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Elizabeth McQuade July 16, 2021

The Use of Geo-Social Networking Applications to Find Sex Partners and Associated High-Risk Sexual Behaviors Among Men Who Have Sex with Men in Lima, Peru

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Abstract

The Use of Geo-Social Networking Applications to Find Sex Partners and Associated High-Risk Sexual Behaviors Among Men Who Have Sex with Men in Lima, Peru
By Elizabeth McQuade

Background: In Peru, men who have sex with men (MSM) are disproportionately affected by HIV, and declines in HIV incidence remain short of UNAIDS targets for ending the HIV/AIDS epidemic by 2030. Simultaneously, geo-social networking (GSN) apps have become increasingly popular for partner seeking, particularly among young MSM in the capital city of Lima, who continue to experience high risk of HIV. This study investigated the association between HIV risk behaviors and the use of GSN apps by examining the prevalence of condomless anal intercourse (CAI) among sexual partners met via GSN apps as compared with partners met by other means.
Methods: This study analyzed data from a cross-sectional survey of MSM in Lima, Peru. Participants were recruited either by online outreach via local lesbian, gay, bisexual, transgender, and queer (LGBTQ) social media networks or in-person at an HIV clinic. Participants reported on up to two sexual partners met within the previous three months. Sexual partner was the unit of analysis. The primary exposure was meeting venue (GSN app, non-GSN online venue, or offline) and the primary outcome was CAI. We used a binomial regression model with a log link to evaluate association between meeting venue and CAI adjusting for covariates. A generalized estimating equation was used to address any correlation generated by multiple sexual partners reported by a single individual.
Results: Overall, 1235 sexual partners were reported by 672 participants, 46% of whom were met using a GSN app. Participants reported engaging in CAI with 42% of partners met using a GSN app. The prevalence of CAI was slightly lower with sex partners met using GSN apps as compared to sex with partners met offline, though the association was not statistically significant (PR: 0.9 95% CI: 0.8 – 1.1). Sex with partners met via a non-GSN online venue was slightly more likely to include CAI than with partners met offline (PR: 1.1 95% CI 0.9 – 1.3), but the association also was not statistically significant.
Conclusion: CAI was slightly less prevalent among sexual partners who met via a GSN app as compared to sexual partners that met via other venues, though the association was not statistically significant. Even so, due to the pervasiveness of GSN apps for partner seeking among a high-risk population, this techonology should be considered for future investigation as a tool for HIV prevention.

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Introduction

Since the beginning of the global AIDS epidemic, it is estimated that over 75 million people have become infected with HIV and over 32 million people have died from AIDS-related illness. [1] Although the decline in HIV incidence worldwide from 3.4 million new cases in 1996 to 1.8 million in 2017 [2] demonstrates progress, annual new cases still far exceed the United Nations' target of less than 500,000 new infections by 2020. [3] In Latin America, there was essentially no change in HIV incidence, with only a 1% reported decline in incidence from 2010 to 2017. During this time period, Peru experienced a reduction in HIV incidence of 14%, but it lags behind the 23% reduction in incidence observed globally. [2]

In June of 2021, the United Nations Member States reaffirmed their commitment to end the HIV/AIDS epidemic by 2030. One of the key commitments of the UNAIDS General Assembly is to ensure that 95% of people at risk for HIV infection have access to effective HIV prevention options. The declaration highlights the need for "scientifically accurate, age-appropriate comprehensive education, relevant to cultural contexts", and also notes the importance of defining specific populations that are more likely to be exposed to or transmit HIV. [1]

Men who have sex with men (MSM) account for 41% of new HIV cases in Latin America [2] and over 50% of new cases in Peru. [4] Additionally, the HIV pandemic disproportionately affects young people – 28% of new HIV infections are concentrated among young people although they only represent 16% of the global population. [1] In Peru, almost 40% of new HIV cases are among people ages 15-24, and people under the age of 30 account for over 65% of new HIV infections. [4]

In order to effectively target HIV prevention efforts, there is a need for increased knowledge surrounding sexual behaviors and risk factors among young MSM in Peru. One important observation related to the sexual behavior of young MSM is the increasingly prevalent use of geo-social networking applications (GSN apps) to find sexual partners. [5] GSN apps use an individual's GPS location to find

potential partners geographically nearby. Although sometimes considered “hook-up apps”, users of GSN apps have also reported using the app to find dates, relationships, and friendship. [6]

In Lima, as in much of Latin America, heteronormativity is pervasive and impacts both sexual behaviors and HIV prevention access for the MSM population. [7] GSN apps may provide a protective environment for MSM in a society infiltrated by stigma surrounding homosexuality. [8] Although virtual spaces have existed for the LGBTQ community for decades, GSN apps have combined virtual and physical spaces, with online conversation preceding physical interaction. [5] With GSN apps, MSM are able to meet potential partners without attending physical venues that are typically for the LGBTQ community, removing a significant barrier for many individuals seeking partners and potentially altering the interaction between partners. [9] Research is needed to better characterize the impact of GSN apps on sexual behaviors, and consequently the incidence of HIV, as these apps are now an integral component of the cultural landscape.

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Background

In Peru, it is estimated that approximately 87,000 people are living with HIV, [2] and men who have sex with men (MSM) are disproportionately affected. The incidence of HIV has declined 23% globally since 2010; [10] however, the decline has been slower in Peru, which has seen a decrease in incidence of only 14%, [2] and new cases continue to occur primarily among MSM. Although the prevalence of HIV in the general population of Peru is 0.3%, [11] the prevalence among MSM is estimated to be as high as 12%, [12] and geographically, approximately 58% of all HIV cases in Peru are concentrated in Lima, the nation's capital. [4]

Sexual transmission is overwhelmingly the most prevalent form of HIV transmission in Peru, with 98% of cases attributable to anal or vaginal sex. [4] This highlights the importance of understanding sexual behaviors in order to design and implement successful HIV prevention interventions in the country. MSM and transgender women account for more than 50% of new HIV cases in Peru, [4] and that is likely an underestimation due to persistent stigma surrounding homosexuality and bisexuality leading to underdiagnosis of HIV in these populations. [11] Among MSM, young MSM account for the majority of new diagnoses. In Peru, approximately 65% of new diagnoses among men are diagnosed in men under the age of 30, with approximately 40% of diagnoses occurring among men younger than 25. [4]

MSM, particularly younger MSM, are increasingly using online platforms to find sex partners. [13, 14] Studies have shown that there is a predominance of adolescents (<20 years of age) and young adults (20 to 25 years) using apps and online platforms to find relationships, sex partners, and friends. [6] In Peru, 91% of the population ages 19-24 report internet use, and 89% of the general population in Lima report using the internet from their cellphone. [15] These numbers are an indication of the ubiquity of mobile phone users and therefore, mobile phone application (app) users in the city.

In recent years, geo-social networking (GSN) apps have gained immense popularity. These apps use a cellphone's global positioning system (GPS) to find potential sex partners that are in geographic proximity to the user. [13] Grindr is the most popular GSN app among MSM; developed in 2009, it now has over 3 million daily users across the globe. [16] The location feature of GSN apps allows users to meet up with potential partners based on characteristics such as shared interests, physical attributes, and geographic proximity. Although GSN apps can provide a sense of community and acceptance and help to destigmatize sexuality for many in the LGBTQ community, [8] some studies have found that GSN app users report increased sexual risk behaviors compared to non-users. [17, 18] However, other studies have found that condom use among GSN app users is higher than their non-GSN app using counterparts. [19]

In a study looking at the prevalence of new sexually transmitted infection (STI) diagnoses among MSM GSN app users vs non-users, those who used GSN apps had a higher risk of gonorrhea and chlamydia, but there was no relationship found between GSN app use and HIV diagnoses. These findings could be indicative of protective behavior associated with known HIV status, but also could be due to the cross-sectional design of the study paired with the relative low incidence of HIV as compared to gonorrhea and chlamydia. [20] Furthermore, when DeVost et al. replicated the aforementioned study and controlled for the number of sexual partners, they found that only gonorrhea was was associated with GSN app use. They also found a signficiant association between STI risk and *number* of venues used to meet sex partners, but no association between risk and a particular venue. [21] From the studies conducted, it is difficult to discern causality between GSN apps and high-risk behaviors, as the use of GSN apps is nuanced and controlling for factors such as intention to engage in CAI is challenging. Even so, it is important to recognize the sexual behaviors associated with GSN app use in order to create more targeted and relevant HIV prevention interventions.

Although there has been extensive research around GSN app use for partner seeking among MSM in the United States, [17-22] there is a paucity of information regarding GSN app use and sexual risk behaviors in Latin America, and more specifically Lima, despite frequent use of this technology. In 2020, Grindr released "Unwrapped", an overview of users and country profiles, and highlighted Peru as among the countries with the highest percentage of self-reported receptive anal sex partners, or 'pasivos'. [23] Considering that receptive anal sex is particularly high risk for HIV infection, [24] it is evident that there is a high-risk population in Peru utilizing GSN apps for partner seeking, and HIV interventions should be developed with this population in mind.

In this study, we estimated the association between GSN app use and HIV-related sexual risk behaviors among MSM in Lima by comparing GSN app use to other forms of meeting, both online and offline, and reports of CAI. The use of GSN apps is increasingly prevalent among MSM in Lima, and South America more broadly, but there is limited evidence regarding how the apps may be associated with high-risk behaviors in these populations. As the relationship between GSN apps and sexual partner seeking becomes ever-more inextricable, a better understanding of the association between sexual risk behaviors and GSN app use will be essential.

Methods

Data Source

Data for this study were obtained from a cross-sectional survey evaluating sexual risk behaviors, including patterns of online platform use to meet sex partners, which was conducted both in-person and online among MSM and transgender women (TW) in Lima, Peru. The online survey link was disseminated utilizing the social media platforms of a local LGBTQ community-based organization (Epicentro), and the in-person survey was administered to eligible individuals who attended an HIV clinic (Vía Libre) using computer-assisted self-completion interviews (CASI). Individuals 18 years of age or older who identified as MSM or TW were eligible to complete the survey. For this study, only responses

from MSM were considered, and of those responses, we restricted the analysis to include only MSM who reported at least one sexual partner within the previous three months. A total of 672 MSM were included in this analysis: 365 from the online survey group and 307 from the in-person group.

Measures

In the survey, participants were asked to report on their sexual behaviors during the previous three months, including a detailed set of questions specific to their sexual encounters with up to two recent partners – their last partner and their penultimate partner (if met within the last three months). Questions regarding partner type (stable,'friends with benefits', casual, transactional), how and where they met the partner, and sexual behaviors were asked about each reported partner. More general questions including sexual risk behaviors and sexual partner meeting venues were asked with regard to the previous three months, and basic demographic information was collected. Sexual partners were the unit of analysis for this study.

The primary exposure for this study was sex partner meeting venue, which was a multi-level variable divided into 1) GSN app, 2) online (non-GSN), and 3) in-person/other. The following sexual partner meeting venues were defined as 'GSN app': Grindr, Hornet, Scruff, Tinder, Badoo, Growlr, or Surge. All other onlines venues were considered 'Online (non-GSN'; these included Manhunt, GayRomeo, PlanetRomeo, WhatsApp, Facebook, Instagram, 'Other Chats', and 'Other site/app'. All other sexual partner meeting venues were classified as in-person/other. The primary outcome of this study was self-reported CAI, either receptive or insertive.

Data Analysis

Bivariate analyses were conducted using $\chi 2$ statistics for categorical variables, and pooled t-tests and Wilcoxon Rank Sum tests were used for continuous variables. A binomial generalized linear model with a log link was used to estimate prevalence ratios for the association between sex partner meeting venue and CAI. To account for any correlation generated by multiple partners reported by a

single individual, we used a generalized estimating equation with an independent correlation structure. We also fit a multivariable regression model to estimate the association between CAI and sexual partner meeting venue, adjusting for age, highest level of education, self-reported sex worker, and self-reported substance use during sex in the past three months. Crude and adjusted prevalence ratios (PR) were reported with 95% confidence intervals (CI). All analyses were performed using SASv9.4 (Cary, NC).

Results

Demographics and Behavioral Characteristics

There were a total of 751 survey respondents, 672 of whom were MSM who reported at least one sexual partner in the previous three months and were therefore included in this analysis. Of these 672 MSM, 322 (46%) met at least one of their reported sexual partners using a GSN app (Table 1). The median age of GSN app users was 26 years old, compared to 30 years old for non-GSN app users. GSN app users tended to have slightly higher educational attainment with 87% having at least some post-secondary education, as compared to 74% of non-GSN app users (p = .0007). Income was similar for GSN app users and non-GSN app users; 36% and 35%, respectively, reported monthly income of greater than 1500 Peruvian Soles (approximately $388)[1]. GSN app users on average reported a higher number of sexual partners in the previous three months: 6 partners (interquartile range (IQR): 3-15) as compared to 4 partners (IQR: 2-8) for non-GSN users (p<.0001). Prevalence of self-reported sex work did not differ significantly across the groups (p=.16). When asked about HIV testing, GSN app users were more likely to have ever been tested for HIV: 89% vs. 84% of non-GSN app users (p=.03), though there was no significant difference in the prevalence of self-reported HIV infection: 14% for GSN app users and 13% for non-GSN app users.

[1] Exchange rate as of July 4, 2021 using xe.com

Sexual Partner Characteristics

A total of 1235 sexual partners were reported by the 672 individuals included in this study (Table 2). Of the 1235 sexual partners, 46% were met on a GSN app, 16% were partners met on an online platform that was not a GSN app, and 38% were partners met in-person or using another method. Of the 566 sexual partners met via a GSN app, participants reported engaging in CAI with 52% of them, compared to 56% of sexual partners met on a non-GSN online platform and 54% of sexual partners met offline (p=.23). The most frequent type of sex with sexual partners met via GSN apps and sexual partners met offline was receptive anal sex with a condom, 39% and 34% respectively, whereas insertive anal sex with a condom was most frequent among sexual partners met via non-GSN online platforms (35%).

Reported partner type varied across forms of meeting. Of the sexual partners met on a GSN app, 62% were classified as casual partners, as compared to 36% among sexual partners met on a non-GSN online platform and 53% of sexual partners met offline (p<.0001). Sexual partners met using a non-GSN online platform were more likely to be primary and/or stable partners (25%) than were sexual partners met via GSN apps (11%) and sexual partners met offline (17%).

Grindr was by far the most popular GSN app, accounting for 94% of the sexual partners met using a GSN app. Facebook was the most popular non-GSN online meeting venue (58%), with some sexual partners having met using Whatsapp (15%) and Manhunt (15%), among others (Table 3).

Association between GSN App Use and Condomless Anal Intercourse

CAI was reported less frequently with sexual partners that were met using a GSN app as compared to sexual partners met on non-GSN online platforms or offline, though the differences were not statistically significant. Sexual partners met on a GSN app had a crude prevalence ratio of 0.9 (CI: 0.8-1.1), indicating that participants were approximately 10% less likely to engage in CAI with such partners compared to sexual partners met offline (reference group). CAI was reported slightly more

frequently with sexual partners met online via a non-GSN platform than with partners who were met offline, but the difference was also not statistically significant (PR=1.1, CI: 0.9-1.3).

In the multivariable analysis, adjusting for age, highest level of education, sex work, and reported substance use during sex, resulted in similar trends across prevalence ratios. CAI was less frequently reported with sexual partners met on a GSN app than with sexual partners met offline (adjusted PR: 0.9 CI: 0.8 – 1.1), and non-GSN online sexual partners had a higher likelihood of reported CAI than sexual partners met offline (adjusted PR: 1.1 CI: 0.9-1.3), but again, neither association was statistically significant. (Table 4)

Discussion

The goal of this study was to assess the association between sexual partner meeting venue, specifically GSN apps, and CAI. We observed a slightly lower prevalence of CAI among sexual partners met via GSN apps, although the difference between partners met via GSN apps and those met via other venues was not statistically significant. A negative and/or statistically insignificant association between GSN app use and CAI has similarly been found in previous studies [19,25,26,27] although other studies have observed positive associations, [17,18] highlighting the need for further investigation into the nuances of this relationship.

One hypothesis for the observed difference in CAI prevalence between sexual partners met via GSN apps as opposed to other meeting venues could be the underlying intention to have sex. When meeting a partner via a GSN app, typically there is a clear intention of sex, allowing the opportunity to prepare to have a condom available. In contrast, when meeting a partner in person or via a non-GSN online venue, initial intentions of sex may not be as explicit, leading to more impulsive or unplanned sex.

Furthermore, individuals' social and sexual networks affect their behaviors. People who are more sexually experienced or more sexually aware may be more likely to be on sex-seeking applications,

and also report higher prevalence of condom use due either to actual use or social desirability. Individuals who are not on partner-seeking apps may not be as sexually experienced or knowledgeable and therefore may not be as likely to report condom use. [28]

The lack of a significant association between GSN app use and CAI could be an indication that the sexual partner meeting venue may not be the mechanism by which CAI is determined, but rather the individual will determine their behavior independently of the meeting venue. A dose-response relationship has been found between the overall number of venues used to meet partners and frequency of CAI, perhaps indicating that it is not the particular type of venue (GSN app, online, offline, etc.) that determines engagement in CAI. [14,18, 29, 30] This hypothesis is supported by the higher number of partners we observed among GSN app users – it may not be the GSN app itself that is influencing behavior, but rather that the app attracts a subset of individuals that are looking for multiple partners, which is similarly reflected in our finding that partners met using a GSN app were much more likely to be characterized as 'casual' partners.

A limitation of this study is that participants were only able to report on up to two partners from the previous three months. Multiple studies have found an increased number of sexual partners among GSN app users as compared to non-users, [18,25,26,30] a trend that was also observed in this study. It is possible that we underestimated the frequency of CAI, particularly by GSN app users, as they may have had more than two partners in the previous three months and a number of those sexual encounters could have included CAI, which would not be captured by our definition of the outcome variable. Survey respondents were also only able to report on sexual partners that they had met within the previous three months. Although this likely helped to protect against recall bias, it may have impeded the accurate classification of the primary outcome variable and/or exposure variables as their behavior within the previous three months may not be indicative of their general sexual behaviors. Furthermore, we did not collect information on the temporal relationship between meeting a partner and engaging in

sex, so while an individual may have met a partner early within the three month recall period, they could have just recently engaged in CAI and therefore meeting venue may not have influenced their engagement in CAI. Future studies could address these limitations by increasing both the maximum number of sexual partners subjects are able to report as well as the timeframe for retrospective reporting. Alternatively, future investigations could include longitudinal prospective cohorts who report on their sexual encounters which would address these limitations and also minimize recall bias.

A further limitation of this study is the generalizability of our findings – both to the MSM population in Lima and more broadly. Participants completed the survey either in person at an HIV clinic or online via a link dispersed using the social media of a LGBTQ community organization. Both of these forms of recruitment likely target a population with greater access to HIV prevention information and tools, such as condoms, compared to the general population of MSM in Lima.

Despite these limitations to the generalizability of the findings, this analysis does contribute to our understanding of this phenomenon in a largely unstudied population, as most studies regarding GSN app use have been conducted in the United States. Contextual factors, such as stigma experienced by MSM in Lima, influence sexual behavior and are not uniform across geographic regions. There have been studies in other populations where stigma is pervasive, [25] but it is important to have data relevant to Latin America, and more specifically Peru, to appropriately guide HIV prevention interventions.

A strength of this study is the self-survey format of data collection, which serves to mitigate social desirability bias. Also, by collecting partner-level data on condom use as well as GSN app use, we were able to observe the association between GSN app use and sexual behaviors at a more granular level, rather than simply a more general association between behavior and “GSN app user”.

These findings suggest a need for further investigation into the relationship between sexual behaviors and the use of GSN apps to meet sex partners. Future studies should focus specifically on the

patterns of GSN app use by individuals and sub-groups, and should seek to control for any observable confounding factors related to individuals' patterns or intentions of engaging in CAI. GSN apps have now become commonplace among diverse MSM populations, and it is important to recognize that different sub-groups of MSM (early-adopters of GSN apps, bisexual men, ethnic minority groups, etc.) may have unique risk behaviors. Further investigation should also be directed at better understanding the specific components of GSN apps (e.g. immediacy, location, photos, etc.) that may influence both high-risk and protective sexual behaviors. Given the ubiquity of GSN apps, examining longitudinal outcomes of their use for partner seeking would provide valuable insights into the use of this techonology as a platform for HIV prevention.

Conclusion

Among MSM in Lima, there was a slightly lower prevalence of CAI reported with sexual partners met via a GSN-app as compared to other meeting venues, though the association was not statistically significant. Even so, due to the pervasiveness of GSN apps for partner seeking, as well as the association of other high-risk behaviors and GSN app use (such as increased number of partners), GSN apps should be considered for further investigation as a potential platform for expanding HIV prevention efforts among the MSM population in Lima, Peru.

FURTHER CONCLUSIONS

The use of GSN applications for partner seeking has become progressively more popular over recent years, and while this study did not find a significant association between GSN apps and CAI, there are characteristics of these apps that may position them as an effective means to target groups most at risk for HIV infection – in Lima, MSM. In the United Nations' most recent political declaration on HIV and AIDS they recognize, "national and regional epidemics have different characteristics and drivers and that, based on different epidemiological contexts, differentiated responses and interventions are required for addressing them"; the findings of this study provide some insights into these characteristics and drivers. [1] To reach UNAIDS' goal of providing access to prevention to 95% of those at risk of HIV infection, it is imperative that we explore innovative and socially-relevant methods of HIV prevention.

Current research demonstrates that HIV prevalence among young MSM in Latin America is high, [31] and our findings support existing data that indicates younger populations are likely to utilize partner-seeking GSN apps. [13] Furthermore, studies have shown that utilizing GSN apps for HIV prevention efforts is both feasible and accepted among diverse MSM populations. [33-36] In Lima, utilizing GSN apps for HIV prevention has the potential to reach populations that may not be accessible via traditional HIV prevention initiatives, as pervasive stigma associated with homosexuality, specifically concerns about disclosure and public attitudes, acts as a barrier to both HIV prevention and treatment. [37]

Because stigma experienced by members of the MSM population may preclude them from accessing HIV prevention, GSN apps are a potential means of bypassing this important barrier in order to provide HIV prevention resources such as information on HIV testing and pre-exposure prophylaxis (PrEP). Although most GSN app users in this study had taken an HIV test at some point in their lifetime, they are likely not a representative sample of all GSN app users in Lima as users in this study were recruited at an HIV Clinic and online using social media of an LGBTQ community group. Other studies

have shown that less than 10% of MSM in Lima comply with the Peruvian Ministry of Health's HIV testing guidelines of testing every six months, and one of the primary motives for not testing was low perception of risk, [38] a barrier that could be addressed through targeted informational campaigns using GSN apps.

Additionally, studies have shown that there is distrust among MSM in Lima in relation to the use of PrEP for HIV prevention. [39, 40] This distrust largely stems from deep-rooted stigma and consequent skepticism of healthcare professionals and pharmaceutical drug trials. In utilizing GSN apps as a platform for the promotion of PrEP, it may be possible to mitigate this barrier to uptake by providing accurate educational information in a non-medical, familiar, and anonymous setting.

In order to reach UNAIDS' goal of ending the HIV/AIDS epidemic by 2030, targeted and novel approaches to HIV prevention must be developed. Technology is continually evolving, and along with it both intended and unintended associated behaviors, including HIV risk behaviors. By contributing to the understanding of sexual behaviors related to an increasingly widespread technology (GSN apps) among an at risk population (MSM in Lima), this study facilitates future work into effective HIV prevention.

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Table 1. Participant-level demographics, substance use, HIV testing history and sexual behavior in a sample of men who have sex with men in Lima, Peru

	All Participants	GSN Users	Non-GSN Users	p-value*
	n (%) 672 (100)	n (%) 322 (46.1)	n (%) 350 (53.9)	
Age - median (min, max)	27 (18-59)	26 (18-58)	30 (18-59)	<.0001
Highest Level of Education – n (%)				.0007
Less than Secondary education	30 (4.5)	5 (1.6)	25(3.7)	
Secondary Education Complete	111 (16.5)	45 (14.0)	66(18.9)	
Some post-secondary	224 (33.3)	119 (40.0)	105(30.0)	
Complete post-secondary	307 (45.7)	153 (47.5)	154 (44.0)	
Income Level – n (%)				.87
>= 1500	240 (35.7)	116 (36.0)	124 (35.4)	
< 1500 soles	432 (64.3)	206 (64.0)	226 (64.6)	
Substance Use Associated w/ Sex in last 3 months- n(%)				.20
Yes	329 (49.0)	166 (51.6)	163 (46.6)	
No	343 (51.0)	156 (48.5)	187 (53.4)	
Number of Sex Partners last 3 months - Median (IQR)	5 (2-10)	6 (3-15)	4 (2-8)	<.0001
Sex Worker				.16
Yes	45 (6.7)	17 (5.3)	28 (8.00)	
No	627 (93.3)	305 (94.7)	322 (92.00)	
HIV Testing - Ever tested				.03
Yes	581 (86.5)	288 (89.4)	293 (83.7)	
No	71 (10.6)	27 (84)	44 (12.6)	
No response	20 (3.0)	7 (2.2)	13 (3.7)	
Self-Reported Positive HIV Test				.66
Yes	94 (14.0)	47 (14.6)	47 (13.4)	
No	578 (86.0)	275 (85.4)	303 (86.6)	
Condomless Anal Intercourse*	363 (54.0)	171 (53.1)	192 (54.9)	.65
Receptive	253 (37.7)	128 (39.8)	125 (35.7)	
Insertive	240 (35.7)	106 (32.9)	134 (38.3)	

*Calculated using χ^2 statistic for categorical varibles, t-test for Age variable, and Wilcoxon Rank Sums for Number of Sex Partners variable.
**Refers to with last or penultimate partner. Participants were able to report multiple positions in one encounter (e.g. both receptive and insertive).

Table 2. Partner-level characteristics of sexual episodes among a sample of men who have sex with men in Lima, Peru.

	Total	GSN App Partner	Online(Non-GSN App) Partner	In-person/Other Partner	p-value
n(%)	1235 (100)	566 (45.8)	196 (15.9)	473 (38.3)	
Condomless Anal Intercourse* – n(%)	543 (43.9)	235 (41.5)	94 (48.0)	214 (45.2)	.23
Receptive w/o Condom	363 (29.4)	173 (30.6)	66 (33.7)	124 (26.2)	.11
Receptive w/ Condom	443 (35.9)	218 (38.5)	66 (33.7)	159 (33.6)	.20
Insertive w/o Condom	341 (27.6)	144 (25.4)	58 (29.6)	139 (29.4)	.29
Insertive w/ Condom	436 (35.3)	215 (38.0)	69 (35.2)	152 (32.1)	.15
	Total	**GSN**	**Online (Non-GSN)**	**In-person/Other**	
Partner Type – n(%)					<.0001
Main Partner/Stable	191 (15.5)	63 (11.1)	48 (24.5)	80 (16.9)	
Friend w/ benefits	295 (23.9)	122 (21.6)	61 (31.1)	112 (23.7)	
Casual/Anonymous	674 (54.6)	351 (62.0)	71 (36.2)	252 (53.3)	
Transactional	75 (6.1)	30 (5.3)	16 (8.2)	29 (6.1)	

*CAI considered to be engaged in any sort of CAI (receptive or insertive). Participants were able to report multiple positions with one partner (e.g. both receptive and insertive), including whether a condom was used for each position.

Table 3. Partner-level GSN Application and Non-GSN Online Platform use among a sample of men who have sex with men in Lima, Peru

GSN Applications	**n***	**%**
Grind'r	530	93.6%
Tinder	20	3.5%
Scruff	8	1.4%
Badoo	6	1.1%
Surge	1	0.2%
Growler	1	0.2%
Total	**566**	**100.00%**
Non-GSN Online Platforms	**n***	**%**
Facebook	113	57.7%
Whatsapp	30	15.3%
Manhunt	21	10.7%
Other	16	8.2%
"Chat"	13	6.6%
Instagram	3	1.5%
Total	**193**	**100.00%**

*Number of partners met using indicated meeting-venue (GSN Application or Non-GSN Online Platform)

Table 4. Association of Meeting Venue (GSN, Online (Non-GSN), or Offline) and Condomless Anal Intercourse among a sample of men who have sex with men in Lima, Peru

	Unadjusted Prevalence Ratio	95% Confidence Interval		p-value	Adjusted Prevalence Ratio*	95% Confidence Interval		p-value
GSN	0.9	0.8	1.1	.30	0.9	0.8	1.1	.22
Online, non-GSN	1.1	0.9	1.3	.57	1.0	0.9	1.3	.64
Offline (reference)	1.0				1.0			

*Adjusted for age, highest level of education, sex work, and substance use during sex within the last 3 months