

# Social Network Dynamics in Transmission of HIV by Sexual Contact

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**Abstract:** According to statistics published by the Joint United Nations Programme on HIV/AIDS (UNAIDS), by the end of 2019, 38 million people were living with HIV. Hornet is the most frequently-used gay-oriented social network worldwide, especially in France, Russia, Brazil, Turkey, and Taiwan. In this study, we focused on the correlation between the route of transmission for the HIV-1 virus and social media application usage in terms of sexual contact according to the generation category in Turkey. The study included 280 heterosexual, bisexual, and men who have sex with men (MSM) who were newly diagnosed and antiretroviral treatment-naïve HIV-1 patients from cities located in the Marmara region in Turkey. Face-to-face interviews were conducted with each patient between 2015 and 2020. As key populations of the study, bisexuals and MSMs were counted together in the MSMs category because in both sexual preferences, MSM. HIV-1 subtypes and circulating recombinant forms (CRFs) were identified by phylogenetic analysis. Subtype B (80%, 224/280), non-subtype B (7.5%, 21/280), and CRFs (12.5%, 35/280) were identified as the most commonly occurring HIV-1 subtypes. HIV-1 acquisition route was found to be largely through MSM contact (67.9%, 190/280) compared to heterosexual contact (32.1%, 90/280). We have analysed the role of sex-oriented social media applications in HIV transmission among different sexual contacts. The study results showed that sex-oriented social media applications play a facilitator role in HIV transmission between key populations. This study may be useful for developing policies to prevent HIV transmission.

**Keywords:** HIV, Hornet, MSM, sexually transmitted Infections, social network

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## 1. Introduction

HIV is the causative agent of Acquired Immunodeficiency Syndrome (AIDS) and is responsible for destroying the human immune system by decreasing CD4+ T-lymphocytes. The main modes of HIV transmission are sexual contact, intravenous drug use, mother to child, and unsafe blood transfusions. HIV continues to be a significant global public health issue. According to statistics published by the Joint United Nations Programme on HIV/AIDS (UNAIDS) data, 38 million people globally were living with HIV, and 23.3 million people had access to antiretroviral treatment in 2019. The estimation analysis suggests that it will reach 33 million people by 2030 (UNAIDS, Global HIV & AIDS statistics 2020).

On the other hand, in Turkey, there are 24,237 HIV-infected individuals confirmed as of July 2020, and approximately five people are infected with HIV-1 every day (Ministry of Health of the Republic of Turkey). According to another source, the International Pharmaceutical Market Database's (IMS) current data for Turkey (October 2019), 16,806 patients have access to antiretroviral treatment (International Medical Statistics 2019). It was revealed that the primary methods through which HIV is transmitted in Turkey are via heterosexual sex (52%), followed by men having sex with men (MSM at 43%), and bisexuality (3.6%) among the total recorded cases (Sayan et al., 2016).

Social media platforms have become an essential part of people's lives worldwide. Statistics show that social media is more important for younger generations (Social Media Trend Report 2019, 2019; The Science of Social Media, 2019). According to the global social media usage statistics, there are 3.499 billion active social media users out of 4.4 billion internet users. From the entire global population (7.7 billion) as of May 2019, 57 percent of the world's population is connected to the internet. This means that those who are online outnumber those who are not.

Additionally, 45% of the world uses some form of social media. On average, each person has 7.6 social media accounts, and the average time spent on social media daily is 2.3 hours (The Science of Social Media Statistics, 2019). The Flagship Report 2019 indicated that populations of emerging nations are much heavier social media users. In Turkey, the average time spent engaging with/connected to social networks during a typical day is

approximately 3 hours. Turkey ranked thirteenth in terms of social media usage duration out of 46 countries (Global Web Index, 2019).

Another recent statistic shows that social media usage is no longer purely related to social activities; in fact, it creates the possibilities for social engagement on a 24/7 basis without the necessity to be in a specific location, which has facilitated the evolution of social platforms into entertainment hubs (Social Media Trend Report 2019, 2019). This trend report shows that social media platform usage has become a more purposeful activity in recent years. People have acquired the opportunity to re-establish their networks. These platforms allow them to select only those they feel the most comfortable with for inclusion in their network. For these reasons, relatively more minor and more specialized social platforms have become more prevalent in recent years among internet users. Sex-oriented social media applications have begun to be widely used by bisexuals and MSMs worldwide. Hornet has the most used gay-oriented social network worldwide, especially in France, Russia, Brazil, Turkey, and Taiwan. Hornet was founded in 2011, and as mentioned on the Hornet website, it is the world's most widely-used gay social network. Hornet has over 25 million users globally.

The mission of this social media network is to empower gay men to come out and enjoy themselves within an openly gay community (Hornet, 2019). Hornet is a specialized gay network different from Facebook, Instagram, Twitter, etc. It is targeted at MSMs. As stated on their website, it is a place for joy. Gay people may feel more comfortable using these kinds of social media networks as the societal stigma can cause them to be perceived as an outgroup by society in their daily routines.

This study aims to examine the possibility that MSM individuals may encounter harm in various ways when using sex-oriented gay-friendly social networks based on the assumption that social media changes how people live.

## **2. Material and methods**

The research question of this study the based on the aim of this article is:

RQ: Do sex-oriented gay-friendly social media platforms affect HIV transmission and extension?

To answer this research question, quantitative and qualitative research methods were used simultaneously within the study. Quantitative research was conducted using two different ways. First, the microbiological examination was performed in a laboratory. With the help of microbiological tests, the HIV acquisition route, diagnosis status, and co-infection status of patients were analyzed (Table 1). Secondly, face-to-face interview methods were carried out with patients. The data obtained from the patients were processed into a data sheet created in SPSS and subsequently presented in tabular form as a content analysis. Furthermore, the questionnaire was designed in a semi-structured style that includes both quantitative and qualitative questions. The main aim of this questioning technique was to explore 'how' besides 'what.' Especially if questions belonging to gay-friendly sex-oriented social media platform usage response was in a positive direction, open-ended questions had been asked to patients to get more detail.

**Table 1:** Demographic characteristics of the study patients

Characteristic	Study group
Patient, n	280
Gender, M/F (%)	270/10 (96.4 / 3.6)
Age, median years (range)	34.7 (18-68)
CD4 <sup>+</sup> T-cell count, median mm <sup>3</sup> (range)	443 (11-1351)
HIV-1 RNA load, median IU/ml (range)	2.2 + E6 (2.8 + E2 – 3.3 + E8)
Sampling, City of Marmara region, n (%)	
İstanbul	237 (84.6)
Bursa	30 (10.7)
Sakarya	8 (2.9)
Kocaeli	5 (1.8)
HIV acquisition route, n (%)	
MSM contact*	190 (67.9)
Heterosexual contact	90 (32.1)

Characteristic	Study group
Diagnosis status, n (%)	
Newly-diagnosed	270 (96.4)
Under treatment	10 (3.6)
Co-infection status, n (%)	
Syphilis	16 (5.7)
Hepatitis B	8 (2.9)
Herpes zoster	3 (1.1)
CMV infection	2 (0.7)
HPV infection	2 (0.7)
Candidiasis	2 (0.7)
Gonorrhoeae	2 (0.7)
Tuberculosis	2 (0.7)
Kaposi sarcoma	1 (0.4)
Brucellosis	1 (0.4)
<u>Pneumonia</u>	<u>1 (0.4)</u>
Total	40 (14.3)

## 2.1 Patient population and measures

The patients' clinical and laboratory characteristics are shown in Table 1. This study was designed to cover the period 2015 – 2020, and it included 280 patients in cities from the Marmara region of Turkey who was newly diagnosed as HIV-1 infected. 270 (96.4%) HIV-infected patients were male, and only 10 (3.6%) patients were female. The average age of the patients was 34.7. For the patients, CD4+ T cell count was accepted as the immunological status and was 443 median mm<sup>3</sup>, HIV-1 RNA load taken as virological status, and was 2.2 +E6 IU/ml. Most of the patients were from İstanbul (237 patients- 84.6%). Then patients from the Bursa region with 10.7 %, from Sakarya with 8 (2.9%), and Kocaeli with 5 (1.8%) were questioned. The importance of the Marmara region is based on its level of urbanization and as it is a central metropolitan area in Turkey. As the density of HIV diagnosis stands out in the Marmara Region, especially in İstanbul, the study was conducted in this area. However, this region has the largest population of MSMs in Turkey, and the density of HIV diagnosis stands out, especially in İstanbul (Sayan et al., 2016). 190 (67.9%) patients' HIV acquisition route was MSM contact, while only 90 (32.1%) patients were heterosexual. The questioned patients mainly were newly diagnosed (270- 96.4%) with HIV. 40 (14.3%) of participant patients have had co-infections besides HIV. Syphilis (16- 5.7%) was placed on top as a common co-infection with HIV.

During the research, the patients were asked, 'Do you use any sexually-oriented applications to find a partner?'. If the patient reported using such an application, they were asked, 'Which application they were using?'. The main common characteristic of sex-oriented applications is that they are based on geolocations, which means that applications use GPS functionality. Then the patients were asked, 'Why do they prefer to use gay-friendly sex-oriented social media applications?'.

For this reason, smartphone users have been reviewed because such devices contain GPS modules. Sex-oriented gay-friendly social media applications include Hornet, Grindr, Scruff, Jack'd, and Chappy. The most prominent sex-oriented mobile application in Turkey is Hornet. Sex-oriented social media application usage frequencies were examined based on different generations.

The generations were determined as follows: Greatest Generation (1927 - 1945), Baby Boomers (1946 - 1964), Generation X (1965 -1979), Generation Y (1980 - 2000), and Generation Z (2001 - 2020) (Öze, 2016).

Only adults were (>18 years + >350 mm<sup>3</sup> CD4+ T cell count) in the study group because paediatric findings were excluded. Childhood infections were excluded because sexual orientation cannot be questioned for children ethically. Ethical approval was obtained from the Clinical Research Ethics Committee of Kocaeli University (KOU KAEK 2013/45), and written informed consent was obtained from all participants. According to the Turkey Ministry of Health records, the patients in the study had been newly diagnosed and were found to be antiretroviral treatment-naïve. HIV-infected patients were categorized according to European AIDS Clinical Society (EACS) Guidelines for the diagnosis and treatment.

The HIV subtype categories are based on the Los Alamos HIV database (Los Alamos National Laboratory. HIV sequences database. <https://www.hiv.lanl.gov/content/sequence/HIV/mainpage.html>).

## 2.2 Statistical analysis

The difference between the two proportions was measured using Pearson's  $\chi^2$  test or Fisher's exact test. A p-value of  $\leq 0.05$  was considered statistically significant. All statistical analyses were performed using SPSS software (v24, IBM, SPSS Statistics, Chicago, USA).

## 3. Results

In this research, HIV is not evaluated as an issue that should be covered up but rather as a topic that needs to be addressed. This study was conducted on 280 people diagnosed as HIV-infected in Turkey. Within the research scope, 96.4% of the patients diagnosed with HIV were male, and 3.6% were female. Also, all patients were in the 18-68 age range, where the average age was 34.7 years.

In terms of the HIV acquisition route, it was found that 90 (32.1%) were transmitted via the heterosexual route and 190 (67.9%) via MSM. This determination was based on the patients' voluntary declarations. It is noteworthy that most HIV-1 patient virus acquisition routes were MSMs. As MSM contact appears to be the primary source of HIV-1 infection, this needs to be examined. Within the scope of the study, some other coinfections were detected in patients with the HIV-1 virus. Coinfection was detected in 14.3% of patients, and the most common coinfection was syphilis. The demographic characteristics of the study patients are shown in Table 1.

**Table 2:** Sex-oriented social media application usage and sexual contact route according to the study patients' generation category

Sexual contact	Generation category	Application usage		Total, n (%)
		App +, n (%)	App -, n (%)	
MSM	Generation Z	ND	1 (0.5)	1 (0.5)
	Generation Y	135 (71.1)	24 (12.6)	159 (83.7)
	Generation X	15 (7.9)	10 (5.3)	25 (13.2)
	Baby Boomers	2 (1.1)	3 (1.6)	5 (2.6)
	Total	152 (80)	38 (20)	190 (100)
Heterosexual	Generation Z	ND	1 (1.1)	1 (1.1)
	Generation Y	ND	45 (50)	45 (50)
	Generation X	ND	31 (34.4)	31 (34.4)
	Baby Boomers	ND	13 (14.4)	13 (14.4)
	Total	-	90 (100)	90 (100)
Total	Generation Z	ND	2 (0.7)	2 (0.7)
	Generation Y	135 (48.2)	69 (24.6)	204 (72.9)
	Generation X	15 (5.4)	41 (14.6)	56 (20)
	Baby Boomers	2 (0.7)	16 (5.7)	18 (6.4)
	Total	152 (54.3)	128 (45.7)	280 (100)

ND; not determined

Of the HIV-infected patients, 54.3% (n=152) were using the application, and 45.7% (n=128) were not using the application. However, 72.9% (n=204) of the HIV-infected patients were determined to be part of Generation Y. Furthermore, 56.8% (n=159) of the patients were MSMs, and 16.1% (n=45) patients were heterosexual in Generation Y. A total of 80% of the HIV-infected MSMs (n=152) were using the application. Only 20% (n=38) of the MSMs were not using the application. None of the heterosexual HIV patients declared using a sex-oriented social media application. Sex-oriented social media application usage according to sexual contact route is shown in Table 2

**Table 3:** HIV-1 subtype diversity according to the sexual contact route of the study patients

HIV-1 subtype	Sexual contact		Total, n (%)
	MSM, n (%)	Heterosexual, n (%)	
B	162 (57.9)	62 (22.1)	224 (80)

HIV-1 subtype	Sexual contact		Total, n (%)
	MSM, n (%)	Heterosexual, n (%)	
Non-Subtype B	13 (4.6)	8 (2.9)	21 (7.5)
CRF	15 (5.4)	20 (7.1)	35 (12.5)
Total	190 (67.9)	90 (32.1)	280 (100)

CRF: Circulating recombinant form

The following HIV-1 strains have been identified as the most commonly occurring in the HIV-infected study patients: Subtype B (80%, 224/280), non-subtype B; A1, C, F, F1, G, K (7.5%, 21/280), and CRFs; CRF01\_AE, CRF02\_AG, B+CRF02\_AG, CRF12\_BF, CRF13\_cpx, CRF17\_BF, CRF29\_BF, CRF 47\_BF, CRF56\_cpx (12.5%, 35/280). Hence, Subtype B was the predominant HIV-1 subtype in the study patients. HIV-1 subtype diversity according to sexual contact route is shown in Table 3.

#### 4. Discussion

People are now increasingly socializing within structured social networks. According to Coleman (1990) and Collins (1998), social networks can be evaluated as an essential component of social capital. People can use social networks to gather and share information, evaluate information, learn about the strictness or compliance of social norms, and affect the attitudes and behaviours of others (Kohler et al., 2007; Heckathorn, Broadhead, and Weakliem, 1999). However, our findings show that HIV-1 and related coinfections can be transmitted via social networks. Furthermore, this study shows that most of the HIV-1 infected patients that used sex-oriented social media applications are MSMs (Table 2). As Amirkhanian (2014) mentioned, MSMs are most affected by HIV worldwide. MSMs are faced with similar experiences in homophobic countries. MSMs are categorized as out-groups by society. MSMs live in extreme normative conditions in Turkey because their family may reject them or evict them from their home due to their sexual orientation. MSMs may also desire to protect their family from societal pressure and social isolation (Bott, 1971; Wah-Shan, 2001; Li et al., 2008; Yoshioka and Schustack, 2001; Mustanski, 2011; Bird and Voisin, 2001; Wah-Shan, 2001).

These factors can play a crucial role in increasing MSM's vulnerability to HIV infections because of risky sexual behaviours such as having casual, multiple partners and unprotected sex (Warren et al., 2007; Ryan, 2009; Offord, 2001; Kelly et al., 2010; Amirkhanian, 2014; Liau, 2006; Chiasson 2007; Fauk et al., 2017; McFarlane et al., 2000; Berkman et al., 2000; Weiss, 1974; Marsden and Friedkin, 1994, Garofalo et al., 2007; Bauermeister et al., 2011; Landovitz et al., 2013; Duncan et al., 2016; Winetrobe et al., 2014; Newcomb et al., 2016; Beymer et al., 2014; Rice et al., 2012, Grov, et al., 2007; Halkitis and Parsons, 2003; Fawzi et al., 2019) on isolated online platforms. MSMs try to find places where they can feel comfortable, accessible and escape from societal same-sex-related stigma, and this is easy to find in online spaces (Baral et al., 2018; Hightow-Weidman and Muessig, 2014). Sex-oriented gay social online networks (Grindr, Hornet, etc.) function as geolocation-based dating software (Queiroz et al., 2017). The lack of social pressure allows MSMs to free themselves from discrimination. This study suggests that the structure of sex-oriented online networks is directly connected with HIV-vulnerable behaviours. This finding may suggest that sexually transmitted diseases other than HIV can also be spread through applications like Hornet, where multi-partnering is prevalent. Hornet is not a network that provides information on how to protect oneself from HIV; it is a place where MSMs to get interaction with weak ties" (Kohler et al., 2007, p. 2).

According to our findings, sexually transmitted co-infections were primarily observed in the MSM population (Table 1). On the other hand, subtype B was the dominant HIV-1 subtype among MSMs patients (Table 3). However, the study group's median CD4 + T-cell count shows that the HIV infection was diagnosed too late (Table 1). CD4 + T-cell can be counted as proof of the time of HIV infection. The number of CD4s cells was 600-1200 in normal individuals (within a 95% confidence interval), but it was found to be 443 in the study patients. Briefly, HIV-1 subtype B mostly circulated among the MSM population, diagnosed as late presenters. However, they were also with second sexually transmitted infections during this time. The findings show that social networks mainly harm MSNs. Therefore, to reduce this harm, it may be helpful to question social networking practices in terms of HIV infections and treatment follow-up.

Gay-friendly sex-oriented social media apps are innovative tools for reaching MSM populations due to the increased accessibility of innovative phone technology. These applications have become popular among MSMs because they offer the opportunity for quick and confidential collection of vital data for obtaining casual and multiple partners and social connections (Ayala et al., 2018). It can be defined as a consideration of how quick these relationships are, in which users perceive their peers as something to be consumed (Beymer et al., 2014; Rice et al., 2012; Yeo and Ng, 2016). This study focuses on sex-oriented social media application usage, casual and multi-partners, and its reflection on HIV vulnerability. The findings show that sex-oriented social media applications usage, particularly the high usage of Hornet, has led MSMs in Generation Y to seek casual sexual partners.

## **5. Conclusion and suggestions**

The level of HIV-related stigma, depressive symptoms (Clum, 2009), lack of HIV disclosure (Simbayi, 2007), limited social support, and employment status (Dixon, 2001) are psychosocial factors that could lead to sexually risky behavioural patterns. All the risk mentioned above factors for HIV-related stigma exists in Turkey. Lui et al. (2018) argued that MSMs are surrounded by significant homophobia and inequality associated with their sexual preferences, gender, and cultural origins. Turkey is not a gay-friendly country, which means that MSMs often experience discrimination and abuse, and there is public tolerance for social interactions with other MSMs. Hornet is a widely used sex-oriented social media application used by Generation Y MSM individuals diagnosed with HIV in the Marmara region. MSM users can quickly and easily interact with casual partners through this sex-oriented network. Sex-oriented social media usage has differentiated aims. Hornet is an online platform that represents an improper way to behave according to societal norms, which breaks the walls of society.

Furthermore, Hornet is an application with increased uncertainties due to the inability to determine HIV status when randomly selecting network partners. This means there is a high tolerance for risk because of the preference for unsafe sex. Hornet can be defined as a social network that is a place for joy but accompanied by high HIV risk.

Our findings show that Generation Y usage of the Hornet application is more intense in metropolitan areas. As 80% of MSM HIV patients use this application, this shows the correlation between HIV infection and application use. This finding proves that MSMs predominantly acquire HIV. In addition to HIV, other sexually transmitted diseases were also found to be more common in MSM patients receiving treatment. MSMs are exclusively motivated to find partners online looking for casual sex rather than romantic relationships. Condom negotiation or HIV status disclosure is not an issue for them, and this could explain the relationship between sex-oriented social media application use and high HIV risk (Winchester III et al., 2012). We suggest that these risky behaviours among diagnosed HIV patients should be investigated for future research. Hence, we offer the literature the acronym "Sex-Oriented Social Media Application Harm (SOSMAH)." Hornet can be considered a sexual network rather than a social network. However, it is essential to note that sex-oriented social media platforms may also reduce HIV risk. These areas can be used as instruments for spreading HIV prevention messages (Bull et al. 2012); analysing social media platforms to understand and monitor HIV risk behaviours and epidemics (Young et al., 2014); using social media to gather participants for HIV-related studies (Young & Jaganath, 2013), and helping to increase the attainment of social support (Valkenburg et al., 2006). This sociological database needs to be well understood to develop preventive policies related to HIV.

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