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Acceptability and feasibility of using established geosocial and sexual networking mobile applications to promote HIV and STD testing among men who have sex with men

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Abstract

This study is the first published multi-app study, of which we are aware, to evaluate both the acceptability and feasibility of providing sexual health information and HIV/STD testing referrals via established geosocial and sexual networking apps for MSM. Data were collected using an online survey and through four apps (A4A Radar, Grindr, Jack'd, and Scruff). Two-thirds (64%) found apps to be an acceptable source for sexual health information. MSM who found apps as acceptable were more likely non-white men, not sure of their current HIV status, and have low HIV testing self-efficacy. One-quarter (26%) of informational chats with the health educator resulted in users requesting and being referred to local HIV/STD testing sites. There were significant differences in the number and types of interactions across apps. Established apps for MSM may be both an acceptable and feasible platform to promote HIV/STD testing. Future research should evaluate interventions that leverage this technology.

Keywords

HIV/AIDS; men who have sex with men; MSM; mobile applications; community-based participatory research

Introduction

Gay, bisexual, and other men who have sex with men (MSM) of all races/ethnicities are disproportionately affected by HIV. MSM represent approximately 4% of the population in the United States [1], yet in 2010, MSM accounted for 63% of all new HIV infections [2]. Furthermore, although overall HIV incidence in the United States has remained relatively

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stable since the mid-1990s [3], the number of new HIV infections among MSM increased 12% from 2008 to 2010².

Significant HIV/AIDS disparities by geographic region exist in the United States. Although the southeastern United States accounts for 37% of the population [4], 49% of HIV diagnoses and 49% of new AIDS diagnoses occurred in this region [5]. The Southeast has the highest HIV and AIDS diagnosis rate in the United States. Furthermore, nine out of the 10 states with the highest HIV case fatality rates were in the South [6]. Moreover, North Carolina was among the top 10 states with the greatest number of HIV diagnoses in 2011 [5] and the HIV incidence rate in North Carolina is nearly 35% higher than the national rate [7]. Thus, it is imperative that we develop innovative interventions designed to reduce HIV exposure and transmission among MSM in the South.

Technology-based HIV and sexually transmitted disease (STD) interventions (including those administered via computer programs, the internet, and text messaging) have been effective in increasing knowledge of sexual health, HIV testing, HIV medication adherence, and follow-up care, and reducing sexual and substance use risk behaviors [8-19]. However, given the ever changing nature of technology, internet sites and technological devices that were once popular have been replaced with newer technology. In particular, mobile phone applications (“apps”) use is on the rise. From 2011 to 2012, time spent on apps increased by 120% [20] among Americans. As of March 2014, there were over 1.1 million apps available through Apple’s App Store [21]. By the end of 2014, it is estimated that there will be more than a total of 30 billion app downloads [22].

Health educators have created new apps designed to provide information, such as information about HIV and other STDs, how to use a condom, and resources for HIV/STD-positive persons [23]. However, these apps are infrequently downloaded, do not reach a large number of at-risk individuals, and are not well-received by users [23].

Perhaps one reason these apps have not been successful is they require additional behaviors by potential users (i.e., downloading, installing, and then finally using the app) before health educators can focus on the behavioral change of interest, such as increasing the use of condoms or testing for HIV and STDs. Leveraging established and highly popular apps may be a more effective method to reach large number of users. Furthermore, using established apps allows health educators to “meet participants where they are,” in the social and sexual networking apps where they already are present and interacting.

Some of the most popular apps designed for geosocial and sexual networking among gay, bisexual, and other MSM already have established large number of users. For example, Grindr, a commonly used app designed for geosocial and sexual networking among MSM reaches as many as 4 million users in 192 countries around the world, and approximately 10,000 more new users download the app everyday (accessed from <http://grindr.com/learn-more> on 3/26/14). These numbers far exceeds the median number of downloads for newly created HIV and STD intervention apps [23].

Another key feature of these apps is the geolocating capabilities, which use global positioning system (GPS) technology to tailor information and data specific to that user. In

the case of apps designed for geosocial and sexual networking, these apps provide information about the geographic proximity of users to facilitate in-person networking. This geographic information may be harnessed so health educators can provide tailored and location-based information about services, such as referrals for HIV and STD testing.

Finally, apps tend to reach MSM who are at increased risk and/or who have not been exposed to other HIV/STD interventions. MSM who use apps to seek sexual partners are similar to men who use the internet to seek sexual partners [24]. Internet samples of MSM, compared to those recruited through conventional sampling (e.g., face-to-face and snowball sampling), are more likely to identify as bisexual, have sex with women (MSMW), and engage in high-risk sexual behavior [25, 26] and MSMW are less likely to have been exposed to AIDS prevention interventions [27]. Rates of unprotected anal intercourse (UAI) in the past 3 months have also been found to be high among MSM who use Grindr [28, 29] and MSM recruited online report higher rates of UAI than MSM recruited at clubs or bars and in community venues [30].

Community-based organizations, health departments, and AIDS service organizations have reported using geosocial and sexual networking apps designed to facilitate geosocial and sexual networking among MSM for HIV prevention activities [31-34]; however, there has been little evaluation of these efforts. Most of the evaluation conducted has been based on the number of contacts as opposed to behavior change.

Given the purpose of these apps is to facilitate friendly and/or romantic connections, it is not clear whether MSM who use these geosocial and sexual networking apps would be receptive to receiving sexual health information, such as HIV and STD testing referrals, while using these apps. We sought to assess the acceptability and feasibility of promoting sexual health, including HIV and STD testing, through established geosocial and sexual networking apps designed for MSM.

Methods for Study 1: Acceptability Study

This study was conducted by a community-based participatory research (CBPR) partnership. This partnership has existed for more than 10 years and has designed numerous studies to explore and promote sexual and reproductive health and reduce HIV risk. The partnership is an authentic co-learning and capacity building-partnership that consists of lay community members, organization representatives, and academic researchers [35].

Participants completed an anonymous online survey that is part of an ongoing CBPR study implementing and evaluating the CyBER/testing intervention in North Carolina. Currently, the partnership is testing the intervention in a four-community randomized trial in North Carolina. Details about the pilot intervention have been described elsewhere [13]. Briefly, the intervention promotes HIV testing among MSM in online social networking sites (e.g., chat rooms). Using a previously validated recruitment strategy [36-39], participants in the ongoing randomized trial were recruited to complete a 25-item survey through posted messages in online social networking sites. To participate in the assessment, participants were men who: (1) used the internet chat rooms for social and/or sexual networking; (2)

were 18 years of age or older; and (3) provided informed consent. Compensation for completing the brief assessment was \$10. Participants could opt to obtain compensation through PayPal, donate their compensation to a nonprofit of their choice, or forego compensation. Data were collected from September 2013 to December 2013.

Measures

The CyBER/testing survey covered five domains: sociodemographics, HIV testing, sexual risk, substance use, and use of geosocial and sexual networking apps. All items have been validated and successfully used in the CBPR partnership's previous research [13,38-42]. Participants reported their sociodemographics, including age, ethnicity/race, county in which they reside, gender, and sexual identity. Participants also reported on how out they were on a 5-point scale (ranging from "not at all" to "totally").

HIV testing history items included lifetime and past 12 month testing, the testing location(s) used in the past 12 months, and results of their most recent HIV test. HIV testing self-efficacy was assessed by asking participants to rate on a 4-point scale how sure they were that they could get tested for HIV from "not at all sure" to "very sure".

Sexual risk in the past 12 months was assessed with four items. The first two items established whether they had engaged in sex with men (oral and/or anal sex) or women (oral, vaginal, and/or anal sex). The next two items assessed frequency of condom use on a 5-point scale, ranging from "never" to "always," with men (during anal sex) and with women (during vaginal or anal sex) separately. A dichotomous variable was created to indicate whether a participant had reported reduced sexual risk for acquiring HIV for the past 12 months. Participants who reported not engaging in sex with a man (anal) or woman (anal or vaginal) in the past 12 months or always using a condom in the past 12 months (consistent condom use) were classified as having reduced sexual risk.

Substance use was also measured. Alcohol use was assessed by asking participants to report in a typical week how many days they were drunk. Participants were also asked which substances they had used within the past 12 months: tobacco, crack, ecstasy, marijuana, alkyl nitrites ("poppers"), GHB, cocaine, crystal meth, and Viagra, Levitra or Cialis for sexual enhancement. Participants also reported whether they had ever used other prescription drugs without a doctor's prescription or for reasons other than for what they were prescribed (i.e., recreational prescription use).

To assess app use, participants reported which of 11 established geosocial and sexual networking apps designed for MSM they had used in the past month. Participants could also provide the name of an app that was not listed.

Acceptability, the outcome of interest from the survey, was measured by asking participants to report whether they would want to receive sexual health information like HIV testing resources on an established app. Participants were asked about the acceptability in general and not for specific apps.

Analysis Plan

Descriptive analyses and logistic regression modeling were conducted. To compare men who found apps an acceptable venue for the promotion of sexual health information to those who did not, variables that were significant ($p < .20$) in the bivariable logistic regression model were entered into a multivariable logistic regression model [43]. All analyses were performed using SPSS 21 (Chicago, IL).

Results for Study 1: Acceptability Study

Description of participants

A total of 457 participants completed the CyBER/testing survey. Of the 457, 7 participants did not answer the outcome of interest question and were removed from analyses. The remaining 450 participants answered all questions.

On average, participants were 41 years old (see Table I). Most were white (82.2%) and from the Piedmont area of North Carolina (65.8%). Two-fifths (40.4%) of participants identified as bisexual. Although over three-quarters (78.9%) of participants had been tested for HIV at least once in their lifetime and only 45.6% had been tested in the past year.

Twenty-three (5.1%) participants reported not being sexually active with men or women in the past year. Of participants who reported having oral and/or anal sex with a man in the past year, slightly less than one-quarter (23.6%) reported consistent condom use during anal sex with men. Almost half (47.1%) reported having oral, vaginal, and/or anal sex with a woman in the past year. Condoms were used consistently during vaginal or anal sex with women by about one-quarter (26.9%) of MSMW.

On average, participants reported being drunk 0.43 days in a typical week. Among other substances used, the three most commonly used substances were tobacco (39.3%), erectile dysfunction medication for sexual enhancement (19.3%), and poppers/rush (16.7%). No marijuana, crack, crystal meth, or GHB use was reported. Recreational prescription use was reported by 9.8% of the sample.

The most frequently reported app used in the past month was Grindr; one-fifth of participants (19.8%, $n=89$) reported using Grindr in the past month. The next most popular apps were A4A Radar (14.0%, $n=63$), Scruff (8.4%, $n=38$), and Jack'd (5.8%, $n=26$). BoyAhoy, GayConnect, Growlr, GuySpy, Hornet, and iDate were each used by less than 5% of the participants. No participants reported using Mister.

Acceptability of apps for sexual health information

About two-thirds (63.8%) of participants reported that they wanted to receive sexual health information via an app. In the multivariable model, several characteristics differentiated those who wanted from those who did not want to receive such information via an app (see Table II). Non-white participants and participants who were not sure of their current HIV status, had low HIV testing self-efficacy, and used poppers reported being significantly more willing to receive sexual health information via an app. Participants who used other prescription medications recreationally and had sex with women were significantly less

willing. For each day drunk, the odds of acceptability of receiving sexual health information via an app decreased by 62%.

Methods for Study 2: Feasibility Study

Between August 2013 and February 2014, a trained health educator promoted HIV testing in 4 apps (i.e., A4A Radar, Grindr, Jack'd, and Scruff) for MSM. Guided by the in-depth knowledge of the community partners in the CBPR partnership (described in the Methods for Study 1), we selected these four apps because they had the highest use in the catchment area (Greensboro, North Carolina).

The health educator was logged into these apps during typical business hours (Monday to Friday from 8:30 am to 5 pm). We selected these hours based on data that the partnership had collected that suggested that although app users were on other times of the day and on weekends, about 93% of users were online between 9 am to 9 pm during the weekday. Therefore, being on during typical business hours allowed us to reach most users and reflected typical practice at community-based organizations, health departments, and AIDS service organizations.

The health educator's profiles included a picture of the actual health educator dressed in business casual attire holding an iPad from the waist up, his actual age, height, weight, and race (common information provided on these apps), his affiliation with the AIDS service organization in Greensboro, North Carolina, and information about his purpose for being on these apps. While each app has a different profile layout, the information provided was the same across all the apps.

The content, number, and type of interactions between the health educator and each app user were recorded and classified into four categories. At the most surface level, a "profile view" occurred when an app user looked at the health educator's profile. A "user-initiated greeting" indicated that an app user initiated a chat with the health educator, generally a greeting. During an "informational chat", the health educator stated his purpose or provided information about sexual health, such as symptoms and transmission of HIV and STDs. The health educator used approved language that accurately explained his purpose for using the app (e.g., "I answer any questions anyone may have about FREE HIV TESTING SITES/HIV/AIDS/STDs. This is a work profile, not a personal one. That is actually why I am on here."). Our partnership wanted to maintain the highest level of respect for the app users' purpose for being on these apps and the social norms within these apps. A "user-requested referral" happened when local HIV and STD testing service information were requested by the user and provided the health educator.

The health educator only responded after a user first contacted him. The health educator did not "target" users. This nonintrusive approach was designed to be respectful and culturally congruent to the community of app users; MSM are not using these apps to be exposed to or targeted with HIV-related messages. Because these apps list users from nearest to farthest, users who were geographically closest to the health educator were more likely to contact him.

This study was reviewed and approved by the Wake Forest University School of Medicine Institutional Review Board.

Data analysis

A descriptive analysis of the number and types of interactions that occurred was performed. Analysis of variance (ANOVA) was used to identify any differences in the number and type of interactions across apps and by day of the week. When applicable post-hoc Tukey's honest significant difference tests were conducted. Because of the different user interface and setup for Grindr (Grindr does not allow the user to see who has viewed his profile), comparisons for "profile views" were only made between A4A Radar, Jack'd, and Scruff. Additionally "conversion rates" were calculated to determine a) what percentage of men who viewed the health educator's profile began chatting with a user-initiated greeting and b) what percentage of men who had an informational chat with the health educator requested and were referred to a local HIV and STD testing service. All analyses were performed using SPSS 21 (Chicago, IL).

Results for Study 2: Feasibility Study

In 6 months, the health educator logged 2,709 interactions with app users; slightly less than two-thirds (65.7%, n=1780) of interactions were profile views (see Table III). Scruff (n=744) had significantly more views than A4A Radar (n=510) and Jack'd (n=526).

Users who initiated chats with the health educator asked for many types of information, including the health educator's purpose (e.g., "So if I ever have any questions about that [prevention of HIV/AIDS/STDs] I can look you up on here?"), facts about HIV transmission (e.g., "Is it true that you can not [sic] get HIV/AIDS if you swallow a man that has it [perform oral sex and swallow the ejaculate of an HIV-positive man]?"), HIV and STD testing locations (e.g., "Hi! Where are the free HIV/STD testing sites in Greensboro? Besides the county clinic..."), and HIV testing availability ("Hey When is the next free day to get tested?"). The health educator would provide factual, accurate, and geographically-specific (when applicable) answers to all questions. Of the 929 chats, two-thirds (67.4%, n=626) were user-initiated greetings, one-quarter (25.8%, n=240) were informational chats, and 6.8% (n=63) were user-requested referrals.

There were significant differences in the number and types of interactions across the apps. The greatest number of chats (sum of user-initiated greetings, informational chats, and user-requested referrals) was on A4A Radar (n=393), followed by Grindr (n=246). There were significantly more chats on both A4A Radar and Grindr than Scruff (n=98) and Jack'd (n=192).

Across the three types of chats, A4A Radar had the highest number of user-initiated greetings, informational chats, and user-requested referrals; user-initiated greetings, informational chats, and user-requested referrals were significantly higher on A4A Radar than Jack'd and Scruff. Similarly for user-initiated greetings and informational chats, Grindr had significantly more user-initiated greetings and informational chats than Jack'd and

Scruff. There was no difference in the number of user-requested referrals across Grindr, Jack'd, and Scruff.

Across apps, there was no difference in the number of interactions across the day of the week. Analyses by app demonstrated that the number of profile views, user-initiated greetings, informational chats, and user-requested referrals did not vary across day of the week.

We also considered the conversion rates within each app, which allows us to make comparisons across the different apps while taking into account the total number of interactions per app. There was large variation in the percentage of those who began chatting with a user-initiated greeting after viewing the health educator's profile. Only 9.0% of those who viewed the health educator's profile on Scruff began chatting, while over half (51.4%) of those on A4A Radar did so. The conversion rate to referrals across all four apps was 26.3%; approximately one-fourth of informational chats with the health educator resulted in the user requesting and the health educator providing referrals to local HIV and STD testing locations.

Discussion

The results of this study demonstrate that providing sexual health information and HIV and STD testing referrals via geosocial and sexual networking apps designed for MSM is both acceptable and feasible. About two-thirds (63.8%) of surveyed MSM reported that they wanted to receive sexual health information via an app. Additionally, providing referrals to local and geographically specific HIV and STD testing is also feasible; across the four apps, 26.3% of informational chats with the health educator resulted in the user requesting and receiving referrals to a local HIV and STD testing site.

Based on the differences between the MSM who found it acceptable to provide sexual health information via apps, an app-based intervention may reach a particularly important population: MSM who are unsure of their HIV status or have low HIV testing self-efficacy. Encouraging these MSM to get tested is particularly important to improve their health and the health of their sexual partners. Sexually active MSM are recommended to be tested for HIV annually by the Centers for Disease Control and Prevention [44]. Some research has found lower rates of HIV testing among online MSM [13,19,38,45]. Fewer than 50% of participants in the CyBER/testing sample had tested in the past 12 months; this percent is profoundly lower than the 67% of sexually active MSM who reported getting an HIV test in the past year in the National HIV Behavioral Surveillance System [46].

Additionally, a significant number of participants in the CyBER/testing sample identified as heterosexual (12.4%). MSM who identify as heterosexual are not an easy group to reach and may have been missed during HIV prevention efforts.

Recreational use of prescription medication and number of days drunk in a typically week were negatively associated with acceptability. Previous research has identified the association between substance use and HIV risk and has noted the importance of incorporating substance use on sexual risk during HIV prevention interventions [47-50];

app-based interventions may be a particularly useful way to reach MSM who use poppers/rush and provide sexual health information.

It should also be noted that all transgender persons reported that they did not want to receive sexual health information via apps. Future research should try to understand these findings; however, this finding may be a result of the small number of transgender persons participating.

Several factors limited these studies. For the acceptability study, the majority of participants were white. Given the disproportionate rates of HIV among men of color, the generalizability of this study is limited. It is also not possible to know how those who completed the survey are different from other chat room users who did not complete the survey.

For the feasibility study, there were differences in the app user interfaces that impacted how data can be collected and prevented an exact recording of the actual number of users who viewed the health educator's profile. Because of the functionality in Grindr, it was not possible to see who had viewed the health educator's profile; therefore, it is not possible to count how many users viewed the health educator's profile. For A4A Radar, a user can only see who the 10 most recent users were to view his profile at any moment in time. Although the health educator was careful to pay close attention, if the health educator's profile was viewed at a heavy rate, some views could have been missed, resulting in an underestimation of the number of users who viewed the health educator's profile on A4A Radar.

It is also not possible to determine whether all interactions with app users were with unique individuals. Given the ease in creating multiple profiles, it is possible that some of the same individuals contacted the health educator under multiple profile names; however, this is likely to be a small subgroup. Additionally, some app users re-contacted the health educator with additional questions or to follow up (e.g., "I went and got tested yesterday"). Being re-approached demonstrates that trust had been built between the app user and health educator and that these users felt comfortable enough to re-contact the health educator for additional information, referrals, and/or support. This also demonstrates the rapport that can be built using culturally congruent and respectful approaches to reach app users. This finding further highlights a strength of a CBPR partnership: rich "insider" knowledge that the health educator has about how app users network socially and sexually.

Despite these limitations, this study is the first published study, of which we are aware, to evaluate both the acceptability and feasibility of providing sexual health and HIV and STD testing referrals via four established and commonly used geosocial and sexual networking apps for MSM. A recent study found a similar percentage of MSM who found app-based HIV prevention interventions acceptable; this study was limited to use of one app and to men between the ages of 18 and 24 [51].

Another strength of the study was the health educator was on four apps simultaneously, which allowed him to reach many and diverse users. Based on the posted profiles, there were differences in the demographics of the users across the apps. For example, Grindr

tended to have younger, college-aged, and white users while Jack'd had predominantly African American users.

Finally, collaborating with community members greatly strengthened this study. Because of the CBPR partnership and close relationships with community-based organizations and health departments, the health educator was able to disseminate the most up-to-date information when providing referrals, including hours, venues, and testing protocols (i.e., blood draw or saliva). The health educator also has an in-depth understanding of the social norms of these apps. The protocol to interact with users was culturally congruent and respectful of the apps' social context. Doing so increased his ability to connect with the app users, and he was never expelled from the apps.

One success story that demonstrates the potential power of the use of mobile apps for the promotion of HIV testing involves an app user who had viewed the health educator's profile on Scruff, which prompted him to ask about where he could get tested for free. As the user did not want to test in his home area due to stigma and personal reasons, the health educator referred him to the local community-based organization where he worked for free HIV and STD testing. The user drove three hours to the community-based organization for HIV, syphilis, gonorrhea, and chlamydia testing the following Monday. He tested positive for HIV, and as a result of testing, he was linked to care and case management near his home. He is currently on medication and in case management.

The results of the study have important public health intervention implications. These data suggest that it is possible to harness the popularity and technology of established geosocial and sexual networking apps for MSM to provide sexual health information and geographically specific HIV and STD testing referrals. Therefore, given the demonstrated acceptability and feasibility, further research, including a proof-of-concept study, would further allow researchers to evaluate and understand how established geosocial and sexual networking apps for MSM can be leveraged to address health disparities.

Conclusions

With the constantly changing technological environment, public health professionals need to be stay abreast and be responsive and creative in designing and implementing interventions. An intervention on established geosocial and sexual networking apps for MSM appears to be an important method to promote HIV and STD testing to MSM and support men who have low HIV testing self-efficacy and who are not meeting the Centers for Disease Control and Prevention HIV testing recommendations.

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Table I

Characteristics of participants from the acceptability study (n=450)

Characteristics	Mean ± SD (Range) or n (%), as appropriate		
	Total sample (n = 450)	Not Acceptable (n=163)	Acceptable (n=287)
Age	41.03 ± 12.73 (18-74)	40.75 ± 12.56 (19-74)	41.18 ± 12.85 (18-65)
Geographic region*			
Piedmont	296 (65.8)	99 (60.7)	197 (66.6)
Mountain	116 (25.8)	58 (35.6)	58 (20.2)
Coastal	38 (8.4)	6 (3.7)	32 (11.1)
Gender			
Male	444 (98.7)	157 (96.3)	287 (100.0)
Transgender	6 (1.3)	6 (3.7)	0 (0.0)
Race*			
White	370 (82.2)	149 (91.4)	221 (77.0)
Non-White	80 (17.8)	14 (8.6)	66 (23.0)
Sexual identity [‡]			
Gay/Homosexual	206 (45.8)	65 (39.9)	141 (49.1)
Bisexual	182 (40.4)	75 (46.0)	107 (37.3)
Heterosexual/Other	62 (13.8)	23 (14.1)	39 (13.6)
Outness			
Not out at all	130 (28.9)	48 (29.4)	82 (28.6)
To some people	149 (33.1)	52 (31.9)	97 (33.8)
To all but family	17 (3.8)	10 (6.1)	7 (2.4)
Totally	154 (34.2)	53 (32.5)	101 (35.2)
Ever tested for HIV*	355 (78.9)	144 (88.3)	211 (73.5)
Recently tested for HIV ¹ , *	205 (45.6)	62 (38.0)	143 (49.8)
Result of last HIV test*			
Positive	42 (9.3)	13 (8.0)	29 (10.1)
Negative	313 (69.6)	131 (80.4)	182 (63.4)
Unsure	95 (21.1)	19 (11.7)	76 (26.5)
Location of last HIV test*			
Non-traditional	269 (59.8)	116 (71.2)	153 (53.3)
Traditional	181 (40.2)	47 (28.8)	134 (46.7)
HIV testing self-efficacy*			
Very sure	371 (82.4)	149 (91.4)	222 (77.4)
Less than very sure	79 (17.6)	14 (8.6)	65 (22.6)
MSMW*	212 (47.1)	93 (57.1)	119 (41.5)
Reduced sexual risk ¹	129 (28.7)	49 (30.1)	80 (27.9)

Characteristics	Mean ± SD (Range) or n (%), as appropriate		
	Total sample (n = 450)	Not Acceptable (n=163)	Acceptable (n=287)
Days drunk in a typical week [*]	0.43 ± 1.05 (0-6)	0.69 ± 1.45 (0-6)	0.29 ± 0.69 (0-5)
Tobacco ²	177 (39.3)	64 (39.3)	113 (39.4)
Marijuana ²	0 (0.0)	0 (0.0)	0 (0.0)
Cocaine ²	12 (2.7)	6 (3.7)	6 (2.1)
Crack ²	0 (0.0)	0 (0.0)	0 (0.0)
Poppers/Rush ^{2, *}	75 (16.7)	7 (4.3)	68 (23.7)
Crystal Meth ²	0 (0.0)	0 (0.0)	0 (0.0)
Ecstasy ²	11 (2.4)	0 (0.0)	11 (3.8)
GHB ²	0 (0.0)	0 (0.0)	0 (0.0)
Erectile dysfunction medication ^{2, 3}	87 (19.3)	31 (19.0)	56 (19.5)
Other substances ²	3 (0.7)	1 (0.6)	2 (0.7)
Recreational prescription use ^{4, *}	44 (9.8)	24 (14.7)	20 (7.0)

¹ In the past 12 months.

² Any use in the past 12 months.

³ For sexual enhancement.

⁴ Any in lifetime.

[‡] $p < 0.20$.

^{*} $p < 0.05$.

Table II

Characteristics of MSM who reported receiving sexual health information on an app to be acceptable compared with those who did not

	Multivariable AOR (95% CI) ^I
Geographic region	
Piedmont	Referent
Mountain	1.72 (.79, 3.78) [‡]
Coastal	1.17 (.41, 3.37)
Race	
White	Referent
Non-White	5.93 (2.31, 15.21)***
Sexual identity	
Gay/Homosexual	Referent
Bisexual	.54 (.28, 1.05) [†]
Heterosexual/Other	.44 (.16, 1.21) [‡]
Recently tested for HIV (past 12 months)	2.02 (.92, 4.45) [†]
Result of last HIV test	
Positive	Referent
Negative	0.81 (0.34, 1.92)
Unsure	5.20 (1.57, 17.29)**
Location of last HIV test	
Non-traditional	Referent
Traditional	2.29 (.83, 6.33) [‡]
HIV testing self-efficacy	
Very sure	Referent
Less than very sure	6.31 (2.63, 15.13)***
MSMW	.48 (.25, .91)*
Days drunk in a typical week	.38 (.26, .56)***
Poppers/Rush use (past 12 months)	9.50 (3.54, 25.48)***
Recreational prescription use (lifetime)	.34 (.15, .79)*

^I AOR = adjusted odds ratio. Because of the significant association between the two HIV testing variables (ever tested and recently tested), only recently tested for HIV was used in the model.

[‡] $p < 0.20$.

[†] $p < 0.10$.

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

Table III

Type of interaction and conversion rates by app

	Profile views (% of all profile views)	User-initiated greetings (conversion rate from profile views) ¹	Informational chats (% of all informational chats)	User-requested referrals (conversion rate from informational chats) ²
A4A Radar	510 (28.7)	262 51.4% $\frac{262}{510}$	102 (42.5)	29 28.4% $\frac{29}{102}$
Grindr	N/A	169 N/A	63 (26.3)	14 22.2% $\frac{14}{63}$
Jack'd	526 (29.6)	128 24.3% $\frac{128}{526}$	51 (21.3)	13 25.5% $\frac{13}{51}$
Scruff	744 (41.8)	67 9.0% $\frac{67}{744}$	24 (10.0)	7 29.2% $\frac{7}{24}$
Total	1780	626 35.2% $\frac{626}{1780}$	240	63 26.3% $\frac{63}{240}$

$$1 \frac{\text{number of user - initiated greetings}}{\text{number of profile views}} \times 100\%$$

$$2 \frac{\text{number of user - requested referrals}}{\text{number of informational chats}} \times 100\%$$