



Published in final edited form as:

AIDS Care. 2020 May ; 32(5): 551–556. doi:10.1080/09540121.2019.1659921.

Understanding the impact of a syndemic on the use of pre-exposure prophylaxis in a community-based sample of Behaviorally PrEP-eligible BMSM in the United States

Cristian J. Chandler^{1,2,*}, Leigh A. Bukowski^{1,2}, Derrick D. Matthews^{1,3,**}, Mary E. Hawk^{1,2}, Nina Markovic^{1,4}, Ronald D. Stall^{1,2}, James E. Egan^{1,2}

¹Center for LGBT Health Research, Graduate School of Public Health, University of Pittsburgh, 130 De Soto Street, Pittsburgh, PA, USA 15261

²Department of Behavioral and Community Health Sciences, Graduate School of Public Health, University of Pittsburgh, 130 De Soto Street, Pittsburgh, PA, USA 15261

³Department of Infectious Diseases and Microbiology, Graduate School of Public Health, University of Pittsburgh, 130 De Soto Street, Pittsburgh, PA, USA 15261

⁴Dental Public Health, School of Dental Medicine, University of Pittsburgh, 3501 Terrace St, Pittsburgh, PA 15213

*Department of Epidemiology, Rollins School of Public Health, Emory University, 1518 Clifton Road, Atlanta, GA 30322; Yale University Center for Interdisciplinary Research on AIDS, 130 College Street, Suite 200, New Haven, CT 06510

**Department of Human Behavior, Gillings School of Global Public Health, University of North Carolina, 361 Rousenau Hall, Chapel Hill, NC 27599

Abstract

HIV Pre-Exposure Prophylaxis (PrEP) has shown great promise in reducing HIV transmission among affected populations; however, PrEP uptake among Black men who have sex with men (BMSM) has stalled. This study compares BMSM using PrEP and BMSM at risk for HIV not using PrEP based on differences in behavior, psychosocial conditions and the presence of a syndemic (n=1,411). BMSM reporting PrEP use were significantly more likely to report three of five HIV risk behaviors and three of four psychosocial conditions. Odds of reporting PrEP use increased as the number of psychosocial conditions increased such that BMSM with three psychosocial conditions (AOR=5.65, 95% CI: 3.17, 10.08) and four conditions (AOR=18.34, 95% CI: 5.01, 67.20) demonstrated significantly greater odds of PrEP use compared to BMSM reporting one or less conditions. While BMSM at greatest risk are using PrEP, strategies are still needed for men at varying risk levels.

Keywords

pre-exposure prophylaxis; black men who have sex with men; syndemic; psychosocial conditions; chemoprophylaxis

Introduction

Pre-exposure prophylaxis (PrEP), a daily tablet of Truvada® is believed to have the ability to greatly reduce and even eliminate HIV seroconversions in groups with greater than average risk (Brooks, Landovitz, Regan, Lee, & Allen Jr, 2015; Grant et al., 2014; Grant et al., 2010; Haire & Kaldor, 2013). There appear to be disparities in PrEP uptake among Black men who have sex with men (BMSM) and White MSM; however, as BMSM have one-in-two lifetime chance of acquiring HIV, advancing HIV bio-behavioral prevention is a priority (Centers for Disease Control and Prevention, 2012, 2014a, 2014b).

Researchers studying racial HIV disparities found that behavior alone (e.g. rates of condomless anal intercourse) could not explain the difference in HIV infection rates (Millett, Flores, Peterson, & Bakeman, 2007; Millett, Peterson, Wolitski, & Stall, 2006); however, these studies did suggest that variances in HIV screening and medical services use have an important role (Maulsby et al., 2014; Millett et al., 2006). Studies are still necessary to uncover the factors associated with PrEP uptake among BMSM in order to improve uptake strategies (Eaton, Driffin, Bauermeister, Smith, & Conway-Washington, 2015; Eaton et al., 2018).

The theory of syndemic production, positing that two or more interrelated epidemic and endemic factors form a confluence of health crises impacting health outcomes (Singer, 2000; Stall et al., 2003) was used along with the 2014 CDC PrEP guidelines (Centers for Disease Control and Prevention, 2014b) to uncover associations of PrEP use among BMSM reporting behavioral HIV risk.

Methods

From 2014-2017, 5,858 MSM and transgender women were recruited to Promoting Our Worth Equality and Resilience (POWER), a serial cross-sectional study of delayed HIV testing and care for BMSM, at Black Pride events in six U.S. cities: Atlanta, GA, Detroit, MI, Houston, TX, Memphis, TN, Philadelphia, PA and Washington, D.C. The study team used two-hour blocks of time location sampling as described in previous literature to recruit participants (Karon & Wejnert, 2012; Kendall et al., 2008). Consenting participants completed a 20-minute self-administered behavioral health survey on an electronic tablet and HIV screening. Unique identifier codes were assigned to all participants in order to identify duplication (Hammer et al., 2003). All study procedures were approved by the University of Pittsburgh Institutional Review Board. More information about recruitment methods can be found elsewhere (Eaton et al., 2015; Matthews et al., 2016).

The current study includes those who: 1) currently identify as male; 2) identified as HIV-negative at the time of the survey; 3) identified as “Black” or “African American” and 4) reported HIV risk activity or current PrEP use.

Measures

Current PrEP use.—Participants were asked to self-report if they were currently taking Truvada[®] to prevent HIV infection as an outcome variable. Responses were recoded dichotomously (0= not currently taking PrEP, 1= currently taking PrEP).

HIV Behavioral Risk Variables.—The behavioral risk variables were developed to closely adhere to the 2014 CDC guidelines for PrEP use based on the years of survey administration (Centers for Disease Control and Prevention, 2012, 2014b). BMSM who reported behavior that conveyed greater HIV risk in any of the following five categories, were included in the analysis: 1) reporting condomless anal sex with someone HIV-positive, or HIV-positive most recent partner; 2) diagnosis with a sexually transmitted infection (STI) in past year (e.g. Chlamydia); 3) reporting 50% or less condom use for anal sex; 4) self-reported sex work engagement regardless of giving or receiving money, drugs or other goods; and 5) reporting three or more partners in the last year as a threshold of risk (Koblin et al., 2006; Mustanski, Garofalo, Herrick, & Donenberg, 2007; Simon Rosser et al., 2008).

Syndemic Variables.—A total of four of the most often used psychosocial condition categories among MSM reported in literature were considered to contribute to a syndemic for analysis (Chandler et al., 2019; Tsai & Burns, 2015). Dichotomous variables were created to assess participants who reported 1) polydrug use defined as using three or more drugs in the previous three months (e.g. cocaine, inhalant “poppers”) not including marijuana (Mimiaga et al., 2015; Stall et al., 2003); 2) past-year intimate partner violence (IPV) defined as physical assault (e.g. being slapped) by a relationship partner; 3) past-week depressive symptomology as defined by the CESD-10 (Andresen, Malmgren, Carter, & Patrick, 1994); and 4) reporting a binge drinking frequency of more than once per month (Jie, Ciyong, Xueqing, Hui, & Lingyao, 2012; Wong, Kipke, & Weiss, 2008).

Analytic Procedure

Of the 1,431 participants who met the inclusion criteria, twenty were eliminated due to missing data and listwise deletion. After demographic comparisons of variance, multivariable logistic regressions were conducted with the number of syndemic conditions associated with PrEP use controlling for demographic variables, year and city of data collection. As syndemic counts may be limited to additive results, it has been suggested to include measures of synergy of syndemic variables (Tsai & Burns, 2015). Three measures were used, namely the relative excess risk of the interaction (RERI), attributable proportion of the interaction (AP), and the synergy index (S) with AP used for OR most often (Rothman, Greenland, & Walker, 1980) for pairwise comparisons of synergy. For all analyses, alpha was set to 0.05 and were conducted in Stata 14.2 (Stata Corp, College Station, TX).

Results

Demographic comparisons of the sample are presented in Table 1. There were significant differences among participants using PrEP and those not using PrEP based on education and relationship status (both $p < 0.001$), reports of an HIV-positive partner in the last 12 months, last year STI and past year sex work (all $p < 0.001$). Men also varied by previous 3-month poly drug use, past year IPV and problematic binge drinking (all $p < 0.001$) with no significant difference by depressive symptomology.

The impact of syndemic condition counts on PrEP is presented in Table 2. In model 1, college educated (AOR=0.39, 95% CI: 0.28, 0.55) and graduate-degree educated participants (AOR=0.50, 95% CI: 0.32, 0.79) had less odds of being on PrEP and those in a relationship (AOR=1.89, 95% CI: 1.40, 2.54) had significantly higher odds of reporting PrEP use. Model 2 demonstrates a minority of BMSM was significantly more likely to be on PrEP as the number of syndemic conditions reported increased, such that BMSM reporting three conditions (AOR=5.65, 95% CI: 3.17, 10.08) and four conditions (AOR=18.34, 95% CI: 5.01, 67.20) were significantly more likely to report PrEP use than those reporting no syndemic conditions.

Table 3 displays the results of pairwise synergy measures in RERI, AP and S. RERI and AP greater than zero show greater than additive synergy, and a value of S above one indicates synergy (Knol et al., 2011). There were synergistic effects between all of the syndemic variables for BMSM who reported current PrEP use. These measures verify that there is synergy between these variables and that a syndemic is present.

Discussion

This study used syndemic theory to examine the differences in PrEP use among behaviorally PrEP-eligible BMSM from a community-based, non-clinical sample. All of the men in this analysis were indicated for PrEP, however only a minority reported use. This analysis found no significant differences in PrEP use associated with current health insurance coverage which differs from some earlier literature (Bauermeister, Meanley, Pingel, Soler, & Harper, 2013; Pérez-Figueroa, Kapadia, Barton, Eddy, & Halkitis, 2015).

A minority of BMSM were more likely to be on PrEP at each level of increasing syndemic count. This suggests that perhaps BMSM at the greatest risk have been successfully engaged in PrEP, and that PrEP efforts may have been less robust among men with comparatively less HIV risk.

Analyses of the joint effects and synergy seeking greater than additivity found that depressive symptomology had a synergistic effect with all other syndemic variables: polydrug use, problematic binge drinking, as well as IPV, which may indicate a renewed need to ensure that mental health is included in interventions aimed at increasing PrEP uptake.

Despite best efforts, there are limitations to this analysis. Data were provided by self-report and subject to recall bias and possible social desirability bias. Mirroring other studies

suggesting slowed PrEP uptake by BMSM, less men reported use yielding large confidence intervals. This study took place while PrEP access was expanding and may not have captured structural changes of PrEP uptake. Several of the syndemic variables were defined by a single question and may not be exhaustive; however, whenever possible the survey instrumentation used validated measures and scales. The generalizability of the sample may be limited, although national data collection increases confidence in these data. Self-reports of PrEP use are an important step in understanding non-clinical samples of BMSM, however, there was no objective biological measure of adherence; future studies should include a biological measure of adherence. Additionally, some of the behaviors that have been reported by BMSM using PrEP have been associated with non-adherence among MSM living with HIV (Chesney et al., 2000). Further exploration of these behaviors as well as the determination of future needs such as adherence interventions is warranted.

Conclusion

These findings highlight the underlying differences in PrEP uptake among BMSM currently at risk for HIV drawn from the community. While the BMSM reporting PrEP use in this sample appear to be those most at risk for HIV, greater PrEP uptake will be necessary to make large-scale changes in the incidence of HIV among BMSM. These findings provide support to ensuring that multiple practitioners are aware of bio-behavioral intervention and perhaps another method of engaging mental health providers and BMSM could be the co-location of health services, which has been suggested previously (Smith, Toledo, Smith, Adams, & Rothenberg, 2012). Lastly, this analysis suggests that while practitioners may be correctly focusing on those considered most at risk, additional strategies will be required to more than stall increases in HIV incidence and prevalence among this critical group.

Acknowledgements:

We thank the Center for Black Equity and local Black Pride organizations for partnering with us to implement POWER, the community based organizations who performed onsite HIV testing on the study's behalf, the thousands of study participants who volunteered their time to contribute to this research, and members of the POWER Study Team who made data collection possible.

The local Black Pride organizations are as follows: D.C. Black Pride, Detroit's Hotter than July, Houston Splash, In the Life Atlanta, Memphis Black Pride, and Philadelphia Black Pride.

The community based organizations who performed onsite HIV testing are as follows: Atlanta: AID Atlanta, AIDS Health Care Foundation, NAESM; Detroit: Community Health Awareness Group, Horizons Project, Unified; Houston: Avenue 360, Houston AIDS Foundation, Positive Efforts; Memphis: Friends for Life; Philadelphia: Access Matters, Philadelphia FIGHT; Washington, D.C.: Us Helping Us.

Conflicts of Interest and Sources of Funding: There are no conflicts of interest to report from the authors. This original, unpublished manuscript has not been submitted for review to any other journal, and has been read and approved by all co-authors. All study procedures were approved by the University of Pittsburgh Institutional Review Board. This study was partially supported by the National Institute for Nursing Research (R01NR013865) and a National Institutes of Health training grant (T32MH904174-07). The funding agencies had no involvement in the study design, analysis or interpretation of data, the writing of the report, or the decision to submit for publication. The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health.

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Table 1.

Demographic Variable Comparison for Participants with HIV Risk and PrEP Using BSM in POWER 2014-2017 (N=1,411)

Demographic Variable	HIV Risk, No PrEP (column %)	PrEP Use (column %)	χ^2 Variance
Age			0.39, p=0.824
18-29	723 (65.3)	180 (63.4)	
30 – 39	267 (24.1)	73 (25.7)	
40+	117 (10.6)	31 (10.9)	
Sexuality			0.71, p=0.871
Gay/Homosexual	907 (81.9)	228 (80.6)	
Heterosexual	6 (0.5)	1 (0.4)	
Bisexual	176 (15.9)	50(17.7)	
Other	18 (1.6)	4 (1.4)	
Annual Income			0.02, p=0.901
\$0-29,999	416 (38.0)	106 (37.6)	
\$30,000+	679 (62.0)	176 (62.4)	
Education			26.93, p<.001
High school or less	207 (18.7)	92 (32.4)	
Some college or college	721 (65.2)	145 (51.1)	
Post Bac/Graduate	178 (16.1)	47 (16.6)	
Relationship status			16.49, p<.001
Single	846 (77.8)	183 (66.1)	
Partnered	241 (22.2)	94 (33.9)	
Current Insurance			0.74, p=0.391
No	154 (13.9)	34 (12.0)	
Yes	952 (86.1)	250 (88.3)	
HIV Risk Variables (all last 12 months)			
HIV-Positive Sexual Partner			47.14, p<.001
No	657 (75.3)	126 (52.5)	
Yes	215 (24.7)	114 (47.5)	
Last year STI			61.77, p<.001
No	872 (78.9)	159 (56.0)	
Yes	234 (21.1)	125 (44.0)	
Three or more sexual partners			0.04, p=0.842
No	344 (31.1)	90 (31.7)	
Yes	763 (68.9)	194 (68.3)	
History of Inconsistent Condom Use for anal sex			0.56, p=0.452
Always, most of the time	567 (51.3)	138 (48.8)	
Half of the time or less	539 (48.7)	145 (51.2)	
Sex Work			15.37, p<.001
No	1041 (94.3)	247 (87.6)	
Yes	63 (5.7)	35 (12.4)	

Demographic Variable	HIV Risk, No PrEP (column %)	PrEP Use (column %)	χ^2 Variance
Syndemic Variables			
3-month Poly Drug Use			
No	1090 (98.5)	253 (89.1)	59.68, p<.001
Yes	17 (1.5)	31 (10.9)	
Depressive Symptoms (CESD-10)			
No	667 (60.3)	175 (61.6)	0.18, p=0.674
Yes	440 (39.8)	109 (38.4)	
Intimate Partner Violence			
No	962 (87.0)	176 (62.0)	95.22, p<.001
Yes	144 (13.0)	108 (38.0)	
Problematic Drinking			
No	756 (68.4)	147 (51.8)	27.34, p<.001
Yes	350 (31.7)	137 (48.2)	

Note: column percentages used within categories

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Table 2.

Logistic Regression Analysis of PrEP Use with Demographic and Syndemic Variables of BMSM in POWER 2014-2017 (N = 284)

Model	Adjusted Odds Ratio	95% Confidence Interval
Model 1 (demographic variables)		
Age		
18-29	0.95	0.61 – 1.49
30 – 39	1.06	0.65 – 1.73
40+	1.0	
Sexuality		
Gay/Homosexual	1.0	
Heterosexual	0.61	0.07 – 5.26
Bisexual	1.10	0.77 – 1.59
Other	1.01	0.32 – 3.17
Annual Income		
\$0-29,999	1.0	
\$30,000+	1.15	0.83 – 1.59
Education		
High school or less	1.0	
Some college or college	0.39 *	0.28 – 0.55
Post Bac/Graduate	0.50 *	0.32 – 0.79
Relationship status		
Single	1.0	
Partnered	1.89 *	1.40 – 2.54
Current Insurance		
No	1.0	
Yes	1.36	0.88 – 2.11
Model 2 (Syndemic count)		
Syndemic = 0-1 (ref)	1.0	
Syndemic = 2	1.32	0.93 – 1.90
Syndemic = 3	5.65 *	3.17 – 10.08
Syndemic = 4	18.34 *	5.01 – 67.20

Note: Model 1 controlled for year and city of data collection; Model 2 controlled for year, city of data collection and demographic variables;

* p .05

Table 3.

Analysis of Joint Effects/Synergy of Syndemic Variables in BMSM using PrEP in the POWER Study 2014-2017, (N = 284)

		Odds Ratio		RERI	AP	S
		Expected	Observed			
Depressive symptomology	Polydrug use	3.79	11.95	8.15	0.68	3.92
Polydrug use	IPV	5.58	16.13	10.25	0.64	3.10
Depressive symptomology	IPV	3.60	3.66	0.06	0.02	1.02
Problematic binge drinking	IPV	3.58	7.51	3.93	0.52	2.52
Depressive symptomology	Problematic binge drinking	5.45	14.27	8.81	0.62	2.98
Poly drug use	Problematic binge drinking	1.88	1.89	0.02	0.01	1.02

RERI=Relative Excess Risk of the Interaction; AP=Attributable proportion of the interaction; S=Synergy Index; IPV=Intimate Partner Violence

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