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ORIGINAL PAPER

Associations Among Perceived HIV Risk, Behavioral Risk and Interest in PrEP Among Black Women in the Southern US

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Abstract
Utilizing data from Southern women, we created an HIV risk index with expanded partner-level factors to better capture women who may benefit from HIV pre-exposure prophylaxis (PrEP). We examined the relationships between potential HIV risk as estimated by laboratory-confirmed bacterial STIs, HIV risk index, perceived HIV risk, and interest in PrEP. Women had multiple PrEP indications; partner characteristics better differentiated STI status than other indicators. Perceived HIV risk differentiated STI status, significantly correlated with the HIV risk index, as well as predicted greater interest in PrEP. Findings can inform how best to evaluate HIV risk and PrEP acceptability among women.

Keywords PrEP · Women · Black or African American · United States

Introduction

Overall, individuals in the US have a 1 in 99 chance of being diagnosed with HIV at some point in their life [1]. However, underlying this overall statistic are significant racial and geographic disparities; while Black men have over 7 times the lifetime risk of an HIV diagnosis of White men, Black women have nearly 20 times the risk of White women [1]. Lifetime HIV risk is greatest for people living in the South, with Georgia ranked 3rd overall (1 in 51 chance) [1]. Reducing HIV among women, especially Black women in the Southern US, is therefore a public health priority.

Pre-exposure prophylaxis (PrEP) is an effective, female-controlled HIV prevention strategy that is not optimally utilized among women at risk for HIV in the Southern US. The daily fixed dose combination of tenofovir disoproxyl fumarate and emtricitabine (TDF/FTC) has been approved for HIV prevention since 2012. Clinical trials and real-world demonstration projects have demonstrated that daily oral PrEP is effective in preventing HIV in women when taken regularly. In the setting of alarming rates of new HIV infections among men who have sex with men (MSM), PrEP promotion for MSM has rapidly escalated, and awareness has increased to as high as 68% among MSM in parts of the US [2]. In contrast, US women report low PrEP awareness; for example, in a multi-site study conducted in 2014, < 10% of women at risk for HIV had heard of PrEP, but once informed, most women found the option to be attractive [3]. While the Centers for Disease Control and Prevention (CDC) estimates that 176,670 US women may benefit from PrEP [4], its use remains disproportionately low for women when compared to men. In 2016, only 7% of PrEP users in the US were women, who accounted for 19% of new HIV diagnoses, and PrEP prescriptions were lowest in Southern states and states with higher proportions of African-American residents [5].

Per US Public Health Service (USPHS) clinical guidance, PrEP is appropriate for HIV-negative heterosexual women who are at "substantial risk" for contracting HIV, especially when they reside in high HIV burden areas [6]. Substantial risk includes: being in a sexual relationship with a HIV-positive partner, inconsistent or non-use of condoms during sex, having a high number of sex partners, recent acquisition of a sexually transmitted infection (STI), engaging in transactional sex, or sharing injection or drug preparation equipment. Currently there is no validated HIV risk assessment tool for capturing substantial risk for US women, and given that the absolute incidence of HIV infection among

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US women is relatively low, development of a validated risk assessment tool that can predict HIV acquisition risk among US women is not feasible [7]. However, a 2017 study conducted among MSM suggests that USPHS guidance for identifying PrEP candidates omits important factors that contribute to substantial HIV risk, such as substance use and partner and relationship attributes [i.e., intimate partner violence (IPV)]; when these indicators were included, the enhanced risk assessment better identified new HIV infections [8]. Specific to the assessment of women who may benefit from PrEP in the US, some experts have recommended including partner characteristics such as partner's concurrency, recent incarceration history, and older age [9], as well as a woman's recent and lifetime IPV as behavioral factors to consider when assessing PrEP eligibility [10].

Helping providers better identify who would benefit from PrEP, particularly in HIV high burden areas, is an important first step in improving PrEP use among women. However, it is unclear if reporting behavioral risk indicators translates to interest and acceptability of PrEP among women. Indeed, beliefs about personal risk for acquisition of HIV are essential to understanding an individual's motivation to engage in protective or risk behaviors. For instance, a woman who believes she is at risk for HIV may be more accepting of new HIV prevention strategies like PrEP to reduce her risk, whereas a woman who has low perceived risk may be less interested. Thus, careful history taking around sexual health that also captures other elements of a woman's personal experiences, including her beliefs about her own risk, may provide opportunities for patient-centered discussions regarding HIV prevention, including PrEP [9].

Dual-process theories posit that people think about their risk both analytically (i.e., cognitive) and affectively (i.e., emotional). A cognitive assessment of perceived risk inquires about "likelihood" of infection or appraisal of behaviors contributing to their risk for HIV [11]. Affective risk assessments are more intuitive measure of HIV risk, and are often captured with items related to worry about contracting HIV, for example [11]. However, studies often only include a single item to assess perceived risk for HIV, which fails to capture both cognitive and emotional aspects of perceived risk. Though cognitive and emotional aspects of perceived risk are modestly correlated, they are generally considered as distinct constructs [11]. Understanding the extent to which perceived risk for HIV, measured with both cognitive and emotional measures of risk-perception, relates to women's actual behavioral risk indicators (i.e., the items included on an HIV risk assessment for PrEP eligibility) and interest in PrEP may help further inform the client-centered communication and HIV risk-reduction counseling providers engage in with their female patients. For example, some women may be behaviorally at risk for HIV and also readily perceive their HIV risk and therefore may be potentially more "ready" for considering PrEP. Other woman may not perceive themselves as at risk for HIV, and thus discussions about PrEP may be less impactful without first implementing other communication strategies, like motivational interviewing techniques, that can help women better align their perceived risk with their actual behavioral risk for HIV.

The purpose of our study was to create an HIV risk assessment index that included expanded partner-level factors to better capture substantial HIV risk for women in the US. To the extent possible with secondary data, we based behavioral HIV risk assessment items on existing USPHS guidelines [6] for determining if a heterosexual woman is at "substantial risk" of HIV. We also added other partner-level indicators cited widely in empirical literature (e.g., sex with recently incarcerated partner; IPV), and recently in PrEP screening recommendations for women [8–10]. We then explored this enhanced HIV risk index's association with results from laboratory STI testing from a sample of Black emerging adult women (ages 18–24 years) in Atlanta, an identified high HIV burden city [1]. Though an enhanced HIV risk assessment tool may help providers better determine if a woman may benefit from PrEP, it is unclear how an individual's perceived HIV risk, measured with cognitive and emotional assessments of perceived risk, predicts women's interest in PrEP. Thus, we examined the relationship between the enhanced HIV risk index score, perceived cognitive risk of HIV/STI and worry about HIV (i.e., affective perceived risk), as well as examined the association between these variables and young Black women's interest in PrEP. In combination, our findings can inform how best to evaluate HIV risk and PrEP acceptability among this understudied population in a geographical HIV hot spot in the US.

Methods

Sample, Procedures, and Measures

We conducted a secondary analysis of data from a behavioral HIV prevention trial conducted among young Black women in Atlanta, Georgia [12]. From January 2012 to February 2014, 560 women were recruited through street and community outreach in Atlanta. Women were eligible if they self-identified as African-American, were 18–24 years old, were not married or pregnant, and had consumed alcohol on at least three occasions and had unprotected vaginal sex with a male in the past 90 days. Data collection included an audio computer-assisted self-interview (ACASI) survey. Questions on the survey included demographics and sexual history variables. After completing the ACASI, participants provided self-collected vaginal swab specimens which were assayed for *C. trachomatis* (CT) and *N. gonorrhoeae* (GC) using the BDProbeTec ET *C. trachomatis* and

N. gonorrhoeae Amplified DNA assay (Becton–Dickinson and Company, Sparks, MD). HIV testing was not included in the trial. Written informed consent was obtained from all participants, and the Emory University Institutional Review Board approved all study protocols. All analyses are based on data only from baseline assessments (collected prior to randomization and intervention participation).

HIV Risk Index

Five items were used from the ACASI survey for inclusion in the risk index: condomless sex at last sex (yes/no), recently (past 90 days) exchanged sex for goods or services (yes/no); recently (past 90 days) had vaginal sex with a male partner who was just released from prison or jail (yes/no); boyfriend/main partner had vaginal sex with another woman in the past 90 days (yes/no); recent (past 90 days) experience of IPV (yes/no). Yes was scored as 1 and no scored as 0, resulting in 0-5 possible risk indicators per person.

Perceived Behavioral Risk for HIV/STIs

A single item captured perceived cognitive assessment of behavioral risk for acquiring HIV or STIs: "How safe do you think your current behavior is in avoiding HIV and other sexually transmitted diseases?" Response options were: "Very safe (1)," "Safe (2)," "Unsure (3)," "Not very safe, (4)" or "Not safe at all (5)."

Worry About HIV

A single item assessed affective perceived risk for HIV, commonly measured as worry about contracting HIV: "How much do you worry that you could get HIV". Response options ranged from "Not at all (1)," to "Some (3)," to "A lot (5)."

PrEP Interest

An additional item captured interest in PrEP: "How likely would you be to use PrEP if it would protect you almost all the time (90% effective)?" Response options were: "Very unlikely (1)," "Unlikely (2)," "Neither likely or unlikely (3)," "Likely," or "Very likely (5)."

Data Analysis

Descriptive statistics were performed for sociodemographic variables and the above mentioned study measures. To assess the relationship between these study measures and potential HIV risk (as measured by STI status), we conducted one-way ANOVAs to determine if HIV risk index score, perceived behavioral HIV/STI risk, worry about HIV, and interest in PrEP differed by participants' laboratory-confirmed STI status. Results of the STI tests were not known to the participant at the time of the ACASI assessment. We used Pearson's correlations to examine the association between HIV risk index scores and participant's perceived behavioral HIV/STI risk and worry about HIV. Finally, we conducted linear regression models in order to examine the extent to with HIV risk index scores, perceived behavioral HIV/STI risk and worry about HIV were associated with interest in PrEP in simple and adjusted models.

Results

Demographics

Participants mean (SD) age was 20.6 (1.9) years. Most (66.1%) had at least graduated from high school or obtained an equivalent degree. Overall, 117 (20.9%) participants tested positive for CT and/or GC (18.8% CT positive and 5.2% GC positive). HIV risk index totals ranged from 0 to 5; 125 (22.3%) participants reported no risk indicators, 239 (42.7%) reported 1, 116 (20.7%) reported 2, 48 (8.6%) reported 3, 27 (4.8%) reported 4 and 5 (0.9%) reported all 5 indicators. Among all participants, interest in using PrEP ranged, with 20.0% reporting they would be very unlikely, 7.0% unlikely, 15.2% neither unlikely or likely, 14.8% likely, and 43.0% reported they would be very likely to use PrEP.

Study Variables and STI Status

Table 1 presents HIV risk index scores, perceived behavioral risk for HIV/STI, worry about HIV and PrEP interest, stratified by bacterial STI status (used as a proxy for potential HIV risk). There was a significant difference in HIV risk index score by STI status, with significantly higher index scores among those testing positive for an STI ($F(1,559) = 5.37$, $p = 0.02$). Among the individual HIV risk indicators assessed, condomless sex, transactional sex and IPV did not differ by STI status, but concurrent partners (Chi square = 2.94, $p = 0.086$) and partner incarceration history (Chi square = 3.78, $p = 0.052$) were more frequent among STI positive women. Perceived behavioral risk for HIV/STI also significantly differed by STI status, with higher perceived behavioral risk reported among those testing positive for an STI ($F(1,559) = 5.14$, $p = 0.02$). Neither worry about HIV nor PrEP interest differed by STI status.

Relationship Between HIV Risk Index Score, Perceived Behavioral HIV/STI Risk and Worry About HIV

The HIV risk index score was significantly positively associated with both perceived behavioral HIV/STI risk ($r = 0.39$, $p = 0.001$) and worry about HIV ($r = 0.31$, $p = 0.002$).

Table 1 HIV risk index score and frequency/percentages per item; stratified by sexually transmitted infection (STI) status (STI negative, STI positive)

Variable	STI negative (n = 443) Frequency (%)	STI positive (n = 117) Frequency (%)
HIV risk index, mean (SD)	1.28 (1.12)	1.55 (1.07)
0 indicators	106 (23.9%)	19 (16.2%)
1 indicator	198 (44.7%)	41 (35.0%)
2 indicators	79 (17.8%)	37 (31.6%)
3 indicators	33 (7.4%)	15 (12.8%)
4 indicators	23 (5.2%)	4 (3.4%)
5 indicators	4 (0.9%)	1 (0.9%)
Condomless vaginal sex at last sex	283 (63.9%)	83 (70.9%)
Exchanged sex for goods/money	51 (11.5%)	15 (12.8%)
Boyfriend has other sex partners[a]	86 (22.8%)	30 (31.3%)
Sex with male released from jail/prison	75 (16.9%)	29 (24.8%)
Intimate partner violence[a]	72 (19.5%)	24 (23.8%)
Perceived risk of HIV/STI, mean (SD)	2.38 (1.29)	2.68 (1.30)
Worry about HIV, mean (SD)	2.82 (1.48)	3.02 (1.42)
PrEP interest, mean (SD)	3.51 (1.59)	3.67 (1.49)
Very unlikely	94 (21.2%)	18 (15.4%)
Unlikely	30 (6.8%)	9 (7.7%)
Neither likely or unlikely	66 (14.9%)	19 (16.2%)
Likely	64 (14.4%)	19 (16.2%)
Very likely	189 (42.7%)	52 (44.4%)

STI status determined by nucleic acid testing of vaginal swabs for chlamydia and gonorrhea. Data presented as frequency (%) except as noted

[a]Data available for n = 370 (STI negative) and n = 101 (STI positive)

Further, we found only a modest positive correlation between perceived behavioral HIV/STI risk and worry about HIV ($r = 0.26$, $p = 0.001$), similar to previous studies supporting that cognitive and affective assessments of perceived risk are modestly correlated but distinct [11].

Association Between Study Variables and Interest in PrEP

In unadjusted models, there was a significant association between the HIV risk index score and interest in PrEP, ($F(1,558) = 8.68$, $p < 0.01$). Participant's interest in PrEP increased for each 0.174 point increase in their HIV risk index score. There was also a significant association between perceived behavioral risk for HIV/STI and interest in PrEP, ($F(1,558) = 13.15$, $p < 0.001$). Participant's interest in PrEP increased for each 0.183 increase in their perceived behavioral risk for HIV. However, worry about HIV was not significantly associated with interest in PrEP ($F(1,558) = 1.10$, $p = 0.294$) thus was not included in multivariable analyses. In a multiple stepwise linear regression model adjusting for education (women with higher education attainment were more interested in PrEP, $r = 0.113$, $p = 0.007$; age was not associated with PrEP interest), HIV risk index score, and perceived behavioral risk for HIV/STI, we found both education ($\beta = 0.10$, $p = 0.025$) and perceived behavioral risk ($\beta = 0.14$, $p = 0.001$) were significant predictors of interest in PrEP (overall $F(2,557) = 9.16$, $p < 0.001$); HIV risk index score was excluded from entry ($p = 0.09$).

Discussion

This is the first study to report PrEP indication and interest among a population of over 500 young Black women in the heart of the current US HIV epidemic—Atlanta, Georgia. This is important as young Black women are disproportionally affected by HIV and PrEP is substantially underutilized among this group [4, 5]. Sexually active young Black women in Atlanta had multiple indications for PrEP, measured using criteria recommended by USPHS clinical practice guidelines as well as expanded indicators recommended in recent PrEP guidance for optimizing PrEP among women [6, 9]. Importantly, the majority of these community-recruited young women reported they would be likely or very likely to use PrEP if available.

Notably, many of the sexually active women in our sample did not report any HIV risk factors, including 16% of women who tested positive for bacterial STIs during the same visit. This finding highlights the challenge of providers

identifying women at substantial risk for HIV infection, and the need for HIV risk assessment tools adapted for US women that include additional factors that affect HIV vulnerability. Indeed, the inclusion of two additional indicators recommended for women specifically [9] pertaining to partner characteristics (partner concurrency and partner incarceration history) better differentiated STI status among our sample of Black women in Atlanta than those included in USPHS-based indices (e.g., condomless sex and transactional sex). Our findings suggest that utilizing an expanded HIV risk assessment inclusive of more partner-related characteristics could better help identify women who may benefit from PrEP.

We also found women's perceived behavioral risk for HIV (a more cognitive/analytic assessment of perceived risk), but not their worry about HIV (a more affective/emotional assessment of perceived risk), differentiated STI status among our sample, as well as was significantly correlated with their HIV risk index score. Perceived behavioral risk for HIV also significantly predicted interest in PrEP in multivariable regression analysis, whereas HIV risk index score did not (though it did in simple regression models). In other words, women who perceived themselves to be at higher behavioral risk for HIV were more interested in and accepting of PrEP than women with lower perceived HIV risk. Thus, assessing women's beliefs about their own personal vulnerability to HIV, which potentially captures an element of personal motivation to engage in protective behaviors like starting PrEP, in addition to determining specific behavioral risk factors via an HIV risk assessment tool, may assist providers in identifying women at substantial risk for HIV who may be more readily accepting of a PrEP recommendation. On the other hand, women who do not perceive themselves to be at risk for HIV may be less likely to uptake PrEP if recommended based on their reported behavioral risk alone. Providers may wish to employ motivational interviewing strategies with these women first to help better align their perceived risk with their actual behavioral risk for HIV before recommending PrEP. Capturing both women's perceived HIV risk and their actual behavioral risk (i.e., the items on an HIV risk assessment for PrEP eligibility when taking a sexual history) can better inform patient-centered discussion regarding HIV prevention, including PrEP, with female patients. However, it should be noted that our study relied on ACASI to assess behavioral risk, which enhances confidentiality and reporting. In the context of an HIV risk assessment with a provider, face-to-face reporting may increase socially desirable reporting (i.e., under reporting of risk), particularly for behaviors that may be perceived as stigmatizing. In practice, it may be critical to assess HIV risk in a manner that enhances self-report (e.g., have women self-complete an HIV risk assessment as part of standard check-in paperwork).

Finally, our study found that two commonly used single-item measures for assessing "perceived HIV risk", which according to dual-process theory are assessing distinct aspects of perceived risk (cognitive and affective appraisals of risk), both related to behavioral risk as assessed by the HIV risk index [11]. We also observed that the two items were only modestly correlated, thus indicating they are tapping into distinct aspects of perceived risk [11]. However, the association between perceived risk and actual behavioral risk (i.e., HIV risk index) was stronger when using the cognitive measure of perceived risk (i.e., single item about perceived behavioral risk for HIV/STI) than the affective measure (i.e., worry about HIV), and only the cognitive measure of perceived risk significantly differed between those with and without an STI as well as was associated with interest in PrEP. Given that most studies only employ one item to assess perceived HIV risk, therefore only capture one dimension of perceived risk, our findings suggest that future studies assessing perceived HIV risk should employ two-item assessments to more robustly and accurately capture perceived risk to draw more accurate conclusions about the relationship between perceived risk, behavioral HIV risk factors, and PrEP interest/acceptability.

This study had limitations: missing data for some variables, no HIV testing, some bacterial STIs were not tested for (i.e., syphilis, though prevalence is low among women in this age group), parent trial inclusion criteria included some HIV risk factors resulting in overestimation of HIV risk if applied to overall population of young Black women in Atlanta, and questionnaires did not capture all items relevant for HIV risk in women according to USPHS guidelines. Despite limitations, to our knowledge, this is one of the first reports on potential PrEP eligibility and interest among young Black women in a high HIV incidence setting in the Southern US.

In conclusion, we demonstrate that sexually active, young Black women in Atlanta are interested in PrEP and would be considered as PrEP eligible per USPHS guidelines. Our data support recent recommendations to expand HIV risk assessments for women to include more indicators that capture elements of partner risk [9, 10], and further highlight the utility of also capturing women's perception of their own vulnerability to HIV. PrEP requires innovative screening and delivery approaches to optimize its benefit among women in high HIV-burden areas across the Southern US. Yet, to date, few efforts have occurred to improve Southern women's knowledge or access to PrEP. Interventions are urgently needed to increase PrEP awareness and delivery for this population.

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Compliance with Ethical Standards

Conflicts of interest J. Sales and A. Sheth are currently receiving grants from Gilead Sciences, Inc. (CO-US-276-4060).

Ethical Approval All procedures performed in studies involving human participants were in accordance with the ethical standards of the institution and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

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