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The role of syringe exchange programs and sexual identity in awareness of pre-exposure prophylaxis (PrEP) for male persons who inject drugs

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Abstract

Background: Male persons who inject drugs (male PWID) are at heightened risk for HIV, particularly if they also have sex with men. Pre-exposure prophylaxis (PrEP) could aid in HIV prevention for this population, but PrEP awareness within different sexual identities among male PWID is not well-understood. We report factors associated with greater awareness among male PWID to identify efficient means of awareness dissemination.

Methods: Data from the 2015 National HIV Behavioral Surveillance (NHBS) system cycle on injection drug use collected in New York City (NYC) were used. Bivariable analyses, using chi-squared statistics, were conducted to examine correlates of awareness of PrEP with socio-demographic, behavioral, and health care variables. Log-linked Poisson regression with robust standard errors was used to estimate adjusted prevalence ratios and determine differences in awareness of PrEP.

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The authors declare that they have no competing interest.

Declarations of Competing Interest

None.

Results: Among a sample of 332 male PWID (i.e., PWID who identified as male, not transgender) we find awareness of PrEP to be low (23%) among male PWID despite 68% reporting condomless vaginal/anal sex and 32% reporting injection equipment sharing in the last twelve months. Multivariable analysis found greater PrEP awareness associated with gay or bisexual identity (aPR: 2.77, 95% CI: 1.81–4.24) and having a conversation about HIV prevention at a syringe exchange program (SEP) (aPR: 2.71, 95% CI: 1.87–3.94) to be associated with increased PrEP awareness.

Conclusion: We found low rates of PrEP awareness among male PWID. However, our findings provide insight into information diffusion that can be utilized to increase PrEP awareness among male PWID and among all PWID. We suggest that gay and bisexual social networks and syringe exchange programs are diffusing PrEP awareness among male PWID and can be harnessed to increase PrEP awareness among male PWID.

Keywords

Pre-exposure prophylaxis (PrEP); HIV; People who inject drugs (PWID); Social networks; Syringe exchange programs; Men who have sex with men (MSM)

Introduction

Although HIV incidence has been declining in the United States among persons who inject drugs (PWID) (Des Jarlais et al., 2017, 2018), recent increases in opioid use may threaten these gains (Peters et al., 2016). In New York City (NYC), PWID may be particularly at risk, as the NYC Department of Health and Mental Hygiene (NYC DOHMH) released an advisory in March 2019 noting concern that NYC may experience increases in HIV diagnoses among PWID (New York City Department of Health & Mental Hygiene, 2019). Male PWID often experience a dual risk for HIV via injection and sexual behaviors. Of particular importance are male PWID who have sex with men (MSM-PWID) who may be at heightened risk (Neaigus et al., 2013; Strathdee & Sherman, 2003). For example, MSM-PWID are more likely to engage in sexual and injection behaviors that place them at risk for HIV and are more likely to be HIV positive, compared non-MSM PWID (Maslow, Friedman, Perlis, Rockwell & Des Jarlais, 2002).

HIV transmission can be prevented via condoms and access to clean injecting equipment, both of which are usually available at needle exchange programs (NSPs) and syringe exchange programs (SEPs). NSPs differ from SEPs in that they do not necessarily include the exchange of syringes. Given the location of this study and the predominance of SEPs, we refer to these generally as SEPs throughout this paper. PWID do not always have access to SEPs, and even when they do have access to condoms and sterile injecting equipment, both using condoms and using sterile injecting equipment might require negotiations with injecting and/or sexual partners (Walters, Reilly, Neaigus & Braunstein, 2017). Pre-exposure prophylaxis (PrEP), a pill taken daily to prevent HIV, can be a useful resource for PWID who are at-risk for HIV, especially MSM-PWID (Baeten et al., 2012; Choopanya et al., 2013; Grant et al., 2010; Smith et al., 2012). PrEP is a user-friendly tool that does not require negotiations with partners as is often the case with the use of condoms or syringe sharing. Previous studies show that most male PWID (84.5%) at-risk are eligible for PrEP

(Roth, Tran et al., 2018), and that PWID enrolled in medication assisted therapy for drug-use dependence can adhere to PrEP regimens (Shrestha, Altice, Karki & Copenhagen, 2018). Despite this, few male PWID who are HIV-negative are on PrEP (Roth, Aumaier et al., 2018). A recent study conducted in California found that among people newly diagnosed with HIV (not specific to PWID) many did not know PrEP existed and were therefore unable to take PrEP (Marcus et al., 2018). This suggests that PrEP awareness is a significant barrier to PrEP uptake. Studies focusing on PrEP awareness among PWID have shown low rates of PrEP awareness (from 13% to 31%), indicating that PrEP awareness is a significant barrier to PrEP uptake among PWID (Kuo et al., 2016; Roth, Tran et al., 2018; Sherman et al., 2019; Walters et al., 2017). The lack of PrEP awareness among PWID, in general, might be attributed to the fact that past campaigns about PrEP have mostly target MSM and were not accessible to many PWID, including some MSM-PWID who may identify as heterosexual (Bazzi et al., 2018). Another barrier to PrEP awareness among PWID could be a lack of willingness to prescribe PrEP to PWID by physicians (Adams & Balderson, 2016; Edelman et al., 2016). The lack of willingness might be attributed to competing priorities for physicians, such as the need to treat a substance use disorders or other immediate health concerns, and/or drug use stigma, such as the belief that PWID cannot adhere to medications (Bazzi et al., 2018).

Many factors can influence HIV risk and preventive behaviors. Among the most salient of these factors may be sexual identity and using syringe exchange programs (Walters et al., 2017, 2018). In the following analysis, we therefore focus specifically on the extent to which these two factors, sexual identity and syringe exchange programs (SEPs), are associated with awareness of PrEP among PWID who identified as male, which we refer to as male PWID throughout this paper. In addition, we provide a theoretical context for the possible importance of these factors.

Background and theoretical motivation

Diffusion of innovations

Diffusion of innovations theory informs a stream of research within social network analysis that examines how innovations (or ideas) spread and are adopted. The first stage of the diffusion process that an individual passes through is awareness of the innovation (Rogers, 2010). Focusing attention on the first stage of diffusion is necessary since, in most cases, awareness precedes adoption (Ryan & Gross, 1943; Valente, 1995). However, few studies focus on awareness of prevention medications (Polonijo & Carpiano, 2013). Preliminary studies examining PrEP awareness found relatively low awareness of PrEP among men who have sex with men (MSM) (Al-Tayyib, Thrun, Haukoos & Walls, 2014; Dolezal et al., 2015; Liu et al., 2008; Mantell et al., 2014; Young & McDaid, 2014) and even lower rates of awareness among PWID (Kuo et al., 2016; Shrestha et al., 2017; Stein, Thurmond & Bailey, 2014). More recent studies have shown a marked increase in PrEP awareness among MSM, suggesting that information about PrEP is diffusing effectively among the MSM population. For instance, a study among MSM (data collected in 2015) reported 85.5% PrEP awareness (Goedel, Halkitis, Greene & Duncan, 2016). Conversely, studies sampling PWID (with data collected in 2015) found 18% PrEP awareness (Shrestha et al., 2017) and 12.4% PrEP

awareness (Roth, Aumaier et al., 2018). Another study sampling PWID in 2016 reported 15% PrEP awareness (Sherman et al., 2018). These studies indicate that disparities in PrEP awareness are increasing between MSM and PWID. Yet, MSM-PWID could potentially bridge this gap, as they may be members of both communities, and possibly diffuse information about PrEP between MSM and PWID communities.

Sexual identity and behavior

One important area of study for HIV transmission among PWID is the overlap of injection drug use, gender, and sexuality (Neaigus et al., 2013; Strathdee & Sherman, 2003). MSM-PWID are more likely to engage in behaviors that place them at risk for HIV and are more likely to be HIV positive, compared to non-MSM male PWID (Maslow et al., 2002). The concurrence of drug use and sex among gay and bisexual men who inject drugs creates a “synergistic effect” in which transmission risk is markedly increased (Bull, Piper & Rietmeijer, 2002).

Importantly for this study, is the added acknowledgment that MSM-PWID are not a homogenous group, in so much as there are differences in risk behaviors—such as condomless anal sex with men, condomless vaginal sex and anal with women, and syringe sharing—by heterosexually-identified, bisexually-identified, gay-identified, and other MSM (Kral et al., 2001). Engagement in risky behaviors and prevention also varies based on men’s identification within “MSM” and/or “PWID” communities—one study concluded that MSM who do not identify as “gay” or do not inject heroin, specifically, are less likely to identify with the MSM community members who inject drugs and, thus, need differently targeted methods of prevention and outreach (Bull et al., 2002).

Previous studies on MSM, PWID, and risk reduction via PrEP, have not directly considered the role of sexual orientation/identity versus sexual behavior. While the behavioral category “MSM” has been used in the HIV health literature since at least 1990, its usage has broadened and is now a conceptual reference category in most research and programming on sexual minority health (Crocker, Major & Steele, 1998; Young & Meyer, 2005). There are two key reasons for choosing to use these terms rather than the identity-based “gay” and “bisexual”: first, is the epidemiological idea that it is behaviors—and not identities—that place people at risk for certain negative health-related outcomes; second, is the notion that sexuality may be fluid and can be socially constructed, and there are many instances in which people may not choose to identify within certain categories, even if they engage in similar behaviors as those who do (Badura-Lotter, 2014; Brandt, 1987).

Much of the literature uses *MSM* and “gay and bisexual men” interchangeably, which (however unintentionally) conflates identity and behavior (Montoya, 2012; Parker & Aggleton, 2003). This is problematic, because when researchers choose *MSM* to label people who describe themselves—that is, self-label—as gay or bisexual, they are impeding and obstructing key research conclusions about sexual behavior and communities. For instance, in his study of Latino sexuality, Munoz-Laboy (2004: 4) noted: “The problem with the MSM category is that many men do not identify with the label, which leads to their increased alienation from HIV prevention strategies” (Muñoz-Laboy, 2004). Indeed, we can only fully understand behavioral patterns, and the politics of HIV prevention, when we also

know—or inquire—about possible shared “sexual minority status, exposure to discrimination and exclusion, relationship patterns, and subcultural norms” (Epstein, 1996). Further, the label MSM is focused on behaviors (and does not always correspond with self-identity), and therefore, MSM does not necessarily address the complex social processes of identity, which include relationships, community, and social networks (Young & Meyer, 2005). A further complication of assuming that sexual identity is equivalent to sexual behaviors among MSM is that there are men who identify as “heterosexual” who also engage in sex with men. It is, therefore, necessary to consider both descriptive concepts of sexual behavior and phenomenological concepts that are meaningful for those social groups engaging in the behavior. When we include identity, we are including the lived experiences of a group, how experiences create identities, and social networks comprised of others with similar experiences and identities. If heterosexually identified MSM do not hold a shared identity, we hypothesize that PrEP information is less likely to disseminate among them due to the lack of social networks and the lack of group cohesion.

Syringe exchange programs

Syringe-exchange programs (SEPs) may be key institutions for diffusing information about PrEP among male PWID, as SEPs have already played an important role in the health of PWID. In New York State, specifically, HIV transmission attributable to injection drug use has decreased markedly over the past decade; likely due to an increase in SEPs. Studies have shown that availability of SEPs reduces the number of new HIV infections among PWID (Aspinall et al., 2014; Bluthenthal, Kral, Gee, Erringer & Edlin, 2000; Des Jarlais et al., 1996). SEPs not only provide clean syringes, they link PWID into additional needed services (Hagan et al., 2000). They also provide information about disease prevention, disposal of syringes, conduct HIV and HCV testing, provide condoms and other safer sex items, and refer people to housing services when needed (Rich & Adashi, 2015). In fact, Walters et al. (2017) found that women who injected drugs (i.e., women who identified as women, not transgender), sampled in NYC in 2015, who had a conversation about HIV prevention at a SEP, had increased PrEP awareness (Walters et al., 2017). Thus, central to this paper is examining the role of SEPs in the diffusion of PrEP awareness because SEPs may situate people with similar interests and life experiences (e.g., PWID with PWID), and as a result, shared spaces, identities, and communities may form, which could provide the social infrastructure(s) through which HIV prevention information may diffuse among population members.

This study sought to understand the prevalence of PrEP awareness among male PWID, as being aware of PrEP is a critical first step along the PrEP care continuum that can lead to PrEP uptake. We sought to understand how PrEP information was spreading among male PWID in NYC. Specifically, we hypothesized that GB male PWID and male PWID who had a conversation about HIV prevention at a SEP would have greater odds of PrEP awareness.

Methods

This analysis utilized data collected by the National HIV Behavioral Surveillance (NHBS) system, a cross-sectional survey that rotates annually among three populations at-risk (men

who have sex with men, people who inject drugs (i.e., injection drug use (IDU) cycle), and heterosexuals at high-risk for HIV infection living in high HIV prevalence areas in the United States. During 2015, the year of data collection used in this analysis, NHBS (sampling PWID) was conducted in 20 metropolitan statistical areas (MSAs) with high HIV prevalence. Study protocols and questionnaires were developed by the Centers for Disease Control and Prevention (CDC) in collaboration with local project sites. Data used for this analysis were from the New York City fourth round of the IDU cycle. Data were collected from PWID who were recruited using respondent-driven sampling (RDS), a peer-driven, chain referral sampling method that is used to survey hidden populations (Heckathorn, 2002). The NHBS protocol, methodology and questionnaire were reviewed and approved by the New York City Department of Health and Mental Hygiene Institutional Review Board.

Prior to data collection, formative research was conducted to inform study implementation, including recommendations for survey incentives, selecting seeds (initial recruits) for RDS sampling (Allen, Finlayson, Abdul-Quader & Lansky, 2009), and location of field sites in New York City boroughs. NHBS eligibility requirements included being 18 years of age or older, being able to respond to the survey in English or Spanish, having a valid coupon for RDS sampling, residing in the New York City metropolitan statistical area, and having injected drugs without a prescription within the 12 months before the interview. Additional seed criteria required that the participant be either male or female (born and identify), not transgender, and be able and willing to recruit PWID due to knowledge of and social connectivity in the community. Transgender persons were eligible for the survey, but they were excluded from this analysis due to small numbers. Therefore, this analysis includes only PWID who identified as male. Anonymous and incentivized interviews were conducted face-to-face, using CDC-provided standard NHBS questionnaires. Consenting and eligible participants were interviewed and offered anonymous rapid point-of-care HIV testing, with test results returned at the end of the survey interview. If a rapid point-of-care HIV test result was positive a Dried Blood Spot sample was collected, and a Western blot test was conducted for confirmation. Linkages to care were made for participants who tested positive. The results were recorded and linked to the survey interview responses for each participant. After the survey interview, participants were asked to recruit other PWID in their social networks and were given up to five coupons to do so.

Participants were incentivized with a \$25 gift card for taking the survey interview, a \$25 gift card for HIV testing, a \$20 gift card for hepatitis C testing, and a \$20 gift card for each participant recruited (up to 5). In an attempt to recruit younger PWID, PWID aged 30 years or younger were given 5 coupons and PWID over 30 years of age were given 3 coupons, which were used to recruit other PWID.

Measures

Dependent variable—To measure PrEP awareness, a binary (yes/no) variable was constructed from the question: “Before today, have you ever heard of people who do not have HIV taking PrEP, the antiretroviral medicine taken every day for months or years to reduce the risk of getting HIV?” The PrEP question was only asked to those who self-reported an HIV-negative or unknown status.

Independent variables—This analysis had two key independent variables. First, a three-level categorical variable was constructed for sexual identity and behavior (male PWID who were gay or bisexual (GB) identified MSM-PWID; male PWID who were heterosexually identified MSM-PWID (i.e., not gay or bisexual identified); and male PWID who were heterosexually identified and were not MSM). Participants were asked about their sexual identity during the survey. The question was, “Do you consider yourself to be” and then participants were given the options (1) heterosexual or “straight”; (2) homosexual or gay; and (3) bisexual. In the analytic sample used, six participants responded homosexual or gay and fourteen responded bisexual. We did not have data on sex at birth and therefore we could not determine gender identity outside of what was self-reported. Due to small numbers, those who indicated homosexual, gay or bisexual were combined into the category indicating gay or bisexual identified male PWID (GB male PWID). One of the 20 GB male PWID did not report sex with a man in the last 12 months, all the others ($n = 20$) reported MSM behavior in the last 12 months. Male PWID who reported having sex with men in the last 12 months, but did not identify as gay or bisexual, were included in the category heterosexually identified MSM-PWID. The remaining male PWID who reported heterosexual identity and did not have sex with men in the last 12 months were categorized as heterosexual male PWID.

The second key independent variable related to syringe exchange programs (SEPs). Access to HIV prevention at SEPs was measured through the following questions: “In the past 12 months, have you had a one-on-one conversation with an outreach worker, counselor, or prevention program worker or participated in an organized group session to discuss ways to prevent HIV infections?” If the participant answered yes, they were asked a series of questions as to where the conversation could have occurred. They were given the opportunity to respond yes to the following options: HIV/AIDS focused organization; gay, lesbian, bisexual, transgender, or queer organization; needle or syringe exchange program; IDU outreach program; doctor’s office, health center, clinic, or hospital; drug or alcohol treatment center; or other community organization. PWID peer-support groups were not included in this list. A binary variable was created for SEPs.

Socio-demographic control variables for age, education, household income, homelessness, and mutually exclusive race/ethnicity were included. The mutually exclusive racial/ethnic categories used in this analysis were Hispanic/Latino, non-Hispanic African American/Black, and non-Hispanic white. Participants who reported Hispanic were coded Hispanic, regardless of other race/ethnicities reported. Otherwise, if a participant indicated multiple race categories they were coded as multiracial. Due to small numbers we excluded 6 male PWID who identified as multiracial or other. Additional control variables used in this analysis were current healthcare (including having health insurance/coverage, having a place that they usually go when they are sick or need advice about their health, and past 12-month healthcare utilization), and preventative behaviors such as being tested for a sexually transmitted infections within the last 12 months. Lastly, common behaviors that place people at risk for HIV, such as (1) whether a participant had condomless anal or vaginal sex within the last 12 months, (2) shared injection equipment (defined as shared cookers, cottons, water, used drugs that had been divided with a previously used syringe, and/or shared

needles/syringes) in the last 12 months, (3) ever been diagnosed with hepatitis C (HCV), and (4) had ever been incarcerated were also included as possible correlates. HCV is an important indicator for HIV risk among PWID because HCV is transmitted through blood, and in the United States, injection drug use is currently by far the most likely way to acquire HCV (Armstrong et al., 2006). Additionally, incarceration was assessed because of the strong association between incarceration and HIV among PWID (Dolan et al., 2015).

Analysis

We limited this analysis to male PWID who had a completed valid survey interview and with non-missing data for the variables of interest. First, descriptive statistics were calculated for the independent variables and covariates of interest. Second, bivariate analyses, using chi-square test statistics, were conducted to examine correlates of PrEP awareness. Third, to estimate prevalence ratios (PRs) and adjusted prevalence ratios (aPRs) we used log-linked Poisson regression with robust standard errors using the GENMOD procedure (Zou, 2004) in SAS (SAS Institute, Cary, CN). Healthcare, prevention, and behavioral variables that were not significant at the $p < .20$ level in binary analysis were excluded from the multivariable analysis with the exception of demographic variables. Non-significant variables other than sociodemographic variables were removed from the final model; all sociodemographic variables were retained in the model regardless of statistical significance. One interaction term was tested examining the interaction between race/ethnicity and gay and bisexual identity in order to explore the potential influence of race/ethnicity on the experience and expression of identity. However, the interaction term was not significant, and we therefore excluded it. Analyses were conducted using SAS 9.4.

Multicollinearity was assessed through correlation matrices and variance inflation scores (VIF). VIF scores did not exceed a value of 2.5 for any of our variables, indicating no potential problems with multicollinearity (Allison, 2012). Goodness of fit was assessed by examining log likelihood statistics and through the Hosmer–Lemeshow test (Hosmer, Lemeshow & Sturdivant, 2013; Tabachnick, Fidell & Osterlind, 2001). Outliers and influential observations were assessed by examining plots of residuals, leverage, influence on parameter estimates, influence on model fit, influence on the estimate for each variable, and deletion differences by predicted probabilities (Allison, 2012). Observations that were identified as potential outliers or influential observations were removed individually, the regression was re-run, and the results were compared to the original. If there were changes in the results and the model improved when the observation was deleted, we would delete the observation (Allison, 2012; Tabachnick, Fidell & Osterlind, 2001). There were no changes and the model did not improve, therefore, no observations were deleted.

The data used in this analysis were not weighted, and therefore, this is not a probability sample. RDS weighted estimates may not be generalizable to the target population if assumptions are not met and large sample sizes may be needed to obtain precise weighted estimates (Salganik, 2006; Wejnert, Pham, Krishna, Le & DiNenno, 2012; White et al., 2012). Thus, the analytical tools used for weighting often fail to reduce bias (Dickens, 1990; McCreesh et al., 2012; Rudolph, Fuller & Latkin, 2013; Wirtz et al., 2016). In order to avoid the problems of weighting discussed above, we ran a separate model (not shown), which

controlled for network size, to account for probability of selection (Broz et al., 2014). Network size did not impact the results, nor did it improve the model fit. We therefore dropped the variable. Finally, a sensitivity analysis was run that assigned the mean responses to the missing variables and the results remained the same; as such we have excluded the 11 observations with missing data.

Results

A total of 528 PWID completed the survey. Ten PWID identified as transgender, one PWID responded that they did not know their gender, and one refused to answer. These 12 PWID were excluded from this analysis. Of the 516 remaining PWID who reported male ($n = 370$) gender, 21 who self-reported HIV-positive status were excluded from the analysis because they were not asked the question about PrEP awareness. Finally, 6 PWID who reported multiracial/other race/ethnicity were excluded due to small sample size, and 11 PWID were dropped due to missing data on one or more of the questions used in this analysis. The final sample size for analysis was 332 male PWID. This is an adequate sample size to perform our analyses, as the common rule is 5–10 respondents per independent variable (Peduzzi, Concato, Kemper, Holford & Feinstein, 1996).

Table 1 displays the samples demographics. The sample was majority men of color and only 25% reported some college or above. Overall the sample reported low annual household income (67% reported up to \$10,000) two-thirds (66%) reported ever being homeless.

A large proportion of male PWID engaged in risk behaviors such as condomless sex (68%), sharing injection equipment and/or syringes within the past 12 months (32%), and binge drinking (29%). Most male PWID in this sample (90%) reported having been incarcerated in their lifetime and 53% of those who provided a response to the question about hepatitis C (HCV) reported ever being diagnosed with HCV.

Only 23% ($n = 78$) of male PWID had heard of PrEP. In terms of the two main variables of interest (sexual identity/behavior and SEPs) the results are as follows: *Sexual identity/behavior*: PrEP awareness was highest among male PWID who identified as gay or bisexual (GB male PWID), with 60% ($n = 12$) of GB male PWID having PrEP awareness. Out of the 312 male PWID who reported heterosexual identity, 7% ($n = 21$) reported having sex with men (i.e., heterosexually identified MSM-PWID). Out of the 21 heterosexually identified MSM-PWID, PrEP awareness was 29% ($N = 6$). Finally, 21% ($n = 60$) of heterosexually identified male PWID who were not MSM were aware of PrEP. *Syringe exchange programs (SEPs)*: 21% ($n = 71$) of male PWID reported having a conversation about HIV prevention with someone at a SEP. Of the 71 male PWID who had a HIV prevention conversation at a SEP, 46% ($n = 33$) were aware of PrEP.

In multivariable analysis (Table 2) we found that GB male PWID were positively associated with awareness about PrEP, compared to heterosexual male PWID who did not engage in MSM behavior (aPR: 2.77, 95% CI: 1.81–1.24). Male PWID who engaged in MSM behavior but did not identify as GB (i.e., heterosexual MSM-PWID) were not significantly

associated with awareness about PrEP, compared to heterosexual male PWID who did not engage in MSM behavior.

Male PWID who had a conversation about HIV prevention at a SEP were positively and significantly associated with greater awareness about PrEP, compared to male PWID who did not have a conversation at a SEP (aPR: 2.71, 95% CI: 1.87–3.94), even after adjusting for sexual identity and behavior. Additionally, we found that current healthcare coverage was significantly associated with PrEP awareness (aPR: 3.90, 95% CI: 1.31–11.63).

Finally, we tested an interaction between race/ethnicity and gay and bisexual identity in order to explore the potential influence of race/ethnicity on the experience and expression of identity. Although both GB Hispanics and GB Blacks were less likely to be aware of PrEP, compared to their white counterparts, the interaction was not at a significantly significant level.

Discussion

This study found low rates of PrEP awareness (23%) among male PWID. However, awareness among this sample is higher than that found by other studies sampling similar populations of PWID (Kuo et al., 2016; Shrestha et al., 2017; Stein et al., 2014). In a previous study using NHBS data sampling PWID in 2012, awareness of PrEP and post exposure prophylaxis (PEP) in New York City was only 9% among male PWID (Walters et al., 2017). The increased awareness in a three-year period is encouraging. Below, we discuss the two key findings that illuminate potential avenues for increasing awareness among male PWID, focusing on sexual identity versus sexual behavior, and syringe exchange programs (SEPs).

Gay and bisexual identity

We found that male PWID who identified as gay or bisexual (GB male PWID) had greater odds of PrEP awareness compared to heterosexual male PWID who did not engage in MSM behavior. We hypothesize that social networks among gay and bisexually identified male PWID may be a powerful source for information dissemination, including information related to PrEP, and that heterosexual MSM-PWID may not be as well-networked, or may be less likely to be networked, within the gay and bisexual male communities, or less likely to have social networks in which information is shared as readily. At the time this data was collected PrEP-related programming and advocacy by the health department and community-based organizations had focused predominantly on MSM, often targeting MSM organizations and groups that are mostly comprised of gay men. GB male PWID could have received PrEP information targeted to gay and bisexual men from health departments, community-based organizations (CBOs), and via other social networks. This is an important distinction as it supports the idea that sexual identity (not just behavior) can impact health (Pathela, Blank, Sell & Schillinger, 2006; Wright & Perry, 2006). In fact, sexual identity likely shapes access to HIV prevention information, and in particular, access to information about PrEP.

Self-identified gay men have been an important group at the fore-front of the HIV movement. It is well documented that the gay community, of which many were gay men, was instrumental in acquiring access to antiretroviral treatment and organizing HIV prevention efforts (Adam, 1995; Altman, 1986; Amirkhanian, 2014; Diedrich, 2016; Epstein, 1996; Patton, 1986). Furthermore, gay men are integrated within formal health systems in the United States. For example, they are physicians, work in health departments, and run CBOs that target populations at risk of HIV and have been instrumental in shaping activism against AIDS and how HIV is treated (Altman, 2013; Diedrich, 2016; Epstein, 1996). Consequently, gay men sometimes have dual identities, one as a gay male community member and another as a professional stakeholder (Braine, Acker, van Sluytman, Friedman & Jarlais, 2011).

Past research has documented that the majority of the activist experiences among gay men as outlined above were largely attributed to white gay and bisexually identified men. Minorities (i.e., Black and Hispanic gay or bisexually identified men and women) have often been underrepresented in HIV activism among gay and bisexual men (Diedrich, 2016). However, our findings do not show that race/ethnicity was associated with PrEP awareness in bivariate analysis. In addition, we interacted race/ethnicity with gay and bisexual identity in the multivariable analysis and did not find a significant interaction effect or large differences by race/ethnicity among GB MSM-PWID with respect to PrEP awareness. We did not find white GB MSM-PWID to have greater PrEP awareness at a statistically significant level. It should be noted that the sample of GB MSM-PWID was small, and this could have limited our ability to detect significant differences by race/ethnicity.

Importantly for public health policy, it is possible that GB male PWID were networked with other gay and bisexual men who do (or do not necessarily) inject drugs, as well as being networked within gay and bisexual communities and heterosexual communities of PWID. In regards to drug use, there is a growing body of literature examining stimulant use, specifically methamphetamine use, among MSM populations (Hoenigl et al., 2016; Teran et al., 2019). Research shows that MSM are engaging in injecting methamphetamines, often use as a drug to enhance their sexual experience (referred to as chemsex) (Nerlander et al., 2018). It is possible that GB male PWID are interacting with other MSM through chemsex networks, both injection and non-injection. However, there is little research comparing GB male PWID to non-injecting MSM, and more research should be conducted to validate this hypothesis (Ibañez, Purcell, Stall, Parsons & Gómez, 2005).

Although we are suggesting that GB male PWID were networked with more mainstream gay networks, which resulted in an association with PrEP awareness, we also recognize that stigma related to HIV, drug use, and/or sexual identity may facilitate the development of social networks through fostering bonds of solidarity (Bluthenthal, 1998; Gudulunas, 2012) and/or impede social networks by fostering social isolation (Garcia et al., 2016). For example, drug use stigma has been associated with discrimination (Ahern, Stuber & Galea, 2007; Earnshaw, Smith & Copenhaver, 2013) and may lead to greater social isolation (Akda et al., 2018; Rapier, McKernan & Stauffer, 2019). Furthermore, PWID tend to experience greater discrimination, and negative health consequences resulting from discrimination, because injection drug use is more stigmatizing than non-injection drug use

(Friedman et al., 2017). Given these studies, it may be possible that drug use stigma impedes the development of social networks, however, it could also create bonds of solidarity. Conversely, chemex networks among MSM may mitigate the negative health outcomes related to stigma and foster community (Power et al., 2018). More research should be conducted to determine the impact of stigmatized identities on social network membership. Specifically, research should aim to identify intersections of stigma, such as HIV, drug use, and sexual orientation, and how these intersections impact social network membership for GB male PWID (Earnshaw, Smith, Cunningham & Copenhaver, 2015).

Given that outreach efforts to expand PrEP awareness have not included PWID as much as other groups, and as a result non-GB PWID may not view PrEP as a treatment for themselves, we suggest that GB male PWID may have received information about PrEP through gay networks. Past research with PWID found that PWID viewed PrEP for MSM, not for PWID (Bazzi et al., 2018; Biello et al., 2018). We suggest that GB male PWID, given the important intersection of both injection drug use and sexual identity, may function as bridges for the wider diffusion of PrEP among and through PWID social networks (Rogers, 2010; Valente, 1995). We suggest not only expanding messaging about PrEP to explicitly target PWID, but to utilize GB male PWID as important change agents who could disseminate PrEP information. Therefore, we suggest targeted messaging within gay and bisexual communities that include PWID as candidates for PrEP by focusing on injection drug use and MSM behaviors.

Syringe exchange programs

Male PWID who had a conversation about HIV prevention at a SEP were over six and a half times more likely to be aware of PrEP suggesting that integrating HIV prevention discussions at SEPs with information about PrEP is an important way to increase awareness of PrEP. Of all the places in which HIV prevention conversations occurred, including healthcare facilities, SEPs were the only places that were associated with greater PrEP awareness in this analysis. This finding points to the importance of SEPs for HIV prevention, even beyond provision of safe injecting equipment, as previous research suggests (Aspinall et al., 2014; Bluthenthal et al., 2000; Des Jarlais et al., 1996; Hagan et al., 2000; Rich & Adashi, 2015).

NYC differs from many other cities in the United States, in that SEPs are more prevalent and accessible. There are currently 49 locations where PWID can access SEP services in NYC, which contrasts with neighboring areas, including the city of Newark in New Jersey and Long Island in New York State, which only have one SEP in their respective locations (Walters et al., 2018). Knowing this, it is reasonable to infer that awareness of PrEP among male PWID in NYC may be higher than communities elsewhere in the United States. Additionally, public health officials should, in collaboration with SEP management and staff, examine how SEPs are informing individuals about PrEP so that (1) we can identify strategies of PrEP information sharing and (2) we can tailor those strategies to other settings. SEPs may offer a non-stigmatizing environment in which prevention can be delivered, allowing for open and honest conversations about prevention to occur (Roth, Tran et al., 2018). Part of the reason SEPs have been successful in their prevention efforts is that, for the

most part, they avoid moralizing PWID and offer judgment free services (Treloar, Rance, Yates & Mao, 2016).

Our findings suggest that prevention conversations can lead to greater awareness of PrEP, and therefore, attempts to encourage and foster these types of conversations across settings could benefit public health and decrease inequalities in PrEP awareness.

Health care

Our study found that healthcare coverage was associated with greater odds of PrEP awareness. However, we did not find interactions about HIV prevention with healthcare systems to be associated with greater PrEP awareness. Despite this, the finding that healthcare coverage was associated with increased PrEP awareness, may reflect increased exposure to health providers and settings where PrEP information can be transmitted to PWID. We suggest that healthcare professionals be trained in being able to identify PWID as viable candidates for PrEP. Future research which examines the process of information diffusion about PrEP through SEPs and through gay and bisexual social networks may provide evidence about PrEP awareness diffusion which could inform PrEP diffusion efforts in health care settings, such as hospital emergency rooms, primary care offices, and community clinics.

Limitations

The study survey did not ask specific questions about social networks and PrEP awareness. We, therefore, have used variables that theoretically are consistent with social network theory to suggest a social network effect. Similarly, the survey did not ask specific questions about social networks within the MSM or PWID communities. Given our results we hypothesize that GB male PWID are networked within MSM and PWID communities. There is little research on this topic, and therefore, more research should be conducted to better understand these social networks. The variable for having a conversation about HIV prevention at a SEP does not indicate whether PrEP specifically was part of the conversation because participants were not asked about how they received PrEP information. It should be noted that the sample of GB MSM-PWID and male PWID who had a conversation at an SEP was small, and for example, this could have limited our ability to detect significant differences by race/ethnicity. We did not have data on sex at birth and therefore we could not determine gender identity outside of what was self-reported. It is possible that someone could have identified as male and could have been born a woman or intersexed. The cross-sectional nature of this study precludes the determination of temporal relationships. Although one of the advantages of RDS is that it has the potential to reduce bias by producing long recruitment chains that bridge relevant groups; however, with RDS it is possible that this study over sampled from well-connected social networks that differ from the target population particularly with respect to housing status, income, and employment. The data are unweighted because assumptions needed for weighting were not met, and therefore are not from a probability sample (Wirtz et al., 2016). The results of this study may not, therefore, be generalizable.

Conclusion

All PWID, especially male PWID who have sex with men, may benefit from PrEP. Awareness of PrEP is a key first step that can lead to PrEP uptake. Although we document low PrEP awareness (23%) among male PWID, our findings provide insight into information diffusion that can be utilized to increase PrEP awareness among male PWID and among all PWID, more generally. We find that GB male PWID—versus heterosexual male PWID (who were not MSM) - had greater awareness of PrEP. Our findings also indicate male PWID who had prevention conversations at SEPs had increased PrEP awareness. Taken together, these findings indicate that social networks may be effective means for diffusing PrEP awareness.

Specifically, GB male PWID may be developed as change agents (Rogers, 2010) to diffuse and share HIV prevention information to the broader PWID community. GB male PWID may not be spreading PrEP information to non-GB PWID because they may not see non-GB PWID as candidates for PrEP. However, if messaging to MSM about PrEP included images and other messages that target PWID, such information may diffuse better. Public health officials should also work with SEPs to promote PrEP and provide SEPs with the resources and support to do so alongside other SEP services. Since SEPs are established prevention programs for PWID, PrEP information has the potential to spread within the social networks of persons who frequent SEPs, and therefore, has the potential to reach a larger proportion of populations of PWID at risk for HIV. A scaling up of PrEP campaigns within SEPs may aid in disseminating PrEP information. With this scaling up, PrEP information could reach PWID who do not attend SEPs, but who belong to the social networks of PWID who do attend SEPs and have been exposed to information about PrEP at these venues. Given that PWID are often a hidden and hard to reach population we suggest working with SEPs as they are often trusted resources for PWID and an entry into the community. In areas where SEPs are sparse, we suggest working with other harm reduction agencies that may have already built relationships of trust with PWID and who can better reach PWID communities.

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Table 1

Demographic and behavioral characteristics of men who inject drugs by knowledge of pre-exposure prophylaxis (PrEP): National HIV Behavioral Surveillance System injection drug use cycle, New York City 2015 ($n = 332$).

Variable	Total <i>n</i>	Col %	Aware of PrEP ($n = 78$) <i>N</i>	Row %	Unaware of PrEP ($n = 254$) <i>n</i>	Row %	Chi-squared statistic (degrees of freedom)	<i>P</i>
PrEP awareness	332	100%	78	23%	254	77%		
Age							$\chi^2 (3)=5.03$	.17
18–29	52	16%	18	35%	34	65%		
30–39	82	25%	17	21%	65	79%		
40–49	104	31%	20	19%	84	81%		
50 and Older	94	28%	23	24%	71	76%		
Race/ethnicity							$\chi^2 (2)=0.80$	.67
Hispanic/Latino	186	56%	42	23%	144	77%		
African American	85	26%	19	22%	66	78%		
White	61	18%	17	28%	44	72%		
Education							$\chi^2 (2) = 3.56$	.17
Some high school or less	116	35%	22	19%	94	81%		
High school graduate or GED	134	40%	31	23%	103	77%		
Some college or above	82	25%	25	30%	57	70%		
Household income							$\chi^2 (2)=3.95$	.14
Up to \$10,000	221	67%	51	23%	170	77%		
\$10,000–\$25,000	78	23%	23	29%	55	71%		
\$25,000 and above	33	10%	4	12%	29	88%		
Homeless (past 12 months)							$\chi^2 (1)=0.82$	.36
Yes	220	66%	55	25%	165	75%		
No	112	34%	23	21%	89	79%		
Sexual identity/behavior								
Gay or bisexual	20	6%	12	60%	8	40%	$\chi^2 (2)=16.47$	<0.001
Heterosexual MSM-PWID	21	6%	6	29%	15	71%		
Heterosexual (no MSM behavior)	291	88%	60	21%	231	73%		
Health care								

Variable	Total <i>n</i>	Col %	Aware of PrEP (<i>n</i> = 78) <i>N</i>	Row %	Unaware of PrEP (<i>n</i> = 254) <i>n</i>	Row %	Chi-squared statistic (degrees of freedom)	<i>P</i>
Healthcare coverage							$\chi^2 (1)=4.85$	.03
Yes	297	89%	75	25%	222	75%		
No	35	11%	3	9%	32	91%		
Usual source of care							$\chi^2 (1)=2.04$	.15
Yes	291	88%	72	25%	219	75%		
No	41	12%	6	15%	35	85%		
Seen healthcare provider (last 12 months)							$\chi^2 (1)=0.29$	.59
Yes	306	92%	73	24%	233	76%		
No	26	8%	5	19%	21	81%		
Prevention conversation at syringe exchange							$\chi^2 (1)=26.55$	<.0001
Yes	71	21%	33	46%	38	54%		
No	261	79%	45	17%	216	83%		
STI test (past 12 months) ^a							$\chi^2 (1)=1.16$	.28
Yes	123	37%	33	27%	90	73%		
No	208	63%	45	22%	163	78%		
Risk behaviors								
Condomless vaginal/anal sex (past 12 months)							$\chi^2 (1)=0.002$	.97
Yes	225	68%	53	24%	172	76%		
No	107	32%	25	23%	82	77%		
Binge drinking (past 30 days) ^a							$\chi^2 (1)=2.08$	.15
Yes	88	29%	16	18%	72	82%		
No	220	71%	57	26%	163	74%		
Injection sharing (past 12 months) ^a							$\chi^2 (1)=1.25$	.26
Yes	106	32%	29	27%	77	73%		
No	225	68%	49	22%	176	78%		
Hepatitis C diagnosis (ever) ^a							$\chi^2 (1)=0.004$	.95
Yes	139	53%	34	24%	105	76%		
No	121	47%	30	25%	91	75%		

Variable	Total <i>n</i>	Col %	Aware of PrEP (<i>n</i> = 78) <i>N</i>	Row %	Unaware of PrEP (<i>n</i> = 254) <i>n</i>	Row %	Chi-squared statistic (degrees of freedom)	<i>P</i>
HIV test result							–	.34 ^b
Positive	5	2%	2	40%	3	60%		
Negative	327	98%	76	23%	251	77%		
Incarceration (ever)							$\chi^2 (1)=0.42$	.52
Yes	300	90%	69	23%	231	77%		
No	32	10%	9	28%	23	72%		

^aIndicates missing responses for the variable.

^bIndicates that Fisher Exact test *p* value is presented due to small expected cell counts under chi-squared test.

Table 2

Multivariable associations with awareness of PrEP among men who inject drugs in New York City: National HIV Behavioral Surveillance System (NHBS) injection drug use (IDU) Cycle 2015 ($n = 332$).

	$n = 332$ aPR	CI
Sexual identity/behavior		
Gay or bisexual	2.77 ***	1.81–4.24
Heterosexual MSM-PWID	1.39	0.74–2.62
Heterosexual male PWID (not MSM)	Ref	
Syringe exchange prevention conversation		
Yes	2.71 ***	1.87–3.94
No	Ref	
Current health care coverage		
Yes	3.90 *	1.31–11.63
No	Ref	
Race/ethnicity		
Hispanic/Latino	0.96	0.58–1.57
African American/Black	0.98	0.57–1.68
White	Ref	
Education		
Some high school or less	Ref	
High school graduate or GED	1.26	0.79–2.01
Some college or above	1.45	0.91–2.31
Household Income		
Up to \$10,000	Ref	
\$10,000–\$25,000	1.27	0.84–1.90
\$25,000 and above	0.57	0.23–1.45
Age (years)		
18–29	1.65	0.99–2.76
30–39	1.01	0.60–1.70
40–49	0.84	0.49–1.44
50 and older	Ref	

* Indicates $p < .05$,

** indicates $p < .01$.

*** Indicates $p < .001$.