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# The Use of Mobile Health Applications Among Youth and Young Adults Living with HIV: Focus Group Findings

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## Abstract

The objective of this study was to conduct focus groups with youth (18–29 years old) living with HIV (YLWH) to better understand preferences for mobile applications in general and to inform the design of a mobile health application aimed at improving retention and engagement in healthcare and adherence to antiretroviral therapy. We conducted four focus groups with YLWH to elicit the names and characteristics of applications that they commonly used, reasons they deleted applications, and the features of an ideal mobile health application. A diverse sample of youth ( $N=17$ ) with a mean age of 25 years, 88.2% male, and 29.4% African American participated in four focus groups. Positive attributes of applications included informative, simple, allowing for networking, timely updates, little overlap with other applications, unlimited access to entertainment, and with ongoing advancement. Participants identified several reasons for deleting applications, including engaging in excessive behaviors (e.g., spending money), for hook ups only, too many notifications or restrictions, occupied too much space on device, or required wireless connectivity or frequent updates. Participants suggested that a mobile health application that they would find useful should have the ability to connect to a community of other YLWH, readily access healthcare providers, track personal data and information (such as laboratory data), and obtain health news and education. Privacy was a key factor in a mobile health application for all participants. Researchers can use the information provided by focus group participants in creating mobile health applications for YLWH.

## Introduction

**I**N THE UNITED STATES, adolescents and young adults have the highest incidence of new HIV infections<sup>1,2</sup>; however, only about 40% are aware of their HIV infection,<sup>3,4</sup> and for those who are aware, only about 30% are retained in care over 3 years,<sup>5,6</sup> and 7% are virally suppressed.<sup>6–8</sup> Despite the necessity to maintain high levels of adherence, research has shown a consistent association between younger age and lower adherence and higher risk of virologic failure.<sup>9–13</sup> Antiretroviral therapy (ART) adherence in the past month among youth living with HIV (YLWH) has been estimated to be as low as 28.3% in one study<sup>14</sup> and 41% in another.<sup>15</sup> These numbers are dramatically lower than the national estimates for adults in the United States.<sup>4,12,16</sup> Due to the ubiquitous nature of technology and that youth are often early adopters of new technology, innovative technological methods provide an important opportunity and can serve as a powerful strategy for engaging youth in care by providing information, support, and links to services and communities.<sup>17</sup>

In the United States, more than 98% of individuals between 18 and 29 years of age have a mobile telephone, 85%

are smartphone owners,<sup>18</sup> greater than 77% download mobile applications (“apps”),<sup>19</sup> and more than 90% use social media.<sup>20</sup> This age group accounts for the highest use of smartphones for text messaging, Internet use, e-mail, social networking, watching videos, and listening to music.<sup>18</sup> Mobile apps provide a convenient vehicle for reaching a large audience and offer the potential to create personalized and interactive interventions that can be used anonymously and discretely. They have the advantage of being convenient to access by the user and flexible to tailor and update. However, app use over time is particularly low for medical and health/fitness apps, with continued use after 90 days being about 27% and 30%, respectively.<sup>21</sup> Therefore, thorough formative work about the user’s needs is necessary to guide the development of novel health-related apps and ensure that the content remains engaging and relevant to a particular population over time. However, for YLWH, little is known about how they use technology and mobile apps or how their use of technology could support their health and influence their engagement in care.

To address the lack of knowledge about YLWHs use of technology, we conducted focus groups to better understand

their preferences for mobile apps in general and to inform the design and development of a mobile health app aimed at improving retention and engagement in care and adherence to ART.

### Materials and Methods

We conducted four focus groups with YLWH (18–29 years of age) to understand their general use of mobile apps and the features and characteristics they find most/least useful and engaging and to identify potential strategies for leveraging apps to support engagement in healthcare and ART adherence. The focus group discussion guide was designed to elicit the following: (1) the names and characteristics of apps that participants commonly used and found most useful, (2) the reasons they stopped using and deleted apps, and (3) the features of an ideal mobile health app. In addition, we assessed participants' reactions to various design styles, which will be presented in a future article.

Participants were recruited from clinics serving individuals living with HIV in the San Francisco Bay Area by posting flyers in the clinic's waiting rooms. Interested participants called the study phone number and were screened for eligibility. Participants were between 18 and 29 years old, living with HIV (substantiated by the HIV clinic where participants had seen our study flyer and the ability to either name their antiretroviral medications and/or their most recent HIV viral load and CD4<sup>+</sup> cell count), and had access to a smartphone. The protocol was reviewed and approved by the University of California, San Francisco's Institutional Review Board, and informed consent was obtained from each participant.

After obtaining informed consent, participants completed a brief survey of demographic information (Table 1), HIV history (Table 1), and use of technology (Table 2) before the initiation of the focus group. The focus groups were facilitated by experienced focus group moderators (M.L. and N.S.) who followed a discussion guide.

We used descriptive statistics to summarize these data and characterize our study sample. Focus group discussions were audio-recorded, transcribed by a professional transcriptionist, and entered into Transana software (Wisconsin Center for Education Research, Madison, WI) for analysis. A coding scheme based on the research questions and domains identified in previous formative work was applied to the data by the research assistant (R.S.K.). This coding scheme was validated by the principal investigator (P.S.) who used these codes to identify and select illustrative quotes pertaining to each question of the focus group discussion guide. The principal investigator (P.S.) also examined the coded text and focus group notes to identify common concepts.

### Results

Seventeen YLWH participated in four focus groups (*N* at each focus group = 4–5). As shown in Table 1, the mean age of participants was 25 years and the majority identified as gay men and had greater than high school education. Our participants included a varied representation of racial/ethnic groups as well as those attending school (29.4%), working (64.7%), and having ever been incarcerated (23.5%) or homeless (64.7%) in the past. Most youth also reported taking antiretroviral medications (88.2%) and knew the names of their medications (47.1% on once-daily regimens). The majority of

TABLE 1. DEMOGRAPHIC CHARACTERISTICS AND SELF-REPORTED HIV CLINICAL INFORMATION OF FOCUS GROUP PARTICIPANTS

	<i>N</i> = 17
Age, mean (SD), years	25.4 (3.2)
Race/ethnicity, <i>N</i> (%)	
White (non-Latino)	5 (29.4)
African American (non-Latino)	5 (29.4)
Latino	4 (23.5)
Other (multiracial or African)	3 (17.7)
Male sex at birth, <i>N</i> (%)	15 (88.2)
Sexual orientation, <i>N</i> (%)	
Homosexual/gay	14 (82.4)
Heterosexual/straight	1 (5.9)
Other	2 (11.8)
Living situation, <i>N</i> (%)	
In own house/apartment	11 (64.7)
At someone else's house/apartment	3 (17.7)
Rooming, boarding, half-way house, group home, shelter	3 (17.7)
Financial situation, <i>N</i> (%)	
I have enough money to live comfortably	8 (47.1)
I can barely get by on the money I have	6 (35.3)
I cannot get by on the money I have	3 (17.7)
Education, <i>N</i> (%)	
Less than high school	3 (17.7)
High school or equivalent	3 (17.7)
Greater than high school	11 (64.7)
In school part-time or full-time, <i>N</i> (%)	5 (29.4)
Working part-time or full-time, <i>N</i> (%)	11 (64.7)
Ever been homeless or lived in a shelter, <i>N</i> (%)	11 (64.7)
Ever served time in jail or prison, <i>N</i> (%)	4 (23.5)
Mean self-reported CD4 <sup>+</sup> cell count (SD), cells/mm <sup>3</sup> ( <i>N</i> = 8)	770.4 (109.4)
Self-reported HIV viral load detectability, <i>N</i> (%)	
Detectable	4 (23.5)
Undetectable	9 (52.9)
Do not know	4 (23.5)
Antiretroviral adherence based on rating scale, <i>N</i> (%)	
Excellent or very good	10 (58.8)
Good	3 (17.7)
Fair, poor, very poor	4 (23.5)
Mean number of adherence barriers to ART (range)	3 (0–6)
Adherence barriers to ART, <i>N</i>	
Fell asleep/slept through dosing time	9 (52.9)
Drinking alcohol and/or using drugs	9 (52.9)
Busy with other things	5 (29.4)
Had problems with pharmacy or insurance company	5 (29.4)
Away from home	4 (23.5)
Ran out of pills	4 (23.5)
Wanted to avoid side effects and toxicity	3 (17.7)
Did not want others to notice	2 (11.8)
Had a change in daily routine	2 (11.8)
Felt sick	2 (11.8)
Had too many pills to take	1 (5.9)

ART, antiretroviral therapy; SD, standard deviation.

participants reported having an undetectable HIV viral load (52.9%)<sup>22</sup> and excellent/very good ART adherence (58.8%) based on the ART adherence rating scale.<sup>23</sup> The most commonly reported reason for nonadherence were sleeping through dosing time (52.9%) and drinking alcohol and/or using

TABLE 2. MOBILE TELEPHONE AND MOBILE APPLICATION USE AMONG FOCUS GROUP PARTICIPANTS

	N = 17
Smartphone type, <i>N</i> (%)	
iPhone	10 (58.8)
Android	7 (41.2)
Phone service carrier, <i>N</i> (%)	
T-mobile	5 (29.4)
Verizon	3 (17.7)
AT&T	3 (17.7)
MetroPCS	3 (17.7)
Other	3 (17.7)
Health-related uses of mobile phone, <i>N</i> (% of total)	
Reminder to keep medical appointments	15 (88.2)
Search Internet for health information	13 (76.5)
E-mail healthcare providers	12 (70.6)
Schedule medical appointments	12 (70.6)
Text healthcare providers	12 (70.6)
Reminder to take medications	11 (64.7)
Refill medications	9 (52.9)
List questions to ask medical providers	5 (29.4)
Keep track of your CD4 <sup>+</sup> cell count or viral load	3 (17.6)
Use mobile phone to access Internet daily or nearly daily, <i>N</i> (%)	16 (94.1)
Number of hours spent on Internet per day, mean (SD), h	6.5 (5.4)
Number of breaks in service in past 6 months, <i>N</i> (%)	
Never	14 (82.4)
Once	3 (17.7)
Plan includes unlimited data and minutes, <i>N</i> (%)	11 (64.7)
Types of mobile health application on mobile phone, <i>N</i> (% of total)	
Exercise, fitness, pedometer, and so on.	5 (29.4)
Medication management (tracking, reminders, etc.)	3 (17.7)
Diet, food, calorie counter, weight management	1 (5.9)
HIV/STD prevention, care, or treatment	1 (5.9)
Wellness (e.g., sleep, mood, quit smoking)	1
Social networking sites currently used	
Facebook	15
Instagram	8
Twitter	5
LinkedIn	4
Google Plus	4
Tumblr	4

SD, standard deviation; STD, sexually transmitted disease.

drugs (52.9%). Most (88.2%) reported having had an appointment with their HIV healthcare provider in the past 6 months and 70.6% reported a scheduled future appointment.

Table 2 summarizes the participants' use of mobile phones. Almost all youth (94.1%) reported that they used the Internet daily or nearly daily and spent a mean 6.5 h per day on the Internet. Most had used their mobile phone to remind themselves of their medical appointments (88.2%), search the Internet for health information (76.5%), e-mail their healthcare provider (70.6%), schedule medical appointments (70.6%), or text their healthcare provider (70.6%). Relatively fewer participants had ever used their phone to set reminders to take medications (64.7%), refill medications (52.9%), or had a medication management mobile app (17.7%).

### Characteristics of apps used or deleted

During the focus groups, participants were asked about their favorite apps and characteristics of apps they continue to use most frequently. Favorite apps categories included dating/social networks (total number of apps mentioned [*N*] = 23), health/exercise (*N* = 8), information/learning (*N* = 7), navigation/transportation (*N* = 6), entertainment (*N* = 4), and shopping (*N* = 3). Participants cited the following attributes of apps that made them likely to continue using them: informative (e.g., news), simple, allow for networking, provide timely updates for problems, little overlap with other apps, provide unlimited access to entertainment (e.g., music apps), and have constant change and evolution. None of the participants reported using an app specifically for HIV-related purposes, but discussed using the phone calendar to set medication reminders (*N* = 1), having used medication reminder apps (*N* = 2), downloading a pharmacy app to refill medications (*N* = 1), and using the patient portal for the clinic's electronic health record (*N* = 1). Opinions on these apps varied from too complicate and erroneous to convenient and fast.

"I use the [pharmacy] app, it's really easy to refill prescriptions. I literally just grab my phone, grab the script and just take a picture of it. It just goes straight to [pharmacy], and they're like: 'when do you want to pick this up?' and I'm like... 'I'll pick it up in a couple of days at this time.' Done! And then,... I'm getting ready for work... [pharmacy] that's right by work, I'm like: 'oh, I should probably get a refill on this.' Click, done!" (25-year-old African American male)

"... [pharmacy] had this app to, like, refill your prescription and stuff, and that just was way too complicated, so I deleted it. Just using it trying to refill stuff was quite difficult. And then they had another one to... kind of try to help you to remind your meds, but it never reminded me when I wanted it to. It was always, like, it went off at noon when I asked for it to go off at, like, 8:00 am. I'm, like, what, what's this about!" (24-year-old Pacific Islander Latino male)

Participants identified a number of reasons why they deleted apps: they perceived that the app influenced them to engage in excessive behaviors (e.g., eating, spending money, or gaming too much), were for hook ups only, included too many notifications or restrictions (e.g., restrictions on the number of free downloads), took up too much space on their device, or required wireless connectivity or frequent updates. Other reasons for deleting an app included boredom with content, spam, not being user-friendly, slow responsiveness due to incompatibly issues, presenting incorrect or too much information, or lacking sufficient challenge levels (e.g., games).

"It's still on my phone. I have yet to delete it... It's just I hate annoying apps that send you notifications all day long." (18-year-old African American female)

"Yeah, I feel like [name of app] is more for hookups, and [name of another app], you could actually have, like, a decent conversation with someone." (25-year-old Latino male)

"Right, space! Like, [name of app] right now is taking up 236 Megabytes. Like, dang! That's a lot of space." (28-year-old, multiracial/multicultural female)

### Privacy and security

Privacy was an important topic that was discussed in detail. Participants were very aware of the importance of security and noted their concern about stigma.

“...people are going to say, ‘oh, why do you have that app on your phone? That’s a HIV app.’ you know what I mean? Like, stigma will kick it hard.” (28-year-old multiracial/multicultural race/ethnicity female)

Participants also expressed a concern that their personal information might be sold to other companies or synced with other social media platforms. Other concerns centered on data security in case of a phone lost or stolen, or others having access to their phone. All participants wanted to have additional passcodes for a health app, which would be required at each login. Other suggestions were for pseudonyms and avatars.

“You may lose your phone... I think if you had it with like, a doctor—almost like a prescription, and something that you have to, like, every year, every so often, like a new passcode, so that way you can log into it, I think that could kind of give some more privacy.” (25-year-old African American male)

“Exactly, and this way, avatars, nobody knows who you are, right? Go ahead, just ask!” (28-year-old multiracial/multicultural female)

“... I’m very secretive about a lot of stuff, especially when it comes to that, so it’s like four passcodes to even get into phone, including my thumb print. So, if you don’t got this thumb, you ain’t getting in this phone.” (18-year-old African American female)

#### *Desired functionality of a mobile health apps*

Participants identified the functionality that would be important to them in a mobile health app. All agreed that a health app should not focus solely on HIV-related information but also on general health among youth.

“... not necessarily just dominated towards HIV but, you know, health in general, STDs ... risk factors or ..., information... That’s what I think about, you know, not just geared towards—okay, this is HIV specific, right? I wouldn’t really necessarily think about that, but about STDs in general, health in general.” (28-year-old multiracial/multicultural female)

Participants suggested four distinct functions that they considered important in a mobile health app: (1) connecting to a community; (2) accessing healthcare providers; (3) tracking personal data and information; and (4) obtaining news and education.

**Connecting to a community.** Participants were interested in receiving peer support from other YLWH. They noted that a social feature in an app could be used for networking, educating others, asking questions, accessing local resources (e.g., events, housing, and drug and alcohol support groups), and establishing forums. This feature was discussed as an important tool for individuals who are newly diagnosed or new to a geographical area.

“If you did develop an app where... I log on and then my little avatar pops up, I could ask a question—if I have bump in my mouth, ‘is that a wart, right?’ And then the community kicks in like: ‘you trippin’ or something like that? ... Like a forum...’” (28-year-old multiracial/multicultural female)

“Like, you can have an avatar, you can be discreet about it, it’s a way to network the community, ... not just HIV positive, but STDs, just personal health, ... I think it would be cool if it’s just like, kind of a community app, and then it just brings more awareness.” (25-year-old African American male)

Participants suggested that the social network should be a closed group, through which healthcare providers would provide eligible YLWH with unique access codes (i.e., a “prescriptive” app) so that the app’s social network would represent a true community of YLWH. Participants discussed the need for a moderator to ensure appropriateness of content and discussions.

“Well, the idea that I was kind of formulating just right now, though, was maybe if that was kind of, like a post-diagnostic service where you could register for the app through your doctor, which would make it a little bit more structured. You’ll have people on there that are for sure HIV positive because, you know, the people were funny. People are funny. Like, if some fool get on there on the app and just want to cause chaos...” (28-year-old African American male)

**Accessing healthcare providers.** Participants discussed various modalities for using their smartphones to directly contact their physician, nurse, social worker, and pharmacist to ask a quick question in lieu of an office visit. Modalities included text, e-mail, and video chat. These modalities could also be used by the clinic to contact the participant. This feature could additionally store information for emergency contacts (e.g., suicide prevention). Participants described several ways that the app would provide access to providers and overcome barriers such as transportation, scheduling, and shyness about verbally articulating questions.

“I never even thought that would be an option, you know. But, ... technology is moving so quickly, ... I’ve never heard of you having your charts on your phone and all that, like—to me, that’s so new, so I think that’s so innovative, that’s so convenient. Because, when I was in L.A., I had to take two and a half hour bus rides all the way to Hollywood to get to like... if I could just text him and tell him, can you send my prescription over, I could take a 2-min walk to the pharmacy. So I think that is one of the best things that you can probably do, you know. To be able to talk to your doctor personally, you know, without going in... That’s awesome.” (28-year-old multiracial/multicultural female)

“...in the past, even when I’ve emailed my doctors and whatnot, they have so many other e-mails that are far more important than mine, that they didn’t even get to mine like that, so if you had an instant messenger-type thing, it’d be easier. Well, I feel like, you know, because it takes my doctor forever, like, four days to email me back, you know. I’m like, what is going on?” (25-year-old African American male)

“...sometimes you have something to say and you don’t know exactly how to say it, but you can, you know, shoot him a text, and get the words out or what you wanted to say a little bit easier... I know sometimes it’s easier for me to just get what I’m trying to say out really quick, you know, and forward the message to my doctor... but also know that it’s being said. They can get it whenever, you know, whenever they’re able to get it, and I know my doctor’s really cool that—that she’ll pay attention to it, and she’ll get back to me.” (28-year-old African American male)

“I don’t use apps to remind me to take my medications, but I do have this feeling and this one, like, desire to have an app that will help me connect better with my pharmacy and with my doctor. That’s been for a while that I—that I wanted an app that I felt like could help me be more connected, and it doesn’t exist like that out there. (28-year-old African American male)

**Tracking personal data and appointment information.** Participants discussed multiple features, including

functions that facilitate scheduling and reminders about clinic appointments, taking medications, refilling medications, renewing health plan, maintaining a medication list, keeping track of laboratory results (mainly CD4<sup>+</sup> cell count and HIV viral load), and having the ability to share these data with others (e.g., sex partners).

“Keeping track of where you’re at... My CD4s, my viral loads... It’s, like... when I had my test done. If they’ve changed me on my medications, like, I can mark down, what meds I had taken, and then, like, what I switched to, so you can keep track of, like, well, this is where I was with this, and now this is where I am with that.” (26-year-old white male)

Participants also indicated that if their healthcare providers had access to data regarding adherence, the provider would be able to contact the patient to assist with nonadherence.

“I think after you skip a number of times, it should send a message to someone on your care team; if you’ve skipped, like more than four times, someone should be getting a message that you’re not taking your medications, so that maybe they can approach it in a different way...” (28-year-old African American male)

**Obtaining news and education.** Participants were interested in receiving news on general health updates and medical advances, HIV cure research and advances, and medication information (e.g., long-term adverse effects of ART). This information would be presented in a distilled manner, which they could share on their other social media platforms.

“...if it’s kind of like a social media app, ...I’m thinking news, so if you constantly update us to what’s going on in the community, you know, with HIV and the medications, and what’s available to us, ... that would be awesome...” (25-year-old African American male)

## Discussion

Our study examined general mobile app use among 18- to 29-year-old youth and young adults living with HIV and the specific features of a mobile health app that would be important for this population. Focus group participants were a diverse sample of YLWH with regard to race/ethnicity and socioeconomic status. As expected, technology and mobile device use was high, which supports the potential and need to develop interventions that use smartphones as a platform for engaging young people in their health. Participants articulated why they used certain apps, why they deleted apps, and what characteristics and functionality are necessary to develop in health apps.

Even though participants frequently used their mobile phones to connect with their medical provider (e.g., medical appointment scheduling and e-mailing /text messaging healthcare providers), fewer used their mobile phones for medication-related purposes (e.g., medication/refill reminders, medication management, pharmacy apps). Research with adults has found a significant correlation between the use of the Internet for healthcare engagement purposes (i.e., to e-mail healthcare providers, refill medications online, and make medical appointments online) and a higher odds of reporting an undetectable HIV viral load and excellent ART

adherence.<sup>24</sup> It is possible that currently available online tools for medication-related purposes (e.g., pharmacy apps or healthcare system’s patient portals) have attributes that are less desirable for YLWH or are less well publicized.

General attributes of mobile apps for youth included the following: simplicity and user-friendliness, minimal yet timely updates, evolution and updates with new information, minimal notifications and no restrictions or spam, occupying little space on their device and having rapid response, availability without regard to wireless connectivity, and not overlapping with other apps. These are important characteristics to consider for all future apps for this population.

Four main domains were specifically discussed in creating a mobile health app for YLWH: connecting to a community of YLWH, tracking personal data and information, obtaining news and education, and accessing healthcare providers. Connecting to a community played a key role in participants’ lives and all had numerous social networking apps that were used on a daily basis. The feeling of social isolation and lack of sense of community has been reported in prior literature<sup>25</sup>; similarly, the desire for connection to a community of other YLWH was important in our focus group discussions. Social networking apps were followed in popularity by apps related to health and information; therefore, tracking of personal health information and obtaining news and education were deemed an important functionality of a mobile health app. Participants agreed that a health app should focus on general health among youth not just HIV-related information. Accessing healthcare providers in a timely manner was also regarded as an important feature in a mobile health app for asking quick questions or for managing barriers to engagement in HIV care, such as missed office visits, transportation difficulties, scheduling issues, and being more candid about health concern. These barriers to engagement in care or appointment attendance have been noted in our prior research with YLWH.<sup>26</sup>

The impact of more streamlined access to healthcare providers (e.g., via text messaging, e-mail, or videoconferencing) on a clinic’s resources and financial burden is unclear. It is possible that these forms of communication can allow for more efficient distribution of responsibilities (e.g., questions related to drug–drug interactions can be routed to the clinical pharmacist). In addition, providing a secure means of communication via these modalities can minimize any inadvertent disclosure of HIV status and reduce privacy concerns, which may be an issue for healthcare providers currently communicating with patients via unprotected technology-based methods. Finally, improved modes of communication may be cost-efficient from a clinical standpoint by improving engagement in care, ART adherence, and HIV viral load. The impact of these modes of communication needs to be examined in future research.

A systematic review of research on the use of self-care technology-based methods by individuals living with HIV to improve ART adherence<sup>27</sup> indicated that participants were interested in using technology-based methods that provided a combination of reminders along with information regarding HIV treatment and enhanced communication with providers. This review concluded that the optimal characteristics of technology-based interventions that may enhance adherence involved the ability to customize, allow for two-way communication with healthcare providers and peers, and provide education, motivation, and behavioral skills. Desires for a

comprehensive app that educates and engages and is customizable have also been key characteristics in other focus groups in men who have sex with men and individuals living with HIV.<sup>28,29</sup> These characteristics, in line with the Information, Motivation, and Behavioral Skills (IMB) Model<sup>30,31</sup> and the ability to allow for two-way communication with healthcare providers and peers and provide education, motivation, and behavioral skills, are in line with the four domains established by our focus group participants.

Privacy was a key factor in a mobile health app for most participants in our focus groups. Despite the high use of online social media and sharing of information, participants were cautious of inadvertent disclosures and potential stigma related to the use of an HIV-specific app. Passcodes at each log-in, pseudonyms, and avatars were some solutions to improving privacy. Limiting app use to those with specific access codes through a “prescription” from the provider was also a suggestion that can ultimately help improve privacy and security of an app.

The idea of a “prescriptive” app or mobile prescription therapy<sup>32,33</sup> is relatively novel. These apps can enhance the connection between the patient and their healthcare team, assist in the daily management of a chronic disease, and may provide immediate health guidance. Prescriptive apps are currently only available for Type 2 Diabetes management, have clearance from the Food and Drug Administration (FDA), and are reimbursable by some insurance companies. For the management of those living with HIV, a prescriptive app can allow for further enhancement of patient-provider relationship, improve engagement in care by enhancing self-care, and restrict their use to specific subgroups (e.g., youth, young adults, and women).

Several studies to date have examined the use of mobile telephones to improve adherence using automated text messages or telephone calls from adherence facilitators.<sup>34,35</sup> However, few have assessed the use of mobile health apps for improved HIV clinical outcomes. One study examined the efficacy of an app that incorporated personalized health-related visual imagery that provided information about the level of medication and the patient’s level of immunoprotection to improve ART adherence.<sup>36</sup> The use of this app showed a significantly higher level of self-reported adherence to ART and decreased HIV viral load at 3 months compared to individuals using the nonvisual version of the app. There are several mobile apps for individuals living with HIV in various stages of development, including Epic Allies (being developed through a partnership between University of North Carolina, Duke University, and Caktus Consulting Group) and Battle Viro (being developed by Brown University, Tufts, and Life-span). These apps incorporate gamification principles and have shown promising acceptability results; however, none of our focus group participants discussed an interest in having a game component in a mobile health app. This may have been due to our participants being slightly older than the participants in pilot studies of the aforementioned apps, having different interests, or not wanting apps with overlapping functionality.

Our participants were mainly young gay men living in the San Francisco Bay Area, with greater than high school education. There was a higher proportion reporting excellent/very good ART adherence, undetectable HIV viral load, and

general engagement in HIV care in comparison to reports in the literature.<sup>6,8</sup> Therefore, our results may not be generalizable to the general population of YLWH in the United States. Our study is also limited by the fact that the purposeful sampling of our population was restricted to individuals with a smartphone, which may not be generalizable to youth who may be more marginalized and less engaged in care.

Mobile health technology has created a shift in the paradigm of self-management for chronic diseases; however, to maximize this potential, it requires the integration of research and expertise from clinical, behavioral, data analytics, and technology.<sup>37</sup> The results of our focus groups indicate that a future mobile health app for YLWH should contain a social networking component of a community of YLWH, a mechanism for youth to access their healthcare providers in a timely manner, a feature to allow for tracking of personal health data and information, and a method for obtaining HIV health news and updates on general medical advances. These features should be further developed to integrate clinical and behavioral components that may be informed by clinical guidelines, best practices, and expertise for developing behavior change strategies. Results from these focus groups will allow us to design and develop a tailored mobile health app aimed at improving engagement in care and adherence to ART among YLWH.

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### Author Disclosure Statement

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