HIV Self Testing uptake and associated factors in Cape Town: a contextual framework.

by

1. **Doris Nyembwe**
NYMDOR003

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Supervisor: Dr Olufunke Alaba

Name and Department and University: SPH Health Economic Unit - UCT

DECLARATION

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Abstract

Background

South Africa bears one of the highest HIV burdens globally, with nearly 8 million people living with the virus. Despite hosting the world's largest antiretroviral therapy (ART) program, HIV-related deaths remain significant, accounting for over 23% of all deaths in 2019. Early detection and timely initiation of ART are essential to prevent transmission, improve quality of life, and reduce HIV-related morbidity and mortality. However, insufficient testing coverage among males and younger individuals remains a concern. HIV self-testing (HIVST) has emerged as a promising strategy to bridge these gaps, offering a private and convenient option for individuals hesitant to access healthcare facilities. The World Health Organization (WHO) endorses HIVST as a complementary approach to enhance access, particularly for populations underserved by traditional testing methods.

While research has examined HIVST uptake in various settings, little is known about the specific factors influencing its adoption in Cape Town. Given South Africa's unique socio-economic landscape and the disparities between urban and rural areas, understanding the factors shaping HIVST uptake is crucial for developing tailored interventions. This thesis seeks to address this gap by investigating and analyzing the demographic, socio-economic, and community-level factors associated with HIVST uptake in Cape Town.

Methods

This study utilized a cross-sectional design to examine HIV testing uptake and associated factors in Cape Town, South Africa, between January and December 2022. The analysis leveraged routine HIV Testing Services (HTS) programmatic data collected by the Anova Health Institute. The dataset included a total of 266,284 observations: 30,785 for HIV self-testing (HIVST) and 235,499 for conventional HIV testing. Data were drawn from individuals aged 18 years and older across the eight subdistricts of the Cape Town metropolitan area: Eastern, Northern, Southern, Western, Khayelitsha, Klipfontein, Mitchells Plain, and Tygerberg.

The data, comprising sociodemographic details and testing information, were deidentified with formal permission from Anova Health Institute and the Department of Health. Individual-level data was recorded through consent forms and HTS registers and subsequently transferred to Red Cap and Power BI for quality checks and analysis. Community-level data, including the number of healthcare facilities, new and registered ART patients, and child acute malnutrition rates, were sourced from City of Cape Town health profiles (2021).

Predictors were selected based on a socio-ecological framework, capturing both individual- and community-level factors. Individual-level variables included age, gender, and HIV testing history. Community-level factors encompassed healthcare access (number of healthcare facilities), HIV burden (number of registered and new ART patients), and socioeconomic status (child acute malnutrition rate).

Descriptive statistics summarize the frequencies of HIVST, and conventional testing variables stratified by subdistrict, alongside community-level factors. A bivariate logistic regression model was conducted to assess associations between individual predictors and HIV testing options. Subsequently, a multivariate logistic regression model was employed to evaluate the influence of both individual- and community-level predictors on HIV testing choices (conventional vs. HIVST). Odds ratios were calculated with 95% confidence intervals to quantify these associations.

This methodology integrates diverse data sources and robust statistical approaches, enabling a comprehensive examination of the factors influencing the uptake of HIV self-testing in Cape Town.

Results

The study had a sample size of 265,063 of which 234,853 (88.60%) had utilized conventional HIV testing method and 30,210 (11.40%) opting for self-testing. Majority of individuals undergoing conventional testing are adults aged 25- 49 (63.16%), followed by older adults aged 50+ (17.16%). Similarly, for self-testing, most users are also within the 25-49 age group (63.84%), but there is a higher proportion of young adults aged 20-24 choosing self-testing (23.72%) compared to conventional testing (15.59%). Additionally, adolescents aged 18-19 are more likely to opt for self-testing (7.75%) than conventional testing (4.08%). Regarding gender, females constitute a larger share of those undergoing conventional testing (65.62%) compared to males (34.38%). The trend is similar for self-testing, where females account for 65.32%, and males make up 34.68%. In terms of the last HIV test, self-testing is more prevalent among individuals who were tested within the past 12 months (63.51%), while conventional testing is more common among those whose last test was over a year ago. Subdistrict analysis shows that conventional testing is most frequent in Tygerberg (20.06%) and Khayelitsha (16.87%), followed by Western (13.24%) and Eastern (12.45%). In contrast, self-testing is more widely utilized in Western (19.38%), Southern (15.33%), and Mitchell's Plain (16.97%).

The bivariate logistic regression indicated that age was a significant factor influencing self-testing preferences, with the likelihood of using HIVST decreasing with age. Individuals aged 20-24 had 20% lower odds of using self-testing compared to adolescents aged 18-19 (OR = 0.80, 95% CI: 0.76–0.85, $p < 0.005$). Those aged 25-49 had 47% lower odds compared to the adolescent group (OR = 0.53, 95% CI: 0.51–0.56, $p < 0.005$), and adults aged 50 and above had 86% lower odds (OR = 0.14, 95% CI: 0.13–

0.15, p < 0.005).

Additionally, for facility testing those who had tested for HIV within the last 12 months were more inclined towards self-testing. In contrast, individuals who last tested more than 12 months ago were 77% less likely to choose self-testing (OR = 0.23, 95% CI: 0.22–0.25, p < 0.005), and those who had never been tested were 40% less likely (OR = 0.60, 95% CI: 0.54–0.67, p < 0.005) to use self-testing.

HIVST was more popular among people living in areas with a high concentration of registered ART patients. Specifically, the odds of choosing self-testing increased by 32% in high-density areas (≥30,001 registered ART patients) (OR = 1.32, 95% CI: 1.28–1.37, p < 0.005) and by 53% in medium-density areas (20,001–30,000 registered ART patients) (OR = 1.53, 95% CI: 1.49–1.58, p < 0.005), compared to areas with fewer than 20,000 registered ART patients.

On the other hand, people living in areas with a higher number of healthcare facilities were more likely to choose conventional HIV testing. The odds of self-testing decreased by 15% in subdistricts with a medium number of healthcare facilities (15–25 facilities) (OR = 0.85, 95% CI: 0.82–0.87, p < 0.005) and by 27% in areas with a high number of facilities (26 or more) (OR = 0.73, 95% CI: 0.71–0.76, p < 0.005), relative to areas with fewer than 15 facilities.

Additionally, communities with a high number of newly enrolled ART patients (≥2,901) showed a 31% lower likelihood of opting for self-testing (OR = 0.69, 95% CI: 0.67–0.72, p < 0.005).

Subdistrict variations were evident, with Southern (OR = 2.04, 95% CI: 1.94–2.13, p < 0.005) and Mitchell's Plain (OR = 2.12, 95% CI: 2.03–2.23, p < 0.005) showing more than twice the odds of self-testing compared to the Eastern subdistrict. Other subdistricts with significantly higher odds of self-testing included Western (OR = 1.63, 95% CI: 1.56–1.71, p < 0.005) and Klipfontein (OR = 1.12, 95% CI: 1.06–1.18, p < 0.005). Conversely, Northern (OR = 0.52, 95% CI: 0.48–0.55, p < 0.005), Tygerberg (OR = 0.55, 95% CI: 0.52–0.57, p < 0.005), and Khayelitsha (OR = 0.97, 95% CI: 0.83–0.91, p < 0.005) had significantly lower odds.

Finally, testing preferences assessed through the multivariate logistic regression model highlighted the influence of both individual- and community-level factors. Consistent with the bivariate analysis findings, age remained a strong predictor of HIVST. Individuals aged 20–24 had 23% lower odds of using self-testing compared to those aged 18–19 (OR = 0.77, 95% CI: 0.73–0.82, p < 0.005), while those aged 25–49 had 49% lower odds (OR = 0.51, 95% CI: 0.48–0.53, p < 0.005). The oldest age group (50 years and above) had 86% lower odds of choosing self-testing compared to the youngest group (OR = 0.14, 95% CI: 0.13–0.15, p < 0.005).

Individuals residing in communities with a medium (20,001–30,000) and high (≥30,001) number of registered ART patients had 240% (OR = 3.40, 95% CI: 3.18–3.65) and 182% (OR = 2.82, 95% CI: 2.70–2.96, p < 0.005) higher odds of using self-testing, respectively, compared to those in areas with low ART caseloads (<20,000).

Additionally, living in areas with more newly enrolled ART patients was negatively associated with self-testing. Residing in communities with a medium number of new ART patients (1,800–2,900) was associated with 68% lower odds of self-testing (OR = 0.32, 95% CI: 0.29–0.34, $p < 0.001$), while living in areas with a high number of new ART initiations (≥2,901) was associated with 81% lower odds (OR = 0.19, 95% CI: 0.18–0.21, $p < 0.001$), compared to areas with a low number of new ART patients (<1,800).

Unlike in the bivariate analysis, gender also played a significant role in the multivariate model, with females having 8% lower odds of choosing self-testing compared to males (OR = 0.92, 95% CI: 0.90–0.94, $p < 0.005$). Additionally, individuals who received a positive HIV test result had 9% lower odds of having used self-testing compared to those who tested negative (OR = 0.91, 95% CI: 0.84–0.98, $p = 0.005$). The number of healthcare facilities was also positively associated with self-testing uptake. Living in areas with a medium (15–25) or high (≥26) number of healthcare facilities increased the odds of self-testing by 13% and 34%, respectively (OR = 1.13, 95% CI: 1.09–1.17, $p < 0.005$; and OR = 1.34, 95% CI: 1.26–1.43, $p < 0.005$), compared to areas with a low number of facilities (0–14).

Conclusion

In conclusion, the study underscores the complex interplay of individual and community-level factors influencing HIV testing preferences in Cape Town. Younger age, recent HIV testing history, male gender, and residence in areas with higher number of registered ART patient and more healthcare facilities were associated with increased likelihood of HIV self-testing (HIVST). Conversely, older age, female gender, living in communities with more newly initiated ART clients, and receiving a positive HIV diagnosis were linked to a lower likelihood of using HIVST. Geographic disparities across subdistricts further highlight the need for targeted, context-specific strategies to enhance HIV testing uptake, particularly among underrepresented groups, and to optimize the reach and impact of self-testing interventions.

Part A: Structured Literature Review

This section covers four key aspects of HIV self-testing (HIVST) examined in this study. First, it provides an overview of HIVST, including its benefits, challenges, and broader public health implications. Second, it examines the factors influencing the choice of HIVST as a testing method. Third, it outlines the relevant HIVST frameworks, including both conceptual and organizational perspectives. Finally, it presents a methodological literature review related to HIVST.

The literature incorporated in this conceptual overview was obtained from various electronic databases, including PUBMED, PLOS, COCHRANE OPEN ACCESS, GOOGLE SCHOLAR, SPRINGER LINKS, CINAHL, and Gray Literature. The search terms used were: HIVST, benefits, challenges, factors associated with HIVST, socio-ecological framework of HIVST, and strategies to improve the uptake of HIVST. Additionally, a manual search for the references cited in the included articles was conducted to enhance the review.

1. Background

1.1. Introduction

The WHO estimates that 85% of people living with HIV in eastern and southern Africa are aware of their HIV status. (Marsh et al., 2019) This progress has been largely driven by a range of HIV testing modalities, including facility-based testing, community-based testing, index testing, and HIV self-testing, which have significantly expanded HIV testing coverage.(Chamie et al., 2021) However, substantial gaps in status awareness still exist among certain demographic and socioeconomic subgroups, such as men, young adults, rural residents, and individuals with lower income or education levels. (Chamie et al., 2021) Consequently, HIV testing efforts have shifted to prioritize reaching the remaining 10–20% of people living with HIV who have not yet been diagnosed.

To bridge these gaps, it is essential to strategically use a variety of HIV testing approaches that enhance both reach and effectiveness.(Cambiano et al., 2019) Methods such as index testing and self-testing have been particularly effective in reaching high-risk groups, including men and individuals who are less likely to access traditional health facilities or community-based services.(Chamie et al., 2021) Research conducted in sub-Saharan Africa has demonstrated that HIVST is especially effective in increasing testing coverage among men, youth, and key populations compared to other HIV testing methods.(Pettifor et al., 2020) Consequently, over the past five years, HIVST has emerged as a leading and innovative strategy with the potential to significantly improve testing coverage among hard-to-reach populations.(Cambiano et al., 2019; Ingold et al., 2019)

The first rapid HIV test was approved in 2002 (Hurt & Powers, 2014), followed by its authorization for use outside clinical settings, making HIV self-testing (HIVST) a reality. Many HIV self-testing kits are adapted versions of HIV rapid diagnostic tests (RDTs) originally designed for use by healthcare professionals. These kits have been modified and repackaged to be user-friendly so that untrained individuals can accurately perform the test on their own. The modifications typically include simplified instructions, easy-to-use components, and built-in safeguards to minimize user error. (Venter et al., 2017) HIVST provides users with immediate and direct results. The process is simple: users collect a specimen using an oral swab or fingerstick, place it in a vial of fluid to incubate, and read the results in about 20 minutes. Individuals who receive a positive result through self-testing are usually directed to counselling services and confirmatory testing, as recommended in accompanying guidelines (Hurt & Powers, 2014).

The HIVST kit provides simple positive or negative results for HIV antibodies without measuring their quantity and is intended for use by individuals testing themselves without the immediate involvement of a healthcare worker (Bwana et al., 2018). The kit detects both HIV-1 and HIV-2 antibodies in finger-prick whole blood or saliva. Once the user applies the sample to the test device, it moves across the test strip by capillary action. If HIV antibodies are present, they bind to a recombinant HIV antigen conjugated with colloidal gold. A positive result is indicated by the appearance of two-colored lines: one serving as an internal control, and the other indicating the presence of the HIV-1/2 antibody-antigen complex. If the control line does not appear, the test is considered invalid, and the user must repeat the test using a new kit (Hermanus & O'Grady, 2022).

Over time, HIV testing strategies have advanced significantly, leading to the development of various HIV tests. A notable milestone occurred in 2012 with the approval of the OraQuick oral point-of-care (POC) HIVST for over the counter (OTC) sales. Although it is less sensitive than blood tests, OraQuick has the potential to help more people know their HIV status, potentially preventing thousands of cases of HIV transmission. This crucial decision played a key role in normalizing HIV diagnosis, a process often overshadowed by stigma and discrimination. (Pant Pai et al., 2013)

1.2. Key aspects of HIVST

Many countries in sub-Saharan Africa, including South Africa, now report having met or surpassed the first 90 of the UNAIDS 90-90-90 targets, which aim to have 90% of all people living with HIV aware of their status. Despite these achievements, significant gaps in HIV status awareness persist within certain demographic and socioeconomic subgroups, particularly among men, young adults, rural residents, and individuals with lower income and educational levels. (Chamie et al., 2021) In South Africa, several reports have indicated an enhancement in HIV testing rates, but these rates remain

alarmingly insufficient among both the young population and males (Jooste et al., 2021).HIVST has been recommended as a supplementary testing strategy to traditional HIV testing services (HTS), specifically targeting underserved populations such as men, adolescents, and key populations (Cambiano et al., 2019; Ingold et al., 2019; C. C. Johnson et al., 2017). Moreover, when HIVST is integrated into broader HIV testing strategies, it has been shown to further enhance both coverage and uptake of testing services. (Choko et al., 2019) These findings underscore the importance of incorporating HIVST into comprehensive HIV testing frameworks to ensure that testing efforts are inclusive and reach those populations most in need.

Despite its potential, the rollout of HIVST in low- and middle-income countries (LMICs) was slow. By 2015, three years after its initial approval in the U.S. (Ingold et al., 2019), access to HIVST in LMICs remained limited, primarily due to policy, regulatory, and market challenges that hindered its wider adoption. (Wong et al., 2014) Unitaid, a global health initiative that was established to improve access to treatments and diagnostic tools for diseases including HIV/AIDS, launched in 2015 a project to advance the HIVST market by ensuring its safety, shaping supportive policy frameworks, and driving demand across key populations. (Ingold et al., 2019) This initiative led to the five-year study on HIVST, "HIV Self-Testing in Africa (STAR) Initiative," which laid a strong foundation for introducing HIVST in low- and middle-income countries (LMICs), demonstrating that HIVST could effectively address testing gaps and be cost-efficient. These positive outcomes facilitated the rapid scale-up of HIVST implementation starting in 2015. (Ingold et al., 2019) Furthermore in 2016, the World Health Organization (WHO) issued new guidelines highlighting the importance of HIVST to expand the reach and accessibility of HIV testing services (World Health Organization, 2015). The WHO framework offers a comprehensive and adaptable plan for countries to implement HIVST effectively, with the aim of supporting global efforts in HIV prevention and control. This framework emphasizes integrating HIVST into existing health systems to complement traditional HIV testing services while ensuring it is accessible to all, particularly in underserved and hard-to-reach populations. It also advocates for the development of national policies tailored to local contexts and underscores the importance of community-based approaches to enhance accessibility. (World Health Organization, 2016)

In South Africa, HIV self-testing (HIVST) was incorporated as a supplementary strategy in the National HIV Testing Services Policy in 2016 (South African Department of Health, 2016). Subsequently, specific guidelines on HIVST were included in the South African National Strategic Plan for HIV, Sexually Transmitted Infections, and Tuberculosis 2017–2022. This plan provides additional guidance to the 2016 policy, with a focused emphasis on the implementation and scale-up of HIVST (Venter et al., 2017). In line with these national frameworks, HIVST was gradually introduced in various provinces, including the Western Cape, through a combination of government-led initiatives and NGO-supported pilot programs, such as those supported by Unitaid and PEPFAR (Johnson et al., 2019). These efforts

aimed to integrate HIVST into existing community testing services, particularly in high-prevalence areas. This policy and programmatic environment form the backdrop of the current study and directly shaped access to HIVST in the study setting.

HIVST represents a crucial advancement in the fight against HIV/AIDS, allowing individuals to test themselves for HIV privately and conveniently. This process involves individuals collecting their own samples, either oral fluid or blood, performing the test, and interpreting the results independently (Wulandari et al., 2019). HIVST is done through two different testing strategies, the supervised and unsupervised strategies. With the supervised strategy participants perform the test themselves with the assistance of a counsellor or health care professional. In contrast, with the unsupervised strategy, the individual performs and interprets the HIVST himself before seeking assistance for counselling and linkage to care (Pai et al., 2013). Contrary to the conventional HIV testing where a tester pricks the person to perform the HIV test, the HIVST gives people the opportunity to test and diagnose themselves, consequently increasing clients' privacy, and confidentiality (Krause et al., 2013)

HIVST kits are distributed via primary and secondary methods. In primary distribution, kits are delivered directly to the end-user. Secondary distribution involves providing kits to individuals who then distribute them to sexual partners, family members, or others in their network. Distribution channels include community-based platforms, where healthcare workers offer kits through door-to-door delivery or community collection points; facility-based channels, which distribute kits in settings such as antenatal and postnatal clinics, STI clinics, and family planning sites to encourage partner testing; workplace programs, which target high-risk groups like miners and truck drivers using both direct and secondary distribution; and other outlets like pharmacies, internet-based sales, and vending machines where individuals can buy or order the kits. HIVST is designed to supplement, not replace, existing HIV testing methods, aiming to reach those who are not easily accessed by traditional approaches. (National HIV Self Screening Guidelines, 2018)

In terms of accuracy, several studies have demonstrated high specificity for both supervised and unsupervised HIVST strategies across various settings. However, there is significant variability in sensitivity estimates, with lower sensitivity observed in studies using the unsupervised strategy. Lower sensitivity has also been reported in high-prevalence settings, often linked to poor adherence to HIVST instructions. (Pant Pai et al., 2013)

Additionally, a modelling study on the cost-effectiveness of different HIVST distribution methods found that distribution through primary healthcare centres was the least cost-effective in terms of life years saved and HIV infections prevented due to a lower HIV positivity rate. However, secondary distribution to partners of ART patients showed the greatest epidemiological impact, albeit at a higher cost, while workplace distribution was cost-saving but had only a moderate impact on preventing HIV

Infections. (Cambiano et al., 2019)

1.3. Benefits of HIVST:

Previous studies have shown that HIV self-testing (HIVST) is a safe and suitable HIV testing strategy for both key and general populations (Choko et al., 2015; Eshun-Wilson et al., 2021; Krause et al., 2013). Several studies have also demonstrated a high level of acceptance of HIVST among the general population and other key groups (Figueroa et al., 2015; Pant Pai et al., 2013; Stevens et al., 2018; World Health Organization, 2015). Unlike conventional HIV testing, where a healthcare provider performs the test, HIVST allows individuals to test and diagnose themselves. This autonomy enhances privacy and confidentiality (Krause et al., 2013). HIVST is designed to address barriers commonly associated with traditional testing methods, such as stigma, lack of privacy, and the logistical challenges of accessing healthcare facilities. It empowers individuals by giving them control over their health decisions and has been shown to increase the frequency of testing, especially among populations at higher risk (Qin et al., 2018; Rose et al., 2021). Additionally, both supervised and unsupervised HIVST approaches are more likely to result in partner self-testing (Pant Pai et al., 2013).

HIV self-testing has proven to be user-friendly and accurate, with untrained individuals achieving an average correct result rate of 98.6%. (Donovan et al., 2004) HIVST has been proposed for a long time as a method to boost the number of people undergoing HIV testing, thus increasing the testing rates among the general population in sub-Saharan Africa, and particularly among hard-to-reach populations.(C. C. Johnson et al., 2017) High positivity rates have been observed for both the Community and the facility based HIVST, approximately 8% and even higher with the facility HIVST (Cambiano et al., 2019; C. C. Johnson et al., 2017). However, it is important to note that these positivity rates may decline with the saturation of a particular distribution model, as countries approach their testing targets (Giguère et al., 2021)

HIVST makes testing available to individuals in remote or underserved areas who might not have easy access to healthcare facilities. It can be done any time and place, offering flexibility for those with busy schedules or limited mobility. (Pant Pai et al., 2013) Another attractive aspect for users is the short time (below 30 minutes) required for testing and reading the results. (Stevens et al., 2018) HIVST has been described as potentially cost savings for health systems. (Cambiano et al., 2015) Furthermore, the community based HIVST targeted to adult men has also been recommended as a strategy to avert of many HIV infections (Cambiano et al., 2019).

Moreover, it's been demonstrated that HIVST was the preferred testing strategy for many Africans and could reach those at high risk of HIV and do not test (Ingold et al., 2019) Oral-fluid tests being more attractive because they were simple to use, painless, and did not require a blood sample. (Figueroa et al., 2015) A study conducted in Kwazulu Natal SA, focused on examining the impact and

acceptance of HIV self-testing (HIVST), found that women exhibited a higher rate of HIV testing service (HTS) utilization compared to men. In contrast, men showed a notably lower engagement in HIV testing, primarily opting for it out of convenience (Harichund et al., 2019). As a result, HIV testing approaches that prioritize convenience and confidentiality, such as community- based methods and HIV self-testing, have led to higher rates of HIV testing among men (Hlongwa et al., 2019).

1.4. Challenges of HIVST:

Despite the above benefits of HIVST, critics have argued that the potential advantages of expanding access to testing may be outweighed by the risk of missed diagnoses due to false-negative results (Hurt & Powers, 2014). This limitation of HIVST, which is common to other antibody-based tests, is attributed to its inability to detect HIV during the "window period", the time between initial infection and seroconversion, a period that is characterised by increased infectiousness to others. Educating users that a negative result does not completely rule out the possibility of HIV infection is significantly more challenging in the context of self-testing (Wood et al., 2014). Furthermore, the higher costs of oral fluid-based self-tests, which are commonly preferred, present a substantial barrier, despite the availability of more affordable blood-based alternatives (Chamie et al., 2021).

The difficulty in promptly providing counselling after self-testing represents a missed opportunity to ask essential questions, discuss prevention services, and facilitate linkage to care for those who test positive (Choko et al., 2015; Kelvin et al., 2016). A frequent argument against unsupervised HIVST is the lack of formal counselling both before and after testing (Wood et al., 2014). A false-negative test result may lead to false reassurance, while receiving a positive result in isolation may may lead to psychological reaction or other adverse events, including suicide. (Krause et al., 2013; Wood et al., 2014).

The unsupervised HIV self-testing presents a particular challenge by moving the test out of healthcare facilities, complicating the verification of results for individuals who self-test. The difficulties arise in verifying whether individuals have actually used the self-tests, as this often relies on self-reporting. (Chamie et al., 2021) Verification involves methods that can link the test result to the person performing the self-test, which is essential for confirming HIV status, ensuring linkage to care, and supporting routine surveillance. This challenge can impact HIV service programs and make it difficult to measure HIV prevalence within a population, determine the proportion of people aware of their HIV status, and conduct epidemic surveillance. (Tahlil et al., 2020) Furthermore, providing adequate support and ensuring that individuals who test positive for HIV are connected to appropriate care services also remains a challenge. (Chamie et al., 2021)

1.5. Public health impact of HIVST

HIVST was officially adopted in 2015 at a global policy level, with the WHO including it in their Consolidated Guidelines on HIV Testing Services. (WHO, 2015) HIVST remains an important approach toward the first of the first UNAIDS target of having 95% of PLHIV knowing their HIV status by 2025 (Pereira et al., 2019). A systematic review comparing HIVST to conventional HIV testing in the general population found that HIVST doubled the rate of testing uptake. This increase was observed across various HIVST delivery models and support tools. Importantly, HIV testing uptake increased with a range of HIVST delivery models and support tools. HIVST can achieve HIV positivity and linkage rates similar to that with standard HIV testing and identify individuals with HIV who may not otherwise test. (Jamil et al., 2021)

Importantly, HIVST achieved similar rates of HIV positivity and linkage to care as conventional testing, successfully identifying individuals who might not have otherwise been tested. (Jamil et al., 2021) HIVST has led to higher rates of testing, particularly among hard-to-reach populations. (Johnson et al., 2017) This testing method complements existing HIV prevention and treatment programs, enhancing overall public health strategies aimed at controlling and eventually ending the HIV epidemic (UNAIDS, 2017), as more frequent testing allows for earlier diagnosis, which is crucial for effective treatment and reducing the viral load in individuals, and therefore reduces the transmission of the virus. (Figueroa et al., 2015)

HIVST empowers individuals to take charge of their health, fostering greater engagement with HIV prevention and treatment efforts. (Greacen et al., 2012) Given its potential to raise awareness of HIV and reduce the number of undiagnosed HIV-infected individuals, one could expect an overall positive benefit by increasing the number of people who know their HIV status. However, there could be a negative public health impact if highly infectious individuals are falsely reassured by recent negative antibody test results. (Stekier et al., 2009)

In South Africa, HIVST was included as a supplementary strategy in the National HIV Testing Services Policy in 2016. Subsequently, guidelines for HIVST were included in the South African National Strategic Plan for HIV, sexually transmitted infections and tuberculosis 2017–2022. (Venter et al., 2017) Despite the implementation of HIVST, South Africa continues to face a significant HIV burden, with nearly 8 million people living with the virus and HIV-related deaths accounting for over 23% of all fatalities in 2019 (L.F. Johnson et al., 2022; Hansoti et al., 2018; Jamieson et al., 2021). The Western Cape province particularly experienced the largest increase in HIV prevalence nationwide between 2012 and 2017, rising from 5% to 9.1%. Within this context, the City of Cape Town has become a critical focus area, with its HIV prevalence increasing significantly from 5.2% in 2012 to 9.7% in 2017. (Simbayi et al., 2021) Cape Town's high HIV prevalence within the province, coupled with gaps in meeting the

first and second UNAIDS 90-90-90 targets (87.8%, 76.2%, and 92.4% in 2017 for individuals aged 15 to 64 years) (Simbayi et al., 2021), underscores the pressing need for targeted, localized interventions. To address the HIV testing challenge, the Western Cape Department of Health (WC DoH) implemented the scale-up implementation of HIVST in Cape Town in March 2021 during the COVID-19 pandemic. HIVST presents a promising solution by offering a private, accessible, and convenient testing option, particularly for underserved populations. By understanding the factors that influence its adoption, utilizing the socio-ecological framework, and acknowledging its extensive public health impact, we can fully harness its potential to enhance health outcomes and achieve public health objectives. (World Health Organization, 2020)

2. Theoretical frameworks

2.1. Health Belief Model (HBM)

Previous research conducted in China on HIVST has indicated that the uptake of HIVST among users is closely linked to their perceived benefits. These perceived benefits include factors such as ease of use, convenience, and assurance of privacy (Li et al., 2021). This observation aligns with the principles of the Health Belief Model (HBM), which posits that individuals' perceptions of the advantages of using health services can significantly shape their attitudes and continued use of those services, ultimately influencing their behaviour (Maiman & Becker, 1977). The HBM has been applied in various contexts, including health behaviours and interventions related to disease prevention, health screening, and health promotion. It provides insight into how individuals assess the benefits of health-related actions and how these assessments influence decision-making. However, it is important to note that the HBM has been criticised for its potential oversimplification of health behaviour and for not fully accounting for the broader social and contextual factors that also influence behaviour. Neighbourhood contexts, for instance, have been shown to have an independent effect on health outcomes, beyond individual-level characteristics (Diez Roux, 2002). This highlights the need to consider both individual and broader social and environmental factors when examining health-related behaviours (Merlo et al., 2006). Therefore, this study will use the Social-Ecological Model (SEM) as the framework to allow for the simultaneous examination of both individual and area-level influences on HIVST outcomes.

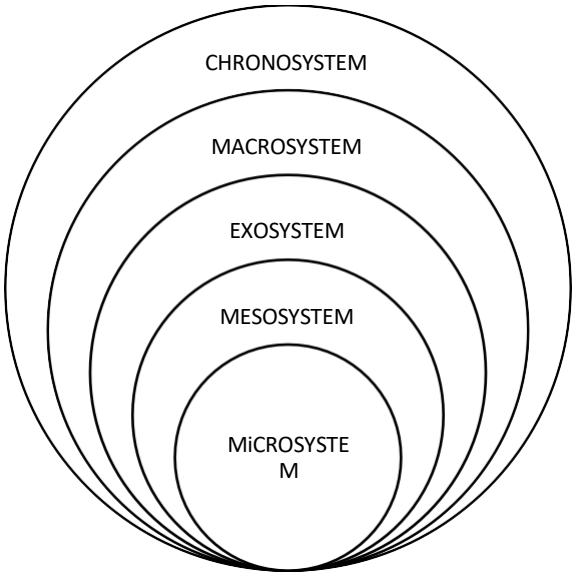
2.2. Social-Ecological Model (SEM)

The Socio-Ecological Model (SEM) was initially introduced by Urie Bronfenbrenner in the 1970s as a framework to enhance our comprehension of human development. Over time, this conceptual model gained recognition and was formally established as a theory in the 1980s, highlighting the complex

interplay between individuals and the environments they live in. (Brofenbrenner & Hess, 1979) Bronfenbrenner's original theory, summarized in Figure 1, is represented by a series of nested circles, with the individual at the centre, surrounded by different systems. The innermost layer, the microsystem, exerts the most significant influence, encompassing interactions and relationships within the individual's immediate environment. The next layer, the mesosystem, goes beyond direct interactions, incorporating places and people the individual regularly engages with, such as work, school, church, and their neighborhood. The exosystem, while not directly interacting with the individual, still affects them by exerting positive or negative forces, such as through community contexts and social networks. The macrosystem includes broader societal, religious, and cultural values and influences. Lastly, the chronosystem encompasses the dimension of time, capturing both internal and external elements, including historical context; in updated versions of the model, this also includes the influence of policies. (Kilanowski, 2017)

The SEM suggests that health is shaped by the interaction of multiple factors, such as individual characteristics, community influences, and broader environmental conditions. These environmental factors include physical, social, and political dimensions, all of which contribute to health outcomes. Rather than being determined solely by individual traits, health is understood as the product of the combined effects of these various layers. The SEM is a widely recognized framework for understanding and predicting behaviors related to preventive health measures. This model's strength lies in its ability to consider multiple levels of influence; individual, interpersonal, community and societal levels, on health behaviors (Adebayo & Gonzalez-Guarda, 2017)

Figure 1: Social-Ecological Model (SEM) (Brofenbrenner & Hess, 1979)



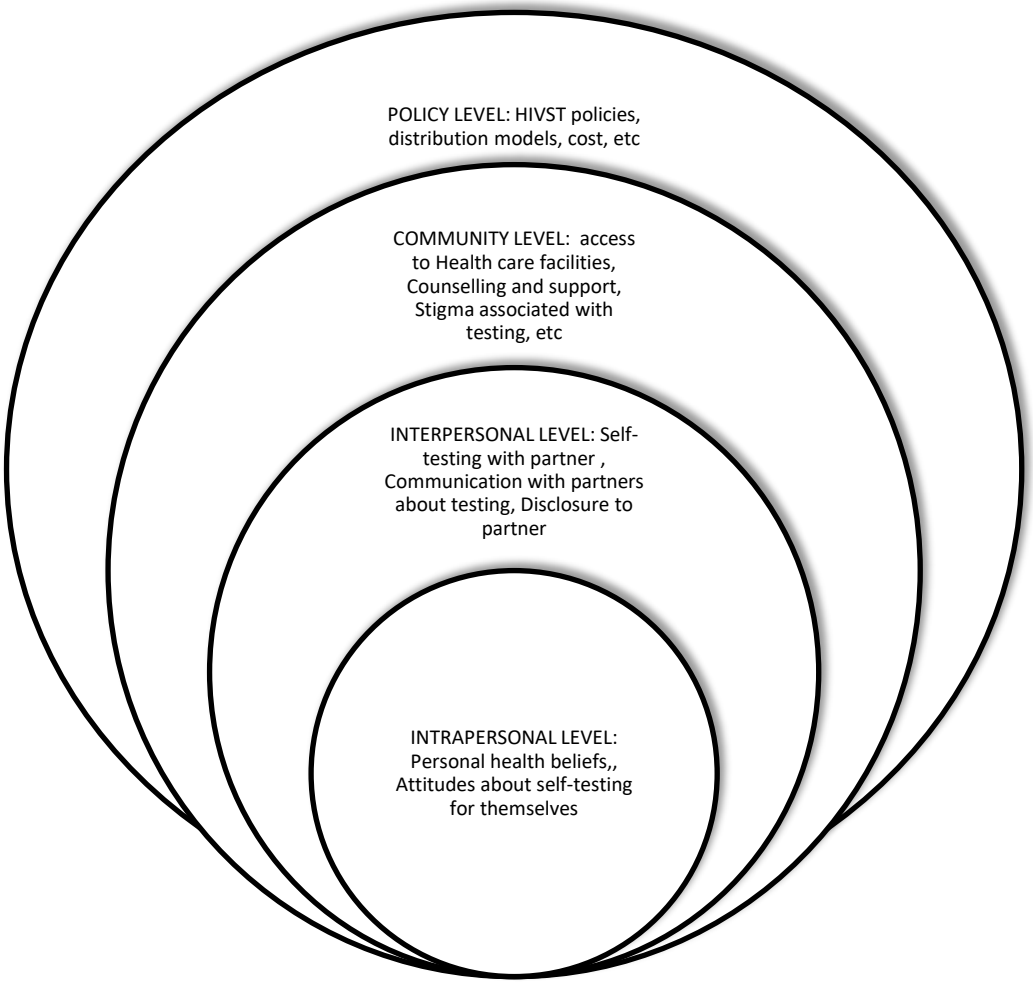
Subsequent revisions and adoptions use the SEM to represent multilevel approaches to different areas, including health promotion initiatives, public health, violence prevention, healthy college campuses, geriatric preventive health, etc. (Decker et al., 2018; Kilanowski, 2017) McLeroy and colleagues expanded Bronfenbrenner's SEM to examine how individual, social, and environmental factors influence the uptake of health promotion interventions.(Mcleroy et al., 1988) Their expanded model specifically highlights intrapersonal factors, interpersonal processes, institutional influences, community dynamics, and public policies as key elements that impact health behaviors and intervention adoption.(Mcleroy et al., 1988) The theory posits that health-seeking behavior often stems from a combination of both internal and external environmental factors, summarized in Figure 2 below . (Christian et al., 2020)

Various studies have identified a range of socio-economic factors associated with HIV testing across different populations and regions. Stigma, socioeconomic status, perceived barriers to HIV services, perceived HIV risk, comprehensive HIV knowledge, and religious and sociocultural influences are some of the key factors examined in HIV testing. For instance, a study conducted in South Africa exploring the association between socio-economic factors and HIV self-testing knowledge among South African women revealed that knowledge of HIVST is relatively low in this group. In addition, low socio-economic status was associated with lower levels of HIVST knowledge (Ekholuenetale et al., 2022).

In Vietnam, educational level, occupation, and the source of HIV information were linked to knowledge and attitudes toward HIV, including testing (Hoang et al., 2019). Similarly, a study conducted in Iran among people who inject drugs found that HIV testing was associated with factors such as education, income, perceived HIV risk, and lower HIV-related stigma (Bayani et al., 2020).

A study evaluating factors associated with HIVST use in Kenya identified age, habitual testing, self-care or partner care, confirmatory testing, and immediate linkage to care upon testing positive as important influencing factors (Ndungu et al., 2023). Additionally, university students who perceived themselves to be at higher risk for HIV were more likely to seek testing. In Nigeria, there is a significant connection between occupation, education level, and awareness of voluntary counselling and testing for HIV among women of reproductive age (Abdullahi Nasir, 2018).

Figure 2: Social–ecological factors impacting choice in self-administered HIV testing (Christian et al., 2020)



2.3. This study conceptual framework

Incorporating the SEM into our study framework offers a comprehensive perspective on the factors influencing the uptake of HIVST in Cape Town. A simplified version of the SEM was used to structure the analysis and interpretation of quantitative data on HIVST in the region. Specifically, a two-level hierarchical model was applied to examine the relationship between community characteristics and HIVST uptake.

While the study was initially conceptualized using the full SEM and a two-level hierarchical model, the use of secondary routine data limited access to several key variables typically required for a complete SEM approach, such as education, marital status, employment, HIV risk perception, and media exposure. Consequently, the framework was adapted to focus on the individual and community level indicators available within the dataset. This limitation is acknowledged, and the modified model was used to guide the analysis within the constraints of the existing data.

At the individual level, we will examine biological factors and personal histories that may increase the likelihood of choosing HIVST as a testing option. These factors include age, gender, the time elapsed

since the individual's last HIV test, and the HIV status reported during the test.

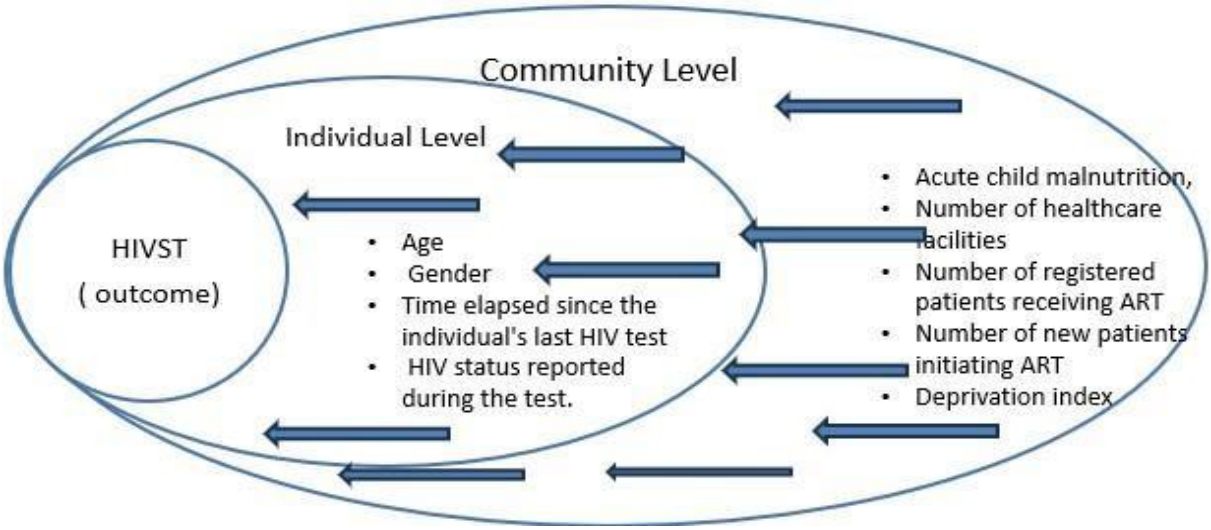
At the community level, we will draw from the latest data provided by the City of Cape Town (City of Cape Town, 2021; City of Cape Town Metropolitan Municipality Profile: City of Cape Town Metro, 2021). We will use child acute malnutrition as a proxy indicator for economic status, recognizing its association with poverty and economic conditions. For instance, families living in poverty may face challenges affording nutritious food for their children.

Additionally, we will consider the number of healthcare facilities in each community, as this can serve as an indicator of access to healthcare services. A higher number of healthcare facilities generally suggests better access to healthcare services for the local population. We will also analyse the total number of registered patients receiving antiretroviral therapy (ART), which can provide insights into the prevalence of HIV within the population. A higher number of registered patients on ART may indicate a higher prevalence of HIV, signifying a significant burden of HIV/AIDS in that specific subdistrict.

Furthermore, we will explore the number of new patients initiating ART in each subdistrict, which can offer valuable insights into the incidence of new HIV infections. A higher number of new patients on ART may suggest a higher incidence of new HIV infections in the respective subdistrict, indicating ongoing virus transmission in that area.

Finally, we will include the deprivation index, which represents a multidimensional measure of socio-economic disadvantage within specific communities. It is designed to assess and quantify various aspects of socio-economic well-being and living conditions at a local level.

Figure 2: Two level socio-ecological model



3. Methodological review

Research on HIVST uptake employs a range of methodologies, each contributing unique insights into the factors influencing its adoption. Qualitative studies, such as interviews and focus groups, have been particularly effective in exploring attitudes, motivations, and barriers to HIVST, providing valuable contextual insights into individual and community perspective.(Nicholls et al., 2022; Ntsepe et al., 2014) These approaches excel at capturing the depth and nuance of lived experiences, but they are often constrained by small, non-representative samples and potential researcher bias. This can limit the generalizability of findings and their application to broader populations.

Quantitative methods, such as surveys and regression analyses, offer a complementary perspective by providing representative data on trends and associations between socio-demographic factors and HIVST uptake. Surveys, while useful for identifying correlations (Daniel et al., 2024; Ekholuenetale et al., 2022), often lack the causal directionality necessary to inform interventions and rely heavily on self-reported data, which can introduce response bias associations. Regression analyses, particularly logistic regression, are well suited for examining the relationships between demographic and contextual variables and offer actionable insights into determinants such as education levels and prior HIV testing (Ekholuenetale et al., 2022). However, these approaches often focus narrowly on socio-demographic factors, overlooking the complex interplay with contextual determinants.

Other methodologies, including modelling studies, pilot implementation studies, Systematic reviews, and mixed methods research, provide additional perspectives. Modelling studies predict the impact and cost-effectiveness of HIVST interventions (Cambiano et al., 2015, 2019), offering valuable insights for policymakers, though they often oversimplify real-world complexities interventions. Pilot and implementation studies assess the feasibility, acceptability, and scalability of various delivery models (Wulandari et al., 2019, 2020), contributing practical insights for real-world interventions but remain limited to specific contexts. Systematic reviews consolidate findings from multiple studies to identify common themes, such as convenience and privacy, as key motivators. (Figueroa et al., 2015) Mixed methods research integrating quantitative and qualitative insights provides a holistic view of barriers and facilitators to HIVST uptake. (Bwalya et al., 2020)

A common limitation of these methodologies is their failure to integrate contextual determinants with socio-demographic factors within a statistically rigorous framework, reducing the applicability of their findings for designing targeted interventions. To address this, the study employs a robust quantitative framework that combines descriptive statistics to identify trends with logistic regression to analyses relationships between variables. By incorporating both individual and contextual factors, it provides a comprehensive understanding of the drivers of HIVST uptake in Cape Town. The use of binary logistic regression strengthens this approach by enabling precise estimation of the odds of HIVST uptake while controlling confounders. Consequently, this quantitative approach offers greater rigor, broader

representativeness, and reduced biases, enhancing its generalizability to similar urban and peri-urban African contexts. (Hosmer et al., 2013).

4. Empirical Review

This section reviews studies that have examined the uptake of HIVST and the factors influencing it. A range of methodologies from various studies were analysed. The studies reviewed were sourced from the following databases: PUBMED, PLOS, COCHRANE Open Access, Google Scholar, Springer Link, and the Cumulative Index to Nursing and Allied Health Literature (CINAHL). Search terms included "HIV self-testing" or "HIVST uptake" along with "factors associated with HIVST uptake." Studies were included if they investigated the relationship between HIVST uptake and associated factors and involved human participants. In these studies, participants were required to collect their own specimens, administer their own HIV tests, and interpret the results themselves. Exclusion criteria applied to animal studies, studies using stored specimens, those not published in English, lacking full-text access, or not focused on the association between HIVST uptake and related factors. Additionally, studies were excluded if participants collected a sample but did not perform or interpret the HIV test themselves, as they did not meet the definition of HIVST.

The uptake of HIV testing services is shaped by a complex interplay of demographic, socio-economic, and behavioural factors. To better understand these influences, we have categorized them into three key dimensions: individual-level factors, community-level factors, and policy-level factors.

4.1. Individual-Level Factors

Key determinants such as age, sex, education level, marital status, wealth status, place of residence, and media exposure play a crucial role in shaping individuals' knowledge and attitudes towards HIVST in South Africa. (Ekholuenetale et al., 2022) Previous research found that HIVST uptake was higher among married women, those with children, and individuals with higher education or wealth, with men engaging in condomless sex also more likely to opt for self-testing. (Indravudh et al., 2020; Pillay & Johnson, 2021) In Malawi, an assessment of outpatients who opted out of testing revealed that risky sexual behaviour and good self-rated health were positively associated with the decision to decline HIVST. (Shaba et al., 2023) A study on the social responses to HIV self-testing in households found that literacy and age significantly influenced the accurate use of HIVST kits. (Bwalya et al., 2020) Similarly, earlier research showed that HIVST was more common among younger, well-educated, higher-income men who have sex with men, particularly those who disclose their sexual orientation and perceive discrimination. (Chiu & Young, 2016) Among women, factors influencing HIVST utilization include age, with older women more likely to self-test, along with education level, wealth, employment, media exposure, and knowledge of modern contraception. (Terefe et al., 2024) In Malawi, HIVST uptake was consistently higher among married women, those with children, and

individuals with higher education or wealth, while men reporting condomless sex were also more inclined to self-test. (Indravudh et al., 2020; Pillay & Johnson, 2021) HIVST requires a basic level of literacy and independence to ensure proper test execution and follow-up, which highlights the need for targeted education and outreach initiatives across various socio-economic groups. Individuals with limited knowledge of HIVST are less likely to use self-testing, while motivation is critical to ensuring confidence in conducting and interpreting the test. (Daniel et al., 2024) In South Africa, awareness of HIVST tends to be higher among individuals living in urban areas, those with higher education levels, and individuals from affluent households, largely due to increased exposure to media and health information campaigns. (Awopegba et al., 2021) Increased access to HIV information and greater control over the decision to get tested are linked to higher testing rates, with educational achievement, employment status, and income generation also contributing to this association. (Jooste et al., 2021) These factors not only affect awareness but also influence individuals' motivations to adopt HIVST as an alternative to traditional clinic-based testing methods. Perceptions and fears surrounding HIV testing further shape behavior. Studies conducted in urban communities in Cape Town and Durban revealed that fear of testing positive and widespread misconceptions about the risks of HIV testing deter many individuals from pursuing it. (Ntsepe et al., 2014) In addition to these fears, a reduced perception of the risk of HIV infection, concerns about HIV status, and the associated stigma prevent many from opting for HIVST. (Obermeyer et al., 2013) However, for key populations like men who have sex with men and transgender individuals, the speed, convenience, and privacy of HIVST are strong motivating factors, as these individuals may seek autonomy and discretion in the testing process. (Figueroa et al., 2015)

Migration also plays a notable role, as individuals from diverse cultural backgrounds may have differing perceptions and attitudes toward HIVST, which can either facilitate or hinder its adoption depending on cultural norms.(Nicholls et al., 2022) Trust in the healthcare system is another critical factor, as individuals with previous negative healthcare experiences often prefer the privacy and convenience of self-testing over clinic-based options. (Pant Pai et al., 2013) Furthermore, research done in Spain indicated that individuals who had undergone multiple conventional HIV tests were more likely to use HIVST, while immigrants who face barriers to accessing traditional healthcare also tended to favour self-testing. (Belza et al., 2014)

4.2. Community Factors

Media exposure plays a crucial role in increasing the uptake of HIVST and promoting self-testing strategies. (Terefe et al., 2024) Visibility through media channels can reduce stigma and normalize HIV testing and encourage individuals to take advantage of self-testing options, especially in areas where fear and misconceptions about HIV persist. (Pant Pai et al., 2013) Geographical location also

significantly impacts HIVST uptake, with higher rates observed in urban areas and affluent households. In contrast, rural areas tend to have lower uptake due to factors such as limited access to media, healthcare infrastructure, and resources. (Awopegba et al., 2021; Shaba et al., 2023) Cultural perceptions, shaped by migration and diversity, further influence behaviours around HIVST. In regions with diverse cultural backgrounds, attitudes toward testing can vary significantly, affecting whether individuals are willing to adopt self-testing. (Nicholls et al., 2022) Additionally, peer influence plays a role, particularly in specific populations. For example, in Malawi, men who reported recent condomless sex had a higher prevalence of HIVST uptake, likely driven by their perceived risk of HIV infection and encouragement from their peers to get tested. (Indravudh et al., 2020) These factors collectively highlight the importance of targeted interventions that consider geographic, cultural and social dynamics in promoting HIVST.

4.3. Policy Factors

Trust-building programs such as the TakeMeHome (TTMH) project play a critical role in increasing the uptake of HIVST. By providing direct-to-consumer HIVST kits, these programs address concerns about privacy and the discomfort associated with interacting with healthcare providers, offering individuals the option to test at home. (Hecht et al., 2020) This trust in the testing process is especially important for populations that may be hesitant to visit clinics due to stigma or previous negative healthcare experiences. Additionally, familiarity and trust in Community Health Workers (CHWs) influence HIVST uptake as participants' comfort and confidence in using HIVST kits are enhanced by demonstrations and supervision provided by CHWs. (Bien-Gund et al., 2022)

The cost and accessibility of HIVST also play a significant role in the usage of HIVST services, thus influencing its uptake. Free or low-cost tests are more attractive to lower-income populations, which can increase testing rates in underserved communities. (WHO, 2016; Pant Pai et al., 2013) Furthermore, the “Door-to-door” distribution of HIVST kits was appreciated for its convenience, privacy, empowerment, and ease of use. (Bien-Gund et al., 2022)

Community-based HIVST (CB-HIVST) initiatives, such as the STAR Initiative in Malawi and Zambia, have demonstrated the effectiveness of distributing self-testing kits through community channels, particularly in rural and peri-urban areas where access to healthcare facilities is limited.(Ingold et al., 2019a) Targeting specific groups, such as adult men, through CB-HIVST strategies has been shown to help prevent new HIV infections. (Cambiano et al., 2019) Additionally, policy-driven interventions that use targeted advertising and partnerships with LGBTQ+ platforms can further expand the reach of HIVST, addressing systemic inequalities and increasing access for marginalized populations. (Hecht et al., 2020) These combined efforts highlight the importance of tailored, cost-effective approaches in promoting widespread HIV testing.

5. References

Abdullahi Nasir, I. (2018). Knowledge, attitude and factors affecting voluntary HIV counselling and testing services among women of reproductive age group in an Abuja 1 2 3 1 3, 4*. In Nigeria Medical Journal of Zambia (Vol. 45, Issue 1).

Adebayo, O. W., & Gonzalez-Guarda, R. M. (2017). Factors Associated with HIV Testing in Youth in the United States: An Integrative Review. Journal of the Association of Nurses in AIDS Care, 28(3). https://doi.org/10.1016/j.jana.2016.11.006

Ajayi, A. I., Awopegba, O. E., Adeagbo, O. A., & Ushie, B. A. (2020). Low coverage of HIV testing among adolescents and young adults in Nigeria: Implication for achieving the UNAIDS first 95. PLoS ONE, 15(5). https://doi.org/10.1371/journal.pone.0233368

Arnesen, R., Moll, A. P., & Shenoi, S. V. (2017). Predictors of loss to follow-up among patients on ART at a rural hospital in KwaZulu-Natal, South Africa. PLoS ONE, 12(5). https://doi.org/10.1371/journal.pone.0177168

Asaolu, I. O., Gunn, J. K., Center, K. E., Koss, M. P., Iwelunmor, J. I., & Ehiri, J. E. (2016). Predictors of HIV testing among youth in sub-Saharan Africa: A cross-sectional study. PLoS ONE, 11(10). https://doi.org/10.1371/journal.pone.0164052

Awopegba, O. E., Ologunowa, T. O., & Ajayi, A. I. (2021a). HIV testing and self-testing coverage among men and women in South Africa: an exploration of related factors. Tropical Medicine and International Health, 26(2), 214–227. https://doi.org/10.1111/tmi.13514

Awopegba, O. E., Ologunowa, T. O., & Ajayi, A. I. (2021b). HIV testing and self-testing coverage among men and women in South Africa: an exploration of related factors. Tropical Medicine and International Health, 26(2), 214–227. https://doi.org/10.1111/tmi.13514

Bayani, A., Ghiasvand, H., Rezaei, O., Fattah Moghaddam, L., Noroozi, A., Ahounbar, E., Higgs, P., & Armoon, B. (2020). Factors associated with HIV testing among people who inject drugs: a meta-analysis. Journal of Addictive Diseases, 38(3). https://doi.org/10.1080/10550887.2020.1771235

Beecroft, A., Vaikla, O., & Pant Pai, N. (2024). Digital HIV self-testing as an exemplar: a perspective on benefits, challenges, and opportunities. Expert Review of Molecular Diagnostics, 24(10), 913–925. https://doi.org/10.1080/14737159.2024.2406974

Belza, M. J., Figueroa, C., Rosales-Statkus, M. E., Ruiz, M., Vallejo, F., & de la Fuente, L. (2014). Low knowledge and anecdotal use of unauthorized online HIV self-test kits among attendees at a street-based HIV rapid testing programme in Spain. International Journal of Infectious Diseases, 25, 196–200. https://doi.org/10.1016/j.ijid.2014.03.1379

Bien-Gund, C. H., Shaw, P. A., Agnew-Brune, C., Baugher, A., Brady, K. A., & Gross, R. (2022). HIV Self-testing and Risk Behaviors Among Men Who Have Sex with Men in 23 US Cities, 2017. JAMA Network Open, 5(12), e2247540. https://doi.org/10.1001/jamanetworkopen.2022.47540

Brofenbrenner, U., & Hess, A. L. (1979). The Ecology of Human Development: Experiments by Nature and Design. https://about.jstor.org/terms

Budlender, D. (1999). Patterns of poverty in South Africa. Development Southern Africa, 16(2), 197–219. https://doi.org/10.1080/03768359908440073

Bwalya, C., Simwinga, M., Hensen, B., Gwanu, L., Hang'Andu, A., Mulubwa, C., Phiri, M., Hayes, R., Fidler, S., Mwinga, A., Ayles, H., Ayles, H., Bond, V., & Bond, V. (2020). Social response to the delivery of HIV self-testing in households: Experiences from four Zambian HPTN 071 (PopART) urban communities. AIDS Research and Therapy, 17(1). https://doi.org/10.1186/s12981-020- 00287-y

Bwana, P., Ochieng, L., & Mwau, M. (2018). Performance and usability evaluation of the INSTI HIV self-test in Kenya for qualitative detection of antibodies to HIV. PLoS ONE, 13(9). https://doi.org/10.1371/journal.pone.0202491

Cambiano, V., Ford, D., Mabugu, T., Napierala Mavedzenge, S., Miners, A., Mugurungi, O., Nakagawa, F., Revill, P., & Phillips, A. (2015). Assessment of the Potential Impact and Cost-effectiveness of Self-Testing for HIV in Low-Income Countries. Journal of Infectious Diseases, 212(4), 570–577. https://doi.org/10.1093/infdis/jiv040

Cambiano, V., Johnson, C. C., Hatzold, K., Terris-Prestholt, F., Maheswaran, H., Thirumurthy, H., Figueroa, C., Cowan, F. M., Sibanda, E. L., Ncube, G., Revill, P., Baggaley, R. C., Corbett, E. L., & Phillips, A. (2019). The impact and cost-effectiveness of community-based HIV self-testing in sub-Saharan Africa: a health economic and modelling analysis for Working Group on Cost Effectiveness of HIV self-testing in Southern Africa. https://doi.org/10.1002/jia2.25243/full

Chamie, G., Napierala, S., Agot, K., & Thirumurthy, H. (2021). Review HIV testing approaches to reach the first UNAIDS 95% target in sub-Saharan Africa. www.thelancet.com/hiv

Chiu, C. C. J., & Young, S. D. (2016). Correlates of requesting home HIV self-testing kits on online social networks among African American and Latino men who have sex with men. AIDS Care - Psychological and Socio-Medical Aspects of AIDS/HIV, 28(3), 289–293. https://doi.org/10.1080/09540121.2015.1090533

Choko, A. T., Corbett, E. L., Stallard, N., Maheswaran, H., Lepine, A., Johnson, C. C., Sakala, D., Kalua, T., Kumwenda, M., Hayes, R., & Fielding, K. (2019). HIV self-testing alone or with additional

interventions, including financial incentives, and linkage to care or prevention among male partners of antenatal care clinic attendees in Malawi: An adaptive multi-arm, multi-stage cluster randomised trial. PLoS Medicine, 16(1). https://doi.org/10.1371/journal.pmed.1002719

Choko, A. T., MacPherson, P., Webb, E. L., Willey, B. A., Feasy, H., Sambakunsi, R., Mdolo, A., Makombe, S. D., Desmond, N., Hayes, R., Maheswaran, H., & Corbett, E. L. (2015). Uptake, Accuracy, Safety, and Linkage into Care over Two Years of Promoting Annual Self-Testing for HIV in Blantyre, Malawi: A Community-Based Prospective Study. PLoS Medicine, 12(9). https://doi.org/10.1371/journal.pmed.1001873

Christian, S. N., Mantell, J. E., Romo, M. L., Grov, C., George, G., Mwai, E., Nyaga, E., Odhiambo, J. O., Govender, K., & Kelvin, E. A. (2020). Applying a social-ecological lens to opinions about HIV self-testing among Kenyan truckers who declined to test: a qualitative study. African Journal of AIDS Research, 19(2), 147–155. https://doi.org/10.2989/16085906.2020.1764070

City of Cape Town., 2021.

City of Cape Town Metropolitan Municipality Profile: City of Cape Town Metro. (2021).

Daniel, D., Hasen, H., Sinebo, Y., Bereku, T., Mekuria, M., Jemal, Z., Amare, M., & Habtu, Y. (2024). Level of knowledge and intention to use oral fluid HIV self-testing and associated factors among Ethiopian health care workers in southern Ethiopia. AIDS Research and Therapy, 21(1). https://doi.org/10.1186/s12981-024-00642-3

Decker, M. R., Wilcox, H. C., Holliday, C. N., & Webster, D. W. (2018). An Integrated Public Health Approach to Interpersonal Violence and Suicide Prevention and Response. Public Health Reports, 133, 65S-79S. https://doi.org/10.1177/0033354918800019

Diez Roux, A. V. (2002). A glossary for multilevel analysis. In Journal of Epidemiology and Community Health (Vol. 56, Issue 8). https://doi.org/10.1136/jech.56.8.588

Donovan, B. J., Rublein, J. C., Leone, P. A., & Pilcher, C. D. (2004). HIV Infection: Point-of-Care Testing. In Annals of Pharmacotherapy (Vol. 38, Issue 4). https://doi.org/10.1345/aph.1D314

Dorward, J., Khubone, T., Gate, K., Ngobese, H., Sookrajh, Y., Mkhize, S., Jeewa, A., Bottomley, C., Lewis, L., Baisley, K., Butler, C. C., Gxagxisa, N., & Garrett, N. (2021). The impact of the COVID-19 lockdown on HIV care in 65 South African primary care clinics: an interrupted time series analysis. The Lancet HIV, 8(3), e158–e165. https://doi.org/10.1016/S2352-3018(20)30359-3

Ekholuenetale, M., Nzoputam, C. I., & Okonji, O. C. (2022a). Association between socio-economic factors and HIV self-testing knowledge amongst South African women. Southern African Journal of HIV Medicine, 23(1). https://doi.org/10.4102/SAJHIVMED.V23I1.1347

Ekholuenetale, M., Nzoputam, C. I., & Okonji, O. C. (2022b). Association between socio-economic factors and HIV self-testing knowledge amongst South African women. Southern African Journal of HIV Medicine, 23(1). https://doi.org/10.4102/SAJHIVMED.V23I1.1347

Ekholuenetale, M., Nzoputam, C. I., & Okonji, O. C. (2022c). Association between socio-economic factors and HIV self-testing knowledge amongst South African women. Southern African Journal of HIV Medicine, 23(1). https://doi.org/10.4102/SAJHIVMED.V23I1.1347

Eshun-Wilson, I., Jamil, M. S., Witzel, T. C., Glidded, D. V., Johnson, C., Le Trouneau, N., Ford, N., McGee, K., Kemp, C., Baral, S., Schwartz, S., & Geng, E. H. (2021). A Systematic Review and Network Meta-analyses to Assess the Effectiveness of Human Immunodeficiency Virus (HIV) Self-testing Distribution Strategies. In Clinical Infectious Diseases (Vol. 73, Issue 4, pp. E1018–E1028). Oxford University Press. https://doi.org/10.1093/cid/ciab029

Fauci, A. S., Redfield, R. R., Sigounas, G., Weahkee, M. D., & Giroir, B. P. (2019). Ending the HIV Epidemic: A Plan for the United States. In JAMA - Journal of the American Medical Association (Vol. 321, Issue 9). https://doi.org/10.1001/jama.2019.1343

Figueroa, C., Johnson, C., Verster, A., & Baggaley, R. (2015). Attitudes and Acceptability on HIV Self-testing Among Key Populations: A Literature Review. AIDS and Behavior, 19(11), 1949–1965. https://doi.org/10.1007/s10461-015-1097-8

Giguère, K., Eaton, J. W., Marsh, K., Johnson, L. F., Johnson, C. C., Ehui, E., Jahn, A., Wanyeki, I., Mbofana, F., Bakiono, F., Mahy, M., & Maheu-Giroux, M. (2021). Trends in knowledge of HIV status and efficiency of HIV testing services in sub-Saharan Africa, 2000–20: a modelling study using survey and HIV testing programme data. The Lancet HIV, 8(5). https://doi.org/10.1016/S2352-3018(20)30315-5

Goudge, J., Gilson, L., Russell, S., Gumede, T., & Mills, A. (2009). The household costs of health care in rural South Africa with free public primary care and hospital exemptions for the poor. Tropical Medicine and International Health, 14(4). https://doi.org/10.1111/j.1365-3156.2009.02256.x

Greacen, T., Friboulet, D., Fugon, L., Hefez, S., Lorente, N., & Spire, B. (2012). Access to and use of unauthorised online HIV self-tests by internet-using French-speaking men who have sex with men. Sexually Transmitted Infections, 88(5). https://doi.org/10.1136/sextrans-2011-050405

Guidelines Consolidated Guidelines on Hiv Testing Services 5cs: Consent, Confidentiality, Counselling, Correct Results and Connection. (2015).

Hansoti, B., Stead, D., Parrish, A., Reynolds, S. J., Redd, A. D., Whalen, M. M., Mvandaba, N., & Quinn, T. C. (2018). HIV testing in a South African Emergency Department: A missed opportunity. PLoS

ONE, 13(3). https://doi.org/10.1371/journal.pone.0193858

Harichund, C., & Moshabela, M. (2018). Acceptability of HIV Self-Testing in Sub-Saharan Africa: Scoping Study. In AIDS and Behavior (Vol. 22, Issue 2, pp. 560–568). Springer New York LLC. https://doi.org/10.1007/s10461-017-1848-9

Harichund, C., Moshabela, M., Kunene, P., & Abdool Karim, Q. (2019). Acceptability of HIV self-testing among men and women in KwaZulu-Natal, South Africa. AIDS Care - Psychological and Socio-Medical Aspects of AIDS/HIV, 31(2), 186–192. https://doi.org/10.1080/09540121.2018.1503638

Hecht, J., Sanchez, T., Patrick, ;, Sullivan, S., Dinenno, E. A., Cramer, N., & Delaney, K. P. (2020). Morbidity and Mortality Weekly Report. https://www.nastad.org/domestic/hiv-prevention

Hermanus, T., & O'Grady, M. (2022). A principle-based approach to justify the use of HIV self-testing in South Africa. Developing World Bioethics, 22(1), 53–62. https://doi.org/10.1111/dewb.12319

Hiv Self-Testing and Partner Notification Supplement To Consolidated Guidelines on HIV Testing Services. (2016).

Hlongwa, M., Mashamba-Thompson, T., Makhunga, S., & Hlongwana, K. (2019). Mapping evidence of intervention strategies to improving men's uptake to HIV testing services in sub-Saharan Africa: A systematic scoping review. In BMC Infectious Diseases (Vol. 19, Issue 1). BioMed Central Ltd. https://doi.org/10.1186/s12879-019-4124-y

Hoang, C. D., Tran, B. X., Pham, M. D., Nguyen, L. H., Do, H. N., Vuong, Q. H., Ho, M. T., Dam, V. N., Vuong, T. T., Nguyen, H. H., Nguyen, V., Pham, H. Q., Ha, G. H., Latkin, C. A., Ho, C. S. H., & Ho, R. C. M. (2019). HIV- and AIDS-related knowledge and attitude of residents in border regions of Vietnam. Harm Reduction Journal, 16(1). https://doi.org/10.1186/s12954-019-0282-x

Hurt, C. B., & Powers, K. A. (2014). Self-testing for HIV and its impact on public health. In Sexually Transmitted Diseases (Vol.41, Issue1, pp.10–12). ttps://doi.org/10.1097/OLQ.0000000000000076

Indravudh, P. P., Hensen, B., Nzawa, R., Chilongosi, R., Nyirenda, R., Johnson, C. C., Hatzold, K., Fielding, K., Corbett, E. L., & Neuman, M. (2020b). Who is Reached by HIV Self-Testing? Individual Factors Associated with Self-Testing Within a Community-Based Program in Rural Malawi. Journal of Acquired Immune Deficiency Syndromes, 85(2), 165–173. https://doi.org/10.1097/QAI.0000000000002412

Ingold, H., Mwerinde, O., Ross, A. L., Leach, R., Corbett, E. L., Hatzold, K., Johnson, C. C., Ncube, G., Nyirenda, R., & Baggaley, R. C. (2019a). The Self-Testing AfRica (STAR) Initiative: accelerating global access and scale-up of HIV self-testing. https://doi.org/10.1002/jia2.25249/full

Jamieson, L., Johnson, L. F., Matsimela, K., Sande, L. A., D'Elbée, M., Majam, M., Johnson, C., Chidarikire, T., Hatzold, K., Terris-Prestholt, F., Nichols, B., & Meyer-Rath, G. (2021). The cost effectiveness and optimal configuration of HIV self-test distribution in South Africa: A model analysis. BMJ Global Health, 6. https://doi.org/10.1136/bmjgh-2021-005598

Jamil, M. S., Eshun-Wilson, I., Witzel, T. C., Siegfried, N., Figueroa, C., Chitembo, L., Msimanga-Radebe, B., Pasha, M. S., Hatzold, K., Corbett, E., Barr-DiChiara, M., Rodger, A. J., Weatherburn, P., Geng, E., Baggaley, R., & Johnson, C. (2021). Examining the effects of HIV self-testing compared to standard HIV testing services in the general population: A systematic review and meta-analysis. EClinicalMedicine, 38. https://doi.org/10.1016/j.eclinm.2021.100991

Johnson, A. L., Butts, S. A., Rodriguez, E., Craker, L., Kanamori, M., & Doblecki-Lewis, S. (2023). "Test-To-PrEP": Assessing Reach and Adoption of a New Approach to Increase HIV Testing and PrEP Knowledge Using HIV Self-Test Kit Distribution Through PrEP Clients' Social Networks. Journal of Acquired Immune Deficiency Syndromes, 94(5). https://doi.org/10.1097/QAI.0000000000003294

Johnson, C. C., Kennedy, C., Fonner, V., Siegfried, N., Figueroa, C., Dalal, S., Sands, A., & Baggaley, R. (2017). Examining the effects of HIV self-Testing compared to standard HIV testing services: A systematic review and meta-Analysis. Journal of the International AIDS Society, 20(1). https://doi.org/10.7448/IAS.20.1.21594

Johnson, C., Kumwenda, M., Meghji, J., Choko, A. T., Phiri, M., Hatzold, K., Baggaley, R., Taegtmeyer, M., Terris-Prestholt, F., Desmond, N., & Corbett, E. L. (2021). 'Too old to test?': A life course approach to HIV-related risk and self-testing among midlife-older adults in Malawi. BMC Public Health, 21(1). https://doi.org/10.1186/s12889-021-10573-7

Johnson, C., Neuman, M., MacPherson, P., Choko, A., Quinn, C., Wong, V. J., Hatzold, K., Nyrienda, R., Ncube, G., Baggaley, R., Terris-Prestholt, F., & Corbett, E. L. (2020). Use and awareness of and willingness to self-test for HIV: An analysis of cross-sectional population-based surveys in Malawi and Zimbabwe. BMC Public Health, 20(1). https://doi.org/10.1186/s12889-020-08855-7

Johnson, L. F., Meyer-Rath, G., Dorrington, R. E., Puren, A., Seathlodi, T., Zuma, K., & Feizzadeh, A. (2022). The Effect of HIV Programs in South Africa on National HIV Incidence Trends, 2000-2019. www.jaids.com

Jooste, S., Mabaso, M., Taylor, M., North, A., Shean, Y., & Simbayi, L. C. (2021). Socio-economic differences in the uptake of HIV testing and associated factors in South Africa. BMC Public Health, 21(1). https://doi.org/10.1186/s12889-021-11583-1

Kelvin, E. A., Cheruvillil, S., Christian, S., Mantell, J. E., Milford, C., Rambally-Greener, L., Mosery, N., Greener, R., & Smit, J. A. (2016). Choice in HIV testing: the acceptability and anticipated use of a self-administered at-home oral HIV test among South Africans. African Journal of AIDS Research, 15(2), 99–108. https://doi.org/10.2989/16085906.2016.1189442

Kilanowski, J. F. (2017). Breadth of the Socio-Ecological Model. In Journal of Agromedicine (Vol. 22, Issue 4, pp. 295–297). Taylor and Francis Ltd. https://doi.org/10.1080/1059924X.2017.1358971

Kombo, B. K., Thomann, M., Lazarus, L., Musyoki, H., Olango, K., Kuria, S., Kyana, M., Otieno, M., Njiriani, M., Musimbi, J., Bhattacharjee, P., & Lorway, R. (2021). Engaging MSM Communities in HIV Self-Testing Research and Programming in Kenya: Collaborations, Tacit Knowledge, and a Community-Based Programme Science Approach. https://doi.org/10.21203/rs.3.rs-861094/v1

Krause, J., Subklew-Sehume, F., Kenyon, C., & Colebunders, R. (2013). Acceptability of HIV self-testing: A systematic literature review. BMC Public Health, 13(1). https://doi.org/10.1186/1471-2458-13-735

Lakhe, N. A., Diallo Mbaye, K., Sylla, K., & Ndour, C. T. (2019). HIV screening in men and women in Senegal: Coverage and associated factors; Analysis of the 2017 demographic and health survey. BMC Infectious Diseases, 20(1). https://doi.org/10.1186/s12879-019-4717-5

Lankowski, A. J., Siedner, M. J., Bangsberg, D. R., & Tsai, A. C. (2014). Impact of geographic and transportation-related barriers on HIV outcomes in sub-saharan Africa: A systematic review. In AIDS and Behavior (Vol. 18, Issue 7). https://doi.org/10.1007/s10461-014-0729-8

Li, J., Marley, G., Zhang, Y., Chen, Y., Tang, W., Rongbin, Y., & Fu, G. (2021). Determinants of Recent HIV Self-Testing Uptake Among Men Who Have Sex with Men in Jiangsu Province, China: An Online Cross-Sectional Survey. Frontiers in Public Health, 9. https://doi.org/10.3389/fpubh.2021.736440

Mabaso, M., Makola, L., Naidoo, I., Mlangeni, L. L., Jooste, S., & Simbayi, L. (2019). HIV prevalence in South Africa through gender and racial lenses: results from the 2012 population-based national household survey. International Journal for Equity in Health, 18(1), 167. https://doi.org/10.1186/s12939-019-1055-6

Maiman, L. A., & Becker, M. H. (1977). The Health Belief Model: Origins and Correlates in Psychological Theory. Health Education & Behavior, 2(4). https://doi.org/10.1177/109019817400200404

Marsh, K., Eaton, J. W., Mahy, M., Sabin, K., Autenrieth, C. S., Wanyeki, I., Daher, J., & Ghys, P. D. (2019). Global, regional and country-level 90-90-90 estimates for 2018: Assessing progress towards the 2020 target. AIDS, 33, S213–S226.

https://doi.org/10.1097/QAD.0000000000002355

Matsimela, K., Sande, L. A., Mostert, C., Majam, M., Phiri, J., Zishiri, V., Madondo, C., Khama, S., Chidarikire, T., D'Elbée, M., Hatzold, K., Johnson, C., Terris-Prestholt, F., & Meyer-Rath, G. (2021). The cost and intermediary cost-effectiveness of oral HIV self-test kit distribution across 11 distribution models in South Africa. BMJ Global Health, 6. https://doi.org/10.1136/bmjgh-2021-005019

Matthews, S. A., & Yang, T. C. (2012). Mapping the results of local statistics: Using geographically weighted regression. Demographic Research, 26, 151–166. https://doi.org/10.4054/DemRes.2012.26.6

Mcleroy, K. R., Bibeau, D., Steckler, A., & Glanz, K. (1988). An Ecological Perspective on Health Promotion Programs. Health Education & Behavior, 15(4), 351–377. https://doi.org/10.1177/109019818801500401

Merlo, J., Chaix, B., Ohlsson, H., Beckman, A., Johnell, K., Hjerpe, P., Råstam, L., & Larsen, K. (2006). A brief conceptual tutorial of multilevel analysis in social epidemiology: Using measures of clustering in multilevel logistic regression to investigate contextual phenomena. In Journal of Epidemiology and Community Health (Vol. 60, Issue 4, pp. 290–297). https://doi.org/10.1136/jech.2004.029454

Metro District Health Plan_2019-20. (2019).

Mumm, R., Diaz-Monsalve, S., Hänselmann, E., Freund, J., Wirsching, M., Gärtner, J., Gminski, R., Vögtlin, K., Körner, M., Zirn, L., Wittwer-Backofen, U., Oni, T., & Kroeger, A. (2017). Exploring urban health in Cape Town, South Africa: an interdisciplinary analysis of secondary data. Pathogens and Global Health, 111(1), 7–22. https://doi.org/10.1080/20477724.2016.1275463

National HIV Self Screening Guidelines. (2018).

Ndungu, K., Gichangi, P., & Temmerman, M. (2023). Evaluation of factors associated with HIV self-testing Acceptability and Uptake among the MSM community in Nairobi, Kenya: A cross-sectional study. PLoS ONE, 18(3 March). https://doi.org/10.1371/journal.pone.0280540

Nicholls, E. J., Samba, P., McCabe, L., Gafos, M., Philips, A. N., Trevelion, R., Rodger, A. J., Burns, F. M., Weatherburn, P., & Witzel, T. C. (2022). Experiences of and attitudes towards HIV testing for Asian, Black and Latin American men who have sex with men (MSM) in the SELPHI (HIV Self-Testing Public Health Intervention) randomized controlled trial in England and Wales: implications for HIV self-testing. BMC Public Health, 22(1). https://doi.org/10.1186/s12889-022-13189-7

Njau, B., Covin, C., Lisasi, E., Damian, D., Mushi, D., Boulle, A., & Mathews, C. (2019). A systematic review of qualitative evidence on factors enabling and deterring uptake of HIV self-testing in Africa. BMC Public Health, 19(1). https://doi.org/10.1186/s12889-019-7685-1

Ntsepe, Y., Simbayi, L. C., Shisana, O., Rehle, T., Mabaso, M., Ncitakalo, N., Davids, A., & Naidoo, Y. D. (2014). Perceptions about the acceptability and prevalence of HIV testing and factors influencing them in different communities in South Africa. Sahara J, 11(1). https://doi.org/10.1080/17290376.2014.937355

Obermeyer, C. M., Neuman, M., Hardon, A., Desclaux, A., Wanyenze, R., Ky-Zerbo, O., Cherutich, P., & Namakhoma, I. (2013). Socio-economic determinants of HIV testing and counselling: A comparative study in four African countries. Tropical Medicine and International Health, 18(9). https://doi.org/10.1111/tmi.12155

Obiezu-Umeh, C., Gbajabiamila, T., Ezechi, O., Nwaozuru, U., Ong, J. J., Idigbe, I., Oladele, D., Musa, A. Z., Uzoaru, F., Airhihenbuwa, C., Tucker, J. D., & Iwelunmor, J. (2021). Young people's preferences for HIV self-testing services in Nigeria: a qualitative analysis. BMC Public Health, 21(1). https://doi.org/10.1186/s12889-020-10072-1

Ong, J. J., Nwaozuru, U., Obiezu-Umeh, C., Airhihenbuwa, C., Xian, H., Terris-Prestholt, F., Gbajabiamila, T., Musa, A. Z., Oladele, D., Idigbe, I., David, A., Okwuzu, J., Bamidele, T., Iwelunmor, J., Tucker, J. D., & Ezechi, O. (2021). Designing HIV Testing and Self-Testing Services for Young People in Nigeria: A Discrete Choice Experiment. Patient, 14(6), 815–826. https://doi.org/10.1007/s40271-021-00522-2

Pai, N. P., Behlim, T., Abrahams, L., Vadnais, C., Shivkumar, S., Pillay, S., Binder, A., Deli-Houssein, R., Engel, N., Joseph, L., & Dheda, K. (2013). Will an unsupervised self-testing strategy for HIV work in health care workers of South Africa? A cross-sectional pilot feasibility study. PLoS ONE, 8(11). https://doi.org/10.1371/journal.pone.0079772

Pant Pai, N., Sharma, J., Shivkumar, S., Pillay, S., Vadnais, C., Joseph, L., Dheda, K., & Peeling, R. W. (2013). Supervised and Unsupervised Self-Testing for HIV in High- and Low-Risk Populations: A Systematic Review. In PLoS Medicine (Vol. 10, Issue 4). https://doi.org/10.1371/journal.pmed.1001414

Pereira, M. D., Teixeira, N. do S. C. C. de A., Oliveira, I. K. F., Lima, C. H. R., & Paiva, A. de A. (2019). Esquema terapêutico e consumo alimentar em pessoas vivendo com HIV/Aids. ARCHIVES OF HEALTH INVESTIGATION, 8(7). https://doi.org/10.21270/archi.v8i7.4625

Pettifor, A., Lippman, S. A., Kimaru, L., Haber, N., Mayakayaka, Z., Selin, A., Twine, R., Gilmore, H., Westreich, D., Mdaka, B., Wagner, R., Gomez-Olive, X., Tollman, S., & Kahn, K. (2020). HIV self-testing among young women in rural South Africa: A randomized controlled trial comparing clinic-based HIV testing to the choice of either clinic testing or HIV self-testing with secondary distribution to peers and partners. EClinicalMedicine, 21. https://doi.org/10.1016/j.eclinm.2020.100327

Pillay, Y., & Johnson, L. (2021). World AIDS Day 2020: Reflections on global and South African progress and continuing challenges. S Afr J HIV Med, 22(1), 1205. https://doi.org/10.4102/sajhivmed

Qin, Y., Han, L., Babbitt, A., Walker, J. S., Liu, F., Thirumurthy, H., Tang, W., & Tucker, J. D. (2018). Experiences using and organizing HIV self-testing. AIDS, 32(3), 371–381. https://doi.org/10.1097/QAD.0000000000001705

Quinn, C., Kadengye, D. T., Johnson, C. C., Baggaley, R., & Dalal, S. (2019). Who are the missing men? Characterising men who never tested for HIV from population-based surveys in six sub-Saharan African countries. https://doi.org/10.1002/jia2.25398/full

Radebe, O., Lippman, S. A., Lane, T., Gilmore, H., Agnew, E., Manyuchi, A., & McIntyre, J. A. (2019). HIV self-screening distribution preferences and experiences among men who have sex with men in Mpumalanga province: informing policy for South Africa. South African Medical Journal, 109(4). https://doi.org/10.7196/SAMJ 2019.v109i4.13818

Rees, K. (2018). Evaluation of Anova Health Institute's programme of support for HIV-related government Health Service slated. Anova Health Institute.

Rose, M., Guy, L., Shamblen, S., Guest, G., Gilbertson, A., & Peiper, N. (2021). LB11. Preliminary Findings from a HIV Self-Testing Program among People Who Use Drugs. Open Forum Infectious Diseases, 8(Supplement_1). https://doi.org/10.1093/ofid/ofab466.1647

Roux, A. V. D. (2001). Investigating Neighborhood and Area Effects on Health. In American Journal of Public Health (Vol. 91, Issue 11).

Shaba, F., Balakasi, K. T., Offorjebe, O. A., Nyirenda, M., Wong, V. J., Gupta, S. K., Hoffman, R. M., & Dovel, K. (2023). Facility HIV Self-Testing in Outpatient Departments: An Assessment of Characteristics and Concerns of Outpatients Who Opt Out of Testing in Malawi. http://links.lww.com/QAI/C179.

Simbayi, L. Chisamu., Zuma, Khangelani., & Zungu, N. (2021). South African national HIV prevalence, incidence, behaviour and communication survey 2017. HSRC Press.

Simo Fotso, A., Johnson, C., Vautier, A., Kouamé, K. B., Diop, P. M., Silhol, R., Maheu-Giroux, M., Boily, M. C., Rouveau, N., Doumenc-Aïdara, C., Baggaley, R., Ehui, E., & Larmarange, J. (2022). Routine programmatic data show a positive population-level impact of HIV self-testing: the case of Côte d'Ivoire and implications for implementation. AIDS, 36(13). https://doi.org/10.1097/QAD.0000000000003328

Stekier, J. D., Swenson, P. D., Coombs, R. W., Dragavon, J., Thomas, K. K., Brennan, C. A., Devare, S. G., Wood, R. W., & Golden, M. R. (2009). HIV testing in a high-incidence population: Is antibody testing alone good enough? In Clinical Infectious Diseases (Vol. 49, Issue 3, pp. 444–453). https://doi.org/10.1086/600043

Stevens, D. R., Vrana, C. J., Dlin, R. E., & Korte, J. E. (2018). A Global Review of HIV Self-testing: Themes and Implications. In AIDS and Behavior (Vol. 22, Issue 2, pp. 497–512). Springer New York LLC. https://doi.org/10.1007/s10461-017-1707-8

Tahlil, K. M., Ong, J. J., Rosenberg, N. E., Tang, W., Conserve, D. F., Nkengasong, S., Muessig, K. E., Iwelunmor, J., Ezechi, O., Gbaja-Biamila, T., Aliyu, S. H., Obiezu-Umeh, C., Kapogiannis, B., & Tucker, J. D. (2020). Verification of HIV Self-Testing Use and Results: A Global Systematic Review. AIDS Patient Care and STDs, 34(4), 147–156. https://doi.org/10.1089/apc.2019.0283

Terefe, B., Jembere, M. M., Reda, G. B., Asgedom, D. K., Assefa, S. K., & Lakew, A. M. (2024). Knowledge, and utilization of HIV self-testing, and its associated factors among women in sub–Saharan Africa: evidence from 21 countries demographic and health survey. BMC Public Health, 24(1). https://doi.org/10.1186/s12889-024-19529-z

UNAIDS. (2017). UNAIDS. Blind spot: reaching out to men and boys-Addreeing a blind spot in the HIV response to HIV. Geneva: Joint United Nations Programme on HIV/AIDS. UNAIDS.

Us. (2018). Hiv Self-Testing Strategic Framework A Guide for Planning, Introducing And Scaling Up Hiv Testing Services.

Venter, F., Majam, M., Jankelowitz, L., Adams, S., Moorhouse, M., Carmona, S., Stevens, W., Msimanga, B. R., Allen, D., Balani, P., Nevhutalu, Z., Rhagnath, N., Shroufi, A., Deville, W., Kazangarare, V., Van Der Wiel, R., Templeman, H., Puren, A., Tucker, T., … Gray, A. (2017). South African HIV self-testing policy and guidance considerations. Southern African Journal of HIV Medicine, 18(1). https://doi.org/10.4102/sajhivmed.v18i1.775

Wabiri, N., & Taffa, N. (2013). Socio-economic inequality and HIV in South Africa. BMC Public Health, 13(1). https://doi.org/10.1186/1471-2458-13-1037

Wong, V., Johnson, C., Cowan, E., Rosenthal, M., Peeling, R., Miralles, M., Sands, A., & Brown, C. (2014). HIV self-testing in resource-limited settings: Regulatory and policy considerations. AIDS and Behavior, 18(SUPPL. 4). https://doi.org/10.1007/s10461-014-0825-9

Wood, B. R., Ballenger, C., & Stekler, J. D. (2014). Arguments for and against HIV self-testing. In HIV/AIDS - Research and Palliative Care (Vol. 6, pp. 117–126). Dove Medical Press Ltd. https://doi.org/10.2147/HIV.S49083

World Health Organization. (2015). Consolidated guidelines on HIV testing services: 5Cs: consent, confidentiality, counselling, correct results and connection 2015. Who, July.

World Health Organization. (2020). Web Annex H. Considerations for monitoring HIV testing services programmes. In: Consolidated guidelines on HIV testing services, 2019. In World Health Organization (Vol. 7, Issue July).

Wulandari, L. P. L., Kaldor, J., & Guy, R. (2020). Uptake and acceptability of assisted and unassisted HIV self-testing among men who purchase sex in brothels in Indonesia: A pilot intervention study. BMC Public Health, 20(1). https://doi.org/10.1186/s12889-020-08812-4

Wulandari, L. P. L., Ruddick, A., Guy, R., & Kaldor, J. (2019). “Self-testing sounds more private, rather than going to the clinic and everybody will find out”: Facilitators and barriers regarding HIV testing among men who purchase sex in Bali, Indonesia. PLoS ONE, 14(4). https://doi.org/10.1371/journal.pone.0214987

Part B: Journal Manuscript

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Title: **HIV Self Testing uptake and associated factors in Cape Town: a contextual framework**.

Dr Doris Nyembwe

Student no: NYMDOR003

Health Economics Unit, School of Public Health, Faculty of Health

Sciences,

University of Cape Town, Anzio Road, Observatory, 7925

Email address: dorisnyembwe@yahoo.com

*Corresponding author: Doris Nyembwe, Health Economics Unit, School of Public Health, Faculty of Health Sciences, University of Cape Town, Anzio Road,

Observatory, 7925

1. Abstract

Background

South Africa bears one of the highest HIV burdens globally, with nearly 8 million people living with the virus. Despite hosting the world's largest antiretroviral therapy (ART) program, HIV-related deaths remain significant, accounting for over 23% of all deaths in 2019. Early detection and timely initiation of ART are essential to prevent transmission, improve quality of life, and reduce HIV-related morbidity and mortality. However, insufficient testing coverage among males and younger individuals remains a concern. HIV self-testing (HIVST) has emerged as a promising strategy to bridge these gaps, offering a private and convenient option for individuals hesitant to access healthcare facilities. The World Health Organization (WHO) endorses HIVST as a complementary approach to enhance access, particularly for populations underserved by traditional testing methods.

While research has examined HIVST uptake in various settings, little is known about the specific factors influencing its adoption in Cape Town. Given South Africa's unique socio-economic landscape and the

disparities between urban and rural areas, understanding the factors shaping HIVST uptake is crucial for developing tailored interventions. This thesis seeks to address this gap by investigating and analyzing the demographic, socio-economic, and community-level factors associated with HIVST uptake in Cape Town.

Methods

This study utilized a cross-sectional design to examine HIV testing uptake and associated factors in Cape Town, South Africa, between January and December 2022. The analysis leveraged routine HIV Testing Services (HTS) programmatic data collected by the Anova Health Institute. The dataset included a total of 266,284 observations: 30,785 for HIV self-testing (HIVST) and 235,499 for conventional HIV testing. Data were drawn from individuals aged 18 years and older across the eight subdistricts of the Cape Town metropolitan area: Eastern, Northern, Southern, Western, Khayelitsha, Klipfontein, Mitchells Plain, and Tygerberg.

The data, comprising sociodemographic details and testing information, were deidentified with formal permission from Anova Health Institute and the Department of Health. Individual-level data was recorded through consent forms and HTS registers and subsequently transferred to Red Cap and Power BI for quality checks and analysis. Community-level data, including the number of healthcare facilities, new and registered ART patients, and child acute malnutrition rates, were sourced from City of Cape Town health profiles (2021).

Predictors were selected based on a socio-ecological framework, capturing both individual- and community-level factors. Individual-level variables included age, gender, and HIV testing history. Community-level factors encompassed healthcare access (number of healthcare facilities), HIV burden (number of registered and new ART patients), and socioeconomic status (child acute malnutrition rate).

Descriptive statistics summarize the frequencies of HIVST, and conventional testing variables stratified by subdistrict, alongside community-level factors. A bivariate logistic regression model was conducted to assess associations between individual predictors and HIV testing options. Subsequently, a multivariate logistic regression model was employed to evaluate the influence of both individual- and community-level predictors on HIV testing choices (conventional vs. HIVST). Odds ratios were calculated with 95% confidence intervals to quantify these associations. This methodology integrates diverse data sources and robust statistical approaches, enabling a comprehensive examination of the factors influencing the uptake of HIV self-testing in Cape Town.

Results

The study had a sample size of 265,063 of which 234,853 (88.60%) had utilized conventional HIV testing method and 30,210 (11.40%) opting for self-testing. Majority of individuals undergoing conventional testing are adults aged 25- 49 (63.16%), followed by older adults aged 50+ (17.16%). Similarly, for self-testing, most users are also within the 25-49 age group (63.84%), but there is a higher proportion of young adults aged 20-24 choosing self-testing (23.72%) compared to conventional testing (15.59%). Additionally, adolescents aged 18-19 are more likely to opt for self-testing (7.75%) than conventional testing (4.08%). Regarding gender, females constitute a larger share of those undergoing conventional testing (65.62%) compared to males (34.38%). The trend is similar for self-testing, where females account for 65.32%, and males make up 34.68%. In terms of the last HIV test, self-testing is more prevalent among individuals who were tested within the past 12 months (63.51%), while conventional testing is more common among those whose last test was over a year ago. Subdistrict analysis shows that conventional testing is most frequent in Tygerberg (20.06%) and Khayelitsha (16.87%), followed by Western (13.24%) and Eastern (12.45%). In contrast, self-testing is more widely utilized in Western (19.38%), Southern (15.33%), and Mitchell's Plain (16.97%).

The bivariate logistic regression indicated that age was a significant factor influencing self-testing preferences, with the likelihood of using HIVST decreasing with age. Individuals aged 20-24 had 20% lower odds of using self-testing compared to adolescents aged 18-19 (OR = 0.80, 95% CI: 0.76–0.85, $p < 0.005$). Those aged 25-49 had 47% lower odds compared to the adolescent group (OR = 0.53, 95% CI: 0.51–0.56, $p < 0.005$), and adults aged 50 and above had 86% lower odds (OR = 0.14, 95% CI: 0.13–0.15, $p < 0.005$).

Additionally, for facility testing those who had tested for HIV within the last 12 months were more inclined towards self-testing. In contrast, individuals who last tested more than 12 months ago were 77% less likely to choose self-testing (OR = 0.23, 95% CI: 0.22–0.25, $p < 0.005$), and those who had never been tested were 40% less likely (OR = 0.60, 95% CI: 0.54–0.67, $p < 0.005$) to use self-testing.

HIVST was more popular among people living in areas with a high concentration of registered ART patients. Specifically, the odds of choosing self-testing increased by 32% in high-density areas (≥30,001 registered ART patients) (OR = 1.32, 95% CI: 1.28–1.37, $p < 0.005$) and by 53% in medium-density areas (20,001–30,000 registered ART patients) (OR = 1.53, 95% CI: 1.49–1.58, $p < 0.005$), compared to areas with fewer than 20,000 registered ART patients.

On the other hand, people living in areas with a higher number of healthcare facilities were more likely to choose conventional HIV testing. The odds of self-testing decreased by 15% in subdistricts with a medium number of healthcare facilities (15–25 facilities) (OR = 0.85, 95% CI: 0.82–0.87, $p < 0.005$) and by 27% in areas with a high number of facilities (26 or more) (OR = 0.73, 95% CI: 0.71–0.76, $p < 0.005$), relative to areas with fewer than 15 facilities.

Additionally, communities with a high number of newly enrolled ART patients (≥2,901) showed a 31% lower likelihood of opting for self-testing (OR = 0.69, 95% CI: 0.67–0.72, p < 0.005).

Subdistrict variations were evident, with Southern (OR = 2.04, 95% CI: 1.94–2.13, p < 0.005) and Mitchell's Plain (OR = 2.12, 95% CI: 2.03–2.23, p < 0.005) showing more than twice the odds of self-testing compared to the Eastern subdistrict. Other subdistricts with significantly higher odds of self-testing included Western (OR = 1.63, 95% CI: 1.56–1.71, p < 0.005) and Klipfontein (OR = 1.12, 95% CI: 1.06–1.18, p < 0.005). Conversely, Northern (OR = 0.52, 95% CI: 0.48–0.55, p < 0.005), Tygerberg (OR = 0.55, 95% CI: 0.52–0.57, p < 0.005), and Khayelitsha (OR = 0.97, 95% CI: 0.83–0.91, p < 0.005) had significantly lower odds.

Finally, testing preferences assessed through the multivariate logistic regression model highlighted the influence of both individual- and community-level factors. Consistent with the bivariate analysis findings, age remained a strong predictor of HIVST. Individuals aged 20–24 had 23% lower odds of using self-testing compared to those aged 18–19 (OR = 0.77, 95% CI: 0.73–0.82, p < 0.005), while those aged 25–49 had 49% lower odds (OR = 0.51, 95% CI: 0.48–0.53, p < 0.005). The oldest age group (50 years and above) had 86% lower odds of choosing self-testing compared to the youngest group (OR = 0.14, 95% CI: 0.13–0.15, p < 0.005).

Individuals residing in communities with a medium (20,001–30,000) and high (≥30,001) number of registered ART patients had 240% (OR = 3.40, 95% CI: 3.18–3.65) and 182% (OR = 2.82, 95% CI: 2.70–2.96, p < 0.005) higher odds of using self-testing, respectively, compared to those in areas with low ART caseloads (<20,000).

Additionally, living in areas with more newly enrolled ART patients was negatively associated with self-testing. Residing in communities with a medium number of new ART patients (1,800–2,900) was associated with 68% lower odds of self-testing (OR = 0.32, 95% CI: 0.29–0.34, p < 0.001), while living in areas with a high number of new ART initiations (≥2,901) was associated with 81% lower odds (OR = 0.19, 95% CI: 0.18–0.21, p < 0.001), compared to areas with a low number of new ART patients (<1,800).

Unlike in the bivariate analysis, gender also played a significant role in the multivariate model, with females having 8% lower odds of choosing self-testing compared to males (OR = 0.92, 95% CI: 0.90–0.94, p < 0.005). Additionally, individuals who received a positive HIV test result had 9% lower odds of having used self-testing compared to those who tested negative (OR = 0.91, 95% CI: 0.84–0.98, p = 0.005). The number of healthcare facilities was also positively associated with self-testing uptake. Living in areas with a medium (15–25) or high (≥26) number of healthcare facilities increased the odds of self-testing by 13% and 34%, respectively (OR = 1.13, 95% CI: 1.09–1.17, p < 0.005; and OR = 1.34, 95% CI: 1.26–1.43, p < 0.005), compared to areas with a low number of facilities (0–14).

Conclusion

In conclusion, the study underscores the complex interplay of individual and community-level factors influencing HIV testing preferences in Cape Town. Younger age, recent HIV testing history, male gender, and residence in areas with higher number of registered ART patient and more healthcare facilities were associated with increased likelihood of HIV self-testing (HIVST). Conversely, older age, female gender, living in communities with more newly initiated ART clients, and receiving a positive HIV diagnosis were linked to a lower likelihood of using HIVST. Geographic disparities across subdistricts further highlight the need for targeted, context-specific strategies to enhance HIV testing uptake, particularly among underrepresented groups, and to optimize the reach and impact of self-testing interventions.

2. Background

South Africa bears one of the highest HIV burdens globally, with nearly 8 million people living with the virus (L. F. Johnson et al., 2022) Despite having the largest antiretroviral treatment (ART) program in the world, HIV-related deaths accounted for more than 23% of all deaths in the country in 2019. (Hansoti et al., 2018; Jamieson et al., 2021) Early detection of HIV, timely initiation of ART, and sustained participation in care are essential to preventing HIV transmission, improving patient outcomes, and reducing AIDS-related morbidity and mortality. (Radebe et al., 2019)

Globally, testing coverage remains insufficient, with only about a third of young people knowing their HIV status, far below the UNAIDS target of 95% of people living with HIV being aware of their status by 2025. (Pereira et al., 2019) In Africa, over 25% of adults still do not know their HIV status, even with expanded testing services. (Njau et al., 2019) Similarly, gaps persist in South Africa, where some individuals have never tested for HIV, a situation worsened by disruptions from the COVID-19 pandemic. (Awopegba et al., 2021; Dorward et al., 2021) In particular, men and youth remain underrepresented in conventional HIV testing, with fewer diagnoses made in these groups compared to the general population. (Awopegba et al., 2021; Cambiano et al., 2019) Structural challenges like stigma, inconvenient clinic hours, and crowded facilities further discourage individuals from seeking testing at healthcare centres. (C. Johnson et al., 2020) Undiagnosed individuals, whether aware or unaware of their status, account for around 80% of new infections, underscoring the need for innovative testing approaches. (Fauci et al., 2019)

HIV self-testing (HIVST) has emerged as a promising strategy to complement conventional HIV testing services, addressing gaps in testing coverage. The World Health Organization (WHO) recommends

HIVST to increase access, especially for groups that are often underserved, such as men, young people, and other key populations. (Cambiano et al., 2019; WHO, 2019). By offering a private, convenient option, HIVST encourages individuals who might hesitate to visit healthcare facilities to test for HIV, potentially improving early diagnosis and facilitating prompt linkage to care.

HIVST can be performed through two different approaches: supervised and unsupervised. In the supervised approach, individuals conduct the test with assistance from a healthcare professional or counsellor. In contrast, with the unsupervised strategy, the individual performs and interprets the HIVST himself before seeking assistance for counselling and linkage to care. (Pant Pai et al., 2013) While HIVST provides users with knowledge of their status, confirmatory testing using national testing algorithms is required for any positive self-test result. (Njau et al., 2019)

Traditional HIV testing services are often hindered by various socio-structural barriers, including the stigma associated with testing and the limited operating hours of healthcare facilities. These challenges make HIVST an appealing alternative for individuals seeking privacy and convenience. (C. Johnson et al., 2020) By allowing people to conduct tests discreetly, HIVST helps mitigate stigma and addresses logistical constraints, making it particularly attractive to those reluctant to visit clinics.

In South Africa, the Western Cape province recorded one of the lowest provincial HIV prevalence estimates in 2017, at 9.1%, alongside the Northern Cape. However, the Western Cape also experienced the most significant increase in HIV prevalence nationwide between 2012 and 2017, rising from 5% to 9.1%. Within this context, the City of Cape Town has emerged as a critical focus area, with HIV prevalence significantly increasing from 5.2% in 2012 to 9.7% in 2017.(Simbayi et al., 2021) Cape Town's high HIV prevalence within the province, combined with gaps in meeting the first and second UNAIDS 90-90-90 targets (87.8%, 76.2%, and 92.4% in 2017 for individuals aged 15 to 64 years), highlights the pressing need for targeted, localized interventions.(Simbayi et al., 2021) The Western Cape Department of Health (WC DoH) implemented the scale-up of HIVST in Cape Town in March 2021 during the COVID-19 pandemic to address these challenges. Notably, this testing strategy was adopted nationally in 2016 and included in South Africa's National Testing Guidelines to reach undertested and testing-averse populations (National HTS Policy, 2016; National HIV Self-Screening Guidelines, 2018). HIVST services in Cape Town have primarily been delivered through a primary distribution model, with secondary distribution planned to commence in March 2024 (WCGH Circular H68 of May 2022)

While HIVST has demonstrated potential in expanding access to HIV testing, limited information is available on the factors influencing its uptake in specific South African settings, such as Cape Town. This gap is particularly evident among the general population and in understanding how demographic

and socio-economic factors shape HIVST adoption. Gaining insights into these dynamics is essential for designing targeted strategies to increase HIVST uptake and ensure the efficient allocation of resources within Cape Town's diverse communities. By leveraging programmatic HIV testing data from the Anova Health Institute, the main district support partner for HIV services (Rees, 2018), this study provides valuable perspectives on HIVST adoption following its scale-up in the Western Cape.

1. Methods

Study Setting and Design

The data used in this study is from Cape Town, located in the Western Cape Province of South Africa. Cape Town is characterized by a diverse population encompassing various ethnicities, social strata, and cultural backgrounds. The city's residents live in distinct subdistricts and neighborhoods, often shaped by socioeconomic and cultural differences (Mumm et al., 2017). This study employed cross-sectional design, utilizing routine HIV Testing Services (HTS) programmatic data collected by the Anova Health Institute from both community- and facility-based testing services in Cape Town. The data spans from January to December 2022 and reflects testing practices across the Cape Metro'ss eight subdistricts, namely Tygerberg, Khayelitsha, Western, Eastern, Southern, Mitchell's Plain, Klipfontein, and Northern. These subdistricts are influenced by varying socio-economic and cultural factors that may influence HIV testing uptake."

Data source and study population

The dataset for this study encompasses both the HIV conventional and self-testing data of individuals 18 years and above, done by Anova Health Institute (Anova) across the 8 subdistricts of the Cape Town metropolitan area: Eastern, Northern, Southern, Western, Khayelitsha, Klipfontein, Mitchells Plain, and Tygerberg. (City of Cape Town, 2021.)

Anova Health Institute is an NGO that focuses specifically on HIV and is the main district support partner in the Cape metro. (Rees, 2018) Anova counsellors are deployed in facilities and the community to provide HTS throughout the Cape Town Metro. During HIV testing, individuals receive information about available testing options, including conventional HIV Testing Services (HTS) and HIV Self-Testing (HIVST), and are empowered to choose their preferred method. A positive HIVST result always necessitates further confirmation through a conventional HIV test, following the validated national HIV testing algorithm. (National HIV Self- Screening Guidelines, 2018) Individual testing data is recorded on a consent form and subsequently entered into an HTS register (either electronic or manual, depending on the facility). After quality checks, the HTS data is transferred to Red Cap and then to Power BI.

With formal permission from Anova and the Department of Health (DOH), deidentified data including

all HIV tests which had complete information on all the variables of interest, was used to analyze the uptake of HIVST and explore its associated factors in Cape Town. Community-level data was extracted from the latest published City of Cape Town profiles and analyses (Metro District Health Plan_2019-20, 2018; City of Cape Town, 2021; City of Cape Town, 2019).

Measures

Outcome/Dependent variable

The outcome of interest in this study was the HIV testing method chosen, either HIVST or conventional testing. Since HIV testing was treated as a binary variable, individuals who opted for HIVST were coded as '1', while those who used conventional testing were coded as '0'.

Predictor/Independent variables

The predictors for this study were selected based on a literature review and a socio-ecological framework (Christian et al., 2020). These social determinants include both individual- and community-level factors. At the individual level, the factors considered included age, categorized into 18–19 (adolescents), 20–24 (young adults), 25–49 (adults), and 50 years and above; sex (male or female); and the last time the individual underwent HIV testing, grouped into 0–12 months, more than 12 months, or never tested before. At the community level, the study explored child acute malnutrition status as a proxy for economic status, the number of healthcare facilities to indicate access to healthcare services, the number of new patients on ART to provide insights into the incidence of new HIV infections, and the number of registered patients receiving ART to reflect the prevalence of HIV in the population (City of Cape Town, 2021). Further details on the outcomes and predictor variables are provided in Table 1

Table 1: Table of Variables

Variable	Type of variable	Variable operationalization
Individual level factors		
Age	Categorical	0= 18-19 (adolescents) 1= 20-24 (Young adults) 2= 25-49 (Adults) 3= 50+ (older adults)
Gender	Binary	0= Female 1= Male
HIV testing results	Binary	0=Negative 1=Male

Last time participant tested for HIV	Categorical	0=12 months or less 1=More than 12 months 2=Never tested
Community level factors		
Subdistricts	Categorical	1=Eastern 2=Northern 3=Southern 4=Western 5=Khayelitsha 6=Klipfontein 7=Mitchell's Plain 8=Tygerberg
Number of healthcare facilities per subdistrict	Categorical	0= low (0-14) 1= medium (15-25) 2 = high (26+)
Number of registered ART patients/subdistrict	Categorical	0= low (0-20000) 1= medium (20001-30000) 2 = high (30001 and above)
Number of new ART patients/subdistrict	Categorical	0= low (less than 1799) 1= medium (1800-2900) 2 = high (2901 and above)
Child acute malnutrition rate/subdistrict (Under/100,000)	Categorical	0= low (less than 0.5) 1= medium (0.5-0.7) 2 = high (0.8-1)
Outcome variable		
HIV testing option	Binary	0=Conventional HIV testing 1=Self-testing

The profile of each subdistrict is outlined in Table 2. The Western subdistrict has the most healthcare facilities (29), followed by Tygerberg (27) and Southern (25). (Metro District Health Plan_2019-20, 2018) Although Khayelitsha has fewer facilities (16), it has the highest count of registered ART patients (47,675), far exceeding other subdistricts, which suggests a higher HIV burden. Western and Mitchell's Plain also report significant numbers of ART patients, with 31,984 and 28,182, respectively. Additionally, Khayelitsha leads in the number of new ART patients (3,298), which aligns with its overall high patient numbers, while Eastern (2,922) and Western (2,801) follow closely. In terms of malnutrition, the Western subdistrict has the highest rate (1 per 100,000), whereas Klipfontein and Mitchell's Plain have the lowest rates (0.3 per 100,000). These variations may reflect differences in socioeconomic factors, access to healthcare, and nutrition programs across the subdistricts.

Table 2: Subdistricts profiles

Subdistrict	Number of healthcare facilities	Number of registered ART patients in 2020/21	Number of new ART patients in 2020/21	Child acute malnutrition rate (under 5)/100,000
Eastern	21	27,597	2,922	0.7
Northern	13	17,966	1,620	0.4
Southern	25	15,785	1,773	0.6
Western	29	31,984	2,801	1.0
Khayelitsha	16	47,675	3,298	0.6
Klipfontein	19	20,686	1,871	0.3
Mitchell's Plain	14	28,182	2,712	0.3
Tygerberg	27	19,404	1,808	0.9

Statistical analysis

The data were analysed using STATA 15.1, incorporating two datasets for HIV self-testing (HIVST) and conventional HIV testing, collected from both facility-based and community-based testing. Each dataset included variables such as age, gender, HIV testing results, last time tested for HIV, and subdistrict. However, the community outreach dataset for conventional testing lacked the variable "last time one tested for HIV."

All datasets were de-identified and did not include unique personal identifiers, making it impossible to track individuals across multiple testing episodes at different healthcare facilities or through a combination of facility and community-based services, or to determine whether the same person accessed both testing modalities during the study period. Therefore, it was not possible to establish whether individuals tested more than once or used both HIVST and conventional testing methods. However, repeat HIV testing is expected, particularly in high-prevalence settings where guidelines recommend frequent retesting—ranging from annual screening in low-risk populations to every three months for high-risk groups (Waters et al., 2011; WHO, 2015). Given this, the analysis was conducted at the testing-event level to reflect real-world testing behaviors rather than unique individual choices. Following data cleaning, individual-level data were merged with community-level variables using subdistrict as the key linking variable. Descriptive statistics were reported for self-testing and conventional testing, with absolute numbers and percentages presented. A summary of community-level factors was also provided.

Bivariate logistic regression models were fitted to assess the association between HIV testing modality (self-testing vs. conventional testing) and each predictor variable, with odds ratios (ORs) and 95% confidence intervals (CIs) reported.

A multivariate logistic regression model was then fitted to identify predictors independently associated with the choice of HIVST, including age, gender, HIV testing result; and at the community level, the number of healthcare facilities, the number of new patients on ART, the number of registered patients receiving ART, and the subdistrict. The variables "last time one tested for HIV" and child acute malnutrition status were excluded from this model due to missing data in the community outreach dataset and high collinearity, respectively, which could compromise the interpretability and stability of the regression estimates. Model fit was assessed using appropriate diagnostic methods, and no evidence of over-dispersion was observed. Given the binary nature of the outcome variable and the model diagnostics, logistic regression remained the most suitable approach. As such, alternative models such as negative binomial regression were not required.

2. Results

This study had a sample size of 265,063 of which 234,853 (88.60%) had utilized conventional HIV testing method and 30,210 (11.40%) opting for self-testing. As shown in Table 3, the majority of individuals undergoing conventional testing are adults aged 25- 49 (63.16%), followed by older adults aged 50+ (17.16%). Similarly, for self-testing, most users are also within the 25-49 age group (63.84%), but there is a higher proportion of young adults aged 20-24 choosing self-testing (23.72%) compared to conventional testing (15.59%). Additionally, adolescents aged 18-19 are more likely to opt for self-testing (7.75%) than conventional testing (4.08%).

Regarding gender, females constitute a larger share of those undergoing conventional testing (65.62%) compared to males (34.38%). The trend is similar for self-testing, where females account for 65.32%, and males make up 34.68%.

In terms of the last HIV test, self-testing is more prevalent among individuals who were tested within the past 12 months (63.51%), while conventional testing is more common among those whose last test was over a year ago.

Subdistrict analysis shows that conventional testing is most frequent in Tygerberg (20.06%) and Khayelitsha (16.87%), followed by Western (13.24%) and Eastern (12.45%). In contrast, self-testing is more widely utilized in Western (19.38%), Southern (15.33%), and Mitchell's Plain (16.97%).

Table 3: Descriptive statistics stratified by HIV testing options

Variable	Categories	HIV Conventional Testing N = 234,853 (88.60%)	HIV Self-Testing N = 30,210 (11.40%)	Chi-square

		n	%	N	%	
Age	18–19	9,583	4.08	2,341	7.75	0.000
	20–24	36,634	15.59	7,166	23.72	
	25–49	148,303	63.16	19,291	63.84	
	50+	40,333	17.16	1,419	4.70	
Gender	Male	80,675	34.38	10,481	34.68	0.306
	Female	154,178	65.62	19,729	65.32	
Test Result	Negative	228,03	97.13	29,382	97.23	0.357
	Positive	6,823	2.87	828	2.77	
Last Time Tested	0–12 months	76,528	32.60	19,191	63.51	0.000
	>12 months	138,012	58.76	7,963	26.38	
	Never tested	20,313	8.63	3,056	10.10	
Subdistrict	Eastern	29,236	12.45	3,368	11.16	0.000
	Northern	20,032	8.53	1,193	3.95	
	Southern	19,776	8.42	4,631	15.33	
	Western	31,092	13.24	5,854	19.38	
	Khayelitsha	39,609	16.87	3,608	11.95	
	Klipfontein	26,931	11.47	3,458	11.44	
	Mitchell's Plain	21,036	8.96	5,124	16.97	
	Tygerberg	47,141	20.06	2,967	9.82	

According to the bivariate analyses in Table 4, gender was not a significant predictor of HIV preference (OR = 0.99, 95% CI: 0.92–1.01, p = 0.306), while age showed a negative gradient (as age increased, the likelihood of choosing self-testing over conventional testing decreased significantly). Compared to adolescents (reference category), young individuals are more likely to opt for HIV self-testing. Specifically, individuals aged 20-24 have 20% lower odds of using self-testing compared to adolescents aged 18-19 (OR = 0.80, 95% CI: 0.76–0.85, p < 0.005). The likelihood decreases further with age, as those aged 25-49 have 47% lower odds compared to the adolescent group (OR = 0.53, 95% CI: 0.51–0.56, p < 0.005), and adults aged 50 and above have 86% lower odds (OR = 0.14, 95% CI: 0.13–0.15, p < 0.005) compared to adolescents.

In terms of the last time an individual had an HIV test (data available for facility-level testing only), those who had tested within the past 12 months were more inclined towards self-testing. In contrast, individuals who last tested more than 12 months ago were 77% less likely to choose self-testing (OR = 0.23, 95% CI: 0.22–0.25, p < 0.005), while those who had never been tested were 40% less likely (OR = 0.60, 95% CI: 0.54–0.67, p < 0.005) to use self-testing."

HIV self-testing is more popular among people living in areas with a high concentration of registered ART patients. Specifically, the odds of choosing self-testing increase by 32% in high-density ART areas

(OR = 1.32, 95% CI: 1.28–1.37, p < 0.005) and by 53% in medium-density ART areas (OR = 1.53, 95% CI: 1.49–1.58, p < 0.005) compared to areas with low ART patient density.

On the other hand, people living in areas with a high number of healthcare facilities are more likely to choose conventional HIV testing. The odds of self-testing decreased by 15% in medium-density healthcare facility areas (OR = 0.85, 95% CI: 0.82–0.87, p < 0.005) and by 27% in high-density facility areas (OR = 0.73, 95% CI: 0.71–0.76, p < 0.005).

Communities with a high number of new ART patients show a 31% lower likelihood of opting for self-testing (OR = 0.69, 95% CI: 0.67–0.72, p < 0.005).

Subdistrict variations are evident, with Southern (OR = 2.04, 95% CI: 1.94–2.13, p < 0.005) and Mitchell's Plain (OR = 2.12, 95% CI: 2.03–2.23, p < 0.005) showing more than twice the odds of self-testing compared to the Eastern subdistrict. Other subdistricts with significantly higher odds of self-testing include Western (OR = 1.63, 95% CI: 1.56–1.71, p < 0.005) and Klipfontein (OR = 1.12, 95% CI: 1.06–1.18, p < 0.005). Conversely, Northern (OR = 0.52, 95% CI: 0.48–0.55, p < 0.005), Tygerberg (OR = 0.55, 95% CI: 0.52–0.57, p < 0.005), and Khayelitsha (OR = 0.97, 95% CI: 0.83–0.91, p < 0.005) had significantly lower odds. These findings highlight opportunities for targeted self-testing initiatives in areas where self-testing uptake is currently lower.

Table 4: Bivariate logistic analysis between HIV testing option and predictor variables

Variable	Level	Odds ratio	Standard error	p-value	Confidence interval
Individual level factors					
Gender	Male (reference)				
	Female	0.99	0.013	0.306	[0.92,1.01]
Age	18-19 (reference)				
	20-24	0.80	0.021	0.000	[0.76,0.85]
	25-49	0.53	0.012	0.000	[0.51,0.56]
	50+	0.14	0.006	0.000	[0.13,0.15]
Result of HIV test	Negative (reference)				
	Positive	0.97	0.034	0.357	[0.90,1.04]
Last time one had an HIV test	0-12 months (reference)				
	More than 12 months	0.23	0.008	0.000	[0.22,0.25]
	Never tested	0.60	0.033	0.000	[0.54,0.67]
Community level variables					

Number of healthcare facilities	low (reference)				
	medium	0.85	0.014	0.000	[0.82,0.87]
	high	0.73	0.012	0.000	[0.71,0.76]
Number of registered ART patients	low (reference)				
	medium	1.53	0.022	0.000	[1.49,1.58]
	high	1.32	0.021	0.000	[1.28,1.37]
Number of new ART patients	low (reference)				
	medium	0.94	0.015	0.000	[0.91,0.97]
	high	0.69	0.03	0.000	[0.67,0.72]
Acute child malnutrition rate	Very low (reference)				
	low	1.31	0.020	0.000	[1.27,1.35]
	moderate	0.91	0.013	0.000	[0.89,0.94]
Subdistrict	Eastern (Reference)				
	Northern	0.52	0.018	0.000	[0.48,0.55]
	Southern	2.04	0.050	0.000	[1.94,2.13]
	Western	1.63	0.037	0.000	[1.56,1.71]
	Khayelitsha	0.97	0.019	0.000	[0.83,0.91]
	Klipfontein	1.12	0.028	0.000	[1.06,1.18]
	Mitchell's Plain	2.12	0.051	0.000	[2.03,2.23]
	Tygerberg	0.55	0.014	0.000	[0.52,0.57]

The multivariate logistic regression model in Table 5 examines factors influencing HIV testing preferences at both individual and community levels. To ensure consistency in the analytical sample, the model was revised to exclude the variable "last time one had an HIV test", as this variable was not available in the community-based testing dataset. This adjustment allowed the analysis to include both facility-based and community-based testing participants, enabling a more comprehensive and comparable interpretation of the results across the full sample. Unlike the bivariate analysis, gender emerged as a statistically significant factor after adjusting for other variables: females had 8% lower odds of choosing self-testing compared to males (OR = 0.92, 95% CI: 0.90–0.94, $p < 0.005$). Age was also a strong predictor: individuals aged 20–24 had 23% lower odds of using self-testing compared to those aged 18–19 (OR = 0.77, 95% CI: 0.73–0.82, $p < 0.005$), while those aged 25–49 had 49% lower odds (OR = 0.51, 95% CI: 0.48–0.53, $p < 0.005$). The oldest age group (50 years and above) had 86% lower odds of choosing self-testing compared to the youngest group (OR = 0.14, 95% CI: 0.13–0.15, $p < 0.005$). In addition, individuals who received a positive HIV test result had 9% lower odds of having used self-testing compared to those who tested negative (OR = 0.91, 95% CI: 0.84–0.98, $p = 0.005$).

At the community level, the number of healthcare facilities was positively associated with self-testing uptake. Living in areas with a medium or high number of facilities increased the odds of self-testing by 13% and 34%, respectively, compared to areas with few facilities (OR = 1.13, 95% CI: 1.09–1.17, p < 0.005; and OR = 1.34, 95% CI: 1.26–1.43, p < 0.005, respectively). Similarly, individuals residing in communities with a medium number of registered ART patients had 240% higher odds of using self-testing (OR = 3.40, 95% CI: 3.18–3.65), while those in high ART caseload areas had 182% higher odds (OR = 2.82, 95% CI: 2.70–2.96, p < 0.005) compared to those in low ART areas.

In contrast, living in areas with more newly enrolled ART patients was negatively associated with self-testing. Residing in areas with a medium number of new ART patients was associated with 68% lower odds of self-testing (OR = 0.32, 95% CI: 0.29–0.34, p < 0.001), while living in areas with a high number of new ART patients was associated with 81% lower odds (OR = 0.19, 95% CI: 0.18–0.21, p < 0.001), relative to areas with few new ART initiations.

In summary, HIV self-testing was more likely among younger individuals, men, and residents of areas with medium and high number of healthcare facilities. However, older adults, women, those with a positive HIV diagnosis, and individuals in areas with newly expanding ART services were less likely to use self-testing, indicating the need for targeted strategies to improve uptake in these groups.

Table 5: Multivariate logistic regression model showing the relationship between HIV testing options and predictors

Variable	Level	Odds ratio	Standard error	p-value	Confidence interval
Individual level Factors					
Gender	Male (reference)				
	Female	0.92	0.012	0.000	[0.90,0.94]
Age	18-19 (reference)				
	20-24	0.77	0.021	0.000	[0.73,0.82]
	25-49	0.51	0.013	0.000	[0.48,0.53]
	50+	0.14	0.005	0.000	[0.13,0.15]
Result of HIV test	Negative (reference)				
	Positive	0.91	0.034	0.010	[0.84,0.98]
Community level Variables					
Number of healthcare facilities	low (reference)				
	medium	1.13	0.021	0.000	[1.09,1.17]
	high	1.34	0.044	0.000	[1.26,1.43]

Number of registered ART patients	low (reference)				
	medium	3.40	0.119		[3.18,3.65]
	high	2.82	0.067	0.000	[2.70, 2.96]
Number of new ART patients	low (reference)				
	medium	0.32	0.013	0.000	[0.29,0.34]
	high	0.19	0.006	0.000	[0.18,0.21]

3. Discussion

This study offers valuable insights into the uptake and factors influencing the choice of HIVST over conventional testing, highlighting how individual characteristics and community-level factors shape testing preferences. Given the limited number of population-based studies on HIVST in Cape Town, our study provides evidence on the characteristics of individuals likely to use HIVST within the context of an urban HIVST program in Africa.

The results indicate that age is a significant factor influencing self-testing preferences, with the highest uptake of HIVST observed among younger individuals, particularly adolescents (18–19 years) and young adults (20–24 years). Among self-testing users, adolescents account for 7.75%, and young adults make up 23.72%. In contrast, older adults (50+ years) show a strong preference for conventional testing, with 86% lower odds of choosing self-testing compared to adolescents.

Similar trends in HIVST uptake have been observed in previous studies, where age was strongly associated with self-testing, with the lowest uptake seen among individuals aged 40 and older. (Bien-Gund et al., 2022; Choko et al., 2015; Daniel et al., 2024; Indravudh et al., 2020a; C. Johnson et al., 2021) The higher uptake of HIVST among young individuals likely reflects the greater privacy and convenience it offers. This is especially appealing to those who may have concerns about confidentiality or fear of stigma in healthcare settings. (Figueroa et al., 2015; Obiezu-Umeh et al., 2021) This preference for self-testing among adolescents and young adults underscores a critical opportunity to target this age group with tailored self-testing interventions, especially considering their lower likelihood of engaging with conventional healthcare services.

Older adults (50+ years) have demonstrated lower uptake of both conventional HIV testing (17,16%) and self-testing (4,70%). This trend has been linked to their association of age with respectability, their perception of HIV as “a disease of youth,” and the stigma they associate with HIV testing, which conflicts with age-related norms. (C. Johnson et al., 2021) Despite this, older adults strongly prefer

conventional testing, with 86% lower odds of choosing self-testing compared to adolescents. This presents a significant opportunity to raise awareness about HIVST among this group and increase its uptake. Previous research has shown that older adults still value the discretion and convenience offered by HIVST. Strategies such as door-to-door HIVST distribution by an older provider, combined with the option of an additional kit for a partner, could substantially enhance uptake within this demographic. (C. Johnson et al., 2021)

Gender significantly influences HIV testing preferences. Multivariate analysis reveals that women are 8% less likely to opt for self-testing compared to men (OR = 0.92, $p < 0.001$), highlighting a strong preference for self-testing among men. This supports evidence from other Sub-Saharan African studies that found men are less likely to test for HIV overall, yet more inclined to choose HIVST when offered (Quinn et al., 2019; WHO 2016). This paradox reflects underlying gender norms such as masculine ideals, that discourage help-seeking, which HIVST may help to overcome by offering privacy and autonomy (Arnesen et al., 2017). To capitalize on this, HIVST initiatives should incorporate workplace and community-based interventions tailored to engage men (Jamieson et al., 2021; Matsimela et al., 2021; WHO, 2022).

We observed differences in odds ratios for variables such as sex and age between bivariate and multivariate models. These changes suggest the presence of confounding, which was addressed through multivariate adjustment for individual- and community-level covariates. Additionally, we explored potential interaction terms (e.g., between sex and age or community-level factors), but none were statistically significant and were therefore excluded to preserve model simplicity and interpretability.

For facility testing level, the bivariate analysis showed a strong association was observed between previous testing history and the choice of testing method. Individuals who had tested within the last 12 months were more likely to choose self-testing, while those who had not tested in over a year or had never tested were significantly less likely to opt for this method (OR = 0.21 and OR = 0.49, respectively). This pattern suggests that self-testing may appeal more to individuals who are already engaged in regular health monitoring and are comfortable with the idea of testing, whereas those with a sporadic or non-existent testing history may prefer the guidance and support provided in conventional settings. Similar findings were observed in previous studies. (Belza et al., 2014; Daniel et al., 2024; Indravudh et al., 2020) This finding underscores the need for targeted campaigns to promote self-testing, particularly among individuals who are overdue for testing or have never been tested. Highlighting the simplicity and accessibility of self-testing kits could effectively engage these groups, addressing gaps in HIV status awareness, an essential step toward timely linkage to care.

On the other hand, individuals who a received a positive HIV test result appeared to have a slightly

lower odds of choosing self-testing compared to those who tested negative (OR = 0.91, $p < 0.001$). This trend may reflect the role of HIVST as a convenient method for re-engaging with care among people living with HIV (PLHIV) who were previously diagnosed but not linked or retained in care. (Hacking et al., 2022) Additionally, HIVST may also appeal to individuals with ongoing high-risk behaviours, offering greater privacy and autonomy (Jamil et al., 2017; WHO, 2016). At the same time, other population groups, particularly those who perceive themselves at low risk of infection, may be less inclined to use HIVST, as found in a study from Malawi (Shaba et al., 2023). These differences highlight the importance of tailoring HIVST strategies to address varied risk perceptions and motivations.

In this analysis, living in areas with a medium or high number of healthcare facilities increased the odds of using self-testing by 13% and 34%, respectively, compared to areas with fewer facilities (OR = 1.13 and OR = 1.34, both $p < 0.005$). This suggests that in communities with a medium or high number of healthcare facilities, where access to healthcare is better, individuals are more inclined to use self-testing. This aligns with previous studies showing that areas with more healthcare facilities tend to have better socioeconomic conditions and improved access to health services (Gordon et al., 2020), while poorer communities often face barriers that limit both access to and uptake of HIV self-testing (Bien-Gund et al., 2022; Ekholuenetale et al., 2022; Terefe et al., 2024). In contrast, living in areas with higher numbers of newly enrolled ART patients was negatively associated with self-testing. Residing in areas with a medium number of new ART patients was associated with 68% lower odds of self-testing (OR = 0.32, $p < 0.001$), while living in areas with a high number of new ART patients was associated with 81% lower odds (OR = 0.19, $p < 0.001$), compared to areas with fewer new ART initiations. Khayelitsha Subdistrict, which has fewer healthcare facilities and a higher number of new ART patients, is also associated with 81% lower odds of HIVST.

Geographical differences in HIV testing preferences highlight areas where targeted interventions could be especially impactful. In regions like Khayelitsha, which has a relatively lower number of healthcare facilities and a higher number of new ART patients, the likelihood of using self-testing is expected to be low. However, given its higher number of registered ART patients, the odds of self-testing would be expected to be higher. These trends underscore the complexity of HIV testing preferences and highlight the need for integrated approaches that do not position self-testing as a replacement but as a complementary strategy to conventional services, particularly in high-burden areas (UNAIDS, 2021).

Conversely, the Southern and Mitchell's Plain subdistricts showed more than twice the odds of self-testing compared to the Eastern subdistrict (used as the reference category), presenting an opportunity to promote self-testing initiatives in areas where uptake is currently lower. Areas like Tygerberg and Khayelitsha, which show a higher preference for conventional testing, may benefit from integrated strategies that combine self-testing with community-based support to address potential

barriers. These variations in testing preferences across subdistricts may reflect differences in local HIV awareness campaigns or cultural attitudes toward testing. For example, the higher uptake of HIVST in Mitchell's Plain and the Western subdistrict may be the result of stronger promotional efforts (Us, 2018).

Despite identifying critical factors influencing HIVST uptake, future research should focus on exploring the barriers faced by older individuals, women, and other underrepresented groups—with an emphasis on how community engagement and health education shape their testing preferences. This includes developing tailored interventions to address their unique challenges and preferences, ensuring broader reach and greater impact in improving HIV testing uptake.

4. Strengths and Limitations

This study draws on a large, representative sample from HIV testing data collected by the Anova Health Institute over a one-year period across the entire City of Cape Town Metro. By leveraging this extensive dataset, the study provides valuable insights into HIVST uptake following its scale-up implementation in the Western Cape in March 2021. This research is among the first to evaluate real-world HIVST use in Cape Town, offering insight into the progress made in addressing HIV testing gaps and highlighting the social determinants associated with HIVST. Additionally, by utilizing programmatic, routinely collected data, the study presents a cost-effective model that can be easily replicated in other settings to monitor HIVST uptake and implementation.

Focusing on Cape Town, this analysis is context-specific and addresses limitations in previous studies that often generalize findings across diverse settings without accounting for local determinants. The use of binary logistic regression as the primary analytical method strengthens the study by enabling the estimation of the odds of HIVST uptake while adjusting for potential confounding variables. This statistical approach enhances the reliability and interpretability of the results by quantifying associations between key sociodemographic factors and HIVST uptake. While not without limitations, logistic regression offers a rigorous and widely accepted framework for analysing programmatic data, contributing to more informed, data-driven decision-making in similar urban and peri-urban African contexts (Hosmer et al., 2013).

Moreover, the study integrates individual- and community-level factors, offering a comprehensive framework for understanding HIVST adoption. This holistic approach goes beyond sociodemographic variables such as age and education to include contextual elements like healthcare access and ART patient density, aligning with the multifaceted realities of HIV testing behaviours. The results, presented as odds ratios (ORs), provide granular insights into gender, recent HIV testing history, and

healthcare facility density. These practical and actionable findings offer guidance to public health stakeholders in designing evidence-based interventions tailored to specific high-risk populations in Cape Town (UNAIDS, 2022).

While previous studies often focused on broad sociodemographic factors, this study advances the field by exploring regional and contextual nuances relevant to urban African settings. The use of binary logistic regression, which adjusts for confounding variables and models the likelihood of HIVST uptake, adds methodological rigor and strengthens the interpretation of associations within the dataset. However, this rigor is tempered by several limitations inherent in the study design and data source.

Specifically, the exclusion of records with missing data may introduce selection bias, potentially affecting the generalizability of the findings. The dataset also lacked key sociodemographic variables such as education level, marital status, and occupation, which are known to influence health-seeking behaviour and HIV testing preferences. The absence of racial classification data is a limitation, particularly in Cape Town, where racial disparities rooted in apartheid-era policies, continue to shape health outcomes. Studies have shown significantly higher HIV prevalence and lower testing uptake among Black South Africans, underscoring race as a critical social determinant of health (Simbayi et al., 2019). Without this data, the study may overlook important structural inequities influencing HIVST uptake. Furthermore, the lack of area-based deprivation indices for specific subdistricts constrains the study's capacity to evaluate economic influences at the community level, which are essential for understanding spatial inequalities in access and uptake.

Additionally, the cross-sectional nature of the study restricts its ability to infer causality between observed associations. Temporal relationships between predictors and HIVST uptake cannot be established, limiting the interpretation of findings to correlations rather than causal inferences. Future research should consider longitudinal or mixed methods designs and incorporate these additional variables to provide a more comprehensive and nuanced understanding of HIVST implementation, equity, and scalability (Johnson et al., 2019).

Conclusion

The study highlights the importance of investigation using a contextual framework, going beyond individual factors to community factors. Our study shows that individual-level factors, such as age, gender and testing history, and community-level factors, like the number of healthcare facilities, and residing in communities with a medium number of registered ART patients, as well as the number of new ART patients in a community significantly shape HIV testing behavior. HIV self-testing was more likely among younger individuals, men, and residents of better-served communities with to medium 15-25) to high number of health care facilities (more then 25). However, older adults, women, those

with a positive HIV diagnosis, and individuals in areas with more newly enrolled ART patients were less likely to use self-testing, indicating the need for targeted strategies to improve uptake in these groups. Geographic variations in sub-district testing preferences further indicate that the implementation of HIVST may drive distinct testing trends across different areas of Cape Town. These findings underscore the importance of developing differentiated HIV testing strategies that consider demographic, behavioral, and community-specific factors.

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Availability of data and materials

The data used in this study belongs to Anova Health Institute. Access to these data is restricted and governed by the policies of the Anova Health Institute. Requests for data access should be directed to the Institute in accordance with their data-sharing policies.

This research utilized secondary data, and no primary materials, such as questionnaires or surveys, were employed. For inquiries regarding the data used in this study, please contact the corresponding author.

Authors' contributions

Doris Nyembwe conceptualized the study, conducted the analysis, drafted the manuscript, and reviewed the paper in preparation for submission.

Ethics approval and consent to participate

This study used secondary analysis based on Anova Health Institute HIVST, available at Anova Health Institute. Ethics approval was obtained from Human Research Ethics Committee (HREC) at the University of Cape Town (HREC REF: 776 / 2023).

Competing interests

No competing interests

5. References

Abdullahi Nasir, I. (2018). Knowledge, attitude and factors affecting voluntary HIV counselling and testing services among women of reproductive age group in an Abuja 1 2 3 1 3, 4*. In Nigeria Medical Journal of Zambia (Vol. 45, Issue 1).

Adebayo, O. W., & Gonzalez-Guarda, R. M. (2017). Factors Associated with HIV Testing in Youth in the United States: An Integrative Review. Journal of the Association of Nurses in AIDS Care, 28(3). https://doi.org/10.1016/j.jana.2016.11.006

Ajayi, A. I., Awopegba, O. E., Adeagbo, O. A., & Ushie, B. A. (2020). Low coverage of HIV testing among adolescents and young adults in Nigeria: Implication for achieving the UNAIDS first 95. PLoS ONE, 15(5). https://doi.org/10.1371/journal.pone.0233368

Arnesen, R., Moll, A. P., & Shenoi, S. V. (2017). Predictors of loss to follow-up among patients on ART at a rural hospital in KwaZulu-Natal, South Africa. PLoS ONE, 12(5). https://doi.org/10.1371/journal.pone.0177168

Asaolu, I. O., Gunn, J. K., Center, K. E., Koss, M. P., Iwelunmor, J. I., & Ehiri, J. E. (2016). Predictors of HIV testing among youth in sub-Saharan Africa: A cross-sectional study. PLoS ONE, 11(10). https://doi.org/10.1371/journal.pone.0164052

Awopegba, O. E., Ologunowa, T. O., & Ajayi, A. I. (2021a). HIV testing and self-testing coverage among men and women in South Africa: an exploration of related factors. Tropical Medicine and International Health, 26(2), 214–227. https://doi.org/10.1111/tmi.13514

Awopegba, O. E., Ologunowa, T. O., & Ajayi, A. I. (2021b). HIV testing and self-testing coverage among men and women in South Africa: an exploration of related factors. Tropical Medicine and International Health, 26(2), 214–227. https://doi.org/10.1111/tmi.13514

Bayani, A., Ghiasvand, H., Rezaei, O., Fattah Moghaddam, L., Noroozi, A., Ahounbar, E., Higgs, P., & Armoon, B. (2020). Factors associated with HIV testing among people who inject drugs: a meta-

analysis. Journal of Addictive Diseases, 38(3). https://doi.org/10.1080/10550887.2020.1771235

Beecroft, A., Vaikla, O., & Pant Pai, N. (2024). Digital HIV self-testing as an exemplar: a perspective on benefits, challenges, and opportunities. Expert Review of Molecular Diagnostics, 24(10), 913–925. https://doi.org/10.1080/14737159.2024.2406974

Belza, M. J., Figueroa, C., Rosales-Statkus, M. E., Ruiz, M., Vallejo, F., & de la Fuente, L. (2014). Low knowledge and anecdotal use of unauthorized online HIV self-test kits among attendees at a street-based HIV rapid testing programme in Spain. International Journal of Infectious Diseases, 25, 196–200. https://doi.org/10.1016/j.ijid.2014.03.1379

Bien-Gund, C. H., Shaw, P. A., Agnew-Brune, C., Baugher, A., Brady, K. A., & Gross, R. (2022). HIV Self-testing and Risk Behaviors Among Men Who Have Sex with Men in 23 US Cities, 2017. JAMA Network Open, 5(12), e2247540. https://doi.org/10.1001/jamanetworkopen.2022.47540

Brofenbrenner, U., & Hess, A. L. (1979). The Ecology of Human Development: Experiments by Nature and Design. https://about.jstor.org/terms

Budlender, D. (1999). Patterns of poverty in South Africa. Development Southern Africa, 16(2), 197–219. https://doi.org/10.1080/03768359908440073

Bwalya, C., Simwinga, M., Hensen, B., Gwanu, L., Hang'Andu, A., Mulubwa, C., Phiri, M., Hayes, R., Fidler, S., Mwinga, A., Ayles, H., Ayles, H., Bond, & Bond, V. (2020). Social response to the delivery of HIV self-testing in households: Experiences from four Zambian HPTN 071 (PopART) urban communities. AIDS Research and Therapy, 17(1). https://doi.org/10.1186/s12981-020- 00287-y

Bwana, P., Ochieng, L., & Mwau, M. (2018). Performance and usability evaluation of the INSTI HIV self-test in Kenya for qualitative detection of antibodies to HIV. PLoS ONE, 13(9). https://doi.org/10.1371/journal.pone.0202491

Cambiano, V., Ford, D., Mabugu, T., Napierala Mavedzenge, S., Miners, A., Mugurungi, O., Nakagawa, F., Revill, P., & Phillips, A. (2015). Assessment of the Potential Impact and Cost-effectiveness of Self-Testing for HIV in Low-Income Countries. Journal of Infectious Diseases, 212(4), 570–577. https://doi.org/10.1093/infdis/jiv040

Cambiano, V., Johnson, C. C., Hatzold, K., Terris-Prestholt, F., Maheswaran, H., Thirumurthy, H., Figueroa, C., Cowan, F. M., Sibanda, E. L., Ncube, G., Revill, P., Baggaley, R. C., Corbett, E. L., & Phillips, A. (2019). The impact and cost-effectiveness of community-based HIV self-testing in sub-Saharan Africa: a health economic and modelling analysis for Working Group on Cost Effectiveness of HIV self-testing in Southern Africa. https://doi.org/10.1002/jia2.25243/full

Chamie, G., Napierala, S., Agot, K., & Thirumurthy, H. (2021). Review HIV testing approaches to reach the first UNAIDS 95% target in sub-Saharan Africa. www.thelancet.com/hiv

Chiu, C. C. J., & Young, S. D. (2016). Correlates of requesting home HIV self-testing kits on online social networks among African American and Latino men who have sex with men. AIDS Care - Psychological and Socio-Medical Aspects of AIDS/HIV, 28(3), 289–293. https://doi.org/10.1080/09540121.2015.1090533

Choko, A. T., Corbett, E. L., Stallard, N., Maheswaran, H., Lepine, A., Johnson, C. C., Sakala, D., Kalua, T., Kumwenda, M., Hayes, R., & Fielding, K. (2019). HIV self-testing alone or with additional interventions, including financial incentives, and linkage to care or prevention among male partners of antenatal care clinic attendees in Malawi: An adaptive multi-arm, multi-stage cluster randomised trial. PLoS Medicine, 16(1). https://doi.org/10.1371/journal.pmed.1002719

Choko, A. T., MacPherson, P., Webb, E. L., Willey, B. A., Feasy, H., Sambakunsi, R., Mdolo, A., Makombe, S. D., Desmond, N., Hayes, R., Maheswaran, H., & Corbett, E. L. (2015). Uptake, Accuracy, Safety, and Linkage into Care over Two Years of Promoting Annual Self-Testing for HIV in Blantyre, Malawi: A Community-Based Prospective Study. PLoS Medicine, 12(9). https://doi.org/10.1371/journal.pmed.1001873

Christian, S. N., Mantell, J. E., Romo, M. L., Grov, C., George, G., Mwai, E., Nyaga, E., Odhiambo, J. O., Govender, K., & Kelvin, E. A. (2020). Applying a social-ecological lens to opinions about HIV self-testing among Kenyan truckers who declined to test: a qualitative study. African Journal of AIDS Research, 19(2), 147–155. https://doi.org/10.2989/16085906.2020.1764070

City of Cape Town., 2021.

City Of Cape Town Metropolitan Municipality Profile: City Of Cape Town Metro. (2021).

Daniel, D., Hasen, H., Sinebo, Y., Bereku, T., Mekuria, M., Jemal, Z., Amare, M., & Habtu, Y. (2024). Level of knowledge and intention to use oral fluid HIV self-testing and associated factors among Ethiopian health care workers in southern Ethiopia. AIDS Research and Therapy, 21(1). https://doi.org/10.1186/s12981-024-00642-3

Decker, M. R., Wilcox, H. C., Holliday, C. N., & Webster, D. W. (2018). An Integrated Public Health Approach to Interpersonal Violence and Suicide Prevention and Response. Public Health Reports, 133, 65S-79S. https://doi.org/10.1177/0033354918800019

Diez Roux, A. V. (2002). A glossary for multilevel analysis. In Journal of Epidemiology and Community Health (Vol. 56, Issue 8). https://doi.org/10.1136/jech.56.8.588

Donovan, B. J., Rublein, J. C., Leone, P. A., & Pilcher, C. D. (2004). HIV Infection: Point-of-Care Testing. In Annals of Pharmacotherapy (Vol. 38, Issue 4). https://doi.org/10.1345/aph.1D314

Dorward, J., Khubone, T., Gate, K., Ngobese, H., Sookrajh, Y., Mkhize, S., Jeewa, A., Bottomley, C., Lewis, L., Baisley, K., Butler, C. C., Gxagxisa, N., & Garrett, N. (2021). The impact of the COVID-19 lockdown on HIV care in 65 South African primary care clinics: an interrupted time series analysis. The Lancet HIV, 8(3), e158–e165. https://doi.org/10.1016/S2352-3018(20)30359-3

Ekholuenetale, M., Nzoputam, C. I., & Okonji, O. C. (2022a). Association between socio-economic factors and HIV self-testing knowledge amongst South African women. Southern African Journal of HIV Medicine, 23(1). https://doi.org/10.4102/SAJHIVMED.V23I1.1347

Ekholuenetale, M., Nzoputam, C. I., & Okonji, O. C. (2022b). Association between socio-economic factors and HIV self-testing knowledge amongst South African women. Southern African Journal of HIV Medicine, 23(1). https://doi.org/10.4102/SAJHIVMED.V23I1.1347

Ekholuenetale, M., Nzoputam, C. I., & Okonji, O. C. (2022c). Association between socio-economic factors and HIV self-testing knowledge amongst South African women. Southern African Journal of HIV Medicine, 23(1). https://doi.org/10.4102/SAJHIVMED.V23I1.1347

Eshun-Wilson, I., Jamil, M. S., Witzel, T. C., Glidded, D. V., Johnson, C., Le Trouneau, N., Ford, N., McGee, K., Kemp, C., Baral, S., Schwartz, S., & Geng, E. H. (2021). A Systematic Review and Network Meta-analyses to Assess the Effectiveness of Human Immunodeficiency Virus (HIV) Self-testing Distribution Strategies. In Clinical Infectious Diseases (Vol. 73, Issue 4, pp. E1018–E1028). Oxford University Press. https://doi.org/10.1093/cid/ciab029

Fauci, A. S., Redfield, R. R., Sigounas, G., Weahkee, M. D., & Giroir, B. P. (2019). Ending the HIV Epidemic: A Plan for the United States. In JAMA - Journal of the American Medical Association (Vol. 321, Issue 9). https://doi.org/10.1001/jama.2019.1343

Figueroa, C., Johnson, C., Verster, A., & Baggaley, R. (2015). Attitudes and Acceptability on HIV Self-testing Among Key Populations: A Literature Review. AIDS and Behavior, 19(11), 1949–1965. https://doi.org/10.1007/s10461-015-1097-8

Giguère, K., Eaton, J. W., Marsh, K., Johnson, L. F., Johnson, C. C., Ehui, E., Jahn, A., Wanyeki, I., Mbofana, F., Bakiono, F., Mahy, M., & Maheu-Giroux, M. (2021). Trends in knowledge of HIV status and efficiency of HIV testing services in sub-Saharan Africa, 2000–20: a modelling study using survey and HIV testing programme data. The Lancet HIV, 8(5). https://doi.org/10.1016/S2352-3018(20)30315-5

Goudge, J., Gilson, L., Russell, S., Gumede, T., & Mills, A. (2009). The household costs of health care in rural South Africa with free public primary care and hospital exemptions for the poor. Tropical Medicine and International Health, 14(4). https://doi.org/10.1111/j.1365-3156.2009.02256.x

Greacen, T., Friboulet, D., Fugon, L., Hefez, S., Lorente, N., & Spire, B. (2012). Access to and use of unauthorised online HIV self-tests by internet-using French-speaking men who have sex with men. Sexually Transmitted Infections, 88(5). https://doi.org/10.1136/sextrans-2011-050405

Guidelines Consolidated Guidelines on HIV Testing Services 5cs: Consent, Confidentiality, Counselling, Correct Results and Connection. (2015).

Hansoti, B., Stead, D., Parrish, A., Reynolds, S. J., Redd, A. D., Whalen, M. M., Mvandaba, N., & Quinn, T. C. (2018). HIV testing in a South African Emergency Department: A missed opportunity. PLoS ONE, 13(3). https://doi.org/10.1371/journal.pone.0193858

Harichund, C., & Moshabela, M. (2018). Acceptability of HIV Self-Testing in Sub-Saharan Africa: Scoping Study. In AIDS and Behavior (Vol. 22, Issue 2, pp. 560–568). Springer New York LLC. https://doi.org/10.1007/s10461-017-1848-9

Harichund, C., Moshabela, M., Kunene, P., & Abdool Karim, Q. (2019). Acceptability of HIV self-testing among men and women in KwaZulu-Natal, South Africa. AIDS Care - Psychological and Socio-Medical Aspects of AIDS/HIV, 31(2), 186–192. https://doi.org/10.1080/09540121.2018.1503638

Hecht, J., Sanchez, T., Patrick; Sullivan, S., Dinenno, E. A., Cramer, N., & Delaney, K. P. (2020). Morbidity and Mortality Weekly Report. https://www.nastad.org/domestic/hiv-prevention

Hermanus, T., & O'Grady, M. (2022). A principle-based approach to justify the use of HIV self-testing in South Africa. Developing World Bioethics, 22(1), 53–62. https://doi.org/10.1111/dewb.12319

HIV Self-Testing and Partner Notification Supplement to Consolidated Guidelines on HIV Testing Services. (2016).

Hlongwa, M., Mashamba-Thompson, T., Makhunga, S., & Hlongwana, K. (2019). Mapping evidence of intervention strategies to improve men's uptake to HIV testing services in sub-Saharan Africa: A systematic scoping review. In BMC Infectious Diseases (Vol. 19, Issue 1). BioMed Central Ltd. https://doi.org/10.1186/s12879-019-4124-y

Hoang, C. D., Tran, B. X., Pham, M. D., Nguyen, L. H., Do, H. N., Vuong, Q. H., Ho, M. T., Dam, V. N., Vuong, T. T., Nguyen, H. H., Nguyen, V., Pham, H. Q., Ha, G. H., Latkin, C. A., Ho, C. S. H., & Ho, R. C. M. (2019). HIV- and AIDS-related knowledge and attitude of residents in border regions of

Vietnam. Harm Reduction Journal, 16(1). https://doi.org/10.1186/s12954-019-0282-x

Hurt, C. B., & Powers, K. A. (2014). Self-testing for HIV and its impact on public health. In Sexually Transmitted Diseases (Vol. 41, Issue 1, pp. 10–12). https://doi.org/10.1097/OLQ.0000000000000076

Indravudh, P. P., Hensen, B., Nzawa, R., Chilongosi, R., Nyirenda, R., Johnson, C. C., Hatzold, K., Fielding, K., Corbett, E. L., & Neuman, M. (2020a). Who is Reached by HIV Self-Testing? Individual Factors Associated with Self-Testing Within a Community-Based Program in Rural Malawi. www.jaids.com

Indravudh, P. P., Hensen, B., Nzawa, R., Chilongosi, R., Nyirenda, R., Johnson, C. C., Hatzold, K., Fielding, K., Corbett, E. L., & Neuman, M. (2020b). Who is Reached by HIV Self-Testing? Individual Factors Associated with Self-Testing Within a Community-Based Program in Rural Malawi. Journal of Acquired Immune Deficiency Syndromes, 85(2), 165–173. https://doi.org/10.1097/QAI.0000000000002412

Ingold, H., Mwerinde, O., Ross, A. L., Leach, R., Corbett, E. L., Hatzold, K., Johnson, C. C., Ncube, G., Nyirenda, R., & Baggaley, R. C. (2019a). The Self-Testing AfRica (STAR) Initiative: accelerating global access and scale-up of HIV self-testing. https://doi.org/10.1002/jia2.25249/full

Ingold, H., Mwerinde, O., Ross, A. L., Leach, R., Corbett, E. L., Hatzold, K., Johnson, C. C., Ncube, G., Nyirenda, R., & Baggaley, R. C. (2019b). The Self-Testing AfRica (STAR) Initiative: accelerating global access and scale-up of HIV self-testing. https://doi.org/10.1002/jia2.25249/full

Jamieson, L., Johnson, L. F., Matsimela, K., Sande, L. A., D'Elbée, M., Majam, M., Johnson, C., Chidarikire, T., Hatzold, K., Terris-Prestholt, F., Nichols, B., & Meyer-Rath, G. (2021). The cost effectiveness and optimal configuration of HIV self-test distribution in South Africa: A model analysis. BMJ Global Health, 6. https://doi.org/10.1136/bmjgh-2021-005598

Jamil, M. S., Eshun-Wilson, I., Witzel, T. C., Siegfried, N., Figueroa, C., Chitembo, L., Msimanga-Radebe, B., Pasha, M. S., Hatzold, K., Corbett, E., Barr-DiChiara, M., Rodger, A. J., Weatherburn, P., Geng, E., Baggaley, R., & Johnson, C. (2021). Examining the effects of HIV self-testing compared to standard HIV testing services in the general population: A systematic review and meta-analysis. EClinicalMedicine, 38. https://doi.org/10.1016/j.eclinm.2021.100991

Johnson, A. L., Butts, S. A., Rodriguez, E., Craker, L., Kanamori, M., & Doblecki-Lewis, S. (2023). "Test-To-PrEP": Assessing Reach and Adoption of a New Approach to Increase HIV Testing and PrEP Knowledge Using HIV Self-Test Kit Distribution Through PrEP Clients' Social Networks. Journal of

Acquired Immune Deficiency Syndromes, 94(5). https://doi.org/10.1097/QAI.0000000000003294

Johnson, C. C., Kennedy, C., Fonner, V., Siegfried, N., Figueroa, C., Dalal, S., Sands, A., & Baggaley, R. (2017). Examining the effects of HIV self-Testing compared to standard HIV testing services: A systematic review and meta-Analysis. Journal of the International AIDS Society, 20(1). https://doi.org/10.7448/IAS.20.1.21594

Johnson, C., Kumwenda, M., Meghji, J., Choko, A. T., Phiri, M., Hatzold, K., Baggaley, R., Taegtmeyer, M., Terris-Prestholt, F., Desmond, N., & Corbett, E. L. (2021). 'Too old to test?': A life course approach to HIV-related risk and self-testing among midlife-older adults in Malawi. BMC Public Health, 21(1). https://doi.org/10.1186/s12889-021-10573-7

Johnson, C., Neuman, M., MacPherson, P., Choko, A., Quinn, C., Wong, V. J., Hatzold, K., Nyrienda, R., Ncube, G., Baggaley, R., Terris-Prestholt, F., & Corbett, E. L. (2020). Use and awareness of and willingness to self-test for HIV: An analysis of cross-sectional population-based surveys in Malawi and Zimbabwe. BMC Public Health, 20(1). https://doi.org/10.1186/s12889-020-08855-7

Johnson, L. F., Meyer-Rath, G., Dorrington, R. E., Puren, A., Seathlodi, T., Zuma, K., & Feizzadeh, A. (2022). The Effect of HIV Programs in South Africa on National HIV Incidence Trends, 2000-2019. www.jaids.com

Jooste, S., Mabaso, M., Taylor, M., North, A., Shean, Y., & Simbayi, L. C. (2021). Socio-economic differences in the uptake of HIV testing and associated factors in South Africa. BMC Public Health, 21(1). https://doi.org/10.1186/s12889-021-11583-1

Kelvin, E. A., Cheruvillil, S., Christian, S., Mantell, J. E., Milford, C., Rambally-Greener, L., Mosery, N., Greener, R., & Smit, J. A. (2016). Choice in HIV testing: the acceptability and anticipated use of a self-administered at-home oral HIV test among South Africans. African Journal of AIDS Research, 15(2), 99–108. https://doi.org/10.2989/16085906.2016.1189442

Kilanowski, J. F. (2017). Breadth of the Socio-Ecological Model. In Journal of Agromedicine (Vol. 22, Issue 4, pp. 295–297). Taylor and Francis Ltd. https://doi.org/10.1080/1059924X.2017.1358971

Kombo, B. K., Thomann, M., Lazarus, L., Musyoki, H., Olango, K., Kuria, S., Kyana, M., Otieno, M., Njiriani, M., Musimbi, J., Bhattacharjee, P., & Lorway, R. (2021). Engaging MSM Communities in HIV Self-Testing Research and Programming in Kenya: Collaborations, Tacit Knowledge, and a Community-Based Programme Science Approach. https://doi.org/10.21203/rs.3.rs-861094/v1

Krause, J., Subklew-Sehume, F., Kenyon, C., & Colebunders, R. (2013). Acceptability of HIV self-testing: A systematic literature review. BMC Public Health, 13(1). https://doi.org/10.1186/1471-2458-13-735

Lakhe, N. A., Diallo Mbaye, K., Sylla, K., & Ndour, C. T. (2019). HIV screening in men and women in Senegal: Coverage and associated factors; Analysis of the 2017 demographic and health survey. BMC Infectious Diseases, 20(1). https://doi.org/10.1186/s12879-019-4717-5

Lankowski, A. J., Siedner, M. J., Bangsberg, D. R., & Tsai, A. C. (2014). Impact of geographic and transportation-related barriers on HIV outcomes in sub-saharan Africa: A systematic review. In AIDS and Behavior (Vol. 18, Issue 7). https://doi.org/10.1007/s10461-014-0729-8

Li, J., Marley, G., Zhang, Y., Chen, Y., Tang, W., Rongbin, Y., & Fu, G. (2021). Determinants of Recent HIV Self-Testing Uptake Among Men Who Have Sex with Men in Jiangsu Province, China: An Online Cross-Sectional Survey. Frontiers in Public Health, 9. https://doi.org/10.3389/fpubh.2021.736440

Mabaso, M., Makola, L., Naidoo, I., Mlangeni, L. L., Jooste, S., & Simbayi, L. (2019). HIV prevalence in South Africa through gender and racial lenses: results from the 2012 population-based national household survey. International Journal for Equity in Health, 18(1), 167. https://doi.org/10.1186/s12939-019-1055-6

Maiman, L. A., & Becker, M. H. (1977). The Health Belief Model: Origins and Correlates in Psychological Theory. Health Education & Behavior, 2(4). https://doi.org/10.1177/109019817400200404

Marsh, K., Eaton, J. W., Mahy, M., Sabin, K., Autenrieth, C. S., Wanyeki, I., Daher, J., & Ghys, P. D. (2019). Global, regional and country-level 90-90-90 estimates for 2018: Assessing progress towards the 2020 target. AIDS, 33, S213–S226. https://doi.org/10.1097/QAD.0000000000002355

Matsimela, K., Sande, L. A., Mostert, C., Majam, M., Phiri, J., Zishiri, V., Madondo, C., Khama, S., Chidarikire, T., D'Elbée, M., Hatzold, K., Johnson, C., Terris-Prestholt, F., & Meyer-Rath, G. (2021). The cost and intermediary cost-effectiveness of oral HIV self-test kit distribution across 11 distribution models in South Africa. BMJ Global Health, 6. https://doi.org/10.1136/bmjgh-2021-005019

Matthews, S. A., & Yang, T. C. (2012). Mapping the results of local statistics: Using geographically weighted regression. Demographic Research, 26, 151–166. https://doi.org/10.4054/DemRes.2012.26.6

Mcleroy, K. R., Bibeau, D., Steckler, A., & Glanz, K. (1988). An Ecological Perspective on Health Promotion Programs. Health Education & Behavior, 15(4), 351–377. https://doi.org/10.1177/109019818801500401

Merlo, J., Chaix, B., Ohlsson, H., Beckman, A., Johnell, K., Hjerpe, P., Råstam, L., & Larsen, K. (2006). A brief conceptual tutorial of multilevel analysis in social epidemiology: Using measures of clustering in multilevel logistic regression to investigate contextual phenomena. In Journal of Epidemiology and Community Health (Vol. 60, Issue 4, pp. 290–297). https://doi.org/10.1136/jech.2004.029454

Metro District Health Plan_2019-20. (2019).

Mumm, R., Diaz-Monsalve, S., Hänselmann, E., Freund, J., Wirsching, M., Gärtner, J., Gminski, R., Vögtlin, K., Körner, M., Zirn, L., Wittwer-Backofen, U., Oni, T., & Kroeger, A. (2017). Exploring urban health in Cape Town, South Africa: an interdisciplinary analysis of secondary data. Pathogens and Global Health, 111(1), 7–22. https://doi.org/10.1080/20477724.2016.1275463

National HIV Self Screening Guidelines. (2018).

Ndungu, K., Gichangi, P., & Temmerman, M. (2023). Evaluation of factors associated with HIV self-testing Acceptability and Uptake among the MSM community in Nairobi, Kenya: A cross-sectional study. PLoS ONE, 18(3 March). https://doi.org/10.1371/journal.pone.0280540

Nicholls, E. J., Samba, P., McCabe, L., Gafos, M., Philips, A. N., Trevelion, R., Rodger, A. J., Burns, F. M., Weatherburn, P., & Witzel, T. C. (2022). Experiences of and attitudes towards HIV testing for Asian, Black and Latin American men who have sex with men (MSM) in the SELPHI (HIV Self-Testing Public Health Intervention) randomized controlled trial in England and Wales: implications for HIV self-testing. BMC Public Health, 22(1). https://doi.org/10.1186/s12889-022-13189-7

Njau, B., Covin, C., Lisasi, E., Damian, D., Mushi, D., Boulle, A., & Mathews, C. (2019). A systematic review of qualitative evidence on factors enabling and deterring uptake of HIV self-testing in Africa. BMC Public Health, 19(1). https://doi.org/10.1186/s12889-019-7685-1

Ntsepe, Y., Simbayi, L. C., Shisana, O., Rehle, T., Mabaso, M., Ncitakalo, N., Davids, A., & Naidoo, Y. D. (2014). Perceptions about the acceptability and prevalence of HIV testing and factors influencing them in different communities in South Africa. Sahara J, 11(1). https://doi.org/10.1080/17290376.2014.937355

Obermeyer, C. M., Neuman, M., Hardon, A., Desclaux, A., Wanyenze, R., Ky-Zerbo, O., Cherutich, P., & Namakhoma, I. (2013). Socio-economic determinants of HIV testing and counselling: A comparative study in four African countries. Tropical Medicine and International Health, 18(9). https://doi.org/10.1111/tmi.12155

Obiezu-Umeh, C., Gbajabiamila, T., Ezechi, O., Nwaozuru, U., Ong, J. J., Idigbe, I., Oladele, D., Musa, A. Z., Uzoaru, F., Airhihenbuwa, C., Tucker, J. D., & Iwelunmor, J. (2021). Young people's preferences for HIV self-testing services in Nigeria: a qualitative analysis. BMC Public Health, 21(1). https://doi.org/10.1186/s12889-020-10072-1

Ong, J. J., Nwaozuru, U., Obiezu-Umeh, C., Airhihenbuwa, C., Xian, H., Terris-Prestholt, F., Gbajabiamila, T., Musa, A. Z., Oladele, D., Idigbe, I., David, A., Okwuzu, J., Bamidele, T., Iwelunmor, J., Tucker, J. D., & Ezechi, O. (2021). Designing HIV Testing and Self-Testing Servicesfor Young People in Nigeria: A Discrete Choice Experiment. Patient, 14(6), 815–826. https://doi.org/10.1007/s40271-021-00522-2

Pai, N. P., Behlim, T., Abrahams, L., Vadnais, C., Shivkumar, S., Pillay, S., Binder, A., Deli-Houssein, R., Engel, N., Joseph, L., & Dheda, K. (2013). Will an unsupervised self-testing strategy for HIV work in health care workers of South Africa? A cross-sectional pilot feasibility study. PLoS ONE, 8(11). https://doi.org/10.1371/journal.pone.0079772

Pant Pai, N., Sharma, J., Shivkumar, S., Pillay, S., Vadnais, C., Joseph, L., Dheda, K., & Peeling, R. W. (2013). Supervised and Unsupervised Self-Testing for HIV in High- and Low-Risk Populations: A Systematic Review. In PLoS Medicine (Vol. 10, Issue 4). https://doi.org/10.1371/journal.pmed.1001414

Pereira, M. D., Teixeira, N. do S. C. C. de A., Oliveira, I. K. F., Lima, C. H. R., & Paiva, A. de A. (2019). Esquema terapêutico e consumo alimentar em pessoas vivendo com HIV/Aids. ARCHIVES OF HEALTH INVESTIGATION, 8(7). https://doi.org/10.21270/archi.v8i7.4625

Pettifor, A., Lippman, S. A., Kimaru, L., Haber, N., Mayakayaka, Z., Selin, A., Twine, R., Gilmore, H., Westreich, D., Mdaka, B., Wagner, R., Gomez-Olive, X., Tollman, S., & Kahn, K. (2020). HIV self-testing among young women in rural South Africa: A randomized controlled trial comparing clinic-based HIV testing to the choice of either clinic testing or HIV self-testing with secondary distribution to peers and partners. EClinicalMedicine, 21. https://doi.org/10.1016/j.eclinm.2020.100327

Pillay, Y., & Johnson, L. (2021). World AIDS Day 2020: Reflections on global and South African progress

and continuing challenges. S Afr J HIV Med, 22(1), 1205. https://doi.org/10.4102/sajhivmed

Qin, Y., Han, L., Babbitt, A., Walker, J. S., Liu, F., Thirumurthy, H., Tang, W., & Tucker, J. D. (2018). Experiences using and organizing HIV self-testing. AIDS, 32(3), 371–381. https://doi.org/10.1097/QAD.0000000000001705

Quinn, C., Kadengye, D. T., Johnson, C. C., Baggaley, R., & Dalal, S. (2019). Who are the missing men? Characterising men who never tested for HIV from population-based surveys in six sub-Saharan African countries. https://doi.org/10.1002/jia2.25398/full

Radebe, O., Lippman, S. A., Lane, T., Gilmore, H., Agnew, E., Manyuchi, A., & McIntyre, J. A. (2019). HIV self-screening distribution preferences and experiences among men who have sex with men in Mpumalanga province: informing policy for South Africa. South African Medical Journal, 109(4). https://doi.org/10.7196/SAMJ 2019.v109i4.13818

Rees, K. (2018). Evaluation of Anova Health Institute's programme of support for HIV-related government Health Serviceslated . Anova Health Institute.

Rose, M., Guy, L., Shamblen, S., Guest, G., Gilbertson, A., & Peiper, N. (2021). LB11. Preliminary Findings from a HIV Self-Testing Program among People Who Use Drugs. Open Forum Infectious Diseases, 8(Supplement_1). https://doi.org/10.1093/ofid/ofab466.1647

Roux, A. V. D. (2001). Investigating Neighborhood and Area Effects on Health. In American Journal of Public Health (Vol. 91, Issue 11).

Shaba, F., Balakasi, K. T., Offorjebe, O. A., Nyirenda, M., Wong, V. J., Gupta, S. K., Hoffman, R. M., & Dovel, K. (2023). Facility HIV Self-Testing in Outpatient Departments: An Assessment of Characteristics and Concerns of Outpatients Who Opt Out of Testing in Malawi. http://links.lww.com/QAI/C179.

Simbayi, L. Chisamu., Zuma, Khangelani., & Zungu, N. (2021). South African national HIV prevalence, incidence, behaviour and communication survey 2017. HSRC Press.

Simo Fotso, A., Johnson, C., Vautier, A., Kouamé, K. B., Diop, P. M., Silhol, R., Maheu-Giroux, M., Boily, M. C., Rouveau, N., Doumenc-Aïdara, C., Baggaley, R., Ehui, E., & Larmarange, J. (2022). Routine programmatic data show a positive population-level impact of HIV self-testing: the case of Côte d'Ivoire and implications for implementation. AIDS, 36(13). https://doi.org/10.1097/QAD.0000000000003328

Stekier, J. D., Swenson, P. D., Coombs, R. W., Dragavon, J., Thomas, K. K., Brennan, C. A., Devare, S. G., Wood, R. W., & Golden, M. R. (2009). HIV testing in a high-incidence population: Is antibody testing alone good enough? In Clinical Infectious Diseases (Vol. 49, Issue 3, pp. 444–453). https://doi.org/10.1086/600043

Stevens, D. R., Vrana, C. J., Dlin, R. E., & Korte, J. E. (2018). A Global Review of HIV Self-testing: Themes and Implications. In AIDS and Behavior (Vol. 22, Issue 2, pp. 497–512). Springer New York LLC. https://doi.org/10.1007/s10461-017-1707-8

Tahlil, K. M., Ong, J. J., Rosenberg, N. E., Tang, W., Conserve, D. F., Nkengasong, S., Muessig, K. E., Iwelunmor, J., Ezechi, O., Gbaja-Biamila, T., Aliyu, S. H., Obiezu-Umeh, C., Kapogiannis, B., & Tucker, J. D. (2020). Verification of HIV Self-Testing Use and Results: A Global Systematic Review. AIDS Patient Care and STDs, 34(4), 147–156. https://doi.org/10.1089/apc.2019.0283

Terefe, B., Jembere, M. M., Reda, G. B., Asgedom, D. K., Assefa, S. K., & Lakew, A. M. (2024). Knowledge, and utilization of HIV self-testing, and its associated factors among women in sub–Saharan Africa: evidence from 21 countries demographic and health survey. BMC Public Health, 24(1). https://doi.org/10.1186/s12889-024-19529-z

UNAIDS. (2017). UNAIDS. Blind spot: reaching out to men and boys-Adhering a blind spot in the HIV response to HIV. Geneva: Joint United Nations Programme on HIV/AIDS. UNAIDS.

UNAIDS. (2021). Joint United Nations Programme on HIV/AIDS. Global AIDS strategy 2021-2026: End inequalities. End AIDS.

Us. (2018). HIV Self-Testing Strategic Framework A Guide for Planning, Introducing and Scaling Up HIV Testing Services.

Venter, F., Majam, M., Jankelowitz, L., Adams, S., Moorhouse, M., Carmona, S., Stevens, W., Msimanga, B. R., Allen, D., Balani, P., Nevhutalu, Z., Rhagnath, N., Shroufi, A., Deville, W., Kazangarare, V., Van Der Wiel, R., Templeman, H., Puren, A., Tucker, T., … Gray, A. (2017). South African HIV self-testing policy and guidance considerations. Southern African Journal of HIV Medicine, 18(1). https://doi.org/10.4102/sajhivmed.v18i1.775

Wabiri, N., & Taffa, N. (2013). Socio-economic inequality and HIV in South Africa. BMC Public Health, 13(1). https://doi.org/10.1186/1471-2458-13-1037

Wong, V., Johnson, C., Cowan, E., Rosenthal, M., Peeling, R., Miralles, M., Sands, A., & Brown, C. (2014). HIV self-testing in resource-limited settings: Regulatory and policy considerations. AIDS and Behavior, 18(SUPPL. 4). https://doi.org/10.1007/s10461-014-0825-9

Wood, B. R., Ballenger, C., & Stekler, J. D. (2014). Arguments for and against HIV self-testing. In HIV/AIDS - Research and Palliative Care (Vol. 6, pp. 117–126). Dove Medical Press Ltd. https://doi.org/10.2147/HIV.S49083

World Health Organization. (2015). Consolidated guidelines on HIV testing services: 5Cs: consent, confidentiality, counselling, correct results and connection 2015. Who, July.

World Health Organization. (2020). Web Annex H. Considerations for monitoring HIV testing services programmes. In: Consolidated guidelines on HIV testing services, 2019. In World Health Organization (Vol. 7, Issue July).

Wulandari, L. P. L., Kaldor, J., & Guy, R. (2020). Uptake and acceptability of assisted and unassisted HIV self-testing among men who purchase sex in brothels in Indonesia: A pilot intervention study. BMC Public Health, 20(1). https://doi.org/10.1186/s12889-020-08812-4

Wulandari, L. P. L., Ruddick, A., Guy, R., & Kaldor, J. (2019). "Self-testing sounds more private, rather than going to the clinic and everybody will find out": Facilitators and barriers regarding HIV testing among men who purchase sex in Bali, Indonesia. PLoS ONE, 14(4). https://doi.org/10.1371/journal.pone.0214987

Part C: Policy Brief

1. Background

South Africa continues to face a significant HIV burden, with nearly 8 million people living with the virus and HIV-related deaths accounting for over 23% of all fatalities in 2019 (L.F. Johnson et al., 2022; Hansoti et al., 2018; Jamieson et al., 2021). Despite hosting the world's largest ART program, testing gaps persist, particularly among men and youth. These gaps are exacerbated by barriers such as stigma, inconvenient clinic hours, and overcrowded facilities (C. Johnson et al., 2020; Awopegba et al., 2021). Many undiagnosed individuals continue to drive new infections, which account for nearly 80% of global transmission (Fauci et al., 2019).

In the Western Cape, HIV prevalence increased from 5% in 2012 to 9.1% in 2017, with Cape Town rising from 5.2% to 9.7% in the same period. (Simbayi et al., 2021) The city's struggle to meet UNAIDS 90-90-90 targets underscores the need for localized interventions.

To address these challenges, the Western Cape Department of Health (WC DOH) scaled up HIV Self-Testing (HIVST) in March 2021. HIVST offers a private and convenient testing option, reducing stigma and improving early diagnosis and linkage to care (Njau et al., 2019). Anova Health Institute, a USAID-

funded NGO, is the primary implementing partner for HIVST in Cape Town, distributing test kits at healthcare facilities and through mobile community outreaches.

Understanding HIVST adoption is essential for optimizing testing strategies. By analyzing Anova's program data, this study provides insights that will enhance HIVST uptake and improve resource allocation across Cape Town's diverse communities.

2. Data and Methods

This study analyses HIV testing data from Anova Health Institute, covering individuals 18 years and older across Cape Town's MetroHealth eight subdistricts: Eastern, Northern, Southern, Western, Khayelitsha, Klipfontein, Mitchells Plain, and Tygerberg. The dataset includes both conventional HIV testing (HTS) and HIV self-testing (HIVST), collected at healthcare facilities and community outreach sites.

HIV testing data was recorded on consent forms and entered into an HTS register, either electronically or manually. After quality checks, the data was transferred to RedCap and Power BI for analysis. De-identified data with complete records was used for this study, with formal approval from Anova and the Department of Health (DOH). Community-level data was extracted from City of Cape Town reports and Metro District Health Plans. The study examines factors influencing the choice of HIV testing method, comparing HIVST and conventional HTS. The outcome variable was binary, with HIVST users coded as 1 and conventional HTS users as 0.

Independent variables were selected based on a socio-ecological framework. Individual factors included age categories (18–19, 20–24, 25–49, and 50+), sex, and the last HIV test, classified as within the past 12 months, more than 12 months ago, or never tested. Community-level factors included economic status, proxied by child malnutrition rates, the availability of healthcare facilities, the number of new ART initiations as an indicator of HIV incidence, and the total number of ART patients reflecting HIV prevalence.

These factors were analyzed to determine their association with HIVST uptake and to inform targeted strategies for expanding self-testing in Cape Town.

3. Key Findings

Age distribution plays a significant role in testing preferences. Adults aged 25–49 constitute the majority of users for both conventional testing (63.16%) and self-testing (63.84%). However, adolescents (18–19) and young adults (20–24) show a relatively higher uptake of self-testing. Among HIVST users, 7.75% are adolescents compared to 4.08% in conventional testing, and 23.72% are young

adults versus 15.59% in conventional testing. In contrast, older adults (50+) predominantly prefer conventional testing (17.16%), while only 4.70% of HIVST users fall into this category.

Gender trends reveal key insights. Women represent the majority of users for both testing methods, comprising 65.62% of conventional testers and 65.32% of self-testers. Men account for 34.38% and 34.68%, respectively, indicating persistent gender disparities that may require targeted efforts to better engage men in HIV testing services.

Data collected from facility-level HIV testing history revealed significant differences. Among self-testing users, 63.51% had their last HIV test within the past 12 months, compared to only 32.60% of conventional testers. Conversely, 58.76% of conventional testers had not tested in over 12 months, while only 26.38% of self-testers fell into this category. Additionally, 8.63% of conventional testers and 10.10% of self-testers had never tested before, suggesting that self-testing may be slightly more appealing to first-time testers.

Geographic factors also shape testing preferences. Conventional testing is most prevalent in Tygerberg (20.06%) and Khayelitsha (16.87%), while self-testing uptake is highest in the Western (19.38%), Mitchell's Plain (16.97%), and Southern (15.33%) subdistricts. People residing in areas with a medium (15–25 facilities) or high number of healthcare facilities (more than 25 facilities) were 13% and 34% more likely, respectively, to use HIVST compared to those in areas with fewer facilities. This suggests that greater healthcare access may facilitate and even increase the likelihood of using self-testing. In contrast, residing in areas with a high number of newly enrolled ART patients decreased the likelihood of using HIVST, relative to areas with fewer new ART initiations.

Multivariate analysis further confirms that women were 8% less likely to choose self-testing than men. Additionally, individuals who received a positive HIV test result had a 9% lower chance of having used self-testing compared to those who tested negative.

4. Implications for Policy and Practice

- **Targeted Community-Based Approaches (Kombo et al., 2021)**
- Focus on individuals overdue for testing and those who have never tested.
- Leverage local leaders, community organizations, and peer educators. (Bwalya et al., 2020)
- Train health workers to provide culturally sensitive HIVST support.
- **Enhancing HIVST Uptake Among Men (Jamieson et al., 2021; Matsimela et al., 2021; WHO, 2022.)**
- Expand workplace-based distribution tailored for male populations.
- Implement targeted campaigns addressing barriers men face in testing
- **Improving HIVST Access for Youth**
- Distribute HIVST kits in schools, universities, and youth centers. (Obiezu-Umeh et al., 2021)
- Leverage digital health tools to encourage first-time testers. (Beecroft et al., 2024)
- **Increasing Testing Among Older Adults**.
- Introduce door-to-door distribution with an extra kit for partners. (C. Johnson et al., 2021)
- Implement targeted awareness campaigns in high-prevalence areas.
- **Expanding HIVST in Low-Density Healthcare Areas**
- Increase distribution in subdistricts with Low number of healthcare facilities (below 15) per subdistrict.
- Strengthen integration with existing HIV services.
- **Leveraging Technology for HIVST Expansion. (Beecroft et al., 2024)**
- Use mobile apps for test guidance, result interpretation, and linkage to care.
- Apply digital tools to identify and address low-uptake areas.

5. Conclusion

HIV self-testing presents a transformative opportunity to overcome barriers to HIV testing in Cape Town, particularly for younger populations, men, and underserved communities. By enhancing accessibility, tailoring interventions to local needs, leveraging technology, and strengthening collaborations with community organizations, HIVST can play a central role in advancing HIV prevention and treatment goals. Expanding self-testing initiatives and refining distribution strategies will be key to increasing uptake, improving early diagnosis, and ensuring linkage to care, ultimately contributing to South Africa's broader efforts in combating the HIV epidemic.

6. References

Beecroft, A., Vaikla, O., & Pant Pai, N. (2024). Digital HIV self-testing as an exemplar: a perspective on benefits, challenges, and opportunities. Expert Review of Molecular Diagnostics, 24(10), 913–925. https://doi.org/10.1080/14737159.2024.2406974

Bwalya, C., Simwinga, M., Hensen, B., Gwanu, L., Hang'Andu, A., Mulubwa, C., Phiri, M., Hayes, R., Fidler, S., Mwinga, A., Ayles, H., Ayles, H., Bond, V., & Bond, V. (2020). Social response to the delivery of HIV self-testing in households: Experiences from four Zambian HPTN 071 (PopART) urban communities. AIDS Research and Therapy, 17(1). https://doi.org/10.1186/s12981-020-00287-y

Indravudh, P. P., Hensen, B., Nzawa, R., Chilongosi, R., Nyirenda, R., Johnson, C. C., Hatzold, K., Fielding, K., Corbett, E. L., & Neuman, M. (2020). Who is Reached by HIV Self-Testing? Individual Factors Associated with Self-Testing Within a Community-Based Program in Rural Malawi. www.jaids.com

Jamieson, L., Johnson, L. F., Matsimela, K., Sande, L. A., D'Elbée, M., Majam, M., Johnson, C., Chidarikire, T., Hatzold, K., Terris-Prestholt, F., Nichols, B., & Meyer-Rath, G. (2021). The cost effectiveness and optimal configuration of HIV self-test distribution in South Africa: A model analysis. BMJ Global Health, 6. https://doi.org/10.1136/bmjgh-2021-005598

Johnson, A. L., Butts, S. A., Rodriguez, E., Craker, L., Kanamori, M., & Doblecki-Lewis, S. (2023). "Test-To-PrEP": Assessing Reach and Adoption of a New Approach to Increase HIV Testing and PrEP Knowledge Using HIV Self-Test Kit Distribution Through PrEP Clients' Social Networks. Journal of Acquired Immune Deficiency Syndromes, 94(5). https://doi.org/10.1097/QAI.0000000000003294

Johnson, C., Kumwenda, M., Meghji, J., Choko, A. T., Phiri, M., Hatzold, K., Baggaley, R., Taegtmeyer, M., Terris-Prestholt, F., Desmond, N., & Corbett, E. L. (2021). 'Too old to test?': A life course approach to

HIV-related risk and self-testing among midlife-older adults in Malawi. BMC Public Health, 21(1). https://doi.org/10.1186/s12889-021-10573-7

Kombo, B. K., Thomann, M., Lazarus, L., Musyoki, H., Olango, K., Kuria, S., Kyana, M., Otieno, M., Njiriani, M., Musimbi, J., Bhattacharjee, P., & Lorway, R. (2021). Engaging MSM Communities in HIV Self-Testing Research and Programming in Kenya: Collaborations, Tacit Knowledge, and a Community-Based Programme Science Approach. https://doi.org/10.21203/rs.3.rs-861094/v1

Matsimela, K., Sande, L. A., Mostert, C., Majam, M., Phiri, J., Zishiri, V., Madondo, C., Khama, S., Chidarikire, T., D'Elbée, M., Hatzold, K., Johnson, C., Terris-Prestholt, F., & Meyer-Rath, G. (2021). The cost and intermediary cost-effectiveness of oral HIV self-test kit distribution across 11 distribution models in South Africa. BMJ Global Health, 6. https://doi.org/10.1136/bmjgh-2021-005019

Obiezu-Umeh, C., Gbajabiamila, T., Ezechi, O., Nwaozuru, U., Ong, J. J., Idigbe, I., Oladele, D., Musa, A. Z., Uzoaru, F., Airhihenbuwa, C., Tucker, J. D., & Iwelunmor, J. (2021). Young people's preferences for HIV self-testing services in Nigeria: a qualitative analysis. BMC Public Health, 21(1). https://doi.org/10.1186/s12889-020-10072-1

Simbayi, L. Chisamu., Zuma, Khangelani., & Zungu, N. (2021). South African national HIV prevalence, incidence, behaviour and communication survey 2017. HSRC Press.

WHO. (2022).

Part D: Appendices

Appendix 1. Health Facilities in Cape Metro Health District (Metro District Health Plan_2019-20, 2018)

Table 6: Facilities in Cape Metro Health District

MDHS	**CDC**	**CHC**	**Clinic**	**Mobile**	**Satellite**	**Specialised Services**	Total	District Hospital
wc Cape Town Western Health sub-District	6	2	0	0	0	3	11	2
wc Mitchells Plain Health sub-District	2	1	0	0	0	0	3	1
wc Cape Town Eastern Health sub-District	6	0	0	0	0	0	6	2
wc Cape Town Southern Health sub-District	4	1	0	0	0	0	5	1
wc Cape Town Northern Health sub-District	3	1	0	0	0	0	4	0
wc Klipfontein Health sub-District	4	1	0	0	0	1	6	0
wc Tygerberg Health sub-District	8	2	0	0	0	1	11	1
wc Khayelitsha Health sub-District	2	1	0	0	0	1	4	1
Total MDHS	*35*	*9*	*0*	*0*	*0*	*6*	50	8
CCT								
	CDC	**CHC**	**Clinic**	**Mobile**	**Satellite***	**Specialised Services**	Total	
wc Cape Town Western Health sub-District	0	0	11	3	2	0	16	
wc Mitchells Plain Health sub-District	1	0	8	0	1	0	10	
wc Cape Town Eastern Health sub-District	1	0	10	1	1	0	13	
wc Cape Town Southern Health sub-District	1	0	15	1	2	0	19	
wc Cape Town Northern Health sub-District	0	0	9	0	0	0	9	
wc Klipfontein Health sub-District	0	0	9	0	4	0	13	
wc Tygerberg Health sub-District	1	0	10	0	4	0	15	
wc Khayelitsha Health sub-District	4	0	3	0	0	4	11	
Total CoCT	*8*	*0*	*75*	*5*	*14*	*0*	102	
Cape Town District platform	**43**	**9**	**75**	**5**	**14**	**6**	**152**	

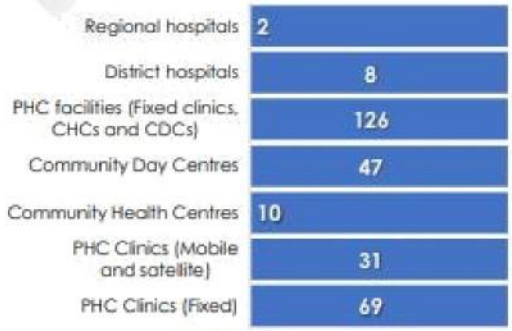
Appendix 2. Subdistricts Profiles (City of Cape Town, 2021)

HEALTH

Tuberculosis

New patients registered for treatment

Healthcare facilities



Maternal health

Sub district 2020/21	Maternal Mortality Rate	Delivery rate to women under 20 years	Termination of pregnancy rate
Eastern Health	38.7	11.6	0.7
Northern Health	48.3	13.8	0.3
Southern Health	15.3	8.7	0.5
Western Health	114.1	6.6	1.2
Khayelitsha	67.7	8.9	2.2
Klipfontein	0.0	11.9	0.4
Mitchells Plain	34.4	11.5	1.1
Tygerberg	168.8	9.8	1.2
City of Cape Town	**83.8**	**9.4**	**1.0**

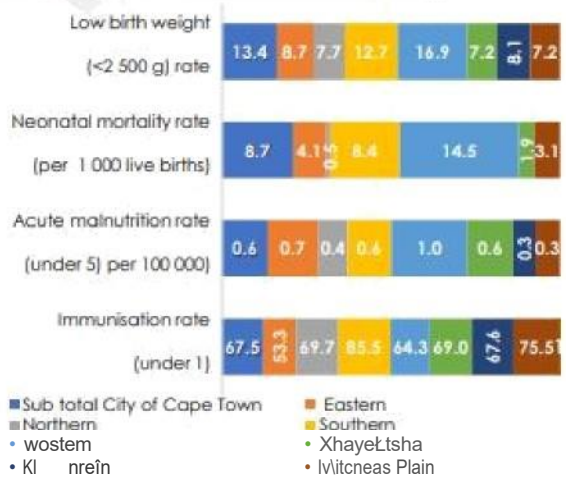
Emergency medical services

Health Indicator	No of operational ambulances	No of ambulances per 10 000
City of Cape Town	122	4

HIV/AIDS

Sub District	Total Registered patients receiving ART		Number of new ART patients	
	2019/20	2020/21	2019/20	2020/21
Eastern	27.043	27.597	4.112	2.922
Khayelitsha	48.974	47.675	5.934	3.298
Southern	15.676	15.785	2.656	1.773
Western	31.577	31.984	3.913	2.801
Klipfontein	21.187	20.686	2.725	1.871
Mitchells Plain	28.524	28.182	4.270	2.712
Northern	17.921	17.966	2.412	1.620
Tygerberg	19.901	19.404	2.736	1.808
Sub-total City of Cape Town	**210.803**	**209.279**	**28.758**	**18.805**

Child health



Appendix 3. Summary of studies that assessed association between HIVST uptake and associated factors

N0	Author,Year of publication & Country	Type of the study	Title	Study population	Factors associated with HIVST			Results
					Individual factors: age, Sex	Previous HIV test done	Other associated factors	
1	Ekholuenetale et al., 2022. South Africa	cross-sectional, population-based household survey	Association between socio-economic factors and HIV self-testing knowledge amongst South African women	A sample of 8182 women of reproductive age a from the 2016 South African Demographic and Health Survey	Sex		Education level, Place of residency (Rural or Urban), socioeconomic status.	Women with tertiary education were significantly more likely (3.93 times) to have HIVST knowledge compared to those with no formal education (OR: 3.93; 95% CI: 1.37–11.26). In contrast, rural residents had a 33% lower likelihood of having HIVST knowledge compared to urban dwellers (OR: 0.67; 95% CI: 0.51–0.89). Additionally, women from wealthier households had higher odds of HIVST knowledge, with those from richer and richest households being 1.88 and 2.24 times more likely, respectively, compared to those from the poorest households.
2	Awopegba et al., 2021. South Afrca	cross-sectional study	HIV testing and self-testing coverage among men and women in South Africa: an exploration of related factors	12 312 men and women from 2016 South African Demographic and Health Survey programme (SADHS)	Sex	Yes	Education level, Marital status, Exposure to media, History of having sex.	Self-testing awareness was low (22%), and only 2.9% of respondents had self-tested for HIV. The odds of having ever tested for HIV were significantly higher among respondents who were aged 25–29 (AOR: 4.02; 95% CI: 3.27–4.95), had a higher level of education (AOR: 3.18; 95% CI: 2.19–4.61), were married (AOR: 1.63; 95% CI: 1.36–1.94), had high media exposure (AOR: 1.23; 95% CI: 1.06–1.44) and had ever had sex (AOR: 5.57; 95% CI: 4.67–6.64), but lower among men (AOR: 0.39; 95% CI: 0.35–0.44).

3	Nicholls et al., 2022. England and Wales	Qualitative study (interviews)	Experiences of and attitudes towards HIV testing for Asian, Black and Latin American men who have sex with men (MSM) in the SELPHI (HIV Self-Testing Public Health Intervention) randomized controlled trial in England and Wales: implications for HIV self-testing	29 MSM from Asian, Black and Latin American backgrounds	Sex		Ethnicity, Sexual Orientation.	HIVST responds to some service access barriers experienced by Asian, Black and Latin American MSM. HIVST may have the potential to increase testing uptake and frequency, particularly for MSM of minority ethnic backgrounds who are likely to experience anxiety and discomfort in clinic waiting rooms more acutely than White MSM
4	Ntsepe et al., 2014. South Africa	Qualitative study (Focus Groups))	Perceptions about the acceptability and prevalence of HIV testing and factors influencing them in different communities in South Africa	Male and female participants, 12 years of age and older drawn from four race groups (Africans, Coloureds, Indians and Whites) from Cape Town and Durban, South Africa.	Sex		Ethnicity, awareness HIV testing process, confidentiality	Participants from African and Indian Focus Groups (FGs) reported being less likely to do self-initiated HIV testing and counselling, while those from the FG consisting of young whites were more likely to learn about their HIV status through blood donations and campus HIV testing campaigns. Most FGs said they were likely to test if they understood the testing process better and also if the results are kept confidential.
5	Figueroa et al., 2015	Literature review	Attitude and acceptability of HIVST among Key populations: a literature review	Key Populations			convenience, speed of obtaining results, and privacy	convenience, speed of obtaining results, and privacy found to be strong motivators for the use of HIVST

6	Daniel et al., 2024 Ethiopia	cross-sectional study	Level of knowledge and intention to use oral fluid HIV self-testing and associated factors among Ethiopian health care workers in southern Ethiopia	352 healthcare workers.	Age	Yes	Knowledge of oral HIVST, receiving support for HIVST implementation, hearing about HIVST, having prior HIVST experience, having a spouse or partner, and having multiple sexual partners, costs and having poor knowledge.	Several factors were associated with knowledge and intention to use oral HIV self-testing (HIVST). Good knowledge of oral HIVST was linked to being male (AOR=2.28), receiving support for HIVST implementation (AOR=2.07), hearing about HIVST (AOR=5.05), having prior HIVST experience (AOR=2.94), having a spouse or partner (AOR=2.78), and having multiple sexual partners (AOR=2.76). The Intent to use oral fluid HIVST was significantly associated with being aged 25–29 (AOR=2.54), perceiving high kit costs negatively (AOR=0.37), and having poor knowledge (AOR=1.91).
7	Belza et al., 2014 Spain	cross-sectional study	Low knowledge and anecdotal use of unauthorized online HIV self-test kits among attendees at a street-based HIV rapid testing programme in Spain	3340 participants		Yes	Ethnicity, education, media	Of the participants, 5.3% knew that self-tests were sold online, and 7.5% believed they existed but had never seen one, with only 0.6% having used an HIVST. Factors associated with awareness and use included having undergone more than two previous HIV tests (OR 3.6 for awareness and OR 7.3 for use), not being of Spanish or Latin American origin (OR 3.8), and having a university degree (OR 0.2). The impact of unauthorized HIVST use was low at the time of the study, but media attention following approval in the USA could have influenced the situation.
8	Indravudh et al., 2020 Malawi	secondary analysis of a cluster-randomized trial.	Who is Reached by HIV Self-Testing? Individual Factors Associated With Self-Testing Within a Community-Based Program in Rural Malawi	Secondary analysis of an end line survey administered under a cluster randomized trial of community-based distribution of HIVST kits	Sex, Age	Yes	Marital status, having children, education level, socioeconomic status, use of condoms in the past 3 months	The prevalence of ever using HIV self-testing (HIVST) was 45.0% among men and 40.1% among women. Age was strongly associated with HIVST use, with lower prevalence in older age groups (40+ years). Compared to adults aged 25–39, HIVST use was significantly lower in adults aged 40 years and older for both men (34.4%) and women (30.0%). Women who were married, had children, were wealthier, or had higher education levels were more likely to self-test. Men who had condomless sex in the past three months had a higher HIVST prevalence (47.9%) compared to those who did not (43.1%). Previous HIV testing exposure and household HIVST uptake were also

								linked to higher HIVST prevalence in both men and women.
9	Hecht et al., 2020 USA	Implementation science study	Increasing Access to HIV Testing Through Direct-to-Consumer HIV Self-Test Distribution — United States, March 31, 2020–March 30, 2021	Key Populations individuals who ordered HIV self-test kits through the initiative		Yes	Sexual orientation, media.	Among the participants: 67% were cisgender men, and 6% were transgender, nonbinary, or genderqueer. 36% of participants had never tested for HIV before ordering the self-test kit. From the 855 respondents to the follow-up survey (17% of those who received kits): 73% reported male-to-male sexual contact. 71% heard about the program via marketing on gay dating apps. The main reasons for ordering the kit were convenience (63%) and privacy (46%). 90% said they would recommend the program to a friend. 10% accessed additional STI testing, and 8% accessed PrEP after receiving the kit. Among those who had never previously tested for HIV, 8% pursued additional STI testing, and 6% accessed PrEP. Health departments that matched kit orders to HIV case surveillance estimated that 0.6%–0.8% of those who received a kit was newly diagnosed with HIV
10	WHO, 2016	Supplement to the WHO's broader guidelines on HIV testing services.	HV Self-Testing And Partner Notification Supplement To Consolidated Guidelines On HV Testing Services	General population			Cost	The cost and accessibility of HIVST are significant factors influencing uptake. Free or low-cost tests are more attractive to lower-income populations, which can increase testing rates in underserved communities.

11	Wulandari et al., 2020 Indonesia	pilot intervention study	Uptake and acceptability of assisted and unassisted HIV self-testing among men who purchase sex in brothels in Indonesia: a pilot intervention study	Key Populations			Education level, ever been tested for HIV, with 6.4% of the men mentioned that they had being tested for HIV before, condom use	48.9% of participants had completed at least senior high school, 47.3% were Javanese, 13.3% had ever been tested for HIV, with 6.4% of the men mentioned that they had been HIV tested in the last 12 months, and 58.9% reported condom use at their last sexual encounter with a FSW.
12	Ingold et al., 2019 Sub-Saharan Africa	Implementation science study	The Self-Testing AfRica (STAR) Initiative: accelerating global access and scale-up of HIV self-testing	General population			Distribution model and cost of HIVST	HIVST delivery models vary in their acceptability depending on the target population. HIVST has been shown to be cost-effective, but to maximize its health impact within available budgets, it needs to be targeted strategically. Cost-effectiveness is likely when HIVST is focused on groups with a high prevalence of undiagnosed HIV or a high likelihood of HIV incidence. For example, community-based HIVST can be cost-effective when aimed at women involved in transactional sex and adult men, particularly if undiagnosed HIV prevalence is above 3% and delivered through campaigns, such as once every five years.
13	Cambiano et al., 2019 Sub-Saharan Africa	Modelling study	The impact and cost-effectiveness of community-based HIV self-testing in sub-Saharan Africa: health economic and modelling analysis for Working Group on Cost Effectiveness of	Three sub-populations: women having transactional sex (WTS); young people (15 to 24 years); and adult men (25 to 49 years).	Sex, Age		Un diagnosed HIV Prevalence, Linkage to Other Services, Cost of CB-HIVST	The factors associated with HIVST: Adult Men (25 to 49 years): Targeting this group offered the greatest impact in terms of averted infections and deaths. Women Having Transactional Sex (WTS): This group was identified as the most cost-effective target for CB-HIVST. Undiagnosed HIV Prevalence: The effectiveness and cost-effectiveness of CB-HIVST were highly influenced by the prevalence of undiagnosed HIV, requiring it to be above 3% for effective implementation. Linkage to Other Services: Enhancing the impact of CB-HIVST could be achieved through integration with voluntary medical male circumcision (VMMC). Cost of CB-HIVST: The overall costs associated with

			HIV self-testing in Southern Africa					implementing CB-HIVST were significant determinants of its cost-effectiveness.
14	Chiu & Young, 2016 United state	cross-sectional study	Correlates of requesting home HIV self-testing kits on online social networks among African American and Latino men who have sex with men	Key Populations			Use of online social networks, engaged with sex under influence of alcohol	The study found that participants were more likely to request an HIV self-test (HIVST) kit if they used social networks to seek sexual partners (aOR: 2.47), perceived these networks as easier for finding partners (aOR: 1.87), had an uncertain HIV status (aOR: 4.29), engaged in sex under the influence of alcohol (aOR: 2.46), or had not been tested for HIV in over 6 months (aOR: 2.53). Conversely, individuals who frequently discussed sex with men online were less likely to request a test kit (aOR: 0.73). Overall, social media outreach effectively reached at-risk individuals who were unsure of their HIV status or had not been tested recently.
15	Johnson et al., 2021 Malawi	Qualitative study: focus group discussions and in-depth interviews	Too old to test?': A life course approach to HIV-related risk and self-testing among midlife-older adults in Malawi, 2021				Sexual orientation, Perceived HIV discrimination, higher education, higher income level	Factors Associated with HIVST: Sexual Orientation Disclosure: More likely among those who disclose their orientation. Perceived HIV Discrimination: Individuals experiencing discrimination are more inclined to use HIVST. Younger Age: Younger people are more likely to engage in HIV self-testing. Higher Education: Educated individuals show a greater preference for HIVST. Higher Income Levels: Wealthier individuals tend to adopt HIVST more frequently

16	(Shaba et al., 2023) Malawi	a cross-sectional study.	Facility HIV Self-Testing in Outpatient Departments: An Assessment of Characteristics and Concerns of Outpatients Who Opt Out of Testing in Malawi	Seven hundreds seventy-one outpatients at 5 facilities in Central and Southern Malawi	Sex, Age		Working, risky sexual behaviour, residency, and self-rated health	Factors associated with a higher likelihood of opting out included: Urban Residency: Participants living in urban areas had an increased risk (adjusted risk ratio [aRR] 3.48; 95% CI: 1.56 to 7.76). Self-Reported Poor Health: Those reporting poor health were also more likely to opt out (aRR 1.86; 95% CI: 1.27 to 2.72). Gender: Male participants had a 69% higher risk of opting out (aRR 1.69; 95% CI: 1.14 to 2.51), although the risk was 38% lower among working males. The primary reasons for opting out were feeling unprepared to test (49.4%) and a perceived low risk of HIV infection (30.4%). Only a small percentage cited unclear instructions (2.6%) or privacy concerns (1.7%) as reasons for not testing.
17	Bwalya et al., 2020 Zambia	Qualitative study, component of a cluster randomised trial (CRT)	Social response to the delivery of HIV self-testing in households: experiences from four Zambian HPTN 071 (PopART) urban communities	General populati.on	Age		Literacy, trust, distrbution	Factors associated with HIV self-testing (HIVST) include: Familiarity and Trust in Community Health Workers (CHiPs): Participants' familiarity with and trust in CHiPs facilitated the usage and storage of HIVST kits. The provision of demonstrations and supervision by CHiPs helped participants feel more comfortable using the kits. Door-to-Door Distribution: This method was appreciated for its convenience, privacy, empowerment, and ease of use. Literacy and Age: Participants' literacy levels and age influenced their ability to use HIVST kits accurately. Concerns About Accuracy: The novelty of using oral fluids raised questions, anxiety, and doubts about the accuracy of HIVST. Stigma: While HIVST helped participants avoid clinic-based stigma, it did not eliminate self-stigma. Impact on Relationships: HIVST generally strengthened relationships within households, though some couples reported social harms related to its use.

18	Bien-Gund et al., 2022 USA	Cross sectional study	HIV Self-testing and Risk Behaviors Among Men Who Have Sex with Men (MSM) in 23 US Cities, 2017	MSM	Age		Sexual orientation, media, education level, patient income,	The study examined factors associated with HIV self-testing (HIVST) among 6,563 men who have sex with men (MSM) in 23 urban areas, revealing that 7.7% reported HIVST in the past year. Key findings indicated several positive associations with HIVST: sexual orientation disclosure was strongly associated with a prevalence ratio (aPR) of 10.27, perceived discrimination against people with HIV increased likelihood (aPR=1.53), younger age was linked to higher usage (aPR=0.74), while individuals with higher educational levels (aPR=1.20) and higher income levels (aPR=1.18) were also more likely to engage in HIVST. Conversely, there were no significant associations found with specific sexual risk behaviors, including condomless anal sex (aPR=0.96), sexually transmitted infections (aPR=0.96), or pre-exposure prophylaxis (PrEP) use (aPR=0.99). These findings suggest that HIVST is more prevalent among younger, well-educated, and higher-income MSM who disclose their sexual orientation and perceive discrimination, rather than being influenced by specific sexual risk behaviors.
19	Terefe et al., 2024 sub–Saharan Africa	cross-sectional study	Knowledge, and utilization of HIV self-testing, and its associated factors among women in sub–Saharan Africa: evidence from 21 countries demographic and health survey	Women in Sub-Saharan Africa	Age		Education level, wealth status, Employment, media exposure, knowledge of modern contraception, residence, having multiple sexual partners, women who heard about STIs and those who delivered in a health facility	The overall prevalence of knowledge and utilization of HIV self-testing (HIVST) among women was low, at 2.17% (95% CI: 2.12, 2.23). Factors significantly associated with higher HIVST utilization included women aged 25–34 years (AOR=1.78, 95% CI: 1.65, 1.92) and 35–49 years (AOR=1.33, 95% CI: 1.22, 1.46), those with primary education (AOR=1.25, 95% CI: 1.12, 1.38) or secondary/higher education (AOR=3.08, 95% CI: 2.79, 3.41). Wealth status also played a role, with poorer (AOR=1.22, 95% CI: 1.08, 1.38), middle-income (AOR=1.19, 95% CI: 1.06, 1.37), richer (AOR=1.45, 95% CI: 1.45, 1.64), and the richest women (AOR=1.81, 95% CI: 1.59, 2.05) more likely to use HIVST. Employment (AOR=1.73, 95% CI: 1.62, 1.85), mass media exposure (AOR=1.39, 95% CI: 1.31, 1.49), knowledge of modern contraception (AOR=2.75, 95% CI: 1.84, 4.13), urban residence (AOR=1.53, 95% CI: 1.63, 1.73), and having multiple sexual partners (AOR=1.32, 95% CI: 1.24, 1.41)

								were also positively associated with HIVST utilization. Additionally, women who heard about STIs (AOR=7.47) and those who delivered in a health facility (AOR=1.17, 95% CI: 1.02, 1.37) were more likely to utilize HIVST.
20	Namande et al.,2021 Uganda	cross-sectional study	Prevalence and Factors Associated with Utilization of HIV Self Testing Among Students of Universities in Southwestern Uganda.	university students of Kampala International University (KIU) and Mbarara University of Science and Technology (MUST)in South western Uganda		Yes	Education level, having a sexual partner and place of residence	Of the 356 participants, the study had 57.3% of the participants from KIU and 42.7% were from MUST. The study found that university students who had ever self-tested were 43.2% Sociodemographic variables associated with utilization of HIV self-testing were the student's year of study (p=0.007), having a sexual partner (p=0.012), and place of residence(p=0.000).
21	Johnson et al., 2023	Implementation study	Test-To-PrEP": Assessing Reach and Adoption of a New Approach to Increase HIV Testing and PrEP Knowledge Using HIV Self-Test Kit Distribution Through PrEP Clients' Social Networks	PrEP clients		-	social networks (Prep clients), previous HIV test	The 100 enrolled egos reported a total of 414 alters. Participants received 293 Test-to-PrEP kits for distribution with 47 of the 100 participants distributing at least 1 kit. Of those who scanned the quick-response code and responded to the survey, 16.2% reported no previous HIV test and 38.5% reported no prior knowledge of PrEP; 32.5% reported interest in distributing Test-to-PrEP kits, 3 successfully distributed kits, and 2 initiated PrEP.

22	Ong et al.,2021 Nigeria	Experiment	Designing HIV Testing and Self-Testing Services for Young People in Nigeria: A Discrete Choice Experiment	Nigerian youth (age 14–24 years)	Age, Gender		Education, Cost, distribution model, availability of medication at the testing site, person conducting the test.	A total of 504 youth participated: mean age 21 years (standard deviation 2 years), 38% male, and 35% had a higher than secondary school education. Male individuals were less likely to test for HIV or use HIVST kits. Youth preferred HIV testing services (with attributes in order of importance) that are free, blood-based testing, available in private/public hospitals or home, for HIV medications to be available in the same location as testing, and a doctor conducts the test. Participants preferred HIVST kits testing, having the option of an online chat, and oral(Ong et al., 2021)(Ong et al., 2021)-based HIVST.
23	Mwangi et al., 2022 Kenya	cross-sectional study	Characteristics of users of HIV self-testing in Kenya, outcomes, and factors associated with use: results from a population-based HIV impact assessment, 2018	Population based study	Age	Yes	Education level, having a lifetime sexual partner and wealth.	Among 23,673 adults who had tested for HIV, only 4.1% had ever self-tested, with the highest prevalence in Nyanza (6.4%). HIV self-testing was more common among those with secondary education, higher wealth, and more sexual partners, while older adults (≥50 years) were less likely to have self-tested. These findings reveal socioeconomic and demographic disparities in HIV self-testing uptake.

Appendix 4. Plagiarism declaration

Plagiarism Declaration:

1) I know that plagiarism is wrong. Plagiarism is to use another's work and pretend it is one's own.

2) I have used the APA style for referencing in the research protocol, literature review and journal manuscript. Each quotation in this thesis from the work(s) of other people has been attributed and has been cited and referenced.

3) This dissertation is my own work. I have not allowed and will not allow anyone to copy my work with the intention of passing it off as his/her own work.

SIGNATURE: 

Appendix 5. Ethics approval

UBgZVERBZT¥' OF CAPE TOWN
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HRBC REfi: 9'76/2DZ9

Dr CHufunke Ababa
Health economl€g unft
Bchool of Publ ie Health
Email:

Dear Dr AJaba

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Thank you For submitting your PI response dabed 8" Dece mber 3023 zo tha Faculty of Heelth defences Humen ReseerCh EChhgg Committee (HREC).

ft Is a pleasure to ini'orm you thet The HREC has fo•naaffy approved the above-mentioned study.

Atzpzoval la only grantaa Sor one year until €tse 30 January' 2D2B.

Please submit a progress report, using Che standardised Annual Progress Report P-arme {rH0016a or (MB O17) if the atudy continues beyond tha approval period. Please submit a Standard Closure fbrm (FHS 010) when the study has been <omple6ed, thls Includes aAer pu b3lcation or tlmals aubmlmion arid final COmpleuOn.
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Please note that for all studles approved by the I-JREC, Line prlndpal Investfgacor muat ob¢ain appropnata InstftutiQnel appraval, where necessary, beforo the research may DcCur.

Please note that the or›gioing ethical conduct of the sLudy remeirts the responsiLXtity of the prtnopal invastigaLor.

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Yours sincerely

PROFESSOR MARC BLOCK
CHAIRPERSON, CU O SCIENCES HUMA S CH ICS COMMITTEE
Federal Wide Assurance Number: PWAOoOO1637 .1nstltutlonel Revlew Board {IRB} number: IRBDOOO193B NHREC-registration number: REC-2102OB-007

HREC REF NO. 776/2023

This serves to confirm that the University of Cape Town Human Research Ethics Committee complies to Ehe Ethlcs Standards for Clinical Research with a new drug In patients, based on the Medical Research Council (NRC-SA), Food and Drug Administration (FOA-USA), International Council for Harmonisation of Technlcal Requirements for Pharmaceuticals for Human Use: Good Clinical Practice (ICH GCP), South African Good Clinical Practice Guidelines (DoH 2020), based on the Association of the British Pharmaceutical Industry Guidelines (ABPI), and Declaration of Helslnkl (2013) guidelines. The Human Research Ethics Committee granting this approval is in compliance with the ICH Harmonised Tripartite Guidelines E6: fJote for Guidance on Good Clinical Practice (CPMP/ICH/135/95) and FDA Code Federal Regulation Part 50, 56 and 312.

UNIVERSITY OF CAPE TOWN

FACULTY OF HEALTH SCIENCES
Human Research Ethics Committee

FHS017: Annual Progress Report / Renewal

Record Reviews/Audits/Collection of Biological Specimens/Repositories/Databases/Registries

HREC office use only (FWA00001637; IRB00001938)			
This serves as notification of annual approval, including any documentation described below.			
☐ Approved	Annual progress report	Approved until/next renewal date	31.01.2026
☐ Not approved	See attached comments		
Signature Chairperson of the HREC/ Designee		Date Signed	23/1/25

Note: Please note that incomplete submissions will not be reviewed.
Our website address: https://health.uct.ac.za/home/human-research-ethics

HUMAN RESEARCH ETHICS COMMITTEE
HEALTH SCIENCES FACULTY
UNIVERSITY OF CAPE TOWN

Please email this form and supporting documents (if applicable) in a combined pdf-file to hrec-enquiries@uct.ac.za.

Principal Investigator to complete the following:

1. Protocol information

Date (when submitting this form)	23rd January 2025		
HREC REF Number	776 / 2023	Current Ethics Approval was granted until	30th January 2025
Protocol title	**HIV Self Testing uptake and associated factors in Cape Town: a contextual framework.**		
Principal Investigator	**Olufunke Alaba**		
Department and email address	**SPH: Health Economics Unit olufunke.alaba@uct.ac.za**		
1.1 Does this protocol receive US Federal funding?		☐ Yes	☑ No

2. Protocol status (tick ✓)

☐	Research-related activities are ongoing
☐	Data collection is complete, data analysis only
☑	Publication or thesis submitted and final completion?

Please indicate (in the block below) the titles and HREC reference numbers of any projects currently making use of the Database/registry/repository.

Not applicable

3. Protocol summary

Total number of records or specimens collected, reviewed or stored since the original approval	266286
Total number of records or specimens collected, reviewed or stored since last progress report	

Have any research-related outputs (e.g. publications, abstracts, conference presentations) resulted from this research? If yes, please list and attach with this report		☑ Yes	☐ No
Please complete the Closure form (FHS019) if the study is completed within the approval period			

4. Signature

Signature of PI		Date	22/1/2025

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Appendix 6. Research Protocol

HIV Self Testing uptake and associated factors in Cape Town: a contextual framework.

Dr Doris Nyembwe

Student no: NYMDOR003

Table of Contents

1. Background

The HIV burden in South Africa (SA) is one of the highest in the world, with close to 8 million of South Africans living with HIV (L. F. Johnson et al., 2022). The number of HIV related deaths has been over 23% of all death in SA in 2019, despite having the largest Antiretroviral Treatment (ART) program globally (Hansoti et al., 2018; Jamieson et al., 2021). The key to prevent HIV transmission, improve patient quality of life, and reduce AIDS-related mortality and morbidity is early detection of HIV-positive people (PLHIV) who are unaware of their status, prompt initiation of antiretroviral therapy (ART) and ensure continued participation in care. (Radebe et al., 2019).

HIV testing targets have not been met worldwide, approximately a third of the global youth know their HIV status, which is far below the first UNAIDS target of having 95% of PLHIV knowing their HIV status by 2025 (Pereira et al., 2019) In Africa, more than 25% of adults do not know their HIV status, regardless of the wider availability of HIV testing services (Njau et al., 2019; Pereira et al., 2019). Similarly, In SA there are still individuals who have never tested for HIV, gap further exacerbated by the effect of the Covid 19 pandemic (Awopegba et al., 2021b; Dorward et al., 2021). Moreover, testing men and adolescents (10 to 19 years) remain a challenge with the conventional HIV testing, with lower proportions diagnosed than in the general population (Awopegba et al., 2021; Cambiano et al., 2019). This poor HTS coverage among certain population groups has been explained by the socio-structural challenges associated with conventional HTS in a health care facility, such as the stigma linked to accessing HTS, the limited operating hours of certain health care services and the limited space for physical distancing in clinics (C. Johnson et al., 2020). It is important to note that undiagnosed individuals have a higher risk of transmitting the HIV virus to others, with about 80% new infections contracted from people both diagnosed and undiagnosed not in care (Awopegba et al., 2021; Fauci et al., 2019). As a result, new approaches of testing that increase the HTS uptake, result in early HIV diagnosis and treatment initiation and provide prevention options for those who test HIV negative, have gained a particular focus, including HIVST (Dorward et al., 2021; Harichund & Moshabela, 2018). WHO recommend HIV self-testing (HIVST) as a supplementary testing strategy to the conventional HTS that could reach people who have remained underserved by HIV testing services, such as men, adolescents, and key populations (Cambiano et al., 2019; Ingold et al., 2019; C. C. Johnson et al., 2017).

HIVST is done through two different testing strategies, the supervised and unsupervised strategies. With the supervised strategy participants perform the test themselves with the assistance of a counsellor or health care professional. In contrast, with the unsupervised strategy, the individual performs and interpret the HIVST himself before seeking assistance for counselling and linkage to care (Pai et al., 2013). HIVST is a screening tool which allows users to know their HIV status, therefore does not provide a definitive diagnosis. Clients with positive self-test results are required to confirm their HIV status following the national testing algorithms (Njau et al., 2019). With HIVST a person will privately retrieve

their own specimen (often oral fluid or blood), conduct the HIV test, and interpret the result with or without the aid of an HTS tester, additionally the self-tests are validated through on-site rapid tests as well as laboratory tests (Jamieson et al., 2021; Pai et al., 2013).

The implementation of HIVST in South Africa is a DOH mandate supported by NGO- partners. In Cape Town, Anova Health institute (Anova), USAID founded NGO who supports the South African government in providing HIV and TB related health services (Rees, 2018), is the main implementing partner of HIVST. The Western Cape Department of Health (DOH) adopted the upscale implementation of HIVST in Cape Town in March 2021, where HIVST services are mainly provided through a primary distribution model, HIVST kits are distributed by the counsellor or health care worker to the individual testing for personal use, at facilities and during community testing done through mobile outreaches.

2. Literature review

Previous studies have shown that HIVST has a high safety and is a suitable HIV testing strategy for both key and general population. It can be accurately performed by the majority of people, however the linkage to treatment and care services remains a major challenge (Eshun-Wilson et al., 2021; Krause et al., 2013; Simo Fotso et al., 2022). Contrary to the conventional HIV testing where a tester pricks the person to perform the HIV test, the HIVST gives people the opportunity to test and diagnose themselves, consequently increasing clients' privacy, and confidentiality (Krause et al., 2013). Moreover, it's been demonstrated that HIVST was the preferred testing strategy for many Africans and could reach those at high risk of HIV and do not test (Ingold et al., 2019).

The STAR Initiative, conducted in Southern Africa, is a strong foundation to the introduction of HIVST in LMICs. This study showed that HIVST could help address the testing gaps and that its introduction in LMICs was cost effective. These results allowed the quick scaled-up implementation of HIVST, which started in 2015 (Ingold et al., 2019). Furthermore, a modelling study on the cost effectiveness of the different distribution modalities of HIVST have shown that the PHC distribution of HIVST was the least cost-effective in terms of saving life years as well as avoiding HIV infections due the lower HIV positivity rate. The secondary distribution to partners of ART patients will have the largest epidemiological impact but at a high cost, while distribution of HIVST to workplaces will be cost saving but have only a moderate impact on averting HIV infections (Cambiano et al., 2019).

Despite reports indicating an enhancement in HIV testing rates within SA, it remains alarmingly insufficient among both the young population and males (Jooste et al., 2021). HIVST has been described as a testing strategy that could increase HIV testing uptake and reach people who will not test otherwise, with high positivity rates for both the Community and the facility based HIVST, approximately 8% and even higher with the facility HIVST (Cambiano et al., 2019; C. C. Johnson et al., 2017). Furthermore, the CB- HIVST targeted to adult men has also been recommended as a strategy which tends to allow the

aversion of many HIV infections (Cambiano et al., 2019). However, it is important to note that these positivity rates may decline with saturation of a particular distribution model, as countries approach their testing targets (Giguère et al., 2021). Testing men earlier for HIV remains critical for earlier linkage to life-saving treatment, prevent onward transmission to sexual partners and achieve epidemic control., Research has demonstrated that men are less inclined than women to utilize healthcare services and undergo HIV testing (UNAIDS, 2017). Furthermore, a study conducted in Kwazulu Natal SA, focused on examining the impact and acceptance of HIV self-testing (HIVST), found that women exhibited a higher rate of HIV testing service (HTS) utilization compared to men. In contrast, men showed a notably lower engagement in HIV testing, primarily opting for it out of convenience (Harichund et al., 2019). As a result, HIV testing approaches that prioritize convenience and confidentiality, such as community-based methods and HIV self-testing, have led to higher rates of HIV testing among men (Hlongwa et al., 2019).

Many factors have been associated with the uptake of HIV testing services. Demographic and socio-economic factors, such as age, sex, level of education, marital status, wealth status, place of residence and the exposure to media influence the knowledge of HIVST in SA (Ekholuenetale et al., 2022). Greater access to HIV information and increased control over the decision to get tested have been linked to higher rates of testing, with factors like educational achievement, employment status, and income generation playing a role in this association (Jooste et al., 2021). Furthermore, the awareness of HIVST in SA was found significantly higher in urban areas, among highly educated individuals, those living in affluent households and those that were frequently exposed to media (Awopegba et al., 2021). Additionally, the analysis of people's perceptions of HIV testing in formal and informal urban communities from different age and races, in Cape Town and Durban, revealed that most participants were afraid of testing positive for HIV, having a misconception about the risks associated with HIV testing Ntsepe et al., 2014). Migrations have also been described as factors that affect HIVST uptake, by contributing to the development of diverse cultures which affect people's perception and attitudes towards HIVST (Nicholls et al., 2022). Other obstacles to the uptake of HIVST include reduced perception of the risk of HIV infection, as well as concerns related to one's HIV status and the associated stigma (Obermeyer et al., 2013).

The neighbourhood has also been recognised as an important factor that may affect health independently of individual level characteristics (Roux, 2001).(Roux, 2001). Studies done in SSA on HIV testing proved that geographic and socioeconomic inequalities affect the access to HIV testing services (Ajayi et al., 2020; Lakhe et al., 2019). This context is particularly relevant to SA, where the apartheid legacy left one of the most unequal societies in the world. Existent geographical variations around urban and rural districts, such as differences in access to basic infrastructure (. i.e., road, water, electricity), which influence access to healthcare facilities and to education (Budlender, 1999; Mabaso et al., 2019; Matthews & Yang, 2012). Rural areas are characterized by widespread poverty, low HIV testing rates,

which are often attributed to limited HIV awareness, knowledge and logistical challenges like long travel distances and the cost of transportation. These factors collectively hinder access to healthcare services and HIV testing (Goudge et al., 2009; Lankowski et al., 2014; Wabiri & Taffa, 2013). Interestingly, another research done in SA in 2021 did not find a statistically significant difference in the coverage of HIV testing across SA provinces, but individual-level factors were significantly associated with uptake of HIV testing unlike the community and household-related factors (Awopegba et al., 2021) Conversely, a modelling study conducted in South Africa to investigate factors influencing the uptake of HIV/AIDS self-testing uncovered significant differences in HIV self-testing uptake across different regions of the country and identified variations in the factors influencing self-testing uptake within different districts in South Africa (Jooste et al., 2021). However, little is known on the actual socio-economic factors influencing the uptake of HIVST in Cape Town, highlighting a significant gap in the implementation process. Therefore, HIVST should be understood not only medically, but also socially to design appropriate individual, facility, and health system-wide strategies that promote its uptake.

3. Justification of the study

A modelling study conducted in South Africa has projected that the expansion of HIVST could make a significant contribution to achieving testing targets, especially for individuals who may be hesitant to visit primary healthcare facilities (Jamieson et al., 2021) . Meanwhile, an analysis of HIVST prevalence and its associated factors in Malawi revealed some interesting trends. It showed that HIVST uptake was higher among men compared to women, and age played a crucial role for both genders, with the lowest rates observed among adults aged 40 and older. Among women, those who were married, had children, had higher levels of education, or possessed greater wealth were more inclined to engage in self-testing. On the other hand, men who reported recent condomless sex in the past 3 months had a higher prevalence of HIVST compared to those who did not engage in recent condomless sex. Additionally, a history of previous exposure to HIV testing was associated with HIVST adoption (Indravudh et al., 2020). However, questions remain regarding the extent to which HIVST has effectively addressed testing gaps within Cape Town and how individual and contextual variations may have influenced its adoption. Therefore, it is crucial to conduct an in-depth analysis of the uptake of HIVST and the factors associated with it, taking into account the specific context within the different Subdistricts of the Cape Metro. This analysis will inform the development of tailored implementation strategies that can expand HIV testing services in Cape Town and ensure the efficient allocation of limited resources.

It is noteworthy that previous studies have not extensively utilized programmatic data to explore the relationships between HIVST and social determinants. This study seeks to address this gap by leveraging the HIVST data collected by Anova Health Institute across the eight health subdistricts of Cape Town, which represents a diverse sample of the Cape Town population. Through this approach, the study aims

to provide a more comprehensive understanding of the factors that influence the adoption of HIVST.

4. Purpose of the Study

a. Aim

- Analyse the uptake of HIVST in Cape town and investigate the factors associated with the choice of HIVST as the individual testing option, in Cape Town from January 2022 to December 2022, using a contextual framework.

b. Objectives

- Analyse the uptake HIVST in Cape Town by various demographic indicators.
- Evaluate the individual and community characteristics associated with the uptake of HIVST in Cape town.

5. Conceptual framework

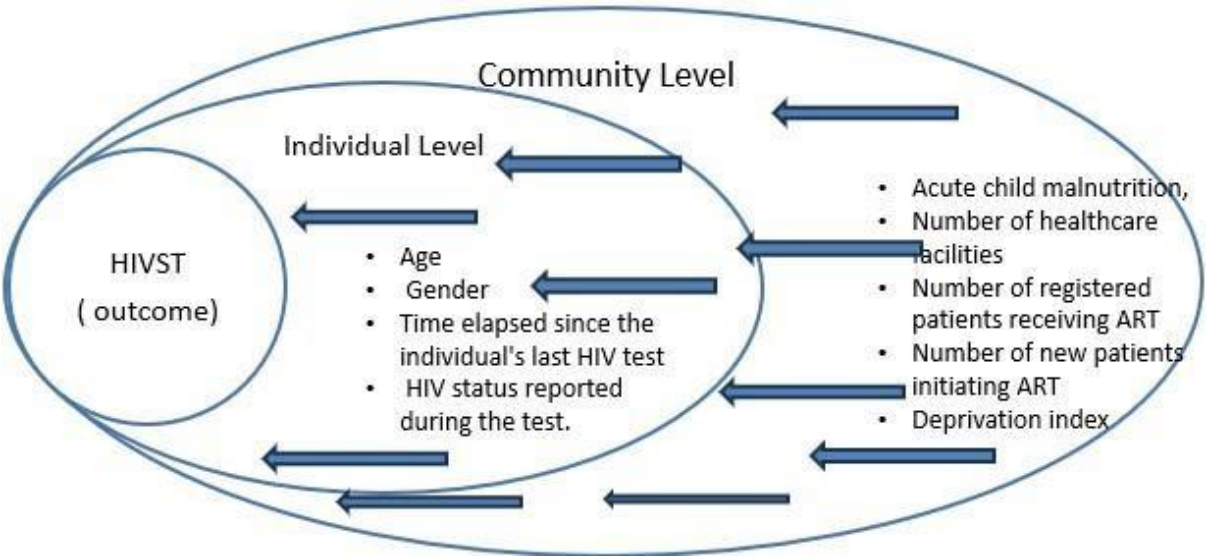
Previous research conducted in China on HIVST has indicated that the uptake of HIVST among users is closely linked to their perceived benefits. These perceived benefits encompass factors such as ease of use, convenience, and the assurance of privacy (Li et al., 2021). This observation aligns with the principles of the Health Belief Model, which posits that individuals' perceptions of the advantages associated with utilizing health services can significantly shape their attitudes and ongoing utilization of those services, ultimately influencing their behavior(Maiman & Becker, 1977) .The Health Belief Model has found application in various contexts, including health behaviors and interventions related to disease prevention, health screening, and health promotion campaigns. It provides valuable insights into how individuals assess the benefits of health-related actions and how these assessments influence their decisions. However, it's essential to acknowledge that the Health Belief Model has faced criticism for its potential overs simplification of health behavior and its limited consideration of the broader social and contextual factors that can also influence behavior. Health behavior is often influenced by a complex interplay of individual, interpersonal, community, and societal factors. Additionally, neighborhood contexts have been shown to exert an independent influence on health outcomes, distinct from individual-level characteristics. This underscores the importance of considering not only individual-level factors but also the broader social and environmental context in understanding health-related behaviors (Diez Roux, 2002). Therefore, the analysis of HIVST should encompass a multilayered approach, allowing for the simultaneous examination of both individual and area-level variables on individual outcomes (Merlo et al., 2006). To facilitate this comprehensive examination, we will utilize the Social-Ecological Model (SEM) as the study framework.

The SEM is a widely recognized framework for understanding and predicting behaviors related to preventive health measures, including those related to HIV prevention. This model's strength lies in its ability to consider multiple levels of influence; individual, interpersonal, community and societal levels,

on health behaviors (Adebayo & Gonzalez- Guarda, 2017). Incorporating the SEM into our study framework will provide a holistic view of the factors that influence the uptake of HIVST. Specifically, we will employ a two-level hierarchical model to explore the association between community characteristics and HIVST. At the individual level, we will examine biological factors and personal histories that may increase the likelihood of choosing HIVST as a testing option. These factors include age, gender, the time elapsed since the individual's last HIV test, and the HIV status reported during the test. At the community level, we will draw from the latest data provided by the City of Cape Town (City of Cape Town 2021, City of Cape Town Metropolitan Municipality Profile: City of Cape Town Metro, 2021). We will use child acute malnutrition as a proxy indicator for economic status, recognizing its association with poverty and economic conditions. For instance, families living in poverty may face challenges affording nutritious food for their children. Additionally, we will consider the number of healthcare facilities in each community, as this can serve as an indicator of access to healthcare services. A higher number of healthcare facilities generally suggests better access to healthcare services for the local population. We will also analyze the total number of registered patients receiving antiretroviral therapy (ART), which can provide insights into the prevalence of HIV within the population. A higher number of registered patients on ART may indicate a higher prevalence of HIV, signifying a significant burden of HIV/AIDS in that specific Subdistrict. Furthermore, we will explore the number of new patients initiating ART in each Subdistrict, which can offer valuable insights into the incidence of new HIV infections. A higher number of new patients on ART may suggest a higher incidence of new HIV infections in the respective Subdistrict, indicating ongoing virus transmission in that area. The deprivation index which represents a multidimensional measure of socio-economic disadvantage within specific communities. It is designed to assess and quantify various aspects of socio-economic well-being and living conditions at a local level.

Understanding the impact of these various levels of influence on HIVST in Cape Town is crucial for the development of multi-tiered interventions aimed at promoting HIVST, especially within populations that may still have limited access to HIV testing services. This comprehensive approach will enable us to address existing testing gaps effectively and contribute to improved public health outcomes.

Figure 2: Two level socio-ecologic model



6. Methods

a. Study Setting

This study took place in Cape Town, the legislative capital of South Africa, situated in the Western Cape Province. This city, covering an area of 2,461 km², ranks as the second most populous urban area in the country. It is marked by a diverse population encompassing various ethnicities, social strata, and cultural backgrounds. Residents tend to reside in distinct subdistricts and neighborhoods, often influenced by socioeconomic and cultural distinctions (Mumm et al., 2017).

b. Study Design

This study used a cross-sectional study design of routine HIV conventional and self-testing programmatic data collected by Anova Health Institute from January to December 2022, of individuals 18 years and above who tested for HIV in PHC facilities and communities in the 8 health Sub-Districts (SD) of the Cape Town Metropolitan Area, namely Eastern, Northern, Southern, Western, Khayelitsha, Klipfontein, Mitchells Plain and Tygerberg (City of Cape Town 2021).

c. Data collection

The study relied on data collected by the Anova Health Institute in Cape Town from both community outreaches and facility HTS. During HIV testing, individuals receive information about available testing options, including conventional HTS and HIVST, and are empowered to choose their preferred method. A positive HIVST result always necessitates further confirmation through testing conducted by a counsellor, following the validated national HIV testing algorithm from the beginning (NATIONAL HIV SELF SCREENING GUIDELINES, 2018). It's noteworthy that in some facilities, the full implementation of HIVST is still pending, and conventional HTS remains the sole testing option. Individual testing data is

recorded on a consent form, subsequently entered into an HTS register (either electronic or manual, depending on the facility), and after quality checks, the HTS data is transferred to Red Cap and then to Power BI.

The HTS dataset for this study encompasses all individuals aged 18 years and above who underwent HIV testing from January to December 2022, utilizing both conventional testing methods and supervised HIVST in healthcare facilities and communities. This comprehensive dataset will facilitate a thorough examination of the uptake of HIVST and its associated factors in Cape Town.

With formal permission from Anova and the Department of Health (DOH), deidentified data was used to analyze the uptake and investigate factors associated with HIV testing in the Sub-Districts of Cape Town. Community-level data was extracted from the latest published City of Cape Town profiles and analyses (City of Cape Town, 2021.; City of Cape Town Metropolitan Municipality Profile: City of Cape Town Metro, 2021.)

d. Measures

Outcome/Dependent variable

The outcome of interest was HIV testing option; either HIV self-testing (HIVST) or Conventional HIV testing. HIV testing was a binary variable, testing with HIVST (=1) or Conventional HIV testing (=0).

Predictor/Independent variables

The predictors were chosen based on the review of literature and a socio-ecological framework. These social determinants are determined at individual and community levels. The individual level factors considered in this study are age in years (categories 18-19 20-24, 25-49 and 50 and above), sex (male or female), the last time the patient had an HIV test (0 to12 months, above 12 months, never had an HIV test before),The community factors that were explored in each SD (City of Cape Town 2021.) were; child acute malnutrition status used as a proxy of the economic status, the number of healthcare facilities which give an indication of the access to healthcare services in the SD , number of new patients on ART providing an insights into the incidence of new HIV infections, and the number of registered patients receiving ART which give an indication of the prevalence of HIV in the population. Further details on outcomes and predictor variables are provided in table 1.

Table 1: Table of Variables

Variable	Type of variable	Variable operationalization
Individual level factors		
Age	Categorical	0= 18-19 (adolescents) 1= 20-24 (Young adults) 2= 25-49 (Adults) 3= 50+ (older adults)
Gender	Binary	0= Female 1= Male
HIV testing results	Binary	0=Negative 1=Male
Last time participant tested for HIV	Categorical	0=12 months or less 1=More than 12 months 2=Never tested
Community level factors		
Subdistricts	Categorical	1=Eastern 2=Northern 3=Southern 4=Western 5=Khayelitsha

		6=Klipfontein 7=Mitchell's Plain 8=Tygerberg
Number of healthcare facilities per subdistrict	Categorical	0= low (0-14) 1= medium (15-25) 2 = high (26+)
Number of registered ART patients/subdistrict	Categorical	0= low (0-20000) 1= medium (20001-30000) 2 = high (30001 and above)
Number of new ART patients/subdistrict	Categorical	0= low (less than 1799) 1= medium (1800-2900) 2 = high (2901 and above)
Child acute malnutrition rate/subdistrict (Under/100,000)	Categorical	0= low (less than 0.5) 1= medium (0.5-0.7) 2 = high (0.8-1)
Outcome variable		
HIV testing option	Binary	0=Conventional HIV testing 1=Self-testing

e. Statistical analysis

We will employ Stata® 15.1 (StataCorp, TX, USA) as our statistical software to carry out data exploration, cleansing, and analysis. In the analysis, any missing data points, and extreme values (those that are negative or zero) will be excluded. Initially we will generate descriptive statistics for all the variables provided, offering a summary of the study population. These statistics will be presented through frequency and percentage tables. Subsequently, a bivariate analysis will be conducted to assess all individual and community-level variables. This analysis will help us identify which variables should be considered for inclusion in the regression analysis.

Given the conceptualization of the study, which includes individuals at level 1 and communities at level 2, our analytical approach involves several steps. First, we will establish a baseline model using only individual-level variables. Following that, we will construct a multilevel logistic regression model that incorporates both individual-level and community-level variables. Additionally, we will stratify our analysis based on gender, allowing us to examine gender-specific patterns and associations within the data.

7. Strengths

This study will be one of the first studies to assess in real life HIVST use in Cape Town after its upscale implementation in the Western Cape in March 2021. It will give an insight into the progress made in addressing the HIV testing gaps and highlight the socio-determinants factors associated with HIVST in Cape Town.

By using programmatic routinely collected indicators data, this study could be easily replicated in other contexts to monitor the uptake and implementation of HIVST without any additional cost.

8. Limitations

This study is subject to limitations attributed to the use of secondary data, where the exclusion of participants with missing data may lead to a selection bias and alter the results.

The study is unable to incorporate biological or other individual sociodemographic factors such the educational level, marital status, and occupational type that could also explain the preference of testing using the HIVST, as this information is not available in the dataset.

9. Ethics

The research project poses no specific risks to the participants involved, as it does not utilize any personal identifying information like names, ID numbers, or addresses. All necessary precautions have been taken to eliminate such personal identifiers from the Power BI dataset. The data will be treated with utmost confidentiality and will not be shared with any entity other than the research team. It will be securely stored on a computer protected by a password, with access restricted to only the research coordinator and assistant. This data will be retained for at least 5 years after the study's completion, after which it will be permanently deleted to ensure it cannot be recovered.

The community-level data used in this study will be obtained from the latest published data of the City of Cape Town (City of Cape Town, 2021). Since this research relies on secondary data analysis and does not involve direct participation of human subjects, there are no medical ethical issues anticipated. Nevertheless, consent will be sought from the University of Cape Town's Human Research Ethics Committee.

10. Potential benefits of this study

The results of this study will give an insight on the current uptake of HIVST in Cape town and will give an insight into the progress made in addressing the HIV testing gaps, particularly in reaching men, and

highlight the socio- determinants factors associated with HIVST in Cape Town.

This will allow policy makers to develop appropriate strategies that promote the use of HIVST in the general population and mitigate the existing testing gaps among population groups.

The findings will add to the literature on HIVST implementation in Cape town, which may be helpful for other provinces in SA or countries that are also in the process of implementing or upscaling HIVST as a testing modality for HIV.

This study is in line with the SA Government's mandate to eliminate new HIV transmissions by 2030, with a focus on a population group that has been hard to reach, particularly men in SA.

11. Data dissemination plan

The results of this study will be shared through a journal article and a policy brief. The journal article will undergo peer review and be submitted to suitable journals for publication. Additionally, it will be provided to the University of Cape Town's Health Economics Unit, the Anova Health Institute, and the Western Cape Department of Health. The study's findings will also be presented at academic workshops and published in international peer-reviewed academic journals.

12. List of Abbreviations

HIV: Human Immunodeficiency Virus HIVST: HIV Self Testing

HTS: HIV Testing Services ART: Antiretroviral therapy SA: South Africa.

SD: Sub- district.

SEM: Social-Ecological Model DOH: Department of Health.

13. Annexes

Figure 1: Eights SD of the Cape Town Metro

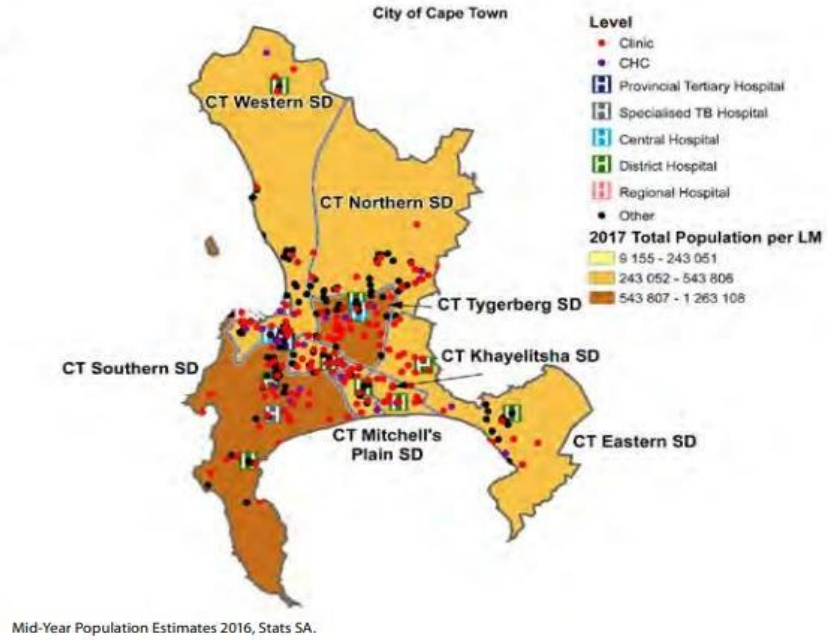
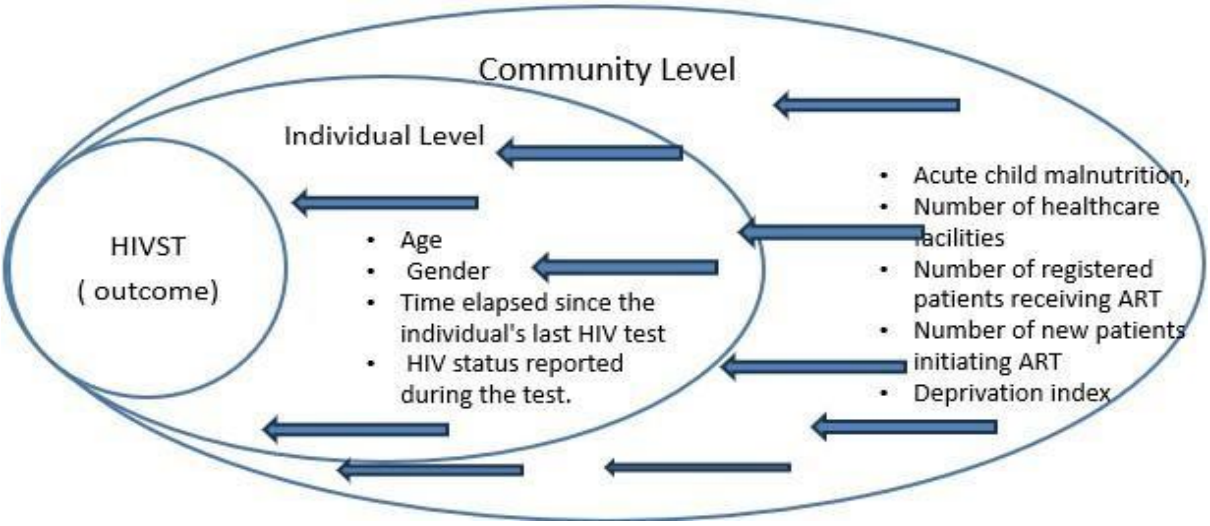


Figure 2: Two level socio-ecologic model



14. Bibliography

Abdullahi Nasir, I. (2018). Knowledge, attitude and factors affecting voluntary HIV counselling and testing services among women of reproductive age group in an Abuja 1 2 3 1 3, 4*. In Nigeria Medical Journal of Zambia (Vol. 45, Issue 1).

Adebayo, O. W., & Gonzalez-Guarda, R. M. (2017). Factors Associated with HIV Testing in Youth in the United States: An Integrative Review. Journal of the Association of Nurses in AIDS Care, 28(3). https://doi.org/10.1016/j.jana.2016.11.006

Ajayi, A. I., Awopegba, O. E., Adeagbo, O. A., & Ushie, B. A. (2020). Low coverage of HIV testing among adolescents and young adults in Nigeria: Implication for achieving the UNAIDS first 95. PLoS ONE, 15(5). https://doi.org/10.1371/journal.pone.0233368

Arnesen, R., Moll, A. P., & Shenoi, S. V. (2017). Predictors of loss to follow-up among patients on ART at a rural hospital in KwaZulu-Natal, South Africa. PLoS ONE, 12(5). https://doi.org/10.1371/journal.pone.0177168

Asaolu, I. O., Gunn, J. K., Center, K. E., Koss, M. P., Iwelunmor, J. I., & Ehiri, J. E. (2016). Predictors of HIV testing among youth in sub-Saharan Africa: A cross-sectional study. PLoS ONE, 11(10). https://doi.org/10.1371/journal.pone.0164052

Awopegba, O. E., Ologunowa, T. O., & Ajayi, A. I. (2021). HIV testing and self-testing coverage among men and women in South Africa: an exploration of related factors. Tropical Medicine and International Health, 26(2), 214–227. https://doi.org/10.1111/tmi.13514

Bayani, A., Ghiasvand, H., Rezaei, O., Fattah Moghaddam, L., Noroozi, A., Ahounbar, E., Higgs, P., & Armoon, B. (2020). Factors associated with HIV testing among people who inject drugs: a meta-analysis. Journal of Addictive Diseases, 38(3). https://doi.org/10.1080/10550887.2020.1771235

Beecroft, A., Vaikla, O., & Pant Pai, N. (2024). Digital HIV self-testing as an exemplar: a perspective on benefits, challenges, and opportunities. Expert Review of Molecular Diagnostics, 24(10), 913–925. https://doi.org/10.1080/14737159.2024.2406974

Belza, M. J., Figueroa, C., Rosales-Statkus, M. E., Ruiz, M., Vallejo, F., & de la Fuente, L. (2014). Low knowledge and anecdotal use of unauthorized online HIV self-test kits among attendees at a street-based HIV rapid testing programme in Spain. International Journal of Infectious Diseases, 25, 196–200. https://doi.org/10.1016/j.ijid.2014.03.1379

Bien-Gund, C. H., Shaw, P. A., Agnew-Brune, C., Baugher, A., Brady, K. A., & Gross, R. (2022). HIV Self-testing and Risk Behaviors Among Men Who Have Sex with Men in 23 US Cities, 2017. JAMA Network Open, 5(12), e2247540. https://doi.org/10.1001/jamanetworkopen.2022.47540

Brofenbrenner, U., & Hess, A. L. (1979). The Ecology of Human Development: Experiments by Nature and Design. https://about.jstor.org/terms

Budlender, D. (1999). Patterns of poverty in South Africa. Development Southern Africa, 16(2), 197–219. https://doi.org/10.1080/03768359908440073

Bwalya, C., Simwinga, M., Hensen, B., Gwanu, L., Hang'Andu, A., Mulubwa, C., Phiri, M., Hayes, R., Fidler, S., Mwinga, A., Ayles, H., Ayles, H., Bond, V., & Bond, V. (2020). Social response to the delivery of HIV self-testing in households: Experiences from four Zambian HPTN 071 (PopART) urban communities. AIDS Research and Therapy, 17(1). https://doi.org/10.1186/s12981-020-00287-y

Bwana, P., Ochieng, L., & Mwau, M. (2018). Performance and usability evaluation of the INSTI HIV self-test in Kenya for qualitative detection of antibodies to HIV. PLoS ONE, 13(9). https://doi.org/10.1371/journal.pone.0202491

Cambiano, V., Ford, D., Mabugu, T., Napierala Mavedzenge, S., Miners, A., Mugurungi, O., Nakagawa, F., Revill, P., & Phillips, A. (2015). Assessment of the Potential Impact and Cost-effectiveness of Self-Testing for HIV in Low-Income Countries. Journal of Infectious Diseases, 212(4), 570–577. https://doi.org/10.1093/infdis/jiv040

Cambiano, V., Johnson, C. C., Hatzold, K., Terris-Prestholt, F., Maheswaran, H., Thirumurthy, H., Figueroa, C., Cowan, F. M., Sibanda, E. L., Ncube, G., Revill, P., Baggaley, R. C., Corbett, E. L., & Phillips, A. (2019). The impact and cost-effectiveness of community-based HIV self-testing in sub-Saharan Africa: a health economic and modelling analysis for Working Group on Cost Effectiveness of HIV self-testing in Southern Africa. https://doi.org/10.1002/jia2.25243/full

Chamie, G., Napierala, S., Agot, K., & Thirumurthy, H. (2021). Review HIV testing approaches to reach the first UNAIDS 95% target in sub-Saharan Africa. www.thelancet.com/hiv

Chiu, C. C. J., & Young, S. D. (2016). Correlates of requesting home HIV self-testing kits on online social networks among African-American and Latino men who have sex with men. AIDS Care - Psychological and Socio-Medical Aspects of AIDS/HIV, 28(3), 289–293. https://doi.org/10.1080/09540121.2015.1090533

Choko, A. T., Corbett, E. L., Stallard, N., Maheswaran, H., Lepine, A., Johnson, C. C., Sakala, D., Kalua, T., Kumwenda, M., Hayes, R., & Fielding, K. (2019). HIV self-testing alone or with additional interventions, including financial incentives, and linkage to care or prevention among male partners of antenatal care clinic attendees in Malawi: An adaptive multi-arm, multi-stage cluster randomised trial. PLoS Medicine, 16(1). https://doi.org/10.1371/journal.pmed.1002719

Choko, A. T., MacPherson, P., Webb, E. L., Willey, B. A., Feasy, H., Sambakunsi, R., Mdolo, A., Makombe, S. D., Desmond, N., Hayes, R., Maheswaran, H., & Corbett, E. L. (2015). Uptake, Accuracy, Safety, and Linkage into Care over Two Years of Promoting Annual Self-Testing for HIV in Blantyre, Malawi: A Community-Based Prospective Study. PLoS Medicine, 12(9). https://doi.org/10.1371/journal.pmed.1001873

Christian, S. N., Mantell, J. E., Romo, M. L., Grov, C., George, G., Mwai, E., Nyaga, E., Odhiambo, J. O., Govender, K., & Kelvin, E. A. (2020). Applying a social-ecological lens to opinions about HIV self-testing among Kenyan truckers who declined to test: a qualitative study. African Journal of AIDS Research, 19(2), 147–155. https://doi.org/10.2989/16085906.2020.1764070

City of Cape Town. (2021).

City of Cape Town Metropolitan Municipality Profile: City of Cape Town Metro. (2021).

Daniel, D., Hasen, H., Sinebo, Y., Bereku, T., Mekuria, M., Jemal, Z., Amare, M., & Habtu, Y. (2024). Level of knowledge and intention to use oral fluid HIV self-testing and associated factors among Ethiopian health care workers in southern Ethiopia. AIDS Research and Therapy, 21(1). https://doi.org/10.1186/s12981-024-00642-3

Decker, M. R., Wilcox, H. C., Holliday, C. N., & Webster, D. W. (2018). An Integrated Public Health Approach to Interpersonal Violence and Suicide Prevention and Response. Public Health Reports, 133, 65S-79S. https://doi.org/10.1177/0033354918800019

Diez Roux, A. V. (2002). A glossary for multilevel analysis. In Journal of Epidemiology and Community Health (Vol. 56, Issue 8). https://doi.org/10.1136/jech.56.8.588

Donovan, B. J., Rublein, J. C., Leone, P. A., & Pilcher, C. D. (2004). HIV Infection: Point-of-Care Testing. In Annals of Pharmacotherapy (Vol. 38, Issue 4). https://doi.org/10.1345/aph.1D314

Dorward, J., Khubone, T., Gate, K., Ngobese, H., Sookrajh, Y., Mkhize, S., Jeewa, A., Bottomley, C., Lewis, L., Baisley, K., Butler, C. C., Gxagxisa, N., & Garrett, N. (2021). The impact of the COVID-19 lockdown on HIV care in 65 South African primary care clinics: an interrupted time series analysis. The Lancet HIV, 8(3), e158–e165. https://doi.org/10.1016/S2352-3018(20)30359-3

Ekholuenetale, M., Nzoputam, C. I., & Okonji, O. C. (2022). Association between socio-economic factors and HIV self-testing knowledge amongst South African women. Southern African Journal of HIV Medicine, 23(1). https://doi.org/10.4102/SAJHIVMED.V23I1.1347

Eshun-Wilson, I., Jamil, M. S., Witzel, T. C., Glidded, D. V., Johnson, C., Le Trouneau, N., Ford, N., McGee, K., Kemp, C., Baral, S., Schwartz, S., & Geng, E. H. (2021). A Systematic Review and Network Meta-analyses to Assess the Effectiveness of Human Immunodeficiency Virus (HIV) Self-testing Distribution Strategies. In Clinical Infectious Diseases (Vol. 73, Issue 4, pp. E1018–E1028). Oxford University Press. https://doi.org/10.1093/cid/ciab029

Fauci, A. S., Redfield, R. R., Sigounas, G., Weahkee, M. D., & Giroir, B. P. (2019). Ending the HIV Epidemic: A Plan for the United States. In JAMA - Journal of the American Medical Association (Vol. 321, Issue 9). https://doi.org/10.1001/jama.2019.1343

Figueroa, C., Johnson, C., Verster, A., & Baggaley, R. (2015). Attitudes and Acceptability on HIV Self-testing Among Key Populations: A Literature Review. AIDS and Behavior, 19(11), 1949–1965. https://doi.org/10.1007/s10461-015-1097-8

Giguère, K., Eaton, J. W., Marsh, K., Johnson, L. F., Johnson, C. C., Ehui, E., Jahn, A., Wanyeki, I., Mbofana, F., Bakiono, F., Mahy, M., & Maheu-Giroux, M. (2021). Trends in knowledge of HIV status and efficiency of HIV testing services

in sub-Saharan Africa, 2000–20: a modelling study using survey and HIV testing programme data. The Lancet HIV, 8(5). https://doi.org/10.1016/S2352-3018(20)30315-5

Goudge, J., Gilson, L., Russell, S., Gumede, T., & Mills, A. (2009). The household costs of health care in rural South Africa with free public primary care and hospital exemptions for the poor. Tropical Medicine and International Health, 14(4). https://doi.org/10.1111/j.1365-3156.2009.02256.x

Greacen, T., Friboulet, D., Fugon, L., Hefez, S., Lorente, N., & Spire, B. (2012). Access to and use of unauthorised online HIV self-tests by internet-using French-speaking men who have sex with men. Sexually Transmitted Infections, 88(5). https://doi.org/10.1136/sextrans-2011-050405

Guidelines Consolidated Guidelines on HIV Testing Services 5cs: Consent, Confidentiality, Counselling, Correct Results And Connection. (2015).

Hansoti, B., Stead, D., Parrish, A., Reynolds, S. J., Redd, A. D., Whalen, M. M., Mvandaba, N., & Quinn, T. C. (2018). HIV testing in a South African Emergency Department: A missed opportunity. PLoS ONE, 13(3). https://doi.org/10.1371/journal.pone.0193858

Harichund, C., & Moshabela, M. (2018). Acceptability of HIV Self-Testing in Sub-Saharan Africa: Scoping Study. In AIDS and Behavior (Vol. 22, Issue 2, pp. 560–568). Springer New York LLC. https://doi.org/10.1007/s10461-017-1848-9

Harichund, C., Moshabela, M., Kunene, P., & Abdool Karim, Q. (2019). Acceptability of HIV self-testing among men and women in KwaZulu-Natal, South Africa. AIDS Care - Psychological and Socio-Medical Aspects of AIDS/HIV, 31(2), 186–192. https://doi.org/10.1080/09540121.2018.1503638

Hecht, J., Sanchez, T., Patrick, ;, Sullivan, S., Dinenno, E. A., Cramer, N., & Delaney, K. P. (2020). Morbidity and Mortality Weekly Report. https://www.nastad.org/domestic/hiv-prevention

Hermanus, T., & O'Grady, M. (2022). A principle-based approach to justify the use of HIV self-testing in South Africa. Developing World Bioethics, 22(1), 53–62. https://doi.org/10.1111/dewb.12319

HIV Self-Testing and Partner Notification Supplement To Consolidated Guidelines On HIV Testing Services. (2016).

Hlongwa, M., Mashamba-Thompson, T., Makhunga, S., & Hlongwana, K. (2019). Mapping evidence of intervention strategies to improving men's uptake to HIV testing services in sub-Saharan Africa: A systematic scoping review. In BMC Infectious Diseases (Vol. 19, Issue 1). BioMed Central Ltd. https://doi.org/10.1186/s12879-019-4124-y

Hoang, C. D., Tran, B. X., Pham, M. D., Nguyen, L. H., Do, H. N., Vuong, Q. H., Ho, M. T., Dam, V. N., Vuong, T. T., Nguyen, H. H., Nguyen, V., Pham, H. Q., Ha, G. H., Latkin, C. A., Ho, C. S. H., & Ho, R. C. M. (2019). HIV- and AIDS-related knowledge and attitude of residents in border regions of Vietnam. Harm Reduction Journal, 16(1). https://doi.org/10.1186/s12954-019-0282-x

Hurt, C. B., & Powers, K. A. (2014). Self-testing for HIV and its impact on public health. In Sexually Transmitted Diseases (Vol. 41, Issue 1, pp. 10–12). https://doi.org/10.1097/OLQ.0000000000000076

Indravudh, P. P., Hensen, B., Nzawa, R., Chilongosi, R., Nyirenda, R., Johnson, C. C., Hatzold, K., Fielding, K., Corbett, E. L., & Neuman, M. (2020b). Who is Reached by HIV Self-Testing? Individual Factors Associated with Self-Testing Within a Community-Based Program in Rural Malawi. Journal of Acquired Immune Deficiency Syndromes, 85(2), 165–173. https://doi.org/10.1097/QAI.0000000000002412

Ingold, H., Mwerinde, O., Ross, A. L., Leach, R., Corbett, E. L., Hatzold, K., Johnson, C. C., Ncube, G., Nyirenda, R., & Baggaley, R. C. (2019). The Self-Testing AfRica (STAR) Initiative: accelerating global access and scale-up of HIV self-testing. https://doi.org/10.1002/jia2.25249/full

Jamieson, L., Johnson, L. F., Matsimela, K., Sande, L. A., D'Elbée, M., Majam, M., Johnson, C., Chidarikire, T., Hatzold, K., Terris-Prestholt, F., Nichols, B., & Meyer-Rath, G. (2021). The cost effectiveness and optimal configuration of HIV self-test distribution in South Africa: A model analysis. BMJ Global Health, 6. https://doi.org/10.1136/bmjgh-2021-005598

Jamil, M. S., Eshun-Wilson, I., Witzel, T. C., Siegfried, N., Figueroa, C., Chitembo, L., Msimanga-Radebe, B., Pasha, M. S., Hatzold, K., Corbett, E., Barr-DiChiara, M., Rodger, A. J., Weatherburn, P., Geng, E., Baggaley, R., & Johnson, C. (2021). Examining the effects of HIV self-testing compared to standard HIV testing services in the general population: A systematic review and meta-analysis. EClinicalMedicine, 38. https://doi.org/10.1016/j.eclinm.2021.100991

Johnson, A. L., Butts, S. A., Rodriguez, E., Craker, L., Kanamori, M., & Doblecki-Lewis, S. (2023). "Test-To-PrEP": Assessing Reach and Adoption of a New Approach to Increase HIV Testing and PrEP Knowledge Using HIV Self-Test Kit Distribution Through PrEP Clients' Social Networks. Journal of Acquired Immune Deficiency Syndromes, 94(5). https://doi.org/10.1097/QAI.0000000000003294

Johnson, C. C., Kennedy, C., Fonner, V., Siegfried, N., Figueroa, C., Dalal, S., Sands, A., & Baggaley, R. (2017). Examining the effects of HIV self-Testing compared to standard HIV testing services: A systematic review and meta-Analysis. Journal of the International AIDS Society, 20(1). https://doi.org/10.7448/IAS.20.1.21594

Johnson, C., Kumwenda, M., Meghji, J., Choko, A. T., Phiri, M., Hatzold, K., Baggaley, R., Taegtmeyer, M., Terris-Prestholt, F., Desmond, N., & Corbett, E. L. (2021). 'Too old to test?': A life course approach to HIV-related risk and self-testing among midlife-older adults in Malawi. BMC Public Health, 21(1). https://doi.org/10.1186/s12889-021-10573-7

Johnson, C., Neuman, M., MacPherson, P., Choko, A., Quinn, C., Wong, V. J., Hatzold, K., Nyrienda, R., Ncube, G., Baggaley, R., Terris-Prestholt, F., & Corbett, E. L. (2020). Use and awareness of and willingness to self-test for

HIV: An analysis of cross-sectional population-based surveys in Malawi and Zimbabwe. BMC Public Health, 20(1). https://doi.org/10.1186/s12889-020-08855-7

Johnson, L. F., Meyer-Rath, G., Dorrington, R. E., Puren, A., Seathlodi, T., Zuma, K., & Feizzadeh, A. (2022). The Effect of HIV Programs in South Africa on National HIV Incidence Trends, 2000-2019. www.jaids.com

Jooste, S., Mabaso, M., Taylor, M., North, A., Shean, Y., & Simbayi, L. C. (2021). Socio-economic differences in the uptake of HIV testing and associated factors in South Africa. BMC Public Health, 21(1). https://doi.org/10.1186/s12889-021-11583-1

Kelvin, E. A., Cheruvillil, S., Christian, S., Mantell, J. E., Milford, C., Rambally-Greener, L., Mosery, N., Greener, R., & Smit, J. A. (2016). Choice in HIV testing: the acceptability and anticipated use of a self-administered at-home oral HIV test among South Africans. African Journal of AIDS Research, 15(2), 99–108. https://doi.org/10.2989/16085906.2016.1189442

Kilanowski, J. F. (2017). Breadth of the Socio-Ecological Model. In Journal of Agromedicine (Vol. 22, Issue 4, pp. 295–297). Taylor and Francis Ltd. https://doi.org/10.1080/1059924X.2017.1358971

Kombo, B. K., Thomann, M., Lazarus, L., Musyoki, H., Olango, K., Kuria, S., Kyana, M., Otieno, M., Njiriani, M., Musimbi, J., Bhattacharjee, P., & Lorway, R. (2021). Engaging MSM Communities in HIV Self-Testing Research and Programming in Kenya: Collaborations, Tacit Knowledge, and a Community-Based Programme Science Approach. https://doi.org/10.21203/rs.3.rs-861094/v1

Krause, J., Subklew-Sehume, F., Kenyon, C., & Colebunders, R. (2013). Acceptability of HIV self-testing: A systematic literature review. BMC Public Health, 13(1). https://doi.org/10.1186/1471-2458-13-735

Lakhe, N. A., Diallo Mbaye, K., Sylla, K., & Ndour, C. T. (2019). HIV screening in men and women in Senegal: Coverage and associated factors; Analysis of the 2017 demographic and health survey. BMC Infectious Diseases, 20(1). https://doi.org/10.1186/s12879-019-4717-5

Lankowski, A. J., Siedner, M. J., Bangsberg, D. R., & Tsai, A. C. (2014). Impact of geographic and transportation-related barriers on HIV outcomes in sub-saharan Africa: A systematic review. In AIDS and Behavior (Vol. 18, Issue 7). https://doi.org/10.1007/s10461-014-0729-8

Li, J., Marley, G., Zhang, Y., Chen, Y., Tang, W., Rongbin, Y., & Fu, G. (2021). Determinants of Recent HIV Self-Testing Uptake Among Men Who Have Sex With Men in Jiangsu Province, China: An Online Cross-Sectional Survey. Frontiers in Public Health, 9. https://doi.org/10.3389/fpubh.2021.736440

Mabaso, M., Makola, L., Naidoo, I., Mlangeni, L. L., Jooste, S., & Simbayi, L. (2019). HIV prevalence in South Africa through gender and racial lenses: results from the 2012 population-based national household survey. International Journal for Equity in Health, 18(1), 167. https://doi.org/10.1186/s12939-019-1055-6

Maiman, L. A., & Becker, M. H. (1977). The Health Belief Model: Origins and Correlates in Psychological Theory. Health Education & Behavior, 2(4). https://doi.org/10.1177/109019817400200404

Marsh, K., Eaton, J. W., Mahy, M., Sabin, K., Autenrieth, C. S., Wanyeki, I., Daher, J., & Ghys, P. D. (2019). Global, regional and country-level 90-90-90 estimates for 2018: Assessing progress towards the 2020 target. AIDS, 33, S213–S226. https://doi.org/10.1097/QAD.0000000000002355

Matsimela, K., Sande, L. A., Mostert, C., Majam, M., Phiri, J., Zishiri, V., Madondo, C., Khama, S., Chidarikire, T., D'Elbée, M., Hatzold, K., Johnson, C., Terris-Prestholt, F., & Meyer-Rath, G. (2021). The cost and intermediary cost-effectiveness of oral HIV self-test kit distribution across 11 distribution models in South Africa. BMJ Global Health, 6. https://doi.org/10.1136/bmjgh-2021-005019

Matthews, S. A., & Yang, T. C. (2012). Mapping the results of local statistics: Using geographically weighted regression. Demographic Research, 26, 151–166. https://doi.org/10.4054/DemRes.2012.26.6

Mcleroy, K. R., Bibeau, D., Steckler, A., & Glanz, K. (1988). An Ecological Perspective on Health Promotion Programs. Health Education & Behavior, 15(4), 351–377. https://doi.org/10.1177/109019818801500401

Merlo, J., Chaix, B., Ohlsson, H., Beckman, A., Johnell, K., Hjerpe, P., Råstam, L., & Larsen, K. (2006). A brief conceptual tutorial of multilevel analysis in social epidemiology: Using measures of clustering in multilevel logistic regression to investigate contextual phenomena. In Journal of Epidemiology and Community Health (Vol. 60, Issue 4, pp. 290–297). https://doi.org/10.1136/jech.2004.029454

Metro District Health Plan_2019-20. (2019).

Mumm, R., Diaz-Monsalve, S., Hänselmann, E., Freund, J., Wirsching, M., Gärtner, J., Gminski, R., Vögtlin, K., Körner, M., Zirn, L., Wittwer-Backofen, U., Oni, T., & Kroeger, A. (2017). Exploring urban health in Cape Town, South Africa: an interdisciplinary analysis of secondary data. Pathogens and Global Health, 111(1), 7–22. https://doi.org/10.1080/20477724.2016.1275463

National HIV Self Screening Guidelines. (2018).

Ndungu, K., Gichangi, P., & Temmerman, M. (2023). Evaluation of factors associated with HIV self-testing Acceptability and Uptake among the MSM community in Nairobi, Kenya: A cross-sectional study. PLoS ONE, 18(3 March). https://doi.org/10.1371/journal.pone.0280540

Nicholls, E. J., Samba, P., McCabe, L., Gafos, M., Philips, A. N., Trevelion, R., Rodger, A. J., Burns, F. M., Weatherburn, P., & Witzel, T. C. (2022). Experiences of and attitudes towards HIV testing for Asian, Black and Latin American men who have sex with men (MSM) in the SELPHI (HIV Self-Testing Public Health Intervention) randomized controlled trial in England and Wales: implications for HIV self-testing. BMC Public Health, 22(1). https://doi.org/10.1186/s12889-022-13189-7

Njau, B., Covin, C., Lisasi, E., Damian, D., Mushi, D., Boulle, A., & Mathews, C. (2019). A systematic review of qualitative evidence on factors enabling and deterring uptake of HIV self-testing in Africa. BMC Public Health, 19(1). https://doi.org/10.1186/s12889-019-7685-1

Ntsepe, Y., Simbayi, L. C., Shisana, O., Rehle, T., Mabaso, M., Ncitakalo, N., Davids, A., & Naidoo, Y. D. (2014). Perceptions about the acceptability and prevalence of HIV testing and factors influencing them in different communities in South Africa. Sahara J, 11(1). https://doi.org/10.1080/17290376.2014.937355

Obermeyer, C. M., Neuman, M., Hardon, A., Desclaux, A., Wanyenze, R., Ky-Zerbo, O., Cherutich, P., & Namakhoma, I. (2013). Socio-economic determinants of HIV testing and counselling: A comparative study in four African countries. Tropical Medicine and International Health, 18(9). https://doi.org/10.1111/tmi.12155

Obiezu-Umeh, C., Gbajabiamila, T., Ezechi, O., Nwaozuru, U., Ong, J. J., Idigbe, I., Oladele, D., Musa, A. Z., Uzoaru, F., Airhihenbuwa, C., Tucker, J. D., & Iwelunmor, J. (2021). Young people's preferences for HIV self-testing services in Nigeria: a qualitative analysis. BMC Public Health, 21(1). https://doi.org/10.1186/s12889-020-10072-1

Ong, J. J., Nwaozuru, U., Obiezu-Umeh, C., Airhihenbuwa, C., Xian, H., Terris-Prestholt, F., Gbajabiamila, T., Musa, A. Z., Oladele, D., Idigbe, I., David, A., Okwuzu, J., Bamidele, T., Iwelunmor, J., Tucker, J. D., & Ezechi, O. (2021). Designing HIV Testing and Self-Testing Services for Young People in Nigeria: A Discrete Choice Experiment. Patient, 14(6), 815–826. https://doi.org/10.1007/s40271-021-00522-2

Pai, N. P., Behlim, T., Abrahams, L., Vadnais, C., Shivkumar, S., Pillay, S., Binder, A., Deli-Houssein, R., Engel, N., Joseph, L., & Dheda, K. (2013). Will an unsupervised self-testing strategy for HIV work in health care workers of South Africa? A cross-sectional pilot feasibility study. PLoS ONE, 8(11). https://doi.org/10.1371/journal.pone.0079772

Pant Pai, N., Sharma, J., Shivkumar, S., Pillay, S., Vadnais, C., Joseph, L., Dheda, K., & Peeling, R. W. (2013). Supervised and Unsupervised Self-Testing for HIV in High- and Low-Risk Populations: A Systematic Review. In PLoS Medicine (Vol. 10, Issue 4). https://doi.org/10.1371/journal.pmed.1001414

Pereira, M. D., Teixeira, N. do S. C. C. de A., Oliveira, I. K. F., Lima, C. H. R., & Paiva, A. de A. (2019). Esquema terapêutico e consumo alimentar em pessoas vivendo com HIV/Aids. ARCHIVES OF HEALTH INVESTIGATION, 8(7). https://doi.org/10.21270/archi.v8i7.4625

Pettifor, A., Lippman, S. A., Kimaru, L., Haber, N., Mayakayaka, Z., Selin, A., Twine, R., Gilmore, H., Westreich, D., Mdaka, B., Wagner, R., Gomez-Olive, X., Tollman, S., & Kahn, K. (2020). HIV self-testing among young women in rural South Africa: A randomized controlled trial comparing clinic-based HIV testing to the choice of either clinic testing or HIV self-testing with secondary distribution to peers and partners. EClinicalMedicine, 21. https://doi.org/10.1016/j.eclinm.2020.100327

Pillay, Y., & Johnson, L. (2021). World AIDS Day 2020: Reflections on global and South African progress and continuing challenges. S Afr J HIV Med, 22(1), 1205. https://doi.org/10.4102/sajhivmed

Qin, Y., Han, L., Babbitt, A., Walker, J. S., Liu, F., Thirumurthy, H., Tang, W., & Tucker, J. D. (2018). Experiences using and organizing HIV self-testing. AIDS, 32(3), 371–381. https://doi.org/10.1097/QAD.0000000000001705

Quinn, C., Kadengye, D. T., Johnson, C. C., Baggaley, R., & Dalal, S. (2019). Who are the missing men? Characterising men who never tested for HIV from population-based surveys in six sub-Saharan African countries. https://doi.org/10.1002/jia2.25398/full

Radebe, O., Lippman, S. A., Lane, T., Gilmore, H., Agnew, E., Manyuchi, A., & McIntyre, J. A. (2019). HIV self-screening distribution preferences and experiences among men who have sex with men in Mpumalanga province: informing policy for South Africa. South African Medical Journal, 109(4). https://doi.org/10.7196/SAMJ.2019.v109i4.13818

Rees, K. (2018). Evaluation of Anova Health Institute's programme of support for HIV-related government Health Serviceslated . Anova Health Institute.

Rose, M., Guy, L., Shamblen, S., Guest, G., Gilbertson, A., & Peiper, N. (2021). LB11. Preliminary Findings from a HIV Self-Testing Program among People Who Use Drugs. Open Forum Infectious Diseases, 8(Supplement_1). https://doi.org/10.1093/ofid/ofab466.1647

Roux, A. V. D. (2001). Investigating Neighborhood and Area Effects on Health. In American Journal of Public Health (Vol. 91, Issue 11).

Shaba, F., Balakasi, K. T., Offorjebe, O. A., Nyirenda, M., Wong, V. J., Gupta, S. K., Hoffman, R. M., & Dovel, K. (2023). Facility HIV Self-Testing in Outpatient Departments: An Assessment of Characteristics and Concerns of Outpatients Who Opt Out of Testing in Malawi. http://links.lww.com/QAI/C179.

Simbayi, L. Chisamu., Zuma, Khangelani., & Zungu, N. (2021). South African national HIV prevalence, incidence, behaviour and communication survey 2017. HSRC Press.

Simo Fotso, A., Johnson, C., Vautier, A., Kouamé, K. B., Diop, P. M., Silhol, R., Maheu-Giroux, M., Boily, M. C., Rouveau, N., Doumenc-Aïdara, C., Baggaley, R., Ehui, E., & Larmarange, J. (2022). Routine programmatic data show a positive population-level impact of HIV self-testing: the case of Côte d'Ivoire and implications for implementation. AIDS, 36(13). https://doi.org/10.1097/QAD.0000000000003328

Stekier, J. D., Swenson, P. D., Coombs, R. W., Dragavon, J., Thomas, K. K., Brennan, C. A., Devare, S. G., Wood, R. W., & Golden, M. R. (2009). HIV testing in a high-incidence population: Is antibody testing alone good enough? In Clinical Infectious Diseases (Vol. 49, Issue 3, pp. 444–453). https://doi.org/10.1086/600043

Stevens, D. R., Vrana, C. J., Dlin, R. E., & Korte, J. E. (2018). A Global Review of HIV Self-testing: Themes and Implications. In AIDS and Behavior (Vol. 22, Issue 2, pp. 497–512). Springer New York LLC. https://doi.org/10.1007/s10461-017-1707-8

Tahlil, K. M., Ong, J. J., Rosenberg, N. E., Tang, W., Conserve, D. F., Nkengasong, S., Muessig, K. E., Iwelunmor, J., Ezechi, O., Gbaja-Biamila, T., Aliyu, S. H., Obiezu-Umeh, C., Kapogiannis, B., & Tucker, J. D. (2020). Verification of HIV Self-Testing Use and Results: A Global Systematic Review. AIDS Patient Care and STDs, 34(4), 147–156. https://doi.org/10.1089/apc.2019.0283

Terefe, B., Jembere, M. M., Reda, G. B., Asgedom, D. K., Assefa, S. K., & Lakew, A. M. (2024). Knowledge, and utilization of HIV self-testing, and its associated factors among women in sub–Saharan Africa: evidence from 21 countries demographic and health survey. BMC Public Health, 24(1). https://doi.org/10.1186/s12889-024-19529-z

UNAIDS. (2017). UNAIDS. Blind spot: reaching out to men and boys-Addreeing a blind spot in the HIV response to HIV. Geneva: Joint United Nations Programme on HIV/AIDS. UNAIDS.

Us. (2018). HIV SELF-TESTING STRATEGIC FRAMEWORK A GUIDE FOR PLANNING, INTRODUCING AND SCALING UP HIV TESTING SERVICES.

Venter, F., Majam, M., Jankelowitz, L., Adams, S., Moorhouse, M., Carmona, S., Stevens, W., Msimanga, B. R., Allen, D., Balani, P., Nevhutalu, Z., Rhagnath, N., Shroufi, A., Deville, W., Kazangarare, V., Van Der Wiel, R., Templeman, H., Puren, A., Tucker, T., … Gray, A. (2017). South African HIV self-testing policy and guidance considerations. Southern African Journal of HIV Medicine, 18(1). https://doi.org/10.4102/sajhivmed.v18i1.775

Wabiri, N., & Taffa, N. (2013). Socio-economic inequality and HIV in South Africa. BMC Public Health, 13(1). https://doi.org/10.1186/1471-2458-13-1037

Wong, V., Johnson, C., Cowan, E., Rosenthal, M., Peeling, R., Miralles, M., Sands, A., & Brown, C. (2014). HIV self-testing in resource-limited settings: Regulatory and policy considerations. AIDS and Behavior, 18(SUPPL. 4). https://doi.org/10.1007/s10461-014-0825-9

Wood, B. R., Ballenger, C., & Stekler, J. D. (2014). Arguments for and against HIV self-testing. In HIV/AIDS - Research and Palliative Care (Vol. 6, pp. 117–126). Dove Medical Press Ltd. https://doi.org/10.2147/HIV.S49083

World Health Organization. (2015). Consolidated guidelines on HIV testing services: 5Cs: consent, confidentiality, counselling, correct results and connection 2015. Who, July.

World Health Organization. (2020). Web Annex H. Considerations for monitoring HIV testing services programmes. In: Consolidated guidelines on HIV testing services, 2019. In World Health Organization (Vol. 7, Issue July).

Wulandari, L. P. L., Kaldor, J., & Guy, R. (2020). Uptake and acceptability of assisted and unassisted HIV self-testing among men who purchase sex in brothels in Indonesia: A pilot intervention study. BMC Public Health, 20(1). https://doi.org/10.1186/s12889-020-08812-4

Wulandari, L. P. L., Ruddick, A., Guy, R., & Kaldor, J. (2019). “Self-testing sounds more private, rather than going to the clinic and everybody will find out”: Facilitators and barriers regarding HIV testing among men who purchase sex in Bali, Indonesia. PLoS ONE, 14(4). https://doi.org/10.1371/journal.pone.0214987