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Nicholas Fonseca Nogueira Date

PrEP Awareness and Use among Reproductive Age Women in Miami, Florida

By

Nicholas Fonseca Nogueira

MPH

Applied Epidemiology

Nicole Luisi

Committee Chair

Maria L. Alcaide

Committee Member

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By

Nicholas Fonseca Nogueira

Bachelor of Science and Bachelor of Arts

University of Miami

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Thesis Committee Chair: Nicole Luisi, MPH, MS

Thesis Field Advisor: Maria L. Alcaide, MD

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Abstract

PrEP Awareness and Use among Reproductive Age Women in Miami, Florida

By Nicholas Fonseca Nogueira

Introduction: Miami, Florida is the epicenter of the HIV epidemic in the US, with 20% of new HIV infections occurring in women. Despite the effectiveness of Pre-Exposure Prophylaxis (PrEP) in preventing HIV, only 10% of eligible women benefit from its use. This study evaluates PrEP awareness and use, and factors associated with PrEP awareness among sexually active women in Miami-Dade County, Florida.

Methods: From 2018 to 2022, cis-gender, HIV-negative, 18-45-year-old, sexually active women were recruited as part of a study evaluating recurrent bacterial vaginosis and HIV risk. Participants completed a questionnaire assessing: socio-demographics, HIV risk factors, history of HIV testing and reproductive tract infections, PrEP awareness and PrEP use. Factors associated with PrEP awareness were analyzed by Chi-square, Fisher's exact test, or studentized t-test. Multivariable logistic regression (MLR) was performed to identify factors associated with PrEP awareness.

Results: Overall, 295 women were enrolled (median age 31 (24-38) years). The sample was 49% Black, 39% White, and 34% Hispanic. Eighty percent were heterosexual, 24% had consistent condom use, and the mean number of male partners in the previous month was 1.6 (±2.57). Of the 63% who knew about PrEP, only 5% were on PrEP. Women with income below poverty line (OR=2.00 [1.04,3.87]; p=0.04), more male sexual partners (OR=1.30 [1.01,1.68]; p=0.04), prior HIV testing (OR=6.42 [2.83,14.52]; p<0.01), or a current diagnosis of bacterial vaginosis (OR=2.28 [1.18,4.40]; p=0.01) were more likely to be aware of PrEP. Lower odds of PrEP awareness were associated with being Black (OR=0.38 [0.15,0.96]; p=0.04), Hispanic (OR=0.18 [0.08,0.39]; p<0.01), Heterosexual (OR=0.29 [0.11,0.77]; p<0.01), and reporting inconsistent condom use during vaginal sex (OR=0.21 [0.08,0.56]; p<0.01).

Conclusion: Despite high risk for HIV acquisition, PrEP awareness is low among reproductive age women in a high-risk setting. Culturally tailored interventions are needed to increase PrEP awareness and uptake, especially among for Black and Hispanic women who have inconsistent condom use during vaginal sex.

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Table of Contents

List of Tables and Figures

Literature Review

Problem and Purpose

Women are disproportionally affected by HIV and use of effective HIV biomedical prevention tools is low. There is a paucity of information on factors associated with PrEP use and awareness among women of reproductive age in multiracial and multiethnic locations like Miami, a city with the highest number of new HIV infections in the US. Findings of this project could direct development of tailored public health interventions to increase PrEP uptake in diverse communities for sexually active women of reproductive age. Therefore, the aim of this cross-sectional study is to investigate associations of socio-behavioral and demographical factors with PrEP awareness and use among sexually active cis-gender women (n=195) between the ages of 18–45 years living in Miami, Florida.

HIV and Southern United States

The management of human immunodeficiency virus (HIV) infection has dramatically improved since the invention of antiretroviral therapies (ART). However, an important step in controlling the HIV epidemic continues to be identifying sexual behaviors and other factors that may increase the risk of HIV acquisition and transmission. The U.S. Deep South - AL, FL, GA, LA, MS, NC, SC, TN, TX - is home to high poverty levels, HIV diagnosis rate, and mortality rates of persons living with HIV; yet previous studies have identified regional inequities arising from differences in federal funding and lower allocation for funding for individuals living with

HIV in the South compare to other regions in the United States [1]. Despite having only 38% of the country's population, the Southern U.S accounts for 52% of new HIV diagnoses, with about 17.6 persons diagnosed per 100,000 [2, 3]. Florida, in particular, has one of the highest adult and adolescents incidence and prevalence of HIV in the nation, with 23.7 persons newly diagnosed and 615.0 persons living with HIV per 100,000 persons in 2019 [4, 5]. Approximately 25% of all new HIV cases in Florida are diagnosed in the county of Miami-Dade with about 20% of new incidences occurring in women [4-7]. Additionally, racial and ethnic disparities still persist. Hispanic/Latinx and Black individuals account for 29% and 41% of new incidences of HIV, even though they represent only 18% and 13% of the U.S. population, respectively [8].

HIV Transmission and Risk Factors

Women's increased risk of HIV has been characterized to the interplay of biological predictors, sociobehavioral factors, stigma, discrimination, and socioeconomic inequity [9]. Yet, there is evidence of global success in HIV prevention efforts through the reduction of mother-to-child HIV transmissions and improved ART adherence in women [9]. Mother-to-child HIV prevention strategies include treatment as prevention (TasP) given to HIV-infected pregnant women, PrEP to pregnant women at time of delivery, and post-exposure prophylaxis (PEP) to newborns [10]. It has also been suggested that HIV counseling, screening, and education of uninfected pregnant women provides a great opportunity for HIV prevention due to clinical recommendations of HIV testing during pregnancy [11]. As for horizontal transmission, risk factors for HIV infection among women include recent sexually transmitted infections (STI), bacterial vaginosis (BV), number of sexual partners, inconsistent condom use, substance use, and

partner violence, amongst many others [12, 13]. Heterosexual contact is the primary avenue for new HIV infections across all racial groups in female adults and adolescents; and more prominent in persons identifying as Black/African American (91%) or Hispanic/Latino (87%) [4]. Between HIV-serodiscordant couples, data from clinical trials have confirmed that ART-induced virologic suppression eliminates the risk of HIV transmission during sexual encounters; indicating that active and successful management of HIV is a critical component of prevention of transmission [10]. While others encourage a more comprehensive multidisciplinary approach beyond ART adherence, including counseling and sexual education to prevent HIV transmission in serodiscordant couples [14]. Specifically in women, novel methods like the use of microarray patches (MAPs) have been suggested as a platform for the delivery of contraceptives and antiretrovirals to protect sexual and reproductive health [15].

Sociobehavioral factors may also mediate risk of HIV acquisition. For instance, factors such as partner violence and substance use may decrease women's ability to use condoms to prevent HIV [16, 17]. Women who experience domestic violence by men are at a higher risk for contracting HIV [18]. In fact, findings from a study with 14,000 women demonstrated that intimate partner violence (IPV) increases the risk of HIV infection 3-fold (aOR = 3.44, 95% CI (1.28-9.22) and that 11.8% of cases of HIV infection among women were attributable to past year IPV [19]. In developing countries, additional considerations need to be made for women who are unable to negotiate monogamy and condom use practices, as they are also at an increased risk of HIV [20]. Women may also engage in condomless intercourse because they hope to conceive. Therefore, modern demands warrant an approach to HIV prevention that is tailored for the unique needs and experiences of women in the South, controlled by women, not reliant on partner negotiations, and that can be used during the process of conception.

PrEP Success in HIV Prevention among Women

The use of pre-exposure prophylaxis (PrEP) has been an effective tool for HIV prevention for eligible individuals when adherence is high [21]. If taken as prescribed, oral pill or long-acting injectable PrEP reduces the risk for sexual acquisition of HIV infection by approximately 99% [22]. Research has indicated that daily PrEP dosing, when compared to time-driven or event-driven dosing, improves coverage of sex events, adherence, and drug concentrations [23]. However PrEP adherence may be unique to each age group [24]. The U.S. South is a great setting for PrEP uptake as it contains the highest proportion of PrEP eligible persons living within a 60-minute drive of PrEP providers in the country [21]. Florida provides PrEP free of cost to individuals who qualify under the Department of Health and Human Service's "Ready, Set, PrEP" program in ending the HIV epidemic endeavors. This program ensures that individuals without health insurance coverage for prescription drugs, with a history of HIV negative testing prior to program initiation, PrEP prescription, and residing in the United States qualify [25]. Due to high rates of uninsured individuals in the South, lowering barriers to PrEP accessibility and coverage through federal programs presents an opportunity to facilitate and enhance PrEP uptake [21]. Furthermore, the association between low health literary and low PrEP is well-documented due to complexities in counseling, monitoring, and PrEP coverage services [21]. As a result, it may be beneficial to include PrEP information and education as part of routine primary care to reduce additional barriers to uptake [8]. Also, current online resources disseminating PrEP information surpass the reading level of most U.S. adults; suggesting that

improving readability of online PrEP information could enhance uptake [26]. Addressing a shift in language could work in tandem with other strategies needed to reduce PrEP stigma experienced at community and population levels to secure a broader reach of PrEP and HIV prevention programs.

Original WHO recommendations for oral PrEP from 2012 and revision in 2014 mainly included MSM, transgender women, and serodiscordant couples [9]. However, WHO guidance was expanded in 2015 following the findings of high-quality clinical trials to persons at substantial risk of HIV acquisition, which included cis-gender women [9]. According to National HIV Behavioral Surveillance (NHBS) data from 2019, only one-third of heterosexually active adults in HIV prevalent cities are aware of PrEP and 1% actively use it; even though heterosexual individuals comprise 23% of new HIV diagnosis [27]. Among heterosexually active adults indicated for PrEP use in 2015, approximately 70% were females [28].

Currently, emtricitabine/tenofovir (Truvada; oral PrEP) and Cabotegravir (long-aciting injectable form of PrEP) are available options for cis-gender women engaging in vaginal sex; with emtricitabine/tenefovir alafenamide (Descovy; oral PrEP) not FDA approved for protection of HIV transmission during vaginal sex [29]. Despite the potential effectiveness of PrEP for decreasing HIV acquisition risk, uptake of PrEP among women most at risk for acquiring HIV is low. PrEP-to-need ratio (PnR) for women, defined as the number of PrEP users by new HIV diagnoses, is approximately one-fifth the PnR of men, indicating possible unmet HIV prevention needs among women [30, 31]. Women also account only for 4.7% of filled PrEP prescriptions in 2016 [12, 32-34]. It has been suggested that uptake challenges may stem from knowledge deficits instead of attitudes toward prevention [35] as PrEP awareness is especially low in women, with awareness levels ranging from 10–20% [12, 32].

Predictors of PrEP Awareness and Use

It is critical to examine factors related to HIV acquisition and contexts surrounding its prevention as those may inform individual PrEP awareness levels, especially for women. As PrEP indications are simple (i.e. those engaging in sexual practices, recent bacterial STIs, sex partners of unknown/HIV positive status, and inconsistent condom use), additional factors like gender identity, sexual orientation, substance use, and pregnancy intentions are important in assessing HIV risk and recommendations for testing and prevention [36, 37]. In an article published by Algarin et. al in 2021, the authors used a socioecological framework which included individual (e.g., age, sex, race/ethnicity), interpersonal (e.g., transaction sex, sexual partners, stigma) and community (e.g., urban/rural residence, primary care) factors as predictors of PrEP awareness among people living with HIV [38]. Socioecology provides a great modeling strategy to assess predictors of PrEP awareness due to the exclusive environmental influences and experiences that are unique to women.

With many PrEP trials and advertising focused on HIV prevention for men who have sex with men and the LGBTIA+ community, cis-gender women are often left out of research and education efforts, and culturally adapted interventions to increase PrEP awareness and uptake among women are growing but still scarce [27, 39]. Given the high percentage of Hispanic women living in Miami, it is necessary to ensure Hispanic women are included in these efforts. In addition, Black women are disproportionately affected by HIV and underutilize PrEP, indicating that this may be an important demographic group to target HIV prevention strategies [40]. As a result, the current study sought to identify factors related to PrEP awareness and uptake among sexually active women of reproductive age in Miami-Dade County, Florida. The

identification of these factors is critical step in the planning and evaluation of public health program. Findings from this project will inform future interventions at targeting improvements in awareness and use of PrEP for women at-risk.

Manuscript

PrEP Awareness and Use among Reproductive Age Women in Miami, Florida

Introduction

Despite having only 38% of the country's population, the Southern U.S accounts for 52% of new HIV diagnoses, with about 17.6 persons diagnosed per 100,000 [2, 3]. Florida has one of the highest adult and adolescents incidence and prevalence of HIV in the nation, with 23.7 persons newly diagnosed and 615.0 persons living with HIV per 100,000 persons in 2019 [4, 5]. Approximately 25% of all new HIV cases in Florida are diagnosed in the county of Miami-Dade with about 20% of new incidences occurring in women [4-7]. Risk factors identified for HIV infection among women include recent sexually transmitted infections (STI), bacterial vaginosis (BV), number of sexual partners, inconsistent condom use, substance use, and partner violence, [12, 13]. In addition, heterosexual contact is the primary transmission route of new HIV infections across all racial groups; and more common in women identifying as Asian (93%), Black/African American (91%), or Hispanic/Latino (87%) [4]. Factors such as partner violence and substance use may decrease women's ability to use condoms to prevent HIV [16, 17]. Women may also decide not to use condoms because they hope to conceive. This warrants an

approach to HIV prevention tailored for the unique needs and experiences of women in the South, controlled by women, does not rely on condom use, and can be used during the process of conception.

The use of pre-exposure prophylaxis (PrEP) has been an effective tool for HIV prevention for eligible individuals when adherence is high [21]. If taken as prescribed, oral pill or long-acting injectable PrEP reduces the risk for sexual acquisition of HIV infection by approximately 99% [22]. Among heterosexually active adults indicated for PrEP use in 2015, approximately 70% were females [28]. Despite the potential effectiveness of PrEP for decreasing HIV acquisition risk, overall uptake of PrEP among women most at risk for acquiring HIV is low. PrEP-to-need ratio (PnR) for women, defined as the number of PrEP users by new HIV diagnoses, is approximately one-fifth the PnR of men, indicating possible unmet HIV prevention needs among women [30, 31]. Women also account only for 4.7% of filled PrEP prescriptions in 2016 [12, 32-34]. PrEP awareness is especially low in women, with awareness levels ranging from 10–20% [12, 32]. As result, it has been suggested that uptake challenges may stem from knowledge deficits instead of attitudes toward prevention [35].

Thus, it is critical to examine factors related to HIV acquisition and contexts surrounding its prevention as those may inform individual PrEP awareness levels. As PrEP indications are simple (i.e. those engaging in sexual practices, recent bacterial STIs, sex partners of unknown/HIV positive status, and inconsistent condom use), additional factors like gender identity, sexual orientation, substance use, and pregnancy intentions are important in assessing HIV risk and recommendations for testing and prevention [36, 37]. With many PrEP trials and

advertising focused on HIV prevention for men who have sex with men and the LGBTQIA+ community, cis-gender women who have sex with men are often left out of research and education efforts, and culturally adapted interventions to increase PrEP awareness and uptake among women are growing but still scarce. [39]. Given the high percentage of Hispanic women living in Miami, it is necessary to ensure Hispanic women are included in these efforts. As a result, the current study sought to identify factors related to PrEP awareness and uptake among sexually active women of reproductive age in Miami-Dade County, Florida.

Methods

Recruitment

Recruitment occurred between November 2018 and January 2022 in Miami-Dade County, Florida. Individuals were reached through passive (e.g., flyers, friend & family referrals, and word-of-mouth) and active (e.g., coordinator outreach and community events) efforts as part of an on-going longitudinal study "Women, HIV, Immunology, Microbiome, and Sexual Health" (WHIMS; R01AI138718). This study evaluates factors associated with BV recurrence using a multidisciplinary approach [41]. Referrals from the Florida Department of Health, Center for AIDS Research (CFAR; P30A1073961), and the Center for HIV Research and Mental Health (CHARM; P30MH116867) contributed significantly to recruitment endeavors. Cis-gender women, between the ages of 18-45, and sexually active within the last three months were eligible. Women were not eligible if they were pregnant; immunosuppressed; diagnosed with HIV; had an intrauterine device; had a history of cervical surgical treatment or cervical intra-epithelia neoplasia (Grade 2 & 3); had recent antibiotic use or allergy/intolerance to metronidazole; or were diagnosed with chlamydia or gonorrhea within the last 2 months. The

University of Miami Institutional Review Board (IRB# 20180758) approved the study, and all participants completed written informed consent prior to initiating study assessments.

Procedures and Measures

Participants were telephonically screened and completed a self-administered questionnaire remotely (e.g., electronically or by phone) using REDCap. The questionnaire assessed sociodemographic characteristics, PrEP awareness and use, medical history (e.g., HIV testing, hormone use, pregnancy), and HIV risk factors (e.g., recent and lifetime sexual behaviors, condom use, and substance use). PrEP related outcomes included "Have you ever heard about PREP (Truvada)? This is a pill that can be taken to prevent HIV infection" and "Are you currently taking PrEP?" Subsequently, an in-person visit with additional testing including a gynecological examination at the Infectious Diseases Research Unit at the University of Miami was conducted to determine enrollment eligibility for the larger study, at which point participants were tested for HIV, pregnancy, STIs, and BV.

Statistical Analysis

Descriptive analyses were conducted to characterize the study population. Group comparisons between PrEP aware and unaware participants were analyzed using Chi-square, Fisher's exact test, or studentized t-test, where appropriate. A multivariable unconditional logistic regression was performed to obtain maximum likelihood estimates of factors contributing to PrEP awareness. Inclusion of covariates in a full model were based on scientific reasoning, biological plausibility, and previous literature [42-44]. Backward elimination using $\alpha=0.25$ was used for model selection. Assumption of linearity between independent variables and log-odds was

assessed using Box-Tidwell's test; while multicollinearity was assessed by condition indices ≥ 30 and variance decomposition proportions ≥ 0.8 [45]. Influential observations were examined in plots using individual delta-beta measurements and Cook's distance. Goodness of fit was evaluated using Hosmer-Lemeshow Statistic. Adjusted odds ratios (aOR) and 95% confidence intervals (CI) were reported and presented as forest plots. Observations with missing values for the response or explanatory variables were not included in the model. Statistical significance was determined using $\alpha = 0.05$ and analyses were conducted using SAS statistical software version 9.4 (SAS Institute).

Results

Overall, 295 women were enrolled in the study. The sample was diverse in terms of race, ethnicity, and socioeconomic status (Table 1). About 63% of women had heard about PrEP. Out of the 185 women reporting having heard about PrEP, only 5.4% were actively using it. Many HIV acquisition behaviors were generally higher in the PrEP aware compared to the PrEP unaware group. Mean number of sexual partners (1.8 v. 1.3; p=0.04), history of sex with same sex (77% v. 23%; p<0.01), history of sex for drugs, money, or shelter (85% v. 15%; p=0.03) and having BV (72.4% v. 27.6%; p<0.01) (Table 2).

Covariates included in the multivariable logistic regression were race, ethnicity, below poverty line status, sexual orientation, BV status, history of HIV testing, condom use during vaginal sex, and number of sexual partners (Appendix Tables 1 and 2). A non-significant Box-Tidwell test indicated no violations of linearity assumption. There was no evidence of multicollinearity in the selected model (largest CNI=12.3). Hosmer and Lemeshow goodness-of-fit test indicated no

evidence of lack of fit (X^2= 6.9; df=8; p=0.55). Adjusted Odds Ratios are presented in Figure 1 and Appendix Table 2. In multivariable logistic regression, women with average household income below poverty line (OR=2.00 [1.04,3.87]; p=0.04), more sexual partners (OR=1.30 [1.01,1.68]; p=0.04), prior HIV testing (OR=6.42 [2.83,14.52]; p<0.01), and BV (OR=2.28 [1.18,4.40]; p=0.01) were more likely to be aware of PrEP. Lower odds of PrEP awareness were associated with being Black compared to white (OR=0.38 [0.15,0.96]; p=0.04), Hispanic compared to non-Hispanic (OR=0.18 [0.08,0.39]; p<0.01), Heterosexual compared to non-heterosexual (OR=0.29 [0.11,0.77]; p<0.01), and reporting inconsistent condom use (OR=0.21 [0.08,0.56]; p<0.01).

Discussion

Miami, a culturally and ethnically diverse city, has one of the highest HIV incidences and prevalence in the United States [4, 6, 7]. This study assessed predictors of PrEP awareness in sexually active women of reproductive age in Miami-Dade County, Florida. Results show that although most women had heard about PrEP (62.7%), there was a low reported PrEP use among this group (5.4%). This is consistent with the national PrEP use previously observed in the literature [12, 32, 33].

Women with recent HIV testing have higher odds of PrEP awareness, which could indicate that women with higher HIV risk are more likely to educate themselves about HIV prevention options. It could also indicate that providers are using HIV testing visits as an opportunity to provide PrEP education to women. Research on the timing of PrEP education supports the notion that there are opportunities to provide education at specific timepoints, such as STI screenings,

peri-conception, and contraceptive counseling [13, 46, 47]. Although women diagnosed with BV at the study visit were more likely to have heard about PrEP, it is unclear whether this relationship is mediated by increased levels of sexual risk, prior STI testing experiences due to reoccurring BV, or another reason. It is encouraging that the women below the poverty line were more likely to be aware of PrEP, although education alone will not address financial barriers to PrEP uptake.

Our findings are in agreement with other reports highlighting ethnic and racial disparities in PrEP awareness and use [32]. Reports indicate that while Hispanic women welcome the idea of using PrEP, [48], PrEP awareness is significantly lower than in non-Hispanics, especially among Hispanic adolescents aged 14-17 [49]. Given the low awareness and high willingness to use PrEP among Hispanic women [50], culturally appropriate and sexual education initiatives present a clear and effective opportunity in the delivery of PrEP information and services in ethnically diverse areas. Similarly to Bush et al. [51], we found that Black women were less likely to have heard about PrEP than White women. This suggests that additional efforts are needed that are tailored to these groups.

Findings that heterosexual women and women with inconsistent condom use during intercourse are less likely to know about PrEP are concerning because receptive vaginal intercourse with men is associated with a higher HIV acquisition risk than other sexual practices common among women who have sex with women only. It is possible that women who access LGBTQIA+ community resources are exposed to the higher levels of PrEP messaging geared towards sexual minority men who have sex with men, and additional messaging is needed in community

locations frequented by heterosexual women.

This study is limited in the sample size as rates of PrEP uptake were too low to examine as factors associated with PrEP uptake. Although safe spaces were provided and questionnaires were self-administered, some participants may have felt compelled to give socially desirable responses as many questions were sensitive and private in nature. Given this sample represents an ethnically diverse population in Miami, its generalizability may be limited to less diverse areas across the country. Furthermore, PrEP is available in Florida at no cost to individuals. As a result, individuals residing in states with more restricting PrEP coverage policies may be subjected to unique sociopolitical environments that differ when compared to Miami.

Studies have suggested improved socioeconomical resources, PrEP knowledge, health literary, accessibility and insurance coverage, and perceived HIV risk as potential targets for improvement in PrEP initiation rates [21, 34, 52]. Furthermore, obstacles to PrEP initiation among women specifically included framing of PrEP information, effects of long-term medication use, social cues, insurance coverage, and challenges in identifying women with an increased HIV-risk [12, 34, 53]. Overall, our study found that PrEP education efforts in Miami-Dade County have been moderately successful in reaching women, but there is still a need for more focused outreach towards Black, Hispanic, and heterosexual women.

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Expanded Discussion

Miami, a culturally and ethnic diverse city, has one of the highest HIV incidences and prevalence in the United States [4, 6, 7]. This study assessed predictors of PrEP awareness in sexually active women of reproductive age in Miami-Dade County, Florida. Results show that although most women had heard about PrEP (62.7%), there was a low reported PrEP use among this group (5.4%). This is consistent with the national PrEP use previously observed in the literature [12, 32, 33]. In addition, HIV acquisitions factors (e.g., Bacterial Vaginosis (BV), number of sexual partners, history of sex for drugs, money, shelter, and current STIs) were generally higher in women who were aware of PrEP. This could be because women engaging in behaviors that increase risk of HIV may be receiving more PrEP education from providers and counselors due to meeting PrEP eligibility criteria. Furthermore, results from this study found that household income below the poverty line, number of sexual partners, HIV testing, BV, race, ethnicity, sexual orientation, and condom use were all significant predictors of PrEP awareness. To our knowledge, this is the first study to examine predictors of PrEP awareness in reproductive-age women in Miami.

Women with recent HIV testing have higher odds of PrEP awareness, which could indicate that women with higher HIV risk are more likely to educate themselves about HIV

prevention options. It could also indicate that providers are using HIV testing visits as an opportunity to provide PrEP education to women. Research on the timing of PrEP education supports the notion that there are opportunities to provide education at specific timepoints, such as STI screenings, peri-conception, and contraceptive counseling [13, 46, 47]. Although women diagnosed with BV at the study visit were more likely to have heard about PrEP, it is unclear whether this relationship is mediated by increased levels of sexual risk, prior STI testing experiences due to reoccurring BV, or another reason. It is encouraging that the women below the poverty line were more likely to be aware of PrEP, although awareness alone may not address financial barriers to PrEP uptake. For instance, PrEP cost and concerns about insurance and Medicaid coverage is a well-documented barrier to PrEP interest, uptake, and adherence in cis-gender women [29].

Our findings are in agreement with other reports highlighting ethnic and racial disparities in PrEP awareness and use [32]. Reports indicate that while Hispanic women welcome the idea of using PrEP, [48], PrEP awareness is significantly lower than in non-Hispanics, especially among Hispanic adolescents aged 14-17 [49]. Given the low awareness and high willingness to use PrEP among Hispanic women [50], culturally appropriate and sexual education initiatives present a clear and effective opportunity in the delivery of PrEP information and services in ethnically diverse areas. Similarly to Bush et al. [51], we found that Black women were less likely to have heard about PrEP than White women. This suggests that additional efforts are needed that are tailored to these groups.

Findings that heterosexual women and women with inconsistent condom use during intercourse are less likely to know about PrEP are concerning because women who have sex with men are those most at risk for acquiring HIV, while women who have sex exclusively with

women are unlikely to acquire HIV. It is possible that women who access LGBTQIA+ community resources are exposed to the higher levels of PrEP messaging geared towards sexual minority men who have sex with men, and additional messaging is needed in community locations frequented by heterosexual women. Current PrEP educational program focus their attention on men who have sex with men and transgender women as they are at highest risk for HIV. However, this study reveals a great opportunity to address an unmet need by engage heterosexual women in future PrEP communications.

This analysis is subject to several limitations. Due to the small sample size relative to PrEP uptake, it was not possible to examine factors associated with PrEP uptake. In addition, the cross-sectional study design limited the ability to control for unknown confounders. Although safe spaces were provided and questionnaires were self-administered, some participants may have felt compelled to give socially desirable responses as many questions were sensitive and private in nature. Given this sample represents an ethnically diverse population in Miami, its generalizability may be limited to less diverse areas across the country. Furthermore, PrEP is available in Florida at no cost to individuals. As a result, individuals residing in states with more restricting PrEP coverage policies may be subjected to unique sociopolitical environments that differ when compared to Miami.

Studies have suggested improved socioeconomical resources, PrEP knowledge, health literary, accessibility and insurance coverage, perceived HIV risk as potential targets for improvement in PrEP initiation rates [21, 34, 52]. Furthermore, obstacles to PrEP initiation among women specifically included framing of PrEP information, effects of long-term medication use, social cues, insurance coverage, and challenges in identifying women with an increased HIV-risk [12, 34, 53]. Future studies may want to examine predictors of PrEP

awareness with validated scores to ascertain key areas can be target for improvement in PrEP uptake. In addition, studies should attempt to address challenges to PrEP education while simultaneously investigating barriers to uptake. Public health interventions focusing on facilitators of PrEP that women encounter may also ease the transition from awareness to uptake, when indicated. The health belief model would be a phenomenal pivot point in influencing PrEP awareness and uptake by educating the public on susceptibility and detriments of HIV and benefits of sexual protection for preventing STIs. In summary, our study suggests that PrEP messaging in Miami-Dade County have been moderately successful in reaching women, but there is still a need for more focused outreach towards Black, Hispanic, and heterosexual women, and for interventions to increase uptake in this vulnerable population.

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Tables

Table 1. Sociodemographic, history of pregnancy and HIV testing, and contraceptive use by PrEP Awareness Status (n = 295)

	PrEP Aware* **(n = 185)**	**PrEP Unaware*** **(n = 110)**	**p**
Age – years, median (IQR)	32 (25 – 39)	29 (22 – 37)	0.06
Race – n (%) [a]			**<0.01**
Black or African American	107 (74.3)	37 (25.7)	
White	61 (52.6)	55 (47.4)	
Other	17 (48.6)	18 (51.4)	
Ethnicity - n (%)			**<0.01**
Hispanic	43 (43.4)	56 (56.6)	
Non-Hispanic	142 (72.4)	54 (27.6)	
Heterosexual - n (%)	135 (57.5)	100 (42.6)	**<0.01**
Relationship Status – n (%) [b]			0.59
Legally Married	19 (55.9)	15 (44.1)	
Unmarried with Partner	35 (70.0)	15 (30.0)	
Unmarried	107 (62.6)	64 (37.4)	
Other	24 (60.0)	16 (40.0)	
Employment – n (%)	75 (58.1)	54 (41.9)	0.15
Below Poverty Line – n (%)	98 (72.6)	37 (27.4)	**<0.01**
Educational Attainment – n (%)			0.32

Less than High School	31 (75.6)	10 (24.4)	
Completed High School	56 (62.2)	34 (37.8)	
Some College or Associates Degree	49 (57.7)	36 (42.4)	
Completed 4 years of college	31 (58.5)	22 (41.5)	
Attended or Completed Graduate School	18 (69.2)	8 (30.8)	
History of Pregnancy – n (%)	112 (67.5)	54 (32.5)	0.06
History of HIV test – n (%)	159 (70.7)	66 (29.3)	**<0.01**
Contraception Use– n (%) [c]	27 (52.9)	24 (47.1)	0.11

Notes

*PrEP Aware - persons who heard about PrEP; PrEP Unaware – persons who never heard about PrEP.

[a] Asian, Native American, Native Hawaiian or pacific islander were collapsed into Other.

[b] Widowed, divorced, separated, and never married were collapsed into Unmarried.

[c] Contraceptive use refers to pills, patch, ring, implant (etonosgestrel), or depot (DMPA).

Legend. Participants completed self-administered or interviewer-administered questionnaire. Responses were stratified by PrEP awareness. Descriptive statistics were reported as counts (frequencies), mean (standard deviation), and median (interquartile range). Group comparisons were examined using chi-square, fishers exact test, and studentized test, where appropriate. Race, ethnicity, sexual orientation, poverty line status, and history of HIV test significantly differed between PrEP aware and unaware groups.

Table 2. PrEP Use, Risk Behaviors, BV, and STI by PrEP Awareness Status (n = 295)

	PrEP Aware* (n = 185)	**PrEP Unaware* (n = 110)**	**p**
PrEP use – n (%)	10 (100.0)	N/A	N/A
HIV Risk Behaviors			
History of Substance Use – n (%) [a]	98 (65.3)	52 (34.7)	0.34
Alcohol Use – n (%) [†]	109 (63.4)	63 (36.6)	0.78
Age at First Sexual Encounter – median (IQR)	16 (14 – 18)	17 (15 – 18)	0.12
Sexually Active – n (%) [†]	161 (62.4)	97 (37.6)	0.77
Condom Use during Vaginal Sex– n (%) [†]			0.11
Always	41 (69.5)	18 (30.5)	
Sometimes	25 (50.0)	25 (50.0)	
Never	88 (62.9)	52 (37.1)	
New Male Sexual Partners – n (%) [†]	34 (54.0)	29 (46.0)	0.11
Number of Sexual Partners– μ ± SD [†]	1.8 ± 3.15	1.3 ± 0.95	**0.04**
Sexual Partners in past 5 years - μ ± SD	5.5 ± 7.95	4.5 ± 5.98	0.25
Number of Sexual Encounters- μ ± SD [†]	6.5 ± 7.92	6.8 ± 7.33	0.68
History of Sex with same Sex – n (%)	57 (77.0)	17 (23.0)	**<0.01**
History of Sex for Drugs, Money, or Shelter – n (%)	17 (85.0)	3 (15.0)	**0.03**
Current BV and STI			
Bacterial Vaginosis – n (%)	105 (72.4)	40 (27.6)	**<0.01**
Current STI (n = 140) - n (%) [b]	29 (80.6)	7 (19.4)	0.19

*PrEP Aware - persons who heard about PrEP; PrEP Unaware – persons who never heard about PrEP.

† Timeframe defined within the last month unless otherwise specified

[a] Substance use includes medical or recreational marijuana, cocaine, crack, heroin, methamphetamine, hallucinogens, club drugs, or any other illicit or recreational drugs.

[b] Sexually transmitted infections were laboratory confirmed and include gonorrhea, chlamydia, and trichomonas.

Legend. Participants completed self-administered or interviewer-administered questionnaire. Responses were stratified by PrEP awareness. Participants were assessed for bacterial vaginosis (BV) using Amsel and Nugent criteria. Individuals with confirmed BV were also tested for gonorrhea, chlamydia, and trichomonas. Descriptive statistics were reported as counts (frequencies), mean (standard deviation), and median (interquartile range). Group comparisons were examined using chi-square, fishers exact test, and studentized test, where appropriate. Number of sexual partners, history of sex with same sex, history of sex for drugs/money/shelter, and bacterial vaginosis significantly differed between PrEP aware and unaware groups.

(APPENDIX) Table 3. Multivariable Logistic Regression Assessing Predictors of PrEP Awareness (n = 247) *

Parameter		OR (95% CI)	p
Race (reference = White)			
	Black	0.38 (0.15, 0.96)	**0.04**
	Other	0.77 (0.29, 2.05)	0.61
Hispanic (reference = Non-Hispanic)		0.18 (0.08, 0.39)	**<0.01**
Below Poverty Level		2.00 (1.04, 3.87)	**0.04**
Heterosexual (reference = LGBTIA+)		0.29 (0.11, 0.77)	**0.01**
Diagnosed with BV		2.28 (1.18, 4.40)	**0.01**
History of HIV Test		6.42 (2.83, 14.52)	**<0.01**
Condom Use (reference = Always)			
	Sometimes	0.21 (0.08, 0.56)	**<0.01**
	Never	0.60 (0.27, 1.31)	0.20
Higher Number of Sexual Partners in past month		1.30 (1.01, 1.68)	**0.04**

Note

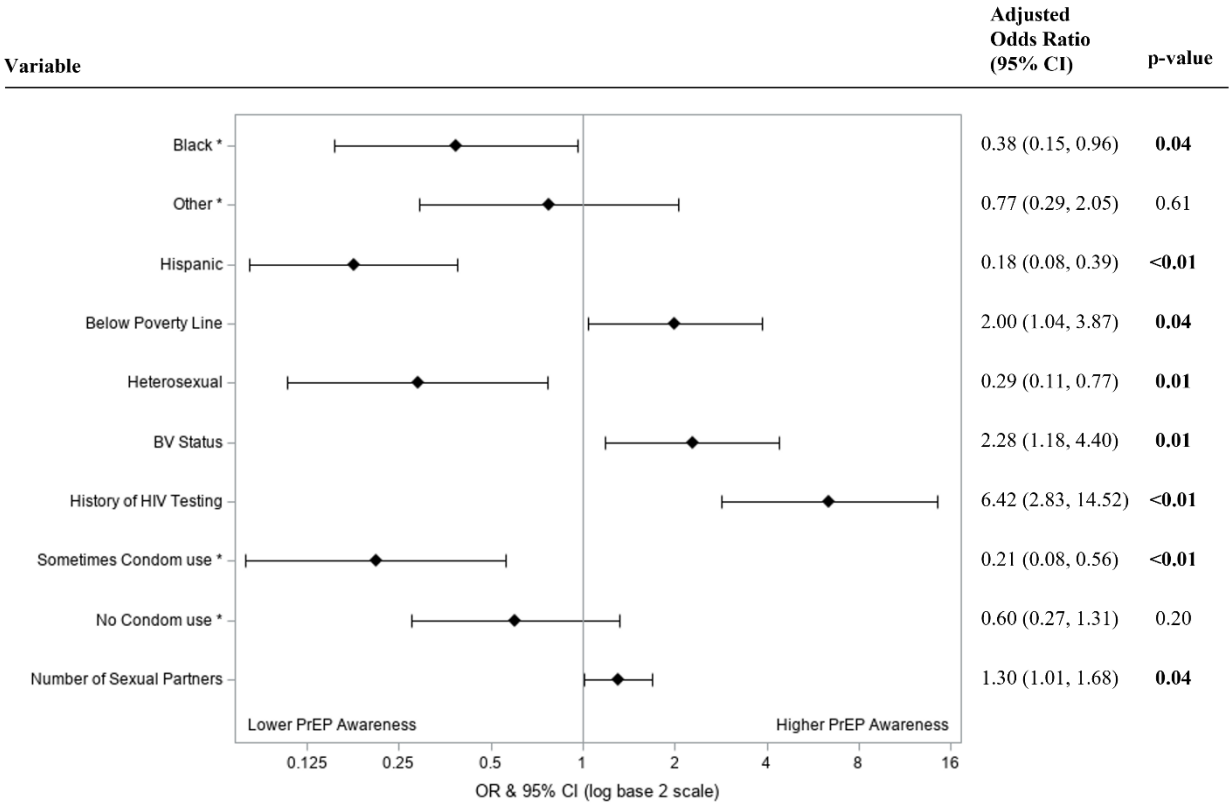
* 51 observations were deleted due to missing values for the outcome or explanatory variables.

Legend. Predictors of PrEP awareness in a multivariable logistic regression model containing race, ethnicity, poverty line status, sexual orientation, BV status, history of HIV testing, condom use, and number of sexual partners after backward elimination. Adjusted odd ratios (aORs) were calculated and presented with 95% confidence intervals and p-values. Significant predictors of PrEP awareness included identifying as black (reference = white), Hispanic (reference = non-

hispanic), average monthly household income below the poverty line, sexual orientation, BV diagnosis, history of HIV testing, sometimes using condoms (reference = always), and having more sexual partners.

Figures

Figure 1. Adjusted Odds Ratios for PrEP Awareness, by Predictors



**Note. Reference Category for Race was White & Condom Use was "Always"*

Legend. Predictors of PrEP awareness in a multivariable logistic regression model containing race, ethnicity, poverty line status, sexual orientation, BV status, history of HIV testing, condom use, and number of sexual partners. Adjusted odd ratios (aORs) were calculated and presented using a log base 2 scale in a Forest Plot. Null line is indicated for no predictor effects and bolded lines represent aORs with 95% confidence intervals. Bolded lines above and below the null line indicate increased or decreased odds of PrEP awareness, respectively.