently exists. Due to the distinctive features of HCV, such as the relatively high rate of replication and the likelihood of multiple mutations - a viable vaccine does not presently exist. As such, the neutralising antibodies develop far too late to inhibit chronic infection (Liang *et al.* 2000: 296 and Jawaid and Khuwaja 2008: 129). For this reason, HCWs are encouraged to observe the recommended post exposure protocol (Greyling 2014: 36). Guidelines provided by WHO (2021) outlined effective wound management, exposure reporting, assessment of infection risk and appropriate treatment, follow up and counselling, as vital elements of post exposure management.

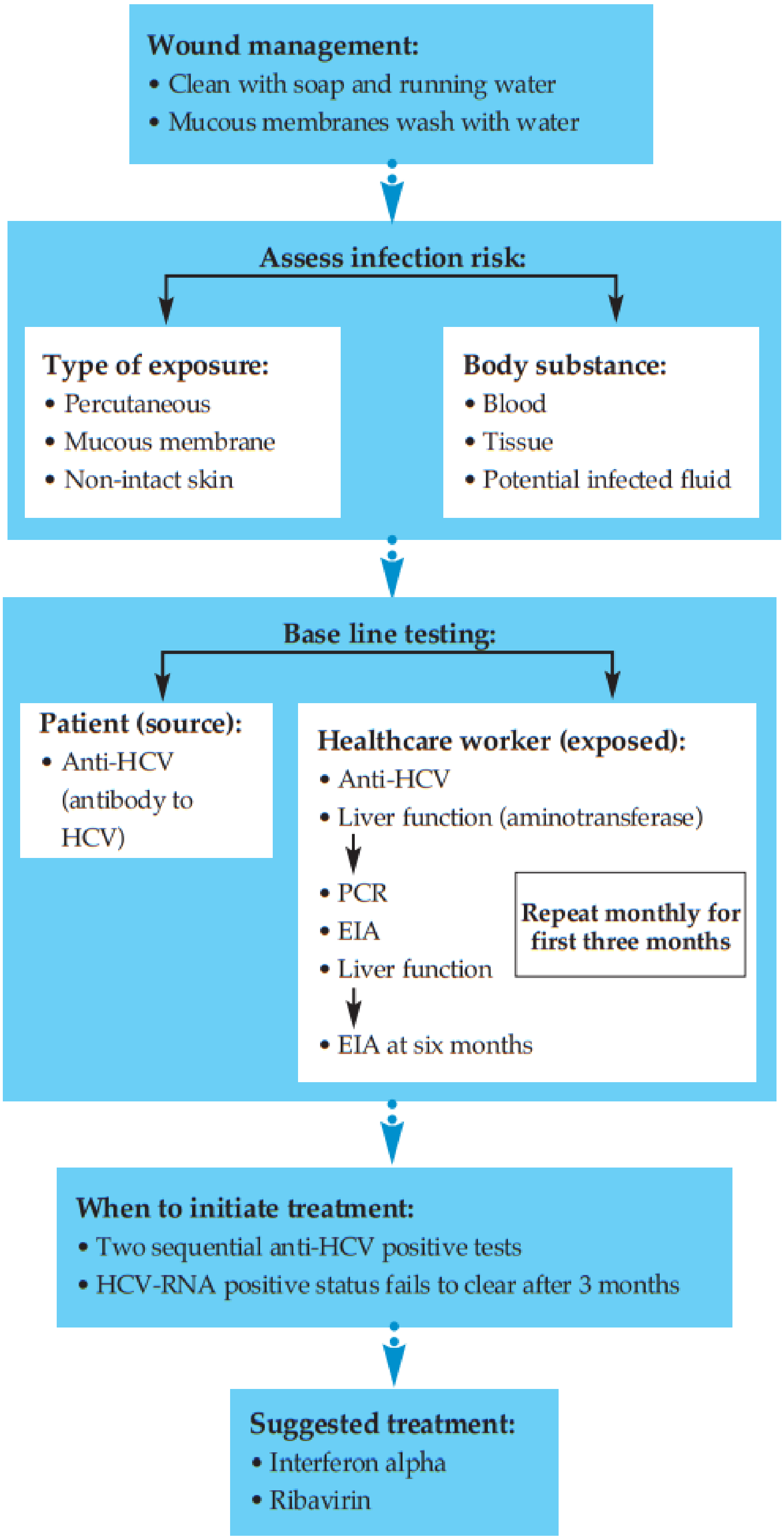

Figure 9: The suggested post-exposure protocol (Greyling 2014: 36).

2.8 KNOWLEDGE OF HCWS IN RELATION TO BLOOD AND BODILY FLUID EXPOSURE

The foundation which determines successful health promotion or disease prevention lies in unwavering coherence between health awareness and knowledge, and knowledge and practices (Zaidi *et al.* 2012: 209). A series of previous literature investigated the knowledge of HCWs in relation to BBF exposure (Zaidi *et al.* 2012: 209). A cross-sectional study undertaken by Zaidi *et al.* (2012: 209) in United Arab Emirates (UAE) aimed to determine the KAP of HCWs in relation to occupational exposure to be BFF. Referring to the findings of Zaidi *et al.* (2012: 209) a sizeable proportion of HCWs were significantly knowledgeable on the different avenues of treatment available following an exposure, and further displayed an awareness indicating subsequent knowledge regarding the absence of presently existing immunity for the hepatitis C pathogen. Contrary to the findings described by Zaidi *et al.* (2012: 209) a similar study performed by Jankovic *et al.* (2009: 409) in Bosnia and Herzegovina found that 25% of the study population (total of 537 participants) erroneously believed that a vaccine for HCV was in existence, thereby indicating a lack of knowledge amongst the population under study. Possible discrepancies in the findings of both authors, may arise from differences in sample size (230 versus 537 participants), geographic area (Middle East versus Europe), the way in which each study was executed, methodological technique employed by each author, as well as differences in notions.

A study conducted in Iran revealed that nurses in particular are at an increased risk of developing NSI mucocutaneous exposures and associated infections, due to inadequate medical education, which can consequently result in this category of workers being susceptible to unsafe practices (Geravandi *et al.* 2011: 85). Whereas Geravandi *et al.* (2011: 85) uncovered poor knowledge amongst the fully qualified nurses in Iran, in respect to NSI and mucocutaneous exposure, Saleem *et al.* (2010: 155) presented findings that illustrated and overall satisfactory level of knowledge displayed by medical students in Karachi, Pakistan- regarding the transmission of BBI via NSI. The disparity in above findings may potentially owe to differences in professional category – as medical students appear to display a greater rate of knowledge than nursing professionals.

A more recent study performed in west of Iran reported an inadequate level of knowledge relating to HIV/AIDS status and transmission amongst HCWs (Mirzaei-Alavijeh *et al.* 2020: 4). Additionally, the study highlighted several gaps in HIV/AIDS infection exposure, risk prevention and occupational transmission, thus expressing the need for more rigorous education and training programmes amongst this subgroup of employees. The researcher theorised an association between the moderate level of HIV knowledge and age (30-49-year-old HCWs presented with a moderate level of knowledge) (Mirzaei-Alavijeh *et al.* 2020: 4). The results of the study performed by Mirzaei-Alavijeh *et al.* (2020: 3) in west Iran concurred with the findings of a similar study performed in Ahvaz, a neighbouring Iranian state (Saydkhani *et al.* 2012: 3). The study performed in Ahvaz, Iran revealed that 60% of anaesthesia staff had a moderate level of knowledge regarding HIV/AIDS infection as of 2010. Conversely, Kumar *et al.* (2017: 41) had reported contrasting results. A study conducted in 2017 on paramedical staff employed in private healthcare facilities in New Delhi revealed that majority of the study population possessed an unsatisfactory level of awareness pertaining to HIV transmission (Kumar *et al.* 2017: 41). However, by way of contrast, a cross-sectional study performed by Desai *et al.* (2016: 133) displayed a relatively high level of knowledge amongst HCWs, with 80% of the study participants exhibiting cognisance of HIV post-exposure prophylaxis (PEP). Where the studies executed by Geravandi *et al.* (2011: 85), Mirzaei-Alavijeh *et al.* (2020: 3) and Saydkhani *et al.* (2012: 3) argued against a satisfactory standard of knowledge relating to BBF exposures amongst HCWS throughout the different states of Iran, a study conducted by Rostamzadeh *et al.* (2018: 1) documented a generally high level of knowledge amongst health care professionals in Iran.

A cross-sectional study carried out in Serbia aimed to analyse the knowledge of clinical course students and HCWs on blood borne exposures and associated diseases (Markovic-Denic *et al.* 2014: 72). The results of the study showed similar levels of knowledge on the likelihood of viral transmission via blood between students and HCWs. Majority of the study population believed blood exposure to be the most notable biological medium for transmission of HIV. However, a closer look at literature revealed varying routes of HIV transmission between countries. Approximately one third of HCWs in India incorrectly believed HIV was transmissible via faeces, and two thirds believed via saliva (Kermode *et al.* 2005: 258). Similarly, more than one quarter of HCWs in a Nigerian study incorrectly assumed faeces, urine and saliva as the primary route of exposure of HIV (Aisien *et al.* 2005: 77). Corroborating the findings of the Iranian study performed by Saleem *et al.* (2010: 155), students involved in the Serbian study appeared to possess a greater level of awareness in comparison to HCWs (Markovic-Denic *et al.* 2014: 32). According to Markovic-Denic *et al.* (2014: 72) this occurrence was most likely a result of students successfully utilising the corresponding learning material and actively participating in practical sessions during academic years. Interestingly, a study performed in Taiwan found a negative correlation between incorrect knowledge of route of HBV spread and exposure to NSIs, which contradicted the original hypothesis of the study (He *et al.* 2012: 1485). Although uncertain, reverse causation is assumed to be a probable source of the phenomenon observed (He *et al.* 2012: 1485). The study showed that dentists who experienced an NSI were more inclined to improve their subsequent knowledge on the path of transmission of HBV following a NSI, so as to avoid an associated infection arising from exposure. A cross-sectional study was initiated in India with the motive to evaluate the knowledge of HCWs on hepatitis infection (Setia *et al.* 2013: 551). Despite adequate knowledge presented by the study population regarding the existence of an HBV vaccine, 48%, 29% and 65.5% of dental, medical and nursing interns, respectively, incorrectly believed that a viable vaccine against HCV presently existed (Setia *et al.* 2013: 551). Although the study highlighted a significant gap in knowledge and misconceptions of HCWs regarding the presence of an attainable vaccine, the researcher failed to describe the basis of this misbelief. As a result, the unexpected findings in this study signal the need for further research, to better understand the misconceptions surrounding HCV amongst HCWs in India.

A study performed in Shiraz, Iran found a correlation between safety precautions taken post-exposure and current state of knowledge pertaining to PEP (Shaghaghian *et al.* 2014: 1). Additionally, a statistically significantly higher level of knowledge was denoted in dentists who immediately cleansed the site of exposure as compared to those who did not engage in such preventative practice following subsequent BBF exposure ($p < 0.001$). Moreover, intervention strategies were found to improve the practice of dentists by increasing their awareness in handling themselves, in the wake of an exposure, as those who had attended an infection control seminar were more likely to employ preventative measures following a BBF exposure, in comparison to those dentists who did not attend such conventions. The results established by Shaghaghian *et al.* (2014: 1) coincided with findings exhibited in Africa (Owolabi *et al.* 2012: 179). In Nigeria, Owolabi *et al.* (2012: 179) too found an inadequate level of PEP knowledge among the study population. A review of literature has revealed several gaps and misconceptions in the knowledge of HCWs with regards to BBF that require addressing. All literature reviewed on the subject emphasised the need for reform in knowledge in prevention and medical education.

Enhanced HBV related knowledge plays a crucial role in establishing a prime positive environment which may give rise to the introduction, promotion and sustenance of quality HBV control practices (Yang *et al.* 2015: 103). A study conducted by Hebo *et al.* (2019: 1) set out to investigate the KAP of HCWs regrading HBV and HIV infections. A satisfactory level of knowledge was observed amongst the Southeast Ethiopian study population regarding the existence of PEP for HBV (Hebo *et al.* 2019: 1). Conversely, Yang *et al.* (2015: 103) denoted a substandard degree of awareness pertaining to specific aspects of hepatitis in general, amongst HCWs in Bantama, Ghana. This finding may be considered particularly distressing as majority of the HCWs involved in the study incorrectly believed HBV possessed a cure, thus providing an insight on the depth of HCW knowledge in this domain. Furthermore, the shortfall in knowledge pertaining to the fatality of HBV, other forms of viral hepatitis and transmission via faecal-oral route was alarming. The study conducted by Atlam *et al.* (2010: 754) amongst Tanta University students in Egypt revealed majority of participants with a satisfactory knowledge on HBV and HCV. The findings established by Atlam *et al.* (2010: 754) denoted a statistically significant association between level of knowledge and older participants, females, participants residing in urban areas and students in their clinical academic years. Similarly, these findings corresponded with research performed on Omani medical students (Aljabri *et al.* 2004: 484). Specific areas of inadequate knowledge surrounded the mode of transmission, associated complications, the existence of a vaccine and appropriate treatment options. Comparatively, two thirds of medical students involved in the study displayed ignorance on factors relating to food and water as vehicles for exposure to HBV and HCV (Atlam *et al.* 2016: 752). These results mirrored the findings described in South West Ethiopia, where only one third of the study population were aware that the above occurrence was not plausible (Hebo *et al.* 2018: 6). The findings of a Sudanese study indicated an overall adequate rate of knowledge on HBV infection (Mohammed-elbager *et al.* 2019: 4). The results of the study showed that a substantial number of HCWs were aware of HBV being a viral infection (90.9%) associated with chronic or acute infection. Additionally, participants in the study appeared to be greatly knowledgeable on complications associated with HBV infection, with 82.7%, 52.7% and 81.8% of HCWs recognising liver cirrhosis, hepatocellular carcinoma and death as such complications respectively. According to the perspective of Mohammed-Elbager *et al.* (2019: 3) a statistically significant association between the dependent variable (knowledge) and several independent variables (age, marital status, occupation, level of education and work experience) did not exist. However, Elsheikh *et al.* (2016: 19) conversely denoted a significant correlation between occupational and academic level amongst HCWs in a neighbouring region of Sudan. The variability between the findings of the two studies may potentially owe to the differences in professions observed. Whereas the study performed by Mohammed-elbager *et al.* (2019: 4) focused primarily on nurses and midwives, the studies facilitated by Elmukashfi *et al.* (2012: 37) looked at doctors, pharmacist, all categories of nurses, midwives and theatre operators, laboratory technicians and labourers.

In a study of 100 HCWs at a dental training Institute in Durban, KZN, a significant proportion of the study group displayed a satisfactory level of awareness on percutaneous injuries. Approximately 56.2% correctly identified such injuries as an accidental prick or injection with a scaler, needle or other miscellaneous sharp, or contaminated instrument. Additionally, only 15% of participants recognised a break in the epidermis as an identifiable injury. Although one of the key objectives of the study focused on determining the knowledge of HCWs on clinical management of percutaneous injuries, the study performed by Moodley and Naidoo (2015: 336) vaguely described the knowledge of HCWs as such. The results of the study may potentially be considered inconclusive. Although Moodley and Naidoo (2015: 336) outlined the population of HCWs with a good understanding of percutaneous injuries, by means of a percentage- the authors failed to describe possible associations between the different variables related to knowledge. The study described only the number of participants with a good understanding but failed to postulate an association between probable factors that may influence the results established. The study produced by Moodley and Naidoo (2015: 336) gave rise to more questions than answers. The vague findings on the knowledge of HCWs signal the need for additional studies to be performed in this domain of research in South Africa, more specifically KZN, so as to provide a comprehensive grasp on the knowledge of HCWs on percutaneous exposure incidents (PEIs). No attempt was made to quantify the association between the knowledge of HCWs and PEIs. Much of the research was descriptive in nature and failed to show whether a statistically significant association existed between variables. In order to make inferences from the sample group to the general population of study, the use of inferential statistics would have greatly enriched the study. A study conducted in South Africa set out to assess the efficacy of an occupational health and infection control program, orchestrated in the Free State province of South Africa. The results of the study revealed an increase in mean knowledge scores from before to after the program was initiated ($p = 0.02$) (Liautaud *et al.* 2017: 172). Furthermore, considerable difficulties were met by HCWs in preserving the achieved advancements, due in part to inadequate former knowledge and experience, accompanied by suboptimal staffing and inadequate support offered by management. Although integrated educational interventions presented an undeniable improvement in HCWs knowledge, skills and practices- as mentioned in the previously analysed study performed by Moodley and Naidoo (2015: 4), emphasis should be placed on comparing specific factors such as socioeconomic elements, in order to ensure educational efforts are sustained, amongst this population group. Socioeconomic factors may influence substandard staffing, unsatisfactory level of education, and lack of resources. All studies reviewed emphasised the indisputable need for education and training programmes in health institutions in hopes of minimising potential BBF exposures and associated incidents in the future.

2.9 ATTITUDE OF HCWS IN RELATION TO BLOOD AND BODILY FLUID EXPOSURE

The cornerstone of prevention of BBI lies in an appropriate attitude towards such infections (Mansour-Ghanaie *et al.* 2022: 25). A study performed by Zaidi *et al.* (2012: 209) aimed to assess the KAP of HCWs on BBF exposure in UAE. The results of the study highlighted the reluctance of HCWs to report occupational exposures. The vast majority of HCWs expressed a great deal of knowledge on the various routes of treatment available post-exposure and the significance of blood tests for themselves, and the source patient. Be that as it may, Zaidi *et al.* (2012: 209) found the study population bypassing testing and opting for immediate treatment, excluding a formal risk assessment, following a subsequent exposure to potentially infectious BBF. In the authors' view, the HCWs may have believed the level of risk outweighed the practicality of testing, at the time of exposure. Moreover, the gravity of reporting an incident was severely trivialised. This was reflected by the resistance of HCWs to test, which would require subsequent reporting. A cross sectional study performed in a nursing college in Varanasi, India set out to review the attitudes of nursing students regarding OE to HIV (Shivalli 2014: 1). The nursing staff illustrated varying attitudes toward universal precautions and additional factors pertaining to the management of HIV infected patients (Shivalli 2014: 1). A high proportion (97.1%) of nursing students believed that inpatients required HIV testing. In alike manner, majority of the study population (94.2%) proposed that nurses also be tested, despite only 87.4% of them displaying willingness to get the HIV test performed. Interestingly, a third of the nursing staff (38.8%) displayed a negative attitude toward HIV positive nurses continuing to perform their duties. Although majority (99%) of the participants displayed a positive attitude toward the universal precautions, a significant gap in implementation of such measures existed. Of note, most of the participants placed greater importance on self-protection as opposed to patient HIV status confidentiality. Most compelling evidence exists to support the relationship between attitude and practices (Jain *et al.* 2012: 30, Senthil *et al.* 2012: 74 and Shriyan and Annamman 2012: 93). The vast majority of HCWs advocated for all patients to be tested. Such sentiments expressed by the nursing students in the above studies may support the opinion of (Shivalli 2014: 1) who cited the implementation of prejudicial measures of safety, depending on the HIV status of the patient, as the rationale behind the nurse's attitudes. This notion was reflected in the significant reduction in the number of BBF exposure encountered whilst nursing HIV positive patients. Corroborating the above findings were similar studies performed in other regions of India (Jain *et al.* 2012: 30 and Senthil *et al.* 2012: 74). The results of these studies proved that awareness of HIV status influenced the administration of safety protocols. The authors argued against this biased approach, stating that negatively tested HIV patients may be in a window period, and may albeit spread the disease, regardless.

The findings of Ali *et al.* (2017: 1) established trends between attitude and sociodemographic factors such as job category, sex and age groups. Doctors displayed a greater attitude score than medical students, females possessed a higher attitude score than males, and older respondents showed more favourable attitudes than younger participants. Additionally, a statistically significant association between knowledge and attitude was depicted in the study. As previously described in the results found by Shivalli (2014: 1), the HCWs displayed a favourable attitude to HBV training programmes (Ali *et al.* 2017: 1). A study performed by Shahghain *et al.* (2014: 1) aimed to assess the attitude presented by dentists toward PEP following a BBF exposure. The results of the study found an unfavourable attitude amongst a significant proportion of HCWs to PEP. The study participants believed PEP to be ineffective in the prevention of HBV and HCV, respectively, with 13.1% of the HCWs claiming PEP incapable of reducing the risk of acquiring AIDS. Additionally, 43.4% of the participants in the study showed a negative attitude toward post-exposure preventative measures, such as the washing of the site of exposure with water immediately after an incident. This was due to the belief that such attempts were futile in the prevention of HIV and hepatitis.

Infection control seminars were found to positively influence the attitude of dentists toward handwashing following an exposure. Where the study performed in Shiraz, southern Iran found an undesirable attitude of HCWs to PEP owing to the disbelief of its effectiveness, a study performed in Lahore, Pakistan, on the other hand, provided evidence that the HCWs under study did not regard PEP as important, or were simply unaware of it (Singh *et al.* 2015: 2). The findings of Singh *et al.* (2015: 2) support the evidence provided by Ali *et al.* (2017: 1) that indicated a significant proportion of HCWs exhibiting an improper attitude towards the effectiveness of PEP in the prevention of HIV. According to Singh *et al.* (2015: 2) 25.9% of participants believed PEP to be effective in reducing the risk of acquiring HIV infection, with 21.7% disagreeing and 25.5% completely unaware of the effects of PEP. The basis of improper attitudes amongst the HCWs noted in the study may owe to the disinterest in providing a planned policy pertaining to PEP for HIV by the organisation and health care institutes (Singh *et al.* 2015: 2).

Contradicting the findings described by Ali *et al.* (2017: 1) Rostamzadeh *et al.* (2018: 7) found no significant association between the extent of KAP and sex. Where Rostamzadeh *et al.* (2018: 7) argued against an association between sex and level of attitude, Rabiee *et al.* (2012: 58) presented a case for an association between the abovementioned variables. According to Rabiee *et al.* (2012: 58) female HCWs with a significantly higher level of knowledge than male HCWs presented a negative attitude toward the treatment of HIV, HBV and HCV infected patients. This difference was equated to the greater knowledge of the female HCWs, which may have resulted in the improper attitude adopted, when managing and treating infected patients (Rostamzadeh *et al.* 2018: 7). In the view of Mansour-Ghanaie *et al.* (2013:197) a high proportion of HCWs favoured the use of two pairs of gloves when treating or managing a bleeding HBV or HIV infected patient, with a significant measure of participants (83%) advocating that an individual be tested for HBV and HIV prior to the receipt of health care. However, a lesser proportion (21.2%) of HCWs believed that HBV or HIV infected patients should be treated as the last appointment of a work shift. The findings described by Mansour-Ghanaie *et al.* (2013: 197) were in conjunction with the results established in a similar study performed by Guilan, Iran (Joukar *et al.* 2012: 2238). Of the population under study, 74.4% were reportedly double-gloved when attending to a bleeding HCV infected patient. Additionally, almost half of the HCWs similarly believed that HIV infected patients should be allocated the last appointment of the day (Joukar *et al.* 2012: 2238).

Contradicting the findings of Rostamzadeh *et al.* (2018: 7) 69% of the study population in an Australian study displayed a favourable attitude regarding physical interaction with an HIV infected individual when required to treat such patients (Van de Mortel 2002: 1). This further challenged the results established by Rostamzadeh *et al.* (2018: 7) where only 34.7% of HCWs claimed to be comfortable with treating an HBV or HCV infected patient. In spite of the dissatisfactory attitude recorded amongst HCWs in literature reviewed on the most recent epidemiological data, the statistics indicated a positive association between the knowledge of the HCWs and improved attitude. A number of authors have recognised this association, disputing the findings illustrated in the Australian study performed by Van de Mortel (2002: 1) who found no significant association between the knowledge of HCWs and attitude toward hepatitis C (Razi *et al.* 2010: 40, Talpur *et al.* 2007: 163 and Joukar *et al.* 2010: 2238). It would appear that researchers, Rostamzadeh *et al.* (2018: 7) reached a conclusion that heightened vigilance on factors such as the nature of exposure, symptoms of infection, modes of transmission and methods of prevention and treatment of HBV and HIV infections may positively modify the behaviour of HCWs, and thus increase willingness of HCWs to care for HIV infected individuals. This approach may be effective in reducing consequential discrimination toward infected patients.

An inordinate rate of HBV prevalence presents itself in sub-Saharan African countries (Tan *et al.* 2021: 27 and Taye *et al.* 2014: 272). In order to assess the KAP of health science students on HBV infection, a cross-sectional epidemiological study was performed amongst 246 health profession students, in Northwest Ethiopia (Abdela *et al.* 2016: 4). Results of the study depicted a generally favourable attitude of participants. Approximately 83.3% of participants believed adherence to IPC protocols as effective in infection prevention, with 81.7% of participants acknowledging the protective capabilities of the vaccine against HBV infection. These findings were in line with those observed in a similar study performed in Saudi Arabia amongst dentists (Abeje *et al.* 2015: 17). Similar to the Australian study performed by Van de Mortel (2002: 1) 82% of respondents displayed comfort in treating infected patients. That being said 55.7% of the participants believed that all patients should be tested before receiving treatment. A mixed method study was performed amongst Nigerian HCWs (Aluko *et al.* 2016: 11). A summation of attitude scores revealed a predominantly favourable attitude in majority (80%) of HCWs with respect to safety practices and mitigation of threats to occupational health and safety. This positive attitude may owe to the increased knowledge scores, which resulted in subsequent vigilance toward occupational diseases. Additionally, a satisfactory attitude was observed amongst respondents with regard to hand washing. An astonishing revelation indicated that 99% of study participants were in favour of capacity building that focused on PEP, occupational health hazards and record keeping and documentation of occupational exposures as a means of minimising risk of exposure. Interestingly, some respondents found the observation of safety precautions against occupational exposure as cumbersome and tedious, despite the importance of PPE use before a clinical procedure (Aluko *et al.* 2016: 11).

The findings of Aluko *et al.* (2016: 11) described a seemingly statistically significant association between occupational categories and knowledge as well as attitude. Additionally, a statistically significant association was denoted between ethnicity and attitude (p = 0.028), religion and attitude (p = 0.016) and sex and attitude (p = 0.007). When compared to previously conducted global studies this finding corresponded greatly with that of Rabiee *et al.* (2012: 58) but contradicted the notion of Rostamzadeh *et al.* (2018: 7) that found no statistically significant relationship between attitude and sex. Majority of respondents (80%) in the study performed by Aluko *et al.* (2016: 11) had a positive attitude to safety procedures and mitigation of workplace hazards. This may possibly owe to the fear of HCWs contracting potentially harmful occupationally related diseases, as well as the high level of knowledge presented by respondents (Aluko *et al.* 2016: 11). The participants indicated a positive attitude to handwashing. This finding was particularly reassuring as HCWs often place minimal emphasis on personal health and safety, when tending to patients, especially during emergency cases. However, one should keep in mind that this study was initiated within a tertiary healthcare facility, a model of best practice in the health care industry. As such, generalisation of the results established in the study to other regions of Nigeria may not be an accurate representation of conditions within the surrounding health institutions of Nigeria, as the conditions in public health care facilities may be worse off than described in the study conducted by Aluko *et al.* (2016: 11). Although Aluko *et al.* (2016: 11) presented a compelling argument for factors associated with the knowledge, attitude and perceptions of occupational hazards and safety practices among Nigerian HCWs, certain inconsistencies in the authors' findings may discredit the validity of the results and reliability of the study. Contradictions in the scientific literature was noted. The authors began describing a statistically significant association between religion and attitude (p = 0.016). However, further into the study, the authors contradict their own scientific findings by stating that religion was not statistically related to attitude (p = 0.130). As such, this specific association between religion and attitude is disparate and thus, inconclusive. The inconsistent findings signal the need for additional studies in this domain of the Nigerian health care setting in order to better validate the above relationship.

A study performed in Sudan found that of the 295 respondents enrolled in the study, 41% maintained that their attitude towards treating HBV infected patients will remain unchanged throughout their working lifetime. Additionally, majority of the study population strongly believed that handwashing was effective against the development of HBV. With regard to the use of PPE such as gloves, doctors displayed a negative attitude whereas nurses and laboratory technicians presented a generally favourable attitude toward glove usage when tending to patients. According to the findings of Bakry *et al.* (2012: 95) the efficacy of the vaccine was severely underestimated. The primary reasons that accounted for the lack of vaccine uptake were ignorance relating to the availability of the vaccine, scepticism in the efficacy of the vaccine in disease prevention, disbelief that the vaccine forms an integral component of preventive as well as the fear of developing the disease from receipt of the vaccine. However, according to the results of a similar study executed in Sudan by Mohammed-Elbager (2019: 4) 82.7% of the HCWs under study cited vaccination as an integral source of protection against subsequent infection. This distinguishable disparity in findings between the two studies performed in Sudan could owe to differences in sample size for one. The Sudanese study performed by Bakry *et al.* (2012: 95) had more than two times the participants than the Sudanese study performed by Mohammed-Elbager (2019: 4) (295 vs. 110 participants). Additionally, variations in geographic area, economic development between the two areas as well as differences in job categories under study could potentially justify the dissimilarities between the research. The study performed by Bakry *et al.* (2012: 95) focused on a spectrum of HCWs including doctors, nurses, laboratory technicians and other paramedical staff, whereas Mohammed-Elbager (2019: 4) focused primarily on nurses and midwives. However, considering that the study performed by Bakry *et al.* (2012: 95) was performed seven years prior to the study performed by Mohammed-Elbager (2019: 4) one may conclude that with time the attitude of HCWs could have undergone significant change in favour of vaccination as an imperative preventive measure against infection.

In conjunction with the findings of Aluko *et al.* (2016: 6) a substantial proportion of HCWs expressed an appropriate attitude toward preventive measures for BBF exposures such as the sterilisation of instruments, the use of PPE, including gloves and uptake of PEP and vaccinations. (Aluko *et al.* 2016: 6 and Mohammed-Elbager 2019: 4). In concurrence with previous literature on the subject, Atlam *et al.* (2016: 749) described a generally positive attitude of Egyptian HCWs toward HBV and HIV. The findings of the study performed in Egypt described a statistically significant association between knowledge and attitude (*p* = 0.000). Additionally, 72% of HCWs whom presented a positive attitude also reported good practices (*p* = 0.035). However, sufficient knowledge was not statistically significantly associated with good practice (*p* = 0.48). The flaws in attitude that was highlighted in the literature reviewed presents a serious consequence to HCWs and may compromise the integrity of healthcare delivered to patients alike in HCF. Knowledge, attitude and practices go hand in hand, as seen in the scientific body of evidence. As such, hospital management should place urgency on strengthening health education, which in turn has proven to improve attitude- a variable found to correlate directly with safer practices when handling BBF (Atlam *et al.* 2016: 749).

Preliminary research performed by Moodley and Naidoo (2015: 334) set out to investigate the perceptions of dental staff and students on percutaneous injuries in Kwa-Zulu Natal. Although investigation into the growing burden of percutaneous injuries found majority of HCWs reporting an injury, some respondents believed a risk of infection did not exist, and therefore presumed the reporting of such incidents as unnecessary. The findings of a cross-sectional study performed by Rasweswe and Mmapheko (2020: 1) on clinical nurses employed in the intensive care unit (ICU), occupational therapy (OT), emergency department (ED) and maternity wards of Gauteng, illustrated the primary reasons for lack of reporting an occupational exposure to BBF. A significant proportion of the study population refused to provide an answer for questions pertaining to failure in reporting. However, 14.88% of HCWs cited unawareness on avenues for reporting, use of PPE at the time of an incident, firmly established fear of testing positive or being ostracised, negative attitude to the potential use of ARVs arising out of ignorance amongst the study population, and the optimisation of safety measures beforehand, as justification for not reporting an incident of exposure. The findings on reporting of BBF differed greatly between the two authors. Where Rasweswe and Mmapheko (2020: 1) adduced several factors to explain the unfavourable attitude of HCWs to reporting, Moodley and Naidoo (2015: 334) were only able to establish a single cause for lack of reporting. Differences in results may be attributed to geographic variations (Kwa-Zulu Natal vs Gauteng). Additionally, contrasting cadres of work between the two studies may have also influenced the results obtained. Where Rasweswe and Mmapheko (2020: 1) focused on a vast majority of nurses from various departments in a hospital, Moodley and Naidoo (2015: 334) prioritised dental staff.

The reasons behind not reporting an injury correlated with those established in similar studies performed across Africa (Mathewos *et al.* 2013: 508 and Sendo 2014: 4). Additionally, the study highlighted a negative attitude of HCWs to seek HIV PEP from the facility (Rasweswe and Mmapheko 2020: 1). A few nurses involved in the study expressed comfort in seeking such treatment away from their place of work or home. These findings coincided with the results in a similar study performed in Cape Town (Papavarnavas *et al.* 2017: 23). The study performed in Cape Town revealed a willingness of HCWs to seek treatment in other facilities, so as to uphold the element of confidentiality. A study performed in Swaziland (Eswatini) expressed similar findings (Hendriks *et al.* 2018: 495). The above literature highlighted the growing stigma associated with HIV in South Africa. As such, consequences including a low incidence reporting rate may contribute to a delay or lack of PEP uptake in potentially infected individuals. In contrast with the findings of Rasweswe and Mmapheko (2020: 1) who described a low rate of incidence exposure reporting, Aigbodion *et al.* (2019: 958) established a substantially high rate of incident reporting amongst intern doctors, in four different hospitals of Gauteng. (83.5% vs 46%). Evidence from the extensive body of research analysed suggests a domino effect the trend of underreporting of incidents may have on the overall health of HCWs. Failure to report an accidental exposure inhibits the evaluation of the effectiveness of current preventative measures, consequently placing HCWs at an increased risk of acquiring infections, during their daily work activities.

2.10 PRACTICES OF HCWS IN RELATION TO BLOOD AND BODILY FLUID EXPOSURE

An estimated three to six billion injections are administered each year in India (Rehan *et al.* 2012: 177). Of three to six billion injections, two thirds involved unsafe practices (Arepogo *et al.* 2020: 53). HCWs may be considered particularly vulnerable to infection with blood borne pathogens (Kasatpibal *et al.* 2016: 39). A substandard approach adopted by HCWs following a BBF exposure places this cadre of employee at an increased risk of infection (Kasatpibal *et al.* 2016: 39). An array of factors governs the risk of transmission (Centre for Disease Control and Prevention 2013: 1).

Determinants such as degree of skin penetration, status of the source patient, level of bleeding, the immunity of the host and post exposure precautions- significantly influence the likelihood of spreading an infection arising from a BBF exposure (Centre for disease control and prevention 2013: 1). Ideally, in order to ensure effective and efficient management of health, post exposure, precautionary measures need to be observed. Such measures include proper washing of the infected area with soap and water, timely reporting of an incident to the relevant authorities in the health care facility, immediately, identification of the source patient and related individuals, who may require testing for HIV, HBV or HCV (Kasatpibal *et al.* 2016: 39). Additionally, upon informed consent, suspected individuals should undergo baseline HIV, HBV and HCV testing (Kasatpibal *et al.* 2016: 39). In the likely course of HIV exposure, HCWs are encouraged to receive PEP and antiretroviral prophylaxis within two hours after exposure (Centre for Disease Control and Prevention 2013: 1 and Russo *et al.* 2014: 37).

A cross-sectional study performed by Kasatpibal *et al.* (2016: 41) provided much relevant information on the practices of HCWs regarding BBF exposure in Thailand, between June 2011 and May 2012. Investigation into the behaviours of operating room nurses revealed unsuitable practices, improper reporting of incidents and an influence of BBF exposures on personal welfare- as primary issues arising from the study. Following subsequent exposure, only 39.1% of nurses filed a formal incident report to the appropriate IPC unit. By the same token, 60.9% of incidents were thus underreported. Underreporting of BBF exposure incidents appears to be an open problem in several countries and health professions. In conjunction with the findings reported by Kasatpibal *et al.* (2016: 41), a similar study performed in United Kingdom (UK) denoted findings that mirrored that established in Thailand (Au *et al.* 2008: 66). In the authors' analysis, 77% of surgeons did not report an NSI related incident (Au *et al.* 2008: 66). Interestingly, senior surgeons were found to report an incident statistically significantly less than their junior counterparts ($p < 0.001$). Occupationally related injuries are not unheard of in resource constrained countries (Rehan *et al.* 2012: 177). Approximately 40-75% of occupational injuries go unreported (Goel *et al.* 2017: 24). Approximately 16 billion injections are administered each year in emerging and transitional nations (Pandit and Choudhary 2008: 936).

In agreement with Kasatpibal *et al.* (2016: 41) and Au *et al.* (2008: 66), researchers Kessler *et al.* (2011: 2) and Azadi *et al.* (2011: 488) described similar results amongst health care students in USA and Iran. In USA, 33% and 83% of the study population failed to report sharp and mucocutaneous exposures, respectively (Kessler *et al.* (2011: 2). In Iran 63% of nursing staff underreported NSIs (Azadi *et al.* 2011: 488). However, Voide *et al.* (2012: 142) contended the findings described by the above authors, by providing evidence in a Swiss study that illustrated a rate of underreporting as low as 27% amongst HCWs. This surprisingly low rate of underreporting, in contrast with previously mentioned studies, may be substantially related to the impeccable initiative taken by Swiss health care institutes in increasing the awareness of HCWs, on appropriate measures to follow, post-exposure. Validating the previously mentioned sentiments of Zaidi *et al.* (2012: 209), it was evident that the cornerstone of successful health promotion amongst the Swiss health care facilities lay in appropriate training and education of HCWs on proper incident reporting procedures and avenues, provisions for a reporting hotline, a continuous health education programme and assistance in reporting of BBF exposures, thereby enabling adequate preventative measures and post-exposure management (Voide *et al.* 2012: 142). Reporting of incidents plays an integral role in the estimation of risk of exposure (Nagao *et al.* 2009: 541).

Lack of reporting further contributes to misconstrued rates of BBF exposures. Underreporting is accompanied by dire consequences such as ineffective prevention strategies and post-exposure management (Au *et al.* 2008: 66, Fullerton and Gibbons 2011: 33, Kessler *et al.* 2011: 2, Voide *et al.* 2012: 142 and Nagao *et al.* 2009: 541).

In the analysis by Kasatpibal *et al.* (2016: 41), a myriad of improper practices was observed amongst the HCWs under investigation. Incorrect behaviours such as delay in washing of the site of injury, the discharge of blood and fluid from broken skin, or the disinfecting of ruptured skin with antiseptic solution presents severe ramifications. Failure to immediately cleanse the site of injury may result in an increased likelihood of exposure to blood borne pathogens (Centre for Disease Control and Prevention 2013: 1). Complications such as hyperaemia and inflammation may arise from expressing blood or fluid from the wound (Centre for Disease Control and Prevention 2013: 1 and Russo *et al.* 2014: 37). Additionally, the use of concentrated agents such as bleach, iodine or alcohol should be avoided at all costs. Subsequent use of such chemicals may exacerbate tissue damage, which in turn increases the risk of transmission (Centre for Disease Control and Prevention 2013: 1 and Russo *et al.* 2014: 37). A study performed in north India depicted a statistically significant difference among practices between physicians and nurses (Goel *et al.* 2017: 23). In the findings outlined by Goel *et al.* (2017: 23) physicians (71.2%) were more likely noted to employ the correct safety measures of hand washing with soap and water, post-exposure, in comparison to nurses (48.3%) (p = 0.001).

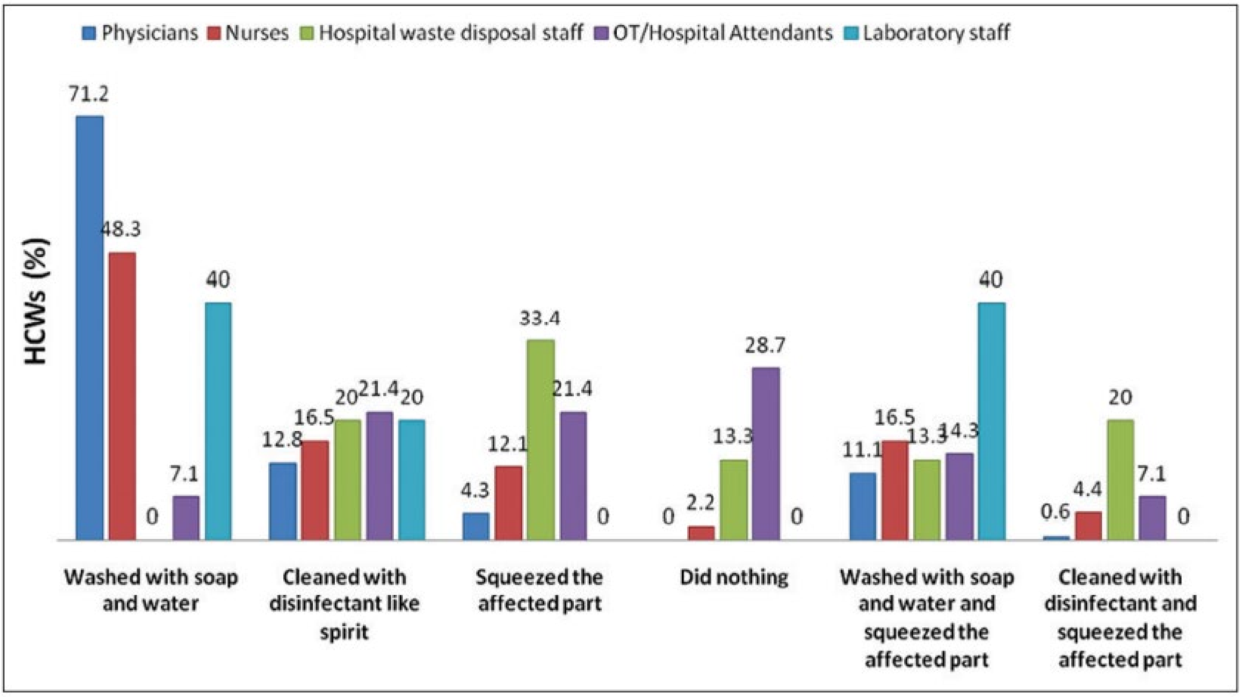

Figure 10: The immediate actions undertaken by health-care workers following an exposure (Goel *et al.* 2017: 23).

Despite the previously mentioned deterrence against the use of bleach and alcohol containing agents by the Centre for Disease Control and Prevention (2013: 10) and Russo et al. (2014: 37), the subjects involved in the study performed in north India were observed to disinfect the site injury with antiseptic solutions, such as hypochlorite and methylated spirits. Additionally, the findings of Goel *et al.* (2017: 23) were similar to that established by Kasatpibal *et al.* (2015: 42). In both North Indian and Thailand HCWs utilised antiseptic solution to disinfect a puncture wound, and were also found to express the wound. Such unsafe practices highlight the gap in knowledge of HCWs on the associated consequences of their careless behaviour (Goel *et al.* 2017: 23 and Kasatpibal *et al.* 2015: 42). Apart from improper management of an injury post-exposure, high risk activities, during which HCWs were susceptible to acquiring an NSI, included: needle recapping and disposal, post-use (Sharma *et al.* 2010: 5 and Muralidhar *et al.* 2010: 406). However, Goel *et al.* (2017: 23) disputed this notion by providing evidence that cited medical procedures (85%) as the most common cause of injury than recapping (11.3%) and sharp disposal (37%). Further contradicting the findings of Sharma *et al.* (2010: 5) and Muralidhar *et al.* (2010: 406), results similar to Goel *et al.* (2017: 23) were reported in Vellore and Goa with relatively low incidence of injury resulting from needle recapping and disposal (Jayanth *et al.* 2009: 45 and Salelkar *et al.* 2010: 18). The results indicated a high level of hazard awareness and safer methods of needle disposal practiced amongst HCWs at the All India Institute of Medical Sciences (AIIMS) in New Delhi disposal (Jayanth *et al.* 2009: 45 and Salelkar *et al.* 2010: 18). Proper hand hygiene such as hand washing is critical in inhibiting healthcare acquired infections (HCAIs) (Halboub *et al.* 2015: 18). These techniques may be regarded as the number one most effective method of prevention against occupationally related infections (Mutters *et al.* (2014: 18).

It is imperative that HCWs adhere to appropriate hand hygiene protocols as the hands serve as a reservoir for infectious agents (Mutters *et al.* 2014: 18). A significant proportion of HCWs (62.4%) in north India exhibited adequate hand washing practices. However, the same could not be said for HCWs involved in a Yemeni study, where proper hand washing post-exposure was only observed by 43% of the study population (Halboub *et al.* 2015: 18). Correspondingly, alike findings were denoted in studies initiated in UAE and Brazil (Rahman *et al.* 2013: 16 and De Souza *et al.* 2012: 282). Probable deviations in hand washing compliance between north India and Yemen and UAE may owe to differences in the years of experience and level of work (north Indian physicians presented with better hand washing compliance than students under study in Yemen and UAE). Proper hand hygiene was found to play an integral role in inhibiting HCAIs (Mutters *et al.* 2014: 18).

In addition to proper hand hygiene, another vital factor that rendered HCWs susceptible to infection was incorrect disposal of sharps immediately after use (Wu *et al.* 2016: 365). A study performed in China found that HCWs improperly disposed of sharps, however majority of the participants were found to employ appropriate protection measures, following an exposure. Although observed to employ relevant precautionary action, a high proportion of HCWs were still found to engage in high risk behaviour, such as the recapping of potentially infectious needles. Similarly, Singh *et al.* (2015: 2) denoted poor performance of HCWs in a Lahore Hospital in disposing of used sharps and associated equipment, that may give rise to transmission of BBI. Additionally, 20% of the nursing population under observation did not apply basic universal precautions such as the use of gloves during high risk practices (Singh *et al.* 2012: 2). On the contrary, a study performed in Iran greatly contradicted the findings described in the above literature (Rostamzadeh 2028: 2). Based on the findings of the Iranian study, relatively good practices with regards to HIV, HBV and HCV were observed amongst dentists. A satisfactory rate of PPE usage was observed among this category of HCW. This difference in findings may owe to dissimilarities in professions - dentists in the Iranian study presented with better practices than other levels of work (nurses, doctors, laboratory technicians and health technicians) (Wu *et al.* 2016: 365 and Singh *et al.* 2015: 2). However, further research should be explored, in order to better understand the relationship between categories of work and practices.

Knowledge, attitude and practice surveys are useful tools that assist in the formulation of health intervention strategies and public health policies (Abdela *et al.* 2016: 4). There is currently a dearth of evidence pertaining to the relationship between knowledge and practices and occupational exposure to BBF amongst HCWs in African countries (Abdela *et al.* 2016: 4). A study performed in northwest Ethiopia amongst medical and health science students not only uncovered unsafe practices among the study population, but also identified a degree of negligence toward the prevention of HBV. Despite the advocacy of the World Health Organisation (WHO) (2015) for all HCWs in highly endemic countries to be vaccinated against HBV, the study performed by Abdela *et al.* (2016: 4) presented the lowest vaccination acceptance rate (2%) by participants in comparison to several alike studies performed in Vientiane, Laos and Cameroon (Pathoumthonga *et al.* 2014: 4995 and Noubiap *et al.* 2013; 148). The malpractice of HCWs to the prevention of BBIs was similarly observed in a health district in Cameroon (Aminde *et al.* 2015: 7). Despite the alarming rate of occupational exposure to BBF, only 18.9% of the study population had received PEP (Aminde *et al.* 2015: 7). Although low, this rate of PEP uptake was marginally higher than that observed at an Abhuja Teaching Hospital (6% vs. 18.9%) (Owolabi *et al.* 2012: 181). The modest uptake of PEP in the Cameroonian study was consistent with findings reported in Uganda and Kenya (Alenyo *et al.* 2009: 101 and Taegtmeyer *et al.* 2008: 307). In contrast with the above literature, Mashoto *et al.* (2013: 4) described satisfactory practice of HCWs in regulating workplace exposure to HIV (68.8% of HCWs presented with good practices) in two regional hospitals of Tanzania.

	Tumbi hospital (%)	Dodoma hospital (%)	All (%)
Occupational injury			
Needle stick (used needle)	64 (37.4)*	41 (17.8)	105 (26.2)
Blood stained sharp objects	64 (37.4)*	37 (16.1)	101 (25.2)
Blood or body fluid splash	81 (47.4)*	73 (31.7)	154 (38.4)
Blood or body fluid contact with ulcerated or abraded skin	63 (36.8)*	38 (16.5)	101 (25.2)
Human bite	45 (26.3)*	21 (9.1)	66 (16.5)
At least one occupational injury	98 (57.3)*	94 (40.9)	192 (47.9)
Managing occupational exposure			
Good practice	118 (69.0)	158 (68.7)	276 (68.8)

*p < 0.001.

Figure 11: The management and types of occupational exposure to HIV in the past 12 months by hospital (Mashoto *et al.* 2013: 4).

Additionally, a statistically significant association was established between the following factors of study: sex, age, awareness on avenues of communication in the event of an occupational exposure as well as risk of transmission, and adequately managing an occupational exposure to HIV (Mashoto *et al.* 2013: 4). These results remained relatively consistent in the wake of stratifying review by hospital. This study emphasised the influence of routine health education and provision of training in strengthening HCW practices in effectively managing exposure to HIV in a work environment. According to Mbaisi *et al.* (2013: 4) procedures that presented a significant risk factor for percutaneous exposures amongst Kenyan HCWs include: stitching (29.7%) and blood specimen collection (19%). Correspondingly, Cervini *et al.* (2005: 419) deduced stitching as the greatest source of injury amongst doctors. Additionally, procedures found to expedite incidence were the manipulation of needles (34%), movement of patients (20%), needle recapping (3.4%) and the inappropriate collection and disposal of sharps (3%). Comparatively, these findings were reported by the CDC (2020) where manipulation of needles and needle recapping promoted 26% and 6% of injuries respectively. Consistent use of PPE (gloves, goggles, masks and gowns) may prevent the unnecessary exposure of skin and mucous membranes to BBF (Mbaisi *et al.* 2013: 4). Findings of the Kenyan study indicated that 98% of HCWs utilised PPE at the time of an exposure, with 9% and 11% of HCWs wearing double gloves and masks, respectively. However, at the time of a splash exposure, during the performance of a procedure, PPE such as eye and face shields were not used.

In Conjunction with previously mentioned studies carried out in Thailand, UK, USA and Iran, reporting of exposures in Kenya also appeared to be a significant hurdle in the fight against occupational exposure to BBF, with 45% of HCWs failing to report an occurrence of injury (Kasatpibal *et al.* 2016: 39, Au *et al.* 2008: 66, Kessler *et al.* 2011: 2 and Azadi *et al.* 2011: 488). Failure to report an exposure is a critical barrier to injured HCWs seeking out the relevant preventative measures post-exposure. Reportedly, lack of reporting owed to an array of factors such as perception of risk as low, misjudgement of the infection status of the source patient, lack of time and absence of reporting protocol and the stigma associated with infection (Mbaisi *et al.* 2013: 4).

Research has indicated that attitude and practices are influence by several factors including societal norms, belief and culture (Yang *et al.* 2015: 103). According to Yang *et al.* (2015: 103) HCWs are not unbeknown to the importance of glove use during procedures such as drawing of blood. However, some HCWs do not practice glove use during high risk activities due in part to circumstances such as high HCW to patient ratio, which in turn results in a busy work schedule. Additionally, poor culture in certain health institutions does not govern the use of PPE such as gloves. As such, proper preventative practices may not be initiated, regardless of knowledge possessed by HCWs. Furthermore, familiarity in the work environment and comfort in performing tasks may be linked to diligence of HCWs in practicing their job safely. The positive association depicted between knowledge and attitude, knowledge and practice and attitude and practice in the research performed by Yang *et al.* (2015: 103) further validates the influence of KAP on infection control practices. These results were consistent with previous literature; however, such literature lacked the perspective from the target population ((Haq *et al.* 2012: 692 and Singh and Purohit 2010: 6). However, the results established in Kenya provided pertinent evidence exhibiting the interconnected relationship between all aspects of KAP. Adequate knowledge gives rise to a favourable attitude, which in turn paves the way for positive practices in HCWs.

Data illustrating the occupational exposure of nurses to HIV, in South Africa is few and far between (Kabotho and Chivese 2020: 9). A cross-sectional study performed in Western Cape South Africa revealed that only 58.2% of the respondents who had experienced an occupational exposure had reported the incident and sought out appropriate care (see figure 1) (Kabotho and Chivese 2020: 9). Despite favourable behaviour towards reporting of incidents and seeking treatment, only 60% of those who sought treatment completed the course, as such a dropout rate of 40% was observed (Kabotho and Chivese 2020: 9). The discontinuation of treatment reportedly owed to the adverse side-effects experienced by HCWs on the medication, as well as the HCWs perceiving treatment as enough, before the course could be fully completed (Kabotho and Chivese 2020: 9). These findings corroborate those illustrated in a 2016 Botswana study, where less than three quarters of 69% of participants completed treatment (Awoke *et al.* 2018: 48). In support of the findings by Kabotho and Chivese (2020: 2), Awoke *et al.* (2018: 48) found that a portion of participants alike, discontinued treatment, due to its associated side effects. However, despite inconsistent utilisation of PEP, majority of the study population (94.97%) successfully made use of PPE when expected to encounter a BBF exposure (Kabotho and Chivese 2020: 9). A significant proportion of respondents reportedly discard use sharps in the relevant container, with 76.47% of participants claiming to never recap a needle (Kabotho and Chivese 2020: 9). Only 60.78% of participants reportedly sealed the sharps disposal container when it has reached the required capacity mark as required by the FDA (2018) and NHS (2019: 6).

Approximately 83% of the study population presented with adequate infection-control practices, with only 3% displaying "poor" IPC. Interestingly, (Kabotho and Chivese 2020: 2) failed to establish a statistically significant association between occupational exposure to HIV and infection-control practice scores. The study revealed that one out of nine nurses employed within the study site at Western Cape had experienced an occupational exposure, with NSIs responsible for approximately two thirds of exposure. The trend of exposure within the Western Cape study mirrored those described in a 2015 Tanzanian study and 2011 Nigerian study, where NSIs accounted for 62.9% and 63.6% of injuries, respectively. In conjunction with the findings of the South African study, a study performed in Southeast Ethiopia revealed a report rate of 59% (versus Western Cape 58.82%) (Bekele *et al.* 2015: 3). Researchers Bekele *et al.* (2015: 3) proposed that factors such as lack of time, sharps by which an incident was caused was not contaminated by an infected patient, and lack of sufficient knowledge on reporting as probable elements that inhibited the reporting of injuries. The lack of reporting is accompanied by grave consequences. Exposures that go underreported may inevitably result in the emergence of new HIV-related cases – as lack of reporting may impede HCWs receipt of PEP (Kabotho and Chivese 2020: 9). The analysis by Kabotho and Chivese (2020: 9) provided much incite on the practices of HCWs relating to reporting and optimisation (or lack thereof) of HIV treatment provided by the health facility. Default in treatment transcends type of infection. In Gauteng a mere 19.9% of 29.5% of respondents who had been vaccinated had completed all three doses of HBV vaccination (Burnett *et al.* 2011: 4293). This finding was lower than those established in similar studies performed globally (Dannetun *et al.* 2006: 202, Mengal *et al*. 2008: 46 and Hatipoglu 2007: 200). In Sweden, Pakistan and Turkey, 38.7%, 37.2% and 55.8% of the study population had completed all three doses, respectively (Dannetun *et al.* 2006: 202, Mengal et al 2008: 48 and Hatipoglu 2007: 200). However, the study experienced several shortcomings- the most prominent being that nurses and doctors were primarily surveyed – with doctors comprising only 9.7% (70/725) of the study population. As such allied HCWs at an increased risk of exposure such as: laboratory personnel were not included in the study. Therefore, the results of the study cannot be generalised to all HCWs in

Gauteng. This highlights the need for additional all-inclusive research to be conducted in the domain, such that data may be extrapolated to all HCWs who may come into contact with BBF during their work shift. A plethora of research conducted in South Africa focused on preventative practices (such as the use of PEP and HBV vaccination coverage) and reporting or under reporting practices of HCWs. However, few to none reported on associated high-risk practices that increase the risk of exposure of HCWs to BBF during a normal work shift (Elabor *et al.* 2020: 1, Kabotho and Chivese 2020: 5, Burnett *et al.* 2011: 4295 and Sondlane *et al.* 2016: 3858). A more systematic and theoretical analysis is required to determine practices of HCWs that render them vulnerable to BBF exposure.

2.11 FACTORS AFFECTING INFECTION PREVENTION AND CONTROL

The cost of HCAIs in all National Health Service (NHS) hospitals of England was estimated at £2.7 billion in 2016/2017 (Guest *et al.* 2019: 6). Despite the significant role that universal precautions play in the spread of blood borne pathogens, these guidelines are not fully appreciated nor are they appropriately effectuated by HCWs (Vaz *et al.* 2010: 171). A document published in 1983 by the United States Centre for Disease Control and Prevention (CDC) advised on appropriate precautionary measures to be adopted when handling the BBF of a suspected or confirmed case of blood borne infection (Thacker and Berkelman 1988: 164). Additionally, the CDC advocated for caution to be ceaselessly exercised by HCWs when treating or managing a patient, in spite of the patients' infection status. The practice of precautionary measures when handling BBF regardless of the patient infection status is known as the "universal blood and body fluid precautions" or simply, "universal precautions" (McCarthy 2000: 556 and Thacker and Berkelman 1988: 164). These interventional strategies are aimed primarily at the prevention of occupationally acquired HIV, HBV and HCV in HCWs performing health care services (Vaz *et al.* 2010: 171). As of 1996, the CDC adopted the current universal precautions into a more preventive notion, now known as the "standard precautions" (Garner 1996: 53). The standard precautions are different to the universal precautions in that, the standard precautions extend to every patient seeking care in a health care setting, regardless of infection status (Vaz *et al.* 2010: 171). The practice of standard precautions is imperative, particularly during the use of potentially infected devices and tools, during procedures that may present a risk of contact with contaminants such as blood, bodily fluids, excretions (excluding sweat), secretions, broken or non-intact skin and mucocutaneous tissue (Garner 1996: 53). The standard precautions explicitly outline the following preventative techniques: washing of hands with soap, use of PPE such as gloves, masks, gowns and caps, practising caution when using tools, appropriate disposal of potentially contaminated or used sharp devices and needles and suitable accommodation of infectious patients as a source of transmission (Garner 1996: 53). A study performed in India revealed a generally favourable level of knowledge and awareness regarding infection control practices amongst HCWs employed in a tertiary care hospital (Wadhwa *et al.* 2013: 1387). In the abovementioned study, 40% of HCWs had an 80% positive response rate, with regards to questions pertinent to infection control. A review of past literature has indicated variation in the knowledge of HCWs regarding IPC (Paudyal *et al.* 2008: 597 and Darawad and Al-Hussami 2013: 582). According to Paudyal *et al.* (2008: 597) only 16% of HCWs in Nepal possessed adequate knowledge on infection control. However, in contrast with the findings described by Paudyal *et al.* (2008: 597), Darawad and Al-Hussami (2013: 582) found that almost 50% of HCWs (49.6%) in Jordan had sufficient knowledge pertaining to infection control. Contrastingly, 75.5% of nurses in a tertiary care hospital in India displayed infection control knowledge (Darawad and Al-Hussami 2013: 582). Additionally, nurses in supervisory positions were more likely to adhere to infection control practices (Wadhwa *et al.* 2013: 1387). These findings were consistent with those described in a related study performed in India (Suchitra and Lakshmi Devi 2007: 184).

An array of material presently exists to safely guide HCWs during the performance of their duties. However, the need for further education and training remains (Wadhwa *et al.* 2013: 1387). Several studies have indicated poor training of HCWs on IPC policies. (Fashafsheh *et al.* 2015: 79 and Gasaba *et al.* 2020: 4). As such, health institutions shall benefit from routine appraisal of policies pertaining to education and training on IPC. This system will ensure that all staff have received adequate training, and high-risk staff are made aware of continually updated preventative strategies and precautionary measures. In agreement with Fashafsheh *et al.* (2015: 79) and Gasaba *et al.* (2020: 4) a study performed amongst Iranian nurses highlighted the need for constant reviews and revision of HCWs guidelines, (Geravandi *et al.* 2011: 85). A study performed in Yemen found that despite a 96.6% use of gloves amongst the study population, results which coincided with related studies performed in UAE and Iran, (Rahman *et al.* 2013: 16 and Azadi *et al.* 2011: 488) the consistency of use of other protective barriers such as protective eyewear and face masks was inadequate. (Halboub *et al.* 2015: 18). This unsatisfactory use of face masks and protective eyewear may bring to surface the lack of awareness of the study population in additional routes of transmission of blood borne infections such as blood splashes and aerosols. (Halboub *et al.* 2015: 18). The above literature revealed overall poor compliance of HCWs to IPC practices in health care institutions. Therefore, continuous training and education programmes and workshops are the cornerstone of improving the infection control and prevention capabilities, of HCWs, at all levels.

According to (Tenna *et al.* 2013: 4) authoritative physicians and nurses in a leadership position should serve as pioneers for infection control practices. A study performed in Addis Ababa, Ethiopia found that a mere 30% of HCWs stated that individuals in an authoritative position, place emphasis on the importance of IPC practices ((Tenna *et al.* 2013: 4). With this in mind, a change in culture of supervision should be established, with prominence placed on increasing IPC responsibility and leadership amongst HCWs, which is the bedrock for a successful IPC programme. (Edwards 2012: 10).

HIV creates the greatest discomposure amongst HCWs. However, unbeknownst to this cadre of professionals, hepatitis C presents the most severe risk (Wallis *et al.* 2007: 276). Researchers Henderson *et al.* (2010: 213) believed that upon confirmation of infection with a BBI in South Africa, the medical fraternity should offer immediate support to the infected HCWs. Such support may be offered by experts in the field or specialist review panels in the facility or department. This way designated specialists may provide support and assistance to infected professionals. This in turn may contribute to the mitigation of risk of spread, and disease progression- by imparting knowledge on suitable treatment and infection control and prevention practices. Several countries throughout the globe have established prevention, control and management guidelines, strategies, and protocols to successfully combat the transmission of blood borne viruses, amongst HCWs (Rossouw 2014: 732). Regrettably however, discrepancy in the burden of disease, work practices and health management resources create a complex situation for South Africa, in adopting international guidelines (Rossouw 2014: 732). Health care facilities are plagued by several challenges arising from the HIV/AIDS pandemic (United Nations AIDS Special

Analysis (2016: 1). As such, WHO Guidelines (2013) along with the South African National Department of Health (2016) have developed standard precautions which consist of standardised procedures, strategies, and interventions to be implemented, ensuring the protection against and prevention of BBF exposure in a health care setting. These guidelines urge HCWs to make use of resources provided for protection and treatment recommended through HIV PEP, in the case of accidental exposures. According to Moorhouse (2015: 2) post-exposure prophylaxis measures to prevent HIV infection in the South African health care setting do exist and would ideally include the following intervention mechanisms: HIV counselling, the administration of first aid measures, risk assessment, investigation of blood samples of exposed individuals and sources as well as the supply of antiretroviral treatment within 2-72 hours of exposure, over a period of 28 days. A study performed by Kabotho and Chivese (2020: 9) in the Western Cape province of South Africa recorded unsafe practices exhibited by HCWs. HCWs involved in the study reported high-risk behaviour such as the manual removal of sharps or forceful compaction of bin lids in order to close the overfilled container. These questionable actions of HCWs further emphasised the gap in knowledge and awareness of HCWs on IPC practices, thereby suggesting the need for more vigorous infection control training amongst HCWs in South Africa.

2. 12 CONCLUSION

The etiology of BBIs in South Africa is thought to be multifactorial. However, as evidence supports, congruity between health cognizance and behaviour is key in fostering successful health promotion and disease prevention in HCWs. Blood and bodily fluid exposure are ubiquitous in the health care setting. The risk presented by an occupational exposure not only compromises the wellbeing of health professionals, but also jeopardizes the integrity of care delivered to patients, thus endangering their overall state of health. As such critical policy implications are perpetuated, giving rise to deep-seated ethical challenges. Health care workers hailing from resource constrained regions of the globe, more specifically, Africa, and South Africa, are at risk of an occupational exposure owing to the prevailing high rate of BBI such as HIV, HBV and HCV in relation to the developed world. Ground-breaking progress needs to be effectuated in order to safeguard the health and safety of vulnerable professions in health institutions, due in part to poor IPC practices, and the existing burden of infectious diseases, in South Africa. Provisions need to be made to guide and inform procedures for prevention and control of potential infections arising in the work environment. Hospital management needs to be provided with data to address the knowledge and attitude shortfalls in relation to HCWs behaviour and practices, when working with BBF, in hopes of reducing the rate of BBF exposures, and its associated public health burden. Active awareness of hospital management on the shortfalls in IPC from the perspective of the HCWs, will enable management to implement pivotal intervention strategies to combat this affliction. The following chapter (chapter three) explores the research methodology employed in the execution of this study.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 STUDY DESIGN

Quantitative research is concerned with the optimisation of statistical, numerical and mathematical data in order to systematically explicate epidemiological findings (Watson 2015:1). As such, it can be deduced that this type of research entails the quantification of data, and theorises that the variables under study can be measured. Through measurement and analysis of the phenomena under study, syllogistic conclusions can be inferred (Watson 2015: 1). Quantitative research has been applied in an array of research domains including: biology, geology, physics, natural and social sciences (Sukamason 2000: 1). According to Watson (2015: 1) quantitative research is focused on social phenomena, and makes use of experiential methodologies and assertions. Quantitative study designs are further categorised into two sub-groups, namely: descriptive and analytical research or alternatively, observational and interventional research (Rezigalla 2020: 1).

3.2 CROSS-SECTIONAL STUDY DESIGN

A cross-sectional study is best applied when the researcher is required to describe associations between exposures and outcomes, at one point in time (Rezigalla 2020: 1). The selection of participants in a cross-sectional study is based on a predetermined inclusion and exclusion criteria, unlike cohort or case-control studies. An institutional based, observational-descriptive cross-sectional study with a quantitative approach was conducted in order to determine the association between the knowledge and attitudes of HCWs and behavioral risks for occupational exposure as well as the perceptions of HCWs on the barriers to IPC in a public hospital of KwaZulu-Natal.

3.2.1. ADVANTAGES OF CROSS-SECTIONAL STUDY DESIGN

Several strengths are associated with the application of a cross-sectional study. Apart from their feasibility, these types of studies provide the researcher with much relevant information pertaining to the prevalence of outcomes and exposures and include the following (Watson 2015:1):

- Cross-sectional studies pave the way for cohort studies by informing the study on outcomes and exposures.
- Additionally, these type of studies provide direction in the design of surveillance systems and assessment of public health outcomes.
- Furthermore, multiple exposures and outcomes can be analysed in cross-sectional studies.

3.2.2 DISADVANTAGES OF CROSS-SECTIONAL STUDY DESIGN

Despite the strength of cross-sectional studies, such studies are still prone to certain constraints. These include the following according to Carneiro and Howard (2011: 1):

- The concurrent evaluation of outcome and exposure inhibits the investigation of temporal associations between the two variables.
- Rare diseases cannot be studied effectively.
- Incidence cannot be estimated.

3.3 RESEARCH PARADIGM

According to Kuhn (1970: 175) a research paradigm is a covenant amongst the scientific community, and refers to a set of shared values, beliefs and assumptions relating to the nature in which research should be approached. In quantitative methodologies, objective measurements are given prominence as well as statistical, numerical, and mathematical quantification and interpretation of data cumulated via questionnaires, polls, surveys, or through exploiting precedent statistical data, by employing algorithmic procedures (Babbie 2010: 2). Quantitative research is defined by the collection of numeric data which can be extrapolated to the general population (Brians 2011: 14). The overall objective of quantitative research is to stratify and quantify attributes and fabricate statistical models in an endeavour to illustrate what was observed (Brians 2011: 14). Quantitative research designs are either descriptive or experimental (Babbie 2010: 2). For the purpose of this study, a descriptive research design was utilised. This descriptive study established an association between variables, as opposed to establishing a causal relationship, as expressed in an experimental research design. This research study gathered data using a structured research instrument- a predetermined questionnaire. Results of the study were based on a relatively large sample size that was representative of the general population under study. Given the reliability of the study, the research study may be reproduced. The research topic for the study was clearly delineated, to which distinct objectives were sought. Prior to data collection, all aspects of the study had been carefully outlined in the research proposal. Upon completion of data collection, data was coded and entered onto an MS Excel spreadsheet and analyzed using SPSS version 26.0 (2018). Univariate analysis of continuous variables was summarized using means, median, mode and standard deviation and univariate analysis of discrete data was carried out with data expressed in the form of frequency tables, graphs, means and standard deviations. Bivariate analysis using correlation and regression were performed. Results of the study may generalise concepts more extensively and predict results in the future.

3.4 STUDY SITE

According to the eThekwini District Health Plan 2015/16 (2016) district hospitals are situated at a lengthy geographic distance from each other. Apart from being at a relative distance from one another, district hospitals are scarce in number in comparison to the populous communities in need of health services. The eThekwini District Health Plan 2015/16 (2016) described Osindisweni Hospital as a prime example of a public sector facility that is tasked with serving a geographically dispersed populace, in the far North. Statistics presented by eThekwini District Health Plan 2015/16 (2016) cited the Greater Inanda/Tongaat sub district as the most highly populated sub district, with 18% (614 568) of the district residing within this community (See figure 2). A single district hospital was noted to serve this region, Osindisweni Hospital. According to eThekwini District Health Plan 2015/16 (2016) the Greater Inanda/Tongaat region has the second lowest ratio of clinics to population, behind the Outer West sub district, with a ratio of 0.22 clinics per 10 000 populations. It can therefore be deduced that the single district hospital may be in a situation of severe strain, as high reliance may be placed on these public sector services, offered by Osindisweni Hospital.

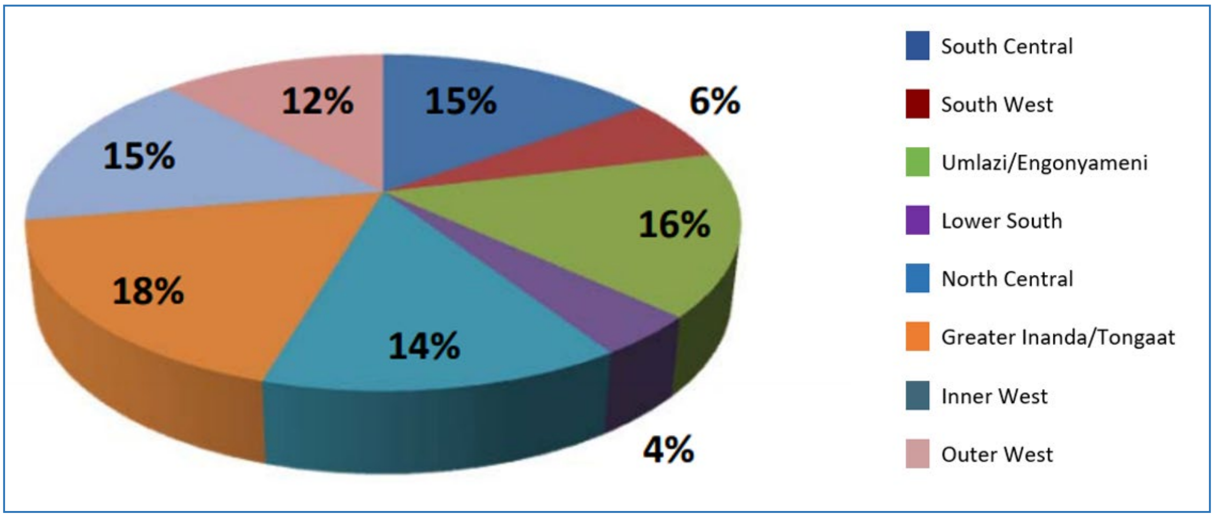

Figure 12: Pie chart showing the population distribution per Sub-District of eThekwini (eThekwini District Health Plan 2015/16: 2016).

The study site was based at a district hospital on the North Coast of KwaZulu-Natal. The research site is responsible for rendering health care services to communities surrounding the North Coast area, namely: Osindisweni, Hazelmere, Ndwedwe, Waterloo, Tongaat, Verulam and Amaoti. The district hospital is situated at an approximate distance of 10km inland from a town named, Verulam. Verulam is located within the north of the eThekwini Municipality. The surrounding city, Verulam consists of a population of 37 273. Majority of the public lay between the working-age population of 15-64 years (73.1%). Additionally, the medical sector contributes to 3.6% of jobs in contribution to the GDP inward in the area (IYER 2010: 22). Despite a decrease in HIV prevalence within the district, as reported by the eThekwini District Health Plan 2015/16 (2016), high prevalence rates were noted in the sub-district, Greater Inanda/Tongaat (Verulam and Tongaat). In light of this evidence, it can be assumed that HCWs may in turn be at an exceptional risk of exposure, arising from possibly managing or treating potentially infected patients, emerging from the surrounding region, to which the district hospital provides health services.

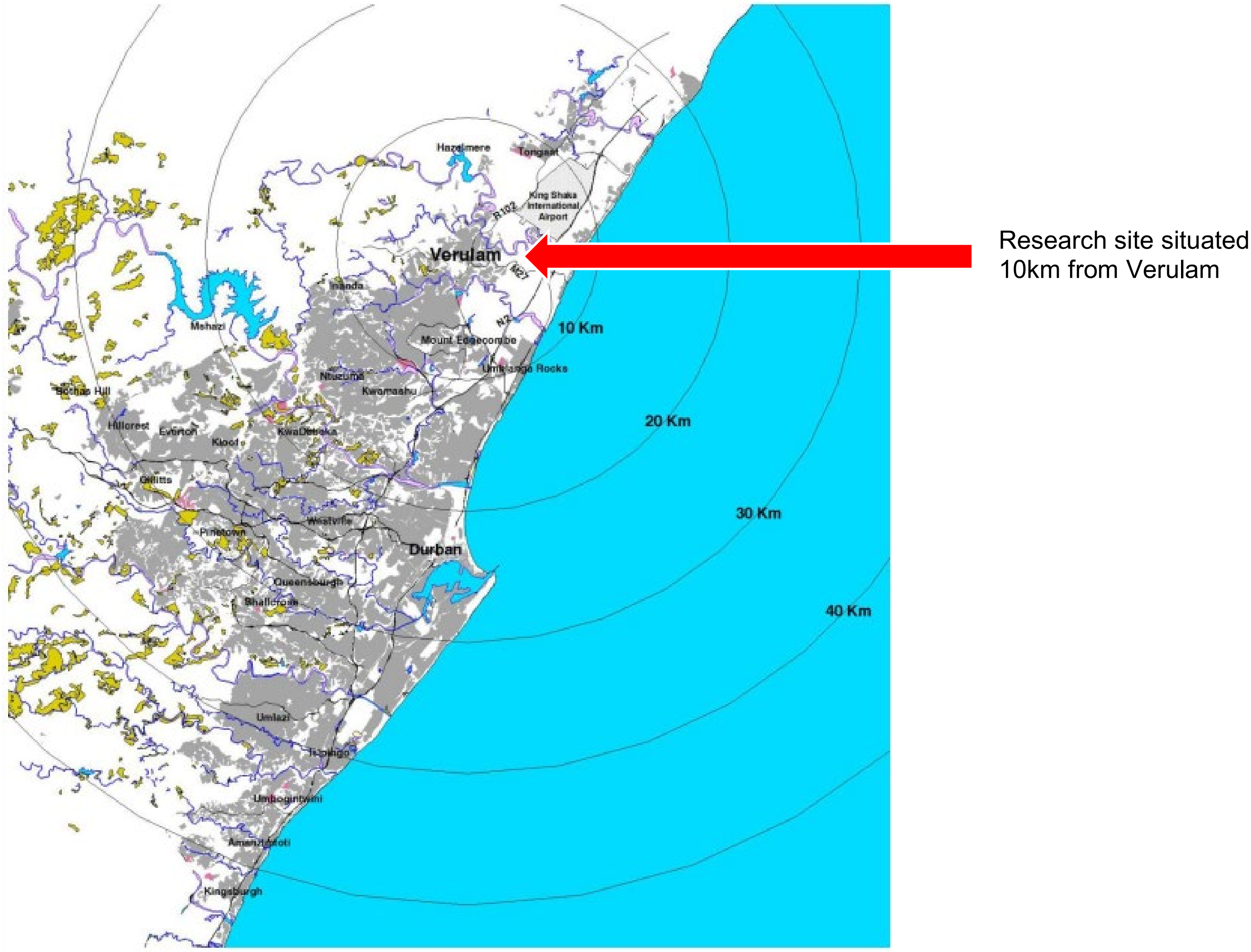

Figure 13: The map depicting an aerial view of eThekwini as well as the nearest neighbouring town to the research site, Verulam (IYER 2010).

This nearest town of Osindisweni Hospital constitutes a large population of black South Africans (98.8%). Prior research suggests a higher chronic carriage of HBV amongst black South Africans, as compared to individuals of associated ethnicity (Burnett *et al.* 2011: 4293). Additionally, a study performed by Kew (1996: 6) revealed a higher HBsAg (Hepatitis B surface antigen) chronic carriage amongst rural black populations (15.5% in a rural region of Eastern Cape) in relation to urban black populations in Soweto, Gauteng (1.3%).

3.5 STUDY POPULATION

The target population for this study includes all HCWs (nurses, nursing assistants, medical officers (doctors), community service doctors, laboratory personnel (laboratory technologists and technicians) and mortuary attendants employed within a working capacity at Osindisweni Hospital.

The study sample for this research project included all HCWs mentioned above who regularly treat or attend to alive or deceased patients and are therefore in constant contact with the patients, or who may potentially be exposed to blood or bodily fluids while obtaining, attending to or handling samples of patients' blood or bodily fluid, or who met the inclusion criteria allocated to the study. A random group of the above mentioned HCWs, in general was selected to participate in the study as the study was designed to evaluate the knowledge, attitudes and practices of all HCWs regarding occupational exposure to BBF in a public hospital, KwaZulu-Natal. The study is not specifically focussed on specific groups of HCWs, but HCWs in general, regardless of the category they may belong to.

Participants aged 18 – 64 years of age, regardless of gender were recruited into the study. This particular age group was selected in order to determine whether specific variables such as age and experience are associated with the occupational exposure to BBF and the association between the knowledge and attitudes of HCWs and behavioral risks for occupational exposure and the perceptions of HCWs on the barriers to infection control and prevention.

3.6 ELIGIBILITY CRITERIA

3.6.1 INCLUSION CRITERIA

- All permanent HCWs (physicians (doctors, resident doctors, and interns), registered nurses, nursing assistants, nursing students, health officers, laboratory technicians and technologists and mortuary attendants) employed within a working capacity at Osindisweni Hospital for twelve months or longer.
- HCWs at increased risk of exposure to BBF whilst performing their duties were eligible for participation in this study.

- All HCWs within the facility, who provide care or management of patients and have direct involvement in patient care or management, were eligible to participate in the study.
- Participants must be 18 years and older.

3.6.2 EXCLUSION CRITERIA

- HCWs not willing to participate in the study voluntarily or display reluctance.
- HCWs that are not permanent staff of Osindisweni Hospital.
- Individuals who are not in direct contact or management of patients.
- HCWs on annual, sick, study or maternity leave during the period of data collection and individuals performing general administrative tasks.

3.7 SAMPLE SIZE

This study utilised a simple-random sampling of all HCWs (nurses, nursing assistants, medical officers (doctors), community service doctors, laboratory personnel (laboratory technologists and technicians) and mortuary attendants employed within a working capacity at Osindisweni Hospital who were willing and eligible to participate in the study at Osindisweni Hospital. The total number of HCWs is 199 and the minimum sample size was calculated at 166 by a statistician, in which the margin of error was set at 5%. A total of 180 HCWs were randomly sampled at the hospital, from a total population size of 199. The table below depicts the sample size that is proportional to each category of HCW to be included in the study.

Table 1: The sample size proportional to the category of HCWs.

Category of Health Care Worker	Total Number	Required Sample Size
Nurses	116	90
Nursing Assistants	58	51
Medical Officers (Doctors)	12	12
Community Service Doctors	5	5
Laboratory Personnel	5	5
Mortuary Attendants	3	3
TOTAL	**199**	**166**

3.8 SAMPLING STRATEGY

Prior to the commencement of sampling, permission from all relevant stakeholders (Department of Health and Hospital Management) was solicited in order to execute the study at the desired study site. This study utilised a simple-random sampling technique that was employed in order to ensure that a fair representation of all HCWs in all the different departments were included in the study. The sampling framework was prepared upon receipt of a list of HCWs currently employed within Osindisweni Hospital, as obtained from the Public Relations Officer at the Department of Health. The recruitment process began with a meeting held with the CEO or an Advisory Board of the hospital. A meeting was arranged to formally introduce the study and request permission to approach their employees to initiate the recruitment of HCWs into the study. Additionally, the Public Relations Officer was convened to inform the most effective recruitment approach. Additionally, once permission had been granted by the CEO of the institution, the unit manager of each department in the hospital was approached, to kindly assist in recruiting HCWs via an email containing the proposed flyer that was physically and virtually distributed to the hospital staff. Prior to administering the questionnaire, a debriefing process was conducted in easily accessible staff common areas. The participants were given a basic, concise and informative explanation regarding the rationale and benefits of the study and the methods used. Participants were afforded the opportunity to ask questions regarding the study. A brief explanation on what the study set out to achieve was carried out as well as the benefits of the study to the concerned officials. Participants were given sufficient time for consultation between the recruitment and the point of decision making and were not required to make an immediate decision.

3.9 VARIABLES OF STUDY

3.9.1 DEPENDENT VARIABLE

- Blood and Bodily Fluid Exposure

3.9.2 INDEPENDENT VARIABLES

- Sociodemographic (sex, age, profession/job category, educational level, year of service).

- HCWs occupational exposure determinants (what were they exposed to, how many times in past year)
- Knowledge
- Attitude
- Behavior/practices
- Type of exposure (needle stick, laceration, splash- if so what and where).
- IPC (perceptions, presence of infection prevention committee, availability of infection prevention guidelines/legislation, training on ICP).

3.10 DATA COLLECTION

3.10.1 RESEARCH TECHNIQUE: STANDARDISED QUESTIONNAIRE (DATA COLLECTION INSTRUMENT)

The questionnaire serves as the primary mode of data collection in a research study. A questionnaire is comprised of methodical questions pertinent to the objectives of the study- this compendium of questions may be referred to as 'items' (Trobia 2008: 2). These items, as such, are systematically arranged in order to optimally gather data on a topic of interest (Trobia 2008: 2). So as to ensure the validity and reliability of the data collection instrument, it is often administered in a standardised manner, in order to ensure comparable responses between all the participants involved in the study. When a questionnaire is engineered, four major elements must be taken into consideration. First and foremost, a plethora of theoretical knowledge pertaining to the research topic must be acquired. This may be achieved by means of an intense review of relevant literature, or through the accumulation of anecdotal evidence. Secondly, validity, reliability and internal consistency of the instrument must be upheld. Thirdly, the construction of a good questionnaire requires experience in questionnaire development or alternatively, a reliable repository of previously reviewed and published questionnaires (Trobia 2008: 2). Fourthly, a reliable questionnaire is one that is befitting to the population under study. In this study, the researcher employed the use of a standardised questionnaire (Appendix A) in order to gather data pertaining to the KAP of the HCWs on BBF in Osindisweni Hospital.

During the present study, the questionnaires were distributed directly to the sample population. According to NHS (2020) the response rate arising out of manually dispersing the questionnaire to the population of the study is expected to be for greater than the response rate that may be achieved through a postal survey.

However, despite surplus benefits the use of a standardised questionnaire might yield, there may be certain drawbacks associated with this method of data collection. For instance, in the study that was executed by the researcher, a consequential disadvantage that was anticipated from the application of the questionnaire was the inclusion of a portion of retrospective survey questions, which inevitably introduced a recall bias. According to Le Morte (2020) a recall bias takes precedent when there are fastidious variances in the study subjects recollecting or disclosing their own past experiences, exposures or outcomes. The potential reporting bias presented through the use of a self-administered questionnaire was another limitation that was rightfully expected via the use of this mode of data collection. Reservations on the accuracy of the surveys are unavoidable and ascertaining whether the response truly reflect the participants' actions was arduous at best (Parma guinea it out 2010 six) see global. However, in order to ensure that the survey questions were answered, as far as reasonably possible, without prejudice, certain remedial measures were focused on by the researcher, during the construction phase of the questionnaire.

In order to reduce the likelihood of a recall biased, the researcher took the initiative to ensure that each and every question included in the study was carefully devised, thereby ensuring unambiguity and thus promoting accuracy and completeness of the questionnaire. Similarly, with the intention of minimising the likelihood of a reporting bias, the use of a self-administered questionnaire, as opposed to one-on-one interviews was expected to reduce the prejudice that these questions that may be considered socially sensitive may pose.

3.10.2 DATA COLLECTION METHOD

The process of data collection began via the distribution of questionnaires to all participants eligible for participation in the study, and whom voluntarily agreed to take part in the study upon informed consent. In addition to the instructions delineated on the cover page of the data collection tool, the researcher proceeded to further explain what was expected to each individual who expressed interest in completing a questionnaire. The researcher was present during all data collection processes. Upon receipt of 'finished' questionnaires, by the researcher, room for incompleteness was eliminated, as the researcher verified completeness and consistency, by manually checking each and every questionnaire, as recovered, for completion, clarity and accuracy of data. Those questionnaires that were revealed to be incomplete were immediately returned to the respondent, for completion. Questionnaires belonging to participants who were unavailable to finish were immediately excluded from the study.

The questionnaire used to gather data for the study was sub-divided into five parts, categorised into fourteen sections, comprised of one hundred items, and consisted of questions relating to the knowledge, attitude and practices of health care workers as well as factors affecting infection prevention.

The technique employed was subjected to time constraints. The researcher established a timeframe of fifteen to twenty minutes per questionnaire. Intrinsically, the researcher intended to dedicate this amount of time to be present for query purposes, during the answering of the questionnaire by the participant, alternatively, the researcher may have been contacted telephonically. In order to prevent the attrition of potential participants as a result of lack of time, and maximise participation, the researcher aimed to target several participants at a time frequenting the breakroom. A minimum of 45 participants were targeted a day in order to complete the data collection process within the allocated four-day timeframe. In order to further reduce the likelihood of a response bias the researcher avoided the use of any uniform that may be deemed threatening by the respondents. Additionally, the researcher took care to ensure that the process was conducted in the most amicable manner – so as to create a sense of comfort amongst the research participants.

3.11 PILOT STUDY

The denomination of a pilot study may serve two prime functions in the social field of science, namely: feasibility and the pre-testing of the proposed research tool (Teijlingen and Hundley 2001: 1). According to Teijlingen and Hundley (2001: 1) a pilot study proves advantageous in predicting the shortfalls of the principal research study, pinpointing deviations from the desired research protocol and enabling conjectures to be established, regarding the suitability of methods or instruments to be employed. The traditional approach of a pilot study involves the use of two stages. The first stage may entail rigorous focus group discussions and interviews, in order to bring to light latent drawbacks, presented by a wide reaching questionnaire survey. This may be followed by stage two: which involves the pre-testing of the actual data collection tool, in order to evaluate the design of the questionnaire, for example: words and sequence of questions. A final trial maybe incorporated to test the robustness of the research process, such as the method of distribution and collection of completed questionnaires (Teijlingen and Hundley 2001: 1).

In the study a similar process as described above was followed. Before implementing this large-scale questionnaire survey, a focus group discussion was arranged, consisting of approximately 5% (eight participants) of the sample population to be included in the study, in order to determine the validity, reliability and internal consistency of the data collection instrument. The pilot study was performed within a regional public health care facility, operating as a level two hospital, within Johannesburg, Gauteng. The focus group discussion comprised of: two professional nurses, two medical officers, one laboratory technician, an environmental health practitioner and two nursing assistants. The pitfalls identified in the research tool will be described further. The members of the focus group discussion provided positive feedback on the level of ease in understanding the questions posed. Despite several parties expressing concern over the number of questions included in the survey, it was concluded that each and every question was relevant to the research topic and therefore pertinent to the value of research. Additionally, members of the focus group discussion recommended changes to be effected on the survey layout. This direction saw the rearrangement of certain questions and created a consistent flow in related questions – thereby ensuring quality responses to the questions presented. Overall, all participants forming the focus group discussion had agreed that the questions included in the survey encompassed the vast majority of the target population, and thus fundamental to study. Additionally, the focus group commended the distribution channels to be used in issuing of the questionnaire, which were common areas places of assembly. Furthermore, through the pilot survey, it was noted that in order to ensure active inclusion of participants, questionnaire surveys should also be handed to midwives and unit managers, who will be able to distribute the surveys to those under their command, whom also wish to participate. It was agreed that such avenues of dissemination would further maximise involvement in the study.

3.12 VALIDITY AND RELIABILITY

Validity is a measure of the degree to which a notion is accurately measured within a quantitative study. (Heale and Twycross 2015: 66). Reliability refers to the level of consistency of a tool in measuring what it is intended to measure (Taherdoost 2016: 28). In order to maintain the validity and reliability of the data collection tool, a pre-test was performed through a pilot survey that was issued to 5% of the sample group, in order to ensure the validity, reliability and internal consistency of the data collection instrument. Once the pilot survey data had been collected, each and every questionnaire feedback was independently examined in order to detect any possible issues associated with the instrument. A key concern was the probability that the questions may have been too vague, resulting in respondents being unable to answer the questions. Therefore, the pilot study was essential in identifying and corrective these drawbacks if need be.

3.13 DATA ANALYSIS

The data collected from the responses was analysed with SPSS version 27.0. The results presented the descriptive statistics in the form of graphs, cross tabulations and other figures for the quantitative data that was collected. Inferential techniques included the use of correlations and chi square test values, which were interpreted using the *p*-values. The traditional approach to reporting a result requires a statement of statistical significance. A *p*-value was generated from a test statistic. Level of significance $p \leq 0.05$ was regarded as statistically significant. After data collection, each questionnaire was checked for completeness and missing data. Before analysis can even begin, the data was cleaned, coded and inspected. As soon as data had been received, cleaned, coded and checked, the data was entered into a Microsoft excel spreadsheet. Depending on the distribution of data the appropriate parametric or non-parametric statistical tests were employed. All outliers in the study were removed depending on the range. Variables in each section of the questionnaire were stratified against one another to determine any probable associations. Univariate analysis of continuous variables was summarized using means, median, mode and standard deviation- and univariate analysis of discrete data (such as the number of needle stick injuries or other blood or bodily fluid exposures) was carried out with data expressed in the form of frequency tables, graphs (which can be horizontal or vertical bars), means and standard deviations. Bivariate analysis using correlation and regression was performed. Correlation and regression are two techniques that describe the connection between the actual dimensions of two or more variables. Pearson's Correlation Test was used to assess the strength of the relationship between two variables. Correlation and regression in this data analysis was used to model the relationships between the various variables of study. Similarly, bivariate analysis using correlation and regression was performed to determine an association between sociodemographic factors and perceptions and knowledge of HCWs regarding infection control and prevention. Variables of study within the perceptions section of the questionnaire was also stratified against one another to determine similarities in the perceptions of HCWs regarding the barriers to infection control and prevention, thereby highlighting common themes. Binary logistic regression was used to analyse variables that were dichotomous in nature. Binary logistic regression was used to determine the odds ratios of independent variables and the effect on a dependent variable. Binary logistical regression was used to model the factors associated with an experience of injury whilst performing or assisting with procedures over a professional lifetime. Data was presented using odds ratio (OR) and their 95% confidence interval to determine a link between the dependent variables and independent variables.

3.14 ETHICAL CONSIDERATIONS

The following measures were carried out to ensure that the study is performed in an ethical manner. The research proposal was submitted to Durban University of Technology Institutional Research Ethics Committee (IREC) to be reviewed and approved in order to conduct a pilot study and eventually the full study. Once approval was granted the study was issued an ethics clearance number (IREC 027/21) by DUT IREC. A letter requesting permission to conduct the study was submitted to the KwaZulu-Natal Department of Health (Appendix B). Gatekeeper's permission was sought from the hospital institutional management, the CEO as well as from HCWs managers before the participants may be approached (Appendix C and D). Permission was requested from the Chief Director of Health – eThekwini (Appendix E). A letter of information which contained the details of the researcher and the study was provided to prospective participants (Appendix F). Informed consent was obtained from all participants involved in the study (Appendix F). A principle support letter issued by the CEO of Osindisweni Hospital granting provisional permission, upon successful ethical approval, to conduct the study in the institution and a Department of Health Approval Letter was provided (Appendix J and K). All participants were made aware of their rights prior to conducting the study. Participants was informed that participation was voluntary and that they have the fundamental right to withdraw from the study at any point without consequence. All respondents were treated with the utmost respect. The study site name and address was kept confidential throughout the study. The questions in the questionnaire are designed in a manner that was not intrusive or offensive to the participants. Anonymity and confidentiality was maintained throughout the study, no names only codes were used. The data will be kept for a period of 5 years and then discarded – all hard copies will be stored in a locked cupboard accessible to only the researcher and supervisor and shredded after five years while the electronic copies will be stored on a password locked laptop and deleted after five years.

3.15 IDENTIFIED RISK TO THE PARTICIPANT AND ASSOCIATED RISK MITIGATION

Risk 1: Potential infection of the participants involved in the study by the researcher or fellow research participants, that may be symptomatic or asymptomatic, during the debriefing process to be conducted in a staff hall, centre, or boardroom.

Risk 1 Mitigation: In order to inhibit the risk of researcher to participant transmission during the debriefing process the following safety measures were stringently adhered to:

- Prior to entry into the venue the temperature of all persons entering were recorded. Additionally, a contact tracing register was completed by each participant (See Appendix I). This register outlined the temperature of individuals entering the venue, date, time, and nature of in-person contact, as well as the name and contact details of every individual entering the venue. This register served as a mere precaution, to assist in contact tracing, should the need arise. Due to the nature of the information contained on the COVID-19 contact tracing register (personal identifiable information), the register was secured and stored in a locked cupboard, accessible to only the researcher and supervisor, and thereafter shredded, following a minimum period of three months. The strictest conditions as stipulated under the Protection for Personal Information Act was adhered to (Greef 2020: 3).

- Upon entry into the venue, all individuals were required to sanitise using an alcohol (70%) based hand sanitiser. Additionally, the venue did not contain any fomites (furniture, stationery) that may harbour and transmit the COVID-19 virus to individuals entering the venue.
- Social distancing of at least 2 metres was enforced in common meeting areas via conspicuous markings. If the venue was unable to accommodate the prescribed number of persons observing a social distance of 2 metres then no more than 50% of the venues capacity was occupied for research activities, subject to strict adherence to COVID-19 health protocols and social distancing measures (The South African Department of Co-Operative Governance 2021: 5).

Risk 2: Potential infection of the participants involved in the study by the researcher or fellow research participants, that might be symptomatic or asymptomatic during the data collection process which constitutes a paper-based approach (self-administered questionnaires). This presents a significant risk as the novel coronavirus can reside on paper for 2-3 days (with certain estimates citing 5 days) (Greef 2020: 1).

Risk 2 Mitigation: In order to inhibit the risk of researcher to participant transmission during the data collection process the following safety measures were stringently adhered to:

- At the debriefing process all potential participants were provided with their own pen should they decide to participate in the study at a later stage. The participants were assured that the provision of the pen did not constitute participation in the study, but rather served as a precautionary measure against COVID-19, should they decide to participate in the study. A set of questionnaires were distributed to each unit manager of each department in the hospital. This ensured the prevention and control of fomite spread via contact with the paper questionnaires. Should potential candidates express interest in participating in the study, such individuals could approach their unit head/manager requesting a questionnaire for completion. Upon completion of the questionnaire, the researcher informed potential participants to drop off the questionnaire in a plastic zip lock bag, that was kept with the researcher, at an agreed upon venue such as the facility used for the debriefing process.

- As described above social distancing of at least 2 metres was enforced in the drop-off area via conspicuous markings. If the venue was unable to accommodate the prescribed number of persons observing a social distance of 2 metres then not more than 50% of the venue's capacity was occupied for research activities, subject to strict adherence to COVID-19 health protocols and social distancing measures (The South African Department of Co-Operative Governance 2021: 5).

Risk 3: Probable infection by handling potentially infectious objects (pens, paper questionnaires).

Risk 3 Mitigation: In order to inhibit fomite exposure of all interested participants present at the debriefing process, each individual was provided with their own pen, additionally a set of questionnaires were distributed to each unit manager of each department in the hospital. This ensured the prevention and control of fomite spread via contact with the paper questionnaires. Should potential candidates express interest in participating in the study, such individuals could approach their unit head/manager requesting a questionnaire for completion. Upon completion of the questionnaire, the researcher informed potential participants to deposit the questionnaire in a plastic zip lock bag that was kept with the researcher, at an agreed upon venue such as the facility used for the debriefing process. The zip lock bag was sealed and sanitised at the end of each day and all questionnaires inside the plastic zip lock bag were left untouched for a minimum of three days, further reducing the spread of the virus.

Risk 4: High risk participants such as individuals over the age of sixty years, as well as those who may have a comorbidity or additional disease resulting in immunocompromised health.

Risk 4 Mitigation: In order to safeguard the health of probable participants over the age of sixty years, as well as those who may have a comorbidity or additional disease resulting in immunocompromised health, a specific debriefing time was set aside for high-risk individuals each day.

Risk 5: The transmission of the virus from the research site to the home, or rest of the community.

Risk 5 Mitigation: The above protocols were implemented to significantly reduce the risk of transmission from research site to home or the rest of the community.

Risk 6: Being reprimanded (fined or arrested) for failure of adherence to the prevalent lockdown alert level restrictions (e.g., no masks used).

Risk 6 Mitigation: In order to avoid disciplinary action, the researcher ensured that all national regulations, directions and protocols were adhered to during the conduct of the study, by both the researcher and the participants.

3.16 IDENTIFIED RISK TO THE RESEARCHER AND ASSOCIATED RISK MITIGATION

Risk 1: Potential infection of the researcher that might be in contact with a symptomatic or asymptomatic participant during the debriefing process to be conducted in a staff hall, centre, or boardroom.

Risk 1 Mitigation: In order to inhibit this risk, precautionary measures outlined under "Identified risk to the researcher and associated risk mitigation- Risk 1 Mitigation" above, was implemented.

Risk 2: Potential infection of the researcher that might be in contact with a symptomatic or asymptomatic participant during the collection of completed data collection tools (paper-based self-administered questionnaires). As previously mentioned, this presents a significant risk as the novel coronavirus can reside on paper for 2-3 days (with certain estimates citing 5 days) (Greef 2020: 1).

Risk 2 Mitigation: In order to inhibit the risk of researcher to participant transmission during the data collection process the precautionary measures outlined under "Identified risk to the researcher and associated risk mitigation- Risk 2 Mitigation" above, was implemented.

Risk 3: Probable infection by handling potentially infectious objects (pens, paper questionnaires).

Risk 3 Mitigation: In order to inhibit fomite exposure, precautionary measures outlined under "Identified risk to the researcher and associated risk mitigation- Risk 3 Mitigation" above, was implemented.

Risk 4: The researcher will be vulnerable to infection by COVID-19 as the study is expected to be conducted in a high-risk environment (Osindisweni Hospital).

Risk 4 Mitigation: The researcher personally adhered to all national regulations, guidelines, and protocols to ensure his/her personal safety. Additionally, telephonic queries regarding the study was encouraged where possible, thereby reducing the risk of transmission.

Risk 5: The transmission of the virus from the research site to the home and family members.

Risk 5 Mitigation: The above protocols were implemented to significantly reduce the risk of transmission from research site to home and family members.

Risk 6: Being reprimanded (fined or arrested) for failure of adherence to the prevalent lockdown alert level restrictions (e.g., no masks used).

Risk 6 Mitigation: In order to avoid disciplinary action, the researcher ensured that all national regulations, directions and protocols were adhered to during the conduct of the study, by both the researcher and the participants.

3.17 REPUTATIONAL DAMAGE TO THE RESEARCHER AND/OR THE UNIVERSITY

Risk 1: The risk of blame placed on the university by participants who may have acquired COVID-19 from the researcher during the performance of the study.

Risk 1 Mitigation: The above protocols were implemented to significantly reduce the risk of transmission from the researcher to the participants. In order to avoid infection, to the best of his/her ability- the researcher ensured that all national regulations, directions and protocols were adhered to during the conduct of the study, by both the researcher and the participants.

Risk 2: The risk of blame placed on the university by researcher who may have transmitted COVID-19 into a private home or community.

Risk 2 Mitigation: The above protocols were implemented to significantly reduce the risk of transmission from the researcher to their home and family. In order to avoid infection, to the best of his/her ability- the researcher ensured that all national regulations, directions and protocols were adhered to during the conduct of the study.

Risk 3: The risk of blame placed on the university by researcher who may have acquired COVID-19 during the conduct of research.

Risk 3 Mitigation: The above protocols were implemented to significantly reduce the risk of transmission by the researcher during the conduct of the study. In order to avoid infection, to the best of his/her ability- the researcher ensured that all national regulations, directions and protocols were adhered to during the conduct of the study.

Risk 4: Researchers not complying with the disaster and alert level lockdown regulations (e.g., the visitation of participants at their homes when social interaction is not permitted).

Risk 4 Mitigation: So as to ensure that the study ran unobstructed, the researcher, at all times adhered to the national regulations, directions and protocols.

3.18 CONCLUSION

This study sets out to determine the knowledge and attitude shortfalls in relation to HCWs behaviour and practices, when working with BBF, in hopes of reducing the rate of BBF exposures, and its associated burden. Furthermore, this study aims to determine how HCWs perceive factors that may adversely influence IPC within the hospital. In order for these objectives to be attained, the procedures outline in this chapter must be adhered to.

CHAPTER FOUR

RESULTS

4.1 INTRODUCTION

This Chapter presents the findings obtained from the questionnaires employed in the study. The questionnaire was the primary tool that was used to collect data and was distributed among 166 respondents. The data collected from the responses was analysed with SPSS version 27.0. The results shall present the descriptive statistics in the form of graphs, cross tabulations and other figures for the quantitative data that was collected. Inferential techniques include the use of correlations and chi square test values, which are interpreted using the *p*-values. The traditional approach to reporting a result requires a statement of statistical significance. A *p*-value was generated from a test statistic. A significant result was indicated with "$p < 0.050$".

4.2 THE SAMPLE

In total, 166 questionnaires were despatched and 166 were returned which gave a 83.4% response rate. This was directly in line with the recommended sample size as described in the statistician's report.

4.3 RELIABILITY STATISTICS

The two most important aspects of precision are reliability and validity. Reliability is computed by taking several measurements on the same subjects. A reliability coefficient of 0.60 or higher is considered as "acceptable" for a newly developed construct.

Table 1: Cronbach's alpha score for all the items that constituted the questionnaire.

Sr.no	Section	Number of Items	Cronbach's Alpha
1	'Please circle what you may feel is FALSE, NOT SURE or TRUE. Heath Care Workers can be at risk of needle stick or sharp injuries when they:'	4	0.572
2	'To what extent do you AGREE or DISAGREE with the following statements? Please circle the number you may feel most appropriate. The following practices may expose you to Hepatitis B.'	5	0.877
3	'To what extent do you AGREE or DISAGREE with the following statements? Please circle the number you may feel most appropriate. The following practices may expose you to Hepatitis C.'	5	0.957
4	'To what extent do you AGREE or DISAGREE with the following statements? Please circle the number you may feel most appropriate. The following practices may expose you to HIV.'	5	0.911
5	'To what extent do you carry out the following statements? Please circle the number you may feel appropriate.'	4	0.296
6	'Which of the following factors would you consider as a barrier to IPC within the hospital? Please circle NO, NOT SURE or YES.'	7	0.847

The reliability scores for 4 sections exceed the recommended Cronbach's alpha value. This indicates a degree of acceptable, consistent scoring for these sections of the research. One section had a score marginally lower than 0.60 and another section had a much lower score (E43). The inconsistencies are mainly due to interpretations amongst the different levels of respondents. This is seen in the cross-tabulations further on in the study.

4.4 SECTION A: SOCIODEMOGRAPHIC FACTORS

This section summarises the biographical characteristics of the respondents.

4.4.1 SEX

Table 3 indicated that females constituted an appreciable portion (78.9%) of the total sample population as compared to males who only accounted for 21.1% of the total sample. Overall, the ratio of males to females was approximately 1:4 (21.1%: 78.9%) ($p < 0.001$).

Table 2: Frequency of respondents' gender.

Respondents'	Frequency	Percent
Female	131	78.9
Male	35	21.1
Total	166	100.0

4.4.2 AGE

Table 4 described the age distribution among the respondents. A considerable amount (19.3%) of the respondents were between the ages of 36 to 40 years and 46 to 50 years. Respondents between the age categories 31 to 35 years, 26 to 30 years and 41 to 45 years' account for 16.9%, 16.3% and 15.7% of the sample population respectively, with the age range of 51 to 55 years, greater than 55 years and 18 to 25 years correspondingly accounting for 6.6%, 4.8% and 1.2% of the total sample, respectively. The age distributions were not similar, as there were more respondents in the middle-aged group ($p < 0.001$).

Table 4: Frequency of respondents' age.

Age group years	Frequency	Percent
18 - 25	2	1.2
26 - 30	27	16.3
31 - 35	28	16,9
36 - 40	32	19.3
41 - 45	26	15.7
46 - 50	32	19.3
51 - 55	11	6.6
> 55	8	4.8
Total	166	100.0

4.4.3 LEVEL OF EDUCATION

Figure 14 indicated that more than half (55.4%) of the respondents held a national diploma, 22.9% were in possession of a first degree, 11.4% held a postgraduate qualification and 10.2% hold high school (Grade 12 National Senior Certificate).

Table 5: Frequency of respondents' level of education.

Level of education	Frequency	Percent
High School	17	10.2
National Diploma	92	55.4
First Degree	38	22.9
Postgraduate	19	11.4
Total	166	100.0

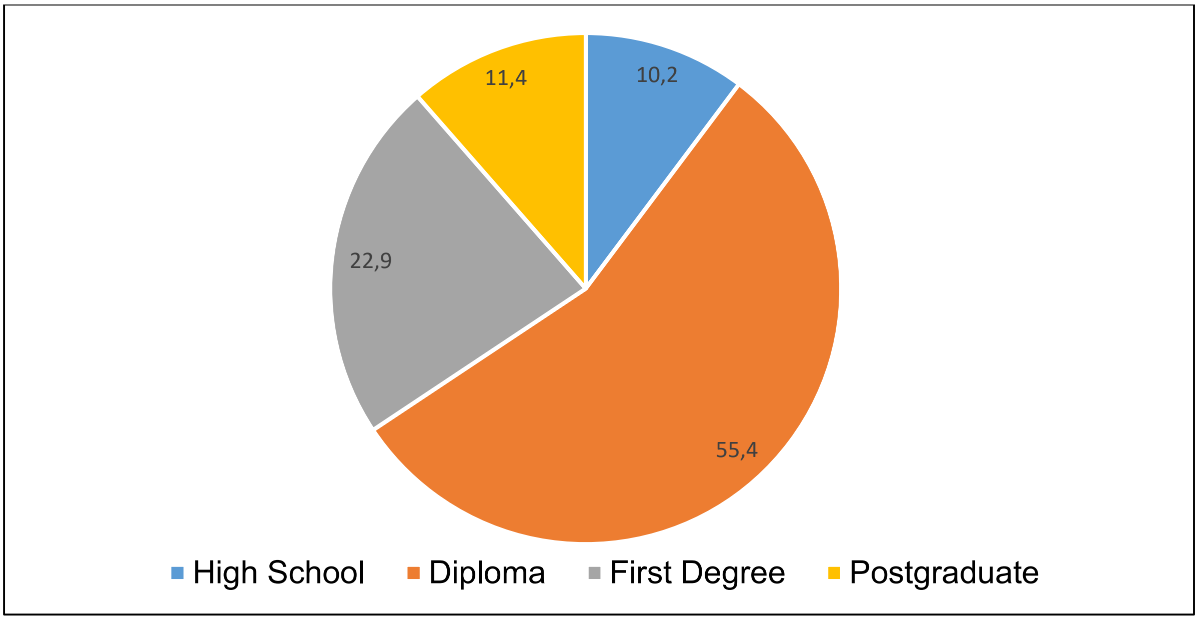

Figure 14: Pie chart showing respondents' level of education in percentage.

4.4.4 YEARS OF EMPLOYMENT AT THE HOSPITAL

As shown in Figure 15, 33.7% of the respondents had been employed in the hospital as a health care worker for 1 to 5 years, 23.5% between 11 to 15 years, 22.3% between 6 to 10 years, 10.8% between 16 to 20 years, whilst the years 21 to 25 and 26 to 30 accounted for a marginal proportion of service in the hospital (4.8% and 4.2%, respectively). Years of service exceeding 30 years accounted for a negligible percentage of 0.6%. The years of employment were not alike as there were more respondents in the 1 to 5-year category ($p < 0.001$).

Table 6: Frequency showing years of employment as a HCW in the hospital.

Years of employment	Frequency	Percent
1 – 5	56	33.7
6 – 10	37	22.3
11 – 15	39	23.5
16 – 20	18	10.8
21 – 25	8	4.8
26 – 30	7	4.2
> 30	1	0.6
Total	166	100.0

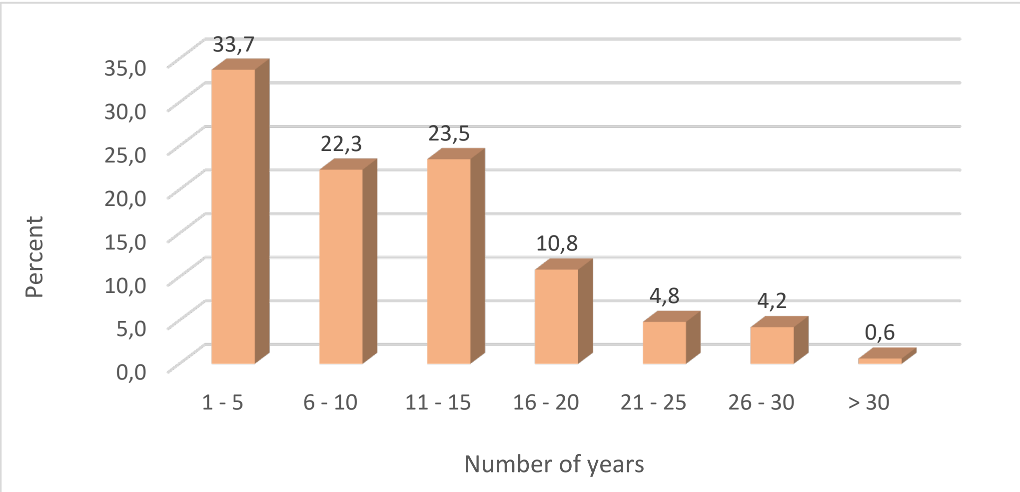

Figure 15: Bar graph showing years of employment as a HCW in the hospital in percentage.

4.4.5 PROFESSION

Table 7 below, provided a comprehensive breakdown of the category of HCW by profession. A significant proportion of the HCW population within the total sample were nurses (54.2%), while nursing assistants accounted for 30.7% of the respondents. Medical doctors constituted 7.2%, with medical interns and laboratory technicians accounting for 3.0% each of the total sample. Mortuary attendants accounted for a meagre 1.8% of the total sample. Vast differences were present in the number of respondents within each profession, with nurses accounting for a significant portion of the total sample ($p < 0.001$).

Table 7: Frequency showing the category of profession of HCWs in the hospital.

Profession	Frequency	Percent
Medical doctor	12	7.2
Medical intern/student	5	3.0
Nurse	90	54.2
Nursing assistant	51	30.7
Mortuary attendant	3	1.8
Laboratory technician	5	3.0
Total	166	100.0

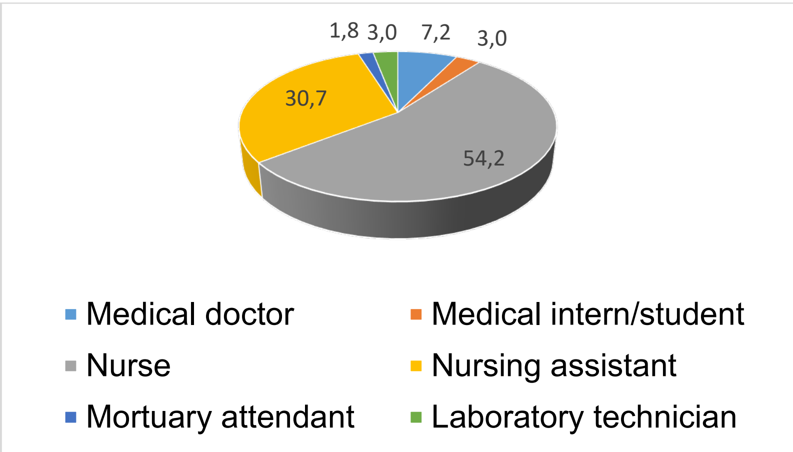

Figure 16: Pie chart showing the category of profession of HCWs in the hospital in percentage.

4.4.6 WORKING DEPARTMENT

As shown in Table 8, 46.4% of the respondents were operational within the 'general wards male and female', 17.5% were employed within the 'casualty and OPD departments', 15.1% within the 'maternity and labour ward', 7.8% within the 'paediatric ward', 5.4% in 'theatre, CSSD, SOPD' and 3.6%, 2.4%, 1.2%, and 0.6% within the 'laboratory', 'mortuary', 'mobile clinic' and 'intensive care unit (ICU)'. The distribution of HCWs in each department were not similar as most of the respondents were operational within the ‘general wards male and female’ ($p < 0.001$).

Table 8: Frequency showing the working departments of HCWs in the hospital.

Working department/unit	Frequency	Percent
Casualty and OPD	29	17.5
Paediatric ward	13	7.8
Maternity and labour ward	25	15.1
Theatre, CSSD, SOPD	9	5.4
General wards male and female	77	46.4
Mobile clinic	2	1.2
Mortuary attendants	4	2.4
Laboratory	6	3.6
Intensive Care Unit (ICU)	1	0.6
Total	166	100.0

4.5 SECTION B: OCCUPATIONAL EXPOSURE INFORMATION

This section detailed the occupational exposure information of the respondents. In this section the aim was to establish the occupational exposure determinants for respondents that administered injections, IVs or any other miscellaneous form of BBF exposure.

4.5.1 QUANTITY OF INJECTONS ADMINISTERED BY HCWS

Table 9 below, summarised the scoring patterns for the number of injections given per week, whilst table 10 provided a detailed breakdown of injections administered per profession. When considering medical doctors, the average number of injections were 26 (mean = 26). The standard deviation of the mean was also 26. The standard deviation, as interpreted in terms of the data for number of injections administered to patients in a week, by medical doctors, was 100% (26) of the mean, and hence exceptionally high, in the context of the data set. This standard deviation indicated a relatively large spread of values away from the mean. The data below also indicated that nursing assistants followed medical doctors in terms of quantity of injections administered weekly, with 25 injections being administered by nursing assistants.

A standard deviation of 21 was denoted by this set of data. Similar to the standard deviation expressed in the profession of medical doctors, this value may also be considered relatively high, considering the data, thereby indicating significant scattering of values about the mean. Comparably, nurses too depicted a rather high standard deviation (24) in comparison to the mean (24) of injections administered to patients on a weekly basis. In contrast, medical students/interns produced a comparatively low standard deviation (3) in collation to the mean (15), as such the results of this particular category expressed a relatively high degree of reliability. On the other hand, the mean of injections administered by laboratory technicians was 2, with standard deviation of 5, thus indicating an inconsistent distribution of values around the mean.

Table 9: Summary of the scoring patterns for the number of injections given per week by all HCWs within the hospital.

N	Minimum	Maximum	Mean	Std. Deviation
166	0	100	23.080	22.781

Table 10: Frequency showing a detailed breakdown of the number of injections given per week by profession.

Profession	Number of injections administered each week?				
	Mean	Median	Standard Deviation	Percentile 25	Percentile 75
Medical doctor	26	18	26	10	28
Medical intern/student	15	15	3	12	16
Nurse	24	15	24	11	25
Nursing assistant	25	20	21	15	25
Laboratory technician	2	0	5	0	0

4.5.2 EXPERIENCE OF AN INJURY WHILE PERFORMING OR ASSISTING PROCEDURES IN A PROFESSIONAL LIFETIME

As shown in Table 11 below, 59% of the respondents claimed to have not experienced an injury while performing or assisting procedures in a professional lifetime, while 41% of respondents stated that they did in fact experience some degree of injury, while performing or assisting procedures in a professional lifetime.

Table 11: Frequency showing the experience of an injury while performing or assisting procedures in your professional lifetime.

The experience of an injury in a professional lifetime	Frequency	Percent
No	98	59.0
Yes	68	41.0
Total	166	100.0

4.5.2.1 CROSS-TABULATION BETWEEN EXPERIENCE OF AN INJURY WHILE PERFORMING OR ASSISTING PROCEDURES IN A PROFESSIONAL LIFETIME AND WORKING DEPARTMENT

Table 12 below, quantitatively analysed the relationship between experience of an injury while performing or assisting procedures in a professional lifetime and working department. A Fisher's Exact Test indicated $p = 0.244$. This implied no significant relationship between the experience of an injury while performing or assisting procedures in a professional lifetime and working department.

Table 12: Cross-tabulation showing the relationship between experience of an injury while performing or assisting procedures in a professional lifetime and working department.

Cross-tabulation relationship between experience of an injury while performing procedures in a professional lifetime			Working department/unit (%)									Total
			Casualty and OPD	**Paediatric ward**	**Maternity & labour**	**CSSD, SOPD**	**General wards**	**Mobile clinic**	**Mortuar**	**Laborator**	**ICU**	
Experience of an injury while assisting procedures in a professional lifetime	**No**	Count	16	11	7	6	49	1	3	4	1	98
		% Of people experienced an injury in a professional lifetime	16.3	11.2	7.1	6.1	50.0	1.0	3.1	4.1	1.0	100.0
		Within Working department %	55.2	84.6	28.0	66.7	63.6	50.0	75.0	66.7	1000	59.0
		Total %	9.6	6.6	4.2	3.6	29.5	0.6	1.8	2.4	0.6	59.0
	Yes	Count	13	2	18	3	28	1	1	2	0	68
		% Of people experienced an injury in a professional lifetime	19.1	2.9	26.5	4.4	41.2	1.5	1.5	2.9	0.0	100.0
		Within Working department %	44.8	15.4	72.0	33.3	36.4	50.0	25.0	33.3	0.0	41.0
		Total %	7.8	1.2	10.8	1.8	16.9	0.6	0.6	1.2	0.0	41.0
Total		Count	29	13	25	9	77	2	4	6	1	166
		% Of people experienced an injury in a professional lifetime	17.5	7.8	15.1	5.4	46.4	1.2	2.4	3.6	0.6	100.0
		Within Working department %	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
		Total %	17.5	7.8	15.1	5.4	46.4	1.2	2.4	3.6	0.6	100.0

Table 12 above, described the relationship between the experience of an injury while performing or assisting procedures in a professional lifetime and working department. When presented with the question 'Have you ever experienced an injury while performing or assisting procedures in your professional lifetime?', of the total sample, 29.5% of respondents who indicated that they did not experience an injury while performing or assisting procedures in their professional lifetime were employed within the general wards (male and female). Therefore, the rest of the work departments may be considered to have a higher probability of experiencing an injury in a professional lifetime. This is also indicated in table 12 as the rate of no injury within the other departments were marginally lower, ranging from 0.6% to 9.6%.

Interestingly enough, a considerable amount (16.9%) of the respondents who did in fact experience an injury, while performing or assisting procedures in their professional lifetime, were also employed within the general wards (male and female). This occurrence may be attributed to the significantly greater number of respondents employed in that particular unit, as compared to the other units (28 in general wards (male and female) as compared to 0-18 respondents in the rest of the wards), thereby influencing the overall result. Additionally, the maternity and labour ward accounted for the second greatest department, whereby injury had occurred.

The *p*-value between 'the experience of an injury while performing or assisting procedures in a professional lifetime' and 'working department' is $p < 0.026$. This implied a significant relationship between these two variables. That is, the working department of the respondents did play a significant role, in terms of the experience of an injury while performing or assisting procedures, in a professional lifetime.

4.5.2.2 CROSS-TABULATION BETWEEN THE EXPERIENCE OF AN INJURY WHILE PERFORMING OR ASSISTING PROCEDURES IN A PROFESSIONAL LIFETIME AND PROFESSION

Table 13 below, quantitatively analysed the relationship between the experience of an injury while performing or assisting procedures in a professional lifetime and profession. A Fisher's Exact Test indicated $p = 0.244$. This implied no significant relationship between experience of an injury while performing or assisting procedures in a professional lifetime and profession.

Table 13: Cross-tabulation showing the relationship between the experience of an injury while performing or assisting procedures in a professional lifetime and profession.

Cross-tabulation relationship between the experience of an injury while performing or assisting procedures in a professional lifetime and profession.			Profession						Total
			Medical doctor	Medical intern/student	Nurse	Nursing assistant	Mortuary attendant	Laboratory technician	
The experience of an injury while assisting procedures in a professional lifetime	No	Count	6	3	47	37	2	3	98
		% Of people experienced an injury in a professional	6.1	3.1	48.0	37.8	2.0	3.1	100.0
		Within Working department %	50.0	60.0	52.2	72. 5	66.7	60.0	59.0
		Total %	3.6	1.8	28.3	22.3	1.2	1.8	59.0
	Yes	Count	6	2	43	14	1	2	68
		% Of people experienced an injury in a professional	8.8	2.9	63.2	20.6	1.5	2.9	100.0
		Within Working department %	50.0	40.0	47.8	27.5	33.3	40.0	41.0
		Total %	3.6	1.2	25.9	8.4	0.6	1.2	41.0
Total		Count	12	5	90	51	3	5	166
		% Of people experienced an injury in a professional	7.2	3.0	54.2	30.7	1.8	3.0	100.0
		Within Working department %	100.0	100.0	100.0	100.0	100.0	100.0	100.0
		Total %	7.2	3.0	54.2	30.7	1.8	3.0	100.0

Table 13, above described the relationship between experience of an injury while performing or assisting procedures in a professional lifetime and profession. When presented with the question ‘Have you ever experienced an injury while performing or assisting procedures in your professional lifetime?’, of the total sample, 28.3% of respondents who indicated that they did not experience an injury while performing or assisting procedures in their professional lifetime belonged to the category ‘nurses’, whilst 22.3% were affiliated with the nursing assistant category. Medical doctors followed with 3.6% indicating lack of injury. Medical interns/students (1.8%), laboratory technicians (1.8%) and mortuary attendants (1.2%) expressed a higher probability of experiencing an injury in a professional lifetime as indicated in table 13, as the rate of no injury within these departments were marginally lower. Again, however, these results may be influenced by the relatively lower number of respondents in those categories, in comparison to nurses and nursing assistants, which accounted for a large portion of the sample (90 nurses and 51 nursing assistants as compared to 12 medical doctors, 5 medical interns/students, 3 mortuary attendants and 5 laboratory technicians).

A significant amount (25.9%) of the respondents who did in fact experience an injury while performing or assisting procedures in their professional lifetime, were employed in the nurse category. Again, these results may be attributed to the significantly higher proportion of nurses employed within the facility in relation to the rest of the professions, as previously mentioned. After nurses, nursing assistants (8.4%), followed by medical doctors (3.6%), medical interns/students and laboratory technicians (both 1.2%) and mortuary attendants (0.6%) consecutively accounted for the rest of the departments, whereby injury had occurred. The *p*-value between ‘experience of an injury while performing or assisting procedures in a professional lifetime’ and ‘profession’ is $p = 0.244$. This implied no significant relationship between these two variables under study. The profession of the respondents did not play a significant role, in terms of the experience of an injury while performing or assisting procedures in a professional lifetime.

4.5.2.3 CROSS-TABULATION BETWEEN THE EXPERIENCE OF AN INJURY WHILE PERFORMING OR ASSISTING PROCEDURES IN A PROFESSIONAL LIFETIME AND SEX

Table 14 below, quantitatively analysed the relationship between the experience of an injury while performing or assisting procedures in a professional lifetime and sex of HCWs employed within the hospital. A Pearson Chi-Square Test indicated $p = 0.093$. This implied no significant relationship between the experience of an injury while performing or assisting procedures in a professional lifetime and sex.

Table 14: Cross-tabulation showing the experience of an injury while performing or assisting procedures in a professional lifetime against sex.

Cross-tabulation showing the experience of an injury in a professional lifetime against sex.			Sex		Total
			Female	Male	
The experience of an injury while assisting procedures in a professional lifetime	**No**	**Count**	73	25	98
		% Of people experienced an injury in a professional	74.5	25.5	100.0
		Within Working department %	55.7	71.4	59.0
		Total %	44.0	15.1	59.0
	Yes	Count	58	10	68
		% Of people experienced an injury in a professional	85.3	14.7	100.0
		Within Working department %	44.3	28.6	41.0
		Total %	34.9	6.0	41.0
Total		Count	131	35	166
		% Of people experienced an injury in a professional	78.9	21.1	100.0
		Within Working department %	100.0	100.0	100.0
		Total %	78.9	21.1	100.0

As can be seen in Table 14, of those respondents who selected option 'no' in response to the question 'Have you ever experienced an injury while performing or assisting procedures in your professional lifetime?', 74.5% who indicated that they did not experience an injury while performing or assisting procedures in their professional lifetime, were of the female sex, with males accounting for approximately 25.5% of respondents. Within the sex category of females (only), 55.7% responded ‘no’ and 71.4% within the sex category of males (only) had also selected the option ‘no’. Collectively, this category of females that selected ‘no’ attributed to 44.0% of the total sample with males constituting 15.1%.

Table 14, indicated that of the option ‘yes’ in response to the question ‘Have you ever experienced an injury while performing or assisting procedures in your professional lifetime?’, 85.3% of the respondents who indicated that they did in fact experience an injury while performing or assisting procedures in their professional lifetime, were of the female sex, with males accounting for approximately 14.7% of respondents. Within the sex category of females (only), 44.3% responded ‘yes’ and 28.6% within the sex category of males (only) had also selected the option ‘yes’. Collectively, this category of females that selected ‘yes’ attributed to 34.9% of the total sample with males constituting 6.0%.

4.5.3 THE EXPERIENCE OF AN INJURY WHILE PERFORMING OR ASSISTING PROCEDURES IN THE PAST 12 MONTHS

With reference to Table 15 below, a notable proportion (95.8%) of the respondents had not encountered an injury while performing or assisting procedures in the past 12 months, with only a small number (7%) of respondents claiming that they did experience an injury.

Table 15: Frequency showing percentage of HCWs who have or have not experienced injury while performing or assisting procedures in the past 12 months.

Have you ever experienced an injury in the past 12 months?	Frequency	Percent
No	159	95.8
Yes	7	4.2
Total	166	100.0

4.5.4 TYPE OF ACCIDENTS THAT LED TO AN OCCUPATIONAL EXPOSURE

Table 16, showed the potential sources of accidental exposure as experienced by respondents. Additionally, 59.0% of the data was ‘missing’, as it was believed that those respondents who did not indicate the type of accident that led to an accidental injury, may not have experienced an occupational exposure to BBF during their professional lifetime. In the data presented in table 16, 30.1% of injuries were a result of NSIs, 9.0% due to bodily fluid splashes or blood and 1.8% arose from cuts. When the prevalence ratios between each source of accident were examined, the observed differences were found to be statistically significant ($p < 0.001$).

Table 16: Frequency showing potential sources of accidental exposure as experienced by respondents.

What type of accidents led to your occupational exposure?	Frequency	Percent
NSI	50	30.1
Body splashing of fluid or blood	15	9.0
Cut	3	1.8
Total	68	41.0
Missing	98	59.0
Total respondents	166	100.0

4.5.5 PROCEDURES RESULTING IN THE BBF EXPOSURE

Table 17, illustrated the procedures those HCWs who had experienced a BBF exposure were engaged in, during the time of the accident. Emergency and elective surgeries, cleaning of contaminated cloths and procedures such as biopsies were not identified as high-risk procedures, as none of the HCWs who had experienced an injury had highlighted such activities (0.0%). However, blood collection (i.e., drawing of blood samples) (20.5%), intravenous line insertion (10.8%), assisting during labour procedures (6.0%), needle disposal (4.2%), needle recapping (3.6%), assisting during surgical procedures (3.6%), suturing (3.0%), amniotic fluid splash (3.0%), overfilled sharps containers (3.0%), cleaning of contaminated instruments (e.g. sharps) (1.8%), procedures such as intramuscular injections (1.8%), putting blood into a specimen bottle (1.2 %), and dressing of wounds (0.6%) were all deduced to be high risk practices, as these activities predominantly contributed to accidental exposure of HCWs.

Table 17: Frequency showing the procedures resulting in BBF exposure.

Procedures resulting in BBF exposure	Count	Percent
Emergency surgeries	0	0.0
Elective surgeries	0	0.0
Cleaning contaminated cloths	0	0.0
Procedures such as biopsies	0	0.0
Procedures such as dressing of wounds	1	0.6
Putting blood into a specimen bottle	2	1.2
Procedures such as intramuscular (IM) injections	3	1.8
Cleaning contaminated instruments	3	1.8
Overfilled sharps containers	5	3.0
Amniotic fluid splash	5	3.0
Procedures such as suturing	5	3.0
Assisting in surgical procedures	6	3.6
Needle recapping	6	3.6
Needle disposal	7	4.2
Conducting labour	10	6.0
Blood collection	18	10.8
Intravenous line insertion	34	20.5

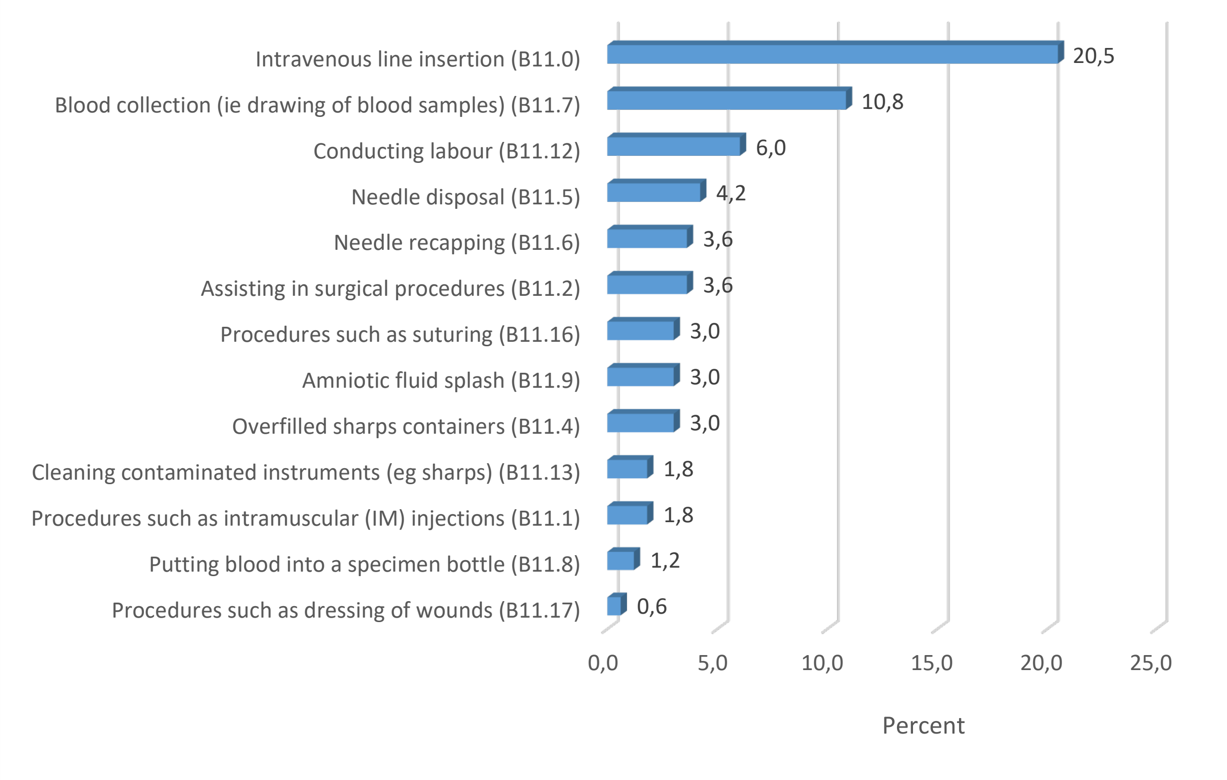

Figure 17: Bar graph showing the procedures resulting in BBF exposure.

Figure 17, was arranged from procedures associated with the highest estimated risk of expsoure, to the lowest. Using figure 17, intravenous line insertion was deduced to run the greatest risk of BBF expsoure to HCWs (20.5%), with blood collection following soon after (10.8%). The conduct of labour procdures presented a moderate, but still prominent risk of expsoure, with needle disposal (4.2%), needle recapping (3.6%), assisting during surgical procedures (3.6%), suturing (3.0%), amniotic fluid splash (3.0%) and overfilled sharps containers (3.0%) all presenting a similar, marginally lower level of risk. Cleaning of contaminated instruments (eg. sharps) (1.8%), procedures such as intramuscular injections (1.8%), putting blood into a specimen bottle (1.2 %), and dressing of wounds (0.6%) presented a relatively low risk of exposure, but should not be overlooked.

4.6 SECTION C: HEALTH CARE WORKER KNOWLEDGE OF OCCUPATIONAL EXPOSURE TO BBF

This section detailed the knowledge of HCWs regarding occupational exposure to BBF. In this section the aim was to establish the level of knowledge HCWs possess when considering BBF and its exposure.

4.6.1 POST-EXPOSURE PROPHYLAXIS

As described in table 18, in response to the question 'have you heard of the term 'Post-Exposure Prophylaxis (PEP)?', an outstanding figure of 92.8% of respondents answered 'yes', with only a small portion of respondents stating 'no' (7.2%. This result was indeed anticipated, considering the population group under study.

Table 18: Frequency showing awareness of respondents on PEP.

Have you heard of the term 'Post-Exposure Prophylaxis'?	Frequency	Percent
No	12	7.2
Yes	154	92.8
Total	166	100.0

4.6.2 LEVEL OF KNOWLEDGE ON THE SIGNIFICANCE OF PEP

Table 19, provided an in-depth analysis of the degree of knowledge possessed by HCWs, on the significance of PEP. Respondents displaying a moderate to good level of knowledge on the matter, both constituted 38.6% of the total sample, with only 10.8% exhibiting a level considered to be 'very good'. Despite only 9.0% and 3.0% of respondents claiming to have 'vague' or 'little to no' knowledge on the significance of PEP, respectively, these figures still commission an area of concern, when considering the nature and activities of the study population.

Table 19: Frequency showing the degree of knowledge possessed by HCWs on the significance of PEP.

Knowledge on the significance of PEP	Frequency	Percent
Little to None	5	3.0
Vague	15	9.0
Moderate	64	38.6
Good	64	38.6
Very Good	18	10.8
Total	166	100.0

4.6.2.1 CROSS-TABULATION BETWEEN KNOWLEDGE OF PEP AND LEVEL OF EDUCATION

Table 20 below quantitatively analysed the relationship between knowledge of PEP and level of education. A Fisher's Exact Test indicated $p < 0.001$. This implied a statistically significant association between knowledge of PEP and level of education

Table 20: Cross-tabulation showing knowledge of PEP and level of education.

Knowledge of PEP and level of education			Level of education				Total
			High School	Diploma	First Degree	Postgraduate	
Have you heard of the term 'Post-Exposure Prophylaxis (PEP)'?	No	Count	2	10	0	0	12
		% Within knowledge of 'Post-Exposure Prophylaxis?	16.7	83.3	0.0	0.0	100.0
		% Within Level of education	11.8	10.9	0.0	0.0	7.2
		Total %	1.2	6.0	0.0	0.0	7.2
	Yes	Count	15	82	38	19	154
		% Within Have you heard of the term 'post-Exposure?	9.7	53.2	24.7	12.3	100.0
		% Within Level of education	88.2	89.1	100.0	100.0	92.8
		Total %	9.0	49.4	22.9	11.4	92.8
Total	Count		17	92	38	19	166
	% Within Have you heard of the term 'post-Exposure?		10.2	55.4	22.9	11.4	100.0
	% Within Level of education		100.0	100.0	100.0	100.0	100.0
	Total %		10.2	55.4	22.9	11.4	100.0

Within the PEP knowledge category of 'no', in response to the question 'have you heard of the term 'Post-Exposure Prophylaxis (PEP)?', HCWs in possession of a diploma accounted for 83.3% of respondents, with those HCWs in possession of a high school qualification accounting for only 16.7%. Within the category of diploma (only), 10.9%% had no knowledge of PEP, and within the category of high school (only), 11.8% answered 'no' to the question 'have you heard of the term 'Post-Exposure Prophylaxis (PEP)?'. Collectively, this category of HCWs with a diploma who lacked PEP knowledge attributed to 6.0% of the total sample, with high school constituting 1.2% of the total sample.

Within the PEP knowledge category of 'yes, in response to the question 'have you heard of the term 'Post-Exposure Prophylaxis (PEP)?', HCWs in possession of a diploma accounted for 53.2% of respondents, with those HCWs in possession of a first degree accounting for 24.7%, and those with a postgraduate qualification attributing to 12.3%. Those HCWs who held only a high school qualification constituted 9.7% of respondents. Within the category of diploma (only), 89.9% had knowledge of PEP, within the category of first degree (only) and postgraduate qualification (only),100.0% answered 'yes' to the question 'have you heard of the term 'Post-Exposure Prophylaxis (PEP)?'. Those HCWs who held a high school qualification (only) constituted 88.2% of respondents. Collectively, this category of HCWs with a high school qualification, diploma, first degree and postgraduate qualification with PEP knowledge attributed to 9.0%, 49.4%, 22.9% and 11.4% of the total sample, respectively.

Those HCWs possessing a first degree and postgraduate qualification did not show any indication regarding lack of knowledge of PEP, and it could be argued further that an increase in level of education may result in the subsequent increase in knowledge of PEP. A statistically significant relationship was demonstrated between the knowledge of PEP and level of education, with those HCWs in possession of a degree and postgraduate qualification displaying greater awareness than those in possession of a diploma and high school qualification only ($p < 0.041$).

Inconsistencies in responses were found, as those HCWs that lacked PEP knowledge and were in possession of a diploma constituted 83.3% of responses, but those HCWs who did have knowledge of PEP and held a diploma accounted for 53.2% of respondents.

4.6.3 EFFECTIVENESS OF PEP AFTER 72 HOURS OF INITIAL EXPOSURE TO HIV

The data contained within Table 21, aimed to highlight the active awareness of HCWs regarding PEP usage. This section sought to establish whether or not HCWs were aware of the basic requirements with regards to how long can PEP be prolonged, before it became ineffective for the user. Surprisingly, 72.9% of respondents incorrectly believed that the effectiveness of PEP was upheld after 72-hours of exposure. Only 14.5% were accurate when selecting 'ineffective' to the posed question. Those respondents who claimed to lack knowledge on the matter accounted for 12.7% of the population. Altogether, a significant figure of 85.6% (respondents possessing both inaccurate or lack of knowledge) of respondents displayed deplorable apprehension on effective PEP usage.

Table 21: Frequency showing knowledge of HCWs on maximum delay for effective PEP usage.

Is PEP ineffective or effective after 72-hours of initial exposure to HIV?	Frequency	Percent
Ineffective	24	14.5
I don't know	21	12.7
Effective	121	72.9
Total	166	100.0

4.6.4 SHARPS DISPOSAL

Table 22, evaluated the awareness of HCWs regarding disposal of sharp materials. A significant number of respondents (95.2%) were accurately aware that sharps should be discarded within a puncture resistant sharps container, with only 4.2% and 0.6%, opting for disposal of infectious material in the general waste bin or recycling bin, respectively. A Fisher's Exact Test indicated $p < 0.001$. This implied a significant difference between the knowledge regarding various disposal avenues of sharp materials.

Table 22: Frequency showing HCWs knowledge regarding disposal of sharp materials.

Where should sharp materials be discarded?	Frequency	Percent
General waste bin	7	4.2
Puncture resistant sharps container	158	95.2
Recycling bin	1	0.6
Total	166	100.0

4.6.5 FACTORS BELIEVED TO INCREASE THE RISK OF HEALTH CARE WORKERS TO NSIS

Table 23 below, summarised the scoring patterns for what HCWs may consider to increase their liklihood of NSIs. Respondents were requested to provide statements 'false', 'not sure, or 'true' when posed the statement 'HCWs can be at risk of NSIs or sharp injuries when they:'

Table 23: Frequency showing the scoring patterns for risk factors believed to increase the liklihood of NSIs.

Risk factors believed to increase the likelihood of NSIs	False		Not sure		True		Chi Square *p*-value
	Count	Row N %	Count	Row N %	Count	Row N %	
Recap needles	31	18.7	0	0.0	135	81.3	< 0.001
Fail to dispose of needles in a puncture-resistant sharps container	4	2.4	1	0.6	161	97.0	< 0.001
Lack proper workstations for procedures using sharps	4	2.4	1	0.6	161	97.0	< 0.001
Bump into a needle/sharp/person holding sharp	11	6.6	2	1.2	153	92.2	< 0.001

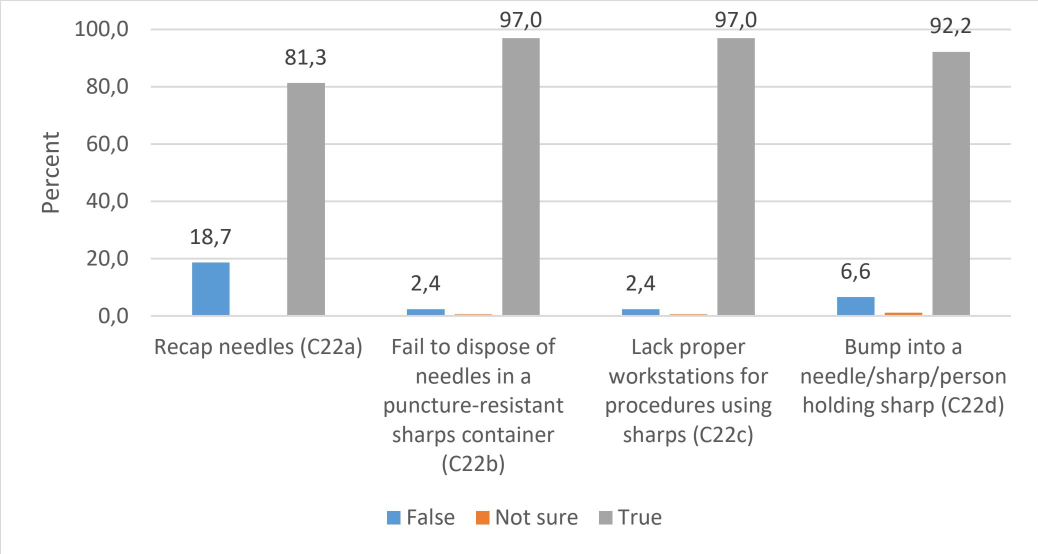

Figure 18: Bar graph showing the scoring patterns for risk factors believed to increase the liklihood of NSIs.

In Figure 18 above, all statements show (significantly) higher levels of agreement (True) whilst other levels of agreement are lower. There are no statements with higher levels of disagreement (False). The significance of the differences were tested and indicated in table 23. The statements: 'Fail to dispose of needles in a puncture-resistant sharps container', 'Lack proper workstations for procedures using sharps', and 'Bump into a needle/sharp/person holding sharp', have similarly high levels of scoring "True". The reason for this occurrence may be attributed to the fact that these factors are not within the control of the HCWs, with their safety in the potential responsibiilty of external sources such as hospital management. Additionally, it is worth considering that in the hospital environment, HCWs are subjected to work pressures and stress that result in unsafe behvaiours (Al-Samarraie and Dodoo 2019: 1). Those statements with a high scoring of 'true' may be due to increase pressure and work demands as described by Al-Samarraie and Dodoo (2019: 1). The recapping of needles, had a lower level of the scoring "True", which may be attributed to the fact that recapping requires additional time, which HCWs may not be in excess of, in a high work demand environment. Furthermore, the respondents were in control of recapping needles and were therefore responsible for their own health and safety.

To determine whether the scoring patterns per statement were significantly different per option, a chi square goodness-of-fit test was done. The null hypothesis claimed that similar numbers of respondents scored across each option for each statement (one statement at a time). The alternate stated that there was a significant difference between the levels of True and False. The results are shown in the table 23.
The highlighted significant values (*p*-values) are less than 0.05 (the level of significance), it implies that the distributions were not similar. That is, the differences between the way respondents scored, 'False', 'Not sure', 'True' were significant.

4.7 SECTION D: HEALTH CARE WORKER ATTITUDE OF OCCUPATIONAL EXPOSURE TO BBF

This section detailed the attitude of HCWs regarding occupational exposure to BBF. In this section the aim was to establish the attitude and belief system of HCWs in relation to BBF and its exposure.

4.7.1 IMPORTANCE OF SAFETY PRECAUTIONS IN HEALTH CARE ORGANISATIONS

Table 24, indicated the degree of importance of safety precautions in health care organisations from the perception of HCWs. Evidently, a large proportion of respondents found safety precautions in health care organisations to be of great importance.

Table 24: Frequency showing the degree of importance of safety precautions in health care organisations from the perception of HCWs.

Importance of safety precautions in health care organisations	Frequency	Percent
Neutral	4	2.4
Important	10	6.0
Very Important	152	91.6
Total	166	100.0

4.7.1.1 CROSS-TABULATION BETWEEN THE IMPORTANCE OF SAFETY PRECAUTIONS IN HEALTH CARE ORGANISATIONS AND PROFESSION

Table 25 below, quantitatively analysed the relationship between the importance of safety precautions in health care organisations and profession. A Fisher's Exact Test indicated $p = 0.581$. This implied no significant relationship between the importance of safety precautions in health care organisations and profession.

Table 25: Cross-tabulation showing the relationship between the importance of safety precautions in health care organisations and profession.

Cross-tabulation between the importance of safety precautions in health care organisations and profession			Profession						Total
			Medical doctor	Medical intern	Nurse	Nursing assistant	Mortuary attendant	Laboratory technician	
Importance of safety precautions in health care organisations	Neutral	Count	0	0	1	3	0	0	4
		% Rate of safety precautions in health care organisations	0.0	0.0	25.0	75.0	0.0	0.0	100.0
		% Within Profession	0.0	0.0	1.1	5.9	0.0	0.0	2.4
		Total %	0.0	0.0	0.6	1.8	0.0	0.0	2.4
	Important	Count	1	0	8	1	0	0	10
		% Rate of safety precautions in health care organisations	10.0	0.0	80.0	10.0	0.0	0.0	100.0
		% Within Profession	8.3	0.0	8.9	20	0.0	0.0	6.0
		Total %	0.6	0.0	4.8	0.6	0.0	0.0	6.0
	Very Important	Count	11	5	81	47	3	5	152
		% Rate of safety precautions in health care organisations	7.2	3.3	53.3	30.9	2.0	3.3	100.0
		% Within Profession (A5)	91.7	100.0	90.0	92.2	100.0	100.0	91.6
		Total %	6.6	3.0	48.8	28.3	1.8	3.0	91.6
Total		Count	12	5	90	51	3	5	166
		% Rate of safety precautions in health care organisations	7.2	3.0	54.2	30.7	1.8	3.0	100.0
		% Within Profession	100.0	100.0	100.0	100.0	100.0	100.0	100.0
		Total %	7.2	3.0	54.2	30.7	1.8	3.0	100.0

4.7.2 ATTITUDE OF HCWS ON THE PRESENCE OF PPE IN ALL WORK DEPARTMENTS

Table 26 described the opinion of HCWs on the presence of PPE in all work departments. Nearly all HCWs (99.4%) advocated for the importance PPE in all units of work.

Table 26: Frequency showing the attitude of HCWs on the presence of PPE in all work departments.

Do you think PPE should be present in all units of the healthcare facility?	Frequency	Percent
No	1	0.6
Yes	165	99.4
Total	166	100.0

4.7.3 ATTITUDE OF HCWS TOWARD RECEIPT OF THE HBV VACCINE

Table 27, described the perception of HCWs regarding the HBV vaccine. A significant proportion of respondents had already received the HBV vaccine (49.4%), with a considerable percentage (41.0%) of those who did not receive the vaccine displaying a favourable attitude toward its receipt. Additionally, only 1.2% of respondents had displayed reluctance to receiving the HBV vaccine. It is evident from the findings described in table 27 that approximately 90.4% of the respondents had a positive attitude toward the HBV vaccine.

Table 27: Frequency showing the perception of HCWs regarding the HBV vaccine.

If you have not received the HBV Vaccine, are you willing to take it?	Frequency	Percent
No	2	1.2
Not sure	14	8.4
Yes	68	41.0
Already received the vaccine	82	49.4
Total	166	100.0

4.7.4 ATTITUDE OF HCWS TOWARD ACQUIRING A BBF EXPOSURE

When asked about the concern of HCWs about acquiring a BBF exposure, 78.3% of respondents indicated that they were in fact apprehensive about acquiring a BBF occupational exposure. However, in the context of the nature of the environment and work being performed, what may be considered a notable size (21.7%) of the population answered ‘no’ to the proposed question, thereby displaying a distinctly negative attitude toward encountering a BBF exposure.

Table 28: Frequency showing the attitude of HCWs toward acquiring a BBF exposure.

Are you concerned about acquiring a blood borne infection?	Frequency	Percent
No	36	21.7
Yes	130	78.3
Total	166	100.0

4.7.4.1 CROSS-TABULATION BETWEEN THE CONCERN OF HCWS ACQUIRING A BLOOD BORNE INFECTION AND LEVEL OF EDUCATION

Table 29, quantitatively analysed the relationship between the concern of HCWs acquiring a blood borne infection via a BBF exposure and level of education. A Fisher's Exact Test indicated $p < 0.001$. This implied a statistically significant relationship between HCWs acquiring a blood borne infection via a BBF exposure and level of education.

Table 29: Cross-tabulation showing the relationship between the concern of HCWs acquiring a blood borne infection via a BBF exposure and level of education.

Cross-tabulation showing the relationship between the concern of HCWs via a BBF exposure and level of education.			Level of education				Total
			High School	Diploma	First Degree	Postgraduate	
Are you concerned about acquiring a blood borne infection via a blood ?	No	Count	8	23	1	4	36
		% Within Are you concerned about acquiring a blood borne infection?	22.2	63.9	2.8	11.1	100.0
		% Within Level of education	47.1	25.0	2.6	21.1	21.7
		Total %	4.8	13.9	0.6	2.4	21.7
	Yes	Count	9	69	37	15	130
		% Within Are you concerned about acquiring a blood borne infection?	6.9	53.1	28.5	11.5	100.0
		% Within Level of education	52.9	75.0	97.4	78.9	78.3
		Total %	5.4	41.6	22.3	9.0	78.3
Total		Count	17	92	38	19	166
		% Within Are you concerned about acquiring a blood borne infection?	10.2	55.4	22.9	11.4	100.0
		% Within Level of education	100.0	100.0	100.0	100.0	100.0
		Total %	10.2	55.4	22.9	11.4	100.0

Table 29 above, described the relationship between HCW concern of acquiring a blood borne infection and the level of education of the HCW. When presented with the question 'are you concerned about acquiring a blood borne infection via a blood or bodily fluid exposure?', of the total sample, 13.9% of respondents who indicated lack of concern were in possession of a national diploma, whilst 4.8%, 2.4% and 0.6% held a high school qualification, postgraduate qualification and first degree, respectively. Contrastingly, those respondents who did in fact express concern about acquiring a BBF exposure accounted for 78.3% of the total population, with 41.6% of the respondents having a national diploma, 22.3% with a first degree, 9.0% having a postgraduate qualification and 5.4% holding a high school qualification. The *p*-value between 'the concern of HCWs acquiring a blood borne infection via a BBF exposure' and 'level of education' is $p < 0.001$. This implied a significant relationship between these two variables. That is, the level of education of the respondents did play a significant role, in terms of concern of the HCW in acquiring a blood borne infection, via a BBF exposure.

It was also noted that significantly more HCWs with a high school qualification only (47.1%) expressed a lack of concern in acquiring a BBF exposure, as compared to the other levels of education (diploma 25.0% and postgraduate qualification 21.2%). Respondents in possession of a first degree presented with a significantly low lack of concern (2.6%). Contrastingly, respondents in possession of a first degree presented with the highest level of concern, with HCWs holding a postgraduate qualification (78.9%) and diploma (75.0%) denoting a significantly high degree of concern, as compared to those respondents with a high school qualification only (52.9%).

4.7.4.2 CROSS-TABULATION BETWEEN THE CONCERN OF HCWS ACQUIRING A BLOOD BORNE INFECTION AND PROFESSION

Table 30, quantitatively analysed the relationship between the concern of HCWs acquiring a blood borne infection via a BBF exposure and profession. A Fisher's Exact Test indicated $p < 0.030$. This implied a statistically significant relationship between HCWs acquiring a blood borne infection via a BBF exposure and profession.

Table 30: Cross-tabulation showing the relationship between the concern of HCWs acquiring a blood borne infection via a BBF exposure and profession.

Cross-tabulation showing the relationship between the concern of HCWs infection via a BBF exposure and profession.			**Profession**						**Total**
			Medical doctor	**Medical intern**	**Nurse**	**Nursing assistant**	**Mortuary attendant**	**Laboratory technician**	
Are you concerned about acquiring a blood borne infection via a blood or bodily fluid exposure?	No	Count	0	0	28	7	0	1	36
		% Within Are you concerned about acquiring a blood borne infection?	0.0	0.0	77.8	19.4	0.0	2.8	100.0
		% Within Profession	0.0	0.0	31.1	13.7	0.0	20.0	21.7
		Total %	0.0	0.0	16,9	4.2	0.0	0.6	21.7
	Yes	Count	12	5	62	44	3	4	130
		% Within Are you concerned about acquiring a blood borne infection?	9.2	3.8	47.7	33.8	2.3	3.1	100.0
		% Within Profession	100,0	100,0	68,9	86.3	100.0	80.0	78.3
		Total %	7,2	3,0	37,3	26,5	1,8	2,4	78,3
Total		Count	12	5	90	51	3	5	166
		% Within Are you concerned about acquiring a blood borne infection?	7.0	3.0	54.2	30.7	1.8	3.0	100.0
		% Within Profession	100.0	100.0	100.0	100.0	100.0	100.0	100.0
		Total %	7.2	3.0	54.2	30.7	1.8	3.0	100.0

Table 30 above, described the relationship between HCW concern of acquiring a blood borne infection and the profession of the HCW. When presented with the question 'are you concerned about acquiring a blood borne infection via a blood or bodily fluid exposure?', of the total sample, 16.9% of respondents who indicated lack of concern belonged to the category 'nurses', whilst 4.2% and 0.6% were affiliated with the nursing assistant and laboratory technician profession, respectively. Medical doctors, medical interns/students and mortuary attendants did not express an immediate lack of concern, as indicated by the response rate of 0.0% for this particular question.

Contrastingly, those respondents who did in fact express concern about acquiring a BBF exposure accounted for 78.3% of the total population, with 37.3% of the respondents within the capacity of a nurse, 26.53% nursing assistants, 7.2% doctors, 3.0% medical interns/students, 2.4% laboratory technicians and 1.8% mortuary attendants. The *p*-value between 'the concern of HCWs acquiring a blood borne infection via a BBF exposure' and 'profession' is $p < 0.030$. This implied a significant relationship between these two variables. That is, the profession of the respondents did play a significant role, in terms of concern of the HCW in acquiring a blood borne infection, via a BBF exposure.

It was also noted that significantly more nurses (31.1%), laboratory technicians (20.0%) and nursing assistants (13.7%) expressed a lack of concern in acquiring a BBF exposure as compared to the rest of the category of professions (0.0% medical doctors, medical interns/students and mortuary attendants). Contrastingly, significantly more (100%) medical doctors, medical interns/students and mortuary attendants conveyed concern, as compared to nurses (68.9%), nursing assistants (86.3%) and laboratory technicians (80%).

4.8 SECTION E: HEALTH CARE WORKER PRACTICES REGARDING OCCUPATIONAL EXPOSURE TO BBF

This section detailed the practice of HCWs regarding occupational exposure to BBF. In this section the aim was to establish the behaviour which may increase the likelihood of HCW exposure to BBF.

4.8.1 RECEIPT OF POST-EXPOSURE PROPHYLAXIS FOLLOWING AN HIV EXPOSURE

As described in table 31, in response to the question 'If you have experienced a Needle Stick Injury (NSI) or Blood or Bodily Fluid (BBF) exposure in the past 12 months, have you received Post-Exposure Prophylaxis (PEP) for HIV?', 58.4% of the total sample selected, 'not applicable', This implied a lack of exposure to NSI or BBF. However, of those respondents who did experience an accidental exposure, a substantial amount of 35.5% indicated that they did not receive PEP following an NSI or BBF exposure, whilst only 6.0% stating that they did.

Table 31: Frequency showing receipt of post-exposure prophylaxis following an HIV exposure.

Have you received Post-Exposure Prophylaxis (PEP) for HIV?	Frequency	Percent
No	59	35.5
Yes	10	6.0
Not applicable	97	58.4
Total	166	100.0

4.8.1.1 CROSS-TABULATION BETWEEN THE RECEIPT OF POST-EXPOSURE PROPHYLAXIS FOLLOWING AN HIV EXPOSURE AND AGE

Table 32, quantitatively analysed the relationship between the receipt of post-exposure prophylaxis following an HIV exposure and age. A Fisher's Exact Test indicated $p < 0.001$. This implied a statistically significant relationship between the receipt of post-exposure prophylaxis following an HIV exposure and age.

Table 32: Cross-tabulation showing the relationship between the receipt of post-exposure prophylaxis following an HIV exposure and age.

Cross-tabulation relationship between the receipt of post-exposure prophylaxis following an HIV exposure and age.			Age group (years)								Total
			18 - 25	26 – 30	31 - 35	36 - 40	41 - 45	46 - 50	51 - 55	> 55	
have you experienced a (NSI) or (BBF) exposure or have you received Post-Exposure Prophylaxis (PEP) for HIV?	No	Count	1	6	9	16	18	5	3	1	59
		% If you have experienced a (NSI) or (BBF) exposure or for HIV?	1.7	10.2	15.3	27.1	30.5	8.5	5.1	1.7	100.0
		% Within Age group (years)	50.0	22.2	32.1	50.0	69.2	15.6	27.3	12.5	35.5
		Total %	0.6	3.6	5.4	9.6	10.8	3.0	1.8	0.6	35.5
	Yes	Count	0	2	1	3	0	1	2	1	10
		% If you have experienced a (NSI) or (BBF) exposure or (PEP) for HIV?	0.0	20.0	10.0	3.0	0.0	100	20.0	10.0	100.0
		% Within Age group (years)	0.0	7.4	3.6	9.4	0.0	3.1	18.2	12.5	6.0
		Total %	0.0	1.2	0.6	1.8	0.0	0.6	1.2	0.6	6.0
	Not applicable	Count	1	19	18	13	8	26	6	6	97
		% If you have experienced a (NSI) or (BBF) exposure or (PEP) for HIV?	1.0	19.6	18.6	13.4	8.2	26.8	6.2	6.2	100.0
		% Within Age group (years)	50.0	70.4	64.3	40.6	30.8	81.3	54.5	75.0	58.4
		Total %	0.6	11.4	10.8	7.8	4.8	15.7	3.6	3.6	58.4
Total		Count	2	27	28	32	26	32	11	8	166
		% If you have experienced a (NSI) or (BBF) exposure or (PEP) for HIV?	1.2	16.3	16.9	19.3	15.7	19.3	6.6	4.8	100.0
		% Within Age group (years)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
		Total %	1.2	16.3	16.9	19.3	15.7	19.3	6.6	4.8	100.0

Table 32, described the relationship between the receipt of post-exposure prophylaxis following an HIV exposure and age. When presented with the question 'If you have experienced a Needle Stick Injury (NSI) or Blood or Bodily Fluid (BBF) exposure in the past 12 months, have you received Post-Exposure Prophylaxis (PEP) for HIV?', of the total sample, 58.4% of the total sample selected, 'not applicable', suggesting potential lack of exposure to NSI or BBF in a professional lifetime. The remaining population who did experience an accidental exposure and did not receive PEP following an NSI or BBF exposure accounted for 35.5% of the total sample. Those respondents who did not receive PEP following an incident, were predominantly between the middle age groups of 51 to 45 years (10.8%) and 36-40 years (9.6%). Respondents between the age category of 26 to 30 years (3.6%), 46 to 50 (3.0%) years and 51 to 55 years (1.8%), moderately contributed to the cohort, whilst the youngest (18 to 25 years) and oldest (>55 years) age categories had the lowest rate (0.6%) of indicating 'no' when presented with the above-mentioned question, regarding the receipt of PEP following an NSI or BBF exposure.

Those respondents who did in fact receive PEP following a subsequent exposure constituted only 6.0% of the total sample, with the respondents occurring mainly within the 26-to-30-year (1.2%) and 46 to 50 year (1.2%) age category as well as 36 to 40 years (1.8%), with the remaining age categories making a minor contribution to the group. The *p*-value between 'the receipt of post-exposure prophylaxis following an HIV exposure.' and 'age' is $p < 0.001$. This implied a significant relationship between these two variables. That is, the age of the respondents did play a significant role, in terms of the receipt of post-exposure prophylaxis, following an HIV exposure.

4.8.1.2 CROSS-TABULATION BETWEEN THE RECEIPT OF POST-EXPOSURE PROPHYLAXIS FOLLOWING AN HIV EXPOSURE AND LEVEL OF EDUCATION

Table 33, quantitatively analysed the relationship between the receipt of post-exposure prophylaxis following an HIV exposure and level of education. A Fisher's Exact Test indicated $p = 0.027$. This implied a statistically significant relationship between the receipt of post-exposure prophylaxis following an HIV exposure and level of education.

Table 33: Cross-tabulation showing the relationship between the receipt of post-exposure prophylaxis following an HIV exposure and level of education.

Cross-tabulation relationship between the receipt of post-exposure prophylaxis following an HIV exposure and level of education.			Level of education				Total
			High School	Diploma	First Degree	Postgraduate	
Have experienced a Needle Stick Injury (NSI) or Blood or Bodily Fluid (BBF) exposure in the past 12 months, have you received Post-Exposure Prophylaxis (PEP) for HIV?	No	Count	9	39	7	4	59
		% If you have experienced a (NSI) or (BBF) exposure or for HIV?	15.3	66.1	11.9	6.8	100.0
		% Within Level of education	52.9	42.4	18.4	21.1	35.5
		Total %	5.4	23.5	4.2	2.4	35.5
	Yes	Count	1	7	2	0	10
		% If you have experienced a (NSI) or (BBF) exposure or for HIV?	10.0	70.0	20.0	0.0	100.0
		% Within Level of education	5.9	7.6	5.3	0.0	6.0
		Total %	0.6	4.2	1.2	0.0	6.0
	Not applicable	Count	7	46	29	15	97
		% If you have experienced a (NSI) or (BBF) exposure or for HIV?	7.2	47.4	29.9	15.5	100.0
		% Within Level of education	41.2	50.0	76.3	78.9	58.4
		Total %	4.2	27.7	17.5	9.0	58.4
Total		Count	17	92	38	19	166
		% If you have experienced a (NSI) or (BBF) exposure or for HIV?	10.2	55.4	22.9	11.4	100.0
		% Within Level of education	100.0	100.0	100.0	100.0	100.0
		Total %	10.2	55.4	22.9	11.4	100.0

Table 33, reflected the association between the receipt of post-exposure prophylaxis following an HIV exposure and level of education. Level of education seemed to have played a significant role in failure to seek PEP, following an NSI or BBF exposure. This was reflected in table 33 above, as those respondents that were in possession of a national diploma only, formed a greater portion (23.5%) of respondents who did not receive PEP following an incident, as compared to those who held a first degree and postgraduate qualification, who presented significantly lower statistics of 4.2% and 2.4%, respectively, in response to the same question. Interestingly, respondents in possession of a high school qualification accounted for only 5.4% of the total sample who did not seek PEP following an accidental exposure.

Despite the small proportion of respondents above, indicating that they did not receive PEP after an exposure, these lower figures observed within the first degree and postgraduate qualification, were not necessarily indicative of a high rate of respondents seeking PEP, as only 1.2% of the total sample in possession of a first degree had indicated receiving PEP following an incident, with none (0.0%) of the respondents in possession of a postgraduate qualification seeking PEP. Such disparities may be largely accredited to the small amount (only 6.0% of total sample) of respondents who overall sought PEP following an occupational exposure.
The p-value between 'the receipt of post-exposure prophylaxis following an HIV exposure.' and 'level of education' is $p = 0.027$. This implied a significant relationship between these two variables. That is, the level of education of the respondents did play a significant role, in terms of the receipt of post-exposure prophylaxis, following an HIV exposure.

It was also noted that significantly more HCWs with a high school qualification only (52.9%) and national diploma (42.4%) did not receive PEP following an incident as compared to the other levels of education (postgraduate qualification 21.1% and first degree 18.4%).

4.8.2 REPORTING PRACTICES

Table 34 below, provided a comprehensive breakdown of the responses of HCWs to the question 'Did you report your NSI/BBF exposure?'. In the data, 55.4% of the total sample was ‘missing’, as a result of respondents selecting, ‘not applicable’, and therefore suggesting lack of NSI or BBF exposure. Within the remaining sample, 27.7% of respondents stated that they did not report the NSI or BBF exposure as compared to only 37.8% who indicated that they did report the incident. A significant difference was presented between the responses ($p < 0.001$).

Table 34: Frequency showing the reporting practices of HCWs.

Did you report your NSI/BBF exposure?	Frequency	Percent
No	46	27.7
Yes	28	16.9
Total	74	44.6
Missing	92	55.4
Total respondents	166	100.0

4.8.2.1 CROSS-TABULATION BETWEEN THE REPORTING PRACTICES OF HCWS AND PROFESSION

Table 35, quantitatively analysed the relationship between the reporting practices of HCWs and profession. A Fisher’s Exact Test indicated $p = 0.003$. This implied a statistically significant relationship between the reporting practices of HCWs and profession.

Table 35: Cross-tabulation showing the relationship between the reporting practices of HCWs and profession.

Cross-tabulation showing the relationship between the reporting practices of HCWs and profession.			Profession						Total
			Medical doctor	Medical intern	Nurse	Nursing assistant	Mortuary attendant	Laboratory technician	
Did you report your NSI/BBF exposure?	No	Count	1	0	28	15	0	2	46
		% Within Did you report your NSI/BBF exposure?	2.2	0.0	60.9	32.6	0.0	4.3	100.0
		% Within Profession	25.0	0.0	70.0	68.2	0.0	100.0	62.2
		Total %	1.4	0.0	37.8	20.3	0.0	2.7	62.2
	Yes	Count	3	5	12	7	1	0	28
		% Within Did you report your NSI/BBF exposure?	10.7	17.9	42.9	25.0	3.6	0.0	100.0
		% Within Profession	75.0	100.0	30.0	31.8	100.0	0.0	37.8
		Total %	4.1	6.8	16.2	9.5	1.4	0.0	37.8
Total		Count	4	5	40	22	1	2	74
		% Within Did you report your NSI/BBF exposure?	5.4	6.8	54.1	29.7	1.4	2.7	100.0
		% Within Profession	100.0	100.0	100.0	100.0	100.0	100.0	100.0
		Total %	5.4	6.8	54.1	29.7	1.4	2.7	100.0

Table 35, illustrated the reporting patterns of HCWs across professional category. Holistically, nurses accounted for the highest professional category from the total sample, who did not report an injury and within the profession nurses (only), nurses had also accounted for the highest number of respondents who failed to report an injury accounting for 70.0% of this category expressing negative reporting practices. Only 30.0% of nurses within the nurse professional category were indicated to have reported an injury. Nursing assistants also presented generally unfavourable reporting behaviours with 20.3% of nursing assistants failing to report injuries.

Favourable reporting behaviour was noted amongst medical doctors and medical interns/students, as a greater proportion of respondents in these professions were found to report an NSI or BBF exposure as compared to failure to report (4.1% compared to 1.4% for medical doctors and 6.8% compared to 0.0% for medical interns/ students). Mortuary attendants constituted a minor portion of respondents who reported injuries (1.4%), with laboratory technicians not reporting any incidents (0.0%). The p-value between 'the reporting practices of HCWs' and 'level of education' is p = 0.003. This implied a significant relationship between these two variables. That is, the profession of the respondents did play a significant role in terms of the reporting practices of HCWs.

4.8.2.2 CROSS-TABULATION BETWEEN THE REPORTING PRACTICES OF HCWS AND WORK DEPARTMENT

Table 36, quantitatively analysed the relationship between the reporting practices of HCWs and work department. A Fisher's Exact Test indicated p = 0.871. This implied no significant difference between the reporting practices of HCWs and work department. However, it is worth noting which departments reported NSI or BBF exposures the least.

Table 36: Cross-tabulation showing the relationship between the reporting practices of HCWs and working department.

Cross-tabulation relationship between the reporting practices of HCWs and working department.			Working department/unit									Total
			Casualty and OPD	Paediatric ward	Maternity ward	CSSD, SOPD	General wards	Mobile clinic	Mortuary attendants	Laboratory	ICU	
Did you report your NSI/BBF exposure?	No	Count	10	6	5	2	19	1	0	2	1	46
		% Within Did you report your NSI/BBF exposure?	21.7	13.0	10.9	4.3	41.3	2.2	0.0	4.3	2.2	100.0
		% Within Working department	66.7	75.0	55.6	50.0	59.4	50.0	0.0	100.0	100.0	62.2
		Total %	13.5	8.1	6.8	2.7	25.7	1.4	0.0	2.7	1.4	62.2
	Yes	Count	5	2	4	2	13	1	1	0	0	28
		% Within Did you report your NSI/BBF exposure?	17.9	7.1	14.3	7.1	46.4	3.6	3.6	0.0	0.0	100.0
		% Within Working department	33.3	25.0	44.4	50.0	40.6	50.0	100.0	0.0	0.0	37.8
		Total %	6.8	2.7	5.4	2.7	17.6	1.4	1.4	0.0	0.0	37.8
Total		Count	15	8	9	4	32	2	1	2	1	74
		% Within Did you report your NSI/BBF exposure?	20.3	10.8	12.2	5.4	43.2	2.7	1.4	2.7	1.4	100.0
		% Within Working department	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
		Total %	20.3	10.8	12.2	5.4	43.2	2.7	1.4	2.7	1.4	100.0

The *p*-value between 'the reporting practices of HCWs' and 'working department' presented no indication of a significant relationship between the two variables measured in Table 36 above (p = 0.871). That is, the work department of the respondents did not play a significant role in terms of the reporting practices of HCWs. However, table 36 provided a useful description of which units in particular had inadequate reporting behaviour. General wards (male and female) were observed to have the most adverse reporting practices of NSI and BBF exposure (25.7% of the total sample), followed by casualty and OPD (13.5%). Paediatric (8.1%) and maternity and labour ward (6.8%) had similarly moderate lack of reporting polls with theatre, CSSD and SOPD (2.7%) as well as laboratory (2.7%), mobile clinic (1.4%) and ICU (1.4%) in succession. Only 1.8% of respondents within the mortuary department had reported an injury.

4.8.3 CONTROL MEASURES POST-EXPOSURE

Table 37 below, evaluated the measures taken by HCWs after their last subsequent BBF exposure. This particular question had a 97% response rate, with 3% of the sample failing to participate in this segment. This may be a result of a lack BBF exposure experienced on the respondent's part. Of those 97% of respondents who did participate in the section, a significant proportion of the participants (36.1%) stated that they 'rinsed wound with water and soap after some time', with only 13% stating to have 'rinsed wound with water and soap immediately'. An alarming proportion of respondents stated to 'Rinse wound with antiseptic solution' (22.9%). Those respondents that selected 'Tested patient for HBV/HCV/HIV' accounted for 12.0% of the total sample. The options 'Expressed blood from wound', 'Rinsed wound with bleach' and 'Rinsed wound with iodine solution', were among the less popular options and accounted for 8.4%, 3.0% and 1.2% of responses, respectively. A statistically significant association between the various measures was observed ($p < 0.001$).

Table 37: Frequency showing the measures taken by HCWs after their last subsequent BBF exposure.

Frequency showing the measures taken by HCWs	Frequency	Percent
Rinsed wound with water and soap immediately	22	13.3
Rinsed wound with water and soap after some time	60	36.1
Rinsed wound with antiseptic solution	38	22.9
Rinsed wound with bleach	5	3.0
Rinsed wound with iodine solution	2	1.2
Expressed blood from wound	14	8.4
Tested patient for HBV/HCV/HIV	20	12.0
Total	161	97.0
Missing	5	3.0
Total respondents	166	100.0

4.8.4 CONTROL MEASURES POST-EXPOSURE

Table 38, described the safety practices of HCWs regarding the coverage of open cuts and wounds before the start of a work shift. A large number (84.3%) of respondents indicated to 'always' cover cuts and wounds before the commencement of work, with 14.5% selecting 'sometimes' and 1.2% claiming to 'never' cover cuts and wounds before a work shift. A statistically significant association between the various options was noted ($p < 0.001$).

Table 38: Frequency showing the safety practices of HCWs regarding the coverage of open cuts and wounds before the start of a work shift.

How often do you cover wounds or cuts on the skin before you start work?	Frequency	Percent
Never	2	1.2
Sometimes	24	14.5
Always	140	84.3
Total	166	100.0

4.8.5 NEEDLE RECAPPING PRACTICES

In table 39, the needle recapping practices of the respondents was clearly delineated. In the sample population, 74.1% of respondents claimed to ‘never’ recap needles, with a distressing proportion of the total sample (12.0%) stating to ‘always’ recap needles after use. The remainder of the population were found to recap needles ‘sometimes’ (14.5%) and ‘most times’ (4.8%) after subsequent use. It was evident from the results indicated in table 39, that approximately a quarter (25.8%) of the respondents engage in some degree of needle recapping after use. A statistically significant association between the various options was noted ($p < 0.001$).

Table 39: Frequency showing the needle recapping practices of the respondents.

How often do you recap needles after use?	Frequency	Percent
Never	123	74.1
Sometimes	15	9.0
Most times	8	4.8
Always	20	12.0
Total	166	100.0

4.8.5.1 CROSS-TABULATION BETWEEN THE NEEDLE RECAPPING PRACTICES AND PROFESSION

Table 40, quantitatively analysed the relationship between needle recapping practices and profession. A Fisher’s Exact Test indicated $p = 0.918$. This implied no significant relationship between needle recapping practices and profession. Regardless, table 40 below provided an indication of which profession in particular, engaged in a higher frequency of needle recapping.

Table 40: Cross-tabulation showing the relationship between needle recapping practices and profession.

Cross-tabulation showing the relationship between needle recapping practices and profession.			Profession						Total
			Medical doctor	Medical intern	Nurse	Nursing assistant	Mortuary attendan	Laboratory technician	
How often do you recap needles after use?	Never	Count	9	5	63	39	3	4	123
		% Within How often do you recap	7.3	4.1	51.2	31.7	2.4	3.3	100.0
		% Within Profession	75.0	100.0	70.0	76.5	100.0	80.0	74.1
		Total %	5.4	3.0	38.0	23.5	1.8	2.4	74.1
	Sometimes	Count	2	0	11	2	0	0	15
		% Within How often do you recap	13.3	0.0	73.3	13.3	0.0	0.0	100.0
		% Within Profession	16.7	0.0	12.2	3.9	0.0	0.0	9.0
		Total %	1.2	0.0	6.6	1.2	0.0	0.0	9.0
	Most times	Count	0	0	4	4	0	0	8
		% Within How often do you recap	0.0	0.0	50.0	50.0	0.0	0.0	100.0
		% Within Profession	0.0	0.0	4.4	7.8	0.0	0.0	4.8
		Total %	0.0	0.0	2.4	2.4	0.0	0.0	4.8
	Always	Count	1	0	12	6	0	1	20
		% Within How often do you recap	5.0	0.0	60.0	30.0	0.0	5.0	100.0
		% Within Profession	8.3	0.0	13.3	11.8	0.0	20.0	12.0
		Total %	0.6	0.0	7.2	3.6	0.0	0.6	12.0
Total		Count	12	5	90	51	3	5	166
		% Within How often do you recap	7.2	3.0	54.2	30.0	1.8	3.0	10.0
		% Within Profession (A5)	100.0	100.0	100.0	10.,0	100.0	100.0	100.0
		Total %	7.2	3.0	54. 2	30.7	1.8	3.0	100.0

The *p*-value between 'needle recapping practices' and 'profession' presented no indication of a significant relationship between the two variables measured in table 40 above ($p = 0.918$). That is, the profession of the respondents did not play a significant role in terms of the needle recapping practices. However, table 40 provided a useful description of which category of employment in particular had inadequate recapping behaviour. Nurses were among the highest respondents to engage in needle recapping after use (7.2%), succeeded by nursing assistants (3.6%). Medical doctors and laboratory technicians displayed the lowest rate of needle recapping behaviours (both having a 0.6% response rate for 'always'), with medical interns/students and mortuary attendants engaging in no forming of needle recapping (both having a 0.0% response rate for 'always', 'most times' and 'sometimes').

4.8.5.2 CROSS-TABULATION BETWEEN THE NEEDLE RECAPPING PRACTICES AND AGE

Table 41, quantitatively analysed the relationship between needle recapping practices and age. A Fisher's Exact Test indicated $p = 0.056$. This implied a significant relationship between needle recapping practices and age.

Table 41: Cross-tabulation showing the relationship between needle recapping practices and age.

Cross-tabulation showing the relationship between needle recapping practices and age.			Age group (years)								Total
			18 - 25	26 - 30	31 - 35	36 - 40	41 - 45	46 - 50	51 - 55	> 55	
How often do you recap needles after use?	Never	Count	1	20	20	22	21	28	6	5	123
		% Within How often do you recap needles after use?	0.8	16.3	16.3	17.9	17.1	22.8	4.9	4.1	100.0
		% Within Age group (years)	50.0	74.1	71.4	68.8	80.8	87.5	54.5	62.5	74.1
		Total %	0.6	12.0	12.0	13.3	12.7	16.9	3.6	3.0	74.1
	Some times	Count	0	4	4	1	0	3	1	2	15
		% Within How often do you recap needles after use?	0.0	26.7	26.7	6.7	0.0	20.0	6.7	13.3	100.0
		% Within Age group (years)	0.0	14.8	14.3	3.1	0.0	9.4	9.1	25.0	9.0
		Total %	0.0	2.4	2.4	0.6	0.0	1.8	0.6	1.2	9.0
	Most times	Count	0	1	2	2	3	0	0	0	8
		% Within How often do you recap needles after use?	0.0	12.5	25.0	25.0	37.5	0.0	0.0	0.0	100.0
		% Within Age group (years)	0.0	3.7	7.1	6.3	11.5	0.0	0.0	0.0	4.8
		Total %	0.0	0.6	1.2	1.2	1.8	0.0	0.0	0.0	4.8
	Always	Count	1	2	2	7	2	1	4	1	20
		% Within How often do you recap needles after use?	5.0	10.0	10.0	35.0	10.0	5.0	20.0	5.0	100.0
		% Within Age group (years)	50.0	7.4	7.1	21.9	7.7	3.1	36.4	12.5	12.0
		Total %	0.6	1.2	1.2	4.2	1.2	0.6	2.4	0.6	12.0
Total		Count	2	27	28	32	26	32	11	8	166
		% Within How often do you recap needles after use?	1.2	16.3	16.9	19.3	15.7	19.3	6.6	4.8	100.0
		% Within Age group (years)	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
		Total %	1.2	16.3	16.9	19.3	15.7	19.3	6.6	4.8	100.0

In Table 41, the middle age category between 36 to 40 years (4.2%), most often employed needle recapping, followed by 51 to 55 years (2.4%). The groupings, 26 to 30 years, 31 to 35 years, and 41 to 45 years displayed a needle recapping rate of 1.2%. Contributing to the lowest rate (0.6%) of needle recapping behaviours were the age groups, 18 to 25 years, 46 to 50 years and greater than 55 years.

The *p*-value between 'between needle recapping practices' and 'age' is $p = 0.056$. This implied a significant relationship between these two variables. That is, the age of the respondents did play a significant role, in terms of the needle recapping practices of HCWs.

4.8.6 NEEDLE DISPOSAL PRACTICES

Table 42, outlined the needle disposal practices of the respondents. A substantial measure (86.1%) of respondents indicated 'always' when asked 'how often do you dispose of sharps in a puncture-resistant safety box?', with 5.4% selecting 'sometimes', 4.8% opting for 'never' and 3.6% claiming to dispose of sharps in a puncture-resistant safety box (most times). A statistically significant association between the various options was noted ($p < 0.001$).

Table 42: Frequency showing the needle disposal practices of the respondents.

How often do you dispose of sharps in a puncture-resistant safety box?	Frequency	Percent
Never	8	4.8
Sometimes	9	5.4
Most times	6	3.6
Always	143	86.1
Total	166	100.0

4.8.7 PRECAUTIONARY MEASURES OF HCWS REGARDING BBF EXPOSURE

Table 43 below, summarised the scoring patterns for the precautionary measures HCWs may engage in, that may decrease their liklihood of a BBF exposure. Respondents were requested to provide statements ‘never, ‘sometimes’, ‘most times’ or ‘always’ when posed the question: ‘To what extent do you carry out the following practices?’.

Table 43: The scoring patterns for the precautionary measures HCWs may engage in, that may decrease their liklihood of a BBF exposure.

Scoring patterns for the precautionary measures of HCWs	Never		Sometimes		Most times		Always		Chi Square *p*-value
	Count	Row N %	Count	Row N %	Count	Row N %	Count	Row N %	
I wash hands after a bodily fluid exposure	4	2.4	22	13.3	8	4.8	132	79.5	< 0.001
I wash hands after a blood exposure	0	0.0	0	0.0	19	11.4	147	88.6	< 0.001
I provide nursing care considering all patients as potentially infectious	1	0.6	1	0.6	22	13.3	142	85.5	< 0.001
I protect myself against bodily fluids of all patients regardless of their diagnosis	0	0.0	0	0.0	23	13.9	143	86.1	< 0.001

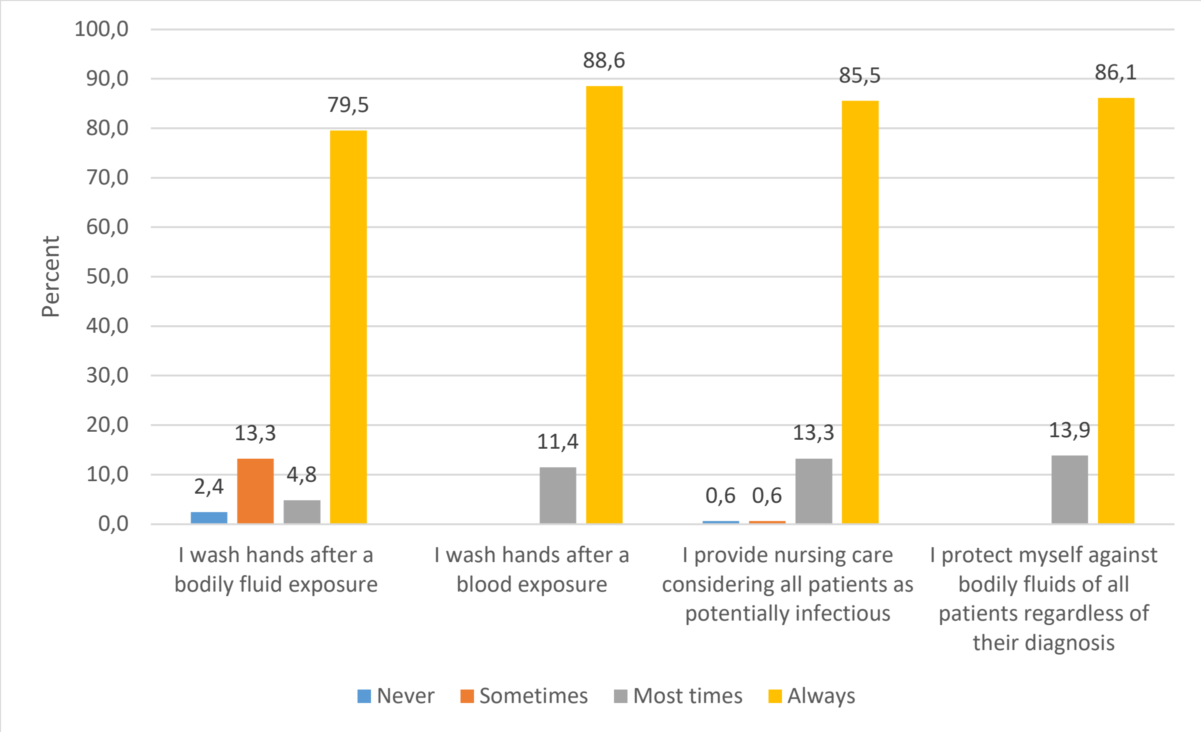

Figure 19: Bar graph showing the scoring patterns for the precautionary measures HCWs may engage in, that may decrease their liklihood of a BBF exposure.

In figure 19 above, all statements showed (significantly) higher levels of performance (Always) whilst other levels of performance were lower. Statements with higher levels of non-performance (Never) constitute a range between 0.0% to 2.4%. The significance of the differences were tested and indicated in table 43. The statements: 'I wash hands after a blood exposure', 'I provide nursing care considering all patients as potentially infectious', and 'I protect myself against bodily fluids of all patients regardless of their diagnosis', have similarly high levels of scoring "Always".

To determine whether the scoring patterns per statement were significantly different per option, a chi square goodness-of-fit test was done. The null hypothesis claimed that similar numbers of respondents scored across each option for each statement (one statement at a time). The alternate stated that there was a significant difference between the levels of performance. The results are shown in the table 43.

The highlighted significant values (*p*-values) were less than 0.05 (the level of significance), it implied that the distributions were not similar. That is, the differences between the way respondents scored, 'never, 'sometimes', 'most times' or 'always' were significant.

4.9 SECTION F: PERCEPTIONS OF HEALTH CARE WORKERS ON INFECTION PREVENTION AND CONTROL

This section detailed the perceptions of health care workers on infection prevention and control of occupational exposure to BBF. In this section the aim was to establish what the HCWs may consider to be barriers to IPC.

4.9.1 BARRIERS TO IPC

Table 44, summarised the scoring patterns for the barriers to IPC from the perspective of the HCW. Respondents were requested to provide statements 'no, 'not sure' or 'yes' when posed the statement: 'which of the following factors would you consider as a barrier to IPC within the hospital?'.

Table 44: Frequency showing the scoring patterns for the barriers to IPC from the perspective of the HCW.

Barriers to IPC	No		Not sure		Yes		Chi Square *p*-value
	Count	Row N %	Count	Row N %	Count	Row N %	
Lack of knowledge on infection control	15	9.0	10	6.0	141	84.9	< 0.001
Cost requirements for interventions	13	7.8	85	51.2	68	41.0	< 0.001
Lack of surveillance	45	27.1	13	7.8	108	65.1	< 0.001
Lack of feedback on monitoring infection	20	12.1	7	4.2	138	83.6	< 0.001
Infrequent or absence of regular infection prevention and control committee meetings	14	8.4	38	22.9	114	68.7	< 0.001
Lack of training on infection prevention and control	18	10.8	4	2.4	144	86.7	< 0.001
Lack of availability of infection prevention and control guidelines	18	10.8	7	4.2	141	84.9	< 0.001

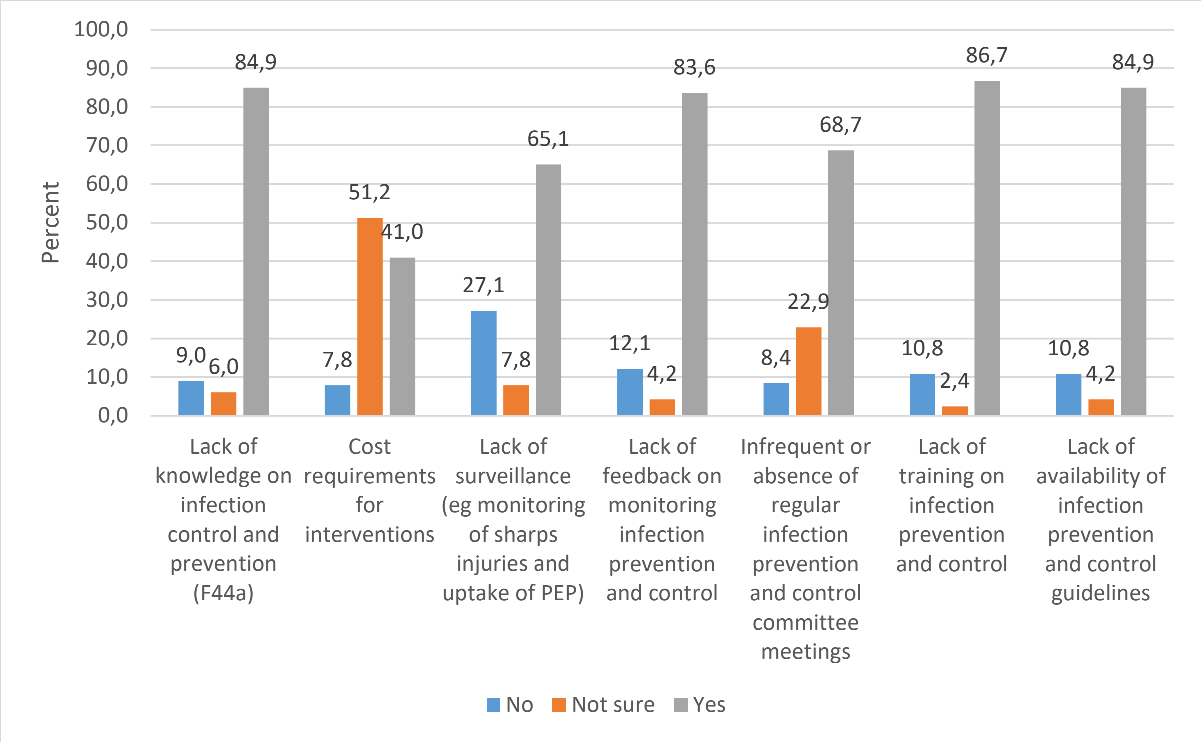

Figure 20: Bar graph showing the showing the scoring patterns for the barriers to IPC from the perspective of the HCW.

In figure 20, the statements: 'Lack of knowledge on infection control and prevention', 'Lack of feedback on monitoring infection prevention and control', 'Lack of training on infection prevention and control' and 'Lack of availability of infection prevention and control guidelines', showed (significantly) higher levels of agreement (Yes). However, a considerable amount of respondents (27.1%), indicated that 'Lack of surveillance (eg monitoring of sharps injuries and uptake of PEP)', was not a barrier to IPC. Furthermore, 22.9% of respondents selected 'not sure' for the statement, 'Infrequent or absence of regular infection prevention and control committee meetings', thereby displaying a potential lack of awareness on this event altogether. Additionally, when asked whether 'Cost requirements for interventions' may likely be impeding IPC, more than half of the total sample exhibited complete ignorance in this regard.

To determine whether the scoring patterns per statement were significantly different per option, a chi square goodness-of-fit test was done. The null hypothesis claimed that similar numbers of respondents scored across each option for each statement (one statement at a time). The alternate stated that there was a significant difference between the levels of agreement. The results are shown in the table 44.

The highlighted significant values (*p*-values) were less than 0.050 (the level of significance), and implied that the distributions were not similar. That is, the differences between the way respondents scored each statement.

4.9.2 INFECTION PREVENTION AND CONTROL COMMUNICATION

Table 45, represented the perception of HCWs regarding effective communication on matters pertinent to IPC within the institution. In the sample population, 68.1% of respondents stated ‘yes’, 13.3% stated ‘no’, with 18.7% of the sample population appearing to be ‘not sure’ of the degree of communication relating to IPC. Collectively, 32.0% of the total sample presented with what may be perceived as a generally unfavourable view in terms of effective communication on IPC. A statistically significant association between the various options was noted ($p < 0.001$).

Table 45: Frequency showing the perception of HCWs regarding effective communication on matters pertinent to IPC within the institution.

Is there effective communication regarding infection prevention and control within the hospital?	Frequency	Percent
No	22	13,3
Not sure	31	18,7
Yes	113	68,1
Total	166	100,0

4.9.3 INFECTION PREVENTION AND CONTROL EMPHASIS BY HOSPITAL MANAGEMENT

Table 46, described the impression that HCWs may have on the level of emphasis hospital management may place on IPC. In conjunction with the response (Yes), illustrated in table 45, 68.1% of respondents again agreed that hospital management did in fact give IPC adequate attention. Contrastingly, a significant proportion of respondents (31.3%) stated ‘No’, thereby proposing that IPC was not prioritised by the leadership of the hospital. Additionally, only 0.6% of respondents reported to be unsure in this regard. A statistically significant association between the various options was noted ($p < 0.001$).

Table 46: Frequency showing the impression HCWs have on the emphasis hospital management places on IPC.

Do you think hospital management gives infection prevention and control adequate attention?	Frequency	Percent
No	52	31.3
Not sure	1	0.6
Yes	113	68.1
Total	166	100.0

4.9.4 INFECTION PREVENTION AND CONTROL PRINCIPLES

Table 47, indicated whether or not respondents have received information and training on IPC principles. As shown in table 47, 76.5% of the respondents claimed to be adequately informed on the IPC principles. However, a considerable amount of respondents stated ‘no’, thereby indicating a potential lack of knowledge on the basic prevention and control standards and norms. Of the sample, 1.8% indicated ‘not sure’ to the proposed statement- which could potentially be a probable indication of lack of awareness on the matter. A statistically significant association between the various options was noted ($p < 0.001$).

Table 47: Frequency showing the receipt of information and training on IPC principles.

Have you been informed about the infection	Frequency	Percent
No	36	21.7
Not sure	3	1.8
Yes	127	76.5
Total	166	100.0

4.9.5 INFECTION PREVENTION AND CONTROL TRAINING

The respondents who stated that they had undergone information and training on IPC principles were required to indicate the last training programme they had undergone. A considerable number of respondents (30.7%) were found to have received training more than 24 months ago, with 28.9% stating that the last programme was attended 13 to 24 months ago, and only 9.6% and 7.2% of respondents indicting that they had undergone training between 6 to 12 months ago and less than 6 months, respectively.

According to the Occupational Health and Safety Act (No. 85 of 1993), Regulations for Hazardous Biological Agents – Information and Training, it is the duty of the employer to ensure that their employees undergo refresher training annually, or at intervals deemed appropriate by the health and safety committee or representative in the organisation (South African Department of Labour 1993: 207). A statistically significant association between the various intervals of training was observed ($p < 0.001$).

Table 48: Frequency showing last training undergone on information and training on IPC principles.

If you answered Yes to question 51, when last have you undergone training?	Frequency	Percent
< 6 months	12	7.2
6 - 12 months	16	9.6
13 - 24 months	48	28.9
> 24 months	51	30.7
Total	127	76.5
Missing	39	23.5
Total respondents	166	100.0

4.9.6 AWARENESS OF REGULATIONS FOR HAZARDOUS BIOLOGICAL AGENTS

The respondents were asked to indicate whether or not they were aware of the 'Regulations for Hazardous Biological Agents, as stipulated in the Occupational Health and Safety Act No 85 of 1993'. Table 49 indicated that 57.8% of the total sample were knowledgeable about the previously mentioned regulations. Despite constituting a substantial portion of the total sample, this figure cannot be considered a desirable ratio of awareness, especially within a precarious work environment like that of a hospital setting. Additionally, an estimated 31.3% of respondents claimed to be unaware of such regulations, with 10.8% of the total sampling expressing a degree of uncertainty. Distressingly, approximately 42.1% of the sample population expressed displeasing feedback regarding awareness on the Hazardous Biological Agents Regulations. A statistically significant association between the different responses was observed ($p < 0.001$).

Table 49: Frequency showing awareness of regulations for hazardous biological agents.

Awareness of the Regulations for Hazardous Biological Agents	Frequency	Percent
No	52	31.3
Not sure	18	10.8
Yes	96	57.8
Total	166	100.0

4.10 BINARY LOGISTIC REGRESSION

The following binary logistical regression model of factors associated with an experience of injury whilst the performance or in assistance of procedures over a professional lifetime is depicted in table 50. This model was generated using the question, "Have you ever experienced an injury while performing or assisting procedures in your professional lifetime?" as the dependent variable, and each of the following as independent variables:

- Level of education
- How many years have you been employed in the hospital as a HCW?
- Working department/unit
- Where should sharp materials be discarded?
- Are you concerned about acquiring a blood borne infection via a blood or bodily fluid exposure?
- How often do you recap needles after use?
- Have you been informed about the infection prevention principles?

No adjustments were made as the highlighted (in orange) chi square *p*-values were also significant for the individual cross-tabulations. The odds ratio is given by Exp (B).

Table 50: Frequency showing binary logistical regression model of factors associated with an experience of injury whilst the performance or in assistance of procedures over a professional lifetime.

Frequency showing binary logistical regression model of factors associated with an experience of injury	B	Wald	Df	Sig.	Exp(B)	95% C.I.for EXP(B)	
						Lower	Upper
Level of education: Postgraduate		10.908	3	0.012			
Level of education: High School	3.433	10.106	1	0.001	30.984	3.731	257.323
Level of education: Diploma	1.054	2.107	1	0.147	2.870	0.691	11.920
Level of education: First Degree	0.812	0.910	1	0.340	2.252	0.425	11.931
1 - 5 years have you been employed in the hospital as an HCW?		29.137	6	0.000			
6 - 10 years have you been employed in the hospital as an HCW?	-1.916	9.659	1	0.002	0.147	0.044	0.493
11 - 15 years have you been employed in the hospital as an HCW?	-4.256	27.554	1	0.000	0.014	0.003	0.069
16 - 20 years have you been employed in the hospital as an HCW?	-2.268	7.283	1	0.007	0.104	0.020	0.538
21 - 25 years have you been employed in the hospital as an HCW?	-2.152	3.989	1	0.046	0.116	0.014	0.961
26 - 30 years have you been employed in the hospital as an HCW?	-2.573	4.134	1	0.042	0.076	0.006	0.911
> 30 years have you been employed in the hospital as an HCW?	-22.358	0.000	1	1.000	0.000	0.000	
Working department/unit: Casualty and OPD		16.481	8	0.036			
Working department/unit: Paediatric ward	-0.882	0.717	1	0.397	0.414	0.054	3.189
Working department/unit: Maternity and labour ward	3.036	10.520	1	0.001	20.822	3.325	130.403
Working department/unit: Theatre, CSSD, SOPD	0.255	0.037	1	0.848	1.291	0.094	17.673
Working department/unit: General wards male and female	0.436	0.505	1	0.477	1.547	0.465	5.150
Working department/unit: Mobile clinic	2.920	2.404	1	0.121	18.536	0.463	742.550
Working department/unit: Mortuary attendants	0.756	0.238	1	0.626	2.130	0.102	44.525

Working department/unit: Laboratory	1.914	2.564	1	0.109	6.778	0.651	70.529
Working department/unit: Intensive Care Unit (ICU)	-18.861	0.000	1	1.000	0.000	0.000	
Where should sharp materials be discarded? General waste bin		0.175	2	**0.916**			
Where should sharp materials be discarded? Puncture resistant sharps container	0.460	0.175	1	0.676	1.584	0.184	13.661
Where should sharp materials be discarded? Recycling bin	-18.838	0.000	1	1.000	0.000	0.000	
Are you concerned about acquiring a blood borne infection via a blood or bodily fluid exposure? No	1.326	5.340	1	0.021	3.765	1.223	11.591
How often do you recap needles after use? Always		1.880	3	0.598			
How often do you recap needles after use? Never	0.327	0.244	1	0.621	1.387	0.378	5.087
How often do you recap needles after use? Sometimes	1.225	1.734	1	0.188	3.404	0.550	21.077
How often do you recap needles after use? Most times	0.248	0.047	1	0.828	1.281	0.138	11.924
Have you been informed about the infection prevention principles? No		1.122	2	0.571			
Have you been informed about the infection prevention principles? Not sure	0.707	0.248	1	0.618	2.027	0.126	32.619
Have you been informed about the infection prevention principles? Yes	0.567	1.062	1	0.303	1.764	0.600	5.189

In table 50, with regard to level of education, it was evident that respondents with a high school qualification were 30.984 times more likely to have suffered an injury than a postgraduate respondent. Respondents with a diploma or a degree were also more than 2 times more likely to suffer an injury compared to a postgraduate. Inverse referencing of the odd ratios for number of years worked in the hospital, indicated that respondents with longer service were more likely to injure themselves compared to the baseline of less than 5 years of work experience. Most respondents had higher odds of injury whilst working in other departments when compared to (the reference department of) Casualty and OPD. With regard to occupational exposure to BBF, respondents within the nursing category was found to constitute the greatest risk of exposure.

CHAPTER FIVE

DISCUSSION

5.1. INTRODUCTION

This study was designed to extensively evaluate the knowledge, attitude and practices of HCWs regarding BBF exposure and to assess HCWs perceptions on the barriers to infection prevention and control in a public hospital of KwaZulu-Natal. The study was based at Osindisweni Hospital, a district hospital within the eThekwini Health District. The primary method of data collection involved the use of a structured, standardised questionnaire and consisted of questions relating to the knowledge, attitude and practices of health care workers as well as factors affecting infection prevention and control. The objective of the study was to furnish hospital management with the necessary data to address the knowledge and attitude shortfalls in relation to HCWs behaviour and practices, when working with BBF, in hopes of reducing the rate of BBF exposures, and its associated burden. Furthermore, this study also strove to determine how HCWs perceive factors that may negatively impact IPC within the hospital. Once the perceptions of HCWs have been identified, hospital management may be actively aware of the pitfalls in IPC, as perceived by the HCWs, and thus effectuate intervention strategies that are most appropriate to withstand this indisposition.

The questionnaire response rate was 100%. This exceptional proportion of response from all HCWs recruited for the study may potentially owe to the presence of the researcher during the entire data collection process. Upon receipt of seemingly ‘completed’ questionnaires by the HCWs, the probability of incompleteness was eliminated, as the researcher verified completeness and consistency, by manually checking each and every questionnaire, as recovered, for completion, clarity and accuracy of data. Those questionnaires that were revealed to be incomplete were immediately returned to the respondent, for completion. Additionally, the target population within the study setting was somewhat vast (199 HCWs), as such attainment of a 100% response rate was achievable. Heightened and direct contact with respondents and manual dispersion of questionnaires appeared to be linked with an increased rate of response (NHS 2020 and Emerald Publishing 2022).

5.2. SOCIODEMOGRAPHIC FACTORS

A significant proportion of HCWs employed within the hospital were observed to be female, with males constituting only a minor portion of the workforce. A contributing factor to this occurrence, as described by Mao *et al.* (2021: 1) is that the nursing profession continues to be a female-dominated field. This may potentially owe to the fact that as per prevailing social norms, work that involves the provision of care were mainly within the domain of women, whereas men were regarded as the breadwinners of the household, thereby resulting in the marginalisation of males who opted for this career pathway (Mao *et al.* 2021: 1).

A large proportion of the respondents were between the middle age groups of 36 to 40 years and 46 to 50 years. This age category did not show much deviation from the statistics displayed within the Age Statistics generated by the South African Nursing Council (2019: 1). Additionally, the contributing factor to an aging nurse workforce may be attributed to fewer young individuals opting for a profession in nursing (Buerhaus *et al.* 2000:1).

More than half of the respondents were in possession of a national diploma, with the HCWs also in possession of other forms of tertiary education such as a degree, postgraduate qualification and a small proportion of the workforce in possession of a high school education only.

Most of the respondents were only employed within the hospital for 1 to 5 years, thereby indicating that a large number of the HCWs employed within the hospital have limited experience within this particular setting, and may be unfamiliar with the norms and standards within the hospital.

A significant proportion of the HCW population were within the nursing and nursing assistant profession, with medical doctors only constituting a small percentage. Other professions, less commonly occurring than nurses, nursing assistants and medical doctors were also present such as medical interns/students, laboratory technicians and mortuary attendants. These findings were consistent with those described by Lee *et al.* (2017: 3).

A large portion of the respondents were operational within the general wards (male and female), followed by the casualty and OPD departments, maternity and labour ward, paediatric ward, theatre, CSSD, SOPD, laboratory, mortuary, mobile clinic and intensive care unit (ICU). These findings were not in line with those of Markovic *et al.* (2013: 790), who found that HCWs were most frequently occurring within the clinical wards and operating theatres, whereas in the study performed by the researcher, theatre accounted for a lower proportion of HCWs.

5.3. RISK FACTORS FOR OCCUPATIONAL EXPOSURE TO BBF

Medical doctors were found to administer the greatest average amount of injections, IVs or any other miscellaneous activities that may have increased likelihood of BBF exposure. This was followed closely by nursing assistants and nurses, with medical interns/students and laboratory technicians administering the least. These results were mirrored, to an extent, by those presented by Mekonnin *et al.* (2018: 4) who also found medical doctors to participate in activities of greatest risk to BBF. However, where Mekonnin *et al.* (2018: 4) found laboratory technicians along the similar high risk of exposure as doctors, the study conducted by the researcher actually found laboratory technicians at the lowest risk of exposure. This low risk of exposure to BBF by the laboratory technicians described in this study, was consistent with the findings denoted in a study performed by Muluken and Gedefaw (2014: 17) in North West Ethiopia.

A notable degree of the respondents claimed to have not experienced an injury while performing or assisting procedures in a professional lifetime, however, a significant percentage of respondents claimed to have experienced some degree of injury. Almost the entire population of the sample stated to not have experienced an injury in the past 12 months. When evaluating the relationship between experience of an injury while performing or assisting procedures in a professional lifetime and profession, nurses and nursing assistants were found to most often experience an occupational exposure to BBF. This finding was consistent with that established by Lee *et al.* (2017: 5) who attributed these results to the high proportion of nurses as compared to other medical professions in the hospital environment. Medical doctors, medical interns/students, laboratory technicians, and mortuary attendants did not make a significant contribution to the overall experience of an injury whilst performing duties in this study. However, contradicting the findings of this study, Kermode *et al.* (2005: 36) had reported a higher incidence of occupational exposure amongst rural North Indian medical doctors. Further contradicting the findings of this study, Karani *et al.* (2011: 464) whose study aimed to assess the prevalence of occupational exposures amongst medical interns, at Addington Hospital in Durban, found medical interns to be significantly exposed to BBF during their intern years (Karani *et al.* 2011: 464). Therefore, results obtained from this study and previous studies reflect that exposure to BBF is not confined to any particular health profession.

When assessing the relationship between experience of an injury while performing or assisting procedures in a professional lifetime and working department, a large number of the respondents who did in fact experience an injury while performing or assisting procedures in their professional lifetime were employed within the general wards (male and female) and the maternity and labour ward, with the lowest rate of injury occurring in the ICU department (0.0-0.6%). These findings were consistent with a similar study performed by Mekonnin *et al.* (2018: 4) who had also found occupational exposures to BBF to occur most frequently within the gynaecological and obstetrics ward. Alike results were presented in a study conducted among six hospitals in Northern Ethiopia, whereby the delivery room and gynaecological ward presented the highest likelihood of exposure (Gessessew and Kashu 2009: 213). Results of a similar study revealed contrasting results to that established in this study and the results of Gessessew and Kashu (2009: 213) study. That is, researchers Tesfay and Habtewold (2014: 1) provided much relevant information on organisational risk factors for BBI transmission amongst HCWs, in Ethiopia. This study indicated that working department constituted a significant contributing factor to risk of exposure to BBI, particularly within the outpatient department as compared to the delivery room (Tesfay and Habtewold 2014: 1). Contrasting a specify finding of this study whereby ICU accounted for the least amount of injuries, a study conducted by Liyew *et al.* (2020: 3) in Ethiopia found the highest incidence of injury to take place within ICU. The study performed by the researcher found a statistically significant relationship between the experience of an injury while performing or assisting procedures in a professional lifetime and working department. That is, the working department of the respondents did play a significant role in terms of the experience of an injury while performing or assisting procedures in a professional lifetime. As such results from this study and previous studies may indicate that work department may in fact play a role in acquiring a BBF exposure.

The relationship between experience of an injury while performing or assisting procedures in a professional lifetime and sex, was not found to be statistically significant, despite a substantial proportion of the respondents being female as compared to male. This result was consistent with the findings in previous research, whereby a similar study performed by Kirakoya-Samadoulougou *et al.* (2014: 662) in Burkina Faso indicated a higher rate of HIV amongst female HCWs as compared to male HCWs, but with no statistically significant difference between male and female healthcare workers.

A significant proportion of BBF exposures were attributed to NSIs, followed by bodily fluid splashes or blood and then cuts. This finding was similar to the Canada communicable disease report (2003: 24) whereby NSIs accounted for the greatest source of BBF exposure, followed by splashes, then cuts with sharp objects. Additional sources of exposure were highlighted and include, pricks with sticks other than needle sticks, scratches and bites.

Procedures responsible for most of the exposures in this study included blood collection, intravenous line insertion and assisting during labour procedures, with needle disposal, needle recapping, assisting during surgical procedures, suturing, amniotic fluid splash, overfilled sharps containers, cleaning of contaminated instruments (eg. sharps), procedures such as intramuscular injections, putting blood into a specimen bottle and dressing of wounds, accounting for significantly lower sources of exposure. These results differed to a certain degree from those described in a similar study performed by Mbaisi *et al.* (2013: 1). Where this study found suturing to present a low risk of exposure, the study performed by Mbaisi *et al.* (2013: 1) found suturing to produce the highest risk. Correspondingly, Cervini *et al.* (2005: 419) deduced stitching as the greatest source of injury amongst doctors. Additionally, procedures found to expedite incidence were the manipulation of needles, movement of patients, needle recapping, and the inappropriate collection and disposal of sharps. However, similarities in the study performed by Amita *et al.* (2008: 142) and the study performed by the researcher were present as needle recapping, despite constituting a risk of exposure, constituted a low risk of exposure. Contrastingly, a study performed by Reda *et al.* (2021: 1) evaluated alternate sources of BBF exposure as opposed to NSIs. Interestingly, this study found needle recapping to constitute a large proportion (almost 50% of the study population) of potential BBF exposure.

5.4. KNOWLEDGE OF HCWS IN RELATION TO BLOOD AND BODILY FLUID EXPOSURE

Several studies propose a significant gap in information regarding PEP in the health care setting (Tebeje and Hailu 2010: 54, Ajibola *et al.* 2014: 2 and Kiragu *et al.* 2014: 1). In this study, an outstanding proportion of the respondents were aware of HIV PEP, as was expected, considering their educational background. Those HCWs possessing a first degree and postgraduate qualification did not show any indication regarding lack of knowledge of PEP, and it could be concluded that an increase in level of education may result in the subsequent increase in knowledge of PEP. A statistically significant relationship was demonstrated between the knowledge of PEP and level of education, with those HCWs in possession of a degree and postgraduate qualification displaying greater awareness than those in possession of a diploma and high school qualification only. However, despite the increased level of awareness, respondents still present with deficient knowledge on PEP, as a substantial number of respondents in this study incorrectly believed that the effectiveness of PEP was upheld after 72-hours of exposure. Additionally, a study performed by Kinigwa *et al.* (2021: 3) evaluated the level of PEP knowledge of HCWs, in Tanzania. This Tanzanian study yield results similar to the current study, in that a statistically significant association between level of education and PEP knowledge were established (Kinigwa *et al.* 2021: 3). Those respondents with a degree, appeared to have greater knowledge on PEP, as opposed to respondents with a certificate only. In this study and the Tanzanian study, the insubstantial degree of knowledge of HCWs with a certificate only could be a result of weak engagement of PEP training in their courses. As such these results substantiate the need for the subject of PEP to be made a more salient topic in university curriculums.

A study performed in Lagos demonstrated the knowledge and practices of HCWs regarding PEP (Ajibola *et al.* 2014: 2). The results of the Lagos study produced data similar to results depicted in this study, as a considerable number of the respondents did present sufficient awareness on the existence of PEP, but a large proportion of respondents also presented inadequate knowledge on when to employ PEP usage upon subsequent blood borne exposure, with less than half the population knowing how long HIV PEP should be used for (Ajibola *et al.* 2014: 2). According to Kiragu *et al.* (2014: 1) the primary reasons for lack of PEP usage include inadequate information on HIV PEP, as well as fear associated with seeking HIV PEP and any consequences as perceived by the HCW.

A vital factor that rendered HCWs susceptible to infection was incorrect disposal of sharps immediately after use (Wu *et al.* 2016: 365). A study performed in China found that HCWs improperly disposed of sharps. Similarly, Singh *et al.* (2015: 2) denoted poor performance of HCWs in a Lahore Hospital, in the disposal of used sharps and associated equipment, that may give rise to transmission of BBI. In the present study, a significant proportion of respondents were accurately aware that sharps should be disposed in a puncture-resistant sharps container, as opposed to the general waste bin or recycling bin.

Respondnets strongly believed that failure to dispose of needles in a puncture-resistant sharps container, lack of proper workstations for procedures using sharps, and bumping into a needle/sharp/person holding sharp increases the liklihood of NSIs. The reason for this occurrence may be attributed to the fact that these factors are not within the control of the HCWs, with their safety in the potential responsibiilty of external sources such as hospital management. Additionally, it is worth considering that in the hospital environment, HCWs are subjected to work pressures and stress that result in unsafe behvaiours (Al-Samarraie and Dodoo 2019: 1). In agreement with Al-Samarraie and Dodoo (2019: 1) a study performed by Bazie (2020: 2453) idenitifed factors relating to NSI and sharp injuries amongst HCWs in a private facility. This study agreed with the propositions of Al-Samarraie and Dodoo (2019: 1) and suggested that workload played a signifcant role in icreasing the risk of HCWs to BBF exposure. Those HCWs under increased demand to provide care for more than the average number of patients were more susceptible to an NSI or sharps injury as compared to those who provide health care to below the average number of patients (Bazie 2020: 2453). This may owe to impeded concentration and the need to meet a target by the end of the work shift. Further supporting the results of this study, an Egyptian study performed by Abebe *et al.* (2017: 1) provided much relevant information on the importance of proper work stations in the prevention of an NSI, as HCWs with adequate availability of sharp disposal containers in their work station were less prone to experience an NSI or sharps injury than those who had improper work organisation (Abebe *et al.* 2017: 1).

5.5. ATTITUDE OF HCWS TO BLOOD AND BODILY FLUID EXPOSURE

An appropriate attitude toward BBIs is fundamental in the prevention of such dispositions (MansourGhanaei *et al.* 2013: 197). In this present study, most respondents found safety precautions in health care organisations to be of great importance. A study based in Nigeria aimed to investigate the attitude of HCWs on occupational exposure to BBF (Aluko *et al.* 2016: 6). An exceptional number of respondents believed that the recognition of occupational hazards should take precedence in health care facilities, and be assimilated into work provisions. Additionally, 99% of participants considered staff training, and the provision of personal protective equipment as imperative, in minimizing employee risk of exposure, to occupational hazards, in a health care setting (Aluko *et al.* 2016: 6).

In this study, nearly all HCWs (99.4%) advocated for the importance of PPE in all units of work. Interestingly, this was not reflected in a study performed by Aluko *et al.* (2016: 11) as a certain degree of respondents found the optimisation of safety precautions to prevent occupational exposure, cumbersome and tedious, despite the importance of PPE use before a clinical procedure (Aluko *et al.* 2016: 11).

Additionally, a significant proportion of respondents in the present study had reported to have already received the HBV vaccine, with a large proportion of those who did not receive the vaccine displaying a favourable attitude toward its receipt. Opposing the finding of the present study, a study performed in Northwest Ethiopia by Abdela *et al.* (2016: 4) presented the lowest vaccination acceptance rate (2%) by participants in comparison to several alike studies performed in Vientiane, Laos and Cameroon (Pathoumthonga *et al.* 2014: 4995 and Noubiap *et al.* 2013; 148).

A wide range of respondents indicated that they were in fact apprehensive about acquiring a BBF occupational exposure. However, considering the hazardous of the nature of the work environment, a sizeable portion of the population displayed what may be considered a distinctly negative attitude toward encountering a BBF exposure. In addition, when assessing the relationship between HCW concern of acquiring a blood borne infection and the profession of the HCW, it was observed that significantly more nurses and laboratory technicians expressed a lack of concern in acquiring a BBF exposure as compared to the rest of the category of professions, with medical doctors conveying the highest level of concern. Completely contradicting the findings of the present study, that depicted doctors with the most concern regarding a BBF exposure and nurses and laboratory technicians with the least concern, with regard to attitude toward preventing BBF via glove usage, doctors actually displayed a negative attitude whereas nurses and laboratory technicians presented a generally favourable attitude, toward glove usage when tending to patients.

At an education only level, and not looking at this category in relation to the rest of the total sample, it was noted that significantly more HCWs with a high school qualification only expressed a lack of concern in acquiring a BBF exposure as compared to HCWs within the other levels of education (diploma, and postgraduate qualification). This further highlights the significant association between knowledge and attitude. The flaws in attitude that was highlighted in the literature reviewed presents a serious consequence to HCWs and may only be resolved once it has been realised that knowledge and attitude go hand in hand. As such, hospital leadership should place emphasis on strengthening health information programmes, which in turn has proven to improve the overall attitude of HCWs.

5.6. PRACTICES OF HCWS IN RELATION TO BLOOD AND BODILY FLUID EXPOSURE

A portion of HCWs appeared to have not experienced an NSI or BBF exposure. However, a substantial amount of those respondents who did experience an accidental exposure, indicated that they did not receive PEP following an NSI or BBF exposure. A study conducted amongst nurses in Cameroon revealed a poor state of knowledge on HIV PEP, despite the alarming rate of occupational exposure to BBF (Aminde *et al.* 2015: 7). According to Aminde *et al.* (2015: 7) only a small percentage (18.9%) of the study population had received PEP. Although low, this rate of PEP uptake was marginally higher than that observed at an Abhuja Teaching Hospital (6% vs. 18.9%) (Owolabi *et al.* 2012: 181). The modest uptake of PEP in this study as well as the abovementioned studies was consistent with findings reported in Uganda and Kenya (Alenyo *et al.* 2009: 101 and Taegtmeyer *et al.* 2008: 307).

A statistically significant relationship ($p < 0.001$) between the receipt of post-exposure prophylaxis following an HIV exposure and age existed in this study. That is, the age of the respondents did play a significant role in terms of the receipt of post-exposure prophylaxis following an HIV exposure. When assessing the relationship between these two variables, those respondents who did in fact receive PEP following a subsequent exposure constituted only 6.0% of the total sample, with the respondents occurring mainly within the 26 to 30 year (1.2%) and 46 to 50 year (1.2%) age category as well as 36 to 40 years (1.8%). With the remaining age categories making a minor contribution to the group. These results differed significantly from a study conducted among the general population seeking treatment services at a health centre, as patients seeking PEP occurred statistically significantly more, between the age category of 30 and 39 years (35.7%), whereas in the present study respondents which fell within this category (36 to 40 years) accounted for only 1.8% of the population who sought PEP (Beymer *et al.* 2014: 850).

When evaluating the association between the receipt of post-exposure prophylaxis following an HIV exposure and level of education. Level of education seemed to have played a statistically significant role in failure to seek PEP, following an NSI or BBF exposure ($p < 0.027$). with regards to profession only, it was also noted that significantly more HCWs with a high school qualification only (52.9%) and national diploma (42.4%) did not receive PEP following an incident as compared to the other levels of education (postgraduate qualification 21.1% and first degree 18.4%). A dearth of research presented itself in terms of receipt of PEP in relation to age and level of education. As such this present study is expected to enrich those such areas that may be lacking within the research body.

With regard to reporting practices of HCWs, in this study, a portion of the respondents suggested a lack of NSI or BBF exposure, and thus not legible for reporting of an exposure, however. Within the remaining sample, a greater percentage of HCWs were observed to have reported an occupational exposure to BBF as compared to those who had not.

When examining the reporting patterns of HCWs across professional category. Holistically, nurses accounted for the highest professional category from the total sample, who did not report an injury and within the profession nurses (only), nurses had also accounted for the highest number of respondents who failed to report an injury accounting for almost three quarters of this category expressing negative reporting practices. Nursing assistants had also presented generally unfavourable reporting behaviours.

Favourable reporting behaviour was noted amongst medical doctors and medical interns/students, as a greater proportion of respondents within their own professions were found to report an NSI or BBF exposure as compared to failure to report. These findings were inconsistent with those established in a study performed by Mbah *et al.* (2011: 4) that found medical doctors had a greater likelihood of not reporting in relation to nurses. This relationship was found to be statistically significant (p = 0.011). furthermore, Haiduven *et al.* (1999: 151) also found underreporting to be greater amongst physicians as compared to nurses (Haiduven *et al.*1999: 151). A study performed in a dental training institute within South Africa highlighted that a major cause of the underreporting of incidents may have been attributed to the perception of the injury being too small to be considered significant (Moodley and Naidoo 2015: 337). Additionally, Bekele *et al.* (2015: 3) proposed that factors such as lack of time, sharps by which an incident was caused was not contaminated by an infected patient, and lack of sufficient knowledge on reporting as probable elements that inhibited the reporting of injuries. It should be noted that unawareness on avenues for reporting may also serve as justification for not reporting an incident of exposure. As such, care should be taken to provide appropriate training and education of HCWs on proper incident reporting procedures and avenues.

When assessing the relationship between reporting practices of HCWs and work department, there was no statistically significant association between the two variables in this study ($p = 0.871$). That is, the work department of the respondents did not play a significant role in terms of the reporting practices of HCWs. However, it was useful to note which units in particular had inadequate reporting behaviour. General wards (male and female) were observed to have the most adverse reporting practices of NSI and BBF exposure, followed by casualty and OPD, paediatric, maternity and labour ward, theatre, CSSD and SOPD, laboratory, mobile clinic, ICU and the mortuary. Additionally, general wards (male and female) and casualty and OPD were reportedly the busiest units, with a high work demand. As previously mentioned by Bazie (2020: 2453) HCWs under greater work pressure are more suspectible to an NSI or sharps injury, similalry, such HCWs may not be afforded the time in their work schedule to report any such injury.

With regards to the control measures taken by the respondents following an exposure, most of the respondents stated that they rinsed the wound with water and soap only after a certain period of time has lapsed, with only a minor portion of respondents claiming to have rinsed the wound with water and soap immediately after an exposure. An alarming proportion of respondents stated that they rinsed the wound with antiseptic solution, which was consistent with behaviours established amongst nurses in an Ethiopian study, whereby 51.5% of study sample reported the use of antiseptic solution after an NSI exposure (Liyew *et al.* 2020: 3). It should be noted that a relatively small portion of respondents had tested the patient for HBV, HCV, or HIV. None of the respondents were found to expressed blood from the wound, rinsed the wound with bleach, or with iodine solution. A *p*-value between these different avenues of control was $p < 0.001$, thereby suggesting a statistically significant association between the various control methods. Although a significant proportion of HCWs engaged in the correct hand hygiene practices as directed by the Centre for Disease Control and Prevention (CDC) (CDC 1987: 19) failure to perform these measures immediately after an exposure still ran the risk of the HCW acquiring a potential BBI. In conjunction with the findings of this study, an Iranian study also found health staff to have a debilitating

approach to the washing of the injury site with water immediately after an incident (Shahghain *et al.* 2014: 1). This was due to the belief that such attempts were futile in the prevention of HIV and hepatitis. However, infection control seminars were found to positively influence the behaviour of HCWs toward handwashing following an exposure. In contrast with this present study and the study performed in Iran, the Nigerian study performed by Aluko *et al.* (2016: 11) found respondents displaying a positive outlook to safety procedures and mitigation of workplace hazards. This may possibly owe to the fear of HCWs contracting potentially harmful occupationally related diseases, as well as the high level of knowledge presented by respondents. Signifying, once again the interdependent relationship between knowledge, attitude and practices in the control and prevention of occupational exposure to BBF.
An appreciable number of respondents reported to always cover cuts and wounds before the commencement of work, with only 1% of the respondents stating to never cover injuries before a work shift. These results are considered to be acceptable, taking into account the fact that several researchers equate entry of blood into non-intact skin with a heightened risk of acquiring HIV, HBV and HCV (Westermann *et al.* 2015: 883, Deuffuc-Burban *et al.* 2011: 4 and Tavoschi *et al.* 2019: 59).

The *p*-value between needle recapping practices and profession indicated no significant relationship between these two variables ($p = 0.918$). The profession of the respondents had no significant role in terms of needle recapping practices. However, it is useful to note the category of employment in particular that had inadequate recapping behaviour. Nurses were among the highest respondents to engage in needle recapping after use, followed closely by nursing assistants, Medical doctors and laboratory technicians displayed the lowest rate of needle recapping behaviours. Medical interns/students and mortuary attendants engaged in no forming of needle recapping. Additionally, a similar study performed Liyew *et al.* (2020: 3) found the risk of acquiring an NSI due to needle recapping 1.78 times higher amongst nurses. This inappropriate practice of recapping needles may largely be attributed to the lack of proper workstations, resulting in the inability of HCWs to immediately dispose of sharps properly or puncture-resistant sharp containers placed at a lengthy distant from the area of work.

The *p*-value between needle recapping practices and age indicated a significant relationship between these two variables ($p = 0.056$). The age of the respondents did play a significant role in terms of the needle recapping practices of HCWs. The middle age category between 36 to 40 years most often engaged in needle recapping behaviour with the youngest age group pf 18 to 25 years displaying the lowest rate of needle recapping. These results were inconsistent with those established by Liyew *et al.* (2020: 3) who found no significant associate between these two variables. Additionally, further contradicting the findings of this study, Martins *et al.* (2012: 1) found younger respondents at greater risk of injury due to needle recapping.

A considerable amount of the respondents was found to observe the correct precautionary measures following a BBF exposure and when treating a patient. These appropriate behaviours regarding BBF exposure was mirrored in a recent study performed by (Aluko *et al.* 2016: 6) whereby HCWs were found to observe the correct procedures when treating patients or exposed to blood or bodily fluids.

5.7. FACTORS AFFECTING INFECTION PREVENTION AND CONTROL

Lack of knowledge, feedback on monitoring and training on IPC, as well as lack of availability of infection prevention and control guidelines were believed be barriers to IPC in the hospital, as perceived by the HCWs. The findings of the present study were comparable to a study performed in India that denoted a generally favourable degree of knowledge and awareness regarding infection control practices amongst HCWs employed in a tertiary care hospital (Sodhi *et al.* 2013: 271). A review of large body of literature has indicated variation in the knowledge of HCWs regarding IPC (Paudyal *et al.* 2008: 597, Darawad and Al-Hussami 2013: 582 and Taneja *et al.* 2009: 105). According to Paudyal *et al.* (2008: 597) only a minor portion of HCWs in Nepal possessed adequate knowledge on infection control. However, in contrast with the findings described by Paudyal *et al.* (2008: 597), Darawad and Al-Hussami (2013: 582) found that almost half of the HCWs in Jordan had sufficient knowledge pertaining to infection control. Contrastingly, three quarters of nurses in a tertiary care hospital in India displayed infection control knowledge (Darawad and Al-Hussami 2013: 582). Additionally, nurses in supervisory positions were more likely to adhere to infection control practices (Sodhi *et al.* 2013: 271). These findings were consistent with those described in a related study performed in India (Suchitra and Lakshmi Devi 2007: 184).

Respondnets in this study also displayed a potential lack of awareness on the infrequent or absence of regular infection prevention and control committee meetings. Additionally, more than half of the total sample exhibited complete ignorance in terms of cost requirements for IPC interventions as a likely impedance of IPC. This finding questions the communication between management and hospital staff and may actually highlight the need for improvement in this regard. Despite a substantial number of respondents advocating for effective communication on matters pertinent to IPC within the institution, what may be considered a moderately sizeable proportion of respondents, in relation to the hazardous nature of work being performed, expressed what may be perceived as a generally unfavourable view in terms of effective communication on IPC. Similarly, despite an equally decent portion of the population as above stating the prioritisation of IPC by management, one should consider the relatively significant proportion of HCWs, despite not constituting the majority, proposing that IPC is not prioritised by the leadership of the hospital. A study performed in KwaZulu-Natal by Mohamed and De Beer (2018: 12) found results similar to that described in this study. According to Mohamed and De Beer (2018: 12) HCWs found hospital management to lack support, in terms of IPC. Additionally, a significant barrier to IPC, as described by the HCWs was lack of regular meetings between management and staff, failure to maintain staff morale or mandate polices. As such it is imperative that hospital management are conscientiously involved in infection control.

A significant proportion of the respondents claimed to be adequately informed on the IPC principles. However, some of the respondents stated a lack of knowledge on the basic prevention and control standards and norms. The respondents who stated that they had undergone information and training on IPC principles were required to indicate the last training programme they had undergone. A large number of respondents were found to have received training more than 24 months ago. According to the Occupational Health and Safety Act (No. 85 of 1993), Regulations for Hazardous Biological Agents – Information and Training, it is the duty of the employer to ensure that their employees undergo refresher training annually, or at intervals deemed appropriate by the health and safety committee or representative in the organisation (South African Department of Labour 1993: 207). A statistically significant association between the various intervals of training was observed ($p < 0.001$). More than half of the total sample were knowledgeable about the previously mentioned regulations. Despite constituting a significant proportion of the total sample, this figure cannot be considered a desirable ratio of awareness, especially within a precarious work environment like that of a hospital setting. Distressingly, approximately 42.1% of the sample population expressed displeasing feedback regarding awareness on the Hazardous Biological Agents regulations.

Several studies have also indicated poor training of HCWs on IPC policies. (Fashafsheh *et al.* 2015: 79 and Gasaba *et al.* 2020: 4). As such, health institutions shall benefit from routine appraisal of policies pertaining to education and training on IPC. This system will ensure that all staff have received adequate training, and high-risk staff are made aware of continually updated preventative strategies and precautionary measures. The above literature revealed overall poor compliance of HCWs to IPC practices in health care institutions. Therefore, continuous training and education programmes and workshops are the cornerstone of improving the infection control and prevention capabilities, of HCWs, at all levels.

5.8. BINARY LOGISTICAL REGRESSION MODEL OF FACTORS ASSOCIATED WITH AN EXPERIENCE OF INJURY

For level of education, it is noticed that respondents with a high school qualification were 30.984 times more likely to have suffered an injury than a postgraduate respondent. Respondents with a diploma or a degree were also more than 2 times more likely to suffer an injury compared to a postgraduate. Educational background seemed to have significantly contributed to the likelihood of an experience of an injury. These results were in contrast to those described by Liyew *et al.* (2020: 3) in Nigeria, in which a statistically significant association between educational status and the experience of an NSI was not present.

Inverse referencing of the odd ratios for number of years worked in the hospital, indicates that respondents with longer service were more likely to injure themselves compared to the baseline of less than 5 years of work experience. These findings deviated from those established by Liyew *et al.* (2020: 3) and Hassanipour *et al.* (2021: 4) whereby respondents with less work experience were less likely to experience an injury. This divergence in findings may be attributed to those with limited experience, as a result of immediate entry into the workplace following completion of studies, having a more recent knowledge on safety precautions and prescribed needle stick behaviour, compared to those HCWs who have been employed for a longer time and consequently a prolonged period out of the education system. This low rate of NSI amongst those respondents with less experience may also be indicative of an updated university curriculum on NSI safety.

Most respondents had higher odds of injury whilst working in other departments when compared to (the reference department of) Casualty and OPD. These findings may be attributed to the extent of exposure and nature of work present within the maternity, mobile clinic and laboratory respondents would have higher odds due to the nature of their work.

With regard to occupational exposure to BBF, respondents within the nursing category was found to constitute the greatest risk of exposure, and emphasis should be placed, by hospital management and the staff themselves, to minimise the threat present within this category of employee. Additionally, as a representative of the total sample, nurses did constitute a great deal of the sample population, which furthermore contributed to their conspicuously high risk knowledge, attitude and practices observed in this study.

Despite a statistically significant association between the receipt of post-exposure prophylaxis following an HIV exposure and age and level of education in this study, scarcity of research evaluating this crucial relationship between these particular variables were found. Although this study denoted that a statistically significant relationship between these two variables presents itself, further research is warranted to establish the exact reasons for this association. Similarly, a gap in needle recapping practices and age of respondents was also established and affirms the necessity for further investigation.

CHAPTER SIX

CONCLUSION AND RECOMMENDATIONS

6.1. CONCLUSION

In summary, the research to date has, to a certain extent only illustrated the knowledge variables concerning the recapping of needles, status of the source patient, reporting of incidents and use of gloves; attitude variables: such as importance of PEP; and practice variables: such as acquiring a NSI, reporting of incidents and vaccination receipt. However, no study to date has examined the following variables: knowledge regrading PEP, discarding of used needles, factors that place HCWs at an increased risk of BBF exposure, type of practices that may lead to an exposure, awareness of precautionary measures to be adopted, infection prevention principles and Hazardous Biological Agents (HBA) Regulations; attitude: regarding the importance of safety precautions, perceptions on PPE usage, willingness to be vaccinated and concerns associated with acquiring a BBI and practices such as uptake of PEP following and exposure, reporting of exposures, measures taken following an exposure, use of PPE and protection of open wounds (a potential route of entry) at work of HWCs, despite all these variables considered to be preeminent elements in this particular field. This study was one of the few (only one other conducted by Nkoko et al. (2014: 382) to be conducted in South Africa- and the first to extensively evaluate the KAP and factors affecting IPC amongst HCWs, to be facilitated in the KwaZulu-Natal province. This study differed greatly from other studies in South Africa, in that it explored variables that have not yet been investigated. Furthermore, the study highlighted prominent gaps relating to KAP of HCWs on BFF exposure, by identifying additional relationships that were associated with an increased risk of exposure. additionally, the sizeable sample size employed in this study enabled the identification of additional relationships relating to KAP of HCWs on BFF exposure, and factors affecting ICP in a healthcare setting.

In summary, the following anomalies were pinpointed amongst the health care setting and shall briefly be elaborated on. Nurses were found to be the most highly exposed cadre of employee in terms of blood borne pathogens, with the work departments including the general wards (male and female) and the maternity and labour ward presenting the greatest risk. Additionally, blood collection, intravenous line insertion and assisting during labour procedures were considered the highest risk procedures. Level of education played a significant role in HCW knowledge of PEP. The following factors were found to be primary contributing factors to a BBF exposure: failure to dispose of needles in a puncture-resistant sharps container, lack of proper workstations for procedures using sharps, and bumping into a needle/sharp/person holding sharp increases the liklihood of NSIs. A considerable number of HCWs displayed what may be considered a distinctly negative attitude toward encountering a BBF exposure. Furthermore, a substantial amount of those respondents who did experience an accidental exposure, indicated that they did not receive PEP following an NSI or BBF. Nurses accounted for the highest professional category from the total sample, who did not report an injury. An alarming proportion of respondents stated that they rinsed the wound with antiseptic solution, which is known to exacerbate tissue damage, and increase the risk of transmission. The age of the respondents did play a significant role in terms of the needle recapping practices of HCWs, with the middle age category between 36 to 40 years most often engaged in needle recapping behaviour. As per the active belief of the HCWs themselves, lack of knowledge, feedback on monitoring and training on IPC, as well as lack of availability of infection prevention and control guidelines were considered to be barriers to IPC in the hospital. Respondnets in this study also displayed a potential lack of awareness on the infrequent or absence of regular infection prevention and control committee meetings. Additionally, more than half of the total sample exhibited complete ignorance in terms of cost requirements for IPC interventions as a likely impedance of IPC. A disquieting amount of HCWs were found to have received training more than 24 months ago which deviated from the recommended annual refresher training as per the Occupational Health and Safety Act (No. 85 of 1993).

The objectives of this study have been fulfilled, the association between the KAP of HCWs and their likelihood of engaging in unsafe behaviour and practices, regarding occupational exposure to BBF in a public hospital of KwaZulu-Natal has been identified. The perceptions on the barriers to IPC in a public hospital of KwaZulu-Natal has been established. Several hallmarks of the study emphasised the highly integrated relationship between knowledge, attitude and practices, in the control and prevention of occupational exposure to BBF as well as the significant role hospital management plays in the support of staff. As such all endeavours should be made to address the shortfalls highlighted in this study, amongst south African HCWs.

6.2 RECOMMENDATIONS

In order to mitigate occupational exposure to blood borne infections, it is the duty of the employer, or in the case of a hospital setting- hospital management, to develop and see the implementation of a control plan for exposure. This control plan should provide an in-depth analysis of how the employer is expected to employ the hierarchy of control in eliminating the occupational exposure of HCWs to BBF. These recommendations will further elaborate on the control plan for reducing exposure to blood borne pathogens (United States Department of Labour 2021).

6.2.1 ELIMINATION OF THE HAZARD

This particular approach involves the absolute removal of the hazard in question from the work environment. It is considered the first and most effective line of defence, that is recommended above any. Whenever feasible, this method of hazard mitigation should always be implemented, as far as reasonably practicable. Elimination of the hazard in terms of blood borne pathogens involves the removal of needle sticks or any other miscellaneous sharp devices, whenever possible, and may include substitution with jet injectors in place of needles and syringe or the use of intravenous system that does not require the use of needles. Additionally, this approach also involves the eradication of avoidable injections.

6.2.2 ENGINEERING CONTROLS

Engineering controls refer to the complete isolation, elimination or mitigation of the hazard from the occupational environment. This method control may involve the use of safer and more reliable medical equipment (needless apparatus), the use of plastic capillary tubes or guarded needle-related equipment. Alternatively, and probably a more feasible approach for low-income health settings, engineering controls could be simply achieved through the use of regularly maintained hand washing facilities, for the washing of hands after glove removal or following a subsequent BBF exposure.

employees must be encouraged to make use of a puncture-resistant sharps container, that is leak proof and colour coded.

6.2.3. ADMINISTRATIVE CONTROLS

This approach emphasises the necessity of controlling the hazard through the use of standard operating procedures (SOPS), work practices, information and training, medical surveillance, and hepatitis B vaccination. These controls aim to reduce the risk of exposure intended through the alteration of work practices, and include the applicable procedures for washing of hands, disposal of sharps and the handling of contaminated items such as laundry or medical devices. The "Universal Precautions" are aimed primarily at the prevention of occupationally acquired HIV, HBV and HCV in HCWs performing health care services. It is imperative that HCWs at all times practice the standard precautions, particularly during the use of potentially infected devices and tools, during procedures that may present a risk of contact with contaminants such as blood, bodily fluids, excretions (excluding sweat), secretions, broken or non-intact skin and mucocutaneous tissue. Work practice controls prohibit the following behaviours: storage of food items within the vicinity of blood or blood samples, eating, drinking, smoking, application of makeup or contact lenses where an occupational exposure is likely to occur and breakage of contaminated sharp devices or needle sticks.

Furthermore, hospital management should maintain proper housekeeping and ensure all surfaces are free of blood and bodily fluids. All infectious waste must be appropriately disposed of as stipulated in the 'Universal Precautions'. Hospital management must ensure the that hepatitis B vaccination is made available to all HCWs likely to encounter a BBF exposure and should encourage the uptake of PEP following an HIV exposure. finally, should undergo refresher training on matters pertaining to hazardous biological agents at intervals stipulated in the Occupational Health and Safety Act (No. 85 of 1993), Regulations for Hazardous Biological Agents – Information and Training.

6.2.4. PERSONAL PROTECTIVE CONTROLS

Personal protective equipment is clothing or equipment designed to provide individualised protection against a hazard that may have not been engineered out by design or resolved through work practice. It is considered to the last and least effective line of defence as it is based largely on human intervention. Hospital management must ensure that all HCWs are provided with protection for both the eyes and mouth such as safety goggles, glasses, face masks or face shields to prevent an accidental exposure to blood and bodily fluid splashes, spray or droplet spread. Additionally, the provision of aprons, surgical; caps, gowns, shoe covers are mandatory.

6.3. LIMITATIONS

The following limitations were encountered during the execution of this study:

- Respondents were subject to a recall bias and could not remember if the sustained an injury in the past 12 months, due to this one-year exposure experience.

- Some respondents were wary about confidentiality. Additionally, the study was predominantly self-reported data. Both these factors may adversely affect the validity of the results due to information bias and social desirability.

- The cross-sectional nature of study prevented cause-effect relationships to be explored.

- A portion of the questions within the data collection tool were based largely on agreeing or disagreeing with the proposed statements, as such the results were at threat of acquiescence bias.

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APPENDIX A - QUESTIONNAIRE

Questionnaire Number	

INSTRUCTIONS

Please answer all questions below to the best of your ability. Additional space is provided for you to enter any details you may feel necessary to include.

SECTION A: SOCIODEMOGRAPHIC FACTORS

Please mark with a cross (X) the option(s) that best applies to you in the appropriate box and answer/provide any necessary information in the space provided.

1. Sex

   Female^{0} ☐ Male^{1} ☐ Other ^{2} ☐

2. What is your age group?

   18 – 25 ^{1} ☐ 26 – 30 ^{2} ☐ 31 – 35 ^{3} ☐ 36 – 40 ^{4} ☐

   41 – 45 ^{5} ☐ 46 – 50 ^{6} ☐ 51 – 55 ^{7} ☐ > 55 ^{8} ☐

3. Level of education

   High school^{0} ☐ Diploma^{1} ☐ First degree^{2} ☐ Postgraduate^{3} ☐

4. How many years have you been employed in the hospital as a HCW?

   1 – 5 years^{0} ☐ 6 – 10 years^{1} ☐ 11 – 15 years^{2} ☐ 16 – 20 years^{3} ☐ 21 – 25 years^{4} ☐ 26 – 30 years^{5} ☐ > 30 years^{6} ☐

5. Profession

   Medical doctor^{0} ☐ Medical intern/student^{1} ☐ Registered nurse^{2} ☐

   Nursing assistant^{3} ☐ Nursing intern/student^{4} ☐ Mortuary attendant^{5} ☐

   Laboratory technician^{6} ☐

If other, specify. ____

6. Working department/unit

Casualty and OPD[0] ☐ Paediatric ward[1] ☐ Maternity and labour ward[2] ☐

Theatre, CSSD, SOPD[3] ☐ General wards male and female[4] ☐ Mobile clinic[5] ☐

Mortuary attendants[6] ☐ Laboratory[7] ☐ Intensive Care Unit (ICU)[8] ☐

If other, specify. ____

SECTION B: OCCUPATIONAL EXPOSURE DETERMINANTS FOR PARTICIPANTS THAT DELIVER/ADMINISTER INJECTIONS/IVS

Please mark with a cross (X) the option(s) that best applies to you in the appropriate box. Please answer/provide any necessary information on the spaces provided below.

7. How many injections do you administer to patients altogether in a week (please estimate a single number)? ___________________ injections.

8. Have you ever experienced an injury while performing or assisting procedures in your professional lifetime?

   No[0] ☐ Yes[1] ☐

9. Have you ever experienced an injury while performing or assisting procedures in the past 12 months?

   No[0] ☐ Yes[1] ☐

10. If you answered *Yes* to question 8 and 9, what type of accidents led to your occupational exposure? If you answered *No* to question 8 and 9, please proceed to question 16 (Section C).

    NSI[0] ☐ Body splashing of fluid or blood[1] ☐ Cut[2] ☐

    If other, please specify

    ____

11. Please state what you were doing at the time of the accident. More than one option may be selected.

Intravenous line insertion[0]	☐	Procedures such as intramuscular (IM) injections[1]	☐
Assisting in surgical procedures[2]	☐	Emergency surgeries[3]	☐
Overfilled sharps containers[4]	☐	Needle disposal[5]	☐
Needle recapping[6]	☐	Blood collection (i.e. drawing of blood samples)[7]	☐
Putting blood into a specimen bottle[8]	☐	Amniotic fluid splash[9]	☐
Emergency surgeries[10]	☐	Elective surgeries[11]	☐
Conducting labour[12]	☐	Cleaning contaminated instruments (e.g. sharps)[13]	☐
Cleaning contaminated cloths[14]	☐	Procedures such as biopsies[15]	☐
Procedures such as suturing[16]	☐	Procedures such as dressing of wounds[17]	☐

Other procedure (s)? Please specify.

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12. In which department did the occupational exposure occur?

Casualty and OPD[0] ☐ Paediatric ward[1] ☐ Maternity and labour ward[2] ☐

Theatre, CSSD, SOPD[3] ☐ General wards male and female[4] ☐ Mobile clinic[5] ☐

Mortuary attendants[6] ☐ Laboratory[7] ☐ Intensive Care Unit (ICU)[8] ☐

If other, please specify.

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13. Were you aware of the HIV status of the source patient?

No[0] ☐ Yes[1] ☐

14. Were you aware of the HBV status of the source patient?

No[0] ☐ Yes[1] ☐

15. Were you aware of the HCV status of the source patient?

No[0] ☐ Yes[1] ☐

16. If you answered *Yes* to question 13, 14 and 15, what was the status of the last source patient you may have experienced a blood or bodily fluid exposure from? More than one option may be selected.
If you answered *No* to question 13, 14 and 15 please proceed to question 17

HIV positive[0] ☐ HCV positive[1] ☐ HBV positive[2] ☐

SECTION C: HEALTH CARE WORKER KNOWLEDGE OF OCCUPATIONAL EXPOSURE TO BBF

Please mark with a Cross (X) the option(s) that best applies to you in the appropriate box. Please answer/provide any necessary information on the spaces provided below.

17. Have you heard of the term 'Post-Exposure Prophylaxis (PEP)'?

No[0] ☐ Yes[1] ☐

18. Please rate your level of knowledge on the significance of PEP.

Little to None 1	Vague 2	Moderate 3	Good 4	Very Good 5

19. Is PEP ineffective or effective after 72-hours of initial exposure to HIV?

Ineffective[0] ☐ I don't know[1] ☐ Effective[2] ☐

20. What is the maximum delay to start HIV Post –Exposure Prophylaxis?

24 hours[0] ☐ 14 days[1] ☐ 28 days[2] ☐ I don't know[3] ☐

21. Where should sharp materials be discarded?

Puncture resistant sharps container[0] ☐ General waste bin[1] ☐ Recycling bin[2] ☐

Radioactive waste[3] ☐ I don't know[4] ☐

22. Please circle what you may feel is FALSE, NOT SURE or TRUE.
Heath Care Workers can be at risk of needle stick or sharp injuries when they:

a.	Recap needles.	FALSE^{0} / NOT SURE^{1} / TRUE^{2}
b.	Fail to dispose of needles in a puncture-resistant sharps container.	FALSE^{0} / NOT SURE^{1} / TRUE^{2}
c.	Lack of proper workstations for procedures using sharps.	FALSE^{0} / NOT SURE^{1} / TRUE^{2}
d.	Bump into a needle/sharp/person holding sharp.	FALSE^{0} / NOT SURE^{1} / TRUE^{2}

23. To what extent do you AGREE or DISAGREE with the following statements? Please circle the number you may feel most appropriate. *The following practices may expose you to Hepatitis B.*

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
a. Injections	5	4	3	2	1
b. IV line insertion	5	4	3	2	1
c. Blood sampling	5	4	3	2	1
d. Surgery	5	4	3	2	1
e. Incision	5	4	3	2	1

24. To what extent do you AGREE or DISAGREE with the following statements? Please circle the number you may feel most appropriate. *The following practices may expose you to Hepatitis C.*

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
a. Injections	5	4	3	2	1
b. IV line insertion	5	4	3	2	1
c. Blood sampling	5	4	3	2	1
d. Surgery	5	4	3	2	1
e. Incision	5	4	3	2	1

25. To what extent do you AGREE or DISAGREE with the following statements? Please circle the number you may feel most appropriate. *The following practices may expose you to HIV.*

	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
a. Injections	5	4	3	2	1
b. IV line insertion	5	4	3	2	1
c. Blood sampling	5	4	3	2	1
d. Surgery	5	4	3	2	1
e. Incision	5	4	3	2	1

SECTION D: HEALTH CARE WORKER ATTITUDE OF OCCUPATIONAL EXPOSURE TO BBF

Please mark with a Cross (X) the option(s) that best applies to you in the appropriate box. Please answer/provide any necessary information on the spaces provided below.

26. Please rate the importance of safety precautions in health care organisations.

Unimportant 1	Somewhat Important 2	Neutral 3	Important 4	Very Important 5

27. Do you think PPE should be present in all working departments/units of the healthcare facility?

No[0] ☐ Not sure[1] ☐ Yes[2] ☐

28. If you have not received the HBV Vaccine, are you willing to take it?

No[0] ☐ Not sure[1] ☐ Yes[2] ☐ Already received the vaccine[3] ☐

29. If you answered *No* to question 28 above, please give a reason as to why you are unwilling to receive the vaccine.

____

____

30. Are you concerned about acquiring a blood borne infection via a blood or bodily fluid exposure?

No[0] ☐ Yes[1] ☐

SECTION E: HEALTH CARE WORKER PRACTICES REGARDING OCCUPATIONAL EXPOSURE TO BBF.

- **Please mark with a Cross (X) the option(s) that best applies to you in the appropriate box.**
- **Please answer/provide any necessary information on the spaces provided below.**

31. If you have experienced a Needle Stick Injury (NSI) or Blood or Bodily Fluid (BBF) exposure in the past 12 months, have you received Post-Exposure Prophylaxis (PEP) for HIV? If you answered *Not Applicable,* please progress to question 33.

No[0] ☐ Yes[1] ☐ Not applicable[2] ☐

32. Did you report your NSI/BBF exposure?

No[0] ☐ Yes[1] ☐

33. How soon after the incident did you report?

Immediately[0] ☐ By the end of the work shift[1] ☐ Never[2] ☐

34. Measures taken after **EVERY** subsequent exposure to blood or bodily fluids. Mark with an X **ALL** appropriate boxes (More than one option may be selected).

Rinsed wound with water and soap[0] ☐ Rinsed wound with antiseptic[1] ☐

Test patient for HBV/HCV/HIV[2] ☐

35. How often do you wear goggles to protect the eyes during procedures that generate spray of blood or bodily fluids?

Never[0] ☐ Sometimes[1] ☐ Always[2] ☐

36. Does the hospital provide you with personal protective equipment?

No[0] ☐ Not sure[1] ☐ Yes[2] ☐

37. How often do you cover wounds or cuts on the skin before you start work?

Never[0] ☐ Sometimes[1] ☐ Always[2] ☐

38. How often do you recap needles after use?

Never[0] ☐ Sometimes[1] ☐ Most times[2] ☐ Always[3] ☐

39. How often do you dispose of sharps in a puncture-resistant safety box?

Never[0] ☐ Sometimes[1] ☐ Most times[2] ☐ Always[3] ☐

40. When last did you attend a biosafety course?

Last 3 months[0] ☐ Last 6 months[1] ☐ Last 12 months[2] ☐ > 12 months[3] ☐

41. If you have attended a biosafety course, how often do you follow what you have been trained? Never[0]

☐ Rarely[1] ☐ Sometimes[2] ☐ Most times[3] ☐ Always[4]

42. Please rate your knowledge regarding the local policy in the hospital for NSI. Mark with an X the scale below.

Little to None 1	Vague 2	Moderate 3	Good 4	Very Good 5

43. To what extent do you carry out the following statements? Please circle the number you may feel appropriate.

	Never	Sometimes	Most times	Always
a. I wash hands after a bodily fluid exposure.	0	1	2	3
b. I wash hands after a blood exposure.	0	1	2	3
c. I provide nursing care considering all patients as potentially infectious.	0	1	2	3
d. I protect myself against bodily fluids of all patients regardless of their diagnosis.	0	1	2	3

SECTION F: PERCEPTIONS OF HEALTH CARE WORKERS ON INFECTION PREVENTION AND CONTROL

- **Please mark with a Cross (X) the option(s) that best applies to you in the appropriate box.**
- **Please answer/provide any necessary information on the spaces provided below.**

44. Which of the following factors would you consider as a barrier to IPC within the hospital? Please circle *NO, NOT SURE* or *YES*.

a.	Lack of knowledge on infection control and prevention.	NO^0 / NOT SURE^1 / YES^2
b.	Cost requirements for interventions.	NO^0 / NOT SURE^1 / YES^2
c.	Lack of surveillance (e.g. monitoring of sharps injuries and uptake of PEP).	NO^0 / NOT SURE^1 / YES^2
d.	Lack of feedback on monitoring infection prevention and control.	NO^0 / NOT SURE^1 / YES^2
e.	Infrequent or no regular infection prevention and control committee meetings.	NO^0 / NOT SURE^1 / YES^2
f.	Lack of training on infection prevention and control.	NO^0 / NOT SURE^1 / YES^2
g.	Lack of availability of infection prevention and control guidelines.	NO^0 / NOT SURE^1 / YES^2

45. Is there adequate availability of hand hygiene stations at each patient point of care?

No^0 ☐ Not sure^1 ☐ Yes^2 ☐

46. Is there effective communication regarding infection prevention and control within the hospital?

No^0 ☐ Not sure^1 ☐ Yes^2 ☐

47. Are there safety signs present throughout the facility?

No^0 ☐ Not sure^1 ☐ Yes^2 ☐

48. Do you think hospital management gives infection prevention and control adequate attention?

No^0 ☐ Not sure^1 ☐ Yes^2 ☐

49. If you answered *No* to question 48, do you think hospital management should invest more effort and attention to infection control and prevention?

No^0 ☐ Not sure^1 ☐ Yes^2 ☐

50. Are you aware of the steps to follow, following a blood or bodily fluid exposure, in terms of the CDC 'How to prevent needle stick and sharp injuries' Guidelines?

No⁰ ☐ Not sure¹ ☐ Yes² ☐

51. Have you been informed about the infection prevention principles?

No⁰ ☐ Not sure¹ ☐ Yes² ☐

52. If you answered *Yes* to question 51, when last have you undergone training?
If you answered *No* or *Not sure* to question 51, please proceed to question 53.

< 6 months⁰ ☐ 6 - 12 months¹ ☐ 13 - 24 months² ☐ > 24 months³ ☐

53. Are you aware of the Regulations for Hazardous Biological Agents, as stipulated in the Occupational Health and Safety Act No. 85 of 1993?

No⁰ ☐ Not sure¹ ☐ Yes² ☐

54. Does the hospital ensure that you are informed and updated on the Regulations for Hazardous Biological Agents, as stipulated in the Occupational Health and Safety Act No. 85 of 1993?

No⁰ ☐ Not sure¹ ☐ Yes² ☐

Thank You

APPENDIX B: PERMISSION LETTER TO KZN DEPARTMENT OF HEALTH

Miss Nakita Govender

21520416

Durban University of Technology,
Department of Community Health Studies

4000

December 2020

To: The KZN Department of Health Research Office

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO CONDUCT A RESEARCH STUDY

I am currently registered as a Master of Health Sciences: Environmental Health student, at the Durban University of Technology in the Department of Community Health Studies. The research I wish to conduct is titled**: 'The knowledge, attitudes and practices of Health Care Workers regarding occupational exposure to BBF in a Public Hospital, KwaZulu-Natal'.** This project shall be conducted under the guidance of Dr Shanaz Ghuman (Supervisor) and Dr. Ivan Niranjan (Co-Supervisor).

The objectives of the study are:

1. To evaluate an association between the knowledge of HCWs and their likelihood of engaging in unsafe behaviour and practices, regarding occupational exposure to BBF in a public hospital, KwaZulu-Natal.
2. To evaluate an association between the attitude of HCWs and their likelihood of engaging in unsafe behaviour and practices, regarding occupational exposure to BBF in a public hospital, KwaZulu-Natal.
3. To investigate the practices of HCWs regarding occupational exposure to BBF in a public hospital, KwaZulu-Natal.
4. To determine the barriers to IPC in a public hospital, KwaZulu-Natal.

Despite being a scantly studied field of research, the verifiably high prevalence of occupational exposure to BBF continues to be a pre-eminent phenomenon presently experienced in isolated and underdeveloped areas of Africa. The rationale of this study was prompted by – as far as the researcher's knowledge – lack of neoteric studies that centre on the association between the HCW's knowledge and attitude and the likelihood of engaging in unsafe behaviours and practices that may increase their risk for occupational exposure to BBF. Additionally, a paucity of research was found within South Africa, specifically, district level hospitals of KwaZulu-Natal, regarding first hand impressions and perceptions of HCWs (at all levels within a hospital) on the barriers to IPC within the different departments of the hospital.

I hereby request your permission to approach hospital management, in order to conduct a research project within Osindisweni Hospital, within KZN, as well as administer an epidemiologic questionnaire to a portion of HCWs currently employed in the facility, who voluntarily wish to participate in the study. I have enclosed a copy of my research proposal for your viewing, which consists of the study design and consent forms to be used in the research process, as well as an ethical clearance certificate from the Institutional Research Ethics Committee (IREC) at the Durban University of Technology.

Upon completion of the study, a bound copy of the entirety of the dissertation shall be made available to the KwaZulu-Natal Department of Health.

Your support and permission to perform the study at Osindisweni Hospital will be greatly appreciated.

Sincerely,

Nakita Govender

…………………………………..	…………………………………..	…………………………………..
N. Govender (Miss)	S. Ghuman (Dr)	I. Niranjan (Dr)
MHSc Student	Supervisor	Co-Supervisor
079 966 5970	083 588 3245	031 373 2807
Email: govnakit09@gmail.com	Email: shanazg@dut.ac.za	Email: ivann@dut.ac.za

APPENDIX C: PERMISSION LETTER TO INSTITUTIONAL MANAGEMENT

Miss Nakita Govender

Durban University of Technology

Department of Community Health Studies

4000

December 2020

To: Osindisweni Hospital Management

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO CONDUCT A RESEARCH STUDY

I am currently registered as a Master of Health Sciences: Environmental Health student, at the Durban University of Technology in the Department of Community Health Studies. The research I wish to conduct is titled**: 'The knowledge, attitudes and practices of Health Care Workers regarding occupational exposure to BBF in a Public Hospital, KwaZulu-Natal'.** This project shall be conducted under the guidance of Dr Shanaz Ghuman (Supervisor) and Dr. Ivan Niranjan (Co-Supervisor).

The objectives of the study are:

1. To evaluate an association between the knowledge of HCWs and their likelihood of engaging in unsafe behaviour and practices, regarding occupational exposure to BBF in a public hospital, KwaZulu-Natal.
2. To evaluate an association between the attitude of HCWs and their likelihood of engaging in unsafe behaviour and practices, regarding occupational exposure to BBF in a public hospital, KwaZulu-Natal.
3. To investigate the practices of HCWs regarding occupational exposure to BBF in a public hospital, KwaZulu-Natal.
4. To determine the barriers to IPC in a public hospital, KwaZulu-Natal.

Despite being a scantly studied field of research, the verifiably high prevalence of occupational exposure to BBF continues to be a pre-eminent phenomenon presently experienced in isolated and underdeveloped areas of Africa. The rationale of this study was prompted by – as far as the researcher's knowledge – lack of neoteric studies that centre on the association between the HCW's knowledge and attitude and the likelihood of engaging in unsafe behaviours and practices that may increase their risk for occupational exposure to BBF. Additionally, a paucity of research was found within South Africa, specifically, district level hospitals of KwaZulu-Natal, regarding first hand impressions and perceptions of HCWs (at all levels within a hospital) on the barriers to IPC within the different departments of the hospital.

I hereby humbly request your permission to approach hospital management, in order to conduct a research project within Osindisweni Hospital, as well as administer an epidemiologic questionnaire to a portion of HCWs currently employed in the facility, who voluntarily wish to participate in the study. I have enclosed a copy of my research proposal for your viewing, which consists of the study design and consent forms to be used in the research process, as well as an ethical clearance certificate from the Institutional Research Ethics Committee (IREC) at the Durban University of Technology.

Additionally, upon completion of the study, a bound copy of the entirety of the dissertation shall be made available to the hospital.

Your support and permission to perform the study at Osindisweni Hospital will be greatly appreciated.

Yours sincerely, Nakita Govender

……………………………..	……………………………..	……………………………..
N. Govender (Miss)	S. Ghuman (Dr)	I. Niranjan (Dr)
MHSc Student	Supervisor	Co-Supervisor
Tel: 079 966 5970	Tel: 031 373 2807	Tel: 031 373 2807
Email: govnakit09@gmail.com	Email: shanazg@dut.ac.za	Email: ivann@dut.ac.za

APPENDIX D: PERMISSION LETTER TO INSTITUTIONAL CEO

Miss Nakita Govender

Durban University of Technology

Department of Community
Health Studies

4000

December 2020

To: Mr Nathi Shabane (CEO)

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO CONDUCT A RESEARCH STUDY

I am currently registered as a Master of Health Sciences: Environmental Health student, at the Durban University of Technology in the Department of Community Health Studies. The research I wish to conduct is titled**: 'The knowledge, attitudes and practices of Health Care Workers regarding occupational exposure to BBF in a Public Hospital, KwaZulu-Natal'.** This project shall be conducted under the guidance of Dr Shanaz Ghuman (Supervisor) and Dr. Ivan Niranjan (Co-Supervisor).

The objectives of the study are:

5. To evaluate an association between the knowledge of HCWs and their likelihood of engaging in unsafe behaviour and practices, regarding occupational exposure to BBF in a public hospital, KwaZulu-Natal.
6. To evaluate an association between the attitude of HCWs and their likelihood of engaging in unsafe behaviour and practices, regarding occupational exposure to BBF in a public hospital, KwaZulu-Natal.
7. To investigate the practices of HCWs regarding occupational exposure to BBF in a public hospital, KwaZulu-Natal.
8. To determine the barriers to IPC in a public hospital, KwaZulu-Natal.

Despite being a scantly studied field of research, the verifiably high prevalence of occupational exposure to BBF continues to be a pre-eminent phenomenon presently experienced in isolated and underdeveloped areas of Africa. The rationale of this study was prompted by – as far as the researcher's knowledge – lack of neoteric studies that centre on the association between the HCW's knowledge and attitude and the likelihood of engaging in unsafe behaviours and practices that may increase their risk for occupational exposure to BBF. Additionally, a paucity of research was found within South Africa, specifically, district level hospitals of KwaZulu-Natal, regarding first hand impressions and perceptions of HCWs (at all levels within a hospital) on the barriers to IPC within the different departments of the hospital.

I hereby humbly request your permission to approach hospital management, in order to conduct a research project within Osindisweni Hospital, as well as administer an epidemiologic questionnaire to a portion of HCWs currently employed in the facility, who voluntarily wish to participate in the study. I have enclosed a copy of my research proposal for your viewing, which consists of the study design and consent forms to be used in the research process, as well as an ethical clearance certificate from the Institutional Research Ethics Committee (IREC) at the Durban University of Technology.

Additionally, upon completion of the study, a bound copy of the entirety of the dissertation shall be made available to the hospital.

Your support and permission to perform the study at Osindisweni Hospital will be greatly appreciated.

Yours sincerely, Nakita Govender

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N. Govender (Miss)	S. Ghuman (Dr)	I. Niranjan (Dr)
MHSc Student	Supervisor	Co-Supervisor
Tel: 079 966 5970	Tel: 031 373 2807	Tel: 031 373 2807
Email: govnakit09@gmail.com	Email: shanazg@dut.ac.za	Email: ivann@dut.ac.za

APPENDIX E: PERMISSION LETTER TO CHIEF DIRECTOR OF HEALTH ETHEKWINI

Miss Nakita Govender

Durban University of Technology

Department of Community Health Studies

4000

December 2020

To: The Chief Director of Health Ethekwini

Dear Sir/Madam

RE: REQUEST FOR PERMISSION TO CONDUCT A RESEARCH STUDY

I am currently registered as a Master of Health Sciences: Environmental Health student, at the Durban University of Technology in the Department of Community Health Studies. The research I wish to conduct is titled**: 'The knowledge, attitudes and practices of Health Care Workers regarding occupational exposure to BBF in a Public Hospital, KwaZulu-Natal'.** This project shall be conducted under the guidance of Dr Shanaz Ghuman (Supervisor) and Dr. Ivan Niranjan (Co-Supervisor).

The objectives of the study are:

9. To evaluate an association between the knowledge of HCWs and their likelihood of engaging in unsafe behaviour and practices, regarding occupational exposure to BBF in a public hospital, KwaZulu-Natal.
10. To evaluate an association between the attitude of HCWs and their likelihood of engaging in unsafe behaviour and practices, regarding occupational exposure to BBF in a public hospital, KwaZulu-Natal.
11. To investigate the practices of HCWs regarding occupational exposure to BBF in a public hospital, KwaZulu-Natal.
12. To determine the barriers to IPC in a public hospital, KwaZulu-Natal.

Despite being a scantly studied field of research, the verifiably high prevalence of occupational exposure to BBF continues to be a pre-eminent phenomenon presently experienced in isolated and underdeveloped areas of Africa. The rationale of this study was prompted by – as far as the researcher's knowledge – lack of neoteric studies that centre on the association between the HCW's knowledge and attitude and the likelihood of engaging in unsafe behaviours and practices that may increase their risk for occupational exposure to BBF. Additionally, a paucity of research was found within South Africa, specifically, district level hospitals of KwaZulu-Natal, regarding first hand impressions and perceptions of HCWs (at all levels within a hospital) on the barriers to IPC within the different departments of the hospital.

I hereby humbly request your permission to approach hospital management, in order to conduct a research project within Osindisweni Hospital, as well as administer an epidemiologic questionnaire to a portion of HCWs currently employed in the facility, who voluntarily wish to participate in the study. I have enclosed a copy of my research proposal for your viewing, which consists of the study design and consent forms to be used in the research process, as well as an ethical clearance certificate from the Institutional Research Ethics Committee (IREC) at the Durban University of Technology.

Additionally, upon completion of the study, a bound copy of the entirety of the dissertation shall be made available to the hospital.

Your support and permission to perform the study at Osindisweni Hospital will be greatly appreciated.

Yours sincerely, Nakita Govender

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N. Govender (Miss)	S. Ghuman (Dr)	I. Niranjan (Dr)
MHSc Student	Supervisor	Co-Supervisor
Tel: 079 966 5970	Tel: 031 373 2807	Tel: 031 373 2807
Email: govnakit09@gmail.com	Email: shanazg@dut.ac.za	Email: ivann@dut.ac.za

APPENDIX F: INFORMATION & CONSENT

LETTER OF INFORMATION

Warm Greetings!

My name is Nakita Govender and I am currently pursuing a Master of Health Sciences in Environmental Health at the Durban University of Technology. I would like to humbly invite you to participate in this research study that I wish to initiate within your workplace. Additional information regarding the prospective study is made available below for your understanding.

Title of the Research Study:

The knowledge, attitudes and practices of HCWs regarding occupational exposure to BBF in a Public Hospital, KwaZulu-Natal

Principal Investigator/s/researcher:

Nakita Govender - BTech: Environmental Health

Co-Investigator/s/supervisor/s:

Dr. Shanaz Ghuman (Supervisor) and Dr. Ivan Niranjan (Co-Supervisor)

Brief Introduction and Purpose of the Study:

In sub-Saharan countries, where exists an alarmingly high rate of infectious diseases such as HIV and hepatitis B and C among patients, needle stick injuries presented and unsettling and all too recurrent occupational health hazard to HCWs. The rationale of this study was prompted by – as far as the researcher's knowledge – lack of recent studies that centre on the association between the HCWs knowledge and attitude and their likelihood of engaging in unsafe behaviours and practices that may increase their risk for occupational exposure to BBF. Additionally, following an extensive review of literature, a paucity of research was available within South Africa, specifically, district level hospitals of KwaZulu-Natal, regarding first hand impressions and perceptions of HCWs (at all levels within a hospital) on the barriers to IPC within the different departments of the hospital. This all-inclusive study aims to incorporate several categories of HCWs arising from an array of departments of the hospital, in order to systematically evaluate the highest risk category of HCWs based on each department’s knowledge, attitude and practices. The results of the study are expected to provide hospital management with data that can be used to address the knowledge and attitude shortfalls in relation to HCWs behaviour and practices when working with BBF. Furthermore, this study aims to grasp the apprehension of HCWs on probable factors that may adversely influence IPC within the hospital. Once the perceptions of HCWs have been identified, hospital management shall be actively aware of the shortfalls in IPC from the perspective of the staff and thus appropriately implement effective intervention strategies.

Outline of the Procedures:

An institutional based, observational-descriptive cross-sectional study which employs a quantitative approach shall be employed. The study will be comprised of a single phase. This phase shall include the administration of a structured questionnaire. An information and consent form (Appendix F) will be made available for you to complete prior to completion of the questionnaire. Your anonymity shall be upheld throughout the process as you are not permitted nor required to provide any personal details such as any form of identification on the questionnaire. As a result, I therefore humbly request that you answer all questions with integrity and reliability and as honest as reasonably practicable. A period of 15-20 minutes shall be required of your time for completion of the questionnaire. Your availability to complete the questionnaire shall be during a time agreed upon by both the participants and the researcher. Should you be interested in the outcomes of the study, the researcher should be informed in this regard.

Risks or Discomforts to the Participant:

No foreseeable risks or discomforts are expected from this study.

Benefits:

To You: This study will be carried out in order to determine whether an association exists between the knowledge and attitudes of HCWs and their likelihood to engage in unsafe behaviours and practices that may increase their risk for occupational exposure to BBF. The study also aims to explore the perceptions of HCWs on the barriers to IPC within the different departments of the hospital. The above factors will be investigated extensively in order to identify the underlying risk factors associated with the occupational exposure of HCWs to BBF as well as to evaluate the knowledge and attitude of HCWs regarding occupational exposure to BBF in a Public Hospital, KwaZulu-Natal. Once the patterns in knowledge and attitude of HCWs have been established, an association between such factors and likelihood to engage in unsafe behaviours prior to, during and in the aftermath of working with BBF can be determined. Once the above information has been distinguished, the gaps in HCWs knowledge and attitudes, and the likelihood of unsafe practices when handling BBF can potentially be bridged. Additionally, the study also aims to investigate HCWs perceptions on the barriers to infection control and prevention. Once these factors, as perceived by the HCWs have been identified, the result of these findings shall be made available to hospital management, who shall be actively aware of the shortfalls in infection control and prevention, from the perspective of the staff and thus appropriately implement effective intervention strategies, aimed at improving IPC within the hospital.

To the Researcher: The publication of at least two papers in international accredited journals, which may result in conference proceedings.

Reason/s why you may be withdrawn from the study:

You may withdraw from the study if it comes to the researcher's attention that the eligibility criteria were not met, in other words there are non-compliances with the eligibility criteria. In the case of you being withdrawn from the study either voluntarily or by the researcher, the participant shall not be subject to adverse consequences.

Remuneration:

If you choose to participate in this study, you will not be offered any monetary gain, or any other form of remuneration. Participation in this study is wholly voluntarily and at the consent and discretion of you as the participant.

Costs of the Study:

You are not expected to cover any costs in participation in this study.

Confidentiality:

The confidentiality of the data that you provide will be ensured via the completion of questionnaires anonymously, thereby protecting the identity of you, the research participant. Your identity will be further protected during the write-up of the thesis as your names and any other personal information such as age, gender, race, etc. shall not be included. During the dissemination of the results, no names of any research participants shall be disclosed. In order to differentiate between different questionnaires, upon completion of data from the hospital, numbers will be randomly assigned to each questionnaire to distinguish between them. Data will be securely stored in a locked cabinet, in the environmental health science office at the Durban University of Technology, for a maximum period of five years. Access to this data will be restricted to the researcher and supervisor only. After five years have elapsed the data will then be shredded.

Research-related Injury:

No direct harm will come to you during the undertaking of this study, as it is non-invasive and purely observational. However, the risk of transmission of COVID-19 presents itself. For this purpose, all national regulations, guidelines and protocols relating toCOVID-19 will be strictly adhered to during the conduct of research. All COVID-19 precautionary measures shall be enforced to significantly reduce the risk of transmission from the researcher to the participants or from participants to participants.

Persons to Contact in the Event of Any Problems or Queries:

Nakita Govender (researcher) - 079 966 5970.

Dr. Shanaz Ghuman (supervisor) – 083 588 3245.

Institutional Research Ethics Administrator - 031 373 2375.

Complaints can be reported to the Director: Research and Postgraduate Support Dr. L. Linganiso on 031 373 2577 or researchdirector@dut.ac.za

CONSENT

Statement of Agreement to Participate in the Research Study:

- I hereby confirm that I have been informed by the researcher, Nakita Govender about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: _________________.
- I have also received, read and understood the above written information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my sex, age, date of birth, initials and diagnosis will be anonymously processed into a study report.
- In view of the requirements of research, I agree that the data collected during this study can be processed in a computerised system by the researcher.
- I may, at any stage, without prejudice, withdraw my consent and participation in the study.
- I have had sufficient opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.
- I understand that significant new findings developed during the course of this research which may relate to my participation will be made available to me.

____________________	____________________	____________________	____________________
Full Name of Participant /	**Date**	**Time**	**Signature / Right Thumbprint**

I, Nakita Govender herewith confirm that the above participant has been fully informed about the nature, conduct and risks of the above study.

Full Name Of Researcher	Date	Signature
Full Name Of Witness (If Applicable)	Date	Signature
Full Name Of Legal Guardian (If Applicable)	Date	Signature

APPENDIX G: ETHICS TRAINING CERTIFICATE

TRREE

Zertifikat

Certificado

Certificat

Certificate

Promouvoir les plus hauts standards éthiques dans la protection des participants à la recherche biomédicale
Promoting the highest ethical standards in the protection of biomedical research participants

Clinical Trials Centre
The University of Hong Kong

Certificat de formation - Training Certificate

Ce document atteste que - this document certifies that

Nakita Govender

a complété avec succès - has successfully completed

Public Health Research Ethics

du programme de formation TRREE en évaluation éthique de la recherche
of the TRREE training programme in research ethics evaluation

Release Date: 2021/03/24
CID : ibUisFK9r9

Professeur Dominique Sprumont
Coordinateur TRREE Coordinator

FMH Continuing Education Program (5 Credits)
Programme de Formation continue (5 Crédits)

Foederatio Pharmaceutica Helvetiae FPH Programmes de formation continue
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Ce programme est soutenu par - This program is supported by :
European and Developing Countries Clinical Trials Partnership (EDCTP) (www.edctp.org) - Swiss National Science Foundation (www.snf.ch) - Canadian Institutes of Health Research (http://www.cihr-irsc.gc.ca/e/2891.html) - Swiss Academy of Medical Science (SAMS/ASSM/SAMW) (www.samw.ch) - Commission for Research Partnerships with Developing Countries (www.kfpe.ch)

[REV : 20170510]

APPENDIX H: STATISTICAL REPORT

What margin of error can you accept? 5% is a common choice	5 %	The margin of error is the amount of error that you can tolerate. If 90% of respondents answer *yes*, while 10% answer *no*, you may be able to tolerate a larger amount of error than if the respondents are split 50-50 or 45-55. Lower margin of error requires a larger sample size.
What confidence level do you need? Typical choices are 90%, 95%, or 99%	95 %	The confidence level is the amount of uncertainty you can tolerate. Suppose that you have 20 yes-no questions in your survey. With a confidence level of 95%, you would expect that for one of the questions (1 in 20), the percentage of people who answer *yes* would be more than the margin of error away from the true answer. The true answer is the percentage you would get if you exhaustively interviewed everyone. Higher confidence level requires a larger sample size.
What is the population size? If you don't know, use 20000	199	How many people are there to choose your random sample from? The sample size doesn't change much for populations larger than 20,000.
What is the response distribution? Leave this as 50%	50 %	For each question, what do you expect the results will be? If the sample is skewed highly one way or the other, the population probably is, too. If you don't know, use 50%, which gives the largest sample size.
Your recommended sample size is	166	This is the minimum recommended size of your survey. If you create a sample of this many people and get responses from everyone, you're more likely to get a correct answer than you would from a large sample where only a small percentage of the sample responds to your survey.

http://www.raosoft.com/samplesize.html

APPENDIX I: COVID-19 CONTACT TRACING REGISTER

Location/Venue: ______________________________________

Researcher: ______________________________________

Date	Time	Name and Surname	Activity Attended	Phone Number	Temperature(°c)

APPENDIX J: PRINCIPLE PERMISSION LETTER OSINDISWENI CEO

KWAZULU-NATAL PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

DIRECTORATE: DHS

Private Bag X 15
Osindisweni District Hospital
Oakford Verulam 4340
Tel: 0325419201 Fax: 0325410304
nathi.shabane@kznhealth.gov.za / nathi.shabane@gmail.com

OSINDISWENI DISTRICT HOSPITAL
OFFICE OF THE CEO

Enquiries : Mr JN Shabane
Date : Wednesday, 09 June 2021
Reference : Permission to conduct research

Attention:

Ms Nakita Govender

Durban University of Technology

Durban

Dear Ms Nakita Govender

RE: PERMISSION TO CONDUCT RESEARCH ON "THE KNOWLEDGE, ATTITUDES AND PRACTICES OF HEALTH CARE WORKERS REGARDING EXPOSURE TO BLOOD AND BODILY FLUIDS IN A PUBLIC HOSPITAL, KWAZULU-NATAL'.

Kindly note that following our telephonic discussions regarding permission to conduct research has reference. We are willing as an institution to give you written permission to conduct research in our facility. You do however need to get written permission from Ethics and Research Department from Head Office in Pietermaritzburg. You also must have a written permission for the office of the Chief Director for Health eThekwini. Only then procedurally am I allowed to issue a letter to you.

Yours Sincerely,

Mr JN Shabane

Chief Executive Officer

APPENDIX K: DEPARTMENT OF HEALTH APPROVAL LETTER

KWAZULU-NATAL PROVINCE
HEALTH
REPUBLIC OF SOUTH AFRICA

DIRECTORATE:
Health Research & Knowledge Management Unit

Postal Address: Private Bag X9050
Physical Address: 330 Langalibalele Str; PM Burg; 3201
Tel: 0333953189/3123/2805 **Fax: 033-3943782**
Email address: hrkm@kznhealth.gov.za
www.kznhealth.gov.za

NHRD Ref: KZ_202105_008

Dear Ms N Govender
(DUT)

Approval of research

1. The research proposal titled **'The knowledge, attitudes and practices of Health Care Workers regarding the occupational exposure to blood and bodily fluids in a Public Hospital, KwaZulu-Natal.'** was reviewed by the KwaZulu-Natal Department of Health (KZN-DoH).

   The proposal is hereby **approved** for research to be undertaken at Osindisweni hospital.

2. You are requested to take note of the following:

   a. *All research conducted in KwaZulu-Natal must comply with government regulations relating to Covid-19. These include but are not limited to: regulations concerning social distancing, the wearing of personal protective equipment, and limitations on meetings and social gatherings.*
   b. *Kindly liaise with the facility manager BEFORE your research begins in order to ensure that conditions in the facility are conducive to the conduct of your research. These include, but are not limited to, an assurance that the numbers of patients attending the facility are sufficient to support your sample size requirements, and that the space and physical infrastructure of the facility can accommodate the research team and any additional equipment required for the research.*
   c. *Please ensure that you provide your letter of ethics re-certification to this unit, when the current approval expires.*
   d. *Provide an interim progress report and final report (electronic and hard copies) when your research is complete to **HEALTH RESEARCH AND KNOWLEDGE MANAGEMENT, 10-102, PRIVATE BAG X9051, PIETERMARITZBURG, 3200** and e-mail an electronic copy to hrkm@kznhealth.gov.za*
   e. *Please note that the Department of Health shall not be held liable for any injury that occurs as a result of this study.*

For any additional information please contact Ms G Khumalo on 033-395 3189.

Yours Sincerely

Dr E Lutge
Chairperson, Health Research Committee
Date: 27/07/21.

GROWING KWAZULU-NATAL TOGETHER