

## ***Factors Associated with Awareness and Utilization of Pre-Exposure Prophylaxis (PrEP) among Pregnant Women Attending Antenatal Care in Selected Public Hospitals in Lusaka, Zambia***

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### **ABSTRACT**

**Background:** Pregnant women are at high risk for HIV infection. Although pre-exposure prophylaxis (PrEP) has been shown to be safe and effective in preventing HIV among risk populations, awareness and utilization of PrEP among pregnant women, remain low in Zambia. This study aimed to assess factors associated with awareness and utilization of PrEP among pregnant women in selected public hospitals in Lusaka City, Zambia.

**Methods and Materials:** A cross-sectional study was conducted and systematic random sampling was used to select HIV-negative participants from four randomly selected hospitals in Lusaka Zambia. A validated questionnaire was used to collect data on demographic characteristics, awareness, and utilization of PrEP. Chi-square and Mann-Whitney tests were used to assess association between categorical variables Logistic regression analysis was used to identify factors associated with awareness and utilization of PrEP. Data was analyzed using Stata version 15 and for all statistical analysis, a p-value of <0.05 was considered significant.

**Results:** Among the 377 pregnant women included, almost half 187 (48.8%) were between 21 – 30 years, and only 10(2.6%) were 41 or more years old. There were 53.1% (n=200) who were aware and 12.2% (n=46) were utilizing PrEP. In multivariable analysis, not knowing health facilities that offer PrEP (AOR = 2.88; 95% CI: 1.05 – 10.83; p = 0.023), not knowing eligibility for PrEP (AOR = 4.12; 95% CI: 2.08 – 12.02; p=0.004) and not knowing importance of PrEP (AOR = 6.05; 95% CI: 2.14 – 9.88) were significantly associated with decreased utilization of PrEP. For awareness, those who knew importance of PrEP (AOR = 7.06; 95% CI: 2.09 – 12.8; p=0.002), eligibility criteria (AOR = 2.52; 95% CI: 1.15 – 5.53; p = 0.017) and knowing facilities that offer PrEP (AOR = 6.98, 95% CI: 3.12 – 10.66; p<0.0001) were more likely to be aware of PrEP.

**Conclusions:** Awareness was low (53.1%) as well as utilization (12.2%) of PrEP. The factors associated with awareness were knowing the facilities that offer PrEP, eligibility, and importance of PrEP. Non-utilisation of PrEP was associated with not knowing the importance, the correct source, eligibility criteria as well as not knowing whether pregnant women can take PrEP.

**Keywords:** Antenatal Care, HIV/AIDS, HIV Epidemic Control Model, PrEP, Pre-Exposure Prophylaxis.

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## Introduction

Pre-exposure prophylaxis (PrEP) is the use of Human Immunodeficiency Virus (HIV) Drugs before exposure to HIV in order to reduce the chance of getting HIV, Intervention preventive de l'Exposition aux Risques avec et pour les Gays (IPERGAY/WHO, 2016). More than a decade after the first efficacy evidence for oral HIV pre-exposure prophylaxis (PrEP) was reported, PrEP uptake globally has been inadequate, and global HIV prevention targets have been missed (Bavinton BR and Grulich AE, 2021). In 2015, recognising that PrEP has potential population-wide benefits, the World Health Organisation (WHO) released new guidelines recommending that PrEP should be offered as a choice to people who are at substantial risk of HIV infection as part of a combination HIV prevention programme (WHO 2015). As of June 2018, 46 countries had regulatory approval for PrEP within their HIV policies: of these 39 had started implementation, and there was a 40% increase from 2016, mostly in Europe and Africa (WHO, 2015). PrEP uptake globally has been inadequate to meaningfully accelerate progress towards ending the HIV epidemic (Rutstein SE et al., 2020).

The United Nations General Assembly's 2016, political declaration on HIV and Acquired Immunodeficiency Syndrome (AIDS) included a commitment to provide three million people at higher risk of HIV infection with PrEP by 2020, however, by the end of 2017 only 350,000 people were on PrEP. Despite having one of the highest burdens of HIV/AIDS in sub-Saharan Africa, Zambia has made progress towards reducing the devastating impact of the HIV epidemic. In the last eight years, concerted efforts by main stakeholders have resulted in a 27% decrease in new HIV infections and an 11% reduction in AIDS-related deaths. However, Zambia's current progress towards the United Nations Program of HIV/AIDS (UNAIDS) 90-90-90 goals stands at 66-89-89 (WHO, 2016).

According to the 2016 Zambia Population-based Impact Assessment (ZAMPHIA) reports, among

pregnant women living with HIV, approximately 18% are not on antiretroviral therapy (ART), resulting in nearly 9,000 children infected by HIV from mother-to-child transmission. In the same year, the annual incidence of HIV among adults aged 15 to 59 years in Zambia was 0.66%, 1.0% among females and 0.33% among males. The prevalence of HIV among adults aged 15 to 59 years in Zambia is 12.3%, 14.9% among females, and 9.5% among males. Interventions such as PrEP and the community HIV epidemic control model (CHEC) are necessary to identify the remaining 34% of the 1.2 million people living with HIV (PLHIV) as Zambia continuously seeks novel approaches to stopping HIV infections (ZAMPHIA, 2016, 2021).

The acquisition of HIV during pregnancy and postpartum periods remains high despite increased access to and initiation of antiretroviral therapy (ART) in sub-Saharan Africa (Baeten et al., 2012). There are biological and behavioral factors that drive high HIV incidence during pregnancy and breastfeeding periods such as hormonal changes that alter genital mucosal surfaces and frequent condomless sex with HIV – infected partners of unknown serostatus (Donnell et al., 2020). Material seroconversion during pregnancy and breastfeeding contributes significantly to pediatric HIV infections in sub-Saharan Africa (Beaten, et al., 2012).

Prevention within serodiscordant couples is an area of multi-component prevention that requires attention to both partners and the development of synergies between ART initiation in HIV-infected partners and PrEP for HIV-negative partners to avoid missing prevention opportunities. (Drake et al., 2014). Further, integrating PrEP into postnatal care may be more complex, because of the different care providers and locations. For example, postnatal care, well-baby visits, and immunization visits may all be separate providers in different locations from antenatal care providers. Operations research studies are urgently required to understand the role of peer –educators, counsellors, nurses, and

doctors in promoting PrEP use and ensuring adherence through vulnerable periods of pregnancy and lactation (Drake et al., 2014).

Few studies have evaluated PrEP use during pregnancy, but available data suggest that PrEP is safe during pregnancy, however, implementation approaches that efficiently use resources to optimize the benefit of PrEP while balancing potential concerns regarding PrEP use during pregnancy have not been defined (Pintye et al., 2016). A tool for assessing awareness of HIV prevention and risk during routine antenatal care could guide the prioritization of women most likely to benefit from PrEP and other prevention strategies (Pintye et al., 2016).

The gap is that there is too much misconception concerning PrEP, The World Health Organisation released guidelines on the usage of PrEP, and yet only sex workers are utilizing PrEP and not pregnant and not pregnant Women for example at LMUTH as of July 2019, only 33 clients on PrEP and none of them were antenatal mothers, UTH Adult Hospital had 800 on PrEP but none were antenatal mothers, Chawama level 1 Hospital had only one antenatal mother on PrEP and Kanyama level 1 Hospital had 2 antenatal mothers on PrEP.

Although data on adolescents and young adults infected with HIV are limited in resource-constrained settings, it is clear that these comorbidities can also make health-seeking behaviours more challenging for youth (Drake, et al., 2014). Further contributing to risk in this population is poor access to and uptake of effective biomedical HIV preventions, such as PrEP, due to structural challenges in the form of ethical, legal, policy, and regulatory hurdles. Furthermore, perceived challenges in working with adolescents often lead to their exclusion from critical research studies that are conducted on adults, resulting in an absence of data that can help to inform guidance and policy on programme implementation among young people and pregnant women (Wenger et al., 2014).

PrEP is a public health priority and cost-effective in settings of high HIV incidence (WHO, 2015). This is especially true during peri-conception, pregnancy, and breastfeeding in Southern Africa where HIV incidence is high and the probability of vertical transmission is highest when women are seroconverted and are viremic. In women, daily adherence is key to its effectiveness in the prevention of HIV acquisition (Price et al., 2016). Studies have demonstrated that in high-adherence participants the effectiveness of PrEP resulted in an 85% reduction in new HIV infections (Thomson et al., 2016). Zambia has a high HIV prevalence among women as well as fertility rate (UNAIDS, 2016).

Despite the efforts being put in place by WHO and the Ministry of Health of Zambia to provide PrEP services in most health institutions across the country, most pregnant women still are not aware and therefore do not utilize PrEP and this may result in contracting HIV during their pregnancy period. In addition, anecdotal data in public health facilities in Lusaka such as Levy Mwanawasa University Teaching Hospital there are only 33 people enrolled on PrEP for the past 2 years, and none of the 33 are antenatal mothers. At UTH 886 people are on PrEP and no one is an antenatal mother and one at Kanyama Level 1 Hospital.

### **Study Justification**

PrEP delivery is effective at preventing HIV acquisition during pregnancy and lactation, especially in high HIV incidence settings (Keating et al., (2012). This study is important to other researchers as a reference to studies concerning the use of PrEP in health institutions in pregnant women. If awareness and utilization of PrEP are increased, this can result in increased usage, and with high adherence,, this can result in reduced HIV transmission. PrEP has proven to be efficacious in the reduction of the risk of HIV transmission between partners and the unborn baby.

**Research Question**

What proportion of women attending antenatal care at WNBH-UTH, LMUTH, CLIH, and KLIH are aware of and utilize PrEP and what are the factors associated with the usage of Pre-Exposure Prophylaxis (PrEP)?

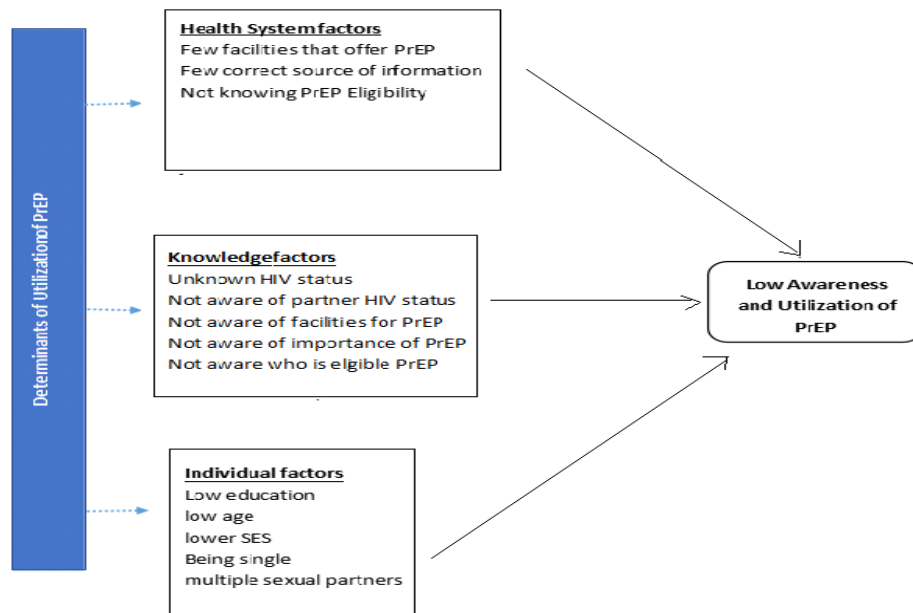
**Objectives of the Study**

**General Objectives**

To assess factors associated with awareness and utilization of pre-exposure prophylaxis (PrEP) among women attending antenatal care at WNBH-UTH, LMUTH, CLIH, and KLIH in Lusaka Zambia.

**Specific Objectives**

- To determine factors associated with awareness and utilization of Pre-Exposure Prophylaxis (PrEP) among pregnant women attending antenatal care.
- To determine the prevalence of awareness of PrEP among women attending antenatal care.
- To determine the prevalence of utilization of PrEP among women attending antenatal care.



Source: Conceptualised by Authors (2023)

**Figure 1: Conceptual Framework.**

**Study Design**

This was a cross-sectional study.

**Study Setting**

The study was conducted in four randomly selected hospitals. These are Kanyama level 1 hospital, Chawama level 1 hospital, Levy Mwanawasa University Teaching hospital, and the Women and Newborn hospital of the University Teaching Hospitals. These are located in Lusaka City which has an approximate population of 3.5

million people (CSO, 2018). There are 9 public hospitals in Lusaka with antenatal and delivery facilities but 4 were randomly selected. In all these hospitals PrEP was introduced.

**Target Population**

The target population was all pregnant women in Lusaka City attending antenatal care at the four randomly selected hospitals. This was done in line with CDC-recommended guidelines for screening eligible pregnant women for PrEP (CDC, 2014). All

important questions were included in the questionnaire and they are important to identify women for PrEP services.

### Study Population

All women attending antenatal care at the four randomly selected facilities met the eligibility and inclusion criteria during the period of the study.

### Inclusion and Exclusion Criteria

#### Inclusion Criteria

Pregnant women able to consent and of HIV-negative status.

#### Exclusion Criteria

Those who were involved in another study and were not able to consent to another study, not willingness to provide informed consent to participate in the study, and those who were HIV Positive antenatal mothers.

### Sample Size Calculation

The primary objective was to determine the prevalence of awareness and utilization of PrEP, and therefore, we used these to estimate the required sample size. Available data indicated that the proportion of pregnant women aware of PrEP service is not known and those who utilize the service are not known as well. Therefore, a default of 50% prevalence in both cases was used.

Using prevalence formula:

$$n = \frac{z^2 p(1-p)}{e^2}$$

n =

n= sample size z= 95% CI (1.96) p= prevalence (50%) the default when the true prevalence is not known.

e= standard error (0.05)

### Sample Size = 385

It was assumed that a 10% non-response of missing data. With a statistical power of 80% at a 5% level of significance. Since no previous similar study has been conducted in the same setting, awareness and utilization were assumed to be 50% and therefore proportion of 0.5 was used in

the sample size formula. Therefore, a total of 385 participants were recruited for this study.

A second sample size for factors associated with awareness and utilization of PrEP was determined using the most important variable which is knowing the importance of both awareness and utilisation of PrEP. According to a study conducted in the USA (Wingood et al., 2013) showed that knowing the importance of PrEP determines both awareness and utilization. Wingood et al. (2013) showed that knowing the importance was only 17.7%.

Using prevalence formula:

$$n = \frac{z^2 p(1-p)}{e^2}$$

n= sample size z= 95% CI (1.96) p= prevalence (17.7%) the default when the true prevalence is not known.

e= standard error (0.05)

### Sample Size = 247

Therefore, the sample size that was used in this study is 385 to Carter for the sample size for associated factors.

### Sampling

A systematic random sampling was used to select participants. Sampling proportional to size was done according to the total number of women attending antenatal care in each hospital during the study period. The antenatal bookings for Kanyama level 1 hospital were 3635, Chawama level 1 Hospital 2852, Women and Newborn Hospital 890, and Levy Mwanawasa University Teaching Hospital 150 in 6 months. The total sample size calculated was 385 and when proportion to size was considered, this rendered sampling fractions of 185 (48.3%), 146 (38%) 45 (11.7%), and 8 (2.1%) from Kanyama level 1 hospital, Chawama level 1 hospital, Women and Newborn hospital and Levy Mwanawasa University Teaching hospital respectively. During sampling different sampling interval values were used for each site. To calculate the sampling

interval value for each site, the expected number of women during the study was divided by the calculated sample size from each site. The sampling interval values were 20, 20, 20, and 19 for Kanyama Level 1 Hospital, Chawama Level 1 Hospital, Women and Newborn Hospital UTH, and Levy Mwanawasa UTH respectively. The total expected number of women attending antenatal was divided by the sample size for each site to come up with the sampling interval value. The sampling interval value was the interval used during the sampling. To determine the first participant, a random number was selected between 1 and the sampling interval value, and samples were then selected until the required sample was reached. The first participants from each site were randomly selected by choosing a random number between 1 and the sampling interval value. The first participants were 9, 12, 6, and 3 from Kanyama Level 1 Hospital, Chawama Level 1 Hospital, Women and Newborn Hospital UTH, and Levy Mwanawasa UTH respectively. A total sample size of 385 was recruited.

The source population was defined as pregnant women attending antenatal care services in any of the public hospitals in Lusaka who attended antenatal care visits between August 2020 and January 2021. There are 9 hospitals that were considered but 4 were randomly selected and these were Kanyama Level 1 Hospital, Chawama Level 1 Hospital, Women and Newborn hospital-UTH, and Levy Mwanawasa UTH.

### Measurement of Variables

The questionnaire assessed socio-demographic characteristics and knowledge-related questions for awareness and utilization of PrEP. Outcome variables of interest were awareness and utilization of PrEP. Specifically, for awareness participants were asked, 1) "Before today, are you aware of PrEP?"

2) For utilization, participants were asked "Before today do you utilize PrEP?"

The collected demographic characteristics were informed by literature which included age,

marital status, education level, employment status, residence, religion, parity, and gravidity. Information on age was categorized to reflect what most studies conducted showed regarding PrEP awareness and use as well as local antenatal care services. Education was recorded as the highest education level attended which was categorized as primary, secondary, and tertiary. Employment status was categorized as employed or not employed. For marital status, those married or cohabiting were classified as married and those not married, widow or widower, and divorced were categorized as not married. For residence, the categorization was based on the Zambia Statistical Agency classification and it was categorized as low, medium, and high.

For questions to assess knowledge regarding awareness and utilization participants were asked and were expected to respond whether they know or not. Participants were asked 1) "As far as you know, before today do you know your HIV status? 2) As far as you know, before today do you know your sexual partner's HIV status? 3) Are you aware that HIV can be prevented? 4) Do you know the correct HIV prevention methods? Participants were expected to mention at least any four correct methods to be considered that they know. 5) Do you know the correct source of PrEP? 6) Do you know any healthcare facility that offers PrEP? 7) Do you know who is eligible for PrEP? 8) Do you know if a pregnant woman can be on PrEP? 9) Do you know the importance of PrEP? These questions were with "yes" or "no" responses.

### Data collection

Two interviewers (research assistants) from each site were trained by the Principal Investigator (PI) in interview technique and research procedure. These interviewers were midwives who were attending to women during antenatal care. After explaining the study's purpose, the interviewer asked the participants to sign a written informed consent form.

The validated and reliable structured questionnaire was then used to collect data. Data were collected from August 2020 to January 2021. A description of pre-exposure prophylaxis (PrEP) was provided to all participants to introduce the study. The questions consisted of closed-ended questions regarding personal characteristics, awareness, and utilisation of PrEP. Missing, inconsistent, or illogical information was clarified with notes and subsequently rectified. Only the PI was allowed to correct the information in the forms. An audit trail of data was kept for all data collection and data rectification. During data collection, no participant exercised their right to withdraw from the study. The approximate time to answer the questionnaire was 20 minutes. After data collection, some random checks were conducted by the research assistants to help ensure completeness and accuracy of questionnaire answering.

#### **Data Management**

The hard copy forms of the collected data were temporarily stored in an office accessible to the PI only. Data were entered into Epi-data (Epidata Association, Odense, Denmark), and this was done in order to check for logical errors, missing information, or incorrect coding that could be done automatically. Although basic data cleaning was largely handled by the Epi-data, data entry errors remained to be verified. Therefore, range checking, detection, and handling of any missing data were performed on a daily basis as the data was being updated to maximize the completeness of data (WHO, 2008). Once data entry had been completed, it was de-identified and the resulting electronic dataset was securely stored in a password-protected computer by the PI.

#### **Data Analysis**

Data from Epi-data (Epidata Association; Odense, Denmark) was exported to Stata version 15 (Stata Corp., College Station, Texas, USA) for analysis. Frequency distributions for all categorical variables were created with their respective percentages. All continuous variables such as parity and gravidity were first tested for normality

using the Shapiro-Wilk test and were found to be not normally distributed; therefore, median and interquartile ranges (IQR) were reported for descriptive statistics. In all analyses, potential confounding variables and effect modifiers were considered. Descriptive statistical analyses were initially performed. Specifically, characteristic variables that were not normally distributed such as parity and gravidity between those who were utilizing PrEP and those who were not utilizing PrEP as well as those aware and not aware associations were determined using the Mann-Whitney test. Chi-square test for categorical variables in a situation where the assumption of a Chi-square test was met but if not, Fischer's exact test was used. Variables were tested for association with Utilization and awareness of PrEP. The association between each independent variable with awareness and utilization of PrEP was investigated using logistic regression models. Odds ratios and 95% CI for association between demographic and knowledge variables with awareness and utilization were presented. Potential confounding factors were considered based on prior knowledge and literature review. In the final analysis, multiple logistic regression models adjusting for all demographic characteristics were conducted to determine factors associated with awareness and non-utilization of PrEP. For all statistical analysis, a p-value of <0.05 was considered significant.

#### **Ethical Consideration**

Ethical approval to conduct this study was obtained from the University of Zambia Biomedical Research Ethics Committee (UNZABREC) approval number 926-2020 and the National Research Authority. Permission was obtained from the Lusaka district health office and medical superintendents from the respective hospitals. Before data collection, participants were given information sheets and later signed an informed consent form, and those who could not read or write were explained to in their local language and consented by putting a thumbprint. The study ensured that participants were aware of the purpose of the study so as to get their consent

and participate freely. The statement of the research purpose, description of any potential risks or discomforts, description of potential benefits, and the description of confidentiality were explained to participants. No information regarding the names of participants was obtained. The data set was handled with confidentiality and only used for purposes of this study. The data was not subject to undue prejudice.

**Demographic characteristics of the Study Participants**

In the study 377 pregnant women attending antenatal care were recruited. In terms of age,

almost half 187 (48.8%) were between 21 – 30 years, 60 (15.7%) were 20 years or less and only 10(2.6%) were 41 or more years old. The majority 147 (39.8%) had a secondary education level with slightly above one-fifth 79(21.4%) having primary education. Most 321 (84.5%) were married, about two-thirds were not employed 222(65.3%) and almost all participants were Christians 371 (96.9%). Just over half 189 (52.4%) of them were from high-density residence areas and under one-fifth 70 (19.4) were from low-density areas. The median parity and gravidity for the participants were 1 (0 – 2) and 2 (1 – 3) respectively (Table 4.1).

Variable	Category	Frequency (%)
Age (years)	≤20	60 (15.7)
	21 – 30	187 (48.8)
	31 – 40	126 (32.9)
	≥41	10 (2.6)
Education level	Primary	79 (21.4)
	Secondary	147 (39.8)
	Tertiary	143 (38.8)
Marital status	Not Married	59 (15.5)
	Married	321 (84.5)
Employment status	Employed	118 (34.7)
	Not Employed	222 (65.3)
Religion	Christian	371 (96.9)
	Muslims	12 (3.1)
	Other	0 (0)
Residence	Low	70 (19.4)
	Medium	102 (28.2)
	High	189 (52.4)
Median (IQR)		
Parity	1	0 - 2
Gravidity	2	1 - 3

IQR = interquartile range

**Table 4. 1 Demographic characteristics of pregnant women attending antenatal care at selected hospitals, Lusaka Zambia (N= 377).**

**Description of knowledge regarding pre-exposure prophylaxis (PrEP)**

In this study, almost all participants 362 (96.1%) responded that they knew their HIV status, 317 knew their partners’ HIV status, 348 (92.3%) were aware that HIV can be prevented and more than three quarters 302 (80.2) knew correct HIV

prevention methods. Concerning PrEP, above half 200 (54.3%) were aware of PrEP with just over three quarters 199 (67.5%) responding that they knew the correct source of PrEP but less than half 171 (47.8%) knew that health facility offers PrEP. Below half 166 (47.4%) knew who was eligible for PrEP and 220 (64.5%) of the participants

responded that they knew that pregnant women could be on PrEP. Just above two-thirds 228

(67.8%) reported that PrEP is important (Table 4.2).

Variable	Category	Frequency (%)
Know their HIV status	Yes	362 (96.1)
	No	15 (3.9)
Know their partners HIV status	Yes	317 (83.9)
	No	61 (16.1)
Aware HIV can be prevented	Yes	348 (92.3)
	No	29 (7.7)
Know correct HIV prevention methods	Yes	302 (80.2)
	No	75 (10.9)
Aware of PrEP	Yes	200 (54.3)
	No	168 (45.7)
Know correct source of PrEP	Yes	199 (67.5)
	No	123 (32.5)
Know Health care facility offer PrEP	Yes	171 (47.8)
	No	187 (52.2)
Know who is eligible for PrEP	Yes	166 (47.4)
	No	184 (52.6)
Know if pregnant woman can be on PrEP	Yes	220 (64.5)
	No	121 (35.5)
Know important of PrEP	Yes	228 (67.8)
	No	109 (32.2)

**Table 4. 2 Description of knowledge regarding PrEP of pregnant women attending antenatal care in selected hospitals, Lusaka Zambia (N= 377).**

PrEP = Pre-exposure prophylaxis; HIV = Human immunodeficiency virus; SD = standard deviation

When the prevalence of PrEP utilization was determined, only 46(12.2%) were utilized while the majority 331(86.4%) did not utilize PrEP. For PrEP awareness, the majority of 200 (54.4%) were aware of PrEP (Table 4.3).

Proportion of utilization and awareness of PrEP among pregnant women attending antenatal care in selected hospitals Lusaka Zambia

Variable	Frequency	Percentage
Utilization of PrEP	Yes	46
	No	331
Awareness of PrEP	Yes	200
	No	177

PrEP = pre-exposure prophylaxis

**Table 4. 3 Proportion of Utilization and Awareness of PrEP among Pregnant women attending antenatal care from selected hospital Lusaka, Zambia (N= 377).**

**Association between Utilization of PrEP and demographic characteristics**

When the association between utilization of PrEP and demographic characteristics was assessed, there was a significant association between those with employment status, residence, and education level. Those who were not employed had a higher proportion of utilizing PrEP compared to those who were employed (15.9% versus 7.3%; Chi-square = 4.69, p = 0.030). For education level, the proportion of those participants with primary education or no education to utilize PrEP was significantly higher 26.5% compared to 11.5% or

9.0% for participants with secondary and Tertiary education respectively (Chi-square 110.8, p <0.0001). Similarly, Participants, who reported that they live in low-density areas had a higher proportion of utilizing PrEP than those from either medium or low-density areas (21.4% versus 11.8% or 9.5%; Chi-square = 146.6, p <0.0001). The associations between Utilisation of PrEP and age, marital status, and religion were not significant. Likewise, the comparison of parity and gravidity between those participants who utilized PrEP and those who did not was not significant (Table 4.4).

Variable	Utilization of PrEP N (%)	No Utilization of PrEP N (%)	P-value
Age (years)			
≤20	7 (13.5)	45 (86.6)	0.278 <sup>f</sup>
21 – 30	27 (16.6)	136 (83.4)	
31 – 40	12 (10.2)	106 (89.9)	
≥ 41	0 (0.0)	9 (100)	
Employment status			
Employed	8 (7.3)	102 (92.7)	0.030 <sup>c</sup>
Not employed	31 (15.9)	164 (84.1)	
Marital status			
Not Married	9 (16.9)	44 (83.0)	0.387 <sup>c</sup>
Married	36 (12.6)	250 (87.4)	
Education level			
Primary	18 (26.5)	50 (73.5)	<0.0001 <sup>c</sup>
Secondary	15 (11.4)	117 (88.6)	
Tertiary	18 (9.0)	121 (90.9)	
Religion			
Christian	45 (13.5)	288 (86.5)	0.835 <sup>f</sup>
Muslim	1 (11.1)	8 (88.9)	
Residence			
Low	15 (21.4)	55 (78.6)	<0.0001 <sup>c</sup>
Medium	12 (11.8)	90 (88.2)	
High	18 (9.5)	171 (90.5)	
Parity	1 (1 – 2)	1 (0 – 2)	0.931 <sup>m</sup>
Gravidity	2 (1 -3)	2 (1 – 3)	0.162 <sup>m</sup>

C= Chi-square test; F= Fischer’s exact test; M = Mann-Whitney test

**Table 4. 4 Association between utilization of PrEP and demographic characteristics of pregnant women from selected hospitals, 2020, Lusaka Zambia (N= 377).**

**Association between awareness and demographic characteristics**

The association was conducted to determine the association between demographic characteristics and Awareness using the Chi-square test because assumptions for the test were met by all the variables. For age categories, those aged 21 – 31 years were more likely to be in the not aware and aware groups (46.4% versus 50.4%). Unemployment was more in the group that was not aware of PrEP than in the group that was aware (67.9% versus 61.8). For marital status, those who were married were less common in the group that was not aware than the group that was

aware (80.2% versus 87.4%). Tertiary education was significantly less common among participants who were not aware compared to those who were aware of PrEP (22.8% versus 49.5%, Chi-square = 17.4, p<0.001). In both groups (not aware and aware) almost everyone belongs to the Christian religion (95.8% versus 97.5%). Likewise, the common residence area for participants in both groups (not aware and aware) was a low residence area (64.1% versus 61.9%) respectively. When parity and gravidity were compared between the not-aware and aware groups, the medians in both were 1 and 2 respectively (Table 4.5).

Variable	Not Aware of PrEP	Aware of PrEP	P-value
Age (years)	<b>N (%)</b>	<b>N (%)</b>	0.233 <sup>c</sup>
≤20	33 (19.6)	24 (12.0)	-
21 – 30	78 (46.4)	101 (50.5)	-
31 – 40	52 (30.9)	70 (35.0)	-
≥ 41	5 (2.9)	5 (2.5)	
Employment status			0.241 <sup>c</sup>
Employed	49 (32.0)	68 (38.2)	
Not employed	104 (67.9)	110 (61.8)	
Marital status			0.060 <sup>c</sup>
Not Married	33 (19.8)	25 (12.6)	
Married	134 (80.2)	174 (87.4)	
Education level			<0.0001 <sup>c</sup>
Primary	41 (25.3)	35 (18.0)	
Secondary	76 (46.9)	63 (32.5)	
Tertiary	45 (27.8)	96 (49.5)	
Religion			0.370 <sup>c</sup>
Christian	161 (95.8)	195 (97.5)	
Muslim	7 (4.2)	5 (2.5)	
Residence			<0.876 <sup>c</sup>
Low	107 (64.1)	120 (61.9)	
Medium	31 (18.6)	40 (20.6)	
High	29 (17.4)	34 (17.5)	
Parity, median (IQR)	1 (0 – 2)	1 (0 – 2)	0.765 <sup>m</sup>
Gravidity, median (IQR)	2 (1 – 3)	2 (1 – 3)	0.852 <sup>m</sup>

PrEP = Pre-exposure prophylaxis; C = Chi-square test; M = Mann – Whitney test

**Table 4. 5 Association between Awareness with demographic characteristics among pregnant women who attended antenatal care between x and y in selected hospitals Lusaka, Zambia (N=377)**

**Association between knowledge of PrEP and Utilization of PrEP among Pregnant Women**

When an association between utilization of PrEP (outcome variable) and knowledge regarding PrEP was conducted, there was a significant association between utilization and whether they knew health facilities that offer PrEP, who is eligible for PrEP, whether or not a pregnant woman can be on PrEP and importance of PrEP. For those who responded that they knew health facilities that offer PrEP, a higher proportion of them were utilizing PrEP than those who were not utilizing PrEP (81.4% versus 43.3%; Chi-square = 21.69, p <0.001). Surprisingly, participants who

responded that they knew the correct source of PrEP were less likely to utilize PrEP compared to those who were not utilizing it (40.0% versus 55.9%). There was also a higher proportion of those that utilize PrEP among participants that reported that they knew health facilities that offer PrEP 81.4% versus 43.3%, Chi-square = 21.9, df =1, p <0.0001), knew who is eligible for PrEP (23.8% versus 4.1%; Chi-square = 26.6, df = 1, p < 0.0001), pregnant women can be given PrEP (83.7% versus 41.5%; p <0.0001) and knew the importance of PrEP (95.5% versus 59.4%, Chi-square = 20.41, p < 0.0001) compared to their counterparts who did not know (Table 4.6).

Variable	Utilize PrEP	Not Utilize PrEP	P-value
Know their HIV status			
Yes	44 (95.7)	280 (96.2)	0.853
No	2 (4.40)	11 (3.8)	
Know your partners HIV status			
Yes	36 (81.8)	248 (84.4)	0.669
No	8 (18.2)	46 (84.4)	
Aware HIV can be prevented			
Yes	37 (86.1)	228 (80.0)	0.348
No	6 (13.9)	57 (20.0)	
Know correct HIV prevention methods			
Yes	17 (37.8)	224 (41.9)	0.602
No	28 (62.2)	172 (58.1)	
Know correct source of PrEP			
Yes	14 (40.0)	85 (55.9)	0.089
No	21 (60.0)	67 (44.1)	
Know Health care facility offer PrEP			
Yes	35 (22.2)	123 (77.8)	<0.0001
No	8 (4.7)	161 (95.3)	
Know who is eligible for PrEP			
Yes	35 (81.4)	123 (43.3)	<0.0001
No	8 (18.6)	162 (56.7)	
Know if pregnant woman can be on PrEP			
Yes	40 (95.2)	161 (59.4)	<0.0001
No	2 (4.8)	110 (40.6)	
Know importance of PrEP			
Yes	41 (95.4)	163 (59.9)	<0.0001
No	2 (4.7)	109 (40.1)	

PrEP = pre-exposure prophylaxis; HIV = Human immunodeficiency virus

**Table 4. 6 Association between knowledge and Utilization of PrEP among Pregnant Women in Selected Hospitals 2020, Lusaka Zambia (N= 377).**

**Association between knowledge of PrEP and Awareness**

When knowledge about PrEP was compared among participants, almost all participants in both groups (not aware and aware of PrEP) knew their HIV status at the time they were enrolled in this study (94.6% versus 96.9%). However, the majority (21.6%) in the group that was not aware did not know their partners HIV status compared to the group that was aware of PrEP (11.6%) and the difference was statistically significant (Chi-square = 6.74, p=0.01). Similarly, participants who were not aware of PrEP were more likely not to know that HIV can be prevented than those who were aware (28.7% versus 10.9%, Chi-square = 17.83, p <0.0001). Surprisingly, those who responded that they were not aware of PrEP were more likely to know the correct HIV prevention

methods than those who were aware of PrEP (55.9% versus 37.7%) but were less likely to know the correct source of PrEP information (42.9% versus 51.1%) respectively. Further, when participants were asked whether they knew health facilities that offer PrEP, those who were not aware of PrEP were significantly less likely to know than those who were aware (12.5% versus 76.8%, Chi-square = 138.77, p < 0.0001). Likewise, participants who were not aware of PrEP were significantly less common to know eligibility criteria for PrEP (14.5% versus 76.9%; Chi-square = 120.31, p <0.0001), whether pregnant woman can be on PrEP (39.6% versus 82.5%, Chi-square = 65.25, p <0.0001) and importance (32.4% versus 88.7%, Chi-square = 88.79, p <0.0001) compared to those participants who were aware of PrEP (Table 4.7).

Variable	Not aware of PrEP N (%)	Aware of PrEP N (%)	P-value
Know their HIV status			
Yes	158 (94.6)	191 (96.9)	0.260 <sup>c</sup>
No	9 (5.4)	6 (3.1)	
Know their partners HIV status			
Yes	131 (78.4)	176 (88.4)	0.010 <sup>c</sup>
No	36 (21.6)	23 (11.6)	
Aware HIV can be prevented			
Yes	117 (71.3)	170 (89.1)	<0.0001 <sup>c</sup>
No	47 (28.7)	21 (10.9)	
Know correct HIV prevention methods			
Yes	94 (55.9)	75 (37.7)	0.216 <sup>c</sup>
No	74 (44.1)	124 (67.3)	
Know correct source of PrEP			
Yes	10 (42.9)	94 (51.1)	0.553 <sup>c</sup>
No	8 (57.4)	90 (48.9)	
Know Health facilities that offer PrEP			
Yes	19 (12.4)	150 (75.8)	<0.0001 <sup>c</sup>
No	134 (85.5)	48 (24.2)	
Know who is eligible for PrEP			

Yes	22 (14.5)	142 (76.9)	<0.0001c
No	130 (85.5)	50 (26.1)	
Know if pregnant woman can be on PrEP			
Yes	55 (39.6) 84	160 (82.5)	<0.0001c
No	(60.4)	34 (17.4)	
Know importance of PrEP			
Yes	46 (32.4)	172 (88.7)	<0.0001c
No	96 (67.6)	22 (11.3)	

PrEP = Pre-exposure; HIV = Human immunodeficiency virus; C= Chi-square test

**Table 4. 7 Association between Awareness and knowledge among pregnant women who attended antenatal care between x and y in selected Hospital in Lusaka, Zambia (N=377)**

**Multivariable logistic regression analysis for the determinates of non-utilization of PrEP**

In the final analysis, a multivariable regression model was conducted to identify determinants of non-utilization of PrEP while adjusting for baseline characteristics. The variables that emerged as significant determinants of non-utilization of PrEP were knowing the health care facility that offers PrEP, knowing who is eligible for PrEP, knowing if a pregnant woman can be on PrEP, and the importance of PrEP. In the adjusted regression model. Participants who responded that they did not know health facilities that offer PrEP were more than two and half times more

likely not to utilize PrEP compared to their counterparts who knew the health facilities that offer PrEP (AOR = 2.88; 95% CI: 1.05 – 10.83). Likewise, those who reported that they didn’t know who was eligible for PrEP were more than four times more likely not to utilize PrEP compared to their counterparts who knew who was eligible for PrEP (AOR = 4.12; 95% CI: 2.08 – 12.02). Furthermore, those who responded that they didn’t know the importance of PrEP were six times more likely not to utilize PrEP compared to the ones who knew the importance of PrEP (AOR = 6.05; 95% CI: 2.14 – 9.88) as shown in (Table 4.8).

Variable	AOR	95% CI	P-value
Education level			
Primary	Ref		
Secondary	0.89	0.73 – 2.32	0.231
Tertiary	0.73	0.59 – 1.99	0.112
Employment status			
Employed	Ref		
Not Employed	0.75	0.53 – 2.59	0.223
Residence			
Low	Ref		
Medium	0.94	0.68 – 2.65	0.244
High	0.75	0.58 – 2.38	0.109
Know correct HIV prevention methods			
Yes	Ref		
No	1.23	0.98 – 4.109	0.129
Aware of PrEP			
Yes	3.11	1.45 – 9.99	0.018

No			
Know correct source of PrEP	Ref		
Yes	1.76	0.95 – 6.04	0.201
No			
Know health care facility offer PrEP	Ref		
Yes	2.88	1.05 – 10.83	0.023
No			
Know who is eligible for PrEP	Ref		
Yes	4.12	2.08 – 12.02	0.004
No			
Know if pregnant woman can be on PrEP	Ref		
Yes	2.14	1.14 – 6.08	0.033
No			
Know important of PrEP	Ref		
Yes	6.05	2.14 – 9.88	<0.0001
No			

AOR = adjusted odds ratio; CI = confidence; Ref = reference category; PrEP = pre-exposure prophylaxis; HIV = Human immunodeficiency virus

**Table 4. 8 Multivariable logistic regression models showing determinants of non-utilization of Pre-exposure prophylaxis.**

**4.10: Multiple logistic regression model**

After the Chi-square test of association between demographic and Knowledge with awareness was conducted, all variables that had  $p < 0.2$  were considered as candidate variables for the multivariable logistic regression model. Therefore, the variables marital status, education level, know their partners.

HIV status, awareness that HIV can be prevented, the importance of PrEP, knowing who is eligible for PrEP, knowing facilities that offer PrEP, and knowing whether pregnant women can be on PrEP were included in the multivariable logistic regression model. The analysis showed that those

who knew the importance of PrEP were seven times more likely to be aware of PrEP compared to those who were not aware of PrEP (AOR = 7.06; 95% CI: 2.09 – 12.83;  $p = 0.002$ ). Similarly, a participant who knew facilities that offer PrEP were almost six times more likely to be aware of PrEP compared to their counterparts who were not aware of PrEP (AOR = 5.98; 95% CI: 3.12 – 10.6;  $p < 0.0001$ ). Those participants who reported not knowing the eligibility criteria for PrEP were 61% less likely to be aware of PrEP compared to those participants who were aware (AOR = 0.39, 95% CI: 0.18 – 0.82;  $p = 0.020$ ) as shown in Table 4.9.

Variable	AOR	95% CI	P-value
Education level			
Primary	Ref		
Secondary	2.15	0.86 – 5.40	0.824
Tertiary	1.96	0.89 – 4.30	0.101
Marital status			
Married	Ref		
Not Married	1.82	0.76 – 4.34	0.178

Know partner's HIV status			
Yes	Ref		
No	1.15	0.46 – 2.85	0.751
Know HIV prevention methods			
No	Ref		
Yes	1.77	0.77 – 4.05	0.172
Know importance of PrEP			
No	Ref		
Yes	7.06	2.09 – 12.82	0.002
Know need for PrEP in Pregnancy			
Yes	Ref		
No	0.47	0.14 – 1.61	0.235
Know who is eligible for PrEP			
Yes	Ref		
No	0.39	0.18 – 0.82	0.020
Know facilities that offer PrEP			
No	Ref		
Yes	6.98	3.12 – 10.66	<0.0001

AOR = adjusted odds ratio; CI= confidence interval; HIV = Human immunodeficiency virus; PrEP = pre-exposure prophylaxis; Ref = reference category

**Table 4. 9 Multivariable logistic regression models showing determinants of awareness of Pre-Exposure Prophylaxis.**

**Discussion**

**Overview of the findings**

The study results showed the differences in demographics and knowledge of PrEP characteristics of pregnant women attending antenatal care by their awareness and utilization of PrEP in selected hospitals in Lusaka, Zambia. The findings showed that the levels of awareness were 53.1% while utilization was 12.2%. The determinates of non-utilization of PrEP were not aware of PrEP, health care facilities that offer PrEP, who is eligible for PrEP, if a pregnant woman can be on PrEP, and know the importance of PrEP. For awareness, participants who knew facilities that were offering PrEP, knew eligibility criteria for PrEP and those who knew the need for PrEP in pregnancy were likely to be aware of PrEP.

**Levels of awareness and utilization of PrEP**

The level of awareness and utilization of PrEP observed in this study is lower than the 68.9% and 18.9% respectively reported in a cross-sectional study conducted in Nigeria among university students (Ajayi et al., 2018). Similarly,

awareness and utilization were reported to be 78.2% and 18.7% respectively among Men who have Sex with Men (MSM) in New York City (Garnett et al., 2018). PrEP is FDA-approved and despite PrEP being free and accessible in most health facilities awareness and utilization in Zambia remain low.

Similar findings have been reported even in developed countries especially amongst populations at substantial risk for HIV infection (Eaton et al., 2015) and the low awareness and utilization deters overall effort and impact of PrEP use in the fight against HIV prevention. The results of low awareness and utilisation of PrEP reported in this study among women may be due to stigma which has been demonstrated to be associated with negative PrEP uptake partly due to conflict with male partners (Moran et al., 2020). Stigma may suggest that during the rolling out and implementation of PrEP, the package underscores the importance of including individual-level stigma reduction strategies.

Furthermore, the findings of the current study and indeed those of others call for attention to better understand and strengthen the implementation of medical and scientific evidence advances for community uptake for interventions such as PrEP to succeed. Although studies have suggested strategies on how to implement and uptake PrEP (Beaten et al., 2013; Norton et al., 2013) primary healthcare providers and other stakeholders should strongly link the ongoing HIV care services in antenatal which remain potential areas of intervention for PrEP. If the status quo of the current does not change, PrEP may remain largely underutilized and the fight against HIV prevention strategy may be hampered. In this study, although at the time all participants were enrolled were HIV-negative, in line with evidence from recent studies (Pillay et al., 2020; Daniel et al., 2018; Nicholas et al., 2018) the results of this study may indicate the risk associated with condomless sex which led to pregnancy observed among participants and understanding risk associated would be the initial step to oral PrEP awareness and utilization.

The fact that these women were pregnant and the majority were not aware of PrEP, this finding could suggest missed opportunities to offer counselling and oral PrEP to these women perceived to be at risk of HIV. There are other studies that have reported an even lower prevalence of awareness and utilization of PrEP in different population groups. For example, a recent cross-sectional study in the USA showed that the level of PrEP awareness among persons who inject drugs (PWID) was 12.4% and only 2.6% were utilizing PrEP and recommended some additional efforts to promote both awareness and utilization of PrEP among this risky group (Roth et al., 2019).

Another USA study among women who inject drugs showed that the PrEP awareness level was 31% which suggested that social networks could be one way of strengthening means of disseminating messages strategies such as PrEP which others have shown could possibly work

(Walters et al., 2017). In agreement with this study, a cross-sectional study conducted in Brazil found that 51% of the participants were aware of PrEP among MSM but did not report utilization although 56% indicated their willingness to use (Torres et al., 2019). In most settings and different populations awareness and utilization of PrEP remain low and this calls for community-based interventions that could reach the most vulnerable people in order to effectively prevent HIV transmission. Furthermore, the finding of this study is in consonant with another study conducted in the USA which showed that

MSM who were aware of PrEP were more likely to take up PrEP as a preventive measure for HIV (Eaton et al., 2015). Similarly, a study in Taiwan among individuals seeking Voluntary and Counselling Testing (VCT) for HIV showed that prior knowledge of PrEP was associated with preparedness for uptake of PrEP (Lee et al., 2017). Likewise, Goedel and colleagues (2016) in the USA reported that among gay, bisexual, and MSM there was a significant association between awareness with willingness to use PrEP. The findings of this study and indeed those from others suggest that heightened and persistent awareness of PrEP may culminate into likelihood of acceptance and use of PrEP. However, any efforts to promote the uptake of PrEP to populations at risk of HIV infection should be accompanied with context-specific information, education, and counselling (Lee et al., 2017).

#### **Education and Awareness/Utilization of PrEP**

In this study, it was surprising to note that a higher proportion of women who had lower education levels (primary and secondary) were more likely to be aware of and utilize PrEP compared to those with tertiary education. This finding is in disagreement with other studies who reported that women with lower education levels are more likely not to be aware of and utilize PrEP (Moran et al., 2020; Kinuthia et al., 2020). This finding in the current study could be due to self-reporting leading to overestimation since a self-administered questionnaire was used, there is

potential for most participants to have tertiary education when probably they had primary or secondary education levels. Some researchers have reported that educational level is associated with information-seeking behavior in many health services including PrEP awareness and use and this may raise questions about the physiological and economic challenges of taking this prophylactic medication (Mutchler et al., 2015). This may suggest stigma or the context in which it is offered should be looked at in order to increase awareness and uptake.

#### **HIV Status and Awareness/Utilization of PrEP**

It is encouraging to note that in the current study, more than 80% of participants knew their HIV status as well as their partners contrary to a recent South African study which reported that the majority of the PrEP users did not know the status of their partners (Moran et al., 2020). Knowing HIV status is a good initial step required for awareness and utilization of PrEP since some studies have suggested that having a partner of unknown HIV status or not tested reduces the chances of PrEP utilization of the HIV-negative partner (Moran et al., 2020).

#### **Marital status and Awareness/Utilization of PrEP**

In this study, women who reported that they were not married (15%) were more likely to be aware of PrEP. One possible explanation could be due to women who are not married are more likely to have multiple sexual partners and could have more contact with several sources of PrEP information such as social networks and singles friendly. The potential of having multiple partners by single women may predispose them to a higher risk for HIV infection and therefore seek information regarding PrEP through their partners or expanded social networks (Eaton et al., 2015).

#### **Employment status and Awareness/Utilization of PrEP**

Surprisingly, in this study, awareness of PrEP was low among employed compared to unemployed

women. This finding may suggest that there is a need to heighten and intensify outreach and education especially in workplaces beyond traditional health facilities to reach all women since pregnancy itself is an indication of exposure to HIV and the working-class women can benefit from PrEP.

Enhanced and accessible PrEP as well as awareness is one preventive strategy for HIV prevention, and this study has demonstrated that some disparities exist in awareness among women attending antenatal care services. High awareness was observed among women from low-density areas, which may suggest better economic status, and with age group 21–30 years, the most reproductive age group while it was a surprise to see low awareness in those with tertiary education. In terms of age, this study is in keeping with studies conducted in MSM (Kingsley et al., 2018).

In the current study, although knowledge of the HIV status of the participants or their partners was not significant, other studies have reported that HIV testing knowledge is associated with awareness of PrEP (Eaton et al., 2015). One plausible explanation for the finding from the study by Eaton and colleagues could be due to the nature of the study participants. In that study the participants were MSM and these are at higher risk of HIV therefore they are more likely to be aware of PrEP and linked to understanding of HIV prevention services compared to participants of this study. Also, given the power imbalance that exists between men and women, men when it comes to negotiating for safer sex practices thus, it is likely that men in a study conducted by Eaton and colleagues were at elevated risk and knew several prevention measures compared with women in this study.

#### **Access and Awareness/Utilization**

In this study, less than half (47%) of the participants knew that healthcare facilities offer PrEP. This is similar to a study by Ayala and colleagues (2013) who reported that there is

generally unacceptably poor access to PrEP service, an essential HIV prevention tool. They reported that only 43% of individuals who were in need of PrEP had access to the service. One of the possible explanations for the poor access to PrEP is higher levels of homophobia which a number of studies have observed especially in settings where education and counselling have not been intensified (Song et al., 2011; Knox et al., 2011). Likewise, discussants in qualitative studies from South Africa, Kenya, and Nigeria have highlighted some challenges sounding access to PrEP such as social stigma and criminalization which result in poor health-seeking behaviour and affect both awareness and uptake of PrEP (Arreola et al., 2012; Stall et al., 2006). The data from this study and that of others (Ayala et al., 2013) indicate that healthcare workers with the responsibility to facilitate HIV care services and access should consider community engagement and connection of PrEP to antenatal services in order for pregnant women and others who may be in need to be comfortable with service providers. This finding is in keeping with other studies with different study populations such as gay, bisexual, and MSM which have suggested the use of familiar local community-based organizations and non-judgmental service providers as these may look at PrEP service from a holistic perspective (Jackson et al., 2012; Poynten et al., 2012) and is likely to increase both awareness and use of PrEP.

#### **Eligibility and Awareness/Utilization of PrEP**

According to Centers for Disease Control (CDC) guidelines, to be eligible for PrEP, an individual should test HIV-negative (CDC, 2015). This study found that less than half (47%) of the participants knew who is eligible for PrEP. Participants who did not know the eligibility criteria for PrEP were more likely not to be aware and not to utilize PrEP. In line with the finding of this study, another study which was set out to evaluate PrEP eligibility criteria, reported that participants who were enrolled despite not knowing the eligibility criteria were less likely to use PrEP (Cornelisse et al., 2018). This finding may suggest educating clients in HIV care services if the current trend in

HIV prevalence especially in resource-poor settings is to be reversed.

#### **Limitations of the study**

This study has some limitations. First, the collected data is self-reported thus, there is a possibility of social desirability bias in responses. Second, lack of measurement of how participants perceive. HIV risk makes conclusions about its role in determining PrEP awareness and utilization limited. Third, the cross-sectional nature of the study cannot determine the causality of PrEP awareness and utilization, but the description of determinants allows for potential identification variables that would be beneficial for future prospective studies to consider when identifying potential causality variables. Also, the study participants were only pregnant women attending antenatal care services in selected hospitals of Lusaka city, and therefore, this study's ability to make generalizable recommendations is limited.

#### **Strength of the study**

The study also has several strengths. The nature of study participants, pregnant women which means they were exposed to unprotected sex thus predisposing them to HIV infection, in a geographic setting with high HIV prevalence gives an opportunity for these women at risk to be aware and uptake PrEP. In this study, with majority being unemployed and from high-density areas may suggest most of them were poor and this may reflect the disparities identified as contributing to the disproportionate HIV prevalence or access to health care services that exist between men and women as well as rich and poor populations in Zambia.

#### **Conclusion**

In this study, the awareness was low (53.1%) as well as utilisation (12.2%) of PrEP. The factors associated with awareness were knowing the facilities that offer PrEP, eligibility, and importance of PrEP. Non-utilisation of PrEP was associated with not knowing the correct source of PrEP, not knowing eligibility for PrEP, not

knowing the importance of PrEP as well as not knowing that pregnant women can take PrEP.

### Recommendations

Government and stakeholders should identify new and strengthen existing strategies that can improve awareness and uptake of PrEP through health and educational promotion during antenatal care services. These should be the first steps towards increasing awareness and utilization of PrEP. Professional health workers with the responsibility to attend to pregnant women during antenatal care should heighten the dissemination of information and availability as well as the importance of PrEP in order to begin to reverse the current HIV prevalence among women

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in Zambia. And if possible include a few words on PrEP on the cover page of the Antenatal cards.

Furthermore, health workers may need support and additional training to acquire skills that can be utilized to identify opportunities to discuss with women during antenatal care about the risk of HIV and encourage the uptake of potential options for HIV prevention such as PrEP.

Future researchers on this topic should try and do a prospective study and do country-wide research instead of limiting the study to selected hospitals in Lusaka.

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