
A Review of Risk Behaviors for HIV Infection by Men Who Have Sex With Men Through Geosocial Networking Phone Apps

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The purpose of our review was to analyze the relationship between the use of geosocial networking phone apps and risk behaviors for HIV infection in men who have sex with men (MSM). The review was guided by the question: Does the use of geosocial networking apps to find sex partners increase risk behaviors for HIV infection by MSM? We searched the databases PubMed, Web of Science, CINAHL, and LILACS, considering primary studies published up to December 2015, without any time restraint. All 14 studies that met our search criteria analyzed sexual behaviors in relation to sociocultural and economic characteristics, number of partners, unprotected anal sex, drug use, HIV testing, risk management measures, and the presence of other sexually transmitted diseases. The results indicated that use of geosocial networking apps to find sex partners may lead to new patterns of behavior and relationships that place MSM at risk for HIV.

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Key words: integrative literature review, men who have sex with men, mobile phone applications, sexual behavior, social networks

HIV is a condition that is not restricted to specific populations. It involves key risk behaviors such as condomless or unprotected anal and/or vaginal sex,

and injection drug use; it can affect anyone, without discrimination. HIV is a pandemic, infectious disease; it is caused by a virus and is not delimited by geopolitical barriers. Its epidemiological characteristics and patterns may vary according to social context and geographic region. Understanding these differences and specificities contributes to global vigilance about the epidemic and the implementation of more effective interventions (Kagotho & Ssewamala, 2012; Kamat et al., 2013).

Although heterogeneity of cases is observed in the worldwide population, more recent studies have indicated key groups for infection control in this global epidemic. One such group, men who have sex with

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men (MSM), stands out among these groups by showing higher prevalence rates than the general population (Beyrer et al., 2012; Joint United Nations Programme on HIV/AIDS [UNAIDS], 2010; Malavé, Ramakrishna, Heylen, Bharat, & Ekstrand, 2014).

One of the characteristics of HIV infection is that its agent is both transmitted and prevented through a common factor: behavior. Risk behaviors for HIV infection are identified by risk assessment and management, and individuals may engage in both protective and risky behaviors (Nodin, Carballo-Diéguez, & Leal, 2015).

The literature has clearly presented evidence that points to high HIV prevalence, lack of awareness of HIV-infection status (both self and partners), unprotected anal sex, and increased drug use during sexual activity as contributing substantially to new infections among MSM (Landovitz et al., 2013). Associated with these behaviors, incidence of HIV infection may increase with the use of geosocial networking applications (apps) to make friends, arrange dates, and start relationships. These mobile apps are sometimes used to arrange for occasional sexual intercourse, without adopting prevention measures (Boone, Cook, & Wilson, 2013).

Many MSM use these apps, especially younger men (<20 years). Casual sex through social networking apps is almost always quick, unplanned, circumstantial, and at a young age (Landovitz et al., 2013). In most situations, MSM using these apps do not use condoms, they change partners frequently (because the relations are casual), and include the possibility of group sex (Baral et al., 2015; Beyrer et al., 2013; Boone et al., 2013; Muessig et al., 2013).

Despite the importance of social media and apps to arrange dates, few studies have evaluated the relationship between the use of geosocial networking apps and increased risk behaviors for sexually transmitted infections (STIs). In addition, insufficient public policies as well as social and legal disadvantages increase the vulnerability of this group and become obstacles to health services (Beyrer et al., 2012; Beyrer et al., 2013; Sullivan et al., 2012).

Two questions guided this literature review: *Does the use of geosocial networking apps to find sex partners increase the risk of HIV infection for MSM?* and *How can geosocial networking apps facilitate HIV*

acquisition and transmission? The objective of our literature review was to analyze the relationship between the use of geosocial networking apps and risk behaviors for HIV infection by MSM.

Method

We completed an integrative literature review, one of the main methods used for evidence-based practice. The method seeks to summarize empirical literature produced about a phenomenon, and thus provide a more comprehensive understanding of it (Whittemore & Knafli, 2005). The development of our study involved the following steps: (a) definition of the objective, (b) definition of inclusion and exclusion criteria for sampling purposes, (c) search and selection of primary studies, (d) data extraction of selected studies, and (e) analysis and discussion of results.

MeSH descriptors were used for online searches in MEDLINE databases via the PubMed portal of the U.S. National Library of Medicine and the Web of Science. Combined descriptors and key words were used for the CINAHL and LILACS databases. Terms in Portuguese, English, and Spanish were used for LILACS; English terms only were used for the other databases.

Inclusion criteria were primary studies for which full texts were available that had been published up to December 2015. Book chapters, theses, dissertations, and technical reports were excluded from the initial search. The searches were conducted December 1-15, 2015, simultaneously by two investigators.

The following descriptors were used: *sexual behavior*; *men who have sex with men*; *sexually transmitted diseases*; and *social networks*. Key words and descriptors belonging to the same category were separated by “OR” and descriptors belonging to different categories by “AND.” The terms used in the search were classified by the databases:

PubMed and Web of Science (MeSH descriptors): *sexual behavior OR sexual AND behavior; OR sexual behavior AND men OR men AND sex OR sex AND men OR men AND sexually transmitted disease; OR sexually AND transmitted AND diseases; (All Fields) OR sexually transmitted diseases AND social support OR social AND*

support OR social support OR social AND networks OR social networks.

CINAHL (CINAHL titles): *sexual behavior AND men who have sex with men AND sexually transmitted diseases AND social networks OR social media.*

LILACS (descriptors and keywords): *sexual behavior AND men OR men's, AND behavior AND sexual OR sexuality, behavior OR sexually transmitted diseases AND sex AND social networking, and corresponding terms in Portuguese and Spanish.*

Analysis for study selection was conducted in three stages, as follows. First, the studies selected from the databases were analyzed and preselected, observing inclusion and exclusion criteria, by reading titles and abstracts. For articles with no abstracts, or if the abstracts didn't allow article exclusion or inclusion, articles were read. Studies ($n = 625$) were extracted from PubMed, CINAHL ($n = 9$), LILACS ($n = 25$), and Web of Science ($n = 194$), totaling 853 studies. In the second stage, the 853 studies were analyzed in terms of potential inclusion in the study, evaluating possible fulfillment of the study questions, along with the type of investigation, objectives, sample, method, outcomes, results, and conclusions, resulting in retention of 35 articles. In the third stage, the full texts of all 35 articles were read in order to collect specific data for the objectives of the review, and the number was reduced to the 14 articles selected for our study (see [Figure 1](#)). This stage was conducted by three investigators, who carried out online meetings to discuss and reach consensus about whether every article should be included or excluded. Two other articles from references of the selected articles were also included. The reasons for the exclusion of the other 841 studies are shown in [Table 1](#).

Results

The 14 studies included in the review were identified as A1 to A14. All were in English, with a predominance of studies conducted in the United States ($n = 12$, 85.7%). They were mostly published in 2015 ($n = 6$, 42.8%), and in terms of study design, they were mostly descriptive studies ($n = 12$, 85.7%; [Table 2](#)).

Grindr was the most analyzed app ($n = 12$, 85.7%). Wide variation was observed in sample sizes. Most studies evaluated risk behaviors in relation to sociodemographic, cultural, and economic characteristics; drug use; number of partners; unprotected anal sex; and presence of other sexually transmitted diseases ([Table 3](#)).

Sociodemographic Characteristics

The studies showed a predominance of young people (<20 years of age) and young adults (20 to 25 years of age; [Beymer et al., 2014](#); [Bien et al., 2015](#); [Burrell et al., 2012](#); [Duncan et al., 2016](#); [Grosskopf et al., 2014](#); [Lehmiller & Ioeberger, 2014](#); [Newcomb et al., 2016](#); [Phillips et al., 2014](#); [Winetrobe et al., 2014](#); [Yeo & Ng, 2016](#)). Younger ages were associated with higher frequency of app use, greater search for sex via apps, a higher number of sexual partners ([Burrell et al., 2012](#); [Grosskopf et al., 2014](#); [Holloway et al., 2015](#)), and a higher chance of prior STI ([Beymer et al., 2014](#); [Holloway et al., 2015](#)).

Use of Apps

The studies showed that MSM were familiar with apps and reported high frequencies of app use for long periods – 1 year or more. The use of apps was reported to be daily or several times during the week, and apps were commonly used in the afternoon and at night, on weekdays, and weekends ([Grosskopf et al., 2014](#); [Holloway et al., 2015](#); [Landovitz et al., 2013](#); [Winetrobe et al., 2014](#); [Yeo & Ng, 2016](#)). The main reasons for using apps included finding sex partners ([Goedel & Duncan, 2015](#)), making friends ([Lehmiller & Ioeberger, 2014](#); [Rice et al., 2012](#)), and “killing time” ([Goedel & Duncan, 2015](#); [Rice et al., 2012](#)).

Sexual Behaviors and Vulnerability

Searching sex partners on apps occurred even when MSM were in steady relationships, indicating that they had multiple partners (steady and casual partners; [Holloway et al., 2015](#); [Lehmiller & Ioeberger, 2014](#); [Yeo & Ng, 2016](#)). Depending on how sex occurred (with or without protection, receptive or insertive anal sex), an

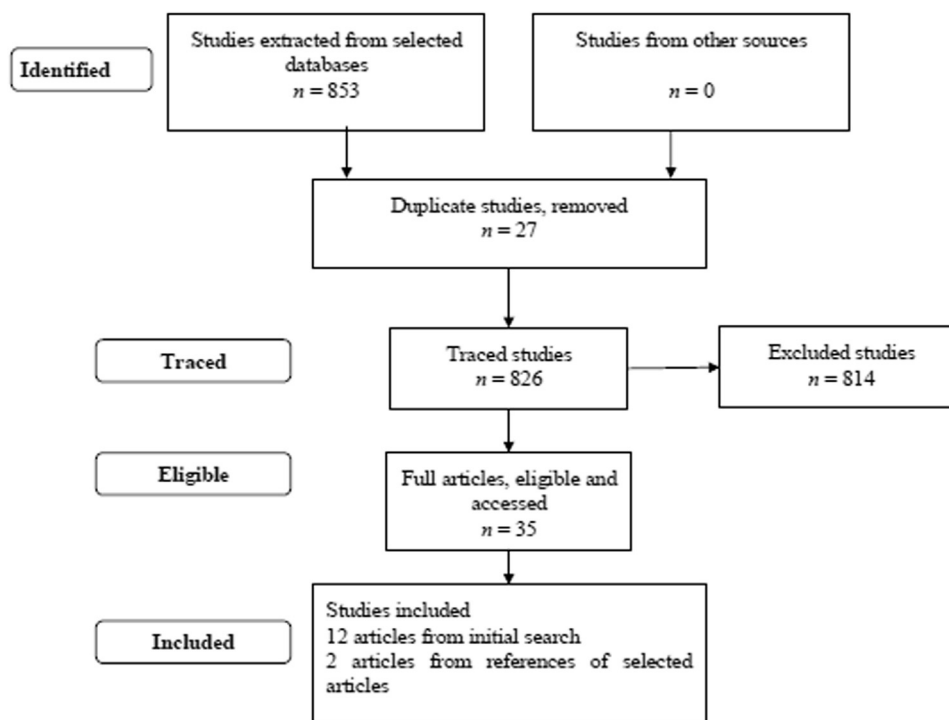


Figure 1. Flowchart for study selection.

important chain for the transmission of STIs was identified. In addition, arranging sex via apps showed strong characteristics of immediacy (Grosskopf et al., 2014; Newcomb et al., 2016) and recurrence (Landovitz et al., 2013).

The studies identified high frequency of unprotected anal sex (Bien et al., 2015; Burrell et al., 2012; Duncan et al., 2016; Goedel & Duncan, 2015; Grosskopf et al., 2014; Holloway et al., 2015; Phillips et al., 2014; Winetrobe et al., 2014; Yeo & Ng, 2016) as well as partner changing during a lifetime and in the last few months (Burrell et al., 2012; Holloway et al., 2015; Lehmler & Ioerger, 2014; Phillips et al., 2014; Winetrobe et al., 2014; Yeo & Ng, 2016). Studies that assessed the incidence of other STIs highlighted gonorrhea, syphilis, and chlamydia (Beymer et al., 2014; Holloway et al., 2015).

HIV testing was investigated in various studies (Bien et al., 2015; Goedel & Duncan, 2015; Holloway et al., 2015; Lehmler & Ioerger, 2014; Newcomb et al., 2016) and the results varied widely.

However, in all studies, testing rates were self-reported, which may be an important bias. Drug use was also high in all studies that evaluated this variable, and it was always associated with unprotected anal sex (Duncan et al., 2016; Landovitz et al., 2013; Winetrobe et al., 2014; Yeo & Ng, 2016). The more common drugs indicated in the studies were alcohol, marijuana, ecstasy, cocaine, and inhaled substances (poppers; Beymer et al., 2014; Duncan et al., 2016; Landovitz et al., 2013; Winetrobe et al., 2014). Drug use was also associated with a history of other STIs (Beymer et al., 2014).

Discussion

This is the first integrative review to investigate the relationship between the (a) use of geosocial networking apps to arrange dates and (b) risk behaviors for HIV infection by MSM. The Internet is a popular tool for sex searches among MSM for many reasons. It is an effective and convenient way to

Table 1. Reasons for the Exclusion of Articles

Reasons	Number Excluded (<i>N</i> = 841)
Study not conducted with MSM, gays, or bisexuals, either involving women or nonheterosexual and heterosexual men.	153
Study involved MSM, gays, or bisexuals, but did not evaluate risk behaviors.	187
Study analyzed MSM, gays, or bisexuals, but evaluated risk behaviors in ways other than networking phone apps.	355
Study analyzed MSM, gays, or bisexuals, evaluated risk behaviors through social media, but not geosocial networking phone apps (Facebook, Myspace, online chat)	64
Literature reviews	36
Methodology studies	15
Duplicate studies	27
Reflexive studies	3
Technical reports	1

Note. MSM = men who have sex with men.

locate sex partners more quickly than other traditional and offline ways. The Internet also allows MSM to screen partners according to their preferences: age, sexual orientation, ethnicity, and HIV status, among others (Rosser et al., 2011). However, the use of smartphones and tablets to access social media, combined with the possibility of finding someone's location using the Global Positioning System, has allowed greater interaction between the virtual and real worlds, further changing the profile of relations and speeding the possibility of dates and sexual practices, creating a new and unique experience for the manifestation of sexuality (Brito et al., 2015).

In 2013, Grindr® (West Hollywood, CA) became the most popular of these applications, with about six million users in 192 countries. In the virtual environment, a variety of risk factors (confidence and low perception of risk) and types of protection (serum adaptation, strategic positioning, and safe sex negotiation) tended to occur simultaneously. However, a competitive environment that encourages the consumption of people through ephemeral and casual relationships, usually limited to sex, propitiates the constant search for new experiences to satisfy sexual needs and desires. In this scenario, quick selection of partners can put risk management in second place

(Brito et al., 2015; Goedel & Duncan, 2015; Grosskopf et al., 2014; Ross, Tikkanen, & Berg, 2014).

The impact of the use of apps with geosocial networking tools on daily life can be easily seen in these new experiences, which are increasingly individual and disposable (Landovitz et al., 2013; Lehmler & Ioerger, 2014). This is similar to modern relationships with smartphones, in which users shape devices according to their needs and discard them when they aren't needed or when better devices are found.

A mixed methods study that analyzed risk management for HIV found that MSM combined biomedical methods to decrease HIV risk, using preexposure prophylaxis (PrEP) and undetectable viral loads. Individuals using PrEP or having undetectable viral loads had unprotected anal sex with HIV-infected partners found via apps, provided the partners had undetectable viral loads or used PrEP (Newcomb et al., 2016). The findings of our analysis were linked to risk factors (unprotected anal sex with infected individuals, but with undetectable viral loads) and protective factors (use of PrEP) that coexist and overlap in the microenvironment provided by the apps.

High familiarity with these apps and longer times as app users may further expose MSM to risk situations, as these factors ensure more effective use of app resources, optimizing time spent on apps. This means better understanding of app functionalities, characteristics, languages used by users, and efficient screening strategies to achieve goals, such as sex partners, friends, or loving relationships.

The constant use of apps may also cause changes in relationship profiles. Some studies (Grosskopf et al., 2014; Holloway et al., 2015; Landovitz et al., 2013) have indicated that MSM prefer to find sex partners via apps rather than in person. In the United States (Phillips et al., 2014; Winetrobe et al., 2014), individuals who had used apps for 1 year or more were identified as being more inclined to use drugs, present depression symptoms, and believe their partners had other sex partners; results similar to other studies (Goedel & Duncan, 2015; Holloway et al., 2015; Landovitz et al., 2013; Rice et al., 2012; Yeo & Ng, 2016). The immediacy of relations ensured by apps does not allow for learning about a partner's preventive measures, which may expose app users to frequent risk situations.

Table 2. Distribution of Publications According to Title, Publication Year, Country Where it Was Conducted, and Study Design

#	Title	Publication Year	Country	Study Design
A1	A study of intimate partner violence, substance abuse, and sexual risk behaviors among gay, bisexual, and other men who have sex with men in a sample of geosocial networking smartphone application users (Duncan et al., 2016).	2015 Ahead of print	United States	Cross-section
A2	Association of unprotected anal intercourse with Grindr-met partners among Grindr-using young men who have sex with men in Los Angeles (Winetrobe, Rice, Bauermeister, Petering, & Holloway, 2014).	2014	United States	Cross-sectional descriptive
A3	Epidemiology, sexual risk behaviors, and HIV prevention practices of men who have sex using Grindr in Los Angeles (Landovitz et al., 2013).	2013	United States	Cross-sectional descriptive
A4	Social networking smartphone applications and sexual health outcomes among men who have sex with men (Lehmiller & Ierger, 2014).	2014	United States	Cross-sectional analytical
A5	Gay apps for seeking sex partners in China: Implications for MSM sexual health (Bien et al., 2015).	2015	China	Cross-sectional descriptive
A6	Geosocial networking app usage patterns of gay, bisexual, and other men who have sex with men: Survey among users of Grindr, a mobile dating app (Goedel & Duncan, 2015).	2015	United States	Cross-sectional descriptive
A7	Network influences on the sexual risk behaviors of gay, bisexual, and other men who have sex with men using geosocial networking applications (Holloway, Pulsipher, Gibbs, Barman-Adhikari, & Rice, 2015).	2015	United States	Cross-sectional analytical
A8	Partner disclosure of PrEP use and undetectable viral loads on geosocial networking apps: Frequency of disclosure and decisions about condomless sex (Newcomb, Mongrella, Weis, McMillen, & Mustanski, 2016).	2015 Ahead of print	United States	Cross-sectional descriptive; mixed approach
A9	Sex on demand: Geosocial networking phone apps and risk of sexually transmitted infections among a cross-sectional sample of men who have sex with men in Los Angeles county (Beymer et al., 2014).	2014	United States	Cross-sectional analytical
A10	Sex risk among young men who have sex with men who use Grindr, a smartphone geosocial networking application (Rice et al., 2012).	2014	United States	Cross-sectional descriptive
A11	Sexual risk behaviors among apps-using young men who have sex with men in Hong Kong (Yeo & Ng, 2016).	2015	Japan	Cross-sectional descriptive
A12	Use of geosocial networking (GSN) mobile phone applications to find men for sex by MSM in Washington, DC (Phillips et al., 2014).	2014	United States	Cross-sectional descriptive
A13	Use of the internet and mobile-based "apps" for sex-seeking among men who have sex with men in New York City (Grosskopf, LeVasseur, & Glaser, 2014).	2014	United States	Cross-sectional analytical
A14	Use of the location-based social networking application Grindr as a recruitment tool in rectal microbicide development research (Burrell et al., 2012).	2012	United States	Randomized clinical trial

Note. PrEP = preexposure prophylaxis; MSM = men who have sex with men.

Table 3. Articles According to Primary Objective, App Analyzed, Sample Size, and Main Results

#	Primary Objective	App Analyzed	Sample Size	Main Results
A1	Investigate relations between experiences of intimate partner violence and the use of substances and sexual risk behaviors in a sample of MSM via Grindr.	Grindr	175	The average number of partners in the last 3 months varied according to sexual behaviors, especially whether partners were found on apps. Insertive sex and being submitted to violence were associated with a higher number of partners, higher frequency of condomless sex, and partners found on apps. Having suffered physical violence increased with the number of partners for oral sex and partners via the app. Suffering individual violence was associated with higher chances of drug use and other risk behaviors. Suffering violence through intimidation was associated with substance abuse, and isolation was associated with (passive) anal sex, which was associated with risk behaviors and more partners via the app.
A2	Analyze the associations of unprotected anal sex with partners found via Grindr in young MSM in Los Angeles.	Grindr	195	Of 146 young MSM who reported sexual relations with partners found via Grindr, 20% had unprotected anal sex in the last sexual relation. Young MSM on Grindr for at least 1 year tended to show naked chest or abdomen in profile pictures, and reported that partners found via the app were more likely to have unprotected anal sex. Longer time of app use lead to greater familiarity with it, which was associated with unprotected anal sex with partners known in the app.
A3	Characterize epidemiology, risk behaviors, HIV status and HIV testing behavior, and the adoption of HIV prevention strategies among young MSM who use Grindr in the metropolitan region of Los Angeles.	Grindr	375	Most participants reported high numbers of sex partners, unprotected anal sex, and low perception of HIV risk; 83.1% reported they had been tested for HIV in the last 12 months; 4.3% had never been tested. However, 4.5% reported they were infected with HIV, which was associated with increased numbers of anal sex partners in the last 3 months, inconsistent HIV testing of partners, and reporting that app use was also to “make friends.” Drug use reported by 48%; of these, more than 90% used drugs during sex. Men found via Grindr presented high risk of HIV transmission or acquisition.
A4	Learn about sex life of MSM who look for sex partners via mobile apps and compare sexual health and personalities of app users and nonusers.	Grindr Adam4 Adam GROWR Scruff Manhunt	112	App users had a higher average number of sex partners than app nonusers in the last 3 months and in the last month. However, no difference was observed in sexual practices of the groups (receptive or insertive anal sex, with or without condoms), and no difference observed when comparing HIV history or frequency and results of HIV testing. App users presented higher probability of having one diagnosed STI and more lifetime sex partners.
A5	Analyze sociodemographic characteristics and sexual behaviors of Chinese MSM who use geosocial networking apps compared to MSM who do not use apps.	Jack'd Grindr Blued BoyAhoy	1,342	Compared to nonusers, app users were younger, of higher education level, assumed they were gay, and single. They were also more likely to have more sex partners and more frequent HIV testing.

(Continued)

Table 3. (Continued)

#	Primary Objective	App Analyzed	Sample Size	Main Results
A6	Describe the use of geosocial networking apps and recent sexual behaviors of MSM in the Atlanta metropolitan area.	Grindr	92	For MSM: 38% reported use of mobile apps to find new sex partners; 18.5% used apps to “kill time” when feeling bored. Users who reported being in relationships were less inclined to use apps to make friends with other MSM, but more inclined to use apps for sex. Interviewees had an average of 3.11 mobile app accounts. Most were more active on apps in the afternoon and at night (40.2%) and on weekdays (64.1%). App users checked mobile apps an average of 8.38 times a day and spent an average of 1.31 hours on them. App use initiation was associated with age at first sexual experience for both insertive and receptive anal sex.
A7	Understand if inclusion of individuals met via geosocial networking apps in social circles was associated with increased risk behaviors for HIV in a probability sample of MSM from Los Angeles.	Jack’d Grindr Blued BoyAhoy	295	MSM who used gay apps were more likely to be younger, single, and students or have at least one college degree. MSM self-reported as gay, and had “assumed” their homosexuality, in comparison to nonusers. MSM who used apps were almost twice as likely to have had at least two male anal sex partners in the last 3 months.
A8	Investigate the frequency of MSM who find potential sex partners on apps and who also use any type of biomedical prevention.	Not informed	2,098	Most had found potential sex partners who used PrEP or had undetectable viral loads, using it as a prevention strategy. Most MSM who met these partners had had condomless anal sex at least once. Qualitative analysis found that most who reported unprotected anal sex did so after they “calculated” HIV transmission risk. Strategies for risk reduction were identified, such as “biomedical combination”: having condomless anal sex only when both partners used PrEP or had undetectable viral loads.
A9	Determine if MSM self-reported as HIV uninfected and users of clinical HIV services who used geosocial networking apps present higher rates of STIs compared to uninfected MSM who met in person.	Grindr	7,184	App users reported more drug use compared to those who met their partners in person and presented a higher proportion of other STIs such as gonorrhea and chlamydia. However, individuals who only used apps had a lower proportion of HIV (1.9%). App users reported greater use of cocaine and ecstasy.
A10	Evaluate motivations of young MSM who use apps and their risk behaviors for HIV in relations with other app users.	Grindr	195	Although they used the app for several purposes (entertainment, social media, connection with gay community), most app users said they used apps for casual sex only (95.1%), and reported more relations than those who did not use apps (average = 2.4, 1.1, respectively). Most who arranged their last sexual relation via app said they used condoms (59.8%). Only 14.7% reported unprotected anal sex with last partner arranged via Grindr; they also reported higher rates of anal sex with male partners than those who did not report unprotected anal sex with partners found on Grindr.

A11	Assess risk behaviors among young MSM who use apps in Hong Kong.	Grindr Jack'd	213	Differences observed in sexual behaviors related to app use. For young MSM app users, infrequent use of condoms was common, especially with casual partners (45.8%); 19.3% of sample reported condomless internal ejaculation for insertive sex and 19.8% for receptive sex. Finding sex partners via apps doubled the chance of unprotected anal sex with regular partners (ORa = 1.99) and nonregular partners (ORa = 2.17). Condomless anal sex was more common for men who were not in a steady relationship (ORa = 3.25) and who used drugs during sex (ORa = 3.79). However, chances were reduced in cases of group sex (ORa = 0.15). Condomless insertive anal ejaculation increased in nonexclusive relations (ORa = 4.10), with more recent partners (ORa = 2.47), and with use of alcohol (OR = 4.04). For condomless insertive internal ejaculation, the chance increased among bisexuals and in exclusive, lengthier relationships.
A12	Identify the prevalence of meet-up apps and compare app use to find sex partners to other virtual ways.	Not clear	379	In MSM, 63.6% used apps; of these, 58.9% were looking for sex partners, had assumed they were gay (91.7%; OR: 2.18), and had been tested for HIV (96.7%; OR: 0.60); 11.4% were HIV infected. Of these, 59.8% had had five or more sex partners in the last 12 months, 59.3% had steady and casual partners, and 32.4% had only casual partners. MSM who had used apps to find other men in the last 12 months were more likely to identify themselves as homosexual (ORa = 3.20), have been tested for HIV in last year (ORa = 2.03), reported depression symptoms (ORa = 2.89), and believed their last male sex partner had other partners (ORa = 2.27).
A13	Evaluate extent to which Internet and apps are used to help satisfy MSM in gay identity affirmation and search for sexual satisfaction; analyze how these are associated with use of apps and Internet.	Grindr Jack'd Scruff, etc.	126	A high frequency of app use was identified, and a preference for meeting men via apps (overall: 47.2%). Most participants met other men via an app, had sex soon after they met (96.5%), and had unprotected anal sex (57.7%). They identified themselves as gay and as part of this subculture, but presented low levels of internalized homophobia. No variables reported any difference between partners met via the Internet and apps.
A14	Compare sociodemographic characteristics and risk behaviors in MSM recruited via Grindr vs. MSM recruited via other communication vehicles.	Grindr	105	The study showed that investigating sexual behaviors of MSM via apps was more effective than other methods. Frequency of unprotected (insertive and receptive) anal sex was recorded for lifetime, last year, last 3 months, and last 14 days. MSM who used apps had had more sex partners in the last 14 days (1.88 vs. 1.10), and more receptive anal sex (2.0 vs. 1.8) and insertive anal sex (2.5 vs. 1.9), than the other MSM in the study.

Note. ORa = odds ratio adjusted; OR = odds ratio; MSM = men who have sex with men; PrEP = preexposure prophylaxis; STI = sexually transmitted infection.

MSM reported high numbers of recent and lifetime sex partners, as well as sexual relations immediately after meeting someone via an app (Grosskopf et al., 2014; Holloway et al., 2015). The presence of steady partners did not prevent the search for casual partners on apps (Holloway et al., 2015; Lehmler & Ioerger, 2014; Yeo & Ng, 2016), indicating that affective/loving and sexual needs may be fulfilled by different people, which reinforces new behavior and relationship patterns. One study (Rice et al., 2012) compared searching for partners via apps versus in person and identified a greater likelihood that app partners would become casual partners.

Searching for ways to fulfill sexual needs is driven by progressively higher levels of stimulation and excitement. Individuals engage in increasingly intense and risky sexual behaviors and experiences (Boone et al., 2013). The association of drugs with sex involves a mix of sensations to increase pleasure. The use of drugs by MSM during sex was associated with unprotected anal sex and a history of other STIs (Duncan et al., 2016; Landovitz et al., 2013; Winetrobe et al., 2014; Yeo & Ng, 2016).

The results of our review show that further studies should be conducted, using other methodological designs, especially addressing interventions in health education, considering continuous growth in users of geosocial networking apps. The evidence gathered in this review provided a source for future discussion in the literature once new evidence reveals profiles and behaviors most associated with risk for HIV infection and the use of apps.

Limitations

Our study had some limitations. Our method provided a one-sided picture of the reality investigated and only included content from the scientific literature. To perform a systematic review would have been impossible, because it would have been necessary to compare interventions, and because of the limited number of published studies, especially randomized clinical trials (Webb & Roe, 2008). The small number of published studies was an obstacle to the objectives of our study, because most published studies were conducted in the United States and had very different sample sizes.

Conclusions

The studies analyzed in our literature review found that geosocial networking apps were more frequently used by young MSM who were aiming to find sex partners. High average numbers of partners were ensured by recurrent use of apps, which allowed high frequency of recent sex (in the last few months) and lifetime sex.

Sex with partners found via apps was characterized, in general, as occasional, immediate, unprotected, with drugs, and with no information about the HIV status of partners. Finding sex partners via apps leads to new behavior and relationship patterns, placing MSM in situations with a high risk of HIV infection.

Disclosures

The authors report no real or perceived vested interests that relate to this article that could be construed as a conflict of interest.

Key Considerations

- Most studies of sexual relationships mediated by geolocation-based applications and their interface with HIV infection have been restricted to describing the phenomenon, requiring explanatory and intervention studies.
- Relationships emerging from applications have their own dynamics and characteristics that may lead to vulnerable behaviors and attitudes.
- Sex with partners found via apps was characterized, in general, as occasional, immediate, unprotected, with drugs, and with no information about the HIV status of partners.

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