



Gay and Bisexual Men's Strategies to Maintain Daily Adherence to Their HIV Pre-exposure Prophylaxis (PrEP) Medication: Results from a Qualitative Study

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Abstract

Since FDA approval in 2012, HIV pre-exposure prophylaxis (PrEP) has been adopted by key populations, including gay and bisexual men (GBM), to reduce their HIV transmission risk. Given that PrEP is optimally effective when taken as prescribed, it is critical to understand the adherence strategies GBM use. We conducted one-on-one, semi-structured interviews with GBM taking PrEP in 2015–2016 ($n = 103$). Using thematic analysis, we identified six adherence strategies, with most participants (84.3%) utilizing *multiple* strategies to maintain adequate adherence: (1) integrating PrEP into part of a daily routine, (2) using a pillbox, (3) cognitive strategies/visual cues, (4) setting recurring smartphone alarms or reminders, (5) keeping medication on oneself at all times, and (6) partner or peer support for reminders and/or pill sharing. Overall, participants reported high PrEP adherence ($M = 1.6$ missed doses in the prior 30 days), though nearly all described missing at least one dose unintentionally in the past. Participants credited their high levels of adherence in part to the strategies they adopted. Providers working with GBM prescribed PrEP, especially patients reporting difficulties with adherence, might consider recommending any or all of the six strategies described in this study.

Keywords Pre-exposure prophylaxis (PrEP) · Adherence · Gay and bisexual men · HIV · Qualitative data

Introduction

Throughout the USA, key populations, such as gay, bisexual, and other men who have sex with men (GBM), have been

adopting HIV pre-exposure prophylaxis (PrEP; currently FDA approved in the form of once-daily tenofovir disoproxil fumarate/emtricitabine [Truvada], an antiretroviral medication) as a significant component of their HIV prevention strategies. In a 2015 US national online survey of GBM conducted by the CDC Division of HIV/AIDS Prevention, 4.9% of the participants self-reported PrEP use in the last year—an increase from previous years, though certainly not commensurate with PrEP eligibility (Delaney et al. 2016; Flash et al. 2014; Patrick et al. 2017). Further, a study on medication prescription data identified 98,731 individuals initiating PrEP between 2012 and 2016, with prescriptions estimated to be as high as 136,000 by mid-2017 (Mera Giler et al. 2017). Alongside the expansion of PrEP, concerns have grown that some individuals may not maintain sufficient adherence to benefit from PrEP's protection (Golub et al. 2013; Taylor et al. 2017; Van der Elst et al. 2013). Currently, most PrEP research has focused on PrEP initiation or uptake, rather than PrEP adherence. To date, there is limited evidence that adherence strategies previously identified as successful for antiretroviral therapy or other medications would prove effective for

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those struggling to adhere to their PrEP regimen (Taylor et al. 2017).

Researchers have identified external factors that might interfere with PrEP uptake and that could impact adherence. These external factors include both perceived and experienced stigma (being labeled as “sexually promiscuous” by taking PrEP, or a fear of being mistaken as HIV positive because of taking antiretroviral medications; Calabrese and Underhill 2015; Schwartz and Grimm 2017). External factors can also include structural barriers, such as having insufficient access to insurance to pay for PrEP (including the potential of losing insurance coverage for PrEP), or not finding a provider willing and able to prescribe it (Krakower et al. 2014; Patel et al. 2017). For those men taking PrEP, much less is known about the *strategies* they adopt to maintain adherence.

In comparison, there is a large body of literature detailing strategies to improve or maintain adherence to other types of medications. Systematic reviews have identified evidence-based interventions to improve medication adherence across a variety of conditions, including diabetes, rheumatoid arthritis, asthma, hypertension, and psychiatric disorders. When available, medication dosing schemes that reduce the number of doses per day have been associated with high levels of adherence (Atreja et al. 2005; McDonald et al. 2002). Further, to address challenges of patient health literacy, clinicians have implemented picture-based health education materials, video presentations, explaining medication drug labeling in lay terms, and including a spouse or family member in the medication information process—all of which are associated with greater adherence (Bosworth et al. 2011; Sudore and Schillinger 2009). Interventions with equivocal support include electronic reminders, computerized alerts to providers and pharmacists, and alternative packaging schemes (e.g., blister packaging). Patient self-monitoring techniques also appear to promote adherence. These include the use of diaries and logs to track medication-taking behavior, as well as situational cues to integrate medication taking into existing routines (e.g., taking medications with meals or at bedtime or placing medications next to car keys or a cellphone; Bosworth et al. 2011). Ultimately, multifaceted interventions that combine educational, behavioral, dosing, and affective strategies (Dolder et al. 2003) have shown particular promise for improving medication adherence across a range of populations (Atreja et al. 2005; McDonald et al. 2002; Bosworth et al. 2011).

Numerous studies have also explored medication adherence in samples of HIV-positive individuals taking antiretroviral (ARV) medications (Boeni et al. 2014; Chaiyachati et al. 2014; Robbins et al. 2014; Simoni et al. 2006), which

have noted that a variety of relatively simple approaches are effective to maintain adherence. For instance, daily pill boxes/organizers are a low-cost adherence tool and have been associated with improved adherence to HIV medications (Boeni et al. 2014; Chaiyachati et al. 2014; Petersen et al. 2007; Scanlon and Vreeman 2013). Automated daily or weekly reminders have been recommended for optimizing adherence and can be implemented through mobile text messaging, smart phone applications, or cell phone call reminders (Chaiyachati et al. 2014; Lewis et al. 2013; Pop-Eleches et al. 2011; Robbins et al. 2014; Rodrigues et al. 2012; Scanlon and Vreeman 2013; Shet et al. 2014). Further, relying on members of a social network has also been associated with adherence to HIV medications among some groups of HIV-positive individuals, via reminders and medication sharing among those on similar regimens (Gonzalez et al. 2004; Remien et al. 2013; Scanlon and Vreeman 2013; Simoni et al. 2007). We acknowledge, however, that there are distinct differences between taking a medication for treatment versus prophylactically for prevention. Thus, although the parallel literature on adherence to antiretroviral therapy among HIV-positive individuals may be useful to inform research on PrEP adherence among HIV-negative individuals, it is, in-and-of itself, insufficient. Although there are limited data focused on facilitators and barriers to PrEP use among key populations like gay and bisexual men, some early qualitative findings point to several factors associated with greater PrEP adherence. These include leveraging an existing medication routine, social support, and personal gain and support from healthcare staff in maintaining sufficient adherence to daily PrEP (Tangmunkongvorakul et al. 2013). Further, some current efforts being tested in ongoing trials to support PrEP adherence include counseling (cognitive-behavioral therapy, motivational interviewing, supportive counseling, etc.), SMS and mHealth interventions, and adherence feedback (reporting plasma drug levels to patients; Haberer 2016). Although many of these interventions have proven successful for other populations and medical conditions, further research is needed to determine adherence strategies best used for PrEP adherence specifically.

Current Study

In 2012, the U.S. Food and Drug Administration approved once-daily PrEP for use with key populations at risk for HIV (such as GBM) to provide maximum protection against HIV in the event of an exposure. Although data suggest that PrEP has high efficacy in the event of occasional missed doses (Grant et al. 2014; Krakower et al. 2015), it remains critical to investigate strategies to maximize PrEP adherence—especially if alternate dosing strategies currently under investigation are approved, whereby PrEP could be taken less

frequently (e.g., on-demand or intermittent dosing) and, thus, be less forgiving of missed doses given the irregular or lower blood concentrations of the drug (Kibengo et al. 2013; Molina et al. 2015; Parsons et al. 2015). To provide evidence on this question, we conducted one-on-one qualitative interviews with 103 GBM on PrEP, asking them about the strategies they used to remember to take their medication. Based on the complimentary literature on ARV adherence, we anticipated strategies such as using pillboxes, setting reminders, and relying on social networks for adherence support (e.g., reminders, pill sharing/loaning). Drawing on the strengths of qualitative designs, we also expected to identify unique strategies not previously identified in the literature that would emerge from a more open-ended investigation of participants' personal narratives.

Method

Participant and Procedures

Data for this manuscript were taken from the baseline visit of *PrEP & Me*, a prospective study assessing PrEP adherence in 104 New York City GBM. The digital file for one interview was mistakenly erased before transcription, leaving us with an analytic sample of 103. Participants were recruited from November 2015 to November 2016 via targeted sampling (Watters and Biernacki 1989), which included advertising and preliminary screening in GBM-concentrated neighborhoods and GBM-rich settings (e.g., gay bars, pride events, LGBT community venues), as well as digital recruitment on GBM social networking websites, apps, and social media platforms. Potential participants who clicked one of our digital ads were routed to a secure online survey that assessed preliminary eligibility criteria. Those deemed preliminarily eligible (in any screening setting) were asked to provide contact information for additional telephone-based screening with a staff member. Subsequently, eligible individuals were scheduled for a face-to-face assessment at our research office.

To be eligible, participants had to (1) be 18 years or older; (2) be cisgender male; (3) identify as gay, bisexual, or queer; (4) have been taking PrEP for at least 30 days, but not via a research study that directly provided the PrEP medication (e.g., demonstration project, clinical trial); (5) reside in the New York City area (so that they could participate in an in-person interview); and (6) have access to the Internet such that they could complete prospective online components of the study (to meet a different study aim not described here). One of the goals of the parent study was to examine the role of club drug use on PrEP adherence. Thus, half of the sample self-reported club drug use in the last 30 days (ketamine,

MDMA/ecstasy, GHB, cocaine, or methamphetamine). All participants provided proof that they were taking PrEP by bringing their PrEP prescription bottle (along with their pills), with their name/date printed on it, to their study visit. Participants were compensated \$40 for this assessment, which included a semi-structured qualitative interview described in the next section. The baseline assessment was the only timepoint in which qualitative data were collected. All procedures were approved by the IRB of the City University of New York.

Measures

Participants completed a one-on-one, audio-recorded, 30 to 45-min, semi-structured interview. The interview guide was developed by the research team and refined via feedback from community representatives and independent researchers external to the study. The interview guide covered a range of topics, such as how participants first learned about PrEP and how they decided that PrEP was right for them as an HIV prevention strategy. One component of the interview asked participants to discuss their adherence to PrEP. Specifically, we asked participants to recount their experiences of missed doses, and the strategies they use to maintain adherence (whether they reported missed doses or not). The questions themselves were open-ended. The present manuscript details data collected during these latter questions.

Demographic and other descriptive characteristics reported in our results (e.g., length of time on PrEP, race and ethnicity, age, income) were derived from quantitative assessments (e.g., computerized survey) completed during the baseline assessment.

Analysis Plan

Interviews were transcribed verbatim by one staff member, and initial transcripts were independently verified against the original audio file by a second staff member. Using the principles of thematic analysis, the research team reviewed the transcripts to code the narratives about participants' PrEP adherence strategies. Thematic analysis has shown to be an effective method for evaluating this type of qualitative data (Miles and Huberman 1994; Patton 1990). A coding team, comprising the Principal Investigator and two additional staff (the second and third authors), developed a codebook from the interview guide and a close-read of a subset of 10 transcripts. The staff were then trained to use the codebook to identify text that represented the codes (Neuendorf 2002; Saldaña 2013). The second author initially coded all transcripts, and those codes were then independently verified by the third author. The first author also reviewed coded transcriptions for overlap and

discrepancies. Any discrepancies were discussed with coding team and consensus (100% agreement) was reached over the application of a given code. Throughout the coding process, the team adjusted the codebook to reflect emergent data from the transcripts. We report the percentages of participants endorsing a given strategy; however, note that these may be under estimates of the full extent of strategies used, given the open-ended nature of the assessment tool.

Results

Table 1 reports demographic characteristics. The mean age was 32.5 years, and 63.1% had been taking PrEP for less than 1 year. Half were men of color, most (79.6%) reported having obtained a 4-year college degree or greater education, and 42.8% reported personal incomes of > \$50,000 annually. Overall, men reported being highly adherent to PrEP. On average, participants reported 1.6 (SD = 3.0) missed doses in the 30 days prior to interview.

All (100%) participants described at least one behavioral or psychological strategy that they used intentionally to maintain their PrEP adherence. Most (84.3%) participants reported the use of *multiple* strategies. Through the coding process, we classified these strategies into six themes. These themes did not appear to vary significantly by demographic characteristics nor whether the participant was a club drug user, or not. Quotes illustrated below include the participant identification number, age, and race or ethnicity.

- (1) *Integrating PrEP into an existing routine (67.6%)*. Two-thirds of participants described a strategy to maintain PrEP adherence by linking the pill-taking behavior to an existing daily routine. These strategies varied based on how participants timed their dose (e.g., in the morning or at night) such as taking PrEP when they brushed their teeth or with morning coffee. Further, many participants (27.4%) described specifically combining their PrEP dosing to a pre-existing medication routine. Most participants who endorsed this strategy also indicated they embedded their medication regimen within a larger behavioral routine (e.g., ‘I take PrEP when I take my vitamins, and I take my vitamins with breakfast’). However, in a few cases, participants simply noted that they added PrEP to an existing medication regimen without reference to a broader behavioral pattern.

I take a lot of supplements in the morning. Like [for example], I’ll drink a protein shake and have a vitamin and fish oil, you know, so I’m already taking other pills

Table 1 Descriptive characteristics of gay and bisexual men taking PrEP in NYC 2015–2016, *N* = 103

Characteristics	M ± SD or <i>n</i> (%)
Age	32.5 ± 8.7
Race/ethnicity	
Black	12 (11.7)
Latino	27 (26.2)
White	52 (50.5)
Multiracial	9 (8.7)
Other	3 (2.9)
Education	
High school diploma, GED, or less	6 (5.8)
Some college	23 (22.3)
4-year college degree	53 (51.5)
Graduate school	21 (20.4)
Employment	
Full-time	60 (58.3)
Part-time	24 (23.3)
Unemployed	19 (18.4)
Income	
Less than \$10,000	13 (12.6)
\$10,000–\$19,999	7 (6.8)
\$20,000–\$29,999	14 (13.6)
\$30,000–\$39,999	11 (10.7)
\$40,000–\$49,999	14 (13.6)
\$50,000–\$74,999	22 (21.4)
\$75,000 or more	22 (21.4)
Length of time on PrEP	
1–3 months	15 (14.4)
3–6 months	24 (23.1)
6–12 months	27 (26)
1–2 years	28 (26.9)
More than 2 years	10 (9.6)
Missed taking PrEP in the last 90 days?	
Yes	63 (61.2)
No	40 (38.8)
How long ago did you miss a dose? Among <i>n</i> = 63	
Today	1 (1.6)
Yesterday	2 (3.2)
2–3 days ago	9 (14.3)
4–7 days ago	18 (28.6)
2–3 weeks ago	15 (23.8)
4–6 weeks ago	9 (14.3)
7–9 weeks ago	6 (9.5)
10–12 weeks ago	3 (4.8)

in the morning. It’s [taking PrEP] just really ingrained in my routine, so it’s pretty easy. [30307, 24 years old, multiracial].

It's part of a regimen that I do. It's part of me brushing my teeth, taking a shower, and like getting dressed. It's part of that whole bathroom thing that you first do when you get up. You know, washing your face, taking a shower, and PrEP. [30336, 27 years old, Latino]

- (2) *Using a pillbox (38.2%)*. Some participants reported using a pillbox to help them remember to take their PrEP—with many specifically citing the use of a 7-day SMTWTFS pillbox. This not only helped participants know if they might have missed a dose (e.g., the pill is still in the segment of the pillbox for that day), but also helped participants avoid accidental double dosing (i.e., taking a pill twice in a day because they could not remember if they had already taken it earlier).

I also have a weekly pill box. So it's like Sunday through Saturday ... I leave the lid open if I've taken it, and if it's closed then there's supposed to be a pill inside. So, yeah, that's how I keep track. [30118, 30 years old, White]

I have a weekly pill thing and every Sunday I fill it up for Sunday-Monday-Tuesday-Wednesday-Thursday-Friday. And, in the morning, I get up and have my protein shake and take my medication. That's just part of my daily thing. And ... I don't even think about it, honestly. [30003, 46 years old, Black]

- (3) *Cognitive strategies/visual cues (32.3%)*. Nearly one-third of participants described using cognitive strategies and visual cues to remind them to take their PrEP medication. For many men, these strategies consisted of leaving their pills in a place where they would be sure to be seen by participants at the time they would normally take them, such as next to their bed for those who took it at night, or next to their toothbrush.

Normally, my PrEP is just sitting in the bottle that it's stored, on my table in front of my TV in my living room, which I frequent every morning to roll up to and eat [breakfast]. So, one of the first things I make eye contact [with] in my morning is, in fact, my PrEP. [30265, 21 years old, Latino]

Another participant described storing his PrEP near his phone as a reminder to take his PrEP when he wakes up in the morning.

It's like, literally, I have that thing right next to my phone, next to my bed. So, it's the first thing I do [in the morning], is I check my phone and then I see the pill—my pill [container]—and, 'Oh! I gotta take my PrEP.' So that's, literally, all I do [to maintain adherence]. [30298, 28 years old, White]

Other participants detailed creative cognitive strategies or visual cues that were unique to them and served as personal reminders. One participant described placing his pill bottle one-way before he took his pill and turning it a different way after taking the pill. Another detailed how he convinced himself that PrEP helps him to sleep, so he remembers to take it at night.

I also kind of, this is really stupid, but I sort of convinced myself... that it just helps me sleep so, therefore, there's a placebo effect. You remind yourself, 'Oh, I want to go to sleep,' so I take this [PrEP]. [30065, 40 years old, White]

- (4) *Setting smartphone alarms or reminders (28.4%)*. Nearly one-third of participants discussed setting alarms or reminders using their smartphones. Specifically, many participants described setting a recurring alarm that would chime at the same time every day. One benefit of this approach was that an alarm that is set only once could help participants to take their PrEP at the same time every day. Other participants reported setting occasional alarms if they anticipated ahead of time the potential for them to forget later (i.e., due to a change in their routine), or if they needed to remind themselves to take it when they were next able (e.g., "remind me when I get home").

So, I have my alarm set every day at noon, because I figure I usually am awake ... I also have... my doctor has a web portal, an app, where I can get my test results and make appointments, all that kind of stuff. But, it also has all the medications that I've ever taken, and it allows you to set a reminder, so I have that set for noon. [30135, 37 years old, White]

I set an alarm on my phone, and I set a reminder alarm an hour later, just to make sure—because sometimes, if

I'm in a meeting in the morning, or I slept through it if it's the weekend, I make sure that it goes off and I always have it as a reminder. [30153, 26 years old, White]

- (5) *Keeping medication on oneself at all times (23.5%).* Approximately one-quarter of participants described keeping their medication with them at all times. Many of these participants described keeping their pill bottle (all their medication) in a bag they use daily (e.g., backpack, gym bag). In addition, one-fifth (20.5%) described retaining a supplementary supply of pills on their person (often in the form of a “backup” pill) or in secondary locations, like in a desk at work.

I never know where I could be—at my partner's place, or I could be at my place—so I keep it [my PrEP bottle] in my backpack, because plans change. If [my PrEP is] at home, I'm not gonna go home. [30065, 40 years old, White]

Just to be safe, I also carry a dose [pill] in my wallet just in case I uh am not in my home in the next morning. [30319, 25 years old, Black]

- (6) *Partner or peer support for reminders or PrEP pill sharing (12.7%).* One-in-eight participants described relying on either a partner or peer support to help them remember to take their PrEP and, in some instances, noted borrowing pills from partners or peers who were also taking PrEP. Participants indicated that reminders could come via partners or peers who were HIV positive, as well as those who were HIV negative—and may or may not have been taking PrEP themselves.

My partner and I take our pill at the same time at night so, you know, it reminds each other—we set a specific time that we will take and it works. I usually get home at 10pm, and then want to watch TV or do other stuff. So, his alarm will go off on his phone and that will just be a reminder for both of us to take it. And, if I see him not take it, I'll remind him as well. It's kinda like, vice versa. He would do the same thing for me. [30363, 31 years old, Black]

I have a pillbox—me and my coworker who both take it [PrEP]. We have a spare in case either of us needs one.

Because he's forgotten, and he's like, 'Hey, do you have a pill, can I borrow?' I was like, 'I have one in my pillbox, it's in my little thing.' So now we have a set [of backup pills] for work. [30401, 32 years old, Latino]

Discussion

In this study of racially and ethnically diverse, PrEP-using GBM, we found that most participants generally reported being highly adherent, and described using a variety of behavioral, psychological, and social strategies to maintain their adherence—with most (84%) employing multiple strategies. These findings can inform providers treating GBM with PrEP, particularly those who have difficulty adhering to their PrEP regimen.

Despite our cohort's high adherence, we recognize that clinically relevant barriers to establishing medication adherence can emerge that impact the health of key populations (Lam and Fresco 2015). Although there are limited data regarding barriers to PrEP adherence, one study among GBM revealed that—although 65% of participants reported one or more strategies for adherence—77% reported one or more barriers to adherence, as well (Liu et al. 2014). Further, that same survey identified changes to one's routine, forgetting, and being away from home as significant barriers (Liu et al. 2014). Additionally, qualitative findings illustrated how inconsistent routine, substance use, travel, stigma, stress, and side-effects act as barriers to PrEP adherence (Gilmore et al. 2013; Tangmunkongvorakul et al. 2013). These findings bolster the need for continued identification of strategies that support adherence with respect to commonly experienced barriers. For example, for those with an existing behavioral or medication routine, providers may encourage patients to add their daily PrEP pill to that routine. Meanwhile, for those who travel frequently, providers may suggest adding automated reminders to their smartphones. For PrEP users who struggle with traditional reminders and regular routine, unconventional approaches such as peer support and cognitive/visual cues may prove helpful. Identifying medication adherence strategies that are culturally relevant and responsive to specific adherence barriers faced by key populations may help to guide providers prescribing PrEP, as well as individuals working to establish PrEP adherence into their daily routine.

Certainly, not all strategies identified by participants in this study would work well for all GBM. Those men who are concerned about being stigmatized for taking PrEP (or those in a relationship characterized by partner abuse) may be reluctant to carry pills with them or to store their pills prominently as a visual reminder, or may not have a social network that could provide them with positive social support and adherence reminders. For men who face this type of challenge, building

psychological skills to manage stigma might be a helpful first-line intervention strategy. Although partner abuse was not discussed explicitly by study participants, providers working with GBM should consider assessing patients for this key risk factor (Pantalone et al. 2014).

Next, although medication alerts might be helpful for some patients, others might be wary of this strategy. For men with privacy concerns resulting from someone else seeing a medication alert on their phone (e.g., “take your pill”), these individuals might set up a reminder that they personally know means to take their PrEP, but actually says something different (e.g., “have you called your mother today?”). Additionally, unique strategies in the form of peer reminders may be helpful for men who have difficulty integrating PrEP into daily routines but who feel comfortable disclosing their PrEP use within their social support networks. Overall, providers should strive to be mindful of the diversity of contexts in which PrEP-taking GBM live and, as such, try to make recommendations about adherence strategies that are tailored to their patients’ unique circumstances.

There is consensus in the social psychology literature that consistent habits (such as medication adherence) are established by strengthening the associations between situational cues and a desired behavior until that behavior becomes routine or automatic (Lally et al. 2010; Stawarz et al. 2015). This principle was reflected strongly in the behavioral strategies that participants detailed: linking a diverse set of cues (daily routines, visuals, alerts) to daily pill-taking behavior. Previous work also suggests that early repetitions of successful cue/behavior linking (e.g., brushing your teeth and taking your pills) result in greater increases in habit strength (Lally et al. 2010), which speaks more directly to the need for early adoption of behavioral adherence strategies for GBM on PrEP. Researchers have also noted significant variability in the length of time it takes for individuals to successfully form new habits (Lally et al. 2010; Ronis et al. 1989; Stawarz et al. 2015). Although this dimension of adherence was not addressed in our study (i.e., how long it took participants to establish consistent pill-taking) it represents an important consideration for providers working with GBM on PrEP and reflects an opportunity for further study of their behavioral adherence strategies. Congruent with Lally and colleagues’ recommendations for successful habit formation (2010), interventions to improve PrEP adherence may require continued support to help individuals adopt consistent pill-taking behavior that becomes habitual.

With regard to behavioral strategies, integrating PrEP into a daily routine was the most common adherence strategy reported. However, this integration could prove to be difficult for men with unconventional or erratic schedules. Providers might consider recommending that the men carry extra doses of PrEP with them, if possible. Men could also employ the use of portable pillboxes to ensure having access to PrEP given

busy or unpredictable schedules. Further, providers may recommend a daily alarm reminder or other alert, such as on a smartphone or watch, which can act as a cue when patients are not at home (Pop-Eleches et al. 2011; Rodrigues et al. 2012; Shet et al. 2014). At least one participant mentioned a patient portal through their healthcare venue that enabled patients to set automated reminders for the specific prescriptions active in their records. Similarly, there are many health-focused smartphone apps that individuals could install to track medication taking and set dosing reminders.

Finally, in future studies, it is worth investigating strategies that mobilize social networks to reinforce PrEP initiation and subsequent adherence. There is evidence that some peer-focused interventions have been successful when working to improve antiretroviral adherence and address sexual risk and substance use to prevent the spread of HIV (Simoni et al. 2011). However, social networks have yet to be explored as channels for increasing PrEP adherence. Further, it could be useful to develop an assessment instrument that measures contextual factors that are likely to facilitate or impede PrEP adherence. Insight into contextual factors that facilitate adherence could help inform PrEP campaigns as well as provider recommendations and interventions.

Limitations

Data for this study were extracted from an open-ended, qualitative, semi-structured interview in which participants recalled and self-reported their use of adherence strategies. This open-ended approach illuminated those strategies most salient for the participants, offering an in-depth exploration of the men’s lived experience of their PrEP regimen. However, this approach may have caused us to underrepresent the prevalence of a given adherence strategy, in that a participant may not have recalled every strategy he used during his interview. Indeed, qualitative methods are used for hypothesis generation and not hypothesis testing or estimates of epidemiologic prevalence and, thus, an adequately powered quantitative study would be needed to evaluate those research questions. Had participants been presented with a list of options from which to “select all that apply,” recall might have improved since, in general, cued recall surpasses free recall. However, such an approach would run the risk of omitting novel strategies not pre-populated on the assessment that are key for a given participant. Thus, researchers should evaluate the strengths and limitations of both open-ended and closed-ended questions to investigate PrEP adherence among GBM and other populations.

Overall, the participants reported being well-educated, employed, and making a living wage. This may be emblematic of who is able to gain access to PrEP; however, research that specifically targets populations from a range of socioeconomic statuses is needed. Our data were collected in 2015 and

2016, when PrEP was beginning to be adopted on a larger scale in NYC. We believe that many of our participants could best be classified as “early adopters.” It may be that both GBM on PrEP at the time, as well as GBM willing to participate in a research study about their PrEP use, are different from those adopting PrEP today or those who are unwilling to participate in PrEP research. Further, although this study assessed the strategies that participants reported using, we did not assess the process of how they adopted these strategies or systematically assess which were the most or least effective. That is, participants may have tried various strategies that did not work before settling on those that did, and further study is needed to establish the independent and comparative effectiveness of the various strategies identified.

Finally, based on the study design, half our participants were club drug users. We did not discern differences in adherence strategies reported by club drug users versus non-users; however, in the future, it could be helpful to investigate how sub-populations experience unique medication adherence challenges. Half of our sample comprised men of color, despite data suggesting that the vast majority of men initiating PrEP are White (Bush et al. 2015; Snowden et al. 2017). We did not observe any racial or ethnic differences in the strategies that participants reported (in that there seemed to be roughly equal proportions of White men and men of color endorsing each strategy); however, this too would be important to investigate more directly in future studies.

Conclusion

Participants in this study reported overall high PrEP adherence, although nearly all described unintentionally missing at least one dose in the past. Participants credited their overall high adherence in part to the variety of strategies they adopted—the most common of which included integrating PrEP use into a pre-existing behavioral routine, using a pillbox, and setting recurring reminders. Providers working with GBM taking PrEP, especially those reporting adherence difficulties, might consider recommending any or all of the six strategies described by our participants. Although data suggest that daily oral PrEP remains highly effective even in the event of an occasional missed dose, it remains critical to continue building the knowledge base of strategies to improve PrEP adherence. This will be especially relevant were PrEP to receive approval for different dosing schedules (e.g., intermittent or on-demand PrEP), in which the timing of a dose becomes crucial to maximizing PrEP’s effectiveness (Glidden et al. 2016; Kibengo et al. 2013; Molina et al. 2015; Parsons et al. 2015).

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Compliance with Ethical Standards

Conflicts 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 the study.

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