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Sexual risk profiles among Black sexual minority men: Implications for targeted PrEP messaging

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Abstract

Black gay, bisexual, and other Black sexual minority men (BSMM) continue to experience some of the largest sexual health disparities in the U.S. Engaging BSMM in PrEP is crucial to improving sexual health outcomes and reducing disparities. However, knowledge of the profiles of sexual risk and PrEP initiation among this group is limited. This study used latent class analysis (LCA) to identify HIV risk and PrEP initiation patterns among BSMM in the HPTN 073 study (n=226). Guided by current CDC screening guidelines, latent class indicators included relationship status, condom use, number of sexual partners, substance use, sexually transmitted infection (STI) history, and partner HIV status. Age and PrEP initiation were used in a multinomial regression to identify correlates of class membership. Three latent classes were identified: Single with Condomless Partners, Single with Multiple Partners, and Serodiscordant Partners. Single with Multiple Partners had the highest conditional probabilities of having greater than three male partners, substance use before sex, and receiving an STI diagnosis. Serodiscordant Partners had a 100% conditional probability of condomless sex and having a male partner living with HIV. BSMM who initiated PrEP were less likely to be classified as Single with Condomless Partners

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Declarations

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Informed Consent. Informed consent was obtained from all individual participants included in the study.

Code availability (software application or custom code). Not applicable

than Serodiscordant Partners (AOR=0.07, 95% CI=0.02, 0.66). Findings support the need for culturally relevant tailored and targeted messaging for BSMM with multiple sexual risk indicators.

Keywords

HIV; Pre-exposure prophylaxis (PrEP); sexual health; Black sexual minority men; disparities

Introduction

Black gay, bisexual, and other Black sexual minority men (BSMM) continue to experience the greatest HIV-related health disparities in the United States (U.S.) (Centers for Disease Control and Prevention [CDC], 2020; Hess et al., 2017). Between 2010 and 2017, HIV incidence increased by 42% among BSMM ages 25–34 and in 2018, BSMM accounted for 37% of HIV incidence among all U.S. gay and bisexual men (CDC, 2020). Efforts to successfully engage BSMM in pre-exposure prophylaxis (PrEP) are urgently needed, since PrEP can reduce HIV acquisition risk by up to 99% (CDC, 2017; Volk et al., 2015). However, PrEP use remains low for this group and solutions to increase uptake remain elusive.

For HIV-uninfected adult men who have sex with men, the CDC recommends PrEP use for those with any male partner in the past six months, who are not in a monogamous partnership with another HIV-uninfected man, and who have either had condomless anal sex or a sexual transmitted infection (STI) in the past six months (CDC, 2018). Additional sexual risk indicators include drug use and being in a sexual relationship with HIV seropositive male partners (CDC, 2018). However, despite having an acute risk for HIV acquisition, BSMM are less likely to meet CDC PrEP indicators than other racial/ethnic groups (Ezennia et al., 2019; Hoots et al., 2016; Lancki et al., 2018; Rolle, Rosenberg, Siegler, et al., 2017). Studies have shown that only 52%–65% of BSMM who seroconverted had an indication for PrEP based on CDC guidelines (Hoots et al., 2016; Lancki et al., 2018; Sullivan et al., 2015) and that BSMM have higher proportion of meeting indications from other sexual risk assessments than CDC guidelines (Lancki et al., 2018).

Evaluating sexual risk among BSMM requires more nuanced approaches to identify best PrEP candidates, since they are more likely than other sexual minority men to use condoms (Maulsby et al., 2013; Millett et al., 2012; Sullivan et al., 2014) and uptake remains suboptimal even when removing structural barriers (Rolle, Rosenberg, Siegler, et al., 2017). Since many BSMM do not meet CDC indicators for PrEP and uptake remains low, a better understanding of sexual risk patterns is needed. Current guidelines rely upon independent, binary measures of behavioral risk (i.e., condom use, STI history, or relationship status) (CDC, 2018) and inadequately identify highest risk BSMM (Hoots et al., 2016; Rolle, Rosenberg, Luisi, et al., 2017). Therefore, current approaches to identify high risk BSMM and increase PrEP uptake among this group are limited.

To fill this gap, this study identified sexual risk and PrEP use patterns among BSMM in the HPTN 073 study, a culturally informed, client-centered intervention to support PrEP understanding, initiation, and adherence among BSMM in three U.S. Cities (Wheeler et al.,

2019). In the study, 79% of participants initiated PrEP, which exceeded reported uptake in other PrEP randomized controlled trials (Grant et al., 2014) or observational studies among BSMM (Hoots et al., 2016; Liu et al., 2016). Since few studies have shown high uptake of PrEP among BSMM, exploring the patterns of sexual risk and PrEP initiation among BSMM in HPTN 073 could provide insight into the behaviors of those who are most likely to initiate and identify targeted messaging strategies for those who are less likely to initiate. Although some correlates of PrEP initiation have been identified (Cahill et al., 2017; Hoots et al., 2016; Rolle, Rosenberg, Luisi, et al., 2017), clarification on the patterns of co-occurring HIV risk behaviors and PrEP use are still needed. Findings from this study could provide a foundation for culturally relevant tailored and targeted interventions to increase PrEP initiation among BSMM of different risk profiles.

Methods

This study utilized latent class analysis (LCA) using baseline data from the HPTN 073 study. Details of the study design have been previously published (Wheeler et al., 2019). LCA is a useful method to identify how a set of behaviors create different profiles of “risk” (Dangerfield II, Harawa, et al., 2018; Gilreath et al., 2014; Lanza & Rhoades, 2011). Specifically, LCA quantifies the profiles of co-occurring behaviors and identifies conditional probabilities of behaviors within latent classes (Lanza & Rhoades, 2011; Muthen, 2004). LCA can add to the understanding of how sexual risk profiles correlate to PrEP use along with a more accurate HIV risk assessment for BSMM that is not currently available to interventionists and clinical providers. Moreover, independent, binary outcome measures of condomless sex or relationship status limit the understanding of sexual risk behaviors among BSMM (Maulsby et al., 2013; Millett et al., 2012; Sullivan et al., 2014). LCA is one way to obtain more insight into nuanced patterns of sexual risk and consider the complex behavioral factors that influence PrEP initiation.

A total of 226 BSMM were recruited from Washington, D.C., Los Angeles, CA, and Chapel Hill, NC between 2013 and 2014 through peer referrals, venue-based sampling, local media and word-of-mouth. Eligibility criteria included: self-identified as Black; being 18 years of age; serologically confirmed HIV-uninfected; male at birth; and self-reporting at least one of the following criteria in the previous six months: condomless receptive or insertive anal intercourse with a male partner; having any anal intercourse with more than three male sex partners; having exchanged sex with a male partner for money gifts, shelter or drugs; having using drugs or alcohol before anal intercourse with a male partner; and being diagnosed with an STI (Wheeler et al., 2019). The HPTN 073 Study protocol was reviewed and approved by institutional review boards of University of California at Los Angeles, The University of North Carolina at Chapel Hill, and George Washington University. All study participants provided written informed consent, and study procedures for the present analysis were approved by the Johns Hopkins School of Medicine Institutional Review Board.

Latent Class Indicators

The following behaviors were assessed at enrollment and baseline and were used as latent class indicators based on the CDC risk behavior assessment to identify indications for sexual risk and PrEP among men who have sex with men (CDC, 2018):

Condom use.—Participants were asked to report if they had any condomless receptive or insertive anal intercourse with a male partners in the previous six months. Response options were dichotomous: “yes” and “no.”

Number of sexual partners.—Participants were asked to indicate whether they had receptive or insertive anal intercourse with greater than three male sexual partners in the previous six months. Responses were dichotomized as “yes” and “no.”

Substance use.—Participants were asked to indicate drug or alcohol use within two hours of sexual activity in the previous six months. Responses were dichotomized as “yes” and “no.”

STI History.—Participants were asked to indicate whether they received an STI diagnosis in the previous six months. Responses were dichotomized as “yes” or “no.”

Relationship status.—Participants were asked to indicate their relationship status from one of the following: Single/divorced/widowed; Married/civil union/legal partnership; Living with primary or main partner; or Have primary or main partner, not living together. Relationship status was dichotomized as “Single” or “In a relationship.”

Any HIV positive male partner.—Participants were asked to indicate the HIV status of their main male partner along with sexual behaviors with casual male partners who were living with HIV. Individuals who indicated the HIV status of their main male partner or any sexual behavior with a casual partner who was living with HIV were recoded as having any HIV positive male partner.

Covariates Associated with Latent Class Membership

Age.—Age was dichotomized into two categories: (1) 18–34 and (2) 35 and older.

PrEP Initiation.—Participants were offered and could initiate PrEP at any time between enrollment and week 48 of the study period. PrEP initiation was defined as self-report of taking the first dose of the PrEP prescription. Participants who initiated PrEP at any time during the course of the study were classified as “yes” for PrEP initiation.

Statistical Analysis

Variable recoding and descriptive statistics were conducted using SAS.9.4. LCA to explore underlying sexual risk profiles and PrEP initiation was conducted using Mplus 8.4. A series of LCA models specifying one to five latent classes was tested. To ensure that the global maximum likelihood estimates were reached, each model ran with 2000 starts, with a maximum number of iterations for each run being 1000 times. Indices used to determine

the optimal LCA solution included the Akaike information criteria (AIC) and the Bayesian information criteria (BIC) (Dangerfield II, Harawa, et al., 2018; Nylund et al., 2007). These criteria tested the improvement in fit for the model under consideration compared with a model with one less class. The best-fitting model was identified by considering the lowest log likelihood, AIC and BIC values before these values increased with the addition of another class. The entropy and interpretability of the classes were also considered during model selection (Dangerfield II, Craddock, et al., 2017; Dangerfield II, Harawa, et al., 2018; Nylund et al., 2007).

After identifying the best-fitting latent class solution, age and PrEP initiation were used as covariates in a multinomial regression model to identify the correlates of participants' classification to Class 1 and Class 2 relative to Class 3, the smallest class. Covariates were treated as auxiliary variables using the R3STEP option (Asparouhov & Muthén, 2014; Bakk et al., 2013; Muthen & Muthen, 2005), which allows one to initiate the multinomial regression and control for uncertainty in class assignment while maintaining the class structure and meaning found initially. This approach also yields adjusted odds ratios (AORs) and confidence intervals (CIs), illustrating associations between these covariates and class membership relative to Class 3.

Results

Table I describes the demographic and behavioral characteristics among BSMM in the HPTN 073 study. The mean age of the sample was 29.4 years ($SD=9.9$); 47.8% reported an income of less than \$20,000 in the previous 12 months. Most (82.7%) reported being single, divorced, or widowed; the remaining 17.3% reported being partnered. More than two-thirds (68.8%) reported having health insurance coverage in the previous 12 months. Regarding sexual risk behaviors in the six months prior to enrollment, 88.9% reported having condomless receptive or insertive anal intercourse, 45.6% reported having more than three male partners for anal sex, and 57.5% reported drug or alcohol use prior to sex. Thirty-six (15.9%) reported receiving an STI diagnosis in the six months prior to enrollment.

A comparison of model fit indicated a three-class solution as optimal (Table II). Class distribution highlighted three distinct latent profiles of BSMM in HPTN 073: Class 1 (Single, Condomless Partner), Class 2 (Single, Multiple Partners), and Class 3 (Serodiscordant Partners). Class 1 was the largest, comprising 69.4% of the sample, followed by Class 2 (19.0%) and Class 1 (11.5%).

Table III displays the latent class distributions and conditional probabilities of co-occurring sexual risk behaviors within each class. Single, Condomless Partners (Class 1) had the second highest probability of being single (84.1%), having condomless IAI or RAI in the previous 6 months (86.2%), and having a recent STI diagnosis in the previous six months (8.2%). Single, Multiple Partners (Class 2) had the highest conditional probability of being single (99.6%), having condomless IAI or RAI (90.5%), having greater than three male partners in the previous six months (93.6%), substance use before sex (58.1%), and receiving an STI diagnosis in the previous six months (42.6%). Serodiscordant Partners (Class 3) had an almost equal chance of being single (46.7%) and a 100% conditional

probability of engaging in condomless sex with a male partner and having a male partner who was living with HIV.

Table IV shows the multinomial regression of age and PrEP use as covariates associated with class membership relative to the smallest class (Serodiscordant Partners). BSMM who initiated PrEP had 93% lower odds of being classified as Single, Condomless Partners than Serodiscordant Partners relative to BSMM who did not use PrEP, after adjusting for age (AOR=0.07, 95% CI=0.02, 0.66). Additionally, BSMM ages 18–34 were marginally statistically significantly more likely to be classified as Single, Condomless Partners than Serodiscordant Partners compared to BSMM over age 35 (AOR=2.89, 95% CI=0.97, 8.61). There was no statistically significant difference by PrEP initiation or age comparing Single, Multiple Partners to men classified as Serodiscordant Partners.

Discussion

The objective of this study was to use latent class analysis (LCA) to identify HIV risk and PrEP initiation patterns among BSMM, as a basis to understand differences in sexual risk profiles and implications for targeted messaging for this group. This study identified three latent classes of sexual risk among BSMM in the HPTN 073 study: (1) Single, Condomless Partners, (2) Single, Multiple Partners, and (3) Serodiscordant Partners. Single, Condomless Partners comprised the largest class, followed by Single, Multiple Partners, than Serodiscordant Partners. Across all classes, men displayed high (>85%) conditional probabilities of condomless sex and varying probabilities of other sexual risk indicators in the previous six months. Our findings confirm previous research that suggest that PrEP guidelines may not sufficiently identify sexual risk patterns among BSMM and that targeted strategies are needed to increase PrEP use among for BSMM of varying sexual risk profiles (Dangerfield II, Harawa, et al., 2018; Hoots et al., 2016; Lancki et al., 2018; Sullivan et al., 2015).

Although Single, Condomless Partners comprised the largest class of the sample, PrEP users were more likely to be classified as Serodiscordant Partners. This is an important finding that shows lower odds of PrEP use among a key subgroup of BSMM with high probabilities of sexual risk indications who comprise most of the sample. Since some BSMM assess their PrEP needs based upon partner type and partner HIV status (Ober et al., 2017; Wilton et al., 2015), targeted PrEP messaging could involve behaviors focus on single men with patterns of condomless sex with partners of HIV-negative or unknown status. Condomless sex with partners of unknown HIV status confers greater risk of transmission than condomless sex with a partner of known HIV infection with an undetectable viral load (Eisinger et al., 2019; Hall et al., 2015; Vallabhaneni et al., 2012). Therefore, HIV uninfected BSMM who have partners living with undetectable viral loads may not be the highest risk candidates in need of PrEP, despite the fact that having a partner living with HIV is noted as a sexual risk indicator (CDC, 2018). However, this study cannot confirm that partners living with HIV had an undetectable viral load. Therefore, data on the risk of transmission from these partners is unavailable. Nonetheless, tailored and targeted messaging strategies to support PrEP initiation for BSMM emphasizing the risk of condomless sexual behaviors with casual partners are needed.

Single, Multiple Partners only comprised one-fifth of the sample but displayed the highest conditional probabilities of condomless sexual behaviors, having more than three male partners, substance use before sex, and STI history relative to the other two classes. Other studies utilizing LCA among BSMM (Dangerfield II, Harawa, et al., 2018) and other SMM subgroups (Dangerfield et al., 2020; Dangerfield II, Craddock, et al., 2017; Dangerfield II, Carmack, et al., 2018) have found that the smallest proportions of samples have highest risk behaviors requiring intervention. These findings also support the need for tailored and targeted messaging strategies for BSMM with a combination of high sexual risk indicators. Specifically, healthcare providers should discuss the additive risks associated with having multiple partners, condomless sex, substance use, and having an STI rather than independent risk behaviors (e.g., condomless sex or STI history) (Hightow-Weidman et al., 2019). Since Single Men Multiple Partners had the greatest conditional probability of having multiple partners, substance use before sex, and STI history, healthcare providers could use these indicators as a gateway to introduce PrEP to BSMM with these behaviors. Additionally, methods for assessing the relative risk of multiple behaviors on HIV acquisition are needed.

Limitations should be considered for this study. The small sample size, use of self-reported sexual risk behaviors and the generalizability of findings is limited as sites reflect three U.S. regions using convenience sampling. However, this is one of the largest studies of U.S. BSMM focusing on PrEP uptake, and therefore provides much needed insight into the risk behavior profiles of these men. Additionally, the sample displayed high-risk behaviors due to the inclusion criteria of the HPTN 073 study, thus limiting generalizability to BSMM generally. Lastly, the impact of the sexual health counseling and client centered care coordination of the HPTN study on PrEP uptake and risk behaviors in this study is unknown.

Despite limitations, this research provides important insight into the sexual risk profiles among BSMM and PrEP using BSMM. Different messaging strategies could be used to target BSMM of different risk profiles (Turner et al., 2020). An alternative screening tool could be designed to identify BSMM of different subgroups for targeted messaging. Potentially, a clinical tool could be designed to classify and identify the relative sexual risk and PrEP need of individuals with multiple risk indicators. Future research should continue to identify profiles of sexual risk generally and among PrEP-using BSMM. Additional research should also explore the role of sexual positioning practices (i.e., insertive or receptive anal sex) in the sexual risk profiles of BSMM, since risk of HIV varies by sexual positioning (Dangerfield II, Smith, et al., 2017; Wilton et al., 2015) and some BSMM perceive their sexual risks relative to sexual positioning (Dangerfield II, Ober, et al., 2018; Dangerfield II, Smith, et al., 2017; Irvin et al., 2015; Ober et al., 2017). Larger longitudinal studies to identify potential changes in sexual risk behaviors and PrEP adherence among BSMM should also be conducted. Culturally-tailored research should also identify the motivations for sexual risk and PrEP use patterns among BSMM of different sexual risk profiles to aid in the design of targeted messaging strategies.

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Table 1.

Baseline demographic and behavioral characteristics of Black sexual minority men in HPTN 073 (n=226)

	n (%)
Age	
Range	18–69
Mean (SD)	29.4 (9.9)
Sexual Orientation	
Gay/Homosexual/Same Gender Loving	160 (70.1)
Other	66 (29.2)
Highest education completed	
Some High School	10 (4.42)
High School Graduate or Equivalent	46 (20.3)
Vocational/trade/technical school	10 (4.42)
BA/BS degree	45 (19.9)
AA or other 2 year degree	10 (4.4)
Masters or other advanced degree	22 (9.7)
Employment Status	
Employed full time	85 (37.6)
Employed part-time	68 (30.1)
Self-employed	12 (5.3)
On disability	4 (1.8)
Unemployed or between jobs	48 (21.2)
Other	9 (3.9)
Income past 12 months*	
Less than \$20,000	108 (47.8)
Between \$20,000 and \$40,000	55 (24.3)
More than \$40,000	60 (26.6)
Marital status	
Single/divorced/widowed	187 (82.7)
Primary or main partner, not living together	12 (5.3)
Living w/primary or main partner	24 (10.6)
Married/civil union/legal partnership	3 (1.3)
Health insurance coverage	
Yes	155 (68.6)
No	71 (31.4)
Study Location	
Washington D.C.	75 (33.2)
Los Angeles, CA	76 (33.6)
Charlotte/Wake County, NC	75 (33.2)
Condomless sex past 6 months	

	n (%)
Yes	201(88.9)
No	25(11.1)
Anal sex with > 3 male partners past 6 months	
Yes	103 (45.6)
No	123 (54.4)
Exchange sex for money, gifts, shelter, or drugs past 6 months	
Yes	28 (12.4)
No	198 (87.6)
Drug or alcohol use before sex past 6 months	
Yes	130 (57.5)
No	96 (42.5)
STI diagnosis past 6 months	
Yes	36 (15.9)
No	190 (84.1)

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Table 2.

Tests of Model Fit

	Loglikelihood	AIC	BIC	aBIC	Entropy	LMR/LRT
Class 1	-715.76	1443.53	1464.05	1445.03		
Class 2	-703.77	1433.55	1478.02	1436.82	.628	0.043
Class 3	-693.25	1426.51	1494.92	1431.53	.754	0.008
Class 4	-686.98	1427.96	1520.32	1434.75	.796	0.042
Class 5	-682.33	1432.67	1548.97	1441.22	.782	0.566

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Table 3:

Latent class distribution of sexual risk indicators (n=226)

Latent Class Indicators	Class 1: Single with Condomless Partners 157 (69.4%)	Class 2: Single with Multiple Partners 43 (19.0%)	Class 3: Serodiscordant Partners 26 (11.5%)
Relationship Status			
Single or not in a committed relationship	0.841	.996	.467
Relationship	0.159	.034	.533
Condomless IAI or RAI	0.862	.905	1.00
3 male partners	.313	.936	.190
Substance use before sex	.574	.581	.571
STI history	.082	.426	.000
Any HIV positive male partners	.000	.466	1.00

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Table 4.

Multinomial regression model of covariates associated with class membership relative to Class 3: Serodiscordant Partners

Class 3:Serodiscordant Partners=REF	AOR (95% CI)	<i>p</i>
Class 1: Single with Condomless Partners		
Age 18–34	2.89 (0.97, 8.61)	.057
PrEP Initiation	0.07 (0.01, 0.66)	.020
Class 2: Single with Multiple Partners		
Age 18–34	1.72 (0.42, 7.00)	.451
PrEP Initiation	1.72 (0.01, 262.79)	.833

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