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## Concomitant utilization of pre-exposure prophylaxis (PrEP) and meningococcal vaccine (MenACWY) among gay, bisexual and other men who have sex with men in Los Angeles County, California

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### Abstract

Recent outbreaks of serogroup C meningococcal disease in Southern California have led the California Department of Public Health to recommend the quadrivalent meningococcal vaccine (MenACWY) for gay, bisexual and other men who have sex with men (GBMSM) in Southern California. High-risk GBMSM have also been advised to utilize pre-exposure prophylaxis (PrEP) for HIV prevention. Data collected from a community-based sample of HIV-negative GBMSM in Los Angeles County (N=476) were used in a multinomial logit regression analysis to identify patterns in MenACWY and PrEP usage and evaluate factors associated with use of both, one, or neither of these prevention methods. Nearly half (56%) of participants had neither been vaccinated nor used PrEP. A smaller percentage (34%) had either been vaccinated or were PrEP users, leaving

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10% who had concomitant PrEP and MenACWY use. Higher education, more recent sex partners, illicit drug use and recent receptive condomless anal sex (CAS) were significantly associated with greater odds of using both prevention methods relative to neither. Higher education, prior sexually transmitted infection (STI) diagnosis, more recent sex partners and recent receptive CAS were significantly associated with greater odds of just PrEP use relative to neither. Higher education was the only factor significantly associated with greater odds of just MenACWY immunization relative to neither. Findings highlight important gaps in immunization among GBMSM in conjunction with immunization. Public health practitioners should consider the ways in which strategies to increase PrEP and vaccine-preventable illnesses among GBMSM may complement one another.

### Keywords

PrEP; meningitis; MSM; GBMSM; vaccination

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### Introduction

Gay, bisexual and other men who have sex with men (GBMSM) are disproportionately impacted by HIV (Centers for Disease Control and Prevention, 2018) and are simultaneously at risk for a number of vaccine preventable diseases, including Hepatitis A, Hepatitis B, Human Papilloma Virus (HPV) and invasive meningococcal disease (IMD) (Kim, 2010; Los Angeles County Department of Public Health, 2016; Meites, Markowitz, Paz-Bailey, & Oster, 2014; Pitasi, Bingham, Sey, Smith, & Teshale, 2014; Rhodes & Hergenrather, 2002; Rudy, Detels, Douglas, & Greenland, 2003; Sanchez, Sineath, Kahle, Tregear, & Sullivan, 2015; Thomas & Goldstone, 2011). IMD is of particular concern given recent disease outbreaks primarily affecting GBMSM and the high morbidity and mortality associated with IMD (Atkinson, Gandhi, & Balmer, 2016; Weiss & Varma, 2013). There is significant overlap between risk factors for HIV and IMD, including illicit drug use, multiple sex partners, engagement in anonymous sex and use of online dating applications or websites to meet partners (Folaranmi et al., 2017). While effective biomedical prevention strategies for HIV (i.e., pre-exposure prophylaxis) and IMD (i.e., MenACWY vaccine) exist, it is unclear the degree to which these public health strategies targeting GBMSM are being used in isolation or in combination with one another.

### Pre-exposure Prophylaxis (PrEP)

Pre-exposure prophylaxis (PrEP) is a potent biomedical prevention strategy with significant potential to reduce HIV incidence among gay, bisexual and other men who have sex with men (GBMSM) (Carnegie et al., 2015; Juusola, Brandeau, Owens, & Bendavid, 2012; Kessler et al., 2014; Zablotska, 2017). Increasing PrEP uptake among GBMSM is now part of the National HIV/AIDS Strategy as well as several city and state-wide plans for ending the HIV/AIDS epidemic across the country (Centers for Disease Prevention and Control, 2018; Office of National AIDS Policy, 2015). However, despite its efficacy, uptake of PrEP among adult GBMSM for whom it is indicated has been low (Hood et al., 2016). According to estimates from Gilead, the maker of Truvada, which is currently the only FDA approved drug for PrEP, only 180,000 GBMSM have received Truvada prescriptions for PrEP

(Magnuson, Hawkins, & Mera, 2018; POZ, 2018). This number is well below the estimated 4.5 million GBMSM in the U.S. who may be good candidates for PrEP (Magnuson et al., 2018; Parsons et al., 2017), which include those with an HIV-positive sex partner, those recently diagnosed with a bacterial STI, those with a high number of sex partners, those who have a history of inconsistent or no condom use, and those who are engaged in commercial sex work (Centers for Disease Control and Prevention, 2017a). To increase PrEP uptake among GBMSM, novel strategies are needed that leverage other existing healthcare interventions for GBMSM. One such intervention strategy may be IMD vaccination, which has been recommended for GBMSM in specific geographic areas following recent disease outbreaks (California Department of Public Health, 2016, 2017). Using IMD vaccination encounters to educate GBMSM about PrEP and evaluate GBMSM for PrEP eligibility based on behavioral factors may be an important opportunity for improving PrEP uptake in this population.

### **MenACWY Vaccination**

Over the past several decades, there have been reports of invasive meningococcal disease (IMD) outbreaks within GBMSM communities across the United States (New York City, Los Angeles County, Chicago). Surveillance data from 2012 – 2015 demonstrates increased risk for IMD among GBMSM in the United States – up to 4 times that in the general population (Folaranmi et al., 2017). Data from U.S. outbreaks highlight risk factors that may make GBMSM more vulnerable to IMD, several of which overlap with those that place GBMSM for elevated risk of HIV acquisition (Folaranmi et al., 2017; Imrey et al., 1996; Jackson, Schuchat, Reeves, & Wenger, 1995). Recent outbreaks of serogroup C meningococcal disease in Southern California have led the California Department of Public Health (CA DPH) to recommend the quadrivalent meningococcal vaccine (MenACWY) – a single vaccine that protects against four strains of meningococcal disease (MenA, MenC, MenW, MenY) – for all GBMSM in Southern California, who collectively have comprised the majority of reported clinically observed meningitis cases in the region (California Department of Public Health, 2016, 2017). However, MenACWY immunization among GBMSM remains low. In a community-based sample of GBMSM from Los Angeles County following the recent IMD outbreak in Southern California, less than one-third of participants reported having received the vaccination (Holloway et al., 2018). Similar to PrEP, novel strategies are needed to increase MenACWY uptake among GBMSM, especially in the context of an ongoing outbreak. Ensuring that all GBMSM who take PrEP also receive the MenACWY vaccination is an opportunity for increased immunization coverage in this population. Those taking PrEP are being seen routinely by a healthcare provider, which presents an opportunity for education about MenACWY and receipt of the one-time vaccination.

Using data collected from a community-based sample of GBMSM in Los Angeles County during an active IMD outbreak in 2016–2017, we sought to identify patterns in PrEP and MenACWY usage among HIV-negative GBMSM and evaluate factors associated with use of both, one, or neither of these prevention methods. The goal of this study was to determine the degree of concomitant PrEP and MenACWY usage in order to inform targeted interventions that could leverage existing public health resources aimed at improving

GBMSM health and well-being. In addition, we sought to examine intersecting factors that may have contributed to PrEP/MenACWY uptake. These factors included sociodemographic characteristics (e.g., age, race/ethnicity) and behavioral health characteristics associated with vulnerability to HIV and IMD transmission (e.g., substance use, sexual risk behavior).

## Methods

### Study Design and Sample

From December 2016 through February 2017, we utilized venue-based sampling to gather survey data from GBMSM in Los Angeles County, California. This method has proven successful in obtaining representative samples of hard-to-reach populations in serial cross-sectional survey samples (Muhib et al., 2001). Our venue sampling frame included 146 locations consisting of clinics, community-based organizations, AIDS service organizations, LGBTQ-serving specialized businesses, bathhouses, stores, bars, clubs, recreational areas/facilities, and restaurants/coffee shops. This list was developed based on formative work with GBMSM in Los Angeles County and guidance from a standing Community Advisory Board comprised of community members, public health workers, and other stakeholders engaged with our Southern California HIV/AIDS Policy Research Center ([www.chprc.org](http://www.chprc.org)).

We approached men entering randomly selected venues on any given data collection outing to participate in the study. Those who expressed interest were then asked a brief series of questions to assess their eligibility. The screening questions included age, sex at birth, gender identity, sexual partners in the past 3 months (i.e., men only, women and men, women only), English/Spanish proficiency (Yes/No), Los Angeles County residency (Yes/No), and willingness to participate (Yes/No). Persons were eligible to enroll in our study if they were English or Spanish-speaking, non-institutionalized, male (sex at birth and gender identity) with any male sexual partners in the past 3 months, 18 years or older, living in Los Angeles County, California, and able to provide oral consent once eligibility was determined. Eligible GBMSM were then asked to take the 15–30 minute survey (Mean 17.66 minutes), which was administered immediately by trained interviewers on iPads, who read questions aloud and entered participants' answers directly into Qualtrics. Participants received a \$50 cash incentive. The *masked for review* Institutional Review Board (IRB) reviewed and approved the study prior to survey implementation. Data analysis was approved by the IRBs at *masked for review* and *masked for review*.

### Instrumentation & Measurement

Our consent form, screener, and survey instrument were developed in English and Spanish using forward-backward translation. The survey Flesch Reading Ease (62.9) and Flesch-Kincaid (7.1) scores were acceptable, corresponding with a 6 – 8th grade reading level fluency (National Cancer Institute, 2003). The items included in the final instrument examined individual sociodemographic characteristics, MenACWY immunization status and PrEP use.

Sociodemographic data on the survey included age, race and ethnicity, insurance type, highest level of education, employment status, household income, residential zip code, and

HIV status. Race/ethnicity was assessed using two questions; the first asked about ethnicity (Hispanic vs. non-Hispanic); the second asked about race using the U.S. Census categories. Based on the answers to these two questions, race/ethnicity was collapsed into four categories by the investigators (see Table 1). Educational attainment was dichotomized to reflect having received a college degree vs. not. Insurance type was classified as private (e.g., employer-based), Medicare/Medicaid, other, or uninsured. Zip code of residence was used to classify individuals according to neighborhood. We divided the sample into two groups: those residing in West Hollywood, a predominantly gay city in Los Angeles County, where social marketing regarding MenACWY immunization was focused during the 2016–2017 outbreak, and those residing outside of West Hollywood. We limited the sample for this study to those who were eligible for PrEP based on their reported HIV status (i.e., HIV negative).

In addition to sociodemographic characteristics, we examined behavioral health characteristics that are established correlates of HIV and IMD transmission. Substance use was assessed according to recent (past 6 months) alcohol, cannabis, and past 6 month illicit drug (i.e., methamphetamine/crystal, heroin, cocaine/crack, ecstasy/MDMA/Molly, Ketamine/Special K, GHB) use. Sexual risk behavior was defined by number of sexual partners, type of recent (past 6 months), HIV status of recent partners, sexual activity (e.g., receptive and insertive condomless anal intercourse), and previous STI diagnosis. Finally, we assigned a risk score to participants based on six measures (i.e., age, number of partners, receptive condomless anal sex [CAS], HIV-positive partners, insertive CAS with an HIV-positive man, and methamphetamine use) from the CDC's PrEP clinical practice recommendations (CDC, 2017a, 2017b). This validated risk score had been developed using behavioral and HIV test data from HIV-negative MSM from two different longitudinal datasets and generalized estimating equations and logistic regression analyses to identify these significant predictors of HIV infection, which were then assigned weights and regression coefficients summed to create this risk score (Smith, Pals, Herbst, Shinde, & Carey, 2012). Participants with scores  $\geq 10$  were considered high risk and recommended for PrEP screening (Smith, Pals, et al., 2012). A score  $\geq 10$  could be achieved in two ways: cumulatively, as a sum total of points scored across various measures, or at once, if the participant reported any receptive CAS in the past 6 months.

PrEP use and receipt of the MenACWY vaccine were measured as single items that asked participants to indicate whether they were currently using PrEP (Yes/No) and whether they had received MenACWY immunization (Yes/No/Don't know). Participants who reported not knowing whether they had received MenACWY immunization (i.e., 30.2% of the analytic sample) were collapsed with those who reported not having received MenACWY immunization to create a dichotomous outcome mirroring the structure of the PrEP use variable (Yes/No). Individuals were categorized by concomitant use of PrEP and MenACWY: PrEP+/MenACWY+ (i.e., PrEP user and MenACWY vaccinated), PrEP+/MenACWY- (i.e., PrEP user but not MenACWY vaccinated), PrEP-/MenACWY+ (i.e., MenACWY vaccinated but not a PrEP user), PrEP-/MenACWY- (i.e., neither a PrEP user nor MenACWY vaccinated). This nominal variable for concomitant use of PrEP and MenACWY served as our primary outcome variable.

## Statistical Analysis

We restricted the analysis to individuals who were eligible for PrEP (i.e. not living with HIV) and who had complete data for both PrEP use and MenACWY uptake. Following data cleaning and a review of all item results, we evaluated characteristic differences and ran descriptive analyses among the different categories of the outcome variable using SAS 9.3.

Bivariate and multivariate associations were conducted to assess associations between independent and dependent variables. Specifically, Pearson's chi-square (for categorical variables) and Kruskal Wallis ANOVA (for non-normally distributed continuous variables) tests were used to analyze associations between sets of the outcome variable, sociodemographic characteristics and behavioral health variables. Significance levels were set at  $\alpha=0.10$  at the bivariate level due to the exploratory nature of this work; in the multivariable model, significance levels were set at  $\alpha=0.05$ . Independent variables that were significant in the bivariate analyses along with theoretically relevant covariates were included in the multivariable analysis. A multinomial logit model was used to evaluate the association between the independent variables and the nominal dependent variable (i.e., concomitant PrEP use and MenACWY immunization), where PrEP-/MenACWY- was used as the reference group.

## Results

A total of 2,250 men were approached for the study, of which 749 were screened for eligibility. Of the 749 screened, a total of 520 surveys were completed by eligible individuals (response proportion = 69%). Of these 520, 476 (91.5%) were retained for the PrEP and MenACWY analysis. Concomitant PrEP+/MenACWY+ use was reported in 47 (9.9%) of men, whereas 57 (12.0%) reported PrEP+/MenACWY-, 104 (21.9%) reported PrEP-/MenACWY+ and 268 (56.3%) reported PrEP-/MenACWY-.

At the bivariate level, concomitant PrEP and MenACWY use significantly differed by age, education, illicit drug use, any STI diagnosis, number of sex partners in the last six months and any receptive CAS in the past six months. Those who were neither PrEP users nor recipients of the MenACWY vaccination (i.e., PrEP-/MenACWY-) tended to be younger, not have a college degree or more, and not have health insurance compared to the other groups (Table 1). PrEP-/MenACWY- individuals also tended to not use illicit drugs, not report any previous STI diagnosis, report fewer sex partners in the last six months and not report any receptive CAS in the past six months (Table 2).

Results from the multivariable analysis indicated that education was significantly associated with all comparisons of concomitant use of PrEP and MenACWY (Table 3). Those who completed at least a bachelor's degree were 6.0 times more likely to be both a PrEP user and MenACWY recipient versus being neither ( $p=.001$ ), 2.4 times more likely to be a PrEP user only versus neither ( $p=.041$ ), and 2.5 times more likely to be a MenACWY recipient only versus neither ( $p=.004$ ) compared to those who had less education.

The multivariable results also indicated that the number of sex partners in the last six months and any recent receptive CAS were significantly associated to the comparison involving



PrEP+/MenACWY+ and PrEP-/MenACWY- (Table 3). Those who reported having 6–10 sex partners in the last six months were 3.3 times more likely to be both PrEP users and MenACWY recipients versus neither compared to those who reported only having 1–5 sex partners in the past six months ( $p=.011$ ). Likewise, those who reported having 11 or more sex partners in the last six months were 8.0 times more likely to be both PrEP users and MenACWY recipients versus neither compared to those who reported having only 1–5 sex partners in the last six months ( $p<.001$ ). Those who reported any recent receptive CAS were 2.3 times more likely to be both PrEP users and MenACWY recipients versus neither compared to those who did not report recent receptive CAS ( $p=.030$ ).

In addition to education, any STI diagnosis, number of sex partners in the past 6 months and any receptive CAS in the past 6 months were significantly associated with being a PrEP user but not MenACWY vaccinated (i.e., PrEP+/ MenACWY-). That is, those who reported an STI diagnosis were 3.0 times more likely to be a PrEP user only relative to being neither compared to those who did not report a recent STI ( $p=.007$ ). Those who reported 11 or more sex partners in the past 6 months were 3.9 times more likely to be only PrEP users versus neither compared to those who reported having only 1–5 sex partners in the last six months ( $p=.002$ ). Finally, those who reported any recent receptive CAS were 2.6 times more likely to be PrEP users only versus neither relative to those who did not report recent receptive CAS ( $p=.007$ ).

## Discussion

This study sought to understand the degree of overlap in PrEP use and quadrivalent meningococcal vaccine (MenACWY) immunization in a sample of GBMSM in Southern California during an ongoing invasive meningococcal disease outbreak primarily affecting GBMSM. Overall, the results point to low uptake of these two prevention modalities in combination among this sample of HIV-negative GBMSM. Specifically, less than 10% of the sample was protected against both HIV and IMD. This finding may indicate missed opportunities for HIV prevention and IMD prevention among GBMSM in Los Angeles County.

The participants who reported PrEP use but not MenACWY immunization (~12% of the sample) are of particular interest. GBMSM PrEP users are engaged with regular medical care as CDC clinical guidelines recommend quarterly HIV and STI screening for PrEP users (Centers for Disease Control and Prevention, 2017a). These regular medical visits would be an ideal time for providers to speak with their patients about IMD. It is unclear the degree to which providers recognize risks for IMD among GBMSM and perform regular chart reviews to determine IMD coverage among GBMSM patients. While GBMSM PrEP users should discuss sexual behaviors with their providers during regular follow-up visits (Centers for Disease Control and Prevention, 2017a), a recent analysis by Parsons et al (2018) indicated 23% of GBMSM reported not discussing sexual behavior with their PrEP care provider at their last visit (Parsons, John, Whitfield, Cienfuegos-Szalay, & Grov, 2018). Indeed, GBMSM may find it difficult to discuss sexual behavior with healthcare providers for a number of reasons (Mimiaga, Goldhammer, Belanoff, Tetu, & Mayer, 2007), including disclosure of sexual orientation (Durso & Meyer, 2013). Findings presented here suggest



that both patients and providers require additional information about reviewing MenACWY immunization history and sexual risk behavior when prescribing PrEP and monitoring PrEP use.

Another potential complication in leveraging PrEP visits for MenACWY vaccination is the fact that many GBMSM receive PrEP from specialists, while routine healthcare (including vaccinations) are often provided by primary care providers (PCPs). A recent study by Petroll and colleagues (Petroll et al., 2017) noted that fewer PCPs had heard of PrEP (76%), felt familiar with prescribing PrEP (28%), or had prescribed it previously (17%) compared to HIV specialists. Researchers have called for the integration of PrEP into routine primary care for all adults (Calabrese, Krakower, & Mayer, 2017). One way to increase the dual implementation of vaccination and PrEP in primary care settings may be to initiate electronic medical record triggers that notify providers about recommendations for GBMSM patients related to both prevention strategies. Some health systems have begun to include sexual orientation and gender identity fields (Callahan, Hazarian, Yarborough, & Sánchez, 2014; Callahan et al., 2015), as well as behavioral risk factors for HIV testing (Goetz et al., 2008) and immunization (Gerard et al., 2008) into electronic medical records. These types of strategies may be especially effective in improving dual PrEP and immunization coverage as electronic medical records are increasingly integrated across systems of primary care and specialty care (Burton, Anderson, & Kues, 2004).

Participants who had received the MenACWY immunization but were not current PrEP users (~22% of the sample) also warrant attention; however, recommending a course of action for these men is less clear. Among this group, approximately 63% would be good candidates for PrEP given their scores on the CDC risk index. Based on their immunization status, GBMSM in this group are likely aware of gay-specific health issues (Aubert et al., 2015). In 2017, the CA DPH recommended that all gay and bisexual men in Los Angeles, Orange and San Diego Counties receive MenACWY immunization (California Department of Public Health, 2016, 2017). This was a policy change from 2016 when CA DPH stated, “gay and bisexual men who may be at increased risk for meningococcal disease to consider receiving MenACWY” (California Department of Public Health, 2016). The stronger language in 2017 prompted a range of public health efforts in Los Angeles County to increase MenACWY vaccination, including social marketing campaigns and free vaccination at LGBT health centers, public health clinics, and community events. Disease outbreaks among GBMSM may represent a crucial window when perceived susceptibility to VPDs are elevated; these times may also be opportunities for public health professionals and providers to have conversations with GBMSM about other prevention strategies, including PrEP.

That said, integrating PrEP screening into MenACWY vaccination visits is challenging for a number of reasons. First, as was the case in Los Angeles County, public health vaccination events are often mounted quickly in the context of ongoing disease outbreaks. These vaccination visits may take place at health fairs, mobile clinics and other temporary venues where the focus is disseminating vaccine to vulnerable groups quickly. In service of this goal, vaccination may be delivered by volunteers or paraprofessionals, who may have limited knowledge of PrEP and limited time in which to initiate conversations. At the very

least, informational materials, including those from the recent CDC campaign regarding PrEP might be easily disseminated (Centers for Disease Control and Prevention, 2017c). Another challenge to integrating these two approaches is the fact that PrEP, as it currently stands, requires complex decision-making for patients in the context of risk over time, and does not necessarily lend itself to a one-time vaccination appointment. As injectable PrEP comes online (Beymer, Gildner, Holloway, & Landovitz, 2018), there may be opportunities for administration of both MenACWY and PrEP for those who are ready to begin using PrEP right away. However, for many GBMSM, this will require a longer appointment, multiple conversations and lead time to facilitate the decision to initiate PrEP. A MenACWY immunization visit may be the first step in a longer process toward PrEP initiation, but it can also be a crucial time to begin the conversation, especially in the context of a VPD outbreak. Further research on how integrating PrEP conversations into MenACWY vaccination visits in the context of larger health issues for MSM (e.g., other VPDs, STI testing, substance use disorder screening, and mental health screening) is warranted.

The majority of participants in our study reported not being prescribed PrEP or being vaccinated against IMD (~56%). These GBMSM were less likely to use illicit drugs, to have been diagnosed with an STI or to report recent receptive CAS compared to GBMSM in the other groups. In some ways, this finding is intuitive; GBMSM with lower behavioral health risk may not need prevention modalities like PrEP and MenACWY immunization, which have traditionally been tied to “higher risk” individuals. That said, over half (55%) would be good candidates for PrEP given their scores on the CDC risk index. This largest group, especially those within this group who could benefit from PrEP, demands more research on best practices for healthcare engagement.

Numerous barriers have been shown to impact PrEP uptake, including practical, structural, and psychological factors (Gallagher et al., 2014; Krakower & Mayer, 2015; Levy, 2014; Marcus et al., 2013; Pérez-Figueroa, Kapadia, Barton, Eddy, & Halkitis, 2015; Smith, Toledo, Smith, Adams, & Rothenberg, 2012). Similar multi-level barriers to vaccination have been observed among MSM, including poor general knowledge about vaccination among MSM (Hester, Squires, & Delaney, 2005; Kypri et al., 2004; Lieb et al., 2011; Neighbors, Larimer, & Lewis, 2004), which may result in difficulty assessing disease severity and susceptibility (Schutten, de Wit, & van Steenberg, 2002). Additional barriers include low perceived vaccination benefit, limited healthcare access, limited provider communication about risk behaviors, and distrust of government (Parker, Vardavas, Marcum, & Gidengil, 2013). Finally, personal and structural barriers (e.g., racial/ ethnic minority status, structural stigma, vaccine availability) may add to YMSM’s immunization challenges (Graham et al., 2011).

Future studies should seek to better understand attitudes toward individual and combination prevention interventions for GBMSM. Others have recommended a more holistic approach to addressing HIV among diverse GBMSM, given the syndemic health issues affecting this population (Halkitis, Wolitski, & Millett, 2013). In this context, a holistic approach would include direct and open communication regarding behavioral risk factors for both HIV and IMD, including a thorough sexual health history assessment (Fuzzell, Fedesco, Alexander,

Fortenberry, & Shields, 2016; Meanley et al., 2015). For many GBMSM, a conversation about vaccination could lead to a conversation about PrEP and vice versa.

There are limitations to this research, which should be taken into account when interpreting our findings. First, all data were collected via self-report, which limits our ability to accurately estimate the true prevalence of PrEP use and MenACWY immunization in our sample. PrEP uptake in our sample (~22%) was similar to that estimated by the Division of HIV and STD Programs' MSM PrEP Continuum of Care (~21%), which relies on filled prescription data. Recall bias and social desirability bias could be addressed in future research on PrEP and immunization uptake by relying on medical record review and/or biomarkers of PrEP and immunization. Second, our data were collected in diverse GBMSM venues in Los Angeles during an ongoing IMD outbreak and a concerted effort by LAC DPH to increase PrEP uptake among GBMSM. As a result, we are not able to generalize our findings to GBMSM who do not attend gay-identified venues. In addition, our results are unlikely to mirror other geographies where MenACWY immunization and PrEP uptake are not prioritized for GBMSM.

## Conclusion

Despite these limitations the findings presented here have the potential to advance the field of GBMSM health research. PrEP is highly efficacious in preventing HIV; however, uptake among GBMSM remains low (Kirby & Thornber-Dunwell, 2014; Krakower et al., 2012). Similarly, MenACWY immunization for IMD prevention is underutilized by GBMSM (Holloway et al., 2018). Given the substantial public health resources being devoted to expanding PrEP coverage among GBMSM, it makes sense to utilize PrEP screening and follow-up as opportunities for discussing vaccination. In addition, when outbreaks of VPDs occur among GBMSM, public health professionals have a window of opportunity to initiate conversations about PrEP with GBMSM who may be otherwise difficult to engage. More attention in research and practice can be focused on the combination of diverse health promotion and disease prevention strategies to improve the overall well-being of GBMSM.

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**Table 1.**

Demographic characteristics.

	PrEP+/MenACWY + (9.9%, n=47)	PrEP+/MenACWY - (12.0%, n=57)	PrEP-/MenACWY + (21.9%, n=104)	PrEP-/MenACWY - (56.3%, n=268)	Total (N=476)	p-value
Variable	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	
Age (years)	32.1 (30.2, 34.0)	33.1 (31.0, 35.2)	33.8 (31.8, 35.8)	32.4 (31.1, 33.6)	32.7 (31.9, 33.6)	.50
Age categories (years)						< .01 <sup>a</sup>
18–24	10.6 (4.4, 23.4)	10.5 (4.8, 21.7)	16.3 (10.4, 24.8)	28.0 (22.9, 33.7)	21.6 (18.2, 25.6)	
25–44	83.0 (69.3, 91.3)	80.7 (68.3, 89.1)	63.5 (53.7, 72.2)	58.6 (52.6, 64.4)	64.7 (60.3, 68.9)	
45–64	6.4 (2.0, 18.2)	8.8 (3.7, 19.6)	20.2 (13.5, 29.1)	12.7 (9.2, 17.3)	13.2 (10.5, 16.6)	
65+	0	0	0	0.7 (0.2, 3.0)	0.4 (0.1, 1.7)	
Race/Ethnicity						.17
White	42.6 (29.2, 57.1)	48.2 (35.4, 61.3)	36.5 (27.8, 46.3)	33.3 (27.9, 39.2)	36.7 (32.5, 41.2)	
Black	12.8 (5.8, 25.9)	16.1 (8.5, 28.3)	12.5 (7.4, 20.4)	15.0 (11.2, 19.8)	14.3 (11.5, 17.8)	
Hispanic	27.7 (16.7, 42.2)	19.6 (11.1, 32.3)	40.4 (31.3, 50.1)	31.8 (26.5, 37.7)	31.9 (27.8, 36.2)	
Other	17.0 (8.7, 30.7)		10.6 (5.9, 18.2)	19.9 (15.5, 25.1)	17.1 (14.0, 20.8)	
Education (BA or more)	87.2 (74.1, 94.2)	75.4 (62.5, 85.0)	77.9 (68.8, 84.9)	63.4 (57.5, 69.0)	70.4 (66.1, 74.3)	< .01 <sup>a</sup>
Employment (Full-time)	46.8 (33.0, 61.1)	49.1 (36.3, 62.0)	43.3 (34.0, 53.0)	42.7 (36.9, 48.7)	44.0 (39.6, 48.5)	.81
Insured						.05 <sup>a</sup>
Private	68.1 (53.4, 79.9)	66.1 (52.7, 77.3)	69.2 (59.7, 77.4)	50.8 (44.7, 56.8)	58.5 (53.9, 62.9)	
Medicare / Medicaid	19.1 (10.2, 33.1)	23.2 (13.9, 36.2)	18.3 (11.9, 27.0)	26.9 (21.9, 32.7)	23.8 (20.1, 27.9)	
Other	4.3 (1.0, 15.7)	3.6 (0.9, 13.4)	1.9 (0.5, 7.4)	6.9 (4.4, 10.7)	5.1 (3.5, 7.6)	
None	8.5 (3.2, 20.8)	7.1 (2.7, 17.7)	10.6 (5.9, 18.2)	15.4 (11.5, 20.3)	12.6 (9.9, 16.0)	
West Hollywood	46.8 (33.0, 61.1)	52.6 (39.6, 65.3)	43.3 (34.0, 53.0)	38.1 (32.4, 44.0)	41.8 (37.4, 46.3)	.18

<sup>a</sup> p<.10

**Table 2.**

Health characteristics.

	<b>PrEP+/MenACWY + (9.9%, n=47)</b>	<b>PrEP+/MenACWY - (12.0%, n=57)</b>	<b>PrEP-/MenACWY + (21.9%, n=104)</b>	<b>PrEP-/MenACWY - (56.3%, n=268)</b>	<b>Total (N=476)</b>	<b>p-value</b>
Variable	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CI)	% (95% CH)	
Alcohol use	61.7 (47.0, 74.5)	61.4 (48.1, 73.2)	55.8 (46.1, 65.1)	56.3 (50.3, 62.2)	57.4 (52.8, 61.7)	.81
Marijuana use	38.3 (25.5, 53.0)	38.6 (26.8, 51.9)	29.8 (21.8, 39.3)	34.3 (28.9, 40.2)	34.2 (30.1, 38.6)	.63
Illicit Drug Use	46.8 (33.0, 61.1)	47.4 (34.7, 60.4)	30.8 (22.6, 40.3)	24.3 (19.5, 29.8)	30.7 (26.7, 35.0)	< .01 <sup>a</sup>
STI diagnosis	44.7 (31.1, 59.1)	52.6 (39.6, 65.3)	30.8 (22.6, 40.4)	22.4 (17.8, 27.8)	30.0 (26.1, 34.3)	< .01 <sup>a</sup>
No. Sexual Partners						< .01 <sup>a</sup>
0-5	38.3 (25.5, 53.0)	52.6 (39.6, 65.3)	77.9 (68.8, 84.9)	81.3 (76.2, 85.6)	72.9 (68.7, 76.7)	
6-10	21.3 (11.8, 35.4)	17.5 (9.6, 29.8)	12.5 (7.4, 20.4)	11.2 (7.9, 15.6)	13.2 (10.5, 16.6)	
11+	40.4 (27.3, 55.0)	29.8 (19.3, 43.0)	9.6 (5.2, 17.0)	7.5 (4.9, 11.3)	13.9 (11.0, 17.3)	
Any Recent Receptive CAS	70.2 (55.6, 81.6)	73.7 (60.7, 83.6)	51.0 (41.4, 60.5)	43.7 (37.8, 49.7)	51.5 (47.0, 56.0)	< .01 <sup>a</sup>
CDC Risk Score	22.2 (19.4, 24.9)	19.9 (17.3, 22.6)	13.8 (12.2, 15.4)	12.6 (11.7, 13.5)	14.7 (13.8, 15.5)	< .01 <sup>a</sup>
High CDC Risk Score ( > 10)	88.6 (75.2, 95.3)	83.3 (70.8, 91.2)	62.9 (52.8, 72.0)	55.0 (48.9, 61.0)	63.3 (58.8, 67.7)	< .01 <sup>a</sup>

<sup>a</sup> p<.10

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**Table 3.**

Multinomial logit of concomitant use of PrEP and MenACWY.

	PrEP+/ MenACWY+ vs. PrEP-/ MenACWY-	PrEP+/ MenACWY- vs. PrEP-/ MenACWY-	PrEP-/ MenACWY+ vs. PrEP-/ MenACWY-
Variable	RRR (95% CI)	RRR (95% CI)	RRR (95% CI)
Age 30+ (ref=18–29) <sup>b</sup>	1.10 (.54, 2.24)	1.45 (.74, 2.85)	.99 (.61, 1.62)
Race/Ethnicity (ref=White)			
Black	1.32 (.43, 4.06)	1.57 (.60, 4.10)	1.06 (.48, 2.32)
Hispanic	1.01 (.42, 2.43)	.66 (.28, 1.58)	1.54 (.86, 2.74)
Other	1.09 (.39, 3.03)	.94 (.36, 2.43)	.65 (.29, 1.44)
Education: BA or more (ref=No)	6.04 <sup>a</sup> (2.10, 17.33)	2.39 <sup>a</sup> (1.04, 5.52)	2.52 <sup>a</sup> (1.34, 4.74)
Full-time Employment (ref=No)	.64 (.27, 1.56)	.77 (.36, 1.69)	.82 (.45, 1.50)
Insured (ref=No)	1.42 (.44, 4.59)	1.82 (.58, 5.71)	1.54 (.74, 3.24)
West Hollywood (ref=No)	1.33 (.65, 2.73)	1.69 (.87, 3.27)	1.18 (.72, 1.95)
Alcohol Use (ref=No)	1.52 (.54, 4.24)	1.01 (.40, 2.57)	1.20 (.60, 2.42)
Marijuana Use (ref=No)	.97 (.39, 2.44)	.79 (.35, 1.80)	.83 (.43, 1.61)
Illicit Drug Use (ref=No)	2.41 (.92, 6.36)	2.29 (.98, 5.38)	1.59 (.84, 3.03)
Any STI (ref=No)	1.87 (.75, 4.63)	3.05 <sup>a</sup> (1.35, 6.90)	1.74 (.94, 3.23)
No. Sexual Partners (ref=0–5)			
6–10	3.28 <sup>a</sup> (1.31, 8.21)	2.10 (.88, 5.03)	1.01 (.49, 2.08)
11+	8.04 <sup>a</sup> (3.40, 18.99)	3.86 <sup>a</sup> (1.66, 9.02)	1.03 (.44, 2.40)
Any Recent Receptive CAS (ref=No)	2.27 <sup>a</sup> (1.08, 4.75)	2.60 <sup>a</sup> (1.31, 5.19)	1.30 (.81, 2.10)

<sup>a</sup> p<.05<sup>b</sup> Age was dichotomized at median age 30 due to small cell sizes < 5