

Knowledge as A Determinant of Uptake for Pre-Exposure Prophylaxis among Human Immune-Deficiency Virus Infected and Acquired Immunodeficiency Syndrome Discordant Couples in Kitui West Sub-County, Kitui County, Kenya.

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Abstract

Human Immunodeficiency virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) is a global pandemic afflicting individuals, households and economies across the globe. Data abounds to the realization that HIV/AIDS discordant couples administer Pre-exposure Prophylaxis (PrEP) to mitigate further exposure and infection risk. Studies have been done on Knowledge, as a key aspect in PrEP management among discordant couples. In Kitui West Sub County however, there is paucity of studies on knowledge on PrEP among discordant couples. The specific objective of this study was to examine awareness levels of serodiscordant couples towards the use of PrEP in HIV/AIDS prevention and transmission. The study was guided by Health Belief Model theory which explains and predicts health related behaviors in regard to the uptake of health services or intervention strategies. It was a qualitative research by design and focused on serodiscordant couples in Kitui West Sub County. The target population was 68 with a sample population of 28 couples. The study utilized qualitative research tools which included a questionnaire, key informant interviews, In-depth interviews, physical observation, and photography for data collection. Data was analyzed using Statistical Packages for Social Science to generate descriptive statistics, presented in tables, charts and graphs in a bid to arrive at conclusions and recommendations. Data obtained from key informants was analyzed thematically and presented in form of narratives that were used to provide answers to the study's research question. The findings indicated a moderate PrEP awareness level among the target population. There was found erroneous knowledge which did not aid PrEP implementation and administration but created myths and conspiracy theories against the drug. There was prevalent belief among the target beneficiaries of PrEP therapy was an agenda of international governments and drug manufacturers to continually ensure infection existed in poor countries and to create a consistent trade, business and profit for the drug makers at the expense of the poor consumers. Thus, PrEP implementation in Kitui West Sub County has not been fully adopted by the eligible clients and there was need for concerted effort that should include Public Private Partnership, to create adequate awareness and knowledge on the successful uptake of PrEP. Therefore, (i) there was need for urgent correction of the prevailing erroneous information among the study population by adopting a PrEP promotion strategy which targets provision of correct, free and easy to understand information to debunk the prevailing myths and theories. This would be done through psycho-social support groups, (ii) PrEP trainers and promoters should be persons under a PrEP program because target beneficiaries would find it easy to believe them (iii) PrEP content should be translated and presented in local Kamba language

Keys Words: *Pre-Exposure Prophylaxis, Discordant Couples, Human Immune-deficiency Virus, Acquired Immunodeficiency Syndrome, serodiscordant couples, Health Belief Model, Antiretroviral Therapy, Seroconversion, Tenofovir, Emtricitabine*

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I. Introduction

Anti-retroviral therapy including PrEP has shown success in prolonging life. However, Sub-Saharan Africa continues to bear the greatest burden of HIV-1 infection with 1 out of every 25 adults living with Human Immune-deficiency Virus, (Bell & Hansen, 2021). Thirty eight million persons globally live with HIV out of which 1.7 million infections occurred in 2018 alone. In addition, 690,000 patients died out of Human Immune-deficiency Virus (HIV) and Acquired Immunodeficiency Syndrome (AIDS) related complications in 2019 (Agegnehu et al, 2022). Kenya is ranked twelfth globally among countries with highest HIV infections with 1.5

million persons living with the virus out of which 1,388,200 are aged above 15 years while 105,200 are aged between 0-14 years (Kahema, 2020).

A report by the MoH (2020) concludes that HIV prevalence among adults in the country stands at 4.9% with 52,800 new infections annually across all ages. The World Health Organization (2020) indicates that in 2019 alone, over 28, 200 deaths were recorded in Kenya, (Walker et al, 2020; Achwoka, 2021).

There are two types of HIV Positive couples, namely concordant and serodiscordant. Serodiscordancy (also referred to as mixed status) refers to a sexual relationship whereby one partner either comes into the union already infected or becomes infected later through extra-marital sexual contacts while still in the union. Serodiscordance sharply contributes to the spread of HIV in sub Saharan Africa especially in Kenya, (Mchome et al, 2020; Winskell et al, 2020).

It contrasts seroconcordant relationship whereby both partners are of the same HIV Sero status (either HIV infected or non-infected). In seroconcordant relationships, the infected partner transmits HIV to the previously uninfected partner, (Wang et al, 2020).

When it comes to sexual activity, serodiscordant couples face many challenges that are not faced by seroconcordant couples. These include the level of sexual activity and engagement, psychological stress, guilt and financial strain especially when the positive partner is not able to work. Research on serodiscordant couples has continued to offer insights into many aspects of survival, transmission and prevention, which are unclear, (Wang et al, 2020; Lafortune et al, 2021; Atwijukiire, 2022).

Pre-Exposure Prophylaxis (PrEP) is the use of an antiretroviral drug to block the acquisition of HIV infection by uninfected people especially when they have sexual intercourse with infected persons. PrEP was established in laboratory animal studies and real world application in the prevention of mother-to-child transmission of HIV and post exposure prophylaxis. According to Peterson et al (2019), the safety of the drug being considered for PrEP (such as Tenofovir and Emtricitabine), has been established through their use for treatment and in safety trials in uninfected people. Since year 2005, five trials of effectiveness of oral PrEP (Phase II b and Phase III) have been conducted. The focus of the trials was on the effectiveness of PrEP among injection drug users, serodiscordant couples, heterosexual women and high risk men who have sex with men, MSM (Boothe et al, 2021). Kamitani et al (2020) argues that several clinical studies have confirmed the efficacy of the PrEP in the management of the risk of transmission of HIV. The main participants in these clinical trials were men who have sex with men (MSM), heterosexual couples and injection drug users.

The foregoing notwithstanding, the efficacy of PrEP is highly affected by adherence to daily doses of the drugs. Studies targeting MSM population in both France and England have shown highly successful results of up to 86% reduction in HIV acquisition. Volk et al (2012) indicated that since its approval in San-Fransisco there was a dramatic uptake among MSM and no new HIV-1 infections (Molina J.M et al. (2015) and Volk J.E et al. (2015). Thus the expansion of PrEP implementation to more diverse settings is needed in order to reduce HIV transmission to vulnerable populations.

Although the results of these trials were positive and promising, there was need for a deeper understanding of the social, cultural, inter-personal context within which PrEP is administered. Such was especially on the knowledge related to the uptake of PrEP. Hence my study sought to find out the level of awareness (knowledge) of informants on pre-exposure prophylaxis among HIV-AIDS discordant couples in Kitui West Sub County of Kitui County.

According to Kharsany&Karim (2016) emerging data indicate that a large proportion of new infections in Sub Saharan Africa occur in stable HIV discordant relationships while Achando et al. (2011) and Bruyn et al. (2007) argue that with increased testing of couples it has become apparent that a large proportion of couples affected by HIV are HIV Sero-discordant. Demographic and health surveys (DHS) show that between 45% and 75% of married HIV positive individuals have HIV negative spouses. Thus it is necessary to provide evidence that can be used to fast track the efforts to prevent HIV transmission among couples (Allen et al., 2008).

Johnson et al. (2012) argue that couples can be a potential source of support for taking PrEP just as it was evidenced in serodiscordant couples where relationships can foster treatment adherence and reduce sexual risk behaviors (Gamarelet al, 2015). Secondly, intimacy and intimacy motivations have been linked to the increased uptake of PrEP in order to preserve intimacy during sexual encounter. Additionally, intimacy motivations have been linked to increased uptake of PrEP in order to preserve intimacy during sexual encounters. This study targeted only persons who are living with HIV-1, and who are in a relationship with partners who are HIV negative in order to understand the dynamics of PrEP uptake

Most HIV transmission in Africa occurs among HIV discordant couples who are unaware of their discordant HIV sero-status (Farquhar, 2007). In addition, HIV-negative individuals living in stable HIV-discordant partnerships are twice as likely to get infected with HIV as those living in concordant HIV negative relationships. The percentages of couples in HIV serodiscordant relationships range from 5 to 31% in the various countries of Africa.

In Kenya, at least two thirds (66.7%) of the infected couples are discordant. This means that there is scope for prevention among couples. The United Nations Agency for AIDS (UNAIDS, 2005) mentions the following groups as being key populations to whom prevention programs should be specifically targeted: women and girls, youth, men who have sex with men, injecting and other drug users, sex workers, people living in poverty, prisoners, migrant laborers, people in conflict and post-conflict situations and refugees and internally displaced persons. This is a very broad list, but it does not mention HIV negative cohabiting partners of HIV positive individuals as a group that should be specially targeted for prevention (Walque, 2006; Deuba et al, 2020; Boothe et al, 2021).

What accounts for high rates of HIV discordance and why some individuals remain uninfected despite repeated sexual exposure to HIV is unknown. HIV serodiscordance within stable sexual partnerships is a phenomenon that is poorly understood by the lay community and even by some HIV counselors (Were et al, 2008). Studying HIV discordant couples may contribute to understanding of HIV immunity and acute infection. Consequently, HIV discordant couples are increasingly viewed as a valuable source of participants for HIV vaccine and prevention trials. (Were et al, 2008).

Misconceptions about discordance are widespread among discordant couples. Some view HIV transmission as a result of luck and that their luck could end at any time. Others consider it an act of God, or that the HIV negative couple member has peculiar protective characteristics, rather than on the infectiousness of the HIV positive partner, and yet others believe in protection by God, while others believe hidden infection is not detectable by HIV tests, or that the negative partner may be in the 'window period'. Other couples think that transmission is a consequence of 'rough sex' and that 'gentle sex' will protect HIV-negative partners, (Gitonga et al, 2012). Similar findings are reported by Bunnell et al, (2005) and Senyonjo&Atenu, (2011).

Studies conducted by Walque(2006) in six countries namely Uganda, Kenya, Botswana, Lesotho, Tanzania and Cameroon showed that the proportion of heterosexual couples that are HIV serodiscordant is much higher than the proportion where both couples are HIV-positive, the only exception being Lesotho. In Tanzania and Kenya, the proportion of serodiscordant couples is at least twice as high as the proportion of seroconcordant couples. The analysis also showed that in most cases where a couple is HIV serodiscordant, the man was the infected partner. The study further revealed that between 30 and 40 percent of the infected couples were discordant female couples where the female partner was the only one infected. This was at odds with the common perception or assumption in the public and in the HIV/AIDS community that unfaithful males are the main link between high risk groups and the general population.

II. Research Problem

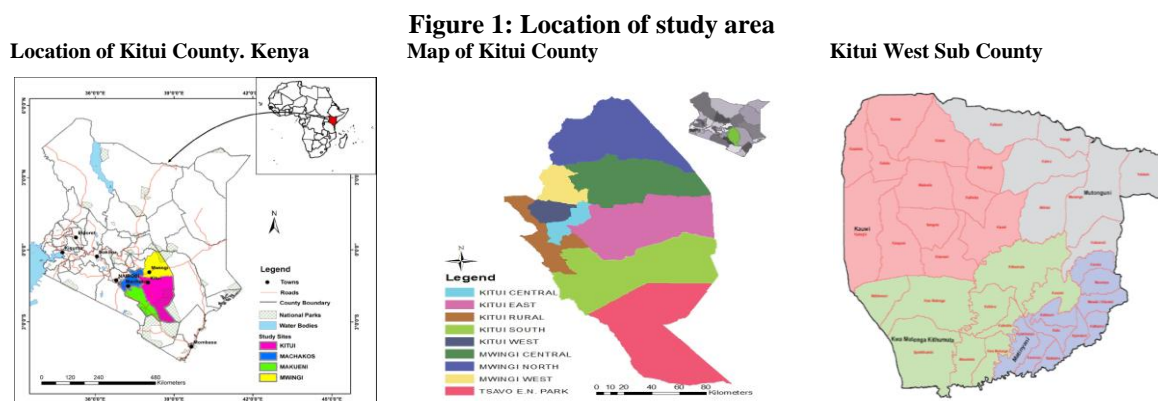
Despite the fact that there is evidence from recent studies showing that pre- exposure prophylaxis (PrEP) reduces HIV acquisition risk by 75% in HIV/ AIDS among serodiscordant heterosexual couples, its adoption remains low. Various factors including lack of accurate information have been cited. However, it is not clear if awareness of PrEP translates to knowledge and proper use of PrEP. Hence this study sought to explore the extent to which serodiscordant heterosexual couples in Kitui West Sub-County are aware of PrEP as a HIV and AIDS tool of prevention of transmission and whether their awareness translates to knowledge of PrEP. As such, the research study therefore sought to uncover the knowledge that HIV serodiscordant couples have in relation to usability, adoption and use of PrEP as a prevention tool of transmission in Kitui West Sub County.

RESEARCH OBJECTIVE AND QUESTION

This study sought to examine knowledge levels as a determinant of uptake for Pre-Exposure Prophylaxis among human immune-deficiency virus infected and aids discordant couples in Kitui West Sub County, Kitui County, Kenya. As such, the study was guided by the question "What kind of knowledge do discordant couples in Kitui West Sub County hold on acceptance and adoption of Pre-Exposure Prophylaxis?"

III. Research Methodology

The study was qualitative in nature. This was useful in securing evidence concerning the situation of PrEP within the study area as envisioned by Mugenda and Mugenda, (2003). The research area was as given below:-



Adopted from IEBC (2012)

Kauwi Hospital is the Kitui West Sub County referral public health facility located in Kauwi Sub location, Kauwi location, in Kitui West Sub County of Kitui County. The study targeted all the 68 patients that attend ART therapy at Kauwi Hospital and its associated clinics in Kitui West Sub County. This included pre-CVCT and Post CVCT in the same facilities in Kauwi ward. Kauwi ward was selected for the study due to its strategic location and its markets found on highways, with a relatively higher population and a relative number of ART patients.

This study adopted two non-probabilistic sampling methods to identify the informants and collect qualitative data from the participants who included persons under PrEP treatment and key informants in Kauwi hospital and affiliated health centers. These methods were: purposive and snowball. The application of the two methods was useful for the purposes of triangulation and enhancement of the findings. To participate in the study the PrEP users had to be at least 18 years of age, sexually active with one another whether in a marriage or cohabiting relationship. The Key informants were selected based on their role in PrEP administration, relationship with HIV patients in terms of testing, counseling and maintenance of support groups.

The study utilized qualitative data collection methods namely in-depth questionnaires and key informant interviews in addition to observation and digital photography. It applied purposive sampling method to identify and select persons with critical information related to administration, adoption and reactions of PrEP clients in Kitui west Sub County. By this method, the opinions of the health facility managers, health care workers and HIV-AIDS counselors within the study area were incorporated in the study as key informants sampled below:-

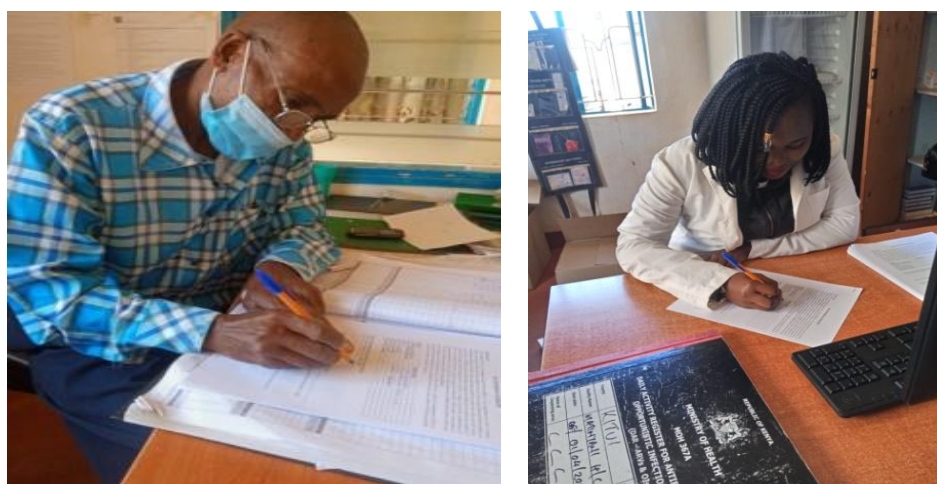


Figure 2: Key informants responding to issues

Snowballing sampling was used to find and interview target subjects. This was necessitated by the fact that the study population was small (68 clients under PrEP) and difficult to find because of the nature of the study topic. Agreeing participants were requested to recommend to the researcher friends in similar circumstances and willing to participate in the study. This happened from client 001 (referred by Registered

Clinical Officer 001 at Kauwi sub county hospital) to client 028 in a snowballing process. This way, a sample size of 28 out of a population of 68 was arrived at.

To enhance validity the study ensured non manipulation of results and accuracy of collected data. In addition, all the tools were adopted and contextualized to Kitui west Sub County.

For reliability, the researcher allowed for expert review of the tools by her thesis supervisors. The researcher confirmed the accuracy of the data collection tools by applying the tools to a pilot study. The intention of the pilot was to find out the ease with which the participants were able to both comprehend and respond to questions accurately. This produced the final tool for this study and the results of both the pilot and final study were consistent (Kerlinger, 2003) although the results of the pilot study were not used in the final study results.

Data was analyzed using Statistical Packages for Social Science (SPSS) version 20 to generate descriptive statistics, presented in tables, charts and graphs in a bid to arrive at conclusions and recommendations. Data obtained from Key informants was analyzed thematically and presented in form of narratives that were used to provide answers to the studies research questions.

IV. Study Findings

The research findings were as follows below:-

i. Age

As stated in the introduction, the primary participants had to be at least eighteen (18) years of age in order to be admitted into the study. This was important because it is the minimum legal age that allows individuals to provide consent to participate in such studies. The informants were grouped into three age groups namely; (i) youth, 18-35 years (ii) middle adulthood/economically active group 36-55 years and (iii) over 55 years old, who were persons approaching retirement. The majority (48.3%) of the informants were lie within the youth age bracket. This is mostly the sexually active segment of any society. The middle age group formed 37.9% while the more elderly group formed 13.8% of the participants.

ii. Gender and marital status

Sixty two per cent were female while thirty eight percent were male indicating that more females than males were involved in the study. Majority of the informants were married (n=22 or 79%) while n=6 (20.7% were single but had been in stable relationships with one partner for more than six months continuously. Out of the married couples, only 6 (or 22.27%) accepted to be interviewed together as partners while the rest (n=16 or 72.73%) were interviewed as individuals citing need for privacy in the interviews as important to ensure free flow of thought. When asked to explain the duration they had lived in a discordance relationship, 14.8% indicated that they had lived in discordancy between six month and 12 months while the majority (85.2%) had lived in discordance relationship for more than 1 year. This was cutting across all participants.

iii. Highest Level of Formal Education

The education level of an individual is critical in understanding and interpreting phenomenon and its impact in real live. The study was keen to learn the relationship between formal education and application of HIV prevention methods. It appears from this finding that clients with primary level of education are the majority and the proportion reduces at secondary and tertiary level respectively. The biggest proportion of primary study participants (n=16 or 55.2%) had attained primary school education while 27.6% (or n=8) had attained secondary education and 13.8% (or n=3) had attained tertiary education. Only a small proportion (3.4%) had not attained any formal education.

Highest level of formal education	Number	Proportion (%)
None	1	3.4
Primary	16	55.2
Secondary	8	27.6
Tertiary	3	13.8
	N=28	100

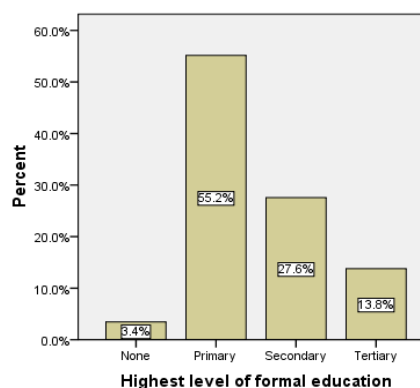


Figure 3: Highest level of formal education of participants

iv. Sexual Orientation

HIV-1 transmission and AIDS is always related to sexual orientation of individuals. Studies earlier have shown that men who have sex with men, for example, stand a higher risk of contracting HIV when compared with men and women in heterosexual unions. The findings of this study indicate that 44.83% (or n=13) of the informants were in hetero-sexual relationships while 55.17% (or n=15) indicated that they “don’t know” their sexual orientation (refer figure 7). The latter finding is significant considering that homosexual relationships are frowned upon.

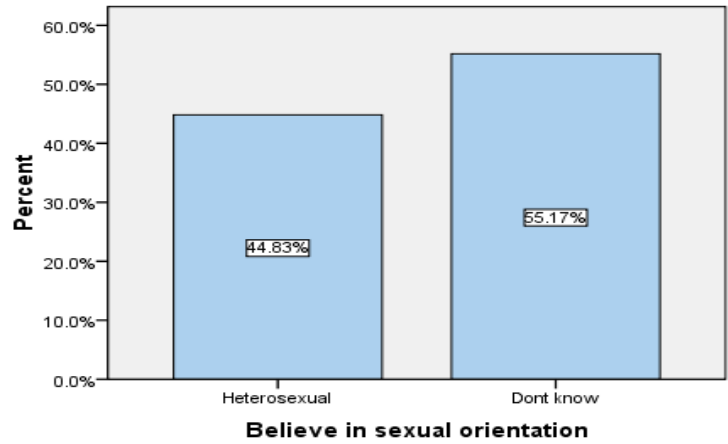


Figure 4: Sexual orientation of participants

v. Experience with Discordance

All the informants said that they were aware of the discordance relationship within which they live and experience daily. However, all of them reported having difficult experiences immediately they learnt of their discordance condition. Majority (72%) had no idea of the HIV status of their partners before their first sexual intercourse experience. All uninfected partners experienced pain, guilt and a tendency to hate the HIV positive partner for not disclosing their HIV status before initial sexual intercourse with the partner and more-so the failure of infected partner to use protection such as condoms. They still feel betrayed and condemned to lifetime of taking medication in the form of Prep. About 35% of the participants were HIV infected while 65.4% were un-infected and out of the infected informants, 18 % have been aware of their HIV status for between 3 and four years, 28.6% had known their status for a period of over five years while 53.6 % have known their HIV positive status for between 1-2 years.

Table 8 provides a comparison between the HIV status of the participants and the length of time since they discovered their HIV status.

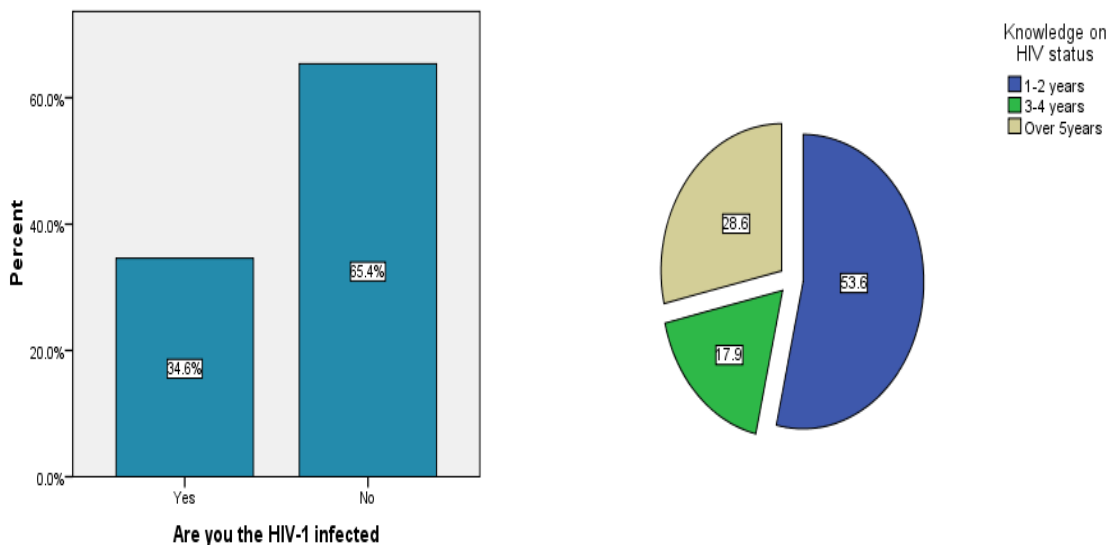


Figure 5: HIV status of participants

vi. **Source of Pre Exposure Prophylaxis information**

The participants were asked to say how they received information about PrEP for the first time. This was an important question because it shows the most “vocal method” of communicating PrEP information. Health workers seemed to be the most important means of communicating PrEP information to HIV infected persons. Eighty nine per cent of the participants learnt about PrEP for the first time from health workers, while 6.9% learnt about it from friends and another 3.4% from the media. This was corroborated by findings from the key informant interviews that media usability has not been fully exploited. The fact that 89% of participants received initial information about PrEP from healthcare workers shows how important they are in the management of HIV/AIDS. The availability of over five (5) FM radio station that broadcast in Kikamba may have contributed to information sharing or communication of PrEP. The role of healthcare workers in HIV/AIDS management could be enhanced by use of these vernacular FM radio stations to continue empowering listeners with PREP relevant information in an effort to empower the newly infected patients (who may not know about existence of PrEP) , the general population and clients on PrEP treatment to continually ensure provision of free, accurate and non-biased information. Secondly the proposal by the participants to enhance psycho-social group support could also as a means of support for enhanced adherence, compliance and information communication among SDCs.

The information provided by the health work reflected well with the level of understanding of usability of PrEP. When asked about who qualifies to use PrEP as a transmission prevention tool, 89.7% of participants indicated that PrEP is for the un-infected sexual partner, whether male or female while 6.9% said it is for infected male partner and another 3.4% indicated that PrEP is utilized by both partners when both are infected. This shows that there exists a PrEP knowledge gap. This shows some error although minor in the participants’ understanding of usability of PrEP. The PrEP administration facilities need to have trained health workers who understand fully the dynamics of PrEP use. The table below gives a summary of the nature of knowledge held by the participants on PrEP.

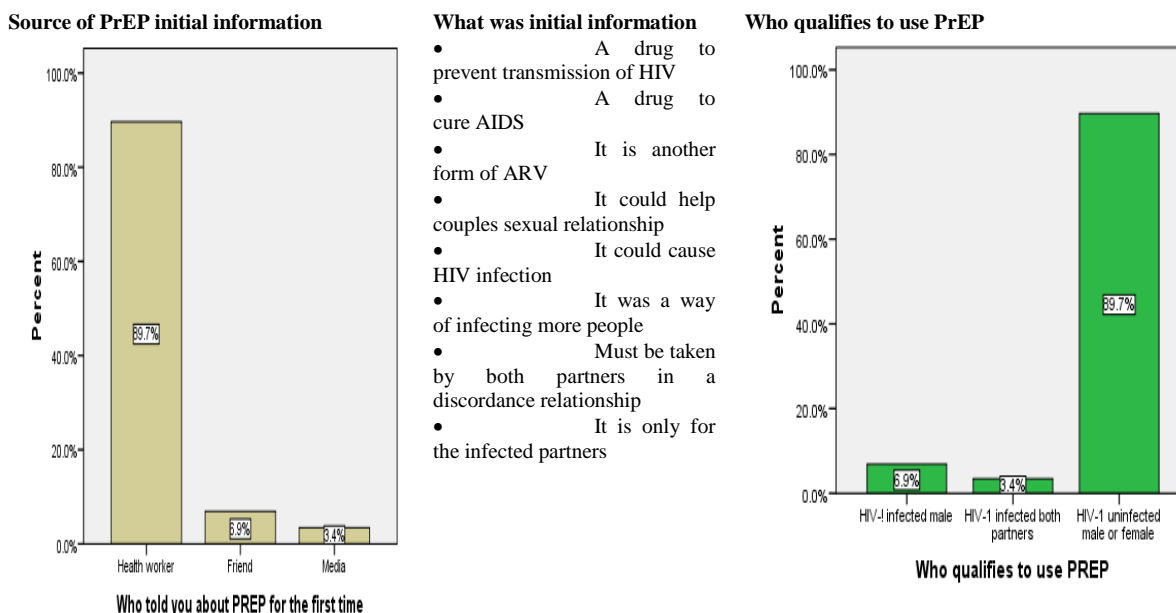


Figure 6: Kind of knowledge held by participants

Analysis of the participants responses (initial PrEP information) reveals several inconsistencies and possible error or inaccuracies) in the kind of information that was provided by the sources about PrEP and its clinical purpose. This could be a source of the many fears, concerns myths and conspiracy theories around use, misuse and abuse of the PrEP therapy which is prevalent within Kitui west Sub County.

This situation is corroborated by information gathered from the key informant interviews which gave a PrEP awareness score PrEP at 5 (in a scale of 1-10, where 1 was “not aware and 10 meant “very aware”. The informants identified prioritization of training and provision of accurate, free and easy-understand PrEP information to clients, especially first timers. The policy makers should consider provision of such information in local language especially using the many available FM radio stations. There is need to debunk the prevailing myths around HIV, AIDS and PrEP.

vi. Myths Surrounding PrEP

When asked to name the prevailing myths, the key informants identified the following as the main myths which must be debunked for successful adoption of PrEP by target users. The myths include: (i) PrEP is a drug for commercial sex workers (ii) It is for female partners only (iii) Religion and believe that God will protect non-infected sexual partners despite the risk they could be exposed to (iv) The government introduced PrEP to ensure HIV transmission to uninfected partners without their knowledge and so please donors (v) Continued use of PrEP will lead to drug toxicity and destruction of user’ liver and kidney

These myths have the potential to negatively affect full adoption and rollout of PrEP. When asked to describe the most effective approach that relevant agencies can use to debunk these myths and fears, the Key informants provided a list of prescriptions which if implemented could help reduce the fear and concerns. The findings of this study suggest critical actions which can be undertaken to enhance PrEP usability in Kitui West Sub County.

Table 1: Key action areas

Informant	Action	Description
Health Workers	Trainer recruitment and empowerment	The most effective and easy-to trust trainers could be PrEP users who have shown full support to PrEP and are willing to share their lived experiences with other users to enhance their lives.
Registered Clinical Officers	Information provision	<ul style="list-style-type: none"> Provide adequate, accurate, free and easy to understand information that can be easily internalized by the clients for them accept PrEP therapy The use of short message services (SMS) is able to send personal information which ensures confidence
HIV Testing Officers	Awareness	Employ easy to understand methods, tools and content
Peer Educators	Psycho-social support	Organize clients into support groups
Sub County Aids Coordinating Officers	Stakeholder involvement	<ul style="list-style-type: none"> Pursue the route to engage sex-intercourse hot spots (such as bars, clubs, lodges and guest houses, brothels) so that PrEP can be availed freely just the same way condoms are supplied freely. Pursue the possibility of working with churches and religious organizations to access persons in discordant sexual unions as a venue to train, provide the drug and encourage them to move on.

vii. Adherence and Non-adherence to PrEP Schedule

According to CDC (2019), PrEP therapy requires high levels of adherence and when taken as per prescribed schedule, PrEP is extremely effective in preventing HIV transmission and it is in very rare cases that strict adhering MSM have been infected. Thus it has been proved that strict adherence to PrEP schedule produces high effectiveness against infection.

That evidence notwithstanding, the informants in Kitui West showed evidence of skipped schedule. When probed on adherence to the PrEP schedule, 42.31 % of the participants admitted to skipping dosage often while 57.68% are careful with the dosage schedule and do not skip (fig 10). The largest proportion of dosage skippers (76.92 %) sited forgetfulness and explained that once they forget to take a dose, the feeling of failure and guilty many times leads them to withdrawal from the program, only to come back later to start again with serious health ramifications. The second largest proportion of those who skip dosage (15.38 %) cited fatigue and boredom as the main drivers of their inconsistency in the use of PrEP.

Do you skip Prep dosage?



Why participants skip Prep dose?

- To reduce impact of side effect (7.6%)
- Forgetfulness and subsequent feeling of failure followed by temporal withdrawal (76.92 %)
- Boredom (15.38%)
- Stay away from partner (7.6%)

viii. Fears and Concerns about PrEP

The study found that upon receipt of initial information about PrEP, 39.29% of participants were anxious and had fears and concerns that made them not to take it up immediately. However, 60.71% did not have any fears or concerns and took it up almost immediately. Over time, the proportion of participants who still held fears went down to 24.1% (+15.19%) while 75.9% (+15.19%) developed confidence in Prep overtime. This shows positive development.

However, when asked to describe the nature of fears and concerns that prevented the users from total faith in PrEP, 42 % of users quoted fear of side effects after long term use was rated as the greatest while 26% believed that it could be harmful to immune system and lead to HIV infection and AIDS, 16% did not understand why healthy persons should take a medicine for “ever”. There is a unique fear held by 12 % of the users that long term use of PrEP is toxic to the liver and kidneys while 4% couldn’t explain their fear.

ix. Use or Non-use of PrEP

Over Sixty two percent (62.1%) of informants have ever used Prep but 37% had not used it, despite their discordance status. Out of the participants who have used prep, 14% do not like it at all. They just take for the sake. When probed to find out the reasons for like or dislike of PREP, participants had varied reasons. The participants who like PrEP provided reasons such as desire to live a healthy live longer, ability to get a baby with the HIV + partner at will, the fact that the pill is small in size and therefore comfortable to swallow. Majority of the users have confidence in PrEP that it is effective over long time.

Contrary to the above pro-PrEP reasons, informants who did not like PrEP complained of its bitter taste, many side effects and the fact that it was not easy to adopt a daily drug taking lifestyle yet they are not infected or sick. Others expressed social stigma and labeling , fear that PrEP is a government ploy to infect more people with the virus that causes AIDS and the requirement to take a daily dosage drug while still required to use protection in form of condoms against other STIs was not clearly understood by the informants.

The non-use of PrEP among the study informants is also promoted by religious believes. Six percent of the participants who do not use it cited religion (and faith in God) as the bases upon which they will not use the drug. They are convinced that God will protect them from contradicting HIV from their infected partners. When asked the reasons for visiting the clinics yet they did not intend to use the drugs, all of them explained that they would receive the pills and threw them away afterwards but convince their partners that they have taken the drug. Thus. they visit clinic to appease their partners. This is an important factor and an impediment in the war against HIV infection and spread of AIDS in the local community.

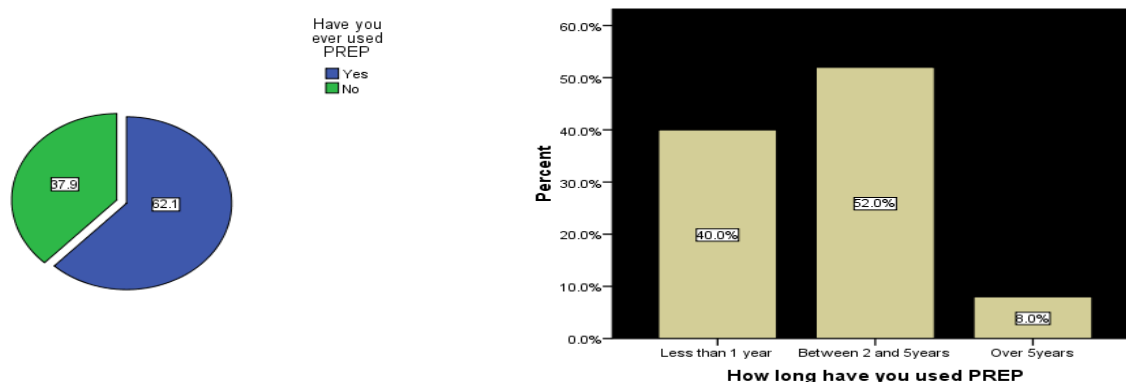


Figure 7: Participants use or non-use of PrEP

Over 67 % (n=19) of the participants offered exclusive negative views of PrEP , reporting that the drug is burdensome in several ways: (i) strict prescription schedule (ii) inability to prevent pregnancy thus users must also use emergency pills (iii) drug toxicity (iv) encouragement of sexually risky behavior (v) reduces couples concern for safe sex and (vi) stigma

This information was confirmed by key informants who expressed that the following aspects of PrEP therapy make it hard for adoption in Kitui west Sub County.

V. Discussion Of Findings

i) Awareness and knowledge of PrEP uptake

This study specifically sought to examine awareness levels of serodiscordant couples towards the use of PrEP in HIV/AIDS prevention and transmission in Kitui West Sub County. The preceding findings indicated a moderate PrEP awareness level among the target population and there was found erroneous knowledge which did not aid PrEP implementation and administration but created myths and conspiracy theories against the drug. The findings are consistent with those of Gianluca et al (2021) who found out that in a sample of Italian men ,over 87.5% were aware of PrEP and despite their risky behavior, only 7.2% had ever used it indicating that knowledge alone is not enough stimulus to use PrEP. Further, there was prevalent belief among the target participants in Kitui west sub county that PrEP therapy was an agenda of international governments and drug manufacturers to continually ensure infection existed in poor countries and to create a consistent trade, business and profit for the drug makers at the expense of the poor consumers. Analysis of the participants responses on initial PrEP information revealed that several inconsistencies and possible error or inaccuracies in the kind of information that was provided by the sources about PrEP and its clinical purpose. This could be a source of the many fears, concerns myths and conspiracy theories around use, misuse and abuse of the PrEP therapy which is prevalent within Kitui west Sub County. Thus, PrEP implementation in Kitui West Sub County has not been fully adopted by the eligible clients and there was need for concerted effort that should include Public Private Partnership, to create adequate awareness and knowledge on the successful uptake of PrEP .This findings and observations, are consistent with Ishiekwene et. al. (2018) in their study in the United States of America which evaluated awareness, knowledge and use of PrEP amongst serodiscordant partners in an urban clinic and concluded that although awareness is increasing slowly, uptake remains low and thus awareness does not translate into knowledge and application of knowledge in PrEP usability.

The findings also are consistent with Taggat et al (2020) in their study entitled *“Awareness of and willingness to use PrEP among Black and Latinx adolescents residing in higher prevalence areas in the United States”* who concluded that misconceptions about PrEP still persist while (i) PrEP stigma (ii) fear of community punishment and (iii) provider attitudes affected not only uptake levels but also willingness of individuals to participate in target group discussions. The study recommended use of strategies such as socio-demographic and health behavior data to target key populations who may be unwilling to use PrEP, improving provider attitude and communication and creation of culturally-friendly PrEP education materials which target common misconceptions among specific communities.

ii) Source of Pre Exposure Prophylaxis information

Findings from participants in Kitui West sub county on source of **Pre Exposure Prophylaxis information indicated that** Health workers were the most important means of communicating PrEP information to HIV infected persons. Eighty nine per cent of the participants learnt about PrEP for the first time from health workers, while 6.9% learnt about it from friends and another 3.4% from the media. The availability of over five (5) FM radio station that broadcast in Kikamba may have contributed to information sharing or communication of PrEP. In contrast to Mijiti et al (2013) in Xinjiang study Findings where only 10 participants (2.8%) reported having heard of PrEP and only 2% reported ever using PrEP.

iii) Adherence and Non-adherence to PrEP Schedule

In relation to PREP adherence, findings from the study indicated that the informants in Kitui West showed evidence of skipped schedule, with 42.31 % of the participants admitting to skipping dosage often while 57.68% were careful with the dosage schedule and did not skip as indicated in fig 10. The largest proportion of dosage skippers (76.92 %) sited forgetfulness and explained that once they forget to take a dose, the feeling of failure and guilty many times led them to withdrawal from the program, only to come back later to start again with serious health ramifications. The second largest proportion of those who skipped dosage (15.38 %) cited fatigue and boredom as the main drivers of their inconsistency in the use of PrEP. The non-use of PrEP among the study informants was also promoted by religious believes. Six percent of the participants who did not use it cited religion (and faith in God) as the bases upon which they would not use the drug and were convinced that God would protect them from contradicting HIV from their infected partners and only visit clinic to appease their partners and would receive the pills and throw them away later.

Similar adherence challenges were cited by Johnson et al. (2012), who argue that couples can be a potential source of support for taking PrEP just as it was evidenced in serodiscordant couples where relationships can foster treatment adherence and reduce sexual risk behaviors, as observed by Gamarelet al(2015). Further, it was observed that intimacy and intimacy motivations have been linked to the increased uptake of PrEP in order to preserve intimacy during sexual encounter. Informants who did not like PrEP

complained of its bitter taste, many side effects and the fact that it was not easy to adopt a daily drug taking lifestyle yet they are not infected or sick. Others expressed social stigma and labeling, fear that PrEP is a government ploy to infect more people with the virus that causes AIDS and the requirement to take a daily dosage drug while still required to use protection in form of condoms against other STIs was not clearly understood by the informants.

iv) Fears and Concerns about PrEP

The study found that upon receipt of initial information about PrEP, 39.29% of participants were anxious and had fears and concerns that made them not to take it up immediately. However, 60.71% did not have any fears or concerns and took it up almost immediately and over time, the proportion of participants who still held fears went down to 24.1% (+15.19%) while 75.9% (+15.19%) developed confidence in Prep overtime, showing positive development.

These findings are consistent with some studies such as Fowler et al (2015) that show that more serodiscordant couples were unwilling to use PrEP for fear of side effects and cultural non acceptance of prophylactic medication. In many cases, the challenges faced by sero-discordant couples are major over and above the challenges faced by sero-concordant couples and these challenges affect the way they accept prevention and treatment whenever it is presented to them. Findings from this study are similar to challenges cited by Kalomo (2018) and Derbew (2022), who identified some of these challenges that include physical and psychological violence, psycho-social stress, risk of being infected with HIV-1 and even loss of income in addition to stigma. Some participants cited side effects as their main concern which was consistent with Egan et al (2020), who observed that use of PrEP may trigger psychiatric disorders such as anxiety and depression and continues to argue that prolonged PrEP use may lead to increased serum amylase and abdominal pains. Other side effects of PrEP cited include (i) gastrointestinal (nausea, flatulence) (ii) neurological (dizziness, headache, fatigue) (iii) muscular-skeletal (back pain, decreased mineral density) (iv) metabolic (hyperglycemia) and (v) renal (Fanconi syndrome,).

Stigma was cited by majority of participants as their main fear and concern, making 37% of respondents not use PrEP even when they were aware of its benefits. This findings are consistent to that of Ayele (2021), who observes that HIV serodiscordant couples in sub Saharan Africa face a myriad of challenges, the greatest being stigma. Similarly, manifestations of stigma has been cited in various studies including Lee et al. (2005), who observed that in China, 56% of participants were not willing to be friends with anyone who was HIV positive while 73% thought that those living with HIV should be isolated from the general community.

v) Attitudes of Serodiscordant Couples towards PrEP Usage

The preceding findings on attitudes and usage of PrEP by participants indicated that Over Sixty two percent (62.1%) of informants had ever used Prep but 37% had not used it, despite their discordance status. Reasons by the majority of participants who had adopted PrEP were consistent with those of Ngure et al. (2016) who conducted a study entitled *“I knew I would be safer: experiences of Kenyan HIV Serodiscordant couples soon after pre-exposure prophylaxis [PrEP] administration”* in Thika, Kiambu County. The study reported that not only did PrEP offer HIV serodiscordant couples an additional strategy to reduce the risk of HIV transmission; it also met their fertility desires and helped them cope with serodiscordance. Ngure et al. (2016) provide us with evidence that there was willingness and acceptance in the use of PrEP in Thika by discordant couples and their attitude was positive and had adopted and coped well with serodiscordance. However, in Kitui County, out of the participants who had used prep, 14% did not like it at all and just took it for the sake, showing a negative attitude towards it. The findings confirm what Baeten et al (2016) in their study titled *“Integrated delivery of PrEP and ART results in sustained near elimination of HIV transmission in African HIV serodiscordant couples”* in Uganda and Kenya observed that serodiscordant couples were on ART initiation but found that serodiscordant couples did not always accept clinical recommendations to initiate ART, especially those aged 25 years and above. Further, the preceding findings collaborate findings by Kharsany&Karim (2016) on emerging data that indicated that a large proportion of new infections in Sub Saharan Africa occur in stable HIV discordant relationships.

vi) Myths Surrounding PrEP

Study findings indicate various myths surrounding uptake of PrEP which must be debunked for successful adoption of PrEP by target users. such myths includes; PrEP is a drug for commercial sex workers and that continued use of PrEP will lead to drug toxicity and destruction of user’ liver and kidney and that the government introduced PrEP to ensure HIV transmission to uninfected partners without their knowledge in order to please donors . This findings on prevalent myths and misconceptions about prep from participants and key informants call for interventions to counter them and enhance usability, acceptance and adoption of prep.

Similar to the preceding findings, Camlin et al (2020) indicated that serodiscordant couples in Malawi believed and held on some inaccurate information about HIV/AIDS and PrEP that can be seen as myths. The prevalent belief among the Kitui west sub county target beneficiaries of PrEP that the drug was an agenda of international governments and drug manufacturers to continually ensure infection existed in poor countries and to create a consistent trade, business and profit for the drug makers at the expense of the poor consumers, is an indication of such myths. These myths have the potential to negatively affect full adoption and rollout of PrEP in Kitui west Sub County.

VI. Conclusion

In response to the study objective that sought to examine knowledge levels as a determinant of uptake for Pre-Exposure Prophylaxis among human immune-deficiency virus infected and aids discordant couples in Kitui West Sub County, Kitui County, and as a reflection of the findings, the study concluded that:-

- i. the study has shown that the knowledge held by eligible PrEP clients in Kitui west Sub County has high level of error and the situation has been used albeit sub-consciously to build up myths which must be debunked for a smoother implementation and administration of PrEP therapy in the study area.
- ii. The role of healthcare providers/workers cannot be underestimated in the HIV prevention. The success of PrEP programs in rural Kenya is greatly impacted by the level of empowerment and capacity building the implementers put in these healthcare workers.

VII. Recommendations

In order to debunk the erroneous and highly mythical understanding held by discordant couples in Kitui West Sub County, in as far as the purpose and uptake of PrEP is concerned, the study recommendations in that:-

- (i) The level of formal education attained by majority of the SDC clients is basic education. This would negatively influence their ability to receive, internalize and take-up PrEP information when communicated in the technical language of medical science. To enable proper information, PrEP promotion content should be translated into local Kamba language and be provided freely for ease of understanding. Information relating to use, availability and side effects of PrEP should be presented in Kamba, the language spoken and well understood majority of people living within the study area. This will ensure enhanced internalization, understanding and comprehension of accurate information and thus increase applicability and usability of PrEP.
- (ii) Aspects of erroneous and mythical knowledge held by over 43% of the respondents on the purpose of PrEP included that: - (a) the drug was a plan by governments to ensure new infections continued since the larger population had taken protection as a critical measure of HIV/AIDS prevention. Many respondents put that as reason that the drug is administered to HIV un-infected persons, (b) the drug was a plan by manufacturers of drugs to continue selling and making profit out of the poor African people and (c) the drug promoted social stigma. Such misinformation remained a significant barrier to its full uptake in society. Hence the researcher recommended that a clarification of these issues should form core content of PrEP promotion.

References

- [1]. Ajayi, A. I., Mudefi, E., Yusuf, M. S., Adeniyi, O. V., Rala, N., & Ter Goon, D. (2019). Low awareness and use of pre-exposure prophylaxis among adolescents and young adults in high HIV and sexual violence prevalence settings. *Medicine*, 98(43).
- [2]. Baeten, J. M., Heffron, R., Kidoguchi, L., Mugo, N. R., Katabira, E., Bukusi, E. A., ...& Partners Demonstration Project Team. (2016). Integrated delivery of antiretroviral treatment and pre-exposure prophylaxis to HIV-1-serodiscordant couples: a prospective implementation study in Kenya and Uganda. *PLoS medicine*, 13(8), e1002099. Chicago
- [3]. Baeten, J. M., Donnell, D., Ndase, P., Mugo, N. R., Campbell, J. D., Wangisi, J., ...& Celum, C. (2012). Antiretroviral prophylaxis for HIV prevention in heterosexual men and women. *New England Journal of Medicine*, 367(5), 399-410.
- [4]. Atwijukiire, H., Nakidde, G., Otwine, A. T., & Kabami, J. (2022). Experiences of HIV Positive Serostatus Disclosure to Sexual Partner Among Individuals in Discordant Couples in Mbarara City, Southwestern Uganda. *HIV/AIDS (Auckland, NZ)*, 14, 231.
- [5]. Lafortune, D., Blais, M., Miller, G., Dion, L., Lalonde, F., & Dargis, L. (2021). Psychological and interpersonal factors associated with sexualized drug use among men who have sex with men: A mixed-methods systematic review. *Archives of sexual behavior*, 50(2), 427-460.
- [6]. Achwoka, D. E. (2021). Non-communicable Diseases (NCDS) Burden Among People Living With HIV/AIDS (PLHIV) in Kenya (Doctoral dissertation, University of Nairobi).
- [7]. Agegnehu, C. D., Techane, M. A., Mersha, A. T., & Atalell, K. A. (2022). Burden and Associated Factors of Virological Failure Among People Living with HIV in Sub-Saharan Africa: A Systematic Review and Meta-Analysis. *AIDS and Behavior*, 1-10.
- [8]. Ayele, W. M., Tegegne, T. B., Damtie, Y., Chanie, M. G., & Mekonen, A. M. (2021). Prevalence of consistent condom use and associated factors among serodiscordant couples in Ethiopia, 2020: a mixed-method study. *BioMed Research International*, 2021.
- [9]. Baeten, J. M., Palanee-Phillips, T., Brown, E. R., Schwartz, K., Soto-Torres, L. E., Govender, V., ...& Hillier, S. (2016). Use of a vaginal ring containing dapivirine for HIV-1 prevention in women. *New England Journal of Medicine*, 375(22), 2121-2132.
- [10]. Baeten, J., Heffron, R., Kidoguchi, L., Mugo, N., Katabira, E., Bukusi, E., ...& Odoyo, J. (2016, July). Integrated delivery of PrEP and ART results in sustained near elimination of HIV transmission in African HIV serodiscordant couples: final results from The Partners Demonstration Project. In 21st International AIDS Conference (pp. 18-22).
- [11]. Bell, D., & Hansen, K. S. (2021). Relative burdens of the COVID-19, malaria, tuberculosis, and HIV/AIDS epidemics in sub-Saharan Africa. *The American Journal of Tropical Medicine and Hygiene*, 105(6), 1510.

- [12]. Bernstein, K. T., Liu, K. L., Begier, E. M., Koblin, B., Karpati, A., & Murrill, C. (2008). Same-sex attraction disclosure to health care providers among New York City men who have sex with men: implications for HIV testing approaches. *Archives of internal medicine*, 168(13), 1458-1464.
- [13]. Boothe, M. A., SemáBaltazar, C., Sathane, I., Raymond, H. F., Fazito, E., Temmerman, M., & Luchters, S. (2021). Young key populations left behind: The necessity for a targeted response in Mozambique. *PLoS one*, 16(12), e0261943.
- [14]. Brooks, R. A., Landovitz, R. J., Kaplan, R. L., Lieber, E., Lee, S. J., & Barkley, T. W. (2012). Sexual risk behaviors and acceptability of HIV pre-exposure prophylaxis among HIV-negative gay and bisexual men in serodiscordant relationships: a mixed methods study. *AIDS patient care and STDs*, 26(2), 87-94.
- [15]. Calabrese, S. K., Willie, T. C., Galvao, R. W., Tekeste, M., Dovidio, J. F., Safon, C. B., ... & Kershaw, T. S. (2019). Current US guidelines for prescribing HIV pre-exposure prophylaxis (PrEP) disqualify many women who are at risk and motivated to use PrEP. *Journal of acquired immune deficiency syndromes (1999)*, 81(4), 395.
- [16]. Cambiano, V., Rodger, A. J., & Phillips, A. N. (2011). 'Test-and-treat': the end of the HIV epidemic? *Current opinion in infectious diseases*, 24(1), 19-26.
- [17]. Camlin, C. S., Koss, C. A., Getahun, M., Owino, L., Itiakorit, H., Akatukwasa, C., ... & Havlir, D. V. (2020). Understanding demand for PrEP and early experiences of PrEP use among young adults in rural Kenya and Uganda: a qualitative study. *AIDS and Behavior*, 24(7), 2149-2162.
- [18]. Collier, K. L., Colarossi, L. G., & Sanders, K. (2017). Raising awareness of pre-exposure prophylaxis (PrEP) among women in New York City: community and provider perspectives. *Journal of health communication*, 22(3), 183-189.
- [19]. Derbew, T., Ambaw, F., & Wasihun, Y. (2022). Lived experience of people on anti-retroviral therapy in the context of covid-19: a phenomenological study.
- [20]. Deuba, K., Sapkota, D., Shrestha, U., Shrestha, R., Rawal, B. B., Badal, K., ... & Ekström, A. M. (2020). Effectiveness of interventions for changing HIV related risk behaviours among key populations in low-income setting: A Meta-Analysis, 2001–2016. *Scientific reports*, 10(1), 1-13.
- [21]. Eakle, R., Bourne, A., Mbogua, J., Mutanha, N., & Rees, H. (2018). Exploring acceptability of oral PrEP prior to implementation among female sex workers in South Africa. *Journal of the International AIDS Society*, 21(2), e25081.
- [22]. Eaton, L. A., Matthews, D. D., Driffin, D. D., Bukowski, L., Wilson, P. A., & Stall, R. D. (2017). A multi-US city assessment of awareness and uptake of pre-exposure prophylaxis (PrEP) for HIV prevention among black men and transgender women who have sex with men. *Prevention Science*, 18(5), 505-516.
- [23]. Edame, G. E., Ekpenyong, A. B., Fonta, W. M., & Duru, E. J. C. (2011). Climate change, food security and agricultural productivity in Africa: Issues and policy directions. *International journal of humanities and social science*, 1(21), 205-223.
- [24]. Egan, J. E., Ho, K., Stall, R., Drucker, M. T., Tappin, R., Hendrix, C. W., ... & Mayer, K. H. (2020). Feasibility of short-term PrEP uptake for men who have sex with men with episodic periods of increased HIV risk. *JAIDS Journal of Acquired Immune Deficiency Syndromes*, 84(5), 508-513.
- [25]. El-Khatib, Z., Ekstrom, A. M., Coovadia, A., Abrams, E. J., Petzold, M., Katzenstein, D., ... & Kuhn, L. (2011). Adherence and virologic suppression during the first 24 weeks on antiretroviral therapy among women in Johannesburg, South Africa—a prospective cohort study. *BMC public health*, 11(1), 1-13.
- [26]. Fowler, N., Arkell, P., Abouyannis, M., James, C., & Roberts, L. (2015). Attitudes of serodiscordant couples towards antiretroviral-based HIV prevention strategies in Kenya: a qualitative study. *AIDS patient care and STDs*, 29(1), 33-42.
- [27]. Gamarel, K. E., & Golub, S. A. (2015). Intimacy motivations and pre-exposure prophylaxis (PrEP) adoption intentions among HIV-negative men who have sex with men (MSM) in romantic relationships. *Annals of Behavioral Medicine*, 49(2), 177-186.
- [28]. Gardner, E. M., McLees, M. P., Steiner, J. F., Del Rio, C., & Burman, W. J. (2011). The spectrum of engagement in HIV care and its relevance to test-and-treat strategies for prevention of HIV infection. *Clinical infectious diseases*, 52(6), 793-800.
- [29]. Gitonga, M. M., Ballidawa, J., & Ndege, S. (2012). Challenges and coping strategies among couples of mixed HIV status presenting at a large comprehensive care centre in Eldoret, Kenya.
- [30]. Hodges-Mameletzis, L., Fonner, V. A., Dalal, S., Mugo, N., Msimanga-Radebe, B., & Baggaley, R. (2019). Pre-exposure prophylaxis for HIV prevention in women: current status and future directions. *Drugs*, 79(12), 1263-1276.
- [31]. Irungu, E. M., Odoyo, J., Wamoni, E., Bukusi, E. A., Mugo, N. R., Ngure, K., ... & Partners Scale-Up Project Team. (2021). Process evaluation of PrEP implementation in Kenya: adaptation of practices and contextual modifications in public HIV care clinics. *Journal of the International AIDS Society*, 24(9), e25799.
- [32]. Ishiekwe, C., Thomas-Powell, S., Ghitan, M., Kuhn-Basti, M., Chapnick, E., & Lin, Y. S. (2018). Evaluation of the awareness, knowledge and use of pre-exposure prophylaxis (PrEP) among the serodiscordant partners of HIV infected individuals on ART in an urban HIV clinic. *Cogent Medicine*, 5(1), 1475124.
- [33]. Kagucia, E. W., Gitonga, J. N., Kalu, C., Ochomo, E., Ochieng, B., Kuya, N., ... & Scott, J. A. G. (2021). Seroprevalence of anti-SARS-CoV-2 IgG antibodies among truck drivers and assistants in Kenya. *medRxiv*.
- [34]. Kahema, S. N. (2020). Factors Affecting Adherence to HIV Anti-Retroviral Therapy among HIV Positive Adults in Kibra, Nairobi County, Kenya (Doctoral dissertation, Daystar University, School of Human and Social Sciences).
- [35]. Kalomo, E. N. (2018). Associations between HIV-related stigma, self-esteem, social support, and depressive symptoms in Namibia. *Aging & Mental Health*, 22(12), 1570-1576.
- [36]. Kamitani, E., Johnson, W. D., Wichser, M. E., Adebukola, H. A., Mullins, M. M., & Sipe, T. A. (2020). Growth in proportion and disparities of HIV PrEP use among key populations identified in the United States national goals: systematic review & meta-analysis of published surveys. *Journal of acquired immune deficiency syndromes (1999)*, 84(4), 379.
- [37]. Kharsany, A. B., & Karim, Q. A. (2016). HIV infection and AIDS in sub-Saharan Africa: current status, challenges and opportunities. *The open AIDS journal*, 10, 34.
- [38]. Lee, M. B., Wu, Z., Rotheram-Borus, M. J., Detels, R., Guan, J., & Li, L. (2005). HIV-related stigma among market workers in China. *Health Psychology*, 24(4), 435.
- [39]. Mchome, Z., Mshana, G., Aloyce, D., Peter, E., Malibwa, D., Dwarumpudi, A., ... & Stöckl, H. (2020). "Don't You Think It Is Violence Forcing Me to Have Sex While Not Happy?" Women's Conceptualization of Enjoyable Sex and Sexual Intimate Partner Violence in Mwanza, Tanzania. *International journal of environmental research and public health*, 17(21), 7937.
- [40]. Ngure, K., Heffron, R., Curran, K., Vusha, S., Ngutu, M., Mugo, N., ... & Baeten, J. M. (2016). I knew I would be safer. Experiences of Kenyan HIV serodiscordant couples soon after pre-exposure prophylaxis (PrEP) initiation. *AIDS patient care and STDs*, 30(2), 78-83.
- [41]. Peterson, M., Macmadu, A., Truong, A. Q., Rich, J., Pognon, K., Lurie, M., ... & Brinkley-Rubinstein, L. (2019). Pre-exposure prophylaxis awareness and interest among participants in a medications for addiction treatment program in a unified jail and prison setting in Rhode Island. *Journal of Substance Abuse Treatment*, 106, 73-78.

- [42]. Stelzle, D., Godfrey-Faussett, P., Jia, C., Amiesimaka, O., Mahy, M., Castor, D., ...& Dalal, S. (2021). Estimating HIV pre-exposure prophylaxis need and impact in Malawi, Mozambique and Zambia: A geospatial and risk-based analysis. *PLoS medicine*, 18(1), e1003482.
- [43]. Stelzle, D., Godfrey-Faussett, P., Jia, C., Amiesimaka, O., Mahy, M., Castor, D., ...& Dalal, S. (2021). Estimating HIV pre-exposure prophylaxis need and impact in Malawi, Mozambique and Zambia: A geospatial and risk-based analysis. *PLoS medicine*, 18(1), e1003482.
- [44]. Taggart, T., Liang, Y., Pina, P., & Albritton, T. (2020). Awareness of and willingness to use PrEP among Black and Latinx adolescents residing in higher prevalence areas in the United States. *PLoS One*, 15(7), e0234821.
- [45]. Taggart, T., Liang, Y., Pina, P., & Albritton, T. (2020). Awareness of and willingness to use PrEP among Black and Latinx adolescents residing in higher prevalence areas in the United States. *PLoS One*, 15(7), e0234821.
- [46]. Vellozzi, C., Buchacz, K., Baker, R., Spradling, P. R., Richardson, J., Moorman, A., ...& HOPS Investigators. (2011). Treatment of hepatitis C virus (HCV) infection in patients coinfecting with HIV in the HIV Outpatient Study (HOPS), 1999–2007. *Journal of viral hepatitis*, 18(5), 316-324.
- [47]. Wang, L., Moqueet, N., Lambert, G., Grace, D., Rodrigues, R., Cox, J., ...& Mishra, S. (2020). Population-level sexual mixing according to HIV status and preexposure prophylaxis use among men who have sex with men in Montreal, Canada: implications for HIV prevention. *American journal of epidemiology*, 189(1), 44-54.
- [48]. Winskell, K., Singleton, R., Sabben, G., Tiendrébéogo, G., Obong'o, C., Dia, F. L., ...& Stephenson, R. (2020). Social representations of the prevention of heterosexual transmission of HIV among young Africans from five countries, 1997-2014. *Plos one*, 15(3), e0227878.
- [49]. Zablotska, I. B., Vaccher, S. J., Bloch, M., Carr, A., Foster, R., Grulich, A. E., ...& Templeton, D. (2019). High adherence to HIV pre-exposure prophylaxis and no HIV seroconversions despite high levels of risk behaviour and STIs: the Australian demonstration study PrELUDE. *AIDS and Behavior*, 23(7), 1780-1789.
- [50]. Zuniga, J. M. (2021). Charting a course for public health leadership by cities on HIV, tuberculosis, and viral hepatitis. *The Lancet HIV*, 8(12), e732-e733.