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Sources of Information about Pre-Exposure Prophylaxis (PrEP) and Associations with PrEP Stigma, Intentions, Provider Discussions, and Use in the United States

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Abstract

The amount and type of information individuals receive about HIV pre-exposure prophylaxis (PrEP) may influence PrEP uptake. We surveyed 331 HIV-negative sexual and gender minorities who have sex with men at a Midwestern Pride festival in 2018 ($M_{\text{age}}=32$, 68% White, 87% cisgender men) to assess sources and perceived tone of PrEP information and associated outcomes. Most participants (88%) had heard about PrEP. The most common sources were the internet (70%), social media (59%), and friends (54%). Messages from health campaigns were perceived as most positive and those from religious institutions as least positive. Sources differed based on demographics. Controlling for indications for PrEP use, those who heard about PrEP from health campaigns and those who heard more positive messages reported lower levels of PrEP stigma, $\beta_s=-0.27-0.23$, $p_s<.05$. Non-users who heard about PrEP from the internet had stronger intentions to use PrEP, $\beta=0.28$, $p<.05$. Those who heard about PrEP from sexual partners and health campaigns were more likely to discuss PrEP with providers, $PR_s=1.60-1.80$, $p_s<.01$. Finally, those who heard about PrEP from friends and partners were more likely to use PrEP, $PR_s=2.01-2.24$, $p_s<.05$. Leveraging sexual partners, social network members, and health campaigns are promising avenues to advance PrEP implementation.

Keywords

pre-exposure prophylaxis; sexual and gender minorities; socialization; HIV prevention

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Declarations:

Conflicts of interest: The authors declare that they have no conflicts of interest.

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

Informed consent: The data collected in this study were fully anonymous. Due to the low-risk nature of the study, participants received an informational letter describing the study, and completion of the survey constituted consent.

HIV remains a critical health challenge, particularly for sexual and gender minorities who have sex with men (SGMSM), including cis and trans men, transgender women, and non-binary individuals. Although HIV rates are declining in the U.S. (Singh et al., 2018), they are holding steady for gay, bisexual, and other MSM, and widening racial disparities in HIV diagnoses are a concern (McCree et al., 2019). Black MSM are particularly at risk for HIV; given current diagnosis rates, it is projected that 50% or more of Black MSM could be diagnosed with HIV in their lifetimes (CDC, 2017a; Matthews et al., 2016). Transgender women also contend with high rates of HIV; with meta-analysis indicating HIV prevalence of 11.8–27.7% among transgender women in the U.S. (Baral et al., 2013; Herbst et al., 2008). Although transgender MSM are an understudied population (Dang et al., 2022), research suggests they are also at increased risk for HIV acquisition (Reisner & Murchison, 2016; Rowniak et al., 2011).

Biomedical technologies such as HIV pre-exposure prophylaxis (PrEP) offer great promise for reducing the spread of HIV (Anderson et al., 2012; Deutsch et al., 2015; Grant et al., 2014; Hoagland et al., 2017; Liu et al., 2016; McCormack et al., 2016; Volk et al., 2015). However, although PrEP awareness and use have been increasing over time, PrEP uptake has been relatively slow, especially outside of large urban areas and among those most at risk (Hoots et al., 2016; Khanna et al., 2016; Kuhns et al., 2017; Mera et al., 2016). Among HIV-negative MSM who could benefit from PrEP based on behavioral indications of HIV risk, PrEP uptake was reported by 9.1% in a United States (U.S.) nationwide sample in 2015 (Parsons et al., 2017), with a substantial increase to 20–26% by 2017 for these men engaged in research (John et al., 2019; Sullivan et al., 2020). Nonetheless, fewer than 60,000 males had a PrEP prescription in the second quarter of 2017 (Siegler et al., 2018), suggesting uptake is modest based on a conservative estimate of 492,000 MSM meeting indications for PrEP use based on guidelines from the Centers for Disease Control and Prevention (CDC, 2014, 2018; Smith et al., 2015). Lower uptake has been reported among transgender populations, with only 4.5% of transgender women reporting PrEP use in a sample from Chicago and Boston recruited between 2012 and 2014 (Kuhns et al., 2016). Additionally, research suggests racial disparities related to PrEP awareness and uptake, with Black MSM less likely to be aware of PrEP or using PrEP than White MSM (Fennell et al., 2019; Khanna et al., 2016; Kuhns et al., 2017; Pulsipher et al., 2016; Strauss et al., 2017). Potentially related to slow uptake, qualitative work suggests that individuals perceive stigma related to PrEP use (Golub et al., 2017; Mutchler et al., 2015; Perez-Figueroa et al., 2015), and that PrEP stigma is related to lower likelihood of PrEP use (Quinn et al., 2019; Walsh, 2019).

Increasing PrEP uptake requires a better understanding of factors influencing uptake and antecedents to uptake, including PrEP stigma, intentions to use PrEP, and PrEP discussions with providers, among SGMSM. One factor that may influence PrEP outcomes is the amount and type of information individuals receive about PrEP from various sources. People receive messages about safer sex and HIV prevention from a multitude of sources, including from families, peers, sexual or dating partners, the internet and social media, mass media, public health campaigns and healthcare providers, schools, and religious organizations (Bleakley et al., 2009; Ward, 2003). Research focused on messages about sexual behavior, safer sex, and sexual orientation conducted with heterosexual young people has suggested

that the tone of these messages may vary across sources and across individuals (Calzo & Ward, 2009; Epstein & Ward, 2008). Across studies focused primarily on heterosexual young people, common sources of sexual health information include friends, television and radio, health care providers, the internet, parents, and public health campaigns (Abiona et al., 2014; Khurana & Bleakley, 2015; Whitfield et al., 2013). Research focusing on young Black MSM specifically has also identified friends, television, and the internet as important sources of sexual health and HIV prevention information; additionally, LGBTQ community agencies have been noted as an information source (Voisin et al., 2013). Some research has suggested that SGMSM youth are especially likely to search for sexual health information online, sometimes because they perceive no other sources of information (DeHaan et al., 2013; Mitchell et al., 2014; Pingel et al., 2013). Studies have also suggested the potential for PrEP information specifically to spread via social media and the internet (Kudrati et al., 2021; Macapagal et al., 2020; McLaughlin et al., 2016). One study has noted that Black MSM sometimes distrust HIV prevention information coming from mainstream media sources and prefer receiving information from close friends and family members (Voisin et al., 2013). Many MSM also report discussions about sexual health—including PrEP—with sexual partners (Gamarel & Golub, 2020; John et al., 2018; Starks et al., 2019; Walsh et al., 2022); these discussions, which may serve as a source of information about PrEP, may occur in person or on geosocial networking apps (Macapagal et al., 2020; Newcomb et al., 2016).

Past research has also found that the amount and type of information received about sexual health relates to sexual health outcomes (Aspy et al., 2007; Brown et al., 2006; Fisher et al., 2009; Harper et al., 2004; Sutton et al., 2014; Walsh & Ward, 2010; Ward, 2003; Widman et al., 2016), although this research has primarily focused on engagement in sexual activity and on condoms and contraception. In contrast, there have been relatively few studies exploring where SGMSM learn about PrEP or how sources of information about PrEP may relate to PrEP outcomes (Algarin et al., 2019; Bauermeister et al., 2013; Dolezal et al., 2015; Mutchler et al., 2015). Prior research in this area has several gaps and weaknesses: sources of information about PrEP have rarely been closely examined, questions have often focused only on where individuals *first* learned about PrEP, and few studies have considered how sources and tone of information about PrEP relate to PrEP outcomes.

Therefore, although past research has indicated multiple sources of general sexual health and HIV prevention information and has identified associations between sources of information and other sexual health outcomes, additional studies are needed to specifically investigate where SGMSM are learning about PrEP, whether they are receiving positive or negative messages about PrEP, and how the information they receive regarding PrEP is related to PrEP outcomes. A better understanding of individuals' sources of information and socialization related to PrEP may inform educational campaigns and public health interventions.

Research Questions

The current study sought to address gaps in the literature related to sources of PrEP information and associations between sources of information and PrEP outcomes by

surveying a sample of SGMSM at a community event in the Midwest. We aimed to answer the following research questions:

1. Where do SGMSM learn about PrEP, and are the messages they receive about PrEP perceived as positive or negative?
2. Do sources of PrEP information and the perceived tone of messages received about PrEP differ based on race/ethnicity, gender identity, age, material hardship, or indications for PrEP use?
3. Are there associations between sources of PrEP information and the perceived tone of messages received about PrEP and PrEP outcomes, including PrEP stigma, PrEP intentions, PrEP discussions with health care providers, and PrEP use?

Method

Participants and Procedure

The current study was a cross-sectional survey of a convenience sample of SGMSM in the Midwest. Participants ($N = 331$, 68% White, 25% Black, 11% other races, 12% Latinx, $M_{age} = 31.74$ [range: 18–76], $SD_{age} = 13.06$) completed an anonymous survey on paper at a Pride festival in Milwaukee, WI in June 2018. Participants were recruited by research staff at a table in a heavily trafficked Health and Wellness area at the event. To be eligible for participation, individuals had to be 18 years of age or older; identify as male, a man, or transgender; and not be visibly intoxicated or impaired. The sample for this research was limited to participants who did not report being HIV-positive, including cisgender men (87%), transgender women (4%), transgender men (6%), and non-binary individuals (4%) who reported having sex with men. The sample size was determined by the number of eligible and interested participants attending the festival, rather than based on an a priori power analysis. Further demographic and sexual behavior characteristics of the participants are included in Table 1. Participants were offered a small cash incentive or gift (\$5 in value) in return for their time. Participation took approximately 10–20 minutes. The Medical College of Wisconsin Institutional Review Board approved all procedures.

Measures

Demographics.—We asked participants to report their age, race and ethnicity, gender identity, and material hardship. For race and ethnicity, variables were created indicating whether participants identified as Black/African American/Caribbean; another race (i.e., Asian, Native Hawaiian or Pacific Islander, Native American, or another race); or Latinx/Hispanic. Participants could identify as more than one race/ethnicity; 2% identified as Black and Latinx, 4% as another race and Latinx, and less than 1% as other combinations. Identifying as non-Hispanic White was the reference category. For gender identity, we coded whether participants identified as transgender or non-binary; identifying as a cisgender man was the reference category. To assess material hardship, participants responded to 5 items (Elo et al., 2009). Items assessed how often participants reported not having enough money for basic housing needs (e.g., “How often have you been unable to afford the kind of food you should have?”) on a 1 to 5 scale. Items were averaged to create a composite score, with

higher scores indicating more financial hardship ($\alpha = .94$); this score was standardized for analyses.

Indications for PrEP use.—To determine whether participants had indications for PrEP use based on CDC guidelines (CDC, 2018), we matched existing survey questions to these guidelines as closely as possible. Participants were considered to have indications for use if any of the following were reported in the past three months: (1) sexual partners who were HIV-positive or of unknown HIV status, (2) diagnosis with a sexually transmitted infection (STI), (3) 2+ sexual partners, (4) condomless anal intercourse with someone other than a partner with whom they were in a mutually monogamous relationship, (5) exchanging sex for food, a place to stay, money, or drugs, or (6) injection drug use.

Sources and perceived tone of information about PrEP.—Participants reported whether they had heard anything about PrEP in the past year from each of 11 sources (family members; friends; sexual or dating partners; the internet; social media [e.g., Instagram, Facebook]; TV shows, movies, or music; newspapers or magazines; healthcare providers; public health campaigns; religious institutions; and schools); participants could also indicate if they had heard about PrEP from any other source. For each source a participant had heard about PrEP from, they indicated their perceptions of the overall tone of what they had heard from that source (“Thinking about everything you’ve heard about PrEP from this source, has it been mostly negative or positive?” from 1 = *very negative* to 5 = *very positive*).

PrEP stigma.—Stigma was assessed with 5 items (Walsh, 2019; e.g., “People who take PrEP are promiscuous,” $\alpha = .84$). Responses were on a 5-point scale from *strongly disagree* (1) to *strongly agree* (5). Stigma scale scores were created by averaging the 5 items, with higher scores indicating more PrEP stigma.

PrEP intentions.—Intentions were assessed with 3 items asking about PrEP behaviors in the next three months (Walsh, 2019; e.g., “During the next three months, I will talk to a health care provider about PrEP,” $\alpha = .90$). Responses were on a scale from *definitely will not do* (1) to *definitely will do* (4). Intention scale scores were created by averaging the 3 items, with higher scores indicating greater intentions to use PrEP.

PrEP discussion.—Participants reported whether they had ever talked to a healthcare provider about PrEP (0 = *no*, 1 = *yes*).

PrEP use.—Participants reported whether they were currently taking PrEP (0 = *no*, 1 = *yes*).

Data Analysis

Missing data was relatively rare (4% of all data was missing). To address missing data, we used multiple imputation (MI), a modern method for dealing with missing data which allowed us to maintain the maximum sample size and avoid biases associated with complete case analysis or single imputations (Schafer, 1999).

Descriptive statistics were used to examine sources of PrEP information and the perceived tone of information received (Research Question 1 [RQ1]). To examine demographic correlates of sources and perceived tone (RQ2), regressions included all demographic characteristics of interest (race/ethnicity, gender identity, age, SES, and indications for PrEP use) as predictors and PrEP information source and tone variables as outcomes. These regressions focused on a variety of outcomes: (1) having heard about PrEP from each of the nine more common individual sources of information (those sources endorsed by >10% of the sample) or from any source; (2) the total number of sources of PrEP information; (3) the perceived tone of information received from the five most common sources (the internet, social media, friends, public health campaigns, and health care providers); and (4) the overall (average) perceived tone of messages from all sources. For regressions looking at perceived tone (3 and 4), due to skewed responses, we dichotomized tone to Very positive/Somewhat positive (0) vs. Very negative/Somewhat negative/Neutral (1). Finally, to explore associations between sources and perceived tone and PrEP outcomes (RQ3), we used regressions with sources of information and overall perceived tone of information as predictors and PrEP stigma, intentions, discussion, and use as outcomes, controlling for demographic covariates and indications for PrEP use. We first examined each source/tone variable independently, and then combined predictors that showed associations with outcomes ($p < .10$) to build the multiple regression model. In this combined regression, coefficients for source/tone predictors that were non-significant ($p < .05$) were constrained to zero to increase model parsimony and stabilize estimates (Bentler & Mooijaart, 1989). Because those who discussed PrEP with a provider or were prescribed PrEP would all necessarily have heard about PrEP from a provider (because PrEP needed be prescribed by a provider at the time of this survey), we excluded having heard about PrEP from a provider as a predictor in the multiple regression analyses for these outcomes.

Analyses were conducted in Mplus 8 (Muthén & Muthén, 1998–2022) and in R 4.1.0 (R Core Team, 2020). Mplus was used to generate the multiple imputation data (100 datasets including all study variables) and for linear regression analyses involving stigma and intentions (RQ3). We fit linear regression models using a full information maximum likelihood estimator robust to non-normality (the MLR estimator). In order to generate prevalence ratios for categorical outcomes in RQ2 and RQ3, R's `geeglm` procedure was used to perform general linear modeling Poisson regression with a log link function and robust sandwich estimator (Zou, 2004). Finally, negative binomial regression in R (via the `glm.nb` procedure) was utilized when examining predictors of number of sources of PrEP information (RQ2). We report prevalence ratios (PRs) for categorical outcomes, standardized coefficients (β s) for continuous outcomes, and incidence rate ratios (IRR) for the negative binomial outcome. We also report 95% confidence intervals for all statistics. We used an alpha of .05 when choosing which results to discuss.

Results

Descriptive Information

Nearly half of the sample (48%) had at least one indication for PrEP use, and many participants had talked to a healthcare provider about PrEP (42%, including 52% of those

with indications for use). However, only 18% of participants were currently using PrEP, including 28% of those with indications for use. Participants had relatively low levels of PrEP stigma ($M = 2.08$ on a 1-to-5 scale, $SD = 0.86$). Among those who were not current PrEP users, intentions to use PrEP were relatively low ($M = 2.23$ on a 1-to-4 scale, $SD = 0.80$). Descriptive statistics related to demographic characteristics and PrEP outcomes are summarized in Table 1.

RQ1: Sources and Perceived Tone of Information About PrEP

Sources of PrEP information and the perceived tone of messages received are detailed in Table 2. Most participants (88%) had heard about PrEP from at least one source; the average number of different sources of PrEP information was 3.97 ($SD = 2.72$). The most common sources were the internet (70%), social media (59%), friends (54%), public health campaigns (52%), and healthcare providers (45%); the least common of our *a priori* sources were schools (10%) and religious institutions (7%). Examples of “other” sources identified by participants included events (e.g., fundraisers, Pride events, drag shows), research studies, and work.

Messages about PrEP were generally perceived as positive (overall $M = 4.13$ on a 1-to-5 scale, $SD = 0.91$). Those from public health campaigns were perceived as the most positive ($M = 4.45$, $SD = 0.90$), and those from religious institutions were perceived as the least positive ($M = 3.54$, $SD = 1.56$).

RQ2: Demographic Differences in Sources and Perceived Tone of Information About PrEP

Results of regressions exploring the associations between demographic characteristics and sources and perceived tone of PrEP information are included in Tables 3 and 4. These models included all demographic covariates and indications for PrEP use simultaneously.

Race and ethnicity.—Black participants were more likely to have heard about PrEP from healthcare providers than White participants, $PR = 1.56$, 95% CI [1.24,1.95], $p < .001$. Two thirds of Black participants (63%) had heard about PrEP from a provider, compared to one third (37%) of White participants. Black participants were also more likely to have heard about PrEP from their families compared to White participants and other race participants, $PR = 5.16$, 95% CI [2.90,9.15], $p < .001$ and $PR = 3.42$, 95% CI [1.52,7.71], $p = .003$, respectively. Nearly one third (29%) of Black participants had heard about PrEP from their families, compared to 6% of White participants and 8% of participants of other races. Black participants were more likely to have heard about PrEP from newspapers and magazines (38%) than White and other race participants (26% and 25%, respectively), $PR = 1.64$, 95% CI [1.14,2.37], $p = .008$ and $PR = 1.96$, 95% CI [1.05,3.68], $p = .04$, respectively. They were also more likely to have heard about PrEP from TV shows, movies, or music (36%) than White participants (21%), $PR = 1.61$, 95% CI [1.09,2.36], $p = .02$. In line with these findings, Black participants had heard about PrEP from more sources overall than White participants, $IRR = 1.19$, 95% CI [1.004,1.42], $p = .046$. Black participants had heard about PrEP from 4.51 sources on average ($SD = 3.04$), while White participants had heard about PrEP from 3.75 sources ($SD = 2.64$).

Black participants were more likely to describe the tone of messages they received about PrEP as negative or neutral (vs. positive) than were White participants. This was true across all sources considered, PRs = 1.84–3.08, p s < .05, and for overall perceived tone, PR = 2.38, 95% CI [1.57,3.62], p < .001. Black participants were also more likely than participants of other races to describe the tone of messages they received about PrEP from social media as negative or neutral, PR = 2.83, 95% CI [1.13,7.12], p = .03.

Gender identity.—Transgender and non-binary participants were less likely than cisgender participants to have heard about PrEP from their friends, PR = 0.61, 95% CI [0.41,0.93], p = .006. Only 33% of transgender and non-binary participants had heard about PrEP from their friends as compared to 58% of MSM. Transgender and non-binary participants had also heard about PrEP from fewer sources overall than cisgender participants (3.14 [SD = 2.38] vs. 4.09 [SD = 2.75]), IRR = 0.75, 95% CI [0.59,0.95], p = .02.

Age.—Older participants were more likely to have heard about PrEP from newspapers or magazines, PR = 1.21, 95% CI [1.09,1.35], p = .001. More than a third (35%) of those over age 30 had heard about PrEP from these sources, compared to only 23% of those age 30 or younger. There were no other significant associations between age and sources or perceived tone of PrEP information.

Material hardship.—Those experiencing more material hardship were less likely to have heard about PrEP from healthcare providers, PR = 0.87, 95% CI [0.77,0.99], p = .03. Only 39% of those who often or very often had trouble affording basic needs had heard about PrEP from a provider, compared to 47% of those with less material hardship. Additionally, those with more hardship were less likely to have heard about PrEP from any source, PR = 0.96, 95% CI [0.92,0.99], p = .02.

Indications for PrEP use.—Those with indications for PrEP use were more likely to have heard about PrEP from four of the nine sources we compared (social media, friends, healthcare providers, and sexual or dating partners), compared to those without indications, PRs = 1.37–1.59, p s < .001. Additionally, they were more likely to have heard about PrEP from any source, PR = 1.10, 95% CI [1.02,1.19], p = .01, and had heard about PrEP from more sources overall, IRR = 1.28, 95% CI [1.10,1.49], p = .001, compared to those without indications. Nearly everyone with indications for PrEP use (94%) had heard about PrEP from at least one source, compared to 84% of those without indications. Those with indications had heard about PrEP from 4.46 sources on average (SD = 2.60), while those without indications had heard about PrEP from 3.45 sources (SD = 2.68). Additionally, those with indications for PrEP use were less likely to perceive the tone of PrEP information from friends as negative or neutral (vs. positive) than were those without indications, PR = 0.54, 95% CI [0.31,0.96], p = .04.

RQ3: Associations Between Sources and Perceived Tone of Information About PrEP and PrEP Outcomes

Results of regressions showing the associations between sources and perceived tone of PrEP information and PrEP outcomes are included in Table 5. These multiple regressions controlled for all demographic covariates as well as indications for PrEP use.

PrEP stigma.—Controlling for demographics and indications for use, those who had heard about PrEP from sexual or dating partners, healthcare providers, and public health campaigns had lower levels of PrEP stigma, $\beta = -0.34$ – -0.24 (0.11–0.12), $ps < .05$, as did those who had heard from more sources overall, $\beta = -0.13$ (0.06), 95% CI $[-0.25, -0.01]$, $p = .04$. Additionally, those who perceived the messages they received about PrEP as more positive reported lower levels of stigma, $\beta = -0.25$ (0.06), 95% CI $[-0.36, -0.14]$, $p < .001$. When all sources and perceived tone were considered simultaneously, those who had heard about PrEP from a health campaign and those who had heard more positive messages overall held less PrEP stigma, $\beta = -0.27$ (0.11), 95% CI $[-0.49, -0.06]$, $p = .01$ and $\beta = -0.23$ (0.06), 95% CI $[-0.35, -0.12]$, $p < .001$. In terms of covariates, transgender and non-binary participants held less PrEP stigma than did cisgender participants, $\beta = -0.46$ (0.16), 95% CI $[-0.76, -0.16]$, $p = .003$.

PrEP intentions.—We explored PrEP intentions among those who were not current PrEP users ($n = 267$). Controlling for demographics and indications for use, those who had heard about PrEP from the internet had greater intentions to use PrEP, $\beta = 0.28$ (0.12), 95% CI $[0.04, 0.51]$, $p = .02$. No other sources of information were associated with intentions, nor was perceived tone of messages associated with intentions. In terms of covariates, Latinx participants had greater intentions to use PrEP, $\beta = 0.41$ (0.20), 95% CI $[0.02, 0.79]$, $p = .04$, as did those with indications for use, $\beta = 0.42$ (0.12), 95% CI $[0.19, 0.65]$, $p < .001$. Older participants had lower PrEP intentions, $\beta = -0.22$ (0.06), 95% CI $[-0.34, -0.09]$, $p = .001$.

PrEP discussion with a health care provider.—Controlling for demographics and indications for use, those who had heard about PrEP from family members, friends, sexual or dating partners, the internet, social media, newspapers and magazines, healthcare providers, public health campaigns, and schools were more likely to have discussed PrEP with a healthcare provider, PRs = 1.47–5.57, $ps < .05$. Additionally, those who had heard from more sources overall were more likely to have discussed PrEP with a provider, PR = 1.16, 95% CI $[1.12, 1.21]$, $p < .001$. Because participants who had discussed PrEP with a healthcare provider would necessarily have heard about PrEP from a provider, we excluded healthcare providers as a source in the combined regression. When other sources were considered simultaneously, those who had heard about PrEP from their partners and public health campaigns were more likely to discuss PrEP with a provider, PR = 1.80, 95% CI $[1.34, 2.41]$, $p < .001$ and PR = 1.60, 95% CI $[1.18, 2.16]$, $p = .002$, respectively. In terms of covariates, Black participants and participants with indications for PrEP use were more likely to have discussed PrEP, PR = 1.48, 95% CI $[1.17, 1.88]$, $p < .001$ and PR = 1.41, 95% CI $[1.10, 1.81]$, $p = .007$, respectively.

PrEP use.—Controlling for demographics and indications for use, those who had heard about PrEP from friends, sexual or dating partners, social media, newspapers or magazines, health care providers, and public health campaigns were more likely to be current PrEP users, PRs = 1.77–6.50, p s < .05, as were those who had heard about PrEP from more sources overall, PR = 1.21, 95% CI [1.13,1.31], p < .001. Because participants who had received a prescription for PrEP from a health care provider would have heard about PrEP from a provider, we again excluded healthcare providers as a source in the combined regression. When other sources were considered simultaneously, those who had heard about PrEP from their friends or partners were more likely to be current PrEP users, PR = 2.24, 95% CI [1.07,4.72], p = .03, and PR = 2.01, 95% CI [1.12,3.62], p = .02, respectively. In terms of covariates, Black participants and those with indications for PrEP use were more likely to be PrEP users, PR = 1.79, 95% CI [1.15,2.78], p = .01 and PR = 2.42, 95% CI [1.44,4.07], p = .001, respectively.

Discussion

This study among a community sample of adult SGMSM in Milwaukee, WI found that participants had heard of PrEP from a variety of sources. On average, participants had heard about PrEP from almost four different sources, most commonly the internet, social media, friends, public health campaigns, and healthcare providers. These findings align with prior research indicating the internet, friends, public health campaigns, and health care providers are common sources of sexual health information for young people in general (Abiona et al., 2014; Khurana & Bleakley, 2015; Whitfield et al., 2013) and for sexual and gender minority youth specifically (Voisin et al., 2013). Although the internet has been emphasized as a particularly important source of sexual health information for sexual and gender minority youth (DeHaan et al., 2013; Mitchell et al., 2014; Pingel et al., 2013), our research suggests that friends, providers, and public health campaigns are also important sources of PrEP information for sexual and gender minority adults. Our findings also concur with qualitative work from Mutchler et al. (2015) identifying health care providers, friends, the internet, and prevention education programs as sources of PrEP information for young Black MSM and their close friends, and with Algarin et al.'s (2019) recent research from Miami Gay Pride identifying friends, social media, and the internet as the most common first sources of PrEP information for adult men. Participants in our study generally reported that the tone of the messages about PrEP that they received was relatively positive, especially from public health campaigns, providers, friends, and partners. Messages received from religious institutions, schools, and family members were perceived as somewhat less positive.

Demographic Differences in Sources of PrEP Information

The likelihood of receiving information about PrEP from various sources differed based on demographic characteristics. Black SGMSM were more likely to have heard about PrEP from multiple sources, including healthcare providers; newspapers or magazines; TV shows, movies, or music; and family members; they had also heard about PrEP from more sources overall. Given racial disparities in HIV (McCree et al., 2019) and in PrEP uptake (Kuhns et al., 2017; Pulsipher et al., 2016; Strauss et al., 2017), these results are encouraging, suggesting that messages about PrEP are reaching those most at need. However, Black

SGMSM were also more likely to perceive messages about PrEP as negative or neutral than White SGMSM; this was true across all sources considered, including public health campaigns and healthcare providers. This may suggest the need to better tailor PrEP messaging for specific groups. Given that Black SGMSM are a prioritized population for PrEP, continued attention should be paid to how messaging from providers and within public health campaigns may be perceived, and campaigns should be developed with the aid of community advisory boards that include Black SGMSM to ensure messaging is appropriate, acceptable, and does not perpetuate stigma.

Controlling for indications for PrEP use, transgender and non-binary participants in our sample were less likely than cisgender men to have heard about PrEP from friends and had heard about PrEP from fewer sources than cisgender men. These findings suggest a need for more PrEP outreach to trans and non-binary populations, who are also at risk of HIV (Baral et al., 2013; Herbst et al., 2008; Reisner & Murchison, 2016; Rowniak et al., 2011). Social network interventions may be called for in the trans community to enhance conversation about PrEP between friends. Additionally, because trans individuals may be less likely to hear about PrEP from friends, to fill this gap, it may be particularly important for public health campaigns to specifically target this population, and for providers to be trained to deliver trans and gender fluid affirming care that incorporates PrEP discussions.

Encouragingly, participants with indications for PrEP use based on CDC guidelines were more likely to have heard about PrEP from a variety of sources. These individuals were more likely to hear about PrEP from members of their social networks (including friends, sexual or dating partners, and social media) as well as from healthcare providers.

Sources of PrEP Information and PrEP Outcomes

Controlling for both demographic characteristics and indications for PrEP use, we found a variety of associations between sources and perceived tone of PrEP information and PrEP stigma, intentions, discussion with providers, and use. Those who heard about PrEP from public health campaigns and those who heard messages they perceived as more positive reported lower levels of PrEP stigma. Non-users who heard about PrEP from the internet had stronger intentions to use PrEP. Those who heard about PrEP from sexual and dating partners and public health campaigns were more likely to discuss PrEP with a provider. Finally, those who heard about PrEP from friends and sexual partners were more likely to use PrEP.

Supporting the efforts of many cities to raise awareness about PrEP through public health campaigns (e.g., the PrEP4Love campaign in Chicago [Dehlin et al., 2019] or the Stay PrEP'd Up campaign in Milwaukee [ARCW, 2019]), results suggested public health campaigns might help reduce PrEP stigma and encourage discussions with healthcare providers. Additionally, interventions might benefit from using trusted peers and partners to spread positive PrEP messages (Hull et al., 2013; Latkin et al., 2013; Latkin & Knowlton, 2015; Young et al., 2018). Public health campaigns have capitalized on this approach, specifically promoting the idea of friends and family talking about PrEP (e.g., the CDC's "Start Talking. Stop HIV" campaign [CDC, 2017b]).

There are multiple possible interpretations of the finding that those who had heard about PrEP from the internet indicated greater intentions to use PrEP. First, information provided on the internet may have encouraged these participants to consider PrEP; for example, websites clearly lay out the steps involved in obtaining PrEP and make it easy to locate PrEP providers (Siegler et al., 2017). Alternatively, SGMSM who are thinking about using PrEP might seek out information on the internet. Either way, continuing to provide high quality and easily accessible information on the internet and social media sites may help inform and encourage those considering PrEP use.

Limitations

There were several limitations to the current study. First, our community sample included individuals attending a Pride event, and attendees were not representative of all SGMSM. In particular, those with less connection to the LGBTQ community or unable to attend the event may be underrepresented. Second, our assessment of sources of PrEP information was based on participant recall, and participants' memories of where they heard about PrEP or of particular positive or negative PrEP messages may have been inaccurate or biased. Third, we assessed the perceived tone of messages from different sources using a single item per source, and there was not much variance in perceived tone of messages in our sample. Although our measure of perceived tone did show construct validity with stigma (with those receiving more negative messages reporting more PrEP stigma), in the future, we may need to develop more nuanced, multi-item measures to understand the types of messages individuals are receiving about PrEP. Fourth, this study did not investigate potential mechanisms by which sources of PrEP information or messages about PrEP might impact PrEP outcomes. Future research should consider factors such as social norms related to PrEP as potential mediators. Finally, our research was cross-sectional, precluding us from drawing causal conclusions. For example, we found that hearing about PrEP from the internet was associated with intentions to use PrEP, but that may be because SGMSM who are interested in PrEP seek out info on the internet. Future longitudinal work is warranted.

Implications

Our results have several possible implications for research and public health practice. Given associations between hearing about PrEP from a variety of sources and PrEP outcomes, including stigma, discussion with providers, and uptake, there may be benefits to increasing the frequency of PrEP communication—especially positive communication—to SGMSM. Public health researchers and interventionists can consider social network interventions to increase the frequency of communication about PrEP between friends and sexual partners. In peer change agent interventions (Pagkas-Bather et al., 2020), individuals are trained to spread positive health messages—in this case regarding PrEP—to others within their friendship networks. Social network intervention approaches have been shown to positively impact sexual health behaviors such as condom use (Jones et al., 2008; Kelly et al., 1997; Wang et al., 2011), and have potential to increase PrEP uptake. Social network interventions including trans and non-binary SGMSM may be especially relevant given that our results show trans and non-binary participants heard about PrEP from fewer sources overall and were specifically less likely to hear about PrEP from friends. Research and public health practice can also focus on PrEP communication between sexual partners, given that our

results suggest hearing about PrEP from partners is associated with both provider discussion and PrEP use.

Notably, our results indicate that although Black SGMSM in Milwaukee were more likely to hear about PrEP from a variety of sources, they were also more likely to perceive the messages they received about PrEP to be negative, including messages from public health campaigns and healthcare providers. Qualitative work has suggested that Black and Latinx MSM are dissatisfied with stereotypical imagery in health campaigns (Drumhiller et al., 2018). It is possible that including Black SGMSM when developing PrEP-related public health campaigns could help improve perceptions of these campaigns for this population. With regards to providers, experimental work has suggested potential provider bias in PrEP prescription, including increased perceptions of risk compensation and adherence difficulties among Black versus white patients (Calabrese et al., 2014; Hull et al., 2021); this bias may impact provider communication with Black patients. Provider training, including content focused specifically on provider bias and racial stereotyping, may be called for (Pinto et al., 2018).

Conclusions

This research represents one of the first in-depth explorations of sources and tone of PrEP information for SGMSM. Those in a community sample of SGMSM had heard of PrEP from a variety of sources. The likelihood of receiving information about PrEP from various sources differed based on demographic characteristics, and sources and perceived tone of information were associated with PrEP outcomes. A better understanding of sources of PrEP information for SGMSM could help inform educational campaigns and interventions.

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Table 1

Descriptive Characteristics for a Sample of Sexual and Gender Minorities who Have Sex with Men (N = 331) Recruited at a Pride Event in Milwaukee, WI in June 2018

Variable	% or <i>M</i> (<i>SD</i>)
Age	31.74 (13.06)
<i>Race</i>	
White (ref.)	68%
Black	25%
Another race	11%
Latinx ethnicity	12%
<i>Gender identity</i>	
Cisgender man (ref.)	87%
Transgender woman	4%
Transgender man	6%
Non-binary/gender fluid	4%
Material hardship [range: 1–5]	2.46 (1.35)
Indications for PrEP use (past 3 months)	48%
<i>PrEP outcomes</i>	
PrEP stigma [range: 1–5]	2.08 (0.86)
PrEP intentions [range: 1–4] ^a	2.23 (0.80)
Has talked to a healthcare provider about PrEP	42%
Currently using PrEP	18%

Note. PrEP = pre-exposure prophylaxis.

^aAmong those not currently using PrEP.

Table 2

Sources of Information about PrEP and Perceived Tone of Messages Received in the Past Year among Sexual and Gender Minorities (N = 331) Recruited at a Pride Event in Milwaukee, WI in June 2018

Source of PrEP Information	Heard About PrEP	Perceived Tone ^a
	%	<i>M (SD)</i>
The internet	70%	4.11 (0.93)
Social media	59%	4.15 (1.00)
Friends	54%	4.27 (0.95)
Public health campaigns	52%	4.45 (0.90)
Healthcare providers	45%	4.30 (1.01)
Sexual or dating partners	43%	4.24 (0.99)
Newspapers or magazines	28%	4.12 (0.98)
TV shows, movies, or music	25%	3.86 (1.04)
Family members	12%	3.72 (1.16)
Schools	10%	3.67 (1.30)
Religious institutions	7%	3.54 (1.56)
Other sources	7%	4.22 (1.00)
Any source	88%	--
	<i>M (SD)</i>	<i>M (SD)</i>
Total number of sources	3.97 (2.72)	--
Overall tone of messages	--	4.13 (0.91)

Note. PrEP = pre-exposure prophylaxis.

^a Among those who have heard about PrEP from a specific source.

Table 3

Associations between Demographic Characteristics and Indications for PrEP Use and Sources of PrEP Information among Sexual and Gender Minorities (N = 331) Recruited at a Pride Event in Milwaukee, WI in June 2018

Demographic Characteristic	Internet		Social Media		Friends		Public Health Campaigns		Health Care Providers		Sexual or Dating Partners		Newspapers or Magazines		TV Shows, Movies, or Music		Family Members		Any Source		Number of Sources	
	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	AIRR [95% CI]
Black	0.84 [0.70,1.02]	1.05 [0.86,1.29]	1.00 [0.79,1.26]	1.09 [0.86,1.39]	1.56 ^{***} [1.24,1.95]	0.92 [0.68,1.25]	1.64 ^{**} [1.14,2.37]	1.61 [*] [1.09,2.36]	5.16 ^{***} [2.90,9.15]	1.01 [0.92,1.10]	1.19 [*] [1.004,1.42]											
Another race	1.01 [0.83,1.23]	0.83 [0.59,1.16]	1.09 [0.83,1.44]	0.91 [0.65,1.30]	0.77 [0.49,1.22]	1.08 [0.76,1.52]	1.04 [0.57,1.90]	0.86 [0.45,1.67]	0.98 [0.27,3.52]	1.08 [*] [1.002,1.15]	0.93 [0.72,1.20]											
Latinx	1.10 [0.91,1.34]	1.21 [0.93,1.57]	1.09 [0.83,1.43]	1.28 [0.97,1.69]	1.29 [0.92,1.81]	1.32 [0.97,1.80]	1.11 [0.63,1.96]	1.05 [0.60,1.85]	1.79 [0.84,3.81]	0.96 [0.85,1.08]	1.16 [0.92,1.47]											
Age	0.96 [0.90,1.02]	0.95 [0.88,1.02]	0.94 [0.87,1.03]	0.97 [0.89,1.06]	0.94 [0.85,1.03]	0.94 [0.84,1.05]	1.21 ^{***} [1.09,1.35]	0.93 [0.78,1.10]	1.12 [0.90,1.40]	0.98 [0.94,1.01]	0.96 [0.90,1.02]											
Material hardship	0.95 [0.88,1.02]	1.00 [0.91,1.10]	0.92 [0.83,1.02]	0.97 [0.88,1.08]	0.87 [*] [0.77,0.99]	1.03 [0.91,1.16]	1.06 [0.90,1.24]	1.01 [0.83,1.22]	1.12 [0.82,1.52]	0.96 [*] [0.92,0.99]	0.98 [0.90,1.05]											
Trans/non-binary	0.95 [0.75,1.20]	1.03 [0.79,1.33]	0.61 [*] [0.40,0.93]	0.73 [0.49,1.07]	0.71 [0.46,1.09]	0.63 [0.39,1.04]	0.65 [0.34,1.24]	0.49 [0.23,1.06]	1.20 [0.52,2.75]	0.89 [0.76,1.03]	0.75 [*] [0.59,0.95]											
Indications for PrEP	1.15 [1.00,1.33]	1.37 ^{***} [1.13,1.65]	1.50 ^{***} [1.22,1.84]	1.08 [0.88,1.34]	1.57 ^{***} [1.23,2.00]	1.59 ^{***} [1.23,2.05]	0.99 [0.70,1.41]	1.00 [0.68,1.46]	0.76 [0.42,1.37]	1.10 [*] [1.02,1.19]	1.28 ^{***} [1.10,1.49]											

Note. APR = Adjusted Prevalence Ratio; AIRR = Adjusted Incidence Rate Ratio; Trans = Transgender; PrEP = Pre-exposure prophylaxis. Age was divided by 10 for analyses such that 1 unit of change is equivalent to 10 years.

p < .001

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p < .01

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p < .05

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Table 4

Associations between Demographic Characteristics and Indications for PrEP Use and Likelihood of Receiving Less Positive Messages About PrEP from Various Sources among Sexual and Gender Minorities (N = 331) Recruited at a Pride Event in Milwaukee, WI in June 2018

Demographic Characteristic	Internet	Social Media	Friends	Public Health Campaigns	Healthcare Providers	Sexual or Dating Partners	Overall Perceived Tone
	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]	APR [95% CI]
Black	2.47 *** [1.62,3.77]	3.08 *** [1.87,5.05]	1.84 * [1.06,3.22]	2.49 ** [1.31,4.76]	1.95 * [1.09,3.48]	2.47 ** [1.32,4.61]	2.38 *** [1.57,3.62]
Another race	1.07 [0.54,2.12]	0.59 [0.15,2.40]	0.99 [0.43,2.25]	0.28 [0.04,1.95]	0.61 [0.17,2.21]	1.26 [0.54,2.95]	0.99 [0.50,1.96]
Latinx	1.29 [0.75,2.22]	0.88 [0.41,1.85]	1.40 [0.72,2.74]	1.95 [0.80,3.88]	1.29 [0.63,2.61]	1.66 [0.75,3.72]	1.35 [0.77,2.38]
Age	0.96 [0.80,1.16]	0.99 [0.80,1.22]	0.84 [0.61,1.15]	0.99 [0.71,1.39]	0.93 [0.68,1.27]	0.98 [0.70,1.37]	0.98 [0.82,1.17]
Material hardship	1.04 [0.84,1.28]	0.96 [0.75,1.24]	1.02 [0.77,1.36]	0.89 [0.63,1.24]	0.81 [0.69,1.11]	1.35 [1.00,1.83]	1.00 [0.81,1.23]
Trans/non-binary	0.90 [0.42,1.92]	1.07 [0.52,2.23]	0.91 [0.27,3.08]	0.47 [0.07,3.11]	0.80 [0.27,2.38]	1.57 [0.56,4.39]	1.26 [0.67,2.39]
Indications for PrEP	1.05 [0.68,1.61]	0.93 [0.58,1.49]	0.54 * [0.31,0.96]	1.53 [0.77,3.02]	0.89 [0.49,1.61]	0.88 [0.49,1.59]	0.92 [0.60,1.40]

Note. APR = Adjusted Prevalence Ratio; Trans = Transgender; PrEP = Pre-exposure prophylaxis. Models explore the likelihood of describing messages from a source as “Very negative,” “Somewhat negative,” or “Neutral” (vs. “Somewhat positive” or “Very positive”). Participants reported on perceived tone of messages only when they had heard something about PrEP from a particular source in the past year. Age was divided by 10 for analyses such that 1 unit of change is equivalent to 10 years.

p < .001

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p < .01

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p < .05

Table 5

Associations between Sources and Perceived Tone of PrEP Information and PrEP Outcomes among Sexual and Gender Minorities (N = 331) in Milwaukee, WI in June 2018

Source	PrEP Stigma			PrEP Intentions (N = 267)			PrEP Discussion			PrEP Use		
	Individual Sources	Multiple Sources Simultaneously	β [95% CI]	Individual Sources	Multiple Sources Simultaneously	β [95% CI]	Individual Sources	Multiple Sources Simultaneously	APR [95% CI]	Individual Sources	Multiple Sources Simultaneously	APR [95% CI]
The internet	-0.20 [-0.44,0.04]			0.28* [0.04,0.51]		0.28* [0.04,0.51]	1.73** [1.23,2.43]	†	1.75 [0.96,3.18]		†	†
Social media	-0.21 [-0.43,0.02]	†		0.05 [-0.18,0.28]			1.87*** [1.36,2.57]	†	1.77* [1.005,3.11]		†	†
Friends	-0.21 [-0.44,0.02]	†		0.16 [-0.08,0.39]			1.67*** [1.24,2.25]	†	3.04*** [1.56,5.94]		†	2.24* [1.07,4.72]
Public health campaigns	-0.34** [-0.56,-0.13]		-0.27* [-0.49,-0.06]	0.19 [-0.03,0.41]			1.90*** [1.42,2.54]		2.32** [1.34,3.99]		†	†
Healthcare providers	-0.24* [-0.48,-0.01]	†		0.19 [-0.06,0.45]			5.57*** [3.69,8.40]	Excl.	6.50*** [2.85,14.81]		Excl.	Excl.
Sexual or dating partners	-0.25* [-0.48,-0.02]	†		0.19 [-0.05,0.43]			2.07*** [1.56,2.73]		2.67*** [1.55,4.61]			2.01* [1.12,3.62]
Newspapers or magazines	-0.20 [-0.46,0.05]			0.08 [-0.21,0.37]			1.54*** [1.20,1.98]	†	2.09** [1.32,3.33]		†	†
TV shows/ movies/music	0.03 [-0.26,0.31]			0.05 [-0.23,0.32]			0.96 [0.72,1.29]		1.12 [0.66,1.89]			
Family members	-0.02 [-0.37,0.34]			0.31 [-0.15,0.76]			1.68*** [1.22,2.31]	†	1.69 [0.88,3.25]			
Schools	0.29 [-0.11,0.69]			-0.03 [-0.46,0.40]			1.47** [1.10,1.97]	†	1.75 [1.00,3.08]		†	†
Religious institutions	0.35 [-0.17,0.86]			-0.01 [-0.60,0.57]			1.32 [0.88,1.98]		1.80 [0.97,3.36]		†	†
Number of sources	-0.13* [-0.25,-0.01]	Excl.		0.10 [-0.03,0.23]			1.16*** [1.12,1.21]	Excl.	1.21*** [1.13,1.31]		Excl.	Excl.
Overall perceived tone	-0.25*** [-0.36,-0.14]		-0.23*** [-0.35,-0.12]	0.02 [-0.11,0.15]			1.05 [0.89,1.25]		1.24 [0.90,1.71]			

Covariates	β [95% CI]	β [95% CI]	APR [95% CI]	APR [95% CI]
Black	± 0.12 [-0.13,0.37]	± 0.17 [-0.14,0.48]	± 1.48 *** [1.17,1.88]	± 1.79 ** [1.15,2.78]
Another race	± 0.07 [-0.29,0.44]	± -0.25 [-0.63,0.14]	± 0.78 [0.49,1.25]	± 0.58 [0.21,1.64]
Latinx	± 0.08 [-0.23,0.40]	± 0.41 * [0.02,0.79]	± 1.15 [0.82,1.62]	± 0.77 [0.32,1.85]
Age	± 0.07 [-0.04,0.18]	± -0.22 *** [-0.34,-0.09]	± 0.93 [0.84,1.04]	± 1.04 [0.89,1.22]
Material hardship	± 0.09 [-0.01,0.20]	± 0.03 [-0.09,0.14]	± 0.98 [0.87,1.11]	± 0.85 [0.67,1.07]
Trans/non-binary	± -0.46 ** [-0.76,-0.16]	± 0.02 [-0.26,0.31]	± 0.62 [0.38,1.02]	± 0.30 [0.08,1.09]
Indications for PrEP	± -0.14 [-0.34,0.07]	± 0.42 *** [0.19,0.65]	± 1.41 ** [0.10,1.81]	± 2.42 *** [1.44,4.07]

Note. APR = Adjusted Prevalence Ratio; PrEP = pre-exposure prophylaxis; Trans = Transgender. Age was divided by 10 (1 unit change = 10 years). For binary predictors of continuous outcomes, we report STDY estimates from Mplus, which can be interpreted as the change in the outcome variable in standard deviation units when the categorical covariate changes from zero to one (Muthén & Muthén, 1998–2022).

± = Covariates were included in models when exploring individual sources (not reported).

† = Indicates sources originally included in models; paths for non-significant sources were fixed to 0 to increase parsimony. Excl. = Excluded from model. Healthcare providers were not included when considering multiple sources simultaneously because those who discuss PrEP with providers or are prescribed PrEP would necessarily hear about PrEP from a provider. Number of sources was considered to be redundant with individual sources and was not included as a predictor in any combined regression.

p < .001

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p < .01

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p < .05