INVESTIGATING PREDICTORS OF WILLINGNESS TO RECEIVE AN HIV VACCINE IN A SOUTH AFRICAN SAMPLE OF YOUNG ADULTS

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ABSTRACT

HIV continues to be a major global health challenge, leading to substantial morbidity, mortality, and economic burden. Low and middle-income countries have long borne the brunt of the global epidemic. Specifically, South Africa has the largest population of people living with HIV. Promisingly, new infections have generally decreased largely due to immense treatment-as-prevention efforts. However, HIV incidence remains an issue, especially among youth, and young woman in South Africa. Many experts believe that the addition of a protective HIV vaccine is critical in completely controlling the epidemic. However, as we have witnessed in recent years, vaccine availability does not necessarily result in public acceptance and uptake. Therefore, considering how instrumental an HIV vaccine would be in curbing HIV incidence, it is important to explore key populations- namely young adult's- willingness to receive one.

This quantitative study employed a cross-sectional design to investigate willingness and associated factors within a sample of young adults. Specifically, the role of socio-demographic factors, key psychological antecedents, HIV stigma, HIV knowledge, perceived risk and perceived severity of HIV were examined as potential predictors of HIV vaccine willingness. In this study 173 HIV-negative young adults between the ages of 18 and 25 were recruited through a convenience sample at two youth clinics in Khayelitsha, Cape Town. This population is characterised by high levels of HIV incidence and are likely to be targeted by initial vaccination efforts. Data were collected through facilitated face-to-face surveys in either English or isiXhosa and stored on REDCap. The statistical analyses in this study were preformed using IBM SPSS Statistics (Version 28.01, 2021). Descriptive statistics were generated for key variables, followed by inferential analyses, including Fisher's Exact Test and one-way ANOVA, to compare group means. For non-normally distributed data, non-parametric alternatives were applied. Regression analyses were conducted to assess predictors of vaccine willingness, ensuring all assumptions, such as homoscedasticity,

The results of the study indicate that there is high willingness to receive an HIV vaccine (82.04%) amongst young adults in this sample. Furthermore, the results showed that HIV stigma, and the key psychological antecedents of collective responsibility and constraints, were significant predictors of willingness within this sample. Sociodemographic variables, HIV knowledge and perceived HIV risk and severity showed no significant association. These results suggest that public health interventions aimed at enhancing vaccine uptake should consider focusing on fostering a sense of collective responsibility while addressing HIV stigma and constraints linked to health seeking.

Understanding the factors that influence willingness to receive an HIV vaccine is crucial for public health planning. The findings of this study hope to address the existing gap in the literature on young adults’ attitudes towards a future HIV vaccine in South Africa.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

AIDS	Acquired immunodeficiency syndrome
ANOVA	Analysis of Variance
ARV	Antiretrovirals
BeSD	Behavioral and Social Drivers of Vaccination
CoCT	City of Cape Town
5Cs	Five Psychological Antecedents of Vaccination
GVCI	Global Vaccine Confidence Index
HBM	Health Belief Model
HICs	High-income Countries
HMRU	HIV Mental Health Research Unit
HPV	Human Papillomavirus
HREC	Human Research Ethics Committee
ICF	Informed Consent Form
JRF	Joint Reporting Form
LMICs	Low-middle-income countries
MMR	Measles, mumps, and rubella
PACVS	Parent Attitudes about Childhood Vaccines Survey
PrEP	Pre-exposure Prophylaxis
Q-Q plot	Quantile-Quantile Plot
RCT	Randomised Control Trial
SADAG	South African Depression and Anxiety Group
SD	Standard Deviation
SAGE	Strategic Advisory Group of Experts on Immunization

TAsP	Treatment-as-prevention
WHO	World Health Organisation
WTP	Willingness to Participate
VPD	Vaccine Preventable Diseases
VCS	Vaccine Confidence Scale
VHS	Vaccine Hesitancy Scale
VIF	Value Inflation Factor
YMSM	Young Men who have Sex with Men
UCT	University of Cape Town
$\boldsymbol{\chi}$ **2**	Chi-square

CHAPTER 1

INTRODUCTION

1.1 Context

In the global context, human immunodeficiency virus (HIV) presents a staggering public health challenge: an estimated 38 million people are living with HIV worldwide, and approximately 1.5 million new infections occur annually (UNAIDS, 2022). The HIV burden is markedly disparate in low-middle-income countries (LMICs), particularly in sub-Saharan Africa (Dybul et al., 2021). In this region 68% of people with HIV (PWH) reside despite constituting merely 15% of the global population (Dybul et. al, 2021). Nowhere is this impact more pronounced than in South Africa – the country currently with the highest rate of annual new infections globally (n = 240 000) (Laher et al., 2020). Extensive HIV testing and early treatment as prevention (TASP) efforts, have resulted in an overall decline in incidence in Southern Africa (Rautenbach et al., 2024), however rates of new infection remain high enough to sustain the epidemic and warrant major concern (Zuma et al., 2022).

Of particular concern is the vulnerability of young adults in South Africa, who not only represent 38% of new infections (Zuma et al., 2022), but are also the group with the lowest rates of viral load suppression (HSRC, 2023). Among this age group, young women face an especially elevated risk of HIV acquisition, and account for the majority of new infections (Zuma et al., 2022). This was further highlighted in the most recent South African HIV Prevalence, Incidence and Behaviour survey conducted by the Human Sciences Research Council (2023), where the prevalence was approximately twice as high in females than in males aged 15–19 years. Moreover, in the age group of 25–29 years, the prevalence among females was over three times higher (20% compared to 6%) than their male counterparts (HSRC, 2023).

The disproportionate burden of HIV carried by young women can be attributed to several factors – including biological, social, behavioural, cultural, economic, and structural determinants (Ramjee & Daniels, 2013). Previous research highlights that age-disparate relationships are associated with increased risk, where women acquire HIV around five to seven years earlier than young men (Dellar et al., 2015).

Given these challenges, there is a robust scientific consensus emphasising the urgent need for a safe and effective HIV vaccine as a critical tool in controlling and potentially ending the HIV epidemic (Dybul et al., 2021; J. Kim et al., 2021). The development of an HIV vaccine could provide long lasting protection against HIV to a diverse range of people, while at the same time eliminating some of the challenges associated with current prevention efforts (Dybul et al., 2021). Current challenges include poorer quality of life for PWH due to treatment and HIV-related symptoms, and increased psychological and social challenges (such as depression, substance abuse, physical abuse, and stigma or discrimination) (Berner & Louw, 2023). Furthermore, there is a growing financial burden for LMIC's as more people rely on ART as a chronic medication (Dybul et al., 2021). Lastly, an HIV vaccine may be particularly valuable to women who would no longer rely on negotiating safe sex practices or confronting their partners about risk concerns (Rudy et al., 2005).

1.2 Where are we now: HIV Vaccine

To date, despite several HIV vaccine trial attempts, no vaccine has shown sufficient efficacy and has been approved for public use (Ng'uni, Chasara & Ndhlovu, 2020). Developing an effective vaccine against HIV is a challenging task, as outlined by Verma et al. (2016), who identified five primary challenges. Firstly, HIV specifically targets and attacks the immune system, particularly CD4+ T cells. This makes it challenging to develop a vaccine that effectively stimulates an immune response, as the virus undermines the very system the vaccine aims to activate. Secondly, upon entering the body, HIV integrates its genetic material into the DNA of human cells. This integration occurs in a way that often goes unnoticed by the immune system, making it difficult for the body to recognise and mount an effective defence against the virus. Thirdly, HIV is characterised by multiple subtypes, and even within each subtype, the virus exhibits significant variability. This diversity poses a challenge for creating a vaccine that can effectively target all the different strains of the virus. Fourthly, HIV has a high mutation rate, leading to constant changes in its genetic makeup. This adaptability allows the virus to evade immune responses and makes it difficult to develop a vaccine that remains effective over time. And lastly, unlike some other infections where individuals may develop natural immunity after recovery, no one has been documented to fully recover from an HIV infection. The absence of a natural mechanism for the body to imitate complicates the development of a vaccine.

However, lessons from previous trials have yielded an extensive pipeline of early HIV vaccine candidates (Kim et al., 2021). Since the identification of HIV as the cause of AIDS in 1987, researchers have examined over 50 preventive vaccine candidates across more than 100 funded clinical trials (Verma et al., 2016). This ongoing commitment to vaccine research reflects the enthusiasm and hope felt by researchers in the field despite recent disappointments. The latest phase 3 randomised control trial (RCT) by Janssen, called Mosaico, was terminated at the start of 2023 after data analyses indicated that the regime did not provide sufficient protection against HIV (Johnson & Johnson, 2023). Similarly, the phase 2b Imbokodo trial concluded that the experimental vaccine did not provide sufficient protection in a population of young women in Sub-Saharan Africa and was terminated in 2021 (Johnson & Johnson, 2023). Despite all current vaccine trials being in early stages of development, and the notable setbacks of the Mosaico and Imbokodo trials, many researchers are hopeful that we will have an available vaccine within the next decade (Beaney, 2023).

1.3 If we have one, will people take it?

Historically, vaccination has not been as simple as access equals uptake. In fact, reports of communities refusing or delaying vaccination date back to the introduction of vaccines themselves (Lago, 2018). Recent examples include low compliance levels during the H1N1 pandemic in Switzerland in 2009 (Gilles et al., 2011), or reluctance despite having access to take the human papillomavirus (HPV) vaccine in Japan and India (Eskola et al., 2015). Low vaccination levels pose significant risk to both the individual and the wider community (Cooper et al., 2018). This is because high vaccine coverage is needed to reach a threshold of vaccine uptake that will insure herd immunity for everyone (Cooper et al., 2018). If this threshold is not met within a community, the possibility of an outbreak of the vaccine preventable disease (VPD) is significantly increased (Cooper et al., 2021). One particularly infamous example illustrates the public health impact of suboptimal vaccination. In 1988, the Lancet infamously published a report that linked cases of autism, and inflammatory bowel disease with the measles, mumps and rubella (MMR) vaccine (Lago, 2018). This report was later in all respects falsified but has left a lasting effect on public opinion (Lago, 2018). To this day, vaccine hesitant groups still cite the safety of the MMR vaccine as justification not to vaccinate (Lago, 2018). The delay in vaccination of hesitant individuals has led to various measles outbreaks in USA and Europe (de Figueiredo et al., 2020). Another striking example is the polio vaccine boycott in Nigeria during 2003 and 2004 which resulted in a huge drop in vaccination coverage, mostly driven by rumours and distrust (Cooper et al., 2021). The boycott resulted in polio incidence quintupling in Nigeria in the following few years and contributed to polio outbreaks across three different continents (Cooper et al., 2021). Most recently, reluctance to receive the COVID-19 vaccine was observed globally and is reported to have significantly affected efforts to curb the pandemic (Troiano & Nardi, 2021).

Responding to the growing phenomenon, the World Health Organisation identified vaccine hesitancy as one of the top 10 threats to public health (WHO, 2019), stimulating global focus on this issue. Hesitancy towards vaccination is seen to exist on a continuum from complete rejection of vaccines with no doubts to complete acceptance of vaccination with no doubts (see figure 1.1) (MacDonald, 2015). Generally, vaccine hesitant individuals are expected to fall somewhere in the middle of the continuum of accepting all vaccines and refusing all vaccines (Dubé et al., 2013). It must be noted that an individual who is vaccine hesitant may not display the same hesitancy towards all vaccines (MacDonald, 2015). For example, a young woman from South Africa may choose to accept the HPV vaccine with no concerns but may express uncertainty about getting the HIV vaccine. This variation underscores the complexity of vaccine decision-making and the factors influencing individual choices.

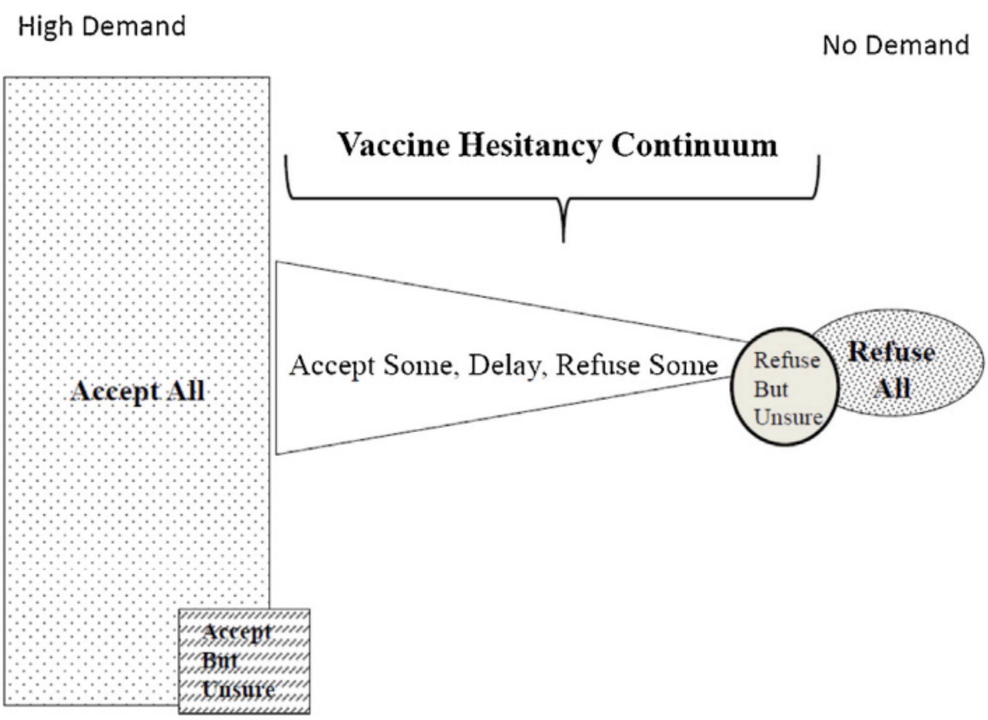

Figure 1.1 – The continuum of vaccine hesitancy between full acceptance and outright refusal of all vaccines. MacDonald, N. E. (2015). Vaccine hesitancy: Definition, scope and determinants. *Vaccine*, *33*(34), 4161–4164.

It is widely accepted that vaccine hesitancy is complex and context specific, as individuals may be influenced by the type of vaccine, the place, and the time (MacDonald, 2015). This also means that the type of person who is vaccine hesitant can fluctuate depending on the context resulting in a highly heterogenous group of people being categorised as vaccine hesitant (Dubé et al., 2013). Furthermore, different individuals often have different reasons for being vaccine hesitant even towards the same vaccine, making it difficult to address vaccine hesitancy with a one-size-fits-all approach (Bedford et al., 2018). The diversity in vaccine hesitancy drivers underscores the need for tailored interventions that consider individuals' unique concerns, perceptions, and motivations. For example, some individuals may indicate that a lack of trust in the healthcare providers is driving their hesitancy whereas others may be concerned about the safety of the vaccine or feel like they have a lack of information about the vaccine (Truong et al., 2022).

1.4 How do people make decisions?

An important consideration in effectively addressing vaccine hesitancy is understanding how and why people make the decisions they do. Previous research has shown that the Health Belief Model (HBM) may hold promising capacity for understanding individuals' intentions to vaccinate in a wide range of contexts (Al-Metwali et al., 2021; Wong et al., 2020). According to the HBM, for anyone to engage in health seeking behaviour, they need to first believe that the threat is real and potentially quite severe (Janz & Becker, 1984; Zampetakis & Melas, 2021). The person also needs to believe that they are personally at risk, and that the recommended health behaviour is effective or at least less risky than doing nothing to protect themselves (Zampetakis & Melas, 2021). Behaviour change theory offers an opportunity to understand the drivers of vaccine hesitancy and may inform interventions to address it.

1.5 Research rationale and problem statement of the study

Throughout history, vaccines have proven highly effective in safeguarding against numerous infectious diseases (Brewer et al., 2017). However, one of the pivotal lessons learnt from the COVID-19 pandemic is that neither vaccine effectiveness nor vaccine availability are the primary determinants of acceptance. Beyond these factors, a myriad of personal, inter-personal, contextual, vaccine-related, and disease-related determinants play a critical role in shaping people's willingness to receive a vaccine. In order to understand what will influence HIV vaccine willingness in South Africa, an exploration of a broad array of determining factors is necessary. Given the significant toll HIV takes on the lives of South Africans, particularly young adults, a high level of HIV vaccine acceptance would be pivotal in decreasing HIV-related morbidity, mortality, and stigma (Dybul et al., 2021).

It is important to highlight that the predominant focus of vaccine hesitancy literature has been shaped by a Westernised perspective, potentially limiting its relevance to the diverse racial and cultural groups found in South Africa (Matos et al., 2022). Given the inherent variability in the causes of vaccine hesitancy, influenced by specific vaccines, communities, and evolving timeframes, the relevance of Western theories becomes increasingly questionable when addressing the distinctive challenges associated with an HIV vaccine in the South African context (MacDonald, 2015; Newman & Logie, 2010). Furthermore, an HIV vaccine may experience unique challenges due to the inherent nature of the disease itself. Over the last 40 years, social perceptions of HIV have been fuelled by fear, stigma, and ignorance (WHO, 2024b). These entrenched societal dynamics, coupled with the persistent stigma surrounding HIV, could profoundly influence the willingness to receive an HIV vaccine. Considering the research gap that currently exists, it is pertinent that more local research needs to be done to further elucidate this phenomenon. This is particularly relevant within the target population of young adults, as they represent a high-risk group that is likely to be some of the first to be offered an HIV vaccine when one becomes available.

With this context in mind, the purpose of this study is to determine how key sociodemographic variables drawn from the literature, key psychological antecedents of vaccination, health beliefs, knowledge of HIV, and HIV stigma predict willingness to receive an HIV vaccine amongst young adults attending primary health care facilities in Khayelitsha, South Africa.

1.6 Research aims and objectives

This study aims to explore factors associated with young adults' willingness to receive an HIV vaccine in primary care settings in Cape Town, South Africa. Examining factors that could impact the decision-making process of this vulnerable population regarding an HIV vaccine will yield valuable insights for public health authorities issuing vaccination recommendations. The objectives of the current study are as follows:

(1) To quantify willingness to receive an HIV vaccine.
(2) To compare persons from this sample who **are** and are **not** willing to receive a vaccine with regard to key variables: demographic characteristics, psychological antecedents of vaccination, perceived HIV-related risk, perceived severity of HIV infection, HIV/AIDS knowledge and HIV-related stigma.
(3) To determine associations with willingness to receive an HIV vaccine based on significant variables identified in Objective 2.

CHAPTER 2

LITERATURE REVIEW AND THEORETICAL PERSPECTIVES UNDERPINNING VACCINE HESITANCY

2.1 Introduction

This chapter presents a review of the literature and research related to vaccine hesitancy and vaccine willingness in general, and specifically in the South African context. The chapter begins by exploring the benefits and challenges associated with vaccination. Subsequently, the chapter includes a detailed exploration of vaccine hesitancy, delineating its conceptualisation and the debate surrounding its definition. Following this, the chapter looks at the evolving conceptual frameworks of vaccine hesitancy, accompanied by an exploration of commonly employed measurement approaches. Finally, the chapter closes with a review of the underlying causes of vaccine hesitancy in general as well as looking at some of the unique challenges a novel HIV vaccine may face.

2.2 Benefits of vaccination

The development of safe and effective vaccines has significantly decreased morbidity and mortality globally and is widely recognised for its role in disease control (Rodrigues & Plotkin, 2020). The World Health Organisation (WHO) estimates that 3-3.5 million lives are saved per year by current immunization strategies from diseases like diphtheria, tetanus, pertussis, influenza, and measles (WHO, 2024a). And as such, vaccination is often said to be one of the most significant public health advancements of the 21st century (Rodrigues & Plotkin, 2020).

2.3 Challenges of vaccination

Despite its well-documented success in reducing disease prevalence worldwide, vaccination uptake is not without its challenges (Lindstrand et al., 2021). Over the last decade, research has indicated that vaccine uptake has been variable across different populations and vaccines (Dror et al., 2020). Inconsistent rates of vaccine uptake arise from a complex interplay of supply- and demand-side factors (Nabia et al., 2023). Supply side factors include concerns about infrastructure and storage facilities, instances of vaccine stockouts, suboptimal policies or their weak implementation, and challenges associated with inadequate human resources and technical issues (Olutuase et al., 2022). Conversely, demand-side challenges, associated with vaccine recipients, involve aspects such as affordability, accessibility, health literacy, and a lack of awareness (Azhar S et al., 2012). Beyond these practical barriers, a significant psychosocial challenge further contributes to reduced coverage rates – vaccine hesitancy.

An expanding body of evidence indicates that vaccine hesitancy is rooted in diminished trust in the importance, safety, or effectiveness of vaccines and can result in under vaccination amongst certain populations (de Figueiredo et al., 2020). Globally, the consequences of vaccine hesitancy are evident in the resurgence of VPD such as measles (de Figueiredo et al., 2020).

2.4 Vaccine Hesitancy

In the past decade vaccine hesitancy has become a key topic of investigation in various fields including public health, biomedical and the social sciences. Moreover, attention to the topic peaked during the COVID-19 pandemic, as the impact of vaccine hesitancy on limiting vaccine uptake became strikingly evident (Bussink-Voorend et al., 2022). Since this field of study is relatively new and crosses multiple disciplines, vaccine hesitancy has been defined and applied in numerous ways, often leading to overlapping or even contradictory ways in which it is understood. In this next section, I will discuss the main arguments in the literature and present a final working definition for vaccine hesitancy that will be used in this study.

2.5 Conceptualising and defining vaccine hesitancy

In 2012, the Strategic Advisory Group of Experts on Immunization (SAGE) working group on vaccines became the first body to systematically consolidate the construct of vaccine hesitancy (MacDonald, 2015). According to SAGE, vaccine hesitancy is defined as "A delay in acceptance or refusal of vaccines despite availability of vaccination services. It is influenced by factors such as complacency, convenience and confidence." (MacDonald, 2015). Despite facing criticism for some perceived limitations (Bedford et al., 2018; Bussink-Voorend et al., 2022), this definition of vaccine hesitancy has become the most widely known and cited definition to date (Chen et al., 2023).

Bussink-Voorend et al (2022), argues that SAGE's definition portraying vaccine hesitancy as a behavioural phenomenon leads to errors in its measurement. This is because behaviour is measured as a binary outcome, either a person has taken the vaccine or they have not. As such behaviour as a measure of vaccine hesitancy is not able to differentiate between those who are delaying due to concern or those who are delaying vaccination due to practical barriers such as access (Bussink-Voorend et al., 2022). Furthermore, Bedford et al. (2018) points out that due to this definition, vaccine uptake, or lack of uptake, statistics have been previously and erroneously used as a proxy for vaccine hesitancy. Such that vaccine hesitancy has been incorrectly identified as the cause for under vaccination when in reality causes may be related to pragmatics, competing priorities, and system failures (Bedford et al., 2018). Similarly, Bedford et al. (2018) criticises the working group's definition for the inconsistencies in the application of the term "convenience". According to their proposed definition, factors that fall under convenience include both individual (such as personal decisions about convenience) and system level factors (such as access and affordability). Dube et al. (2014) demonstrates that the ambiguity surrounding the definition of vaccine hesitancy led to significant variations in understanding and interpretation among European immunization managers (IMs). Such varied interpretations meant that some IM's thought vaccine hesitancy was a huge problem, and some didn't, some thought that geographical barriers constituted vaccine hesitancy, and some didn't (Dubé et al., 2014). Overall, most of the IM's struggled to provide an estimate of how many people where unvaccinated due to a vaccine hesitancy – highlighting a lack of practical tools in the field (Dubé et al., 2014).

2.5.1 A final working definition

With further developments in the field , and much theoretical debate, the WHO Behavioral and Social Drivers of Vaccination (BeSD) Working Group provided a much awaited new definition to replace the previous one developed by SAGE (World Health Organisation, 2022). Vaccine hesitancy is now defined as;

> "a *motivational state* [emphasis added] of being conflicted about, or opposed to, getting vaccinated; this includes intentions and willingness"

As noted by several authors, this new definition marks a pivotal moment in vaccine literature, as it enhances the ability for researchers and policy makers to pinpoint the root causes of hesitancy in specific populations and therefore implement effective strategies to combat vaccine hesitancy (Bedford et al., 2018). There are two important aspects of the new definition proposed by the BeSD working group that are worth taking note of. Firstly, the new definition conceptualises vaccine hesitancy as a psychological state rather than a behavioural one (Bussink-Voorend et al., 2022). This concept shift has significant implications on the way that vaccine hesitancy is measured. For example, as previous research has highlighted, vaccine uptake can be influenced by a myriad of factors including but not limited to vaccine hesitancy, and therefore using vaccination behaviour as a measure of hesitancy fails to appropriately delineate the different causes (Bedford et al., 2018; Dubé et al., 2013; Peretti-Watel et al., 2015). This has important implications for designing vaccination campaigns. For example, efforts targeting a lack of confidence in a vaccine would be ineffective if the primary driver of under-vaccination is due to limited access (Bedford et al., 2018). In simple terms, vaccine hesitancy is a very useful term when describing a situation where vaccination services are easily accessible, and yet vaccine uptake is less than expected. Therefore, for research on poor vaccine uptake to be both effective and practical, it is essential to focus on delineating those who are willing from those who are unwilling, and then identifying specific root causes affecting willingness (Bedford et al., 2018).

2.6 Models of vaccine hesitancy

Several frameworks have been developed and used within the field to better categorise and understand the main factors contributing to vaccine hesitancy. What people think and feel about vaccination can be very complex (MacDonald, 2015). As a result, different determinants can influence the decision process around vaccination at different times (Zhong et al., 2021). To address this complexity, this study incorporates a diverse selection of theoretical frameworks to better understand underlying causes of vaccine hesitancy and to better inform the development of this thesis. Most leading theories of vaccine hesitancy have been developed in Western contexts and validated primarily in Western populations. While no vaccine hesitancy frameworks have originated in South Africa, several have been adapted to better fit the local context, accounting for unique socio-cultural, historical, and structural influences on vaccine decision-making. In the following section, the 3C model, the 5C model, the Vaccine Hesitancy Matrix, and the Indifference/Commitment Axes will be discussed in more detail, with consideration given to their applicability in the South African setting.

2.6.1 The 3C model

In addition to the initial definition put forth by the SAGE working group, they also developed the 3C model of vaccine hesitancy (MacDonald, 2015). This framework was the first to identify three distinct factors contributing to vaccine hesitancy, namely confidence, complacency, and convenience. According to MacDonald (2015), confidence refers to the level of trust a person has in the vaccine, the system that delivers them, and the authority that makes decisions. Complacency is an individual’s assessment of the risk versus benefit of taking the vaccine. Whereas, convenience includes the practical barriers in the persons daily life such as affordability, geographical accessibility, and quality of services (real or perceived) (MacDonald, 2015). The 3C's model (see Figure 2.1), first proposed by the group in 2011, was intentionally incorporated into their definition of vaccine hesitancy for its accessibility, aiming to facilitate understanding, particularly among those unfamiliar with the terminology (MacDonald, 2015). However, more recently some researchers argue that this model may over simplify our understanding of the complex social and cultural influences of vaccine hesitancy (Bedford et al., 2018). Resulting in an over focus on the influence of ‘confidence’ in affecting vaccine decision making (MacDonald et al., 2022). Despite these critiques, this model is of value as it represents a foundational theory that many researchers have subsequently build upon.

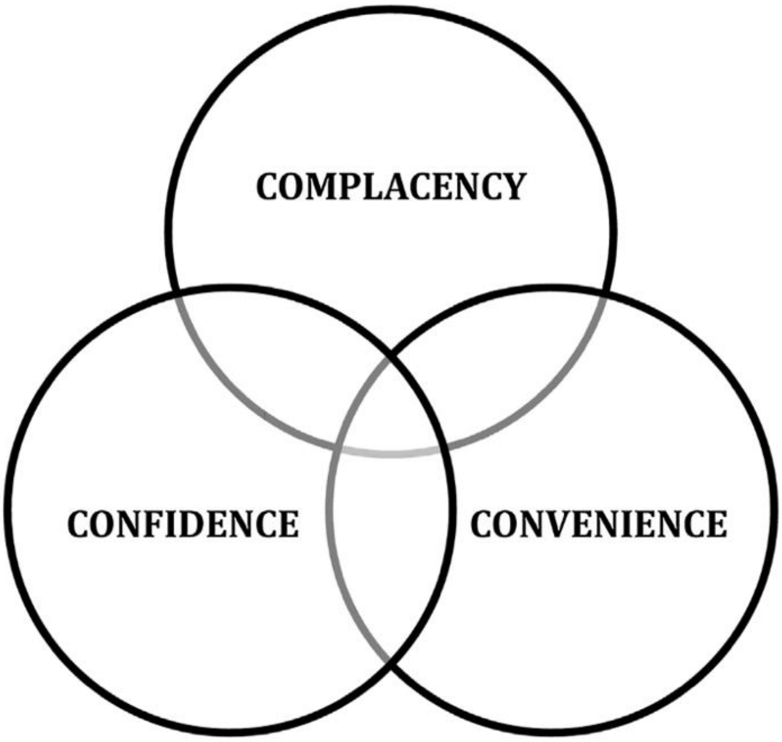

Figure 2.1 – The 3C's model of vaccine hesitancy. From MacDonald, N. E. (2015). Vaccine hesitancy: Definition, scope and determinants. *Vaccine*, *33*(34), 4161–4164. https://doi.org/10.1016/j.vaccine.2015.04.036

2.6.2 The 5C model

Subsequently, Betsch et al. (2018) developed the 5C scale which adds calculation and collective responsibility to the 3C domains above. In this updated model, Betsch et al. (2018) deliberately broadens the foundational 3C theory to 'go beyond confidence. Firstly, responding to the widely criticised term of 'convenience', Betsch et al. (2018) offer the term 'constraints' instead. In this new model, constraints are considered an issue when "physical availability, affordability and willingness-to-pay, geographical accessibility, ability to understand (language and health literacy) and appeal of immunization service affect uptake" (Betsch et al., 2018). The construct of 'constraints' primarily focuses on distinguishing access barriers from hesitancy (Tuckerman et al., 2022). However, psychological barriers can also affect perceived ability to access vaccination (Betsch et al., 2018). These barriers include a lack of perceived behavioural control, low self-efficacy, and disempowerment (Betsch et al., 2018). Perceived behavioural control is the amount of control a person believes to have over preforming a certain behaviour (Britt et al., 2014). For example, if a person believes that it will be difficult to get vaccinated, it will discourage them from attempting to vaccinate. Similarly, self-efficacy is closely related and pertains to one's confidence in their ability to act (Betsch et al., 2018). Those with low self-esteem may feel overwhelmed by perceived obstacles, such as navigating the healthcare system or dealing with potential side effects, which could reduce their motivation to seek vaccination. Disempowerment can also play a crucial role, particularly in contexts of socio-economic inequality (Milionis et al., 2023). People who feel powerless in broader aspects of their lives – whether due to poverty, lack of autonomy, or distrust in institutions – may also feel that their choices regarding vaccination are not entirely within their control. This could be exacerbated by historical experiences of medical mistrust or a perception that vaccines are being imposed rather than offered as a personal health choice (Watermeyer et al., 2022). In this way, both tangible access barriers (e.g., transportation, cost, clinic availability) and psychological barriers act as 'gatekeepers' to vaccination (Betsch et al., 2018).

Calculation measures a person's tendency to make decisions based on an assessment of the benefits and risks involved, either choosing to vaccinate or to not vaccinate (Betsch et al., 2018). A person who falls into this construct may also delay vaccination due to not having come to an answer they are satisfied with yet. Furthermore, depending on the source of information used, high levels of calculation may lead to vaccine hesitancy especially considering the high volumes of misinformation that can be easily accessed on the internet or through social media (Betsch et al., 2018).

The internet has played a pivotal role in empowering individuals to manage their health independently (Durach et al., 2022). Approximately 80% of internet users routinely turn to online platforms to consult medical information, highlighting the significant impact of digital resources in shaping health-related knowledge (Basch et al., 2017). Despite the advantages, the unregulated nature of the internet and the anonymity of content creators create a fertile ground for the production and dissemination of misinformation (Basch et al., 2017; Durach et al., 2022). Vaccine-related content is widely accessible across social media platforms and more broadly across the internet (Puri et al., 2020). Numerous studies have examined how it has been portrayed and have consistently identified the prevalence of misinformation. For instance, a 2002 study that evaluated the top 10 websites on seven prominent search engines, discovered that slightly over half of them featured anti-vaccination content (Davies et al., 2002). More recently, in a review of 87 top-watched YouTube videos, Basch et al. (2017) revealed that there was more anti-vaccine than pro-vaccine videos, 65.5% to 25.3% respectively. With YouTube being the most popular video-based website (over a billion unique users each month), it has been highlighted as a platform with the power to sway public opinion (Basch et al., 2017). The addition of calculation to the 5C scale makes the tool particularly useful for exploring hesitancy toward new vaccines where perceived risks are higher, and individuals might need more information to make an informed decision (Betsch et al., 2018).

Collective responsibility, as defined by Betsch et al. (2018), gauges the degree to which individuals ground their vaccination decisions in the well-being of society. Conversely, a person low in collective responsibility will show willingness to 'free-ride', meaning that they would be happy if everyone else received the vaccine so that they wouldn't have to (Betsch et al., 2018). The addition of the collective responsibility dimension to the 5C scale sets it apart from other measures, as it is the first time the extent to which individuals are motivated to vaccinate for the benefit of society is being measured within the vaccine hesitancy field (Betsch et al., 2018). This focus on social responsibility adds a valuable layer for understanding vaccine hesitancy within a community context, where the decision to vaccinate may be influenced by concerns for the well-being of others rather than purely personal risk calculations (Betsch et al., 2018).

Overall, each antecedent in this model represents individual preferences or psychological appraisals of the environment within which they exist (Betsch et al., 2018). This model does not claim to 'measure' an overarching level of vaccine hesitancy, but rather provides insight into the individual psychological drivers that influence vaccination behaviour (Betsch et al., 2018). The relevance of these psychological drivers, namely confidence, complacency, convenience, constraints and collective responsibility, has been explored within the African continent, and South Africa specifically. A recent study by Hester et al. (2023) found the 5C model effective in predicting vaccine demand in Nepal, Senegal, and Zambia. Vaccine willingness was positively correlated with higher levels of confidence and collective responsibility, with collective responsibility emerging as the strongest predictor. The authors attribute this to cultural norms of cohesion and interconnectedness prevalent in these populations. Both physical and psychological constraints also influenced vaccination intention, with physical access posing greater challenges in rural areas. Interestingly, complacency and calculation—factors often negatively associated with vaccine uptake—had minimal impact in this study. In a South African study, the 5C scale was used to explore caregivers' attitudes towards their daughters receiving the HPV vaccine (Khosa et al., 2022). Statistically significant differences between caregivers of vaccinated and unvaccinated daughters were identified for confidence (vaccinated group higher), complacency (unvaccinated group higher), constraints (unvaccinated group higher) and collective responsibility (vaccinated group higher) (Khosa et al., 2022). This study was the first to provide evidence for the 5C scale's usefulness in the South African setting. Khosa et al. (2022), note that despite accurate and culturally sensitive translation into Afrikaans and Sesotho (the most common languages spoken in the district), the calculation domain remained an insignificant predictor – suggesting that the phrasing of the questions in this domain may not be suitable to the South African context.

2.6.3 The Determinants of Vaccine Hesitancy Matrix

The second more complex model developed by the SAGE working group, is the Vaccine Hesitancy Matrix (See Figure 2.2) (MacDonald, 2015). This model pays tribute to the scope of determinants of vaccine hesitancy and distinguishes between the contextual, individual and vaccine/vaccination specific factors that may influence vaccine acceptance (Dubé et al., 2014). The working group identified the determinants from research studies, experiences of group members in the field, and discussions with experts working in the area (MacDonald, 2015).

According to the SAGE working group, individual and group influences include personal and social/peer factors, such as knowledge, beliefs, and attitudes, including those shaped by previous experiences with vaccination. Contextual influences are those that arise from sociodemographic, culture, historical, or systematic factors. And lastly, vaccine/vaccination-specific issues relate directly to factors associated with vaccine delivery, access, and administration. Knowing the specific determinants of vaccine hesitancy in a particular context is crucial as it allows for the targeted development of interventions to increase vaccine coverage in that setting (Oduwole et al., 2022). Oduwole et al. (2022) highlight that not all interventions will work for all vaccines in all contexts. Keeping this in mind, the matrix is acknowledged as a useful model due to its breadth of factors, but it is not easily operationalised into a survey-ready format to transform theory into practice

(Larson et al., 2015). In section four of this chapter, the drivers of vaccine hesitancy will be expanded on according to this model, exploring its implications for vaccine acceptance.

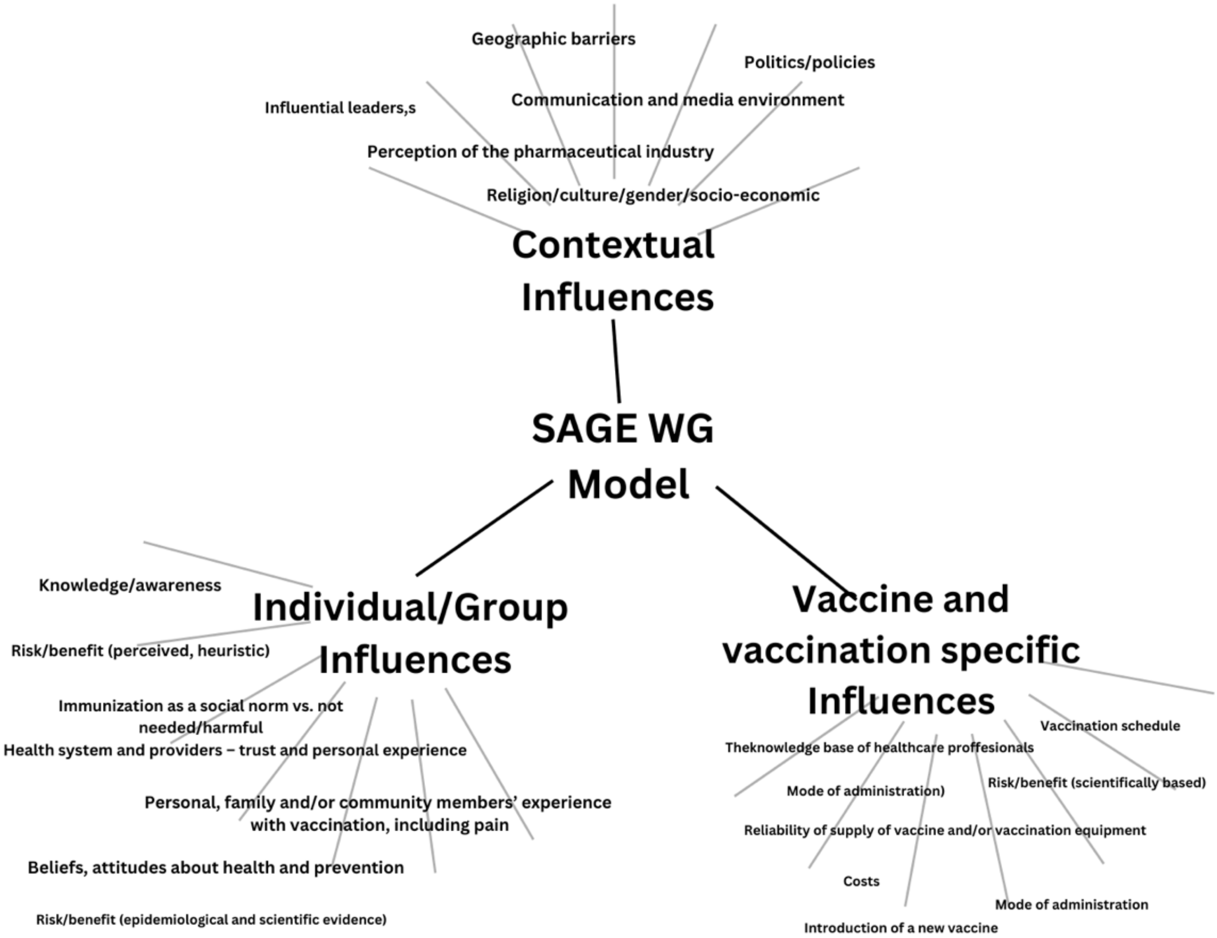

Figure 2.2 - SAGE Working Group Matrix of Vaccine Hesitancy. Figure reproduced from Larson, Jarrett, Eckersberger, Smith, and Paterson, Vaccine, 2014. Figure illustrates the determinants of vaccine hesitancy as laid out by the SAGE Working Group

2.6.4 The indifference/commitment axis

Perreti-Watel et al.'s theory (2015) proposes that there are axes of vaccine hesitancy (see Figure 2.3). This model expands on the idea that vaccine hesitant individuals purely exist on a continuum from willing to hesitant, but that hesitancy itself can be divided into two different types (Peretti-Watel et al., 2015). Firstly, individuals whose reasons reflect passiveness, inaction, or dependence (i.e., "I didn't think about it that much"), correspond to the lower left quadrant of the diagram (Peretti-Watel et al., 2015). Whereas individuals who report having decided after careful consideration (i.e., after some deliberation I have decided not to do it"), reflect a hesitant profile located in the lower right quadrant (Peretti-Watel et al., 2015). From a psychological perspective, this axis echoes the impact of locus of control on decision making, where individuals with an internal locus of control are more likely to actively engage in their health outcomes (Peretti-Watel et al., 2015). Conversely, individuals who experience life with an external locus of control, tend to have less agency in their decision making (Peretti-Watel et al., 2015).

Additionally, some authors suggest that a growing interest towards “healthism” may affect vaccination (Milionis et al., 2023). First coined by Crawford (1980), healthism was described as a “preoccupation with personal health as a primary— often the primary—focus for the definition and achievement of well-being”. An individual with healthist attitudes tends to feel responsible for their own health and consequently guidance from medical professionals is often met with scepticism (Milionis et al., 2023). This type of person is likely to engage in their “own research” on vaccines and vaccination programmes on the internet which can result in overestimating the side effects and undervaluing the risks of infectious diseases in modern day society (Kirbiš, 2023). Today healthism and the corresponding discourse around individual health is most evident in western middle-class societies specifically among health-aware, information rich individuals (Connolly, 2017; Greenhalgh, 2004). Considering the impact of healthism on individuals information seeking and personal decision making, this construct may echo that of *calculation* as described by Betsch et al. (2018).

The effect of healthism in LMIC’s has not been explored yet and represents a gap in the current literature. However, previous research has shown that poverty is associated with an external locus of control (Stephenson-Hunter, 2017). Suggesting that vaccine hesitant individuals from lower socioeconomic groups may be more likely to fall into passive hesitancy rather than rationalised hesitancy. Furthermore, this axis shows that improving self-efficacy and health empowerment by encouraging communities to place importance on their health may inadvertently shift passive hesitancy to rationalised hesitancy, if there is no trust in the vaccine or health authorities (Peretti-Watel et al., 2015).

Lastly, as vaccine hesitancy is strongly influenced by context, an individual’s type of hesitancy may also be variable (Peretti-Watel et al., 2015). Therefore, instead of categorising people as vaccine-hesitant, it is suggested that one should rather consider whether a specific context or vaccine influences their hesitancy (Peretti-Watel et al., 2015). For example, when faced with novel vaccines such as H1N1, HPV, or a new HIV vaccine, some individuals may tend to engage in information seeking which corresponds to a more rationalised form of hesitancy (Peretti-Watel et al., 2015). On the other hand, for routine vaccines like childhood vaccinations or seasonal influenza, individuals may be more inclined to adopt a passive approach, relying on their physician's guidance (Peretti-Watel et al., 2015).

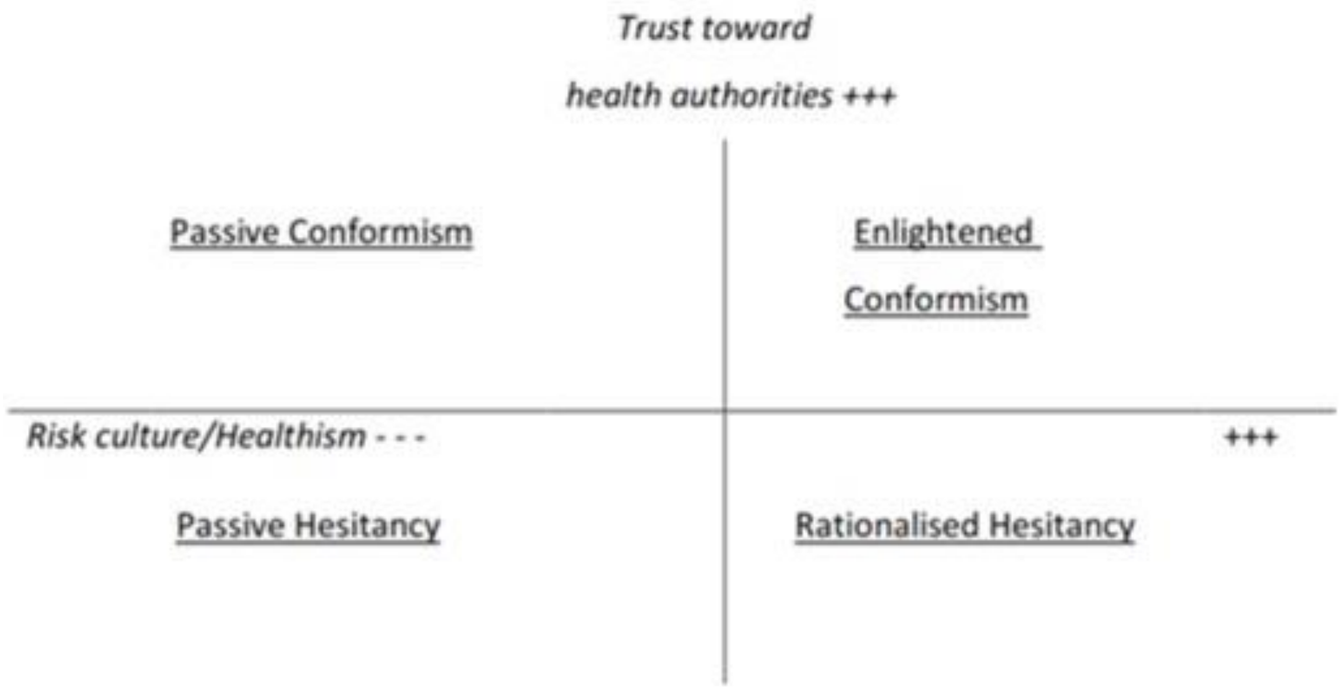

Figure 2.3 – Vaccine Hesitancy along two axes: commitment to risk culture / healthism (horizontal axis) and distrust/trust toward health authorities (vertical axis). From Peretti-Watel, P., Ward, J. K., Schulz, W. S., Verger, P., & Larson, H. J. (2015). Vaccine Hesitancy: Clarifying a Theoretical Framework for an Ambiguous Notion. *PLoS Currents*.

2.7 Predictors based on theoretical behaviour models

Theoretical models of health beliefs and risk perceptions are also useful for understanding what influences people's decision making. In this section, I will provide a more detailed discussion of the Health Belief Model (HBM) and discuss how the model is useful for understanding vaccine hesitancy and willingness

2.7.1 The Health Belief Model

The Health Belief Model (HBM) was originally developed in the 1950s by a group of social psychologists who aimed to understand the reluctance of individuals to engage with disease prevention strategies in general (Janz & Becker, 1984). The model originated from a robust foundation of psychological and behavioural evidence, highlighting the dependency of behaviour on two key variables: (1) the value that an individual places on a particular goal and (2) the individual's subjective estimate of achieving this goal (Janz & Becker, 1984). When applied specifically to health behaviour, the model delves into (1) an individual's desire to evade a specific illness or disease and (2) the conviction that a particular health action will diminish or prevent that illness (Janz & Becker, 1984). Specifically, the HBM contains the following four dimensions according to Janz & Becker (1984):

Perceived Susceptibility involves individuals' subjective perception of their vulnerability to a particular condition. It includes factors such as estimates of re-susceptibility, belief in the diagnosis, and susceptibility to illness in general.

Perceived Severity includes varied feelings regarding the seriousness of contracting an illness or leaving it untreated. This dimension encompasses evaluations of both medical/clinical consequences (e.g., death, disability, pain) and potential social consequences (e.g., effects on work, family life, and social relations).

Perceived Benefits or acceptance of personal susceptibility to a serious condition is seen as a motivating force, but the specific course of action depends on beliefs about the effectiveness of available actions in reducing the disease threat. Individuals are more likely to take recommended health actions if they perceive them as feasible and efficacious.

Perceived Barriers recognises potential negative aspects of a health action as potential impediments to undertaking recommended behaviour. A cost-benefit analysis occurs, where individuals weigh the effectiveness of the action against perceptions that it may be expensive, dangerous, unpleasant, inconvenient, time-consuming, and so forth.

The HBM has become one of the mostly widely used models for understanding vaccination behaviour across diverse global contexts (Limbu et al., 2022). For example, Limbu et al. (2022) examined studies from Asia, North America and Europe in a systematic review and found that HBM was effective in predicting and understanding drivers of COVID-19 vaccine uptake. In a survey of working age adults in France, vaccine refusal was identified as being associated with lower perceived severity of COVID-19 (Schwarzinger et al., 2021). Whereas in another study, perceived susceptibility to COVID-19 was shown to predict willingness to receive a COVID-19 vaccine amongst healthcare workers in Iraq (Al-Metwali et al., 2021). However, very limited research has investigated the usefulness of the HBM in understanding HIV vaccine hesitancy specifically. One study that was conducted in the US has previously linked higher perceived susceptibility and higher perceived risk of contracting HIV with increased HIV vaccine acceptability amongst college students, providing evidence for its utility in HIV vaccine willingness research (Ravert & Zimet, 2009).

However, a gap in the research exists for the application of the HBM in understanding South African vaccine willingness generally, and specifically HIV vaccine willingness. This model may still be valuable within our context considering the supporting evidence found in many other diverse settings.

2.8 Predictors of vaccine hesitancy

As I have mentioned, decision making around vaccination is highly complex and can be influenced by a range of contextual, individual and vaccine specific factors (MacDonald, 2015). With the absence of an existing HIV vaccine, current research on the topic pivots towards individuals' intentions or willingness to receive a hypothetical vaccine. Relying solely on intentions, rather than observed behaviour, introduces a potential margin for error, as intentions do not always translate into actual vaccination uptake. Therefore, to mitigate this limitation, this literature review has cautiously leveraged insights from the extensive body of research on COVID-19, HPV, MMR, H1N1, and other vaccines. Analysing how individuals have responded to these vaccines provides a solid foundation for understanding potential patterns and offers valuable parallels that can enhance our knowledge of how an HIV vaccine might be received. Furthermore, insights from a substantial body of research on participants' willingness to participate (WTP) in HIV vaccine trials, including agreeing to take the experimental vaccine, may provide valuable perspectives on HIV vaccine acceptability (Connochie et al., 2019; Fleming et al., 2020; Huyen et al., 2022). Previous research has identified several overlapping themes between WTP research and HIV vaccine willingness/acceptability (Newman et al., 2008). These themes included (1) fear of vaccine-induced HIV infection, (2) false-positives, (3) side effects, (4) partial vaccine efficacy, (5) mistrust, (6) AIDS stigma, (7) low perceived HIV risk, and (8) relationship concerns.

The following section offers a comprehensive overview of the contextual, individual/group and vaccine/vaccination specific influences of vaccine hesitancy relevant to this study.

2.8.1 Contextual influences

According to the vaccine hesitancy matrix, contextual factors are the influences arising from historic, socio-cultural, environmental, health system/institutional, economic, or political factors (MacDonald, 2015).

South Africa’s sociodemographic climate may produce unique challenges and opportunities for HIV vaccine uptake. Past research has shown that many sociodemographic factors have been identified to influence vaccine uptake in different contexts, such factors include age, gender, employment, ethnicity, and education (Truong et al., 2022). As there is limited research done on HIV vaccine willingness in South Africa, I have drawn on results from other vaccines in our context and compared those to global estimates. Lastly, I discuss some HIV vaccine specific findings.

Drawing from South African literature, past research on COVID-19 vaccination revealed several important sociodemographic variables in our context. Specifically, participants who identified as Black/or Coloured were more likely to be unvaccinated than those who self-identified as White (Engelbrecht et al., 2022). However, contrary to research done in the US and Europe, Black/Coloured individuals were less likely to be vaccine-hesitant in South Africa (Engelbrecht et al., 2022). The discrepancy between willingness and vaccination status in South Africa points to a more pervasive issue of unequal access to healthcare in poorer communities rather than the more prototypical psychological determinates of vaccine hesitancy such as confidence or trust in the vaccine (Dhanani & Franz, 2022). This finding may be important when an HIV vaccine becomes available, as Black and Coloured people from economically marginalised communities, on top having a higher risk of acquiring HIV, tend to struggle with greater inequality in accessing healthcare services (Gordon et al., 2020; Mabaso et al., 2019). Suggesting that access to facilities may pose a greater barrier than willingness amongst this group. In terms of education level as a factor, Engelbrecht et al.'s (2022) results echoed global findings, where lower education was associated with a higher chance of being unvaccinated and vaccine hesitant. Similarly, in another study during the outbreak of the Ebola Virus disease in Guinea, higher acceptability of vaccines was seen among men and wealthy or educated people (Irwin et al., 2017). However, other studies have reported conflicting results. One cross-sectional online survey among a Chinese population found that both vaccine confidence and willingness to receive a COVID-19 vaccine increased with decreasing education levels (Wang et al., 2021).

The influence of age on vaccine hesitancy also tends to produce conflicting results. Older age is mostly associated with increased willingness of COVID-19 vaccination. For example, older people in South Africa (Engelbrecht et al., 2022) and Portugal (Soares et al., 2021) were more willing to receive the COVID-19 vaccine than their younger counterparts. However, younger age has also been associated with increased willingness in a global scoping review across several different vaccines (including but not limited to HPV, MMR, polio, tetanus, and tuberculosis) (de Figueiredo et al., 2020). The discrepancy between these findings may highlight the extent to which the context and type of vaccine can affect willingness and uptake. Previous authors have proposed that there is a link between willingness to be vaccinated and perceived risk of acquiring the disease and perceived severity of symptoms (Ravert & Zimet, 2009). Following this line of thinking, it makes sense that older people were more willing to receive the COVID-19 vaccine as this demographic were associated with greater likelihood of severe illness and death (Madhi & Nel, 2021).

In terms of an HIV vaccine, HIV affects all ages indiscriminately, and therefore we may not find an association with age. Instead, factors associated with risk of acquiring HIV may be more influential, such as relationship status, perceived sexual safety, and personal experience with HIV such as having a close relationship with someone who has HIV. An American study found that HIV vaccine acceptability was associated with having more lifetime sexual partners, a higher perceived risk of contracting HIV, lower danger invulnerability (i.e., feeling less invulnerable to physical harm), and higher psychological invulnerability (i.e., feeling more resilient to emotional harm) (Ravert & Zimet, 2009). These results are corroborated by a South African study conducted in Soweto amongst adolescents, showing that willingness may be related to high levels of HIV risk perception (de Bruyn et al., 2008a). It is important to note that both above-mentioned study's (conducted in 2008) are somewhat outdated. While they provide valuable insights, the findings may not fully reflect current trends, particularly given the advancements in HIV public health approaches since then. The lack of recent research on HIV vaccine willingness represents a limitation of the current review and highlights the need for more recent research on this topic.

One potential influence, as history has shown, is that widespread public controversy surrounding a certain vaccine can have determinantal effects on vaccine uptake (de Figueiredo et al., 2020). For example, shortly after the dengue virus vaccine programme was launched in 2017 in the Philippines, parents and health professionals raised alarms to the potentially severe health risks associated with children who had not been exposed to the virus before (Larson et al., 2019). This unexpected outcome triggered widespread panic and outrage amongst the affected community, resulting in a dramatic decline in vaccine confidence in general (Larson et al., 2019). Reports indicate that vaccine coverage for other diseases plummeted at the time, raising concerns about potential outbreaks (Larson et al., 2019). The Dengue Controversy serves as a key case study, as it shows the importance of maintaining trust and transparency regarding vaccine safety and efficacy (Larson et al., 2019). It also highlights how a single vaccine can significantly influence public opinion, affecting not only that specific vaccines' uptake but also broader vaccine campaigns in general (Larson et al., 2019).

Considering the negative impact that the COVID-19 vaccination campaign had on public opinion surrounding the safety and necessity of vaccines globally and in South Africa, it would be fair to assume that any new vaccine, such as the HIV vaccine, may inherit some of its predecessor's reputation. Previous authors have reported that extreme levels of vaccine hesitancy towards the COVID-19 vaccine can be linked to a complex network of factors including 'fear' of the vaccines fuelled by conspiracy and rumours, 'uncertainty' in the effectiveness of the vaccine, and a 'lack of trust' in the government's intentions and health messaging (Watermeyer et al., 2022). Given the lack of research on HIV vaccine willingness in the post COVID-19 era, it remains unclear to what extent the controversy surrounding COVID-19 vaccines will affect future attitudes towards an HIV vaccine.

Lastly, understanding how vaccines are situated within the historical and socio-political landscape of South Africa is crucial. Historically, Western medicine has been associated with abusive practices and mistreatment of African communities (Jarolimova et. al, 2021). The unethical medical research conducted by Western scientists has left deep scars on public trust in biomedical interventions. For example, Kenya has had a long and complex history with HIV research. Many critics have raised concerns about unethical practices and unequal benefit sharing among international researchers and local participants (Doshi et al. 2017). Participants have voiced feelings of disappointment and disillusionment towards participating in medical research (Doshi et al. 2017), which may affect their attitudes towards western medicine in the future.

Beyond historical injustices, contemporary structural inequalities in healthcare access continue to reinforce mistrust. Many marginalised communities in South Africa experience inadequate healthcare services, long-standing disparities in medical treatment, and systemic neglect and racism, further exacerbating scepticism toward Western medicine. Mistrust in Western medicine, therefore, extends beyond isolated events; it is a product of historical, structural, and experiential realities that shape public perceptions. This deeply rooted mistrust is theorised to have contributed to the spread of vaccine hesitancy, conspiracy theories, and scepticism towards the western biomedical field (Watermeyer et al., 2022). Consequently, the success of a future HIV vaccine campaign will rely heavily on careful health communication strategies that prioritise transparency, acknowledge historical harms, and foster trust between communities, healthcare systems, and leadership (Brewer et al., 2017).

2.8.2 Group/Individual influences

According to the vaccine hesitancy matrix, group and individual influences arise from personal perception of the vaccine or influences of the social/peer environment (MacDonald, 2015).

2.8.2.1 HIV knowledge

Poor HIV knowledge may be a modifiable barrier to HIV vaccine uptake. Currently, there is very limited research on the influence of HIV knowledge specifically on HIV vaccine willingness. However, we can gain valuable insights by looking at the impact of HIV knowledge on other HIV prevention methods, the influence of HIV knowledge on WTP in HIV vaccine trials, and the influence of knowledge on the acceptance of other vaccines. Previous authors have reported that accurate knowledge about HIV has been shown to decrease transmission of the disease through the application of other preventative measures (De Wet et al., 2019). It is believed that adequate HIV knowledge, which includes the correct understanding of HIV transmission, high-risk behaviours, and prevention and care strategies, improves people's self-efficacy and problem-solving capacity resulting in improved care engagement (De Wet et al., 2019). For example, low knowledge of HIV and awareness of pre-exposure prophylaxis (PrEP) has been associated as a barrier to care (Poteat et al., 2019).

Contradicting this, Kalichman & Simbayi (2003) found that HIV knowledge was not associated with HIV testing in South Africa. The authors suggest that this result indicates that factual based information although necessary, may be ineffective at promoting HIV testing (Kalichman & Simbayi, 2003). Similarly, results from the body of work on WTP in HIV vaccine trials found no significant association between participants' level of HIV knowledge and their WTP in an HIV trial in Tanzania (Iseselo et al., 2020). Lastly, past research shows that knowledge about VPD's and the associated risks has been associated with vaccine acceptance across several vaccines, including COVID-19 (Myburgh et al., 2023), HPV (Masika et al., 2015) and polio (Abbasi et al., 2022). The conflicting evidence in the literature around the role of knowledge in care engagement and vaccine uptake highlights that although knowledge is an important aspect of health engagement, it may not be sufficient as a stand-alone variable.

2.8.2.2 Trust and the role of health professionals

It is well documented that individuals' trust in health authorities, pharmaceutical companies and the government influences their decisions to vaccinate across various vaccines including COVID-19 (Wang et al., 2021), Measles, mumps, and rubella (MMR) (Krishnamoorthy et al., 2019), and HIV (Newman & Logie, 2010). For example, in a nationally representative study in China, low levels of trust in the vaccine, the delivery system, or the government predicted higher levels of vaccine hesitancy (Wang et al., 2021). Notably, the recommendations of medical doctors hold significant sway in the decision-making process. A mixed-methods study conducted during the Measles-Rubella vaccination campaign in rural India revealed that parents, despite inadequate knowledge about vaccines, often deferred to their trust in doctors or healthcare workers, underscoring the pivotal role of healthcare professionals in influencing vaccination decisions (Krishnamoorthy et al., 2019). Additionally, Dimi et al. (2019) found that perceived effectiveness of a hypothetical HIV vaccine as well as trust in the physician had a significant effect on acceptability in a French population.

The protective role of trust within HIV care engagement has been well-documented. A literature review on the role of trust in healthcare systems in sub-Saharan Africa found that trust between patients and providers was a crucial part in fostering demand for HIV services (Østergaard, 2015). Another study among adolescent girls and young women in South Africa and Zimbabwe, found that trust in their providers was highly associated with accurate self-reported adherence of PrEP (Beauchamp et al., 2023). Unfortunately, marginalised and vulnerable populations, most in need of healthcare often report higher levels of mistrust (Earnshaw et al., 2013). This mistrust can be attributed to a history of unethical medical experimentation as well as on going discrimination within the healthcare systems (Earnshaw et al., 2013). Thus trust serves as a cornerstone for patients to believe in the intentions of both their healthcare provider and the government when making decisions (Beauchamp et al., 2023).

It is reasonable to expect that the role of trust will similarly affect the adoption of an HIV vaccine. This effect could be particularly pronounced among young adults, who might face accusations of promiscuity for seeking access to an HIV vaccine. Societal stigma, and mistrust of healthcare providers perpetuates and maintains health disparities – a phenomenon that is starkly evident within the context of HIV (Earnshaw et al., 2013).

2.8.2.3 Perceived safety and efficacy of a vaccine

Research suggests that an imbalance between perceived risk and perceived benefit of vaccination, results in people refusing or delaying vaccination (Karafillakis & Larson, 2017). Concerns about the risks of vaccination are frequently cited by individuals as a reason not to get vaccinated, however drawing a distinction between perceived risks and scientifically based calculated ones is important. Dube et al. (2013) define risk perceptions as the "perceived vulnerability or likelihood of harm if no action is taken and perceived severity or seriousness of the consequences if harm was to occur". In a systematic literature review, Karafillakis and Larson (2017) identified common beliefs about perceived risks of vaccination in Europe. This included vaccine safety, the perceived low risk of contracting VPDs, beliefs that VPDs are not dangerous, that vaccines do not work, that vaccines are not needed or that adults or children were healthy enough not to need vaccination and that there was not enough evidence or adequate testing of vaccines. When trying to understand peoples risk assessments, it's important to understand that it is not usually based on a rational approach that can be counteracted by ensuring that the emotional or cognitive bias affecting judgement is corrected but is rather based on individual “uncertainties and ambiguities” (Dubé et al., 2013). This could potentially explain the conflicting results surrounding HIV education, as the provision of logical information will not combat illogical personal biases. Within this context, it is worth noting that lay people conduct risk assessments quite differently to experts, where experts are more likely to make judgments in accordance to empirical evidence, lay people are more likely to be affected by past experiences (with vaccination and healthcare services), and the anecdotal experiences of others (Dubé et al., 2013).

Interestingly, vaccine safety has been identified as a common concern across various countries and vaccines (Karafillakis & Larson, 2017). However, distinct categories of safety concerns have been identified for different vaccines. For instance, while concerns surrounding HPV vaccination often revolved around perceived long-term and severe adverse events, those associated with influenza vaccination were typically milder and centred on beliefs that the vaccine induces flu-like symptoms (Karafillakis & Larson, 2017). Due to the unique characteristics of HIV, it can be expected that safety concerns for a new HIV vaccine may focus on issues specific to the virus, such as a fear of vaccine-induced infection, fear of a false positive and fear of long-term side effects (specifically to the reproductive system) (Newman et al., 2008). Furthermore, a South African study identified concerns about whether the government or pharmaceutical companies would be honest about the risks associated with a new HIV vaccine (Sayles et al., 2010). Such concerns will most likely add complexity to future health messaging campaigns.

2.8.3 Vaccine/vaccination specific influences

According to the vaccine hesitancy matrix, vaccine specific issues are directly related to the vaccine or vaccination (MacDonald, 2015).

2.8.3.1 Scientifically based safety and efficacy concerns

Unlike perceived safety and efficacy concerns, evidence based concerns are also likely to affect uptake of a future HIV vaccine. Research suggests that an HIV vaccine with high efficacy will be more acceptable than a vaccine with low to moderate efficacy (Newman & Logie, 2010). For example, Connochie et al. (2019) found that efficacy was significantly associated with acceptability of an HIV vaccine in a group of young men who have sex with men (YMSM). Similarly, Newman and Logie (2010) revealed that across their systematic review, low efficacy vaccines received considerably lower rates of acceptances (40%) than highly efficacious vaccines (73.8%). With no current HIV vaccine available for public use, and no specific vaccine characteristics available it is difficult to predict how people will respond. However, what we do currently know is that the higher the efficacy the more willing people will be to receive the vaccine. Unfortunately, this relationship does not appear to work in favour of reaching successful rates of coverage, as a novel HIV vaccine is likely to have low to moderate efficacy, and thus conversely requires higher acceptance rates to attain herd immunity (Newman & Logie, 2010).

2.9 Unique challenges faced by an HIV vaccine

As mentioned previously, vaccine hesitancy is a highly complex global phenomenon, that varies across time, place and vaccines (MacDonald, 2015). Although similarities may exist across vaccines, it is critical to understand the key differences so that interventions can be tailored to the specific context (Marti et al., 2017). For example, in countries affected by Ebola, people were afraid to attend health care facilities due to the risk of contracting the disease, whereas a survey in Europe revealed that people did not perceive themselves at risk of acquiring measles, and thus did not adhere to vaccination schedules (Marti et al., 2017). These examples illustrate that interventions to increase vaccination in both these settings will require completely different public health approaches. The introduction of an HIV Vaccine will likely face a unique set of challenges. Studies from South African WTP in HIV vaccine trials suggest that there is a wide range of willingness, from 52% to 94% (Chimoyi et al., 2017; de Bruyn et al., 2008a; Jaspan et al., 2006; Otwombe et al., 2011). However, reasons and willingness to participate in an HIV vaccine trial may be different to what influences the uptake of an actual HIV vaccine. For example, altruism is often cited as a reason for people to participate in HIV vaccine trials (Connochie et al., 2019; Doshi et al., 2017; Huyen et al., 2022; Jaspan et al., 2006), and is likely to not play as much as a role in the context of an approved HIV vaccine (Sayles et al., 2010). This was illustrated by de Bruyn et al. (2008), who revealed that 79% of adolescents were either definitely or probably willing to participate in an HIV vaccine trial, compared to 42% who were willing to receive a safe and effective vaccine when one came available. The variability in willingness between participating in HIV vaccine trials versus receiving a publicly available HIV vaccine, may reflect the influence of research related benefits (such as compensation) on people's willingness. Additionally, participants who enrol in trials are not necessarily representative of the general population who will be targeted in initial HIV vaccine efforts (Sayles et al., 2010).

2.9.1 Stigma and discrimination

HIV remains a highly stigmatised disease, imposing significant social, emotional, and economic burdens on PWH (Armstrong-Mensah et al., 2019). HIV-related stigma encompasses the negative beliefs, feelings, and attitudes towards PWH, their families and others who are associated with them (Rendina et al., 2019). The fear of HIV-related stigma, and the potential discrimination or violence that accompanies it, undermines people's ability to engage in current HIV prevention and treatment efforts (Armstrong-Mensah et al., 2019). Since the beginning of the HIV epidemic, individual perceived stigma, or the fear of being stigmatised if HIV-positive, has long been associated with delays in testing or decisions not to test (Treves-Kagan et al., 2017). Similar challenges are seen across the HIV care continuum and are likely to influence the acceptance of an HIV vaccine (Sayles et al., 2010). For example, daily oral PrEP is over 90% effective in preventing HIV with consistent use, however its uptake has fallen below anticipated levels (Velloza et al., 2020). The lower-than-expected adherence and adoption have been linked to concerns surrounding both anticipated and experienced stigma (Velloza et al., 2020). "Anticipated stigma" encompasses fears related to potential negative reactions from others regarding PrEP use, whereas "experienced stigma" refers to first-hand encounters with stigma arising from the actual utilisation of PrEP (Velloza et al., 2020). Sayles et al. (2010) found that stigma may influence HIV vaccine acceptability in two ways. Firstly, participants shared concerns about having to get an HIV test before receiving the vaccine due to the fear of being stigmatised if their result came back positive. Secondly, participants were worried that taking the vaccine would label them as sexually promiscuous. This concern is notably heightened among youth and young adults, as they anticipate scrutiny from partners, parents, family, church members, and the broader community, who might question why a young person would "need" an HIV vaccine. Furthermore, fear of stigmatisation may be heightened as early HIV vaccination campaigns are likely to be targeted towards vulnerable populations. Such singling out of persons "at risk of acquiring HIV" may present a stigmatising context for these individuals (Streefland, 2003).

2.9.2 Beliefs about traditional therapies

Finally, vaccination refusal is sometimes linked to philosophical beliefs or moral convictions concerning health and immunity, such as a preference for "natural" over "western/artificial" medicines (Dubé et al., 2013). Strong religious beliefs have also been linked to vaccination delay or refusal (Dubé et al., 2015). For example, the Orthodox Protestants in the Netherlands and the Amish in the US have been known to reject vaccination on the basis of religious grounds (Dubé et al., 2013). Despite, traditional and Western healthcare systems coexisting in South Africa, where individuals often utilise both simultaneously to address health concerns, local research suggests that an HIV vaccine may not be viewed as compatible with the African healing paradigm in some groups (Sayles et al., 2010). *Traditional medicine* describes local healthcare practices, administered by specialised healers trained in traditional practices, whereas *western medicine* describes treatment that is provided by western-trained professionals who prescribe western pharmaceuticals (Dahlberg & Trygger, 2009). Within this context, mistrust towards Western medicine emerges as a potential obstacle to the acceptability of an HIV vaccine (Sayles et al., 2010). Moreover, findings from a qualitative study by Atujuna et al. (2018), reveals that adherence to traditional healing beliefs might create conflicts regarding the adoption of new Western HIV prevention methods.

2.10 HIV Vaccine hesitancy

The existing literature on vaccine hesitancy concerning prospective HIV vaccines is limited, despite substantial investments in HIV vaccine development and the considerable costs associated with HIV treatment (Dybul et al., 2021). To date, only two systematic reviews have explored the prevalence of vaccine hesitancy and predictors of uptake for a future HIV vaccine. Newman and Logie's (2010) review comprised of 30 studies, predominantly from North America, with limited representation from other geographical contexts such as South Africa (Newman & Logie, 2010). Notably, the review coincided with a pivotal phase three trial demonstrating effectiveness in HIV vaccine prevention (Newman & Logie, 2010). However, the limited global representation in the review prompts a critical examination of the generalisability of findings to diverse contexts with distinct contextual and cultural sensitivities (Newman & Logie, 2010).

Newman and Logie (2010) found that acceptance towards a future HIV vaccine was generally high, with vaccine acceptance ranging from 37.2% to 94% on a 100-point scale, averaging at 65.3% (SD=20). In a more recent review focusing on acceptability and willingness to pay for HIV vaccines by Huyen et al. (2022), a wide range of acceptance was similarly identified. Acceptability ranged broadly from 29.4% to 93.10% with an average of 60% (Huyen et al., 2022). Notably, Huyen and their colleagues deliberately included a diverse range of locations in their review, recognising a gap in previous research efforts. However, despite this most of the studies still originated from the US.

In a South African qualitative study by Sayles et al. (2010) explored motivators and barriers to future HIV vaccine uptake among young adults, revealing a high level of vaccine acceptance (75%). There is a stark gap in the literature regarding more recent estimates of HIV vaccines acceptability in South Africa. Particularly, salient is the fact that there has been no further research on HIV vaccine willingness in South Africa post the COVID-19 pandemic – a global event that put vaccine hesitancy on the map – and therefore this study aims to fill that gap.

2.11 Chapter summary

This chapter presented a review of vaccine hesitancy both globally and locally, focusing specifically on what is known about HIV vaccine acceptability. The chapter commences with a discussion clarifying the working definition of vaccine hesitancy that will be used throughout this study. Following this an extensive review of the current conceptualisations and models used to understand vaccine hesitancy is provided. Next, a breakdown of the factors that may influence vaccine hesitancy is provided. In this section, specific focus was given to HIV vaccine hesitancy in South Africa. However, where research was lacking in the literature, information was drawn from surrounding fields, such as WTP in vaccine trials or acceptability associated with other vaccines. Notably, factors that are thought to specifically affect the uptake of an HIV vaccine were discussed in greater detail. These included HIV related stigma and traditional medicines.

In the following chapter, I will discuss the methodology of the study.

CHAPTER 3
METHODOLGY

3.1 Overview of Chapter

This chapter outlines the research methodology employed in studying young adults' willingness to receive a hypothetical HIV vaccine in Khayelitsha, South Africa. It begins by stating the research aims, objectives, and hypotheses and then provides a rationale for the chosen research design. Following this, the chapter details the study procedure, including participant selection and sampling methods. Subsequently, the chapter discusses the measures employed, including both validated and study developed scales. This will be followed by a section detailing the steps used in the translation of the instrument into isiXhosa. Lastly, the chapter discusses the data analysis techniques, and ethical considerations inherent to the study.

3.2 Research aims, objectives and hypotheses

The current study aimed to explore young adults' willingness to receive a hypothetical preventative HIV vaccine in Khayelitsha, South Africa. The specific objectives of the study included:

(1) To quantify willingness to receive an HIV vaccine.

(2) To compare persons from this sample who **are** and **are not** willing to receive a vaccine regarding key variables: demographic characteristics, psychological antecedents of vaccination, perceived HIV-related risk, perceived severity of HIV infection, HIV/AIDS knowledge and HIV-related stigma.

(3) To determine associations with willingness to receive an HIV vaccine based on significant variables identified in Objective 2.

During this study, five hypotheses were tested. Each hypothesis was selected based on a thorough examination of recent and relevant literature:

H^1: Willingness to receive an HIV vaccine will be determined by key demographic variables, such as gender, education, relationship status, household income, and religious preference.

H^2: Participants who have greater perceived severity and perceived risk of HIV will be significantly more willing to receive an HIV vaccine.

H^3: Participants who have greater levels of HIV knowledge will be significantly more willing to receive an HIV vaccine.

H[4]: Participants who have greater levels of HIV stigma will be significantly less willing to receive an HIV vaccine.

H[5]: Willingness to receive an HIV vaccine will be determined with psychological antecedents of vaccination.

3.3 Rationale for Study Design

This study utilised a cross-sectional analytic research design (Jarmolowicz et al., 2021).
This type of non-experimental research design is a robust way to assess the prevalence of a certain outcome in a population at one point in time (Mann, 2003). It was appropriate to use this design in the current study as this design provides a quick and inexpensive way to collect data from a population of interest (Mann, 2003). Moreover, cross-sectional studies are useful when trying to identify associations (Mann, 2003). One of its major limitations, is that cross-sectional studies are not suitable for differentiating cause and effect from simple associations, which can lead researchers to make incorrect conclusions (Mann, 2003). To mitigate this, findings were interpreted cautiously, focusing on observed patterns rather than causal inferences.

3.4 Setting

This study was conducted in Khayelitsha, a peri-urban settlement located on the outskirts of Cape Town. Khayelitsha is Cape Town's largest and most rapidly growing informal settlement, with an estimated population of 500 000 (Stinson et al., 2016). Demographically, this population predominately consists of working age (15- 64 years of age) Black African, isiXhosa-speaking individuals, and is characterised by poor living conditions, high unemployment, and low levels of education (Statistics South Africa, 2011). Additionally, Khayelitsha has the largest HIV burden in the Western Cape (Stinson et al., 2016). Participants were recruited from primary care facilities in Khayelitsha, specifically Site B Youth clinic and Nolungile Youth clinic. These two clinics offer a range of services including child health, general HIV care, PrEP, family planning, and basic antenatal care. According to a report provided by the clinic manager, Nolungile Youth Clinic has an average daily headcount of 50–80 clients, totalling about 1,700 clients per month. Of these, approximately 450 are HIV-positive, while over 850 clients are tested monthly for HIV, averaging 40 or more HIV tests per day (Sr Mini, personal communication, September 18, 2024). The number of male clients attending the clinic is relatively low, although specific data was unavailable. No specific data was available for Site B Youth Clinic.

3.5 Participants

3.5.1 Inclusion and exclusion criteria

To be included in this study, participants had to be between the ages of 18 and 25, be able to read and understand English and/or isiXhosa and be able to provide informed consent. The age cut off was chosen as young men and especially young women are at increased risk of HIV acquisition (Zuma et al., 2022). Adolescents under 18 were excluded due to ethical considerations, as obtaining parental consent for participation in HIV-related research presents significant challenges. Furthermore, this study aimed to assess vaccine willingness among individuals who can independently make healthcare decisions, aligning with public health policies that focus on young adults as a key demographic for HIV prevention efforts. Additionally, given that the study is investigating willingness to receive an HIV vaccine as prevention, respondents needed to be HIV negative.

3.6 Sampling

Probability sampling is considered the highest-quality method for selecting participants in research. It guarantees that every individual in the population has an equal opportunity to be chosen, ensuring that the findings can be applied to the entire population (Morroni & Myer, 2007). However, probability sampling can be impractical, expensive, and time-consuming, particularly when the entire population is hard to reach or locate (Morroni & Myer, 2007). Therefore, non-probability sampling was used to recruit participants who were attending appointments at the two youth clinics. Convenience sampling at each facility provided access to young adults who are defined as an at-risk population in South Africa and would be amongst the first to be offered an HIV vaccine when one becomes available (Jager et al., 2017). Furthermore, using snowball sampling, male participants were encouraged to spread word of the study to their peers attending the clinic as this demographic was harder to reach in the clinic setting (Handcock & Gile, 2011).

3.7 Sample Size Estimation

A subject-to-predictor (N/p) rule-of-thumb method was used to calculate the sample size (Brooks & Barcikowski, 1994). Brooks and Barcikowski's (1994) propose that an N/p ratio of 10:1 would provide adequate predictive power. This study intends to use 14 predictive variables including gender, marital status, education level, income, religious preference, HIV stigma, HIV education, five antecedents of vaccination, and health beliefs. Furthermore, it is well-reported that an additional 20% is sufficient to account for adjustments due to confounding variables (Martínez-Mesa et al., 2014).

Calculation as follows:

Sample size= 14*10 = 140

140+ 20/140 = 168 ≈ 170

3.8 Study Procedure

Once ethical clearance was received from the University of Cape Town's (UCT) Human Research Ethics Committee (HREC; REF:012/2024; see Appendix A) prior to data collection, permission was sought from the City of Cape Town (CoCT) (Ref: 11013; see Appendix B) to conduct research at Town Two Community Day Centre, Nolungile Youth clinic and Site B Youth clinic. Permission was granted to conduct research at Site B Youth clinic and Nolungile Youth clinic. However, permission to collect data at Town Two clinic was not granted due to the clinic being oversaturated with other clinical research projects. Meetings were set up with the two facility managers, Sr Zulu and Sr Mini from Site B and Nolungile respectively, to introduce ourselves and the project and to discuss the operational details and coordination required for the study. During this process we were able to glean a better idea of the specific days and times that the clinic would be busy, and there for improved recruitment. At each facility we were allocated a private room where we conducted the study assessment.

Participants were recruited from both Site B Youth clinic and Nolungile Youth clinic using a combination of active and passive recruitment strategies. The primary researcher and research assistants actively recruited participants through several methods. Potential participants were identified and approached while they waited for their appointments. Alternatively, the researchers and other clinic staff made announcements detailing the study to patients in the waiting area. Additionally, potential patients were referred by the clinic Sister's to the study after their appointments. Snowball sampling was utilised to further enhance recruitment efforts. Furthermore, passive recruitment was used by placing posters (see Appendix C) in strategic locations in the clinic. The poster directed the participant to the private rooms where the researcher was situated.

Once potential participants were identified, they were approached, and briefly informed about the study. Those who expressed interest were then directed to a private area of the clinic where they were screened for eligibility. The screening process involved a mix of questions (see Appendix D), related to the inclusion and exclusion criteria of the study. As outlined in the inclusion/exclusion section of this protocol, one of the inclusion criteria is that participants should not be living with HIV. Acknowledging the potential risk of inadvertently disclosing participants' HIV status due to the study's requirements, we took several steps to ensure the privacy of the potential participants. Firstly, the privacy of the room was ensured and maintained. Secondly, the comprehensive screening process, involving a variety of questions, ensured that participants remained unaware of which specific questions determined their eligibility for the study. This approach allowed the participants to not feel marginalised due to their HIV status. During this time, the participants' language preferences were also assessed, and the RA which could provide the language best suited to the participant would continue with the assessment.

If the participant was not eligible for the study, either due to their HIV status or their age, they were kindly and unjudgmentally told that they did not meet the criteria and thanked for their time.

If the participant met the eligibility criteria, they were invited to participate and presented with an informed consent form (ICF) (See Appendix E), which outlined further details about the study and emphasised their rights as a participant, such as the assurance of confidentiality and the option to withdraw from the research at any time. It was explicitly stated that choosing not to participate or withdrawing would have no impact on their treatment at the clinic. After confirming their understanding of these rights, participants proceeded to sign and date the ICF.

Once informed consent was obtained, we proceeded to the research assessment. Data were collected through face-to-face facilitated surveys (see

Appendix **F**). This approach was chosen to minimise some of the biases associated with traditional surveys, such as response bias or acquiescence bias as well as to negate item nonresponse. Items were presented as close-ended questions, where responses were recorded on a Likert or dichotomous scale. For some questions, a visual scale was provided to assist participants in making more informed and accurate selections (see Appendix G). Study data were collected and managed using Research Electronic Data Capture (REDCap) hosted on the UCT server. On completion of the questionnaire, the participants were reimbursed with an R50 voucher for their time and effort using Standard Bank's Bulk Issuing System (Emanuel et al., 2004).

3.9 Measures

The measures that were used in this study were selected based on their relevance to this study, individual psychometric properties, and their use in past and current research on vaccine decision making (Stirratt et al., 2015)

3.9.1 Willingness to receive an HIV vaccine

In the last couple of years, vaccine willingness has become a prominent research topic. This has been largely driven by the COVID-19 pandemic, which unequivocally highlighted the significance of vaccine hesitancy around the world (Chen et al., 2023). It has become common practice to assess willingness through variations of a Likert-scale type or binary yes or no question. For example, Kelly et al. (2021) used the question "*When a vaccine for the Coronavirus becomes available, I will get it*", Goldman et al. (2020) utilised the question "*There is no vaccine/immunization currently available for* <u>Coronavirus</u> *(COVID-19). If a vaccine/immunization was available today, would you give it to your child*?", and Ruiz et al. (2021) posed the question "*All things considered, how likely are you to get a coronavirus vaccine when one becomes available?"*

As such, willingness to receive an HIV vaccine was assessed in this study using the following adapted question: **"Imagine that an approved HIV vaccine was made available, and the government provided the service free of charge, how likely would you be to get this vaccine?"**. Adaptions to this question include specifying that the vaccine would be free. In South Africa, all HIV testing and treatment services are currently offered as a free service in the public health system, and therefore it is reasonable to assume that an HIV vaccine would be included in this service. Additionally, it was made clear that there is currently no HIV vaccine available for public use.

Responses to this question were measured using a 5-point Likert scale ranging from "very unlikely (1)" to "very likely (5)". During data analysis the answers were categorised with those who responded very likely or likely coded as "willing to vaccinate", those whose responses were unlikely, or very unlikely coded as "not willing to vaccinate" and those who responded "neutral" as neutral. It is important to note that a measure of intention to receive a vaccine is not synonymous with vaccine hesitancy. Despite these two concepts being undoubtably linked, measuring willingness provides insights into the acceptability of a vaccine, but is not a good measure of the psychological state of vaccine hesitancy (Bussink-Voorend et al., 2022). It is suggested that the trait of indecision, key to vaccine hesitancy, when operationalised by willingness may result in a middling of response instead (Howard, 2024).

3.9.2 Sociodemographic variables

Eight sociodemographic variables were incorporated into the survey. These choices were informed by their established significance in the existing literature. These are: age, gender, racial or ethnic background, marital status, education level, employment status, income level, and religious preference.

3.9.3 Psychological antecedents of vaccination

The 5C scale (Betsch et al., 2018) was designed based on definitions derived from psychological theories, health behaviour models, existing measures and established theoretical models of vaccine hesitancy and acceptance to measure the "psychological antecedents of vaccination". The scale consists of 15 items where each of the Cs—Confidence, Constraints, Calculation, Complacency and Collective responsibility—are captured by three items (Betsch et al., 2018). The 15-item scale was adapted specifically for HIV in this study. For example, "I am completely confident that vaccines are safe" was adapted to "I am completely confident that HIV vaccines will be safe." Answers were given on a five-point Likert scale, ranging from strongly disagree (1) to strongly agree (5) (Betsch et al., 2018). Furthermore, the Likert scale was adapted from a seven-point scale to a five-point scale in this study. This adjustment was made as such a long scale may be confusing and tedious to answer and would impact data quality.

Responses are graded from 1-5, so that each subscale may produce a total 15. Each item is coded so that higher values indicate greater levels of the construct (Betsch et al., 2018). Betsch et al. (2018) propose that it is theoretically unjustifiable to total the score of the subscales to calculate some grand "vaccine hesitancy" score, but that one should rather assess each psychological antecedent independently. Each of the subscales is a reliable predictor of a person's vaccination behaviour and intention, yielding high Cronbach alpha values: Confidence (α=0.85), Constraints (α=0.85), Calculation (α=0.78), Complacency (α=0.76) and Collective responsibility (α=0.71) (Betsch et al., 2018). Furthermore, the 5Cs scale is a valid predictor of vaccination behaviour for several types of vaccines and has similar psychometric properties when used to measure general versus specific vaccine antecedents (Betsch et al., 2018). Despite the scale being developed and validated in Germany and the United States of America, it has been successfully used in the African context (Ghazy et al., 2022). However, Ghazy et al. (2022) explored the psychological antecedents within a population of healthcare workers who may differ in attitudes, experiences, and knowledge with regards to vaccines compared to a non-specialist population. Lastly, the survey was assessed by the researcher for clarity and minor edits were made to the wording to correct any potential misinterpretations.

3.9.4 Perceived HIV-related risk

HIV risk perception is one's belief about their own susceptibility to HIV infection (Weinstein et al., 2007). Many health behaviour theories, such as the Health Belief Model (Becker, 1974), highlight risk-perception as an important factor in predicting engagement in health seeking behaviour (Weinstein et al., 2007). In the current study, HIV risk perceptions were assessed using three study developed items adapted from the Perceived Risk of HIV Scale developed by Napper et al. (2012). Napper et al. (2012) includes three dimensions of perceived risk in their final scale.

Firstly, perceived risk operationalised as a cognitive assessment of risk, such as probability or likelihood of becoming infected with HIV (Napper et al., 2012). Secondly, perceived risk operationalised as an affective and intuitive processing, such as "gut feeling" or "feeling vulnerable" (Napper et al., 2012). And lastly, Napper et al. (2012) includes the dimension of 'salience' of the risk or how frequently the person thinks about the risk. I have drawn and adapted a single item from each of these subscales to represent the different dimensions of perceived risk. For example, cognitive or deliberate processing will be gauged by the following question: "Based on your current behaviour, how likely are you to get HIV?" Responses will be recorded on a 5-point Likert scale ranging from "extremely unlikely (1)" to "extremely likely (5)." This item has been conditionally operationalised to limit variability in interpreting the question (Napper et al., 2010). Furthermore, measuring risk-perception in this way has been associated with increased likelihood of finding associations between risk perception and future behaviour (Napper et al., 2010).

Affective processing will be gauged by the item "I worry about getting infected with HIV… (Never, Almost never, Sometimes, Often, Very often)?" and salience will be measure by the item "Getting HIV is something I have… (Never thought about, Almost never thought about, sometimes thought about, Thought about often, Thought about very often). Each question will be scored out of 5, with larger scores indicating higher levels of perceived risk of acquiring HIV.

3.9.5 Perceived Severity of HIV infection

Perceived severity of acquiring HIV was assessed using an adapted perceived risk scale. Asuquo et al. (2013) adapted the Champion Health Belief Model Scale (Champion, 1984) which was originally developed to measure perceived susceptibility to breast cancer, to assess perceived severity in relation to acquiring HIV amongst nurses in Nigeria. The scale consists of four questions and responses are recorded with a 5-point Likert scale ranging from "strongly disagree (1)” to “strongly agree (5)”. The instrument has a Cronbach’s reliability coefficient ranging from 0.88 to 0.92 (Asuquo et al., 2013). Higher scores indicated increased perceived severity of HIV infection.

3.9.6 HIV/AIDS Knowledge

An 11-item HIV/AIDS knowledge scale (Kalichman & Simbayi, 2004) was used to assess HIV-risk and prevention knowledge. Kalichman & Simbayi (2004) adapted and shortened this scale from an 18-item measure (HIV-KQ-18) reported by Carey & Schroder (2002), specifically for use in South Africa. The measure reflects information about HIV casual contagion, HIV transmission/prevention, and HIV disease processes (Kalichman & Simbayi, 2004). The item responses are coded as ‘Yes’, ‘No’, or ‘Don’t know’, with the latter being marked as incorrect (Kalichman & Simbayi, 2004). HIV/AIDS knowledge is measured by the number of correct answers, with higher scores indicating better knowledge (Kalichman & Simbayi, 2004). The scale was tested in both English and isiXhosa among 487 men and woman living in a Township on Cape Town, South Africa and was shown to be internally consistent, with α=0.70 (Kalichman & Simbayi, 2004).

3.9.7 HIV-related Stigma

The current study measured HIV-related stigma using a validated scale. Kalichman et al. (2005) introduced a specialised scale for assessing AIDS-related stigma within the South African context, drawing from previous work done in Southern Africa as well as previous measures of HIV/AIDS related stigma and finally hosting collaborative discussions with service providers. The 9-item scale has sufficient internal consistency (α = 0.75) as well as good indicators of validity (Kalichman et al., 2005). Respondents are presented with a choice of dichotomous response options: 'Agree' or 'Disagree’, with higher scores indicating heightened levels of HIV/AIDS-related stigmatising attitudes (Kalichman et al., 2005). The scale was development in the Western Cape, and therefore will be directly generalisable to the current study’s population.

3.9.8 Personal experience with HIV/AIDS

Personal experience with HIV/AIDS was measured using three study developed items based on what is known in the literature. Two items explored the personal impact that HIV has had on the participants life with the questions: “Do you know someone close to you who has HIV?”; and “Do you know someone close to you who has died of HIV/AIDS?” and a third question asked if the participant has tested for HIV before. All responses were recorded as either “yes

(2)” or “no (1)”, and interpreted on a continuum, where higher scores indicate more personal experience with HIV.

3.9.9 Experience with vaccination

Past experiences with vaccination were measured using a single study developed item “Have you received at least one COVID-19 vaccine?” Responses were recorded as either “Yes” or “No”.

3.10 Translating the measures

For the current study, the translation of the measures from English to isiXhosa involved three steps. Firstly, the measures were translated from the original English version to isiXhosa by a third-party native isiXhosa speaking member of the HIV Mental Health Research Unit (HMHRU). The measure was then back translated by another third-party isiXhosa speaker, who was blinded to the original English text. In order to assess the accuracy of the translation, the original English version and the back translated version were compared (Toma et al., 2017). It was assumed that if the item content of the two versions were the same or very similar, the translation was accurate. Conversely, items that appeared unmatched were deemed inaccurate and highlighted for further translation. A third independent isiXhosa speaking member of the HMHRU re-translated the highlighted discrepancies. Finally, the researcher facilitated a meeting with the original translator to discuss the final items, with specific focus on ensuring linguistic and grammatical correctness. Throughout the translation process certain challenges arose. In particular, the lack of directly translatable words between English and isiXhosa presented as an obstacle. For example, the word *severe* is best translated into isiXhosa as *nzima.* However, the word nzima can also mean ‘difficult’ or ‘serious. If the question, “Getting HIV is not so <u>*severe*</u> that I should be vaccinated”, was understood as “Getting HIV is not so <u>*difficult*</u> that I should be vaccinated”, this would change the inherent meaning of the item. To ensure that the meaning of this question, and a few others remained the same, they were highlighted as potentially ambiguous. The flagged items were discussed with the RAs, so that they could ensure the correct interpretation of the item during data collection.

3.11 Data-analysis

The statistical analyses in this study were preformed using IBM SPSS Statistics (Version 28.01, 2021) and involved three main processes. Firstly, general descriptive statistics were generated for each variable of interest, namely sociodemographic factors, willingness to receive an HIV vaccine, psychological antecedents of vaccination, perceived HIV risk, perceived HIV severity, HIV knowledge, HIV stigma, and experiences with HIV/AIDS. Of particular importance was the outcome of willingness to receive an HIV vaccine. The main features of the data are presented as frequency counts and bar graphs. Next, inferential techniques such as were used to address the second and third objectives, as described below.

3.11.1 Comparison of means

3.11.1.1 Fisher's exact test

Initially a chi-squared test was performed to compare the categorical variables. However, a chi-squared test was found to be unsuitable for this data, as the expected value was less than 5 in more than 20% of the cells (McHugh, 2013). This violation was due to a very low distribution of data in some of the cells of interest (McHugh, 2013). For example, within the variable of 'gender', fewer than five men, and transgender individuals were neutral or unwilling to receive an HIV vaccine. Therefore, in order to avoid a Type 1 or Type 2 error, Fisher's Exact Test was used to evaluate the relationship between willingness to receive an HIV vaccine and sociodemographic variables.

3.11.1.2 One-way ANOVA

A one-way ANOVA was utilised in this study to examine the means across two or more groups (T. K. Kim, 2017). This statistical analysis is one of the most popular methods in research (T. K. Kim, 2017). However, there are several assumptions that need to be met before an ANOVA can be used (Pallant, 2007). Firstly, independence of observations is satisfied when one observation or measurement is not influenced by another. Secondly, the data must be normally distributed. And thirdly, the groups must satisfy the assumption of homogeneity of variances. If the data met all three of these assumptions, an ANOVA was conducted. The assumption of independence of observations is considered valid based on the methodology employed in data collection. The second assumption was determined through a graphical assessment of Q-Q plots (see section 1.11.3 for further explanation). Homogeneity of variances was assessed using Levene's test where a $p < .05$ was considered sufficient to accept equal variances (Pallant, 2007). If the data violated one of these assumptions the non-parametric alternative, Kruskal-Wallis, was used instead (Pallant, 2007). In this case, Mann-Whitney test was employed to determine where the differences between specific groups occurred (Pallant, 2007).

3.11.2 Regression analysis

A regression analysis is useful as it quantifies the amount of change one can expect based on a given value of the independent value (Skrepnek, 2005). Four basic assumptions were checked for the regression (1) Linearity, (2) Homoscedasticity, (3) Independence, and (4) Normality. Significant variables identified in the simple linear regression were then used in a multiple linear regression to explore the predictive power of the entire model. Adding additional predictors to a regression model can lead to skewed or misleading results due to multicollinearity (Shrestha, 2020). Multicollinearity is present in a model when one or more predictors are significantly correlated with not only the dependent variable but also each other (Shrestha, 2020). To satisfy the consideration of multicollinearity the tolerance levels should be above 0.4 and value inflation factor (VIF) < 5 (Shrestha, 2020).

3.11.3 Normal distribution

Various statistical tests make assumptions about normality of the data, and as such normality testing is a prerequisite to parametric testing (Mishra et al., 2019). Normality testing can be conducted through both graphical and by mathematical methods (Avram & Mărușteri, 2022). According to the central limit theorem, data sets that are large enough tend to approximate a normal distribution (Avram & Mărușteri, 2022). As such many specialists agree that a violation of normality for a data set over 100 samples is not a major issue (Ghasemi & Zahediasl, 2012). However as there is no specific number identified as "big enough" it is also universally agreed that normality checks should be done regardless of sample size (Avram & Mărușteri, 2022). Normality testing is important as these checks determine what type of statical tests should be applied to the data. Specifically, if the data is normally distributed parametric testing should be used and if the data is not normally distributed, nonparametric testing should be used instead (Avram & Mărușteri, 2022). In this study, graphical assessments of normality were used to check the distribution of the data. Specifically, as parametric tests use mean values as a representative element of the data, the data were initially checked for any outliers (Mishra et al., 2019). Furthermore, quantile-quantile (QQ) plots were generated for each variable and each plot was assessed for linearity (Avram & Mărușteri, 2022). When the points of the Q-Q plot fell approximately on the 45-degree reference line, the data were considered normal. Lastly, items were assessed in terms of skewness and kurtosis. Skewness is a measure of symmetry of the data and kurtosis is a measure of the peakedness of the distribution (Mishra et al., 2019). Values between -2.00 and +2.00 and between -7.00 and +7.00, respectively, were considered sufficient for the parametric assumptions of normality (Mishra et al., 2019).

A combination of observational and inferential methods were used to test the normality of the numerical data, including inspection of descriptive statistics such as the mean and median, a visual inspection of histograms and Q-Q plots and an interpretation of the skewness and kurtosis of the data. Lastly, the Kolomogrov-Smirnov test for normality was also employed to assess normality through an inferential technique. This test was chosen instead of the Shapiro-Wilk test due to its suitability for larger sample sizes ($n \geq 50$) (Mishra et al., 2019).

3.12 Ethical Considerations

3.12.1 Ethical approvals

Ethical approval was obtained from the health science's department ethics committee and the University of Cape Town Human Research Ethics Committee (HREC) (REF:012/2024; see Appendix A). This study received approval to collect data from the City of Cape Town (Ref: 11013; see Appendix B).

3.12.2 Community Engagement and Presentation of Results

As part of the study's agreement, the researchers hosted a presentation of the results and a Q&A session at each of the facilities that were utilised in this study.

3.12.3 Confidentiality and Screening Process

As outlined in the inclusion/exclusion section of this protocol, one of the inclusion criteria is that participants should not be living with HIV. I acknowledge the potential risk of inadvertently disclosing participants' HIV status due to the study's requirements. To address this concern, a comprehensive screening process was conducted for each participant, involving a variety of questions. This approach ensures that participants remain unaware of which specific questions determined their eligibility for the study.

3.12.4 Compliance with Ethical Standards

This study complied with the principles of the latest Declaration of Helsinki as well as followed standard principles for good clinical practice. In particular, a high standard of informed consent was upheld. A participant was only considered informed once they had a clear understanding about who the researchers are, the intent of the research, how the data will be collected, and what the potential risks of participating were (Fleming & Zegwaard, 2018).

3.12.5 Informed Consent and Anonymity

The information on the consent form was well written and clear so as to avoid 'weak' consent agreements (Fleming & Zegwaard, 2018). Furthermore, the participant was informed that they can opt out at any point of the survey. Anonymity was maintained by collecting only participant demographics without requiring any personally-identifying information such as names, addresses, email addresses, phone numbers, photographs or other forms of personal identification (Fleming & Zegwaard, 2018).

3.12.6 Data Management and Confidentiality

Furthermore, data were coded in such a way that the participants' data will be identifiable by a numbering system. The raw data were safeguarded in a locked office, on a password-protected computer and only the primary researcher, statistical consultants and supervisors had access to the data.

3.12.7 Support for Participants

Although the risks associated with this study were minimal for participants, contact details were provided to the participants for SADAG (a free telephonic counselling service) at the end of the study when they felt like they needed further counselling.

3.13 Risks and Benefits

3.13.1 Potential risks

As previously mentioned, this study posed a low risk to participants as the content being discussed was not intrusive or harmful. However, there was a possibility that some participants may experience emotional discomfort or distress when discussing topics related to HIV, stigma, or personal beliefs. The research team took measures to minimise discomfort, provide support, and offer resources if needed. Additionally, we ensured that the participants knew they can choose not to answer a question should they not want to. Respondents may fear potential stigmatisation, especially in a community with a high prevalence of HIV. The study team emphasized the confidential nature of the research and took precautions to avoid inadvertent disclosure.

3.13.2 Potential benefits

By participating in this research, Study participants were able to contribute to the understanding of factors influencing willingness to receive an HIV vaccine. This research could potentially inform public health strategies and interventions in the future, and thus provide the participant with a sense of pride for contributing towards something that may benefit their community. Furthermore, engaging in the study may enhanced participants' awareness of HIV-related issues, vaccination, and healthcare services. This increased awareness may have positive implications for their health and well-being. Lastly, participants received a R50 voucher as reimbursement for their time and effort, which can be viewed as a tangible benefit.

3.14 Chapter summary

This chapter discussed the research design and methodology utilised in this current study. The chapter began by delineating the research aims, objectives, and hypotheses. This was followed by a discussion of the research procedure, including a detailed overview of participant selection criteria and sampling methodologies. Furthermore, the chapter discussed the measures employed, highlighting the steps involved in translating them into isiXhosa, thus ensuring cultural sensitivity and accuracy. Lastly, the chapter provides an overview of the data analysis techniques utilised and addresses the ethical considerations integral to safeguarding participant welfare and upholding research integrity.

The following chapter presents the results of the study.

CHAPTER 4

RESULTS OF THE STUDY

4.1 Overview of chapter

This study aimed to explore young adults' willingness to receive a hypothetical preventative HIV vaccine in Khayelitsha, South Africa. The objectives were to quantify willingness, compare willing and unwilling participants across key demographic and psychological factors, and predict willingness based on significant variables.

The following hypotheses were tested:

H^1: Willingness to receive an HIV vaccine will be associated by key demographic variables, such as gender, education, relationship status, household income, and religious preference.

H^2: Participants who have greater perceived severity and perceived risk of HIV will be significantly more willing to receive an HIV vaccine.

H^3: Participants who have greater levels of HIV knowledge will be significantly more willing to receive an HIV vaccine.

H^4: Participants who have greater levels of HIV stigma will be significantly less willing to receive an HIV vaccine.

H^5: Willingness to receive an HIV vaccine will be associated with psychological antecedents of vaccination.

Accordingly, the following chapter presents the results of the statistical analyses applied to the data to address the above hypotheses. The results are presented in the following order. First, the demographic characteristics of the sample are presented. This is followed by a detailed presentation of the descriptive statistics specifically related to the item assessing willingness to receive an HIV vaccine, including a frequency analysis (Objective 1). The analysis then focuses on each key variable in the study: sociodemographic variables, the 5C antecedents of vaccination, perceived HIV risk, perceived HIV severity, HIV knowledge, and HIV stigma. For each of these variables, the chapter presents descriptive statistics, followed by the results of the comparison of means (Objective 2) and regression analyses (Objective 3).

4.2 Demographic characteristics for the study sample

In total, 250 prospective participants were approached for this study. Of these, 192 were screened, and 19 were subsequently excluded for not meeting the inclusion criteria, resulting in a final sample of 173 participants (*n* = 173). Among those excluded, 10 participants were HIV positive and nine participants were younger than eighteen at the time of the study. The mean age of the sample was 20.14 years (SD = 2.10), with the majority identifying as women (*n* = 153; 87.3%), followed by men (*n* = 16; 9.2%). Just over half the participants reported being single (*n* =93; 53.4%). No participants in this sample indicated that they were married either by traditional or conventional means. Analysing education levels of the sample revealed a fairly diverse distribution such that 55% of the participants had completed matric, 23% had not completed matric and 21% were still in school. Reflecting the severe economic hardship of the population from which this sample was taken, most participants were unemployed (*n* =113; 65%), and more than half (*n* = 90; 52%) lived in households earning less than R1600 per month. Most of the participants in this sample were either Christian (*n* =104; 60.1%) or Traditional African religion (*n* =57; 32.9%). Interestingly, nearly half of participants in the sample received at least one COVID-19 vaccine (*n* =86; 49.7%). Notably, almost all participants had been tested for HIV previously (*n* =167; 96.5%).

4.3 Willingness to receive an HIV vaccine

Overall, 82.08% were willing to receive the HIV vaccine when it becomes available (19.2% were likely and 62.4% were very likely). The majority of both women (*n* = 123; 80.9%), and men (*n* = 15; 93.8%) expressed that they would be willing to receive an HIV vaccine. Interestingly, no men in this sample were unwilling to receive an HIV vaccine, compared to 18 (11.8%) women. See Table 4.1 below for a full summary of results.

Table 4.1

Summary of demographic characteristics of sample according to willingness to receive an HIV vaccine

		Sample *(n=170)* *f (%)*	Unwilling *(n=18)* *f (%)*	Neutral *(n=13)* *f (%)*	Willing *(n=142)* *f (%)*
Gender	Man	16 (9.2)	0 (0)	1 (6.3)	15 (93.8)
	Woman	152 (87.9)	18 (11.8)	11 (7.2)	123 (80.9)
	Transgender	2 (1.2)	0 (0)	0 (0)	2 (100)

	Prefer not to answer	3 (1.7)	0 (0)	1 (33.3)	2 (66.7)
Race	Black	173 (100)	18 (10.4)	13 (7.5)	142 (82.1)
Matric	Completed	96 (55.5)	11 (11.5)	4 (4.2)	81 (84.4)
	Not completed	40 (23.1)	4 (10)	5 (12.5)	31 (77.5)
	Currently at school	37 (21.4)	3 (8.1)	4 (10.8)	30 (81.1)
Relationship Status	Single	92 (53.2)	12 (13)	10 (10.9)	70 (76.1)
	In a relationship	80 (46.2)	6 (7.5)	3 (3.8)	71 (88.8)
	Prefer not to answer	1 (0.6)	0 (0)	0 (0)	1 (100)
Employment status	Full-time student	31(17.9)	1 (3.2)	3 (9.7)	27 (87.1)
	Employed	24 (13.9)	2 (8.3)	1 (4.2)	21 (87.5)
	Unemployed	113 (65.3)	15 (13.3)	9 (8.0)	89 (78.8)
	Self-employed	5 (2.9)	0 (0)	0 (0)	5 (100)
Monthly Income	R0 - R1600	90 (52)	12 (13.3)	7 (7.8)	71 (78.9)
	R1601 - R6400	45 (26)	2 (4.4)	4 (8.9)	39 (86.7)
	R6401- R12800	16 (9.2)	2 (12.5)	1 (6.3)	13 (81.3)
	R12801 - R25600	9 (5.2)	1 (11.1)	1 (11.1)	7 (77.8)
	More than R25600	4 (2.3)	1 (25.0)	0 (0)	3 (75.0)
	Prefer not to answer	9 (5.2)	0 (0)	0 (0)	9 (100)
Monthly Income	R0 - R1600	90 (52)	12 (13.3)	7 (7.8)	71 (78.9)
	R1601 - R6400	45 (26)	2 (4.4)	4 (8.9)	39 (86.7)
	R6401- R12800	16 (9.2)	2 (12.5)	1 (6.3)	13 (81.3)
	R12801 - R25600	9 (5.2)	1 (11.1)	1 (11.1)	7 (77.8)
	More than R25600	4 (2.3)	1 (25.0)	0 (0)	3 (75.0)
	Prefer not to answer	9 (5.2)	0 (0)	0 (0)	9 (100)

Religious preference	Christianity	104 (60.1)	8 (7.7)	9 (8.7)	87 (83.7)
	Traditional African Religion	57 (32.9)	7 (12.3)	4 (7.0)	46 (80.7)
	None	12 (6.9)	3 (25.0)	0 (0)	9 (75.0)
COVID-19 Vaccine	Yes	86 (49.7)	7 (8.1)	8 (9.3)	71 (82.6)
	No	87 (50.3)	11 (12.6)	5 (5.7)	71 (81.6)
Tested for HIV	Yes	167 (96.5)	17 (10.2)	12 (7.2)	138 (82.6)
	No	6 (3.5)	1 (16.7)	1 (16.7)	4 (66.7)

4.4 **Sociodemographic variables**

4.4.1 **Comparison of means**

In order to test whether there was a significant difference between the three groups (unwilling, neutral and willing) in terms of the demographic characteristics of the sample, a Fisher's Exact Test was applied. The results of the Fisher's Exact test showed that there were no significant differences in any of the categorical variables across the different levels of willingness ($p > 0.05$). Therefore, the null hypothesis was accepted that there is no relationship between any of the sociodemographic variables and willingness to receive an HIV vaccine. See the full summary of the Fisher's Exact test in Table 4.2 below.

Table 4.2

Summary of Fisher's Exact Test for categorical variables

Variable	N	p-value
Gender	173	.470
Matric	173	.400
Relationship status	173	.228
Employment status	173	.736
Monthly income	173	.747
Religious preference	173	.346
Received at least one COVID-19 vaccine	173	.484
Tested for HIV before	173	.293

4.5 Psychological antecedents of vaccination

In this section descriptive statistics were first used to provide an overview of participants' responses across the psychological antecedents of vaccination, followed by inferential analyses to compare differences in these antecedents between participants who were willing, unwilling, or neutral regarding HIV vaccination. Finally, linear regression models were constructed to determine the predictive power of these antecedents on vaccine willingness.

4.5.1 Descriptive statistics for psychological antecedents of vaccination

The descriptive analysis of the psychological antecedents of vaccination revealed that most participants endorsed higher scores in the Confidence (M = 12.33), Calculation (M = 11.60), and Collective Responsibility (M = 12.02) scales, and lower scores in the Complacency (M =6.39) and Constraints (M = 5.76) scales. It was noted that the mean and median values were approximately equal, and that skewness and kurtosis fell within acceptable ranges for all five domains, suggesting that the data are approximately normally distributed (Mishra et al., 2019). To assess the internal consistency of the 5C scale, Cronbach's Alpha was calculated. The analysis yielded a Cronbach's Alpha of .435 for confidence, .438 for complacency, .341 for constraints, .58 for calculation and .349 for collective responsibility. The descriptive statistics for the entire sample are presented in Table 4.3 below.

Table 4.3

Descriptive statistics for the five antecedents of vaccination scale

	Mean	Median	*SD*	Skewness	Kurtosis
Confidence	12.33	12	1.74	-.310	-.005
Complacency	6.39	6	2.15	.134	-.685
Constraints	5.76	6	1.73	.440	.359
Calculation	11.60	12	2.28	-.777	.852
Collective	12.02	12	1.95	-.414	.158

Note. N = 173. *SD* indicates standard deviation.

4.5.2 Comparison of means

A one-way ANOVA was conducted to compare the scores of each antecedent across those who were willing, unwilling, and neutral towards HIV vaccination, in order to assess if there were significant differences.

Two assumptions of ANOVA, normality of the data, and homoscedasticity, were checked. Firstly, normality was checked using quantile-quantile (Q-Q) plots (refer to Appendix H). Each variable showed satisfactory alignment with the reference line, suggesting that the data are normally distributed. Secondly, homoscedasticity was checked by Levene's test. The results were insignificant ($p > .05$), indicating that the variances amongst the groups was approximately equal.

The results of the one-way ANOVA revealed that there was a statistically significant difference between at least two groups in the following antecedents; confidence ($F(2, 170) = [5.617]$, $p = .004$), complacency ($F(2, 170) = [4.348]$, $p = .014$), constraints ($F(2, 170) = [7.514]$, $p <.001$) and collective responsibility ($F(2, 170) = [8.494]$, $p <.001$). No significant relationship was identified for the antecedent of calculation (p=.079).

Posthoc tests were conducted on all the significant variables to identify which groups were significantly different (see Appendix I for a full set of results). Specifically, Tukey's HSD Test for multiple comparisons found that the mean value of confidence was significantly different between those who were willing and those who were neutral ($p = .007$, 95% C.I. = [.353, 2.675]). There was no statistically significant difference in mean scores between willing and unwilling (p=.246) or neutral and unwilling (p=.369). Similarly, Tukey's test revealed that the mean value of complacency was significantly different between willing and unwilling participants ($p = .010$, 95% C.I. = [-2.7988, -.3060]). There was no statistically significant difference in mean scores between willing and neutral (p=.990) or neutral and unwilling (p=.137). Further exploration of constraints revealed that the mean values were significantly different between willing and unwilling participants ($p <.001$, 95% C.I. = [-2.5905, -.6161]). However, there was no statistically significant difference in mean scores between willing and neutral (p=.639) or neutral and unwilling (p=.136). Lastly, Tukey's test identified that the mean value of collective responsibility (M = 12.29) was significantly different between willing (M = 12.29) and unwilling (M = 10.66) (p =.002, 95% C.I. = [.5228, 2.7354]) and willing and neutral (M = 10.92) ($p <.033$, 95% C.I. = [.0915, 2.6539]). There was no statistically significant difference in mean scores between neutral and unwilling (p=.925). Results of the ANOVA are presented in Table 4.4 below.

Table 4.4

Summary of the ANOVA results for the five antecedents of vaccination

	Unwilling	Neutral	Willing

	$F(2,170)$	p	n^2	M	SE	M	SE	M	SE
Confidence	5.617	.004	.07	11.83_{ab}	1.68	11.00_{a}	2.08	12.51_{b}	1.65
Complacency	4.348	.014	.05	7.77_{a}	1.73	6.30_{ab}	2.01	6.22_{b}	2.15
Constraints	7.514	<.001	.09	7.16_{a}	1.88	6.00_{ab}	1.41	5.56_{b}	1.66
Calculation	2.574	.079	.03	11.77	2.12	12.95	1.25	11.45	2.33
Collective Responsibility	8.494	<.001	.10	10.66_{a}	2.19	10.92_{a}	1.89	12.29_{b}	1.82

Note. Means in a row not sharing subscripts are significantly different from one another. For example, 'unwilling' is significantly different from 'willing', and not significantly different from 'neutral' in terms of complacency.

4.5.3 Linear regression

A linear regression was used to test the association between five antecedents of vaccination and willingness to receive an HIV vaccine.

4.5.3.1 Simple linear regression

In order to determine if there is an association between confidence, complacency, calculation, constraints or collective responsibility and willingness to receive an HIV vaccine, a simple linear regression was applied to the data. Initially, each antecedent was analysed as a separate linear regression. Regression results revealed that there were significant findings for confidence ($F(1,171) = 5.906$, $p < .016$), complacency ($F(1,171) = 7.517$, $p < .007$), constraints ($F(1,171) = 14.553$, $p < .001$), and collective responsibility ($F(1,171) = 16.029$, $p < .001$). No significant finding was found for calculation ($p = .221$). Confidence explained approximately 2.8% ($R^2 = .028$) of the variance in willingness to receive an HIV vaccine. Whereas complacency, constraints, and collective responsibility each explained 3.7% ($R^2 = .037$), 7.8% ($R^2 = .078$), and 8,6% ($R^2 = .086$), respectively. See Table 4.5 below.

Table 4.5

Summary of simple linear regression for the 5C antecedents of vaccination

Variable	**B**	β	95% CI	p
Confidence	0.068	0.183	[0.013, 0.122]	0.016*
Complacency	-0.061	-0.205	[-0.106, -0.017]	0.007*

Constraints	-0.104	-0.280	[-0.58, -0.050]	0.001*
Calculation	-0.026	-0.094	[-0.069, 0.016]	0.221
Collective Responsibility	0.097	0.23	[0.049, 0.144]	0.001*

*Note. *Significant at p < 0.05*

4.5.3.2 Multiple linear regression

A multiple linear regression was performed on the significant independent variables emerging from simple regression (confidence, complacency, constraints, and collective responsibility) to explore the predictive power of the entire model.

In this regression, multicollinearity was considered acceptable given that the tolerance values ranged from 0.719 to 0.819 while VIF ranges from 1.220 to 1.391, indicating that multicollinearity is not a problem in this study. This model was significant ($F(4,168) = 6.418$, $p <.001$), indicating that the set of predictors reliably explains the variance in the dependent variable. The R^2 was 0.133 (Adjusted $R^2 = 0.112$), indicating that confidence, complacency, constraints and collective responsibility collectively explained approximately 13.3% of the variance in willingness to receive an HIV vaccine. Among the predictors, the collective responsibility scale ($B = 0.071$, $\beta = 0.216$, $p = 0.008$) was a significant positive predictor of willingness to receive an HIV vaccine. In contrast, the constraints scale ($B = -0.073$, $\beta = -0.196$, $p = 0.015$) was a significant negative predictor. Other predictors, including confidence and complacency scales, did not show significant effects in the entire model ($p > 0.05$). These findings suggest that, while each antecedent shows a significant relationship with willingness to receive an HIV vaccine in isolation, only collective responsibility and constraints uniquely contribute to predicting willingness when considered together with the other factors. See Table 4.6 below.

Table 4.6

Summary of multiple regression for 5C antecedents of vaccination

Variable	**B**	95% CI	β	p
Confidence	0.019	[-0.39, 0.077]	0.052	0.511
Complacency	-0.007	[-0.057, 0.043]	-0.275	0.784
Constraints	-0.073	[-0.131, -0.014]	-0.196	0.015*
Collective Responsibility	0.071	[0.019, 0.124]	0.216	0.008*

Note. R^2 =0.133, $F(4,168) = 6.418$

*p < .05.

4.6 HIV/AIDS knowledge

4.6.1 Descriptive statistics for HIV Knowledge scale

The descriptive analysis for the HIV knowledge scale revealed that the participants answers were negatively skewed, with most participants endorsing correct answers. The total mean score was 20.36 (SD = 1.38). To assess the internal consistency of the HIV knowledge scale, Cronbach's Alpha was calculated. The analysis yielded a Cronbach's Alpha of .375, which indicates a low internal consistency. Table 4.7 below presents the frequency and mean score of each item of the HIV knowledge scale.

Table 4.7

Descriptive statistics for each item of the HIV knowledge scale

	f (%)		Mean
	Correct	Incorrect	
Is HIV spread by kissing?	151 (87.3)	22 (12.7)	1.87
Can a person get HIV by sharing kitchens and bathrooms with someone who has HIV?	152 (87.9)	21 (12.1)	1.88
Can you get HIV by touching someone with HIV?	164 (94.8)	9 (5.2)	1.95
Can a man give HIV to a woman?	167 (96.5)	6 (3.5)	1.96
Can a woman give HIV to a man?	167 (96.5)	6 (3.5)	1.96
Must a person have many different partners to get HIV?	97 (56.1)	76 (43.9)	1.56
Does washing after sex help to protect against HIV?	141 (81.5)	32 (18.5)	1.82
Can a pregnant woman give HIV to her baby?	160 (92.5)	13 (7.5)	1.92

Can a person get rid of HIV by having sex with a virgin?	153 (88.4)	20 (11.6)	1.88
Is HIV the virus that causes HIV/AIDS?	143 (82.7)	30 (17.3)	1.8266
Is there a cure for HIV?	124 (71.7)	49 (28.3)	1.72

Note. N =173. An incorrect answer is coded as one, and a correct answer is coded as two.

4.6.2 Comparison of means

Normality of the data was assessed graphically through an inspection of the Q-Q plot. The observed value fell approximately on the reference line. Additionally, the skewness (-0.949) and kurtosis (0.837) values were acceptable for the HIV knowledge scale. Lastly, the assumption of homoscedasticity was inspected using Levene's test ($p > .05$), indicating equivalence of variances.

A one-way ANOVA was performed to compare the effect of willingness on HIV knowledge scores. The results of the ANOVA were statistically non-significant ($F(2, 170) = [0.675]$, $p = .510$), indicating that there is not a significant difference in HIV Knowledge scores across the groups. See table 4.8 below.

Table 4.8

Summary of the ANOVA results for HIV knowledge

				Unwilling		Neutral		Willing	
	$F(2,170)$	p	n^2	M	SD	M	SD	M	SD
Knowledge	.675	.510	.008	20.00	1.18	20.38	1.04	20.40	1.42

Note[1] Means in a row not sharing subscripts are significantly different from one another

Note[2] Higher knowledge scores indicating greater HIV knowledge. Highest score possible is 22.

4.7 HIV-related stigma

4.7.1 Descriptive statistics for the HIV Stigma scale

Initial descriptive analysis of the HIV stigma scale indicated that most participants endorsed lower scores on the overall HIV stigma scale, with a mean score of 9.81 (SD = 1.13). To assess the internal consistency of the HIV stigma scale Cronbach's Alpha was calculated. The analysis yielded a Cronbach's Alpha of .568. The full set of frequency results are presented in Table 4.9 below.

Table 4.9

Descriptive statistics for individual items of the HIV stigma scale

	f (%)		
	Correct	Incorrect	Mean
People who have HIV are dirty.	168 (97.1)	5 (2.9)	1.02
People who have HIV are cursed.	167 (96.5)	6 (3.5)	1.03
People who have HIV should be ashamed.	168 (96.5)	5 (2.9)	1.02
It is safe for people with HIV to work with children.	139 (80.3)	34 (19.7)	1.2
People with HIV must expect some restrictions on their freedom	112 (64.7)	61 (35.3)	1.35
A person with HIV must have done something wrong and deserves to be punished.	165 (97.7)	4(2.3)	1.05
People who have HIV should be isolated.	169 (97.7)	4 (2.3)	1.02
I do not want to be friends with someone who has HIV.	164 (94.8)	9 (5.2)	1.05
People who have HIV should not be allowed to work.	164 (94.8)	9 (5.2)	1.05

Note. N = 173. Each question is scored out of maximum of two, where the stigmatising answer is scored as two, and the less stigmatising answer is scored as one.

4.7.2 Comparison of means

Levene's test for homoscedasticity ($p < .05$) indicated a violation of the assumption of equal variances. As a result, non-parametric analyses were used. The Kruskal-Wallis test was used to examine whether there was a significant difference in HIV stigma scores in those who were unwilling, neutral, and willing towards receiving an HIV vaccine. The Kruskal-Wallis revealed a statistically significant difference in HIV stigma scores across the three degrees of willingness (unwilling, neutral, and willing), χ2 (2, N = 173) = 8.48, *p* = .014. See table 4.10.

Table 4.10

Descriptive Statistics and Kruskal Wallis Test Results for HIV stigma across willingness to receive an HIV vaccine

	Groups	*n*	*Mdn*	Mean rank	χ2	*df*	*p*
HIV Stigma	Unwilling	18	10	116.53			
	Neutral	13	10	89.31			
	Willing	142	9	83.05			
Overall					8.48	2	0.014

Follow up Mann-Whitney U tests revealed that HIV stigma scores were significantly lower for willing (*Mdn* = 9.00, *n* = 142) compared to unwilling (*Mdn* = 10.00, *n* = 18), *U* = 788.50, *z* = -2.88, *p* = .004, with a small effect size *r* = .23. Furthermore, Mann-Whitney U tests showed that there was no significant difference in HIV stigma scores between unwilling (*Mdn* = 10.00, *n* = 18) and neutral (*Mdn* = 10.00, *n* = 13), *U* = 75.00, *z* = -1.79, *p* = .097, and willing (*Mdn* = 9.00, *n* = 142) and neutral (*Mdn* = 10.00, *n* = 13), *U* = 851.00, *z* = -.512, *p* = .608. See Table 4.11 for results of the posthoc test.

Table 4.11

Results of Mann-Whitney U Tests comparing HIV Stigma scores across willingness to receive an HIV Vaccine

Comparison	*U*	Mean rank	z	*p*	*r*
Unwilling vs Willing	788.50	116.53	-2.88	0.004	0.23
Unwilling vs Neutral	75.00	89.31	-1.79	0.097	0.32.
Willing vs Neutral	851.00	83.05	-0.512	0.608	0.04

4.7.3 Linear regression

A simple linear regression was calculated to predict willingness to receive an HIV vaccine based on HIV stigma. A significant regression equation was found ($F(1,171) = 8.315$, $p = 0.004$), indicating that HIV stigma reliably explains some variance of willingness to receive an HIV vaccine. The R^2 was 0.046 (Adjusted R^2 = 0.041), indicating that HIV stigma explained approximately 4.6% of the variance in willingness to receive an HIV vaccine.

4.8 Perceived risk of acquiring HIV and perceived severity of HIV infection

4.8.1 Descriptive statistics for perceived HIV risk and perceived HIV severity

One fifth (*n* = 39; 22.3%) of the sample perceived themselves as being at risk for acquiring HIV. Two fifths of the sample (*n* = 72; 41.7%) indicated that they worry often or very often about getting HIV. Similarly, two fifths (*n* = 75; 43.4%) of the sample indicated that they thought about getting HIV often or very often. In terms of perceived severity, 49.7% of participants agreed and 40.5% strongly agreed that they were afraid of getting HIV. Almost three quarters (n = 123; 71.1%) of the sample agreed that if they got HIV, they would experience health problems for a long time. Almost three fifths (*n* = 100; 57.9%) of the sample agreed that if they got HIV, it would threaten their relationship with their partner. Interestingly, just over half (*n* = 89; 51.4%) of the sample did not think their life would change for the worse if they got HIV.

Table 4.12

Descriptive statistics and Levene's test for homogeneity of variances for perceived HIV risk and perceived HIV severity

		Mean	*SD*	*p*
R1	Based on your current behaviour, how likely would you say you are to get HIV?	2.47	1.26	.002*
R2	I worry about getting HIV…	3.26	1.36	.43
R3	How often have you thought about getting HIV?	3.38	1.23	.53
S1	I am somebody who is afraid of getting HIV...	4.20	.93	.20
S2	If I got HIV, I would experience health problems for a very long time.	3.75	1.15	.62
S3	If I got HIV it would threaten my relationship with my partner.	3.84	1.37	.38
S4	If I had HIV my whole life would change for the worse.	2.91	1.42	.64

*Note. R1 is risk question 1, R2 is risk question 2, R3 is risk question 3, S1 is severity question 1, S2 is severity question 2, S3 is severity question 3 and S4 is severity question 4. *Significant at $p<0.05$. Each item has a max score of 5 and a min score of 1.*

4.8.2 Internal reliability of perceived HIV risk and severity

One measure of reliability, namely Cronbach's alpha, was employed in this study to assess the internal reliability of the two study-developed scales, namely perceived HIV risk and perceived HIV severity. The study developed a scale for perceived HIV severity consisting of three questions (α = .491) did not produce an acceptable internal consistency (α ≥ .70) and therefore individual items were used for further analysis. The study developed scale for perceived HIV severity consisting of four items (α = .499) also did not achieve an acceptable alpha value for internal consistency. These low alpha values suggest that the items may reflect different dimensions of risk and severity rather than a unified construct. As such single items were used individually for further analysis.

4.8.3 Correlation between dimensions of risk

To assess the extent to which the dimensions of perceived HIV-related risk were associated with one another, a Pearson correlation analysis was conducted. Results indicated a significant positive correlation between **how often participants think about getting HIV** and **their perceived likelihood of getting HIV** ($r = .325$, $p < .001$). Similarly, a significant correlation was found between **worry about HIV** and **how often participants think about getting HIV** ($r = .362$, $p < .001$). However, no significant correlation was observed between **perceived likelihood of HIV infection** and **worry about getting HIV** ($r = .056$, $p = .462$). The lack of a significant correlation between worry and perceived likelihood of HIV infection may indicate that these questions are not reliability capturing the construct of HIV risk or that the item is poorly worded or misunderstood by participants.

4.8.4 Comparison of means

Levene's test for homoscedasticity ($p < .05$) indicated a violation of the assumption of equal variances for R1. Therefore, the non-parametric test, Kruskal-Wallis was used to compare the effect of willingness on perceived risk of acquiring HIV. The results of the Kruskal-Wallis revealed that there was no significant difference between groups in the question "Based on your current behaviour, how likely would you say you are to get HIV?" ($p = .108$). As no significant result was identified, no further testing was necessary. See Table 4.13 for results of the Kruskal-Wallis.

Table 4.13

Descriptive statistics and Kruskal Wallis Test results for perceived HIV risk across willingness to receive an HIV vaccine

		n	Mdn	$\chi 2$	p
R1	Unwilling	18	3.5		
	Neutral	13	2		
	Willing	142	2		
Overall				4.46	.108

Note. Higher scores indicating greater perceived risk of acquiring HIV on a scale very unlikely (1) to very likely (5).

A one-way ANOVA was performed for each of the remaining questions and no significant results were found (p >.05). See table 4.14 below.

Table 4.14

Summary of the ANOVA results for perceived risk and perceived severity of acquiring HIV

			Unwilling		Neutral		Willing	
	F(2,170)	p	M	SD	M	SD	M	SD
R2	.643	.527	3.28	1.447	2.85	1.14	3.30	1.37
R3	.654	.521	3.22	1.35	3.08	1.32	3.43	1.21
S1	.445	.642	4.00	1.02	4.23	.439	4.22	.932
S2	.229	.796	3.78	1.11	3.54	.967	3.76	1.17
S3	1.393	.251	4.33	1.14	3.92	1.26	3.77	1.40
S4	.926	.398	3.33	1.41	2.77	1.36	2.87	1.43

4.9 Chapter summary

This chapter presented the results of the study, which aimed to identify and explore the key predictors of willingness to receive an HIV vaccine among young adults attending two clinics in Khayelitsha, South Africa. The results were structured around the three main study objectives: quantifying willingness to receive an HIV vaccine, comparing key variables between those who were willing and those who were not, and predicting willingness based on significant variables. Results revealed that most participants expressed a willingness to receive an HIV vaccine if one became available, with 82.1% indicating willingness, 10.4% indicating unwillingness, and 7.5% remaining neutral. The chapter then explored sociodemographic variables, psychological antecedents of vaccination, perceived HIV risk and severity, HIV knowledge, and HIV stigma. Analysis using Fisher's Exact Test found no significant relationship between willingness to receive an HIV vaccine and any of the sociodemographic variables.

For the psychological antecedents of vaccination, the ANOVA results indicated significant differences in confidence, complacency, constraints, and collective responsibility across the different levels of willingness. Subsequent linear regression analyses identified collective responsibility as a significant positive predictor and constraints as a significant negative predictor of willingness to receive an HIV vaccine. HIV knowledge was assessed, showing a good level of understanding among participants. However, there were no significant differences in HIV knowledge among those who were willing versus those who were unwilling to receive an HIV vaccine. HIV stigma was also examined, with results indicating that those with higher levels of stigma were less willing to receive the vaccine. Subsequently, a linear regression analyses revealed that HIV stigma was a significant negative predictor of willingness. Lastly, no significant results were revealed for perceived risk of acquiring HIV and perceived severity of infection on willingness to receive an HIV vaccine.

The next chapter will provide a discussion of these results.

CHAPTER 5

DISCUSSION, RECOMMENDATIONS AND CONCLUSIONS

5.1 Introduction

South Africa currently carries the largest burden of HIV globally (Zuma et al., 2022) to the extent that communities affected by HIV experience higher levels of morbidity, mortality, and economic strain (Aguolu et al., 2022). Youth and young adults in South Africa are at increased risk of acquiring HIV (Zuma et al., 2022). Among this demographic, young women face an especially elevated risk of HIV acquisition, and account for the majority of new infections within this age group (Zuma et al., 2022). With this in mind, global vaccine efforts are focused on producing an effective preventative HIV vaccine with hope of curbing the incidence and potentially ending the HIV epidemic (Dybul et al., 2021; J. Kim et al., 2021). Historically, vaccines have been met with public resistance, a phenomenon most recently highlighted during the COVID-19 pandemic (Soares et al., 2021). Vaccine willingness can be affected by several vaccine and context specific factors, and therefore context specific research is essential (Galagali et al., 2022). In the South African setting, there is a need to better understand young adult's willingness to receive an HIV vaccine, as this population represents a particularly vulnerable group and would most likely be targeted in initial vaccine efforts.

Considering this, the current study sought to investigate young adults' willingness to receive a preventative HIV vaccine. Furthermore, this study explored the associations between willingness and socio-demographic variables, psychological antecedents of vaccination, HIV related knowledge and HIV stigma, and self- perceived risk of acquiring HIV and severity of the disease.

In this chapter a discussion of the study's results is provided, followed by presentation of limitations of the study and recommendations for future research.

5.2 Contextualising results

5.2.1 Willingness to receive a future HIV vaccine

The results suggest a high willingness among young adults in this sample, with most participants (82.04%) being willing to receive an HIV vaccine if one becomes available. This finding aligns with upper-bound estimates of willingness to receive an HIV vaccine in previous studies. For example, in a systematic review Newman et al. (2010) reported a wide range of willingness between 37.2% and 90% across different global contexts. Furthermore, the high level of willingness identified in this current study appears to echo previous South African findings. For example, young adults in Johannesburg expressed high vaccine acceptability towards a hypothetical HIV vaccine during a focus group discussion exploring key barriers and motivators to future HIV vaccine uptake (Sayles et al., 2010). Acceptance amongst this group was linked with a desire to protect oneself from HIV transmission risks outside of their control and a desire to raise a family (Sayles et al., 2010). In a more recent South African study, Atujuna et al. (2018) reported that both men and women, if given the option, would prefer to use an HIV vaccine than other means of HIV prevention due to its longer duration of protection. A key motivator for this was that a vaccine would provide a once off solution compared to current prevention strategies that require daily use and have been linked with pill fatigue (Atujuna et al., 2018). Conversely, a relatively small portion of the participants were unwilling to receive a future HIV vaccine (18.8%) in this study. According to previous studies, potential barriers to HIV vaccine uptake may include mistrust of the government, fear of judgment, and efficacy concerns (Atujuna et al., 2018; Sayles et al., 2010). The factors that influenced participants willingness in this study will be explored in greater detail below. However, the high levels of willingness found in this study, corroborated by previous findings in South African contexts, provide promising support for the acceptance of a future HIV vaccine amongst young adults in this population.

5.2.2 Influencing factors

5.2.2.1 5C psychological antecedents

This study produced a few novel insights into the factors that may influence future acceptability and uptake of a preventative HIV vaccine in South Africa. Firstly, one of my main aims was to examine the relative importance of the 5C psychological antecedents (i.e., *confidence, constraints, complacency, calculation,* and *collective responsibility*) in predicting young adults' willingness to receive an HIV vaccine. Results show that although confidence, complacency, constraints, and collective responsibility all show a significant relationship with HIV vaccine willingness, only collective responsibility and constraints remained significant predictors of willingness in the multiple linear regression. The decrease in significance for confidence and complacency in the multiple linear regression, suggests that these two variables contribute less unique impact on willingness to receive an HIV vaccine when other factors are controlled for.

Collective responsibility, defined as the willingness to protect others through one's own vaccination (Betsch et al., 2018), is deeply rooted in altruism and communal orientation. The significance of collective responsibility may be rooted in the African cultural philosophy of *Ubuntu.* Ubuntu is a way of being, a deep respect for our interconnectedness and common humanity, and a code of ethics and behaviour that is deeply embedded in African culture (Nussbaum, 2003). The practical manifestations of ubuntu philosophy could include any behaviour that shows compassion and seeks to uphold the dignity and well-being of others (Nussbaum, 2003). Drawing on cultural dimension's theory, Hofstede (2011) describes six dimensions of culture which influence normal etiquette and behaviour within a cultural group. One of these dimensions measures the degree to which a culture adopts individualistic versus collectivistic attitudes (Hofstede, 2011). Collectivistic communities tend to view themselves as strongly embedded in their social group and often prioritise interdependence over autonomy and independence (Leonhardt & Pezzuti, 2022). The cultural dimension of collectivism has been particularly successful in predicting prosocial behaviour in past research, and as such speaks to the dimensions usefulness in understanding social relationships and the importance individuals put on the welfare of others (Morren & Grinstein, 2016). For example, Leonhardt and Pezzuti (2022) were able to link higher COVID-19 vaccine acceptance among people from countries who have greater levels of collectivism. Interestingly, but not surprisingly, their research revealed that empathy mediated the relationship between communal orientation and vaccination (Leonhardt & Pezzuti, 2022). The role of empathy was not directly explored in this current study, but considering its potential influence, it may be valuable to investigate in a larger future study as a potential target of future vaccination promotion strategies.

Alternatively, the high level of fear this sample felt towards acquiring HIV may be an important factor in shaping willingness as other studies have shown that people are less likely to act in a prosocial way on issues that are less relevant to themselves and their own community (Yuan & Chu, 2022). Considering this, it would be interesting to explore how community responsibility influences the decisions of people less impacted directly by HIV. Overall, this research suggests that future HIV vaccine promotion programmes should consider incorporating a focus on cultivating feelings of interdependence and responsibility for the well-being of others to maximise vaccine uptake.

The results of this study also revealed that constraints were a significant negative predictor of HIV vaccine willingness. Constraints, as defined by Betsch et al. (2018), include barriers to vaccine uptake that are related to physical availability, affordability, geographical accessibility, ability to understand (language and health literacy), and appeal of vaccination services/facilities. Therefore, this broad definition of constraints encompasses both structural (access) and psychological barriers (real or perceived) that impede vaccination intention and behaviour (Betsch et al., 2018). In the present study, everyday stress, trust in healthcare providers, and the convenience of the youth clinic specifically formed part of the constraint construct. This study showed that an increase in constraint, significantly decreased willingness to vaccinate. Promisingly, results from this study show that most participants (94.7%) would find it convenient to receive the vaccine at their respective youth clinic, highlighting the potential for these settings to serve as effective and accessible distribution points for future HIV vaccination efforts. Furthermore, results show that the participants would be willing to get the HIV vaccine because they trusted the healthcare staff (93.1%). Both results provide encouraging evidence for future HIV distribution strategies, especially as both accessibility of healthcare services and trust in providers have been previously highlighted as potential barriers to other HIV prevention strategies (Croome et al., 2017). However, it’s worth highlighting, this population is representative of already health-seeking young adults. Their existing engagement with the healthcare system may explain the lack of constraints they experience. It would be important to explore the experiences of people who are not already integrated into the healthcare system, as their constraints may be different. For example, male care engagement in primary healthcare settings is consistently much lower than their female counterparts (Zissette et al., 2016). This phenomenon was also witnessed in this study. Despite efforts to include males, there were approximately 8 female participants for every 1 male. Indicating a noticeable underrepresentation of men at the youth clinics. These results suggest that although people currently engaged with healthcare services at the youth clinics may face minimal barriers to accessing future HIV vaccination services in the clinic, challenges may arise when trying to reach people outside of these services.

Adequate access to healthcare has been a longstanding issue in South Africa and disproportionally affects economically marginalised communities (Gordon et al., 2020). Although the HIV vaccine remains hypothetical, the broader socio-economic and healthcare landscape of South Africa highlights the reality that structural constraints may play a role in hindering future HIV vaccine uptake among those not already engaged in the healthcare system. Given that 'constraints' is a broad construct encompassing individual, community, and systemic barriers, future research could consider exploring these different levels to better understand their distinct impacts. This could inform the development or adaptation of multi-level interventions aimed at increasing vaccine uptake by addressing specific constraints more effectively.

5.2.2.2 HIV-related stigma

HIV-related stigma represents a significant barrier that affects various aspects of HIV care engagement (Croome et al., 2017), and results of this study suggest that it will be a barrier to future HIV vaccination too. This study provides evidence that individuals who hold stigmatising beliefs about people who have HIV are significantly less willing to receive a future HIV vaccine. The scale used in this study specifically assessed a broad range of stigmatising attitudes including negative beliefs about people living with HIV (e.g., dirty, cursed, untrustworthy), shamefulness of living with HIV (e.g., guilt, did something wrong to get HIV), and beliefs about social sanctions (e.g., should not work with children or should be isolated) (Kalichman et al., 2005). One explanation of this result may be that young adults in this sample who hold stigmatising beliefs about people with HIV also associate the HIV vaccine negatively. For example, they may believe at some level that the action of getting the HIV vaccine aligns them with the HIV-positive community, and therefor may fear the risk of judgment from others. This aligns with the concept of anticipated stigma, where fear of social judgment influences health-related behaviours, including vaccine acceptance (Velloza et al., 2020). Additionally, HIV-related stigma can be intertwined with attitudes related to moral judgment. Individuals who believe that people with HIV are inherently “dirty” or must have done something wrong such as engaging in “risky” or “taboo” behaviour to acquire HIV may be opposed to accepting the HIV vaccine as prevention as this could be seen as aligning themselves with the behaviours thought to spread it.

Previous research highlights how HIV-related stigma has impacted various stages of HIV care engagement, from HIV testing to adherence, ultimately contributing to poorer health outcomes for those impacted (Earnshaw et al., 2013). Typical HIV stigma drivers within healthcare facilities include healthcare workers' negative attitudes, discriminatory behaviours both in the health care system and in the community, a lack of knowledge of HIV and HIV-associated stigma, and lack of clinical competency in managing HIV within the facility (De Los Santos et al., 2022). In early qualitative HIV vaccine willingness studies conducted in South Africa, stigma was identified as having multiple angles of influence (Atujuna et al., 2018; Sayles et al., 2010). Firstly, HIV stigma was thought to influence decisions to get vaccinated due to fear that family, friends, and community members may believe those seeking the vaccine are already living with HIV or that they may be receiving medication (ART) when they go to the clinic to get the vaccination (Atujuna et al., 2018). Alternatively, the association between HIV and infidelity or promiscuity is imagined resulting in judgment or fear of being judged for getting the HIV vaccine (Sayles et al., 2010). This could contribute to lower trust in healthcare services, making potential vaccines less appealing or accessible. Thus, even when physical access to vaccines is addressed, fear of stigmatisation is likely to play a significant role in vaccine hesitancy. Therefore, going forward interventions and public health messaging targeting HIV related stigma both within communities and within clinics will be essential to mitigate this significant barrier.

5.2.2.3 HIV-related knowledge

HIV-related knowledge was explored in this study to determine if higher levels of knowledge were associated with increased willingness. Surprisingly, no significant association was identified. Despite this study being the first to explore the role of HIV Knowledge on HIV vaccine willingness, this result is still unexpected given that prior research has also linked HIV-related knowledge to improved engagement across the HIV care continuum, including increased HIV testing (Walter & Morocho, 2021), uptake of PreP (Poteat et al., 2019), and adherence to ART (Bor et al., 2021). Furthermore, knowledge has been identified as a facilitator of vaccine willingness in other contexts. For example, a study conducted in Kenya identified that teachers who had less knowledge were less likely to accept or recommend an HPV vaccine to their close friends or family (Masika et al., 2015).

One explanation of this finding could be that the level of HIV knowledge across the study sample was generally high, therefore variability in this phenomenon was not easily explored. A high HIV-knowledge base may be a unique feature of this sample, as mentioned previously, the young adults selected in this study are already health-seeking individuals - evidenced by their attendance at the youth clinic. Future research may find it valuable to explore this phenomenon in a non-health seeking population, such as a community-based sample, where HIV knowledge may be more variable. Alternatively, gaps in medical knowledge have been shown to shape social norms around care engagement and foster the spread of misconceptions and conspiracy (Freeman et al., 2017). Specifically, misinformation has been previously linked with decreased HIV health seeking behaviour (Garett & Young, 2022). For example, in a qualitative study conducted among African American and Hispanic persons living in the United States poor adherence to ART was linked with misinformation about the medication such as "you get belly fat… or sicker" (Freeman et al., 2017). Similar findings have been found in the South African context, where adolescents with lower HIV knowledge were more likely to hold conspiracy beliefs about HIV origin and prevention (Hogg et al., 2017). Suggesting that HIV knowledge may act as a mediator between misconceptions concerning HIV prevention and HIV care engagement. As an HIV vaccine is still a hypothetical prevention measure, there is a chance that when one becomes available, unique misconceptions and conspiracies linked to the vaccine will arise. This may be particularly pertinent considering how susceptible both HIV and vaccines are to the spread of misinformation (Garett & Young, 2022; Seddig et al., 2022). Considering this, HIV knowledge may play a greater role in protecting individuals against misinformation linked to the HIV vaccine when one becomes widely available. As such, it may be valuable for future research to explore this relationship when an HIV vaccine is on the market. Furthermore, knowledge specifically related to HIV was explored in this study – such as HIV acquisition, prevention, and treatment. Other studies have shown that vaccine-specific knowledge may influence willingness. For example, a study on COVID-19 vaccines demonstrated that individuals with higher vaccine-specific knowledge –such as understanding vaccine side effects, antibodies and dosing – were less likely to report hesitancy (Kumari et al., 2022).

Therefore, it may be valuable for future research to examine how vaccine-related knowledge might influence HIV vaccine willingness.

5.2.2.4 Perceived risk and perceived severity of HIV

Perceived risk and perceived severity of HIV were not associated with increased willingness to receive an HIV vaccine in the current study. The study population was drawn from a community characterised by extreme poverty, interpersonal violence, and high incidence of HIV (Stinson et al., 2016). Living in this setting increases risk of acquiring HIV as well as increases an individual's exposure to the impact of HIV on the lives and livelihood of friends, family, and community members. Considering this setting, high levels of perceived risk and severity of HIV were measured in this study. One fifth of the study population perceived themselves at risk of acquiring HIV and three quarters believed they would experience health problems for a long time if they acquired HIV. The lack of association in the current study was found in contrast to an extensive body of research connecting perceived risk and perceived severity with increased willingness to vaccinate. For example, Nigerian healthcare workers who believed they were at risk were more likely to accept a Hepatitis B vaccine (Ogundele et al., 2017). More recently, acceptance of the COVID-19 vaccine has also been associated with increased perceived risk of the disease across a variety of different populations including healthcare workers, students, and the general population (Al-Metwali et al., 2021; Limbu et al., 2022; Schwarzinger et al., 2021).

However, findings from other vaccines should be considered cautiously as the unique context that an HIV vaccine finds itself in may influence willingness to receive a vaccine differently. Unfortunately, limited research has directly investigated how perceived severity and risk may influence willingness to receive an HIV vaccine, making this study a valuable contribution to the field. The lack of association observed in this study may be explained by several factors, including the unique socio-demographic and contextual characteristics of the sample. Unlike healthcare workers with heightened disease awareness, participants in this study may not directly link their perceived risk of HIV to proactive behaviours such as vaccine acceptance. Alternatively, high levels of perceived risk may be normalised within this community, reducing the urgency to act on this cue. This is consistent with the Health Belief model which posits that while perceived severity and risk are important motivating factors, they must be coupled with perceived benefits, self-efficacy, and cues to action to drive behaviour change (Rosenstock et al., 1988). Therefore, perceived severity and perceived risk may not be sufficient on their own to predict HIV vaccination in this population.

5.2.2.5 Sociodemographic variables

Lastly, this study's results reveal no significant associations between any of the sociodemographic variables and willingness to receive an HIV vaccine. While these findings contrast those of previous research done on general vaccine willingness, they align with previous research done on HIV vaccine willingness specifically. For example, extant research exploring predictors of COVID-19 vaccine willingness have shown that several sociodemographic factors influence acceptability, such as ethnicity, working status, religiosity, politics, gender, and income (Troiano & Nardi, 2021). Similar findings were replicated in South Africa (Engelbrecht et al., 2022) and on other vaccines (Lee et al., 2017). However, previous research on HIV vaccine willingness has found limited support for the influence of these variables (de Bruyn et al., 2008b; Dimi et al., 2019; Iseselo et al., 2020; Newman & Logie, 2010). This interesting finding reflects the context-specific nature of vaccine willingness and may indicate the unique influence of HIV on shaping societal perceptions of risk, stigma, and health behaviours. Unlike other diseases, HIV has historically been intertwined with issues of morality, sexuality, and discrimination, which could profoundly affect individuals' willingness to engage with preventive measures like vaccines. In such a context, the expected benefits of an HIV vaccine may be substantial enough to overshadow any variations in participants' characteristics, resulting in a more uniform willingness to vaccinate regardless of sociodemographic differences. This suggests that promoting a future HIV vaccine might not require targeting specific socio-demographic groups, as willingness to vaccinate appears to be broadly consistent across these different characteristics.

5.3 Limitations and recommendations for future research

Several limitations should be considered when interpreting the results of this study. Participants were recruited using non-probability sampling, specifically making use of convenience and snowballing strategies, from two youth clinics in Khayelitsha. Therefore, the results may not be generalised beyond the study participants. Secondly, the results need to be interpreted with caution, considering the low alpha values reported for the translated measures. However, it was beyond the scope of this research to investigate he psychometric properties and future research could benefit from validating these measures in our context. Despite these limitations, this study provides valuable insights into HIV vaccine willingness among health-seeking young adults in a high-prevalence area, offering a foundation for future research and targeted interventions in similar settings. Furthermore, the study sample included more young female adults than young male adults. This is not surprising as the demographic of these youth clinics mostly consists of women. This is consistent with existing literature that highlights the disproportionately lower levels of male engagement in healthcare services within these settings (Rabie et al., 2020; Rotheram-Borus et al., 2024; Zissette et al., 2016). Given that HIV vaccination is likely to be integrated into primary healthcare services, this gender disparity poses a potential challenge. The limited participation of men in healthcare engagement may hinder the success of vaccination programmes. To address this, future research should consider focusing on understanding young men's willingness to receive an HIV vaccine and identifying alternative settings where men might be more inclined to access vaccination services. Moreover, the study sample is representative of already health-seeking individuals as they were recruited while they waited for their clinic appointment. This may have increased this sample's willingness to receive an HIV vaccine. To explore this further, it would be important to assess the attitudes of a more generalised community sample.

Furthermore, the cross-sectional study design limits the capacity to infer causality as data is collected at one time point (Chirico, 2023). However, the findings of this study still provide valuable insights into the factors associated with vaccine willingness within this sample that may guide future more in-depth research designs. Another limitation to keep in mind is that the results of this study were collected through self-reported measures. This form of data collection relies on the participant being accurate and honest. For example, participants may have felt hesitant to share truthfully about their vulnerability towards HIV due to the stigma surrounding HIV acquisition, which is often linked to perceptions of promiscuity in this context. To mitigate evoking social desirability biases in this study, the participants were reminded that there were no wrong answers, and that the researchers would not judge them on any of their answers. Almost all the participants were first language isiXhosa speaking and therefore may have misunderstood the items in the survey, which could have skewed the answers. In an attempt to overcome this, language proficiency was verbally assessed during screening and participants with poor English were asked if they would prefer to continue the assessment in isiXhosa with an isiXhosa speaking research assistant. Future studies should consider validated translations of vaccine hesitancy measures to improve accessibility and accuracy of responses. Lastly, this study explored willingness towards a hypothetical HIV vaccine. Although, willingness was shown to be high within this population, there is a chance that these results might change when faced with a real vaccine with specific characteristics.

5.4 Conclusion

South Africa continues to carry the largest burden of HIV in the world. Its impact is most detrimental on already socioeconomically marginalised communities, resulting in greater health inequalities in South Africa. As previously highlighted, young adults, especially young women have the highest risk of acquiring HIV. Therefore, this study aimed to determine young adults' willingness to receive a preventative HIV vaccine. Overall, the high level of willingness found within this sample provides promising evidence for future HIV vaccine acceptability among young adults. Specifically, willingness was associated with higher levels of collective responsibility, lower levels of constraints, and lower levels of HIV stigma. Ultimately, this study's contributions may offer valuable direction for future policy and research efforts aimed at increasing HIV vaccine acceptance.

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Appendix A: UCT Human Research Ethics Committee Approval Letter

UNIVERSITY OF CAPE TOWN

Faculty of Health Sciences

Human Research Ethics Committee

E52-Room 46, Old Main Building
Groote Schuur Hospital
Observatory 7925
Email: hrec-enquiries@uct.ac.za
Website: www.health.uct.ac.za/fhs/research/humanethics/forms

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3 April 2024

HREC REF: 012/2024

Prof J Joska
Psychiatry & Mental Health
2nd Floor, Room H74
Human Resources and Development Centre (aka Doctors' Bungalows)
Email: john.joska@uct.ac.za
Student Email: morgan.watson@uct.ac.za

Dear Prof Joska

PROJECT TITLE: INVESTIGATING PREDICTORS OF WILLINGNESS TO RECEIVE AN HIV VACCINE IN A SOUTH AFRICAN SAMPLE OF YOUNG ADULTS (MASTER DEGREE - MS MORGAN MATSHEDISO ROEBERT WATSON)

Thank you for submitting your PI Response dated 11 March 2024 to the Faculty of Health Sciences Human Research Ethics Committee (HREC) for review.

It is a pleasure to inform you that the HREC has **formally approved** the above-mentioned study.

Approval is granted for one year until the 30 April 2025.

Please submit a progress report, using the standardised Annual Progress Report Forms (FHS016) **or** (FHS 017) if the study continues beyond the approval period. Please submit a Standard Closure form (FHS 010) when the study has been completed, this includes after publication or thesis submission and final completion.
(Forms can be found on our website: www.health.uct.ac.za/fhs/research/humanethics/forms)

Please note that for all studies approved by the HREC, the principal investigator **must** obtain appropriate institutional approval, where necessary, before the research may occur.

***The HREC acknowledges that the following staff member will be involved in the study: Ms Morgan* Matshediso Roebert Watson.**

Please note that the ongoing ethical conduct of the study remains the responsibility of the principal investigator.
Please quote the HREC REF number 012/2024 in all your correspondence.

Yours sincerely

PROFESSOR
CHAIRPERSON, FACULTY OF HEALTH SCIENCE HUMAN RESEARCH ETHICS COMMITTEE

Appendix B: City of Cape Town Approval Letter

CITY OF CAPE TOWN
ISIXEKO SASEKAPA
STAD KAAPSTAD

CITY HEALTH

Dr Natacha Berkowitz
Epidemiologist: City Health

T: 021 400 6864
E: Natacha.Berkowitz@capetown.gov.za

Ref: 11013

2024-05-17

RE: Investigating predictors of willingness to receive an HIV vaccine in a South African sample of young adults

Dear John Joska

Your research request has been approved as per your protocol. Please refer to the subsequent pages for the approval of any facilities or focus areas requested. Approval comments on any proposed impact on City Health resources are also provided.

Eastern & Khayelitsha:

Contact Person: Prof Vera Scott (Area East Manager)

Tel/Cell: 021 360 1258/082 308 8059

Email: Vera.scott@capetown.gov.za

Please note the following:

1. All individual patient information obtained must be kept confidential.
2. Access to the clinic and its patients must be arranged with the relevant Manager such that normal activities are not disrupted.
3. A copy of the final report must be uploaded to https://web1.capetown.gov.za/web1/mars/ProjectClosure/UploadReport/0/11013, within 6 months of its completion and feedback must also be given to the clinics involved.
4. Your project has been given an ID Number (11013). Please use this in any future correspondence with us.
5. No monetary incentives to be paid to clients on the City Health premises
6. If this research gives rise to a publication , please submit a draft before publication for City Health comment and include a disclaimer in the publication that "the research findings and recommendations do not represent an official view of the City of Cape Town "
7. As the research is approved as per submitted protocol, any changes to the protocol need to be submitted and approved by City Health prior to implementation.

Thank you for your co-operation and please contact me if you require any further information or assistance.

Kind Regards
Dr Natacha Berkowitz Epidemiologist: City Health

Facilities

Area	Subdistrict	Facilities		
Area East	Khayelitsha	**Facility name**	**Interaction start date**	**Interaction end date**
		Nolungile Youth Clinic	2024-05-01	2024-12-31
		Site B Youth Clinic	2024-05-01	2024-12-31

Please note

- If a requested facility does not appear in the list above, its interation request has been rejected and the reason for the rejection can be viewed in the link below
- Approval comments for facilities may exist. These comments can be viewed in the link

below. https://web1.capetown.gov.za/web1/mars/ProjectFacility/Read/0/11013

Impacted resources

Impacted resource	Decision	Comment
Additional load on nursing	Approved	approved

Appendix C: Recruitment Poster (English)

Recruitment Poster (isiXhosa)

Appendix D: Screening Questions

University of Cape Town

Screening Questions

1. Have you ever been diagnosed with any chronic medical conditions?

   ☐ **YES** ☐ **NO**

2. Have you participated in a similar research study in the past?

   ☐ **YES** ☐ **NO**

3. How old are you?

   ………………

4. Have you ever tested positive for HIV?

   ☐ **YES** ☐ **NO**

Appendix E: Participant Information Sheet and Informed Consent

Study Title:

Investigating predictors of willingness to receive an HIV vaccine in a South African sample of young adults

Dear Participant,

We are pleased to invite you to take part in this research study. Please read this form carefully and ask any questions before you agree to be in the study. This study is being conducted by a Masters student in the Department of Psychiatry at the University of Cape Town (UCT).

WHAT IS THE PURPOSE OF THIS STUDY?

The purpose of this study is to explore young adults willingness to receive a preventative HIV vaccine. Currently, there isn't a vaccine for HIV, and although ongoing research holds promise, it is essential to note that a safe and effective vaccine may still be several years away. In the meantime we want to understand your perspective on this potential vaccine before it becomes widely accessible. Your thoughts and feelings play a crucial role in helping us gain valuable insights.

HOW LONG WILL THIS STUDY LAST?

It will take about 15-20 minutes of your time to answer this survey today.

WHAT DOES THE STUDY ENTAIL?

After you sign the consent form, the research assistant will start to go through the study questionnaire with you. You can expect questions around the following topics:

- **Basic Demographic Information:** We'll start by asking you some basic questions about yourself. This helps us understand our participants better.

- **Opinions on HIV Vaccine:** Next, we'll inquire about your feelings and thoughts regarding an HIV vaccine. We're interested in your opinions and concerns.
- **Understanding HIV:** In this section, we'll explore your knowledge about HIV and your general feelings towards the topic. Your responses will help us gauge awareness levels and attitudes.

It is important that you feel free not to answer any questions that make you uncomfortable. You can also ask me any questions as we go along or stop participating at any time.

WHAT ARE THE POSSIBLE RISKS?

There are no major risks associated with completing the study. However, some of the questions in the survey may make you feel uncomfortable or upset. Please utilise the below resource should you feel like you need extra support.

- SADAG at 011 234 4837 or www.sadag.org

WHAT ARE THE POSSIBLE BENEFITS?

You will receive R50 from our research team as a token of thanks for your time spent completing the survey today. Furthermore, by participating you contribute valuable insights to our understanding of HIV vaccine acceptance.

ARE THERE ANY COSTS TO TAKE PART IN THIS STUDY?

There are no expected costs for participating in this study.

HOW WILL THE INFORMATION COLLECTED FROM ME BE KEPT A SECRET (CONFIDENTIAL) IN ORDER TO PROTECT MY PRIVACY?

All information gathered from the screening questionnaire and the actual study will be kept confidential. This means that the answers you provide will be kept in secure computer files on a password-protected laptop. We will not be collecting any personal information that you may be identified by (such as name, surname or contact details). Your research records will not be released without your permission unless required by law or a court order.

CAN I WITHDRAW FROM THIS STUDY?

Now that you know a little bit more about the study, I want to emphasise that it is your choice to continue with this study or not. You can change your mind at any point and decide not to continue with the study. If you opt out, it will not affect how you are treated by myself or affect the care you receive from the clinic.

PERMISSION TO PROCEED

Do you have any questions about anything I just told you? Is it okay for me to proceed with the study survey? Remember you can say no at this time or at any point of me asking.

YES ☐ NO ☐

Signature: ______________________________

Date: __________________________________

Isihloko Sophononongo:

Ukuphanda iingqikelelo zokulangazelela ukufumana isitofu sokugonya i-HIV kwisampuli yaseMzantsi Afrika yabantu abadala abaselula

Mthathi-nxaxheba Othandekay,

Siyavuya ukukumema ukuba uthathe inxaxheba kolu phononongo lophando. Nceda ufunde le fomu ngononophelo kwaye ubuze nayiphi na imibuzo phambi kokuba uvume ukuba kuphononongo. Olu phando luqhutywa ngumfundi weMasters kwiSebe lezeNgqondo kwiYunivesithi yaseKapa (UCT).

YINTONI INJONGO YOLUPHANDO?

Injongo Yoluphando kukuphonononga ukuzimisela kwabantu abadala abaselula ekufumaneni isitofu sokuthintela i-HIV. Okwangoku, asikabikho isitofu sokugonya i-HIV, kwaye nangona uphando oluqhubekayo luthembisa, kubalulekile ukuphawula ukuba isitofu sokugonya esikhuselekileyo nesisebenzayo sisenokubakho eminyakeni emininzi ekude ezayo. Okwangoku sifuna ukuqonda imbono yakho ngesi sitofu sokugonya phambi kokuba sibekhona ngokubanzi. Iingcinga zakho kunye neemvakalelo zakho zidlala indima ebalulekileyo ekusincedeni ukuba sifumane ulwazi olubalulekileyo.

LUYAKUTHATHA IXESHA ELINGAKANANI OLUPHANDO?

Liya kuthatha malunga nemizuzu eyi-15-20 yexesha lakho ukuphendula olu phando namhlanje.

LUQUKA NTONI OLU PHONONONGO?

Emva kokuba usayine ifomu yemvume, umncedisi wophando uza kuqalisa ukufunda nawe kwiphepha lemibuzo yophononongo. Unokulindela imibuzo malunga nezi zihloko zilandelayo:

- **Ulwazi Olusisiseko Lwedemografi:** Siza kuqala ngokukubuza imibuzo esisiseko malunga nawe. Oku kusinceda ukuba sibaqonde ngcono abathathi-nxaxheba.
- **Izimvo ngesitofu sokugonya i-HIV:** Okulandelayo, siza kubuza malunga neemvakalelo zakho neengcinga zakho malunga nesitofu sokugonya i-HIV. Sinomdla kwizimvo zakho kunye neenkxalabo zakho.

- **Ukuqonda i-HIV:** Kweli candelo, siza kuphonononga ulwazi lwakho nge-HIV kunye neemvakalelo zakho ngokubanzi malunga nesisihloko. Iimpendulo zakho ziya kusinceda silinganise amanqanaba okuqonda kunye nezimo zengqondo.

Kubalulekile ukuba uzive ukhululekile ukuba ungaphenduli nayiphi na imibuzo ekwenza uzive ungakhululekanga. Ungandibuza nayiphi na imibuzo njengoko siqhuba okanye uyeke ukuthatha inxaxheba nangaliphi na ixesha.

YEYIPHI IMNGCIPHEKO ENOKUBAKHO?

Akukho mingcipheko mikhulu enxulumene nokuthatha inxaxheba koluphando. Nangona kunjalo, eminye yemibuzo ekuphando inokukwenza uziv ungakhululekanga okanye ukhathazekile. Nceda usebenzise esi sixhobo singezantsi ukuba uziva ngathi ufuna inkxaso eyongezelelweyo.

SADAG at 011 234 4837 or www.sadag.org

ZEZIPHI IINZUZO EZINOKUBAKHO?

Uya kufumana ama-R50 kwiqela lethu lophando njengomqondiso wombulelo ngexesha lakho olichithe ugqibezela uphando namhlanje. Ngaphaya koko, ngokuthatha inxaxheba unegalelo kwiimbono ezixabisekileyo ekuqondeni kwethu ulwamkelo lwesitofu sogonyo lwe-HIV.

INGABA ZIKHO IINDLEKO ZOKUTHATHA INXAXHEBA KOLU PHANDO?

Akukho ndleko zilindelekileyo ngokuthatha inxaxheba kolu phononongo.

INKCAZELO EQOKELELWE KUM IZA KUGCINWA NJANI IYIMFIHLO (IYIMFIHLO) UKUZE IKHUSELE UBUMFIHLO BAM?

Lonke ulwazi oluqokelelwe kwiphepha lemibuzo lokuhlola kunye nophononongo lokwenyani luya kugcinwa luyimfihlo. Oku kuthetha ukuba iimpendulo ozinikezelayo ziya kugcinwa kwiifayile zekhompyuter ezikhuselekileyo kwilaptop ekhuselweyo ngegama eliyimfihlo. Asizi kuqokelela naziphi na iinkcukacha zobuqu onokuthi uchongwe ngazo (ezifana negama, ifani okanye iinkcukacha zoqhagamshelwano). Iirekhodi zakho zophando aziyi kukhululwa ngaphandle kwemvume yakho ngaphandle kokuba zifunwa ngumthetho okanye umyalelo wenkundla.

NDINGARHOXA KOLU PHANDO?

Ngoku usazi kancinci malunga nesifundo, ndifuna ukugxininisa ukuba lukhetho lwakho ukuba uyaqhubeka nesi sifundo okanye hayi. Ungayitshintsha ingqondo yakho nangaliphi na ixesha kwaye uthathe isigqibo sokuba ungaqhubeki nophononongo. Ukuba uyaphuma, indlela ophathwa ngayo ndim okanye ukhathalelo olufumana ekliniki aluzuchazeleka.

IMVUME YOKUQHUBEKA

Ngaba unayo nayiphi na imibuzo malunga nantoni na endisandula ukukuxelela yona? Ngaba kulungile ukuba ndiqhubeke nophando? Khumbula ukuba unokuthi hayi ngeli xesha okanye nangaliphi na ixesha lokubuza
kwam.

EWE ☐ HAYI ☐

Signature: ______________________________

Date: ______________________________

Appendix F: Study Questionnaire

Section 1: Biographical information

English	isiXhosa
1. What is your date of birth? ____________________________	**1. Luthini usuku lwakho lokuzalwa?** ____________________________
2. How would you describe your gender? a. Man b. Woman c. Transgender d. Prefer not to answer	2. **Sithini isini sakho?** a. Indoda b. Mfazi c. Umntu otshintshe isini d. Khetha ukungaphenduli
3. How do you identify your racial or ethnic background? a. Black b. Coloured c. Indian/Asian d. White e. Prefer not to answer	**3. Ulubona njani uhlanga lwakho okanye imvelaphi yohlanga lwakho?** a. Mnyama b. Ungumntu webala c. UliNdiya / waseAsia d. Mhlophe e. Khetha ukungaphenduli
4. Which <u>best</u> describes your current relationship status? a. Single b. Married c. In a relationship	**4. Yeyiphi eyichaza <u>ngcono</u> imeko yakho yobudlelwane bangoku?** a. Awutshatanga b. Utshatile c. Kubudlelwane

d. Prefer not to answer

d. Khetha ukungaphenduli

5. Have you completed Matric?

1. Yes
2. No

5. Ingaba uye wayigqiba imatriki?

1. Ewe
2. Hayi

6. How would you describe your employment status?

a. Unemployed
b. Employed
c. Self -employed
d. Other

6. Ungasichaza njani isimo sakho sengqesho?

a. Awusebenzi

b. Uyasebenza

c.Uyazisebenzela

d. Okunye

7. Which amount best corresponds with your monthly income?

a. R0 – R1600
b. R1601 – R6400
c. R6401 – R12800
d. R12801 – R25600
e. More than R25600

7. Yeyiphi imali ehambelana kakuhle nomvuzo wakho wenyanga?

a. R0 – R1600
b. R1601 – R6400
c. R6401 – R12800
d. R12801 – R25600
e. More than R25600

8. What is your religious or spiritual preference, if any?

a. Christianity
b. Traditional Religion
c. Islam
d. Hinduism
e. Buddhism
f. None

8. Luluphi ukhetho lwakho lwenkolo okanye lokomoya, ukuba lukhona?

a. Inkolo yamaKrestu
b. Inkolo yesiNtu
c. Inkolo yamaSilamsi
d. Unkolo yamaHindu
e. Inkolo yakwaBudda
f. Akukho nanye

9. Have you received at least one COVID-19 vaccine?

1. Yes
2. No

9. Ingaba ufumene isitofu esinye ubuncinane se-COVID-19?

a. Ewe
b. Hayi

10. Have you tested for HIV before?

a. Yes
b. No

10. Ngaba ubukhe wazivavanya i-HIV ngaphambili?

a. Ewe
b. Hayi

11. Imagine that an HIV vaccine came out now, and the government provided the service free of charge, how likely would you be to get this vaccine?"

a. Very unlikely
b. Unlikely
c. Neutral
d. Likely
e. Very likely

11. Khawufane ucinge ukuba isitofu sokugonya i-HIV siphumile ngoku, kwaye urhulumente wabonelela ngenkonzo simahla, ulindeleke kangakanani ukuba usifumane esi sitofu?"

a. Akulindelekanga kakhulu
b. Akunakwenzeka
c. Ngaphakathi
d. Mhlawumbi
e. Inokwenzeka kakhulu

Section 2:

5 Psychological Antecedents of vaccination

1. I am completely confident that HIV vaccines will be safe.

a. Strongly disagree
b. Disagree
c. Neutral
d. Agree

1. Ndiqinisekile ngokupheleleyo ukuba izitofu zokugonya ze-HIV ziya kukhuseleka.

a. Andivumi kakhulu
b. Andivumi
c. Ngaphakathi
d. Ndiyavuma

e. Strongly agree

e. Ndivuma kakhulu

2. HIV vaccinations will be effective.

a. Strongly disagree
b. Disagree
c. Neutral
d. Agree
e. Strongly agree

2. Ugonyo lwe-HIV luya kusebenza.

a. Andivumi kakhulu
b. Andivumi
c. Ngaphakathi
d. Ndiyavuma
e. Ndivuma kakhulu

3. Regarding HIV vaccines, I am confident that the Government will decide in the best interest of the community.

a. Strongly disagree
b. Disagree
c. Neutral
d. Agree
e. Strongly agree

3. Ngokumalunga nezitofu zokugonya i-HIV, ndiqinisekile ukuba uRhulumente uya kwenza isigqibo ngokona kulungileyo kuluntu.

a. Andivumi kakhulu
b. Andivumi
c. Ngaphakathi
d. Ndiyavuma
e. Ndivuma kakhulu

4. Vaccination is unnecessary because HIV is not common anymore.

a. Strongly disagree
b. Disagree
c. Neutral
d. Agree
e. Strongly agree

4. Ugonyo aluyomfuneko kuba i-HIV ayisaxhaphakanga.

a. Andivumi kakhulu
b. Andivumi
c. Ngaphakathi
d. Ndiyavuma
e. Ndivuma kakhulu

5. My immune system is so strong; it protects me against HIV.

a. Strongly disagree

5. Amajoni am omzimba omelele kakhulu; iyandikhusela kwi-HIV.

a. Andivumi kakhulu

b. Disagree
c. Neutral
d. Agree
e. Strongly agree

b. Andivumi
c. Ngaphakathi
d. Ndiyavuma
e. Ndivuma kakhulu

6. Getting HIV is not so *severe* that I should be vaccinated

a. Strongly disagree
b. Disagree
c. Neutral
d. Agree
e. Strongly agree
f.

6. Ukufumana i-HIV akukho *nzima kangako* kangangokuba kufuneka ndigonywe.

a. Andivumi kakhulu
b. Andivumi
c. Ngaphakathi
d. Ndiyavuma
e. Ndivuma kakhulu

7. I predict that everyday stress (such as work or family) will prevent me from being vaccinated against HIV.

a. Strongly disagree
b. Disagree
c. Neutral
d. Agree
e. Strongly agree

7. Ndiqikelela ukuba uxinzelelo lwemihla ngemihla (njengomsebenzi okanye usapho) luya kundithintela ekubeni ndigonyelwe i-HIV.

a. Andivumi kakhulu
b. Andivumi
c. Ngaphakathi
d. Ndiyavuma
e. Ndivuma kakhulu

8. If an HIV vaccine was being offered at this clinic, I would find it convenient to get the vaccine.

a. Strongly disagree
b. Disagree
c. Neutral
d. Agree
e. Strongly agree

8. Ukuba isitofu sokugonya se-HIV besinikwa kule kliniki, bendiza kukufumanisa kulula ukufumana isitofu sokugonya.

a. Andivumi kakhulu
b. Andivumi
c. Ngaphakathi
d. Ndiyavuma
e. Ndivuma kakhulu

9. I wouldn't get the HIV vaccine because I don't trust the doctors at the clinic.

a. Strongly disagree
b. Disagree
c. Neutral
d. Agree
e. Strongly agree

9. Andinakusifumana isitofu sokugonya i-HIV kuba andibathembi oogqirha basekliniki.

a. Andivumi kakhulu
b. Andivumi
c. Ngaphakathi
d. Ndiyavuma
e. Ndivuma kakhulu

10. I am the type of person who would need to think about it a lot and weigh up the benefits and risks, before deciding to get the HIV vaccine.

a. Strongly disagree
b. Disagree
c. Neutral
d. Agree
e. Strongly agree

10. Ndiluhlobo lomntu ekuya kufuneka acinge ngalo kakhulu kwaye avavanye izibonelelo kunye nobungozi, phambi kokuba athathe isigqibo sokufumana isitofu sokugonya i-HIV.

a. Andivumi kakhulu
b. Andivumi
c. Ngaphakathi
d. Ndiyavuma
e. Ndivuma kakhulu

11. I am the type of person who would need to closely consider whether the vaccine would be useful for me before I got it.

a. Strongly disagree
b. Disagree
c. Neutral
d. Agree
e. Strongly agree

11. Ndiluhlobo lomntu ekufuneka eqwalasele ngokufutshane ukuba ingaba isitofu sokugonya singaba luncedo na kum phambi kokuba ndisifumane.

a. Andivumi kakhulu
b. Andivumi
c. Ngaphakathi
d. Ndiyavuma
e. Ndivuma kakhulu

12. It would be really important for me to fully understand the topic of HIV vaccination before I get vaccinated.

a. Strongly disagree
b. Disagree
c. Neutral
d. Agree
e. Strongly agree

12. Kuya kubaluleka ngokwenene kum ukuba ndisiqonde ngokupheleleyo isihloko sogonyo lwe-HIV phambi kokuba ndigonywe.

a. Andivumi kakhulu
b. Andivumi
c. Ngaphakathi
d. Ndiyavuma
e. Ndivuma kakhulu

13. I would wait until everyone else is vaccinated, so that I don't need to get the HIV vaccine.

a. Strongly disagree
b. Disagree
c. Neutral
d. Agree
e. Strongly agree

13. Ndingalinda de wonke umntu agonywe, ukuze kungabikho mfuneko yokuba ndifumane isitofu sokugonya i-HIV.

a. Andivumi kakhulu
b. Andivumi
c. Ngaphakathi
d. Ndiyavuma
e. Ndivuma kakhulu

14. I would get the HIV vaccine as soon as I could because I would be able to protect other people.

a. Strongly disagree
b. Disagree
c. Neutral
d. Agree
e. Strongly agree

14. Ndingafumana isitofu sokugonya i-HIV ngokukhawuleza kangangoko ndinako ngoba ndizokwazi ukukhusela abanye abantu.

a. Andivumi kakhulu
b. Andivumi
c. Ngaphakathi
d. Ndiyavuma
e. Ndivuma kakhulu

15. I believe that everyone needs to get the HIV vaccine, including myself, because it is a community responsibility.

15. Ndikholelwa ukuba wonke umntu kufuneka afumane isitofu sokugonya i-HIV, kubandakanywa nam, kuba luxanduva loluntu.

a. Strongly disagree b. Disagree c. Neutral d. Agree e. Strongly agree	a. Andivumi kakhulu b. Andivumi c. Ngaphakathi d. Ndiyavuma e. Ndivuma kakhulu
Section 3 **Perceived risk and perceived severity**	
1. Based on your current behaviour, how likely would you say you are to get HIV? a. Very likely b. Unlikely c. Neutral d. Likely e. Very unlikely	1. **Ngokusekelwe kwindlela oziphethe ngayo ngoku, unokuthi unethuba elingakanani lokufumana i-HIV?** a. Inokwenzeka kakhulu b. Akunakwenzeka c. Ngaphakathi d. Mhlawumbi e. Akulindelekanga kakhulu
2. I worry about getting HIV… a. Never b. Almost never c. Sometimes d. Often e. Very often	**2. Ndinexhala lokufumana i-HIV…** a. Zange b. Phantse zange c. Ngamanye amaxesha d. Rhoqo e. Qho
3. Getting HIV is something I have… a. Never thought about b. Almost never thought about	**3. Ukufumana i-HIV yinto endi...** a. Ngazange ndicinge ngayo

c. Sometimes thought about
d. Thought about often
e. Thought about very often

b. Phantse andazange ndicinge ngayo
c. Yicinge ngamanye amaxesha
d. Yicinge rhoqo
e. Yicinge qho

4. I am somebody who is afraid of getting HIV…

a. Strongly disagree
b. Disagree
c. Neutral
d. Agree
e. Strongly agree

4. Ndingumntu owoyikayo ukufumana i-HIV…

a. Andivumi kakhulu
b. Andivumi
c. Ngaphakathi
d. Ndiyavuma
e. Ndivuma kakhulu

5. If I got HIV, I would experience health problems for a very long time

a. Strongly disagree
b. Disagree
c. Neutral
d. Agree
e. Strongly agree

5. Ukuba ndine-HIV, ndiza kuba neengxaki zempilo ixesha elide kakhulu.

a. Andivumi kakhulu
b. Andivumi
c. Ngaphakathi
d. Ndiyavuma
e. Ndivuma kakhulu

6. If I got HIV it would threaten my relationship with my partner.

f. Strongly disagree
g. Disagree
h. Neutral
i. Agree
j. Strongly agree

6. Ukuba ndifumene i-HIV ingasongela ubudlelwane bam neqabane lam.

a. Andivumi kakhulu
b. Andivumi
c. Ngaphakathi
d. Ndiyavuma

e. Ndivuma kakhulu

7. If I had HIV my whole life would change for the worse.

a. Strongly disagree
b. Disagree
c. Neutral
d. Agree
e. Strongly agree

7. Ukuba bendine-HIV ubomi bam bonke bebungatshintsha kakubi

a. Andivumi kakhulu
b. Andivumi
c. Ngaphakathi
d. Ndiyavuma
e. Ndivuma kakhulu

Section 4:

HIV Knowledge

1. Is HIV spread by kissing?

a. Yes
b. No
c. I don't know

1. Ngaba i-HIV isasazeka ngokuncamisana?

a. Ewe
b. Hayi
c. Andiyazi

2. Can a person get HIV by sharing kitchens and bathrooms with someone who has HIV?

a. Yes
b. No
c. I don't know

2.Ngaba umntu angayifumana i-HIV ngokusebenzisa iikhitshi kunye nezindlu zokuhlambela kunye nomntu one-HIV?

a. Ewe
b. Hayi
c. Andiyazi

3. Can you get HIV by touching someone with HIV?

3. Ngaba ungayifumana i-HIV ngokubamba umntu one-HIV?

a. Ewe

a. Yes
b. No
c. I don't know

4. Can a man give HIV to woman?

a. Yes
b. No
c. I don't know

5. Can a woman give HIV to a man?

a. Yes
b. No
c. I don't know

6. Must a person have many different partners to get HIV?

a. Yes
b. No
c. I don't know

7. Does washing after sex help to protect against HIV?

a. Yes
b. No
c. I don't know

b. Hayi
c. Andiyazi

4.Ngaba indoda inganika umfazi i-HIV?

a. Ewe
b. Hayi
c. Andiyazi

5. Ngaba umfazi anganika indoda i-HIV?

a. Ewe
b. Hayi
c. Andiyazi

6. Ngaba umntu kufuneka abe namaqabane amaninzi awohlukeneyo ukuze afumane i-HIV?

a. Ewe
b. Hayi
c. Andiyazi

7. Ingaba ukuhlamba emva kokwabelana ngesondo kunceda ukukhusela kwi-HIV?

a. Ewe
b. Hayi
c. Andiyazi

8.Can a pregnant woman give HIV to her baby? a. Yes b. No c. I don't know	**8. Ngaba owasetyhini okhulelweyo angayinika i-HIV kusana lwakhe?** a. Ewe b. Hayi c. Andiyazi
9. Can a person get rid of HIV by having sex with a virgin? a. Yes b. No c. I don't know	**9. Ngaba umntu angayophula i-HIV ngokulala nentombi enyulu?** a. Ewe b. Hayi c. Andiyazi
10. Is HIV the virus that causes HIV/AIDS. a. Yes b. No c. I don't know	**10. Ngaba i-HIV yintsholongwane ebangela i-HIV/AIDS.** a. Ewe b. Hayi c. Andiyazi
11. Is there a cure for HIV? a. Yes b. No c. I don't know	**11. Ingaba lukhona unyango lwe-HIV?** a. Ewe b. Hayi c. Andiyazi
Section 6: **HIV stigma**	
1**. People who have HIV are dirty.**	**1. Abantu abane-HIV bamdaka.**

a. Yes
b. No
c. I am not sure

a. Ewe
b. Hayi
c. Andiqinisekanga

2. People who have HIV are cursed.

a. Yes
b. No
c. I am not sure

2. Abantu abane-HIV baqalekisiwe.

a. Ewe
b. Hayi
c. Andiqinisekanga

3. People who have HIV should be ashamed.

a. Yes
b. No
c. I am not sure

3. Abantu abane-HIV kufuneka babe neentloni

a. Ewe
b. Hayi
c. Andiqinisekanga

4. It is safe for people who have HIV to work with children.

a. Yes
b. No
c. I am not sure

4. Kukhuselekile ukuba abantu abane-HIV basebenze nabantwana.

a. Ewe
b. Hayi
c. Andiqinisekanga

5. People with HIV must expect some restrictions on their freedom.

a. Yes
b. No
c. I am not sure

5. Abantu abane-HIV kufuneka balindele izithintelo ezithile kwinkululeko yabo.

a. Ewe
b. Hayi
c. Andiqinisekanga

6. A person with HIV must have done something wrong and deserves to be punished. a. Yes b. No c. I am not sure	**6. Umntu one-HIV inokuba wenze into engalunganga kwaye ufanele ukohlwaywa.** a. Ewe b. Hayi c. Andiqinisekanga
7. People who have HIV should be isolated. a. Yes b. No c. I am not sure	**7. Abantu abane-HIV kufuneka babe bodwa.** a. Ewe b. Hayi c. Andiqinisekanga
8. I do not want to be friends with someone who has HIV. a. Yes b. No c. I am not sure	**8. Andifuni ukuba ngumhlobo nomntu one-HIV.** a. Ewe b. Hayi c. Andiqinisekanga
9. People who have HIV should not be allowed to work. a. Yes b. No c. I am not sure	**9. Abantu abane-HIV abanfanelanga kuvunyelwa ukuba basebenze.** a. Ewe b. Hayi c. Andiqinisekanga
Section 7 Experience with HIV	
1. I would rather use traditional medicine than a new HIV vaccine to prevent HIV infection.	1. **Ndikhetha ukusebenzisa amayeza esintu kunogonyo olutsha lwe-HIV ukuthintela**

a. Yes
b. No
c. I am not sure

usulelo lwe-HIV

a. Ewe
b. Hayi
c. Andiqinisekanga

2. Do you have someone close to you with HIV? (close to you)

a. Yes
b. No

2. Unaye umntu omaziyo osondele kuwe one-HIV?

a. Ewe
b. Hayi

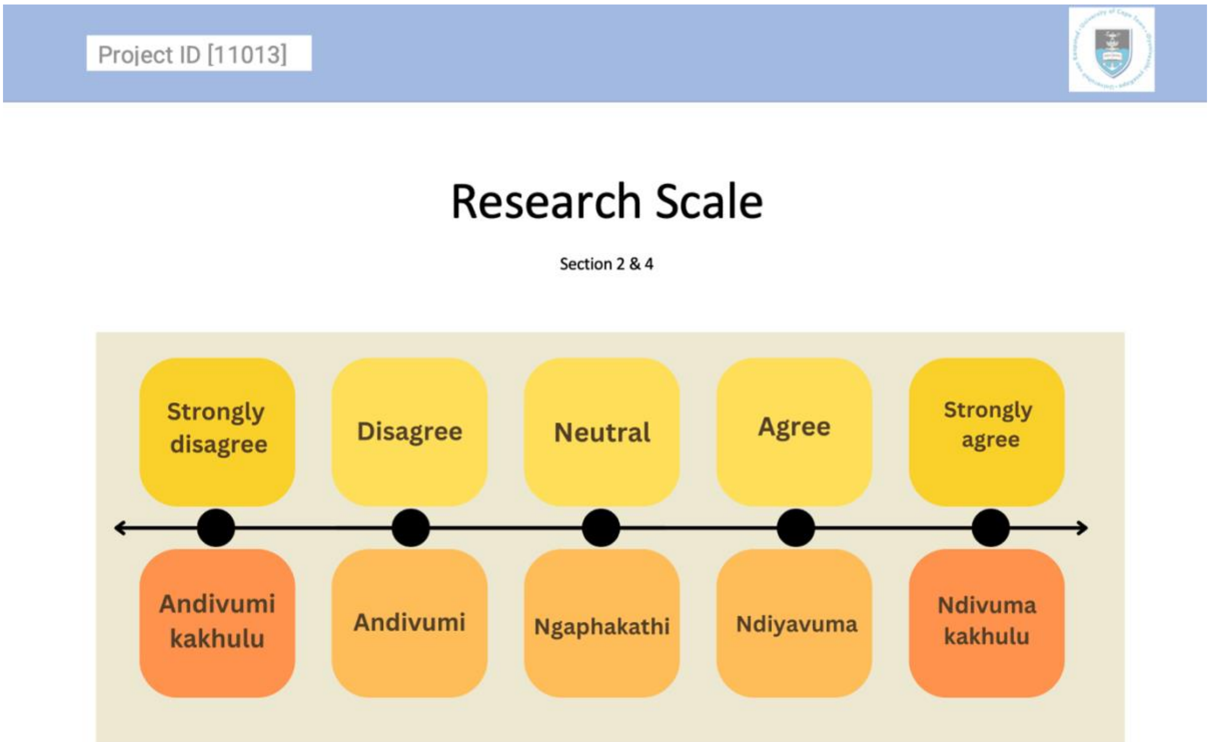
3. Do you know someone personally who has died of HIV/AIDS?

a. Yes
b. No

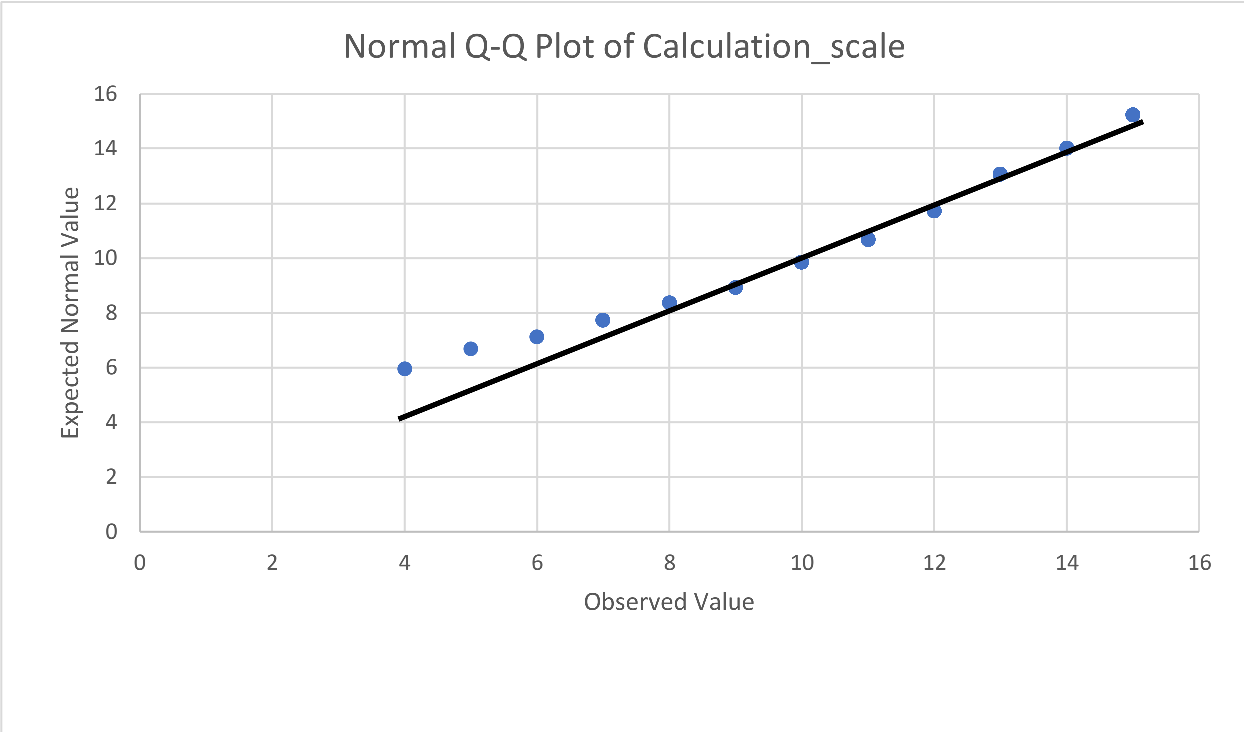
Ukhona umntu omaziyo osondele kuwe obulewe yi-HIV/AIDS?

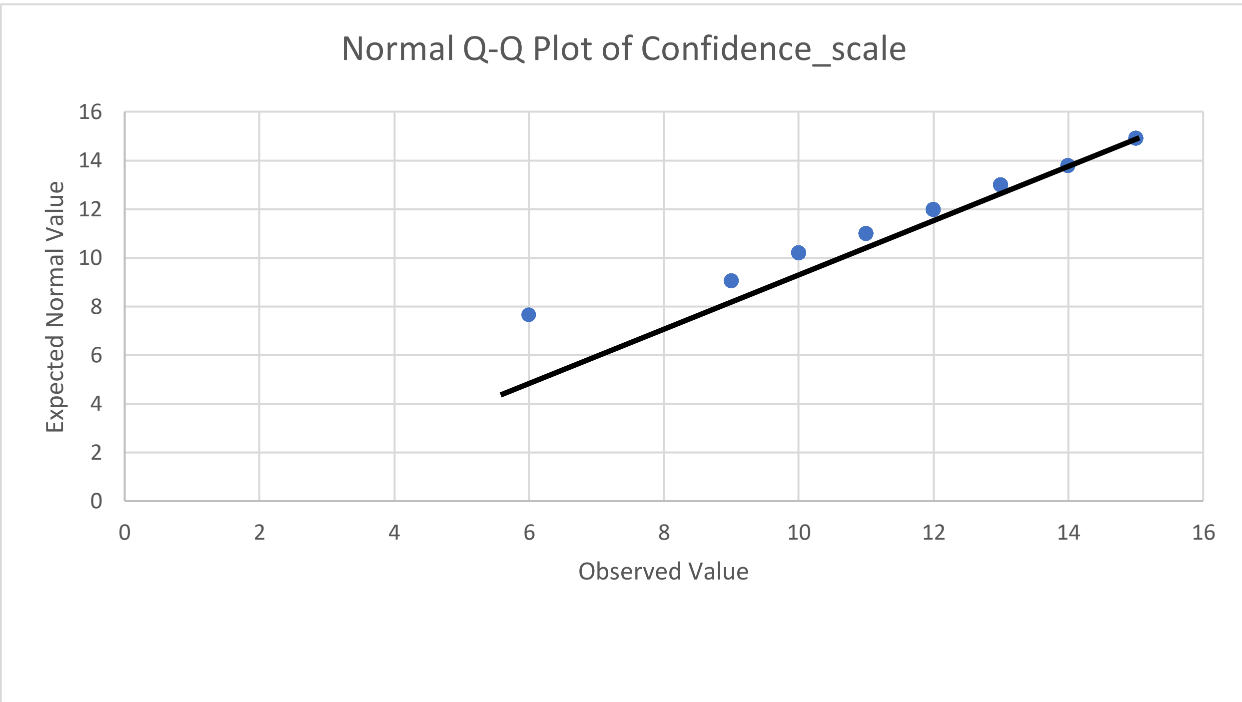
a. Ewe
b. Hayi

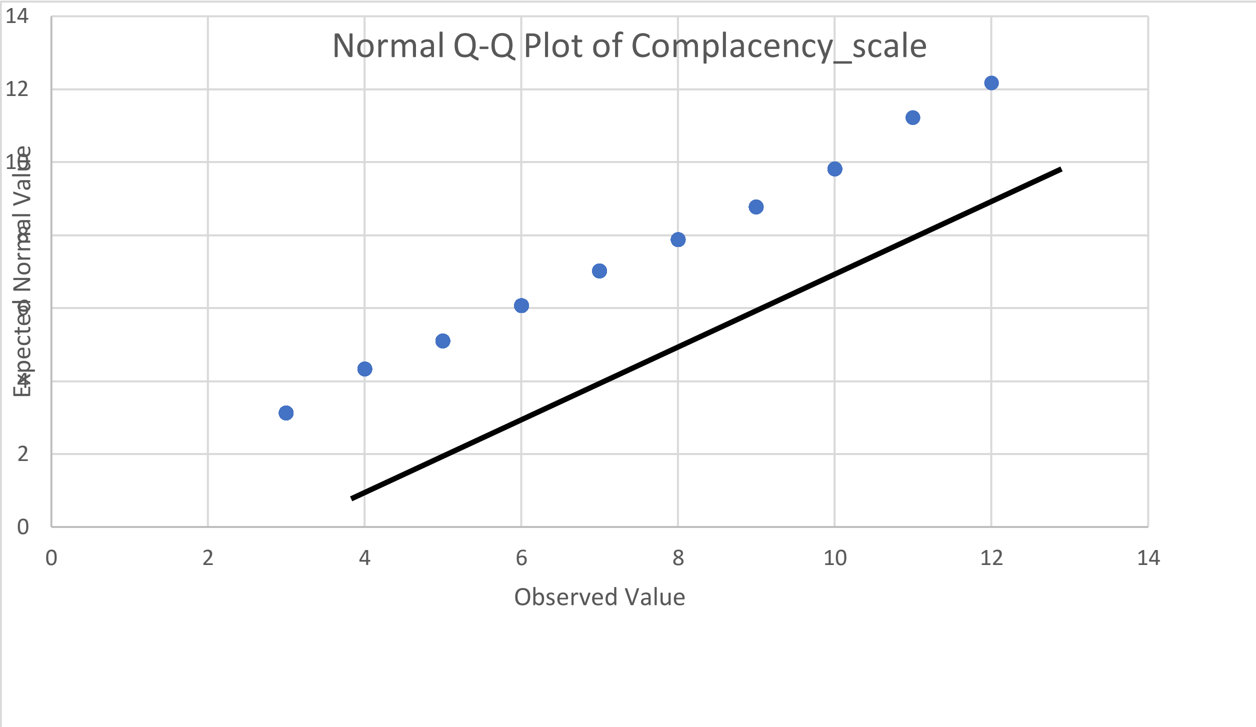
Appendix G: Visual study scale

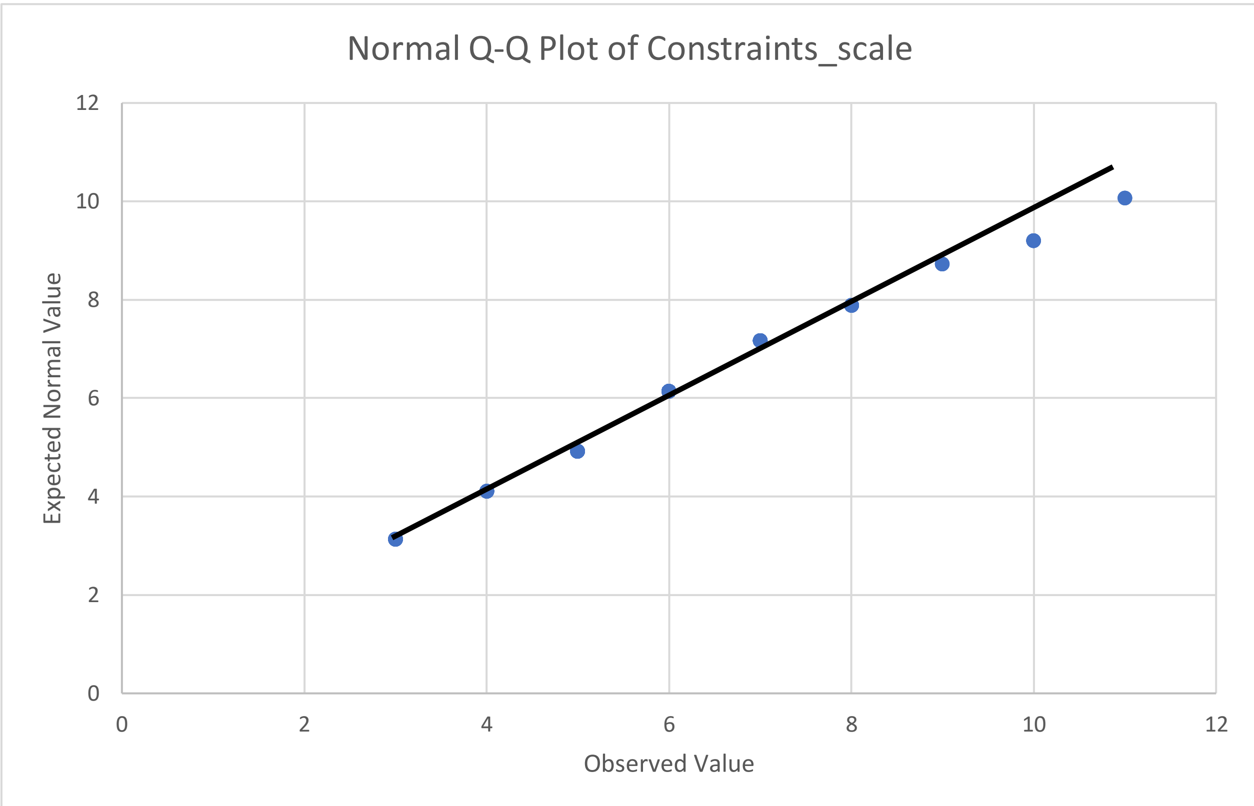


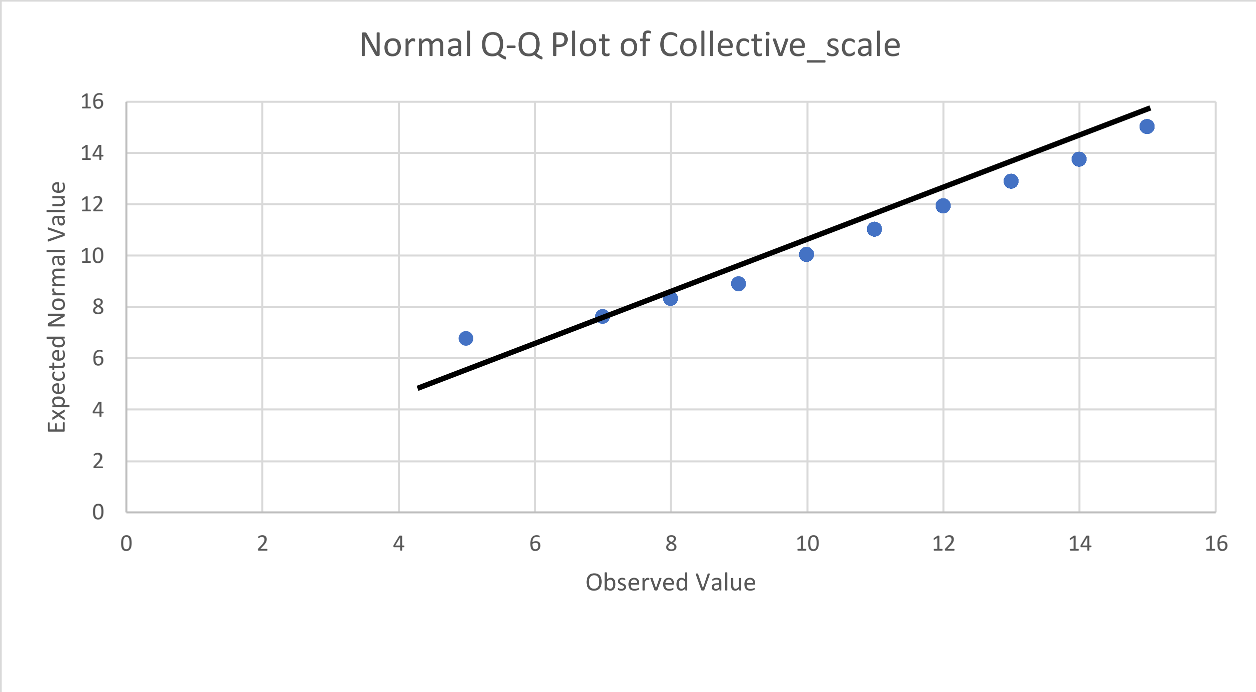
Appendix H: Quantile-Quantile plots generated for the Five Antcendants of Vaccination






Normal Q-Q Plot of Complacency_scale
Observed Value
0
2
4
6
8
10
12
14


Normal Q-Q Plot of Constraints_scale
Expected Normal Value
Observed Value
0
2
4
6
8
10
12


Normal Q-Q Plot of Collective_scale
Expected Normal Value
Observed Value
0
2
4
6
8
10
12
14
16

Appendix I: Summary of Tukey's HSD for the five antecedents of vaccination

	Group 1	Group 2	Mean Diff	SE	95% Confidence Interval	
					Lower Limit	Upper Limit
Confidence	Unwilling	Neutral	.83	.61	-.62	2.29
		Willing	-.68	.42	-1.68	.32
	Neutral	Unwilling	-.83	.61	-2.29	.62
		Willing	-1.51*	.49	-2.67	-.35
	Willing	Unwilling	.68	.42	-.32	1.68
		Neutral	1.51*	.49	.35	2.67
Complacency	Unwilling	Neutral	1.47	.77	-.34	3.28
		Willing	1.55*	.53	.31	2.80
	Neutral	Unwilling	-1.47	.77	-3.28	.34
		Willing	.08	.61	-1.36	1.52
	Willing	Unwilling	-1.55*	.53	-2.80	-.31
		Neutral	-.08	.61	-1.53	1.36
Constraints	Unwilling	Neutral	1.17	.61	-.27	2.60
		Willing	1.60*	.42	.62	2.59
	Neutral	Unwilling	-1.17	.61	-2.60	.27
		Willing	.44	.48	-.71	1.58
	Willing	Unwilling	-1.60*	.42	-2.59	-.62
		Neutral	-.44	.48	-1.58	.71
Collective responsibility	Unwilling	Neutral	-.26	.68	-1.87	1.35
		Willing	-1.63*	.47	-2.74	-.52
	Neutral	Unwilling	.26	.68	-1.35	1.87
		Willing	-1.37*	.54	-2.65	-.09
	Willing	Unwilling	1.63*	.47	.52	2.75
		Neutral	1.37*	.54	.09	2.65

*Note. *Significant at* $p < 0.05$