



# Rates of Pre-exposure Prophylaxis Use and Discontinuation Among a Large U.S. National Sample of Sexual Minority Men and Adolescents

Thomas H. F. Whitfield<sup>1,2</sup> · Jeffrey T. Parsons<sup>3</sup> · H. Jonathon Rendina<sup>1,2,4</sup>

Received: 19 September 2018 / Revised: 27 October 2019 / Accepted: 28 November 2019 / Published online: 16 December 2019  
© Springer Science+Business Media, LLC, part of Springer Nature 2019

## Abstract

Pre-exposure prophylaxis (PrEP) is highly effective in the prevention of HIV acquisition and was recently approved for those under 18 years of age. The primary goal of the present study was to understand the prevalence of and factors associated with PrEP use among a large sample of young and adult sexual minority men (Y/SMM). Participants came from a larger national sample of SMM. Data collected included demographics, substance use, PrEP use, and sexual risk. Participants were recruited via sexual networking/dating applications and resided in the U.S. including Puerto Rico, were at least 13 years old, self-reported being HIV-negative, and identified as male. The sample was divided into two groups: YSMM (13–24 years of age) and adult SMM (25 years of age and up). Multinomial logistic regressions examining associations with never, current, and former PrEP use were run with all variables of interest simultaneously entered into the models. Age was positively associated with both former and current PrEP use among YSMM. Additionally, YSMM who identified as gay (vs. bisexual), lived in the Northeast, Midwest, and West (vs. South), had their own health insurance (vs. those on their parent's), had recently been diagnosed with an STI, and had recently used a drug all had higher odds of being a current PrEP user compared to those that had never used PrEP. Among adult SMM, those who were older did not have higher odds of current PrEP use compared to those that had never used PrEP. Those who identified as queer (vs. gay), single, had their own or were on their partner's insurance (vs. parent's), recent condomless anal sex, recent STI diagnosis, recent drug use, and recent substance use all had higher odds of being a current PrEP user compared to those that had never used PrEP. Research is needed to address the disparities in PrEP uptake among YSMM. Interventions for PrEP access among those on their parents' insurance may also be necessary.

**Keywords** PrEP uptake · Sexual minority men · Biomedical prevention · Sexual risk · HIV prevention · Sexual orientation

## Introduction

Sexual minority men (SMM) are disproportionately affected by human immunodeficiency virus (HIV) in the U.S. and accounted for 83% of all new HIV diagnoses among men in 2016 (Centers for Disease Control and Prevention [CDC], 2018a; U.S. Department of Health and Human Services, 2017). Of particular concern are young sexual minority men (YSMM; ages 13–24), who in 2015 made up 92% of all new infections among men in their age-group (CDC, 2018b). In 2012, the United States Food and Drug Administration (USFDA) approved pre-exposure prophylaxis (PrEP), a once-daily pill that has been shown to be 92–99% effective in the prevention of HIV (CDC, 2012, 2015; USFDA, 2012; Volk et al., 2015). PrEP is currently the most effective biomedical prevention technique available. Upon initial release, PrEP was only made available to those 18 years of age and up, leaving out a very vulnerable group of sexual minority

✉ H. Jonathon Rendina  
hrendina@hunter.cuny.edu

<sup>1</sup> Center for HIV/AIDS Educational Studies and Training, Hunter College of the City University of New York, New York, NY, USA

<sup>2</sup> Health Psychology and Clinical Sciences Doctoral Program, The Graduate Center of the City University of New York, New York, NY, USA

<sup>3</sup> Teaneck, NJ, USA

<sup>4</sup> Department of Psychology, Hunter College of the City University of New York, 695 Park Ave., New York, NY 10065, USA

individuals. Little research has been conducted to understand specific barriers to PrEP use for YSMM.

Since the release of PrEP, more than 140,000 individuals have begun a PrEP regimen and there were an estimated 61,000 users as of the end of 2017 (Sullivan et al., 2018). Emerging research has demonstrated that PrEP is both safe and effective for individuals as young as 15-years-old (Hosek et al., 2017) and on May 15, 2018, it was announced the USFDA had approved PrEP for use by individuals under the age of 18 using the same behavioral eligibility as adults (National Institute of Child Health and Human Development [NICHD], 2018). Prior to the approval of PrEP for those under 18 years of age, some researchers had reported that PrEP use had occurred for some not meeting the age requirement (Holloway et al., 2017; Khanna, Schumm, & Schneider, 2017; Kuhns, Hotton, Schneider, Garofalo, & Fujimoto, 2017). However, with only limited research that examines PrEP use among YSMM, it is impossible to know what additional barriers exist that may impede this vulnerable population from beginning and maintaining a regimen. Further, PrEP uptake for individuals under 24 years of age has been lower than older adult SMM (CDC, 2018a, 2018b) and suggests that there may be different or additional barriers for YSMM. In order to increase PrEP uptake among this younger and highly at-risk population, we must understand these barriers and create interventions that can effectively help YSMM access PrEP when necessary.

One such barrier that may affect YSMM differently than adult SMM is access to health care. A PrEP prescription can cost upward of \$14,000 a year in the U.S. (San Francisco AIDS Foundation, 2018), making access to affordable health care imperative to initiate and maintain a regimen. In the U.S., individuals are able to be on their parent or guardian's insurance until they reach 26 years of age (U.S. Department of Health and Human Services, 2017). For YSMM who are on their parent or guardian's insurance, this may mean having to be open about their sexuality or sexual behaviors to their parents or fearing their parents may find out. These findings would suggest that interventions for YSMM to access PrEP without health insurance may be necessary to increase uptake and thus lower the rate of new HIV infections.

This present study utilized a large national sample of SMM to compare YSMM (13–24 years of age) to adult SMM (25 years of age and up) for group and behavioral associations with never, current, and former PrEP use. We hypothesized that for those 13–24 years of age, age will be positively associated with PrEP use, such that the odds of use increase for each additional year. Conversely, for those 25 years of age and up, we hypothesized that age will be negatively associated with use and result in a decrease of odds for current use for each additional year of age. Additionally, we hypothesized that for YSMM, being on their parent or guardian's health insurance will result in decreased odds of having experience with PrEP. Lastly, we explored additional group differences by demographics and

risk behaviors. These included race, ethnicity, sexual orientation, region, recent condomless anal sex (CAS), recent STI diagnosis, illicit drug use, and heavy drinking. Results from these analyses should provide evidence that in order to increase PrEP use among YSMM, different interventions will need to be implemented than those used for adult SMM.

## Method

### Participants and Procedure

We drew the data for this study from a brief online screening survey used to recruit participants for several studies examining the biopsychosocial predictors of HIV seroconversion among SMM. Targeted advertisements were placed on popular sexual networking/dating applications, which were linked to the survey via qualtrics.com. This survey took approximately 5 min to complete and participants did not receive compensation, though those who met eligibility for a variety of studies had the opportunity for future compensation within that research.

Data were collected between November 2017 and September 2018. IP addresses and contact information were collected at the conclusion of the survey, allowing the deletion of duplicate entries. In total, 116,692 individuals began the survey and 107,794 (75.4%) completed. In order to be included in the following analyses, individuals had to be above 13 years of age, currently identify as male, reside in the U.S. or a U.S. territory, self-report an HIV-negative status, and have recently engaged in sexual activity with another person identifying as a male. This resulted in an analytic sample of 96,243 participants.

## Measures

### Demographics

Individuals were asked a range of demographic questions such as age, gender, sexual identity, race/ethnicity, geographic location, health insurance, and HIV status. Two questions about health insurance were included. One question asked participants whether they have insurance, while the other asked whether this insurance is their own private insurance, or through their parent/guardian, or partner.

### PrEP Use

Participants were provided with the following prompt before answering the question on PrEP use: "PrEP (pre-exposure prophylaxis) is a biomedical strategy to prevent HIV infection. PrEP involves HIV-negative guys taking anti-HIV medications (for example, Truvada) once a day, every day to reduce the likelihood of HIV infection if they were exposed to the virus." Individuals reported current PrEP use by

responding to the question “Have you ever been prescribed HIV medication (e.g., Truvada) for use as PrEP (HIV pre-exposure prophylaxis)?” Response options were, “Yes, I am currently prescribed PrEP,” “Yes, but I am no longer prescribed PrEP,” and “No, I’ve never been prescribed PrEP.”

### Sexual Risk and PrEP Behavioral Eligibility

To measure sexual risk and PrEP behavioral eligibility in the recent past, participants reported how many CAS acts with HIV status unknown or HIV unknown partners they had during the last 6 months. Those that had none were coded as “no,” and those who had engaged in at least one were coded as “yes.”

### Recent STI Diagnosis

Participants reported whether they had received a positive STI diagnosis in the last 6 months. Those who had were coded as “yes,” whereas those who had not were coded as “no.”

### Recent Drug Use

Participants reported whether they had used drugs (e.g., marijuana, cocaine, crack, crystal meth, GHB, heroin) within the last 90 days. Those who reported drug use were coded as “yes,” and those who did not were coded as “no.”

### Heavy Alcohol Use

Participants reported whether in the last 90 days they had engaged in heavy drinking, defined as 5 or more drinks in a single day. Those who had at least one day of heavy drinking were coded as “yes,” and those who did not were coded as “no.”

### Statistical Analyses

We first ran descriptive statistics to characterize the sample in terms of never, current, and former PrEP use. We then used bivariate chi-square tests of independence to examine differences in PrEP use by age, race/ethnicity (White, Black, Asian and other Pacific Islander, American Indian or Alaskan Native, multiracial, other), Hispanic/Latino (yes/no), sexual identity (gay, bisexual, queer), health insurance (yes on parent’s, yes on my own, yes on partner’s, no insurance), age (13–17, 18–24, 25–34, 35–44, 45–54, and 55+ years of age), geographic region determined by zip code (South, Northeast, Midwest, West, other US territory/military), recent CAS, recent STI diagnosis, recent illicit drug use, and recent heavy drinking. Lastly, we split the sample into those who are YSMM (13–24 years of age) and adult SMM (25 years of age and up) before conducting

multinomial logistic regressions examining associations with the three-category PrEP use variable (never on PrEP, formerly on PrEP, currently on PrEP) using the same set of variables entered into the model simultaneously.

## Results

Demographic characteristics of the sample along with the demographic comparisons of never, former, and current PrEP use are presented in Table 1. The majority of the sample was above 25 years of age or older (73.1%), gay, (78.9%), single (69.4%), had recently engaged in CAS with an HIV unknown status partner (81.1%), had not received a recent STI diagnosis (87.7%), more than half recently used an illicit drug (62.7%) and similarly for at least one day of heavy drinking (62.3%). Additionally, the majority of the sample reported having never used PrEP (77.4%), while 16.5% were current users and 6.1% were former users.

The bivariate analysis presented in Table 1 resulted in statistically significant within-group differences for PrEP uptake among all demographics and behavioral variables at the  $p < .001$  level. The age-group reporting the least current use were those 13–17 years of age (1.2%), followed by those 18–24 years of age (7.8%). Current PrEP use increased to 18.1% for those 25–34 years of age, continued to increase for those 35–44 years of age (23.0%), and then decreased to 21.5% for those 45–54 years of age and 18.5% for those 55 years of age and up. Former PrEP use followed a similar pattern with the lowest at 1.0% for those 13–17 years of age and peaked at former use at 25–34 years of age. Compared to those with health insurance, those without health insurance made up the smallest percentage of current PrEP users compared to both never and former PrEP users, whereas those who had their own or were on their partner’s insurance made up the highest percentages of current use. Those who had a recent STI diagnosis, recent illicit drug use, or recent heavy drinking made up a larger percentage of those that were current PrEP users than to those that had not engaged in those behaviors.

### PrEP Use Among Young Sexual Minority Men

Results for the multinomial logistic regression for YSMM examining associations between former and current PrEP use and covariates are presented in Table 2. The first model compared those who had never used PrEP to those that were former PrEP users. Findings indicated that each additional year of age was associated with a 23% increase in the odds of being a former PrEP user compared to never having used PrEP. Multiple demographic covariates were also significant in the model including sexual orientation, relationship status, and geographic region. Those who identified as bisexual (compared

**Table 1** History of PrEP use among a U.S. national sample of young and adult sexual minority men ( $N=96,243$ )

	Full sample		PrEP use					
	<i>n</i>	%	Never		Current		Former	
	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%	<i>n</i>	%
Overall	96,243	100.0	74,482	77.4	15,922	16.5	5839	6.1
Age ( $m = 33.32$ )			$\chi^2(10) = 2981.16, p < .001^{***}$					
13–17	1291	1.3	1263	97.8 <sup>a</sup>	15	1.2 <sup>a</sup>	13	1.0 <sup>a</sup>
18–24	24,599	25.6	21,599	88.8 <sup>b</sup>	1911	7.8 <sup>b</sup>	1089	4.4 <sup>b</sup>
25–34	34,547	35.9	25,681	74.3 <sup>c</sup>	6254	18.1 <sup>c</sup>	2612	7.6 <sup>c</sup>
35–44	17,146	17.8	11,978	69.9 <sup>d</sup>	3937	23.0 <sup>d</sup>	1231	7.2 <sup>c</sup>
45–54	11,765	12.2	8644	73.5 <sup>c</sup>	2526	21.5 <sup>e</sup>	595	5.1 <sup>d</sup>
55+	6895	7.2	5317	77.1 <sup>c</sup>	1279	18.5 <sup>c</sup>	299	4.3 <sup>b</sup>
Race			$\chi^2(10) = 334.58, p < .001^{***}$					
White	60,664	63.0	46,269	76.3 <sup>a</sup>	10,858	17.9 <sup>a</sup>	3537	5.8 <sup>a</sup>
Black	11,986	12.5	9646	80.5 <sup>b</sup>	1651	13.8 <sup>b</sup>	689	5.7 <sup>a</sup>
Asian or other Pacific Islander	5124	5.3	3904	76.2 <sup>a,c</sup>	888	17.3 <sup>a</sup>	332	6.5 <sup>a</sup>
American Indian or Alaskan Native	1645	1.7	1360	82.7 <sup>d</sup>	190	11.6 <sup>c</sup>	95	5.8 <sup>a</sup>
Multiracial	10,272	10.7	7962	77.5 <sup>c</sup>	1522	14.8 <sup>d</sup>	788	7.7 <sup>b</sup>
Other	6552	6.8	5341	81.5 <sup>b,d</sup>	813	12.4 <sup>c</sup>	398	6.1 <sup>a</sup>
Hispanic/Latino			$\chi^2(2) = 94.58, p < .001^{***}$					
No	72,484	75.3	55,794	77.0 <sup>a</sup>	12,440	17.2 <sup>a</sup>	4250	5.9 <sup>a</sup>
Yes	23,759	24.7	18,688	78.7 <sup>b</sup>	3482	14.7 <sup>b</sup>	1589	6.7 <sup>b</sup>
Sexual orientation			$\chi^2(4) = 1887.36, p < .001^{***}$					
Gay	75,888	78.9	56,862	74.9 <sup>a</sup>	14,057	18.5 <sup>a</sup>	4969	6.5 <sup>a</sup>
Bisexual	18,029	18.7	16,073	89.2 <sup>b</sup>	1349	7.5 <sup>b</sup>	607	3.4 <sup>b</sup>
Queer	2326	2.4	1547	66.5 <sup>c</sup>	516	22.2 <sup>c</sup>	263	11.3 <sup>c</sup>
Relationship status			$\chi^2(2) = 215.75, p < .001^{***}$					
Single	66,827	69.4	52,529	78.6 <sup>a</sup>	10,293	15.4 <sup>a</sup>	4005	6.0 <sup>a</sup>
Partnered	29,416	30.6	21,953	74.6 <sup>b</sup>	5629	19.1 <sup>b</sup>	1834	6.2 <sup>a</sup>
Geographic region			$\chi^2(8) = 1063.77, p < .001^{***}$					
Northeast	18,997	19.7	13,528	71.2 <sup>a</sup>	4049	21.3 <sup>a</sup>	1420	7.5 <sup>a</sup>
Midwest	17,423	18.1	13,870	79.6 <sup>b</sup>	2667	15.3 <sup>b</sup>	886	5.1 <sup>b</sup>
South	33,101	34.4	26,980	81.5 <sup>c</sup>	4454	13.5 <sup>c</sup>	1667	5.0 <sup>b</sup>
West	25,666	26.7	19,126	74.5 <sup>d</sup>	4710	18.4 <sup>d</sup>	1830	7.1 <sup>a</sup>
USA territory/military	1056	1.1	978	92.6 <sup>c</sup>	42	4.0 <sup>e</sup>	36	3.4 <sup>c</sup>
Health insurance			$\chi^2(6) = 3492.55, p < .001^{***}$					
None	21,179	20.8	17,627	88.0 <sup>a</sup>	1123	5.6 <sup>a</sup>	1287	6.4 <sup>a</sup>
Own	65,282	64.2	44,843	72.4 <sup>b</sup>	13,172	21.3 <sup>b</sup>	3897	6.3 <sup>a</sup>
Partner's	2170	2.3	1504	69.3 <sup>c</sup>	529	24.4 <sup>c</sup>	137	6.3 <sup>a</sup>
Parent/guardian	12,124	12.6	10,508	86.7 <sup>d</sup>	1098	9.1 <sup>d</sup>	518	4.3 <sup>b</sup>
CAS with HIV status unknown partner			$\chi^2(2) = 176.80, p < .001^{***}$					
No	18,152	18.9	14,663	80.8 <sup>a</sup>	2413	13.3 <sup>a</sup>	1076	5.9 <sup>a</sup>
Yes	78,090	81.1	59,818	76.6 <sup>b</sup>	13,509	17.3 <sup>b</sup>	4763	6.1 <sup>a</sup>
STI diagnosis in the past 6 months			$\chi^2(2) = 4813.16, p < .001^{***}$					
No	84,419	87.7	68,227	80.8 <sup>a</sup>	11,549	13.7 <sup>a</sup>	4643	5.5 <sup>a</sup>
Yes	11,824	12.3	6255	52.9 <sup>b</sup>	4373	37.0 <sup>b</sup>	1196	10.1 <sup>b</sup>
Any drug use in the past 3 months			$\chi^2(2) = 1864.12, p < .001^{***}$					
No	35,946	37.3	30,158	84.9 <sup>a</sup>	3850	10.7 <sup>a</sup>	1578	4.4 <sup>a</sup>
Yes	60,297	62.7	43,964	72.9 <sup>b</sup>	12,072	20.0 <sup>b</sup>	4261	7.1 <sup>b</sup>
5 or more drinks in past 3 months			$\chi^2(2) = 94.39, p < .001^{***}$					
No	36,306	37.7	28,704	79.1 <sup>a</sup>	5598	15.4 <sup>a</sup>	2004	5.5 <sup>a</sup>
Yes	59,937	62.3	45,778	76.4 <sup>b</sup>	10,324	17.2 <sup>b</sup>	3835	6.4 <sup>b</sup>

PrEP pre-exposure prophylaxis, SMM sexual minority men

Row percentages are displayed; percentages within the same column with differing superscripts differ significantly ( $p < .05$ ) within post hoc comparisons

\*\*\* $p < .001$ ; \*\* $p < .01$ ; \* $p < .05$

**Table 2** Demographic and behavioral predictors of PrEP uptake and continuation among young sexual minority men (ages 13–24,  $N=25,890$ )

	Never (ref.) vs. former PrEP Use			Never (ref.) vs. current PrEP Use			Former (ref.) vs. current PrEP Use		
	$\beta$	AOR	95% CI	$\beta$	AOR	95% CI	$\beta$	AOR	95% CI
Age	0.21	1.23***	1.19, 1.27	0.27	1.31***	1.28, 1.35	0.06	1.06**	1.02, 1.11
Hispanic/Latino (ref. yes)									
No	0.09	1.09	0.93, 1.28	0.08	1.08	0.95, 1.23	-0.01	0.99	0.82, 1.20
Race (ref. white)									
Black	0.10	1.11	0.92, 1.33	-0.01	0.99	0.85, 1.15	-0.12	0.89	0.71, 1.11
Asian and other Pacific Islander	-0.14	0.87	0.66, 1.16	0.04	1.04	0.84, 1.28	0.17	1.19	0.85, 1.67
American Indian or Alaskan Native	-0.19	0.83	0.52, 1.34	-0.19	0.83	0.56, 1.22	-0.01	0.99	0.56, 1.79
Multiracial	0.12	1.13	0.94, 1.36	0.01	1.01	0.87, 1.18	-0.11	0.90	0.71, 1.12
Other	-0.22	0.81	0.62, 1.05	-0.50	0.61***	0.48, 0.77	-0.28	0.76	0.54, 1.05
Sexual orientation (ref. gay)									
Bisexual	-0.80	0.45***	0.38, 0.55	-0.95	0.39***	0.33, 0.45	-0.16	0.85	0.67, 1.08
Queer	0.37	1.45**	1.10, 1.92	0.16	1.17	0.92, 1.49	-0.22	0.81	0.57, 1.13
Relationship status (ref. partnered)									
Single	0.23	1.26**	1.09, 1.46	0.03	1.03	0.91, 1.17	-0.20	0.82*	0.68, 0.98
Region (ref. south)									
Northeast	0.62	1.85***	1.56, 2.20	0.70	2.01***	1.76, 2.30	0.08	1.08	0.88, 1.33
Midwest	0.20	1.23*	1.01, 1.49	0.24	1.27**	1.09, 1.48	0.03	1.03	0.82, 1.31
West	0.40	1.49***	1.26, 1.76	0.35	1.42***	1.24, 1.63	-0.04	0.96	0.78, 1.18
US territory/military	-1.08	0.34*	0.12, 0.93	-2.29	0.10**	0.03, 0.41	-1.21	0.30	0.05, 1.64
Medical insurance (ref. Yes, on parent's)									
Own insurance	0.22	1.26***	1.10, 1.45	0.18	1.20***	1.08, 1.34	-0.05	0.95	0.81, 1.12
Partner's insurance	0.15	1.16	0.62, 2.18	0.23	1.26	0.80, 1.99	0.08	1.09	0.52, 2.25
No. insurance	-0.30	0.74**	0.61, 0.89	-1.24	0.29***	0.24, 0.35	-0.94	0.39***	0.30, 0.51
CAS with HIV status unknown partner (ref. No)									
Yes	0.11	1.12	0.95, 1.31	0.12	1.13	1.00, 1.28	0.01	1.01	0.83, 1.23
STI diagnosis in the past 6 months (ref. No)									
Yes	1.22	3.37***	2.92, 3.89	1.56	4.77***	4.27, 5.32	0.35	1.41***	1.20, 1.67
Any illicit drug use in the past 3 months (ref. No)									
Yes	0.44	1.55***	1.34, 1.78	0.40	1.50***	1.34, 1.67	-0.03	0.97	0.81, 1.15
5 or more drinks (ref. No)									
Yes	0.02	1.02	0.88, 1.18	-0.01	0.99	0.88, 1.11	-0.03	0.97	0.82, 1.16

AOR for age represents each one-year increase in age

\*\*\*  $p < .001$ ; \*\*  $p < .01$ ; \*  $p < .05$

to gay) had lower odds, whereas those who identified as queer had higher odds of being a former PrEP user than never having used PrEP. Compared to those who reported having a partner, those who reported being single have higher odds of being a former PrEP user. Source of medical insurance was also significantly associated, such that compared to those that had insurance through their parent or guardian, those who reported being on their own insurance had higher odds, and those without insurance had lower odds of being a former PrEP user. In terms of risk behavior, CAS with an HIV status known partner was not associated with PrEP use for YSMC across any of the three models; however, those who had been recently diagnosed

with an STI had almost three and half times the odds of being a former PrEP user compared to never having used PrEP. Illicit substance use was also associated with higher odds of being a former PrEP user.

The second model compared YSMC who had never used PrEP to those that were current PrEP users. Each additional year of age was associated with a 31% increase in the odds of being a current PrEP user rather than never having used PrEP. Those who identified as bisexual, compared to gay, had lower odds of being a current PrEP user rather than never having used PrEP. Compared to those that live in the South, those who reside in the Northeast, Midwest, and West, all had higher odds of being a current PrEP user. Medical insurance was similarly

associated as in the previous model, such that an individual being on their own insurance resulted in higher odds of being a current PrEP user compared to those that were on their parent or guardian's. Oppositely, those who reported not having insurance had lower odds of being a current user compared to those on their parent or guardian's. Individuals who had recently been diagnosed with an STI had almost five times the odds of being a current PrEP user, and those who had recently used an illicit substance also had increased odds of being a current PrEP user.

The third model compared those who were former PrEP users to those that were current PrEP users. Age was positively associated with PrEP use, such that each increase of one year resulted in a 6% increase in the odds of being a current PrEP

user compared to former PrEP user. Compared to those that reported being in a relationship, those who were single had lower odds of being a current user compared to former PrEP user. Participants who did not have medical insurance had lower odds of being a current PrEP user compared to those that were on their parent or guardian's. Lastly, a recent STI diagnosis was associated with greater odds of bringing a current PrEP user compared to former.

### PrEP Use Among Adult Sexual Minority Men

Results for the multinomial logistic regression for adult SMM examining associations between former and current PrEP use

**Table 3** Demographic and behavioral predictors of PrEP uptake and discontinuation among adult sexual minority men (ages 25+,  $N=70,353$ )

	Never (ref.) vs. former PrEP Use			Never (ref.) vs. current PrEP use			Former (ref.) vs. current PrEP use		
	$\beta$	AOR	95% CI	$\beta$	AOR	95% CI	$\beta$	AOR	95% CI
Age	-0.02	0.99***	0.98, 0.99	0.00	1.00	0.99, 1.00	0.02	1.02***	1.01, 1.02
Hispanic/Latino (ref. Yes)									
No	0.11	1.12**	1.02, 1.22	0.07	1.07*	1.01, 1.14	-0.04	0.96	0.87, 1.06
Race (ref. white)									
Black	-0.02	0.98	0.88, 1.08	-0.09	0.92*	0.86, 0.98	-0.06	0.94	0.84, 1.05
Asian and other Pacific Islander	0.12	1.12	0.98, 1.29	0.05	1.05	0.96, 1.15	-0.07	0.93	0.80, 1.08
American Indian or Alaskan Native	-0.16	0.86	0.67, 1.09	-0.45	0.64***	0.53, 0.76	-0.30	0.74*	0.56, 0.99
Multiracial	0.18	1.19***	1.08, 1.32	-0.11	0.90**	0.83, 0.97	-0.28	0.75***	0.67, 0.85
Other	-0.17	0.85*	0.73, 0.98	-0.27	0.77***	0.69, 0.85	-0.10	0.91	0.77, 1.07
Sexual Orientation (ref. Gay)									
Bisexual	-0.78	0.46***	0.42, 0.51	-1.02	0.36***	0.34, 0.38	-0.24	0.78***	0.70, 0.88
Queer	0.62	1.85***	1.58, 2.17	0.32	1.37***	1.21, 1.55	-0.30	0.74***	0.62, 0.88
Relationship status (ref. partnered)									
Single	-0.02	0.98	0.92, 1.05	0.08	1.08***	1.03, 1.13	0.10	1.10**	1.03, 1.19
Region (ref. south)									
Northeast	0.39	1.48***	1.36, 1.61	0.34	1.40***	1.33, 1.48	-0.05	0.95	0.86, 1.04
Midwest	-0.02	0.98	0.89, 1.08	0.01	1.00	0.94, 1.06	0.02	1.02	0.92, 1.14
West	0.29	1.34***	1.24, 1.45	0.17	1.18***	1.12, 1.24	-0.13	0.88**	0.81, 0.96
US territory/military	-0.63	0.53***	0.37, 0.77	-1.50	0.22***	0.16, 0.31	-0.87	0.42***	0.26, 0.67
Medical insurance (ref. yes, on parent's)									
Own insurance	0.22	1.24*	1.01, 1.53	0.42	1.52***	1.32, 1.75	0.20	1.22	0.97, 1.53
Partner's insurance	0.29	1.33*	1.01, 1.76	0.49	1.63***	1.37, 1.95	0.20	1.22	0.91, 1.66
No insurance	0.08	1.08	0.87, 1.33	-1.09	0.34***	0.29, 0.39	-1.16	0.31***	0.25, 0.40
CAS with HIV status unknown partner (ref. No)									
Yes	0.1	1.11**	1.02, 1.20	0.39	1.48***	1.40, 1.56	0.29	1.34***	1.21, 1.46
STI diagnosis in the past 6 months (ref. No)									
Yes	0.86	2.36***	2.17, 2.56	1.37	3.95***	3.88, 4.17	0.52	1.68***	1.54, 1.83
Any illicit drug use in the past 3 months (ref. No)									
Yes	0.58	1.78***	1.67, 1.91	0.74	2.11***	2.01, 2.20	0.17	1.18***	1.09, 1.27
5 or more drinks (ref. No)									
Yes	0.01	1.01	0.94, 1.07	0.08	1.09***	1.04, 1.13	0.08	1.08*	1.00, 1.16

AOR for age represents each one-year increase in age

\*\*\* $p < .001$ ; \*\* $p < .01$ ; \* $p < .05$

are presented in Table 3. The first model compared those that had never used PrEP to those that were former PrEP users. Age was significantly negatively associated with being a former user such that each increase in one year of age was associated with a 1% decrease in the odds of being a former PrEP user. Compared to those who identified as gay, those who identified as bisexual had lower than half the odds, whereas those who identified as queer had almost twice the odds of being a former PrEP user. In terms of medical insurance status, compared to those who were on their parent or guardian's, those who had their own or their partner's had higher odds of being a former PrEP user. Having recently engaged in CAS with an HIV status unknown partner resulted in higher odds of being a former PrEP user. Individuals who had recently received an STI diagnosis have almost two and half times greater odds of being a former PrEP user, and illicit drug use was associated with over one and a half times the odds compared to those that had not used an illicit drug.

The second model compared those that reported having never used PrEP to those that were current PrEP users. Age was not significantly associated with PrEP use in this model. Compared to those that identified as Latino/Hispanic, those who did not had greater odds of being a current PrEP user. Compared to those who are reported being White, those who were Black, American Indian or Native American, Multiracial, or another race/ethnicity all had lower odds of being a current PrEP user. Identifying as bisexual, compared to gay, was associated with lower than half the odds of being a current PrEP user, whereas those who identified as queer had higher odds. Being single was associated with greater odds of being a current PrEP user compared to never having used PrEP. Individuals who lived in the Northeast and West had increased odds of PrEP use, whereas those in the military or other U.S. territory had lower odds of PrEP use, compared to those in the South. In terms of medical insurance, compared to those that were on their parent or guardian's insurance, both those who were on their own or their partner's insurance had higher odds of being a current PrEP user, whereas those who did not have insurance had lower odds of being a current PrEP user. Sexual risk behavior was associated with current PrEP use such that those who had recently engaged in CAS with an HIV unknown partner had greater odds of being a current PrEP user, and those who had recently been diagnosed with an STI had higher than four times the odds of being a current PrEP user. Illicit drug use and having at least one night of heavy drinking were both positively associated with greater odds of being a current PrEP user, with any illicit drug use resulting in more than two times the odds.

The third model compared former PrEP users to current PrEP users. Age was positively associated with continued PrEP use, such that each increase of one year of age resulted in a 2% increase in the odds of being a current PrEP user compared to former PrEP user. Few differences in race/ethnicity emerged, with only those who reported being American Indian or Alaskan Native and multiracial having lower odds of being a current

PrEP user compared to those who reported being White. Those who identified as bisexual or queer, compared to gay, had lower odds of being a current PrEP user, and those who reported being single also had greater odds of PrEP use. In terms of medical insurance, compared to those who were on their parent or guardian's insurance, those without insurance had lower odds of being a current PrEP user compared to former PrEP user. Lastly, having recently engaged in CAS with an HIV unknown partner, a recent STI diagnosis, recent illicit substance use, and at least one recent night of heavy drinking were all associated with greater odds of being a current PrEP user compared to former PrEP user among adult SMM.

## Discussion

In the present study, we analyzed data from a large US national sample of YSMM and adult SMM to examine group and behavioral associations with never, former, and current PrEP use. Although we hypothesized that the odds of PrEP use would increase with age for YSMM, we did not anticipate the magnitude of change. We found that among those 13–24 years of age, compared to those that never used PrEP, there was an increase of 23% and 31% in odds of former and current PrEP use, respectively, for each increase of one year of age. This finding alone suggests that there are many barriers to PrEP use that decrease with age. More research is needed on this population to identify these barriers and create interventions to overcome those barriers impeding PrEP uptake. Although some research has shown that some YSMM under 18 years of age have had experience with PrEP (Holloway et al., 2017; Khanna et al., 2017; Kuhns et al., 2017), very few in our sample indicated any experience. This is to be expected as the medication has only recently been approved for use with that age-group. However, based on the findings highlighted below, approval of PrEP for individuals under the age of 18 may not lead to substantially higher uptake among this population due to various other barriers. The interventions that are currently being used to increase uptake among adult SMM are likely not including these barriers and must be adjusted to for YSMM.

One additional barrier that we uncovered with this research is how health insurance is obtained. Having health insurance has previously been shown to be associated with PrEP uptake, though the realities of insurance are distinct for younger populations who may still be relying on their parents' plans. This finding is not related to having or not having health insurance, but on the source of the insurance. A construct that has been previously researched pertaining to PrEP uptake is willingness versus intentions (Parsons et al., 2017; Rendina, Whitfield, Grov, Starks, & Parsons, 2017), which may explain why this association exists. Willingness to begin taking PrEP is hypothetical and assumes there are zero barriers to beginning a regimen (e.g., for free, 100% effective, no side effects), whereas

intentions highlight the real-world barriers to use (e.g., health insurance, having a doctor who is willing to prescribe, possible side effects). One such barrier to use that may differentiate willingness from intentions for YSMM is the possibility that their parent or guardian could discover their sexual orientation or behavior via utilization of their shared health insurance. For YSMM who are not open about their sexual orientation or behavior with their parents or guardians, going on PrEP could mean disclosing information to them which they are not comfortable doing. To increase uptake among this population, it may be necessary to develop and implement public health policies that provide access to PrEP through additional insurance policies that guarantee minors' privacy protections. Another potential intervention that may lead to an increase in PrEP use among this population is targeting the parents of the individual at risk. Helping the guardian or caretaker of the individual understand the benefits of use may increase their acceptance and thereby increase uptake.

Differences in sexual orientation were also expected to be found among this sample, as multiple other studies have reported that those who identify as gay are more likely to be willing to use PrEP (Goedel, Halkitis, Greene, & Duncan, 2016; Holt et al., 2012; Mustanski, Johnson, Garofalo, Ryan, & Birkett, 2013). Gay men compared to bisexual men have been shown to be more likely to use LGBTQ health clinics for HIV testing, which has been linked to more PrEP knowledge (Aghaizu et al., 2013; Barash & Golden, 2010). Our findings indicate that those who identified as gay and queer had increased odds of being a former and current PrEP user compared to those that identified as bisexual. A recent STI diagnosis was also linked to both current and former PrEP use among both YSMM and adult SMM. We did not collect data on where individuals are gaining information on PrEP use; however, it is possible that those who are diagnosed with an STI are either being presented with information about PrEP at diagnosis or being diagnosed may have an influence on views of themselves as someone who is at risk. Further research is necessary to determine the associations between STI testing, PrEP knowledge, and changes in self-perception of HIV risk. The close association between an STI diagnosis and PrEP uptake suggests the period of time following a positive STI result may be optimal for interventions aiming to increase uptake to those most at risk. For YSMM specifically, information that addresses their specific concerns that may differ from adult SMM should be addressed by providers.

Another factor that may influence differences in sexual orientation identification is PrEP-related stigma, or negative thoughts and beliefs about those that use PrEP (Gilmore et al., 2013; Haberer et al., 2013; Mack, Odhiambo, Wong, & Agot, 2014; Smith, Toledo, Smith, Adams, & Rothenberg, 2012; Tangmunkongvorakul et al., 2013; Taylor et al., 2014). Men who identify as bisexual may view PrEP as a medication that is primarily for gay men that engage in more risk than they do, or

fear being labeled as gay if they begin a PrEP regimen. It may be important that new marketing strategies are investigated that target increasing uptake among all populations at risk.

Regional differences in PrEP experience are concerning given that rates of HIV transmission among SMM in the U.S. are highest in the South (Centers for Disease Control and Prevention, 2017), which was the region with the lowest likelihood of PrEP experience. The Northeast and West had the highest odds, which may be driven by some of the large urban centers with large numbers of SMM (e.g., New York City, Los Angeles, San Francisco) where PrEP uptake has been higher. It is imperative that we identify specific barriers and facilitators to uptake among those living in the South and other U.S. territories so that we can develop and implement public health interventions that have the potential to address this disparity. One way of doing this may be for researchers to collect qualitative data on where YSMM in the south are obtaining information about PrEP.

In terms of sexual risk, our findings are mixed as engagement in CAS for YSMM was not associated with PrEP use, whereas those with a recent STI diagnosis did have higher odds of current and former PrEP use compared to never. Previous findings indicate that for adult SMM, increased risk is associated with increased uptake (Holt et al., 2012; King et al., 2014), and previous models predicting uptake have determined that self-perception of being at-risk for HIV is associated with uptake (Arnold et al., 2017; Parsons et al., 2017). One reason for this may be the variable we used to determine HIV risk. We assessed risk very broadly, asking participants whether they have recently engaged in CAS with an HIV status unknown partner. Although this casts a wide net to determine who is and is not at risk, it does not take into account the amount of risk (i.e., number of CAS partners or events). Additionally, from our study we are unable to determine changes in risk behavior overtime, and findings with adult SMM for changes in risk behavior due to PrEP uptake have resulted in divergent findings (De Wit et al., 2015; Guest et al., 2008; Koester et al., 2017; Liu et al., 2013; Marcus et al., 2013; Newcomb, Moran, Feinstein, Forscher, & Mustanski, 2018; Sagaon-Teyssier et al., 2016). Researchers, clinicians, and prescribers may need to address risk perception with their participants and clients, as risk perception may be one of multiple keys necessary in getting YSMM engaged in PrEP use.

## Limitations

Although there are many strengths to this research, there are also limitations. One of the strengths of this research is use of a large dataset that is more generalizable to the U.S. population. However, a drawback is the limited set of available variables to consider. Other research has identified both income and employment as predictors of PrEP use; however, this study was limited to data collected during the recruitment of a larger



study where neither was asked. It is unknown how income and employment status might affect PrEP use for YSMM, particularly those who are under 18 where the majority may not be working and thus have access to their own insurance. Similarly, we did not collect data on educational attainment and do not know how this might affect uptake for YSMM. To capture the largest possible portion of individuals potentially at risk for HIV seroconversion, we assessed for risk as having engaged in any recent CAS event with an HIV status unknown partner. Although this casts the broadest net, it is possible that many participants are engaging in different degrees of risk (i.e., more CAS partners or events).

## Future Directions

It is likely that YSMM face many different factors that adult SMM may not, particularly those who are not open about their sexuality or behavior and on their parents' insurance. YSMM have lower odds of having current and former PrEP use compared those who are older; however, new approval from the USFDA has made it possible for those under 18 to begin a PrEP regimen. New interventions to get at-risk YSMM on PrEP need to be developed and implemented, while still allowing for focus on other prevention methods (i.e., condom use, serosorting). Findings from this study suggest that there are various places to start including increasing access to PrEP across all regions of the U.S., helping those on their parents' insurance access PrEP while still protecting their privacy, and assessing for risk perception. In addition to intervention development aimed at increasing access, it is also imperative that we examine psychological predictors (i.e., PrEP awareness, PrEP willingness, PrEP intentions, and family and social structures that may prevent use) of uptake for this population.

**Acknowledgements** The *UNITE* study was funded by a research grant from the National Institute of Allergy and Infectious Diseases and National Institute of Child Health and Human Development (UG3-AI133674; H. Jonathon Rendina, PI). Thomas H.F. Whitfield was supported by a Ruth L. Kirschstein National Research Service Award (NRSA) Individual Pre-doctoral Fellowship (Parent F31) (F31 MH116874-02). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health. The authors would like to acknowledge the contributions of the other members of the *UNITE* Study Team (Devin English, Steven A. John, Ali Talan, Stephen S. Jones, Juan Castiblanco, and Ruben Jimenez), our collaborators and consultants on the project (Brian Mustanski, Carlos Rodriguez-Diaz, Eli Rosenberg, and Mark Pandori) and all of the amazing staff from the Center for HIV/AIDS Educational Studies and Training. Finally, we thank all of our participants in the *UNITE* study.

## Compliance with Ethical Standards

**Conflict of interest** The authors declare that they have no conflict of interest.

**Ethical 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** Informed consent was obtained from all individual participants included in this study.

## References

- Aghaizu, A., Mercey, D., Copas, A., Johnson, A. M., Hart, G., & Nardone, A. (2013). Who would use PrEP? Factors associated with intention to use among MSM in London: A community survey. *Sexually Transmitted Infections*, 89(3), 207–211.
- Arnold, T., Brinkley-Rubinstein, L., Chan, P. A., Perez-Brumer, A., Bologna, E. S., Beauchamps, L., ... Nunn, A. (2017). Social, structural, behavioral and clinical factors influencing retention in pre-exposure prophylaxis (PrEP) care in Mississippi. *PLoS ONE*, 12(2), e0172354. <https://doi.org/10.1371/journal.pone.0172354>.
- Barash, E. A., & Golden, M. (2010). Awareness and use of HIV pre-exposure prophylaxis among attendees of a Seattle gay pride event and sexually transmitted disease clinic. *AIDS Patient Care and STDs*, 24(11), 689–691.
- Centers for Disease Control and Prevention. (2012). *PrEP: A new tool for HIV prevention*. Retrieved July 4, 2018 from [http://www.cdc.gov/hiv/pdf/prevention\\_prep\\_factsheet.pdf](http://www.cdc.gov/hiv/pdf/prevention_prep_factsheet.pdf).
- Centers for Disease Control and Prevention. (2015). *HIV prevention in the United States, new opportunities, new expectations*. Retrieved July 4, 2018 from <https://www.cdc.gov/hiv/pdf/policies/cdc-hiv-prevention-bluebook.pdf>.
- Centers for Disease Control and Prevention. (2017). *HIV in the United States by geography*. Retrieved July 4, 2018 from <https://www.cdc.gov/hiv/statistics/overview/geographicdistribution.html>.
- Centers for Disease Control and Prevention. (2018a). *HIV pre-exposure prophylaxis, by race and ethnicity: United States, 2014–2016*. Retrieved July 4, 2018 from [https://www.cdc.gov/mmwr/volumes/67/wr/mm6741a3.htm#T1\\_down](https://www.cdc.gov/mmwr/volumes/67/wr/mm6741a3.htm#T1_down).
- Centers for Disease Control and Prevention. (2018b). *HIV among gay and bisexual men*. Retrieved July 4, 2018 from <https://www.cdc.gov/hiv/group/msm/index.html>.
- De Wit, J., Murphy, D., Lal, L., Audsley, J., Roth, N., Moore, R., ... Wright, E. (2015). Pre-exposure prophylaxis and risk compensation: Evidence of decreased condom use at three-month follow-up among predominantly gay male participants in the Vicepre Study. *Sexually Transmitted Infections*, 91(Suppl. 2), A68.
- Gilmore, H. J., Liu, A., Koester, K. A., Amico, K. R., McMahan, V., Goicochea, P., ... Grant, R. (2013). Participant experiences and facilitators and barriers to pill use among men who have sex with men in the iPrEx Pre-exposure Prophylaxis Trial in San Francisco. *AIDS Patient Care and STDs*, 27(10), 560–566.
- Goedel, W. C., Halkitis, P. N., Greene, R. E., & Duncan, D. T. (2016). Correlates of awareness of and willingness to use pre-exposure prophylaxis (PrEP) in gay, bisexual, and other men who have sex with men who use geosocial-networking smartphone applications in New York City. *AIDS and Behavior*, 20(7), 1435–1442.
- Guest, G., Shattuck, D., Johnson, L., Akumatey, B., Clarke, E. E. K., Chen, P.-L., & MacQueen, K. M. (2008). Changes in sexual risk behavior among participants in a PrEP HIV prevention trial. *Sexually Transmitted Diseases*, 35(12), 1002–1008.
- Haberer, J. E., Baeten, J. M., Campbell, J., Wangisi, J., Katabira, E., Ronald, A., ... Ware, N. C. (2013). Adherence to antiretroviral prophylaxis for HIV prevention: A substudy cohort within a clinical trial of serodiscordant couples in East Africa.

- PLoS Medicine*, 10(9), e1001511. <https://doi.org/10.1371/journal.pmed.1001511>.
- Holloway, I., Dougherty, R., Gildner, J., Beougher, S. C., Pulsipher, C., Montoya, J. A., ... Leibowitz, A. (2017). PrEP uptake, adherence, and discontinuation among California YMSM using geo-social networking applications. *Journal of Acquired Immune Deficiency Syndromes*, 74(1), 15–20.
- Holt, M., Murphy, D. A., Callander, D., Ellard, J., Rosengarten, M., Kippax, S. C., & de Wit, J. B. (2012). Willingness to use HIV pre-exposure prophylaxis and the likelihood of decreased condom use are both associated with unprotected anal intercourse and the perceived likelihood of becoming HIV positive among Australian gay and bisexual men. *Sexually Transmitted Infections*, 88(4), 258–263.
- Hosek, S. G., Landovitz, R. J., Kapogiannis, B., Siberry, G. K., Rudy, B., Rutledge, B., ... Zimet, G. (2017). Safety and feasibility of antiretroviral preexposure prophylaxis for adolescent men who have sex with men aged 15 to 17 years in the United States. *JAMA Pediatrics*, 171(11), 1063–1071.
- Khanna, A. S., Schumm, P., & Schneider, J. A. (2017). Facebook network structure and awareness of preexposure prophylaxis among young men who have sex with men. *Annals of Epidemiology*, 27(3), 176–180.
- King, H. L., Keller, S. B., Giancola, M. A., Rodriguez, D. A., Chau, J. J., Young, J. A., ... Smith, D. M. (2014). Pre-exposure prophylaxis accessibility research and evaluation (PrEPARE Study). *AIDS and Behavior*, 18(9), 1722–1725.
- Koester, K., Amico, R. K., Gilmore, H., Liu, A., McMahan, V., Mayer, K., ... Grant, R. (2017). Risk, safety and sex among male PrEP users: Time for a new understanding. *Culture, Health & Sexuality*, 19(12), 1301–1313.
- Kuhns, L. M., Hotton, A. L., Schneider, J., Garofalo, R., & Fujimoto, K. (2017). Use of pre-exposure prophylaxis (PrEP) in young men who have sex with men is associated with race, sexual risk behavior and peer network size. *AIDS and Behavior*, 21(5), 1376–1382.
- Liu, A. Y., Vittinghoff, E., Chillag, K., Mayer, K., Thompson, M., Grohskopf, L., ... O'Hara, B. (2013). Sexual risk behavior among HIV-uninfected men who have sex with men (MSM) participating in a tenofovir pre-exposure prophylaxis (PrEP) randomized trial in the United States. *Journal of Acquired Immune Deficiency Syndromes*, 64(1), 87–94.
- Mack, N., Odhiambo, J., Wong, C. M., & Agot, K. (2014). Barriers and facilitators to pre-exposure prophylaxis (PrEP) eligibility screening and ongoing HIV testing among target populations in Bondo and Rarieda, Kenya: Results of a consultation with community stakeholders. *BMC Health Services Research*, 14(1), 231. <https://doi.org/10.1186/1472-6963-14-231>.
- Marcus, J. L., Glidden, D. V., Mayer, K. H., Liu, A. Y., Buchbinder, S. P., Amico, K. R., ... Pilotto, J. (2013). No evidence of sexual risk compensation in the iPrEx trial of daily oral HIV preexposure prophylaxis. *PLoS ONE*, 8(12), e81997. <https://doi.org/10.1371/journal.pone.0081997>.
- Mustanski, B., Johnson, A. K., Garofalo, R., Ryan, D., & Birkett, M. (2013). Perceived likelihood of using HIV pre-exposure prophylaxis medications among young men who have sex with men. *AIDS and Behavior*, 17(6), 2173–2179.
- National Institute of Child Health and Human Development. (2018). *Item of interest: FDA approves PrEP therapy for adolescents at risk of HIV*. Retrieved July 4, 2018 from <https://www.nichd.nih.gov/news/releases/051618-PrEP>.
- Newcomb, M. E., Moran, K., Feinstein, B. A., Forscher, E., & Mustanski, B. (2018). Pre-exposure prophylaxis (PrEP) use and condomless anal sex: Evidence of risk compensation in a cohort of young men who have sex with men. *Journal of Acquired Immune Deficiency Syndromes*, 77(4), 358–364.
- Parsons, J. T., Rendina, H. J., Lassiter, J. M., Whitfield, T. H., Starks, T. J., & Grov, C. (2017). Uptake of HIV pre-exposure prophylaxis (PrEP) in a national cohort of gay and bisexual men in the United States. *Journal of Acquired Immune Deficiency Syndromes*, 74(3), 285–292.
- Rendina, H. J., Whitfield, T. H., Grov, C., Starks, T. J., & Parsons, J. T. (2017). Distinguishing hypothetical willingness from behavioral intentions to initiate HIV pre-exposure prophylaxis (PrEP): Findings from a large cohort of gay and bisexual men in the US. *Social Science and Medicine*, 172, 115–123.
- Sagaon-Teyssier, L., Suzan-Monti, M., Demoulin, B., Capitant, C., Lorente, N., Préau, M., ... Chas, J. (2016). Uptake of PrEP and condom and sexual risk behavior among MSM during the ANRS IPERGAY Trial. *AIDS Care*, 28(Suppl. 1), 48–55.
- San Francisco AIDS Foundation. (2018). *The questions about PrEP*. Retrieved July 4, 2018 from <https://prepfacts.org/prep/the-questions/>.
- Smith, D. K., Toledo, L., Smith, D. J., Adams, M. A., & Rothenberg, R. (2012). Attitudes and program preferences of African-American urban young adults about pre-exposure prophylaxis (PrEP). *AIDS Education and Prevention*, 24(5), 408–421.
- Sullivan, P. S., Giler, R. M., Mouhanna, F., Pembleton, E. S., Guest, J. L., Jones, J., ... McCallister, S. (2018). Trends in the use of oral emtricitabine/tenofovir disoproxil fumarate for pre-exposure prophylaxis against HIV infection, United States, 2012–2017. *Annals of Epidemiology*, 28(12), 833–840.
- Tangmunkongvorakul, A., Chariyalertsak, S., Amico, K. R., Saokhieo, P., Wannalak, V., Sangangamsakun, T., ... Grant, R. (2013). Facilitators and barriers to medication adherence in an HIV prevention study among men who have sex with men in the iPrEx Study in Chiang Mai, Thailand. *AIDS Care*, 25(8), 961–967.
- Taylor, S. W., Mayer, K. H., Elsesser, S. M., Mimiaga, M. J., O'Cleirigh, C., & Safren, S. A. (2014). Optimizing content for pre-exposure prophylaxis (PrEP) counseling for men who have sex with men: Perspectives of PrEP users and high-risk PrEP naive men. *AIDS and Behavior*, 18(5), 871–879.
- United States Food and Drug Administration. (2012). *FDA approves first medication to reduce HIV risk*. Retrieved July 4, 2018 from <https://www.fda.gov/ForConsumers/ConsumerUpdates/ucm311821.htm>.
- U.S. Department of Health and Human Services. (2017). *Young adult coverage*. Retrieved July 4, 2018 from <https://www.hhs.gov/health-care/about-the-aca/young-adult-coverage/index.html>.
- Volk, J. E., Marcus, J. L., Phengrasamy, T., Blechinger, D., Nguyen, D. P., Follansbee, S., & Hare, C. B. (2015). No new HIV infections with increasing use of HIV preexposure prophylaxis in a clinical practice setting. *Clinical Infectious Diseases*, 61(10), 1601–1603.

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.