



# Sex in the Time of COVID-19: Results of an Online Survey of Gay, Bisexual and Other Men Who Have Sex with Men's Experience of Sex and HIV Prevention During the US COVID-19 Epidemic

Rob Stephenson<sup>1,2</sup> · Tanaka M. D. Chavanduka<sup>2</sup> · Matthew T. Rosso<sup>2</sup> · Stephen P. Sullivan<sup>2</sup> · Renée A. Pitter<sup>2</sup> · Alexis S. Hunter<sup>2</sup> · Erin Rogers<sup>2</sup>

Published online: 2 September 2020  
© Springer Science+Business Media, LLC, part of Springer Nature 2020

## Abstract

This paper presents data from a recent cross-sectional survey of gay, bisexual and other men who have sex with men (GBMSM) in the US, to understand changes in sexual behavior and access to HIV prevention options (i.e. condoms and pre-exposure prophylaxis (PrEP)) during the COVID-19 lockdown period. The *Love and Sex in the Time of COVID-19* survey was conducted online from April to May, 2020. GBMSM were recruited through advertisements featured on social networking platforms, recruiting a sample size of 518 GBMSM. Analysis considers changes three in self-reported measures of sexual behavior: number of sex partners, number of anal sex partners and number of anal sex partners not protected by pre-exposure prophylaxis (PrEP) or condoms. Approximately two-thirds of the sample reported that they believed it was possible to contract COVID-19 through sex, with anal sex reported as the least risky sex act. Men did not generally feel it was important to reduce their number of sex partners during COVID-19, but reported a moderate willingness to have sex during COVID-19. For the period between February and April–May 20, 2020, participants reported a mean increase of 2.3 sex partners during COVID-19, a mean increase of 2.1 anal sex partners (range = 40 to 70), but a very small increase in the number of unprotected anal sex partners. Increases in sexual behavior during COVID-19 were associated with increases in substance use during the same period. High levels of sexual activity continue to be reported during the COVID-19 lockdown period and these high levels of sexual activity are often paralleled by increases in substance use and binge drinking. There is a clear need to continue to provide comprehensive HIV prevention and care services during COVID-19, and telehealth and other eHealth platforms provide a safe, flexible mechanism for providing services.

**Keywords** COVID-19 · Sexual behavior · GBMSM

## Introduction

Since the first cases of COVID-19 identified in the US in March 2020, COVID-19 has spread to all 50 States, and by the end of June 2020 there were 1,956,421 confirmed cases resulting in 110,925 deaths [1]. The primary response to the epidemic has been stay at home orders, which limit social mobility as a mechanism for limiting the spread of

COVID-19 infection. These stay at home orders—rolled out at varying time points since March across the US—mean that approximately 316 million people in 42 states, 10 cities, the District of Columbia and Puerto Rico are being urged to stay home [2].

Recent research has begun to consider the effects of the COVID-19 epidemic on access to sexual and reproductive health services. Tang et al. note the need to consider the impacts of the COVID-19 pandemic at the health system level and disruptions or interruptions in regular provision of sexual and reproductive health services, such as pre and postnatal checks, safe abortion, contraception, and services for the treatment and prevention of HIV/AIDS and sexually transmitted infections [3]. Despite the American College of Obstetricians and Gynecologists (ACOG) guidance issued on March 18, 2020, that they “do not support

✉ Rob Stephenson  
rbsteph@umich.edu

<sup>1</sup> Department of Systems, Population and Leadership, School of Nursing, University of Michigan, Ann Arbor, USA

<sup>2</sup> Center for Sexuality and Health Disparities, University of Michigan, Ann Arbor, USA

*Covid-19 responses that cancel or delay abortion procedures*”, governors in a number of states have called for a halt to abortion care throughout the COVID-19. Governors in Texas, Louisiana, Mississippi, Alabama, and Oklahoma have ordered or supported the cessation of both medication and surgical abortion, while governors in other states have directed that surgical abortion alone must stop [4]. In terms of HIV prevention and care, mandated stay at home orders and the resultant closure of many clinics and community-based organizations has significantly reduced access to routine HIV testing and other HIV prevention options such as condoms or pre-exposure prophylaxis (PrEP) [5].

While it seems clear that social distancing and stay at home orders have decreased access to sexual and reproductive health services—primarily through the closure of services—less attention has been paid to how the COVID-19 epidemic has affected sexual behavior. Stay at home orders may shape sexual behavior in several ways, creating more opportunities for sex with sexual partners at home, and limiting the opportunities for sexual partners outside of the home. In a recent survey of adults from three South Asian countries (Bangladesh, India and Nepal), Arafat et al. showed 45% of the respondents reported that the lockdown had impacted their sexual life, with 50% of respondents reporting experiencing positive changes in their emotional bonding with their partner due to the lockdown [6]. Similarly, in a survey of 868 adults in the UK, of which 63.1% were women, and 21.8% aged between 25 and 34 years, Jacob et al. reported that during the stay at home order, 39.9% of the population reported engaging in sexual activity at least once per week [7]. While neither of these studies have pre-COVID-19 data points for comparisons of changes in sexual behavior, they both illustrate that for many sexual activity continues during the COVID-19 epidemic. There is also evidence of increases in non-physical sexual activity: Pornhub, one of the largest online pornography sites, has reported increased pornography use in multiple countries, with global traffic increasing over 11% from late February to March 17, 2020 [8, 9].

Gay, bisexual and other men who have sex with men (GBMSM) continue to be the risk group most severely affected by HIV in the U.S. [10–12], accounting for two-thirds of all new HIV infections each year [10–12]. The closure of essential HIV prevention and care services poses a significant threat for increases in HIV transmission among GBMSM. Two recent studies have investigated how the COVID-19 epidemic is affecting sexual behavior GBMSM in the US. McKay et al. [13] conducted a survey of LGBT Americans from April 10 to May 10, 2020, to understand changes in sexual behavior associated with the stay at home orders. In a sub-sample of 728 gay and bisexual men, they found that the majority reported changing their sexual behavior in response to the pandemic: nine out of 10 men in their sample reported having either one sexual partner or no

sexual partner in the 30 days prior to the survey. Men also reported making changes to the kinds of partners they had and their sexual activities with partners (e.g., more virtual sex).

In a sample of 1051 US men who have sex with men (MSM) (conducted from April 2 to April 13, 2020), Sanchez et al. [14] reported that approximately half (48%) of their survey participants reported no change in their number of sex partners. The use of apps and websites to find sex partners remained high, with 49% reporting no change in the use of these sites. Participants almost universally reported that they had no change in access to (98%) or use of (92%) condoms. However, 10% of participants reported an increase in their use of non-prescription drugs. Sanchez et al. [14] also collected data on non-sexual related impacts of the COVID-19 epidemic. A significant proportion of their sample reported decreased quality of sleep and decreased connection to family, and approximately 20% reported a loss of employment due to the COVID-19 epidemic.

In this paper we present data from a recent cross-sectional survey of GBMSM in the US, to understand changes in sexual behavior and access to HIV prevention options (i.e. condoms and pre-exposure prophylaxis (PrEP)). We build upon recent studies by including data on knowledge, perceptions and perceived seriousness and prevalence of COVID-19, and detailed information on actual and perceived changes in sexual behavior. A nuanced understanding of how the COVID-19 pandemic is shaping sexual behavior for GBMSM can inform the content and targeting of HIV prevention interventions for those who continue to experience risk of HIV acquisition during the pandemic.

## Methods

The *Love and Sex in the Time of COVID-19* survey was conducted online from April to May, 2020. Participants were recruited through paid banner advertisements featured on the social networking platforms Facebook and Instagram, and on the Grindr app. Ethical approval for this study was obtained from the University of Michigan Institutional Review Board (IRB Number HUM00180117). On Facebook, advertisements were targeted to user profiles that were over the age of 18, identified as men, currently resided in the U.S., and had a variety of gay or bisexual related interests. Designing our advertising distribution network to capture male identified Facebook/Instagram users specifically interested in celebrities, film, television, social media influencers, and music that have a sizable LGBTQ+ following, allowed for the possibility of recruiting men who were not out on social media. On Grindr, advertisements consisted of both banner and interstitial design formats. The ads displayed photos of men at their homes and on their phones, with the

caption, “*Still getting those DMs during quarantine? Take this survey about COVID-19 and sexual behaviors*”. Eligibility criteria included adults over the age of 18, current residents of the U.S. and its dependent areas, those assigned male sex at birth and currently identify as a cis man, and individuals reporting any type of sex in the past 12 months. Over a 6 week period, we received 34,930 clicks on our ads, 3864 people entered the survey portal, and 1789 (46.3%) started the survey. Of those who started, 11 (0.6%) reported living outside the U.S., 136 reported a gender other than male (7.6%), 5 reported being younger than 18 years of age (0.3%), and 283 had not had sex with a man in the past 12 months (15.8%), resulting in 1354 eligible participants. In total, 696 (51.4%) of those who started the survey, completed the survey, for a final sample size of 696 GBMSM.

The survey collected data on participant demographics; age, race and ethnicity, employment status, educational attainment, sexual orientation, gender identity, relationship status and recent experiences of indicators of structural vulnerability (incarceration and homelessness). The survey assessed participant’s experience of COVID-19, including: loss or reduction in employment, housing instability, and food insecurity. Participants reported their recent use of non-prescription drugs and alcohol using the ASSIST [15] and AUDIT [16] measures. Participants were asked whether they felt their substance use or binge drinking (episodes of more than 5 alcoholic drinks) had changed during the COVID-19 lockdown, with response categories: reduced, stayed the same, or increased.

To assess changes in sexual behavior, participants were asked to report their sexual behavior for two periods: the 3 months prior to the COVID-19 epidemic and for the time since the beginning of the epidemic. For both periods, participants reported the number of sexual partners (including primary and casual partners), the number of anal sex partners, the number of unprotected anal sex and participation in transactional sex. For those who reported they had participated in transactional sex, they were asked whether they had participated in transactional sex for the first time during the COVID-19 lockdown period. Stem questions for each section were: *Now we are going to ask you about your sexual experiences in the 3 months before the COVID19 pandemic. We are referring to the period between November 2019 and the end of January 2020 and Now we want you to think about the sex you’ve had since the COVID19 pandemic started. We’re referring to the beginning of February 2020 through today.* To address perceptions of changes in sexual behavior, participants were asked about their willingness to engage in sexual activity: *Compared to the 3 months before the COVID19 outbreak, how has the COVID19 pandemic affected your willingness to have sex?* and *Compared to the 3 months before the COVID19 outbreak, how has the COVID19 pandemic affected your willingness to have*

*different types of sex? (kissing, oral sex, anal sex (top), anal sex (bottom) and rimming).* The survey assessed whether participants felt it was possible to get COVID-19 through sex, and through each of these sex acts: kissing, oral sex, anal sex (top), anal sex (bottom) and rimming. Participants were asked how likely they thought they were to contract COVID-19 through sex and through each of the 5 sex acts (kissing, oral sex, anal sex (top), anal sex (bottom) and rimming).

For HIV prevention behaviors, participants were asked whether the COVID-19 epidemic had prevented access to HIV testing and STI testing and, for those on PrEP, access to prescriptions for PrEP. Participants were asked how likely they were to be tested for HIV or STIs during the epidemic (as separate questions). Participants were asked how important they felt it was to reduce their number of sexual partners during the COVID-19 epidemic: *How important do you think it is to reduce your number of sex partners during the COVID19 pandemic?*

Participants were asked to report their experience of testing (and test results) for COVID-19, and participation in social distancing practices. To assess perceptions of the prevalence of COVID-19, participants were asked: *Thinking of the U.S. as a whole, what percentage of the population has tested positive for COVID-19?* and were asked to record their response on a sliding scale from 0 to 100. This question was repeated for the perceived prevalence of COVID-19 in the participant’s state and county and among their friends and sex partners.

Analysis considers changes in self-reported sexual behavior (number of sex partners, number of anal sex partners, and number of unprotected anal sex partners (those that were not protected with either condoms or PrEP) between the 3 months prior to the COVID-19 lockdown and during the lockdown period. For HIV-positive participants, the survey did not collect information on viral suppression, so we were unable to consider being virally suppressed as an element of protected sex. Of the 696 survey responses, 43 participants had missing data for HIV sero-status and 135 did not complete both sections of the sexual health histories (pre- and during COVID-19 lockdown). There were no differences in demographic (i.e. age, race, education or employment) and behavioral (i.e. substance and alcohol use) between those with and without missing data for these variables. The final analysis sample was 518 GBMSM. Multivariable modeling considers 3 continuous outcomes: (a) the difference in the number of self-reported sex partners between the 3 months prior to COVID-19 lockdown and the time during lockdown, (b) the difference in the number of self-reported anal sex partners between the 3 months prior to COVID-19 lockdown and the time during lockdown, and (c) the difference in the number of unprotected anal sex partners (unprotected by either condom or PrEP) between the

3 months prior to COVID-19 lockdown and the time during lockdown. Models include demographic characteristics (age, education, employment, race and relationship) and behaviors experienced during the COVID-19 epidemic (increases in substance use or alcohol, increases in food insecurity or homelessness).

## Results

The majority of the sample was aged between 25 and 44, although almost one-in-five were aged 18–24 (Table 1). The sample was largely White (75.5%), educated (32.6% college educated or higher), gay identifying (82.8%) and currently employed (79.0%). Approximately 9% self-reported currently living with HIV. While approximately half of the sample reported being single, 37.1% reported being in a relationship and 14.3% reported being married to a male partner. 11.8% of participants reported that they had to skip meals more frequently during the period of lockdown, and 4.1% reported experiencing homelessness during the lockdown period. For substance use, 20.5% reported their substance use had increased, 30.1% reported it had decreased and 49.4% reported it had stayed the same. For binge drinking, 29.5% reported their binge drinking had increased, 36.4% reported it has decreased and 34.1% reported it had stated the same. A small percentage (1.4%) reported that they had participated in transactional sex for the first time during the COVID-19 lockdown.

Approximately two-thirds of the sample reported that they believed it was possible to contract COVID-19 through sex (Table 2). While 94.8% believed it was possible to contract COVID-19 through kissing, significantly lower percentages of men believed it was possible to contract COVID-19 through all other sex acts (with anal sex reported as the least risky sex act). Men reported an average importance of 1.8 on a scale of 1–5 for how important it was to reduce their number of sex partners. On a scale of 1–5 (1 being totally changing my sexual behavior to 5 being not changing my sexual behavior), participants reported a mean of 2.1. Men reported a moderate willingness to have sex during COVID-19 (3.5 on a scale from 1 to 5), and there was no variation in willingness to participate in differing sex acts. Men reported a moderate likelihood that they would contract COVID-19 via sex (3.3 on a scale 1–6), with kissing (3.9) and oral-rectal sex (3.7) rated as the most likely sex acts from which they would contract COVID-19.

In terms of changes in self-reported number of sex partners in the 3 months prior to COVID-19 and the COVID-19 lockdown period, participants reported a mean increase of 2.3 sex partners during COVID-19 (with a large range from – 19 to 38). Participants reported mean increase of 2.1 anal sex partners (range – 40 to 70) but a very small increase in

**Table 1** Demographic and behavioral characteristics of an online sample of gay, bisexual and other men who have sex with men (GBMSM) (n = 518)

Characteristic	% (N)
Age	
18–24	18.6 (91)
25–34	49.2 (255)
35–44	23.8 (123)
> 45	9.5 (49)
Education	
High school	26.1 (135)
Some college	41.3 (214)
College graduate or graduate school	32.6 (169)
Employed	
Yes	79.0 (409)
No	21.0 (109)
Race	
Black/African American	4.3 (22)
White	75.5 (391)
Other	20.3 (105)
Sexual identity	
Gay/homosexual	82.8 (429)
Bisexual	11.6 (60)
Other	5.6 (29)
HIV sero-status	
HIV-negative/unknown	91.4 (473)
HIV-positive	8.6 (45)
Relationship status	
Single	48.7 (252)
Has partner (i.e. boyfriend)	37.1 (192)
Married to male partner	14.3 (74)
Changes in substance use during lockdown	
Increased	20.5 (106)
Decreased	30.1 (156)
Stayed the same	49.4 (256)
Changes in binge drinking during lockdown	
Increased	29.5 (153)
Decreased	36.4 (189)
Stayed the same	34.1 (176)
Have skipped meals due to COVID-19	
Yes	11.8 (61)
No	88.2 (456)
Have experienced homelessness during COVID-19	
Yes	4.1 (24)
No	95.9 (494)
Has participated in transactional sex during COVID-19	
Yes	1.4 (4)
No	98.6 (514)

the mean number of unprotected anal sex partners (with a much narrower range of – 5 to 14).

**Table 2** Sexual behaviors and perceptions of COVID-19 related sexual risks among an online sample of gay, bisexual and other men who have sex with men (n=518)

	% (N) or mean (range)
Possible to contract COVID-19 through sex	66.9 (347)
Possible to contract COVID-19 through	
Kissing	94.8 (441)
Oral sex	59.1 (306)
Insertive anal sex	41.7 (216)
Receptive anal sex	45.2 (234)
Oral-rectal sex (rimming)	57.3 (294)
How important is it to reduce your number of sex partners during COVID-19	1.8 (1–5)
Have you reduced your number of sex partners during COVID-19	2.1 (1 to 5)
Compared to pre-COVID-19, how willing are you to have sex during COVID-19	3.5 (1 to 6)
Compared to pre-COVID-19, how willing are you to [act] during COVID-19	
Kissing	2.6 (1 to 6)
Oral sex	2.4 (1 to 6)
Insertive anal sex	2.9 (1 to 6)
Receptive anal sex	2.9 (1 to 6)
Oral-rectal sex (rimming)	2.9 (1 to 6)
How likely do you think you are to get COVID-19 through sex	3.3 (1 to 6)
How likely do you think you are to get COVID-19 through	
Kissing	3.9 (1 to 6)
Oral sex	3.1 (1 to 6)
Insertive anal sex	3.0 (1 to 6)
Receptive anal sex	3.1 (1 to 6)
Oral-rectal sex (rimming)	3.7 (1 to 6)
Difference in number of sex partners reported in 3 months prior to COVID-19 and during COVID-19	2.3 (– 19 to 38)
Difference in number of anal sex partners reported in 3 months prior to COVID-19 and during COVID-19	2.1 (– 40 to 70)
Difference in number of unprotected anal sex partners reported in 3 months prior to COVID-19 and during COVID-19	0.1 (– 5 to 14)

Approximately 8% of the sample reported receiving a COVID-19 test in the past 3 months (with 1% reporting a positive result) (Table 3). The majority had received a HIV test in the past 12 months, although 6.0% reported never testing for HIV. Approximately one-third reported that COVID-19 had prevented them testing for HIV (32.2%) or STIs (29.3%) and were moderately willing to be tested for HIV (3.5, range 1–5) or STIs (3.5, range 1–5) during the epidemic. Current PrEP use was relatively high at 18%, with 9% reporting that COVID-19 had prevented them accessing their PrEP prescriptions.

Perceived prevalence of COVID-19 was generally reported to be higher for more distal units of measurement. The highest reported perceived prevalence was for US (13.9), state (12.9) and county (11.6), with substantially lower reported perceived prevalence for friends (4.7) and sex partners (3.3).

Table 4 shows the results of the regression modeling of self-reported changes in sexual behavior. Few demographic characteristics were significantly associated with changes in sexual behavior: men aged 25–44 were more likely to report

increases in the number of anal sex partners than men aged 18–24, and higher levels of education were associated with increases in number of sex partners but decreases in number of anal sex partners. Interestingly, men who endorsed a sexual identity of other (other than gay, homosexual or bisexual) had significantly greater increases in numbers of sex partners, anal sex partners and unprotected anal sex partners. Men who self-reported living with HIV were significantly less likely to report increases in the number of sex partners.

Men who reported that their substance use had increased during lockdown were significantly more likely to report increases in number of sex partners, anal sex partners and unprotected sex partners, but there was no significant associations with reporting decreases in substance use. Changes in binge drinking were not associated with changes in sexual behavior. Participants who reported experiencing homelessness during COVID-19 were less likely to report increases in number of sex partners and number of unprotected anal sex partners. Men who reported experiencing food insecurity during COVID-19 were less likely to report increases in their number of sex partners.

**Table 3** Engagement in HIV prevention, COVID-19 testing and perceptions of COVID-19 prevalence among an online sample of gay, bisexual and other men who have sex with men (n = 518)

	% (N) or mean (range)
Received test for COVID-19 in past 3 months	7.9 (41)
Received a HIV test	
Past 6 months	37.8 (176)
6–12 months	34.0 (158)
1–3 years	14.0 (65)
> 3 years	8.2 (38)
Never	6.0 (28)
COVID-19 prevented you from testing for HIV	32.2 (166)
Likelihood of receiving a HIV test during COVID-19	3.5 (1–5)
COVID-19 prevented you from testing for STIs	29.3 (150)
Likelihood of receiving a STI test during COVID-19	3.5 (1–5)
Has taken PrEP in the past 3 months	27.3 (123)
Currently taking PrEP	18.0 (93)
COVID-19 has prevented access to PrEP prescription	8.9 (11)
Perceived prevalence of COVID-19 among US population	13.9 (0–100)
Perceived prevalence of COVID-19 among state population	12.9 (0–94)
Perceived prevalence of COVID-19 among county population	11.6 (0–100)
Perceived prevalence of COVID-19 among friends	4.7 (0–100)
Perceived prevalence of COVID-19 among sex partners	3.3 (0–100)

Men who reported perceptions of higher prevalence of COVID-19 at the US national and state levels were less likely to report increases in their number of anal sex partners and unprotected anal sex partners. Additionally, men who perceived the prevalence of COVID-19 to be higher in their sex partners were less likely to report increases in their number of unprotected anal sex partners.

## Discussion

The results illustrate a number of important behavioral changes reported by GBMSM during the COVID-19 lockdown period. A significant number of participants reported experiencing increases in indicators of structural vulnerability: 11.8% reported food insecurity, while smaller numbers reported increases in homelessness and the need to participate in transactional sex. Approximately one-third of men reported that their substance use or binge drinking had increased during the COVID-19 lockdown—although significant percentages also reported that their substance use and binge drinking had decreased during lockdown. These increases in substance and alcohol use may reflect more opportunities for use (while confined to the home and not in a work place settings) and may also reflect an increase in negative coping behaviors in response to high levels of stress and uncertainty during the epidemic.

In terms of sexual behavior, only two-thirds of men believed that COVID-19 could be transmitted through sex, and while participants almost universally agreed that

COVID-19 could be transmitted through kissing, only about half of respondents believed it could be transmitted through other sex acts. There is currently no evidence that the COVID-19 virus is transmitted through semen [17], however, each of these sex acts obviously requires men to be in close physical contact with another person, and it is possible that men are focusing on the perceived lower risk of transmission via the sex act at the expense of the risk of transmission by being physically close to a partner. Men largely did not agree that it was important to reduce their number of sex partners during COVID-19 and reported a moderate willingness to continue their sexual activity during COVID-19 (with similarly moderate levels of willingness to participate in 5 sex acts). Indeed, men reported increases in the number of sex partners and number of anal sex partners between the pre-COVID-19 and COVID-19 lockdown periods, although there was a much smaller (almost zero) increase in the number of unprotected anal sex partners (unprotected by condoms or PrEP). Similarly, Sanchez et al. [14] noted that 48% of their sample of GBMSM reported no change in their number of sexual partners. Stay at home orders have disrupted daily routines for many, and it is possible that for some this may create more opportunities for sexual activity (i.e. sex when they normally would have been in the workplace). From this data, it does seem that this increase in sex partners is not paralleled by an increase in unprotected anal sex, with men maintaining their pre-COVID levels of condom use. Sanchez et al. [14] also noted that > 90% did not report a disruption in access to either condoms to lubricant.

**Table 4** Regression models for self-reported changes in number of sexual partner, number of anal sex partner and number of unprotected anal sex partners in an online sample of gay, bisexual and other men who have sex with men (GBMSM) (n = 518)

Characteristic	Change in number of sex partners	Change in number of anal sex partners	Change in number of unprotected anal sex partners
	Beta (SE)	Beta (SE)	Beta (SE)
Age (18–24)			
25–34	– 0.615 (0.697)	<i>2.201 (0.134)</i>	0.120 (0.163)
35–44	0.899 (0.791)	<i>4.981 (1.459)</i>	0.106 (0.185)
> 45	1.443 (0.989)	2.544 (1.852)	– 0.705 (0.232)
Education (high school)			
Some college	<i>1.633 (0.601)</i>	0.021 (1.109)	0.044 (0.141)
College graduate or graduate school	<i>1.141 (0.364)</i>	– 2.492 (1.123)	– 0.011 (0.156)
Employed (Yes)			
No	– 1.159 (0.305)	0.948 (1.115)	– 0.051 (0.141)
Race (Black/African American)			
White	– 1.463 (1.317)	1.268 (2.301)	0.255 (0.292)
Other	– 1.762 (1.247)	0.097 (2.430)	0.363 (0.309)
Sexual identity (Gay/homosexual)			
Bisexual	0.183 (0.734)	0.524 (1.355)	0.060 (0.172)
Other	<i>2.298 (1.053)</i>	<i>3.780 (1.432)</i>	<i>0.991 (0.247)</i>
HIV sero-status (HIV-negative)			
HIV-positive	– 0.888 (0.104)	1.636 (1.688)	– 0.143 (0.214)
Relationship status (Single)			
Has partner (i.e. boyfriend)	– 0.167 (0.712)	1.365 (0.935)	0.805 (0.118)
Married to male partner	– 1.182 (0.606)	0.848 (1.313)	– 0.051 (0.167)
Change in substance use during lockdown (stayed the same)			
Increased	<i>0.722 (0.210)</i>	<i>1.243 (0.034)</i>	<i>0.124 (0.034)</i>
Decreased	– 0.034 (0.056)	– 0.147 (0.217)	– 0.078 (0.189)
Change in binge drinking during lockdown (stayed the same)			
Increased	– 0.305 (0.545)	– 0.630 (1.007)	0.014 (0.128)
	– 0.214 (0.412)	– 0.146 (0.317)	– 0.154 (0.214)
Have skipped meals due to COVID-19 (No)			
Yes	– 2.297 (0.799)	– 0.845 (1.474)	0.072 (0.187)
Have experienced homelessness during COVID-19 (No)			
Yes	– 1.456 (0.210)	– 1.765 (0.076)	– 0.217 (0.045)
Perceived prevalence of COVID-19 among US population	– 0.033 (0.038)	– 0.115 (0.045)	– 0.154 (0.034)
Perceived prevalence of COVID-19 among state population	– 0.035 (0.037)	0.028 (0.065)	– 0.321 (0.063)
Perceived prevalence of COVID-19 among county population	0.049 (0.026)	0.034 (0.045)	0.089 (0.056)
Perceived prevalence of COVID-19 among friends	0.009 (0.032)	0.036 (0.050)	0.082 (0.098)
Perceived prevalence of COVID-19 among sex partners	– 0.046 (0.028)	– 0.038 (0.048)	– 0.239 (0.081)

Italic values represent significance at the 5% level

The regression models showed that men who reported increases in substance use during the COVID-19 lockdown reported significantly greater increases in all 3 measures of sexual behavior, but there was no impact on sexual behavior of decreases in substance use or binge drinking. These associations may be explained by one or a combination of two factors. Men experiencing lockdown and disruptions to their normal routines may have more time to participate in both sexual activity and substance use. Both increased

sexual activity and substance use may be coping strategies for the stress of living in lockdown. However, both of these behaviors are risk factors for HIV transmission, and there is clearly a need to continue to provide HIV prevention and care services for men during the epidemic.

Approximately one-third of men reported that the COVID-19 epidemic had prevented them from HIV or STI testing, while there was moderately high willingness to continue to test during the epidemic. Jiang et al. (2020)

note the need to continue to provide HIV care during the COVID-19 epidemic [5]. Several recent studies have successfully implemented telehealth interventions to provide HIV prevention and care services to GBMBM throughout the US [18, 19]. Hightow-Weidman et al. [20] recently noted the potential for online delivered telehealth interventions to surmount many of the barriers to service delivery created by the COVID-19 epidemic. Online-delivered interventions offer user flexibility and efficiency, and allow clients the ability to seek care while maintaining social distancing. As telehealth becomes normative across the US, HIV prevention and care must remain priorities for telehealth provision, with the creation of training and implementation guidelines to ensure high quality, culturally appropriate service delivery.

Men reported perceptions that rates of COVID-19 were higher at the US national and state levels than among their friends or sex partners, suggesting a sense of othering—that COVID-19 exists elsewhere and happens to other people. The survey did not assess whether they knew anyone who had tested positive for COVID-19, and this data would perhaps be a more accurate measure of participant's likely perceptions of risk of exposure. Men who reported higher perceived levels of COVID-19 at the national and state levels were less likely to see increases in their number of sex partners, and men who reported a perceived higher prevalence of COVID-19 among their sex partners were less likely to see an increase in their number of unprotected anal sex partners. Men may be making decisions on sexual activity based on perceptions (accurate or inaccurate) of the rates of COVID-19 and their associated likely risk of contracting COVID-19. In their survey of 3000 adults in the UK and USA, Geldsetzer [21] notes high levels of misconceptions of the prevalence of COVID-19 and routes of transmission. These findings point to the need to continue to reinforce the risks of COVID-19 from close physical contact, and to continue to provide digestible epidemiological data in formats that allow individuals to comprehend levels of COVID-19 in their local areas.

There are several limitations to the current study. The data were collected online, and therefore represent only those with access to the internet. Analysis was not able to differentiate between those recruited on social media or Grindr, and it may be that men recruited on a sex-networking app may have different patterns of sexual behavior. The survey did not collect information on viral suppression status for men living with HIV, restricting the ability to include viral suppression in the definition of unprotected anal sex. There was a large degree of missing data, although those with missing data were not demographically or behaviorally different to those with complete data. The sample is predominantly White and highly educated. With a more racially and economically diverse sample we may expect to observe greater

variation in the negative experiences of COVID-19 (in terms of increases in structural vulnerability).

The results illustrate that in this online sample of GBMSM high levels of sexual activity continue during the COVID-19 lockdown period and these high levels of sexual activity are often paralleled by increases in substance use and binge drinking. There is a clear need to continue to provide comprehensive HIV prevention and care services during COVID-19, and telehealth and other eHealth platforms provide a safe, flexible mechanism for providing services. The sexual activity and substance use behaviors observed in this data may to some degree be responses to the stress of COVID-19, and therefore services should consider addressing the mental health needs of those living on lockdown, and incorporate discussions and strategies for managing stress in the delivery of HIV prevention and care services.

## Compliance with Ethical Standards

**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. Ethical approval for this study was obtained from the University of Michigan Institutional Review Board (IRB Number HUM00180117). The authors declare no conflicts of interest. Informed consent was obtained from all participants via an electronic consent form.

## References

- Centers for Disease Control and Prevention. COVIDView: a weekly surveillance summary of US COVID-19 activity. Key Updates Weekly. 2020;19.
- Mervosh S, Lu D, Swales V. See which states and cities have told residents to stay at home. The New York Times. 2020. <https://www.nytimes.com/interactive/2020/us/coronavirus-stay-at-home-order.html>.
- Tang K, Gaoshan J, Ahonsi B. Sexual and reproductive health (SRH): a key issue in the emergency response to the coronavirus disease (COVID-19) outbreak. *Reprod Health*. 2020;17:1–3.
- Bayefsky MJ, Bartz D, Watson KL. Abortion during the CoviD-19 pandemic—ensuring access to an essential health service. *N Engl J Med*. 2020;382:e47.
- Jiang H, Zhou Y, Tang W. Maintaining HIV care during the COVID-19 pandemic. *Lancet HIV*. 2020;7:e308–9.
- Arafat SMY, Alradie-Mohamed A, Kar SK, Sharma P, Kabir R. Does COVID-19 pandemic affect sexual behaviour? A cross-sectional, cross-national online survey. *Psychiatry Res*. 2020. <https://doi.org/10.1016/j.psychres.2020.113050>.
- Jacob L, Smith L, Butler L, Barnett Y, Grabovac I, McDermott D, et al. COVID-19 social distancing and sexual activity in a sample of the British public. *J Sex Med*. 2020. <https://doi.org/10.1016/j.jsxm.2020.05.001>.
- Mestre-Bach G, Blycker GR, Potenza MN. Pornography use in the setting of the COVID-19 pandemic. *J Behav Addict*. 2020. <https://doi.org/10.1556/2006.2020.00015>.



9. Pornhub. Coronavirus insights. 2020. <https://www.pornhub.com/insights/corona-virus>. Accessed 23 Mar 2020.
10. Centers for Disease Control and Prevention. Behavioral and clinical characteristics of persons with diagnosed HIV infection—medical monitoring project, United States, 2015 Cycle (June 2015–May 2016). 2018 [6/8/2019]. Natl Cent HIV/AIDS, Viral Hepatitis, STD, TB Prev; 2018.
11. Centers for Disease Control and Prevention. HIV surveillance report, vol. 28: diagnoses of HIV infection in the United States and dependent areas, 2016; 2016.
12. Linley L, Johnson AS, Song R, Wu B, Hu S, Singh S, et al. Estimated HIV incidence and prevalence in the United States 2010–2015; 2018.
13. McKay T, Henne J, Gonzales G, Quarles R, Gavulic KA, Garcia Gallegos S. The COVID-19 pandemic and sexual behavior among gay and bisexual men in the United States. SSRN Electron J. 2020. <https://doi.org/10.2139/ssrn.3614113>.
14. Sanchez TH, Zlotorzynska M, Rai M, Baral SD. Characterizing the impact of COVID-19 on men who have sex with men across the United States in April, 2020. *AIDS Behav.* 2020;24:2024–32.
15. Khan R, Chatton A, Nallet A, Broers B, Thorens G, Achab-Arigo S, et al. Validation of the French version of the alcohol, smoking and substance involvement screening test (ASSIST). *Eur Addict Res.* 2011;17:190–7.
16. Saunders JB, Aasland OG, Babor TF, De La Fuente Jr, Grant M. Development of the alcohol use disorders identification test (AUDIT): WHO collaborative project on early detection of persons with harmful alcohol consumption-II. *Addiction.* 1993;88:791–804.
17. Marshall III, W. MD. Can you get COVID-19 from sexual activity? Mayo Clinic. 2020. <https://www.mayoclinic.org/diseases-conditions/coronavirus/expert-answers/sex-and-coronavirus/faq-20486572>.
18. Stephenson R, Freeland R, Sullivan SP, Riley E, Johnson BA, Mitchell J, et al. Home-based HIV testing and counseling for male couples (Project Nexus): a protocol for a randomized controlled trial. *JMIR Res Protoc.* 2017;6:e101.
19. Stephenson R, Metheny N, Sharma A, Sullivan S, Riley E. Providing home-based HIV testing and counseling for transgender youth (Project Moxie): protocol for a pilot randomized controlled trial. *JMIR Res Protoc.* 2017;6:e237.
20. Hightow-Weidman L, Muessig K, Claude K, Roberts J, Zlotorzynska M, Sanchez T. Maximizing digital interventions for youth in the midst of Covid-19: lessons from the adolescent trials network for HIV interventions. *AIDS Behav.* 2020;24:2239–43.
21. Geldsetzer P. Knowledge and perceptions of COVID-19 among the general public in the United States and the United Kingdom: a cross-sectional online survey. *Ann Intern Med.* 2020. <https://doi.org/10.7326/M20-0912>.

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.