Title

The Association between Use of Online Social Networks to Find Sex Partners and Sexually Transmitted Infection Diagnosis among Young Men Who Have Sex with Men and Transgender Women Living with HIV.

Authors

Saberi, Parya
Neilands, Torsten B
Lally, Michelle A
et al.

Publication Date

2019

DOI

10.1177/2325958219867324

Peer reviewed

Original Article

Journal of the International Association of Providers of AIDS Care
Volume 18: 1-11

DOI: 10.1177/2325958219867324
journals.sagepub.com/home/jia
SAGE

The Association between Use of Online Social Networks to Find Sex Partners and Sexually Transmitted Infection Diagnosis among Young Men Who Have Sex with Men and Transgender Women Living with HIV

Parya Saberi, PharmD, MAS[1], Torsten B. Neilands, PhD[1], Michelle A. Lally, MD, MSc[2], Sybil G. Hosek, PhD[3], and Lisa Hightow-Weidman, MD, MPH[4]

Abstract

We conducted a cross-sectional analysis of baseline data from the Adolescent Trials Network for HIV/AIDS Interventions to examine the association between the use of social media sites to find sex partners and recent diagnosis of sexually transmitted infections (STIs) among 13- to 24-year-old men who have sex with men and transgender women living with HIV. We used linear regression to determine the relationship between the number of STIs and the number of social media sites used to find sex partners with each type of sex act included in the analysis. Secondary analyses substituted frequency of social media site use for number of social media sites. Among 741 participants, for every 1 social media account used to find sex partners, there was a 2.53% (95% confidence interval: 0.28-5.54) increase in STIs. This association was mediated through condomless receptive anal intercourse or condomless insertive anal intercourse but not barrierless oral intercourse. Similar but attenuated associations were found when frequency of social media site use was substituted for number of social media sites. Future research should examine innovative interventions on these social media sites with respect for its users.

Keywords

youth living with HIV, social media, condomless anal sex, sexually transmitted infection, technology, men who have sex with men

Date received: 20 December 2018; revised: 23 May 2019; accepted: 02 July 2019.

Introduction

Based on the Centers for Disease Control and Prevention, there were 60 900 individuals who were 13 to 24 years old living with HIV by the end of 2013 and approximately 8807 new HIV-positive patients among youth in 2015.[1] In the United States, sexually transmitted infections (STIs) are a major public health concern with nearly 10 million new STIs occurring in adolescents and young adults.[2] Underlying HIV infection can increase susceptibility to STIs,[3,4] and STIs pose other health concerns among persons living with HIV, such as a potential increase in plasma HIV-RNA and decreased CD4 count,[5] increased concentrations of HIV in genital fluids and HIV shedding,[6,7] accelerated HIV or STI progression,[8] prolonged symptomatic periods of STIs, and difficulty in STI treatment.[9] Data suggest that there are increasing cases of primary and secondary syphilis, chlamydia, and gonorrhea among men who have sex with men (MSM) in the United States.[2,10] Data on

[1] Department of Medicine, University of California San Francisco, San Francisco, CA, USA
[2] Department of Medicine, Alpert Medical School of Brown University and Lifespan Hospital System, Providence, RI, USA
[3] Department of Psychiatry, Stroger Hospital of Cook County, Chicago, IL, USA
[4] Department of Medicine, University of North Carolina, Chapel Hill, NC, USA

Corresponding Author:
Parya Saberi, Department of Medicine, University of California San Francisco, Box 0886, 550 16th St, 3rd floor, San Francisco, CA 94143, USA.
Email: parya.saberi@ucsf.edu

What Do We Already Know about This Topic?

There are conflicting findings regarding the relationship between the use of social media to find sex partners and risk for acquisition of sexually transmitted infections (STIs), with some studies indicating a direct relationship and some showing no relationship.

How Does Your Research Contribute to the Field?

Among a diverse sample of 13- to 24-year-old men who have sex with men and transgender women living with HIV, those who used more social media sites and at an increased frequency to find sex partners reported more condomless anal intercourse and had more STI diagnoses; however, the association between the number and frequency of use of social media sites to find sex partners and STI diagnoses was completely mediated through condomless anal intercourse.

What Are Your Research's Implications toward Theory, Practice, or Policy?

Targeted interventions and future research should examine innovative ways to engage both users and owners of social media sites, provide ongoing HIV treatment and prevention messaging, and engage those currently out of care using comprehensive, tailored, and thoughtful methods and metrics for measuring their success. Clinicians can use these data in clinical practice by inquiring about the number of social media sites that their patients use to find sex partners and increasing the frequency of STI screening with increased report of social media use to find sex partners.

transgender women are lacking and often based on small convenience samples.[11]

Social media or online social networks are web sites and platforms that facilitate interactive electronic connection and communication and allow users to create, share, and exchange information, ideas, and content in virtual networks (including linking of online profiles; posting of text, photo, and video content; instant messaging; and e-mail).[12] These platforms may be accessed via computer or mobile devices and may include geolocation features that allow users to connect based on their geographic proximity. Adolescents and young adults frequently access social media, with 92% of teens going online on a daily basis and 71% reporting more than 1 social media site.[13] Social media have been used for seeking sex partners particularly among young MSM and transgender women.[14-19] Although further evaluation among transgender youth is needed, MSM are more likely to use social media to seek sex partners compared to heterosexual individuals[20-22]; therefore, given that many MSM living with HIV use social media sites to meet sex partners,[23,24] these platforms may also be effective places to engage them in intervention efforts.

Condomless anal intercourse, casual or anonymous sex, and multiple concurrent partners have been associated with increased STI risk.[2,11] However, there are conflicting findings regarding the relationship between the use of social media to find sex partners and risk for acquisition of STIs, with some studies indicating a direct relationship[16,21,25-32] and others showing no relationship.[14,33-36] Therefore, given the pervasiveness of the use of social media to find sex partners among youth[20-22] and STI health risks, it is critical to understand this relationship and the potential consequences that this type of communication may pose on sexual health. Also, given the limited data and high burden of HIV infection among transgender women in comparison to other populations,[37-39] the inclusion of transgender women in HIV research is critical.

Prior research has reported a relationship between sexual risk behaviors and frequency of social media use, number of sex partners, and sexualized profile photographs among MSM using social media.[40-42] One study showed that users of online social media had significantly more lifetime sex partners than nonusers, suggesting that social media users may be more sexually active.[42] Consequently, the objective of this study was to examine whether an increase in the number of social media sites used to find sex partners was related to the number of STI diagnoses among adolescents and young MSM and transgender women living with HIV. Using secondary data, we investigated whether the association between STI diagnoses and the use of social media to find sex partners was mediated through condomless/barrierless sex acts. Additionally, we examined the association between the frequency of social media sites used to find sex partners and STI diagnoses in adolescents and young MSM and transgender women living with HIV.

Methods

We conducted a cross-sectional analysis of baseline data from the Adolescent Trials Network for HIV/AIDS Interventions to examine (1) the characteristics of adolescents and young MSM and transgender women with regard to use of technology and social media and (2) the association between the number of STI diagnoses in this cohort and (a) the number of social media sites used to find sex partners and (b) the frequency of social media site used to find sex partners.

Adolescent Trials Network for HIV/AIDS Interventions

Adolescent Trials Network for HIV/AIDS Interventions was a longitudinal observational study of 13- to 24-year-old youth living with HIV receiving care at one of the 14 adolescent medical clinics across the United States in areas with established HIV epidemics, conducted from February 2015 through February 2016.[43] The objective of ATN 125 was to examine clinic-level stages of the HIV cascade of care and to provide data on engagement and retention in care, antiretroviral therapy initiation and persistence, and virologic suppression. The study was approved by each participating medical clinic's local institutional review board or ethics committee.

In ATN 125, 924 individuals, 13 to 24 years, who were behaviorally infected with HIV, receiving or planning to receive their medical care at one of the participating clinical sites, able to understand written and/or spoken English, and willing and able to provide signed informed consent or assent, were included. Those who had any psychiatric symptoms that would impair their ability to provide informed consent or participate in the baseline audio computer-assisted self-interview (ACASI), who were visibly distraught, intoxicated, or under the influence of other substances at the time of consent or the baseline ACASI were excluded. For this study, we analyzed data from the subset of participants who identified as MSM or transgender women (N = 746).

At the baseline of ATN 125, participants responded to questions regarding demographics, sexual behaviors, technology use, and use of social media to find sex partners. Study staff abstracted data regarding diagnosis of STIs and HIV viral load from participants' medical records. For those already in care, these data were collected from up to 26 weeks prior to enrollment.

Study Variables

For this subanalysis of baseline data from ATN 125, we described and examined the following variables among MSM and transgender women:

1) Demographics: Participants' age, race/ethnicity, education, employment status, and type of residence were collected by ACASI.
2) HIV: Age of HIV diagnosis, route of HIV transmission, and antiretroviral therapy usage were collected by ACASI, and HIV viral load was abstracted from medical records.
3) Technology use: Access to the Internet, ownership of mobile telephone, change in mobile telephone number in the past 6 months, names of social media sites to find sex partners or hookups (eg, Jack'd, Grindr, Adam4Adam, Scruff, etc.) from a prespecified list of these sites and an option to write in sites not listed, and frequency of use of these social media sites to find sex partners were collected by ACASI.
4) Sex acts in the past 6 months with HIV-positive or unknown HIV-serostatus partner: Participants' reports of condomless receptive anal intercourse (CRAI) with male or transgender female partners, condomless insertive anal intercourse (CIAI) with male or transgender female partners, and any barrierless oral intercourse (BOI; performing or receiving) with male or transgender female partners were collected by ACASI. These questions were worded as such: "With your HIV-positive male partners during the past 6 months, how many times have you had receptive anal sex without a condom?"
5) Sexually transmitted infection diagnoses: Number of STI diagnoses in the past 6 months constituted the study outcome. Types of STI (syphilis, gonorrhea, or chlamydia/lymphogranuloma venereum) from various sites (rectal, urethral, oral, blood, and uncategorized) were abstracted from medical records. Specifically, these data were abstracted from laboratory reports (primary) or a clinician's note and summed to create a count of the number of STI diagnoses.

Statistical Analysis

One-way frequencies for all variables and measures of central tendency (eg, mean) and variability (eg, standard deviation) characterized the sample, STI diagnoses, and use of technology. Because the mean number of social media accounts that participants used to find sex partners was 1.2, and approximately 10% of the sample used 4 or more social media sites to find sex partners, the number of social media sites used was recoded as 0, 1, 2, 3, and 4 or more. Responses related to the frequency of social media sites used to find sex partners were coded as 0 (do not use social media to find sex partners), 1 (use social media sites to find sex partners once a month or less), 2 (2-3 times a month), 3 (1-2 days a week), 4 (3-5 days a week), 5 (about once a day), or 6 (several times a day).

The primary goal of inferential analyses in this study was to estimate the direct, indirect, and total effects of the number of social media sites on the number of STI diagnoses, potentially mediated through the number of condomless/barrierless sex acts. Because sex acts are considered predictor variables when explaining the STI outcome and are considered outcome variables for the number of social media sites used, linear regression models provided a unified analysis framework to evaluate the mediating role of these variables. Departures from the linear regression assumption of linearity of associations between exposure and outcome variables were detected; therefore, the number of STIs and sex acts were log-transformed, after which the linearity assumption was satisfied for all associations. These transformations also improved regression diagnostic plots for normality and constant variance of residuals. To facilitate interpretation, the base 2 logarithm was used in these transformations to obtain estimates of the increase in STIs per doubling in the number of sex acts.

Next, the linear regression was used to model the log-transformed count of STI outcomes. The primary exposure was the number of social media sites used to find sex partners with each type of sex act (CRAI, CIAI, and BOI) also included in the analysis one by one to evaluate how much each sex act explained the association between the number of STIs and social media use as shown in Figure 1. For these analyses, we computed the direct effect of social media use on STIs and the indirect effect of social media use on STIs through sexual behavior, with the size of the latter effect being quantified as the product of the social media use-to-sexual behavior pathway (pathway A in Figure 1) and the sexual behavior-to-STIs pathway (pathway B in Figure 1). We also examined the total effect of social media use on STIs (ie, the sum of the direct and indirect effects). Because the distributions of indirect effects are often asymmetric, we used the bias-corrected and accelerated bootstrap to compute 95% confidence intervals (CIs)

based on 5000 bootstrap replications.[44] Use of the bootstrap (following data transformation) also protects inferences against any remaining departures of the residuals from the regression model assumptions of normality and constant variance.[45]

If the 95% CI did not include zero, the effect was statistically significant at $P < .05$. Coefficients resulting from the regressions of log-transformed sex act and STI counts onto the number of social media sites were converted to represent percent changes in sex acts or STIs via the inverse transformation formula $100(2^B - 1)$, where B is the original regression coefficient estimate.[46] Coefficients resulting from the regressions of log-transformed STI counts onto the log-transformed condomless sex act variables were converted to represent percentage changes in STIs per doubling in condomless sex acts via the same inverse transformation formula.

In summary, the interpretations for the various pathways, where X is the coefficient, were (1) total, indirect, and direct pathways: for every 1 site increase in social media use, there is an X% increase in the number of STI diagnoses; (2) A pathways (the effect of the exposure on the mediator): for every 1 site increase in social media use, there is an X% increase in condomless/barrierless sex acts; and (3) B pathways (the effect of the mediator on the outcome): for every doubling in the number of condomless/barrierless sex acts, there is an X% increase in the number of STI diagnoses. Each mediator was considered separately to allow for the possibility of differential direct, indirect, and total effect patterns involving each mediator.

As a secondary goal, we conducted an identical analysis but used the frequency of searching on online social media to find sex partners in the past month instead of the number of online social media sites to find sex partners as the exposure.

In these analyses, we adjusted for the prespecified covariates age, employment status, education, race/ethnicity, and clinic site. For these covariates, the regression coefficients represented the percentage increase in the outcome per unit change in the covariate. Finally, we examined the associations between the use of specific social media sites and log-transformed STIs. For the log-transformed STI outcome, simple linear regression with robust standard errors was used.[47] These analyses were adjusted by clinic site to account for potential between-clinic variability.[48] All analyses were conducted using Stata (version 15) and SAS (version 9.4).

Ethical Approval and Informed Consent

This study received approval by the institutional review boards of each of the participating clinics. After screening, all eligible youth were invited to participate, and consent was obtained by study staff.

Results

Characteristics of Study Participants

Table 1 summarizes the demographics of ATN 125 study participants who were MSM or transgender women (N = 746) to characterize the sample. Among the 712 MSM and 34 transgender women with a mean age of 21.4 years, the majority were African American (67.7%) and had an undetectable baseline HIV viral load (55.5%). Overall, 17.0%, 15.3%, and 13.8% had received a diagnosis of syphilis, gonorrhea, or chlamydia, respectively. Among the participants, 258 (34.6%) had any STIs and 88 (11.8%) had 2 or more STIs. Of the 398 recorded STIs, the site of STIs was highest in the blood/serum (N = 137; 34%), followed by rectum (N = 134; 34%), oral/pharynx (N = 60; 15%), uncategorized (N = 58; 15%), and urethra (N = 9; 2%).

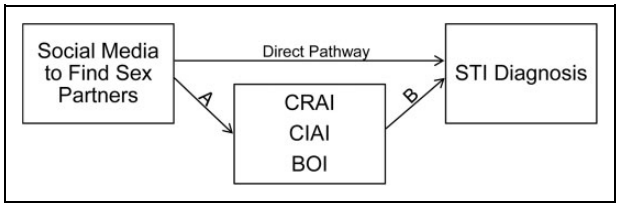

Figure 1. Depiction of the pathways of association. Indirect pathway = A × B. Total pathway = direct pathway + indirect pathway. CRAI indicates condomless receptive anal intercourse; CIAI, condomless insertive anal intercourse; BOI, barrierless oral intercourse.

Table 2 describes the technology access and use by participants in our sample. Almost all (99.1%) participants stated that they had access to the Internet, and 95.6% said they owned a mobile telephone of which 96.9% were smartphones (Table 2). Approximately 77.6% stated that they had a different telephone number in the past 6 months, and 46.5% reported having had their telephone disconnected or cutoff for a mean of 17.4 days. Forty-five percent of all participants stated that they used social media sites to find sex partners, 46.2% among MSM and 17.7% among transgender women. The most commonly used sites were Jack'd (74.7%) and Grindr (47.0%). Participants reported using a mean of 1.2 accounts to find sex partners, with over 33% of the total sample reporting searching for sex partners on social media sites about once daily or more frequently.

Diagnoses of STI and Social Media to Find Sex Partners

We conducted bivariate analyses to examine the association between the number of STI diagnoses and older age (coefficient [95% CI] = −2.43% [−4.07 to −0.76]; ie, for every 1 year increase in age, there was a 2.43% decrease in the number of STI diagnoses), being employed (coefficient [95% CI] = −5.55% [−11.76 to 1.09]), education (coefficient for high school [95% CI] = −4.85% [−13.48 to 4.64]; coefficient for greater than high school [95% CI] = −0.22% [−9.16 to 9.60] compared to less than high school), and race/ethnicity (coefficient for African American [95% CI] = 14.83% [3.36 to 27.57], coefficient for mixed race [95% CI] = 14.06% [−2.56 to 33.51], coefficient for Latino [95% CI] = 10.39% [−3.14 to 25.81], and coefficient for other race [95% CI] = 6.13% [−15.77 to 33.72] compared to white). We adjusted for these variables in examining the total, indirect, direct, and A and B pathways (Figure 1) for the association between the number and frequency of use of online social media sites to find sex

Table 1. Characteristics of Participants.

Characteristics	Response Options	N = 746
Age, mean years (SD)		21.4 (2.0)
Gender identity, n (%)		
	Male	712 (95.4)
	Trans female	34 (4.6)
Race/ethnicity, n (%)		
	African American	505 (67.7)
	Latino (nonwhite)	100 (13.4)
	White	79 (10.6)
	Mixed race	44 (5.9)
	Other	18 (2.4)
Education, n (%)		
	Less than high school	144 (19.3)
	High school or GED	295 (39.5)
	More than high school	302 (40.5)
	Other or missing	5 (0.7)
Employed, n (%)		441 (59.1)
Living, n (%)		
	Parents' house or apartment	316 (42.4)
	Own house or apartment	216 (29.0)
	Nonfamily's house or apartment	75 (10.1)
	Other family's house or apartment	72 (9.7)
	Foster/group home, halfway house, shelter/welfare hotel	32 (4.3)
	On the streets	12 (1.6)
	Other place or missing	23 (3.1)
Age of HIV diagnosis, mean years (SD)		19.2 (2.2)
Years since HIV diagnosis, mean years (SD)		2.19 (2.0)
Route of HIV transmission, n (%)		
	Sex with a man	652 (87.4)
	Other routes	94 (12.6)
Undetectable baseline HIV viral load, n (%)		414 (55.5)
Currently taking ART, n (%)		571 (76.5)
STIs in past 6 months, n (%)		
	Syphilis	127 (17.0)
	Gonorrhea	114 (15.3)
	Chlamydia	103 (13.8)
	No chlamydia, gonorrhea, or syphilis	488 (65.4)
Number of STIs, mean (SD, range)		0.5 (0.9, 0-6)
Sex acts, mean (SD)		
	CRAI	6.5 (74.1)
	CIAI	6.2 (74.0)
	BOI	18.2 (149.1)

Abbreviations: ART, antiretroviral therapy; BOI, barrierless oral intercourse; CIAI, condomless insertive anal intercourse; CRAI, condomless receptive anal intercourse; GED, general educational development; SD, standard deviation; STI, sexually transmitted infection.

partners and condomless or barrierless sex acts in the past 6 months with HIV-positive or HIV-serostatus unknown partners, as well as the association between these sex acts and the diagnosis of any STIs (Table 3).

For every 1 social media account that participants reported using to find sex partners, there was a 22.78% (95% CI = 15.79-31.07) increase in CRAI with male partners who were HIV positive or HIV-serostatus unknown. For every doubling of CRAI acts with these partners, there was a 2.53% (95% CI = 0.28-5.54) increase in the number of STI diagnoses. The use of social media to find sex partners did not have a statistically significant direct association with number of STIs (coefficient [95% CI] = 2.16% [−0.36 to 4.85]); that is, the association between use of social media to find sex partners and the number of STIs was completely mediated through CRAI.

A similar statistically significant effect existed for the association between using social media to find sex partners and CIAI (coefficient [95% CI] = 18.69% [12.03-26.56]). For every doubling of CIAI, these was a 3.49% (95% CI = 1.14-5.97) increase in the number of STI diagnoses. Similarly, the association between using social media to find sex partners and the number of STI diagnoses was completely mediated through CIAI and using social media to find sex partners did not have a statistically significant direct association with the number of STI diagnoses (coefficient [95% CI] = 2.05% [−0.42 to 4.77]).

For every 1 social media account that participants reported using to find sex partners, there was a 35.43% (95% CI = 25.68-46.81) increase in BOI with male or female partners who were HIV-positive or HIV-serostatus unknown. However, the association between BOI and the number of STI diagnoses was not statistically significant, indicating an absence of mediation by BOI.

Similarly, but in an attenuated manner, for every 1-unit increase in frequency of social media use to find sex partners, there was a 13.6% (95% CI = 9.34-18.88), 11.99% (95% CI = 7.75-16.96), and 18.42% (95% CI = 12.42-25.21) increase in CRAI, CRAI, and BOI, respectively (Table 3). The association between frequency of social media use to find sex partners did not have a statistically significant direct association with the number of STI diagnoses (coefficient for CRAI [95% CI] = 0.91% [−0.63 to 2.68]; coefficient for CIAI [95% CI] = 0.82% [−0.74 to 2.55]; and coefficient for BOI [95% CI] = 1.28% [−0.31 to 2.99]). However, the indirect associations were statistically significant for CRAI (coefficient [95% CI] = 0.49% [0.09-1.03]) and CIAI (coefficient [95% CI] = 0.59% [0.21-1.11], suggesting mediation. No statistically significant direct or indirect effects were observed for the association of frequency of social media use to find sex partners and BOI (Table 3).

Discussion

Based on this diverse sample of 13- to 24 year-old MSM and transgender women living with HIV, Internet access and smartphone ownership were nearly ubiquitous. Use of online social media sites to find sex partners was endorsed by 45.0% of

Table 2. Use of Internet, Mobile Telephone, and Social Media among Participants.

Technology Use	Subcategory of Technology Use	Response Options	N = 746
Access to Internet on any device in the past month, n (%)			739 (99.1)
	Devices used most often to access Internet, n (%)		
		Cell phone/smartphone/mobile	674 (91.2)
		Laptop/desktop computer	54 (7.3)
		Tablet computer	11 (1.5)
Own a mobile telephone, n (%)		Yes	713 (95.6)
	Own smartphone	Yes	691 (96.9)
	Different mobile telephone numbers in the past 6 months, n (%)		
		0	165 (22.1)
		1	327 (43.8)
		2	149 (20.0)
		≥3	103 (13.8)
		Do not know or refuse to respond	2 (0.3)
	Disconnected/cutoff mobile telephone in past 6 months, n (%)		270 (46.5)
	Number of days mobile telephone disconnected, mean (SD)		17.4 (23.4)
Use of SM sites to search for a sex partner in the past 6 months, n (%)			
		Yes	336 (45.0)
	SM sites searched for sex partners, n (%)		
		Jack'd	251 (74.7)
		Grindr	158 (47.0)
		Adam4Adam	141 (42.0)
		Facebook	89 (26.5)
		Craigslist	66 (19.6)
		Black Gay Chat	46 (13.7)
		Scruff	39 (11.6)
		Hornet	26 (7.7)
		Manhunt.net	16 (4.8)
		Man4man.com	10 (3.0)
		Gay.com	5 (1.5)
		Other	4 (1.2)
Number of online SM accounts, mean (SD)			1.2 (1.8)
Number of SM sites used to find sex partner in the past month, n (%)			
		0	411 (55.1)
		1	104 (13.9)
		2	99 (13.3)
		3	58 (7.9)
		≥4	73 (9.8)
Frequency of searching online SM for sex partners in the past month, n (%)			
		Do not use SM for sex partners	442 (59.3)
		Once a month or less	50 (6.7)
		2-3 times a month	49 (6.6)
		1-2 days a week	46 (6.2)
		3-5 days a week	47 (6.3)
		About once a day	45 (6.0)
		Several times a day	67 (9.0)

Abbreviations: MSM, men who have sex with men; SD, standard deviation; SM, social media.

participants, and 15.0% stated that they used social media to find sex partners about once daily or more frequently. We noted high frequency of change in mobile telephone numbers (77.6%) and telephone service cutoffs (46.5%) in the past 6 months. Those who used more social media sites to find sex partners and had higher frequency of use reported more

Table 3. Adjusted Coefficients (95% Confidence Intervals) of the Association between Mean Number and Frequency of Social Media Sites to Find Sex Partners, Condomless or Barrierless Sex Acts in Past 6 Months with HIV Positive of HIV-Serostatus Unknown Partner, and the Number of Diagnoses of Sexually Transmitted Infections.[a,b]

	Total	Indirect	Direct	A	B
Number of Social Media Sites and Number of STI Diagnoses					
CRAI	2.92 (0.47 to 5.58)[c]	0.74 (0.10 to 1.63)[c]	2.16 (−0.36 to 4.85)	22.78 (15.79 to 31.07)[c]	2.53 (0.28 to 5.54)[c]
CIAI	2.92 (0.47 to 5.58)[c]	0.85 (0.29 to 1.64)[c]	2.05 (−0.42 to 4.77)	18.69 (12.03 to 26.56)[c]	3.49 (1.14 to 5.97)[c]
BOI	2.92 (0.47 to 5.58)[c]	0.16 (−0.54 to 0.94)	2.79 (0.23 to 5.50)[c]	35.43 (25.68 to 46.81)[c]	0.36 (−1.27 to 2.07)
Frequency of Social Media Sites and Number of STI Diagnoses					
CRAI	1.41 (−0.15 to 3.11)	0.49 (0.09 to 1.03)[c]	0.91 (−0.63 to 2.68)	13.60 (9.34 to 18.88)[c]	2.71 (0.41 to 5.25)[c]
CIAI	1.41 (−0.15 to 3.11)	0.59 (0.21 to 1.11)[c]	0.82 (−0.74 to 2.55)	11.99 (7.75 to 16.96)[c]	3.64 (1.27 to 6.12)[c]
BOI	1.41 (−0.15 to 3.11)	0.13 (−0.25 to 0.57)	1.28 (−0.31 to 2.99)	18.42 (12.42 to 25.21)[c]	0.55 (−1.06 to 2.21)

Abbreviations: total, transformed coefficient for the total effect (ie, direct effect + indirect effect) of the exposure to the outcome; indirect, transformed coefficient for the effect of the exposure to the outcome through the mediator; direct, transformed coefficient for the direct effect of the exposure to the outcome not through the mediator; A, transformed coefficient for the exposure-to-mediator pathway; B, transformed coefficient for the mediator-to-outcome pathway; BOI, barrierless oral intercourse; CIAI, condomless insertive anal intercourse; CRAI, condomless receptive anal intercourse.

[a] N = 741. Five participants did not provide education information.

[b] Adjusted for age (years), race/ethnicity (African American/Latino/mixed/white/other), employment status (yes/no), education (less than high school/high school graduate/greater than high school; Supplemental Table).

[c] Statistical significance at $P < .05$.

condomless anal intercourse and had more STI diagnoses; however, the association between number and frequency of social media sites to find sex partners and the number of STI diagnoses was mediated through condomless anal intercourse. Additionally, the number of STI diagnoses was associated with younger age and African American race.

Over the past 2 decades, numerous studies have examined the health implications of Internet use among youth,[17,49,50] and much of this research has been conducted in young MSM.[16,51-54] With the advent of mobile telephone applications that allow for geolocation technologies, there is increased opportunity for partner seeking and sexual risk-taking. Social media sites allow for individuals to conveniently and quickly locate sex partners, sort sex partners by their characteristics and preferences, and provide information about their own sexual preferences and behaviors. While use of these sites has been associated with increased condomless sex,[23,41] meeting a high number of sex partners,[55,56] and STI diagnosis,[17,57] they also allow users to engage with others without fear of social stigma,[31,58,59] for emotional support, and coping with the stress of living with HIV.[60-63]

The association between the number of sites to meet sex partners and increased odds of STIs has previously been reported in one study.[64] This study also noted a correlation between increased number of social media sites to find sex partners and higher number of sex partners. Another study reported the association between frequent users of social media use to find sex partners and condomless anal intercourse.[40] Our study furthers findings from prior research in that it shows that the association between the number and frequency of social media to find sex partners and STIs is mediated through condomless anal intercourse (but not oral intercourse). Given the increased risk of STIs with a larger pool of sex partners,[2,11] our study also highlights the importance of clinicians inquiring about the number and frequency of social media sites that an individual uses to find sex partners. This information can support increased STI screening in individuals with higher number and frequency of social media site use.

This study has several implications for future research and intervention development. Given that social media for finding sex partners is pervasive in young MSM and transgender women's lives, these sites represent promising platforms for reaching this population for the purposes of public health messages, such as encouraging and providing access to routine STI/HIV testing, treatment, medication adherence, and prevention.[65,66] Social media can provide the opportunity to prioritize, encourage, and sustain such health behavior over time. This research has been initiated by engaging social media users, social media owners, and health department directors to identify structural and behavioral interventions.[67]

Social media site use is not static; thus, remaining vigilant about trends in site usage within the population of interest is critical to ensure the largest impact of any intervention. Importantly, in addition to finding sex partners, social media sites are also used to meet/network with friends and play an important role in the lives of youth. This further highlights the need for continued opportunities for reaching and engaging young MSM and transgender women living with HIV.[68-70]

The recognition of the use of social media to find sex partners can offer health-care providers a chance to further assess sexual risk behaviors and may provide an opening to discuss risk of acquiring STIs, to screen and educate patients for STIs and safer sex, and to counsel around overall Internet safety.[71-74] Given the high frequency of changing mobile telephone numbers and disconnections, yet high endorsement of frequent social media use, future research, clinics, and outreach programs should consider using social media as a means of maintaining connection and minimizing loss-to-follow-up with this population. This is relevant because a study participant or clinic patient does not require access to a mobile telephone to check their social media messages.

Our literature search yielded few publications on the use of social media in transgender individuals.[18,19] While our sample included a relatively small number of transgender women (N = 34), it is noteworthy that their use of social media to find sex partners was considerably lower than use among the MSM in our study. We included transgender women in our study because of the increased HIV vulnerabilities among this population,[37-39,75,76] the similar sexual risk behaviors among MSM and transgender women prereconstructive surgery, and the limited data in this population.[18,19] Future research should prioritize further describing technology use, understanding the best venues for reaching this population.

As with any research, this study has some limitations to consider. Our results are based on a cross-sectional secondary analysis of nonexperimental data and thus causal inferences cannot be drawn. We relied on a clinic-based convenience sample; therefore, our findings may not be generalizable beyond the MSM and transgender women who participated in ATN 125, as well as those who do not speak English or are HIV seronegative. Only 6 transgender women in our sample reported using social media sites to find sex partners, so we could not disaggregate our results by sexual identity; future studies should be conducted with transgender women to explore the specific ways in which they use technology to find sexual partners and related downstream outcomes. Some of our data are based on self-report, which are prone to biases or errors. Due to potential for increased frequency of STI testing in those who were more adherent to their medical appointments or those who had longer duration of established care compared to those with new HIV diagnosis, there is a potential for ascertainment bias of STI testing. Additionally, despite other studies describing high use of the social media site Tinder among MSM adults,[77] we noted only 1 participant who reported using this site. Finally, based on this secondary data analysis, we used the number and frequency of social media sites as a proxy for finding more sex partners; however, future research should measure this construct extensively using more precise and direct measures (eg, number of hours spent on social media sites to find sex partners, geographical variations in using these sites, and the number of sex partners found on these sites) and data collection techniques less subject to recall bias (eg, ecological momentary assessment). However, our study is valuable in that it provides information on the use of technology and social media sites, as well as the association between number and frequency of use of social media to find sex partners and objective measures of STI diagnoses among a large racially and ethnically diverse sample of MSM and transgender women who were 13 to 24 years old and living with HIV.

Infection with HIV can affect the likelihood, presentation, and treatment of STIs.[78,79] Although new data suggest that undetectable HIV viral load means HIV is untransmittable,[80,81] 44.5% of our participants had a detectable HIV viral load and therefore may be inadvertently exposing others to HIV in addition to potentially exposing themselves to STIs. Beyond a personal and public health impact,[2] STIs are an economic drain on the US health-care system costing nearly US$16 billion annually.[82] Additionally, STI drug resistance is increasing, resulting in increased difficulty in treating STIs and decreased treatment options.[83-86] Therefore, it is critical to understand and evaluate factors that are contributing to this public health burden.

Conclusion

This study adds to the growing body of literature and examines the mediation of condomless/barrierless sex acts in the association between the number and frequency of use of online social media to find sex partners and the number of STI diagnoses among young MSM and transgender women. The number and frequency of social media to find sex partners were associated with an increase in sexual risk behaviors leading to increased STIs; however, focusing only on the risks is short sighted. From a clinical standpoint, our study may assist clinicians to ascertain the degree of STI risk and the frequency for STI testing by asking youth about the number of online social media sites they use and the frequency with which they use these sites to find sex partners. Future research should examine innovative ways to engage both users and owners of these sites and should be implemented using comprehensive, tailored, and thoughtful methods and metrics around implementing STI prevention and treatment interventions and measuring their success.

Author Note

The Adolescent Medicine Trials Network for HIV/AIDS Interventions (ATN).

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: Research reported in this publication was supported by the National Institute of Mental Health of the National Institutes of Health under Award Number, Award Numbers K23MH097649 (principal investigator Saberi) and U19HD089881 (principal investigator Hightow-Weidman). This research was also supported by The Adolescent Medicine Trials Network for HIV/AIDS Interventions (ATN) from the National Institutes of Health (U01HD040533 and U01HD040474) through the National Institute of Child Health and Human Development (Kapogiannis, Lee), with supplemental funding from the National Institutes on Drug Abuse (Davenny, Kahana) and Mental Health (Brouwers, Allison). Support was also provided to the third author by the Providence/Boston Center for AIDS Research (P30AI042853, principal investigator: Cu-Uvin) and by U54GM115677 from the National Institute of General Medical Sciences which funds Advance Clinical and Translational Research (Advance-CTR). Network, scientific, and logistical support was provided by the ATN Coordinating Center (Wilson, Partlow) at the University of Alabama at Birmingham. Network operations and data management support were provided by the ATN Data and Operations center at Westat, Inc (Korelitz, Driver). We are greatly appreciative to all of the adolescents and young adults who participated in this study.

Ethical Approval

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. The study was approved by the institutional review boards at each of the 14 participating clinics (clinics were located in the following locations: Los Angeles, California; Washington, District of Columbia; Baltimore, Maryland; Boston, Massachusetts; Chicago, Illinois; Philadelphia, Pennsylvania; New York City, New York; New Orleans, Louisiana; Memphis, Tennessee; Miami, Florida; Tampa, Florida; Detroit, Michigan; Denver, Colorado; and Houston, Texas. All patients provided written informed consent prior to enrollment in the study.

ORCID iD

Parya Saberi, PharmD, MAS https://orcid.org/0000-0002-3793-5112

Supplemental Material

Supplemental material for this article is available online.

References

1. Centers for Disease Control and Prevention. *HIV Among Youth*. 2017. https://www.cdc.gov/hiv/group/age/youth/index.html. Accessed August 27, 2017.
2. Centers for Disease Control and Prevention. *Sexually Transmitted Disease Surveillance 2015*. 2016. https://www.cdc.gov/std/stats15/STD-Surveillance-2015-print.pdf. Accessed August 27, 2017.
3. Mccoy SI, Eron JJ, Kuruc JD, et al. Sexually transmitted infections among patients with acute HIV in North Carolina. *Sex Transm Dis*. 2009;36(6):372–374.
4. Cohen MS. When people with HIV get syphilis: triple jeopardy. *Sex Transm Dis*. 2006;33(3):149–150.
5. Buchacz K, Patel P, Taylor M, et al. Syphilis increases HIV viral load and decreases CD4 cell counts in HIV-infected patients with new syphilis infections. *AIDS*. 2004;18(15):2075–2079.
6. Duffus WA, Mermin J, Bunnell R, et al. Chronic herpes simplex virus type-2 infection and HIV viral load. *Int J STD AIDS*. 2005;16(11):733–735.
7. Cohen MS, Hoffman IF, Royce RA, et al. Reduction of concentration of HIV-1, in semen after treatment of urethritis: Implications for prevention of sexual transmission of HIV-1. *Lancet*. 1997;349(9069):1868–1873.
8. White MK, Gorrill TS, Khalili K. Reciprocal transactivation between HIV-1 and other human viruses. *Virology*. 2006;352(1):1–13.
9. Strick LB, Wald A, Celum C. Management of herpes simplex virus type 2 infection in HIV type 1-infected persons. *Clin Infect Dis*. 2006;43(3):347–356.
10. Center for Disease Control and Prevention. *Reported STDs in the United States: 2015 National Data for Chlamydia, Gonorrhea, and Syphilis*. 2015. https://www.cdc.gov/nchhstp/newsroom/docs/factsheets/std-trends-508.pdf. Accessed August 27, 2017.
11. Center for Disease Control and Prevention. *2015 Sexually Transmitted Diseases Treatment Guidelines: Special Populations*. 2015. https://www.cdc.gov/std/tg2015/specialpops.htm. Accessed August 29, 2017.
12. Wikipedia. *Social Media*. 2017. https://en.wikipedia.org/wiki/Social_media. Accessed September 27, 2017.
13. Lenhart A. *Teens, Social Media & Technology Overview 2015*. 2015. http://www.pewinternet.org/2015/04/09/teens-social-media-technology-2015/. Accessed August 27, 2017.
14. Mustanski B, Lyons T, Garcia SC. Internet use and sexual health of young men who have sex with men: a mixed-methods study. *Arch Sex Behav*. 2011;40(2):289–300.
15. Ybarra ML, Bull SS. Current trends in internet- and cell phone-based HIV prevention and intervention programs. *Curr HIV/AIDS Rep*. 2007;4(4):201–207.
16. Garofalo R, Herrick A, Mustanski BS, Donenberg GR. Tip of the iceberg: young men who have sex with men, the Internet, and HIV risk. *Am J Public Health*. 2007;97(6):1113–1117.
17. McFarlane M, Bull SS, Rietmeijer CA. Young adults on the internet: risk behaviors for sexually transmitted diseases and HIV. *J Adolescent Health*. 2002;31(1):11–16.
18. Sun CJ, Reboussin B, Mann L, Garcia M, Rhodes SD. The HIV risk profiles of Latino sexual minorities and transgender persons who use websites or apps designed for social and sexual networking. *Health Educ Behav*. 2016;43(1):86–93.
19. Patel VV, Masyukova M, Sutton D, Horvath KJ. Social media use and HIV-related risk behaviors in young black and Latino Gay and Bi Men and Transgender individuals in New York City: implications for online interventions. *J Urban Health*. 2016;93(2):388–399.
20. Rosenfeld MJ, Thomas RJ. Searching for a mate: the rise of the internet as a social intermediary. *Am Sociol Rev*. 2012;77(4):523–547.
21. Rice E, Winetrobe H, Holloway IW, Montoya J, Plant A, Kordic T. Cell phone internet access, online sexual solicitation, partner seeking, and sexual risk behavior among adolescents. *Arch Sex Behav*. 2015;44(3):755–763.
22. Glick SN, Morris M, Foxman B, et al. A comparison of sexual behavior patterns among men who have sex with men and heterosexual men and women. *J Acquir Immune Defic Syndr*. 2012;60(1):83–90.
23. Liau A, Millett G, Marks G. Meta-analytic examination of online sex-seeking and sexual risk behavior among men who have sex with men. *Sex Transm Dis*. 2006;33(9):576–584.
24. Grov C, Golub SA, Parsons JT. HIV status differences in venues where highly sexually active Gay and Bisexual men meet sex partners: results from a pilot study. *Aids Educ Prev*. 2010;22(6):496–508.
25. Landovitz RJ, Tseng CH, Weissman M, et al. Epidemiology, sexual risk behavior, and HIV prevention practices of men who have sex with men using GRINDR in Los Angeles, California. *J Urban Health*. 2013;90(4):729–739.
26. Horvath KJ, Bowen AM, Williams ML. Virtual and physical venues as contexts for HIV risk among rural men who have sex with men. *Health Psychol*. 2006;25(2):237–242.
27. Berry M, Raymond HF, Kellogg T, McFarland W. The Internet, HIV serosorting and transmission risk among men who have sex with men, San Francisco. *Aids*. 2008;22(6):787–789.

28. Rendina HJ, Jimenez RH, Grov C, Ventuneac A, Parsons JT. Patterns of lifetime and recent HIV testing among men who have sex with men in New York City who use Grindr. *Aids Behav*. 2014;18(1):41–49.
29. Burrell ER, Pines HA, Robbie E, et al. Use of the location-based social networking application GRINDR as a recruitment tool in rectal microbicide development research. *Aids Behav*. 2012; 16(7):1816–1820.
30. Rosser BRS, Miner MH, Bockting WO, et al. HIV risk and the internet: results of the men's INTernet Sex (MINTS) study. *Aids Behav*. 2009;13(4):746–756.
31. Rosser BRS, Oakes JM, Horvath KJ, Konstan JA, Danilenko GP, Peterson JL. HIV sexual risk behavior by men who use the internet to seek sex with men: results of the men's INTernet Sex Study-II (MINTS-II). *Aids Behav*. 2009;13(3):488–498.
32. Kakietek J, Sullivan PS, Heffelfinger JD. You've got male: internet use, rural residence, and risky sex in men who have sex with men recruited in 12 U.S. cities. *Aids Educ Prev*. 2011;23(2): 118–127.
33. Buhi ER, Klinkenberger N, McFarlane M, et al. Evaluating the internet as a sexually transmitted disease risk environment for teens: findings from the communication, health, and teens study. *Sex Transm Dis*. 2013;40(7):528–533.
34. Chiasson MA, Hirshfield S, Remien RH, Humberstone M, Wong T, Wolitski RJ. A comparison of on-line and off-line sexual risk in men who have sex with men - An event-based on-line survey. *J Acquir Immune Defic Syndr*. 2007;44(2):235–243.
35. Jenness SM, Neaigus A, Hagan H, Wendel T, Gelpi-Acosta C, Murrill CS. Reconsidering the internet as an HIV/STD risk for men who have sex with men. *Aids Behav*. 2010;14(6): 1353–1361.
36. Grov C, Hirshfield S, Remien RH, Humberstone M, Chiasson MA. Exploring the venue's role in risky sexual behavior among gay and bisexual men: an event-level analysis from a national online survey in the U.S. *Arch Sex Behav*. 2013;42(2):291–302.
37. Baral SD, Poteat T, Stromdahl S, Wirtz AL, Guadamuz TE, Beyrer C. Worldwide burden of HIV in transgender women: a systematic review and meta-analysis. *Lancet Infect Dis*. 2013; 13(3):214–222.
38. Herbst JH, Jacobs ED, Finlayson TJ, et al. Estimating HIV prevalence and risk behaviors of transgender persons in the United States: a systematic review. *Aids Behav*. 2008;12(1):1–17.
39. Habarta N, Wang GS, Mulatu MS, Larish N. HIV testing by transgender status at centers for disease control and prevention-funded sites in the United States, Puerto Rico, and US Virgin Islands, 2009-2011. *Am J Public Health*. 2015;105(9): 1917–1925.
40. Lorimer K, Flowers P, Davis M, Frankis J. Young men who have sex with men's use of social and sexual media and sex-risk associations: cross-sectional, online survey across four countries. *Sex Transm Infect*. 2016;92(5):371–376.
41. Winetrobe H, Rice E, Bauermeister J, Petering R, Holloway IW. Associations of unprotected anal intercourse with Grindr-met partners among Grindr-using young men who have sex with men in Los Angeles. *Aids Care*. 2014;26(10):1303–1308.
42. Lehmiller JJ, Ioerger M. Social networking smartphone applications and sexual health outcomes among men who have sex with men. *PLoS One*. 2014;9(1):e86603.
43. Lally MA, van den Berg JJ, Westfall AO, et al. HIV continuum of care for youth in the United States. *J Acquir Immune Defic Syndr*. 2018;77(1):110–117.
44. MacKinnon DP, Lockwood CM, Williams J. Confidence limits for the indirect effect: distribution of the product and resampling methods. *Multivar Behav Res*. 2004;39(1):99–128.
45. Glantz SA, Slinker BK, Neilands TB. eds. *Primer of Applied Regression & Analysis of Variance*. 3rd ed. New York: McGraw-Hill Education; 2016.
46. Vittinghoff E, Glidden DV, Shiboski S, McCulloch CE. *Regression Methods in Biostatistics*. New York, NY: Springer; 2012.
47. Long JS, Ervin LH. Using heteroscedasticity consistent standard errors in the linear regression model. *Am Stat*. 2000;54(3): 217–224.
48. McNeish D, Stapleton LM. Modeling clustered data with very few clusters. *Multivariate Behav Res*. 2016:1–24.
49. Rietmeijer CA, Bull SS, McFarlane M, Patnaik JL, Douglas JM. Risks and benefits of the Internet for populations at risk for sexually transmitted infections (STIs) - Results of an STI clinic survey. *Sex Transm Dis*. 2003;30(1):15–19.
50. Mitchell KJ, Finkelhor D, Wolak J. Youth internet users at risk for the most serious online sexual solicitations. *Am J Prev Med*. 2007; 32(6):532–537.
51. Benotsch EG, Kalichman S, Cage M. Men who have met sex partners via the internet: prevalence, predictors, and implications for HIV prevention. *Arch Sex Behav*. 2002;31(2):177–183.
52. Bolding G, Davis M, Hart G, Sherr L, Elford J. Where young MSM meet their first sexual partner: the role of the Internet. *Aids Behav*. 2007;11(4):522–526.
53. Bauermeister JA, Leslie-Santana M, Johns MM, Pingel E, Eisenberg A. Mr. Right and Mr. Right now: romantic and casual partner-seeking online among young men who have sex with men. *Aids Behav*. 2011;15(2):261–272.
54. Horvath KJ, Rosser BRS, Remafedi G. Sexual risk taking among young Internet-using men who have sex with men. *Am J Public Health*. 2008;98(6):1059–1067.
55. Ng RAC, Samuel MC, Lo T, et al. Sex, drugs (Methamphetamines), and the internet: increasing syphilis among men who have sex with men in California, 2004-2008. *Am J Public Health*. 2013; 103(8):1450–1456.
56. Chiu CJ, Young SD. The relationship between online social network use, sexual risk behaviors, and HIV sero-status among a sample of predominately African American and Latino Men who have sex with men (MSM) social media users. *Aids Behav*. 2015; 19:S98–S105.
57. Beymer MR, Weiss RE, Bolan RK, et al. 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. *Sex Transm Infect*. 2014;90(7): 567–572.
58. Brown G, Maycock B, Burns S. Your picture is your bait: use and meaning of cyberspace among gay men. *Journal of sex research*. 2005;42(1):63–73.

59. Robinson BA, Moskowitz DA. The eroticism of Internet cruising as a self-contained behaviour: a multivariate analysis of men seeking men demographics and getting off online. *Cult Health Sex*. 2013;15(5):555–569.
60. Reeves PM. Coping in cyberspace: the impact of Internet use on the ability of HIV-positive individuals to deal with their illness. *J Health Commun*. 2000;5(Suppl):47–59.
61. Mo PKH, Coulson NS. Exploring the communication of social support within virtual communities: a content analysis of messages posted to an online HIV/AIDS support group. *Cyberpsychol Behav*. 2008;11(3):371–374.
62. Kalichman SC, Benotsch EG, Weinhardt L, Austin J, Luke W, Cherry C. Health-related Internet use, coping, social support, and health indicators in people living with HIV/AIDS: preliminary results from a community survey. *Health Psychol*. 2003;22(1): 111–116.
63. Kalichman SC, Benotsch EG, Weinhardt LS, Austin J, Luke W. Internet use among people living with HIV/AIDS: association of health information, health behaviors, and health status. *Aids Educ Prev*. 2002;14(1):51–61.
64. DeVost MA, Beymer MR, Weiss RE, Shover CL, Bolan RK. App-based sexual partner seeking and sexually transmitted infection outcomes: a cross-sectional study of HIV-negative MSM attending an STI clinic in Los Angeles, California. *Sex Transm Dis*. 2018;45(6):394–399.
65. Ralph LJ, Berglas NF, Schwartz SL, Brindis CD. Finding teens in TheirSpace: using social networking sites to connect youth to sexual health services. *Sex Res Soc Policy*. 2011;8(1):38–49.
66. Sun CJ, Stowers J, Miller C, Bachmann LH, Rhodes SD. 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. *Aids Behav*. 2015;19(3):543–552.
67. Wohlfeiler D, Hecht J, Volk J, Raymond HF, Kennedy T, McFarland W. How can we improve online HIV and STD prevention for men who have sex with men? Perspectives of hook-up website owners, website users, and HIV/STD directors. *Aids Behav*. 2013; 17(9):3024–3033.
68. Taggart T, Grewe ME, Conserve DF, Gliwa C, Roman Isler M. Social media and HIV: a systematic review of uses of social media in HIV communication. *J Med Int Res*. 2015;17(11):e248.
69. Balatsoukas P, Kennedy CM, Buchan I, Powell J, Ainsworth J. The role of social network technologies in online health promotion: a narrative review of theoretical and empirical factors influencing intervention effectiveness. *J Med Int Res*. 2015; 17(6):e141.
70. Guse K, Levine D, Martins S, et al. Interventions using new digital media to improve adolescent sexual health: a systematic review. *J Adolescent Health*. 2012;51(6):535–543.
71. Bailin A, Milanaik R, Adesman A. Health implications of new age technologies for adolescents: a review of the research. *Curr Opin Pediatr*. 2014;26(5):605–619.
72. Smith PK, Thompson F, Davidson J. Cyber safety for adolescent girls: bullying, harassment, sexting, pornography, and solicitation. *Curr Opin Obstet Gyn*. 2014;26(5):360–365.
73. Livingstone S, Smith PK. Annual research review: harms experienced by child users of online and mobile technologies: the nature, prevalence and management of sexual and aggressive risks in the digital age. *J Child Psychol Psyc*. 2014;55(6):635–654.
74. Jacobson C, Bailin A, Milanaik R, Adesman A. Adolescent health implications of new age technology. *Pediatr Clin North Am*. 2016;63(1):183–194.
75. Poteat T, Scheim A, Xavier J, Reisner S, Baral S. Global epidemiology of HIV infection and related syndemics affecting transgender people. *J Acquir Immune Defic Syndr*. 2016;72(Suppl 3): S210–S219.
76. Opeiario D, Soma T, Underhill K. Sex work and HIV status among transgender women - Systematic review and meta-analysis. *J Acquir Immune Defic Syndr*. 2008;48(1):97–103.
77. Chan PA, Crowley C, Rose JS, et al. A network analysis of sexually transmitted diseases and online hookup sites among men who have sex with men. *Sex Transm Dis*. 2018;45(7):462–468.
78. Yang BR, Hallmark CJ, Huang JS, Wolverton ML, McNeese-Ward M, Arafat RR. Characteristics and risk of syphilis diagnosis among HIV-infected male cohort: a population-based study in Houston, *Texas.* Sex Transm Dis. 2013;40(12):957–963.
79. Cohen MS. HIV and sexually transmitted diseases: lethal synergy. *Top HIV Med*. 2004;12(4):104–107.
80. McCray E, Mermin JH. Dear Colleague: September 27, 2017. In *Center for Disease Control and Prevention 2017*. https://www.cdc.gov/hiv/library/dcl/dcl/092717.html. Accessed October 6, 2017.
81. Prevention Access Campaign. U=U. 2017. https://www.preventionaccess.org/. Accessed October 6, 2017.
82. Owusu-Edusei K, Chesson HW, Gift TL, et al. The estimated direct medical cost of selected sexually transmitted infections in the United States, 2008. *Sex Transm Dis*. 2013;40(3):197–201.
83. Matsumoto T. Trends of sexually transmitted diseases and antimicrobial resistance in Neisseria gonorrhoeae. *Int J Antimicrob Agents*. 2008;31(Suppl 1):S35–S39.
84. Chen CC, Hsia KC, Huang CT, et al. Draft genome sequence of a dominant, multidrug-resistant Neisseria gonorrhoeae strain, TCDC-NG08107, from a sexual group at high risk of acquiring human immunodeficiency virus infection and syphilis. *J Bacteriol*. 2011;193(7):1788–1789.
85. del Rio C, Hall G, Hook EW, et al. Cephalosporin susceptibility among Neisseria gonorrhoeae isolates-United States, 2000-2010 (Reprinted from MMWR, vol 60, pg 873-877, 2011). *Jama-J Am Med Assoc*. 2011;306(6):599–602.
86. Katz KA, Pierce EF, Aiem H, et al. Neisseria gonorrhoeae with reduced susceptibility to Azithromycin-San Diego County, California, 2009 (Reprinted from MMWR, vol 60, pg 579-581, 2011). *Jama-J Am Med Assoc*. 2011;306(1):33–35.