Development of an HIV Risk Index for University Students in KwaZulu-Natal, South Africa

By

TRISHKA PILLAY

Submitted in fulfilment of the requirements for the degree of Doctor of Philosophy in Health Sciences in the Faculty of Health Sciences, Durban University of Technology

December 2023

DECLARATION

This study is an original work by the author and has not otherwise been submitted in any form for any degree to any tertiary institution. Where use has been made of the work of others, it has duly been acknowledged in the text.

	21 June 2024
Trishka Pillay	**Date**

As the candidate's supervisor/ co-supervisor, I have approved this dissertation for submission.

	21 June 2024
Supervisor: Prof Poovendhree Reddy	**Date**
	21 June 2024
Co-supervisor: Prof Nalini Govender	**Date**

DECLARATION

PLAGIARISM

I, Trishka Pillay, declare that

1. The research reported in this dissertation, except where otherwise indicated, is my original research.

2. This dissertation has not been submitted for any degree or examination at any other university.

3. This dissertation does not contain other persons' data, pictures, graphs, or other information unless specifically acknowledged as being sourced from other persons.

4. This dissertation does not contain other persons' writing unless specifically acknowledged as being sourced from other researchers. Where other written sources have been quoted, then their words have been re-written, but the general information attributed to them has been referenced. Where their exact words have been used, then their writing has been placed inside quotation marks and referenced.

5. This dissertation does not contain text, graphics or tables copied and pasted from the internet, unless specifically acknowledged, and the source is detailed in the dissertation and the reference sections.

Signed: __ ___

ABSTRACT

Background: Human Immunodeficiency Virus **(**HIV) infection is a global health challenge, with developing countries most affected by the HIV burden. In South Africa (SA), young people aged 15 to 24 years are exceptionally vulnerable to HIV infection. University students are a segment of this vulnerable age group in SA. Significant effort and resources have been invested in HIV prevention and treatment such as availability of free government issue condoms, a large-scale antiretroviral (ARV) programme and intensification of other public health interventions such as male medical circumcision (MMC) and the availability of Pre-exposure prophylaxis (PrEP). Nonetheless, HIV still poses a critical public health challenge 40 years post discovery, particularly among young people. Factors that may increase susceptibility include substance usage, tendency to engage in risky sexual behaviours (RSBs) such as transactional sex, inconsistent condom usage and engaging in sex with multiple partners. Poverty may further perpetuate RSBs such as transactional sex for money or to acquire basic needs. University students form part of the country's economic backbone and are the future leaders of the country, thus context driven HIV prevention interventions for this unique population are imperative. HIV risk is multidimensional and in order to develop effective prevention interventions, risk factors associated with RSBs and HIV seropositivity must be further explored.

Aim: The study aimed to analyse the behavioural and socio-economic components of risk associated with HIV and health among student populations in an attempt to design an evidence-based risk index.

Methodology: This study used a case control study design. Study sites included the four major public sector higher educational institutions (HEIs) in KwaZulu-Natal, South Africa. A structured questionnaire was used to collect data using convenience sampling from the study population with consisted of 375 HIV uninfected students (controls) and 125 HIV infected students (cases). STATA-version 17 was used to conduct data analysis. Data collected from controls was initially used to conduct a preliminary analysis to explore the association between food insecurity which was a socio-economic risk factor and RSBs. Subsequently, the main analysis was undertaken to investigate associations of the following: socio-economic, behavioural and knowledge risk factors with RSBs and HIV seropositivity using bivariate analysis and logistic regression modelling. Results from the case control data analysed was used to develop an HIV risk index tool, for specific use among university students.

Key findings: Preliminary data analysis of control data found significant associations between food insecurity and students engaging in transactional sex for money as well as to meet basic needs. Participants who were food insecure were twice as likely to have multiple sexual partners. The case control analysis with socio-economic risk factors revealed a significant association between socio-economic measures, RSBs and HIV seropositivity. Overall, food insecurity increased the likelihood of multiple partners, transactional sex for money, and transactional sex for basic needs. Students who accessed the government funding scheme and shared the bursary/ loan were more likely to be HIV seropositive. Results from the analysis on behavioural risk factors indicated that heavy episodic drinking [aOR: 2.73 (1.38; 5.44), 0.004], drugs before sex [aOR: 7.46 (2.11; 27.88), 0.003], and a higher number of lifetime sex partners (2 to 5 partners) [aOR: 4.22(1.69; 10.54), 0.002] and ≥ 6 partners [aOR: 16.36 (6.18; 43.28), 0.000] increased students' likelihood of having multiple concurrent sex partners. High risk behaviours such as sex with multiple partners and inconsistent condom use were more prevalent among HIV uninfected students. Data from our study showed that both HIV infected, and uninfected students displayed a better understanding regarding modes of HIV transmission compared to prevention methods. Students with poor knowledge regarding HIV prevention were 2.34 times more likely to be HIV positive and those demonstrating poor knowledge about HIV transmission were 4.79 times more likely to be HIV positive. Several misconceptions regarding HIV transmission methods were prevalent among both HIV infected and uninfected students. The above findings regarding socio-economic, behavioural and knowledge risk factors were used to develop an HIV risk index tool based on logistic regression models. The risk index score comprises 17 factors and used an aggregated score to formulate three risk categories namely, low, medium, and high-risk categories. Questions were formulated for the risk index tool based on variables used in the data analysis.

Conclusion: Our findings demonstrate that university students are at an increased risk of engagement in RSBs which may consequently lead to HIV infection. Therefore, it is of critical importance for public health officials to consider the multidimensional aspects of HIV risk in the university student population when designing interventions targeted at this vulnerable group. Risk measurement is important to guide HIV prevention methods such as Pre-exposure prophylaxis (PrEP). The developed risk index tool has the potential to serve as a powerful public health tool for measurement of HIV risk among university students in developing countries. However, further testing and evaluation is required before implementation.

DEDICATION

I dedicate this dissertation to:

My parents, Rava & Logie Govender.

We did it!

Philippians 4: 13

‘I can do all things through Christ which strengthens me’

ACKNOWLEDGEMENTS

My first thanks go to My Lord and Savior Jesus Christ, for your guidance and grace on my journey.

To my magnificent husband, Clinton Alistair Pillay, thank you for being my backbone and for reigniting the fire of determination in me. For pushing me to go on, on the very many times that I wanted to throw in the towel. For believing in me when I had lost hope. For your patience and sacrifice on the many long nights and early mornings of research endeavours. For supporting me during illness and health and most of all for your love. I could have not done this without you!

To my parents, Rava and Logie Govender, I am eternally grateful to you for being my backbone during this difficult journey and for the many sacrifices you have made for me. Thank you for standing with me from day one, for your motivation and encouragement in times of despair and for every prayer and hug. Mom, your amazing sense of humor saved me from quitting many times, those tight hugs on bad days made things more bearable. Dad thank you for those early morning cups of coffee and for always believing in me. For taking every step to support me and encouraging me on my journey. I will forever be inspired by both of you.

To my siblings, Karina Palmer and Sashlin Govender, thank you for your prayers and encouragement. Karina, thank you for always believing in me, for reviewing manuscripts, sharing resources and always being objective but kind. We started our academic journey together and your tenacity to finish has always inspired me to push forward. To my brother, Sashlin thank you for always enquiring about how things were going and for the biblical encouragement and for always being around to fix my technical glitches. I could have not been blessed with better siblings.

To my supervisor Professor Poovie Reddy for always believing in me even when things seemed impossible, you reminded me of who I was. Thank you for the great amount of time you spent mentoring and guiding me from my undergraduate years until my last post-graduate degree. You always treated me like your own child. Thank you for the many drafts you read, the brilliant solutions you found to solve my research dilemmas, words cannot express my gratitude to you. “Better than a thousand days of diligent study is one day with a great teacher” Japanese Proverb.

To my co-supervisor Professor Nalini Govender, thank you for the countless hours you spent guiding me through each step of the way, for your precious time spent reviewing manuscripts and for always being willing to motivate and encourage me on this tough road. I often clung to your words of encouragement on the rough days.

To Dr Katie Bryant, I am eternally indebted to you for your guidance in academic writing. For reading countless drafts and providing insightful reviews. I could not have done it without you.

To Cornelius Nattey, thank you for assistance rendered with the statistical analysis and all the knowledge that you so willingly imparted to me on data analysis.

To my brother-in-law, Quint André Palmer, thank you for your endless support during my data collection phase. For always treating me like your own sister and endeavouring to make my life easier by solving complex technical problems. Your words 'that's what family is for' will always echo in my ears.

To my dear friend and brother in research Dr Preshod Ramlal, thank you for your constant encouragement and wisdom on this journey. For sharing my burdens and being ever willing to lend your ear whenever I needed any form of assistance. You made the burden lighter.

To my colleague, Thuli Mtshengu, we often discussed how hard it was to "push the bicycle uphill", thank you for all your optimism on my PhD journey and for your early morning motivation sessions on how we will get through our research valley moments.

To my spiritual father, Pastor Ernest Yenketsamy, thank you for every prayer and word of encouragement. For your wise words 'God will make a way', which I always clung to.

To Judith Joseph, my friend and sister in Christ, thank you for encouraging me to keep the faith in difficult situations. For always reminding me of how far I came and how all would be well.

To my research assistants, I thank you for all the hard work and sacrifice you put into collecting data. I will eternally be grateful to you.

My gratitude to the following HODS of campus health services: Sr Hlengiwe (UNIZULU), Mr Mthembu (UKZN), Sr Mkwanazi (MUT) and Sr Warthen (DUT) and staff of each of the campus health clinics, for your support, kindness and hospitality during the course of this study.

To Eleanor Langley (UKZN), I thank you for being the kindest soul, always trying to make a way for me on my journey. You were certainly God-sent. To you I will be eternally grateful. I could never have got through this without you.

TABLE OF CONTENTS

ABSTRACT IV
DEDICATION VI
ACKNOWLEDGEMENTS VII
LIST OF MANUSCRIPTS XII
LIST OF ABBREVIATIONS XIII
LIST OF DEFINITIONS XV
DISSERTATION OVERVIEW 1
CHAPTER 1: INTRODUCTION
1.1 Background 4
1.2 Rationale of the study 8
1.3 Study Aim and Objectives 10
CHAPTER 2: LITERATURE REVIEW
2.1 Introduction 11
2.1.1 Prevalence of HIV infection in Sub-Saharan Africa 12
2.1.2 HIV prevalence and risk among students 13
2.2 Current interventions employed to mitigate HIV incidence in South Africa 14
2.2.1 Global HIV prevention coalition 14
2.2.2 Non-Governmental Organisations in HIV prevention initiatives 15
2.2.3 Department of Education in South Africa 15
2.2.4 Department of Higher Education and Training in South Africa 16
2.2.5 Public Sector Condom Distribution in South Africa 17
2.2.6 Medical Male Circumcision 18
2.2.7 Voluntary Counselling and Testing 20
2.2.8 Antiretroviral Therapy 22
2.2.9 Pre-exposure Prophylaxis 23
2.2.10 Post-exposure Prophylaxis 25
2.3 Risk factors for HIV in Higher Education Institutions 26
2.3.1 Risky Sexual Behaviours 27
2.3.2 Peer pressure 27
2.3.3 Substance usage (alcohol & drugs) 28
2.3.4 Sexual debut / Early coital debut 30
2.3.5 Inconsistent contraceptive usage (barrier & non- barrier methods) 32
2.3.6 Multiple Sexual Partnerships 36
2.3.7 Penile Anal Intercourse 37

2.3.8 Men who have sex with men 39
2.3.9 Transactional sex and Intergenerational relationships 41
2.3.10 Insufficient HIV knowledge 44
2.3.11 Risk Perception 45
2.3.12 Risk Assessment for the likelihood of HIV infection 45
CHAPTER 3: METHODOLOGY
3.1 Ethical considerations 49
3.2 Study sites 50
3.3 Study design 50
3.4 Characteristics of sample population 50
3.4.1 Sample population 50
3.4.2 Sampling strategy 50
3.4.3 Sample size calculation 51
3.5 Participation criteria 51
3.5.1 Case group 51
3.5.2 Control group 52
3.5.3 Referral of participants 52
3.6 Research Instrument 53
3.7 Procedure for Piloting of Research Instrument 54
3.8 Training of Research Assistants 54
3.9 Recruitment and data collection 55
3.9.1 Participant recruitment of controls (HIV seronegative) 55
3.9.2 Participant recruitment of cases (HIV seropositive) 55
3.10 Validity 56
3.11 Reliability 56
3.12 Data management and analysis 57
CHAPTER 4
Manuscript 1: Food Insecurity and Risky Sexual Behaviors among University Students in KwaZulu-Natal, South Africa 58
CHAPTER 5
Manuscript 2: Socio-economic determinants of risky sexual behaviors and HIV seropositivity among university students in South Africa: A case control analysis 70
CHAPTER 6
Manuscript 3: A case-control investigation of factors associated with risky sexual behaviours among South African university students 80

CHAPTER 7
Manuscript 4: HIV knowledge and sexual behaviours amongst South African university students four decades later: Are we there yet? 107
CHAPTER 8
Manuscript 5: Development of an HIV risk index for university students in South Africa..... 127
CHAPTER 9
SYNTHESIS 158
STRENGTHS 168
LIMITATIONS 168
RECOMMENDATIONS 168
CONCLUSION 170
REFERENCES 172
APPENDIX
APPENDIX A: CONSENT FORM 204
APPENDIX B: PARTICIPANT LETTER OF INFORMATION 205
APPENDIX C: RESEARCH QUESTIONNAIRE 207
APPENDIX D: ETHICAL APPROVAL AND GATEKEEPERS PERMISSION LETTERS 223
APPENDIX E: MANUSCRIPTS UNDER REVIEW 229
APPENDIX F: EDITORS LETTER 258

LIST OF MANUSCRIPTS

PUBLISHED

1. Govender, T., Govender, N. & Reddy, P. (2022) Food Insecurity and Risky Sexual Behaviors among University Students in KwaZulu-Natal, South Africa, *International Journal of Sexual Health*, pp. 1-12. DOI: 10.1080/19317611.2022.2117257
2. Pillay, T., Govender, N. & Reddy, P. (2023) Socio-economic determinants of risky sexual behaviors and HIV seropositivity among university students in South Africa: A case control analysis, *Research in Nursing & Health*, 43, pp. 436-444. DOI: 10.1002/nur.22328

UNDER REVIEW

1. Pillay, T., Govender, N. & Reddy, P. (2022) A case-control investigation of factors associated with risky sexual behaviours among South African university students
2. Pillay, T., Govender, N. & Reddy, P. (2023) HIV knowledge and sexual behaviours amongst South African university students four decades later: Are we there yet?

IN PREPARATION

1. Pillay, T., Govender, N. & Reddy, P. (2023) Development of an HIV risk index for university students in South Africa

LIST OF ABBREVIATIONS

AIDS	Acquired Immune Deficiency Syndrome
ART	Antiretroviral therapy
CCMDD	Central Chronic Medicines Dispensing and Distribution
CDC	Centers for Disease Control and Prevention
CD4	Clusters for differentiation 4
DHET	Department of Higher Education and Training
DOH	Department of Health
EC	Emergency contraception
FC	Female condom
FGD	Focus group discussion
HCW	Health care worker
HIVST	HIV self-testing
HIV	Human immunodeficiency virus
HED	Heavy episodic drinking
HEI	Higher educational institution
HEAIDS	Higher education AIDS programme in South Africa
IGS	Intergenerational sex
MMC	Male medical circumcision
NSFAS	National Student Financial Aid Scheme
PAI	Penile-anal intercourse
PEP	Post exposure prophylaxis
PLWHIV	People living with HIV
PrEP	Pre-exposure prophylaxis

RA	Research assistants
RSB	Risky sexual behavior
SA	South Africa
STI	Sexually Transmitted Infection
STD	Sexually transmitted disease
TB	Tuberculosis
TVET	Technical and Vocational Education and Training
VCT	Voluntary counselling and testing
VMMC	Voluntary male medical circumcision
WHO	World Health Organization

LIST OF DEFINITIONS

Age disparate relationships: "Defined as those relationships between younger women and men who are at least five years older" (Chang *et al*., 2021).

Basic material needs: Items needed by students, such as rent, food, and airtime.

Food insecurity: "The lack of access to enough safe and nutritious food for normal growth and development and an active and healthy life" (Food and Agriculture Organization of the United Nations, 2023).

Heavy Episodic Drinking: "Is defined as drinking 6 or more alcoholic drinks on one occasion" (WHO, 2023).

HIV seropositive: "A person who has detectable antibodies to HIV" (HIV.gov, no date).

HIV seronegative: "A person who does not have detectable HIV antibodies" (HIV.gov, no date).

Intergenerational sex: "Heterosexual intercourse with a non-marital partner ten or more years older" (Drakes *et al.*, 2013).

Male Medical Circumcision: "Is the surgical removal of the foreskin of the penis, by a trained healthcare professional or doctor" (Chaps, 2023).

Multiple concurrent sexual partners: "Is where an individual has overlapping sexual relationships with more than one person" (aidsmap, 2009).

Sexual debut: "The age at which people have sexual intercourse for the first time in their lifetime" (IGIGlobal, 2023).

Transactional sex: "Refers to non-marital, non-commercial sexual relationships motivated by an implicit assumption that sex will be exchanged for material support or other benefits" (UNAIDS, 2018).

Risky sexual behavior: "Refers to any behaviour that increases the probability of negative consequences associated with sexual contact" (Abebe *et al*., 2013).

DISSERTATION OVERVIEW

This dissertation is organized into nine chapters and the focus area of each chapter is described below. The key findings emanating from this study are presented in chapters 4 to 8.

Chapter 1: Introduction

This chapter provides a background and rationale for the study as well as the aim and objectives.

Chapter 2: Literature review

This chapter provides a review of literature on the inherent problem of HIV infection and the associated risk factors among young people. Particular focus is given to the unique sexual risks encountered by students in the SA university context.

Chapter 3: Research Methodology

This chapter provides details of the research methods used in this study.

Chapter 4: Manuscript published in the International Journal of Sexual Health. (Paper 1)

This chapter presents the preliminary data involving the control group (HIV negative participants) from the study population and encompasses the socio-economic aspect of objective 1 of this study. The objective of this manuscript was to explore the relationship between food insecurity and RSBs among HIV negative university students.

Chapter 5: Manuscript published in the Research in Nursing and Health Journal. (Paper 2)

This chapter investigates the socio-economic determinants of RSBs and HIV seropositivity among university students linked to objective 1, using case control analyses.

Chapter 6: Manuscript under review. (Paper 3)

This chapter investigates behavioural predictors of risky sexual practices among university students and encompasses the behavioural component of objective 1.

Chapter 7: Manuscript under review. (Paper 4)

This chapter embodies objective 2 of the study and focuses on the evaluation of South African university students' HIV/AIDS knowledge and sexual practices.

Chapter 8: Manuscript in preparation. (Paper 5)

This chapter embodies objective 3 of the study and provides details on the design of an evidence-based risk index tool to measure the HIV risk levels of university students.

Chapter 9: Synthesis and Conclusion

This chapter provides an amalgamation of the research findings and a conclusion. It also highlights the strengths and limitations of this study, together with future recommendations.

Figure 1 provides a summary of the dissertation structure.

A summary of the structure of the dissertation is illustrated in Figure 1.

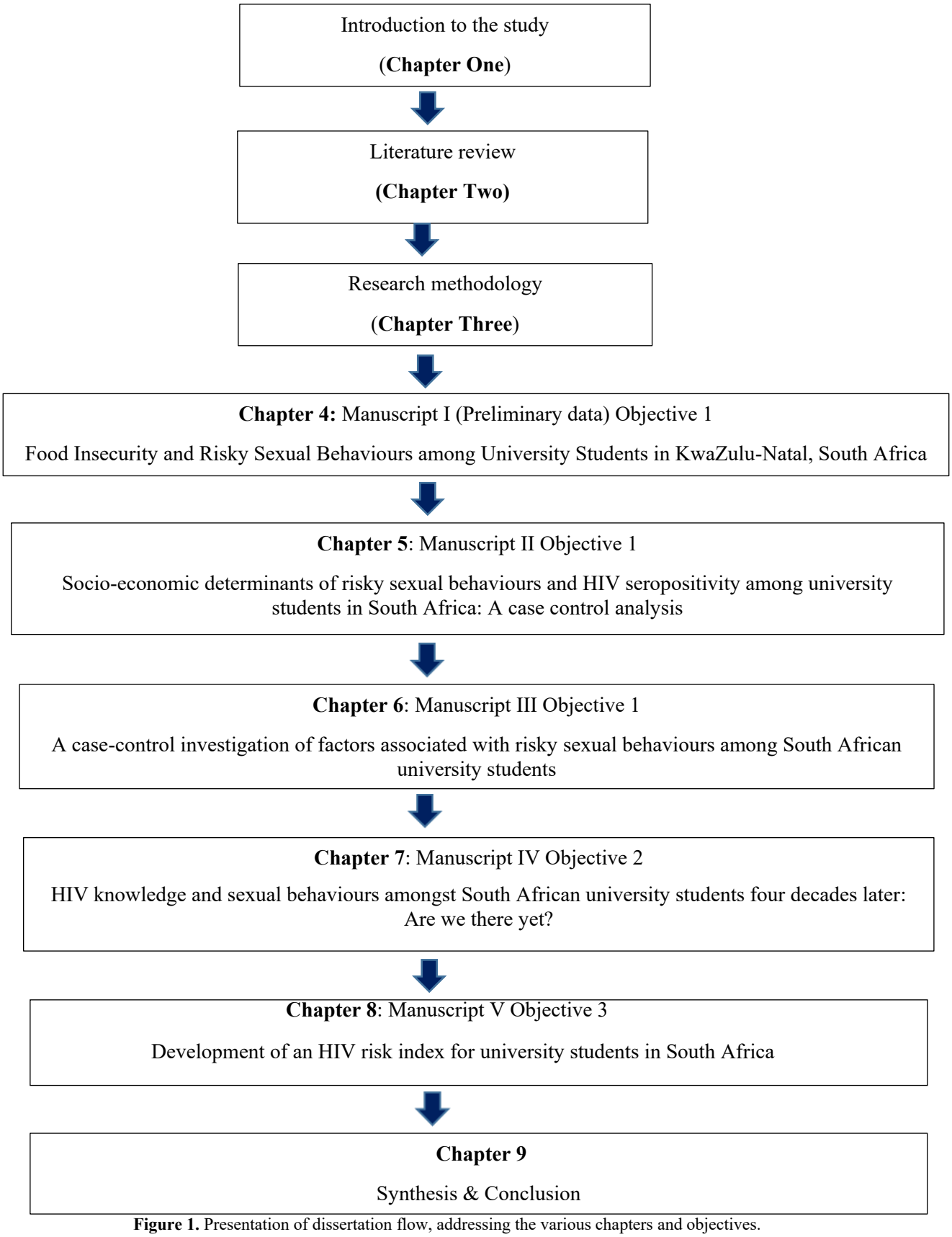


Figure 1. Presentation of dissertation flow, addressing the various chapters and objectives.

CHAPTER 1

INTRODUCTION

1.1 Background

The Human Immunodeficiency Virus (HIV) is identified as one of the world's most critical health and developmental challenges (KFF, 2021), affecting the health of individuals, families and communities as well as national development and economic growth (HIV.gov, 2021). Countries severely affected by the HIV pandemic are also disproportionately burdened by infectious diseases, food security and other serious issues such as non-communicable diseases and road traffic accidents (HIV.gov, 2021; Haileamlak, 2018). In 2020, an estimated 37.7 million people worldwide were living with HIV (UNAIDS, 2021a). Furthermore, 63% of all new HIV infections in sub-Saharan Africa occurred in women and girls (UNAIDS, 2021a). In 2021, the Statistics SA report highlights an overall HIV prevalence rate of 13.7% and 19.5% among adults aged 15-49 years (Statistics SA, 2021). South Africa is considered as the hub of the HIV epidemic and has the fourth highest HIV prevalence in the world (Hiv Rates by Country 2021, 2021; Allinder and Fleischman, 2019). HIV/AIDS has negatively impacted the already constrained health care system and is changing the demographic pattern of those seeking care in the public health sector in SA (Abdool Karim, Abdool Karim and Baxter, 2010). More young adults with normally healthy lifestyles for whom health care services have not previously been provided, are requiring health care (Abdool Karim, Abdool Karim and Baxter, 2010).

There has been remarkable progress in slowing the spread of HIV in SA. The National strategic plan (2017 – 2022) reports a decline of 34% in the sexual transmission of HIV among 15 to 49 year olds from 2011 to 2016 and a reduction in mother-to-child transmission from more than 3.5% in 2010 to 1.8% in 2014 (SANAC, 2017). Furthermore, 90% of people living with HIV (PLWHIV) are knowledgeable of their status, demonstrating that access to HIV testing has drastically improved, meeting the first 90-90-90 target (Clinton Health Access Initiative, 2021). Additionally, 10 million people uptake voluntary HIV testing annually, and 2.4 million male medical circumcisions (MMCs) were conducted in the last four years (SANAC, 2017). South Africa has the largest ART programme globally which is driven by the 'test and treat' national policy, with 3.7 million people on ART (SANAC, 2017; Clinton Health Access Initiative, 2021). Moreover, the HEAIDS has successfully driven HIV testing efforts for students

(SANAC, 2017). Despite the various interventions and financial investments allocated to reducing HIV, Tuberculosis (TB) and Sexually Transmitted Infections (STIs), there are still 270 000 new HIV infections reported annually and it is especially high among women and young girls in certain districts (SANAC, 2017). Furthermore, programmes focused on socioeconomic and structural factors, such as poverty, unemployment, gender inequality and substance usage need to be evaluated for their effectiveness (SANAC, 2017). In order to maximize the impact of the country's response to HIV, TB and STI's, social and behaviour change communication must have high coverage of the target populations (SANAC, 2017). Furthermore, there is a need for national programmes to be tailored to local communities (SANAC, 2017). Ensuring the availability of sufficient and trained human resources, i.e. an increase in the number of nurses and doctors with primary health care training to support services, as well as the strengthening of procurement and supply chain systems is necessary (SANAC, 2017).

Several social, economic, gender and health based factors drive HIV infection in SA (Open Access Government, 2021). Factors influencing HIV infections in SA include multiple concurrent sexual partners, age disparate relationships, inconsistent condom use, high mobility, migration, exposure to sexual violence and alcohol usage (Simbayi *et al*., 2019). Age disparate relationships (i.e. with partners 5 years or more older) associated with an unequal power dynamic between partners often converge with transactional sex (sex in exchange for gifts, money and services) and exacerbate the susceptibility of an individual to HIV infection (Simbayi *et al*., 2019). Young women become more vulnerable as they may experience difficulty in negotiating safer sexual practices such as condom usage, since the older men as providers assume roles of entitlement regarding issues relating to safer sex (Mampane, 2018).

According to UNAIDS's 2021b report, young people aged 15 to 24 made up two out of every seven new HIV infections worldwide in 2019. This confirms that individuals in this age range are a major HIV risk population (UNAIDS, 2021b). University students form part of this vulnerable at-risk population and require ongoing interrogation regarding safer sexual practices. In SA, the most recent HIV prevalence data available is the HEAIDS report which confirmed a prevalence of 3.4% from 21 higher educational institutions (HEIs) (HEAIDS, 2010). The HEAIDS report highlighted the university population as a significant proportion of the 15-to-24-year-old age group, who are required to be part of societal development for the determination of future norms (HEAIDS, 2010). Since most students are in the 15–24 age range

and are known to engage in RSBs, high risk sexual behaviours in HEIs are a concern for global reproductive health (Akintola, Ngubane and Makhaba, 2011).

Risky sexual behaviours include earlier age of sexual debut, unprotected sex, transactional sex and multiple sexual partners (Wana *et al.*, 2019; Shefer, Clowes and Vergnani, 2012). Notably, transactional sex has been foregrounded as a practice that contributes to unsafe and inequitable sexual practices (Shefer, Clowes and Vergnani, 2012), as well as imbalanced power dynamics involving differences in age, wealth and status that converge with gender (Shefer, Clowes and Vergnani, 2012). Such transactional relationships have the potential to exacerbate unsafe and coercive sexual practices amongst young individuals (Shefer, Clowes and Vergnani, 2012). Qualitative investigations involving university students in SA confirmed that transactional relationships with 'sugar daddies', or 'ministers of finance' were common campus practices, implying that material exchange was a normal expectation following sexual intimacy (Shefer, Clowes and Vergnani, 2012). 'Sugar daddies' are represented by 'wealthy male students or employed men from off campus' who use monetary value to exploit vulnerable female students and entice them as sexual partners (Shefer, Clowes and Vergnani, 2012). Qualitative findings from the 2008-2009 HEAIDS study confirmed that underprivileged students living away from home often experience socio-economic challenges such as access to shelter and money for food (HEAIDS, 2010). Interestingly, others reported that transactional sex enables them to maintain the campus lifestyle characterized by the need for fashionable clothing, mobile phones and entertainment money (HEAIDS, 2010). Furthermore, the majority of students were reliant on government funded loans from the National Student Financial Aid Scheme (NSFAS) to fund their tertiary studies. However, given the price of tuition, books, transportation and living expenses, the NSFAS financing was reported to be nominal (HEAIDS, 2010).

Limited socio-economic data is available regarding issues experienced by university students including food insecurity, student funding and their possible association with participation in RSBs. Factors such as social media usage, substance usage (alcohol and cigarettes), peer pressure and visiting night clubs appear to be significantly associated with RSBs (Wana *et al.*, 2019). Alcohol abuse among young people reduces willpower, judgement and inhibitions, thereby exacerbating the onset of RSBs (Dumbili, 2016; Seloilwe, 2005). Reasons differ as to why young people choose to consume alcohol prior to sexual intercourse. According to a qualitative study conducted among Nigerian college students, men use alcohol to boost their confidence and establish sexual relationships, stimulate sexual impulses, prolong erections,

increase sexual satisfaction, and become more aggressive during intercourse (Dumbili, 2016). Similar to men, the use of alcohol amongst women allows them to increase confidence in initiating sexual relationships, feel more aroused, and to increase sexual satisfaction (Dumbili, 2016). Qualitative research among students at the University of Botswana showed that alcohol use hindered control over sexuality (Seloilwe, 2005). Furthermore, those who drank excessively may be at an increased risk for engagement in RSBs such as unprotected sex (Seloilwe, 2005). The liberal sexual attitudes of university students promotes engagement in premarital sex, oral sex and abortion (Hoque, 2011). Moreover, first time entry students exploit the freedom offered by the university setting by freely engaging in sexual expression (Akintola, Ngubane and Makhaba, 2011). As a result, they engage in increased risky sexual behaviour and more sexual experimentation, which puts them at a higher risk of contracting STIs, HIV infection, and unintended pregnancy (Hoque, 2011b).

Higher Health, an organization that works on behalf of the Department of Higher Education and Training (DHET) with universities in SA, emanated from the Higher Education and Training HIV and AIDS programme (HEAIDS) in 2019. This organization focuses on the prevention and effective treatment of students living with HIV/TB (Higher Health, 2021), including the 'First things first' campaigns, which facilitate regular testing and screening for HIV, STIs and TB (HEAIDS, 2019). These university and Technical Vocational Education and Training (TVET) college campaigns are held regularly for three to five days every two months and are coordinated by the institution together with healthcare partners (Higher Health, 2021). In SA, all 26 universities and their campuses currently have campus clinics that provide primary health care services (Higher Health, 2021). Campus health clinics render health care services including Voluntary Counselling and Testing (VCT), TB and STI screening, family planning services, and referrals for high blood pressure and elevated blood sugar free of charge to registered students and staff (HEAIDS, 2018). Higher health also provides convenient and youth-friendly services, including a package of services that require development over time such as biomedical services, preexposure prophylaxis (PrEP), post exposure prophylaxis (PEP), and referral for male medical circumcision (MMC), sexual and reproductive services such as contraceptives, emergency contraceptives, antenatal care and STI treatment as well as ART initiation etc. (Higher Health, 2021). Campus clinics are enabled through public sector partnerships for the supply of consumables like medicines and contraceptives. Where institutions may not have clinics, partnerships are facilitated with the Department of Health (DoH) to establish clinics offering these services on campuses (Higher Health, 2021).

Regardless of the provision of various free prevention interventions available to students, engagement in high-risk sexual behaviours unfortunately continues. Furthermore, programmes focusing on abstinence, which were implemented to encourage younger students to avoid premarital sex and stop engaging in RSBs, regrettably showed no significant effect on their sexual behaviours (Hoque, 2011b). Primordial and primary prevention, together with early diagnosis, can help to prevent HIV infection, promote early initiation of ART, and prevent the further transmission of HIV. Understanding the underlying determinants of HIV incidence among the university student population is a crucial aspect to effectively addressing the epidemic (HEAIDS, 2010).

Therefore, this study sought to investigate the multidimensional facets of HIV risk among both HIV infected and uninfected students in KZN, SA with the aim of developing an HIV risk index. Study sites included higher educational institutions (HEIs) in KZN since the province is the epicentre for HIV infection. Students from public HEIs were included because many were eligible to access the NSFAS government student funding. The findings from this study have the potential to highlight unique risk factors that predispose university students to an increased risk of acquiring HIV. The findings may also be considered in the development of an evidence-based HIV risk index, which may be utilized to identify students who may be at an increased risk for HIV infection. The development of an HIV risk index may improve the strategies currently used in assessing students' risk levels and inform health care decisions regarding the use of PrEP, which may assist in controlling the HIV incidence amongst this vulnerable population. Furthermore, the students' knowledge on their individual HIV risk level may influence safer sexual behaviour.

1.2 Rationale of the study

Globally, sub-Saharan Africa bears the brunt of the HIV burden. South Africa is one of the countries with the highest HIV incidence and prevalence statistics globally. The high infection rates amongst the youth can be attributed to engagement in various risky sexual behaviours. Poor socioeconomic status, knowledge barriers, substance usage and peer pressure may predispose the youth to an increased risk of HIV. Limited employment opportunities among young people may further predispose them to RSBs e.g., transactional sex to fulfil their basic needs. University students form an important segment of this vulnerable population, since the university environment creates many opportunities to freely engage in RSBs like unprotected

sexual activities, alcohol, or drug usage, and attending parties or nightclubs. Most university students in KZN are funded by the NSFAS funding, which suggests that these students have come from financially disadvantaged backgrounds. There remains a paucity of data regarding how socio-economic factors such as food insecurity may influence student participation in RSBs.

Despite the implementation of several interventions and efforts made by the Higher Education sector and governmental and non-governmental organisations, including health education campaigns, the provision of condoms, MMC services and VCT, students continue to engage in risky activities and RSBs. Updated HIV prevalence statistics within the SA university student population are unavailable, as the HEAIDS 2008-2009 report remains the only published literature to date (HEAIDS, 2010). Thus far, substantial cross-sectional investigations have been done regarding the various determinants of RSBs (i.e., substance usage, peer pressure and lack of HIV knowledge in university students). However limited case-control evidence is available regarding the predictors of RSBs among HIV positive and negative university students in SA.

The risk associated with HIV is multidimensional and several factors including those that affect behaviour change must be considered when designing interventions for this specific target population. Therefore, this study was aimed at examining various aspects of HIV risks including socio-economic factors, risky activities and HIV knowledge levels which may be associated with RSBs and HIV acquisition amongst university students. Additionally, the design of a risk index, specifically for the university student population, is novel and may be used to quantify the levels of HIV risk. As far as we are aware, there is no tool that can measure HIV risk in this particular population. The risk index tool will enable the identification of at-risk students according to various levels of risk, enhancing prevention of HIV via early lifestyle counselling and the initiation of PrEP. The tool will also create student awareness regarding HIV infection risk levels, which may prompt individuals to exercise safer sexual behaviours and subsequently prevent HIV infection.

1.3 Study Aim and Objectives

Aim: The study aimed to analyse the behavioural and socio-economic components of risk associated with HIV and health among student populations in an attempt to design an evidence-based risk index.

The objectives were:

1. To evaluate the behavioural and socio-economic components of risk associated with HIV and health among student populations.
2. To assess the association between current level of HIV prevention knowledge and risky sexual behaviours and HIV among student populations.
3. To develop an HIV risk index tool for use in the university student population.

CHAPTER 2

LITERATURE REVIEW

This chapter reviews literature on the inherent problem of HIV infection and the associated risk factors among young people. Focus is given to the unique sexual risks encountered by students in the South African university context.

2.1 Introduction

HIV/AIDS poses a crucial challenge facing Africa in the twenty-first century (Abdool Karim, Abdool Karim and Baxter, 2010). Presently, Africa bears the burden of the HIV epidemic and Southern Africa has the greatest burden of disease on the continent (Abdool Karim, Abdool Karim and Baxter, 2010). According to the 2021 STATS SA report, there are approximately 8.2 million people living with HIV (PLWH) in the country (Statistics SA, 2021). Young people are a critical population for targeted preventive strategies. In 2012 it was found that the incidence rate was 2.8% among young women in the 15 to 24 years age group and the same group also represented 25% of all new infections in this age category (Statistics SA, 2015). Socio-behavioural and biological risks include age disparate sexual encounters between adolescent girls and men in their 30's, a restricted capacity to negotiate safer sex, genital inflammation and vaginal dysbiosis (Abdool Karim and Abdool Karim, 2018). These factors are challenging to mitigate, placing young women at an increased risk (Abdool Karim and Abdool Karim, 2018). University students form part of this high-risk population.

The university environment creates opportunities for students to engage in RSBs. Due to their propensity for sexual exploration, which includes having several partners and using condoms inconsistently, university students constitute a population at risk (Adefuye *et al*., 2009) Residing away from home, lack of parental supervision and being socioeconomically disadvantaged may increase the onset of RSBs and the engagement in transactional sex (Ngidi *et al.*, 2016; Maharaj and Cleland, 2011). Notwithstanding improvements in health care promotion and condom availability and usage, young South African adults remain the most vulnerable to the HIV epidemic (Johnson *et al.*, 2013). Modern HIV prevention methods like condoms and PrEP, according to Abdool Karim and Abdool Karim (2018), have had a limited impact on young women in SA, mostly because of limited access, low uptake, and poor

adherence. Numerous studies in sub-Saharan Africa highlight the risky behaviours that students engage in which increase their risk of acquiring HIV (Mthembu, Maharaj and Rademeyer, 2019; Hoffman *et al.*, 2017; Hoque, 2011a; Mutinta *et al.*, 2013; Mehra *et al.*, 2014). According to Statistics SA (2015), the major determinants for HIV infection in SA are multiple sexual partners, early sexual debut, poor perception of risk to HIV, and lack of correct information on HIV/AIDS.

The high incidence of pregnancy within the university setting suggests a poor student uptake of contraceptive practices (Mbatha, 2009). Additionally, sexually transmitted diseases (STDs) are common among this population group (Mbatha, 2009). Younger people are reported to be more likely to make decisions without sufficiently considering the future consequences, thus predisposing them to RSBs (Mthembu, Maharaj and Rademeyer, 2019). Hence, infections like HIV/ AIDS pose a major challenge as they predominantly cause mortality in young and middle-aged adults during their most productive years, thus negatively influencing the socioeconomic landscape of our country (Whiteside and Sunter, 2000). Although there are numerous efforts aimed at preventing HIV infection within universities, students are still engaging in RSB, which poses serious health consequences (Ngidi *et al.*, 2016). The most educated are typically the ones that initiate behavioural change, hence their practices and behaviours ought to be the vanguard of the change (Maharaj and Cleland, 2011).

2.1.1 Prevalence of HIV infection in Sub-Saharan Africa

Statistics SA has estimated that for the year 2021, 13.7% of the total population in SA was HIV positive (Statistics SA, 2021). Nearly one-fourth of women in SA between the ages of 15 and 49 are estimated to be HIV positive (Statistics SA, 2021). Despite comprising approximately 10% of the population, one in four new infections in sub-Saharan Africa in 2019 were found in young women and adolescent girls (UNAIDS, 2020). Moreover, within the 15-49 years adult population category, the estimated HIV prevalence was 19.5% (Statistics SA, 2021). The burden of HIV differs extensively by geography, age and gender and for key vulnerable populations (SANAC, 2017), with adolescent girls and young women still significantly impacted by the epidemic (SANAC, 2017).

It was estimated that one-fifth of women in SA in the age category of 15-49 years were infected with HIV (Stats SA, 2019). KwaZulu-Natal is the epicentre for HIV infection in SA, with the

highest provincial HIV prevalence of 27% (HSRC, 2018). South Africa's high HIV prevalence is a result of factors such as poor socioeconomic conditions, gender-based violence against women, cultural considerations, age disparate sex, unprotected sex, the desire for dry sex, recreational drug use, and biological factors like the elevated prevalence of STIs (Muula, 2008). HIV prevalence trends have declined from 6.7% in 2002 to 5,5% in 2018 among the 15 to 24 years population, and this has been attributed to several youth targeted intervention strategies (Statistics SA, 2018). These interventions will be discussed further in this chapter.

2.1.2 HIV prevalence and risk among students

The HEAIDS 2008-2009 study conducted amongst 17,062 students in HEIs across SA reported an HIV prevalence of 3.8% among the 65% of sexually active students (HEAIDS, 2010). However, these statistics are dated and according to our knowledge there are no recent studies reporting HIV prevalence among university students in SA. The university environment offers new-found freedom to students, and includes peer pressure and conformance to university culture such as engagement in RSBs, which may predispose an individual to HIV infection (Akintola, Ngubane and Makhaba, 2011). Mutinta *et al.* (2013) described universities as 'fertile grounds for risky behaviours' (Mutinta *et al.*, 2013). Moreover, qualitative findings from research at a University in KwaZulu-Natal among female students concluded that sustained demands from male partners influenced sexual debut (Akintola, Ngubane and Makhaba, 2011). The HEAIDS (2010) report highlighted that the most notable risk reported by students was casual unprotected sex in the context of alcohol intake (HEAIDS, 2010). The findings demonstrated that women had an HIV prevalence of 4.7% and that they had a 3-fold elevated likelihood of being HIV positive than men (1.5%). The lowest prevalence was found in the 18-19-year-old age group (0.7%), while prevalence increased in the 20-25-year old age group (2.3%) and was the highest in those students above 25 years of age (8.3%) (HEAIDS 2010). This trend highlights that younger students who engage in unprotected sex with older students are at a heightened risk of becoming infected with HIV (Rau, Coetzee and Vice, 2010).

The future success of a country depends greatly on students enrolled in tertiary education institutions (Molefe, 2017). These students are perceived as future leaders and form a fundamental portion of the future skilled workforce. It is imperative that they are equipped with information and skills to help them remain HIV negative (Molefe, 2017). It is important to

empower university students with the knowledge and abilities necessary to manage the dangers associated with sex (Akintola, Ngubane, and Makhaba, 2011).

2.2 Current interventions employed to mitigate HIV incidence in South Africa

2.2.1 Global HIV prevention coalition

The 2020 roadmap was a global plan set out in 2016 to reduce new infections by 75% to less than 500 000 by the year 2020 (UNAIDS, 2016). South Africa was one of the 25 coalition countries with a high HIV incidence amongst adolescents in 2016 and was included in this roadmap (UNAIDS, 2016). This plan focused on the ambitious 90-90-90 targets to achieve the following by 2020: 90% of all PLWH to know their HIV status, 90% of all people diagnosed with HIV to receive sustained ART, and 90% of all people receiving ART to have viral suppression (UNAIDS, 2016). As stated by UNAIDS (2016), emphasis was placed on HIV prevention as well as the promotion and distribution of practical tools to prevent HIV infections (UNAIDS, 2016). Halting HIV/AIDS as a hazard to public health by 2030 forms part of the ultimate intent of this plan, and this is also one of the targets for Sustainable Development Goal (SDG) 3.3, which aims at ending epidemics caused by communicable diseases by 2030 (UNAIDS, 2016; United Nations, 2021).

According to the 4th 2020 road map progress report, the incidence of HIV has decreased globally by 18% in 2010-2019 and by 25% in coalition focus countries (Global HIV Prevention Coalition, 2020). Globally, a 34% HIV infection decline was noted among women from the age group 15-24 years and a 11% decrease among men 15 years and older in 2010-2019, due to expanded HIV prevention and treatment access (Global HIV Prevention Coalition, 2020). The scaling up of implementation programmes for vulnerable groups and the expansion of access to VMMC (voluntary male medical circumcision) together with extensive ART scale-up have led to significant declines in the incidence of HIV (UNAIDS, 2020). Nevertheless, the rate of advancement in the fight against HIV transmission is still far too slow in spite of these initiatives (UNAIDS, 2020).

2.2.2 Non-Governmental Organisations in HIV prevention initiatives

Sexual behaviour is significantly influenced by structural factors including society's legal, political, and economic elements. The HIV prevention programmes "Soul City" and "Mothusimpilo" in SA focused on the social, economic, political, and personal factors that contributed to and sustained the HIV epidemic (Mathews, 2005). An NGO called Soul City Institute (SCI) was founded in 1992. In the year 2000, the Soul Buddyz television series was born, which was an initiative of the SCI and South African Broadcasting Corporation (SABC) education (Soul City Institute, 2018). The series was aimed at children 8-12 years old and one of the focus areas included HIV/AIDS, dealing with aspects of rape, human rights, stigma, prevention of mother-to-child transmission (PMTCT), MMC and adherence to treatment (Soul City Instituite, 2018). Thereafter, in 2003, the Soul Buddyz club (SBC) was developed and implemented. The SCI has also initiated various campaigns against concurrent and multiple sexual partners to decrease HIV infections (Soul City Institute, 2018). The Mothusimpilo Outreach Programme is based in Gauteng SA, and provides education on sexually transmitted infections (STIs) as well as HIV counselling (Info4africa, 2014). This organisation raises awareness on HIV/AIDS, distributes condoms, and provides life skills and HIV training for the youth. HIV support groups are also run twice a week (Info4africa, 2014).

2.2.3 Department of Education in South Africa

The Department of Education has introduced life skills education in schools to address the need to teach learners about HIV/AIDS. Life skills are skills required to facilitate communication and decision-making, as well as skills necessary for coping with stress. These skills can be applied whenever a person is faced with a challenging situation. In order for students to comprehend the disease's many facets and refrain from high-risk behaviours, HIV/AIDS education has been regarded as essential in schools (Moroney, 2002). The National Policy on HIV, STIs and TB was developed in 2017 by the Department of Basic education (DBE) (SA Department of Basic Education, 2019). This policy was targeted at students and staff at all primary and secondary schools within the basic education sector. In order to protect learners from HIV/STI infection and unwanted pregnancy, the DBE is required to offer curriculum-based education on sexuality and access to sexual reproductive health services (SA Department of Basic instruction, 2019).

2.2.4 Department of Higher Education and Training in South Africa

The Higher Education and Training Health and Wellness Development Centre, also known as Higher Health, is an organisation that works with universities in SA on behalf of the department of higher education and training (DHET). Higher Health originated from the Higher Education and Training HIV and AIDS programme in 2019 (HEAIDS) (Higher Health, 2021). The HEAIDS programme was created in the early 2000s in order to lessen the effects of HIV and TB on higher education (Higher Health, 2021). The 'First things first' campaigns, an initiative of Higher Health, are held on all university and TVET college campuses during the year (Higher Health, 2021). These campaigns focus on HIV counselling and education which encourages students to be responsible and get tested for HIV, while also promoting sexual health (Durban University of Technology, 2018; Molefe, 2017). 'First things first' campaigns take place every two months and are coordinated by the institution together with health care partners (Higher Health, 2021). This initiative has been successful in promoting HIV testing. In 2016 more than 160 000 students from 429 higher education institutions across SA were tested (Molefe, 2017).

Higher Health has expanded on-campus health facilities to strengthen screening activities, follow-up treatment, and enabling access to ARVs and PrEP as well as counselling and referral services (Higher Health, 2021). However, not all campus health clinics are approved for ART distribution. In the event that the campus clinic is not an ART distributor, students are referred to the nearest DOH facility for initiation of ART treatment. Peer educators facilitate face-to-face peer-to-peer education, and this is conducted through individual discussions, dialogue sessions and workshops (Higher Health, 2021). Students are encouraged to take responsibility for their health, break the silence on sexuality, and learn more about the health and social services available etc. (Higher Health, 2021).

Notwithstanding the above efforts, research conducted in four residences at a university in Durban among 335 students reported varying levels of awareness on HIV prevention methods that were available to them on campus (Ndabarora and Mchunu, 2014). These included awareness of VCT (58%), of freely available condoms (26%), of the wellness programme (7.8%), peer education programme (3.9%) and awareness of ART (1.2%) (Ndabarora and Mchunu, 2014). Moreover, there were varying usage levels of prevention methods available 'on campus', viz 43.9 % of students utilised free condoms. The wellness programme, peer

education programme and ART were among the least utilised methods (Ndabarora and Mchunu, 2014).

2.2.5 Public Sector Condom Distribution in South Africa

Condoms are a critical component in the prevention of pregnancy and STIs in SA (Baker *et al.*, 2018; Myer, 2008, p.166). If utilized correctly and consistently, condoms are an effective method of HIV prevention (Whiteside and Sunter, 2000, p.19; Myer, 2008, p.166). The three key sources for male and female condom provision in SA are via the public sector, social marketing programmes operated by NGOs, and commercial distributers (Myer 2008, p.166-170). The National Department of Health (NDOH) procures government issued condoms and freely supplies them at public sector facilities such as clinics, hospitals, community health centres and government departments for distribution to the public (Myer, 2008, p.170). Furthermore, private individuals and organisations are permitted to purchase and supply public sector condoms free of charge to employees. As part of expanded HIV prevention efforts condom distribution has drastically increased since 1994 (Myer, 2008, p.170).

A survey conducted on students at the University of Witwatersrand, SA indicated that many preferred store-bought condoms as opposed to public sector-issued condoms (Madzena, 2014). Store-bought condoms were considered to enhance satisfaction during sex based on the texture variations such as studded, ribbed, or ultra-thin (Madzena, 2014). Similar thoughts were reported among university students in Kenya, indicating that condoms from dispensers were less acceptable than store-purchased condoms (Adam and Mutungi, 2007). Of note, one female student in particular reported that women ranked males lower if they used condoms from a dispenser (Adam and Mutungi, 2007). In 2016, the existing condoms were rebranded by the SA government to improve their appeal to the youth and encourage safer sex (Western Cape Government, 2016). Coloured and flavoured condoms are freely available as a means to increase condom usage and promote safe sex (Baker *et al.*, 2018). However, condom use has remained low despite attempts by the SA government to increase the appeal of and accessibility to condoms (Baker *et al*., 2018). The 2017 SA national HIV prevalence, incidence and behaviour and communication survey conducted amongst 11 943 individuals, found that only 38.9% reported condom use the last time they engaged in sex (Simbayi *et al*., 2019).

2.2.6 Medical Male Circumcision

Medical male circumcision (MMC) characterised by the complete removal of the foreskin, is identified as a noteworthy HIV prevention strategy (Chiringa, Ramathuba and Mashau, 2016; KZN DOH, 2016b). This was confirmed by the findings of three randomized controlled studies (RCTs) carried out in Kenya, South Africa and Uganda, which showed that MMC has a 60% protective impact against developing HIV (Chiringa, Ramathuba and Mashau, 2016; Gray *et al*., 2007; Auvert *et al*., 2005; Bailey *et al*., 2007). Interestingly, the HIV protective impact of MMC appears to be equivalent to that of a high efficiency vaccine (Auvert *et al*., 2005).
In a randomised controlled intervention trial, involving 3274 uncircumcised men from the 18-24 years age group in SA, MMC was made available to the intervention group as soon as they were recruited and to the non-intervention group at the end of follow-up (Auvert *et al*., 2005). When the trial was discontinued there were 20 HIV infections (incidence rate=0.85 per 100 person-years) in the intervention group and 49 (2.1 per 100 person-years) in the control group at the interim analysis, resulting in a risk ratio (RR) of 0.40 (95% CI 0.24%-0.68%; p = 0.001) (Auvert *et al*., 2005). This risk ratio corresponded to a protection rate of 60% (95% CI 32%-76%) (Auvert *et al*., 2005). This study concurred with findings from research in Uganda among 4966 uncircumcised men aged 15-49 years, which found that HIV incidence was lower in the intervention group than the non-intervention group (0.66 cases per 100 persons in the intervention group compared to 1.33 cases per 100 persons in the control group) (Gray *et al.*, 2007). Results showed that MMC efficiency was estimated at 55% (95% CI 16-72; $p = 0.006$) (Gray *et al*., 2007).

The advantages of MMC include a decrease in heterosexual HIV transmission, protection against other STIs, reduced risk for developing penile cancer for males and cervical cancer for female partners, some protection from urinary tract infections in males and relief from Phimosis and Paraphimosis (disorders of the foreskin) (Leadbeatter, 2012; WHO, 2010: 37). Furthermore, MMC has been proven to halve the risk of HIV transmission to HIV uninfected men (Leadbeatter, 2012). However, if there is engagement in sex prior to wound healing, this increases the risk of HIV from infected men to uninfected partners (Leadbeatter, 2012). Moreover, MMC has not been demonstrated to reduce the risk of contracting HIV via anal sex or to directly decrease the risk of women contracting HIV through vaginal sex (Leadbeatter, 2012).

The World Health Organization (WHO) has advocated for the inclusion of voluntary MMC (VMMC) as a further health sector intervention to lower the risk of HIV transmission among heterosexual men in countries with high HIV prevalence (WHO, 2010; Chiringa, Ramathuba, and Mashau, 2016). Fourteen priority countries in East and Southern Africa have included VMMC as a component of their National HIV Prevention Programmes since the WHO and Joint United Nations recommendation for VMMC in 2007 (World Health Organization, 2012).

Challenges of MMC in SA include low client uptake, post-op care during outreaches and campaigns, negative media coverage of VMMC, obtaining consent from working parents and guardians, and limited access (World Health Organization, 2012). Research in Zimbabwe among 234 15 to 29-year-old males found that knowledge deficits regarding MMC lead to low uptake (Chiringa, Ramathuba and Mashau, 2016). Furthermore, physiological, and psychological factors disclosed by participants included infection and delayed healing (39%), being ashamed and dehumanised (58%), stigmatised and discriminated (40.2%) as well as fear of erection during the treatment period (89.7%) (Chiringa, Ramathuba and Mashau, 2016).

Male medical circumcision has been acknowledged by the NDOH as a crucial method for HIV prevention among men in the country (KZN DOH, 2016b). The provision of MMC in the public health sector has given men in SA the chance to safeguard both themselves and their partners from HIV infection (KZN DOH, 2016b). Males aged 15-49 years who are HIV negative are the target population for MMC in SA. Males between the ages of 10-14 years can also be circumcised if they present voluntarily and meet the criteria for eligibility (KZN DOH, 2016b). University students form part of the high risk group, hence the programme was launched in HEIs within the country in 2013 (KZN Department of Health, 2013). Voluntary male medical circumcision is a collaboration between the NDOH and institutions of higher learning. The aim was to create awareness among students about the benefits of MMC in conjunction with other strategies aimed at preventing HIV (KZN Department of Health, 2013).

Research among 375 university students in Nigeria found that the practice of male circumcision (MC) was almost universal in Northern Nigeria (Iliyasu *et al*., 2012). The majority (98.1%) of participants were circumcised; 57% of circumcisions were performed by a HCW and for religious reasons (79.2%). Only 38% of respondents, however, were aware of MMC's protective role in the suppression of HIV transmission (Iliyasu *et al*., 2012). In contrast, research among 400 college students in SA found that 77.6% of participants had been

circumcised, and among the number of circumcised men, 78.2% had undergone MMC. Participants reported high awareness on the positive role of MMC in relation to the prevention of STI's (Mndzebele and Matonyane, 2019). Most participants (95.6%) reported a strong belief in MMC reducing the risk of STI's (Mndzebele and Matonyane, 2019).

2.2.7 Voluntary Counselling and Testing

In an effort to stop the spread of HIV infection and lessen its effects on individuals, families, and society as a whole, voluntary counselling and testing (VCT) is one of the various strategies used (Addis *et al*., 2013). It is inclusive of both voluntary pre- and post-test counselling together with voluntary HIV testing (USAID, 2002). As the starting point for HIV/AIDS prevention, care and support programmes, this intervention is crucial in preventing HIV infection (USAID, 2002). There are various HIV prevention strategies that can be linked to VCT i.e., PMTCT, STI prevention, screening and treatment, communication regarding behaviour change as well as access to family planning and condoms (USAID, 2002). Voluntary counselling and testing is perceived to be an effective risk reduction approach among sexually active tertiary level students (Addis *et al*., 2013). It is expected that VCT will reduce HIV transmission through reduction in risky sexual behaviours, improved medical care for STIs, as well as improved access to care and support services for HIV seropositive and seronegative persons (USAID, 2002).

Research at a university in Ethiopia reported that stigma and discrimination were among the barriers for uptake of VCT among students (Addis *et al*., 2013). This was consistent with focus group discussions (FGD) held at the University of Limpopo in SA where major barriers for VCT were 'fear of being stigmatised' and 'fear of knowing HIV status' (Meiberg, Bos and Onya, 2008). According to the HEAIDS report (2008), qualitative interviews found that the university culture at the UKZN was perceived as being unsupportive of HIV positive people. 'It becomes a problem for a student to come out of denialism, only to end up completely isolated,' the report said (HEAIDS, 2008: pp.47). Meiberg *et al*., (2008), reported that the main benefit of attending VCT was to be aware of one's HIV status (Meiberg, Bos and Onya, 2008).

An earlier investigation at a SA university among 195 1st year students demonstrated that most students (72%) were willing to know their status and positive peer influence was a motivation for those accessing VCT (Buldeo and Gilbert, 2015). In contrast, a study in Ghana indicated

that although 95% of students knew where to access an HIV test, only 45,5% had tested for HIV ($p < 0.001$) (Oppong Asante, 2013). Some students may choose not to access VCT services due to personal fears or a low risk perception for HIV owing to abstinence (Buldeo and Gilbert, 2015). Student gender was significantly related to the inclination for future HIV testing (Oppong Asante, 2013). Females were less likely to test for HIV in the future than males (Oppong Asante, 2013). In contrast, findings by Nkuna and Nyazema (2016) indicated that generally, more female students were among those who would attend HIV testing and counselling (HTC) in comparison to males (Nkuna and Nyazema, 2016).

Uptake of HIV testing and counselling (HTC) was found to be low at the university of Limpopo (Nkuna and Nyazema, 2016). The notion that one is weak or injured as a result of an illness, which results in a negative attitude about seeking or receiving treatment, was one of the identified causes for this, according to Nkuna and Nyazema (2016). However, Buldeo and Gilbert (2015) found that perceived susceptibility was a motivation for willingness to test for HIV (Buldeo and Gilbert, 2015). This highlighted that help-seeking behaviours are influenced by perceived susceptibility and perceived severity of HIV/AIDS (Buldeo and Gilbert, 2015).

HIV self-testing (HIVST), according to Nkuna and Nyazema (2016), is a technique in which a person administers an HIV rapid diagnostic test and evaluates the results in private (Nkuna and Nyazema, 2016). This emerging strategy is well recognized, possibly cost-effective, and empowering for those who might not otherwise test (Nkuna and Nyazema, 2016). Self-testing could improve opportunities for HIV testing in populations that fear stigma and judgement when accessing conventional HCT services (Grésenguet *et al*., 2017). This concurred with research at the University of Limpopo which found that HIVST could be more acceptable by users who were concerned with stigma or confidentiality of HCT (Nkuna and Nyazema, 2016).

Research among 3662 students from 13 TVETs in SA highlighted that HIVST acceptability was associated with being sexually active [OR: 1.73 (95% CI 1.08-2.75), $p = 0.02$], having ever been tested for HIV [OR: 1.74 (95% CI 1.26-2.38), $p = 0.001$], and having multiple sexual partners [OR: 0.61 (95% CI 0.42-0.88), $p = 0.01$) (Mokgatle and Madiba, 2017). An investigation on HIVST usage among 442 health care users in eThekwini reported the following as obstacles to HIVST: possible suicide if a person tests positive without being counselled (63.8%), sale of unreliable HIVST kits if not regulated by the government (67.2%), inability of a person to read instructions properly (62.5%) whilst (61.5%) indicated that people

could read results incorrectly (Gumede and Sibiya, 2018). Participants also emphasized the possibility of abuse following testing of children and employees against their will (Gumede and Sibiya, 2018).

2.2.8 Antiretroviral Therapy

HIV infection remains incurable; however, access to antiretroviral (ARV) therapy can prolong life significantly (Maartens *et al*., 2012: p.465). Treatment for HIV is crucial, and life-expectancy for HIV positive people on treatment has been extended by decades (Beyrer *et al*., 2013). Antiretroviral treatment works to reduce the viral load, which keeps the immune system functioning well and prevents illness (CDC, 2022b). Additionally, ARVs can help prevent HIV transmission to an HIV negative partner, by reducing the viral load to undetectable, also known as treatment for prevention (CDC, 2022b). Medical treatment has turned this predictably fatal disease into a chronic, manageable although not yet curable condition (Vella *et al.*, 2012). Over the past decade there have been considerable advances in ARV therapy (Vella *et al*., 2012). This has been characterized by the availability of new potent and relatively safer ARV drugs (Vella *et al.*, 2012).

South Africa has progressed greatly in the scaling up of prevention efforts and treatment programmes (Abdool Karim, Abdool Karim and Baxter, 2008). In 2016, the KZN DOH adopted the 'test and treat' policy (KZN DOH, 2016a). This policy has been aligned with the WHO guidelines which indicate that urgent initiation of treatment is required for people who are HIV positive regardless of their cluster of differentiation 4 (CD4) count (KZN DOH, 2016a). Previously CD4 count was an eligibility criterion for the commencement of ART (KZN DOH, 2016a). However, government has now removed CD4 count as an eligibility criterion for PLWH (KZN DOH, 2016a). This strategy was implemented in keeping with the National Development Plan Goal of increasing life expectancy to at least 70 years by 2030 (KZN DOH, 2016a) (National Planning Commission, 2012). By implementing the 'test and treat' policy, people who are diagnosed with HIV are able to live long healthy lives once they are on ARV treatment (KZN DOH, 2016a). Another milestone was the launch of South Africa's Central Chronic Medicines Dispensing and Distribution programme (CCMDD) for patients on ARVs and other chronic medications (Medical Brief, 2018). The programme allows patients to collect their chronic medication from private pharmacy outlets and other pick-up points such as community halls, churches and schools, without visiting public health facilities and standing

in long queues (Medical Brief, 2018). The main objective of this initiative was to increase the availability of ARVs and chronic drugs for patients in SA who were stable and dependent on the public health care system (Medical Brief, 2018).

Currently, there is limited research on accessibility to ARV treatment by university students in SA and their specific challenges. The dated HEAIDS (2010) study findings showed that there was a lack of access to ART on or near campus for staff and students (HEAIDS, 2010). Challenges for those who lacked medical aid involved travelling long distances and the long period of time spent waiting at public health care facilities on a monthly basis to collect treatment (HEAIDS, 2010). This also led to absenteeism from classes or work (HEAIDS, 2010). Recommendations of the HEAIDS study were that all HEIs should ensure that ART was available on or near a campus. In addition, a sector treatment access project was recommended to support HEIs achieve this goal (HEAIDS, 2010).

2.2.9 Pre-exposure Prophylaxis

Biomedical approaches to HIV prevention offer innovative prospects of slowing down the AIDS epidemic. One of these strategies is the pre-exposure prophylaxis (PrEP) (Ware *et al.*, 2012). Pre-exposure prophylaxis, as defined by the NDOH (2016), is 'the use of ARV drugs by HIV-negative people before potential exposure to prevent HIV infection' (NDoH, 2016). Presently, the usage of PrEP involves the daily oral intake of PrEP (tenofovir, emtricitabine, or tenofovir alone); however, this may incorporate other formulations over time (NDoH, 2016).

Earlier clinical studies reported the high potency of PrEP in the fight against HIV infection (University of Washington, 2011; Thigpen *et al*., 2012: 423). A clinical study among (1219) young heterosexual adults in Botswana found that tenofovir disoproxil fumarate and emtricitabine (TDF-FTC) prophylaxis taken orally once daily reduced the HIV infection rate by more than 60% when it was administered as part of a comprehensive package of HIV prevention services (Thigpen *et al*., 2012). This corresponded with a clinical trial involving 4785 HIV serodiscordant couples from Kenya and Uganda, which demonstrated that daily ingestion of tenofovir disoproxil fumarate (TDF) and TDF-emtricitabine reduced HIV by 62% and 73%, respectively (Karim and Karim, 2011; University of Washington, 2011).

Pre-exposure prophylaxis affords autonomy and empowerment for HIV prevention (Heffron *et al*., 2016). It functions as a covert tool that empowers women to manage their own health and guard against HIV infection. Since there is no single resolution to halting HIV infection, multiple prevention strategies are required to achieve epidemic control (International Partnership for Microbicides, 2020). In addition, PrEP is considered a significant pre-conception HIV prevention strategy. It offers a safety strategy for both women and men to protect themselves against the sexual transmission of HIV infection during pregnancy attempts (Heffron *et al*., 2016).

Pre-exposure prophylaxis is able to offer effective protection from HIV; however, it does not offer protection from pregnancy and STIs such as Hepatitis C, Syphilis and Gonorrhoea (CDC, 2022a). Calabrese *et al*. (2017), argue that PrEP may have dangerous consequences to public health. Pre-exposure prophylaxis could be misinterpreted as a substitute for safe sex practices which may lead to careless condom usage (Calabrese, Underhill and Mayer, 2017). This could lead to the potential of risk compensation. According to the risk compensation theory, people who receive a protective device may act riskier because they feel more protected, negating the safety the protective device was intended to provide (Thompson, Thompson, and Rivara, 2002).

Within the African continent, SA was the first country to implement oral PrEP outside of research and demonstration projects (NDoH, 2016). The NDOH started offering oral PrEP to selected sex worker sites in June 2016 (NDoH, 2016). During that time, the guidelines were detailed for the rollout amongst sex workers, and presently, additional target populations have been included in these guidelines (NDoH, 2016). These additional target populations include: MSM, serodiscordant couples, teenage girls and young women (NDoH, 2016). The National HIV/AIDS Strategic Plan for 2017-2022 (NSP) aims to hasten prevention measures to reduce HIV, TB and STIs (SANAC, 2017). Sub-objective 1.1.4 entails the provision of PrEP to identified risk populations (SANAC, 2017). Pre-exposure prophylaxis usage is an important new additional HIV prevention strategy to boost HIV prevention in vulnerable groups and has been deemed to substantially reduce HIV infection (NDoH, 2016; University of Washington, 2011).

Within the SA higher education context, PrEP was first rolled out at seven selected campus health clinics in 2017 (Mbatha, 2017; Lotriet, 2017). Facilities needed to meet readiness criteria

set by the DOH for rollout of PrEP; various factors were considered when determining whether a facility was eligible for rollout. These were inclusive of adequate staffing, qualification of nurses, dispensing licence and adequate storage (Mbatha, 2017). Another prerequisite for PrEP provision was that the campus clinic should already be dispensing ART to students living with HIV as well as offering primary health care services. The University of Zululand (UNIZULU) in KZN was among one of the sites selected for PrEP rollout (Mbatha, 2017). Research among 358 PHC users and 282 university students in SA found that only 12.3% of respondents reported a thorough understanding of PrEP and this was significantly higher among university students ($p < 0.001$) (Haffejee *et al.*, 2022). Moreover, participants with tertiary level education were four times more likely to identify PrEP as an HIV preventative measure [OR: 4.342 (95% CI 1.048-17.994), $p < 0.043$]. In general, participants demonstrated low knowledge levels regarding PrEP (Haffejee *et al.*, 2022). Since a thorough awareness of PrEP is required to make educated decisions, it is necessary to strengthen PrEP education efforts targeted at the student population (Haffejee *et al*., 2022).

2.2.10 Post-exposure Prophylaxis

Post-exposure prophylaxis (PEP) is defined as 'the preventative ARV medical treatment started immediately after exposure to HIV in order to prevent infection' (KZN DOH, 2001). The usage of PEP is recommended in emergency situations and must be initiated within 72 hours of possible exposure to HIV (CDC, 2018). These exposures could be due to sexual assault, sharing of needles or occupational exposure among health care workers (HCWs) (CDC, 2018). The CDC advises that individuals who regularly engage in unprotected sex with an HIV infected partner should not take PEP (CDC, 2018). When PEP is administered after a potential exposure to HIV, more drugs and higher doses are required to block infection than with PrEP (CDC, 2018). Therefore, the CDC only recommends the usage of PrEP should there be an ongoing risk of infection (CDC, 2018).

According to Maartens *et al*., (2012), HCWs are at an elevated risk for occupational exposure to blood-borne viruses such as HIV (Maartens *et al.*, 2012, p.543). Therefore the usage of PEP is essential in protecting HCWs from HIV infection due to occupational exposure (Aminde *et al*., 2015). In addition, medical students are at an increased risk of needle stick injuries due to their relative inexperience (Cervini and Bell, 2005). A study at a university in Cameroon among medical students (n=154) found that the majority of students considered themselves to be at

risk of HIV infection (96.1%), and 52.6% reported having had experience of occupational exposure to HIV (Aminde *et al.*, 2015). From the 81 exposed participants, only 33 (44.4%) underwent HIV testing and there was low uptake of PEP after occupational exposure (4.9%) (Aminde *et al*., 2015). Results from an investigation among 157 medical students at a Canadian university found that 55/157 of the respondents had experienced at least one needle stick injury. Furthermore, in more than half of the cases of needle stick injury, students carried on with their work instead of seeking medical attention (Cervini and Bell, 2005).

Emergency exposure to HIV could also be due to a non-occupational exposure such as sexual assault (CDC, 2018). Prior to administering PEP in a sexual assault case, a thorough evaluation of the nature of the injury should be made (Maartens *et al*., 2012, p.285). 'Exposure may vary from penetration with objects, to forced oral, vaginal and anal sex, as well as dermal exposure to ejaculate' (Maartens *et al*., 2012, p.285). Research among 772 SA university students indicated that there was a low awareness of PEP (24.1%) (Ajayi *et al.*, 2020). Moreover, PEP awareness was lower among respondents who had experienced sexual violence (19.8%) in comparison to those who had not experienced sexual violence in the last year (24.8%) (Ajayi *et al.*, 2020). These findings were corroborated by a study among 169 medical students at a University in SA, which demonstrated that knowledge on non-occupational PEP was poor (Ncube, Meintjes and Chola, 2014). Therefore, education programmes on PEP need to be strengthened to increase awareness (Ncube, Meintjes and Chola, 2014).

2.3 Risk factors for HIV in Higher Education Institutions

HIV/AIDS is one of the greatest health risks that SA university students are confronted with (Rau, Coetzee and Vice, 2010). According to qualitative findings from the HEAIDS (2008-2009) report, 73% of students in tertiary education facilities have already engaged in sexual intercourse before matriculation, while numerous students are likely to start having sex during the period spent at university (HEAIDS, 2010). Additionally, factors predisposing youth to HIV infection are their non or very minimal use of any protective measures, specifically condom usage (Shiferaw *et al*., 2014). The detection of HIV risk factors is fundamental in targeting efforts towards disease prevention (Carr, Unwin and Pless-Mulloli, 2007).

2.3.1 Risky Sexual Behaviours

Risky sexual behaviours (RSBs) can be defined as sexual behaviours leading to unintended pregnancies and STIs inclusive of HIV infection (Perera and Abeysena, 2018). Risky sexual behaviour is inclusive of engaging in sex with multiple partners and having unprotected sex or the failure to use other contraceptive methods (Perera and Abeysena, 2018; Abels and Blignaut, 2011; Pengpid, Peltzer and Skaal, 2013). Furthermore, numerous authors have included the following factors in their definition of RSB: sexual debut at an early age (before 18 years) (Abels and Blignaut, 2011), sexual activity under the influence of alcohol (Dumbili, 2016; Pengpid, Peltzer and Skaal, 2013; Perera and Abeysena, 2018), anal intercourse (Brink, 2017), sexual violence and/ transactional sex and paid sex (Abels and Blignaut, 2011; Clowes *et al*., 2009).

In the SA context, the HIV/AIDS epidemic is driven predominantly by RSBs that expose individuals to the threat of infection (Mathews, 2005, p.144). In tackling the epidemic, the most complex problem of all is attempting to change sexual behaviour (Mathews, 2005, p.144). According to Eaton, Flisher and Aar (2003), factors at three different levels within the individual, in the environment (interpersonal interactions, physical environment, and organizational environment), and in the distal context (cultural and structural determinants) have an impact on HIV risk behaviour (Eaton, Flisher and Aarø, 2003). Findings from an earlier qualitative study showed that campus relationships were regarded as transient as opposed to marriage relationships. This observation was deemed as having significant consequences for sexual decision making (Adam and Mutungi, 2007). Another qualitative study revealed that male sexuality was seen as a 'force of nature', assertive and domineering, hard to regulate, and frequently requiring more than one partner (Clowes *et al*., 2009). Women, in contrast, were typically perceived as being meek, submissive, monogamous, and nurturing, as well as being more interested in relationships than sex (Clowes *et al*., 2009).

2.3.2 Peer pressure

Peer pressure is defined as specific social influence on peers, which results in conformity to a certain way of acting or thinking (Lashbrook, 2000; Macleod and Jearey-Graham, 2016). Young people's sexual orientation and sexual behaviour are influenced by their peers (Eyiah-Bediako *et al*., 2021). An integral aspect of adolescence is belonging to a peer group and thus

young people may conform and engage in high-risk sexual practices as a way to fit into the group. There is immense peer pressure amongst adolescent females and males to be sexually active (Selikow *et al*., 2009). Failure to engage in sexual activity may result in rejection by peers (Selikow *et al*., 2009).

Peer pressure has been implicated in various risky adolescent behaviours, inclusive of unsafe sexual practices and substance abuse (Lashbrook, 2000; Macleod and Jearey-Graham, 2016; Prinstein and Dodge, 2008, p.3-4). Peer pressure may influence youth in SA to engage in sex, consequently heightening their risk of acquiring HIV (Selikow *et al*., 2009). Factors that promote adolescents' engagement in sexual activities include the need for acceptance, curiosity and peer pressure (Eyiah-Bediako *et al.*, 2021).

Research at a university in the Western Cape in SA highlighted that students consider campus to be a highly sexualised space and thus feel pressurised to engage in sexual interactions (Clowes *et al*., 2009). This was consistent with findings from Adam and Mutungi's (2007) study which also emphasised that sexual activity is high within the university setting (Adam and Mutungi, 2007). In addition, male participants indicated that they were often pressurized into earlier and frequent sexual encounters with multiple sexual partners, this was due to fear of not being accepted by peer groups (Ngidi *et al*. 2016: 100). An earlier qualitative study conducted among 44 youth from the Khutsong township in Johannesburg indicated that the sexual behaviour of several young men was influenced by their peers and that condom use was viewed negatively by their peers (MacPhail and Campbell, 2001). In a Kenyan university, being sexually active was highlighted as fashionable and the 'in thing' to do (Adam and Mutungi, 2007).

2.3.3 Substance usage (alcohol & drugs)

Hazardous and harmful alcohol consumption is increasing among teenagers and young adults. It is considered a significant health issue (Lategan, du Preez and Pentz, 2017). According to the WHO's Alcohol Use Disorders Identification Test (AUDIT) measurement tool, hazardous drinking is defined as 'a pattern of alcohol consumption that increases the risk of harmful consequences for the user or others' and harmful drinking was defined as 'alcohol consumption that results in consequences to physical and mental health' (Babor *et al.*, 2001). It is during

the late adolescent and early adulthood period when heavy drinking, alcohol related problems and associated risky behaviours are greatest (Schulenberg and Maggs, 2002).

University students form part of the category of young adults that engage in frequent and dangerous drinking behaviours in contrast to non-student peers (Lategan, du Preez and Pentz, 2017). Entering the university setting often creates fresh opportunities, freedom from family control, and peer pressure to participate in risky activities like alcohol and drug usage (Tesfaye, Derese and Hambisa, 2014). A study amongst students in a SA university, demonstrated that 68,5% of students (n=501) reported ongoing alcohol usage (Maphisa Maphisa and Young, 2018). Of this sample, 57% were female students, 60% lived at the university residence and 73,5% were undergraduate students (Maphisa and Young, 2018). In contrast, findings from a study at the University of Limpopo among 142 undergraduate students indicated a relatively low prevalence of alcohol usage (23%) (Tayob and Van Der Heever, 2014). This could have been attributed to the physical location of this particular campus, which was situated far away from places of entertainment (Tayob and Van Der Heever, 2014). Heavy episodic alcohol drinking (HED), which is a potentially dangerous drinking behaviour, is defined as 'five or more drinks at each sitting for males, and four or more drinks at each sitting for females' (Babor *et al*., 2001). Research undertaken in a rural university in SA among 837 undergraduate students revealed that 14% of students were involved in HED (Nkoana, Sodi and Darikwa, 2016).

Sexual intercourse under the influence of alcohol has many grave consequences (Dumbili, 2016). Global investigation has found substance usage to be a motivating factor for sexual practices among university students (Dumbili, 2016; Tesfaye, Derese and Hambisa, 2014; Blignaut, Jacobs and Vergnani, 2015; Amare, Yeneabat and Amare, 2019). Moreover, earlier research has reported substance use as a determinant of risky sexual practices (Choudhry *et al*., 2014; Sales *et al*., 2012; So, Wong and DeLeon, 2005; Perera and Abeysena, 2018). A meta-analysis consisting of 18 studies considering 10,218 participants in Ethiopia, demonstrated associations between alcohol usage among university students and RSBs [OR: 2.68 (95% CI 1.67- 4.33)] (Amare, Yeneabat and Amare, 2019).

Findings from a qualitative inquiry among Nigerian university students indicated that alcohol was often used as an aphrodisiac (Dumbili, 2016). Both male and female Nigerian students reported various benefits of the use of alcohol prior to initiation of sex (Dumbili, 2016). The

reasons reported for drinking by male students were as follows: greater sexual confidence, stimulation of impulses, prolonged erection, increased sexual satisfaction, and increased aggression during sexual activity (Dumbili, 2016). Female students indicated that alcohol usage boosted sexual arousal and sexual boldness, and increased sexual satisfaction (Dumbili, 2016). Qualitative research by Mthembu *et al*. (2019) among SA university students found that alcohol posed a barrier to the effective and consistent usage of condoms (Mthembu, Maharaj and Rademeyer, 2019). Moreover, students reported that they were more likely to participate in RSBs after consuming alcohol (Mthembu, Maharaj and Rademeyer, 2019).

According to Blignaut, Jacobs and Vergnani (2015), a 6-year cohort study of first-year university students revealed a significant association between sexual activity and drug, alcohol, and tobacco use (Blignaut, Jacobs and Vergnani, 2015). Furthermore, the probability of alcohol usage was 1.7 times higher among students from the sexually active group in contrast to the group that were not sexually active (Blignaut, Jacobs and Vergnani, 2015). There may be several reasons for the relationship between alcohol usage and RSB. Alcohol can act directly on the brain to reduce inhibitions and weaken risk perception, which may lead to engagement in RSB (Mabille, 2009). In a systematic review of literature on sexual risk behaviours among African American women, results suggested that the use of alcohol was associated with increased participation in risky sexual practices (Sales *et al.*, 2012). Furthermore, an investigation involving 1954 Ugandan university students indicated that consumption of alcohol was associated with having multiple sexual partners (Choudhry *et al*., 2014). The alcohol-sex relationship has severe implications for the health of populations due to the HIV/AIDS pandemic (WHO, 2005). For example, when young people consume alcohol before engaging in sex, risky sexual practices may occur (WHO, 2005). Hence, alcohol usage should consequently be accepted as a predictor of HIV transmission (WHO, 2005).

2.3.4 Sexual debut / Early coital debut

Early sexual debut defined as ‘15 years of age or younger’ has been revealed to be a predictor of multiple sexual partnerships (Blum and Mmari, 2004; Mathews *et al*., 2009; Onoya *et al*., 2014), increased risk of pregnancy complications as well as HIV infection and other STIs (Kembo, 2012; Yaya and Bishwajit, 2018). According to Mathews *et al*. (2009), intimate partner violence was also found to be a predictor of early debut of sex (Mathews *et al*., 2009).

A meta-analysis on sexual behaviour involving South African youth between 1990 and 2000 found that 50% of youth were sexually active by the age of 16 years. Furthermore, data reported that between 50–60% of sexually active youth had reported engaging in unprotected sex and between 1-5% of females and 10-25% of males recounted having multiple partners (> 4 partners) in a year (Eaton, Flisher and Aarø, 2003). Research among 2360 school students in Cape Town revealed that transition to first intercourse was significantly associated with intentions to have sexual intercourse, poor self-efficiency to negotiate delayed sex, and intimate relationship abuse (Mathews *et al*., 2009). Moreover, a demographic and health survey in Zimbabwe found significant association between young persons whose age at initial sexual debut was less than 14 years and an elevated risk of HIV infection which was 2.5 times higher in comparison to their peers whose age at first sexual encounter was 20-24 years ($p < 0.001$) (Kembo, 2012). The author attributed these results to the fact that individuals in the age category of 15 to 24 years who engaged in sexual debut at an earlier age were likely to have more sexual partners in their lifetime than those whose sexual debut began later, placing them at risk of acquiring HIV and other STIs (Kembo, 2012). Data from a more recent investigation among 348 first year students in a rural SA university found that an earlier age of sexual debut was positively associated with engaging in sex with multiple partners [OR: 3.5 (95% CI: 1.3-9.6)] (Osuafor and Okoli, 2021).

Several authors have found a link between early sexual debut and an elevated HIV infection risk, and this was attributed to a variety of high risk practices such as multiple partners, inconsistent condom usage, and drug and alcohol usage (Harrison *et al*., 2005; Shiferaw *et al*., 2014). According to a research by Yaya and Bishwajit (2018) involving Nigerian women, those who had their first sexual experience before the age of 18 years had an elevated likelihood of having two or more lifetime partners (Yaya and Bishwajit, 2018). Research among 314 young men in SA demonstrated that 13.1% of 15-24-year-old men experienced sexual debut prior to the age of 15 years (Harrison *et al*., 2005). Early sexual debut was found to be a predictor of reported risk behaviours at first sex. These risky behaviours included unprotected sex, a casual partner, and not feeling they 'had been ready and wanted to have sex' (Harrison *et al*., 2005). This was congruent with research conducted among university students in SA, which revealed that only 45.2% of them used a condom during their first sex encounter (Haffejee, Koorbanally and Corona, 2018).

First-year university students often take advantage of their newfound freedom from parental guidance to adopt the culture of sexual freedom at their universities (Akintola, Ngubane, and Makhaba, 2011). According to research done at the UKZN, many younger students are likely to participate in first sex while attending university (HEAIDS, 2008). Furthermore, despite the fact that many students reported to have grown up under 'restrictive' parental supervision, the norm of student intercourse means that, regardless of the home setting from which they originate, they typically engage in sexual interactions (HEAIDS, 2008). This was ascribed to freedom within the university setting (HEAIDS, 2008). Students reported that the university residence environment was particularly conducive to sexual opportunities (HEAIDS, 2008).

Risk factors associated with earlier sexual debut among 453 students from an Ethiopian college were being female, chewing Khat, exposure to pornographic materials and a poor knowledge of STDs (Yosef *et al.*, 2020). According to qualitative research conducted at a university in SA, students lacked the power to decide when and how their first sexual experiences would take place and were unprepared for their sexual debut (Akintola, Ngubane and Makhaba, 2011). Consequentially, this resulted in regret and physical and emotional suffering (Akintola, Ngubane and Makhaba, 2011). Furthermore, Akintola *et al*., (2011) noted that the main factors for sexual debut were the university culture of sexual permissiveness and peer pressure from friends and male partners who were sexually experienced (Akintola, Ngubane and Makhaba, 2011). The prevalence of early sexual debut may be linked to poor sexual and reproductive health outcomes among students (Yosef *et al.*, 2020).

2.3.5 Inconsistent contraceptive usage (barrier & non- barrier methods)

According to Myer (2008), condoms remain an effective means to prevent unwanted pregnancy and STI's inclusive of HIV (Myer, 2008, p.166). Presently, the male condom is the most widely accessible barrier method for HIV prevention during intercourse (Maartens *et al*., 2012, p.88). Additionally, using male condoms correctly and regularly can contribute to a reduction of HIV infection by 80-97% (Maartens *et al*., 2012, p.88). Moreover, the WHO has approved the female condom (FC) to be an effective method in preventing HIV and other STIs (Maartens *et al*., 2012, p.88). The National Female Condom Programme was introduced by the NDOH in June 1998. Following a pilot programme, FCs were introduced into a limited number of sites in all provinces. Ever since then the programme has extended and the total number of

designated FC distribution sites has increased from 19 to over 300 nationally (Beksinska, Smit and Matell, 2012).

The usage of male condoms is largely controlled by men, thus many women lack negotiation power for condom usage (Maartens *et al*., 2012, p.88; Mantell *et al*., 2015). Subsequently, FCs are advantageous since they afford a more extensive coverage of the external genitalia and can be utilized at the initiative of women without active participation by the male partner (French *et al*., 2003). The FC has been considered the only female-controlled device that affords women dual protection from STIs, including HIV, and from unwanted pregnancies (Guerra, Simbayi and Mthembu, 2016). Hence, access to FCs is central to protecting the sexual and reproductive health and rights of women and girls in SA (Guerra, Simbayi and Mthembu, 2016). At present, there are three varieties of FCs available in SA. The SA government has freely provided all three varieties of the FCs in public places. This promotes choice among the end-users based on comfort and design (Haffejee and Maharajh, 2019).

Within the higher education sector in SA condoms are readily available free of charge from campus health clinics situated at universities (Child, 2015). In addition, VCT and condom promotion campaigns are hosted during the 'First Things First' campaigns hosted by HEAIDS at all SA higher education institutions (HEAIDS, 2019). Female condoms are freely available from campus health services; however, they are only given out once the student or staff member has been given instructions on proper usage (HEAIDS, 2008). According to the HEAIDS (2008) report on UKZN students, it was established that there was a lack of awareness about and interest in utilization of FCs (HEAIDS, 2008). Furthermore, research by Mbelle *et al.* (2018) found that most participants considered FCs to be unappealing and not user friendly, which has led to low uptake (Mbelle *et al.*, 2018).

Research conducted among 441 university students from a SA university found that only 28.5% of students utilized condoms during recent sexual activity (Haffejee, Koorbanally and Corona, 2018). According to Haffejee, Koorbanally and Corona (2018), only 32% (n=127) of respondents felt very confident in using condoms. Additionally, only 33% (n=130) of respondents believed that they would unquestionably be able to negotiate the use of condoms (Haffejee, Koorbanally, and Corona, 2018). This concurred with a study among 1917 university students in Kenya, which revealed that consistent condom usage was low, and only 18% of males and 14% of females reported consistently using condoms during intercourse in

the previous month (Adam and Mutungi, 2007). A South African investigation among students from three Durban universities in SA demonstrated that the prevalence of condom usage was 77% among Africans of both sexes, 82% and 68% for Indian males and females, respectively and lower for whites (Maharaj and Cleland, 2011). Nonetheless, consistent condom usage among this sample was low (Maharaj and Cleland, 2011).

Research by Choudhry *et al*., (2014) among 1954 students in Uganda found that alcohol usage among male respondents was associated with inconsistent condom usage with a new partner [OR: 1.75 (95% CI 1.01-3.08)] (Choudhry *et al.*, 2014). This concurred with a study by Shiferaw *et al*., (2014), which demonstrated that substance usage was a key risk factor for inconsistent condom usage among university students (Shiferaw *et al*., 2014). Participants in a study by Duby *et al.,* (2016) stated that using a condom during penile anal intercourse (PAI) was mostly done for hygiene reasons to prevent faeces from contaminating the penis, rather than as a way to protect against STIs and HIV (Duby *et al*., 2016a). However, a qualitative investigation among 390 students in SA TVET colleges and public universities highlighted that most students displayed positive attitudes towards condom usage and were aware that condoms were a preventative measure against pregnancy, STIs and HIV (Mbelle *et al.*, 2018).

Research in three African countries found that condom usage was associated with casual sex and a lack of trust among partners (Duby *et al*., 2016a). Additionally, women reported experiencing challenges regarding negotiating condom use with 'stable partners', and this was irrespective of the type of sexual practice (Duby *et al*., 2016a). Research among young men (18-26 years) in Australia reported that men perceived that wearing condoms decreased penile sensation and that condoms were difficult to use during the 'heat of the moment' (Flood, 2003).

Participants in Flood's (2003) study conveyed stress regarding the risk of pregnancy rather than STIs and responded to the former risk by relying on partners' use of contraceptives (Flood, 2003). This was corroborated by Maharaj and Cleland's (2011) findings, which demonstrated that more students were worried about unwanted pregnancies than HIV transmission (Maharaj and Cleland, 2011). Pregnancy is seen as a threat that is more urgent than HIV infection and is unfavourable for progression from university to employment (Maharaj and Cleland, 2011). Young women can benefit from dual protection strategies to successfully avoid unwanted pregnancy and STIs (Akintade, Pengpid and Peltzer, 2011).

According to Patel and Kooverjee (2009), rates of abortion among women in SA continued to increase despite the availability of contraceptives (Patel and Kooverjee, 2009). Research among university students (n=3000: 57% women) identified that life-time experience of unplanned pregnancy was high among sexually active African women (24.5%), moderate in Indian women (12.5%) and low in white women (6%) (Maharaj and Cleland, 2011). Hoque and Ghuman's (2012) study on students at a university in KZN, SA demonstrated that 19.5% of female students (n= 582) reported being pregnant, 51.1% of these pregnancies were unplanned, and 22.2% had undergone induced abortions (Hoque and Ghuman, 2012). Emergency contraception (EC) can be defined as 'therapy used to prevent pregnancy after an unprotected or inadequately protected act of sexual intercourse' (ACOG, 2015). Hoque *et al*., (2012), found that 21.2% of the sample (n=582) utilized EC prior to the study (Hoque and Ghuman, 2012).

The utilization of non-barrier methods of contraception at the most recent sexual encounter was reported as being lowest in African women (26.5%), intermediate in Indian women (34%) and highest in White women (52%) (Maharaj and Cleland, 2011). In contrast, research at Mangosuthu University of Technology (MUT) found that 89% of students used contraceptives (Hoque, 2011a). However, almost half (41.5%) sometimes or rarely used contraceptives during sex (Hoque, 2011a). Another study at MUT found that 92% of male students (n=361), reported being in a relationship where contraceptives were being used (Hoque, 2011b). An investigation by Maharaj and Cleland (2011) found that almost half of the women utilizing non-barrier methods also used a condom as a double barrier method of protection (Maharaj and Cleland, 2011). Data from research at a university in Nigeria among a sample of 431 students showed that contraceptive awareness and usage was high and the male condom was the most common contraceptive used (52.4%) (Utoo *et al.*, 2020). This was consistent with a study conducted in Botswana among 346 students, where the male condom was the most commonly used method of contraception (95,6%) followed by the oral contraceptive pill (86,7%) (Hoque, Ntsipe, and Mokgatle-Nthabu, 2013). According to Utoo *et al*., research from 2020 individuals who were sexually active were more likely to use a method of contraception ($p \leq 0.001$). Furthermore, those that used contraceptives were less likely to have an STI ($p \leq 0.001$) (Utoo *et al.*, 2020).

2.3.6 Multiple Sexual Partnerships

Multiple sexual partnerships (MSP) are an important aspect to consider for the risk of STDs, including HIV (Heeren *et al.*, 2014). According to the HEAIDS, engaging in sex with overlapping sexual partners creates multiple pathways for HIV transmission. New infections result in high viral loads within the first 3 months of infection, hence HIV can be transmitted rapidly where such pathways exist (HEAIDS, 2010). Previous studies have demonstrated that individuals who reported engaging in MSP were at an elevated likelihood of being HIV seropositive (Onoya *et al*., 2014; Kembo, 2012).

According to South African research on MSP, factors that were predictive of MSP included race, a history of STI, being in relationships that lasted less than a year, and having suspicions about the present partner's infidelity (Onoya *et al*., 2014). This is consistent with findings from Maharaj and Cleland's (2011) study of university students, in which they found that only 8% of African men reported having only one lifelong partner, compared to 25% of Indian and White men (Maharaj and Cleland, 2011). According to Onoya and colleagues' (2014) study, findings concluded that motives for MSP among men were greater community and social acceptance (Onoya *et al*., 2014). Male participants engagement with MSPs was considered to prevent boredom and allow for sexual variety (Onoya *et al*., 2014). Additionally, MSPs were considered to help conserve steady relationships by 'treasuring' steady partners at home and in turn safeguarding marriages or long-term relationships (Onoya *et al*., 2014). Factors that determined MSP engagement among women were inclusive of economic vulnerability, younger age at sexual debut, and living in formal urban rather than formal rural areas (Onoya *et al*., 2014). According to research conducted in 2011 by Maharaj and Cleland, female students were shown to be more likely than male students to report fidelity (Maharaj and Cleland, 2011).

A study among 201 university students in Eastern Cape SA demonstrated that 46.3% reported engaging in intercourse in the last 3 months. Furthermore, of those, 55.9% reported intercourse with more than one partner (Heeren *et al.*, 2014). Results showed that respondents who had multiple partners also reported having unprotected sex more frequently and using condoms less frequently than those who reported having a single partner (Heeren *et al.*, 2014). According to the HEAIDS (2010) study, African students were more likely than students of other races to have had multiple sex partners in the previous month, both for males [OR: 5.0 (95% CI 3.3-7.6] and females [OR: 2.3 (95% CI 1.6-3.3), $p = 0.001$] (HEAIDS, 2010). Furthermore, 19%

of male students and 6% of female students reported having more than one partner in the past month (HEAIDS, 2010). Results from a study by Onoya and colleagues (2014) showed that participants reporting MSP had an elevated likelihood of being HIV positive (Onoya *et al*., 2014). The likelihood of HIV infection was higher among males in the age category 25-49 years who reported MSP in comparison to those who had one partner in the last 12 months [OR: 2.2 (95% CI 1.2-4.1), $p = 0.011$] (Onoya *et al.*, 2014).

In a cross-sectional survey of university students from nine ASEAN nations, it was shown that men were more likely than women to have had two or more sexual partners in the previous year (Yi *et al*., 2018). Furthermore, participants who reported sex with two or more partners in the last 12 months were significantly more likely to be aged between 20-30 years old, current tobacco smokers and binge drinkers in comparison to those that had fewer than two sex partners (Yi *et al.*, 2018). This concurred with a SA study among female students, where multiple sexual partners was a predictor for substance usage among students, alcohol [OR: 6.9 (95% CI 1.6-30.6), $p = 0.004$] and drugs [OR: 3.5 (95% CI 1.002-12.045), $p = 0.038$] (Hoque, 2011a). Furthermore, another concern is the usage of substances prior to sex, since this may reduce an individual's cognitive ability to consider protection during sex and may lead to participation in RSBs (Hoque, 2011a). Osuafor and Okoli's (2021) research with university students in SA showed that being male [OR: 7.4 (95% CI 2.9-18.7)] and at a younger age at sexual debut [OR: 3.5 (95% CI 1.3-9.6)] was positively associated with having multiple sex partners (Osuafor and Okoli, 2021).

2.3.7 Penile Anal Intercourse

Unprotected anal sex (UAI) has been identified as a practice with a significant risk of transmitting HIV (Baggaley, White, and Boily, 2010; Abdool Karim and Ramjee, 1998). According to McGowan (2008), the rectal compartment is highly susceptible to HIV transmission. The female receptive partner in PAI is at greater risk than she would be in penile vaginal intercourse (PVI) due to the physiological and histological characteristics of the rectum (Duby *et al*., 2016a). This is explained by the higher density of receptor immune cells in the rectal mucosa together with thinner epithelium than the vagina (Duby *et al*., 2016a; McGowan, 2008). Receptive PAI with an HIV positive male partner is the sexual behaviour with the highest per act risk of HIV transmission in both men and women (Duby *et al*., 2016a;

McGowan, 2008). This behaviour is predicted to be 10 to 20 times more dangerous than receptive PVI (Duby *et al*., 2016a; McGowan, 2008).

According to Karim (2008), on average women are seven times more likely to acquire HIV. This ratio increases in PAI where the gender ratio exceeds 20:1 (Karim, 2008). Anal intercourse plays a significant role in heterosexual intercourse, namely PAI, and is important to consider in HIV prevention strategies (Baggaley, White and Boily, 2010). Karim (2008) has noted that this type of intercourse is increasing in several settings both to avoid pregnancy and due to the misguided belief that this may be safer (Karim, 2008). This concurred with views of participants in a study by Duby *et al*., (2016) where it was reported that PAI was perceived as safer than other types of intercourse and this belief reduced the incentive for condom usage during PAI (Duby *et al*., 2016a).

South African research among female sex workers found that anal sex was associated with an increased risk of HIV infection [OR: 2.3 (95% CI 1.1-4.7)] (Abdool Karim and Ramjee, 1998). The investigation also revealed that of the 145 sex workers, 62 (42.8%) engaged in anal sex with their clients. In these women, the HIV prevalence was 61.3% in contrast with 42.7% in women who did not engage in AI ($p > 0.01$) (Abdool Karim and Ramjee, 1998). According to a HEAIDS (2010) research, 1 in 13 male and female university students engaged in heterosexual anal intercourse in the previous year (HEAIDS, 2010). Furthermore, within this group HIV prevalence was higher in males (3,0% vs 1,9%) than among females (8,4 vs 4,4%); however, the difference was only statistically significant for females ($p = 0{,}002$) (HEAIDS, 2010). Qualitative research among 88 women from SA, Uganda and Zimbabwe showed that reasons for engagement in heterosexual PAI included male satisfaction, ensuring relationship security, beliefs that it was a safer type of sex, hiding infidelity, pleasurable physical sensation of PAI, and money (Duby *et al.*, 2016b).

Stealthing is a recent sexual trend which is on the rise globally and raising concerns in SA (Ebrahim, 2019; Northglen News, 2017). Stealthing can be defined as 'the practice of a man non consensually and covertly removing a condom after his partner explicitly expressed that intercourse is subject only to use of a condom'(Ebrahim, 2019). This practice can occur during both heterosexual and homosexual encounters (Ebrahim, 2019). As reported by a newspaper article (Northglen News, 2017), FGDs conducted by the AIDS Healthcare Foundation with women reported that 'men would grow one fingernail and use it to slit the end of the condom

just before penetration, then rolling the condom back and tricking the partner into unprotected sex' (Northglen News, 2017). Marks (2017) indicated that those who engaged in stealthing purposely intend to deceive sexual partners into penetrative sex without a condom. According to Brodsky (2017), men who stealth display the belief that it is a man's natural right to 'spread his seed' even when reproduction is not an option (Brodsky, 2017; Marks, 2017).

A research study in Australia (n=2252) indicated that 32% of women and 19% of MSM attending a sexual health clinic had experienced stealthing, where they would have not willingly engaged in sex without a condom (Latimer *et al*., 2018). Additionally, more than 50 percent of the participants reported that they experienced emotional stress as a result of the incident (Latimer *et al*., 2018). There are both health and ethical concerns regarding this practice, as sexual partners are at risk of unwanted pregnancies and STI's (Marks, 2017; Brodsky, 2017). According to Brodsky (2017), stealthing can be understood to convert consensual sex into non-consensual sex (Brodsky, 2017). Moreover, many men who engage in heterosexual intercourse assume that their partners make use of contraceptive measures, and hence assume that the risk of pregnancy is improbable (Marks, 2017; Flood, 2003); however, the risk of HIV infection remains an issue.

2.3.8 Men who have sex with men

Men who have sex with men (MSM) are at a particularly high risk of contracting HIV (Baral *et al*., 2009). Clinically, the term MSM is often used to refer to sexual behaviour alone, and this is regardless of sexual orientation. For instance, a man may identify as heterosexual but be classified as MSM (CDC, 2021). Previous studies have alluded that MSM are exceptionally susceptible to HIV infection due to engagement in RSB (Baral *et al*., 2009; Brink, 2017). The sexual network, behaviour, or biological factors of men who have sex with men may be at an increased risk for HIV and other STIs. Behavioural factors include number of concurrent partners, unprotected sex, anal sex or substance usage (CDC, 2021). Findings from research in SA HEIs found that student MSM engaged in sexual behaviours which increased their risk of acquiring HIV and other STIs (Brink, 2017).

After starting tertiary level education, MSM are exposed to more freedom and increased socialisation (Zou *et al.*, 2018). According to Zou *et al* (2018), many students will have sex more frequently than before they started attending university. Furthermore, some MSM may

engage in unprotected sex more frequently. Brink *et al.* (2017) found that student MSM in 14 SA HEIs (MSM: n=896) and (non-MSM: n=7973) reported higher levels of substance usage than non-MSM students (Brink, 2017). Moreover, results showed that student MSM engaged in sexual behaviours which increased their risk of HIV and STI infection. These behaviours included unprotected penetrative anal sex (32.4%), unprotected penetrative vaginal sex (37.9%), transactional sex (5.6%) and early sexual debut (24.4%) (Brink, 2017). These findings are corroborated by a study in China among 1824 university students, which showed that MSM students were at an increased likelihood of engaging in RSB. Men who have sex with men had significantly more lifetime partners than non-MSM students (55.9% vs 33.3%) [OR: 5.32 (95% CI 2.81-10.06), $p = 0.000$] (Cong *et al.*, 2008). In addition, MSM students were more likely to have multiple partners in comparison to non-MSM students (36.7% vs 20.6%) [OR: 2.80 (95% CI 1.50-5.22), $p = 0.001$] and less likely to use condoms (Cong *et al.*, 2008).

Brink (2017) reported that 14.2% of student MSM had STIs other than HIV. Moreover,19.8% indicated having genital sores, and discharge from the genitals and/or anus was experienced by 9% and 26.5% who indicated a past experience of a burning sensation while urinating (Brink, 2017). According to Maartens *et al.* (2012), there is a strong correlation between the spread of STIs and HIV transmission (Maartens *et al*., 2012: p.89). Both ulcerated and non-ulcerated STIs increase the risk of HIV transmission through sexual contact (Maartens *et al*., 2012: p.89). Earlier research among MSM in SA found that men who reported a high frequency of past unprotected anal sex were more likely to believe that that it was not necessary to utilize condoms with a trusted or steady partner notwithstanding their current partnership status (Knox *et al*., 2010). Moreover, a multi-country study among 537 MSM found that increasing age, being employed, not always wearing condoms when having sex with men, having been diagnosed with an STI, and having had transactional sex were significantly associated with HIV ($p < 0.05$) (Baral *et al*., 2009). Furthermore, previous studies have shown that MSM with older partners were at an increased risk of HIV infection (Chamberlain *et al*., 2017; Beyrer *et al*., 2013).

Klein (2014) discusses an exceptionally risky practice called ‘gift giving’ within the US context. In this practice an HIV infected person intentionally transmits HIV to an uninfected person, generally with that person’s knowledge and consent (Klein, 2014). In Klein’s (2014) paper two categories of gift-giving practices are discussed namely, ‘Generationing’ and ‘Stealthing’. ‘Generationing’, in the homosexual context, involves the successful HIV infection

of a previously uninfected man, and henceforth the two men join forces to infect other men and so forth (Klein, 2014). 'Stealthing', in the homosexual context, is where a man actively tries to infect an HIV negative man with HIV, without the latter's knowledge or consent (Klein, 2014). Although discussed in international literature, there is a paucity of scientific literature available on 'Stealthing' and 'Generationing' in SA.

2.3.9 Transactional sex and Intergenerational relationships

Transactional sex, which is at the root of young women's heightened susceptibility, is a key element influencing behavioural risks for HIV in Africa (Leclerc-Madlala, 2013). Older males engaging in sex with younger females have been identified to increase unsafe sex practices, which are exacerbated by differences in power and wealth between the partners (Amo-Adjei, Kumi-Kyereme and Tuoyire, 2014). A qualitative exploration in Ghana among 40 female students reported that they were in short-term relationships primarily for material gain, to satisfy 'wants' and not 'survival needs'. Respondents categorised clothing, hairstyles, fast food meals, and gadgets as 'wants'. Additionally, respondents considered receiving gifts as a sign of affection and at times, as a substitute for parental love (Amo-Adjei, Kumi-Kyereme and Tuoyire, 2014).

In a study in Zimbabwe, the author argues that young women pursue transactional relationships for reasons unrelated to survival (Masvawure, 2010). Findings highlighted that lower- and middle-class female students had used sex to attain a coveted lifestyle, while those students from the middle-class used it to maintain an already privileged position (Masvawure, 2010). Several authors have argued that women are engaging in transactional sex for reasons other than subsistence, which included the pursuit of luxurious and modern lifestyles (Leclerc-Madlala, 2003; Amo-Adjei *et al.* 2014; Masvawure, 2010). According to Eller, these relationships are not constrained to the most financially vulnerable women; wealthy students also sought out relationships with older men to maintain the standard of living that they had grown accustomed to at their parents' homes (Eller, 2016). In Masvawure's (2010) research, findings demonstrated that female students employed transactional relationships as a strategy to compete for elevated social standing within their peer groups (Masvawure, 2010). In addition, transactional relationships aided female students to fashion themselves as high-status successful modern women (Masvawure, 2010). South African research at 14 HEI's (n=760)

found that 5.6% of student MSM accepted material benefits for sex (Brink, 2017). Moreover, 10.1% reported having been offered some benefit in exchange for sex (Brink, 2017).

Fielding-Miller and colleagues' (2016) research in Swaziland indicated that transactional relationships were motivated by the need to supplement tuition, support a child, or afford a fashionable lifestyle (Fielding-Miller *et al*., 2016). Qualitative results from research in Kenya highlighted that coercion in the form of gift-giving was a prominent theme in FGDs (Adam and Mutungi, 2007). Students in this study conveyed anxieties regarding relationships between female students and male lecturers, with the exchange of sex for grades (Adam and Mutungi, 2007). A study in Benin corresponded with this notion, as students reported entering into relationships with professors in expectation of good grades, meals in restaurants and monetary gifts (Eller, 2016). South African findings at UKZN were similar, where participants reported many examples of staff-student relationships. Various reasons were offered for these relationships which included favours such as improved marks, employment opportunities, student accommodation, material gain, alcohol or acquiring support for a leadership position (HEAIDS, 2008).

Research in Malawi involving 844 adolescents and women found that food insecurity, residing in households without electricity or running water, and having limited assets were associated with transactional sex (Gichane *et al.*, 2020). As indicated by McCrann *et al*., (2006), poverty increases the susceptibility of young individuals to older individuals with predatory sexual intentions contributing to payment or financial support in some way (McCrann *et al*., 2006). A research inquiry at the University of the Western Cape concurred with McCrann *et al,* (2006) that first year female students originating from socioeconomically disadvantaged and rural settings were highlighted as susceptible to transactional and imbalanced relationships associated with coercive and at times even violent sexual behaviours (Clowes *et al*., 2009). Findings from research in Nigeria (2019) showed that the odds of transactional sex were 56% lower among students who received adequate family support in comparison to those who received no or insufficient family support (Ajayi and Somefun, 2019). Additionally, a positive association was found between polygamous family structure and transactional sex (Ajayi and Somefun, 2019). Authors Ajayi and Somefun (2019), attributed this to polygamous families being larger than the conventional family set-up, suggesting constraints on resources available to children from these homes (Ajayi and Somefun, 2019).

Delayed financial independence compels some young women to pursue relationships with older men as peers of their own age group often lack capacity to provide for their needs (Eller, 2016). There is an anticipation among young women to benefit materially from romantic relationships, regarding this as a representation of their partners' investment and capability (Eller, 2016). Numerous transactional relationships exhibit imbalanced power dynamics, stemming from variations in wealth, age, and social standing, which intertwine with gender in intricate and multifaceted manners (Shefer, Clowes and Vergnani, 2012). Transactional sex has led to many women accepting unsafe sexual practices and placing themselves at substantial risk of acquiring HIV infection (Leclerc-Madlala, 2003). Increased HIV risk has been associated with age-disparate relationships (Maughan-Brown, Evans and George, 2016). Maughan-Brown *et al*., (2016) reported that this heightened risk could be attributed to concurrency in relationships, which increased a young woman's risk of HIV even when her partner was HIV negative at the start of the relationship (Maughan-Brown, Evans and George, 2016).

According to Onoya *et al*., (2014), age-disparate or intergenerational relationships may not only be restricted to older males and younger females (Onoya *et al*., 2014). Qualitative findings demonstrated that relationships existed between older women referred to as 'sugar mommies' and younger males (Onoya *et al*., 2014). Younger boys reported to be motivated by material gain and access to resources (Onoya *et al*., 2014). Poverty increases the susceptibility of young people to older sexual predators contributing to payment or financial support in some way (McCrann *et al*., 2006). Research in SA among 15,717 participants found that young women aged (15-25 years) were less likely to have same-age sexual partners. Those with age disparate partners (> 5 years older) were less likely to use condoms and more likely to be HIV positive and married (Mabaso *et al.*, 2021).

A Nigerian study identified having strong family support and structure as factors that provide protection against transactional sex (Ajayi and Somefun, 2019). In addition, the likelihood of participating in transactional sex was found to be lower for individuals who resided in the same household as their mothers (Ajayi and Somefun, 2019). Authors Ajayi and Somefun (2019) relayed that mothers are the primary source of support within the household. Furthermore, adolescents and young adults who are not living with their parents due to circumstances like death or divorce might experience a lack of maternal affection and care in comparison to those who are residing with their parents (Ajayi and Somefun, 2019).

2.3.10 Insufficient HIV knowledge

Knowledge on HIV/AIDS is critical for changing RSB. Furthermore, health education on HIV/AIDS is a key strategy in the fight against infection (Murwira *et al.*, 2021). A qualitative exploration among university students in Durban reported that participants were aware of behaviours that increased their susceptibility to pregnancy and HIV infection. Nonetheless, they were not against RSB due to their desire to be acknowledged within their social groups (Mthembu, Maharaj and Rademeyer, 2019). A study at a rural university in SA found that only 42% of students had adequate knowledge on HIV (Murwira *et al.*, 2021). Moreover, participants displayed misconceptions regarding HIV transmission routes and prevention aspects (Murwira *et al.*, 2021). In contrast, research by Oppong Asante (2013) found that knowledge of HIV transmission, prevention and treatment among 324 university students in Ghana was high (Oppong Asante, 2013). The author suggests that this was owing to sustained and improved health education programmes among students (Oppong Asante, 2013).

Participants in the study by Ngidi *et al*. (2016) agreed that it was easier to seek advice on sexual behaviour from peers rather than parents (Ngidi *et al*., 2016). However, Selikow *et al*., (2009) argued that adolescents may feel misinformed by their peers and have more confidence in the accuracy of information provided by adults on HIV/AIDS (Selikow *et al*., 2009). Conversely, adolescents may feel more at ease discussing sexual matters with each other instead of adults (Selikow *et al*., 2009). This concurred with previous studies where very few students received information from parents regarding AIDS (Asante and Oti-Boadi, 2013; Oppong Asante, 2013). Ngidi *et al*., (2016) reported that culture and religion were emphasized as barriers to communication with older health practitioners on sex and sexuality (Ngidi *et al*., 2016).

Previous studies have reported inconsistent levels of knowledge on AIDS among university students (Li *et al*., 2004; Asante and Oti-Boadi, 2013). However, research in Ghana showed that a majority (94.4%) of students in the sample were knowledgeable on various ways of preventing HIV infection (Asante and Oti-Boadi, 2013). A study in three African countries found that participants had poor knowledge of anal STIs and HIV transmission via anal sex (Duby *et al*., 2016a). Adam and Mutungi's (2007) research found that students often did not have access to accurate information on HIV/AIDS (Adam and Mutungi, 2007).

2.3.11 Risk Perception

Risk perception has been identified as a critical factor explaining inconsistent or non-usage of HIV prevention interventions (Warren *et al*., 2018). Health decisions take into consideration the likelihood of possible outcomes, as well as their short and long term effects (Warren *et al*., 2018). Buldeo and Gilbert (2015), highlighted that the inclination to help-seeking behaviours is influenced by how individuals perceive susceptibility and their perceived severity of HIV/AIDS (Buldeo and Gilbert, 2015). Moreover, short-term concerns may be felt more immediately and their likelihood may be easier to judge (Warren *et al.*, 2018). Long-term consequences may encompass more uncertainty and the increased timeframe of effects may make future risk more difficult to comprehend (Warren *et al*., 2018).

Qualitative research among MSM students from UKZN found that in spite of a high HIV risk perception, MSM continued to engage in RSB (Gumindega and Maharaj, 2021). Some of the respondents reported utilizing PrEP due to their perceived risk of contracting HIV (Gumindega and Maharaj, 2021). Results from a Kenyan study indicated that the majority of students (89%) perceived themselves to be at a high risk of acquiring HIV (Adam and Mutungi, 2007). In contrast, a study in Ethiopia highlighted self-perception of HIV risk to be low, where 55% of sexually experienced students did not perceive themselves as a potential target for HIV infection (Shiferaw *et al*., 2014). This complacency poses a threat as students at risk with low self-risk perception may not take any HIV preventative measures owing to low risk perception (Shiferaw *et al*., 2014). Research in three African countries reported that participants perceived the risk for acquiring HIV via PAI to be low (Duby *et al*., 2016a). Ndabarora and Mchunu's (2014) research indicated that despite the high risk perception of respondents, this did not correlate with their actual usage of any HIV prevention methods (Ndabarora and Mchunu, 2014).

2.3.12 Risk Assessment for the likelihood of HIV infection

According to Carr *et al*., (2007), risk is defined as the chance, or probability of 'events' occurring where events are generally undesirable effects such as deaths or episodes of disease (Carr, Unwin and Pless-Mulloli, 2007). The concept of risk is fundamental to epidemiology (Carr, Unwin and Pless-Mulloli, 2007). A risk assessment involves the procedure of evaluating the probability of an adverse incident occurring (Tate and Feeney, 2012). An effective risk

assessment tool should possess the capability to accurately evaluate individual risks; this will enable the implementation of suitable preventive measures customized for each person's needs (Amir *et al*., 2010). The majority of risk assessments depend on the principle that past behaviour serves as the best predictor of future behaviour (Tate and Feeney, 2012). The focus is on establishing the existence of previous risk behaviours and additional factors known to influence risk, such as demographic and social factors, mental disorder or intoxication (Tate and Feeney, 2012).

According to Tate and Feeny (2012), risk is dynamic and subject to change. Therefore, a risk assessment is not a fixed event but an ongoing process that remains precise in the short term and gradually loses accuracy over time (Tate and Feeney, 2012). The development of a suitable risk prediction system to identify individuals at elevated risk of contracting HIV during clinical encounters is a critical step in the implementation of preventative strategies (Golden *et al.*, 2004). The identification of those susceptible to HIV infection, together with provision of specific preventative interventions have been shown to be cost efficient (Kagaayi *et al.*, 2014). Risk prediction could be key in preventing HIV infection in populations that are susceptible to HIV infection. Groups that are at increased risk for HIV infection could be targeted with various interventions such as behavioural interventions in combination with VCT, MMC and PrEP (Kagaayi *et al.*, 2014).

Practitioners who work with young individuals require a concise, effective and reliable screening tool to identify those who are vulnerable to HIV/STIs (Jarama *et al*., 2011). Moreover, it is critical to identify high risk behaviours to enable timeous counselling and referrals (Jarama *et al*., 2011). Addressing sex-related behaviours in the HIV/STI risk screening process among adolescents is crucial (Jarama *et al.*, 2011). These behaviours encompass early sexual debut, inconsistent condom use, sex with multiple, older, and/ or same sex partners, and experiences of coerced sexual intercourse (Jarama *et al*., 2011).

Jarama *et al*., (2011) discusses that existing measures assessing risk for HIV/STIs among adolescents are limited in their practicality (Jarama *et al*., 2011). This was linked to factors such as being too lengthy and/or time consuming or having inadequate testing to determine validity and reliability of the tool within the general adolescent population *(*Jarama *et al*., 2011). In addition, Golden and colleagues (2004) mention that risk assessments in clinics seldom include questions about sex partners' HIV status (Golden *et al.*, 2004). Risk indices/ risk

prediction tools have been employed to predict the risk of developing chronic diseases such as diabetes, coronary heart disease and cancer (Kagaayi *et al.*, 2014; Collins *et al.*, 2011; Stephens *et al.*, 2004; Klastersky *et al.*, 2000); however, the utilization in predicting HIV infection in the sub-Saharan African context is limited (Kagaayi *et al.*, 2014). Furthermore, as far as we are aware, there is currently no risk prediction tool tailored specifically for the university population in sub-Saharan Africa, despite the elevated risk of HIV infection within this group.

Several authors have reported on the design and usage of risk assessment tools referred to in literature as 'risk indices'; these tools were used to evaluate the risk of HIV in a variety of settings (Kuznetsov *et al*., 2011; Kagaayi *et al.*, 2014; Ballester-Arnal *et al*., 2016; Jarama *et al*., 2011; Hentzien *et al*., 2018; Susser, Desvarieux and Wittkowski, 1998). Research in Germany reported a short HIV risk behaviour knowledge index among n=210 sexually active people between 18 to 49 years (Kuznetsov *et al.*, 2011). This risk index consisted of questions focused on knowledge regarding HIV transmission and prevention during intercourse and intravenous drug usage. Results from the risk index implementation found that those without further education or the unemployed displayed a lower knowledge of HIV risk behaviour (Kuznetsov *et al.*, 2011). The HIV prevalence statistics in Germany are currently rather low in comparison with SA, 0,1% vs 19.1% respectively (The World Bank, 2022). This particular index was designed for an average risk HIV population, and a more intensive evidence-based risk assessment tool is required to quantify risk among high-risk populations in SA, in particular university students.

Research among Spanish young people (18–30 years old) assessed risk using six variables directly related to condom usage in different sexual situations. Each question was scaled using a four-point Likert scale from 1 (Never) to 4 (Always). Additional indicators were added as per literature, and these questions were answered on a dichotomous scale (true/false). A linear function applied was utilized to estimate risk for each indicator (Ballester-Arnal *et al.*, 2016). Results of the risk score for each indicator were rounded, and this obtained a scale of 4 values: 0 (no risk), 1 (medium risk), 1.25 (medium-high risk) and 1.5 (high risk). Thereafter risk scores on each indicator were summed to get a total risk index (Ballester-Arnal *et al.*, 2016).

Longitudinal research within the sub-Saharan African context in Uganda between 2003 and 2011 formulated gender specific indices used to assess levels of risk among sexually active individuals (Kagaayi *et al*., 2014). The study encompassed a sample of 7497 women and 5783

men (Kagaayi *et al.*, 2014). This study included HIV negative participants aged 15 to 49 years who were followed up at an average of 4 years, to determine seropositivity (Kagaayi *et al.*, 2014). Participants were interviewed and blood samples taken. Statistical analyses were done to test whether variables were significantly associated with HIV infection. Factors were selected based on multivariable analyses (Kagaayi *et al.*, 2014). This study found that where a total of 567 incident cases of HIV occurred, the incident rate was 1.06 per 100 persons, (95% CI 0.97-1.15) (Kagaayi *et al.*, 2014). HIV infection rates are reportedly higher in psychiatric patients than in the general population (Norcini Pala *et al*., 2017). A study by Norcini Pala and colleagues (2017) designed a risk index to determine HIV infection risk among psychiatric services users. This risk prediction tool assigned differential risk to each sexual act and sums the risk across sex acts such as vaginal sex (insertive or receptive), anal sex (insertive or receptive), partner type and HIV status (Norcini Pala *et al*., 2017). Risk coefficients were based on CDC transmission risk values, expert opinions, and face validity (Norcini Pala *et al*., 2017).

In SA the university student population is susceptible to HIV infection; this may be due to various behavioural factors i.e., engagement in sex with multiple partners, inconsistent condom usage, sexual experimentation, transactional sex etc. To our knowledge there is no study available regarding a specifically designed risk prediction tool/ risk index for the SA university student population. This particular population is exposed to distinctive risks within the higher education context, consequently a tailored risk assessment tool is required. Within the SA context a risk measurement tool that is evidence based, user friendly and tested for accuracy and validity can serve as a robust public health tool for assessment of HIV/STI risk among university students.

CHAPTER 3

METHODOLOGY

Data was collected from university students ≥ 18 years of age who were registered at participating universities between July 2019 and May 2021 based on specific inclusion and exclusion criteria.

3.1 Ethical considerations

Ethical approval was granted by the DUT IREC committee prior to commencement of the research study (IREC 005/19). Gatekeeper permission to conduct the study was requested from the respective institutional research offices. A copy of the approved proposal and ethical approval together with a request for permission was submitted to the respective institutional research offices at the study sites. Participation was voluntary; autonomy and confidentiality of all participants was respected and always maintained. An information letter (Appendix B: Participant letter of information) was provided to each participant, informing them of the study and enabling an informed decision for their participation. Participants were not penalised if they opted not to participate. The RA informed all participants of their freedom to withdraw from the study at any point without justification.

Confidentiality and Privacy

The study was conducted with integrity and transparency according to the IREC committee DUT ethical protocols and guidelines. Personal participant data provided was always protected with participant identification codes, which were rigorously adhered to, thus ensuring confidentiality and anonymity. Participants' names were numerically coded to ensure protection of identity. Recruitment of all participants occurred within a private consultation room in the campus health clinic, which reinforced participants' confidentiality and privacy. The rights and dignity of participants were always respected. Electronic data was secured on a password protected computer and physical paper-based data was stored within a locked cupboard.

3.2 Study sites

The study was carried out at various campuses of four public sector HEI's viz., Mangosuthu University of Technology (MUT, Umlazi) (coordinates: -29.97001,30.91251), Durban University of Technology (DUT, Durban) (29°51'05″S 31°0'26″E), University of KwaZulu-Natal (UKZN, Durban) (-29.867145,30.976453), and University of Zululand (UNIZULU, Empangeni) (-28.85359,31.8484), in the province of KZN, SA. KwaZulu-Natal has the second largest population in SA, comprising 11,5 million people (Statistics SA, 2021). In 2021, the estimated HIV prevalence in the country was 13.7% and the total number of people living with HIV was estimated at 8.2 million (Statistics SA, 2021). It was projected that 19.5% of the population aged between 15-49 years was HIV positive (Statistics SA, 2021). Universities in KZN were selected as research study sites due to the high prevalence of HIV in the province. Selected campuses at each of the four HEIs were included. Private universities were excluded from the study sample as students from these universities were not eligible for funding from NSFAS (NSFAS DHET Bursary Scheme South Africa 2020 – 2021, 2020).

3.3 Study design

This study adopted a case control study design in order to assess exposure to risk factors in both controls (HIV seronegative) and cases (HIV seropositive).

3.4 Characteristics of sample population

3.4.1 Sample population

The study population included students from four public sector HEIs in KZN, SA.

3.4.2 Sampling strategy

The sample was selected using convenience sampling methods according to specific inclusion requirements. This method of non-probability sampling was chosen for recruitment based on accessibility, geographical proximity, availability at a given time, and willingness (Etikan, Musa and Alkassim, 2016).

3.4.3 Sample size calculation

The estimated sample size was calculated based on the monthly clinic attendance statistics for each of the study sites and calculated over an average of 12 months. The target population was thus estimated at 8385 people per month. The calculation of sample size and case control ratios was determined in consultation with a biostatistician. The estimated sample size calculated for the control group (HIV negative participants) was 375, based on a 95% confidence and 5% margin of error (Table 1).

Table 1. Sample size for controls

Study sites	Monthly clinic head count	Sample
DUT Ritson campus	800	36
DUT Steve Biko campus	2500	111
MUT	500	23
UKZN Howard College	1678	75
UKZN Westville campus	907	41
UNIZULU	2000	89
Total	**8385**	**375**

Case control sampling ratio

Earlier studies report that no further statistical power is gained above 4 controls per case, thus the recommended number of controls was ≤ 4 (Wacholder *et al.*, 1992; Ehrlich and Joubert, 2014). Hence, the controls were oversampled as per a 1:3 ratio (1 case for every 3 controls), resulting in a sample of 375 controls and 125 cases. The total sample size was thus 500 participants.

3.5 Participation criteria

3.5.1 Case group

Inclusion criteria

Individuals were eligible for participation based on the following criteria:

- Registered students at the four participating public universities.

- ≥18 years old.
- Confirmed as HIV seropositive during or prior to the study period.

Exclusion criteria

Individuals were ineligible for participation based on the following criteria:

- Unregistered students at the four participating public universities.
- <18 years old.
- Confirmed as HIV seronegative during the study period.

3.5.2 Control group

Inclusion criteria

Participants were eligible for participation based on the following criteria:

- Registered students at the four participating public universities.
- ≥18 years old.
- Confirmed as HIV seronegative during the study period.

Exclusion criteria

Participants were excluded from participation based on the following criteria:

- Unregistered students at the four participating public universities.
- <18 years old.
- Unconfirmed as HIV seronegative during the study period.

3.5.3 Referral of participants

Controls (HIV seronegative participants)

Participants were referred by HCWs at the respective campus clinics to the onsite research assistant (RA). All referrals were requested to present their HIV testing form to confirm negative serostatus before participation.

Cases (HIV seropositive participants)

HIV seropositive participants were identified by VCT counsellors and the HIV care and support nurses through consultations when ARTs were collected or via access to primary health care services. Prospective participants were informed of the study during these visits by the HCWs and interested students were then referred to the onsite RA. Some clinics were, however, not distributers of ART. In these instances, the VCT counsellors would telephonically contact students that met the inclusion criteria to extend an invitation for participation. Interested students were then referred to the RA.

3.6 Research Instrument

A self-administered questionnaire comprising 16 sections was used to collect data; sections included the following:

- Sections 1-3: Demographics, socioeconomics, housing, and basic amenities.
- Sections 4-5: Intercourse, sexual practices and engagement, adapted from (Hoque, 2011a; Kharsany *et al*., 2015).
- Section 6: Substance usage.
- Section 7: Contraceptives, adapted from (Hoque and Ghuman, 2012; Hoque, 2011a).
- Section 8: Attitudes to Male Medical Circumcision (MMC), adapted from the HIV Incidence Provincial Surveillance System (HIPPS) questionnaire (Kharsany *et al.*, 2015; Leadbeatter, 2012).
- Sections 9-10: Transactional sex, adapted from (Mehra *et al.*, 2014), Sexually Transmitted Infection (STI) history.
- Section 11: Peer influence, adapted from (Bingenheimer, Asante and Ahiadeke, 2015; Seloilwe, 2005; Ngidi *et al.*, 2016).
- Sections 12-13: Knowledge, Perceived risk for HIV, adopted from the HIPPS questionnaire (Kharsany *et al.*, 2015).
- Section 14: Food security, adopted from (Munro *et al.*, 2013)
- Sections 15-16: Drug Usage Disorders Identification Test (DUDIT), adopted from (Berman *et al.,* 2003) and Alcohol Use Disorders Identification Test (AUDIT), (Babor *et al.,* 2001).

3.7 Procedure for Piloting of Research Instrument

Piloting of the data collection instrument was conducted amongst 10 participants registered at MUT. In a private room, participants were briefed on the research study, given the information letter to peruse and subsequently given the informed consent for completion. Thereafter, the participants were requested to complete the questionnaire and were subsequently interviewed by the researcher. Feedback was provided by each participant regarding the data collection tool.

Feedback received indicated that participants were knowledgeable on the various types of sexual intercourse and that they were comfortable answering all questions. In addition, all participants agreed that the information requested comprised part of the 'life skills' curriculum at school level. Some participants commented on the ambiguity of a few questions and requested rephrasing of questions and/or the use of alternative terminology. All feedback received was considered during review of the final questionnaire. Amendments were made post pilot testing and the modified version was submitted to the IREC at DUT for final approval.

3.8 Training of Research Assistants

Preparation of the training materials for RAs was done by the researcher in consultation with the VCT counsellor at MUT. Training was conducted by the researcher at the DUT Steve Biko Library. RAs were provided with training packs which included training resources and were trained on the following aspects:

- Briefing participants on the research study.
- Plan of study participant recruitment.
- Issue of information letter and completion of informed consent form.
- Always maintaining privacy and confidentiality.
- Ethical collection of data.
- Professional behaviour and conduct.
- Issue of 'token of appreciation' and documentation of airtime log sheets.

3.9 Recruitment and data collection

Recruitment was initially undertaken using the contact route. An online method of recruitment was also used to minimize contact due to the infection risks posed by the COVID-19 pandemic. Participant recruitment of controls and cases are detailed below.

3.9.1 Participant recruitment of controls (HIV seronegative)

Interested participants were referred by the HCWs to the RA, who thereafter met with each one of them in a private consultation room for a study protocol briefing and invited them to participate. Participation was verified by the RA by confirmation of the inclusion criteria (i.e., their age and requesting to view the HIV results form). The HIV results form documented personal details of the student and their HIV results. The RA reiterated that participation in the study was entirely optional and emphasized that participants had the freedom to withdraw at any point if they felt uneasy or uncomfortable. Participant confidentiality was ensured through usage of participant research identity codes and all participants were informed that their names and any other personal details would not be revealed in any reports emanating from the study.

Participants were then issued with information letters that detailed the study protocol and were requested to complete the informed consent forms. All participants were instructed to fold the consent forms and place them into the provided 'ballot cardboard box' with a secure lid. The lid had an opening for the consent form to be inserted into the box, used as a means to maintain participant confidentiality, since personal details were documented on the consent form. The RA then inserted participant research identity codes on the questionnaires to ensure participant anonymity. Once this was completed, participants were then issued with the data collection tool to complete.

3.9.2 Participant recruitment of cases (HIV seropositive)

The HIV care and support nurses and VCT counsellors contacted eligible students and provided them with a brief explanation of the study. Those who were interested were invited to participate by meeting with the RA at the respective campus clinic. Thereafter, the same data collection procedure was followed as with the seronegative students. If the online data collection route was utilized, the HCW provided the participants with a brief overview of the

research study. The HCW obtained verbal consent from the participants to share their email addresses with the RA. Thereafter, the RA sent a link containing the information letter, consent form and questionnaire via email to the participants. All participants were rewarded with an incentive (1x R20-00 airtime voucher) during both contact and online data collection routes once the questionnaire was completed.

3.10 Validity

Construct validity

Construct validity is defined as 'the degree to which an empirical indicator of a concept truly represents the construct of interest', as per the 'Epidemiology research manual for SA', (Ehrlich and Joubert, 2014, p.301). Hence, the construct validity of the data collection questionnaire was strengthened as follows:

- A panel focus group discussion was held with experts in the field of HIV. This focus group included a VCT counsellor and researchers in the field of public health and HIV.
- Field experts highlighted challenges with the questionnaire and provided recommendations, which were considered in the amendment of the questionnaire before the pilot study. Unclear/ambiguous items on the questionnaire were removed to ensure trustworthiness of the tool. This aspect of establishing validity is referred to as 'jury opinion' and entails expert evaluation of the tool (De Vos *et al.,* 2011).
- The questionnaire was pilot tested among 10 registered students from MUT. Thereafter, the pilot participants were requested to complete a questionnaire based on comprehensibility and usability of the data collection tool. In addition, participants were briefly interviewed for suggestions on improvements to the tool. Suggested changes were considered in collation of the final tool.

3.11 Reliability

Reliability is defined as the degree to which an instrument produces reproducible results (Ehrlich and Joubert, 2014, p.301).

Throughout the course of data collection reliability was reinforced in the following ways:

- Selection of suitable RAs. Female, postgraduate health sciences students from the African race group were employed as RAs for this study. African females were selected

as the study population was predominantly African, and participants' queries could thus have been answered in their home language.

- All RAs underwent an intensive training programme prior to beginning data collection. The training was conducted by the researcher and VCT counsellors.
- Preceding administration of the questionnaire, the RA clarified certain questions which may have been perceived as ambiguous by the participants.
- The questionnaire was self-administered to reduce information bias as sensitive information was required from participants. The questionnaire was filled out in a private and confidential room located within the campus clinic. The campus health clinic setting was specifically chosen to maintain confidentiality.

3.12 Data management and analysis

Prior to statistical analysis, raw data was captured into an Excel spreadsheet, coded, and cleaned. All statistical analysis was carried out using STATA version 17 statistical software in consultation with a biostatistician. The complete details regarding data analysis plans are provided in appendix E.

CHAPTER 4

This chapter presents the preliminary data involving the control group (HIV negative participants) from the study population and encompasses the socio-economic aspect of objective 1 of this study.

Manuscript 1: Food Insecurity and Risky Sexual Behaviors among University Students in KwaZulu-Natal, South Africa

Status: Manuscript published in the International Journal of Sexual Health.
DOI: 10.1080/19317611.2022.2117257. Impact factor: 2.152

International Journal of Sexual Health

ISSN: (Print) (Online) Journal homepage: https://www.tandfonline.com/loi/wijs20

Food Insecurity and Risky Sexual Behaviors among University Students in KwaZulu-Natal, South Africa

Trishka Govender, Nalini Govender & Poovendhree Reddy

To cite this article: Trishka Govender, Nalini Govender & Poovendhree Reddy (2022): Food Insecurity and Risky Sexual Behaviors among University Students in KwaZulu-Natal, South Africa, International Journal of Sexual Health, DOI: 10.1080/19317611.2022.2117257

To link to this article: https://doi.org/10.1080/19317611.2022.2117257

Published online: 02 Sep 2022.

Submit your article to this journal

View related articles

View Crossmark data

Full Terms & Conditions of access and use can be found at
https://www.tandfonline.com/action/journalInformation?journalCode=wijs20

INTERNATIONAL JOURNAL OF SEXUAL HEALTH
https://doi.org/10.1080/19317611.2022.2117257

Taylor & Francis
Taylor & Francis Group

Check for updates

Food Insecurity and Risky Sexual Behaviors among University Students in KwaZulu-Natal, South Africa

Trishka Govender[a], Nalini Govender[b] and Poovendhree Reddy[c]

[a]Department of Environmental Health, Faculty of Natural Sciences, Mangosuthu University of Technology, Durban, South Africa;
[b]Department of Basic Medical Science, Faculty of Health Sciences, Durban University of Technology, Durban, South Africa;
[c]Department of Community Health Studies, Faculty of Health Sciences, Durban University of Technology, Durban, South Africa

ABSTRACT

Objective: Risky sexual behavior (RSB) is associated with increased rates of sexually transmitted infections (STIs), Human Immunodeficiency Virus (HIV) infection, and unwanted pregnancies among university students. In view of its global impact on public health, the potential association between food insecurity and RSBs among university students requires investigation. This study aimed to determine the association between food security status and the likelihood to engage in RSBs amongst university students in KwaZulu-Natal (KZN), South Africa (SA). *Methods:* This cross-sectional study was conducted at four public sector higher educational institutions (HEIs) in KZN. A convenience sampling strategy was used to recruit participants ($N = 375$). All data were analyzed using STATA version 15 software. *Results:* Our data shows that food insecurity increased the odds of students engaging in transactional sex for "money" or "to meet basic material needs." Participants who were food insecure were two times more likely to have multiple sexual partners. *Conclusions:* Our findings demonstrate a significant association between food insecurity and RSBs. It is recommended that interventions targeting the alleviation of food insecurity, should be developed and implemented by HEIs to reduce RSB participation.

ARTICLE HISTORY
Received 14 March 2022
Revised 11 July 2022
Accepted 19 August 2022

KEYWORDS
Risky sexual behavior; food insecurity; HIV/AIDS; university students; South Africa

Introduction

The 2021 UNAIDS report indicates that, in 2020, 37.7 million people, worldwide, were living with HIV, with 1.5 million new infections being reported (UNAIDS, 2021). Risky sexual behavior (RSB) is a major contributor to new HIV infections, especially amongst the university populations (Adeniyi et al., 2018; Mthembu et al., 2019). These RSBs include transactional sex (Leclerc-Madlala, 2003), engaging in unprotected sex, having multiple partners simultaneously, and engaging in sex under the influence of substances (Mthembu et al., 2019). Understanding why this vulnerable group continues to engage in RSBs will assist in combating new infections. Food insecurity, defined as "the lack of access to enough safe and nutritious food for normal growth and development and an active and healthy life," may be a determinant for RSBs (Hunger & Food Insecurity, 2021). Several studies suggest that food insecurity may be an important predictor of RSBs among women, adolescents, and the homeless (Loosier et al., 2020; Masa et al., 2019; Miller et al., 2011; Vogenthaler et al., 2013; Weiser et al., 2007), however, this association has not been widely explored among university students.

A study conducted at higher educational institutions (HEIs) in South Africa (SA), confirmed an HIV-positive prevalence rate of 3.4% amongst tertiary students; however, this study was conducted 12 years ago (HEAIDS, 2010). It also found that female students are three times more likely to be HIV positive than male students (HEAIDS, 2010). University students' RSB may be associated with higher levels of sexual experimentation, liberal attitudes, and increased freedom experienced within the university setting (HEAIDS, 2010; Hoque, 2011). To our

CONTACT Trishka Govender govender.trishka@mut.ac.za Department of Environmental Health, Faculty of Natural Sciences, Mangosuthu University of Technology, Durban, South Africa.

© 2022 Taylor & Francis Group, LLC

knowledge, there is limited data on how food insecurity might contribute to students' engagement in RSB.

Despite the high unemployment rate of 63.9% among youth aged 15–24 years in SA (Stats SA, 2022) and the varying sociocultural beliefs and practices (Langa, 2012), issues pertaining to socioeconomic factors and RSBs have been poorly investigated within the university student population. In view of this gap in the literature, our study examined the possible association between food insecurity and RSB among university students at four public universities in KwaZulu-Natal (KZN), SA. Since KZN has the highest HIV prevalence in the country (CDC, 2014) and is the second most populated province (Statistics SA, 2021), we aimed to determine the association between food insecurity and RSB at four public HEIs in KZN. One out of four of these institutions was also reported to have the highest numbers of National Student Financial Aid Scheme (NSFAS) funded graduates in 2019 (NSFAS, 2019). We elected to study the association between food insecurity and RSB only at public HEIs since most students access funding from NSFAS (NSFAS, n.d.).

To be eligible for NSFAS, students must be registered at public HEIs, and have a combined household income not more than R350,000-00 per annum (~22,465.51 USD). Being reliant on NSFAS funding suggests that students come from households that may be socio-economically disadvantaged and/or food insecure. Of note, registered students qualifying for the NSFAS grant are allocated R15,000-00 per year for their living expenses (~962.81 USD), which equates to R41-67 per day for food (~2.67 USD). There is limited national and international data regarding the association between food insecurity and RSB within the university student population. Since university students form a unique HIV risk population, interventions developed for the general society may be unsuitable for this population group. Therefore, it is important to study the possible determinants of RSBs among university students, to develop the body of knowledge necessary to inform targeted interventions. This article aims to determine whether food insecurity is a determinant for RSB among university students in KZN, SA.

Methods

Study sites

This study was based in KZN, the epicenter of HIV infection and the second most populated province (11.5 million people) in SA (Statistics SA, 2021). South Africa has nine provinces with a total population of 60.14 million people (Statistics SA, 2021) and the fourth highest HIV prevalence in the world at 18.9% (HIV Rates By Country, 2021). All four major public universities in KZN were included as research sites for this study.

Study design

This was a cross-sectional and prospective study.

Ethics

Institutional ethics approval was obtained from the Durban University of Technology's Institutional Ethics Committee (IREC 005/19). Official permission was granted by the four HEIs. Participants were required to read an information letter with details of the research. Any further queries were addressed by research assistants. Thereafter, informed consent was obtained from each participant by completing a consent form before participation. Completion of the data collection questionnaire was undertaken in a confidential consultation room. Furthermore, participants were given unique identification codes to ensure anonymity and confidentiality. The payment was not provided for study participation. However, participants were given a token of appreciation for participation. This token was an airtime voucher to the value of R20-00, which is equivalent to 1.37 USD.

Study population and sampling

The study population included registered undergraduate and post-graduate students, who were ≥18 years old. Data from unregistered students and seropositive students were excluded.

Participants were recruited via convenience sampling (i.e., through the voluntary counseling and testing (VCT) counselors at the respective campus clinics).

Data collection

Data was collected using structured pre-coded questionnaires, between July 2019 and April 2020. Before data collection, the questionnaire was piloted among ten students to ensure its validity and reliability. Questions focused on student sexual health and included information pertaining to demographics, socioeconomics, sexual practices and engagement, and food security. The food security component of the questionnaire was adopted from Munro et al. (2013), which included 13 questions. Items were scaled on a 5-point Likert scale, to measure the frequency of food security variables (Table 1).

Table 1. Levels of Food Insecurity (Adapted from Munro et al., 2013, p. 174).

Average scaled score	Average experience of food insecurity (FI) across items	Level of vulnerability to food insecurity (FI)
0	Never	None
1	Seldom	Low
2	Sometimes	Serious
3	Often	Severe
4	Almost always	Critical

Data management and analysis

Data was entered into a Microsoft Excel spreadsheet and subsequently exported into STATA version 15 software for cleaning and analysis. Participants' levels of food insecurity for each of the 13 items were tallied and an average total score was calculated. Using Munro's levels of food insecurity (Table 1), categories were further collapsed by categorizing participants whose average score was between 0 and 1 as food secure, and participants who scored between 2 and 4 as food insecure.

Socio-demographic characteristics were analyzed based on gender stratification (Table 2) and food security status (Table 3); whilst RSB data was stratified by food security status (Table 4). The Pearson chi-squared test was carried out for bivariate analysis to ascertain if significant differences exist. Adjusted binary logistical regression modeling was used to estimate whether food insecurity was a possible predictor of RSBs. In addition, the effect of socio-demographic variables on food insecurity was determined.

Table 2. Socio-Demographic Characteristics Based on Gender ($N = 375$).

Socio-demographics data *n* (%)	Male	Female	*p*-Value
Age ($n = 372$)**			0.0004**
Median (Q1,Q3)	22 (21, 24)	21.5 (20, 23)	
Age category ($n = 372$)*			0.008*
<20 years	17 (25.4)	50 (74.6)	
20–24 years	92 (38.8)	145 (61.2)	
>24 years	35 (51.5)	33 (48.5)	
Racial group ($n = 371$)			
African	144 (38.8)	227 (61.2)	
Level of study ($n = 373$)			0.396
Undergraduate	139 (38.7)	220 (61.3)	
Postgraduate	7 (50)	7 (50)	
Marital status ($n = 369$)			0.710
Single	142 (39.2)	220 (60.8)	
Living with boyfriend/girlfriend	2 (28.6)	5 (71.4)	
Residence while studying ($n = 373$)			0.256
University residences	130 (38)	212 (62)	
Non-university residences	15 (48.4)	16 (51.6)	
Any children ($n = 373$)			0.148
Yes	31 (32.6)	64 (67.4)	
No	114 (41)	164 (59)	
Student financing ($n = 371$)			0.791
Financial aid (NSFAS)	108 (38.4)	173 (61.6)	
Self-funded	36 (40)	54 (60)	
Part time work for food ($n = 165$)			0.761
Yes	45 (46.9)	51 (53.1)	
No	34 (49.3)	35 (50.7)	

*$p < 0.05$ and **$p < 0.005$ was considered statistically significant. *Financial aid*: defined as funding from the NSFAS. Non-financial aid is defined as private/self-funded, study loans, bursary, and scholarship.

Table 3. Socio-Demographic Characteristics Based on Food Security Status ($N = 375$).

Sociodemographic factors *n* (%)	Frequency *n* (%)	Food secure	Food insecure	*p*-Value
Gender ($n = 355$)				0.533
Male	136 (38.3)	85 (37.1)	51 (40.5)	
Female	219 (61.7)	144 (62.9)	75 (59.5)	
Study funding ($n = 353$)				0.485
Financial aid	267 (75.6)	169 (74.5)	98 (77.8)	
No financial aid	86 (24.4)	58 (25.6)	28 (22.2)	
Part time work for food ($n = 153$)*				0.010*
Yes	90 (58.8)	44 (50)	46 (70.8)	
No	63 (41.2)	44 (50)	19 (29.2)	
Sharing of bursary/loan ($n = 345$)**				0.000**
Yes	169 (49)	89 (40.5)	80 (64)	
No	176 (51)	131 (59.6)	45 (36)	
Type of housing ($n = 355$)				0.046
Informal	88 (24.8)	49 (21.4)	39 (30.9)	
Formal	267 (75.2)	180 (78.6)	87 (69.1)	

*$p < 0.05$ and **$p < 0.005$ was considered statistically significant. *Type of housing (Informal)*: 'defined as unplanned settlements and areas where housing is not in compliance with current planning and building regulations (unauthorized housing)' (Masum, 2014, p. 2).

Measures of association

Two logistic regression models were created to investigate associations between the following: (1) Food insecurity and RSB and (2) Socio-demographics and food insecurity. In model I, the outcome variables for RSB were the following: inconsistent condom use, concurrent sex partners, sex for money, sex for basic material needs, and intergenerational sex. In model II, the outcome variable was food insecurity. Food insecurity was the independent variable in model I. In model II, socioeconomic and demographics were the independent variables, respectively.

Logistic regression models were adjusted for the following confounders: age, gender, marital status, any children, relationship status, sharing bursary, study funding, and part-time work. A 95% confidence interval (CI) was used for all models and $p < 0.05$ was considered statistically significant.

Results

The socio-demographic characteristics of all participants based on gender are shown in Table 2. All respondents ($N = 375$) were African university students, with a median age of 22 years for male participants and 21 years for females. Of the total population, 61.3% were females ($n = 228$), of which (145, 61.2%) were between the ages of 20 and 24 years. Of note, 220 (61.3%) females and 139 (38.7%) males were registered for undergraduate studies. Almost all students were single (98%) and 25% reported having one or more children. Approximately 281 (75.7%) of the students reported having access to NSFAS funding. Of the total population, 62% were females who resided in the university residences; and 53.1% of females reported needing to work to purchase food in contrast to 46.9% of males.

A comparison of the socio-demographic characteristics and food security status is shown in Table 3. Of the total population, 35.5% reported being food insecure, with females being more vulnerable ($n = 75$; 59.5%) than males ($n = 51$; 40.5%). Also, 77.8% of those accessing NSFAS funding were food insecure. Participants working part-time for food ($n = 153$) were also significantly associated with food insecurity ($p = 0.010$). Approximately 64% of the students sharing their bursary/loan with family members were identified as food insecure ($p = 0.000$). Despite 75% of the population residing in formal housing types, 69.1% were identified as food insecure ($p = 0.046$).

Table 4 displays RSBs stratified by food security status. Of the 346 respondents, 302 (87.3%) reported "had ever had sexual intercourse." Among those who "had ever engaged in sex," 88.3% were food insecure *vs.* the 11.7% who had never had sex before. Almost 50% of participants first had sex between 17 and 19 years of age, of which 55.4% were identified as food insecure. Notably, 48.5% of the population practiced sexual engagement with sexual partners concurrently. A significant association was noted between

Table 4. Risky Sexual Behavior Stratified by Food Security Status ($N = 375$).

Sexual practices	Frequency n (%)	Food secure	Food insecure	*p*-Value
Ever had sexual intercourse ($n = 346$)				0.669
Yes	302 (87.3)	196 (86.7)	106 (88.3)	
No	44 (12.7)	30 (13.3)	14 (11.7)	
Age of consensual sexual debut ($n = 303$)				0.063
<15 years	15 (5)	12 (6)	3 (2.9)	
15–16 years	67 (22.1)	40 (20)	27 (26.2)	
17–19 years	151 (49.8)	94 (47)	57 (55.4)	
≥20 years	70 (23.1)	54 (27)	16 (15.5)	
Ever had multiple sexual partners concurrently** ($n = 330$)				0.002**
Yes	160 (48.5)	90 (42.3)	70 (59.8)	
No	170 (51.5)	123 (57.7)	47 (40.2)	
Intergenerational sex (IGS)[a] ($n = 241$)				0.204
No	185 (76.8)	126 (79.2)	59 (71.9)	
Yes	56 (23.2)	33 (20.8)	23 (28.1)	
Frequency of condom usage during vaginal sex ($n = 304$)				0.329
Never	64 (21)	36 (18.6)	28 (25.4)	
Inconsistent	183 (60.2)	119 (61.3)	64 (58.2)	
Consistent	57 (18.8)	39 (20.1)	18 (16.4)	
Frequency of condom usage during anal sex ($n = 41$)				0.130
Never	21 (51.2)	15 (57.7)	6 (40)	
Inconsistent	17 (41.5)	8 (30.8)	9 (60)	
Consistent	3 (7.3)	3 (11.5)	0 (0)	
Transactional sex in exchange for money (past 3 months)* ($n = 271$)				0.037*
No	256 (94.5)	170 (96.6)	86 (90.5)	
Yes	15 (5.5)	6 (3.4)	9 (9.5)	
Ever had sex with someone who isn't your regular partner to meet basic material needs (rent, food, airtime)** ($n = 290$)				0.000**
No	267 (92.1)	182 (96.3)	85 (84.2)	
Yes	23 (7.9)	7 (3.7)	16 (15.8)	
Ever had the expectation of receiving something in return after sex (e.g., a gift, airtime, food)** ($n = 287$)				0.001**
No	264 (92)	180 (95.7)	84 (84.9)	
Yes	23 (8)	8 (4.3)	15 (15.2)	

*$p < 0.05$ and **$p < 0.005$ was considered statistically significant.
[a]Intergenerational sex (IGS) is defined as intercourse with a non-marital partner 10 or more years older.

"concurrent sexual partners" and "food insecurity status" ($p = 0.002$); 59.8% who had concurrent sexual partners were food insecure as compared to 40.2% who reported not having concurrent sexual partners. Overall, 76.8% of participants did not engage in intergenerational sex (IGS); of which 71.9% were identified as food insecure. Sixty percent of respondents reported the inconsistent use of condoms during vaginal sex; within the food insecure category 64; 58.2% of participants that inconsistently used condoms were reported as food insecure.

The majority (94.5%) of participants reported not engaging in sex in exchange for money (last 3 months); which was significantly associated with being food secure ($p < 0.05$). Moreover, 92% reported not engaging in sexual activities with someone who was not their regular partner to meet basic material needs. Those who did not report having sex to meet basic material needs were more likely to be food insecure ($p = 0.000$). Notably, 92% of the respondents in this category did not expect something in return for sex, of which 84.9% were food insecure. A statistically significant association was noted between "not expecting something in return for sex" and being food secure ($p = 0.001$).

The adjusted odds ratio for predictors of RSBs is presented in Table 5. Despite a non-significance, we report that food insecurity may be associated with an increased likelihood of inconsistent condom usage adjusted odds ratio [(aOR = 1.3, 95% CI: 0.69; 2.57)], compared to those who were food secure. In addition, those who were food insecure were two times more likely to have concurrent partners than those who were food secure [(aOR = 2.04, 95% CI: 1.22; 3.42), $p = 0.006$]. Participants who were food insecure also had a 3-fold increased odds of engaging in transactional sex for money (in the last 3 months) than those who were food secure [(aOR = 3.18, 95% CI: 1.29; 7.84), $p = 0.012$]. Moreover, being food insecure

Table 5. Model 1 Adjusted Logistic Regression Models for Food Security Status and Risky Sexual Behaviors ($N = 375$).

Characteristic	Inconsistent condom usage (vaginal sex) aOR (95% CI) *p*-value	Concurrent sex partners aOR (95% CI) *p*-value	Transactional sex for money aOR (95% CI) *p*-value	Intergenerational sex aOR (95% CI) *p*-value	Transactional sex for basic material needs[f] aOR (95% CI) *p*-value
Food secure (REF)	1.00[a]	1.00[b]	1.00[c]	1.00[d]	1.00[e]
Food insecure	1.3 (0.69; 2.57) 0.398	2.04 (1.22; 3.42) 0.006*	3.18 (1.29; 7.84) 0.012*	1.51 (0.79; 2.89) 0.210	4.98 (1.93; 12.84) 0.001**

*$p < 0.05$ and **$p < 0.005$ was considered statistically significant.
[a,e]Adjusted for age and gender.
[b]Adjusted for gender, age, marital status, and study funding.
[c]Adjusted for gender, age, marital status, sharing of bursary, and study funding.
[d]Adjusted for gender, sharing of bursary.
[f]Basic material needs are defined as items needed by students, such as rent, food, and airtime.

increased the likelihood of engaging in intergenerational sex by 1.5 times [(aOR = 1.51, 95% CI: 0.79; 2.89), $p > 0.05$]. In addition, the odds of having transactional sex to meet basic material needs were increased by 4.98 times [(aOR = 4.98, 95% CI: 1.93; 12.84), $p = 0.001$] amongst those who were food insecure.

The association between socio-demographic factors and food insecurity as well as the odds ratios are presented in Table 6. Participants who shared their bursary/loan with family members were 2.6 times more likely to be food insecure than those that did not share the bursary/loan [(aOR 2.56, 95% CI: 1.59; 4.12), $p = 0.000$]. Despite the non-significant data, a decreased risk of food insecurity among female participants was observed.

Table 6. Model 2 Adjusted Logistic Regression Models Comparing Socio-Demographics and Food Security Status ($N = 375$).

Socio-demographic characteristics	Food insecurity aOR (95% CI) *p*-value
Student financing	
Private/self-funding (REF)	1.00[a]
Financial Aid (NSFAS)	0.94 (0.54; 1.63) 0.828
Sharing of bursary/loan	
Not sharing bursary/loan (REF)	1.00[b]
Sharing bursary/loan	2.56 (1.59; 4.12) 0.000**
Gender	
Male (REF)	1.00[c]
Female	0.91 (0.56; 1.47) 0.699
Any children[e]	
No (REF)	1.00[d]
Yes	1.54 (0.89; 2.64) 0.120

*$p < 0.05$ and **$p < 0.005$ was considered statistically significant.
[a]Adjusted for any children, sharing of bursary.
[b]Adjusted for age, gender, any children, study funding.
[c,d]Adjusted for age, any children, marital status.
[e]Includes both genders of participants.

Discussion

To our knowledge, we are the first to report an association between food insecurity and RSBs among university students in KZN. Our results suggest that food insecurity may be a significant predictor of university students' engagement in transactional sex, especially "sex for basic material needs" and "sex for money." Food insecure participants had 4.98 times higher odds of engaging in transactional sex to meet basic material needs. Our findings corroborate similar studies conducted in resource-poor settings (Gichane et al., 2020; Miller et al., 2011; Nagata et al., 2021; Oyefara, 2007). For example, a recent study in Malawi on adolescent girls and young women showed that food insecurity was associated with transactional sex (AOR = 1.37, 95% CI 1.01; 1.86) (Gichane et al., 2020). Additionally, research among young adults in the United States found that food insecure young women were at an increased risk of exchanging sex for money (Nagata et al., 2021).

Our study found that food insecurity was associated with a 3.18 times higher risk of engaging in transactional sex for money, which is consistent with a qualitative study conducted among people living with HIV/AIDS (Whittle et al., 2015). In contrast, others suggest that transactional sex may not always be associated with socioeconomically disadvantaged/poor students, since some students are reported to engage in transactional sex as a means to purchase luxury items like clothes, hairstyles, fast food, gadgets, as well as enhance their social status (Amo-Adjei et al., 2014; Masvawure, 2010; Shefer et al., 2012). Food insecurity may compel an individual to engage in transactional sex to fulfill basic survival needs. The majority of the participants in our study are from socioeconomically disadvantaged backgrounds which may predispose them to food insecurity and consequent RSB.

Our findings also demonstrate that 35.5% of all participants reported being food insecure, regardless of 75.7% of the total population receiving NSFAS funding. We report no association between NSFAS funding and food insecurity, which contradicts previous studies (Gaines et al., 2014; Munro et al., 2013; Payne-Sturges et al., 2018). This finding is suggestive that our population was reliant on other means (e.g., part-time work or extended family support) to supplement the NSFAS funding. Albeit we report a significant association between students who shared their bursary/loan with family and being food insecure (2.6 times higher). Moreover, a South African study conducted among 1416 university students found that more than a fifth of all students reported providing financial support to their parents, siblings, children, and partners or spouses (van den Berg & Raubenheimer, 2015). Similarly, participants in our study may be predisposed to further financial disadvantages and consequent food insecurity due to sharing their bursary/loan with family members. Our data indicate the need for large-scale studies to examine the specific characteristics that influence university students' socioeconomic vulnerability, their potential risk of food insecurity, and consequent exposure to RSBs. In addition, future studies should investigate how students are spending the allocated NSFAS grants to better understand factors contributing to their food insecurity.

An earlier study suggests that transactional sex may co-exist with RSBs, such as early sexual debut, multiple sexual partners, and inconsistent condom usage (Choudhry et al., 2014). Moreover, condom negotiation may be increasingly difficult among those engaging in transactional sex, due to unequal power imbalances (Miller et al., 2011; Moore et al., 2007). Almost 60% of our participants reported inconsistent condom usage during vaginal sex, whilst 21% reported never using condoms. Similar findings were reported by a study in Rwanda, where only 15% ($N = 269$) of university students reported consistent condom usage (Pierre et al., 2019). The implications of RSBs, such as inconsistent condom use, increase the risk of STIs, including HIV, amongst this vulnerable population, as well as the risk of unintended pregnancy and consequent abortions (Pierre et al., 2019; Shiferaw et al., 2014). In our study, 58% of those who reported inconsistent use of condoms were identified as being food insecure. Food insecurity may also drive individuals to engage in transactional sex as a means to secure additional funding. In situations involving transactional sex condom negotiation may be difficult, especially in male-dominated relationships or when an individual is financially dependent on their partner (Maharajh & Haffejee, 2021). Although our findings are consistent with data from similarly vulnerable populations who experienced food insecurity (Vogenthaler et al., 2013), limited global data exists on condom usage and food insecurity among university students.

Our data indicate that food insecurity was associated with a 2-fold higher odds of having multiple sexual partners [(aOR = 2.04, 95% CI: 1.22; 3.42), $p = 0.006$], corroborating other studies (Nagata et al., 2021; Vogenthaler et al., 2013). Despite the lack of similar studies being conducted amongst university students globally, a study among young adults in the United States revealed that females who were food insecure were at a higher odds of having multiple sex partners concurrently (aOR 1.32, 95% CI: 1.01; 1.73) in contrast to their male counterparts (Nagata et al., 2021). In the African context, financial hardship and food insecurity were identified as reasons for having multiple sex partners in a study conducted on adolescent Kenyan girls (Onono et al., 2021). Similarly, our study findings suggest that university students are vulnerable to food insecurity, which predisposes them to engage in sexual practices with multiple concurrent partners to increase their access to basic amenities like food and clothing. Having multiple sex partners heightens the risk of acquiring STIs, such as HIV (Shiferaw et al., 2014).

These findings make a noteworthy contribution to literature, given the paucity of research on food insecurity as a determinant for RSBs among university students, especially in areas that are highly burdened by HIV/AIDS. Future studies are necessary to examine this association in other university student population groups to further investigate the potential association both nationally and globally. Furthermore, these findings can help inform future policy development

and interventions regarding food insecurity among this vulnerable population.

Conclusion

Our novel findings suggest that poor socioeconomic status and food insecurity increases the vulnerability of university students and their likelihood to engage in RSBs, which can consequently put them at risk for STIs including HIV. Therefore, we recommend the development of legislation that focuses on the food insecurity concerns relating to students in the higher education sector in SA. Future research is required to examine the specific characteristics that may contribute to university students' socioeconomic vulnerability and can potentially put them at risk of food insecurity, leading to their engagement in RSBs. Longitudinal studies in South Africa and sub-Saharan Africa will increase our understanding of this association. Programmes, such as food banks targeted at university students should be developed to alleviate food insecurity and reduce the risk of RSBs among this vulnerable population group.

Acknowledgments

The authors would like to thank Mr. Cornelius Nattey for providing the statistical support.

Conflict of interest statement

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the paper.

Funding

This work was supported by the Mangosuthu University of Technology Capacity Development Grant 2021, and the Post-graduate Research Grant from the Durban University of Technology.

ORCID

Trishka Govender http://orcid.org/0000-0002-0127-2249

Data availability statement

Data is not available due to ethical restrictions. Due to the nature of the sensitive areas covered in this research, data cannot be shared publicly. Deidentified data is available upon request but cannot be used for other purposes apart from data confirmation.

References

Adeniyi, O. V., Ajayi, A. I., Moyaki, M. G., Goon, D. T., Avramovic, G., & Lambert, J. (2018). High rate of unplanned pregnancy in the context of integrated family planning and HIV care services in South Africa. *BMC Health Services Research*, *18*(1), 4–11. https://doi.org/10.1186/s12913-018-2942-z

Amo-Adjei, J., Kumi-Kyereme, A., & Tuoyire, D. A. (2014). Transactional sex among female university students in Ghana: Implications for HIV education. *Health Education*, *114*(6), 473–486. https://doi.org/10.1108/HE-02-2014-0013

CDC. (2014). *Study to determine effectiveness of HIV prevention and treatment launched*. https://www.cdc.gov/global-health/countries/southafrica/stories/epicentre.htm

Choudhry, V., Östergren, P. O., Ambresin, A. E., Kyagaba, E., & Agardh, A. (2014). Giving or receiving something for sex: A cross-sectional study of transactional sex among Ugandan University students. *PLOS One 9*(11), e112431. https://doi.org/10.1371/journal.pone.0112431

Food and Agriculture Organisation of the United Nations. (2021). *Hunger and Food Insecurity*. https://doi.org/10.1017/S0020818300006160

Gaines, A., Robb, C. A., Knol, L. L., & Sickler, S. (2014). Examining the role of financial factors, resources and skills in predicting food security status among college students. *International Journal of Consumer Studies*, *38*(4), 374–384. https://doi.org/10.1111/ijcs.12110

Gichane, M. W., Moracco, K. E., Pettifor, A. E., Zimmer, C., Maman, S., Phanga, T., Nthani, T., & Rosenberg, N. E. (2020). Socioeconomic predictors of transactional sex in a cohort of adolescent girls and young women in Malawi: A longitudinal analysis. *AIDS and Behavior*, *24*(12), 3376–3384. https://doi.org/10.1007/s10461-020-02910-5

HEAIDS. (2010). *HIV prevalence and related factors: Higher education sector study South Africa 2008–2009*. HEAIDS. https://www.dhet.gov.za/ReportsDocLibrary/HEAIDSSeroPrevalenceSectorReport.pdf

HIV Rates By Country. (2021). https://worldpopulationreview.com/country-rankings/hiv-rates-by-country

Hoque, M. E. (2011). Sexual practices among male undergraduate students in KwaZulu-Natal, South Africa. *Southern African Journal of Epidemiology and Infection*, *26*(3), 157–160. https://doi.org/10.1080/10158782.2011.11441439

Hunger and Food Insecurity. (2021). Food and Agriculture Organisation of the United Nations. https://doi.org/10.1017/S0020818300006160

Langa, M. (2012). *Some gendered practices in a Zulu family: A feminist perspective*. University of Kwazulu-Natal. https://researchspace.ukzn.ac.za/xmlui/handle/10413/9117

Leclerc-Madlala, S. (2003). Transactional sex and the pursuit of modernity. *Social Dynamics*, *29*(2), 213–233. https://doi.org/10.1080/02533950308628681

Loosier, P. S., Haderxhanaj, L., Beltran, O., & Hogben, M. (2020). Food insecurity and risk indicators for sexually transmitted infection among sexually active persons aged 15–44, National Survey of Family Growth, 2011–2017. *Public Health Reports*, *135*(2), 270–281. https://doi.org/10.1177/0033354920904063

Maharajh, R., & Haffejee, F. (2021). Exploring male condom use among women in South Africa: A review of the literature. *African Journal of AIDS Research*, *20*(1), 6–14. https://doi.org/10.2989/16085906.2021.1872663

Masa, R., Graham, L., Khan, Z., Chowa, G., & Patel, L. (2019). Food insecurity, sexual risk taking, and sexual victimization in Ghanaian adolescents and young South African adults. *International Journal of Public Health*, *64*(2), 153–163. https://doi.org/10.1007/s00038-018-1155-x

Masum, F. (2014, June). Challenges of upgrading housing in informal settlements: A strategic option of incremental housing [Paper presentation]. Engaging the Challenges – Enhancing the Relevance, Kuala Lumpur. http://www.fig.net/resources/proceedings/fig_proceedings/fig2014/papers/ts01g/TS01G_masum_7265.pdf

Masvawure, T. (2010). "I just need to be flashy on campus": Female students and transactional sex at a university in Zimbabwe. *Culture, Health & Sexuality*, *12*(8), 857–870. https://doi.org/10.1080/13691050903471441

Miller, C. L., Bangsberg, D. R., Tuller, D. M., Senkungu, J., Kawuma, A., Frongillo, E. A., & Weiser, S. D. (2011). Food insecurity and sexual risk in an HIV endemic community in Uganda. *AIDS and Behavior*, *15*(7), 1512–1519. https://doi.org/10.1007/s10461-010-9693-0

Moore, A., Biddlecom, A., & Zulu, E. (2007). Prevalence and meanings of exchange of money or gifts for sex in unmarried adolescent sexual relationships in sub-Saharan Africa. *African Journal of Reproductive Health*, *11*(3), 44–61.

Mthembu, Z., Maharaj, P., & Rademeyer, S. (2019). "I am aware of the risks, I am not changing my behaviour": Risky sexual behaviour of university students in a high-HIV context. *African Journal of AIDS Research*, *18*(3), 244–253. https://doi.org/10.2989/16085906.2019.1655075

Munro, N., Quayle, M., Simpson, H., Barnsley, S., & Quayle, M. (2013). Hunger for knowledge: Food insecurity among students at the University of KwaZulu-Natal. *Perspectives in Education*, *31*(4), 168–179. http://www.perspectives-in-education.com

Nagata, J. M., Palar, K., Gooding, H. C., Garber, A. K., Tabler, J. L., Whittle, H. J., Bibbins-Domingo, K., & Weiser, S. D. (2021). Food insecurity, sexual risk, and substance use in young adults. *The Journal of Adolescent Health*, *68*(1), 169–177. https://doi.org/10.1016/j.jadohealth.2020.05.038

NSFAS. (2019). *NSFAS Vital Statistics – 2019*. https://www.nsfas.org.za/content/reports/NSFAS-VitalStatistics-2019(2021Edition)V3.pdf

NSFAS. (n.d.). https://www.nsfas.org.za/content/bursary-scheme.html

Onono, M. A., Odhiambo, G., Sheira, L., Conroy, A., Neilands, T. B., Bukusi, E. A., & Weiser, S. D. (2021). The role of food security in increasing adolescent girls' agency towards sexual risk taking: Qualitative findings from an income generating agricultural intervention in southwestern Kenya. *BMC Public Health*, *21*(1), 2028–2011. https://doi.org/10.1186/s12889-021-12051-6

Oyefara, J. L. (2007). Food insecurity, HIV/AIDS pandemic and sexual behaviour of female commercial sex workers in Lagos metropolis, Nigeria. *SAHARA-J: Journal of Social Aspects of HIV/AIDS*, *4*(2), 626–635. https://doi.org/10.1080/17290376.2007.9724884

Payne-Sturges, D. C., Tjaden, A., Caldeira, K. M., Vincent, K. B., & Arria, A. M. (2018). Student hunger on campus: Food insecurity among college students and implications for academic institutions. *American Journal of Health Promotion*, *32*(2), 349–354. https://doi.org/10.1177/0890117117719620

Pierre, G., Umutoni, A., Nzeyimana, Z., & Dzinamarira, T. (2019). Assessment of risky sexual behaviors among university students in Kigali, Rwanda. *International Journal of HIV/AIDS Prevention, Education and Behavioural Science*, *5*(2), 141. https://doi.org/10.11648/j.ijhpebs.20190502.19

Shefer, T., Clowes, L., & Vergnani, T. (2012). Narratives of transactional sex on a university campus. *Culture, Health & Sexuality*, *14*(4), 435–447. https://doi.org/10.1080/13691058.2012.664660

Shiferaw, Y., Alemu, A., Assefa, A., Tesfaye, B., Gibermedhin, E., & Amare, M. (2014). Perception of risk of HIV and sexual risk behaviors among university students: Implication for planning interventions. *BMC Research Notes*, *7*(1), 162. https://doi.org/10.1186/1756-0500-7-162

Statistics SA. (2021). *Mid-year population estimates 2021* (Issue July). http://www.statssa.gov.za/publications/P0302/P03022021.pdf

Stats SA. (2022). *South Africa's youth continue to bear the burden of unemployment*. https://www.statssa.gov.za/?p=15407#:~:text=Q1%3A2022sawthetotal,rateof34%2C5%25.

UNAIDS. (2021). *UNAIDS fact sheet 2021 global HIV statistics*. https://www.unaids.org/sites/default/files/media_asset/UNAIDS_FactSheet_en.pdf

van den Berg, L., & Raubenheimer, J. (2015). Food insecurity among students at the university of the free state, South Africa. *South African Journal of Clinical Nutrition*, *28*(4), 160–169. https://doi.org/10.1080/16070658.2015.11734556

Vogenthaler, N. S., Kushel, M. B., Hadley, C., Frongillo, E. A., Riley, E. D., Bangsberg, D. R., & Weiser, S. D. (2013). Food insecurity and risky sexual behaviors among homeless and marginally housed HIV-infected individuals in San Francisco. *AIDS and Behavior*, *17*(5), 1688–1693. https://doi.org/10.1007/s10461-012-0355-2

Weiser, S. D., Leiter, K., Bangsberg, D. R., Butler, L. M., Percy-de Korte, F., Hlanze, Z., Phaladze, N., Iacopino, V., & Heisler, M. (2007). Food insufficiency is associated with high-risk sexual behaviour among women in Botswana and Swaziland. *PLOS Med*, *4*(10), 1589–1597. https://doi.org/10.1371/journal.pmed.0040260

Whittle, H. J., Palar, K., Napoles, T., Hufstedler, L. L., Ching, I., Hecht, F. M., Frongillo, E. A., & Weiser, S. D. (2015). Experiences with food insecurity and risky sex among low-income people living with HIV/AIDS in a resource-rich setting. *Journal of the International AIDS Society*, *18*(1), 20293–20296. https://doi.org/10.7448/IAS.18.1.20293

CHAPTER 5

This chapter investigates the socio-economic determinants of RSBs and HIV seropositivity among university students linked to objective 1, using case control analyses.

Manuscript 2: Socio-economic determinants of risky sexual behaviors and HIV seropositivity among university students in South Africa: A case control analysis

Status: Published in the Research in Nursing and Health Journal.
DOI: 10.1002/nur.22328. Impact factor: 2.238

Check for updates

Received: 15 September 2022 | Accepted: 8 June 2023

DOI: 10.1002/nur.22328

RESEARCH REPORTS

RESEARCH IN NURSING & HEALTH WILEY

Socioeconomic determinants of risky sexual behaviors and HIV seropositivity among university students in South Africa: A case control analysis

Trishka Pillay[1] | Nalini Govender[2] | Poovendhree Reddy[3]

[1]Department of Environmental Health, Faculty of Natural Sciences, Mangosuthu University of Technology, Durban, South Africa

[2]Department of Basic Medical Science, Faculty of Health Sciences, Durban University of Technology, Durban, South Africa

[3]Department of Community Health Studies, Faculty of Health Sciences, Durban University of Technology, Durban, South Africa

Correspondence
Trishka Pillay, Department of Environmental Health, Mangosuthu University of Technology, 511 Mangosuthu Hwy, Umlazi 4031, KwaZulu-Natal, South Africa.
Email: govender.trishka@mut.ac.za

Funding information
Mangosuthu University of Technology; Durban University of Technology

Abstract

Socioeconomic determinants of risky sexual behaviors in sub-Saharan Africa are well known. The socioeconomic determinants of the sexual behaviors of university students, however, remain unclear. This case control study aimed to investigate the socioeconomic determinants of risky sexual behavior and HIV seropositivity among university students in KwaZulu-Natal (KZN), South Africa. Participants (N = 500; 375 HIV uninfected and 125 HIV infected) from four public higher educational institutions in KZN were recruited, using a non-randomized strategy. Socioeconomic status was assessed by food insecurity, access to the government loan scheme, and sharing of the bursary/loan with family. The findings of this study suggest that students reporting food insecurity were 1.87 times more likely to have multiple sexual partners; 3.18 times more likely to engage in transactional sex for money; and presented a fivefold higher risk of engaging in transactional sex for basic needs other than money. Accessing the government financing for education and sharing of the bursary/loan with family was also significantly associated with an increased risk of having an HIV seropositive status. A significant association between socioeconomic measures, risky sexual behavior, and HIV seropositivity is demonstrated in this study. Moreover, the socioeconomic risks and drivers when determining and/or developing HIV prevention interventions, including preexposure prophylaxis use, should be considered by healthcare providers based at campus health clinics.

KEYWORDS
food insecurity, HIV/AIDS, risky sexual behavior, socioeconomics, university students

1 | INTRODUCTION

HIV/AIDS is the eighth leading cause of mortality among adolescents worldwide with a third of new HIV infections reported among youth aged 15–25 years (Ajayi & Somefun, 2019; Macqueen, 2017; Slogrove & Sohn, 2018). In sub-Saharan Africa, 89% of adolescents are living with HIV (Unicef, 2021). Moreover, 88,400 new infections were reported among 15–24 year olds in 2017, with females representing a threefold higher HIV infection rate than males (Simbayi et al., 2019). High infection rates may be attributed to poor socioeconomic status, consequently increasing vulnerability to age-disparate sexual relationships and risky sexual behavior (RSB)

This is an open access article under the terms of the Creative Commons Attribution-NonCommercial-NoDerivs License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.
© 2023 The Authors. *Research in Nursing & Health* published by Wiley Periodicals LLC.

engagements like transactional sex (Ajayi & Somefun, 2019; Leclerc-Madlala, 2008).

Engaging in RSB is a major risk factor for HIV infection among youth (Choudhry et al., 2015; Emeka-Nwabunnia et al., 2014; Milhausen et al., 2003). In Uganda, risk factors such as young men paying for sex and young women having three to five lifetime sexual partners, were significantly associated with an increased likelihood of testing HIV positive (Choudhry et al., 2015). Poverty and food insecurity are factors reported to predispose an individual to engage in RSBs such as transactional sex (Miller et al., 2011). In a Nigerian university population, RSBs including transactional sex, multiple partners, forced sex, and lower condom use, was reported to be higher among females as opposed to males (Emeka-Nwabunnia et al., 2014). Significant associations were demonstrated for each of these predictors, which consequently increased the risk of HIV seropositivity status in this cohort. Similarly, the incidence of HIV infection was increased for females from 13 to 20 years of age, who reported active participation in transactional sex, albeit in a rural population, especially if money and/or gifts were received on a weekly basis (Kilburn et al., 2018).

Interestingly, RSBs are reported among the food insecure, the homeless, women, young adults, and people living with HIV (Kilburn et al., 2018; Nagata et al., 2021; Vogenthaler et al., 2013; Weiser et al., 2007; Whittle et al., 2015). With few exceptions, the potential socioeconomic vulnerability of university students, particularly from low to middle income countries, appears to be overlooked (van den Berg & Raubenheimer, 2015; Dominguez-Whitehead, 2015; Munro, et al., 2013). South African university students represent a socio-economically vulnerable group that is predisposed to RSB engagement and may be associated with an increased risk of HIV acquisition (Blignaut et al., 2015; Mutinta et al., 2013; Ngidi et al., 2016). This study thus aimed to determine if socioeconomic factors (food insecurity, accessing of government student funding, and sharing of bursary/loan with family) were associated with RSBs among a university population located within the HIV epicenter. In addition, our investigation sought to ascertain whether these factors were determinants of HIV seropositivity within this cohort. Since KwaZulu-Natal (KZN), South Africa is the epicenter of HIV infection among individuals aged 15–49 years, higher educational institutions (HEIs) in KZN, South Africa were selected as study sites (CDC, 2014).

2 | METHODS

2.1 | Study design and setting

A case control approach was employed to recruit 500 students via convenience sampling, from four public HEIs in KZN. The study population included registered undergraduate and post-graduate students who were ≥18 years of age. The sample size was calculated based on 95% confidence, 5% margin of error, and an estimated power of 90%. Due to the low HIV seropositivity rate among university students, the ratio of 3:1 respondents was obtained with 375 controls (HIV seronegative students) and 125 cases (HIV seropositive students).

2.2 | Instrument/measurement

Data were collected in a private room at each of the respective campus health clinics between July 2019 and May 2021. Data regarding socioeconomics, food security, and sexual practices were collected using the study questionnaire. The study questionnaire was developed based on four previously validated study instruments and pilot tested using 10 participants to ensure validity and reliability (Hoque, 2011; Kharsany et al., 2015; Mehra et al., 2014; Munro et al., 2013). The questionnaire evaluated socioeconomic factors such as, student funding, bursary sharing, and food security status, as well as students' sexual behaviors. The variables accessing government student funding and bursary sharing were measured by binomial (yes/no) responses. Thirteen items relating to food security were scaled on a 5-point Likert scale and adopted from a previously published report by Munro et al. (2013). Categories were collated by classifying average scores between 0 and 1 as food secure, and scores between 2 and 4 as food insecure (Govender et al., 2022; Munro et al., 2013). Questions on sexual behaviors were adapted from Hoque (2011), Mehra et al. (2014), Kharsany et al. (2015), and categorized into binomial responses. Six variables were used to measure sexual behaviors, namely, inconsistent condom use (vaginal sex), inconsistent condom use (anal sex), multiple sexual partners, intergenerational sex (IGS), transactional sex for money, and transactional sex for basic needs other than money. Reliability of the questionnaire was measured using Cronbach's α, results yielded a scale reliability coefficient of 0.90.

2.3 | Statistical analysis

All data were analyzed using StataMP version 17 software. Participant characteristics were stratified by HIV status. The test statistic used in the bivariate analysis was the Pearson's χ^2 test. Adjusted binary logistic regression modeling was used to predict whether socioeconomic characteristics such as food security status, accessing of government student funding, and the sharing of study bursary/loan were possible determinants for engagement in RSBs and HIV seropositive status.

Four logistic regression models were created to investigate whether associations existed between the following variables: (1) food security status and RSBs, (2) accessing government student funding and RSBs, (3) bursary/loan sharing and RSBs, (4) socio-economic characteristics and HIV seropositive status. In models I, II, and III, the outcome variables were engagement in RSBs: inconsistent condom use (vaginal sex), inconsistent condom use (anal sex), multiple sexual partners, IGS, transactional sex for money, and transactional sex for basic needs other than money, whereas for model IV, the outcome variable was HIV status. Three socioeconomic

1098240x, 2023, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1002/nur.22328 by South African Medical Research, Wiley Online Library on [05/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

TABLE 1 Participant characteristics stratified by HIV status ($N = 500$).

	HIV negative ($N = 375$) n (%)	HIV positive ($N = 125$) n (%)	X^2	p
Age				<0.001*
Median (IQR)	22.0 (4.0)	24.0 (4.0)		
Age category ($n = 498$)			39.310	<0.001*
<20	67 (18.0)	7 (5.6)		
20–24	238 (63.8)	62 (49.6)		
>24	68 (18.2)	56 (44.8)		
Sex ($n = 498$)			27.132	<0.001*
Male	146 (39.0)	17 (13.7)		
Female	228 (61.0)	107 (86.3)		
Race ($n = 496$)				
African	371 (100.0)	125 (100.0)		
Level of study ($n = 498$)			0.072	0.789
Undergraduate	360 (96.3)	120 (96.8)		
Postgraduate	14 (3.7)	4 (3.2)		
Marital status ($n = 494$)			9.644	0.008*
Single	363 (98.1)	120 (96.8)		
Divorced	7 (1.9)	1 (0.8)		
Living with boyfriend	0 (0.0)	3 (2.4)		
Residence ($n = 499$)			0.464	0.496
University residence	343 (91.7)	117 (93.6)		
Nonuniversity residence	31 (8.3)	8 (6.4)		
Children ($n = 498$)			20.698	<0.001*
No	278 (74.5)	66 (52.8)		
Yes	95 (25.5)	59 (47.2)		
Study funding ($n = 496$)			2.214	0.137
Nonfinancial aid	90 (24.2)	22 (17.7)		
Financial aid	282 (75.8)	102 (82.3)		
Sharing bursary/loan with family ($n = 485$)			20.356	<0.001*
No	185 (50.8)	33 (27.3)		
Yes	179 (49.2)	88 (72.7)		
Part time work for food ($n = 222$)			0.072	0.788
No	69 (41.8)	25 (43.9)		
Yes	96 (58.2)	32 (56.1)		
Housing type ($n = 496$)			13.925	<0.001*
Informal	92 (24.7)	52 (42.3)		
Formal	281 (75.3)	71 (57.7)		
Vaginal sex ($n = 489$)			3.367	0.067
No	49 (13.4)	9 (7.3)		
Yes	316 (86.6)	115 (92.7)		
Anal sex ($n = 448$)			7.913	0.005*
No	310 (92.3)	93 (83.0)		
Yes	26 (7.7)	19 (17.0)		
Currently sexually active ($n = 472$)			0.093	0.761
No	87 (24.7)	28 (23.3)		
Yes	265 (75.3)	92 (76.7)		

Note: Pearson's χ^2 test was used for these bivariate analysis. *$p < 0.05$ was considered statistically significant.

variables, food security status, accessing government student funding, and sharing bursary/loan, were the independent variables for analysis in all four models. Logistic regression models I, II, and III were adjusted for sex, age category, food insecurity, and HIV status. Model IV was only adjusted for sex and age category. A 95% confidence interval (CI) was used for all models and a p value <0.05 was considered statistically significant.

3 | RESULTS

The participant characteristics stratified by HIV status are shown in Table 1. Of the total population, 60.2% ($n = 300$) were aged between 20 and 24 years and 67.3% were female. Of the HIV positive participants, 92% reported previous vaginal sex engagement, in comparison to 86.6% of HIV negative participants (Table 1). As expected, 75.6% ($n = 357$) of the total sample reported being currently sexually active, whereas 90% reported "never engaging in anal sex." Unsurprisingly, "never engaging in anal sex" was significantly associated with an HIV negative status ($X^2 = 7.913$, $p = 0.005$).

In 72.7% of HIV positive cases ($n = 121$), participants confirmed "sharing their bursary/loan with family" in comparison to 49.2% of controls, which was significantly associated with being HIV positive ($X^2 = 20.356$, $p < 0.001$). Notably, 58% of participants reported working part-time to purchase food, while "living in formal housing" was significantly associated with being HIV negative ($X^2 = 13.925$, $p < 0.001$).

Although bivariate analysis was done for all six RSBs, we chose to stratify socioeconomic characteristics by "multiple sexual partners" and "transactional sex for basic needs other than money" as well as by HIV status (see Table 2). Among the HIV positive students, being

1098240x, 2023, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1002/nur.22328 by South African Medical Research, Wiley Online Library on [05/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

TABLE 2 Sociodemographic factors stratified by risky sexual behaviors (multiple partners & transactional sex for basic needs).

Sociodemographic factors *n* (%)	Multiple partners								Transactional sex for basic needs other than money							
	HIV+				HIV−				HIV+				HIV−			
	No (*n* = 88)	Yes (*n* = 34)	X^2	*p*	No (*n* = 179)	Yes (*n* = 170)	X^2	*p*	No (*n* = 95)	Yes (*n* = 11)	X^2	*p*	No (*n* = 281)	Yes (*n* = 24)	X^2	*p*
Age				0.326				0.467				0.340				0.646
Median (IQR)	24.0 (5.0)	24.0 (5.0)			22.0 (4.0)	22.0 (4.0)			24.0 (6.0)	24.0 (4.0)			22.0 (4.0)	22.0 (2.0)		
Age category			1.034	0.596			0.237	0.888			1.498	0.473			4.184	0.123
<20	5 (5.7)	1 (2.9)			32 (17.9)	27 (16.1)			5 (5.3)	0 (0.0)			47 (16.8)	3 (13.0)		
20–24	41 (46.6)	19 (55.9)			114 (63.7)	108 (64.3)			44 (46.3)	7 (63.6)			177 (63.2)	19 (82.6)		
>24	42 (47.7)	14 (41.2)			33 (18.4)	33 (19.6)			46 (48.4)	4 (36.4)			56 (20.0)	1 (4.3)		
Sex			17.674	<0.001*			49.567	<0.001*			14.054	<0.001*			0.038	0.846
Male	5 (5.7)	12 (35.3)			38 (21.3)	99 (58.2)			7 (7.4)	5 (45.5)			111 (39.6)	10 (41.7)		
Female	82 (94.3)	22 (64.7)			140 (78.7)	71 (41.8)			87 (92.6)	6 (54.5)			169 (60.4)	14 (58.3)		
Part time work for food			0.580	0.446			0.013	0.909			1.068	0.301			0.064	0.801
No	18 (41.9)	7 (53.8)			31 (42.5)	36 (43.4)			19 (44.2)	4 (66.7)			54 (42.5)	6 (46.2)		
Yes	25 (58.1)	6 (46.2)			42 (57.5)	47 (56.6)			24 (55.8)	2 (33.3)			73 (57.5)	7 (53.8)		
Sharing bursary/loan with family			0.067	0.796			0.021	0.885			0.524	0.469			0.014	0.907
No	23 (27.1)	10 (29.4)			91 (51.7)	83 (50.9)			24 (26.1)	4 (36.4)			135 (49.1)	11 (47.8)		
Yes	62 (72.9)	24 (70.6)			85 (48.3)	80 (49.1)			68 (73.9)	7 (63.6)			140 (50.9)	12 (52.2)		
Housing type			1.854	0.173			1.71	0.191			1.282	0.257			2.562	0.109
Informal	41 (47.1)	11 (33.3)			47 (26.6)	35 (20.6)			42 (45.2)	3 (27.3)			64 (22.9)	9 (37.5)		
Formal	46 (52.9)	22 (66.7)			130 (73.4)	135 (79.4)			51 (54.8)	8 (72.7)			215 (77.1)	15 (62.5)		
Food security status			0.623	0.430			9.34	0.002*			3.689	0.055			13.281	<0.001*
Food secure	52 (61.2)	17 (53.1)			123 (72.4)	90 (56.3)			56 (61.5)	3 (30.0)			182 (68.2)	7 (30.4)		
Food insecure	33 (38.8)	15 (46.9)			47 (27.6)	70 (43.8)			35 (38.5)	7 (70.0)			85 (31.8)	16 (69.6)		
Children			3.223	0.073			1.821	0.177			0.791	0.374			1.439	0.230
No	41 (46.6)	22 (64.7)			136 (76.4)	119 (70.0)			47 (49.5)	7 (63.6)			206 (73.8)	15 (62.5)		
Yes	47 (53.4)	12 (35.3)			42 (23.6)	51 (30.0)			48 (50.5)	4 (36.4)			73 (26.2)	9 (37.5)		

Note: Pearson's χ^2 test was used for these bivariate analyses. *$p < 0.05$ was considered statistically significant.

10982402x, 2023, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1002/nur.22328 by South African Medical Research, Wiley Online Library on [05/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

female was significantly associated with not having multiple partners ($X^2 = 17.674$, $p < 0.001$). Among the HIV negative students, being male was associated with having multiple partners ($X^2 = 49.567$, $p < 0.001$). Moreover, a large proportion of participants in the HIV negative group reported working for food and having had multiple sex partners (47; 56.6%) as opposed to the HIV positive group (6; 46.2%). In the HIV negative group, being food secure was also associated with having multiple partners ($X^2 = 9.34$, $p = 0.002$), whereas being food insecure was associated with having transactional sex to meet basic needs other than money ($X^2 = 13.281$, $p < 0.001$). In the HIV positive group, being female was associated with not having transactional sex to meet basic needs other than money ($X^2 = 14.054$, $p < 0.001$).

Adjusted logistic regression models for food security status and RSBs are presented in Table 3. Our results demonstrate that respondents who were food insecure were at an increased risk of engagement in RSBs. Participants who reported being food insecure were 1.87 times more likely to have multiple sexual partners (aOR: 1.87 [95% CI: 1.21–2.89], $p = 0.005$). Concomitantly, being food insecure increased the risk of engaging in transactional sex for money by 3.18 times (aOR: 3.18 [95% CI: 1.44–7.05], $p = 0.004$) and transactional sex for basic needs other than money by 5.11 times (aOR: 5.11 [95% CI: 2.29–11.38], $p = 0.000$).

Adjusted logistic regression modeling for government student funding, sharing of bursary and RSBs is shown in Table 4. Accessing the National Student Financial Aid Scheme (NSFAS) reduced the likelihood of engaging in transactional sex for money by 59% (aOR: 0.41 [95% CI: 0.17–0.97], $p = 0.041$). There were no associations between sharing of bursary/loan and RSBs.

The adjusted logistic regression analyses for socioeconomics and HIV status is presented in Table 5. Participants reliant on government student funding were 1.92 times more likely to be HIV positive compared to those who were independent (aOR: 1.92 [95% CI: 1.10–3.38], $p = 0.023$). Notably, those who shared their bursary were at a twofold increased risk of being HIV positive (aOR: 2.17 [95% CI: 1.34–3.49], $p = 0.002$).

4 | DISCUSSION

Our findings confirm a significant association between food insecurity and the likelihood of participants engaging in various RSBs (multiple sexual partners, transactional sex for money, and transactional sex for basic needs other than money) in KZN, South Africa. The study also demonstrates that participants who accessed government student funding (NSFAS) and shared the bursary/loan with family, were more likely to be HIV seropositive. Conversely, those who accessed the NSFAS were at a lower risk of engaging in transactional sex for money. Our data also suggests that food insecurity is associated with the likelihood of South African university students engaging in RSBs, and is corroborated by similar studies evaluating food insecurity and RSB engagement in other vulnerable

TABLE 3 Model 1 adjusted logistic regression models for food security status and risky sexual behaviors, ($N = 500$).

Characteristic	Controls *n* (%)	Cases *n* (%)	Inconsistent condom usage (vaginal sex)	Multiple sexual partners	Intergenerational sex	Transactional sex for money	Transactional sex for basic needs other than money
			aOR (95% CI)	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)
Food secure (REF)	230 (76.2)	72 (23.8)	1.00[1a]	1.00[1b]	1.00[1c]	1.00[1d]	1.00[1e]
Food insecure	126 (72.4)	48 (27.6)	1.38 (0.81–2.35)	1.87 (1.21–2.89)*	1.17 (0.70–1.97)	3.18 (1.44–7.05)*	5.11 (2.29–11.38)*

[1a,b,c,d,e]adjusted for sex, age category, and HIV status.

*$p < 0.05$ was considered statistically significant.

1098240x, 2023, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1002/nur.22328 by South African Medical Research, Wiley Online Library on [05/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

TABLE 4 Model 2 & 3 adjusted logistic regression models for government student funding, sharing of bursary, and risky sexual behaviors, ($N = 500$).

Characteristic	Controls *n* (%)	Cases *n* (%)	Inconsistent condom usage (vaginal sex)	Inconsistent condom usage (anal sex)	Multiple sexual partners	Intergenerational sex	Transactional sex for money	Transactional sex for basic needs other than money
Model 2			aOR (95% CI)	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)	aOR (95% CI)
Private funding (REF)	90 (24.2)	22 (17.7)	1.00^{2a}	1.00^{2b}	1.00^{2c}	1.00^{2d}	1.00^{2e}	1.0^{2f}
Government funding (NSFAS)	282 (75.8)	102 (82.3)	1.11 (0.62–1.98)	0.76 (0.10–5.81)	0.86 (0.52–1.43)	1.13 (0.63–2.02)	0.41 (0.17–0.97)*	0.62 (0.25–1.52)
Model 3								
Not sharing bursary (REF)	185 (50.8)	33 (27.3)	1.00^{3a}	1.00^{3b}	1.00^{3c}	1.00^{3d}	1.00^{3e}	1.0^{3f}
Sharing bursary	179 (49.2)	88 (72.7)	0.98 (0.58–1.65)	0.64 (0.11–3.69)	0.94 (0.60–1.46)	0.98 (0.59–1.64)	0.50 (0.22–1.16)	0.71 (0.31–1.61)

Abbreviation: NSFAS, National Student Financial Aid Scheme.

[2a,b,d]adjusted for sex, age category, and HIV status.

[2c,e,f]adjusted for food insecurity, sex, age, and HIV status.

[3a,b,d]adjusted for sex, age category, and HIV status.

[3c and e]adjusted for food insecurity, sex, age category, and HIV status.

[3f]adjusted for sex, age category, and HIV status.

*$p < 0.05$ was considered statistically significant.

TABLE 5 Model 4 adjusted logistic regression models for socioeconomic factors and HIV status, ($N = 500$).

Characteristic	Controls *n* (%)	Cases *n* (%)	HIV positive status
			aOR (95% CI)
Food secure	230 (76.2)	72 (23.8)	1.00^{4a}
Food insecure	126 (72.4)	48 (27.6)	1.07 (0.67–1.70)
Private funding	90 (24.2)	22 (17.7)	1.00^{4b}
Government student funding (NSFAS)	282 (75.8)	102 (82.3)	1.92 (1.10–3.38)*
Not sharing bursary	185 (50.8)	33 (27.3)	1.00^{4c}
Sharing bursary	179 (49.2)	88 (72.7)	2.17 (1.34–3.49)*
No children	278 (74.5)	66 (52.8)	1.00^{4d}
Children	95 (25.5)	59 (47.2)	1.29 (0.78–2.13)

Abbreviation: NSFAS, National Student Financial Aid Scheme.

[4a,b,c,d]adjusted for sex, age category.

*$p < 0.05$ was considered statistically significant.

populations (Masa et al., 2019; Nagata et al., 2021; Smith et al., 2021; Vogenthaler et al., 2013).

In an earlier study conducted in KZN, 20.8% of the university sample ($n = 1083$) experienced food insecurity (Munro et al., 2013). The current investigation revealed that 36.6% of the respondents experienced food insecurity (sample $N = 500$), despite the study being conducted in the same province and among four HEIs. Furthermore, we demonstrated that 72.4% of HIV negative students were food insecure, in comparison to 27.6% of HIV positive students. Our findings also suggest that HIV negative students who are food insecure may be predisposed to RSB engagement to fulfill basic living needs, which consequently increases their susceptibility to HIV infection. However, being food secure in the HIV negative group was also significantly associated with having multiple partners ($p = 0.002$), indicative of possible reckless behaviors. The HIV positive group appears to exercise more caution regarding decisions that relate to their sexual behavior.

The food insecurity status of this study's population demonstrates an increase in risk of RSB engagement. This suggests that food insecure participants present a 3.18 times higher risk of engaging in transactional sex for money, and were five times more likely to engage in transactional sex for basic needs other than money when compared to those who were food secure. These findings correspond with earlier studies investigating food insecurity and the engagement in transactional sex in sub-Saharan Africa (Chop et al., 2017; Weiser et al., 2007). In Botswana and Swaziland, food insufficiency in women increased the risk of exchanging sex for money or resources by almost two times (AOR 1.84, 95% CI: 1.74–1.93) (Weiser et al., 2007). Additionally, a meta-analysis of studies investigating the sexual behaviors of women living with HIV, indicated that food insecurity was associated with increased sexual risk through transactional sex (Chop et al., 2017).

1098240x, 2023, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1002/nur.22328 by South African Medical Research, Wiley Online Library on [05/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

This study demonstrates that participants who were food insecure had a 1.87 times higher risk of having multiple sexual partners. Our findings concur with data from a study conducted in the United States, which reports a higher possibility of exchanging sex for money, along with multiple concurrent sexual partners among food insecure young women (Nagata et al., 2021). A study examining a similar population group in South Africa also found that young women in this context were in multiple concurrent relationships to obtain more financial and material resources (Mampane, 2018). It is also possible that participants in our study may have had multiple sexual partners to fulfill their economic/social needs and lifestyles. University students may engage in transactional sex to fulfill needs that are unrelated to basic survival. Masvawure (2010) suggests that university students engage in transactional sex to manage their modern lifestyles, consisting of trendy hairdos, fashionable clothes, and takeaway foods, as well as preference for "prestigious food" instead of regular campus meals. Risky sexual practices can negatively influence an individuals' ability to negotiate safer sexual practices thus increasing their vulnerability to HIV/STI infections and unwanted pregnancy (Chop et al., 2017; Mampane, 2018).

Munro et al. (2013) highlight that students who accessed NSFAS were significantly more vulnerable to food insecurity. In our study, 77.4% of respondents reported accessing NSFAS to fund their tertiary studies, of which 82.3% were HIV positive cases in comparison to 75.8% of the controls. This concurs with data from 557 college students in the United States, who reported that those receiving financial aid ($p = 0.011$) or who were financially independent ($p = 0.001$) were at a greater risk of food insecurity (Gaines et al., 2014). In South Africa, however, students are eligible for government student funding based on the financial background of the family, indicating that these students are socioeconomically disadvantaged and thus have limited financial support to supplement personal expenses associated with tertiary educational environments (Munro et al., 2013). A noteworthy characteristic of students funded in this study was that those who received the NSFAS funding had a 59% reduced risk of engagement in transactional sex for money. These findings suggest that the government educational funding provides stable financial support that can potentially reduce the risk of RSB engagement, namely, transactional sex for money.

Moreover, it is also possible that students from disadvantaged backgrounds lack familial financial support and may use portions of their NSFAS funds to support the family financially. In a recent Nigerian student population study, those who received adequate or moderate family financial support were more likely to abstain from sex (Ajayi & Okeke, 2019). Since our study depended on self-reports, the risk of underreporting and respondent bias is possible. It is likely that NSFAS-funded students may have engaged in transactional sex to support elaborate campus lifestyles and did not reveal their RSBs. Hence, some participants may have opted not to disclose sensitive data pertaining to sexual health, for fear of stigma. Engaging and/or participating in transactional sex may be disempowering to some and can limit their ability to negotiate safe sexual practices, which consequently increases the risk of HIV infection (Ajayi & Okeke, 2019).

Furthermore, 72.7% of cases reported sharing their bursary/loan with family in comparison with 49.2% of the control group. Overall, our findings suggest that accessing NSFAS increased the likelihood of HIV seropositivity by 1.92 times (OR: 1.92 [95% CI: 1.10–3.38], 0.023). Participants who accessed the NSFAS educational funding may have misused funding to purchase substances such as alcohol/drugs for usage before sex. Subsequently, substance intoxication may contribute to poor decision making regarding sexual behavior that is, having unprotected sex. This may increase the risk of HIV seropositivity among those receiving educational funding. Furthermore, those who shared their bursary/loan with family were at a twofold higher risk of being HIV positive (OR: 2.17 [95% CI: 1.34–3.49], 0.002). Sharing of the funds with the family is indicative of possible socioeconomic vulnerability and presents an added financial responsibility for the student. These findings indicate that socioeconomic vulnerabilities experienced by students may influence their participation in HIV transmission behaviors, which, in turn, can increase susceptibility to HIV seropositivity.

4.1 | Recommendations

Socioeconomic concerns specific to university environments are key considerations when designing HIV prevention interventions for use at universities in sub-Saharan Africa. The findings of this report suggest that several students are from socioeconomically disadvantaged backgrounds, consequently predisposing them to food insecurity and engagement in transactional sex to support and elevate their campus lifestyles. Engaging in RSBs compromises the welfare of students, as well as predisposes them to unwanted pregnancies and HIV/STI infection. This can adversely affect student productivity and university completion rates, which negatively influences the economy of the country. Clinical assessments of students for HIV prevention, such as preexposure prophylaxis, must take into consideration food security status, as this may be a possible determinant of RSB. HEIs must consider the implementation of interventions such as food banks and soup kitchens, to address food insecurity among their student bodies. However, interventions must be discreet to avoid social stigma and discrimination which may hinder socioeconomically disadvantaged students from accessing these resources. Future studies exploring the associations between student funding, food insecurity, and risky sexual practices, as well as the spending habits of NSFAS grant holders, is warranted.

4.2 | Strengths and limitations

The inclusion of all HEIs within KZN as sample sites and the use of a case control design are major strengths of this study. However, the use of self-reports, which predisposes the data to possible response bias, may be viewed as a limitation. Participants may have been dishonest regarding self-reporting of information pertaining to sensitive questions regarding sexual health.

1098240x, 2023, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1002/nur.22328 by South African Medical Research, Wiley Online Library on [05/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

5 | CONCLUSION

Our findings highlight significant associations between food insecurity and RSBs, as well as government student funding, sharing of the bursary with family, and HIV seropositivity among university students in KZN, South Africa. Front line campus healthcare workers are required to consider the socioeconomic risks that university students potentially face when determining customized HIV prevention services. Measures targeting the alleviation of food insecurity among university students are required to mitigate engagement in RSBs. Future studies are required to guide interventions that address socioeconomic factors and RSBs among university students and that will strengthen the efficiency of existing HIV prevention efforts among this vulnerable population group. Additionally, investigating these associations on a larger scale via longitudinal and national studies in South Africa and other sub-Saharan African countries heavily impacted by the HIV pandemic, will help understand the factors that underlie them.

AUTHOR CONTRIBUTIONS

Study conception and design: Trishka Pillay, Nalini Govender, and Poovendhree Reddy. *Data collection, interpretation of results and draft manuscript preparation*: Trishka Pillay. *Critical revision of manuscript*: Trishka Pillay, Nalini Govender, and Poovendhree Reddy. All authors reviewed the results and approved the final version of the manuscript.

ACKNOWLEDGMENTS

The authors acknowledge Mr Cornelious Nattey for his statistical support and Dr. Katie Bryant for her valuable comments during the development of the manuscript. This study was funded by the Mangosuthu University of Technology Capacity Development Grant and the Durban University of Technology Post Graduate Study Grant.

CONFLICT OF INTEREST STATEMENT

The authors declare no conflict of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author but cannot be used for purposes other than data confirmation. The data are not publicly available due to privacy or ethical restrictions.

ETHICS STATEMENT

Ethical approval was obtained from the Durban University of Technology Ethics Committee (IREC 005/19) and gatekeeper permission was granted by all four participating HEIs. All participants provided informed consent and confidentiality was maintained by using unique identification codes.

ORCID

Trishka Pillay https://orcid.org/0000-0002-0127-2249

PEER REVIEW

The peer review history for this article is available at https://www.webofscience.com/api/gateway/wos/peer-review/10.1002/nur.22328.

REFERENCES

Ajayi, A. I., & Okeke, S. R. (2019). Protective sexual behaviours among young adults in Nigeria: Influence of family support and living with both parents. *BMC Public Health*, *19*, 983.

Ajayi, A. I., & Somefun, O. D. (2019). Transactional sex among Nigerian university students: The role of family structure and family support. *PLoS One*, *14*(1), e0210349. https://doi.org/10.1371/journal.pone.0210349

Blignaut, R. J., Jacobs, J., & Vergnani, T. (2015). Trends in HIV risk behaviour of incoming first-year students at a South African university: 2007–2012. *SAHARA-J: Journal of Social Aspects of HIV/AIDS*, *12*(1), 39–50. https://doi.org/10.1080/17290376.2015.1086275

CDC. (2014). Study to determine effectiveness of HIV prevention and treatment launched. https://www.cdc.gov/globalhealth/countries/southafrica/stories/epicentre.htm#:~:text

Chop, E., Duggaraju, A., Malley, A., Burke, V., Caldas, S., Yeh, P. T., Narasimhan, M., Amin, A., & Kennedy, C. E. (2017). Food insecurity, sexual risk behavior, and adherence to antiretroviral therapy among women living with HIV: A systematic review. *Health Care for Women International*, *38*(9), 927–944. https://doi.org/10.1080/07399332.2017.1337774

Choudhry, V., Ambresin, A. E., Nyakato, V. N., & Agardh, A. (2015). Transactional sex and HIV risks—Evidence from a cross-sectional national survey among young people in Uganda. *Global Health Action*, *8*(1), 27249. https://doi.org/10.3402/gha.v8.27249

Dominguez-Whitehead, Y. (2015). Students' food acquisition struggles in the context of South Africa: The fundamentals of student development. *Journal of College Student Development*, *56*(3), 292–308. https://doi.org/10.1353/csd.2015.0022

Emeka-Nwabunnia, I., Ibeh, B. O., & Ogbulie, T. E. (2014). High HIV seroprevalence among students of institutions of higher education in Southeast Nigeria. *Asian Pacific Journal of Tropical Disease*, *4*(2), 159–165. https://doi.org/10.1016/S2222-1808(14)60334-0

Gaines, A., Robb, C. A., Knol, L. L., & Sickler, S. (2014). Examining the role of financial factors, resources and skills in predicting food security status among college students. *International Journal of Consumer Studies*, *38*, 374–384. https://doi.org/10.1111/ijcs.12110

Govender, T., Govender, N., & Reddy, P. (2022). Food insecurity and risky sexual behaviors among university students in KwaZulu-Natal, South Africa. *International Journal of Sexual Health*, *34*(4), 1–12. https://doi.org/10.1080/19317611.2022.2117257

Hoque, M. E. (2011). Sexual practices among male undergraduate students in KwaZulu-Natal, South Africa. *Southern African Journal of Epidemiology and Infection*, *26*(3), 157–160.

Kharsany, A. B., Cawood, C., Khanyile, D., Grobler, A., Mckinnon, L. R., Samsunder, N., Frohlich, J. A., Abdool Karim, Q., Puren, A., Welte, A., George, G., Govender, K., Toledo, C., Chipeta, Z., Zembe, L., Glenshaw, M. T., Madurai, L., M Deyde, V., & Bere, A. (2015). Strengthening HIV surveillance in the antiretroviral therapy era: Rationale and design of a longitudinal study to monitor HIV prevalence and incidence in the uMgungundlovu District, KwaZulu-Natal, South Africa. *BMC Public Health*, *15*, 1149.

Kilburn, K., Ranganathan, M., Stoner, M. C. D., Hughes, J. P., Macphail, C., Agyei, Y., Gómez-Olivé, F. X., Kahn, K., & Pettifor, A. (2018). Transactional sex and incident HIV infection in a cohort of young women from rural South Africa. *AIDS*, *32*, 1669–1677. https://doi.org/10.1097/QAD.0000000000001866

Leclerc-Madlala, S. (2008). Age-disparate and intergenerational sex in Southern Africa: The dynamics of hypervulnerability. *AIDS*, *22*(Suppl 4), S17–S25. https://doi.org/10.1097/01.aids.0000341774.86500.53

1098240x, 2023, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1002/nur.22328 by South African Medical Research, Wiley Online Library on [05/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

Macqueen, K. M. (2017). Young people, HIV, and life goals. *Journal of the International AIDS Society*, *20*(1), 22267. https://doi.org/10.7448/IAS.20.1.22267

Mampane, J. N. (2018). Exploring the "blesser and blessee" phenomenon: Young women, transactional sex, and HIV in Rural South Africa. *SAGE Open*, *8*(4), 215824401880634. https://doi.org/10.1177/2158244018806343

Masa, R., Graham, L., Khan, Z., Chowa, G., & Patel, L. (2019). Food insecurity, sexual risk taking, and sexual victimization in Ghanaian adolescents and young South African adults. *International Journal of Public Health*, *64*(2), 153–163. https://doi.org/10.1007/s00038-018-1155-x

Masvawure, T. (2010). "I just want to be flashy on campus": Female students and transactional sex at a university in Zimbabwe. *Culture, Health and Sexuality*, *12*(8), 857–870.

Mehra, D., Östergren, P. O., Ekman, B., & Agardh, A. (2014). Inconsistent condom use among Ugandan university students from a gender perspective: A cross-sectional study. *Global Health Action*, *7*(22942), 22942.

Milhausen, R. R., Crosby, R., Yarber, W. L., DiClemente, R. J., Wingood, G. M., & Ding, K. (2003). Rural and nonrural African American high school students and STD/HIV sexual-risk behaviors. *American Journal of Health Behavior*, *27*(4), 373–379. https://doi.org/10.5993/AJHB.27.4.9

Miller, C. L., Bangsberg, D. R., Tuller, D. M., Senkungu, J., Kawuma, A., Frongillo, E. A., & Weiser, S. D. (2011). Food insecurity and sexual risk in an HIV endemic community in Uganda. *AIDS and Behavior*, *15*, 1512–1519. https://doi.org/10.1007/s10461-010-9693-0

Munro, N., Quayle, M., Simpson, H., & Barnsley, S. (2013). Hunger for knowledge: Food insecurity among students at the University of KwaZulu-Natal. *Perspectives in Education*, *31*(4), 168–179. http://search.proquest.com/docview/1566311192?accountid=14116%5Cnhttp://ensor.lib.strath.ac.uk/sfxlcl41?url_ver=Z39.88-2004&rft_val_fmt=info:ofi/fmt:kev:mtx:journal&genre=article&sid=ProQ:ProQ:education&atitle=Hunger+for+knowledge:+Food+insecurity+among+

Mutinta, G., Govender, K., Gow, J., & George, G. (2013). An investigation on students' risky sexual behavior at KwaZulu-Natal University, Durban, South Africa. *American Journal of Sexuality Education*, *8*(3), 121–139. https://doi.org/10.1080/15546128.2013.828339

Nagata, J. M., Palar, K., Gooding, H. C., Garber, A. K., Tabler, J. L., Whittle, H. J., Bibbins-Domingo, K., & Weiser, S. D. (2021). Food insecurity, sexual risk, and substance use in young adults. *Journal of Adolescent Health*, *68*(1), 169–177. https://doi.org/10.1016/j.jadohealth.2020.05.038

Ngidi, N. D., Moyo, S., Zulu, T., Adam, J. K., & Krishna, S. B. N. (2016). Qualitative evaluation of selected social factors that impact sexual risk-taking behaviour among African students in Kwazulu-Natal, South Africa. *SAHARA-J: Journal of Social Aspects of HIV/AIDS*, *13*(1), 96–105. https://doi.org/10.1080/17290376.2016.1218792

Simbayi, L. C., Zuma, K., Zungu, N., Moyo, S., Marinda, E., Jooste, S., Mabaso, M., Ramlagan, S., North, A., van Zyl, J., Mohlabane, N., & Dietrich, C. N. I., SABSSM V, Team. (2019). *South African national HIV prevalence, incidence, behaviour and communication survey*, 2017. https://repository.hsrc.ac.za/handle/20.500.11910/15052

Slogrove, A. L., & Sohn, A. H. (2018). The global epidemiology of adolescents living with HIV: Time for more granular data to improve adolescent health outcomes. *Current Opinion in HIV and AIDS*, *13*(3), 170–178.

Smith, L., Ward, P. B., Vancampfort, D., López-Sánchez, G. F., Yang, L., Grabovac, I., Jacob, L., Pizzol, D., Veronese, N., Shin, J. I., Lee, J., McDermott, D. T., & Koyanagi, A. (2021). Food insecurity with hunger and sexual behavior among adolescents from 53 countries. *International Journal of Sexual Health*, *33*(1), 88–98. https://doi.org/10.1080/19317611.2020.1855287

Unicef. (2021). *HIV and AIDS in adolescents*. https://data.unicef.org/topic/hiv-aids/

van den Berg, L., & Raubenheimer, J. (2015). Food insecurity among students at the University of the Free State, South Africa. *South African Journal of Clinical Nutrition*, *28*(4), 160–169. https://doi.org/10.1080/16070658.2015.11734556

Vogenthaler, N. S., Kushel, M. B., Hadley, C., Frongillo, E. A., Riley, E. D., Bangsberg, D. R., & Weiser, S. D. (2013). Food insecurity and risky sexual behaviors among homeless and marginally housed HIV-infected individuals in San Francisco. *AIDS and Behavior*, *17*(5), 1688–1693. https://doi.org/10.1007/s10461-012-0355-2

Weiser, S. D., Leiter, K., Bangsberg, D. R., Butler, L. M., Percy-de Korte, F., Hlanze, Z., Phaladze, N., Iacopino, V., & Heisler, M. (2007). Food insufficiency is associated with high-risk sexual behaviour among women in Botswana and Swaziland. *PLoS One*, *4*(10), e260. https://doi.org/10.1371/journal.pmed.0040260

Whittle, H. J., Palar, K., Napoles, T., Hufstedler, L. L., Ching, I., Hecht, F. M., Frongillo, E. A., & Weiser, S. D. (2015). Experiences with food insecurity and risky sex among low-income people living with HIV/AIDS in a resource-rich setting. *Journal of the International AIDS Society*, *18*(1), 20293. https://doi.org/10.7448/IAS.18.1.20293

SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

How to cite this article: Pillay, T., Govender, N., & Reddy, P. (2023). Socioeconomic determinants of risky sexual behaviors and HIV seropositivity among university students in South Africa: A case control analysis. *Research in Nursing & Health*, *46*, 436–444. https://doi.org/10.1002/nur.22328

1098240x, 2023, 4, Downloaded from https://onlinelibrary.wiley.com/doi/10.1002/nur.22328 by South African Medical Research, Wiley Online Library on [05/10/2023]. See the Terms and Conditions (https://onlinelibrary.wiley.com/terms-and-conditions) on Wiley Online Library for rules of use; OA articles are governed by the applicable Creative Commons License

CHAPTER 6

This chapter investigates behavioural predictors of risky sexual practices among university students and encompasses the behavioural component of objective 1.

Manuscript 3: A case-control investigation of factors associated with risky sexual behaviours among South African university students

Manuscript under review.

Title

A case-control investigation of factors associated with risky sexual behaviours among South African university students

Authors and affiliations

Pillay Trishka[a]* (MHSc), Govender Nalini[b] (PhD), Reddy Poovendhree[c] (PhD)

[a]Department of Environmental Health, Faculty of Natural Sciences, Mangosuthu University of Technology, KwaZulu Natal, South Africa

[b]Department of Basic Medical Science, Faculty of Health Sciences, Durban University of Technology, KwaZulu Natal, South Africa

[c]Department of Community Health Studies, Faculty of Health Sciences, Durban University of Technology, KwaZulu Natal, South Africa

***For Correspondence:**

Ms Trishka Pillay

ORCID ID: 0000-0002-0127-2249

Email: govender.trishka@mut.ac.za

Phone: 031 907 7614

Word count: 6877

Title

A case-control investigation of factors associated with risky sexual behaviours among South African university students

Abstract

This study investigated risk factors associated with risky sexual behaviours and HIV seropositivity. Using a case-control methodology, we sampled 500 students (375 HIV uninfected and 125 HIV infected) from four universities in KwaZulu-Natal, South Africa the country's epicentre of HIV infection. Data showed that heavy episodic drinking [aOR: 2.73, (95% CI: 1.38; 5.44), $p = 0.004$], drugs before sex [aOR: 7.46, (95% CI: 2.11; 27.88), $p = 0.003$], and a higher number of lifetime sex partners increased students' likelihood of having multiple concurrent sex partners (2 to 5 lifetime partners) [aOR: 4.22, (95% CI: 1.69; 10.54), $p = 0.002$] and ≥ 6 lifetime partners [aOR: 16.36, (95% CI: 6.18; 43.28), $p < 0.001$]. Our investigation found that engagement in sex with multiple concurrent partners and inconsistent condom use was more prevalent among HIV uninfected than HIV infected participants. These findings indicate that South African universities should offer HIV prevention programs that inform students of how their participation in particular risky activities can result in them engaging in specific RSBs. Re-evaluation and strengthening of these prevention programs can ensure optimal efficiency in the battle against HIV infection.

Keywords

HIV, risk factors, risky sexual behaviour, university students, South Africa

Introduction

The global HIV prevalence data in 2021 confirmed that 38.4 million people were living with HIV, with a global HIV incidence of 1.5 million new cases (UNAIDS, 2022). South Africa (SA) remains the epicentre for HIV infection, with an HIV prevalence of 7.7 million (Nuh, 2021). The 2017 SA National HIV prevalence, incidence, behaviour and communication survey reported an overall HIV incidence of 231 100 new infections, with the highest incidence (88400 new infections) amongst youth aged 15 to 24 years (Simbayi et al., 2019). Females within this age category appeared to be disproportionately affected by HIV in comparison to males (66 200 vs 22 200) (Simbayi et al., 2019). In 2019, a 27.0% HIV prevalence was reported in the province of KwaZulu-Natal (KZN) (Kharsany et al*.,* 2019). Key drivers of this epidemic continue to include having multiple sexual partners, inconsistent condom usage, socioeconomic power imbalances, sexual violence, and substance abuse (Zuma et al., 2022). Economic factors viz., poverty were previously reported to influence women's participation in transactional sexual practices, affecting condom use negotiation and consequently increasing the risk of HIV infection (Whiteside, 2010). Several interventions viz., the scale-up of HIV treatment, youth focused interventions, and voluntary male medical circumcision, have been implemented thus far to counteract the rise in HIV infection (Nuh, 2021). Despite these interventions, the number of new HIV infections continues to be a major public health concern.

Previous research specifically undertaken amongst vulnerable populations examined how risky activities such as alcohol and drug usage result in engagement in risky sexual behaviours (RSBs) among young people (Guo et al., 2002), men having sex with men (MSM) (Pufall et al., 2018) and university students (Mthembu et al., 2019). University students worldwide are considered vulnerable to RSB such as having multiple sexual partners (Hoque, 2011), engaging in transactional sex (Masvawure, 2010) and intergenerational sex (HEAIDS, 2010), inconsistent condom use (Adam & Mutungi, 2007), and unprotected vaginal sex (Fierros-gonzalez & Brown, 2002; Brown & Vanable, 2007) predisposing them to HIV infection. An earlier study undertaken amongst students from 21 South African higher educational institutions (HEIs) reported an HIV prevalence of 3.4% [CI: 2.7% - 4.4%] (HEAIDS, 2010). Previous studies conducted in the sub-Saharan African context, indicate that students' susceptibility to RSBs stems from various behavioural and economic risk factors, including alcohol and drug use (Amare et al., 2019), peer pressure (Akintola et al., 2011) and a poor socio-economic background (Ajayi & Somefun, 2019). Despite several studies investigating risk factors associated with RSBs among South African university students (HEAIDS, 2010;

Mutinta, 2014; Hoffman et al., 2017), the HEAIDS 2010 study is the only published HIV prevalence and risk factor stratification by HIV status report applicable to the South African university population. In view of this, more studies are required to investigate university students' engagement in RSBs stratified by HIV status and the risk factors associated with HIV seropositivity as a means to develop effective HIV prevention programs. By developing an understanding of the extent to which students are currently engaging in RSBs, more targeted and evidence informed prevention programs can be developed to possibly curtail HIV incidence. It is important to understand and prevent students' susceptibility to HIV infection given that this population group, particularly in low and middle-income countries has an important role to play in leading and helping with the continued growth and development of their nations (Hoffman et al., 2017). The use of case-control study designs investigating HIV status as an outcome of risky behaviours amongst MSM (Oster et al., 2011), circumcised men (Ediau et al., 2015), and patients that accessed VCT services (Carlos et al., 2017) has generated potentially useful data that can influence management. Since there is limited availability of case-control data from the SA university context, this study investigated the behavioural risk factors associated with RSBs among HIV infected and uninfected students from four public sector universities in KZN.

Materials and Methods

Design, Participants and Data Collection

Ethics approval was received from the Institutional Research Ethics Committee, Durban University of Technology, SA (IREC 005/19) and institutional approvals from all participating study sites. A total of 500 students were recruited between July 2019 and May 2021 via convenience sampling methods from four public HEIs in KZN, SA. Of this sample 375 comprised the control group ('HIV seronegative students') and 125 were the cases ('HIV seropositive students'). All participants were registered students at participating HEIs and ≥ 18 years of age. The HIV status of participants was confirmed prior to participation in the study by voluntary counselling and testing. Additionally, participants with a seronegative HIV status presented a negative HIV test to confirm their status. All HIV seropositive participants who had initiated antiretroviral treatment were briefed on the study by the respective nurses, and interested participants were referred to the study. Interested individuals who met the inclusion criteria were directed to the onsite research assistant based at a private location within the university health clinics. Those willing to participate were required to complete the informed

consent form. Data was collected using a questionnaire with a unique identification number, thereby ensuring confidentiality.

Measures

The questionnaire included various variables adapted from previous validated questionnaires as follows: demographics including age category, sex and race, alcohol/ drug usage, heavy episodic drinking (Babor et al., 2001), sexual practices and engagement (Hoque, 2011), contraceptive use (Hoque, 2011; Hoque & Ghuman, 2012a; Hoque & Ghuman, 2012b), male medical circumcision (MMC) (Leadbeatter, 2012; Kharsany et al., 2015), sexually transmitted infection history, and peer influence (Bingenheimer et al., 2015).

Substance usage was assessed based on the following variables: alcohol use before sex in the past three months, drug use before sex in the past three months, and heavy episodic drinking. Heavy episodic drinking was evaluated by question 3 of the Alcohol Usage Disorders Identification Test (AUDIT) questionnaire, 'How often do you have 6 or more drinks on one occasion?' (Babor et al., 2001). The response 'never' was categorized as 'non-heavy episodic drinking' and 'monthly or less, 2 to 4 times a month, 2 to 3 times a week, and 4 or more times a week were categorized as 'heavy episodic drinking'. Sexual practices and engagement were evaluated by variables such as age of sexual debut, multiple concurrent sex partners, lifetime number of sex partners, and condom usage. Multiple concurrent sex partners was defined as having more than one sexual partner that overlap in time (Mutinta, 2014). Multiple concurrent sex partners were grouped into a binary 'yes/no' response. Lifetime number of sexual partners was categorized as: 1 partner, 2 to 5 partners, and ≥ 6 partners. Age of sexual debut was dichotomized into < 15 years and ≥ 15 years. Condom usage during vaginal sex was stratified into inconsistent and consistent usage. Reproductive health questions focused on use of contraceptives, type of contraceptives used, and reasons for not using contraceptives. The use of emergency contraception was also assessed.

Statistical analysis

Data was exported into a Microsoft Excel spreadsheet and analysed using Stata version 17 software. The chi-square test was used to evaluate participant characteristics and reproductive health characteristics stratified by HIV status. Participant characteristics were stratified by multiple concurrent sexual partners among both case and control groups. Adjusted logistic regression modelling was performed to assess the association of predictors with RSBs and HIV seropositivity. In model 1, risk factors and demographics were tested to ascertain if they were

determinants of RSBs. In the second model, risk factors and reproductive health characteristics were tested as possible predictors of HIV seropositivity. A confidence interval (CI) of 95% was used for all models and $p < 0.05$ was considered statistically significant.

Results

The participant characteristics stratified by HIV status is shown in Table 1. Of the 500 participants recruited, 32.7% were male and 67.3% were female; 60.2% comprised the 20 to 24 years age group; more than 75% were currently sexually active; 75.1% (244) reported no alcohol consumption and 91.1% (247) reported no drug usage before sex in the last three months (Table 1). Furthermore, 72.6% (143) of the HIV negative students reported engaging in heavy episodic drinking, and 10.1% (20) indicated drug use before sex; 5% (16) reported that the onset of sexual debut occurred at < 15 years; 48.7% (170) reported having sex with multiple concurrent sex partners; and 76.5% (195) indicated inconsistent condom usage. In contrast, the following statistics were reported by the HIV positive individuals: heavy episodic drinking [29; 53.7%]; drugs before sex [4; 5.6%]; early sexual debut [1; 0.9%]; sex with multiple concurrent partners [34; 27.9%]; and inconsistent condom usage [70; 68%]). Heavy episodic drinking was significantly associated with an HIV negative status ($p = 0.008$). Moreover, a later age of sexual debut (≥ 18 years) was significantly associated with HIV positive status ($p = 0.030$). Notably, not having multiple concurrent sex partners was also significantly associated with an HIV positive status ($p < 0.001$).

Table 1. Participant characteristics stratified by HIV status

Characteristics	HIV negative (N = 375)	HIV positive (N = 125)
Age**		
Median (Q1, Q3)	22.0 (20.0, 24.0)	24.0 (22.0, 26.0)
Age category (n=498)**		
<20	67 (18.0)	7 (5.6)
20-24	238 (63.8)	62 (49.6)
>24	68 (18.2)	56 (44.8)
Number of lifetime sexual partners**		
Median (Q1, Q3)	4.0 (2.0, 8.0)	3.0 (2.0, 5.0)
Sex (n=498)**		
Male	146 (39.0)	17 (13.7)
Female	228 (61.0)	107 (86.3)
Race (n=496)		
African	371 (100.0)	125 (100.0)
Alcohol before sex (past 3 months) (n=325)		

No	192 (73.0)	52 (83.9)
Yes	71 (27.0)	10 (16.1)
Heavy episodic drinking (n=251)*		
No	54 (27.4)	25 (46.3)
Yes	143 (72.6)	29 (53.7)
Drug before sex (past 3 months) (n=271)		
No	179 (89.9)	68 (94.4)
Yes	20 (10.1)	4 (5.6)
Currently sexually active (n=472)		
No	87 (24.7)	28 (23.3)
Yes	265 (75.3)	92 (76.7)
Age of sexual debut (n=437)*		
< 15 years	16(5)	1(0.9)
15 to 17 years	114(35.6)	33(28.2)
≥ 18 years	190(59.4)	83(70.9)
Inconsistent condom use (n=358)		
Consistent	60 (23.5)	33 (32.0)
Inconsistent	195 (76.5)	70 (68)
Multiple concurrent sex partners (n=471)**		
No	179 (51.3)	88 (72.1)
Yes	170 (48.7)	34 (27.9)

$p < 0.05$*, $p < 0.005$** was considered statistically significant

The behavioural risk factors stratified by multiple concurrent sexual partners are presented in Table 2. Being female was significantly associated with not having multiple concurrent sex partners among HIV positive participants ($p < 0.001$). Moreover, a significant association was noted between being male and having multiple concurrent sex partners among the HIV negative group ($p < 0.001$). Heavy episodic drinking was significantly associated with having multiple concurrent sex partners among HIV negative participants ($p = 0.029$). Furthermore, a later onset (older age) of sexual debut (≥ 18 years) was significantly associated with not having multiple concurrent sex partners among both groups ($p < 0.004$). Most students reported not being pressurized to engage in sex; among the cases, not being pressurized by peers was significantly associated with not having multiple concurrent sex partners ($p = 0.002$).

Table 2. Behavioural characteristics stratified by multiple concurrent sex partners among HIV infected and uninfected participants (N = 500)

	MULTIPLE PARTNERS HIV +		MULTIPLE PARTNERS HIV –	
	No (N = 88)	Yes (N = 34)	No (N =179)	Yes (N=170)
Age				
Median (Q1, Q3)	24.0 (22.0, 27.0)	24.0 (21.0, 26.0)	22.0 (20.0, 24.0)	22.0 (20.0, 24.0)
Sex				

Male	5 (5.7)	12 (35.3)**	38 (21.3)	99 (58.2)**
Female	82 (94.3)	22 (64.7)	140 (78.7)	71 (41.8)
Alcohol before sex (past 3 months)				
No	39 (88.6)	12 (70.6)	87 (77.7)	91 (66.9)
Yes	5 (11.4)	5 (29.4)	25 (22.3)	45 (33.1)
Heavy episodic drinking[1]				
No	18 (51.4)	6 (33.3)	29 (36.3)	24 (21.8)*
Yes	17 (48.6)	12 (66.7)	51 (63.7)	86 (78.2)
Drug before sex (past 3 months)				
No	54 (100.0)	14 (77.8)**	73 (96.1)	95 (84.8)*
Yes	0 (0.0)	4 (22.2)	3 (3.9)	17 (15.2)
Age of sexual debut				
<15	1 (1.2)	0 (0.0)**	0 (0.0)	16 (9.9)**
15-17	17 (20.2)	16 (51.6)	35 (23.2)	77 (47.5)
≥18	66 (78.6)	15 (48.4)	116 (76.8)	69 (42.6)
Peer pressure to have sex				
No	86 (97.7)	27 (81.8)**	152 (85.4)	133 (78.2)
Yes	2 (2.3)	6 (18.2)	26 (14.6)	37 (21.8)

$p < 0.05$* and < 0.005** was considered statistically significant. Definitions: [1.] 'Heavy Episodic drinking' is defined as: drinking 6 or more alcoholic drinks on one occasion (WHO, 2022)

Table 3 illustrates the reproductive health status of the study population. Of those who responded, 78% of participants reported use of contraceptives, and contraceptive usage was significantly associated with being HIV positive ($p < 0.001$). Of note, 61.3% (245) of the students reported condoms as the most common contraceptive measure. Approximately 60% of the participants confirmed contraceptive use during their most recent sexual encounter. Contraceptive use during the most recent sexual encounter was significantly associated with being HIV positive ($p < 0.001$). Usage of emergency contraception (EC) was reported by 54.9% of the sample, and the most reported reason was due to condom breakage [45% among controls versus 61% among cases]; this was significantly associated with being HIV positive ($p = 0.045$). Many male participants reported being medically circumcised at a health care facility; being circumcised was significantly associated with being an HIV negative male ($p = 0.009$). Not being diagnosed with an STI was significantly associated with HIV negative status ($p < 0.001$).

The adjusted logistic regression modelling for risk factors, demographics, and RSBs is shown in Table 4. Participants who used drugs prior to sex were 7.46 more times more likely to have multiple sex partners [aOR: 7.46, (95% CI: 2.00; 27.88), $p = 0.003$]. Heavy episodic drinking was significantly associated with a 2.73 times higher likelihood of having multiple sex partners [aOR: 2.73, (95% CI: 1.38; 5.44), $p = 0.004$]. An older age of sexual debut (≥ 15 years old)

was identified as a protective factor from having multiple sexual partners [aOR: 0.08, (95% CI: 0.01; 0.63), $p = 0.017$]. Respondents who had two to five lifetime sexual partners were 4.22 times more likely to have multiple sex partners [aOR: 4.22, (95% CI: 1.69; 10.54), $p = 0.002$]. Moreover, those who had ≥ 6 lifetime partners were at a 16.36 times higher risk of having multiple sex partners [aOR: 16.36, (95% CI: 6.18; 43.28), $p < 0.001$]. Male participants were at a 5.73 times higher risk of having multiple sex partners in comparison to female students [aOR: 5.73, (95% CI: 3.48; 9.44), $p < 0.001$]. Furthermore, males were 4.68 times more likely to have ≥ 2 lifetime sexual partners [aOR: 4.68, (95% CI: 1.92; 11.40), $p = 0.001$].

Table 3. Reproductive health characteristics stratified by HIV status

	HIV STATUS	
	HIV negative (N = 375)	HIV positive (N = 125)
Contraceptive usage (n=496)**		
No	99 (26.6)	8 (6.5)
Yes	273 (73.4)	116 (93.5)
Contraceptive type		
Condom (n=400)		
No	100 (35.7)	55 (45.8)
Yes	180 (64.3)	65 (54.2)
Injection (n=400)**		
No	197 (70.4)	66 (55.0)
Yes	83 (29.6)	54 (45.0)
Pills (n=400)		
No	245 (87.5)	110 (91.7)
Yes	35 (12.5)	10 (8.3)
Loop (n=400)*		
No	276 (98.6)	112 (93.3)
Yes	4 (1.4)	8 (6.7)
Hormonal patch (n=400)		
No	276 (98.6)	119 (99.2)
Yes	4 (1.4)	1 (0.8)
Natural methods (n=400)*		
No	256 (91.4)	117 (97.5)
Yes	24 (8.6)	3 (2.5)
Birth control implant (n=400)		
No	262 (93.6)	108 (90.0)
Yes	18 (6.4)	12 (10.0)
Other (n=397)		
No	276 (99.3)	116 (97.5)
Yes	2 (0.7)	3 (2.5)
Difficult to get contraceptives (n=194)		
No	142 (97.9)	46 (93.9)
Yes	3 (2.1)	3 (6.1)
Reasons for not using contraceptives		
Condoms reduce sexual satisfaction (n=194)		
No	93 (64.1)	38 (77.6)
Yes	52 (35.9)	11 (22.4)
For economic reasons (n=194)		
No	141 (97.2)	46 (93.9)

Yes	4 (2.8)	3 (6.1)
Partner did not want it (n=193)		
No	136 (94.4)	45 (91.8)
Yes	8 (5.6)	4 (8.2)
Knew nothing about contraception (n=194)		
No	142 (97.9)	46 (93.9)
Yes	3 (2.1)	3 (6.1)
In love with partner (n=194)*		
No	115 (79.3)	45 (91.8)
Yes	30 (20.7)	4 (8.2)
Fear of contraception causing sterility (n=194)		
No	110 (76.4)	42 (84.0)
Yes	34 (23.6)	8 (16.0)
Unavailability of contraception (n=193)		
No	131 (91.6)	48 (96.0)
Yes	12 (8.4)	2 (4.0)
Did not think of contraception at that time (n=194)		
No	129 (89.6)	42 (84.0)
Yes	15 (10.4)	8 (16.0)
Other (n=194)		
No	123 (86.0)	41 (80.4)
Yes	20 (14.0)	10 (19.6)
Contraceptive usage at last sex (n=465)**		
No	153 (44.3)	30 (25.0)
Yes	192 (55.7)	90 (75.0)
Did your partner use any form of contraception the last time you had sex? (n=456)**		
No	180 (53.4)	45 (37.8)
Yes	157 (46.6)	74 (62.2)
Emergency Contraception (EC)		
Have you or your partner ever used emergency contraception EC (n=481)		
No	154 (42.8)	63 (52.1)
Yes	206 (57.2)	58 (47.9)
Reasons for using emergency contraception (n=271)*		
Condom broke	95 (45.5)	38 (61.3)
I/ my partner forgot to take birth control pills at that time	14 (6.7)	2 (3.2)
We had so much to think about, we didn't even think about contraception	52 (24.9)	5 (8.1)
I normally take emergency contraception	25 (12.0)	8 (12.9)
My partner forced me to have sex	2 (1.0)	0 (0.0)
Other	21 (10.0)	9 (14.5)
Male Circumcision		
Circumcised (n=163)*		
No	26 (17.9)	8 (44.4)
Yes	119 (82.1)	10 (55.6)
If so, have you undergone medical circumcision in a clinic/ hospital (n=129)		
No	13 (10.9)	0 (0.0)
Yes	106 (89.1)	10 (100.0)

STI Diagnosis (n=498)**		
No	306 (81.8)	76 (61.3)
Yes	68 (18.2)	48 (38.7)

p < 0.05* and < 0.005** was considered statistically significant. Abbreviation: STI Sexually transmitted infection

Table 4. Model 1 Adjusted models for risk factors, demographics and risky sexual behaviour (N = 500)

Risk factors	Controls n (%)	Cases n (%)	Multiple concurrent sex partners	Inconsistent condom use
			AOR 95%CI	AOR 95%CI
Alcohol use before sex (past 3 months)				
No	192 (73)	52 (83.9)	1.00[1a]	1.00[1b]
Yes	71 (27)	10 (16.1)	1.58 [0.87; 2.86]	1.03 [0.53; 2.00]
Heavy episodic drinking				
No	54 (27.4)	25 (46.3)	1.00[2a]	1.00[2b]
Yes	143 (72.6)	29 (53.7)	2.73 [1.38; 5.44]**	0.60 [0.26; 1.38]
Drug use before sex (past 3 months)				
No	179 (89.9)	68 (94.4)	1.00[3a]	1.00[3b]
Yes	20 (10.1)	4 (5.6)	7.46 [2.00; 27.88]**	2.79 [0.61; 12.77]
Age of sexual debut				
< 15 years old	16 (5)	1 (0.9)	1.00[4a]	1.00[4b]
≥ 15 years old	304 (95)	116 (99.1)	0.08 [0.01; 0.63]*	0.23[0.03; 1.85]
Lifetime no. of sexual partners				
1	41(14)	13(11.7)	1.00[5a]	1.00[5b]
2 to 5	145(49.7)	76(68.5)	4.22[1.69; 10.54]**	0.94[0.39; 2.22]
≥ 6	106(36.3)	22(19.8)	16.36[6.18; 43.28]**	0.70[0.27;1.82]

Demographics	Controls n (%)	Cases n (%)	Multiple partners	Lifetime no of partners
			AOR 95%CI	AOR 95%CI
Sex				
Female	228 (61)	107 (86.3)	1.00 [6a]	1.00 [6b]
Male	146 (39)	17 (13.7)	5.73[3.48; 9.44]**	4.66[1.91; 11.36]**
Age category				
< 20 years	67 (18)	7 (5.6)	1.00 [7a]	1.00 [7b]
20 to 24 years	238 (63.8)	62 (49.6)	0.93[0.45; 1.93]	1.34[0.60; 2.99]
>24 years	68 (18.2)	56 (44.8)	1.52[0.62; 3.73]	2.01[0.74; 5.46]

p < 0.05* and < 0.005** was considered statistically significant. Adjusted for: 1a sex, food insecurity & HIV status; 1b sex & HIV status; 2a age category, sex, food security, HIV status; 2b age category, sex, HIV status; 3a,b sex & HIV status; 4a sex, food insecurity & HIV status; 4b sex & HIV status, 5a,b sex & HIV status; 6a adjusted for age category, age of sexual debut, food insecurity and HIV status; 6b adjusted for age category & HIV status; 7a adjusted for food insecurity, relationship status, alcohol before sex and HIV status; 7b adjusted for sex & HIV status

The adjusted logistic regression modelling for risk factors, reproductive health, and HIV seropositivity data is presented in Table 5. Participants who reported being diagnosed with an STI were at 2.46 times higher risk of HIV seropositivity [aOR: 2.46, (95% CI: 1.50; 4.03), $p < 0.001$]. The use of emergency contraception was protective against HIV seropositivity [aOR: 0.57, (95% CI: 0.36; 0.90), $p = 0.016$]. Furthermore, approximately 54.8% of participants reported having two to five lifetime partners and 31.8% had ≥ 6 lifetime partners. Inconsistent condom use was a protective factor against HIV seropositivity in this sample [aOR: 0.55, (95% CI: 0.31; 0.97), $p = 0.037$].

Table 5. Model 2 Adjusted models for risk factors, reproductive health and HIV seropositivity (N = 500)

Risk factors	Controls n (%)	Cases n (%)	HIV seropositivity
			AOR 95%CI
Alcohol use before sex (past 3 months)			
No	192 (73)	52 (83.9)	1.00[7a]
Yes	71 (27)	10 (16.1)	0.63[0.29; 1.37]
Drug use before sex (past 3 months)			
No	179 (89.9)	68 (94.4)	1.00[7b]
Yes	20 (10.1)	4 (5.6)	0.71[0.22; 2.33]
Lifetime no. of sexual partners			
1	41(14)	13(11.7)	1.00[7c]
2 to 5	145(49.7)	76(68.5)	1.62[0.79;3.32]
≥6	106(36.3)	22(19.8)	1.02[0.44;2.38]
Multiple partners			
No	179 (51.3)	88 (72.1)	1.00[7d]
Yes	170 (48.7)	34 (27.9)	0.64[0.38; 1.06]
Usage of emergency contraception			
No	154 (42.8)	63 (52.1)	1.00[7e]
Yes	206 (57.2)	58 (47.9)	0.57[0.36; 0.90]*
STI diagnosis			
No	306 (81.8)	76 (61.3)	1.00[7f]
Yes	68 (18.2)	48 (38.7)	2.46[1.50; 4.03]**
Inconsistent condom use (vaginal)			
Consistent	60 (23.5)	33 (32.0)	1.00[7g]
Inconsistent	195 (76.5)	70 (68)	0.55[0.31; 0.97]*

$p < 0.05$* and < 0.005** was considered statistically significant. Adjusted for 7a, b, c, d, e, f, g sex & age category.

Discussion

Our data suggest that high-risk activities, like substance use, are associated with engagement in RSBs among university students in KZN, SA. Heavy episodic drinking (HED) and drug usage were significantly associated with having multiple concurrent sexual partners. In contrast, a later age of sexual debut was protective against multiple concurrent sex partners. By using a case-control design, we found that a greater proportion of HIV negative participants engaged in these high-risk activities, predisposing them to RSBs, such as inconsistent condom use and having multiple concurrent sexual partners. University students who participate in high-risk activities are more likely to engage in RSBs, thereby predisposing themselves to an increased risk of HIV infection and unplanned pregnancy.

Notably, HED was more commonly reported among the HIV uninfected than HIV infected students (143; 72.6% vs 29; 53.7%). Our data contradicts findings from Ediau et al (2015), who reported that 60% of HIV infected individuals (n=21) consumed alcohol prior to sex in comparison to 40% of HIV uninfected individuals (14) (Ediau et al., 2015). Heavy episodic drinking is a concerning issue amongst SA university students, as 14% of 837 university students reported being engaged in HED (Nkoana et al., 2016). Almost 69% of all students in our study reported engaging in HED, which is alarming since these students were 2.73 times more likely to have multiple concurrent sex partners compared to those who did not binge drink. Furthermore, amongst the HIV negative participants, HED was significantly associated with having multiple concurrent sex partners ($p = 0.029$). Excessive alcohol consumption has been previously reported as a determinant of high-risk sexual behaviour among young people (Guo et al., 2002). This risky practice may negatively impact the consistent and effective usage of condoms amongst this cohort thus compromising HIV prevention methods (Mthembu et al., 2019). Our data suggests that HED may encourage student engagement in RSBs, (i.e., multiple concurrent sex partners), a practice that may potentially increase the risk of acquiring HIV amongst the HIV uninfected students. However, findings from the HEAIDS (2010) study revealed that students who reported being drunk once in the previous month were significantly less likely to be HIV positive (HEAIDS, 2010). The university environment creates a social and cultural atmosphere that is prone to peer pressure and consequent substance use and abuse (Tayob & Van Der Heever, 2014). Binge drinking together with sexual activities are reported as a source of recreation among university students thereby promoting casual sexual encounters (HEAIDS, 2010). Notwithstanding various HIV prevention efforts targeted at students

registered at HEIs, HIV uninfected students are continuing to engage in risky activities like HED, which may increase their HIV infection risk.

In our study, more controls (HIV negative) reported using drugs before sex in comparison to the cases (10.1% vs 5.6%). Those who used drugs prior to sex were at a 7.46 times higher risk of having multiple concurrent sex partners. However, this finding must be interpreted with caution since only 8% (24) of the sample reported using drugs before sex. Our low prevalence drug use data is consistent with findings from the HEAIDS study, which confirmed that only 1% of their cohort (i.e., student, administrative and service staff) reported the use of injectable drugs. Alcohol and drug usage are reported as significant predictors of RSBs viz., inconsistent condom use and multiple concurrent sexual partners (Ross et al., 2001; Jones et al., 2011; Choudhry et al., 2014; Amare et al., 2019). A meta-analysis study on substance use and sexual behaviour in Peru confirmed higher rates of substance use among the HIV positive populations compared to the general population (Massa & Rosen, 2012). Drug use has been associated with a higher prevalence of HIV seropositivity (Massa & Rosen, 2012), indicative that substance usage is an important predictor of RSBs. In contrast, there was no statistically significant association between usage of injectable drugs in the past month and HIV infection (HEAIDS, 2010). Substance usage, combined with peer pressure and new-found student independence, are reported as possible predictors for students engaging in RSBs (Tesfaye et al., 2014). A SA study conducted in 2012 amongst university students found that the likelihood of a student using drugs was 2.6 times higher in the sexually active group in comparison to sexually inactive students (Blignaut et al., 2015). Alcohol or drug use may impair students' decision-making processes, consequently limiting their ability to negotiate condom usage, which may increase their risk of HIV infection and unplanned pregnancy (Blignaut et al*.,* 2015). The HIV positive participants in our study appeared to be more cautious in their behaviour compared to the HIV negative participants. Despite the exposure to education and other HIV interventions, the HIV negative participants increased their risk of HIV infection as a result of substance usage and HED.

Our data confirm a similar sexual debut age for both controls and cases (≥ 15 years of age; 95% controls and 99.1% cases). Results found that a later age of sexual debut was significantly associated with a positive HIV status. This is contrary to previous reports (Bassols et al., 2010;

Wand & Ramjee, 2012), which indicate that an HIV positive status was significantly associated with earlier age of sexual debut. In our sample, the association between a later age of sexual debut and HIV seropositivity could be due to participants debuting sex with older HIV infected partners. The age of the sexual partner may be a risk factor for HIV infection independent of an individual's own age (Akullian et al., 2017). Moreover, having an older male partner or engaging in transactional sex with an HIV positive partner increases the risk of infection regardless of the age of sexual debut. In our study, those students who had a later age of sexual debut (≥ 15 years of age) were protected from having multiple concurrent sex partners [aOR: 0.08, (95% CI: 0.01; 0.63), $p = 0.017$]. Our finding corroborates that of Raj et al (2017), who concluded that for every year of delay in sexual debut, the risk of STI decreased by 17% [OR: 0.83, (95% CI: 0.74; 0.93), $p = 0.001$]. Additionally, an early age of sexual debut was previously reported as a risk factor for multiple concurrent sex partners (Mah, (2010), and may be associated with an increased risk for STI and HIV transmission (Manhart et al., 2002). In our study, a larger proportion of HIV infected students reported between 2 to 5 lifetime sex partners compared to HIV uninfected students, which contradicts findings from Carlos *et al* (2017). These researchers reported finding similarities regarding ≥ 2 lifetime sexual partners in both cases and controls (89.78% vs 83.51%) (Carlos et al., 2017). Our findings indicated that students who had more than 6 lifetime sexual partners were more likely to have multiple concurrent sex partners than those who had a single lifetime partner. These findings corroborate those of Mah, (2010), who reported that individuals with ≥ 5 lifetime partners were more likely to report having concurrent sexual partners compared to those with 1 to 3 lifetime partners. Kogan et al. (2015) suggested that amongst young African American men, having multiple concurrent sex partners was significantly associated with other RSBs such as inconsistent condom use and self-reported STIs. These findings imply that having more than one lifetime partner increases the risk of RSB engagement and an early sexual debut directly influences the number of future sexual partners, which may perpetuate the spread of HIV infection.

Our findings highlight condom use as a preferred contraceptive method (61.3%), even though 74% of participants reported inconsistently using condoms during sexual activity. These findings are consistent with data from Turkey, (Bal Yilmaz et al., 2010) and Tanzania, (Sweya et al., 2016). Alarmingly, inconsistent condom use was higher amongst the HIV negative group compared to cases (controls 195; 76.5% vs cases 70; 68%). Similar data emerged from a case

control study among STI participants, which revealed a greater proportion of STI uninfected participants engaged in unprotected sex in comparison to STI infected participants (controls 91.1% vs cases 72.3%) (Raj et al*.,* 2017). Despite a higher prevalence of inconsistent condom use among controls than cases, 68% of HIV infected students reported inconsistent use of condoms, consequently increasing the risk of HIV infection amongst their sexual partners. Regular HIV voluntary counselling and testing (VCT) is thus recommended in HEIs, which increases the likelihood of early detection of HIV and prompt initiation of ARV treatment in affected students. Consequently, this will reduce viral loads to further prevent the transmission of HIV and optimize student health. Moreover, regular VCT is required for HIV negative students who are in serodiscordant relationships and timely initiation of Pre-exposure prophylaxis (PrEP) should be introduced to prevent infection.

Protection against HIV, STIs, and pregnancy are dependent on the effective and consistent usage of condoms (Simbayi et al., 2019). Interestingly, Mthembu et al. (2019) found that consistent condom use was practised among students who perceived themselves to be at an increased risk of unplanned pregnancies and HIV (Mthembu et al., 2019). In our study, 34% (63) of the respondents reported not using contraceptives such as condoms as they reduced sexual satisfaction. Only 26% reported consistent use of condoms during intercourse, with a greater proportion of cases reporting consistent condom use in comparison to the controls. This is suggestive that HIV positive participants were being more responsible with their sexual health in comparison to the HIV negative participants. These individuals may have wanted to protect themselves from STIs and unwanted pregnancy. Furthermore, HIV infected participants may have been more health conscious due to awareness of their status and opted to use condoms to protect their partner from HIV infection. Inconsistent use of condoms among SA youth may be attributed to various issues, including difficulties experienced when negotiating condom use with male partners, stable relationship status, alcohol use and/or abuse, and the perceived poor quality and/or dissatisfaction experienced with freely available condoms (Mthembu et al., 2019; Simbayi et al., 2019). Inconsistent condom use may unfortunately lead to STIs. In our study, the diagnosis of an STI increased the risk of HIV seropositivity by 2.46 times, a finding which is congruent with a previous report (Abdool Karim & Abdool Karim, 2010) which highlighted the increased probability of HIV infection among individuals with STIs. However, there is a possibility of other factors not evaluated in this study, such as perinatal infection, and

the use of contaminated needles during injectable drug usage, etc., which may have contributed to the HIV seropositivity. Future studies are required to further evaluate this association. Current condom promotion interventions need to be re-evaluated and improved to increase students' consistent condom usage. Considering the increased freedom and peer pressure experienced by first time entry university students, special education efforts should be targeted and tailored to their unique needs.

In sub-Saharan Africa, male medical circumcision (MMC) significantly reduces the risk of HIV infection in young men (Auvert et al., 2005; Gray et al., 2007). In our study, a high percentage of both the cases and controls reported undertaking medical circumcision in a clinical setting (89.1%; 106 controls vs 100%; 10 cases). In Uganda, only 8.4% of cases and 21.9% of controls were medically circumcised from a cohort of 155 HIV infected and 155 HIV uninfected circumcised men (Ediau et al*.,* 2015). Knowledge and awareness of the benefits of MMC is integral in uptake of this practice. Moreover, students who perceived that they were at high risk of HIV infection were 1.28 times more likely to be circumcised; however, understanding the effectiveness of MMC as an HIV prevention strategy positively increases its uptake (Mamo et al., 2018). In contrast, a Nigerian study revealed that only 38% (n= 144) of their student cohort were knowledgeable that MMC may reduce their risk of HIV infection (Iliyasu et al., 2012). Our data is indicative of an increased knowledge and awareness amongst students regarding the benefits associated with MMC in the prevention of HIV. Increased health promotion efforts on MMC among students can be beneficial in the uptake of these services.

Limitations and future research

A possible limitation of this study is the use of self-reported data collection tools, which could be subject to recall bias. Furthermore, all participants belonged to one racial group and most of the study participants were female. Future large-scale cohort studies are required to investigate exposures such as RSBs and HIV seropositivity among university students from enrolment to exit to determine causal associations.

Recommendations

Campus substance use prevention programmes are required to identify students at risk of HED and drug abuse to ensure interventions are better targeted to address the specified ways in which they are engaging in risky activities. For instance, in terms of education, our findings indicated that HIV uninfected students must be sensitized about how irresponsible drinking and drug use can lead to engagement in RSBs. In addition, in terms of prevention strategies, HIV uninfected students with elevated risk levels may benefit from use of PrEP to prevent HIV infection. Regarding age of sexual debut, the re-evaluation and strengthening of reproductive health education at a primary school level must be considered to encourage an older age of sexual debut, which has a potential to prevent an increase in the number of subsequent lifetime sexual partners. These efforts should provide education on delaying sexual debut as well as the importance of correct and consistent condom usage to prevent HIV and unwanted pregnancy. Programs strengthening condom use efficiency and consistency, as well as improving condom negotiation skills, must be strengthened for both HIV infected and uninfected students. Health promotion efforts on preventing HIV transmission should be intensified among HIV infected students. Additionally, health promotion must be strengthened on educating students about the benefits of MMC in HIV prevention to further improve uptake of services. The promotion of MMC among HIV uninfected students is necessary to help curb HIV infection among these students.

Conclusion

To our knowledge, the HEAIDS report is the only data available that investigated this association within this high-risk population. The HEAIDS findings are more than a decade old and thus we provide an update in the literature regarding the current behaviours of this vulnerable population, which may be used to inform HIV prevention interventions and policy makers. The findings from our study are novel, as they highlight HIV negative participants as a more vulnerable group to engage in risky activities and RSBs in comparison to HIV positive participants in HEIs. The data suggest that HIV infected students were more health conscious in comparison to the HIV uninfected students. Furthermore, this study investigated the association between risky activities and/or risky sexual behaviours and HIV seropositivity amongst a South African university population, who are considered high risk. Our findings suggest that HED and drug usage should be considered potential predictors of RSBs among a

SA university student population. Educational programs on prevention methods, such as the correct and consistent use of condoms, require strengthening; consequently, this will aid in preventing HIV infection and further transmission. Despite many HIV prevention programmes and health education efforts, students continue to engage in RSBs, particularly the HIV uninfected student population. University students should be identified as a vulnerable population and must be considered when developing interventional tools regarding substance use education and RSB programmes. This population requires guidance regarding the risks of engaging in risky activities such as HED and drug usage, and consequent predisposition to RSBs.

Disclosures

The authors report no conflicts of interest.

Acknowledgements

This study was funded by the Mangosuthu University of Technology University Capacity Development grant and the Durban University of Technology Post-graduate funding. The authors acknowledge Dr Katie Bryant for review of and valuable comments on the manuscript and Mr Cornelius Nattey for his support in data analysis.

References

Abdool Karim, S.S. & Abdool Karim, Q. (2010). *HIV/AIDS in South Africa* (Q. Abdool Karim, S.S. & Abdool Karim, Eds.; 2nd edn.). Cambridge.

Adam, M.B. & Mutungi, M. (2007). Sexual Risk Behavior Among Kenyan University Students. *Journal of Arizona-Nevada Academy of Science*, *39*(2), 91–98.

Ajayi, A.I. & Somefun, O.D. (2019). Transactional sex among Nigerian university students: The role of family structure and family support. *PLoS ONE*, *14*(1), 1–17. https://doi.org/10.1371/journal.pone.0210349

Akintola, O., Ngubane, L. & Makhaba, L. (2011). 'I did it for him, not for me': an exploratory study of factors influencing sexual debut among female university students in Durban, South Africa. *Journal of Health Psychology*, *17*(1), 143–153. https://doi.org/10.1177/1359105311410512

Akullian, A., Bershteyn, A., Klein, D., Vandormael A., Barnighausen, T. & Tanser, F. (2017). Sexual partnership age pairings and risk of HIV acquisition in rural South Africa. *AIDS*, *31*(12), 1755–1764. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5508850/

Amare, T., Yeneabat, T. & Amare, Y. (2019). A Systematic Review and Meta-Analysis of Epidemiology of Risky Sexual Behaviors in College and University Students in Ethiopia, 2018. *Journal of Environmental and Public Health*, *2019*. https://doi.org/10.1155/2019/4852130

Auvert, B., Taljaard, D., Lagarde, E., Sobngwi-Tambekou, J., Sitta, R. & Puren, A. (2005). Randomized, controlled intervention trial of male circumcision for reduction of HIV infection risk: The ANRS 1265 trial. *PLoS Medicine*, *2*(11), 1112–1122. https://doi.org/10.1371/journal.pmed.0020298

Babor, T.F., Higgins-Biddle, J.C., Saunders, J.B. & Monteiro, M.G. (2001). *AUDIT Alcohol Use Disorders Identification Test*. 2nd Edition. https://www.who.int/publications/i/item/audit-the-alcohol-use-disorders-identification-test-guidelines-for-use-in-primary-health-care

Bal Yilmaz, H., Kavlak, O. & Ünsal Atan, S. (2010). Sexual activity, knowledge and contraceptive usage by gender among university students in Turkey. *European Journal of Contraception and Reproductive Health Care*, *15*(6), 433–440. https://doi.org/10.3109/13625187.2010.515045

Bassols, A.M.S., de Boni, R. & Pechansky, F. (2010). Alcohol, drugs, and risky sexual behavior are related to HIV infection in female adolescents. *Rev. Bras. Psiquiatr*, *32*(4), 361–368.

Bingenheimer, J., Asante, E. & Ahiadeke, C. (2015). Peer Influences on Sexual Activity among Adolescents in Ghana. *Studies in Family Planning*, *46*(1), 1–19. https://doi.org/10.1111/j.1728-4465.2015.00012.x.Peer

Blignaut, R. J., Jacobs, J. & Vergnani, T. (2015). Trends in HIV risk behaviour of incoming first-year students at a South African university: 2007–2012. *Journal of Social Aspects of HIV/AIDS*, *12*(1), 39–50. https://doi.org/10.1080/17290376.2015.1086275

Brown, J.L. & Vanable, P.A. (2007). Alcohol use, partner type, and risky sexual behavior among college students: Findings from an event-level study. *Addictive Behaviors*, *32*(12), 2940–2952. https://doi.org/10.1016/j.addbeh.2007.06.011

Carlos, S., Burgo, C.L., Burgueño, E., Angel, M., Osorio, A., Ndarabu, A., Passabosc, C., Carlos, S., Burgo, C.L., Burgueño, E., Angel, M., Osorio, A., Ndarabu, A., Passabosc, C. & de Irala, J. (2017). Male condom use, multiple sexual partners and HIV: a prospective case-control study in Kinshasa. *AIDS Care*, *29*(6), 772–781. https://doi.org/10.1080/09540121.2016.1258450

Choudhry, V., Agardh, A., Stafstrom, M. & Ostergren, P. (2014). Patterns of alcohol consumption and risky sexual behavior: a cross-sectional study among Ugandan university students. *BMC Public Health*, *14*(128), 1–11.

Ediau, M., Matovu, J.K.B., Byaruhanga, R., Tumwesigye, N.M. & Wanyenze, R.K. (2015). Risk factors for HIV infection among circumcised men in Uganda: a case-control study. *Journal of the International AIDS Society*, *18*(1), 1–7. https://doi.org/10.7448/IAS.18.1.19312

Fierros-gonzalez, R. & Brown, J.M. (2002). High risk behaviors in a sample of Mexican-American college students. *Psychological Reports*, *90*, 117–130.

Gray, R.H., Kigozi, G., Serwadda, D., Makumbi, F., Watya, S., Nalugoda, F., Kiwanuka, N., Moulton, L.H., Chaudhary, M.A., Chen, M.Z., Sewankambo, N.K.., Wabwire-Mangen, F., Bacon, M.C., Williams, C.F., Opendi, P., Reynolds, S.J., Laeyendecker, O., Quinn, T.C. & Wawer, M.J. (2007). Male circumcision for HIV prevention in men in Rakai, Uganda: a randomised trial. *The Lancet*, *369*(9562), 657–666. https://doi.org/10.1016/S0140-6736(07)60313-4

Guo, J., Chung, I.J., Hill, K.G., Hawkins, J.D., Catalano, R.F. & Abbott, R.D. (2002). Developmental relationships between adolescent substance use and risky sexual behavior in young adulthood. *Journal of Adolescent Health*, *31*(4), 354–362. https://doi.org/10.1016/S1054-139X(02)00402-0

HEAIDS (2010). HIV prevalence and related factors: Higher Education Sector Study 2008-2009. In *Higher Education HIV and AIDs Programme (HEAIDS)*.

Hoffman, S., Levasseur, M., Mantell, J.E., Beksinska, M., Mabude, Z., Ngoloyi, C., Kelvin, E.A., Exner, T., Leu, C.S., Pillay, L. & Smit, J.A. (2017). Sexual and reproductive health risk behaviours among South African university students: results from a representative campus-

wide survey. *African Journal of AIDS Research*, *16*(1), 1–10. https://doi.org/10.2989/16085906.2016.1259171

Hoque, M.E. (2011). Sexual practices among male undergraduate students in KwaZulu-Natal, South Africa. *Southern African Journal of Epidemiology and Infection*, *26*(3), 157–160. https://doi.org/10.1080/10158782.2011.11441439

Hoque, M.E. & Ghuman, S. (2012a). Knowledge, Practices and Attitudes of Emergency Contraception among Female University Students in KwaZulu-Natal, South Africa. *PLoS ONE*, *7*(9), 1–7. https://doi.org/10.1371/journal.pone.0046346

Hoque, M. & Ghuman, S. (2012b). Contraceptive practices in the era of HIV/AIDS among university students in KwaZulu-Natal, South Africa. *Journal of Social Aspects of HIV/AIDS*, *9*(1), 15–19. https://doi.org/10.1080/17290376.2012.665254

Iliyasu, Z., Abubakar, I.S., Sani, I.H., Jibo, A.M., Karaye, I.M., Salihu, H.M. & Aliyu, M.H. (2012). Male Circumcision and HIV Risk Behavior among University Students in Northern Nigeria. *American Journal of Men's Health*, *7*(2), 94–101. https://doi.org/10.1177/1557988312456698

Jones, H.E., Browne, F.A., Myers, B.J., Carney, T., Ellerson, R.M., Kline, T.L., Poulton, W., Zule, W.A. & Wechsberg, W.M. (2011). Pregnant and Nonpregnant Women in Cape Town, South Africa: Drug Use, Sexual Behavior and the Need for Comprehensive Services. *International Journal of Pediatrics*, 1–8. https://doi.org/10.1155/2011/353410

Kharsany, A.B.M., Cawood, C., Khanyile, D., Grobler, A., McKinnon, L.R., Samsunder, N., Frohlich, J.A., Abdool Karim, Q., Puren, A., Welte, A., George, G., Govender, K., Toledo, C., Chipeta, Z., Zembe, L., Glenshaw, M.T., Madurai, L.M., Deyde, V. & Bere A. (2015). Strengthening HIV surveillance in the antiretroviral therapy era: rationale and design of a longitudinal study to monitor HIV prevalence and incidence in the uMgungundlovu District, KwaZulu-Natal, South Africa. *BMC Public Health*, *15*(1), 1–11. https://doi.org/10.1186/s12889-015-2179-2

Kharsany, A.B.M., Cawood, C., Lewis, L., Yende-Zuma, N., Khanyile, D., Puren, A., Madurai, S., Baxter, C., George, G., Govender, K., Beckett, S., Samsunder, N., Toledo, C., Ayalew, K. A., Diallo, K., Glenshaw, M., Herman-Roloff, A., Wilkinson, E., De Oliveira, T. & Abdool

Karim, Q. (2019). Trends in HIV Prevention, Treatment, and Incidence in a Hyperendemic Area of KwaZulu-Natal, South Africa. *JAMA Network Open*, *2*(11), 1–16. https://doi.org/10.1001/jamanetworkopen.2019.14378

Kogan, S.M., Cho, J., Barnum, S.C. & Brown, G.L. (2015). Correlates of concurrent sexual partnerships among young, rural African American Men. *Public Health Reports*, *130*, 392–399. https://doi.org/10.1177/003335491513000418

Leadbeatter, K. (2012). *Male circumcision, HIV and health*. 1–83.

Mah, T.L. (2010). Prevalence and correlates of concurrent sexual partnerships among young people in South Africa. *Sexually Transmitted Diseases*, *37*(2), 105–108. https://doi.org/10.1097/OLQ.0b013e3181bcdf75.Prevalence

Mamo, A., Tadesse, D., Abebe, L., Abera, M. & Asfaw, S. (2018). Assessment of willingness to uptake male circumcision and associated factors among male students in south-west Ethiopia. *MedCrave Online Journal of Public Health*, *7*(6), 358–364. https://doi.org/10.15406/mojph.2018.07.00268

Manhart, L.E., Aral, S.O., Holmes, K.K. & Foxman, B. (2002). Sex partner concurrency: measurement, prevalence, and correlates among urban 18-39-year-olds. *Sexually Transmitted Diseases*, *29*(3), 133–143. http://libproxy.wustl.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=11875374&site=ehost-live&scope=site

Massa, A. & Rosen, M. (2012). The Relationship between Substance Use and HIV Transmission in Peru. *Journal of Addiction Research & Therapy*, *3*(3), 1–25. https://doi.org/10.4172/scientificreports.300

Masvawure, T. (2010). 'I just need to be flashy on campus': female students and transactional sex at a university in Zimbabwe. *Culture, Health and Sexuality*, *12*(8), 857–870. https://doi.org/10.1080/13691050903471441

Mthembu, Z., Maharaj, P. & Rademeyer, S. (2019). "I am aware of the risks, I am not changing my behaviour": risky sexual behaviour of university students in a high-HIV context. *African Journal of AIDS Research*, *18*(3), 244–253. https://doi.org/10.2989/16085906.2019.1655075

Mutinta, G. (2014). Multiple Sexual Partnerships and their Underlying Risk Influences at the University of KwaZulu-Natal. *Journal of Human Ecology*, *46*(2).

Nkoana, S, Sodi, T. & Darikwa, T.B. (2016). Heavy episodic alcohol drinking among students from a rural South African university: correlates with personal-social variables. *Journal of Psychology in Africa*, *26*(4), 368–372. https://doi.org/10.1080/14330237.2016.1208949

Nuh, O, (2021). As HIV incidence declines in South Africa, new infections are concentrating in those over 25. https://www.aidsmap.com/news/sep-2021/hiv-incidence-declines-south-africa-new-infections-are-concentrating-those-over-25

Oster, A.M., Dorell, C.G., Mena, L.A., Thomas, P.E., Toledo, C.A. & Heffelfinger, J.D. (2011). HIV risk among young African American men who have sex with men: a case-control study in Mississippi. *American Journal of Public Health*, *101*(1), 137–143. https://doi.org/10.2105/AJPH.2009.185850

Pufall, E.L., Kall, M., Shahmanesh, M, Nardone, A., Gilson, R., Delpech, V. & Ward, H. (2018). Sexualized drug use ('chemsex') and high-risk sexual behaviours in HIV-positive men who have sex with men. *HIV Medicine*, *19*, 261–270. https://doi.org/10.1111/hiv.12574

Raj, R., Gupta, V., Pathak, M., Sreenivas, V., Sood, S., Singh, S., Verma, K.K., Khanna, N., Das, B.K. & Gupta, S. (2017). What puts them at risk? A cross-sectional case-control survey of demographic profile and sexual behavior of patients with sexually transmitted infections at a tertiary care center in North India. *Indian Journal of Sexually Transmitted Diseases*, *38*(1), 22–36. https://doi.org/10.4103/0253-7184.196885

Ross, M.W., Rosser, B.R.S., Bauer, G.R, Bockting, W.O., Robinson, B. "Bean" E, Rugg, D.L. & Coleman, E. (2001). Drug use, unsafe sexual behavior, and internalized homonegativity in men who have sex with men. *AIDS and Behavior*, *5*(1), 97–103. https://doi.org/10.1023/A:1009567707294

Simbayi, L.C., Zuma, K., Zungu, N., Moyo, S., Marinda, E., Jooste, S., Mabaso, M., Ramlagan, S., North, A., van Zyl, J., Mohlabane, N., Dietrich, C.N.I. & the SVT (2019). *South African National HIV Prevalence, Incidence, Behaviour and Communication Survey, 2017*. https://repository.hsrc.ac.za/handle/20.500.11910/15052

Sweya, M.N., Msuya, S.E., Johnson Mahande, M. & Manongi, R. (2016). Contraceptive knowledge, sexual behavior, and factors associated with contraceptive use among female undergraduate university students in Kilimanjaro region in Tanzania. *Adolescent Health, Medicine and Therapeutics*, *7*, 109–115. https://doi.org/10.2147/ahmt.s108531

Tayob, S.M. & Van Der Heever, H. (2014). Alcohol use among students at the University of Limpopo, South Africa. *African Journal for Physical, Health Education, Recreation & Dance*, *2*, 364–373.

Tesfaye, G., Derese, A. & Hambisa, M.T. (2014). Substance Use and Associated Factors among University Students in Ethiopia: A Cross-Sectional Study. *Journal of Addiction*, 1–8. https://doi.org/10.1155/2014/969837

UNAIDS 2022, *UNAIDS FACT SHEET 2022 Global HIV Statistics*. https://www.unaids.org/sites/default/files/media_asset/UNAIDS_FactSheet_en.pdf

Wand, H. & Ramjee, G. (2012). The relationship between age of coital debut and HIV seroprevalence among women in Durban, South Africa: a cohort study. *BMJ Open*, *2*(1), 1–9. https://doi.org/10.1136/bmjopen-2011-000285

Whiteside, A. (2010). The economic impact of AIDS. In Q Abdool Karim, SS and Abdool Karim (Eds.), HIV/ AIDS in South Africa (Second Edi, pp. 417–431). Cambridge University Press.

WHO (2022). *Alcohol, heavy episodic drinking (population) past 30 days*. https://www.who.int/data/gho/indicator-metadata-registry/imr-details/459#:~:text=Definition%3A,to 6 standard alcoholic drinks.

Zuma, K., Simbayi, L., Zungu, N., Moyo, S., Marinda, E., Jooste, S., North, A., Nadol, P., Aynalem, G., Igumbor, E., Dietrich, C., Sigida, S., Chibi, B., Makola, L., Kondlo, L., Porter, S. & Ramlagun, S. (2022). The HIV Epidemic in South Africa: Key findings from the 2017 National Population-Based Survey. *International Journal of Environmental Research and Public Health*, 19, 8125.

CHAPTER 7

This chapter embodies objective 2 of the study and focuses on the evaluation of South African university students' HIV/AIDS knowledge and sexual practices.

Manuscript 4: HIV knowledge and sexual behaviours amongst South African university students four decades later: Are we there yet?

Status: Manuscript under review.

Title: HIV knowledge and sexual behaviours amongst South African university students four decades later: Are we there yet?

Pillay, Trishka[a,c*] (MHSc), Govender, Nalini[b] (PhD), Reddy, Poovendhree[c] (PhD)

[a]Department of Environmental Health, Faculty of Natural Sciences, Mangosuthu University of Technology, KwaZulu Natal, South Africa

[b]Department of Basic Medical Science, Faculty of Health Sciences, Durban University of Technology, KwaZulu Natal, South Africa

[c]Department of Community Health Studies, Faculty of Health Sciences, Durban University of Technology, KwaZulu Natal, South Africa

***For Correspondence:**

Ms Trishka Pillay

ORCID ID: 0000-0002-0127-2249

Email: govender.trishka@mut.ac.za

Phone: 031 907 7614

Word count: 5454

Title: HIV knowledge and sexual behaviours amongst South African university students four decades later: Are we there yet?

Abstract

Despite the attempted efforts to improve HIV knowledge among university students, many continue to engage in risky sexual behaviors (RSBs), making this vulnerable group a key target population for prevention efforts. Several studies have investigated the association between HIV knowledge and RSBs among students; however, there is a paucity of case control data regarding HIV knowledge levels amongst HIV seropositive and seronegative university students and the association between knowledge and the risk of HIV seropositivity. Therefore, this case control study aimed to determine the association between levels of HIV knowledge, HIV status and engagement in RSBs among university students in KwaZulu-Natal (KZN), South Africa (SA). Convenience sampling was used to recruit 500 students (375 controls and 125 cases), from four public sector higher educational institutions (HEIs) in KZN. Respondents with poor knowledge regarding HIV prevention were 2.34 times more likely to be HIV positive. Our findings confirm that participants demonstrating poor knowledge about HIV transmission were 4.79 times more likely to be HIV positive. Both case and control groups displayed a better understanding regarding modes of transmission compared to prevention methods. Health education efforts strengthening students' knowledge about HIV prevention methods are therefore recommended in HEIs.

Keywords: Knowledge, HIV/AIDS, university students, risky sexual behaviour, South Africa

Introduction

In the year 1982, four decades ago, the human immunodeficiency virus (HIV) was first discovered in SA among homosexual men (Gilbert and Walker, 2002). Medical advances such as access to antiretroviral therapy (ART) has revolutionised the deadly HIV infection into a chronic and manageable illness and demonstrated success in preventing >95% of perinatal HIV transmission (Vreeman *et al.,* 2021). Despite public health advances, the HIV epidemic continues to be a public health concern, particularly in Africa (Choruma *et al.*, 2021). In South Africa (SA) the HIV prevalence was 7.5 million in 2019 (Avert, 2020), whilst in 2021, 19.5% of the 15-49 year age group were HIV positive (Statistics SA, 2021). There was an increase in

the total number of people living with HIV (PLWH) from 4.25 million in 2002 to 7.52 million by 2018. Furthermore, the HIV prevalence amongst young adults aged 15-24 was 5.5% in 2018 (Statistics SA, 2018), and this prevalence is expected to rise as a result of their engagement in risky sexual behaviors (RSBs) (Mthembu *et al.*, 2019). University students are a key HIV target population in this age group since the campus environment provides students with the freedom to engage in RSBs such as casual sex, age disparate relationships, multiple sexual partners, unprotected sex, and open sexual partnerships (Mthembu *et al.,* 2019; Mutinta *et al*., 2013; Shefer *et al*., 2012). The prevalence of HIV infection amongst university students may severely affect the country's socio-economic status since this population comprises our future leaders (Holmes, 2005; Shefer *et al*., 2012). Despite the considerable interventions and education efforts made by the SA government and other national and international organizations to reduce HIV infection among the youth, the incidence and prevalence of HIV in SA continues to escalate, and remains among the highest globally (Shefer *et al*., 2012). South Africa's national level Higher Health programme continues to engage with HEIs to reduce the prevalence of HIV infections and manage students living with HIV and Tuberculosis (TB) (Higher Health, 2021). The 'First Things First,' prevention campaign runs for three to five days every two months, and offers students access to voluntary HIV testing, counselling, and education (Higher Health, 2021). Students are also informed of various on-campus resources such as the clinic health services, peer educators, student counselling services, and educational pamphlets (HEAIDS, 2010; Raijmakers and Pretorious, 2006) which increase access to HIV educational information. However, the high levels of misconceptions regarding HIV transmissions reported by university students in universities in SA, Kenya, and Tanzania (Mwamwenda, 2015) are potential risk factors that predisposes them to a higher risk of HIV infection and stigmatization.

Knowledge on HIV/AIDS amongst university students is indispensable for facilitating safer sexual practices in this at-risk population (Murwira *et al*., 2021). However, the impact of HIV knowledge in overcoming the challenges associated with HIV/AIDS can only be recognized if it is applied (Kwigizile *et al.*, 2013). For instance, high HIV knowledge levels amongst university students do not necessarily translate into safer sexual practices (Mthembu *et al*., 2019; Raijmakers and Pretorious, 2006; Shefer *et al*., 2012). In the absence of a vaccine for HIV, empowering university students with adequate and accurate knowledge remains the backbone of prevention efforts in the country (Murwira *et al*., 2021). Several cross-sectional

studies have investigated HIV prevention knowledge amongst this vulnerable population, as well as the association between knowledge and RSBs (Kwigizile *et al.*, 2013; Fennie and Laas, 2014; Murwira *et al*., 2021; Raijmakers and Pretorius, 2006). To our knowledge, there is no published case control data that document the association between knowledge and RSBs stratified by HIV status. In view of the data paucity, this study investigated whether HIV knowledge is a determinant for RSBs and HIV status among cases (HIV positive) and controls (HIV negative) at four public sector higher educational institutions (HEIs)s in KZN, SA. It is anticipated that an evaluation of knowledge stratified by HIV status will present an opportunity to design relevant and targeted HIV/AIDS intervention strategies as well as educational initiatives that promote behavioural changes.

Materials and Methods

Study design and setting

This case control study was undertaken at four public HEIs in KZN, viz., three in the eThekwini district municipality and one in the uMhlathuze local municipality. Ethics approval was obtained from the Durban University of Technology's Institutional Ethics Committee (IREC 005/19). Gatekeeper permission was provided by the participating HEIs. All participating HEIs provided gatekeeper permission. Informed consent was obtained from all participants prior to participation, and their confidentiality was maintained using unique identification codes.

Study population and sampling

Registered undergraduate and post-graduate students ≥18 years of age were recruited by convenience sampling (N= 500) by the researcher and research assistant. The recruitment was assisted by Voluntary Counselling and Testing (VCT) counsellors at the respective campus clinics and followed a 3:1 ratio (i.e., 375 cases and 125 controls). Cases were defined as 'HIV seropositive students' and controls as 'HIV seronegative students'.

Data collection

Data was collected between July 2019 and May 2021 using structured pre-coded questionnaires that focused on students' sexual health behaviours and knowledge on HIV prevention and transmission. Before data collection, the questionnaire was pilot tested among ten students to ensure its validity and reliability as previously described (Govender *et al.*, 2022). The tool

included questions pertaining to their knowledge, which were adapted from the HIV Incidence Provincial Surveillance System (HIPPS) study protocol questionnaire (Kharsany *et al.*, 2015). Questions relating to RSBs were modified from previously reported studies [Hoque (2011), Mehra *et al*., (2014) and Kharsany *et al*., (2015)].

Data management and analysis

Data was entered into a Microsoft Excel spreadsheet and subsequently exported into STATA version 17 software. Two variables were created for prevention and transmission knowledge. For prevention knowledge, participants' correct responses were tallied with scores of "1 to 4" categorized as 'poor knowledge', and scores of "5 to 9" as 'good knowledge'. Regarding transmission knowledge, correct responses were tallied and scores of "1 to 2" were classified as 'poor knowledge' and "3 to 5" as 'good knowledge'. Demographic characteristics and data pertaining to knowledge were stratified by HIV status. The Pearson's chi-squared test was used in bivariate analysis. Adjusted binary logistic regression modelling was used to estimate whether knowledge was a possible determinant of HIV status and engagement in RSBs.

Two logistic regression models, viz., 1) Knowledge and HIV status, and 2) Knowledge and RSBs, were created to investigate if associations existed between the variables. In model I, the outcome variable was HIV status, whereas in model II, the outcome variables for RSBs were multiple concurrent sex partners and inconsistent condom usage for vaginal sex. HIV prevention and transmission knowledge were the independent variables for analysis in both models. Logistic regression models were adjusted for age and sex. A 95% confidence interval (CI) was used for all models and a p value < 0.05 was considered statistically significant.

Results

The characteristics of participants based on HIV status is shown in Table 1. Of the total population, 67.3% (n=335) were female and the majority (60.2%) were between the ages of 20-24 years. A greater proportion of females (86.3%) were HIV positive in comparison to 13.7% of males. Notably, 96.8% of students who were single were identified as HIV seropositive. The majority of the participants were undergraduate students and lived in the university residences.

Although the majority of our study population (75.3% controls and 76.7% cases) were sexually active, most participants reported not having multiple sex partners. For the cases, not having multiple sex partners was associated with an HIV positive status *($p < 0.001$)*. Notably, 48.7% of those in the control group reported having multiple partners. The majority (60.6% controls *vs* 62.5% cases) reported inconsistent use of condoms during vaginal sex, whilst inconsistent use of condoms during anal sex was reported in 40.4% of controls vs 48.4% of cases.

Table 1: Participant characteristics stratified by HIV status (N = 500)

Participant Characteristics	HIV negative (N = 375)	HIV positive (N = 125)
Age**		
Median (IQR)	22.0 (4.0)	24.0 (4.0)
Sex (n= 498)**		
Male	146 (39.0)	17 (13.7)
Female	228 (61.0)	107 (86.3)
Age category (n= 498)**		
<20	67 (18.0)	7 (5.6)
20-24	238 (63.8)	62 (49.6)
>24	68 (18.2)	56 (44.8)
Race (n= 496)		
African	371 (100.0)	125 (100.0)
Level of Study (n= 498)		
Undergraduate	360 (96.3)	120 (96.8)
Postgraduate	14 (3.7)	4 (3.2)
Marital status* (n= 494)		
Single	363 (98.1)	120 (96.8)
Divorced	7 (1.9)	1 (0.8)
Living with boyfriend	0 (0.0)	3 (2.4)
Residence (n= 499)		
University residence	343 (91.7)	117 (93.6)
Non-university residence	31 (8.3)	8 (6.4)
Any children (n= 498)**		
No	278 (74.5)	66 (52.8)
Yes	95 (25.5)	59 (47.2)
Currently sexually active (n= 472)		
No	87 (24.7)	28 (23.3)
Yes	265 (75.3)	92 (76.7)
Multiple sexual partners (n= 471)**		
No	179 (51.3)	88 (72.1)
Yes	170 (48.7)	34 (27.9)

Sex after alcohol consumption (past 3 months) (n= 326)		
No	192 (72.7)	52 (83.9)
Yes	71 (26.9)	10 (16.1)
Sex after drug usage (past 3 months) (n= 271)		
No	179 (89.9)	68 (94.4)
Yes	20 (10.1)	4 (5.6)
Frequency of condom usage during vaginal sex (n= 434)**		
Never	67 (20.8)	9 (8.0)
Inconsistent	195 (60.6)	70 (62.5)
Consistent	60 (18.6)	33 (29.5)
Frequency of condom usage during anal sex (n= 78)		
Never	24 (51.1)	12 (38.7)
Inconsistent	19 (40.4)	15 (48.4)
Consistent	4 (8.5)	4 (12.9)

Note. statistically significant $p < 0.05$*, <0.005**

Table 2 illustrates the knowledge of HIV prevention methods and modes of transmission. Regarding prevention knowledge levels, 68.8% of HIV positive participants reported poor knowledge in comparison to 49.6% who were HIV negative. Poor knowledge on prevention was significantly associated with being HIV positive ($p \leq 0.005$). A good knowledge regarding condom usage as a method of prevention was reported by both the HIV negative (n=359; 95.7%) and HIV positive participants (n=116; 92.8%) respectively. However, our data demonstrates a significant association between an HIV positive status and lower levels of knowledge with regard to having fewer sexual partners (12; 9.6%), not having sex before marriage (12; 9.6%), male circumcision (30; 24%), having one sexual partner (52; 41.6%), abstaining from sex (64; 51.2%) and avoiding contact with blood and/using gloves (65; 52%).

Regarding knowledge of HIV transmission, 40% of cases reported poor knowledge in comparison to 14.7% of controls. A 'good transmission knowledge' was significantly associated with an HIV negative status ($p \leq 0.005$). Notably, lower knowledge levels of the following modes of transmission were significantly associated with an HIV positive status: contaminated blood transfusion (controls 72.5% vs cases 47.2%), unprotected anal sex (71.1% vs 56%), sharing contaminated needles and razor blades (82.4% vs 53.6%), and unprotected vaginal sex (89.6% vs 68%). It was concerning that many participants from both study groups lacked accurate knowledge concerning modes of HIV transmission. For example, many

reported that mosquito bites, use of public toilets, and touching an HIV infected person contribute to viral transmission. However, a higher proportion of cases reported inaccuracies regarding the specific transmission modes than the control group.

Additionally, most participants reported limited knowledge regarding their perceived highest risk sexual practice. For instance, only 23.9% of controls and 24.6% of cases indicated that anal sex was the highest risk sexual practice. Instead, most students, (68.1% of controls and 73.7% cases), reported that vaginal sex was the highest risk sexual practice. However, 70.6% of controls and 78.6% of cases correctly reported that oral sex posed the lowest risk for HIV infection.

Table 2: HIV Knowledge among university students stratified by HIV status (N = 500)

Knowledge variables	**HIV negative (N = 375) n (%)**	**HIV positive (N = 125) n (%)**
Knowledge level on prevention**		
Good knowledge	189 (50.4)	39 (31.2)
Poor knowledge	186 (49.6)	86 (68.8)
Knowledge on prevention		
(Correct responses)		
Using Condom	359 (95.7)	116 (92.8)
Abstaining from sex**	282 (75.2)	64 (51.2)
Having one sexual partner**	221 (59.1)	52 (41.6)
Having fewer sexual partners*	64 (17.1)	12 (9.6)
Not having sex before marriage**	84 (22.4)	12 (9.6)
Avoid contact with blood/using gloves*	241 (64.4)	65 (52.0)
Using drugs to prevent transmission of HIV from mother to child	150 (40.0)	39 (31.2)
Male circumcision**	161 (42.9)	30 (24.0)
Taking ARVs within 72 hours of being exposed to the HIV virus	127 (33.9)	33 (26.4)
Knowledge level on transmission**		
Good knowledge	320 (85.3)	75 (60)
Poor knowledge		
Knowledge on transmission	55 (14.7)	50 (40)
(Correct responses)		
Transfer of virus from mother to child during delivery & breastfeeding	310 (82.9)	96 (76.8)
Contaminated blood transfusion**	271 (72.5)	59 (47.2)
Unprotected anal sex**	268 (71.7)	70 (56.0)

Sharing contaminated needles & razor blades**	308 (82.4)	67 (53.6)
Unprotected vaginal sex**	335 (89.6)	85 (68.0)
(Incorrect responses)		
Mosquito bites	340 (90.9)	118 (95.2)
Usage of public toilets	350 (93.6)	121 (96.8)
Touching an HIV infected person**	330 (88.2)	123 (98.4)
Risk of HIV Infections:		
Type of sex with highest risk for HIV infection		
Vaginal sex	231 (68.1)	84 (73.7)
Anal sex	81 (23.9)	28 (24.6)
Oral sex	27 (8.0)	2 (1.8)
Type of sex with lowest risk for HIV infection		
Vaginal sex	43 (12.3)	8 (6.8)
Anal sex	60 (17.1)	17 (14.5)
Oral sex	247 (70.6)	92 (78.6)
Can HIV infection be cured?		
No	331 (89.7)	102 (82.9)
Yes	38 (10.3)	21 (17.1)

Note. statistically significant p value < 0.05*, < 0.005**

Our data highlights a statistically significant association between prevention and transmission knowledge with HIV status. Respondents who had poor knowledge about prevention were at a 2.34 times higher risk of being HIV positive [aOR: 2.34 (95% CI 1.47-3.72), $p \leq 0.005$]. In contrast, those participants who had poor knowledge about transmission were 4.79 times more likely to be HIV positive [aOR: 4.79 (95% CI 2.84-8.08), $p \leq 0.005$]. (Table 3).

Table 3: Model 1: Adjusted associations between knowledge and HIV status for university students (N= 500)

HIV Knowledge	**HIV positive status [1]**	
	aOR [95% CI]	p-value
HIV Prevention knowledge		
Good Knowledge	1.00	
Poor Knowledge	2.34 (1.47-3.72)	< 0.005**
HIV Transmission knowledge		
Good Knowledge	1.00	
Poor Knowledge	4.79 (2.84-8.08)	< 0.005**

Note. statistically significant p < 0.05*, < 0.005**
Adjusted for: [1] adjusted for sex & age category

Table 4. demonstrates that students' poor knowledge about HIV prevention methods was associated with having multiple partners amongst the HIV positive group. HIV positive respondents with poor knowledge about prevention were 1.87 times more likely to have multiple partners [aOR: 1.87 (95% CI 0.69-5.03), $p = 0.212$]. Poor HIV transmission knowledge among cases was a protective factor for inconsistent condom usage during vaginal sex [aOR: 0.38 (95% CI 0.15-0.95), $p < 0.05$].

Table 4: Model 2: Adjusted associations between knowledge and risky sexual behaviours (N= 500).

HIV Knowledge	Multiple Partners (HIV +) [2a]		Multiple Partners (HIV -) [2b]		Condom usage (vaginal sex) (HIV+) [3a]		Condom usage (vaginal sex) (HIV-) [3b]	
	aOR [95% CI]	p-value	aOR [95% CI]	p-value	aOR [95% CI]	p-value	aOR [95% CI]	p-value
HIV Prevention								
Good Knowledge	1.00		1.00		1.00		1.00	
Poor Knowledge	1.87(0.69-5.03)	0.212	0.65(0.41-1.03)	0.067	0.70(0.29-1.69)	0.433	0.83(0.46-1.48)	0.524
HIV Transmission								
Good Knowledge	1.00		1.00		1.00		1.00	
Poor Knowledge	1.38(0.58-3.29)	0.47	0.99(0.52-1.89)	0.985	0.38(0.15-0.95)	< 0.05*	0.37(0.14-1.01)	0.052

Note. statistically significant $p < 0.05$*, < 0.005**

Adjusted for: 2a, 2b adjusted for age category & sex; 3a, 3b adjusted for sex

Discussion

Our results suggest that knowledge of HIV prevention and transmission may be a significant determinant of HIV status among university students. Respondents with poor knowledge of HIV prevention were 2.34 times more likely to be HIV positive. Participants who had poor knowledge about viral transmission were 4.79 times more likely to be HIV positive. Both case and control groups reported a better understanding of the modes of HIV transmission compared with prevention methods. However, both respondent groups had several misconceptions regarding HIV transmission methods which is serious considering the effort and interventions dedicated to HIV prevention over the past two decades. Our data also demonstrates that RSBs are a common practice among students despite many reporting having the required HIV prevention and transmission knowledge. Despite the considerable lapse of time since the initial discovery of HIV in SA more than 40 years ago, there are limited gains regarding HIV knowledge among university students. Consequently, this may lead to an increased HIV risk among the student population in SA.

Our findings suggest that poor knowledge on HIV prevention may elevate the risk of HIV infection more than 2-fold. Overall, the majority (54.4%) of all participants displayed limited knowledge about HIV prevention. A higher percentage of HIV positive participants (68.8%) reported poor knowledge on HIV prevention compared to the HIV negative participants (49.6%). Our findings contradict previous studies (Fennie & Laas, 2014; HEAIDS, 2014; Raijmakers & Pretorious, 2006) in which a high level of HIV knowledge was reported by many students from HEIs. Our data demonstrates that poor knowledge of HIV prevention was associated with a 2.34 times higher risk of being HIV positive [aOR = 2.34 (95% CI 1.47-3.72), $p \leq 0.005$] and concurs with Carlos *et al* (2015). These investigators from Congo demonstrate an association between poor HIV knowledge and HIV seropositivity (aOR = 2.79; 95% CI 1.43-5.45) amongst 15–49-year-old patients attending a primary outpatient centre *(Carlos et al*., 2015). This is concerning since both studies report limited knowledge on HIV prevention amongst the seropositive participants who may still be sexually active and vulnerable to engagement in HIV transmission behaviours. A pioneering SA HEAIDS (2010) study confirmed high levels of HIV knowledge amongst most students; however, knowledge regarding HIV transmission through breastfeeding and the availability of PEP in the case of rape was deficient (HEAIDS, 2010). Additional data from SA research conducted among 345 students demonstrates that only 42% reported adequate HIV knowledge levels (Murwira *et al.*, 2021). There is a possibility that strengthening students' HIV/AIDS knowledge levels may

assist in reducing participation in RSBs associated with HIV infection among this population (Murwira *et al*., 2021).

Our findings demonstrated limited awareness with respect to the engagement with fewer sexual partners, not participating in premarital sex, the use of drugs to prevent mother to child transmission, use of male circumcision, and post-exposure prophylaxis (PEP) as factors that can reduce and/or prevent HIV infections. Moreover, students involved in serodiscordant relationships may be unaware of preventative treatment modalities such as PEP and Pre-exposure prophylaxis (PrEP). Thus, empowering them with such knowledge will be instrumental in the fight against HIV infection and consequent engagement in RSBs.

Despite being knowledgeable regarding the methods of HIV prevention, many students continue to engage in RSBs. In our study, both case (92.8%) and control (95.7%) participants correctly reported condom usage as a method of HIV prevention. However, only 18.6% controls and 29.5% cases reported consistent use of condoms during vaginal sex. Similar findings were reported by Raijmakers & Pretorious, (2006) and Perera and Abeysena, (2018). In contrast, a Chinese study reported that students who reported having sufficient HIV/AIDS knowledge were more likely to use condoms (Du *et al*., 2021). This is contrary to our findings, which raises concerns regarding the multidimensional aspects of risk among university students. For instance, Perera & Abeysena (2018) suggest that risk perception contributes to HIV risk and that the failure to use protective measures may be due to low risk perception and not students' ignorance.

Our data highlights that 79% of the total sample reported having a good knowledge about HIV transmission, which was significantly associated with a HIV negative status. However, among the HIV positive respondents, a lower proportion of participants were aware of the transmission modes such as contaminated blood transfusion, unprotected anal sex, sharing contaminated razor blades, and unprotected vaginal sex. Consequently, this poor knowledge regarding viral transmission was significantly associated with 4.79 times higher risk of being HIV positive. Therefore, our results suggest that poor knowledge on HIV transmission may increase an individual's risk of HIV seropositivity. Furthermore, HIV positive students reported lower

knowledge levels on modes of transmission in comparison to those who were HIV negative. This may lead to an increase in RSB engagement among the cohort of HIV positive students.

A study among university students in Georgia confirmed students' awareness that HIV was an STI, and that receiving a contaminated blood transfusion and using unsterile injection needles predisposed them to an increased risk of HIV (Verulava *et al.*, 2018). However, several misconceptions regarding transmission knowledge were evident by responses such as 'HIV could be transmitted by infected household items, by air and mosquito bites' (Verulava *et al.*, 2018). Similarly, various misconceptions were observed amongst South African students regarding HIV prevention and transmission despite them having confirmed having some knowledge about HIV (Murwira *et al.*, 2021). For instance, students believed that 'eating healthy food could prevent HIV infection' or that 'HIV infection was caused by bacteria', which are indicative of misconceptions regarding HIV (Murwira *et al.*, 2021). In our study several misconceptions regarding the modes of HIV transmission (e.g., HIV could be transmitted via mosquito bites, public toilets, and touch) were noted. Our findings corroborate earlier studies (Murwira *et al*., 2021; Nkwonta & Harrison, 2021; and Vadivel *et al.,* 2021), which reiterated this challenge amongst university students. Moreover, inaccuracies regarding knowledge on the specific transmission modes were more evident amongst the HIV seropositive participants than the control group.

Most students in the control group (89.6%) identified unprotected vaginal sex as the most common mode of HIV transmission. However, disconcertingly, only a small proportion of respondents (23.9% of the controls vs 24.6% cases) agreed that anal sex is a high-risk practice for HIV infection. Furthermore, consistent condom use during anal sex was reported by only 8.5% of controls and 12.9% of cases, which is concerning as receptive anal intercourse is recognized as the highest risk sexual practice for HIV infection (Abdool Karim & Abdool Karim, 2010). HIV prevention messages targeting heterosexual female populations are usually focused on penile-vaginal intercourse rather than anal sex as a risk factor for HIV infection (Abdool Karim and Abdool Karim, 2010). It is therefore imperative that university students are made aware of this risk to empower them to recognize anal sex as an RSB.

Our data also confirms that students are aware that HIV is incurable; however, a small proportion (17.1% cases and 10.3% controls) reported otherwise, and this myth may predispose them to RSBs. Additionally, many were unaware of PEP, which may be attributed to a misconception that ARVs could only be used once an individual is infected with HIV and ignorance regarding the HIV preventative benefits provided by ARVs (Bor *et al.*, 2021). A recent investigation from a sexual health centre revealed that 55.6% of patients were unaware that PEP was an emergency treatment administered after risky intercourse (Duteil *et al*., 2021). Although our study population is considered well educated with adequate knowledge on HIV viral transmission, misconceptions in knowledge continue to exist. Urgent interventions are required to improve HIV knowledge among the vulnerable university student population in SA.

Conclusion

Our findings highlight the associations between HIV knowledge levels, RSBs and HIV seropositivity among university students. Overall, students displayed greater knowledge about HIV viral transmission but less knowledge on HIV prevention. Despite reporting high levels of transmission knowledge, students from both groups continue to engage in RSBs. Poor knowledge on both HIV prevention and transmission were associated with HIV seropositivity in our sample. Future large-scale longitudinal studies are needed to investigate this association to determine if a causal association exists. Programmes aimed at building skills to maintain healthy sexual relationships among this vulnerable population group are also necessary. Moreover, the university students' knowledge regarding HIV transmission and prevention strategies should be frequently monitored to identify possible knowledge gaps. HIV education efforts should include information pertaining to common misconceptions relating to HIV transmission such as risks associated with unprotected anal sex. Additionally, special emphasis must be placed on educating students on the benefits of ARV treatment for prevention (PrEP and PEP) to promote health advocacy. It is an assumption that many first-year university students are not sexually active upon enrolment and thus, a compulsory biannual 'survival skills' programme focusing on sexual health will benefit this vulnerable group in reducing their risk. The survival skills programme should focus on encouraging safe sexual health by empowering students with skills such as maintaining abstinence, condom negotiation and safer sexual practices. Future studies are required to determine the multidimensional facets of HIV risk among the university student population. In light of the SDG 3 target to eradicate AIDS

by 2030, 7 years ahead of the deadline, our analysis suggests that SA is not yet there. Despite enormous gains made towards decreasing AIDS related mortality, new HIV infections among the youth in SA continue to jeopardize halting HIV by the year 2030. Efforts towards strengthening HIV knowledge to prevent HIV infection among the university students in SA require urgent attention to enable significant gains towards eradicating AIDS globally by 2030.

Acknowledgements

The authors would like to thank Mr C. Nattey for his statistical support, Dr K. Bryant for review of and valuable comments on the manuscript and the participants for their kind participation in the study.

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

This work was supported by the Mangosuthu University of Technology Capacity Development Grant 2021, and the Post-graduate Research Grant from the Durban University of Technology.

Data availability statement

Data is not available due to ethical restrictions. Due to the nature of the sensitive areas covered in this research, data cannot be shared publicly. Deidentified data is available upon request but cannot be used for purposes other than data confirmation.

References

Abdool Karim, S.S. & Abdool Karim, Q. (2010) *HIV/AIDS in South Africa* (Abdool Karim, S.S. and Abdool Karim, Q (ed.); 2nd ed.). Cambridge.

Avert. (2020) *HIV and AIDS in South Africa*. Available at: https://www.avert.org/professionals/hiv-around-world/sub-saharan-africa/south-africa (Accessed: 19 July 2022).

Bor, J., Musakwa, N., Onoya, D. & Evans, D. (2021) 'Perceived efficacy of HIV treatment-as-prevention among university students in Johannesburg, South Africa', *Sexually*

Transmitted Infections, 97(8), pp.596–600. https://doi.org/10.1136/sextrans-2021-055031

Carlos, S., Ángel Martínez-González, M., Burgueño, E., Burgo, C.L., Del, Ruíz-Canela, M., Ndarabu, A., Tshilolo, L., Tshiswaka, P., Labarga, P. & De Irala, J. (2015) 'Misconceptions about HIV infection in Kinshasa (Democratic Republic of Congo): a case-control study on knowledge, attitudes and practices', *Sexually Transmitted Infections*, 91, pp.334–337. https://doi.org/10.1136/sextrans-2014-051734

Choruma, D. J., Choruma, S.D. & Pasirayi, R.M. (2021) 'Catch them young: Knowledge and awareness levels of HIV and AIDS transmission among high school students in Harare, Zimbabwe', *African Journal of AIDS Research*, 20(3), pp.224–231. https://doi.org/10.2989/16085906.2021.1979060

Du, X., Zhang, L., Luo, H., Rong, W., Meng, X., Yu, H. & Tan, X. (2021) 'Factors associated with risky sexual behaviours of HIV/STDs infection among university students in Henan, China: a cross-sectional study', *Reproductive Health*, 18(1), pp.1–11. https://doi.org/10.1186/s12978-021-01219-3

Duteil, C., de La Rochebrochard, E., Piron, P., Segouin, C. & Troude, P. (2021) 'What do patients consulting in a free sexual health center know about HIV transmission and post-exposure prophylaxis?', *BMC Public Health*, 21(1), pp.1–10. https://doi.org/10.1186/s12889-021-10547-9

Fennie, T. & Laas, A. (2014) 'HIV/AIDS-related Knowledge, Attitudes and Risky Sexual Behaviour among a Sample of South African University Students', *Gender & Behaviour*, 12(1), pp.6035–6044.

Gilbert, L. & Walker, L. (2002) 'HIV/AIDS in South Africa: an overview', *Cad. Saude publica*, 18(3), pp.651-660.

Govender, T., Govender, N. & Reddy, P. (2022) 'Food Insecurity and Risky Sexual Behaviours among University Students in KwaZulu-Natal, South Africa', *International Journal of Sexual Health*, pp.1–12.

HEAIDS (2010) HIV prevalence and related factors: Higher Education Sector Study South Africa 2008-2009. *HEAIDS*. Pretoria. Available at: https://www.dhet.gov.za/Reports

Doc Library/HEAIDS Sero Prevalence Sector Report.pdf

HEAIDS (2014) *HIV and AIDS related knowledge, attitudes and behaviours of students and staff at South African Technical and Vocational Education and Training colleges in South Africa , 2014* (Issue January). Available at: https://higherhealth.ac.za/wp-content/uploads/resources/publications/tvet_kab_abridged_version.pdf

Higher Health (2021) *Higher Health*. Available at: https://higherhealth.ac.za/about-us/who-we-are/(Accessed: 12 January 2020).

Holmes, C. (2005) *The Silence Around Them: AIDS NGOs, Scaling Up and AIDS Fatigue in University Students*. Available at: http://digitalcollections.sit.edu/isp_collection/403/ (Accessed: 12 May 2022).

Hoque, M.E. (2011) 'Sexual practices among male undergraduate students in KwaZulu-Natal, South Africa', *Southern African Journal of Epidemiology and Infection*, 26(3), pp.157–160. https://doi.org/10.1080/10158782.2011.11441439

Kharsany, A.B.M., Cawood, C., Khanyile, D., Grobler, A., McKinnon, L.R., Samsunder, N., Frohlich, J.A., Abdool Karim, Q., Puren, A., Welte, A., George, G., Govender, K., Toledo, C., Chipeta, Z., Zembe, L., Glenshaw, M.T., Madurai, L., M Deyde, V. & Bere, A. (2015) 'Strengthening HIV surveillance in the antiretroviral therapy era: Rationale and design of a longitudinal study to monitor HIV prevalence and incidence in the uMgungundlovu District, KwaZulu-Natal, South Africa', *BMC Public Health*, 15(1), pp.1–11. https://doi.org/10.1186/s12889-015-2179-2

Kwigizile, E., Shao, E., Mtango, G., Sonda, T., Moshi, J. & Chilongola, J. (2013) 'The gap between knowledge and practice of risky sexual behaviors for HIV among university students and staff in Moshi Town in Tanzania', *Journal of Public Health in Africa*, 4(1), pp.38–43. https://doi.org/10.4081/jphia.2013.e8

Mehra, D., Ostergren, P., Ekman, B. & Agardh, A. (2014) 'Inconsistent condom use among Ugandan university students from a gender perspective: a cross-sectional study', *Gender Health Action*, 7(22942): pp.1-10.

Mthembu, Z., Maharaj, P. & Rademeyer, S. (2019) ' "I am aware of the risks, I am not changing my behaviour": Risky sexual behaviour of university students in a high-HIV

context', *African Journal of AIDS Research*, 18(3), pp.244–253. https://doi.org/10.2989/16085906.2019.1655075

Murwira, T.S., Khoza, L.B., Mabunda, J.T., Maputle, S.M., Mpeta, M. & Nunu, W.N. (2021) 'Knowledge of Students regarding HIV/AIDS at a Rural University in South Africa', *The Open AIDS Journal*, 15(1), pp.42–51. https://doi.org/10.2174/1874613602115010042

Mutinta, G., Govender, K., Gow, J. & George, G. (2013) 'An exploratory study of the individual determinants of students' sexual risk behaviour at a South African University', *American Journal of Sexuality Education*, 8(3), pp.121–139. https://doi.org/10.2989/16085906.2012.754836

Mwamwenda, T. (2015) 'Myths and Misconceptions regarding global pandemic HIV/AIDS', *Life Science Journal*, 12(2s), pp.117–124. https://doi.org/10.1145/3132847.3132886

Nkwonta, C.A. & Harrison, S.E. (2021) 'HIV knowledge, risk perception, and testing behaviors among college students in South Carolina', *Journal of American College Health*, pp.1–8. https://doi.org/10.1080/07448481.2021.1891078

Perera, U.A.P. & Abeysena, C. (2018) 'Prevalence and associated factors of risky sexual behaviors among undergraduate students in state universities of Western Province in Sri Lanka: a descriptive cross-sectional study', *Reproductive Health*, 15(1), pp.1–11. https://doi.org/10.1186/s12978-018-0546-z

Raijmakers, L. & Pretorious, J. (2006) 'A snapshot: South African university students' attitudes, perceptions and knowledge of HIV/AIDS'. *SAJHE*, 20(2), pp.299–317.

Shefer, T., Strebel, A. & Jacobs, J. (2012) 'AIDS fatigue and university students' talk about HIV risk', *African Journal of AIDS Research*, 11(2), pp.113–121. https://doi.org/10.2989/16085906.2012.698078

Statistics SA (2018) *Statistics South Africa Mid-year population estimates 2018: Mid-year population estimates*. Pretoria. Available at: https://www.statssa.gov.za/publications/P0302/P03022018.pdf (Accessed: 12 April 2022).

Statistics SA (2021) *Mid-year population estimates 2021* (Issue July). Pretoria. Available at: http://www.statssa.gov.za/publications/P0302/P03022021.pdf (Accessed: 13 April

2022).

Vadivel, I., George, J., Nalliyappan, G., Thangadurai, M., Periyasamy, T. & Thukanayakanpalayam, Y.R. (2021) 'Knowledge and Attitude about HIV / AIDS among the Dental Students in Namakkal District', *University Journal of Medicine and Medical Specialities*, 7(4), pp.1-5.

Verulava, T., Kachkachishvili, I., Abulashvili, S., Chkhaidze, M., Khuroshvili, M. & Kiknadze, L. (2018) 'Students' Awareness, Knowledge and Behavior Regarding HIV / AIDS', *GMJ*, 29, pp.215–218.

Vreeman, R.C., Rakhmanina, N.Y., Nyandiko, W.M., Puthanakit, T. & Kantor, R. (2021) 'Are we there yet? 40 years of sucesses and challenges for children and adolescents living with HIV', *J Int AIDS Soc*, 24(6), e25759.

CHAPTER 8

This chapter embodies objective 3 of the study and provides details on the design of an evidence-based risk index tool to measure the HIV risk levels of university students.

Manuscript 5: Development of an HIV risk index for university students in South Africa

Status: Manuscript in preparation.

Development of an HIV risk index for university students in South Africa.

Pillay, Trishka[a, d*] (MHSc), Govender, Nalini[b] (PhD), Nattey, Cornelius[c] (MSc), Reddy, Poovendhree[d] (PhD)

[a]Department of Environmental Health, Faculty of Natural Sciences, Mangosuthu University of Technology, KwaZulu-Natal, South Africa

[b]Department of Basic Medical Science, Faculty of Health Sciences, Durban University of Technology, KwaZulu-Natal, South Africa

[c]Health Economics and Epidemiology Research Office, University of Witwatersrand, Gauteng, South Africa.

[d]Department of Community Health Studies, Faculty of Health Sciences, Durban University of Technology, KwaZulu-Natal, South Africa

***For Correspondence:**

Ms Trishka Pillay

ORCID ID: 0000-0002-0127-2249

Email: govender.trishka@mut.ac.za

Phone: 031 907 7614

Abstract

Introduction: Globally, university students are included within the high risk 15 to 24 age category and are identified as being an important group at risk for HIV infection.

Methods: A comprehensive risk index score was designed based on the findings emanating from a larger case control study conducted among 500 university students from four higher educational institutions (HEIs) in KwaZulu-Natal (KZN), South Africa (SA). The aim of this risk index score was to predict the risk of HIV infection based on the assessment of socio-economic, risky practices, sexual behaviour, student health and HIV knowledge predictors among university students in KZN.

Results: The variable selection for the risk index score was based on logistic regression modelling study data and data from available literature. The final risk index tool thus included 17 independent variables. All items' scores were summed to obtain a total score for each participant, resulting in a maximum score of 17 and a minimum of 0 based on scores allocated as either (1 or 0). The total scores were ranked and divided into 3 tertiles (1^{st} tertile =low risk, 2^{nd} tertile = moderate risk, and 3^{rd} tertile = high risk).

Conclusion: The risk index tool may be clinically useful in screening university students who may be at increased risk of HIV infection. Risk categorisation could advocate for pre-emptive HIV prevention interventions such as pre-exposure prophylaxis (PrEP) and counselling.

Introduction

Despite the target of sustainable development goal 3 to end the HIV epidemic by 2030 (Assefa and Gilks, 2020), there was a global incidence of 1.5 million new HIV infections during 2021 (UNAIDS, 2023). In sub-Saharan Africa, adolescent girls and young women aged 15 to 24 years are at a three-fold increased risk of HIV infection in contrast to their male counterparts (UNAIDS, 2022). The reduction observed in AIDS related mortality is on course; however, the rate of decline of new HIV infections is not in line with the trajectory needed to achieve the 2030 sustainable development goal target (Assefa & Gilks, 2020). South Africa reported an HIV Incidence of 231 100 new cases in 2017 (Simbayi *et al*., 2019) and 8.45 million people living with HIV (Statistics SA, 2022). In SA, the highest HIV incidence of 88 400 new infections was reported in 2017 amongst youth aged 15 to 24 years (Simbayi *et al*., 2019). University students contribute to this at-risk age category as campus lifestyle and independence increases their vulnerability to RSBs and consequent HIV infection (Akintola, Ngubane and Makhaba, 2011).

The high HIV incidence in sub-Saharan Africa may be attributed to poverty, famine, resistance to sexual behaviour change, high prevalence of sexually transmitted infections, and ignorance of an individual's HIV status (Nyindo, 2005). The 2017 South African National HIV Prevalence survey confirmed early sexual debut, age disparate relationships, multiple sexual partnerships, and inconsistent condom usage as major predictors of HIV infection among young people (Simbayi *et al*., 2019). Poverty and food insecurity also increase the risk of engaging in RSBs such as transactional sex (Miller *et al*., 2011; Pillay, Govender & Reddy, 2023a). Our recent findings demonstrated food insecurity as a significant determinant of student engagement in RSBs such as multiple concurrent sex partners, and transactional sex for both money and basic needs (Pillay, Govender and Reddy, 2023a). South Africa has high rates of poverty and unemployment (Stats SA, 2023), which further exacerbate this vulnerability.

Despite the implementation of various interventions including youth-focused services, provision of free condoms, HIV health promotion campaigns, voluntary male medical circumcision (VMMC), availability of pre-exposure prophylaxis (PrEP) and post-exposure prophylaxis (PEP), the rise in HIV incidence rates remain a challenge. In 2019, 106 383 registered live births from teenage pregnancies indicated unprotected sex and increased risk for STIs and HIV (Statistics SA, 2022b). The university student population represents the country's future work force and embodies the country's future economic growth (Stats SA, 2022b). Careful attention should be given to student wellbeing, including the development and implementation of customized interventions that will encourage positive behavioural changes and thus reduce RSBs that may result in HIV infection. Effective interventions are required to address the determinants of health and vulnerability to end the HIV/AIDS pandemic by the year 2030.

Risk assessment indices are key clinical tools designed to predict and/or measure risk of disease development including communicable diseases like HIV (Susser *et al.,* 1998; Menza *et al*., 2009; Kahle *et al*., 2013; Boileau *et al*., 2008), non-communicable diseases such as diabetes (Schmidt *et al*., 2005; Schulze *et al.,* 2007), cancer (Kim, Rockhill & Colditz, 2004) and depression (Dipnall *et al*., 2017). Globally, HIV risk indices have been designed for various at-risk populations i.e., heterosexual serodiscordant couples (Kahle *et al*., 2013), men who have sex with men (MSM) (Menza *et al*., 2009), young people (Boileau *et al*., 2008) and female

college students in the US (Harlow *et al*., 1993). In SA, there remains a lack of specifically designed HIV risk indices for use in the university setting.

The risk for HIV infection is multidimensional, and consideration of all relevant risk factors is essential when developing targeted HIV prevention interventions. An HIV risk index specifically designed for and based on the predictors of HIV infection within the SA university population will be useful as a public health HIV screening tool to identify students at risk for acquiring HIV infection. This tool may serve as an intervention in campus health clinics, including behavioural changes and biomedical interventions such as PrEP. In view of these potential benefits, this study aimed to develop a multidimensional HIV risk index specifically for use among SA university student populations by using data generated from our earlier case control enquiry.

Methods

Study setting, population and sampling

The HIV risk index score was developed using data emanating from our case control study (Pillay, Govender and Reddy, 2023a; Govender, Govender and Reddy, 2022) Convenience sampling was used to recruit 500 participants aged ≥18years from four HEIs in KZN, SA. The study site, population and sampling details have been published previously (Pillay, Govender and Reddy, 2023a; Govender, Govender & Reddy, 2022).

Ethical considerations

Ethical approval was obtained from the Institutional Research Ethics Committee (IREC 005/19), Durban University of Technology. All participants provided written informed consent prior to participation. Confidentiality was maintained by means of unique identification codes.

Data collection

Data was collected between July 2019 and May 2021. A structured pre-coded questionnaire assessing the possible predictors of RSBs and HIV seropositivity was used to extract data pertaining to student socioeconomic status, risky activities (i.e., alcohol and drug usage, sexual behaviours), student health, and knowledge on HIV prevention and transmission. Development of the study questionnaire was based on previously validated study instruments (Babor *et al*., 2001; Hoque, 2011; Hoque & Ghuman, 2012a; Hoque & Ghuman, 2012b; Leadbeatter, 2012; Kharsany *et al*., 2015; Bingenheimer *et al*., 2015; Mehra *et al*., 2014 & Munro *et al.*, 2013)

(Pillay, Govender & Reddy, 2023a). Pilot testing of the questionnaire was undertaken among 10 participants to ensure validity and reliability.

Data management and analysis

Of the available data (N=500), only participants who had ever engaged in sexual intercourse (n=438) were included as the risk index was targeted at sexually active participants. Data was cleaned, missing data was imputed, and statistical analysis was conducted using STATA (version 17).

A total of 17 categorical variables were extracted from the study questionnaire for inclusion in the analysis. The criteria for variable selection for the risk index score included statistically significant variables during logistic regression modelling and *apriori*, based on prior reporting and analysis conducted (Pillay, Govender & Reddy, 2023a). The 17 variables included in the risk score analysis were socio-economic factors (student funding, sharing of bursary/ loan and food security status), risky activities (usage of alcohol and drugs prior to sex, and heavy episodic drinking), risky sexual behaviours (multiple sexual partners, frequency of condom usage during vaginal and anal sex, intergenerational sex, transactional sex for money and transactional sex for basic needs items, lifetime number of partners, age of sexual debut and sexually transmitted illness (STI) diagnosis), and HIV knowledge on prevention and transmission modes. Prior to data analysis dichotomous responses were created for all variables included in the risk index analysis. The variables of interest were coded as 1 (i.e., food insecure status, sharing of bursary, having multiple partners, inconsistent condom use etc.). The variables that were not of interest (i.e., being food secure, not sharing bursary, not having multiple partners, and consistent condom use) were coded as 0. All item scores were then summed to obtain a total score for each participant which yielded a maximum score of 17 and a minimum of 0 based on coded categories of 1 or 0. The total scores were ranked and divided into three tertiles (1st tertile =low risk (scores 0 to 5), 2nd tertile = moderate risk (scores 6 to 11) and 3rd tertile = high risk (scores 12 to 17). Internal consistency of the HIV risk index was measured using Cronbach's alpha and yielded a high internal consistency value of 0.871. Thereafter, variables were converted to questions aimed at measuring the multidimensional aspects of HIV risk. These questions were added to the 'risk index tool', which is a questionnaire aimed at quantifying HIV risk among university students.

Results

The adjusted logistic regression models for socioeconomic, behavioural/ health, and knowledge risk factors are shown in Table 1. The HIV seropositive status was used as an outcome variable for all logistic regression models presented in Table 1. Logistic regression models for socioeconomic variables and HIV positivity found that participants who accessed government funding were 1.92 times more likely to be HIV seropositive [aOR: 1.92, (95% CI 1.10;3.38)]. Furthermore, sharing of the bursary/ loan increased participants' risk of HIV seropositivity by 2-fold [aOR: 2.17, (95% CI: 1.34; 3.49)].

Regarding behavioural and health variables, heavy episodic/ binge drinking decreased the risk of HIV seropositivity by 32% [aOR: 0.32, (95% CI: 0.16; 0.64)]. The data confirm that participants who reported inconsistent condom use during vaginal sex were at a decreased likelihood of being HIV positive [aOR: 0.55, (95% CI: 0.31; 0.97)]. In contrast, participants who reported engagement in sex with intergenerational sexual partners were at a 2.55 times elevated likelihood of being HIV seropositive [aOR: 2.55, (95% CI: 1.45; 4.46)]. Those reporting an STI diagnosis were 2.46 times more likely to be at risk of HIV infection [aOR: 2.46, (95% CI: 1.50; 4.03)].

Results from the logistic regression models for knowledge variables and HIV seropositivity highlighted that both poor HIV prevention knowledge [aOR: 2.34, (95% CI: 1.47-3.72)] and poor HIV transmission knowledge [aOR: 4.79, (95% CI: 2.84-8.08)] were statistically significant predictors of HIV seropositivity.

Table 1. Adjusted logistic regression models for Socioeconomic, Behavioural, Knowledge variables and HIV seropositivity (n= 500)

Socioeconomic variables	**Controls n (%)**	**Cases n (%)**	**HIV positive status**
			aOR (95%CI)
Food secure	230(76.2)	72(23.8)	1.00
Food insecure	126(72.4)	48(27.6)	1.07[0.67;1.70]
Private funding	90(24.2)	22(17.7)	1.00
Government student funding (NSFAS)	282(75.8)	102(82.3)	1.92[1.10;3.38]*
Not sharing bursary	185(50.8)	33(27.3)	1.00
Sharing bursary	179(49.2)	88(72.7)	2.17[1.34;3.49]*
Behavioural & health variables	**Controls n (%)**	**Cases n (%)**	**HIV positive status**

			aOR (95%CI)
Heavy Episodic Drinking (HED)			
No	54 (27.4)	25 (46.3)	1.00
Yes	143 (72.6)	29 (53.7)	0.32[0.16; 0.64]**
Alcohol use before sex (past 3 months)			
No	192 (73)	52 (83.9)	1.00
Yes	71 (27)	10 (16.1)	0.63[0.29; 1.37]
Drug use before sex (past 3 months)			
No	179 (89.9)	68 (94.4)	1.00
Yes	20 (10.1)	4 (5.6)	0.71[0.22; 2.33]
No. of lifetime sexual partners			
1	41(14)	13(11.7)	1.00
2 to 5	145(49.7)	76(68.5)	1.62[0.79;3.32]
≥6	106(36.3)	22(19.8)	1.02[0.44;2.38]
Multiple partners			
No	179 (51.3)	88 (72.1)	1.00
Yes	170 (48.7)	34 (27.9)	0.64[0.38; 1.06]
Inconsistent condom use (vaginal)			
Consistent	60 (23.5)	33 (32.0)	1.00
Inconsistent	195 (76.5)	70 (68)	0.55[0.31; 0.97]*
Intergenerational sex			2.55[1.45; 4.46]**
Non- IGS	197 (77.2)	58 (22.8)	
IGS	59 (60.8)	38 (39.2)	
Transactional sex for money			0.72[0.26; 2.02]
No	347 (74.3)	120 (25.7)	
Yes	27 (84.4)	5 (15.6)	
Transactional sex for basic needs			2.06[0.90; 4.74]
No	281 (74.7)	95 (25.3)	
Yes	24 (68.6)	11 (31.4)	
STI diagnosis			
No	306 (81.8)	76 (61.3)	1.00
Yes	68 (18.2)	48 (38.7)	2.46[1.50; 4.03]**
Knowledge variables	**Controls n (%)**	**Cases n (%)**	**HIV positive status**
			aOR (95%CI)
HIV Prevention knowledge			
Good Knowledge	189 (82.9)	39 (17.1)	1.00
Poor Knowledge	186 (68.4)	86 (31.6)	2.34 [1.47-3.72]**
HIV Transmission knowledge			
Good Knowledge	320 (81)	75(19)	1.00
Poor Knowledge	55 (52.4)	50 (47.6)	4.79 [2.84-8.08]**

$p < 0.05$ *, and < 0.005** was considered statistically significant; All models were adjusted for sex and age category. Note. Inconsistent condom use during anal sex & age of sexual debut were omitted due to collinearity. References: (Pillay, Govender and Reddy 2023a; Pillay, Govender and Reddy 2023b; Pillay, Govender and Reddy 2022).

The frequency of demographic, socioeconomic, risky activity, RSB, health and knowledge variables for the sample population (n=438) are shown in Table 2. Missing data has been imputed. The majority of the participants were females, and most were aged between 20-24 years.

Table 2. Variables used in the development of a risk index for HIV (n = 438)

Variables	Total n (%)
Sex	
Male	168 (38.4)
Female	270 (61.6)
Age category	
<20	50 (11.5)
20-24	267 (61.2)
>24	119 (27.3)
Any children	
No	296 (67.6)
Yes	142 (32.4)
Food security status	
Not food insecure	278 (63.5)
Food insecure	160 (36.5)
Study funding	
NSFAS	336 (77.2)
Private funding	99 (22.8)
Sharing bursary/Loan with Family	
No	225 (51.4)
Yes	213 (48.6)
Alcohol before sex (Past 3 months)	
No	375 (85.6)
Yes	63 (14.4)
Heavy episodic drinking	
No	299 (68.3)
Yes	139 (31.7)
Drug before sex (Past 3 months)	
No	422 (96.3)
Yes	16 (3.7)
Multiple concurrent sex partners	
No	273 (62.3)
Yes	165 (37.7)
Age of sexual debut	
≥15	424 (96.8)
<15	14 (3.2)
Number of lifetime sexual partners	
0-1	132 (30.1)
≥2	306 (69.9)

Condom use (vaginal)	
Consistent	200 (45.7)
Inconsistent	238 (54.3)
Condom use (anal)	
Consistent	433 (98.9)
Inconsistent	5 (1.1)
Transactional sex for money	
No	414 (94.5)
Yes	24 (5.5)
Transactional sex for basic needs	
No	412 (94.1)
Yes	26 (5.9)
Intergenerational sex (IGS)	
Non IGS	362 (82.6)
IGS	76 (17.4)
STI diagnosis	
No	343 (78.3)
Yes	95 (21.7)
HIV prevention knowledge	
Good Knowledge	212 (48.4)
Poor knowledge	226 (51.6)
HIV transmission knowledge	
Good Knowledge	356 (81.3)
Poor Knowledge	82 (18.7)

Note: *Missing data has been imputed.*
Intergenerational sex (IGS) is defined as intercourse with a non-marital partner 10 or more years older.

The 17 variables included in the risk index are displayed in Table 3 with allocated response scores. Variables were included in the risk index analysis based on the results of statistically significant logistic regression models which found that risk factors increased the likelihood of the outcome of interest (i.e., HIV seropositivity) (Table 1). The variables included study funding, sharing of bursary/ loan, intergenerational sex (IGS), reported STI diagnosis, poor HIV transmission knowledge, and poor HIV prevention knowledge.

Variables that failed to demonstrate a statistically significant association with the outcome variable but were considered *apriori* due to public health significance were also included (Table 4). These variables included food insecurity, alcohol usage before sex, heavy episodic drinking, drug usage before sex, multiple concurrent partners, sex in exchange for money, sex in exchange for basic needs, condom usage during vaginal sex, condom usage during anal sex, age of sexual debut, and number of lifetime sexual partners. A score of 1 was allocated to variables of interest, and a score of 0 was allocated to variables that were not of interest.

Table 3. Risk index variables & score allocation per response

Variable	Response	Scoring
Study funding	NSFAS	1
	Private funding	0
	Other	0
Sharing of the bursary	No	0
	Yes	1
Food security	Food secure	0
	Food insecure	1
Alcohol usage before sex (past 3 months)	No	0
	Yes	1
Heavy episodic drinking	No	0
	Yes	1
Drug usage before sex (past 3 months)	No	0
	Yes	1
Multiple concurrent partners	No	0
	Yes	1
Intergenerational sex	No	0
	Yes	1
Sex in exchange for basic needs items.	No	0
	Yes	1
Sex in exchange for money or gifts	No	0
	Yes	1
Condom usage during vaginal sex	Consistent	0
	Inconsistent	1
Condom usage during anal sex	Consistent	0
	Inconsistent	1
Age of sexual debut	<15 years	1
	≥15 years	0
No. of lifetime sexual partners	1 partner	0
	≥2 partners	1
STI	No	0
	Yes	1
HIV prevention knowledge	Good knowledge	0
	Poor knowledge	1
HIV transmission knowledge	Good knowledge	0
	Poor knowledge	1

Note: *Outcomes of interest were allocated a score of 1. References: (Pillay, Govender and Reddy 2023a).*

Apriori data, which supports the inclusion of variables in the risk index design based on previously published data on HIV, is presented in (Table 4).

Table 4: *Apriori* variables from literature supporting associations between variables and RSBs /HIV seropositivity.

Variables	Sample size & study population	Results	Source
Socioeconomic risk factors			
Food insecurity	Young adults in the United States (aged 24 to 32 years), N = 14,786.	Food insecure young women had an increased likelihood of HIV (23.34, 95% CI 1.98-275.07) in the past 12 months, in comparison to young women who reported being food secure.	Nagata *et al*., (2021)
	Men in the United States, (aged 20 to 49 years), N = 9150.	Food insecure men had increased odds of HIV seropositivity, in comparison to food secure men (AOR: 2.10, 95% CI: 1.01; 4.37).	Palar *et al*., (2016)
Behavioural risk factors			
Alcohol use	Meta-analysis of which included 10 studies.	Results showed that overall alcohol consumption increased the risk of HIV infection [RR: 1.98, (95% CI: 1.59-2.47)].	Baliunas *et al*., (2010)
	A systematic review based on 20 studies conducted in east and southern Africa relating to alcohol usage and HIV.	Findings demonstrated that alcohol users had higher odds of being HIV infected in Africa [pooled OR= 1.70, (95% CI: 1.45; 1.99)].	Fisher, Bang and Kapiga (2007)
HED/ binge drinking	Heterosexually active African American men (n=672) between the ages of 18 to 65 years old from Boston, Massachusetts.	Binge alcohol usage was significantly associated with a recent HIV/STI diagnosis [aOR=1.9, (95% CI: 1.05; 3.6)].	Raj *et al*., (2009)
Drug usage	Men who have sex with men (MSM) in Peru (N=3280).	Cocaine usage before/ during sex was significantly associated with HIV infection (aOR=2.53).	Lama *et al*., (2006)
	Median age and range of participants: 24 years and range (18-71 years)		
No. of lifetime partners	Women in an urban South African setting (n=834).	Results showed that having two or more lifetime partners increased the risk of HIV infection by 4.88 times (OR=4.88, 95% CI: 3.01-7.89).	Zuma *et al*., (2003)

Multiple partners	Nationally representative survey conducted in South Africa (N=6990). Respondents aged 15 years and older.	Male participants (aged 25 to 49 years) who reported multiple sexual partnerships were at an elevated risk of being HIV positive in contrast to those with a single sexual partner (OR=2.2, *p*=0.011).	Onoya *et al.,* (2014)
Age of sexual debut	Demographic and health survey in Zimbabwe among 15- to 24-year-old youth.	Participants aged 15 to 24 years whose age of sexual debut was < 14 years were significantly associated with a greater than 2-fold risk of HIV infection in comparison to those whose age of sexual debut was 20 to 24 years [OR: 2.69: 95% CI: 1.58-4.61), *p* = 0.000].	Kembo *et al*., (2012)
	4393 sexually active women in the 18 to 35 years age category from Zimbabwe.	Binary linear regression models found that HIV risk was increased for participants reporting early age of sexual debut (relative hazard, 1.30; 95% CI, 1.13-1.50).	Pettifor *et al*., (2004)
Unprotected / inconsistent condom use (Vaginal/ Anal)	Men who have sex with men (MSM) in Peru (N=3280).	Unprotected sex increased the odds of HIV infection by 2.81 times among MSM in Peru (aOR=2.81).	Lama *et al*., (2006)
	Individuals aged 15 to 49 years attending a VCT clinic in Kinshasa (N=1000).	Participants who never used condoms were at increased odds of testing HIV positive (aOR=3.38: 95% CI: 1.15-9.93).	Carlos *et al*., (2017)
Transactional sex for money / basic needs	Study was based on case control interview data and medical records among 889 women in South Africa aged (15 to 29 years).	Transactional sex excluding intergenerational sex among participants increased the odds of HIV risk by 2.07 times (uaOR: 2.07, 95% CI: 1.21-3.54).	McCloskey, Eloff & Doran., (2021)
	The sample population included women (16 years and older) attending an antenatal care clinic in Soweto, South Africa.	Transactional sex among female participants increased the odds of HIV seropositivity by 1.54 times (aOR=1.54, 95%CI: 1.07-2.21).	Dunkle *et al*., (2004)
	Sexually active school-going young women (13 to 20 years age group) in rural South Africa (N=693)	Participants who reported engaging in transactional sex were at an elevated risk of HIV seropositivity [(aOR: 2.5, CI 95%: 1.19-5.25), *p* = 0.01].	Ranganathan *et al.,* (2016)

**Included literature which demonstrated significant associations between variables and HIV seropositivity*.

Table 5. presents the designed HIV risk index developed as an outcome of logistic regression models presented in (Table 1) and *apriori* literature shown in (Table 4). The risk index includes sections pertaining to demography, student socioeconomics, food security, substance usage, sexual behaviour, student health as well as HIV prevention and transmission knowledge. The demographic data was not included in the scoring of HIV risk as the risk index was based on socioeconomic, behavioural and knowledge risk factors.

Table 5. University Student HIV Risk Index

INSTRUCTIONS: Please answer the following questionnaire by ticking the appropriate boxes and filling in responses as required. Please note that this questionnaire is completely confidential and will not be shared with anyone else. You name will **NEVER** be used in any way.

Section 1: Demographics					
1.1 What is your age?					
1.2 What is your gender?	Male		Female		Other
1.3 What is your race?	African	Colored	Indian	White	Other
1.4 Are you currently sexually active?	No		Yes		
1.5 What is your year of study?					

Section 2: Student socio-economics			
2.1 How to you fund your studies?	NSFAS	Private funding	Other
2.2 Do you share your bursary or loan with family, friends, or your partner?	No	Yes	NA
For admin use only ***Score =***			

Section 3: Food security			
Items	**0**	**1**	**2**
3.1 How often do you eat a smaller meal than you felt you needed because there was not enough food?	Never	Sometimes	Often
3.2 How often do you eat fewer meals in a day because there is not enough food?	Never	Sometimes	Often
3.3 How often do you eat cheaper foods for several days in a row because there is not enough money for food?	Never	Sometimes	Often
3.4 How often do you eat the same foods for several days in a row because there is not enough money for food?	Never	Sometimes	Often
3.5 How often do you have no food because there is not enough money to buy more food?	Never	Sometimes	Often

3.6 How often do you struggle to concentrate while you are in class during lectures, tutorials or practicals because you are hungry?	Never	Sometimes	Often
3.7 How often do you struggle to concentrate while you are studying because you are hungry?	Never	Sometimes	Often
3.8 How often do you feel weak or tired because you are hungry?	Never	Sometimes	Often
3.9 How often does being hungry put you into a bad mood?	Never	Sometimes	Often
3.10 How often do you miss lectures/tutorials/practical sessions because you are hungry?	Never	Sometimes	Often
3.11 Do you feel that your health suffers because you don't get enough food or because you don't eat enough good food?	Never	Sometimes	Often
3.12 How often do you worry where your next meal will come from?	Never	Sometimes	Often
3.13 How often do you go 24 hours without food because you did not have enough money to buy food?	Never	Sometimes	Often
3.14 How often do you go hungry at the beginning of the semester?	Never	Sometimes	Often
3.15 How often do you go hungry at the end of the semester or during examinations?	Never	Sometimes	Often

Section 4: Substance usage			
4.1 In the past 3 months, have you consumed alcohol before having sex?	No	Yes	NA
4.2 In the past 3 months, have you consumed more than 6 alcoholic drinks at one time?	No	Yes	NA
4.3 In the past 3 months, have you ever used drugs before having sex?	No	Yes	NA
For admin use only ***Scoring=***			

Section 5: Sexual behaviour			
5.1 How old were you when you had sex for the first time?	< 15 years old	≥ 15 years old	
5.2 How many partners have you had sex with, in your lifetime?	1 partner	2 to 5 partners	≥ 6 partners
5.3 In the last 3 months, have you had more than 1 sex partner at the same time?	No	Yes	
5.4 In the last 3 months, have you had sex with someone who was 10 or more years older than you?	No	Yes	
5.5 In the last 3 months, have you had sex in exchange for money or gifts?	No	Yes	
5.6 In the last 3 months, have you had sex in exchange for basic needs items e.g., food, airtime, clothing, rent etc.?	No	Yes	

5.7 In the last 3 months, how often have you used condoms during vaginal sex?	All the time	Sometimes	Never	NA
5.8 In the last 3 months, how often have you used condoms during anal sex?	All the time	Sometimes	Never	NA
For admin use only ***Scoring=***				

Section 6: Student health		
6.1 In the last 3 months, have you been diagnosed with any sexually transmitted infection (STI)? See examples below: Chlamydia, Syphilis, Gonorrhea, Trichomoniasis, HPV, Hepatitis B.	No	Yes
For admin use only ***Scoring=***		

Section 7: HIV Prevention knowledge			
Tick applicable boxes below, multiple responses are possible.			
7.1 What methods can you use to prevent HIV infection?			
Using a condom		Avoid contact with blood/using gloves	
Abstaining from sex		Using medications like preexposure prophylaxis (PrEP) to prevent transmission of HIV	
Sticking to one sexual partner		Male medical circumcision	
Having fewer sexual partners		Taking ARVs within 72 hours of being exposed to the HIV virus.	
Not having sex before marriage		Using emergency contraception after having sex.	
Don't know			
For admin use only ***Scoring=***			

Section 8: HIV Transmission Knowledge			
Tick applicable boxes below, multiple responses are possible.			
8.1. What are the ways in which a person may get infected with HIV?			
Transfer of virus from mother to child during delivery or breastfeeding.		Sharing contaminated needles or razor blades.	
Contaminated blood transfusion		Unprotected vaginal sex	
Unprotected anal sex		Usage of public toilets	
Mosquito bites		Touching an HIV infected person	
For admin use only ***scoring=***			
FINAL SCORE			

RISK INDEX SCORING TABLE

SECTION	**SCORING METHOD**
Section 1: Demographics	Nil scores allocated for questions on demographics.
Section 2: Student socio-economics	Q2.1 Allocate 1 point for the 'NSFAS' response. Q2.2 Allocate 1 point for the 'yes' response. Sum points allocated for Q2.1 & Q2.2.
Section 3: Food security	• This section consists of 15 questions. Calculations are required to determine food security status i.e., 'food secure' or 'food insecure', prior to allocation of a single score for the food security section.

	• Allocate scores for Q3.1 to 3.15 as per Likert scale [scores of 0 to 2 as per frequency 'Never', 'Sometimes' and 'Often'. • Thereafter, sum scores for Q3.1 to Q3.15. • Divide by 15 to obtain an average score. • Further classification into 'food secure' and 'food insecure' categories is required. • If the average score is 0, classify as 'food secure'. • If the average score is between 1 and 2 classify as 'food insecure'. • If the final classification is 'food insecure' allocate 1 point for risk index scoring.
Section 4: Substance usage	Q4.1 Allocate 1 point for 'yes' response. Q4.2 Allocate 1 point for 'yes' response. Q4.3 Allocate 1 point for 'yes' response. Sum points allocated for Q4.1 to Q4.3.
Section 5: Sexual behavior	Q5.1 Allocate 1 point for '< 15 years response'. Q5.2 Allocate 1 point for '2 to 5 partners' or '≥ 6 partners'. Q5.3 Allocate 1 point for 'yes' response. Q5.4 Allocate 1 point for 'yes' response. Q5.5 Allocate 1 point for 'yes' response. Q5.6 Allocate 1 point for 'yes' response. Q5.7 For responses 'sometimes' or 'never' allocate 1 point. Q5.8 For responses 'sometimes' or 'never' allocate 1 point. Sum points allocated for Q5.1 to Q5.8.
Section 6: Student health	Q6.1 Allocate 1 point for 'yes' response.
Section 7: HIV Prevention knowledge	• These questions are intended to assess the respondent's knowledge of HIV prevention methods. • Calculations are required to determine HIV prevention knowledge status i.e., 'poor knowledge' or 'good knowledge', prior to allocation of a single score for the HIV prevention knowledge section. • Allocate 1 point for each of the correct answers as below: ✓ Using a condom ✓ Abstaining from sex. ✓ Sticking to one sexual partner. ✓ Having fewer sexual partners. ✓ Not having sex before marriage. ✓ Avoid contact with blood/ using gloves. ✓ Using medications like preexposure prophylaxis (PrEP) to prevent HIV transmission. ✓ Male medical circumcision ✓ Taking ARVs within 72 hours of being exposed to the HIV virus. • Sum points. The maximum score that can be allocated is 9 points. • Classification into 'poor knowledge' & 'good knowledge' categories is required. • Categorize HIV prevention knowledge as follows: ✓ Scores between 1 to 4 classified as 'poor knowledge'. ✓ Scores between 5 to 9 classified as 'good knowledge'. • If final classification is 'poor knowledge' allocate 1 point for risk index scoring.
Section 8: HIV transmission knowledge	• These questions are intended to assess the respondent's knowledge of HIV modes of transmission. • Allocate 1 point for each of the correct answers below: ✓ Transfer of virus from mother to child during delivery or breastfeeding. ✓ Contaminated blood transfusion. ✓ Unprotected anal sex. ✓ Sharing contaminated needles or razor blades. ✓ Unprotected vaginal sex. • The maximum possible score is 5 points. • Further classification is needed for HIV transmission knowledge into 'poor knowledge' and 'good knowledge' categories.

	• Categorize scores between 1 to 2 as 'poor knowledge'. • Categorize scores between 3 to 5 as 'good knowledge' • If final classification is 'poor knowledge' allocate 1 point for risk index scoring.
Final scoring of risk index	• Sum scores allocated for each question/ section i.e., food security, HIV prevention knowledge and HIV transmission knowledge. • Use the risk index matrix below to determine risk category.

HIV Risk Categorization Matrix	**Scores**
Low risk	0 to 5
Medium risk	6 to 11
High risk	12 to 17

Discussion

Our study provides data that contributes to the development of a comprehensive risk index score and tool for surveillance of HIV/AIDS risk for use in higher education settings in SA. The key components of our tool were based on logistic regression analysis and previous literature on predictors of HIV infection. Variables included in the risk index score formed part of four categories namely, socioeconomic factors, risky activities, RSBs, and health and knowledge. A score of 1 was allocated to variables of interest and a score of 0 was allocated to variables that were not of interest. The summation of risk index scoring can be used to determine HIV risk categorisation of university students in SA (low, medium, or high-risk levels). The risk index is intended for usage in the higher education sector within campus health clinics. Risk categorisation can be used to predict students' risk of acquiring of HIV infection. Usage of the risk index can assist with the roll-out of biomedical interventions such as PrEP. Furthermore, students' knowledge on their personal HIV risk levels may promote behavioural change such as safer sexual practices.

Socioeconomic factors are well known drivers of RSB and HIV in the African context (Dunkle *et al*., 2004; Masa *et al*., 2019; McCloskey *et al.,* 2021; Pillay *et al*., 2023a). Previous studies among adolescents and young adults have demonstrated associations between food insecurity and RSBs such as unwanted sexual contact, age disparate sex (Masa *et al*., 2019), exchanging sex for money, multiple concurrent partners, STIs and HIV (Nagata *et al*., 2021) and condom non-use at last sex (Smith *et al*., 2021). Similarly, we demonstrated significant associations

between food insecurity and the increased likelihood of student participation in several RSBs (multiple sexual partners, transactional sex for money, and transactional sex for basic needs other than money) (Pillay, Govender & Reddy, 2023a). Even though food insecurity did not increase the likelihood of HIV seropositivity in our sample, it was included as a risk factor in the risk index *apriori*, due to previous data related to young adults in the United States (US), which found that food insecure young women had increased odds of HIV [AOR: 23.34, (95% CI: 1.98; 275.07)] in contrast to young women who were food secure (Nagata *et al.,* 2021). Cross-sectional research using secondary data from 9150 men from the US demonstrated that food insecure men were at a 2-fold higher risk of HIV seropositivity [AOR: 2.10, (95% CI: 1.01; 4.37)] compared to food secure men (Palar *et al*., 2016). Additionally, our findings indicate that accessing the NSFAS grant [aOR: 1.92, (95% CI: 1.10;3.38)] and sharing of the bursary or loan with family [aOR: 2.17, (95% CI: 1.34; 3.49)] increased participants' likelihood of being HIV seropositive (Pillay, Govender and Reddy, 2023a). Based on these significant findings, we included food security status, access to NSFAS funding and sharing of bursary and/ loan as possible socioeconomic predictors of HIV in the risk index tool.

Risky activities such as substance usage is widely reported as a motivating factor for irresponsible sexual practices among students (Dumbili, 2016; Blignaut, Jacobs & Vergnani, 2015; Amare, Yeneabat and Amare, 2019). Alcohol and drug usage may inhibit an individual's ability to make rational decisions regarding safer sexual practices, thus increasing one's vulnerability to RSB engagement and HIV seropositivity (Mthembu *et al*., 2019). Metanalysis data from Africa demonstrated significant associations between alcohol usage and HIV seropositivity (Fisher *et al*., 2007). Comparable findings from a SA systematic review also highlight an association between alcohol usage and HIV risk behaviours (Kalichman *et al.,* 2007). A metanalysis conducted among university students in Ethiopia also demonstrated that alcohol usage was associated with an increased likelihood of RSB engagement (Amare, Yenebat & Amare, 2019). In a systematic review in Peru, drug usage was reported to be associated with an elevated prevalence of HIV seropositivity (Massa & Rosen, 2012). Our earlier findings demonstrated significant associations between heavy episodic drinking, drugs usage before sex, and an increased likelihood of having multiple concurrent partners (Pillay, Govender & Reddy, 2022). However, our data did not demonstrate any statistically significant associations between substance usage (alcohol use, heavy episodic drinking, and drug use) and an increased likelihood of HIV seropositivity. Therefore, our inclusion of these variables in the

risk index design was based on *apriori* evidence (Baliunas *et al*., 2010, Fisher *et al*., 2007, Raj *et al.,* 2009, Lama *et al*., 2006).

Risky sexual behaviours have been globally documented as key predictors of HIV seropositivity. Behavioural predictors of RSBs and /HIV seropositivity include younger age of sexual debut (Osuafor & Okoli, 2021; Kembo, 2012), increased number of lifetime partners (Mengistu *et al*., 2013), multiple concurrent partners (Onoya *et al*., 2014; Kembo, 2012), inconsistent / non-use of condoms (Bossonario *et al*., 2022; Dorjgochoo *et al*., 2009; Carlos *et al.,* 2017), transactional sex (Dunkle *et al*., 2004; Wamoyi *et al*., 2016; Ranganathan *et al.,* 2016) and sex with intergenerational partners (McCloskey *et al.,* 2021). Intergenerational sex was included in the risk index design based on our earlier findings, which confirmed that IGS increased the participants' likelihood of HIV seropositivity [aOR: 2.55, (95% CI: 1.45; 4.46)]. The findings from our study corroborated the data from McCloskey *et al* (2011), who demonstrated that women aged 15 to 29 years with an intergenerational partner were at a 2-fold elevated likelihood of HIV infection (OR=1.96; 95% CI: 1.39-2.65) (McCloskey, Eloff and Doran., 2011). However, our results failed to demonstrate any associations for multiple concurrent partners, sex in exchange for money, sex in exchange for basic needs, condom usage during vaginal sex, condom usage during anal sex, age of sexual debut and lifetime number of sexual partners with an increased risk of HIV seropositivity. Inclusion of these variables were *apriori* based on earlier reports confirming their public health significance (Onoya *et al.*, 2014; McCloskey, Eloff and Doran., 2021; Dunkle *et al*., 2004; Ranganathan *et al*., 2016; Lama *et al*., 2006; Carlos *et al*., 2017, Kembo *et al.,* 2012; Pettifor *et al*., 2004; Zuma *et al*., 2003). We previously reported that participants who had an STI diagnosis were more likely to be HIV positive than those who did not report an STI diagnosis [aOR: 2.46, (95% CI: 1.50; 4.03)] (Pillay, Govender & Reddy, 2022). Our results corroborated earlier studies which indicated an elevated likelihood of HIV infection among individuals with STIs and substantiated the inclusion of STI diagnosis as a possible predictor of HIV infection (Dorjgochoo *et al*., 2009; Auvert *et al*., 2001; Altice *et al*., 1998).

A comprehensive HIV knowledge is essential for facilitating safer sexual behaviour and the prevention and control of HIV (Murwira *et al*., 2021). We recently demonstrated that respondents with poor knowledge on HIV transmission [aOR: 4.79, (95% CI: 2.84; 8.08)] and prevention [aOR: 2.34 (95% CI: 1.47; 3.72)] were at an increased risk of HIV seropositivity (Pillay, Govender & Reddy, 2023b). These results are congruent with findings from Carlos and

colleagues (2015), who investigated a sample of patients attending a primary outpatient care centre, and confirmed an association between poor HIV knowledge and HIV seropositivity (Carlos *et al*., 2015). These findings suggest that knowledge is a significant determinant of HIV seropositivity and thus validates the inclusion of HIV prevention and transmission knowledge as possible determinants in the risk index design.

The Cronbach's alpha was utilized to assess internal consistency of the designed risk index. Variables included in the risk score were used to develop the risk index questionnaire, which can be effectively utilized to assess students' risk levels of acquiring HIV. The predictors selected for our final risk score were based on statistical significance of logistic regression modelling and *apriori*. The methodology used for the development of the HIV risk index score was based on an aggregated score technique. The variables of interest for each risk factor were allocated a score of 1.

To our knowledge the HIV risk score defined in our study is the first evidence-based risk assessment tool for identifying South African university students at increased risk of acquiring HIV. The developed risk index is of relevance to the clinical setting as it can be utilized to predict risk of HIV acquisition by assessing HIV risk factors in the student population. We also anticipate that students' knowledge on their risk levels for acquiring HIV may promote a behavioural change towards their perceptions of safer sexual activities. Identifying individuals at greater risk of HIV infection has potential to encourage access to PrEP, which is essential for programme efficiency (NDOH, 2021). The National Department of Health has included adolescent girls, boys, and young women and men as a specific category to be considered at a greater risk of acquiring HIV infection (NDOH, 2021). University students comprise an integral portion of this population group who require urgent and effective intervention. Usage of the risk index can assist with the rollout of new HIV prevention strategies like PrEP to maximize cost effectiveness by targeting those who are at greatest risk (Kahle *et al.,* 2013).
Despite this urgent need, there is no risk assessment tool and /or risk index that is available to measure the HIV risk levels amongst university students in SA. However, in West Africa an HIV monitoring instrument in the form of a questionnaire was developed guided by qualitative data collected via focus groups and in-depth interviews involving young people (Boileau *et al*., 2008). Thereafter, items from the questionnaire were submitted to exploratory factor analysis (Boileau *et al*., 2008). Cross validation was done to refine scales and construct validity was evaluated by logistic regression modelling and internal consistency was assessed using the

Cronbach's alpha (Boileau *et al*., 2008). Similarly, in our study we used logistic regression modelling to ascertain whether significant associations existed between independent variables and dependant variables. Furthermore, the Cronbach's alpha was used to test internal consistency. However, our study did not utilize qualitative methods when designing the risk index. In another report emanating from data gathered from 7 African countries, a risk score specifically for HIV-1 serodiscordant couples was developed (Kahle *et al*., 2013). The risk score designed utilized prospective study data to conduct multivariate modelling which assessed the relationship between predictor variables and HIV-1 infection risk (Kahle *et al.*, 2013). Kahle *et al*., (2013) utilized the risk score to calculate total risk scores for each couple enrolled in the study by summing the scores determined in the final risk model and the HIV incidence for each score was generated.

Susser *et al*. (1998) developed a risk index based on a simple linear function as follows: Risk score = (number of unprotected vaginal episodes) + (2X number of unprotected anal episodes) + (0.1 X number of unprotected oral episodes) (Susser *et al*., 1998). However, a limitation associated with this risk index was that it did not include other risk factors such as socioeconomic factors and behavioural factors which may influence engagement in RSBs and subsequent HIV infection. This index weighted risk factors according to the likelihood of HIV infection through each mode of sexual intercourse. We developed a comprehensive risk index in that it included a wide range of predictors of HIV seropositivity within our population; however, we did not score risk factors according to weightings. Data from a sexually transmitted disease (STD) clinic was previously used to develop prediction models based on medical records of men who have sex with men (MSM), and on clinical and behavioural data (Menza *et al*., 2009). Six binary variables were selected for inclusion in the predictive model based on epidemiological evidence, and the scores were validated using a control group; however, the tool designed by Menza and colleagues was developed and validated among a sample population which consisted of mostly white MSM residing in the United States (Menza *et al*., 2009). Therefore, their findings cannot be extrapolated to South African student populations. We would submit that our risk index tool would be effective for younger adolescents as well, given the many common risk factors shared by university students and students enrolled in schools.

A risk behaviour knowledge index for HIV infection for the average risk population in Germany was developed using clinic data from 315 patients (Kuznetsov *et al.,* 2011). This

study aimed at assessing risk behaviour knowledge regarding HIV/AIDS and thus the risk index only considered the sociodemographic and risk behaviour knowledge aspects and did not focus on behavioural factors that may contribute to HIV risk. In contrast, our risk index was comprehensive as it included multidimensional aspects of risk, viz., knowledge, behavioural, risky activity, and socioeconomic factors. Furthermore, Kuznetsov *et al*, (2011) designed the risk index for a German population with average HIV risk, which may not be clinically useful for use in developing countries such as SA which have higher risk populations.

An earlier study highlights a comprehensive model that was designed to predict risky HIV-related sex in women from a set of behavioural, interpersonal and psycho-attitudinal measures (Harlow *et al*., 1993). The survey measures were only administered to two US university samples of women (n=234 and n=263 respectively) (Harlow *et al*, 1993) in contrast to our risk index, which was designed using data from both male and female students. Notwithstanding the higher national HIV incidence and prevalence among women, we chose to include data from both male and females to ensure that risk levels could be determined for university students regardless of sex.

Our derived risk index may be implemented for student screening within the campus health context both in SA and other African developing countries. Since the variables included in the risk index score have not been numerically weighted according to risk of HIV transmission, students who are categorised as being low risk may be at a higher risk of HIV infection due to engagement in RSBs such as unprotected anal sex. Therefore, this could be riskier than socioeconomic or knowledge risk factors and must be considered when measuring risk. The use of case control data from HIV seropositive and seronegative university students from HEIs in KZN, the epicentre of HIV infection, provides evidence of a key at-risk population. However, a potential limitation in the risk index design is that risk factors were not scored according to weightings. Future work will include validation and pilot testing of our risk index tool prior to implementation among university students.

Conclusion

Risk assessment methods to assess HIV risk levels among high-risk populations such as university students are urgently required. The computation of HIV risk levels based on logistic regression models and *apriori* evidence is useful in targeting prevention interventions such as PrEP to university students. Therefore, the risk index score and risk index tool developed from

findings of our study has the potential to offer a robust, practical method for identifying university students at highest risk of HIV acquisition. Further testing of the tool in a larger sample population is, however, required. Future work will include validation and pilot testing the HIV risk index. Additionally, we plan to conduct a large-scale longitudinal study to measure the HIV risk of students from enrolment to completion of studies.

Acknowledgments

The authors gratefully acknowledge the contributions of the study participants and thank the research assistants involved in data collection for this study.

References

Akintola, O., Ngubane, L. & Makhaba, L. (2011) ' "I did it for him, not for me": An exploratory study of factors influencing sexual debut among female university students in Durban, South Africa', *Journal of Health Psychology*, 17(1), pp.143–153.

Altice, F.L., Mostashari, F., Selwyn, P.A., Checko, P.J., Singh, R., Tanguay, S. & Blanchette, E.A. (1998) 'Predictors of HIV Infection among newly sentenced male prisoners', *Journal of Acquired Immune Deficiency Syndromes and Human Retrovirology*, 18, pp.444-453.

Amare, T., Yeneabat, T. & Amare, Y. (2019) 'A Systematic Review and Meta-Analysis of Epidemiology of Risky Sexual Behaviors in College and University Students in Ethiopia, 2018', *Journal of Environmental and Public Health*, 2019. doi: 10.1155/2019/4852130.

Assefa, Y. & Gilks, C.F. (2020) 'Ending the epidemic of HIV/ AIDS by 2030: Will there be an endgame to HIV, or an endemic HIV requiring an integrated health systems response in many countries', *International Journal of Infectious Diseases*, 100, pp.273-277.

Auvert, B., Ballard, R., Campbell, C., Carael, M., Carton, M., Fehler, G., Gouws, E., MacPhail, C., Taljaard, D., Van Dam, J. & Williams, B. (2001) 'HIV infection among youth in a South African mining town is associated with herpes simplex virus-2 seropositivity and sexual behaviour', *AIDS*, 15(7), pp.885-898.

Baliunas, D., Rehm, J., Irving, H. & Shuper, P. (2010) 'Alcohol consumption and risk of incident human immunodeficiency virus infection: a meta-analysis', *Int J Public Health*, 55, pp.159-166.

Blignaut, R.J., Jacobs, J. & Vergnani, T. (2015) 'Trends in HIV risk behaviour of incoming first-year students at a South African university: 2007–2012', *Journal of Social Aspects of HIV/AIDS*', 12(1), pp.39–50. https://doi.org/10.1080/17290376.2015.1086275

Boileau, C., Rashed, S., Sylla, M. & Zunzunegui, M.V. (2008) 'Monitoring HIV risk and evaluating interventions among young people in urban west Africa: Development and validation of an instrument', *AIDS Education and Prevention*, 20(3), pp.203-219.

Bossonario, P.A., Ferreira, M.R.L., Andrade, R.L.D., de Sousa, K.D.L., Bonfim, R.O., Saita, N.M. & Monroe, A.A. (2022) 'Risk factors for HIV infection among adolescents and the youth: a systematic review', *Rev. Latino-AM. Enfermagem*, 30.

Babor, T.F., Higgins-Biddle, J.C., Saunders, J.B. & Monteiro, M. (2001). *AUDIT Alcohol Use Disorders Identification Test*. Geneva, Switzerland. Available at: https://www.who.int/publications/i/item/audit-thealcohol-use-disorders-identification-test-guidelines-for-use-in-primary-health-care (Accessed: 13 March 2019).

Bingenheimer, J., Asante, E. & Ahiadeke, C. (2015) 'Peer Influences on Sexual Activity among Adolescents in Ghana', *Studies in Family Planning*, 46(1), pp.1–19. https://doi.org/10.1111/j.1728-4465.2015.00012.x.Peer

Carlos, S., Ángel Martínez-González, M., Burgueño, E., Burgo, C.L., Del Ruíz-Canela, M., Ndarabu, A., Tshilolo, L., Tshiswaka, P., Labarga, P. & De Irala, J. (2015) 'Misconceptions about HIV infection in Kinshasa (Democratic Republic of Congo): a case-control study on knowledge, attitudes and practices', *Sexually Transmitted Infections*, 91, pp.334–337. https://doi.org/10.1136/sextrans-2014-051734

Carlos, S., Burgo, C.L., Burgueno, E., Martinez-Gonzalez, M.A., Osorio, A., Ndarabu, A., Passabosc, C. & de Irala, J. (2017) 'Male condom use, multiple sexual partners and HIV: a prospective case-control study in Kinshasa (DRC)', *AIDS CARE*, 29(6), pp.772-781.

Dipnall, J.F., Pasco, J.A., Berk, M., Williams, L.J., Dodd, S., Jacka, F.N. & Meyer, D. (2017) 'Getting rid of the blues: Formatting a risk index for depression (RID) using structural equation modelling', *Aust NZJ Psychiatry*, 51(11), pp.1121-1133.

Dorjgochoo, T., Noel, F., Deschamps, M.M., Theodore, H., Charles, S., Dupont, W., Wright, P.F., Fitzgerald, D.W., Vermund, S.H. & Pape, J.W. (2009) 'Risk factors for HIV infection

among Haitian adolescents and young adults seeking counseling and testing in Port-au-Prince', *J Acquir Immune Defic Syndr*, 52(4). pp.498-508.

Dunkle, K.L., Jewkes, R.K., Brown, H.C., Gray, G.E., McIntryre, J.A. & Harlow, S.D. (2004) 'Transactional sex among women in Soweto, South Africa: prevalence, risk factors and association with HIV infection', *Social Science and Medicine*, 59, pp.1581-1592.

Dumbili, E.W. (2016) 'Gendered sexual uses of alcohol and associated risks: a qualitative study of Nigerian University students', *BMC Public Health*, 16(1), pp.1–12. doi: 10.1186/s12889-016-3163-1.

Fisher, J.C., Bang, H. & Kapiga, S.H. (2007) 'The Association Between HIV Infection and Alcohol Use: A Systematic Review and Meta Analysis of African Studies', *Sexually transmitted diseases*. 34(11), pp.856-863.

Govender, T., Govender, N. & Reddy, P. (2022) 'Food Insecurity and Risky Sexual Behaviours among University Students in KwaZulu-Natal, South Africa', *International Journal of Sexual Health*, pp.1–12.

Harlow, L.L., Quina, K., Morokoff, P.J., Rose, J.S. & Grimley, D.M. (1993) 'HIV risk in women: a multifaceted model', *Journal of Biobehavioural Research*, 1(1), pp.3.38.

Hoque, M.E. (2011) 'Sexual practices among male undergraduate students in KwaZulu-Natal, South Africa', *Southern African Journal of Epidemiology and Infection*, 26(3), pp.157–160.

Hoque, M.E. & Ghuman, S. (2012a). 'Knowledge, Practices, and Attitudes of Emergency Contraception among Female University Students in KwaZulu-Natal, South Africa', *PLoS ONE*, 7(9), pp.1–7.

Hoque, M. & Ghuman, S. (2012b). 'Contraceptive practices in the era of HIV/AIDS among university students in KwaZulu-Natal, South Africa', *Journal of Social Aspects of HIV/AIDS*, 9(1), pp.15–19.

Kahle, E.M., Hughes, J.P., Lingappa, J.R., John-Stewart, G., Celum, C., Nakku-Joloba, E., Njuguna, S., Mugo, N., Bukusi, E., Manongi, R. & Baeten, J.M. (2013) 'An empiric risk scoring tool for identifying high-risk heterosexual HIV-1 serodiscordant couples for targeted HIV-1 prevention', *Journal of Acquired Immune Deficiency Syndrome*, 62(3), pp.339-347.

Kalichman, S.C., Simbayi, L.C., Kaufman, M., Cain, D. & Jooste, S. (2007) 'Alcohol Use and Sexual Risks for HIV/AIDS in Sub-Saharan Africa: A Systematic Review of Empirical Findings', *Prev Sci*. 8, pp.141-151.

Kembo, J. (2012) 'Risk factors associated with HIV infection among young persons aged 15-24 years: Evidence from an in-depth analysis of the 2005-06 Zimbabwe demographic and health survey', *Journal of Social Aspects of HIV/AIDS*, 9(2), pp.54–63. doi: 10.1080/17290376.2012.683579.

Kharsany, A.B.M., Cawood, C., Khanyile, D., Grobler, A., McKinnon, L.R., Samsunder, N., Frohlich, J.A., Abdool Karim, Q., Puren, A., Welte, A., George, G., Govender, K., Toledo, C., Chipeta, Z., Zembe, L., Glenshaw, M.T., Madurai, L.M., Deyde, V. & Bere, A. (2015). 'Strengthening HIV surveillance in the antiretroviral therapy era: Rationale and design of a longitudinal study to monitor HIV prevalence and incidence in the uMgungundlovu District, KwaZulu-Natal', *South Africa. BMC Public Health*, 15(1), pp.1–11. https://doi.org/10.1186/s12889-015-2179-2

Kim, D.J., Rockhill, B. & Colditz, G.A. (2004) 'Validation of the Harvard cancer risk index: a prediction tool for individual cancer risk', *Journal of Clinical Epidemiology,* 57(4), pp.332-341.

Kuznetsov, A.V., Wiseman, M., Ruzicka, T., Zippel, S.A. & Kuznetzov, L. (2011) 'Short risk behaviour knowledge index for HIV average risk population of sexually active age in Munich, Germany', *Central European Journal of Public Health*, 19(2), pp.79–83. doi: 10.21101/cejph.a3633.

Lama, J.R., Lucchetti, A., Suarez, L., Laguna-Torres, V.A., Guanira, J.V., Pun, M., Montano, S.M., Celum, C.L., Carr, J.K., Sanchez, J., Bautista, C. T. & Sanchez, J.L. (2006) 'Association of herpes simplex virus type 2 infection and syphilis with Human Immunodeficiency Virus infection among men who have sex with men in Peru', *JID*, 194, pp.1459-1466.

Leadbeatter, K. (2012) *Male circumcision, HIV and health*. pp.1–83.

Masa, R., Graham, L., Khan, Z., Chowa, G. & Patel, L. (2019) 'Food insecurity, sexual risk taking, and sexual victimization in Ghanaian adolescents and young South African adults', *International Journal of Public Health*, 64(2), p.153–163.

McCloskey, L.A., Eloff, I. & Doran, K. (2021) 'Determinants of intergenerational sexual relationships and HIV risk among South African women outpatients in Gauteng', *AIDS CARE*, 33:5. pp.654-662.

Mehra, D., Östergren, P.O., Ekman, B. & Agardh, A. (2014) 'Inconsistent condom use among Ugandan university students from a gender perspective: a cross- sectional study', *Global Health Action*, 7(1), pp.1-9.

Menza, T.W., Hughes, J.P., Celum, C.L. & Golden, M.R. (2009) 'Prediction of HIV acquisition among men who have sex with men', *Sexually Transmitted Diseases*, 36(9), pp.547-555.

Mengistu, T.S., Melku, A.T., Bedada, N.D. & Eticha, B.T. (2013) 'Risks for STIs/HIV infection among Madawalabu University students, Southeast Ethiopia: a cross sectional study', *Reproductive Health*, 10:38.

Miller, C.L., Bangsberg, D.R., Tuller, D.M., Senkungu, J., Kawuma, A., Frongillo, E.A. & Weiser, S.D. (2011) 'Food insecurity and sexual risk in an HIV endemic community in Uganda', *AIDS and Behavior*, 15(7), pp.1512–1519.

Mthembu, Z., Maharaj, P. & Rademeyer, S. (2019) '"I am aware of the risks, I am not changing my behaviour": Risky sexual behaviour of university students in a high-HIV context', African *Journal of AIDS Research*, 18(3), pp.244–253. https://doi.org/10.2989/16085906.2019.1655075

Munro, N., Quayle, M., Simpson, H. & Barnsley, S. (2013) 'Hunger for knowledge: Food insecurity among students at the University of KwaZulu- Natal', *Perspectives in Education*, 31(4), pp.168–179.

Murwira, T.S., Khoza, L.B., Mabunda, J.T., Maputle, S.M., Mpeta, M. & Nunu, W.N. (2021) 'Knowledge of Students regarding HIV/AIDS at a Rural University in South Africa', *The Open AIDS Journal*, 15(1), pp.42–51. https://doi.org/10.2174/1874613602115010042

Nagata, J.M., Palar, K., Gooding, H.C., Garber, A.K., Tabler, J.L., Whittle, H.J., Bibbins-Domingo, K. & Weiser, S.D. (2021) 'Food insecurity, sexual risk, and substance use in young adults', *The Journal of Adolescent Health*, 68(1), pp.169–177. https://doi.org/10.1016/j.jadohealth.2020.05.038

National Department of Health (NDOH) (2021) *2021 updated guidelines for the provision of oral pre-exposure prophylaxis (PrEP) to persons at substantial risk of HIV infection*. South Africa. Available at: https://knowledgehub.health.gov.za/system/files/elibdownloads/2022-08/PrEP%20Guidelines%20Update%2012%20%20Nov%20%202021%20Final.pdf (Accessed: 07 July 2023).

Nyindo, M. (2005) 'Complementary factors contributing to the rapid spread of HIV-I in sub-Saharan Africa: a review', *East African Medical Journal*, 82(1), pp.40-6.

Onoya, D., Zuma, K., Zungu, N., Shisana, O. & Mehlomakhulu, V. (2014) 'Determinants of multiple sexual partnerships in South Africa', *Journal of Public Health* (United Kingdom), 37(1), pp.97–106. doi: 10.1093/pubmed/fdu010.

Osuafor, G.N. & Okoli, C.E. (2021) 'Factors associated with multiple sexual partners among first-year students in a South African university', *African Journal of Reproductive Health*, 25(5), pp.69–78. doi: 10.29063/ajrh2021/v25i5.7.

Palar, K., Laraia, B., Tsai, A.C., Johnson, M.O., Weiser, S.D. (2016) 'Food insecurity is associated with HIV, sexually transmitted infections and drug use among men in the United States', *AIDS*, 30, pp.1457-1456.

Pettifor, A.E., van der Straten, A., Dunbar, M.S., Shiboski, S.C. & Padian, N.S. (2004) 'Early age of first sex: a risk factor for HIV infection among women in Zimbabwe', *AIDS*, 18 (10), pp.1435-1442.

Pillay, T., Govender, N. & Reddy, P. (2023a) 'Socioeconomic determinants of risky sexual behaviours and HIV seropositivity among university students in South Africa: A case control analysis', *Research in Nursing Health*, 46, pp.436-444.

Pillay, T., Govender, N. & Reddy, P. (2023b) 'HIV knowledge and sexual practices of university students: a South African case control analysis', (Manuscript under review).

Pillay, T., Govender, N. & Reddy, P. (2022) 'A case-control investigation of factors associated with risky sexual behaviours among South African university students'. (Manuscript under review).

Raj, A., Reed, E., Santana, M.C., Walley, A.Y., Welles, S.L., Horsburgh, C.R., Flores, S.A. & Silverman, J.G. (2009) 'The associations of binge alcohol use with HIV/STI risk and

diagnosis among heterosexual African American men', *Drug and Alcohol Dependance*, 101, pp.101-106.

Ranganathan, M., Heise, L., Pettifor, A., Silverwood, R.J., Selin, A., MacPhail, C., Delany-Moretlwe, S., Kahn, K., Gomez-Olive, F.X., Hughes, J.P., Piwowar-Manning, E., Laeyendecker, O. & Watts, C. (2016) 'Transactional sex among young women in rural South Africa: prevalence, mediators and association with HIV infection', *Journal of the International AIDS Society*, 19.

Schulze, M.B., Hoffmann, K., Boeing, H., Linseisen, J., Rohrmann, S., Mohlig, M., Pfeiffer, A.F.H., Spranger, J., Thamer, C., Haring, H., Fritsche, A. & Joost, H. (2007) 'An accurate risk score based on anthropometric, dietary, and lifestyle factors to predict the development of type 2 diabetes', *Diabetes care,* 30(3), pp.510-515.

Schmidt, M.I., Duncan, B.B., Bang, H., Pankow, J.S., Ballantyne, C.M., Golden, S.H., Folsom, A.R. & Chambless, L.E. (2005) 'Identifying individuals at high risk for diabetes', *Diabetes Care*, 28(8), pp.2013-2018.

Simbayi, L.C., Zuma, K., Zungu, N., Moyo, S,. Marinda, E., Jooste, S., Mabaso, M., Ramlagan, S., North, A., van Zyl, J., Mohlabane, N., Dietrich, C.N.I. & the S.V.T. (2019) *South African National HIV Prevalence, Incidence, Behaviour and Communication Survey, 2017*. https://repository.hsrc.ac.za/handle/20.500.11910/15052

Smith, L., Ward, P.B., Vancampfort, D., López-Sánchez, G.F., Yang, L., Grabovac, I., Jacob, L., Pizzol, D., Veronese, N., Shin, J.I., Lee, J., McDermott, D.T. & Koyanagi, A. (2021) 'Food insecurity with hunger and sexual behavior among adolescents from 53 countries', *International Journal of Sexual Health*, 33(1), pp.88–98. https://doi.org/ 10.1080/19317611.2020.1855287

Statistics SA (2023) *Beyond unemployment – Time-Related Underemployment in the SA labour market*. 2023. Available at: https://www.statssa.gov.za/?p=16312#:~:text=For%20the%20first%20quarter%20of,rate%20of%204%2C9%25 (Accessed: 01 July 2023).

Statistics SA (2022) *Mid-year population estimates*. Pretoria, South Africa. Available at: https://www.statssa.gov.za/publications/P0302/P03022022.pdf (Accessed: 05 July 2023).

Statistics SA (2022b) *The young and the restless – adolescent health in SA*. Available at: https://www.statssa.gov.za/?p=15261 (Accessed: 02 July 2023).

Susser, E., Desvarieux, M. & Wittkowski, K.M. (1998) 'Reporting sexual risk behavior for HIV: A practical risk index and a method for improving risk indices', *American Journal of Public Health*, 88(4), pp.671-674.

UNAIDS (2022) *Global AIDS update 2022*. Available at: https://www.unaids.org/sites/default/files/media_asset/2022-global-aids-update-summary_en.pdf (Accessed: 07 July 2023).

UNAIDS (2023) *Global HIV & AIDS statistics — Fact sheet*. Available at: https://www.unaids.org/en/resources/fact-sheet (Accessed: 07 July 2023).

Wamoyi, J., Stobenau, K., Bobrova, N., Abramsky, T. & Watts, C. (2016) 'Transactional sex and risk for HIV infection in sub-Saharan Africa: a systematic review and meta-analysis', *Journal of the International AIDS Society*, 19.

Zuma, K., Gouws, E., Williams, B. & Lurie, M. (2003) 'Risk factors for HIV infection among women in Carletonville, South Africa: migration, demography and sexually transmitted diseases', *International Journal of STD & AIDS*, 14(12), pp. 814-817.

CHAPTER 9

SYNTHESIS

Sub-Saharan Africa bears the brunt of high HIV infection rates, particularly amongst those between the ages of 15-24 years (Simbayi *et al.,* 2019). Our study targeted the university student population at four HEIs in KZN, SA as they form part of the high-risk age category. Several factors may predispose this group to an increased risk of HIV infection, viz., socioeconomic factors, behavioural factors, and HIV knowledge deficits. Therefore, this study used a case control design with the aim of exploring determinants associated with RSBs and HIV seropositivity amongst the university student population. We investigated risk factors for RSBs in both HIV seropositive and seronegative students. In the absence of a cure for HIV, the strengthening of HIV prevention interventions is critical in reducing the infection. Young university students have the potential to significantly contribute to the socioeconomic status of the country. Therefore, interventions that promote behavioural changes in young people and at-risk populations are urgently required. Findings emanating from this study were utilized to guide the design of an 'HIV risk index', aimed at measuring the risk to students of acquiring HIV based on exposure to risk factors. We anticipate the use of the risk index as an HIV prevention intervention. Scores generated by risk index may be used by health care providers within the campus health setting to determine and provide recommendations for preventative interventions such as PrEP, further STI screening, etc. Gaining a comprehensive understanding of HIV risk levels in this particular group has the potential to motivate students to improve adherence to HIV preventative measures and thus encourage behaviour change.

Hence, this chapter offers an overview of the outcomes emanating from the overall study and explores the risk elements associated with RSBs and HIV-positive status amongst students at universities based in KwaZulu-Natal, South Africa. The findings are organized based on the three study objectives and illustrate how the data from these objectives contributed to the development of the HIV risk index tool. The outcomes for each study objective are outlined by the publication of two manuscripts in DHET peer reviewed journals, two manuscripts currently under review and one under development as follows:

Manuscript 1: **'Food insecurity and risky sexual behaviours among university students in KwaZulu-Natal, South Africa'**, (2022) *International Journal of Sexual Health*. https://doi.org/10.1080/19317611.2022.2117257 [Impact factor - 2.152].

Manuscript 2: **'Socio-economic determinants of risky sexual behaviours and HIV seropositivity among university students in South Africa: A case control analysis'**, (2023) *Research and Nursing Health Journal*, 46, pp. 436-444. [Impact factor- 2.238].

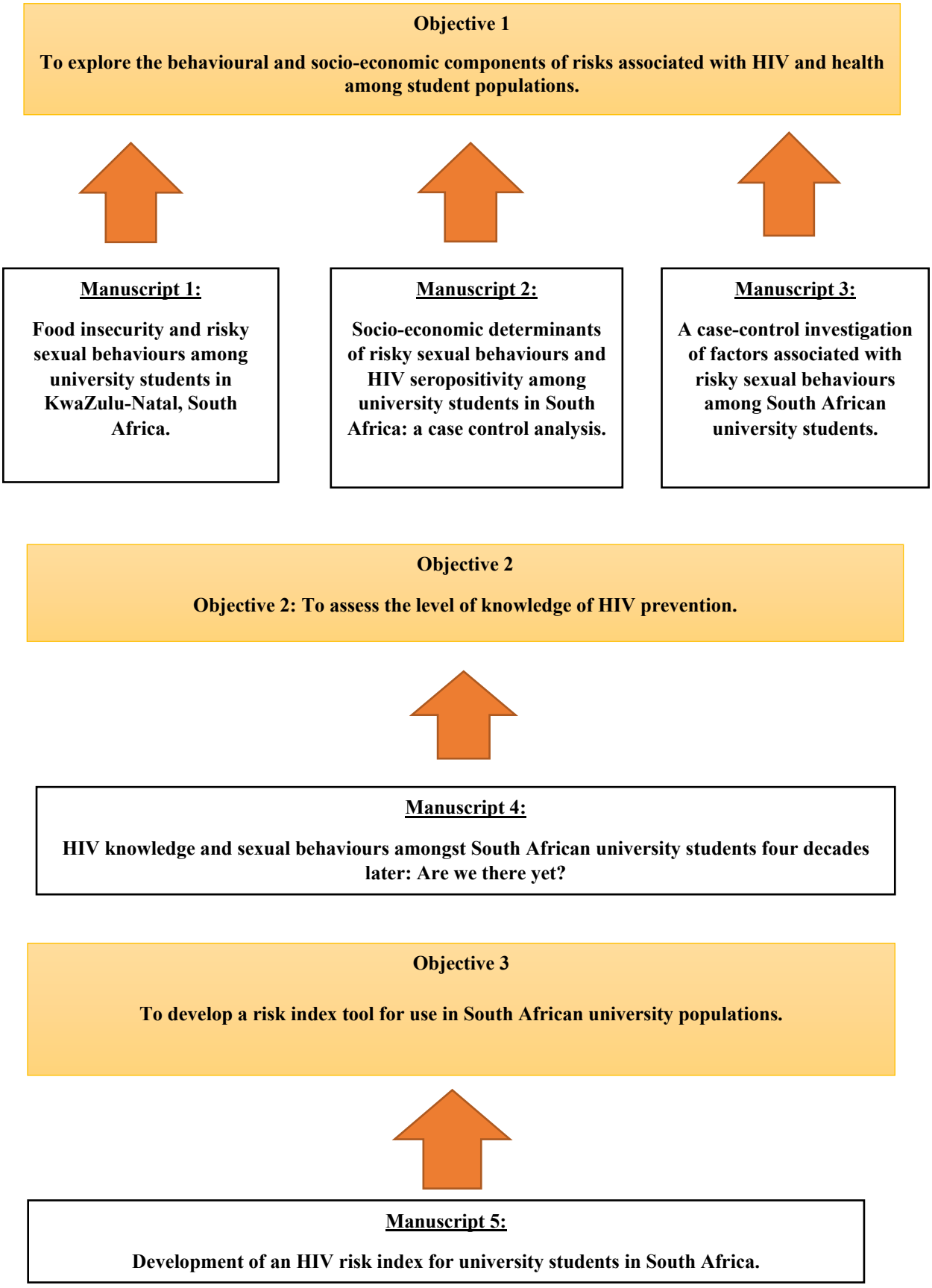
Manuscript 3: **'A case-control investigation of factors associated with risky sexual behaviours among South African university students'.** Currently under review.

Manuscript 4: **'HIV knowledge and sexual behaviours amongst South African university students four decades later: Are we there yet?**' Currently under review.

Manuscript 5: **'Development of an HIV risk index for university students in South Africa'**. Manuscript in preparation.

The outcomes corresponding to each of the study objectives are illustrated in Figure 2.

Figure 2: Schematic illustration of research objectives and manuscripts



The findings for **Objective 1, which aimed to explore the behavioural and socio-economic components of risk associated with HIV and health among student populations**, is demonstrated in Manuscripts 1-3. Manuscript 1 reports the association between food insecurity and RSBs among HIV uninfected students using preliminary data. Further, Manuscript 2 contributed further analyses between socioeconomic risk factors viz., food insecurity, sharing of bursary/ loan and accessing NSFAS, and RSBs among both HIV infected and uninfected participants. In Manuscript 3, the behavioural risk factors (i.e., alcohol and drug usage, age of sexual debut, number of lifetime sexual partners etc.) are further explored as predictors of RSBs. Since there is a paucity of case control investigations examining risk factors among both HIV seropositive and seronegative students in the SA university student context, we deemed this type of investigation necessary to highlight risks experienced by both the HIV negative and positive groups. Data on risk factors in HIV negative groups may contribute to preventative interventions specific to this group. Data emanating from the HIV positive group may help to prevent HIV transmission behaviours and curb the spread of HIV infection. Earlier SA based studies have investigated food insecurity and NSFAS student funding among students (Munro *et al.*, 2013; Dominguez-Whitehead, 2015); however, limited data is available regarding the association between socioeconomic risk factors, engagement in RSBs and HIV seropositivity. Furthermore, socioeconomic determinants such as food insecurity, are widely recognized predictors of RSBs and/or HIV seropositivity among other vulnerable populations viz., women, young adults, adolescents and the homeless (Masa *et al*., 2019; Nagata *et al*., 2021; Smith *et al*., 2021, Vogenthaler *et al*., 2013). Therefore, it was deemed necessary to investigate socioeconomic predictors to determine if these variables influenced the university student populations' engagement in RSBs and HIV seropositivity.

Manuscript 1 **'Food insecurity and risky sexual behaviours among university students in KwaZulu-Natal, South Africa'**

Govender, T., Govender, N., & Reddy, P. (2022) 'Food Insecurity and Risky Sexual Behaviours among University Students in KwaZulu-Natal, South Africa', *International Journal of Sexual Health*, pp.1–12. DOI: https://doi.org/10.1080/19317611.2022.2117257

Preliminary data from HIV negative participants was analysed to examine the students' level of food insecurity and their likelihood of RSB engagement. Results demonstrated that food insecurity raised the probability of respondents participating in the following RSBs: exchanging sex for money [aOR: 3.18, (95% CI: 1.29; 7.84), $p = 0.012$], transactional sex to meet basic needs [aOR: 4.98, (95% CI: 1.93; 12.84), $p = 0.001$] and multiple sexual partners

[aOR: 2.04, (95% CI: 1.22; 3.42), p = 0.006]. Most participants in our study population were NSFAS grant recipients, which indicates a poor socio-economic background. Moreover, having a food insecure status may predispose an individual to unsafe sexual practices in an attempt to acquire material resources such as food. In particular, female students may engage in sexual relationships to increase access to various commodities i.e., food, accommodation, transportation etc. This practice may be driven by the need to fulfil socio-economic necessities (HEAIDS, 2010); however, this is not always true. Earlier investigations provide alternate reasons for transactional sex engagement. These studies report that some students engage in transactional sex to acquire luxury items such as clothing and hairstyles, as well as to elevate their social status (Amo-Adjei *et al*., 2014; Masvawure, 2010; Shefer *et al*, 2012). Due to the lack of resources, poorer students may fall prey to transactional relationships, further exposing them to unsafe sexual practices. Our study further indicates that food insecurity is linked to a 2-fold increased risk of having multiple concurrent sexual partners amongst the sample population [aOR: 2.04, (95% CI: 1.22; 3.42), p = 0.006]. Engaging in multiple concurrent sexual partnerships increases an individual's HIV risk and subsequently the risk of transmission to concurrent sexual partners.

Manuscript 2 **'Socio-economic determinants of risky sexual behaviours and HIV seropositivity among university students in South Africa: a case control analysis'**

Pillay, T., Govender, N and Reddy, P. (2023) 'Socioeconomic determinants of risky sexual behaviours and HIV seropositivity among university students in South Africa: a case control analysis', *Research in Nursing Health*, 46, pp.436-444. DOI: 10.1002/nur.22328

The study aimed at investigating the socio-economic determinants of RSBs and HIV positive status among students (N=500). Since there is a scarcity of knowledge regarding the socioeconomic aspects of students in South African universities, we investigated food security, sharing of bursary/ loan and accessing NSFAS funding as risk factors. In view of the paucity of case control data we aimed to augment the existing knowledge base by examining the association between socioeconomic factors and students' involvement in RSBs, along with their vulnerability to HIV infection.

The data illustrated significant associations between food insecurity and the probability of engaging in RSBs such as multiple sexual partners [aOR: 1.87, (95% CI: 1.21; 2.89), p = 0.005], transactional sex for financial gain [aOR: 3.18, (95% CI: 1.44; 7.05), p = 0.004) and partaking in transactional sex to meet basic needs [aOR: 5.11, (95% CI: 2.29; 11.38), p =

0.000]. These findings concur with the preliminary results presented in Manuscript 1 (Govender, Govender and Reddy, 2022). Moreover, results found that NSFAS funding and sharing of the bursary/ loan with family were significant predictors of HIV seropositivity. Contrarily, participants who accessed NSFAS funding were at a decreased risk of engaging in transactional sex for financial gain.

More than 36% of respondents (n=174) in the sample population experienced food insecurity. Furthermore, results indicated a higher prevalence of food insecurity among those respondents who were HIV negative in comparison to those who were HIV positive. Experiencing food insecurity within the control group was significantly associated with having multiple sexual partners. These results suggest possible reckless behaviours among the HIV uninfected participants and that HIV infected participants were more health conscious. Seventy-seven percent of students in our sample obtained NSFAS funding to support their tertiary education. Within the SA context, students qualify for NSFAS funding based on their family's financial circumstances. Our results showed that 72.7% of HIV infected participants reported sharing their bursary/ loan with family compared to 49.2% of the HIV uninfected participants. Poor socio-economic background may compel students to share their bursary/ loan with their family to provide them with a means of financial support to run households. In doing so, this would further disadvantage a student by presenting an additional financial responsibility.

Manuscript 3 **'A case-control investigation of factors associated with risky sexual behaviours among South African university students'**, which is currently under review, further addressed the behavioural component of HIV risk among students outlined in objective 1. This manuscript aimed to investigate the associations between behavioural variables i.e., substance usage prior to sex, heavy episodic drinking, age of sexual debut and lifetime number of partners with RSB participation. Furthermore, we investigated the associations between behavioural variables and the risk of HIV seropositivity in this sample. Aspects of student health, such as contraceptive usage, STI diagnosis and MMC were also explored in this paper. Extensive literature is available on the behavioural determinants of RSBs among university students both nationally and internationally; however, to our knowledge there is limited literature examining this association using a case control methodology. The HEAIDS (2010) seminal study conducted among SA HEIs had stratified data by HIV status; however, a cross-sectional methodology was employed, and the research was undertaken more than a decade

ago. Therefore, Manuscript 3 aimed to fill this research gap by exploring changes (if any) in the last decade.

Our results demonstrated significant associations between heavy episodic drinking [aOR: 2.73, (95% CI: 1.38; 5.44), $p = 0.004$], drug use before sex [aOR: 7.46, (95% CI: 2.00; 27.88), $p = 0.003$], a higher number of lifetime sex partners [aOR: 4.22, (95% CI: 1.69; 10.54), $p = 0.002$] and students' likelihood of having multiple concurrent sex partners. Additionally, among HIV-uninfected students, intercourse with multiple partners, irregular condom use, high episodic drinking, and drug use before sex were more common compared to HIV infected students. Substance usage may fuel student's impulsive behaviour and promote reckless sexual behaviours i.e., multiple concurrent sexual partners or unprotected intercourse. This may elevate the HIV infection risk among this population group.

Our data indicated a significant association between a later age of sexual debut (≥ 18 years) and HIV seropositive status ($p = 0.030$). This association could be due to participants having debuted sex with older partners who may have been HIV seropositive. Moreover, results indicated that a later age of sexual debut (≥ 15 years) was protective against engaging in sex with multiple concurrent sex partners [aOR: 0.08, (95% CI: 0.01; 0.63), $p = 0.017$]. Early sexual debut may have various health and social consequences for an individual; these include the increased risk of acquiring STIs and HIV infection, unwanted pregnancy, and the possibility of abandonment of studies. An earlier age of sexual debut may also contribute to an individual having an increased number of lifetime sexual partners. Our data showed that a greater proportion of HIV infected respondents reported between 2 to 5 lifetime partners in comparison to HIV uninfected respondents. Having an increased number of lifetime partners may increase an individual's risk of acquiring STIs including HIV.

The majority of participants (78%) reported usage of contraceptives, with condoms (61.3%) being the most used contraceptive. Of the 78% confirming contraceptive use, 93.5% were HIV infected participants in comparison to the 73.4% of HIV uninfected participants. The HIV seropositive participants appeared to be more responsible with respect to their sexual health as indicated by the higher proportion using contraceptives. Both the HIV infected, and uninfected participants reported undertaking MMC in a clinical health setting (89.1% controls vs 100% cases). The high uptake of MMC is suggestive of an increased knowledge and awareness regarding the benefits of MMC.

Manuscript 4 **'HIV knowledge and sexual behaviours amongst South African university students four decades later: Are we there yet?'**, which is a manuscript under review, investigated the associations between university students' knowledge on HIV prevention methods, modes of transmission and RSBs as well as HIV seropositivity. Whilst HIV knowledge and the association between knowledge and RSBs amongst university students have been widely investigated (Kwigizile *et al*., 2013; Fennie & Laas, 2014; Murwira *et al*., 2021; Raijmakers & Pretorius *et al*., 2006), studies employing a case control design, which is a more valuable way of determining risk, is limited. Even though the university population is expected to be knowledgeable, the lack of experience and understanding regarding HIV will result in reckless behaviour and consequent involvement in RSBs. An investigation on HIV knowledge among students is critical to understand knowledge levels and knowledge gaps among both groups of HIV positive and negative groups of students. This information can help to inform HIV prevention interventions that will affect behaviour change among students. Our data suggest that poor knowledge of HIV prevention methods and modes of transmission may be significant predictors of HIV status among university students in our sample. Students who had poor knowledge regarding HIV prevention methods were at a higher likelihood of being HIV seropositive versus those reporting good knowledge [aOR: 2.34, (95% CI: 1.47; 3.72), $p \leq 0.005$). Those reporting poor knowledge regarding HIV modes of transmission were also more likely to be HIV seropositive [aOR: 4.79, (95% CI: 2.84; 8.08), $p \leq 0.005$).

It was disconcerting to note that more than half of the participants reported limited awareness on HIV prevention methods. Significantly, a large proportion of seropositive participants reported poorer knowledge on HIV prevention in comparison to seronegative participants. The elevated risk of HIV infection in this population may be due to poor knowledge on how best to protect themselves. However, a limitation in our study is the lack of exploration of other causes of infection including perinatal infection or infection due to accidents and usage of injectable drugs. Participants had a limited awareness about the advantages of fewer sexual partners, not engaging in premarital sex, using drugs to prevent mother to child transmission, MMC and PEP as strategies to mitigate the risk of HIV infection. Our investigation found that misconceptions about HIV transmission were reported by both controls and cases in our sample. Many participants highlighted mosquito bites, usage of public toilets, and touching an HIV infected person as transmission routes for HIV infection.

Seventy-nine percent of students in our sample showed good knowledge of HIV transmission. Moreover, higher levels of knowledge on modes of transmission were significantly associated with an HIV negative status. It was concerning that modes of transmission such as contaminated blood transfusion, unprotected anal sex, sharing contaminated razor blades and unprotected vaginal sex were reported by only a small proportion of HIV positive participants. Despite acknowledging condom usage as a prevention method, participants continued to engage in inconsistent condom usage during vaginal sex. It is evident that having increased knowledge levels on HIV may not necessarily translate to safer sexual practices. Health education regarding HIV/AIDS targeted at the university student population is critical for the facilitation of safe sex in this vulnerable population (Murwira *et al*., 2021). Therefore, the findings from this study emphasize the urgency for the strengthening of HIV/AIDS education within the higher education sectors in SA as a means to fulfil knowledge gaps and dispel misconceptions regarding HIV.

Manuscript 5 **'Development of an HIV risk index for university students in South Africa',** describes the design and development of an HIV risk index score and tool based on data emanating from objectives 1 and 2 (Manuscripts 2, 3 and 4: Pillay, Govender and Reddy, 2023a; Pillay, Govender and Reddy, 2023b; Pillay, Govender and Reddy, 2022). A major target of sustainable development goal 3 is concluding the HIV epidemic by 2030; however, the rate of decrease of new HIV infections does not correlate with attaining this target (Assefa and Gilks, 2020). Within the sub-Saharan African context, young people aged between 15 to 24 years are exceptionally vulnerable to HIV infection (UNAIDS, 2022) and university students form part of this vulnerable population. With 7 years left before the deadline for the SDG 3 targets, accelerated efforts are required to curb HIV infection rates, particularly within the 15 to 24 years age category in an attempt to end HIV/AIDS by the year 2030. Therefore, the outcome of this study was to develop a risk assessment tool which has potential to assist in screening HIV risk levels and consequently influence behaviour change in university environments.

Risk assessment instruments such as risk indices are clinically useful in measuring the risk of an individual developing diseases such as HIV (Susser *et al*., 1998; Menza *et al,* 2009, Kahle *et al*., 2013; Boileau *et al*., 2008), diabetes mellitus (Schmidt *et al*., 2005; Schulze *et al*., 2007) and cancer (Kim, Rockhill & Colditz, 2004). Worldwide, HIV risk indices are available for identifying vulnerable population groups i.e., heterosexual serodiscordant couples (Kahle *et*

al., 2013), men who have sex with men (MSM) (Menza *et al.,* 2009), young people (Boileau *et al*., 2008) and female college students in the US (Harlow *et al*., 1993). A major gap identified in SA is the lack of risk assessment tools that can be used to measure HIV risk among the university student populations. Students have increased freedom to explore reckless behaviours i.e., substance usage, which encourage participation in risky sexual behaviours. A student HIV risk measurement tool can serve as a powerful public health tool and may be used to determine specific HIV prevention interventions required by students. This study therefore aimed to provide details of the design and development of a risk index score and tool for measuring HIV risk levels among the university student population in SA.

Our risk index was specifically designed for sexually active university students and thus the analysis was done using only students who had reported ever engaging in sexual intercourse which included vaginal/ anal sex. Prior analysis using logistic regression models of socioeconomic, behavioural, and knowledge variables from our initial reports (Pillay, Govender & Reddy, 2023a; Pillay, Govender & Reddy, 2023b unpublished; Pillay, Govender & Reddy, 2022 unpublished) was used to select variables for inclusion in the development of the risk index. Seventeen independent variables of public health significance, regardless of the lack of statistical significance in the logistic regression modelling, were included in the risk index *apriori*. The scores of all items were summed to derive a total score which yielded a maximum score of 17 and minimum of 0 based on coded categories of (1 or 0). The total scores were ranked and divided into 3 tertiles (1st Tertile =low risk, 2nd Tertile = moderate risk and 3rd Tertile = high risk). Questions were then formulated based on the 17 variables included in the risk index analysis and available in a questionnaire format. Each of the responses to questions was assigned a score of either 0 or 1 on the risk index questionnaire. The variables of interest were allocated a score of 1 and the variables that were not of interest were allocated a score of 0. Therefore, the higher an individual scores on the risk index, the more predisposed they are to acquiring HIV. However, a limitation noted during the tool design was that scoring was not weighted according to the risk of a certain behaviour (i.e., engagement in anal sex vs vaginal sex). Further studies will pilot this tool and follow a longitudinal study to determine its efficacy.

The outcome of this study was achieved by exploring various risk factors for RSB and HIV among a university student population in KZN. Data from this investigation has been utilized to inform the development of an HIV risk assessment tool in the form of a risk index score and

questionnaire. The HIV risk index tool thus demonstrates potential for use within the campus health settings as a screening tool for identification of students at risk by measuring HIV risk. Furthermore, the tool can be used to customize HIV prevention interventions such as PrEP and counselling. Furthermore, the risk index may be a warning signal and serve as a deterrent to prevent RSB engagement, used as a strategy to assist students by making them more aware of their HIV risk levels, as well as empowering them to exercise safer sexual behaviours and be more mindful of their health. Further investigation is required to explore the various factors associated with RSBs and HIV using a longitudinal study design to determine if causal relationships exist. Future research will be conducted to examine the validity and reliability of the designed risk index among the SA university student population. Accelerated efforts are required within the higher education sector to prevent HIV infection among vulnerable populations such as university students in SA in an attempt to meet the SDG 3 target to eliminate HIV/AIDS by 2030.

STRENGTHS

The use of a case control study design and the inclusion of all four major HEIs in KZN as study sites is valuable in drawing comparisons between the risk factors for HIV and RSBs among both HIV seropositive and seronegative students. The inclusion of the major HEIs ensured that students from various areas in KZN were represented in the study.

LIMITATIONS

The study population only included South African Black participants, of which the majority were females. The use of convenience sampling techniques may have also introduced bias into the sample and reduced the generalizability of the findings. All data collected was via self-reporting and this may have led to the respondent bias. Furthermore, the use of an observational study design did not allow for the determination of causation between risk factors and outcome variables.

RECOMMENDATIONS

- Despite the vast body of knowledge on RSBs among university students in SA, there is a dearth of available studies on the predictors of HIV infection and RSBs among HIV

positive and negative students. Future research is recommended to examine causality using a longitudinal study design. In particular, the association between socio-economic, behavioural, and knowledge related factors and RSB/HIV seropositivity warrants further investigation. The data from such studies may guide interventions aimed at mitigating RSBs and HIV seropositivity among university students.

- Our study identified that university students were not exempt from food insecurity. Moreover, students were identified as being prone to poor socio-economics conditions in our sample population. This may increase the likelihood of HIV infection. Therefore, measures aimed at addressing food insecurity among university students are urgently needed to reduce their participation in RSB and subsequent exposure to HIV. These could include foodbanks and other forms of nutritional relief programmes.
- Socio-economic determinants may increase the risk of HIV infection among students. Therefore, PrEP can be beneficial in reducing HIV risk among students who are sexually active and socio-economically disadvantaged. Hence, HCWs servicing students must consider socio-economic determinants such as food insecurity, and sharing of bursary and study funding, when providing customized HIV prevention services such as PrEP to students.
- Presently, ARV initiation has only been rolled out at some university campus clinics. In other universities, students are referred to the DOH facilities for initiation of ARV treatment. It is strongly recommended that all universities employ HIV care and support nurses tasked with managing the specific needs of HIV seropositive students, one of these being the initiation of ARVs. In doing so, this will promote the uptake of treatment and provide a supportive and conducive environment for HIV seropositive students to collect their chronic treatment.
- Our study found that students displayed knowledge gaps and misconceptions regarding HIV transmission and prevention. Students require more targeted educational efforts on misconceptions regarding HIV transmission. Frequent monitoring of knowledge regarding HIV prevention and transmission strategies is required to identify knowledge gaps among students, as these gaps and misconceptions can lead to risky behaviours. Furthermore, emphasis must be placed on educating students on the benefits of MMC, PrEP and PEP, which can assist in promoting health advocacy.
- Special emphasis must be given to health education efforts aimed at entry level students, as it is assumed that many of these students may not be sexually active upon

enrolment in university. Special needs/ vulnerabilities of this student population must be considered in designing suitable interventions. Students should be empowered with sexual health 'survival skills' at least biannually. This could include developing skills on abstinence, condom negotiation skills, and safe sexual practices, together with an inclusion of a practical component such as role play and demonstrations.

- Substance use prevention programmes targeting university students are required to identify students at risk of HED and drug abuse. Students must be sensitized on how irresponsible drinking and drug use can lead to engagement in RSBs, which may predispose an individual to HIV infection and unwanted pregnancy.
- Re-evaluation and strengthening of reproductive health education programmes at a primary and secondary school level must be considered. These programmes can encourage a delay in sexual debut among students, which has a potential to prevent a higher number of lifetime sexual partners, thus decreasing HIV risk.
- Condoms must always be readily available in all campus residences and other public places on campus.
- Future investigations determining risk factors associated with RSBs among university populations should also utilize randomized sampling techniques to ensure that each sub-set have equal chances of being selected for participation.

CONCLUSION

This study evaluated the multidimensional facets of HIV risk among university students in SA. Our findings confirm associations between socio-economic, behavioural, HIV knowledge aspects and RSBs/ HIV seropositivity. Given the various predictors of HIV that are prevalent within this population, South African university students are considered a high-risk population and thus require urgent customized and effective interventions to influence behaviour change. Higher education policy makers should take into account the socio-economic risks experienced by students and how they may influence RSB engagement. Emphasis must be given to nutritional relief efforts to assist those identified to be food insecure. Efforts to ensure that all HEIs in KZN and nationally are sufficiently equipped to provide adequate HIV care, and to support HCWs to provide health services and initiate ART among students are important. This has potential to promote ART adherence and subsequently improve health outcomes among those affected. Programmes aimed at empowering students with HIV knowledge and dispelling

misconceptions in an innovative and practical way may also change the trajectory of HIV infection rates within this population. To our knowledge, we are the first to design and develop an HIV risk index tool for this population, which has potential to be a robust public health tool that can measure HIV risk levels. It is anticipated that student's awareness of HIV risk levels may promote behaviour changes which promote sexual health. Future longitudinal research is required to examine the validity and reliability of the designed risk index among the SA university student population.

REFERENCES

Abdool Karim, Q. and Abdool Karim, S.S. (2018) 'HIV-No time for complacency', *American Association for Advancement in Science*, 360(6394), pp.1153. doi: 10.1126/science.aau2663.

Abdool Karim, S.S., Abdool Karim, Q. and Baxter, C. (2008) 'Reducing sexual risk behaviours: Theory and research, successes and challenges'. In Abdool Karim, S. S and Abdool Karim, Q, eds. *HIV/AIDS in South Africa*. 1st edition. Cape Town: Cambridge University Press, pp.143-165.

Abdool Karim, S., Abdool Karim, Q. and Baxter, C. (2010) 'Overview of the book'. In Abdool Karim, S. and Abdool Karim, Q., eds. *HIV/AIDS in South Africa*. 2nd edition. Cape Town, South Africa: Cambridge University Press, pp.1–608.

Abdool Karim, S.S. and Ramjee, G. (1998) 'Anal sex and HIV transmission in women', *American Journal of Public Health*, 88(8), pp.1265–1266.

Abebe, M., Tsion, A & Netsanet, F. (2013) 'Living with parents and risky sexual behaviours among preparatory school students in Jimma zone, South West Ethiopia,' *African Health Sciences*, 13(2), pp.498-506.

Abels, M.D. and Blignaut, R.J. (2011) 'Sexual-risk behaviour among sexually active first-year students at the University of the Western Cape, South Africa', *African Journal of AIDS Research*, 10(3), pp.255–261. doi: 10.2989/16085906.2011.626295.

ACOG (2015) *Emergency Contraception*, *September 2015*. Available at: https://www.acog.org/clinical/clinical-guidance/practice-bulletin/articles/2015/09/emergency-contraception (Accessed: 28 March 2022).

Adam, M.B. and Mutungi, M. (2007) 'Sexual Risk Behavior Among Kenyan University Students', *Journal of Arizona-Nevada Academy of Science*, 39(2), pp.91–98.

Addis, Z., Yalew, A., Shiferaw, Y., Alemu, A., Birhan, W., Mathewose, B. & Tachebele, B.

(2013) ‘Knowledge , attitude and practice towards voluntary counseling and testing among university students in North West Ethiopia : a cross sectional study’, *BMC Public Health*, pp.1–8.

Adefuye, A.S., Abiona, T.C., Balogun, J.A. and Lukobo-Durrel, M. (2009) ‘HIV sexual risk behaviors and perception of risk among college students: Implications for planning interventions’, *BMC Public Health*, 9(281), pp.1–13. doi: 10.1186/1471-2458-9-281.

Aidsmap (2009) *Concurrent sexual partnerships and the spread of HIV - the evidence is limited’*. Available at: https://www.aidsmap.com/news/dec-2009/concurrent-sexual-partnerships-and-spread-hiv-evidence-limited (Accessed at: 27 May 2023).

Ajayi, A.I., Yusuf, M.S., Mudefi, E., Adeniyi, O.V., Rala, N. & Goon, D.T. (2020) ‘Low awareness and use of post-exposure prophylaxis among adolescents and young adults in South Africa: Implications for the prevention of new HIV infections’, *African Journal of AIDS Research*, 19(3), pp.242–248. doi: 10.2989/16085906.2020.1811356.

Ajayi, A.I. & Somefun, O.D. (2019) ‘Transactional sex among Nigerian university students: The role of family structure and family support’, *PLoS ONE*, 14(1), pp.1–18. doi: 10.1371/journal.pone.0210349.

Akintade, O.L., Pengpid, S. & Peltzer, K. (2011) ‘Awareness and use of barriers to family planning services among female university students in Lesotho’, *South African Journal of Obstetrics and Gynaecology*, 17(3), pp.72–78.

Akintola, O., Ngubane, L. & Makhaba, L. (2011) "“I did it for him, not for me”: an exploratory study of factors influencing sexual debut among female university students in Durban, South Africa’, *Journal of Health Psychology*, 17(1), pp.143–153. doi: 10.1177/1359105311410512.

Allinder, S.M. & Fleischman, J. (2019) 'The World’s Largest HIV Epidemic in Crisis: HIV in South Africa'. Available at: https://www.csis.org/analysis/worlds-largest-hiv-epidemic-crisis-hiv-south-africa#:~:text=The reasons are both biological,and widespread poverty and unemployment. (Accessed: 21 July 2022).

Amare, T., Yeneabat, T. & Amare, Y. (2019) 'A Systematic Review and Meta-Analysis of Epidemiology of Risky Sexual Behaviors in College and University Students in Ethiopia, 2018', *Journal of Environmental and Public Health*, 2019. doi: 10.1155/2019/4852130.

Aminde, L.N., Takah, N.F., Noubiap, J.J.N., Tindong, M., Ngwasiri, C., Jingi, A.M., Kengne, A.P. & Dzudie, A. (2015) 'Awareness and low uptake of post exposure prophylaxis for HIV among clinical medical students in a high endemicity setting', *BMC Public Health*, 15(1), pp.1–9. doi: 10.1186/s12889-015-2468-9.

Amir, E., Freedman, O.C., Seruga, B. & Evans, D.G. (2010) 'Assessing women at high risk of breast cancer: a review of risk assessment models', *Journal of the National Cancer Institute*, 102(10), pp.680–691. doi: 10.1093/jnci/djq088.

Amo-Adjei, J., Kumi-Kyereme, A. & Tuoyire, D.A. (2014) 'Transactional sex among female university students in ghana: Implications for HIV education', *Health Education*, 114(6), pp.473–486. doi: 10.1108/HE-02-2014-0013.

Asante, K.O & Oti-Boadi, M. (2013) 'HIV/AIDS knowledge among undergraduate univeristy students: Implications for health education program in Ghana', *African Health Sciences*, 13(2), pp.270–277. doi: 10.4314/ahs.v13i2.11.

Assefa, Y. & Gilks, C.F. (2020) 'Ending the epidemic of HIV/ AIDS by 2030: 'Will there be an endgame to HIV, or an endemic HIV requiring an integrated health systems response in many countries', *International Journal of Infectious Diseases*, 100, pp.273-277.

Auvert, B., Taljaard, D., Lagarde, E., Sobngwi-Tambekou, J., Sitta, R. & Puren, A. (2005) 'Randomized, controlled intervention trial of male circumcision for reduction of HIV infection risk: the ANRS 1265 trial', *PLoS Medicine*, 2(11), pp.1112–1122. doi: 10.1371/journal.pmed.0020298.

Babor, T.F., Higgins-Biddle, J.C., Saunders, J.B & Monteiro, M.G. (2001) *AUDIT Alcohol Use Disorders Identification Test*. Geneva, Switzerland. Available at: http://whqlibdoc.who.int/hq/2001/WHO_MSD_MSB_01.6a.pdf. (Accessed: 13 March 2019).

Baggaley, R. F., White, R. G. and Boily, M. C. (2010) 'HIV transmission risk through anal

intercourse: Systematic review, meta-analysis and implications for HIV prevention', *International Journal of Epidemiology*, 39(4), pp.1048–1063. doi: 10.1093/ije/dyq057.

Bailey, R.C., Moses, S., Parker, C.B., Agot, K., Maclean, I., Krieger, J.N., Williams, C.F.M., Campbell, R.T. & Ndinya-Achola, J.O. (2007) 'Male circumcision for HIV prevention in young men in Kisumu, Kenya: a randomised controlled trial', *Lancet*, 369(9562), pp.643–656. doi: 10.1016/S0140-6736(07)60312-2.

Baker, H., Fried, A., Cloete, A., Sigel, C., Miranda, D., Guillen, J., Rochat, R. & Siegler, A. (2018) '"Give What the People Want": A Situational Analysis of Condom Distribution and a Feasibility Study of User-Friendly Condoms in Cape Town, South Africa', *Journal of the Association of Nurses in AIDS Care*, 29(6), pp.887–901. doi: 10.1016/j.jana.2018.04.002.

Ballester-Arnal, R., Gil-Llario, M.D., Castro-Calvo, J. and Gimenez-Garcia, C. (2016) 'HIV-Risk Index: Development and Validation of a Brief Risk Index for Hispanic Young People', *AIDS and Behavior*, 20(8), pp.1796–1807. doi: 10.1007/s10461-016-1411-0.

Baral, S., Trapence, G., Motimedi, F., Umar, E., Iipinge, S., Dausab, F. & Beyrer, C. (2009) 'HIV Prevalence , Risks for HIV Infection , and Human Rights among Men Who Have Sex With Men (MSM) in Malawi, Namibia, and Botswana', *PLOS One*, 4(3), pp.4–11. doi: 10.1371/journal.pone.0004997.

Beksinska, M.E., Smit, J.A. and Mantell, J. (2012) 'Progress and challenges to male and female condom use in South Africa', *Sex Health*, 9(1), pp.51-58.

Berman, A.H., Bergman, H., Palmstierna, T & Schlyter, F. (2003) The Drug Use Disorders Indentification Test (DUDIT) Manual. Stockholm. Available at: https://paihdelinkki.fi/sites/default/files/duditmanual.pdf (Accessed: 19 April 2022).

Beyrer, C., Sullivan, P., Sanchez, J., Baral, S.D., Collins, C., Wirtz, A.l., Altman, D., Trapence, G. & Mayer, K. (2013) 'The increase in global HIV epidemics in MSM', *AIDS*, 27(17), pp.2665-78. doi: 10.1097/01.aids.0000432449.30239.fe.

Bingenheimer, J., Asante, E. & Ahiadeke, C. (2015) 'Peer Influences on Sexual Activity

among Adolescents in Ghana', *Stud Fam Plann*, 46(1), pp.1–19. doi: 10.1111/j.1728-4465.2015.00012.x.Peer.

Blignaut, R.J., Jacobs, J. & Vergnani, T. (2015) 'Trends in HIV risk behaviour of incoming first-year students at a South African university: 2007-2012', *SAHARA-J*, 12(1), pp. 39-50. https://doi.org/10.1080/17290376.2015.1086275.

Blum, R. & Mmari, K. (2004) *Risk and protective factors affecting adolescent reproductive health in developing countries*. Available at: https://apps.who.int/iris/bitstream/handle/10665/43045/9241592273.pdf;jsessionid=47A2FBC9F9D019C3632875A381794DC6?sequence=1.(Acessed: 20 November 2022).

Brink, J.G. (2017) 'Considerations for South African higher education: a national student sexual behaviour survey, "Men who have sex with men"', *South African Journal of Higher Education*, 31(4), pp.184–207. doi: 10.20853/31-4-877.

Boileau, C., Rashed, S., Sylla, M. & Zunzunegui, M. V. (2008) 'Monitoring HIV risk and evaluating interventions among young people in urban West Africa: Development and validation of an instrument', *AIDS Education and Prevention*, 20(3), pp.203-219.

Brodsky, A. (2017) '"Rape-Adjacent": Imagining Legal Responses To Nonconsensual Condom Removal', *Columbia Journal of Gender and Law*, pp.183–210. Available at: http://perma.cc/F4H2-8UFR].

Buldeo, P. and Gilbert, L. (2015) 'Exploring the Health Belief Model and first-year students' responses to HIV/AIDS and VCT at a South African university', *African Journal of AIDS Research*, 14(3), pp.209–218. doi: 10.2989/16085906.2015.1052527.

Calabrese, S.K., Underhill, K. & Mayer, K. (2017) 'HIV Preexposure Prophylaxis and Condomless Sex : Disentangling Personal Values From Public Health Priorities', *American Journal of Public Health*, 107(10), pp.1572–1576. doi: 10.2105/AJPH.2017.303966.

Carr, S., Unwin, N. & Pless-Mulloli (2007) *An Introduction to Public Health and Epidemiology*. 2nd edition. Mc Graw Hill. Available at:

https://www.publichealth.com.ng/wp-content/uploads/2020/08/An-Introduction-to-Public-Health-and-Epidemiology-2007.pdf.

CDC (2018) *PEP*. Available at: https://www.cdc.gov/hiv/basics/pep.html (Accessed: 30 March 2022).

CDC (2021) *Men who have sex with men (MSM)*. Available at: https://www.cdc.gov/std/treatment-guidelines/msm.html (Accessed: 30 March 2022).

CDC (2022a). *PrEP 101 Pocket Guide*. Available at: https://www.cdc.gov/hiv/pdf/library/pocket-guides/cdc-hiv-pocket-guide-prep.pdf (Accessed: 05 January 2023).

CDC (2022b) *HIV Treatment as Prevention | HIV Risk and Prevention | HIV/AIDS | CDC*. Available at: https://www.cdc.gov/hiv/risk/art/index.html (Accessed: 16 March 2022).

Cervini, P. & Bell, C. (2005) 'Brief report: Needlestick injury and inadequate post-exposure practice in medical students', *Journal of General Internal Medicine*, 20, pp.419–421. doi: 10.1111/j.1525-1497.2005.0092.x.

Chamberlain, N., Mena, L.A., Geter, A. & Crosby, R.A. (2017) 'Is Sex with Older Male Partners Associated with Higher Sexual Risk Behavior Among Young Black MSM?', *AIDS and Behavior*, 21(8), pp.2526–2532. doi: 10.1007/s10461-017-1699-4.

Chang, A.Y., Maswera, R., Moorhouse, L.R., Skovdal, C.N., Nyamukapa, C. & Gregson, S. (2021) 'The determinants and impacts of age-disparate relationships on women in Zimbabwe: a life perspective', *SSM-Population Health*, 16, pp.1-9.

Chaps (n.d.) *Male Medical Circumcision*. Available at: https://chaps.org.za/medical-male-circumcision/. (Accessed: 27 May 2023).

Child, K. (2015) *Grab a bunch of condoms*. Available at: https://www.timeslive.co.za/news/south-africa/2015-03-13-grab-a-bunch-of-condoms/ (Accessed: 15 November 2019).

Chiringa I.O., Ramathuba, D.U. & Mashau, N.S. (2016) ‘Factors contributing to the low uptake of medical male circumcision in Mutare Rural District, Zimbabwe', *African Journal of Primary Health Care & Family Medicine*, 8(2), pp.2071–2936. doi: http://dx. doi.org/10.4102/phcfm. v8i2.966.

Choudhry, V., Agardh, A., Stafstrom, M. & Ostergren, P. (2014) ‘Patterns of alcohol consumption and risky sexual behavior: a cross-sectional study among Ugandan university students’, *BMC Public Health*, 14(1), pp.1–11. doi: 10.1186/1471-2458-14-128.

CLINICAL INFO HIV.gov (n.d) *HIV/AIDS Glossary*. Available at: https://clinicalinfo.hiv.gov/en/glossary/serostatus#:~:text=HIV%2FAIDS%20Glossary&text=For%20example%2C%20HIV%20seropositive%20means,not%20have%20detectable%20HIV%20antibodies. (Accessed at: 27 May 2023).

Clinton Health Access Initiative (2021) Reflection on South Africa’s progress towards global HIV elimination targets. Available at: https://www.clintonhealthaccess.org/case-study/reflection-of-south-africas-progress-towards-the-global-hiv-targets/ (Accessed: 24 July 2022).

Clowes, L., Shefer, T., Fouten, E., Vergnani, T. & Jacobs, J. (2009) ‘Coercive sexual practices and gender-based violence on a university campus’, *Agenda*, 23(80), pp.22–32. doi: 10.1080/10130950.2009.9676236.

Collins, G.S., Mallet, S., Omar, O. & Yu, L. (2011) ‘Developing risk prediction models for type 2 diabetes: a systematic review of methodology and reporting’, *BMC Medicine*, 9(103), pp.1–14.

Cong, L., Ono-Kihara, M., Xu, G., Ma, Q., Pan, X., Zhang, D., Homma, T. & Kihara, M. (2008) ‘The characterisation of sexual behaviour in Chinese male university students who have sex with other men: a cross-sectional study’, *BMC Public Health*, 8, pp.1–7. doi: 10.1186/1471-2458-8-250.

De Vos, A.S., Strydon, H., Fouche, C.B. & Delport, C. S. (2011) Research at grass roots for social sciences and human service proffessions. 4th edn. Pretoria: Van Schaik.

Dominguez-Whitehead, Y. (2015). 'Students' food acquisition struggles in the context of South Africa: the fundamentals of student development', *Journal of College Student Development*, *56*(3), pp.292–308. https://doi.org/10.1353/csd.2015.0022

Drakes, N., Perks, C., Kumar, A., Quimby, K., Patel, R., Hambleton, I.R. & Landis, R.C. (2013) 'Prevalence and risk factors for intergenerational Sex: a cross-sectional cluster survey of Barbadian females aged 15-19', *BMC Women's Health*, 13(53), pp.1-10.

Duby, Z., Hartmann, M., Montgomery, E.T., Colvin, C.J., Mensch, B. & van der Straten, A. (2016a) 'Condoms, Lubricants and Rectal Cleansing: Practices Associated with Heterosexual Penile-Anal Intercourse Amongst Participants in an HIV Prevention Trial in South Africa, Uganda and Zimbabwe', *AIDS and Behavior*, 20(4), pp.754–762. doi: 10.1007/s10461-015-1120-0.

Duby, Z., Hartmann, M., Montgomery, E.T., Colvin, C.J., Mensch, B. & van der Straten, A. (2016b) 'Sexual scripting of heterosexual penile-anal intercourse amongst participants in an HIV prevention trial in South Africa , Uganda and Zimbabwe', *Culture, Health and Sexuality*, 18(1), pp.30–44. doi: 10.1080/13691058.2015.1064165.

Dumbili, E. W. (2016) 'Gendered sexual uses of alcohol and associated risks: a qualitative study of Nigerian University students', *BMC Public Health*, 16(1), pp.1–12. doi: 10.1186/s12889-016-3163-1.

Durban University of Technology (2018) *First things first campaign*. Available at: https://www.dut.ac.za/2018-first-things-first-campaign/.(Accessed: 20 March 2019).

Eaton, L., Flisher, A.J. & Aarø, L.E. (2003) 'Unsafe sexual behaviour in South African youth', *Social Science and Medicine*, 56(1), pp.149–165. doi: 10.1016/S0277-9536(02)00017-5.

Ebrahim, S. (2019) 'I'm not sure this is rape, but… : An Exposition of the Stealthing Trend', *Reproductive Health in Sub-Saharan Africa*, pp.1–11. doi: 10.1177/2158244019842201.

Ehrlich, R & Joubert, G. (2014) Epidemiology: A Research Manual for South Africa. 3rd

edn. Edited by G. Ehrlich, R and Joubert. Cape town: Oxford University Press South Africa.

Eller, A. (2016) ‘Transactional sex and sexual harassment between professors and students at an urban university in Benin’, *Culture, Health and Sexuality*, 18(7), pp.742–755. doi: 10.1080/13691058.2015.1123295.

Etikan, I., Musa, S.A. & Alkassim, R.S. (2016) ‘Comparison of Convenience Sampling and Purposive Sampling’, *American Journal of Theoretical and Applied Statistics*, 5(1), pp.1–4. doi: 10.11648/j.ajtas.20160501.11.

Eyiah-Bediako, S., Quansah, F., Omotosho, J.A. & Hagan, J.E. (2021) ‘Assessment of Peer Pressure and Sexual Adventurism among Adolescents in Ghana: The Moderating Role of Child-Rearing Practices’, *Social Sciences*, 10(11), pp.418. doi: 10.3390/socsci10110418.

Fennie, T. & Laas, A. (2014) 'HIV/AIDS-related Knowledge, Attitudes and Risky Sexual Behaviour among a Sample of South African University Students', *Gender & Behaviour*, *12*(1), pp.6035–6044.

Fielding-Miller, R., Dunkle, K.L., Jama-Shai, N., Windle, M., Hadley, C. & Cooper, H.L.F. (2016) 'The feminine ideal and transactional sex: navigating respectability and risk in Swaziland'. *Social Science and Medicine*, 158, pp.24–33. https://doi.org/10.1016/j.socscimed.2016.04.005

Flood, M. (2003) ‘Lust, trust and latex: why young heterosexual men do not use condoms’, *Culture, Health and Sexuality*, 5(4), pp.353–369. doi: 10.1080/1369105011000028273.

Food and Agriculture Organization of the United Nations (2023) *Hunger and food insecurity*. Available at: https://www.fao.org/hunger/en/#:~:text=What%20is%20food%20insecurity%3F,of%20resources%20to%20obtain%20food (Accessed at: 27 May 2023).

French, P.P., Latka, M., Gollub, E.L., Rodgers, C., Hoover, D.R. & Stein, Z.A. (2003) ‘Use-effectiveness of the female versus male condom in preventing sexually transmitted disease in women’, *Sexually Transmitted Diseases*, 30(5), pp.433–439.

Gichane, M.W., Moracco, K.E., Pettifor, A.E., Catherine, Z., Maman, S., Phanga, T., Nthani, T. & Rosenberg, N.E. (2020) 'Socioeconomic Predictors of Transactional Sex in a Cohort of Adolescent Girls and Young Women in Malawi: A Longitudinal Analysis', *AIDS and Behavior*, 24(12), pp.3376–3384. doi: 10.1007/s10461-020-02910-5.

Global HIV Prevention Coalition (2020) *Implementation of the HIV Prevention 2020 Road Map: Fourth Progress Report*. Available at: https://www.unaids.org/sites/default/files/media_asset/fourth-annual-progress-report-global-hiv-prevention-coalition_en.pdf.(Accessed: 15 November 2022).

Golden, M.R., Brewer, D.D., Kurth, A., Holmes, K.K. & Handsfield, H.H. (2004) 'Importance of sex partner HIV status in HIV risk assessment among men who have sex with men', *Journal of Acquired Immune Deficiency Syndromes*, 36(2), pp.734–742. doi: 10.1097/00126334-200406010-00011.

Govender, T., Govender, N. & Reddy, P. (2022) 'Food Insecurity and Risky Sexual Behaviors among University Students in KwaZulu-Natal, South Africa', *International Journal of Sexual Health*, 1–12. https://doi.org/10.1080/19317611.2022.2117257.

Gray, R.H., Kigozi, G., Serwadda, D., Makumbi, F., Watya, S., Nalugoda, F., Kiwanuka, N., Moulton, L.H., Chaudhary, M.A., Chen, M.Z., Sewankambo, N.K. Wabwire-Mangen, F., Bacon, M.C., Williams, C.F.M., Opendi, P., Reynolds, S.J., Laeyendecker, O., Quinn, T.C. & Wawer, M.J. (2007) 'Male circumcision for HIV prevention in men in Rakai, Uganda: a randomised trial', *The Lancet*, 369(9562), pp.657–666. doi: 10.1016/S0140-6736(07)60313-4.

Grésenguet, G., Longo, J., Tonen-Wolyec, S., Bouassa, R.M. & Belec, L. (2017) 'Acceptability and Usability Evaluation of Finger-Stick Whole Blood HIV Self-Test as an HIV Screening Tool Adapted to the General Public in The Central African Republic', *The Open AIDS Journal*, (11), pp.101–118. doi: 10.2174/1874613601711010 10.

Guerra, F.M, Simbayi, L. C. & Mthembu, J.C. (2016). *Female condoms in South Africa: promoting availability and use*. Available at: https://hsrc.ac.za/uploads/pageContent/7533/HSRC%20Policy%20Brief%2005%20-

%20Female%20Condoms_17-3-2016.pdf (Accessed: 12 March 2019).

Gumede, S.D. & Sibiya, M.N. (2018) 'Health care users' knowledge, attitudes and perceptions of HIV self-testing at selected gateway clinics at eThekwini district, Kwazulu-Natal province, South Africa', *Journal of Social Aspects of HIV/AIDS*, 15(1), pp.103–109. doi: 10.1080/17290376.2018.1517607.

Gumindega, G.C. & Maharaj, P. (2021) 'Factors influencing HIV-risk perception among MSM students at a university in Durban, South Africa', *African Journal of AIDS Research*, 20(3), pp.244–253. doi: 10.2989/16085906.2021.1981413.

Haffejee, F., Fasanmi-Kana, O., Ally, F., Thandar, Y. & Basdev, J. (2022) 'Four years later: do South Africans know what pre-exposure prophylaxis for HIV is?', *AIDS Care*, pp.1–8. doi: 10.1080/09540121.2022.2032573.

Haffejee, F., Koorbanally, D. & Corona, R. (2018) 'Condom Use Among South African University Students in the Province of KwaZulu-Natal', *Sexuality and Culture*, 22(4), pp.1279–1289. doi: 10.1007/s12119-018-9523-5.

Haffejee, F. & Maharajh, R. (2019) 'Addressing Female Condom Use among Women in South Africa : A Review of the Literature Addressing Female Condom Use among Women in South Africa' , *International Journal of Sexual Health*, 31(3), pp.297–307. doi: 10.1080/19317611.2019.1643813.

Haileamlak. A (2018) 'The Triple Challenges of Low and Middle-Income Countries', *Ethiopean Journal of Health Sciences,* 28(1), pp.1–2. Available at: https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5866283/.

Harrison, A., Cleland, J., Gouws, E. & Frohlich, J. (2005) 'Early sexual debut among young men in rural South Africa: Heightened vulnerability to sexual risk?', *Sexually Transmitted Infections*, 81(3), pp.259–261. doi: 10.1136/sti.2004.011486.

Harlow, L.L., Quina, K., Morokoff, P.J., Rose, J.S. & Grimley, D.M. (1993) 'HIV risk in women: a multifaceted model', *Journal of Biobehavioural Research*, 1(1), pp.3.38.

HEAIDS (2008) *HIV and AIDS in the Higher Education Sector: Findings of the study on HIV seroprevalence and related factors at the University of KwaZulu-Natal*. Pretoria. Available at: https://www.ukzn.ac.za/wp-content/miscFiles/docs/reports/ukzn-hiv-survey-report.pdf.

HEAIDS (2010) *HIV prevalence and related factors : Higher Education Sector Study 2008-2009*, *Higher Education HIV and AIDs Programme (HEAIDS)*. Pretoria. Available at: http://heaids.org.za/site/assets/files/1229/4936_hesa_hiv_and_aids_in_the_higher_education_sector.pdf%5Cnhttp://heaids.org.za/site/assets/files/1229/4986_hesa_a_guide_to_implementing_a_hiv_and_aids_workplace_programme.pdf%5Cnhttp://heaids.org.za/site/asse.

HEAIDS (2018) HEAIDS Annual Report 2018/19. Pretoria. Available at: https://higherhealth.ac.za/wp-content/uploads/resources/publications/HEAIDS Annual report 2019.pdf.

HEAIDS (2019) *First Things First _ HEAIDS 2019*. Available at: https://www.heaids.ac.za/programmes/first-things-first/. (Accessed: 10 November 2020).

Heeren, G.A., Mandeya, A., Jemmott, J.B., Chiruka, R.T., Marange, C.S., Batidzirai, J.M., Gwaze, A.R., Tyler, J.C. & Hsu, J. (2014) 'Multiple Partners and Condom Use among Students at a South African University', *Journal of Evidence-Based Social Work*, 11(5), pp.437–444. doi: 10.1080/15433714.2012.759468.

Heffron, R., Pintye, J., Mathews, L.T., Weber, S. & Mugo, N. (2016) 'PrEP as peri-conception HIV prevention for women and men', *Current HIV/AIDS Reports*, 13(3), pp.131–139. doi: 10.1016/j.physbeh.2017.03.040.

Hentzien, M., Delpierre, C., Pugliese, P., Allavena, C., Jacomet, C., Valatin, M., Cabie, A., Cuzin, L., Rey, D., Bani-Sadr, F. & Drame, M. (2018) 'Derivation and internal validation of a mortality risk index for aged people living with HIV: The Dat'AIDS score', *PLoS ONE*, 13(4), pp.1–14. doi: 10.1371/journal.pone.0195725.

Higher Health (2021) *Higher Health*. Available at: https://higherhealth.ac.za/about-us/who-we-are/.(Accessed: 12 January 2020).

HIV.gov (2021) Global statistics: The Global HIV/AIDS Epidemic. Available at: https://www.hiv.gov/hiv-basics/overview/data-and-trends/global-statistics (Accessed: 16 November 2021).

'Hiv Rates By Country 2021' (2021). Available at: https://worldpopulationreview.com/country-rankings/hiv-rates-by-country.

Hoffman, S., Levasseur, M., Mantell, J.E., Beksinska, M., Mabude, Z., Ngoloyi, C., Kelvin, E.A., Exner, T., Leu, C., Pillay, L. & Smit, J.A. (2017) 'Sexual and reproductive health risk behaviours among South African university students: results from a representative campus-wide survey', *African Journal of AIDS Research*, 16(1), pp.1–10. doi: 10.2989/16085906.2016.1259171.

Hoque, M.E. (2011a) 'Reported risky sexual practices amongst female undergraduate students in KwaZulu-Natal, South Africa', *African Journal of Primary Health Care and Family Medicine*, 3(1), pp.1–6. doi: 10.4102/phcfm.v3i1.281.

Hoque, M.E. (2011b) 'Sexual practices among male undergraduate students in KwaZulu-Natal, South Africa', *Southern African Journal of Epidemiology and Infection*, 26(3), pp.157–160. doi: 10.1080/10158782.2011.11441439.

Hoque, M.E. & Ghuman, S. (2012) 'Knowledge, Practices and Attitudes of Emergency Contraception among Female University Students in KwaZulu-Natal, South Africa', *PLoS ONE*, 7(9), pp.1–7. doi: 10.1371/journal.pone.0046346.

Hoque, M.E., Ntsipe, T. & Mokgatle-Nthabu, M. (2013) 'Awareness and practices of contraceptive use among university students in Botswana', *Journal of Social Aspects of HIV/AIDS*, 10(2), pp.83–88. doi: 10.1080/17290376.2013.869649.

HSRC (2018) *THE FIFTH SOUTH AFRICAN NATIONAL HIV PREVALENCE , INCIDENCE , BEHAVIOUR AND COMMUNICATION SURVEY , 2017*. Available at: http://www.hsrc.ac.za/uploads/pageContent/9234/SABSSMV_Impact_Assessment_Summary_ZA_ADS_cleared_PDFA4.pdf. (Accessed: 16 May 2021).

IGIGlobal (2023) *What is sexual debut*. Available at: https://www.igiglobal.com/dictionary/sexual-debut/85380 (Accessed at: 27 May 2023).

Iliyasu, Z., Abubakar, I.S., Sani, I.H., Jibo, A.M., Karaye, I.M., Salihu, H.M. & Aliyu, M.H. (2012) 'Male Circumcision and HIV Risk Behavior among University Students in Northern Nigeria', *American Journal of Mens Health*, 7(2), pp.94–101. doi: 10.1177/1557988312456698.

Info4africa (2014) *Mothusimpilo Outreach Programme*. Available at: https://search.info4africa.org.za/Organisation?Id=86963. (Accessed: 13 February 2019).

International Partnership for Microbicides. (2020) Microbicides: Giving Women Power Over HIV/AIDS _ International Partnership For Microbicides. Available at: https://www.ipmglobal.org/why-microbicides/women-global-hiv/aids-epidemic/microbicides-giving-women-power-over-hiv/aids (Accessed: 2 November 2020).

Jarama, S.L., Stultz, N.A., Parillo, K.M., Snyder, F.R. & Young, P.A. (2011) 'Development of an HIV/STD screening index to measure HIV/STD risk in adolescents', *Journal of HIV/AIDS and Social Services*, 10(3), pp.230–247. doi: 10.1080/15381501.2011.596766.

Johnson, S., Kincaid, D.L., Figueroa, M.E., Delate, R., Mahlasela, L. & Magni, S. (2013) *The Third National HIV Communication Survey, 2012*. Pretoria. Available at: https://www.ccisa.org.za/sites/default/files/hiv_survey.pdf (Accessed: 11 October 2017).

Kagaayi, J., Gray, R.H., Whalen, C., Fu, P., Neuhauser, D., McGrath, J.W., Sewankambo, N.K., Serwadda, D., Kigozi, G., Nalugoda, F., Reynolds, S.J., Wawer, M.J. & Singer, M.E. (2014) 'Indices to Measure Risk of HIV Acquisition in Rakai, Uganda', *PLoS ONE*, 9(4), p. e92015. doi: 10.1371/journal.pone.0092015.

Kahle, E.M., Hughes, J.P., Lingappa, J.R., John-Stewart, G., Celum, C., Nakku-Joloba, E., Njuguna, S., Mugo, N., Bukusi, E., Manongi, R. & Baeten, J.M. (2013) 'An empiric risk scoring tool for identifying high-risk heterosexual HIV-1 serodiscordant couples for targeted HIV-1 prevention', *Journal of Acquired Immune Deficiency Syndrome*, 62(3), pp.339-347.

Karim, S.S.A. and Karim, Q.A. (2011) 'Antiretroviral prophylaxis: a defining moment in HIV control', *The Lancet*, 378(11), pp.e23–e25. https://doi.org/10.1016/s0140-6736(11)61136-7

Kharsany, A.B., Cawood, C., Khanyile, D., Grobler, A., Mckinnon, L.R., Samsunder, N., Frohlich, J.A. Abdool Karim, Q., Puren, A., Welte, A., George, G., Govender, K., Toledo, C., Chipeta, Z., Zembe, L., Glenshaw, M.T., Madurai, L., Deyde, V.M. & Bere, A. (2015) 'Strengthening HIV surveillance in the antiretroviral therapy era: rationale and design of a longitudinal study to monitor HIV prevalence and incidence in the uMgungundlovu District, KwaZulu-Natal, South Africa', *BMC Public Health*, 15, pp.1–11.

Kembo, J. (2012) 'Risk factors associated with HIV infection among young persons aged 15-24 years: Evidence from an in-depth analysis of the 2005-06 Zimbabwe demographic and health survey', *Journal of Social Aspects of HIV/AIDS*, 9(2), pp.54–63. doi: 10.1080/17290376.2012.683579.

KFF (2021) The Global HIV/AIDS Epidemic. Available at: https://www.kff.org/global-health-policy/fact-sheet/the-global-hivaids-epidemic/ (Accessed: 9 November 2021).

Kim, D.J., Rockhill, B. & Colditz, G.A. (2004) 'Validation of the Harvard cancer risk index: a prediction tool for individual cancer risk', *Journal of Clinical Epidemiology,* 57(4), pp.332-341.

Klastersky, J.*,* Paesmans, M., Rubenstein, E.B., Boyer, M., Elting, L., Feld, R., Gallagher, J., Herrstedt, J., Rapoport, B., Rolston, K. & Talcott, J. (2000) 'The Multinational Association for Supportive Care in Cancer Risk Index: A Multinational Scoring System for Identifying Low-Risk Febrile Neutropenic Cancer Patients', *Journal of Clinical Oncology*, 18(16), pp. 3038–3051.

Klein, H. (2014) 'Generationing, stealthing, and gift giving: the intentional transmission of HIV by HIV-positive men to their HIV-negative sex partners', *Health Psychology Research*, 2(1582), pp.54-59.

Knox, J., Yi, H., Reddy, V., Maimane, S. & Sandfort, T. (2010) 'The fallacy of intimacy: sexual risk behaviour and beliefs about trust and condom use among men who have sex with

men in South Africa', *Psychology, Health and Medicine*, 15(6), pp.660–671. doi: 10.1080/13548506.2010.507772.

Kuznetsov, A.V., Wiseman, M., Ruzicka, T., Zippel, S.A. & Kuznetzov, L. (2011) 'Short risk behaviour knowledge index for HIV average risk population of sexual active age in Munich, Germany', *Central European Journal of Public Health*, 19(2), pp.79–83. doi: 10.21101/cejph.a3633.

Kwigizile, E., Shao, E., Mtango, G., Sonda, T., Moshi, J. & Chilongola, J. (2013) 'The gap between knowledge and practice of risky sexual behaviors for HIV among university students and staff in Moshi Town in Tanzania', *Journal of Public Health in Africa*, *4*(1), 38–43.

KZN Department of Health (2013) *Launch of voluntary Medical Male Circumcision (MMC) for the Higher Education sector _ South African Government*. Available at: https://www.gov.za/launch-voluntary-medical-male-circumcision-mmc-higher-education-sector (Accessed: 16 March 2022).

KZN DOH (2001) *HIV and AIDS*. Available at: http://www.kznhealth.gov.za/hivandaids.htm#:~:text=Post Exposure Prophylaxis (PEP)&text=PEP management protocol means that,a period of 28 days (Accessed: 17 March 2022).

KZN DOH (2016a) *KZN Department of Health implements HIV Test and Treat policy*. Available at: http://www.kznhealth.gov.za/mediarelease/2016/KZN-Dept-Health-implements-hiv-test-treat-policy-01092016.htm (Accessed: 12 March 2019).

KZN DOH (2016b) South African National Guidelines for Male Medical Circumcision. Available at: https://www.knowledgehub.org.za/system/files/elibdownloads/2019-07/National%2520MMC%2520Policy%2520guidelines.pdf (Accessed: 16 March 2022).
Lashbrook, J. (2000) 'Fitting in: exploring the emotional dimension of adolescent peer pressure', *Adolescence*, 35(140), pp.747–757.

Lategan, B.W., du Preez, R. & Pentz, C.D. (2017) 'Socio-demographic insights into South African student drinking behaviour', *South African Journal of Higher Education*, 31(5), pp.

90–115. doi: 10.20853/31-5-1512.

Latimer, R.L., Vodstrcil, L.A., Fairley, C.K., Cornelisse, V.J., Chow, E.P.F., Read, T.R.H. & Bradshaw, C.S. (2018) 'Non-consensual condom removal, reported by patients at a sexual health clinic in Melbourne, Australia', *PLOS ONE*, 13(12), pp. 1-16. https://doi.org/10.1371/journal.pone.0209779

Leadbeatter, K. (2012) *Male circumcision HIV and health: a guide*. AIDS Foundation of South Africa. Available at: https://www.aids.org.za/wp-content/uploads/2018/02/Male-Circumcision-HIV-Health.pdf.

Leclerc-Madlala, S. (2003) 'Transactional Sex and the Pursuit of Modernity', *Social Dynamics*, 29(2), pp.213–233. doi: 10.1080/02533950308628681.

Leclerc-Madlala, S. (2013) 'Transactional sex, HIV and young African women: are we there yet?', *Future Virology*, 8(11), pp.1041–1043. doi: 10.2217/fvl.13.90.

Li, X., Lin, C., Gao, Z., Stanton, B., Fang, X., Yin, Q. & Wu, Y. (2004) 'HIV/AIDS knowledge and the implications for health promotion programs among Chinese college students: geographic, gender and age differences', *Health Promotion International*, 19(3), pp.345–356. https://doi.org/10.1093/heapro/dah308

Lotriet, E. (2017) 'Varsities get PrEP', *African Journals*, 17(9).

Maartens, G. Cotton, M., Wison, D., Venter, F., Meyers, T. & Bekker, L. (2012) *Handbook of HIV Medicine*. 3rd edn. Cape Town: Oxford University Press South Africa.

Mabaso, M., Mlangeni, L., Makola, L., Oladimeji, O., Naidoo, I., Naidoo, Y., Chibi, B., Zuma, K. & Simbayi, L. (2021) 'Factors associated with age-disparate sexual partnerships among males and females in South Africa: a multinomial analysis of the 2012 national population-based household survey data', *Emerging Themes in Epidemiology*, 18(3), pp.1–13. doi: 10.1186/s12982-021-00093-5.

Mabille, P. (2009) *The effect of alcohol abuse on high-risk sexual behaviour among students*

in Mafikeng. Stellenbosch University.

Macleod, C.I. & Jearey-Graham, N. (2016) '"Peer Pressure" and "Peer Normalization": Discursive Resources that Justify Gendered Youth Sexualities', *Sexuality Research and Social Policy*, 13, pp.230–240. doi: 10.1007/s13178-015-0207-8.

MacPhail, C. & Campbell, C. (2001) '"I think condoms are good but, aai, I hate those things": Condom use among adolescents and young people in a southern African township', *Social Science and Medicine*, 52(11), pp.1613–1627. doi: 10.1016/S0277-9536(00)00272-0.

Madzena, R. 2014. Witsies unimpressed with free flavoured condoms. Available: https://witsvuvuzela.com/tag/choice-condoms/ (Accessed 26/02/2019).

Maharaj, P. & Cleland, J. (2011) 'HIV protective strategies among college students in Durban , South Africa Résumé', *Journal of Social Aspects of HIV*, 8(3), pp.100–106.

Mampane, J.N. (2018) 'Exploring the "Blesser and Blessee" Phenomenon: Young Women, Transactional Sex, and HIV in Rural South Africa', *SAGE Open*, 8(4). doi: 10.1177/2158244018806343.

Mantell, J.E., Smit, J.A., Exner, T.M., Mabude, Z., Hoffman, S., Beksinska, M., Kelvin, E.A., Ngoloyi, C., Leu, C. & Stein, Z.A. (2015) 'Promoting Female Condom Use among Female University Students in KwaZulu-Natal, South Africa: Results of a Randomized Behavioral Trial', *AIDS and Behaviour*, 19(7), pp.1129-1140. doi:10.1007/s10461-014-0860-6.

Maphisa Maphisa, J. & Young, C. (2018) 'Risk of alcohol use disorder among South African university students: the role of drinking motives', *Addictive Behaviors*, 82, pp.44–49.

Marks, S. (2017) *Explaining stealthing and the conversation about rape that we need to have*. Available at: https://writingfrombelow.org/articulations-of-violence/explaining-stealthing/ (Accessed: 3 June 2019).

Masa, R., Graham, L., Khan, Z., Chowa, G. & Patel, L. (2019) 'Food insecurity, sexual risk taking, and sexual victimization in Ghanaian adolescents and young South African adults',

International Journal of Public Health, *64*(2), pp.153–163. https://doi.org/10.1007/s00038-018-1155-x

Massa, A.A & Rosen, M.I. (2012) 'The relationship between substance use and HIV transmission in Peru', *J Addict Res Ther*, 3(3), pp.1-5.

Masvawure, T. (2010) '"I just need to be flashy on campus": Female students and transactional sex at a university in Zimbabwe', *Culture, Health and Sexuality*, 12(8), pp.857–870. doi: 10.1080/13691050903471441.

Mathews, C. (2005) 'Reducing sexual risk behaviours : Theory and research, successes and challenges', in Abdool Karim S.S & Abdool karim Q. (eds) *HIV/AIDS in South Africa*. 1st edition. Cape Town: Cambridge University Press, pp.143–165.

Mathews, C., Aaro, L.E., Flisher, A.J., Mukoma, W., Wubs, A.G. & Schaalma, H. (2009) 'Predictors of early first sexual intercourse among adolescents in Cape Town, South Africa', *Health Education Research*, 24(1), pp.1–10. doi: 10.1093/her/cym079.

Maughan-Brown, B., Evans, M. & George, G. (2016) 'Sexual behaviour of men and women within age-disparate partnerships in South Africa: Implications for young women's HIV risk', *PLoS ONE*, 11(8), pp.1–17. doi: 10.1371/journal.pone.0159162.

Mbatha, B. (2009) 'Barriers that impede the effectiveness of precautionary measures of combating the spread of HIV and AIDS: the case of the University of Zululand and Mangosuthu University of Technology', *Inkanyiso: Journal of Humanities and Social Sciences*, 1(1), pp.43–50. doi: 10.4314/ijhss.v1i1.62109.

Mbatha, T. (2017) *Steps to consider when proving PrEP in higher-education institutions*. Available at: https://www.spotlightnsp.co.za/2017/12/17/steps-consider-proving-prep-higher-education-institutions/. (Accessed: 10 July 2018).

Mbelle, N., Mabaso, M., Chauke, T., Sigida, S., Naidoo, D. & Sifunda, S. (2018) 'Perception and Attitudes about Male and Female Condom Use amongst University and Technical and Vocational Education and Training (TVET) College Students in South Africa', *Bio Accent*

HIV, 3(3), pp.1–9.

McCrann, D., Lalor, K. & Katabaro, J.K. (2006) 'Childhood sexual abuse among university students in Tanzania', *Childhood Abuse & Neglect*, 30, pp.1343-1351.

McGowan, I. (2008) 'Rectal microbicides: a new focus for HIV prevention', *Sexually Transmitted Infections*, 84(6), pp.413–417. doi: 10.1136/sti.2008.031328.

Medical Brief (2018) *SA's new medicines dispensing programme a 'major benefit'*. Available at: https://www.medicalbrief.co.za/sas-new-medicines-dispensing-programme-major-benefit/ (Accessed: 16 March 2022).

Mehra, D., Ostergren, P., Ekman, B. & Agardh, A. (2014) 'Inconsistent condom usage among Ugandan University students from a gender persepctive: a cross sectional study', *Global Health Action*, 7(22942), pp.1–9.

Meiberg, A.E., Bos., A.E. & Onya, H. (2008) 'Fear of Stigmatization as Barrier to Voluntary HIV Counselling and Testing in South Africa', *East African Journal of Public Health*, 5(2), pp.49–54.

Menza, T.W., Hughes, J.P., Celum, C.L. & Golden, M.R. (2009) 'Prediction of HIV acquisition among men who have sex with men', *Sexually Transmitted Diseases*, 36(9), pp.547-555.

Mndzebele, S. & Matonyane, L. (2019) 'Sexual behaviours , awareness and perceptions towards voluntary medical male circumcision among students in Dr Kenneth Kaunda District, South Africa', *Southern African Journal of HIV Medicine*, 20(1), pp.1–7. Available at: https://journals.co.za/doi/epdf/10.4102/sajhivmed.v20i1.846.

Mokgatle, M.M. & Madiba, S. (2017) 'High acceptability of HIV self-testing among technical vocational education and training college students in gauteng and north west province: What are the implications for the scale up in South Africa?', *PLoS ONE*, 12(1), pp.1–14. doi: 10.1371/journal.pone.0169765.

Molefe. M (2017) *First Things First Targets More Students*. Available at:

https://www.brandsouthafrica.com/play-your-part-category/first-things-first-targets-students (Accessed: 8 November 2021).

Moroney, E. (2002) *Teaching HIV/AIDS education using the life skills approach in two Durban area high schools*. University of KwaZulu-Natal. Available at: https://ukzn-dspace.ukzn.ac.za/bitstream/handle/10413/3680/Moroney_Erica_2002.pdf?sequence=1&isAllowed=y. (Accessed: 15 March 2021).

Mthembu, Z., Maharaj, P. & Rademeyer, S. (2019) '" I am aware of the risks, I am not changing my behaviour": risky sexual behaviour of university students in a high-HIV context', *African Journal of AIDS*, 18(3), pp.244–253. doi: 10.2989/16085906.2019.1655075.

Murwira, T.S., Khoza, L.B., Mabunda, J.T., Maputle, S.M., Mpete, M. & Nunu, W.N. (2021) 'Knowledge of Students regarding HIV/AIDS at a Rural University in South Africa', *The Open AIDS Journal*, 15(1), pp.42–51. doi: 10.2174/1874613602115010042.

Munro, N., Quayle, M., Simpson, H. & Barnsley, S. (2013) 'Hunger for knowledge: Food insecurity among students at the University of KwaZulu-Natal', *Perspectives in Education*, 31(4), pp.168–179.

Mutinta, G., Govender, K., Gow, J. & George, G. (2013) 'An exploratory study of the individual determinants of students' sexual risk behaviour at a South African University', *American Journal of Sexuality Education*, 8(3), pp.121–139. doi: 10.2989/16085906.2012.754836.

Muula, A. (2008) 'HIV Infection and AIDS Among Young Women in South Africa', *Croatian Medical Journal*, 49, pp.423–435. doi: 10.3325/cmj.2008.3.423.

Myer, L. (2008) Barrier methods. In: Abdool Karim, S.S and Abdool Karim, Q, eds. HIV/AIDS in South Africa. 1st ed. Cape Town: Cambridge University Press, 166-181.

Nagata, J.M., Palar, K., Gooding, H.C., Garber, A.K., Tabler, J.L., Whittle, H.J., Bibbins-Domingo, K. & Weiser, S.D. (2021) 'Food Insecurity, Sexual Risk, and Substance Use in Young Adults', *Journal of Adolescent Health*, 68(1), pp.169–177.

https://doi.org/10.1016/j.jadohealth.2020.05.038

National Planning commission (2012) *National Development Plan 2030 : Our future - make it work*. Available at: http://www.dac.gov.za/sites/default/files/NDP 2030 - Our future - make it work_0.pdf. (Accessed: 12 January 2019).

Ncube, N.B.Q., Meintjes, W.A.J. & Chola, L. (2014) 'Knowledge and attitudes of non-occupational HIV post-exposure prophylaxis amongst first- and second-year medical students at Stellenbosch University in South Africa', *African Journal of Primary Health Care and Family Medicine*, 6(1), pp.1–10. doi: 10.4102/phcfm.v6i1.665.

Ndabarora, E. & Mchunu, G. (2014) 'Factors that influence utilisation of HIV/AIDS prevention methods among university students residing at a selected university campus', *Journal of Social Aspects of HIV/AIDS*, 11(1), pp. 202–210. doi: 10.1080/17290376.2014.986517.

NDoH (2016) *PrEP Implementation Pack: South Africa 2016-2017*. Available at: https://www.prepwatch.org/wp-content/uploads/2017/07/SA_ImplementationPack.pdf. (Acessed: 15 June 2019).

Ngidi, N.D., Moyo, S., Zulu, T., Adam, J.K. & Naidu Krishnae, S.B. (2016) 'Qualitative evaluation of selected social factors that impact sexual risk-taking behaviour among African students in Kwazulu-Natal, South Africa', *Journal of Social Aspects of HIV/AIDS*, 13(1), pp. 96–105. doi: 10.1080/17290376.2016.1218792.

Nkoana, S., Sodi, T & Darikwa, T.B. (2016) 'Heavy episodic alcohol drinking among students from a rural South African university: Correlates with personal-social variables', *Journal of Psychology in Africa*, 26(4): pp.368-372.

Nkuna, E. & Nyazema, N.Z. (2016) 'HIV self-testing, self-stigma and HAART treatment at the University of Limpopo : Health Sciences Students ' Opinions and Perspectives', *Open AIDS Journal*, 10, pp.78–82. doi: 10.2174/1874613601610010078.

Norcini Pala, A., McKinnon, K., Wall, M.M., Cournos, F., Guimaraes, M.D & Wainberg,

M.L. (2017) 'An index to examine the sexual HIV risk of psychiatric service users based on sexual partners', *Revista Brasileira de Psiquiatria*, 39, pp.189-190.

Northglen News (2017) *Stealthing is sexual assault says AHF*. Available at: https://northglennews.co.za/110322/stealthing-sexual-assault-says-ahf/ (Accessed: 10 November 2019).

NSFAS DHET Bursary Scheme South Africa 2020 – 2021 (2020). Available at: http://www.zabursaries.co.za/nsfas-funding/ (Accessed: 18 April 2022).

Onoya, D., Zuma, K., Zungu, N., Shisana, O. & Mehlomakhulu, V. (2014) 'Determinants of multiple sexual partnerships in South Africa', *Journal of Public Health (United Kingdom)*, 37(1), pp.97–106. doi: 10.1093/pubmed/fdu010.

Open Access Government (2021) South Africa: An ongoing battle with HIV. Available at: https://www.openaccessgovernment.org/south-africa-hiv/119993/ (Accessed: 21 July 2022).
Oppong Asante, K. (2013) 'HIV/AIDS knowledge and uptake of HIV counselling and testing among undergraduate private university students in Accra, Ghana', *Reproductive Health*, 10(1), pp.1–8. doi: 10.1186/1742-4755-10-17.

Osuafor, G.N. & Okoli, C.E. (2021) 'Factors associated with multiple sexual partners among first-year students in a South African university', *African Journal of Reproductive Health*, 25(5), pp.69–78. doi: 10.29063/ajrh2021/v25i5.7.

Patel, C.J. & Kooverjee, T. (2009) 'Abortion and contraception: Attitudes of South African University Students', *Healthcare for Women International*, 30, pp.550-568.

Pengpid, S., Peltzer, K. & Skaal, L. (2013) 'Mental health and HIV sexual risk behaviour among University of Limpopo students', *South African Journal of Psychiatry*, 19(2), pp.25. doi: 10.7196/sajp.415.

Perera, U.A.P. & Abeysena, C. (2018) 'Prevalence and associated factors of risky sexual behaviors among undergraduate students in state universities of Western Province in Sri Lanka: a descriptive cross sectional study', *Reproductive Health*, 15(1), pp.1–11. doi:

10.1186/s12978-018-0546-z.

Pillay, T., Govender, N & Reddy, P. (2023a) ‘Socioeconomic determinants of risky sexual behaviors and HIV seropositivity among university students in South Africa: a case control analysis', *Research in Nursing Health*, 46, pp.436-444.

Pillay, T., Govender, N. & Reddy, P. (2023b) 'HIV knowledge and sexual practices of university students: a South African case control analysis', *(Manuscript under review).*

Pillay, T., Govender, N. & Reddy, P. (2022) 'A case-control investigation of factors associated with risky sexual behaviours among South African university students'. *(Manuscript under review).*

Prinstein, M. & Dodge, K. (2008) *Understanding Peer Influence in Children and Adolescents*. New York: The Guilford Press. Available at: https://books.google.co.za/books?hl=en&lr=&id=n2Cr7GC0QX4C&oi=fnd&pg=PA1&dq=Prinstein,+M.+J.,+%26+Dodge,+K.+A.+(Eds.).+(2008).+Understanding+peer+influence+in+children+and+adolescents.+New+York:+Guilford+Press.&ots=ZAAQ07DgPf&sig=2r4ydUVUGx11xm9DJFXM8oMnB.

Raijmakers, L.R. & Pretorius, J.D. (2006) 'A snapshot : South African university students’ attitudes , perceptions and knowledge of HIV / AIDS', *SAJHE*, *20*(2), pp.299–317.

Rau, A., Coetzee, J.K. & Vice, A. (2010) ‘Narrating student life in a time of risk’, *Qualitative Sociology Review*, 4(3), pp.81–98. Available at: http://www.qualitativesociologyreview.org/ENG/Volume17/QSR_6_3.pdf#page=83.

SA Department of Basic Education (2019) *Basic education strengthens curriculum content on life skills and life orientation*. Available at: https://www.gov.za/speeches/basic-education-department-strengthening-curriculum-content-life-skills-and-life (Accessed: 14 March 2022).

Sales, J.M., Brown, J.L., Vissman, A.T. & DiClemente, R.J. (2012) ‘The Association Between Alcohol Use and Sexual Risk Behaviors Among African American Women Across Three Developmental Periods: a review’, *Current Drug Abuse Reviews*, 5(2), pp.117–128.

SANAC (2017) *SOUTH AFRICA'S NATIONAL STRATEGIC PLAN FOR HIV, TB and STIs 2017-2022*. Available at: https://sanac.org.za//wp-content/uploads/2017/06/NSP_FullDocument_FINAL.pdf. (Accessed: 15 May 2019).

Schulenberg, J.E. & Maggs, J.L. (2002) 'A developmental perspective on alcohol use and heavy drinking during adolescence and the transition to young adulthood', *Journal of Studies on Alcohol, Supplement*, (s14), pp.54–70. doi: 10.15288/jsas.2002.s14.54.

Schulze, M.B., Hoffmann, K., Boeing, H., Linseisen, J., Rohrmann, S., Mohlig, M., Pfeiffer, A.F.H., Spranger, J., Thamer, C., Haring, H., Fritsche, A. & Joost, H. (2007) 'An accurate risk score based on anthropometric, dietary, and lifestyle factors to predict the development of type 2 diabetes', *Diabetes care,* 30(3), pp.510-515.

Schmidt, M.I., Duncan, B.B., Bang, H., Pankow, J.S., Ballantyne, C.M., Golden, S.H., Folsom, A.R. & Chambless, L.E. (2005) 'Identifying individuals at high risk for diabetes', *Diabetes Care*, 28(8), pp.2013-2018.

Selikow, T., Ahmed, N., Flisher, A.J., Mathews, C. & Mukoma, W. (2009) 'I am not ''umqwayito'': a qualitative study of peer pressure and sexual risk behaviour among young adolescents in Cape Town, South Africa', *Scandinavian Journal of Public Health*, 37(Suppl 2), pp.107-112.

Seloilwe, E.S. (2005) 'Factors that influence the spread of HIV/AIDS among students of the University of Botswana', *Journal of the Association of Nurses in AIDS Care*, 16(3), pp.3–10. doi: 10.1016/j.jana.2005.03.003.

Shefer, T., Clowes, L. & Vergnani, T. (2012) 'Narratives of transactional sex on a university campus', *Culture, Health and Sexuality*, 14(4), pp.435–447. doi: 10.1080/13691058.2012.664660.

Shiferaw, Y., Alemu, A., Assefa, A., Tesfaye, B., Gibermedhin, E. & Amare, M. (2014) 'Perception of risk of HIV and sexual risk behaviors among University students: Implication for planning interventions', *BMC Research Notes*, 7(1), pp.1–8. doi: 10.1186/1756-0500-7-162.

Simbayi, L., Zuma, K., Zungu, N., Moyo, S., Marinda, E., Jooste, S., Mabaso, M., Ramlagan, S., North, A., van Zyl, J., Mohlabane, N., Dietrich, C. & Naidoo, I. (2019) *South African National HIV Prevalence, Incidence, Behaviour and Communication Survey, 2017*. Cape Town. Available at: https://repository.hsrc.ac.za/handle/20.500.11910/15052. (Acessed: 15 June 2020).

So, D., Wong, F. & DeLeon, J. (2005) 'Sex, HIV risks and substance use among Asian American students', *AIDS Education and Prevention*, 17(5), pp.457–468.

Soul City Instituite (2018) *From "Health and Development" to gender and justice*. Available at: https://www.soulcity.org.za/about-us/history (Accessed: 25 March 2019)

Statistics SA (2015) *Millennium Development Goals: Combat HIV/AIDS, malaria and other diseases*. Pretoria. Available at: http://www.statssa.gov.za/MDG/MDG_Goal6_report_2015_.pdf.(Accessed: 12 June 2020).

Statistics SA (2018) *Statistics South Africa: Mid-year population estimates 2018*. Pretoria, South Africa. Available at: https://www.statssa.gov.za/publications/P0302/P03022018.pdf (Accessed: 12 April 2022).

Statistics SA (2021) *Mid-year population estimates 2021*. Pretoria. Available at: http://www.statssa.gov.za/publications/P0302/P03022021.pdf.(Accessed: 13 April 2022).

Stats SA (2019) *Mid-year population estimates 2019*. Pretoria. Available at: https://www.statssa.gov.za/publications/P0302/P03022019.pdf. (Accessed: 19 July 2022).

Stephens, J.W., Ambler, G., Vallance, P., Betteridge, D.J., Humphries, S.E. & Hurel, S.J. (2004) 'Cardiovascular risk and diabetes: are the methods of risk prediction satisfactory?', *European Journal of Cardiovascular Prevention and Rehabilitation*, 11(6), pp.521–528. doi: 10.1097/01.hjr.0000136418.47640.bc.

Susser, E., Desvarieux, M. & Wittkowski, K.M. (1998) 'Reporting sexual risk behavior for HIV: a practical risk index and a method for improving risk indices', *American Journal of Public Health*, 88(4), pp.671–674. doi: 10.2105/AJPH.88.4.671.

Tate, L. & Feeney, A. (2012) 'The principles of risk assessment', *Medicine (United Kingdom)*, 40(11), pp.574–576. doi: 10.1016/j.mpmed.2012.08.010.

Tayob, S.M. & Van Der Heever, H. (2014) 'Alcohol use among students at the University of Limpopo, South Africa', *African Journal for Physical, Health Education, Recreation & Dance*, 2, pp.364–373. Available at: http://search.ebscohost.com/login.aspx?direct=true&db=sph&AN=115470722&site=ehost-live&scope=site.

Tesfaye, G., Derese, A. & Hambisa, M.T. (2014) 'Substance Use and Associated Factors among University Students in Ethiopia: A Cross-Sectional Study', *Journal of Addiction*, pp. 1–8. doi: 10.1155/2014/969837.

The World Bank (2022) *Prevalence of HIV, Total (% of population ages 15-49)*. Available at: https://data.worldbank.org/indicator/SH.DYN.AIDS.ZS?locations=DE (Accessed: 7 March 2022).

Thigpen, M.C., Kebaabetswe, P.M., Paxton, L.A., Smith, D.K., Rose, C.E., Segolodi, T.M., Henderson, F.L., Pathak, S.R., Soud, F.A., Chillag, K.L., Muthanhaurwa, R., Chirwa, L.I., Kasonde, M., Abebe, D., Bulivia, E., Gvetadze, R.J., Johnson, S. & Sukalac, T.J. (2012) 'Antiretroviral Preexposure Prophylaxis for Heterosexual HIV Transmission in Botswana', *New England Journal of Medicine*, 367(5), pp.423–434. doi: 10.1056/nejmoa1110711.

Thompson, D.C., Thompson, R.S. & Rivara, F.P. (2002) 'Risk compensation theory should be subject to systematic reviews of the scientific evidence', *British Medical Journal*, pp.1–7.

UNAIDS (2016) *HIV prevention 2020 road map*. Geneva, Switzerland. Available at: https://www.unfpa.org/sites/default/files/pub-pdf/hiv-prevention-2020-road-map_en.pdf.(Accessed: 19 August 2021).

UNAIDS (2018) *Transactional sex and HIV risk: from analysis to action*. Available at: https://www.unaids.org/sites/default/files/media_asset/transactional-sex-and-hiv-risk_en.pdf (Accessed at: 27th May 2023).

UNAIDS (2020) *Global AIDS Update : Siezing the Moment*. Available at: https://www.unaids.org/en/resources/documents/2020/global-aids-report (Accessed: 20 May 2022).

UNAIDS (2021a) UNAIDS FACT SHEET 2021 Global HIV Statistics. Available at: https://www.unaids.org/sites/default/files/media_asset/UNAIDS_FactSheet_en.pdf (Accessed: 11 October 2021).

UNAIDS (2021b) Young people and HIV. Available at: https://www.unaids.org/sites/default/files/media_asset/young-people-and-hiv_en.pdf. (Accessed: 11 October 2021).

United Nations (2021) *Ensure healthy lives and promote well-being for all at all ages*. Available at: https://www.un.org/sustainabledevelopment/sustainable-development-goals/?fbclid=IwAR1vwG18oIoT6uRT0-JwrbuNtwKGO46EolDUkWscQRWZeeA_XAv47dkcVpA (Accessed: 14 March 2022).

UNAIDS (2022) *Global AIDS update 2022*. Available at: https://www.unaids.org/sites/default/files/media_asset/2022-global-aids-update-summary_en.pdf (Accessed: 07 July 2023).

University of Washington (2011) *Pivotal Study Finds That Hiv Medications Are Highly Effective as Prophylaxis against HIV infection in Men and Women in Africa*. Available at:https://www.thebodypro.com/article/pivotal-study-finds-that-hiv-medications-are-highl (Acessed: 12 April 2021).

USAID (2002) *HIV / AIDS Voluntary Counselling and Testing*. Available at: https://www.who.int/hiv/topics/vct/toolkit/components/policy/review_of_policies_programmes_and_guidelines.pdf.(Accessed: 12 April 202 2).

Utoo, B.T., Unazi, E.U., Eka, P.O., Utoo, P.M. & Maanongun, M.T. (2020) 'Sexual Activity and Contraceptive use among University Female Undergraduates in Makurdi, North-Central Nigeria', *Western Journal of Medical and Biomedical Sciences*, 1(2), pp.132–138. doi: 10.46912/wjmbs.21.

Vella, S., Schwartlander, B., Sow, S.P., Eholie, S.P. & Murphy, R.L. (2012) 'The history of antiretroviral therapy and of its implementation in resource-limited areas of the world', *Aids*, 26(10), pp.1231–1241. doi: 10.1097/QAD.0b013e32835521a3.

Vogenthaler, N.S., Kushel, M.B., Hadley, C., Frongillo, E.A., Riley, E.D., Bangsberg, D.R. & Weiser, S.D. (2013) 'Food insecurity and risky sexual behaviors among homeless and marginally housed HIV-infected individuals in San Francisco', *AIDS and Behavior*, 17(5), 1688–1693.

Wacholder, S., Silverman, D.T., Mclaughlin, J.K. & Mandel, J.S. (1992) 'Selection of Controls in Case-Control Studies', *American Journal of Epidemiology*, 135(9), pp.1042–1050.

Ware, N.C., Wyatt, M.A., Haberer, J.E., Baeten, J.M., Kintu, A., Psaros, C., Safren, S., Tumwesigye, E., Celum, C.L. & Bangsberg, D.R. (2012) 'What's Love Got to Do With It? Explaining Adherence to Oral Antiretroviral Pre-exposure Prophylaxis (PrEP) for HIV Serodiscordant Couples', *Journal of Acquired Immuno deficiency syndrome*, 59(5), pp.2–10. doi: 10.1097/QAI.0b013e31824a060b.What.

Wana, G.W., Arulogun, O., Roberts, A. & Kebede, A.S. (2019) 'Predictors of risky sexual behaviour among pre-college students in Adama town, Ethiopia', *Pan African Medical Journal*, 33, pp.1–12. doi: 10.11604/pamj.2019.33.135.18068

Warren, E.A., Paterson, P., Schulz, W.S., Lees, S., Eakle, R., Stadler, J., Larson, H.J. (2018) 'Risk perception and the influence on uptake and use of biomedical prevention interventions for HIV in sub-Saharan Africa: a systematic literature review', *Plos One*, 13(6), p. e0198680. doi: 10.1371/journal.pone.0198680.

Western Cape Government (2016) *Choice condoms go to the Max | Western Cape Government*. Available at: https://www.westerncape.gov.za/general-publication/choice-condoms-go-max (Accessed: 15 March 2022).

Whiteside, A. & Sunter, C. (2000) *AIDS The Challenge for South Africa*. 2nd editon. Cape Town: Human and Rousseau.

WHO (2005) *Alcohol use and sexual risk behaviour: a cross-cultural study in eight countries*. Geneva, Switzerland. Available at: https://www.who.int/substance_abuse/publications/alcohol_sexual_risk_crosscultural.pdf. (Acessed: 12 May 2019).

WHO (2010) 'Towards Universal Access', *UNAIDS Annual Report*, pp.1–68. Available at: http://www.unaids.org/en/KnowledgeCentre/Resources/Publications/default.asp. (Accessed: 12 May 2019).

World Health Organization (2012) 'Progress in scaling up voluntary medical male circumcision for HIV prevention in East and Southern Africa: January - December 2012', *World Health Organization*, (December), pp. 1–25. Available at: http://www.afro.who.int/sites/default/files/2017-06/aids-progress-in-scaling-up-vmmc-dec2013.pdf. (Acessed: 15 May 2019).

World Health Organization (WHO) (2023) *Alcohol, Heavy episodic drinking (population) in past 30 days*. Available at: https://www.who.int/data/gho/indicator-metadata-registry/imr-details/459#:~:text=Definition%3A,to%206%20standard%20alcoholic%20drinks. (Accessed at: 27 May 2023).

Yaya, S. & Bishwajit, G. (2018) 'Age at first sexual intercourse and multiple sexual partnerships among women in Nigeria: a cross-sectional analysis', *Frontiers in Medicine*, 5, pp.1–8. doi: 10.3389/fmed.2018.00171.

Yi, S., Te, V., Pengpid, S. & Peltzer, K. (2018) 'Social and behavioural factors associated with risky sexual behaviours among university students in nine Asian countries: a multi-country cross-sectional study', *Journal of Social Aspects of HIV/AIDS*, 15(1), pp.71–79. doi: 10.1080/17290376.2018.1503967.

Yosef, T., Nigussie, T., Getachew, D. & Tesfaye, M. (2020) 'Prevalence and factors associated with early sexual initiation among college students in southwest Ethiopia', *BioMed Research International*, 2020. doi: 10.1155/2020/8855276.

Zou, H., Tucker, J.D., Fan, S., Xu, J., Yu, M., Luo, Z., Cai, W. & Grulich, A.E. (2018) 'Learning about HIV the hard way: HIV among Chinese MSM attending university', *The*

Lancet Infectious Diseases, 18(1), pp.16–18. doi: 10.1016/S1473-3099(17)30711-9.

APPENDICES

APPENDIX A: CONSENT FORM

CONSENT FORM

Statement of Agreement to Participate in the Research Study:

Warm Greetings!
My name is Trishka Govender and I am a student doing a PhD research study at the Durban University of Technology. If you would like to take part in this study you will need to fill in this form.

- I hereby confirm that I have been informed by the research assistant, _____ (name of research assistant), about the nature, conduct, benefits and risks of this study - Research Ethics Clearance Number: _____,
- I have also received, read and understood the above information (Participant Letter of Information) regarding the study.
- I am aware that the results of the study, including personal details regarding my gender, age, date of birth, initials and diagnosis will be included into a study report without mentioning my name anywhere in the study.
- In view of the requirements of research, I agree that the information collected during this study can be processed in a computer by the researcher.
- I may, at any stage, decide to drop out of the study without being discriminated against.
- I have had enough opportunity to ask questions and (of my own free will) declare myself prepared to participate in the study.

_____	_____	_____	_____
Full Name of Participant	**Date**	**Time**	**Signature**

I, _____ (name of research assistant) 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**

APPENDIX B: PARTICIPANT LETTER OF INFORMATION

PARTICIPANT LETTER OF INFORMATION

Warm Greetings!
My name is Trishka Govender and I am doing a PhD research study at the Durban University of Technology. I would like to invite you to be part of this study. Below you will find more information about the study.

Title of the Research Study: 'Development of an HIV risk index for University students in KZN, South Africa'.

Principal Investigator/s/researcher: Trishka Govender (Master's Degree)

Co-Investigator/s/supervisor/s: Prof Poovendhree Reddy (PhD) (Supervisor) _____

Dr Nalini Govender (PhD) (Co-supervisor) _____

Brief Introduction and Purpose of the Study:
I am doing a study at universities in KwaZulu Natal, the following universities are included: *Durban University of Technology, Mangosuthu University of Technology, University of KwaZulu Natal and the University of Zululand*. The title of the study is "Development of a HIV risk index for University students in KZN, South Africa". The purpose of the study would be to investigate different types of risks that students are exposed to which may cause them to become at risk of contracting HIV. By knowing the reasons, we can improve and make available health care services and other services that university students require to ensure that students are well taken care of. The study will also design and test a risk index tool, which will be used to assess the risk levels of university students to contracting HIV. This can serve as an early warning system to students and health officials.

Outline of the Procedures:

- If you decide to take part in this study you will you will need to come to the campus clinic.
- At the clinic you will be given an information letter to read and a form to fill in to give your permission (consent form).
- You will be taken to a quiet, private room in the clinic and issued with a questionnaire on health risk to fill in.
- The questionnaire should take you approximately 15-20 minutes to complete.
- Other students will also be taking part in this study; their questionnaires will be filled at different times.

Risks or Discomforts to the Participant: Not applicable

Benefits: The study will help to find out what risk factors contribute to HIV risk among student populations in South Africa. The information will help make it easier for campus health services

to help students to prevent HIV or to ensure proper treatment of HIV. The results of the study can be used to develop policy to help university students.

Reason/s why the Participant May Be Withdrawn from the Study: You are free to drop out of the study at any time; there will be no problems for you if you choose to drop out. You will continue to get the same health care services from the campus clinic.

Remuneration: You will not get any money to take part in the study.

Participation gift: You will receive a R20-00 airtime voucher for a network of your choice. This is a complimentary gift for participation in the study (fully completed data collection tool).

Costs of the Study: You will not have to pay any money to take part in the study.

Confidentiality: Your name will not be written anywhere in the study. Your name will be kept a secret; no one will know that you have taken part in this study. The data collection will take place in a quiet private room away from people.

Research-related Injury: Not Applicable

Persons to Contact in the Event of Any Problems or Queries:
(Poovendhree Reddy 031 3732808) Please contact the researcher (tel no. 031 9077614), my supervisor (tel no. 031 3732808) or the Institutional Research Ethics Administrator on 031 373 2375. Complaints can be reported to the DVC: Research, Innovation and Engagement Prof S Moyo on 031 373 2577 or moyos@dut.ac.za.

APPENDIX C: RESEARCH QUESTIONNAIRE

QUESTIONNAIRE (Version 19 June 2019)

Health Risk Study Questionnaire

Please note:

- Completing the questionnaire is your own choice.
- If you are uncomfortable in answering the questionnaire, you are free to stop filling in the questionnaire and withdraw from the study at any point.
- Please only complete the questionnaire after you have read and understood the participant information sheet and completed the participant informed consent.
- Please do not write your name on the questionnaire since we want to ensure confidentiality of participants. You will be allocated a participant ID number e.g., M01/19
- Please be honest in your responses.
- If you have any queries whilst completing the questionnaire, please ask the research assistant for assistance.

Participant Identification

Date		Time		Site	

Participant study Id number		Research Assistant details	

Confidentiality Disclaimer

The information contained in this document is confidential and will only be used for the purpose of research. Your name will not be mentioned anywhere in this study.

Adapted from questionnaire (Kharsany 2014: 108-11)

SECTION 1: DEMOGRAPHICS

1.1 What is your gender?	Male[0]	Female[1]	Other[2] specify _____		
1.2 What is your age?	Years _____				
1.3 What is your race?	African [0]	Coloured[1]	Indian[2]	White[3]	Other[4] specify _____
1.4 What is your nationality?					
1.5 What is your home language?	English[0]	isiZulu[1]	Xhosa[2]	Afrikaans[3]	Other[4] (specify)_____
1.6 What is your marital status?	Single[0]	Married[2]	Divorced[3]	Living with boyfriend[4]	
1.7 Do you have any children?	☐ No[0]	☐ Yes[1]			
1.7.1 If so, how many children do you have?	_____				
1.7.2 How old are your children?					
Child 1_____	Child 2 _____	Child 3 _____	Child 4 _____		
1.7.3 What type of support do you receive? (tick applicable boxes)					
☐ Child support grant from government [0]	☐ My partner gives me money [3]				
☐ I do part time work to earn money [1]	☐ My parents/ family give me money [4]				
☐ Other [2]	If other, specify _____				

1.8 Year of study			
☐ 1st year [0]	☐ 2nd year [2]	☐ 3rd year [3]	☐ B-tech/4th year[4]
☐ Honours [5]	☐ Masters [6]	☐ PhD[6]	

1.9 Where do you live when you are not studying at the university? (Geographical location is required e.g., Umlazi)
_____
1.10 Where are you currently living while at the university?

☐ campus residence [0]	☐ off campus residence [3]
☐ At home with family [1]	☐ With relatives [4]
☐ With friends [2]	☐ With my boyfriend/ girlfriend [5]

Adapted from questionnaire (Kharsany 2014: 108-111)

1.11 Who do you live with when you are not studying at the university (during holiday time)?	
☐ Mother and father [0] Deceased[1] ☐	☐ Mother[2] Deceased[3] ☐
☐ Father[4] Deceased[5] ☐	☐ Grand parent/s[6]
☐ Uncle/ aunt[7]	☐ Friends[5]

SECTION 2: SOCIO-ECONOMICS (Tick the applicable boxes, you may select more than one)

2.1 How do you fund your studies?	☐ Financial aid NSFAS[0]	☐ Bank loan[1]	☐ Self-funded[2] (parents/family)
☐ Self-funded (own funds)[3]	☐ Bursary[4]	☐ Scholarship[5]	☐ Other[6]
2.2 Do you work part time to provide yourself with?		☐ Food[0]	☐ Airtime[1]
☐ Alcohol/cigarettes[3]	☐ Clothes[4]	☐ Entertainment[5]	☐ Other specify[6] _____
2.3 I need part time employment to cope financially?		☐ No[0]	☐ Yes[1]
2.4 I have to share my loan/bursary with my family?		☐ No[0]	☐ Yes[1]

SECTION 3: HOUSING & BASIC AMENITIES

(The below questions refer to your household i.e., where you live when you are not at university)

3.1 Do you have access to the following in your home:	
☐ Household taps [0]	☐ Flush toilet [1]
☐ Electricity [2]	☐ Landline [3]

3.2 How would you describe your housing?		
☐ Informal [0]	☐ Formal [1]	
3.3 How many rooms are there in your house / dwelling (excluding bathrooms and toilets)?		
☐ 1 bedroom[0]	☐ 2 bedrooms[1]	☐ 3 or more bedrooms[2]
3.4 How many people live in your house/dwelling?	_____	
3.5 Did this household receive a government housing subsidy to obtain this dwelling or any other dwelling?		
☐ No [0]	☐ Yes [1]	

SECTION 4: INTERCOURSE

4.1 Do you know what vaginal sex is?				
☐ No [0]	☐ Yes [1]			
If no, skip to section 4.2				
4.1.1 Have you ever had vaginal sex?				
☐ No [0]	☐ Yes [1]			
4.1.2 In which period of time did you have vaginal sex?				
☐ Within the last 3 months	☐ More than 3 months ago			
4.1.3 If so, how often were condoms used?				
☐ Never [0]	☐ Once a month[1]	☐ 2-4 times a month [2]	☐ 2-3 times a week [3]	☐ 4 or more times a week [4]
4.1.4 Have you ever experienced pain (through friction) during vaginal sex?				
☐ No [0]	☐ Yes [1]	☐ Never [2]		
4.1.5 Have you ever experienced bleeding (through friction) during vaginal sex?				
☐ No [0]	☐ Yes [1]	☐ Never [2]		
4.1.6 Did you make use of condoms in the above instances?				
☐ No [0]	☐ Yes [1]	☐ Never [2]		
4.1.7 Did you make use of lubricants during sexual acts to reduce friction?				
☐ No [0]	☐ Yes [1]	☐ Never [2]		
4.1.7.1 If yes, what type of lubrication did you use?				
☐ Baby oil [0]	☐ Vaseline [1]	☐ KY Gel [2]	☐ Other [3]	Specify if other _____

4.2 Do you know what anal sex is?	☐ No [0]	☐ Yes [1]
If no, skip to section 4.3		
4.2.1 Have you ever had anal sex?	☐ No [0]	☐ Yes [1]
4.2.2 In which period of time did you have anal sex?		
☐ Within the last 3 months	☐ More than 3 months ago	

4.2.3 If so, how often were condoms used?				
☐ Never [0]	☐ Once a month[1]	☐ 2-4 times a month [2]	☐ 2-3 times a week [3]	☐ 4 or more times a week [4]
4.2.4 Have you ever experienced pain (through friction) during anal sex?				
☐ Never [0]	☐ Once a month[1]	☐ 2-4 times a month [2]	☐ 2-3 times a week [3]	☐ 4 or more times a week [4]
4.2.5 Have you ever experienced bleeding (through friction) during anal sex?				
☐ No [0]	☐ Yes [1]	☐ Never [2]		
4.2.6 Did you make use of condoms in the above instances?				
☐ No [0]	☐ Yes [1]	☐ Never [2]		
4.2.7 Did you make use of lubricants during sexual acts to reduce friction?				
☐ No [0]	☐ Yes [1]	☐ Never [2]		
4.2.7.1 If yes, what type of lubrication did you use?				
☐ Baby oil [0]	☐ Vaseline [1]	☐ KY Gel [2]	☐ Other [3]	Specify if other _____

4.3 Do you know what oral sex is?	☐ No [0]	☐ Yes [1]
If no, skip to section 6		
4.3.1 Have you ever had oral sex?	☐ No [0]	☐ Yes [1]
4.3.2 In which period of time did you have oral sex?		
☐ Within the last 3 months	☐ More than 3 months ago	
4.3.3 If so, how often were condoms used?		

☐ Never [0]	☐ Once a month[1]	☐ 2-4 times a month [2]	☐ 2-3 times a week [3]	☐ 4 or more times a week [4]

SECTION 5: SEXUAL PRACTICES AND ENGAGEMENT

5.1 Have you ever had sex in your lifetime (vaginal/ anal)?	☐ No[0]	☐ Yes [1]
5.2 At what age did you consent to having sex?	_____ years old	
5.3 Are you currently sexually active?	☐ No[0]	☐ Yes [1]

5.4 How would you describe your relationship with your partner?		
☐ Steady[0]	☐ Casual [1]	☐ Other [2]
If other, please specify _____		

5.5 Have you ever had more than one partner at the same time?		
☐ No [0]	☐ Yes [1]	☐ N/A[2]

5.6 What is/was your reason for having more than one partner at the same time?	
☐ For seeking sexual pleasure[0]	☐ I was bored with my partner[3]
☐ To get an experienced sexual partner[1]	☐ Seeking money/gifts[4]
☐ Other (if other, specify)[2]	_____

5.7 How many people have you had sex with, in your entire lifetime?		
_____		
5.8 Have you ever had sex with a person that was older than you?	☐ No [0]	☐ Yes [1]
5.8.1 How much older than you was that person?	_____ years older	

Ref: Adopted from data from (Hoque 2010: 157- 160)

SECTION 6: SUBSTANCE USAGE

6.1 Do you consume alcohol?	☐ No [0]	☐ Yes [1]	☐ Never [2]

6.2 How often do you consume alcohol?				
☐ Never [0]	☐ Once a month [1]	☐ 2-4 times a month [2]	☐ 2-3 times a week [3]	☐ 4 or more times a week [4]
6.3 What is your favourite alcoholic beverage?	_____			

6.4 Do you regularly have sex after drinking alcohol?	☐ No [0]	☐ Yes [1]	☐ Never [2]

6.4.1 How often do you have sex after drinking alcohol?				
☐ Never [0]	☐ Once a month[1]	☐ 2-4 times a month [2]	☐ 2-3 times a week [3]	☐ 4 or more times a week [4]

6.4.2 In the last 3 months have you had sex after drinking alcohol?	☐ No [0]	☐ Yes [1]

6.5 Do you use drugs?	☐ No [0]	☐ Yes [1]	☐ Never [2]

6.5.1 Do you regularly have sex after taking drugs?		
☐ No [0]	☐ Yes [1]	☐ Never [2]

6.5.2 How often do you have sex after taking drugs?				
☐ Never [0]	☐ Once a month[1]	☐ 2-4 times a month [2]	☐ 2-3 times a week [3]	☐ 4 or more times a week [4]

6.5.3 In the last 3 months have you ever had sex after taking drugs?	
☐ No [0]	☐ Yes [1]

SECTION 7: CONTRACEPTIVES

7.1 Have you ever used contraceptives?	☐ No [0]	☐ Yes [1]	

7.1.1 If Yes, which contraceptive do you usually use?			
☐ Condom [0]	☐ Injection [1]	☐ Pills [2]	☐ Loop [4]
☐ Hormonal patch [5]	☐ Natural methods such as: Rhythm method, Withdrawal method, cervical mucus method [3]	☐ Birth control implant e.g., Implanon [6]	☐ Other (specify below) [7] _____

7.2 How often do you and your partner use contraceptives, during any type of sexual practice?				
☐ Never [0]	☐ Once a month [1]	☐ 2-4 times a month [2]	☐ 2-3 times a week [3]	☐ 4 or more times a week [4]

7.3 What are your reasons for not using contraceptives? (Tick the applicable boxes)	
☐ Difficult to get contraceptives 0	☐ In love with partner 6
☐ Condoms reduce sexual satisfaction 1	☐ Fear of contraception causing sterility 5
☐ For economic reasons 2	☐ Unavailability of contraception 6
☐ Partner did not want it 3	☐ Did not think of contraception at that time 7
☐ Knew nothing about contraception 4	☐ Other (if other, specify) 8
If other specify_____	

7.4 Did you use any form of contraception the last time you had sex?	☐ No 0	☐ Yes 1
7.5 Did your partner use any form of contraception last time you had sex?	☐ No 0	☐ Yes 1
7.6 Do you find it easy to get contraceptives?	☐ No o	☐ Yes 1
7.7 Do you think contraceptives are essential when having sex?	☐ No 0	☐ Yes 1

Ref: Adapted from data from (Hoque and Ghuman 2012: 15-19; Hoque 2010: 157-160; Hoque and Ghuman 2012: 1-7)

EMERGENCY CONTRACEPTION

7.8 Have you/ your partner ever made use of emergency contraception e.g., morning after pill?	☐ No 0	☐ Yes 1
7.9. If so, what was the reason for using emergency contraception?		
☐ Condom broke 0	☐ I normally take the morning after pill after sex 3	
☐ I/ or my partner forgot to take birth control pills on time 1	☐ My partner forced me to have sex 4	
☐ We had so much to think about we didn't even think about contraception 2	☐ Other (specify) 5 _____	

Ref: Adapted from data from (Hoque and Ghuman 2012: 15-19; Hoque 2010: 157-160; Hoque and Ghuman 2012: 1-7)

SECTION 8: ATTITUDES TO MALE MEDICAL CIRCUMSCISION (MMC)

8.1 Are you circumcised? **(answer if male)**	☐ No 0	☐ Yes 2	
8.2 If so, have you undergone medical circumcision in a hospital/ clinic setting? **(answer if male)**	☐ No 0	☐ Yes 2	
8.3 (If answered no to Q 8.2) have you undergone traditional circumcision?	☐ No 0	☐ Yes 2	
8.4 Is your partner circumcised **(answer if your partner is male)?**	☐ No 0	☐ Yes 2	☐ N/A 3
8.5 If no, would you prefer your partner to be circumcised?	☐ No 0	☐ Yes 2	☐ N/A 3
8.6 Do you know that MMC has been shown to partly reduce the chance of HIV infection **amongst men** who engage in vaginal sex?	☐ No 0	☐ Yes 2	☐ Doesn't matter 3
8.7 Do you know that MMC has been shown to reduce the risk of STIs e.g., Syphilis?	☐ No 0	☐ Yes 2	☐ Doesn't matter 3
8.8 Do you know that MMC contributes to reduction in the risk of developing certain types of cancers such as: penile cancer (in males) and cervical cancer (in females)?	☐ No 0	☐ Yes 2	☐ Doesn't matter 3
8.9 Do you know that MMC offers some protection from urinary tract infections and inflammation of the glans and foreskin?	☐ No 0	☐ Yes 2	☐ Doesn't matter 3
8.10 Do you know that MMC **is not shown** to reduce the risk of contracting HIV from anal sex?	☐ No 0	☐ Yes 2	☐ Doesn't matter 3
8.11 Do you know that MMC has **not been** shown to directly reduce the risk of women contracting HIV through vaginal sex?	☐ No 0	☐ Yes 2	☐ Doesn't matter 3

Adapted from questionnaire (Kharsany 2014: 108-111; Male Circumcision: HIV and Health Guide 2012: 7)

SECTION 9: TRANSACTIONAL SEX

9. Have you ever had sex in exchange of money?	☐ No 0	☐ Yes 1		
9.1 In the last 3 months have you had sex in exchange of money?				
☐ Never 0	☐ Once a month1	☐ 2-4 times a month 2	☐ 2-3 times a week 3	☐ 4 or more times a week 4

9.1.1 Where condoms used in the last 3 months, when having sex in exchange of money?		
☐ No [0]	☐ Yes [1]	☐ N/A [2]
9.2 Have you ever had sex in exchange of gifts, liqour, food or favours?		
☐ No [0]	☐ Yes [1]	☐ N/A [2]
9.2.1 In the last 3 months have you had sex in exchange of gifts, liqour, food or favours?		
☐ No [0]	☐ Yes [1]	☐ N/A [2]
9.2.2 Where condoms used in the last 3 months, when having sex in exchange of gifts, liquor, food or favours?		
☐ No [0]	☐ Yes [1]	☐ N/A [2]
9.3 Have you ever had sex with someone who isn't your regular partner because you needed to meet basic needs such as (e.g. rent, food, airtime)?		
☐ No [0]	☐ Yes [1]	
9.4 Do you ever have the expectation of receiving something in return after having sex (e.g. a gift, airtime, food ect.)?		
☐ No [0]	☐ Yes [1]	

Ref: Adopted from data from (Mehra *et al* 2014: 1-10; Kharsany 2014: 126)

SECTION 10: SEXUALLY TRANSMITTED INFECTION (STI) HISTORY

10.1 Has a Dr or nurse ever told you that you have a sexually transmitted illness (STI)?	☐ No [0]	☐ Yes [1]
10.2 Have you ever been medically treated for an STI?	☐ No [0]	☐ Yes [1]
10.3 If so, what treatment were you given?		
_____		

SECTION 11: PEER INFLUENCE

11.1 Do you have male campus friends who are sexually active?	☐ No [0]	☐ Yes [1]
11.2 Do you have female campus friends who are sexually active?	☐ No [0]	☐ Yes [1]

11.3 Do you have campus friends who drink alcohol?	☐ No [0]	☐ Yes [1]
11.4 Do you have campus friends who take drugs?	☐ No [0]	☐ Yes [1]
11.5 Do you feel comfortable discussing sexual matters with your friends?	☐ No [0]	☐ Yes [1]
11.6 Do you feel comfortable talking to your parents/ older family members about sexual matters?	☐ No [0]	☐ Yes [1]
11.7 Have you ever felt pressurized by your campus friends to have sex?	☐ No [0]	☐ Yes [1]
11.8 In what way do you feel pressurized by campus friends to engage in sex?	_____ _____	

Ref: Adapted from data from (Bingenheimer, Asante and Ahiadeke 2015: 1-19; Seloilwe 2005: 3-10; Ngidi *et al* 2016: 96-105)

SECTION 12: KNOWLEDGE

12.1 Which methods do you know that can be used to prevent HIV[1] (Tick the applicable boxes, multiple responses are possible)	
Using a condom [0] ☐	Using drugs to prevent transmission of HIV from mother to child [6] ☐
Abstaining from sex [1] ☐	Male circumcision [7] ☐
Sticking to one sexual partner [2] ☐	Taking ARVs within 72 hours of being exposed to the HIV virus [8] ☐
Having fewer sexual partners [3] ☐	Don't know [9] ☐
Not having sex before marriage [4] ☐	
Avoid contact with blood/ using gloves [5] ☐	

12.2 Which modes of transmission do you know that a person can contract HIV? (Tick the applicable boxes, multiple responses are possible)	
Transfer of virus from mother to child during delivery & breastfeeding ☐	Sharing contaminated needles or razor blades ☐
Contaminated blood transfusion ☐	Unprotected vaginal sex ☐
Unprotected anal sex ☐	Usage of public toilets ☐
Mosquito bites ☐	Touching an HIV infected person ☐

12.3 Which type of sex is the highest risk for HIV infection?	Vaginal sex ☐	Anal sex ☐	Oral sex ☐
12.4 Which type of sex is the lowest risk for HIV infection?	Vaginal sex ☐	Anal sex ☐	Oral sex ☐
12.5 Can HIV infection be cured?	No ☐	Yes ☐	

13. PERCEIVED RISK FOR HIV (Tick the applicable boxes)

13.1 What do you think are the chances of you becoming infected with HIV in the future?	
I am definitely going to get infected [0] ☐	I probably won't get infected [0] ☐
I am probably going to get infected [1] ☐	I will definitely not get infected [1] ☐
13.2.1 What are your reasons for believing so? (multiple answers are possible)	13.2.2 What are your reasons for believing so? (multiple reasons possible)
▪ I am sexually active [0] ☐ ▪ I have many partners [1] ☐ ▪ I don't use condoms [2] ☐ ▪ I don't always use condoms [3] ☐ ▪ I am sick [4] ☐ ▪ My partner is sick [5] ☐ ▪ My partner died of AIDS [6] ☐ ▪ I had an accident/cuts [7] ☐ ▪ I don't use condoms consistently [8] ☐ ▪ Other _____ [9] ☐	▪ I have never had sex [0] ☐ ▪ I have abstained from sex [1] ☐ ▪ I am faithful to my partner [2] ☐ ▪ I trust my partner [3] ☐ ▪ I use condoms [4] ☐ ▪ I know my HIV status [5] ☐ ▪ My partner is circumscised [6] ☐ ▪ I do not have sex with sex workers [7] ☐ ▪ My ancestors protect me [8] ☐ ▪ God protects me [9] ☐ ▪ I am not at risk for HIV [10] ☐ ▪ Other_____ [11] ☐

Ref: Adopted from questionnaire (Kharsany 2014: 111-112)

SECTION 14: FOOD SECURITY QUESTIONNAIRE

Items	0	1	2	3	4
14.1 How often do you eat a smaller meal than you felt you needed because there was not enough food?	Never	Seldom	Sometimes	Often	Almost always
14.2 How often do you eat fewer meals in a day because there is not enough food?	Never	Seldom	Sometimes	Often	Almost always
14.3 How often do you eat cheaper foods or eat the same foods for several days in a row because there is not enough money for food?	Never	Seldom	Sometimes	Often	Almost always
14.4 How often do you have no food at all because there is not enough money to get more?	Never	Seldom	Sometimes	Often	Almost always
14.5 How often do you struggle to concentrate in class and/or while you are studying because you are hungry?	Never	Seldom	Sometimes	Often	Almost always
14.6 How often do you fell weak or tired because you are hungry?	Never	Seldom	Sometimes	Often	Almost always
14.7 How often does hunger negatively affect your moods?	Never	Seldom	Sometimes	Often	Almost always
14.8 How often do you miss lectures/tutorials because you are hungry?	Never	Seldom	Sometimes	Often	Almost always
14.9 Do you feel that your health suffers because you don't get enough food or because you don't eat enough good food?	Never	Seldom	Sometimes	Often	Almost always
14.10 How often do you worry where your next meal will come from?	Never	Seldom	Sometimes	Often	Almost always
14.11 How often do you go 24 hours without because you did not have enough money for food?	Never	Seldom	Sometimes	Often	Almost always
14.12 How often do you go hungry at the beginning of the semester?	Never	Seldom	Sometimes	Often	Almost always
14.13 How often do you go hungry at the end of the semester or during examination?	Never	Seldom	Sometimes	Often	Almost always

Ref: Adopted from questionnaire in (Munro *et al*. 2013: 171)

SECTION 15: DRUG USAGE DUDIT DRUG USE DISORDERS IDENTIFICATION TEST
Here are a few questions about drugs. Please answer as correctly and honestly as possible by putting an 'X' in the relevant space.

CODING	0	1	2	3	4	SCORE
1. How often do you use drugs other than alcohol? (see list of drugs attached)	Never	Once a month or less often	2-4 times a month	2-3 times a week	4 times a week or more often	
2. Do you use more than one type of drug on the same occasion?	Never	Once a month or less often	2-4 times a month	2-3 times a week	4 times a week or more often	
3. How many times do you take drugs on a typical day?	0	1-2	3-4	5-6	7 or more	
4. How often are you influenced heavily by drugs?	Never	Less often than once a month	Every month	Every week	Daily or almost every day	
5. Over the past year, have you felt that your longing for drugs was so strong that you could not resist it?	Never	Less often than once a month	Every month	Every week	Daily or almost every day	
6. Has it happened, over the past year that you have not been able to stop taking drugs once you started?	Never	Less often than once a month	Every month	Every week	Daily or almost every day	
7. How often over the past year have you taken drugs and then neglected to do something you should have done?	Never	Less often than once a month	Every month	Every week	Daily or almost every day	
8. How often over the past year have you needed to take a drug the morning after heavy drug use the day before?	Never	Less often than once a month	Every month	Every week	Daily or almost every day	
9. How often over the past year have you had guilt feelings or a bad conscience because you used drugs	Never	Less often than once a month	Every month	Every week	Daily or almost every day	
10. Have you or anyone else been hurt (mentally or physically) because you used drugs	No		Yes, but not over the past year		Yes, over the past year	

11. Has a relative or a friend, a doctor or nurse, or anyone else, been worried about your drugs use or said to you that you should stop using drugs?	No		Yes, but not over the past year		Yes over the past year	
						Total

Ref: Adopted from DUDIT checklist (Berman, Bergman and Schlyter 2003: 13)

SECTION 16: ALCOHOL USAGE AUDIT ALCOHOL USE DISORDERS TEST

Here are a few questions about alcohol. Please answer as correctly and honestly as possible by putting an 'X' in the relevant space.

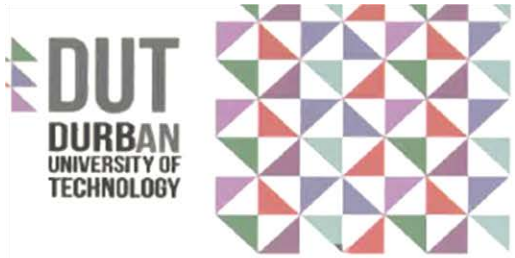
QUESTIONS	0	1	2	3	4	SCORE
1. How often do you have a drink containing alcohol? (if answered never skip to Q 9 & 10)	Never	Monthly or less	2-4 times a month	2-3 times a week	4 or more times a week	
2. How many drinks containing alcohol do you have on a typical day when you are drinking?	1 or 2	3 or 4	5 or 6	7 to 9	10 or more	
3. How often do you have 6 or more drinks on one occasion? Skip to Questions 9 and 10 if Total Score for Questions 2 and 3 = 0	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
4. How often during the last year have you found that you were not able to stop drinking once you had started?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
5. How often during the last year have you failed to do what was normally expected of you because of drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
6. How often during the last year have you needed a first drink in the morning to get yourself going after a heavy drinking session?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
7. How often during the last year have you had a feeling of guilt or remorse after drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
8. How often during the last year have you been unable to remember what happened the night before because of your drinking?	Never	Less than monthly	Monthly	Weekly	Daily or almost daily	
9. Have you or someone else ever been injured as a result of your drinking?	No		Yes, but not in the last year		Yes, during the last year	
10. Has a relative, friend, doctor or other health care worker been	No		Yes, but not in		Yes, during	

concerned about your drinking and suggestion you cut down?		[redacted]	the last year	[redacted]	the last year	
						Total

Ref: Adopted from AUDIT checklist (Babor, Higgins Biddle, Saunder and Monteito 2001: 31)

APPENDIX D: ETHICAL APPROVAL AND GATEKEEPERS PERMISSION LETTERS

ETHICAL APPROVAL



Institutional Research Ethics Committee
Research and Postgraduate Support Directorate
2nd Floor, Berwyn Court
Gate 1, Steve Biko Campus
Durban University of Technology

P.O Box 1334, Durban, South Africa, 4001

Tel: 031 373 2375
Email: lavishad@dut.ac.za
http://www.dut.ac.za/research/institutional_research_ethics

www.dut.ac.za

24 June 2019

Miss T Govender
25 Croton Road
Brindhaven
Verulam
4339

Dear Miss Govender

Development of an HIV risk index for University students in KwaZulu-Natal, South Africa
Ethical Clearance number IREC 005/19

The Institutional Research Ethics Committee acknowledges receipt of your final data collection tool for review.

We are pleased to inform you that the data collection tool has been approved. Kindly ensure that participants used for the pilot study are not part of the main study.

In addition, the IREC acknowledges receipt of your gatekeeper permission letters.

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

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

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

Yours Sincerely,

Professor J K Adam
Chairperson: IREC

GATEKEEPERS PERMISSION LETTERS

Directorate for Research and Postgraduate Support
Durban University of Technology
Tromso Annexe, Steve Biko Campus
P.O. Box 1334, Durban 4000
Tel.: 031-3732576/7
Fax: 031-3732946

4th June 2019

Ms Trishka Govender
c/o Department of Health Sciences
Faculty of Health Sciences
Durban University of Technology

Dear Ms Govender

PERMISSION TO CONDUCT RESEARCH AT THE DUT

Your email correspondence in respect of the above refers. I am pleased to inform you that the Institutional Research and Innovation Committee (IRIC) has granted full permission for you to conduct your research "Development of an HIV risk index for University students in KwaZulu-Natal, South Africa" at the Durban University of Technology.

The DUT may impose any other condition it deems appropriate in the circumstances having regard to nature and extent of access to and use of information requested.

We would be grateful if a summary of your key research findings can be submitted to the IRIC on completion of your studies.

Kindest regards.
Yours sincerely

PROF KEVIN DUFFY
ACTING DIRECTOR: RESEARCH AND POSTGRADUATE SUPPORT DIRECORATE

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

27 November 2019

Miss Trishka Govender
DUT
Email: govender.trishka@mut.ac.za

Dear Miss Govender

RE: PERMISSION TO CONDUCT RESEARCH

Gatekeeper's permission is hereby granted for you to conduct research at the University of KwaZulu-Natal (UKZN) towards your postgraduate studies, provided Ethical clearance has been obtained. We note the title of your research project is:

"Development of an HIV risk index for University students in KwaZulu-Natal, South Africa."

It is noted that you will be constituting your sample by handing out questionnaires to students on the Westville, Edgewood, Pietermaritzburg and Howard College campuses.

Please ensure that the following appears on your notice/questionnaire:

- Ethical clearance number;
- Research title and details of the research, the researcher and the supervisor;
- Consent form is attached to the notice/questionnaire and to be signed by user before he/she fills in questionnaire;
- gatekeepers approval by the Registrar.

You are not authorized to contact staff and students using 'Microsoft Outlook' address book. Identity numbers and email addresses of individuals are not a matter of public record and are protected according to Section 14 of the South African Constitution, as well as the Protection of Public Information Act. For the release of such information over to yourself for research purposes, the University of KwaZulu-Natal will need express consent from the relevant data subjects. Data collected must be treated with due confidentiality and anonymity.

Yours sincerely

DR KE CLELAND
REGISTRAR (ACTING)

Office of the Registrar
Postal Address: Private Bag X54001, Durban, South Africa
Telephone: +27 (0) 31 260 8005/2206 **Facsimile:** +27 (0) 31 260 7824/2204 **Email:** registrar@ukzn.ac.za
Website: www.ukzn.ac.za

1910 - 2010

UNIVERSITY OF KWAZULU-NATAL
INYUVESI YAKWAZULU-NATALI

28 May 2019

Miss Trishka Govender
DUT
Email: govender.trishka@mut.ac.za

Dear Miss Govender

RE: PERMISSION TO CONDUCT RESEARCH

Gatekeeper's permission is hereby granted for you to conduct research at the University of KwaZulu-Natal (UKZN) towards your postgraduate studies, provided Ethical clearance has been obtained. We note the title of your research project is:

"Development of an HIV risk index for University students in KwaZulu-Natal, South Africa."

It is noted that you will be constituting your sample by handing out questionnaires to students on the Westville and Howard College campuses.

Please ensure that the following appears on your notice/questionnaire:

- Ethical clearance number;
- Research title and details of the research, the researcher and the supervisor;
- Consent form is attached to the notice/questionnaire and to be signed by user before he/she fills in questionnaire;
- gatekeepers approval by the Registrar.

You are not authorized to contact staff and students using 'Microsoft Outlook' address book. Identity numbers and email addresses of individuals are not a matter of public record and are protected according to Section 14 of the South African Constitution, as well as the Protection of Public Information Act. For the release of such information over to yourself for research purposes, the University of KwaZulu-Natal will need express consent from the relevant data subjects. Data collected must be treated with due confidentiality and anonymity.

Yours sincerely

MR SS MOKOENA
REGISTRAR

Office of the Registrar
Postal Address: Private Bag X54001, Durban, South Africa
Telephone: +27 (0) 31 260 8005/2206 **Facsimile:** +27 (0) 31 260 7824/2204 **Email:** registrar@ukzn.ac.za
Website: www.ukzn.ac.za
1910 - 2010

Mangosuthu
University of Technology

UMLAZI - KWAZULU NATAL

P.O. Box 12363 Jacobs 4026 Durban Tel: 031 907 7111 Fax: 031 907 2892

27 March 2019

Dear Ms T. Govender

Title: Development of an HIV risk index for university students in KwaZulu- Natal, South Africa Ref: M10/19/09

The Interim MUT Ethics Committee considered and noted your application for the proposed study at their meeting held on 27th March 2019. The study was approved.

Your acceptance of this approval denotes your commitment to comply with the South African National Research Ethics Guidelines of 2004 as amended, South African Good Clinical Practice Guidelines (2006) as amended, and the MUT Research Ethics Policy, Procedures and Guidelines. The approval is valid for one year, (27th March 2019 to 27th March 2020).

Your reference is ME 10/19/09

Furthermore, permission to conduct the project is granted on the condition that any changes to the project must be brought to the attention of the MUT Research Ethics Committee as soon as possible.

Good luck with your research.

Yours faithfully,

Dr Z.L. Kwitshana
Interim Chairperson
Ethics Committee
Mangosuthu University of Technology
Tel: 031 8199273; Email: kwitshanazl@mut.ac.za; Skype Zilungile.Kwitshana

UNIVERSITY OF ZULULAND

University of Zululand, Private Bag X1001, KwaDlangezwa, 3886
W: www.unizulu.ac.za

T: +27 35 902 6731 E: DlelanaM@unizulu.ac.za
Deputy Vice-Chancellor: Research and Innovation

Miss T Govender
25 Croton Road
Brindhaven
Verulam
4339
22 May 2019

Dear Miss T Govender

REQUESTING TO CONDUCT RESEARCH AT UNIZULU: "DEVELOPMENT OF AN HIV INDEX FOR UNIVERSITY STUDENTS IN KWAZULU-NATAL, SOUTH AFRICA."
Your letter to me, refers.

I hereby grant approval for you to conduct part of your research at UNIZULU, as per the methodologies stated in your research proposal and in terms of the data collection instruments that you have submitted. I note also that Durban University of Technology, has issued a provisional ethical clearance certificate and having read the documentation, I am happy to accept that certificate.

You may use this letter as authorization when you approach the relevant persons. Please note that permission is based on the documentation that you have submitted. Should you revise your research instruments, or use additional instruments, you must submit those to us as well.

I wish you well in your research.

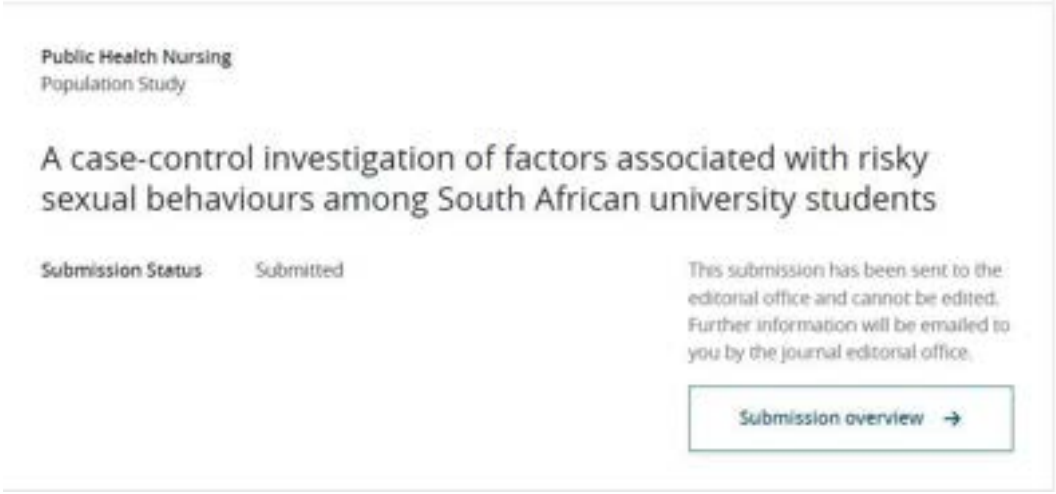
Yours sincerely,

28/5/19

Professor Gideon De Wet
Chairperson: University of Zululand Research Ethics Committee
Deputy Vice-Chancellor: Research and Innovation

APPENDIX E: MANUSCRIPTS UNDER REVIEW

Screenshot evidence of Manuscript 3 under review in the Public Health Nursing Journal (Manuscript ID PHN-24-0687).



Title

A case-control investigation of factors associated with risky sexual behaviours among South African university students

Journal

Public Health Nursing

Authors and affiliations

Ms Trishka Pillay[a]* (MHSc), Professor Nalini Govender[b] (PhD), Professor Poovendhree Reddy[c] (PhD)

[a]Department of Environmental Health, Faculty of Natural Sciences, Mangosuthu University of Technology, KwaZulu Natal, South Africa

[b]Department of Basic Medical Science, Faculty of Health Sciences, Durban University of Technology, KwaZulu Natal, South Africa

[c]Department of Community Health Studies, Faculty of Health Sciences, Durban University of Technology, KwaZulu Natal, South Africa

***For Correspondence:**

Ms Trishka Pillay

ORCID ID: 0000-0002-0127-2249

Email: govender.trishka@mut.ac.za

Phone: 031 907 7614

Word count: 4966

Acknowledgements

This study was funded by the Mangosuthu University of Technology University Capacity Development grant and the Durban University of Technology Post-graduate funding. The authors acknowledge Dr Katie Bryant for review of and valuable comments on the manuscript and Mr Cornelius Nattey for his support in data analysis.

Data Availability statement

Data supporting the results of this study are available upon request from the corresponding author. However, data cannot be used for purposes other than data confirmation. Due to privacy or ethical restrictions data are not publicly available.

Ethics Approval Statement

Ethics approval for this study was granted by the Institutional Research Ethics Committee, Durban University of Technology, South Africa (IREC 005/19).

Conflict of interest statement

The authors report no conflicts of interest.

Title

A case-control investigation of factors associated with risky sexual behaviours among South African university students

Abstract

Objective: This study aimed to investigate risk factors associated with risky sexual behaviours (RSBs) and HIV seropositivity among students from four universities in KwaZulu-Natal, South Africa.

Design: A case-control methodology was used.

Sample: The sample consisted of 500 students (375 HIV uninfected and 125 HIV infected).

Measurement: Adjusted logistic regression modelling was performed to assess the association of predictors with RSBs and HIV seropositivity.

Results: Data showed that heavy episodic drinking [aOR: 2.73, (95% CI: 1.38; 5.44), p = 0.004], drugs before sex [aOR: 7.46, (95% CI: 2.11; 27.88), p = 0.003], and a higher number of lifetime sex partners increased students' likelihood of having multiple concurrent sex partners (2 to 5 lifetime partners) [aOR: 4.22, (95% CI: 1.69; 10.54), p = 0.002] and ≥ 6 lifetime partners [aOR: 16.36, (95% CI: 6.18; 43.28), p < 0.001].

Conclusion: These findings indicate a need for South African universities to offer HIV prevention programs that inform students of how participation in particular risky activities can result in engagement in specific RSBs, contributing to a heightened HIV infection risk. Re-evaluation and strengthening of these prevention programs can ensure optimal efficiency in the battle against HIV infection.

Keywords

HIV, risk factors, risky sexual behaviour, university students, South Africa

Introduction

The global HIV prevalence data in 2021 confirmed that 38.4 million people were living with HIV, with a global HIV incidence of 1.5 million new cases (UNAIDS, 2022). South Africa (SA) remains the epicentre for HIV infection, with an HIV prevalence of 7.7 million (Nuh, 2021). The 2017 SA National HIV prevalence, incidence, behaviour and communication survey reported an overall HIV incidence of 231 100 new infections, with the highest incidence (88400 new infections) amongst youth aged 15 to 24 years (Simbayi et al., 2019). Females within this age category appeared to be disproportionately affected by HIV in comparison to males (66 200 vs 22 200) (Simbayi et al., 2019). In 2019, a 27.0% HIV prevalence was reported in the province of KwaZulu-Natal (KZN) (Kharsany et al*.,* 2019). Key drivers of this epidemic continue to include having multiple sexual partners, inconsistent condom usage, socioeconomic power imbalances, sexual violence, and substance abuse (Zuma et al., 2022). Economic factors viz., poverty were previously reported to influence women's participation in transactional sexual practices, affecting condom use negotiation and consequently increasing the risk of HIV infection (Whiteside, 2010). Several interventions viz., the scale-up of HIV treatment, youth focused interventions, and voluntary male medical circumcision, have been implemented thus far to counteract the rise in HIV infection (Nuh, 2021). Despite these interventions, the number of new HIV infections continues to be a major public health concern.

Previous research specifically undertaken amongst vulnerable populations examined how risky activities such as alcohol and drug usage result in engagement in risky sexual behaviours (RSBs) among young people (Guo et al., 2002), men having sex with men (MSM) (Pufall et al., 2018) and university students (Mthembu et al., 2019). University students worldwide are considered vulnerable to RSB such as having multiple sexual partners (Hoque, 2011), engaging in transactional sex (Masvawure, 2010) and intergenerational sex (HEAIDS, 2010), inconsistent condom use (Adam & Mutungi, 2007), and unprotected vaginal sex (Fierros-gonzalez & Brown, 2002; Brown & Vanable, 2007) predisposing them to HIV infection. An earlier study undertaken amongst students from 21 South African higher educational institutions (HEIs) reported an HIV prevalence of 3.4% [CI: 2.7% - 4.4%] (HEAIDS, 2010). Previous studies conducted in the sub-Saharan African context, indicate that students' susceptibility to RSBs stems from various behavioural and economic risk factors, including alcohol and drug use (Amare et al., 2019), peer pressure (Akintola et al., 2011) and a poor socio-economic background (Ajayi & Somefun, 2019). Despite several studies investigating risk factors associated with RSBs among South African university students (HEAIDS, 2010;

Mutinta, 2014; Hoffman et al., 2017), the HEAIDS 2010 study is the only published HIV prevalence and risk factor stratification by HIV status report applicable to the South African university population. In view of this, more studies are required to investigate university students' engagement in RSBs stratified by HIV status and the risk factors associated with HIV seropositivity as a means to develop effective HIV prevention programs. By developing an understanding of the extent to which students are currently engaging in RSBs, more targeted and evidence informed prevention programs can be developed to possibly curtail HIV incidence. It is important to understand and prevent students' susceptibility to HIV infection given that this population group, particularly in low and middle-income countries has an important role to play in leading and helping with the continued growth and development of their nations (Hoffman et al., 2017). The use of case-control study designs investigating HIV status as an outcome of risky behaviours amongst MSM (Oster et al*.,* 2011), circumcised men (Ediau et al., 2015), and patients that accessed voluntary counselling and testing (VCT) services (Carlos et al., 2017) has generated potentially useful data that can influence management. Since there is limited availability of case-control data from the SA university context, this study investigated the behavioural risk factors associated with RSBs among HIV infected and uninfected students from four public sector universities in KZN.

Materials and Methods

Design, Participants and Data Collection

Ethics approval was received from the Institutional Research Ethics Committee, Durban University of Technology, SA (IREC 005/19) and institutional approvals from all participating study sites. A total of 500 students were recruited between July 2019 and May 2021 via convenience sampling methods from four public HEIs in KZN, SA. Of this sample 375 comprised the control group ('HIV seronegative students') and 125 were the cases ('HIV seropositive students'). All participants were registered students at participating HEIs and ≥ 18 years of age. The HIV status of participants was confirmed prior to participation in the study by VCT. Additionally, participants with a seronegative HIV status presented a negative HIV test to confirm their status. All HIV seropositive participants who had initiated antiretroviral treatment were briefed on the study by the respective nurses, and interested participants were referred to the study. Interested individuals who met the inclusion criteria were directed to the onsite research assistant based at a private location within the university health clinics. Those willing to participate were required to complete the informed consent form. Data was collected using a questionnaire with a unique identification number, thereby ensuring confidentiality.

Measures

The questionnaire included various variables adapted from previous validated questionnaires as follows: demographics including age category, sex and race, alcohol/ drug usage, heavy episodic drinking (Babor et al., 2001), sexual practices and engagement (Hoque, 2011), contraceptive use (Hoque, 2011; Hoque & Ghuman, 2012a; Hoque & Ghuman, 2012b), male medical circumcision (MMC) (Leadbeatter, 2012; Kharsany et al., 2015), sexually transmitted infection (STI) history, and peer influence (Bingenheimer et al., 2015).

Substance usage was assessed based on the following variables: alcohol use before sex in the past three months, drug use before sex in the past three months, and heavy episodic drinking. Heavy episodic drinking was evaluated by question 3 of the Alcohol Usage Disorders Identification Test (AUDIT) questionnaire, 'How often do you have 6 or more drinks on one occasion?' (Babor et al., 2001). The response 'never' was categorized as 'non-heavy episodic drinking' and 'monthly or less, 2 to 4 times a month, 2 to 3 times a week, and 4 or more times a week were categorized as 'heavy episodic drinking'. Sexual practices and engagement were evaluated by variables such as age of sexual debut, multiple concurrent sex partners, lifetime number of sex partners, and condom usage. Multiple concurrent sex partners was defined as having more than one sexual partner that overlap in time (Mutinta, 2014). Multiple concurrent sex partners were grouped into a binary 'yes/no' response. Lifetime number of sexual partners was categorized as: 1 partner, 2 to 5 partners, and ≥ 6 partners. Age of sexual debut was dichotomized into < 15 years and ≥ 15 years. Condom usage during vaginal sex was stratified into inconsistent and consistent usage. Reproductive health questions focused on use of contraceptives, type of contraceptives used, and reasons for not using contraceptives. The use of emergency contraception was also assessed.

Statistical evaluation of the data

Data was exported into a Microsoft Excel spreadsheet and analysed using Stata version 17 software. The chi-square test was used to evaluate participant characteristics and reproductive health characteristics stratified by HIV status. Participant characteristics were stratified by multiple concurrent sexual partners among both case and control groups. Adjusted logistic regression modelling was performed to assess the association of predictors with RSBs and HIV seropositivity. In model 1, risk factors and demographics were tested to ascertain if they were determinants of RSBs. In the second model, risk factors and reproductive health characteristics

were tested as possible predictors of HIV seropositivity. A confidence interval (CI) of 95% was used for all models and $p < 0.05$ was considered statistically significant.

Results

The participant characteristics stratified by HIV status is shown in Table 1. Of the 500 participants recruited, 32.7% were male and 67.3% were female; 60.2% comprised the 20 to 24 years age group; more than 75% were currently sexually active; 75.1% (244) reported no alcohol consumption and 91.1% (247) reported no drug usage before sex in the last three months (Table 1). Furthermore, 72.6% (143) of the HIV negative students reported engaging in heavy episodic drinking, and 10.1% (20) indicated drug use before sex; 5% (16) reported that the onset of sexual debut occurred at < 15 years; 48.7% (170) reported having sex with multiple concurrent sex partners; and 76.5% (195) indicated inconsistent condom usage. In contrast, the following statistics were reported by the HIV positive individuals: heavy episodic drinking [29; 53.7%]; drugs before sex [4; 5.6%]; early sexual debut [1; 0.9%]; sex with multiple concurrent partners [34; 27.9%]; and inconsistent condom usage [70; 68%]). Heavy episodic drinking was significantly associated with an HIV negative status ($p = 0.008$). Moreover, a later age of sexual debut (≥ 18 years) was significantly associated with HIV positive status ($p = 0.030$). Notably, not having multiple concurrent sex partners was also significantly associated with an HIV positive status ($p < 0.001$).

Table 1. Participant characteristics stratified by HIV status

Characteristics	HIV negative (N = 375)	HIV positive (N = 125)
Age**		
Median (Q1, Q3)	22.0 (20.0, 24.0)	24.0 (22.0, 26.0)
Age category (n=498)**		
<20	67 (18.0)	7 (5.6)
20-24	238 (63.8)	62 (49.6)
>24	68 (18.2)	56 (44.8)
Number of lifetime sexual partners**		
Median (Q1, Q3)	4.0 (2.0, 8.0)	3.0 (2.0, 5.0)
Sex (n=498)**		
Male	146 (39.0)	17 (13.7)
Female	228 (61.0)	107 (86.3)
Race (n=496)		
African	371 (100.0)	125 (100.0)
Alcohol before sex (past 3 months) (n=325)		
No	192 (73.0)	52 (83.9)
Yes	71 (27.0)	10 (16.1)

Heavy episodic drinking (n=251)*		
No	54 (27.4)	25 (46.3)
Yes	143 (72.6)	29 (53.7)
Drug before sex (past 3 months) (n=271)		
No	179 (89.9)	68 (94.4)
Yes	20 (10.1)	4 (5.6)
Currently sexually active (n=472)		
No	87 (24.7)	28 (23.3)
Yes	265 (75.3)	92 (76.7)
Age of sexual debut (n=437)*		
< 15 years	16(5)	1(0.9)
15 to 17 years	114(35.6)	33(28.2)
≥ 18 years	190(59.4)	83(70.9)
Inconsistent condom use (n=358)		
Consistent	60 (23.5)	33 (32.0)
Inconsistent	195 (76.5)	70 (68)
Multiple concurrent sex partners (n=471)**		
No	179 (51.3)	88 (72.1)
Yes	170 (48.7)	34 (27.9)

$p < 0.05$*, $p < 0.005$** was considered statistically significant

The behavioural risk factors stratified by multiple concurrent sexual partners are presented in Table 2. Being female was significantly associated with not having multiple concurrent sex partners among HIV positive participants ($p < 0.001$). Moreover, a significant association was noted between being male and having multiple concurrent sex partners among the HIV negative group ($p < 0.001$). Heavy episodic drinking was significantly associated with having multiple concurrent sex partners among HIV negative participants ($p = 0.029$). Furthermore, a later onset (older age) of sexual debut (≥ 18 years) was significantly associated with not having multiple concurrent sex partners among both groups ($p < 0.004$). Most students reported not being pressurized to engage in sex; among the cases, not being pressurized by peers was significantly associated with not having multiple concurrent sex partners ($p = 0.002$).

Table 2. Behavioural characteristics stratified by multiple concurrent sex partners among HIV infected and uninfected participants (N = 500)

	MULTIPLE PARTNERS HIV +		**MULTIPLE PARTNERS HIV –**	
	No (N = 88)	Yes (N = 34)	No (N =179)	Yes (N=170)
Age				
Median (Q1, Q3)	24.0 (22.0, 27.0)	24.0 (21.0, 26.0)	22.0 (20.0, 24.0)	22.0 (20.0, 24.0)
Sex				
Male	5 (5.7)	12 (35.3)**	38 (21.3)	99 (58.2)**

Female	82 (94.3)	22 (64.7)	140 (78.7)	71 (41.8)
Alcohol before sex (past 3 months)				
No	39 (88.6)	12 (70.6)	87 (77.7)	91 (66.9)
Yes	5 (11.4)	5 (29.4)	25 (22.3)	45 (33.1)
Heavy episodic drinking[1]				
No	18 (51.4)	6 (33.3)	29 (36.3)	24 (21.8)*
Yes	17 (48.6)	12 (66.7)	51 (63.7)	86 (78.2)
Drug before sex (past 3 months)				
No	54 (100.0)	14 (77.8)**	73 (96.1)	95 (84.8)*
Yes	0 (0.0)	4 (22.2)	3 (3.9)	17 (15.2)
Age of sexual debut				
<15	1 (1.2)	0 (0.0)**	0 (0.0)	16 (9.9)**
15-17	17 (20.2)	16 (51.6)	35 (23.2)	77 (47.5)
≥18	66 (78.6)	15 (48.4)	116 (76.8)	69 (42.6)
Peer pressure to have sex				
No	86 (97.7)	27 (81.8)**	152 (85.4)	133 (78.2)
Yes	2 (2.3)	6 (18.2)	26 (14.6)	37 (21.8)

$p < 0.05$* and < 0.005** was considered statistically significant. Definitions: [1.] 'Heavy Episodic drinking' is defined as: drinking 6 or more alcoholic drinks on one occasion (WHO, 2022)

Table 3 illustrates the reproductive health status of the study population. Of those who responded, 78% of participants reported use of contraceptives, and contraceptive usage was significantly associated with being HIV positive ($p < 0.001$). Of note, 61.3% (245) of the students reported condoms as the most common contraceptive measure. Approximately 60% of the participants confirmed contraceptive use during their most recent sexual encounter. Contraceptive use during the most recent sexual encounter was significantly associated with being HIV positive ($p < 0.001$). Usage of emergency contraception (EC) was reported by 54.9% of the sample, and the most reported reason was due to condom breakage [45% among controls versus 61% among cases]; this was significantly associated with being HIV positive ($p = 0.045$). Many male participants reported being medically circumcised at a health care facility; being circumcised was significantly associated with being an HIV negative male ($p = 0.009$). Not being diagnosed with an STI was significantly associated with HIV negative status ($p < 0.001$).

The adjusted logistic regression modelling for risk factors, demographics, and RSBs is shown in Table 4. Participants who used drugs prior to sex were 7.46 more times more likely to have multiple sex partners [aOR: 7.46, (95% CI: 2.00; 27.88), $p = 0.003$]. Heavy episodic drinking was significantly associated with a 2.73 times higher likelihood of having multiple sex partners [aOR: 2.73, (95% CI: 1.38; 5.44), $p = 0.004$]. An older age of sexual debut (≥ 15 years old)

was identified as a protective factor from having multiple sexual partners [aOR: 0.08, (95% CI: 0.01; 0.63), $p = 0.017$]. Respondents who had two to five lifetime sexual partners were 4.22 times more likely to have multiple sex partners [aOR: 4.22, (95% CI: 1.69; 10.54), $p = 0.002$]. Moreover, those who had ≥ 6 lifetime partners were at a 16.36 times higher risk of having multiple sex partners [aOR: 16.36, (95% CI: 6.18; 43.28), $p < 0.001$]. Male participants were at a 5.73 times higher risk of having multiple sex partners in comparison to female students [aOR: 5.73, (95% CI: 3.48; 9.44), $p < 0.001$]. Furthermore, males were 4.68 times more likely to have ≥ 2 lifetime sexual partners [aOR: 4.68, (95% CI: 1.92; 11.40), $p = 0.001$].

Table 3. Reproductive health characteristics stratified by HIV status

	HIV STATUS	
	HIV negative (N = 375)	HIV positive (N = 125)
Contraceptive usage (n=496)**		
No	99 (26.6)	8 (6.5)
Yes	273 (73.4)	116 (93.5)
Contraceptive type		
Condom (n=400)		
No	100 (35.7)	55 (45.8)
Yes	180 (64.3)	65 (54.2)
Injection (n=400)**		
No	197 (70.4)	66 (55.0)
Yes	83 (29.6)	54 (45.0)
Pills (n=400)		
No	245 (87.5)	110 (91.7)
Yes	35 (12.5)	10 (8.3)
Loop (n=400)*		
No	276 (98.6)	112 (93.3)
Yes	4 (1.4)	8 (6.7)
Hormonal patch (n=400)		
No	276 (98.6)	119 (99.2)
Yes	4 (1.4)	1 (0.8)
Natural methods (n=400)*		
No	256 (91.4)	117 (97.5)
Yes	24 (8.6)	3 (2.5)
Birth control implant (n=400)		
No	262 (93.6)	108 (90.0)
Yes	18 (6.4)	12 (10.0)
Other (n=397)		
No	276 (99.3)	116 (97.5)
Yes	2 (0.7)	3 (2.5)
Difficult to get contraceptives (n=194)		
No	142 (97.9)	46 (93.9)
Yes	3 (2.1)	3 (6.1)
Reasons for not using contraceptives		
Condoms reduce sexual satisfaction (n=194)		
No	93 (64.1)	38 (77.6)
Yes	52 (35.9)	11 (22.4)
For economic reasons (n=194)		
No	141 (97.2)	46 (93.9)

Yes	4 (2.8)	3 (6.1)
Partner did not want it (n=193)		
No	136 (94.4)	45 (91.8)
Yes	8 (5.6)	4 (8.2)
Knew nothing about contraception (n=194)		
No	142 (97.9)	46 (93.9)
Yes	3 (2.1)	3 (6.1)
In love with partner (n=194)*		
No	115 (79.3)	45 (91.8)
Yes	30 (20.7)	4 (8.2)
Fear of contraception causing sterility (n=194)		
No	110 (76.4)	42 (84.0)
Yes	34 (23.6)	8 (16.0)
Unavailability of contraception (n=193)		
No	131 (91.6)	48 (96.0)
Yes	12 (8.4)	2 (4.0)
Did not think of contraception at that time (n=194)		
No	129 (89.6)	42 (84.0)
Yes	15 (10.4)	8 (16.0)
Other (n=194)		
No	123 (86.0)	41 (80.4)
Yes	20 (14.0)	10 (19.6)
Contraceptive usage at last sex (n=465)**		
No	153 (44.3)	30 (25.0)
Yes	192 (55.7)	90 (75.0)
Did your partner use any form of contraception the last time you had sex? (n=456)**		
No	180 (53.4)	45 (37.8)
Yes	157 (46.6)	74 (62.2)
Emergency Contraception (EC)		
Have you or your partner ever used emergency contraception EC (n=481)		
No	154 (42.8)	63 (52.1)
Yes	206 (57.2)	58 (47.9)
Reasons for using emergency contraception (n=271)*		
Condom broke	95 (45.5)	38 (61.3)
I/ my partner forgot to take birth control pills at that time	14 (6.7)	2 (3.2)
We had so much to think about, we didn't even think about contraception	52 (24.9)	5 (8.1)
I normally take emergency contraception	25 (12.0)	8 (12.9)
My partner forced me to have sex	2 (1.0)	0 (0.0)
Other	21 (10.0)	9 (14.5)
Male Circumcision		
Circumcised (n=163)*		
No	26 (17.9)	8 (44.4)
Yes	119 (82.1)	10 (55.6)
If so, have you undergone medical circumcision in a clinic/ hospital (n=129)		
No	13 (10.9)	0 (0.0)
Yes	106 (89.1)	10 (100.0)

STI Diagnosis (n=498)**		
No	306 (81.8)	76 (61.3)
Yes	68 (18.2)	48 (38.7)

p < 0.05* and < 0.005** was considered statistically significant. Abbreviation: STI Sexually transmitted infection

Table 4. Model 1 Adjusted models for risk factors, demographics and risky sexual behaviour (N = 500)

Risk factors	Controls n (%)	Cases n (%)	Multiple concurrent sex partners	Inconsistent condom use
			AOR 95%CI	AOR 95%CI
Alcohol use before sex (past 3 months)				
No	192 (73)	52 (83.9)	1.00[1a]	1.00[1b]
Yes	71 (27)	10 (16.1)	1.58 [0.87; 2.86]	1.03 [0.53; 2.00]
Heavy episodic drinking				
No	54 (27.4)	25 (46.3)	1.00[2a]	1.00[2b]
Yes	143 (72.6)	29 (53.7)	2.73 [1.38; 5.44]**	0.60 [0.26; 1.38]
Drug use before sex (past 3 months)				
No	179 (89.9)	68 (94.4)	1.00[3a]	1.00[3b]
Yes	20 (10.1)	4 (5.6)	7.46 [2.00; 27.88]**	2.79 [0.61; 12.77]
Age of sexual debut				
< 15 years old	16 (5)	1 (0.9)	1.00[4a]	1.00[4b]
≥ 15 years old	304 (95)	116 (99.1)	0.08 [0.01; 0.63]*	0.23[0.03; 1.85]
Lifetime no. of sexual partners				
1	41(14)	13(11.7)	1.00[5a]	1.00[5b]
2 to 5	145(49.7)	76(68.5)	4.22[1.69; 10.54]**	0.94[0.39; 2.22]
≥ 6	106(36.3)	22(19.8)	16.36[6.18; 43.28]**	0.70[0.27;1.82]

Demographics	Controls n (%)	Cases n (%)	Multiple partners	Lifetime no of partners
			AOR 95%CI	AOR 95%CI
Sex				
Female	228 (61)	107 (86.3)	1.00 [6a]	1.00 [6b]
Male	146 (39)	17 (13.7)	5.73[3.48; 9.44]**	4.66[1.91; 11.36]**
Age category				
< 20 years	67 (18)	7 (5.6)	1.00 [7a]	1.00 [7b]
20 to 24 years	238 (63.8)	62 (49.6)	0.93[0.45; 1.93]	1.34[0.60; 2.99]
>24 years	68 (18.2)	56 (44.8)	1.52[0.62; 3.73]	2.01[0.74; 5.46]

p < 0.05* and < 0.005** was considered statistically significant. Adjusted for: 1a sex, food insecurity & HIV status; 1b sex & HIV status; 2a age category, sex, food security, HIV status; 2b age category, sex, HIV status; 3a,b sex & HIV status; 4a sex, food insecurity & HIV status; 4b sex & HIV status, 5a,b sex & HIV status; 6a adjusted for age category, age of sexual debut, food insecurity and HIV status; 6b adjusted for age category & HIV status; 7a adjusted for food insecurity, relationship status, alcohol before sex and HIV status; 7b adjusted for sex & HIV status

The adjusted logistic regression modelling for risk factors, reproductive health, and HIV seropositivity data is presented in Table 5. Participants who reported being diagnosed with an STI were at 2.46 times higher risk of HIV seropositivity [aOR: 2.46, (95% CI: 1.50; 4.03), $p < 0.001$]. The use of emergency contraception was protective against HIV seropositivity [aOR: 0.57, (95% CI: 0.36; 0.90), $p = 0.016$]. Furthermore, approximately 54.8% of participants reported having two to five lifetime partners and 31.8% had ≥ 6 lifetime partners. Inconsistent condom use was a protective factor against HIV seropositivity in this sample [aOR: 0.55, (95% CI: 0.31; 0.97), $p = 0.037$].

Table 5. Model 2 Adjusted models for risk factors, reproductive health and HIV seropositivity (N = 500)

Risk factors	Controls n (%)	Cases n (%)	HIV seropositivity
			AOR 95%CI
Alcohol use before sex (past 3 months)			
No	192 (73)	52 (83.9)	1.00[7a]
Yes	71 (27)	10 (16.1)	0.63[0.29; 1.37]
Drug use before sex (past 3 months)			
No	179 (89.9)	68 (94.4)	1.00[7b]
Yes	20 (10.1)	4 (5.6)	0.71[0.22; 2.33]
Lifetime no. of sexual partners			
1	41(14)	13(11.7)	1.00[7c]
2 to 5	145(49.7)	76(68.5)	1.62[0.79;3.32]
≥6	106(36.3)	22(19.8)	1.02[0.44;2.38]
Multiple partners			
No	179 (51.3)	88 (72.1)	1.00[7d]
Yes	170 (48.7)	34 (27.9)	0.64[0.38; 1.06]
Usage of emergency contraception			
No	154 (42.8)	63 (52.1)	1.00[7e]
Yes	206 (57.2)	58 (47.9)	0.57[0.36; 0.90]*
STI diagnosis			
No	306 (81.8)	76 (61.3)	1.00[7f]
Yes	68 (18.2)	48 (38.7)	2.46[1.50; 4.03]**
Inconsistent condom use (vaginal)			
Consistent	60 (23.5)	33 (32.0)	1.00[7g]
Inconsistent	195 (76.5)	70 (68)	0.55[0.31; 0.97]*

$p < 0.05$* and < 0.005** was considered statistically significant. Adjusted for 7a, b, c, d, e, f, g sex & age category.

Discussion

Our data suggest that high-risk activities, like substance use, are associated with engagement in RSBs among university students in KZN, SA. Heavy episodic drinking (HED) and drug usage were significantly associated with having multiple concurrent sexual partners. In contrast, a later age of sexual debut was protective against multiple concurrent sex partners. By using a case-control design, we found that a greater proportion of HIV negative participants engaged in these high-risk activities, predisposing them to RSBs, such as inconsistent condom use and having multiple concurrent sexual partners. University students who participate in high-risk activities are more likely to engage in RSBs, thereby predisposing themselves to an increased risk of HIV infection and unplanned pregnancy.

Notably, HED was more commonly reported among the HIV uninfected than HIV infected students (143; 72.6% vs 29; 53.7%). Our data contradicts findings from Ediau et al (2015), who reported that 60% of HIV infected individuals (n=21) consumed alcohol prior to sex in comparison to 40% of HIV uninfected individuals (14) (Ediau et al., 2015). Heavy episodic drinking is a concerning issue amongst SA university students, as 14% of 837 university students reported being engaged in HED (Nkoana et al., 2016). Almost 69% of all students in our study reported engaging in HED, which is alarming since these students were 2.73 times more likely to have multiple concurrent sex partners compared to those who did not binge drink. Furthermore, amongst the HIV negative participants, HED was significantly associated with having multiple concurrent sex partners ($p = 0.029$). Excessive alcohol consumption has been previously reported as a determinant of high-risk sexual behaviour among young people (Guo et al., 2002). This risky practice may negatively impact the consistent and effective usage of condoms amongst this cohort thus compromising HIV prevention methods (Mthembu et al., 2019). Our data suggests that HED may encourage student engagement in RSBs, (i.e., multiple concurrent sex partners), a practice that may potentially increase the risk of acquiring HIV amongst the HIV uninfected students. However, findings from the HEAIDS (2010) study revealed that students who reported being drunk once in the previous month were significantly less likely to be HIV positive (HEAIDS, 2010). The university environment creates a social and cultural atmosphere that is prone to peer pressure and consequent substance use and abuse (Tayob & Van Der Heever, 2014). Binge drinking together with sexual activities are reported as a source of recreation among university students thereby promoting casual sexual encounters (HEAIDS, 2010). Notwithstanding various HIV prevention

efforts targeted at students registered at HEIs, HIV uninfected students are continuing to engage in risky activities like HED, which may increase their HIV infection risk.

In our study, more controls (HIV negative) reported using drugs before sex in comparison to the cases (10.1% vs 5.6%). Those who used drugs prior to sex were at a 7.46 times higher risk of having multiple concurrent sex partners. However, this finding must be interpreted with caution since only 8% (24) of the sample reported using drugs before sex. Our low prevalence drug use data is consistent with findings from the HEAIDS study, which confirmed that only 1% of their cohort (i.e., student, administrative and service staff) reported the use of injectable drugs. Alcohol and drug usage are reported as significant predictors of RSBs viz., inconsistent condom use and multiple concurrent sexual partners (Ross et al., 2001; Jones et al., 2011; Choudhry et al., 2014; Amare et al., 2019). A meta-analysis study on substance use and sexual behaviour in Peru confirmed higher rates of substance use among the HIV positive populations compared to the general population (Massa & Rosen, 2012). Drug use has been associated with a higher prevalence of HIV seropositivity (Massa & Rosen, 2012), indicative that substance usage is an important predictor of RSBs. In contrast, there was no statistically significant association between usage of injectable drugs in the past month and HIV infection (HEAIDS, 2010). Substance usage, combined with peer pressure and new-found student independence, are reported as possible predictors for students engaging in RSBs (Tesfaye et al., 2014). A SA study conducted in 2012 amongst university students found that the likelihood of a student using drugs was 2.6 times higher in the sexually active group in comparison to sexually inactive students (Blignaut et al., 2015). Alcohol or drug use may impair students' decision-making processes, consequently limiting their ability to negotiate condom usage, which may increase their risk of HIV infection and unplanned pregnancy (Blignaut et al*.,* 2015). The HIV positive participants in our study appeared to be more cautious in their behaviour compared to the HIV negative participants. Despite the exposure to education and other HIV interventions, the HIV negative participants increased their risk of HIV infection as a result of substance usage and HED.

Our data confirm a similar sexual debut age for both controls and cases (≥ 15 years of age; 95% controls and 99.1% cases). Results found that a later age of sexual debut was significantly associated with a positive HIV status. This is contrary to previous reports (Bassols et al., 2010; Wand & Ramjee, 2012), which indicate that an HIV positive status was significantly associated

with earlier age of sexual debut. In our sample, the association between a later age of sexual debut and HIV seropositivity could be due to participants debuting sex with older HIV infected partners. The age of the sexual partner may be a risk factor for HIV infection independent of an individual's own age (Akullian et al., 2017). Moreover, having an older male partner or engaging in transactional sex with an HIV positive partner increases the risk of infection regardless of the age of sexual debut. In our study, those students who had a later age of sexual debut (≥ 15 years of age) were protected from having multiple concurrent sex partners [aOR: 0.08, (95% CI: 0.01; 0.63), $p = 0.017$]. Our finding corroborates that of Raj et al (2017), who concluded that for every year of delay in sexual debut, the risk of STI decreased by 17% [OR: 0.83, (95% CI: 0.74; 0.93), $p = 0.001$]. Additionally, an early age of sexual debut was previously reported as a risk factor for multiple concurrent sex partners (Mah, (2010), and may be associated with an increased risk for STI and HIV transmission (Manhart et al., 2002). In our study, a larger proportion of HIV infected students reported between 2 to 5 lifetime sex partners compared to HIV uninfected students, which contradicts findings from Carlos *et al* (2017). These researchers reported finding similarities regarding ≥ 2 lifetime sexual partners in both cases and controls (89.78% vs 83.51%) (Carlos et al., 2017). Our findings indicated that students who had more than 6 lifetime sexual partners were more likely to have multiple concurrent sex partners than those who had a single lifetime partner. These findings corroborate those of Mah, (2010), who reported that individuals with ≥ 5 lifetime partners were more likely to report having concurrent sexual partners compared to those with 1 to 3 lifetime partners. Kogan et al. (2015) suggested that amongst young African American men, having multiple concurrent sex partners was significantly associated with other RSBs such as inconsistent condom use and self-reported STIs. These findings imply that having more than one lifetime partner increases the risk of RSB engagement and an early sexual debut directly influences the number of future sexual partners, which may perpetuate the spread of HIV infection.

Our findings highlight condom use as a preferred contraceptive method (61.3%), even though 74% of participants reported inconsistently using condoms during sexual activity. These findings are consistent with data from Turkey, (Bal Yilmaz et al., 2010) and Tanzania, (Sweya et al., 2016). Alarmingly, inconsistent condom use was higher amongst the HIV negative group compared to cases (controls 195; 76.5% vs cases 70; 68%). Similar data emerged from a case control study among STI participants, which revealed a greater proportion of STI uninfected participants engaged in unprotected sex in comparison to STI infected participants (controls 91.1% vs cases

72.3%) (Raj et al., 2017). Despite a higher prevalence of inconsistent condom use among controls than cases, 68% of HIV infected students reported inconsistent use of condoms, consequently increasing the risk of HIV infection amongst their sexual partners. Regular HIV VCT is thus recommended in HEIs, which increases the likelihood of early detection of HIV and prompt initiation of ARV treatment in affected students. Consequently, this will reduce viral loads to further prevent the transmission of HIV and optimize student health. Moreover, regular VCT is required for HIV negative students who are in serodiscordant relationships and timely initiation of Pre-exposure prophylaxis (PrEP) should be introduced to prevent infection.

Protection against HIV, STIs, and pregnancy are dependent on the effective and consistent usage of condoms (Simbayi et al., 2019). Interestingly, Mthembu et al. (2019) found that consistent condom use was practised among students who perceived themselves to be at an increased risk of unplanned pregnancies and HIV (Mthembu et al., 2019). In our study, 34% (63) of the respondents reported not using contraceptives such as condoms as they reduced sexual satisfaction. Only 26% reported consistent use of condoms during intercourse, with a greater proportion of cases reporting consistent condom use in comparison to the controls. This is suggestive that HIV positive participants were being more responsible with their sexual health in comparison to the HIV negative participants. These individuals may have wanted to protect themselves from STIs and unwanted pregnancy. Furthermore, HIV infected participants may have been more health conscious due to awareness of their status and opted to use condoms to protect their partner from HIV infection. Inconsistent use of condoms among SA youth may be attributed to various issues, including difficulties experienced when negotiating condom use with male partners, stable relationship status, alcohol use and/or abuse, and the perceived poor quality and/or dissatisfaction experienced with freely available condoms (Mthembu et al., 2019; Simbayi et al., 2019). Inconsistent condom use may unfortunately lead to STIs. In our study, the diagnosis of an STI increased the risk of HIV seropositivity by 2.46 times, a finding which is congruent with a previous report (Abdool Karim & Abdool Karim, 2010) which highlighted the increased probability of HIV infection among individuals with STIs. However, there is a possibility of other factors not evaluated in this study, such as perinatal infection, and the use of contaminated needles during injectable drug usage, etc., which may have contributed to the HIV seropositivity. Future studies are required to further evaluate this association. Current condom promotion interventions need to be re-evaluated and improved to increase students' consistent condom usage. Considering the

increased freedom and peer pressure experienced by first time entry university students, special education efforts should be targeted and tailored to their unique needs.

In sub-Saharan Africa, male medical circumcision (MMC) significantly reduces the risk of HIV infection in young men (Auvert et al., 2005; Gray et al., 2007). In our study, a high percentage of both the cases and controls reported undertaking medical circumcision in a clinical setting (89.1%; 106 controls vs 100%; 10 cases). In Uganda, only 8.4% of cases and 21.9% of controls were medically circumcised from a cohort of 155 HIV infected and 155 HIV uninfected circumcised men (Ediau et al*.,* 2015). Knowledge and awareness of the benefits of MMC is integral in uptake of this practice. Moreover, students who perceived that they were at high risk of HIV infection were 1.28 times more likely to be circumcised; however, understanding the effectiveness of MMC as an HIV prevention strategy positively increases its uptake (Mamo et al., 2018). In contrast, a Nigerian study revealed that only 38% (n= 144) of their student cohort were knowledgeable that MMC may reduce their risk of HIV infection (Iliyasu et al., 2012). Our data is indicative of an increased knowledge and awareness amongst students regarding the benefits associated with MMC in the prevention of HIV. Increased health promotion efforts on MMC among students can be beneficial in the uptake of these services.

Limitations and future research

A possible limitation of this study is the use of self-reported data collection tools, which could be subject to recall bias. Furthermore, all participants belonged to one racial group and most study participants were female. Future large-scale cohort studies are required to investigate exposures such as RSBs and HIV seropositivity among university students from enrolment to exit to determine causal associations.

Recommendations

Campus substance use prevention programmes are required to identify students at risk of HED and drug abuse to ensure interventions are better targeted to address the specified ways in which they are engaging in risky activities. For instance, in terms of education, our findings indicated that HIV uninfected students must be sensitized about how irresponsible drinking and drug use can lead to engagement in RSBs. In addition, in terms of prevention strategies, HIV uninfected students with elevated risk levels may benefit from use of PrEP to prevent HIV infection. Regarding age of

sexual debut, the re-evaluation and strengthening of reproductive health education at a primary school level must be considered to encourage an older age of sexual debut, which has a potential to prevent an increase in the number of subsequent lifetime sexual partners. These efforts should provide education on delaying sexual debut as well as the importance of correct and consistent condom usage to prevent HIV and unwanted pregnancy.

Programs strengthening condom use efficiency and consistency, as well as improving condom negotiation skills, must be strengthened for both HIV infected and uninfected students. Health promotion efforts on preventing HIV transmission should be intensified among HIV infected students. Additionally, health promotion must be strengthened on educating students about the benefits of MMC in HIV prevention to further improve uptake of services. The promotion of MMC among HIV uninfected students is necessary to help curb HIV infection among these students.

Implications for public health nursing

Nurses play an indispensable role in HIV prevention, in particular within the university health clinic context. The role of nurses includes VCT services and health education on HIV preventative strategies i.e., PrEP and condom usage. Furthermore, nurses encourage healthy lifestyle practices such as safe sexual practices, avoidance of substance usage and regular HIV screening. Clinical assessments of students for HIV prevention strategies such as PrEP should consider engagement in risky activities i.e., substance usage which may subsequently heighten the HIV infection risk among students. Nurses also play a crucial role in the referral of affected students to university substance usage programmes for further intervention.

Conclusion

To our knowledge, the HEAIDS report is the only data available that investigated this association within this high-risk population. The HEAIDS findings are more than a decade old and thus we provide an update in the literature regarding the current behaviours of this vulnerable population, which may be used to inform HIV prevention interventions and policy makers. The findings from our study are novel, as they highlight HIV negative participants as a more vulnerable group to engage in risky activities and RSBs in comparison to HIV positive participants in HEIs. The data suggest that HIV infected students were more health conscious in comparison to the HIV uninfected students. Furthermore, this study investigated the association between risky activities

and/or risky sexual behaviours and HIV seropositivity amongst a South African university population, who are considered high risk. Our findings suggest that HED and drug usage should be considered potential predictors of RSBs among a SA university student population. Educational programs on prevention methods, such as the correct and consistent use of condoms, require strengthening; consequently, this will aid in preventing HIV infection and further transmission. Despite many HIV prevention programmes and health education efforts, students continue to engage in RSBs, particularly the HIV uninfected student population. University students should be identified as a vulnerable population and must be considered when developing interventional tools regarding substance use education and RSB programmes. This population requires guidance regarding the risks of engaging in risky activities such as HED and drug usage, and consequent predisposition to RSBs.

References

Abdool Karim, S.S. & Abdool Karim, Q. (2010). *HIV/AIDS in South Africa* (Q. Abdool Karim, S.S. & Abdool Karim, Eds.; 2nd edn.). Cambridge.

Adam, M.B. & Mutungi, M. (2007). Sexual Risk Behavior Among Kenyan University Students. *Journal of Arizona-Nevada Academy of Science*, *39*(2), 91–98.

Ajayi, A.I. & Somefun, O.D. (2019). Transactional sex among Nigerian university students: The role of family structure and family support. *PLoS ONE*, *14*(1), 1–17. https://doi.org/10.1371/journal.pone.0210349

Akintola, O., Ngubane, L. & Makhaba, L. (2011). 'I did it for him, not for me': an exploratory study of factors influencing sexual debut among female university students in Durban, South Africa. *Journal of Health Psychology*, *17*(1), 143–153. https://doi.org/10.1177/1359105311410512

Akullian, A., Bershteyn, A., Klein, D., Vandormael A., Barnighausen, T. & Tanser, F. (2017). Sexual partnership age pairings and risk of HIV acquisition in rural South Africa. *AIDS*, *31*(12), 1755–1764. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5508850/

Amare, T., Yeneabat, T. & Amare, Y. (2019). A Systematic Review and Meta-Analysis of Epidemiology of Risky Sexual Behaviors in College and University Students in Ethiopia, 2018. *Journal of Environmental and Public Health*, *2019*. https://doi.org/10.1155/2019/4852130

Auvert, B., Taljaard, D., Lagarde, E., Sobngwi-Tambekou, J., Sitta, R. & Puren, A. (2005). Randomized, controlled intervention trial of male circumcision for reduction of HIV infection risk: The ANRS 1265 trial. *PLoS Medicine*, *2*(11), 1112–1122. https://doi.org/10.1371/journal.pmed.0020298

Babor, T.F., Higgins-Biddle, J.C., Saunders, J.B. & Monteiro, M.G. (2001). *AUDIT Alcohol Use Disorders Identification Test*. 2nd Edition. https://www.who.int/publications/i/item/audit-the-alcohol-use-disorders-identification-test-guidelines-for-use-in-primary-health-care

Bal Yilmaz, H., Kavlak, O. & Ünsal Atan, S. (2010). Sexual activity, knowledge and contraceptive usage by gender among university students in Turkey. *European Journal of Contraception and Reproductive Health Care*, *15*(6), 433–440. https://doi.org/10.3109/13625187.2010.515045

Bassols, A.M.S., de Boni, R. & Pechansky, F. (2010). Alcohol, drugs, and risky sexual behavior are related to HIV infection in female adolescents. *Rev. Bras. Psiquiatr*, *32*(4), 361–368.

Bingenheimer, J., Asante, E. & Ahiadeke, C. (2015). Peer Influences on Sexual Activity among Adolescents in Ghana. *Studies in Family Planning*, *46*(1), 1–19. https://doi.org/10.1111/j.1728-4465.2015.00012.x.Peer

Blignaut, R. J., Jacobs, J. & Vergnani, T. (2015). Trends in HIV risk behaviour of incoming first-year students at a South African university: 2007–2012. *Journal of Social Aspects of HIV/AIDS*, *12*(1), 39–50. https://doi.org/10.1080/17290376.2015.1086275

Brown, J.L. & Vanable, P.A. (2007). Alcohol use, partner type, and risky sexual behavior among college students: Findings from an event-level study. *Addictive Behaviors*, *32*(12), 2940–2952. https://doi.org/10.1016/j.addbeh.2007.06.011

Carlos, S., Burgo, C.L., Burgueño, E., Angel, M., Osorio, A., Ndarabu, A., Passabosc, C., Carlos, S., Burgo, C.L., Burgueño, E., Angel, M., Osorio, A., Ndarabu, A., Passabosc, C. & de Irala, J. (2017). Male condom use, multiple sexual partners and HIV: a prospective case-control study in Kinshasa. *AIDS Care*, *29*(6), 772–781. https://doi.org/10.1080/09540121.2016.1258450

Choudhry, V., Agardh, A., Stafstrom, M. & Ostergren, P. (2014). Patterns of alcohol consumption and risky sexual behavior: a cross-sectional study among Ugandan university students. *BMC Public Health*, *14*(128), 1–11.

Ediau, M., Matovu, J.K.B., Byaruhanga, R., Tumwesigye, N.M. & Wanyenze, R.K. (2015). Risk factors for HIV infection among circumcised men in Uganda: a case-control study. *Journal of the International AIDS Society*, *18*(1), 1–7. https://doi.org/10.7448/IAS.18.1.19312

Fierros-gonzalez, R. & Brown, J.M. (2002). High risk behaviors in a sample of Mexican American college students. *Psychological Reports*, *90*, 117–130.

Gray, R.H., Kigozi, G., Serwadda, D., Makumbi, F., Watya, S., Nalugoda, F., Kiwanuka, N., Moulton, L.H., Chaudhary, M.A., Chen, M.Z., Sewankambo, N.K.., Wabwire-Mangen, F., Bacon, M.C., Williams, C.F., Opendi, P., Reynolds, S.J., Laeyendecker, O., Quinn, T.C. & Wawer, M.J. (2007). Male circumcision for HIV prevention in men in Rakai, Uganda: a randomised trial. *The Lancet*, *369*(9562), 657–666. https://doi.org/10.1016/S0140-6736(07)60313-4

Guo, J., Chung, I.J., Hill, K.G., Hawkins, J.D., Catalano, R.F. & Abbott, R.D. (2002). Developmental relationships between adolescent substance use and risky sexual behavior in young adulthood. *Journal of Adolescent Health*, *31*(4), 354–362. https://doi.org/10.1016/S1054-139X(02)00402-0

HEAIDS (2010). HIV prevalence and related factors: Higher Education Sector Study 2008-2009. In *Higher Education HIV and AIDs Programme (HEAIDS)*.

Hoffman, S., Levasseur, M., Mantell, J.E., Beksinska, M., Mabude, Z., Ngoloyi, C., Kelvin, E.A., Exner, T., Leu, C.S., Pillay, L. & Smit, J.A. (2017). Sexual and reproductive health risk behaviours among South African university students: results from a representative campus-wide survey. *African Journal of AIDS Research*, *16*(1), 1–10. https://doi.org/10.2989/16085906.2016.1259171

Hoque, M.E. (2011). Sexual practices among male undergraduate students in KwaZulu-Natal, South Africa. *Southern African Journal of Epidemiology and Infection*, *26*(3), 157–160. https://doi.org/10.1080/10158782.2011.11441439

Hoque, M.E. & Ghuman, S. (2012a). Knowledge, Practices and Attitudes of Emergency Contraception among Female University Students in KwaZulu-Natal, South Africa. *PLoS ONE*, *7*(9), 1–7. https://doi.org/10.1371/journal.pone.0046346

Hoque, M. & Ghuman, S. (2012b). Contraceptive practices in the era of HIV/AIDS among university students in KwaZulu-Natal, South Africa. *Journal of Social Aspects of HIV/AIDS*, *9*(1), 15–19. https://doi.org/10.1080/17290376.2012.665254

Iliyasu, Z., Abubakar, I.S., Sani, I.H., Jibo, A.M., Karaye, I.M., Salihu, H.M. & Aliyu, M.H. (2012). Male Circumcision and HIV Risk Behavior among University Students in Northern Nigeria. *American Journal of Men's Health*, *7*(2), 94–101. https://doi.org/10.1177/1557988312456698

Jones, H.E., Browne, F.A., Myers, B.J., Carney, T., Ellerson, R.M., Kline, T.L., Poulton, W., Zule, W.A. & Wechsberg, W.M. (2011). Pregnant and Nonpregnant Women in Cape Town, South Africa: Drug Use, Sexual Behavior and the Need for Comprehensive Services. *International Journal of Pediatrics*, 1–8. https://doi.org/10.1155/2011/353410

Kharsany, A.B.M., Cawood, C., Khanyile, D., Grobler, A., McKinnon, L.R., Samsunder, N., Frohlich, J.A., Abdool Karim, Q., Puren, A., Welte, A., George, G., Govender, K., Toledo, C., Chipeta, Z., Zembe, L., Glenshaw, M.T., Madurai, L.M., Deyde, V. & Bere A. (2015). Strengthening HIV surveillance in the antiretroviral therapy era: rationale and design of a longitudinal study to monitor HIV prevalence and incidence in the uMgungundlovu District, KwaZulu-Natal, South Africa. *BMC Public Health*, *15*(1), 1–11. https://doi.org/10.1186/s12889-015-2179-2

Kharsany, A.B.M., Cawood, C., Lewis, L., Yende-Zuma, N., Khanyile, D., Puren, A., Madurai, S., Baxter, C., George, G., Govender, K., Beckett, S., Samsunder, N., Toledo, C., Ayalew, K. A., Diallo, K., Glenshaw, M., Herman-Roloff, A., Wilkinson, E., De Oliveira, T. & Abdool Karim, Q. (2019). Trends in HIV Prevention, Treatment, and Incidence in a Hyperendemic Area of KwaZulu-Natal, South Africa. *JAMA Network Open*, *2*(11), 1–16. https://doi.org/10.1001/jamanetworkopen.2019.14378

Kogan, S.M., Cho, J., Barnum, S.C. & Brown, G.L. (2015). Correlates of concurrent sexual partnerships among young, rural African American Men. *Public Health Reports*, *130*, 392–399. https://doi.org/10.1177/003335491513000418

Leadbeatter, K. (2012). *Male circumcision, HIV and health*. 1–83.

Mah, T.L. (2010). Prevalence and correlates of concurrent sexual partnerships among young people in South Africa. *Sexually Transmitted Diseases*, *37*(2), 105–108. https://doi.org/10.1097/OLQ.0b013e3181bcdf75.Prevalence

Mamo, A., Tadesse, D., Abebe, L., Abera, M. & Asfaw, S. (2018). Assessment of willingness to uptake male circumcision and associated factors among male students in south-west Ethiopia. *MedCrave Online Journal of Public Health*, *7*(6), 358–364. https://doi.org/10.15406/mojph.2018.07.00268

Manhart, L.E., Aral, S.O., Holmes, K.K. & Foxman, B. (2002). Sex partner concurrency: measurement, prevalence, and correlates among urban 18-39-year-olds. *Sexually Transmitted Diseases*, *29*(3), 133–143. http://libproxy.wustl.edu/login?url=http://search.ebscohost.com/login.aspx?direct=true&db=cmedm&AN=11875374&site=ehost-live&scope=site

Massa, A. & Rosen, M. (2012). The Relationship between Substance Use and HIV Transmission in Peru. *Journal of Addiction Research & Therapy*, *3*(3), 1–25. https://doi.org/10.4172/scientificreports.300

Masvawure, T. (2010). 'I just need to be flashy on campus': female students and transactional sex at a university in Zimbabwe. *Culture, Health and Sexuality*, *12*(8), 857–870. https://doi.org/10.1080/13691050903471441

Mthembu, Z., Maharaj, P. & Rademeyer, S. (2019). "I am aware of the risks, I am not changing my behaviour": risky sexual behaviour of university students in a high-HIV context. *African Journal of AIDS Research*, *18*(3), 244–253. https://doi.org/10.2989/16085906.2019.1655075

Mutinta, G. (2014). Multiple Sexual Partnerships and their Underlying Risk Influences at the University of KwaZulu-Natal. *Journal of Human Ecology*, *46*(2).

Nkoana, S, Sodi, T. & Darikwa, T.B. (2016). Heavy episodic alcohol drinking among students from a rural South African university: correlates with personal-social variables. *Journal of Psychology in Africa*, *26*(4), 368–372. https://doi.org/10.1080/14330237.2016.1208949

Nuh, O, (2021). As HIV incidence declines in South Africa, new infections are concentrating in those over 25. https://www.aidsmap.com/news/sep-2021/hiv-incidence-declines-south-africa-new-infections-are-concentrating-those-over-25

Oster, A.M., Dorell, C.G., Mena, L.A., Thomas, P.E., Toledo, C.A. & Heffelfinger, J.D. (2011). HIV risk among young African American men who have sex with men: a case-control study in

Mississippi. *American Journal of Public Health*, *101*(1), 137–143. https://doi.org/10.2105/AJPH.2009.185850

Pufall, E.L., Kall, M., Shahmanesh, M, Nardone, A., Gilson, R., Delpech, V. & Ward, H. (2018). Sexualized drug use ('chemsex') and high-risk sexual behaviours in HIV-positive men who have sex with men. *HIV Medicine*, *19*, 261–270. https://doi.org/10.1111/hiv.12574

Raj, R., Gupta, V., Pathak, M., Sreenivas, V., Sood, S., Singh, S., Verma, K.K., Khanna, N., Das, B.K. & Gupta, S. (2017). What puts them at risk? A cross-sectional case-control survey of demographic profile and sexual behavior of patients with sexually transmitted infections at a tertiary care center in North India. *Indian Journal of Sexually Transmitted Diseases*, *38*(1), 22–36. https://doi.org/10.4103/0253-7184.196885

Ross, M.W., Rosser, B.R.S., Bauer, G.R, Bockting, W.O., Robinson, B. "Bean" E, Rugg, D.L. & Coleman, E. (2001). Drug use, unsafe sexual behavior, and internalized homonegativity in men who have sex with men. *AIDS and Behavior*, *5*(1), 97–103. https://doi.org/10.1023/A:1009567707294

Simbayi, L.C., Zuma, K., Zungu, N., Moyo, S., Marinda, E., Jooste, S., Mabaso, M., Ramlagan, S., North, A., van Zyl, J., Mohlabane, N., Dietrich, C.N.I. & the SVT (2019). *South African National HIV Prevalence, Incidence, Behaviour and Communication Survey, 2017*. https://repository.hsrc.ac.za/handle/20.500.11910/15052

Sweya, M.N., Msuya, S.E., Johnson Mahande, M. & Manongi, R. (2016). Contraceptive knowledge, sexual behavior, and factors associated with contraceptive use among female undergraduate university students in Kilimanjaro region in Tanzania. *Adolescent Health, Medicine and Therapeutics*, *7*, 109–115. https://doi.org/10.2147/ahmt.s108531

Tayob, S.M. & Van Der Heever, H. (2014). Alcohol use among students at the University of Limpopo, South Africa. *African Journal for Physical, Health Education, Recreation & Dance*, *2*, 364–373.

Tesfaye, G., Derese, A. & Hambisa, M.T. (2014). Substance Use and Associated Factors among University Students in Ethiopia: A Cross-Sectional Study. *Journal of Addiction*, 1–8. https://doi.org/10.1155/2014/969837

UNAIDS 2022, *UNAIDS FACT SHEET 2022 Global HIV Statistics*. https://www.unaids.org/sites/default/files/media_asset/UNAIDS_FactSheet_en.pdf

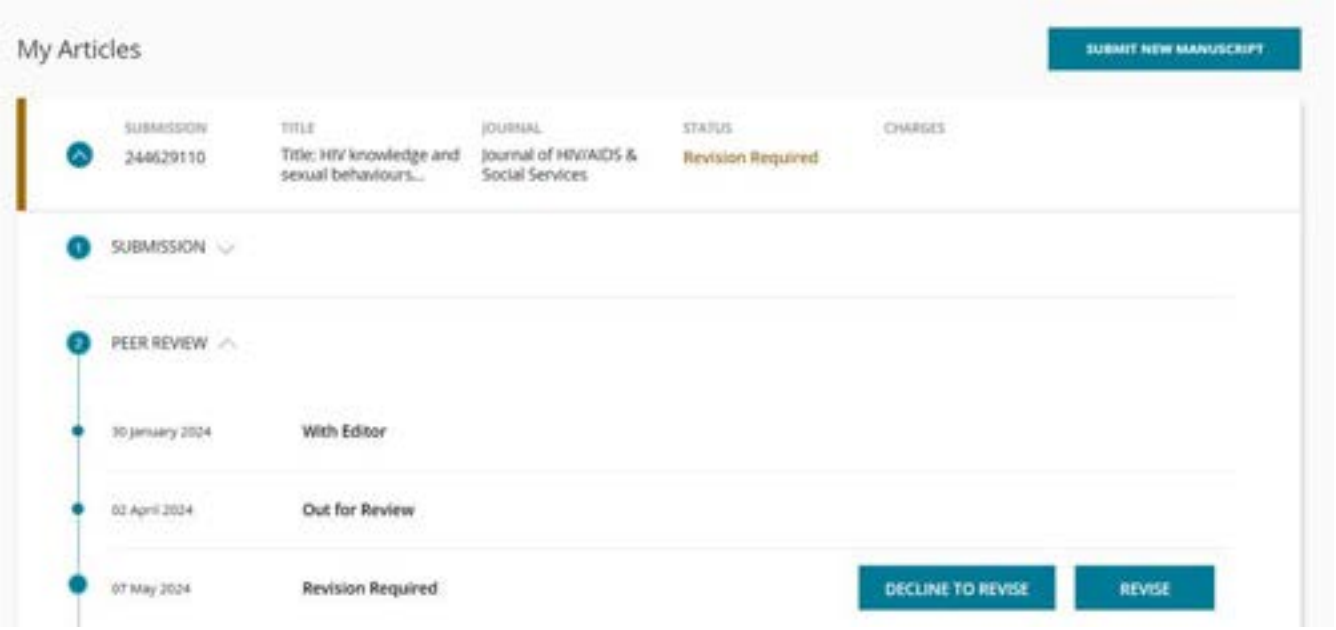
Wand, H. & Ramjee, G. (2012). The relationship between age of coital debut and HIV seroprevalence among women in Durban, South Africa: a cohort study. *BMJ Open*, *2*(1), 1–9. https://doi.org/10.1136/bmjopen-2011-000285

Whiteside, A. (2010). The economic impact of AIDS. In Q Abdool Karim, SS and Abdool Karim (Eds.), HIV/ AIDS in South Africa (Second Edi, pp. 417–431). Cambridge University Press.

WHO (2022). *Alcohol, heavy episodic drinking (population) past 30 days*. https://www.who.int/data/gho/indicator-metadata-registry/imr-details/459#:~:text=Definition%3A,to 6 standard alcoholic drinks.

Zuma, K., Simbayi, L., Zungu, N., Moyo, S., Marinda, E., Jooste, S., North, A., Nadol, P., Aynalem, G., Igumbor, E., Dietrich, C., Sigida, S., Chibi, B., Makola, L., Kondlo, L., Porter, S. & Ramlagun, S. (2022). The HIV Epidemic in South Africa: Key findings from the 2017 National Population-Based Survey. *International Journal of Environmental Research and Public Health*, 19, 8125.

Screenshot evidence of Manuscript 4 under review in the Journal of HIV/AIDS and Social Services (Manuscript ID: 244629110).



APPENDIX F: EDITORS LETTER

To whom it may concern:

Re: Doctoral Thesis entitled:

Development of an HIV Risk Index for University Students in KwaZulu-Natal, South Africa

Submitted in fulfilment of the requirements for the degree of Doctor of Philosophy in Health Sciences in the Faculty of Health Sciences, Durban University of Technology
by **Trishka Pillay**.

I have edited this document in terms of language usage and grammatical correctness.

I am an experienced editor and proof reader and have edited several similar documents.

My qualifications are as follows:

Bachelor of Arts (English and Afrikaans)

University Education Diploma (UED)

Diploma in Translation (Unisa).

Michael Vermeer
Editor/Proof reader

17 November2023