



# The Impact of COVID-19 on Sexual Behavior and Psychosocial Functioning in a Clinical Sample of Men who have Sex with Men Using HIV Pre-exposure Prophylaxis

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## Abstract

The purpose of this study was to evaluate the impact of the Coronavirus Disease 2019 (COVID-19) pandemic on sexual behavior, mental health, and substance use among men who have sex with men (MSM) engaged in pre-exposure prophylaxis (PrEP) care. Generalized linear mixed models and logistic mixed-effect models examined change over time for number of sexual partners, mood, and alcohol consumption. From February 29, 2020 to July 31, 2020, 177 MSM actively engaged in PrEP care were evaluated. The median age was 37 [interquartile range (IQR) 30, 51]. Patients in the sample were largely representative of the clinic population and identified as White (73.0%), Black/African American (9.2%), and other race (17.2%), and 11.8% identified as Hispanic/Latino ethnicity. Men reported an average of 2.60 fewer sexual partners (95% CI -4.04, -1.40) during the pandemic compared to pre-COVID-19. Rates of depressive symptoms and alcohol use remained stable and few patients reported substance use. The reduced number of sexual partners may be explained by patients' efforts to reduce risk of exposure to COVID-19 and low rates of psychosocial symptoms may be indicative of only the highest functioning patients continuing to engage in care. Reductions in sexual partners may offset reduced engagement in care and help mitigate risk of HIV and other sexually transmitted infections (STIs).

**Keywords** COVID-19 · Men who have sex with men (MSM) · Sexual behavior · Pre-exposure prophylaxis · Mood · Alcohol

## Resumen

El propósito de este estudio fue evaluar el impacto que tuvo la pandemia causada por la enfermedad del coronavirus 2019 (COVID-19) en el comportamiento sexual, la salud mental y el uso de sustancias en hombres que tienen sexo con hombres (HSH) que reciben profilaxis previa a la exposición (PrEP). Los modelos lineales mixtos generalizados y los modelos logísticos de efectos mixtos examinaron el cambio a través del tiempo en el número de parejas sexuales, el estado de ánimo y el consumo de alcohol. Desde el 29 de febrero de 2020 hasta el 31 de julio de 2020, se evaluaron 177 HSH que recibían los servicios de la PrEP. La mediana de edad fue de 37 (rango intercuartílico (IQR: 30, 51). Los pacientes de la muestra eran en

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gran parte representativos de la población de la clínica y se identificaban como Blancos (73.0%), Negros/Afroamericanos (9.2%) y de Otra raza (17.2%) y el 11.8% se identificó de origen Hispano/Latino. Los hombres reportaron un promedio de 2.60 parejas sexuales menos (IC del 95%: -4.04, -1.40) durante la pandemia en comparación con antes de COVID-19. Las tasas de síntomas depresivos y el uso de alcohol se mantuvieron estables y pocos pacientes reportaron uso de sustancias. El número reducido de parejas sexuales puede explicarse por los esfuerzos de los pacientes para reducir su riesgo de exposición al COVID-19 y las bajas tasas de síntomas psicosociales pueden ser indicativos de que solo los pacientes con mayor funcionamiento continúan participando. La reducción en el número de parejas sexuales puede contrarrestar la baja participación en la atención médica de la PrEP y ayudar a mitigar el riesgo de contraer el VIH y otras infecciones de transmisión sexual (ITS).

## Introduction

The Coronavirus Disease 2019 (COVID-19) pandemic caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) has fundamentally changed healthcare and aspects of life since January 2020. COVID-19 has resulted in significant morbidity and mortality worldwide, with the United States leading in number of cases and mortality rates. There have been over 60 million cases and over 1.4 million deaths worldwide, with 12.65 million cases and 260,000 deaths in the United States alone [1]. Apart from the physical toll that COVID-19 has had on the health of the population, the pandemic has led to unprecedented behavioral changes, mental health consequences, and healthcare delivery transformations [2–4]. These challenges have not been proportional for all populations in the United States, and the pandemic has exposed significant flaws in healthcare services delivery and access, which has compounded the crisis [5].

The COVID-19 pandemic has affected access to preventive healthcare [6]. More specifically, COVID-19 has compounded pre-existing inequities in access to preventive healthcare in vulnerable populations, including those at risk for and living with HIV [7–9]. Reduced access to HIV preventative care can potentially lead to higher rates of HIV acquisition over time. For example, individuals may not have access to medications, such as pre-exposure prophylaxis (PrEP) for HIV prevention, or sexually transmitted infection (STI) testing, which both place these individuals at a higher risk of acquiring HIV [10]. Those individuals living with HIV may also have reduced access to healthcare, including HIV medications, which could lead to drug resistance or an increased viral load of HIV, resulting in increased risk of transmission [11].

One understudied area is how COVID-19 has affected sexual behaviors over time and how that might in turn affect HIV risk. More specifically, it has not been well-described how changes in social and sexual behaviors due to COVID-19 may impact HIV risk in gay, bisexual and other men who have sex with men (MSM) who have the greatest burden of HIV [12]. Additionally, psychosocial syndemic factors have been shown to be associated with sexual risk [13–16], poor antiretroviral medication adherence and viral suppression

[17–19], and PrEP adherence [20] in MSM increasing risk for both HIV transmission and acquisition.

The goal of the current study was to examine changes in sexual behavior and psychosocial functioning operationalized as depressive symptoms, alcohol use, and substance use among MSM engaged in PrEP care prior to and during the COVID-19 pandemic.

## Methods

### Participants and Procedures

We reviewed medical records for all cisgender male PrEP patients who self-identified as men who have sex with men (MSM) and were engaged in care at the major PrEP program in Rhode Island. We included PrEP patients who had been engaged in care and attended PrEP visits during the time phases analyzed for this study. We included patients who had two or more PrEP clinical visits during the study period. The study sample represents approximately one third of active PrEP clinic patients. Demographic and background information was obtained from review of clinical records. Procedures for the review of de-identified clinic data were approved by The Miriam Hospital Institutional Review Board.

### Defining COVID-19 Pandemic Phases

We divided the study period into three phases according to the COVID-19 pandemic status in Rhode Island: 1) pre-COVID-19 (before February 29th, 2020), 2) emerging (March 1st, 2020–April 11th, 2020), 3) and plateau phase (April 12th, 2020–July 31st, 2020). The first confirmed COVID-19 case was reported on February 29th, 2020 in Rhode Island; we defined the pre-COVID-19 phase as starting approximately six months prior to the first case and ending on February 29th, 2020. We defined from March 1st to April 11th, 2020 as the emerging phase, during which we observed exponential growth in the number of confirmed COVID-19 cases, and during which many individuals in Rhode Island experienced a change in work environment from on-site to remote (if and when possible) and/or

shutdowns at their place of employment. April 12th until the final date in our dataset (July 28) was considered the “plateau phase” during which individuals had adjusted to COVID-19 restrictions and limitations. It was also during this period that there was a national and local reopening of retail and other services that had previously been closed.

### Clinic Procedures

Prior to the COVID-19 pandemic, the PrEP clinic offered in-person appointments only. During the pandemic, the clinic shifted to telehealth visits for PrEP appointments with in-person appointments being limited and scheduled on an as needed basis based on clinical judgement. Patients scheduled to be seen for an in-person appointment were called by clinical staff and were screened for COVID-19 via a phone-based symptom screening protocol prior to their appointment. The rapid shift to telehealth helped maintain PrEP clinical care. As part of routine PrEP care, providers asked patients about the items reported within this manuscript including symptoms, adverse effects, psychosocial functioning, substance use, and medication adherence.

### Measures

Psychosocial functioning was operationalized as depressive symptoms, alcohol use, and substance use. Depressive symptoms were screened using the patient health questionnaire-2 (PHQ-2), which is a two-item depression screener that assesses the frequency of low mood and anhedonia over the past two weeks. Each item ranges from 0—not at all, to 3—nearly every day. Total scores range from 0 to 6, with scores greater than or equal to 3 indicating a positive screen for depression [21]. Problematic alcohol use was assessed by the alcohol use disorders identification test (AUDIT-C), which is a 3-item alcohol screen that helps identify individuals with problematic alcohol use and specifically assesses frequency and quantity of drinking. Each item is ranked on a scale of 0–4 points, with a higher number of points indicating more problematic drinking. Total scores range from 0 to 12 and a score above 4 or more in men is considered as a positive screen for a potential alcohol use disorder [22]. Substance use was assessed by the following question for each substance “Do you use substances? Yes/No.” The following substances were collapsed into the category “party drugs”: crystal methamphetamine, cocaine, ecstasy/MDMA/Molly, and gamma hydroxybutyrate (GHB). Heroin and prescription opioid medications were collapsed into the category opioids. We also assessed medication adherence to PrEP by two questions: *How many doses of PrEP did you miss in the past week?* *How many doses of PrEP did you miss in the past 30 days?* The higher the number of missed doses the lower the adherence.

### Statistical Analyses

Descriptive statistics were used to characterize the sample. Mixed effects modeling was used to examine between and within persons’ change over time across multiple outcomes (e.g. PrEP adherence, sex behaviors, alcohol and substance use, and depressive symptoms). Generalized linear mixed models were used for continuous outcomes and logistic mixed-effect models were used for binary outcomes. Directed acyclic graphs and a priori knowledge were used to determine covariates. An alpha of 0.05 was used as the cutoff for significance. All analyses were conducted in Stata 15.0 (StataCorp LP, College Station, Texas).

## Results

### Sample Characteristics

Of 177 patients included in the sample, the median age was 37 (interquartile range (IQR) 30, 51). The median number of PrEP visits was 5 (IQR 3, 8). The patients included in the study sample were largely representative of the clinic population and identified as White (73.0%), Black/African American (9.2%), and Other race (17.2%), and 11.8% of the sample identified as Hispanic/Latino. Most patients had a college degree or above (73.5%). The median income was \$50,000 (IQR 34,000–\$80,000). With regards to sexual behavior, at their initial clinic visits, 78.5% reported engaging in condomless anal sex, 29.9% reported having 5 partners or more in the past 30 days, and 15.9% reported sex with known HIV positive partners. With regards to psychosocial health, 32.8% endorsed a history of a mental health condition. In the time period observed for the current study only 3.1% screened positive on the PHQ-2. Approximately 64.8% of MSM endorsed drinking behavior that could be problematic based on their AUDIT-C score. Approximately 46.6% reported drug use in their lifetime, but few reported current drug use (7.2%), with most reporting stimulants or other “party drug” use (e.g. inhalants, GHB). None reported opioid use.

### Changes in Sexual Behavior

In the generalized linear mixed effect models, we explored changes in sex behaviors and PrEP adherence during different phases of COVID-19. On average, PrEP patients reported 2.72 fewer sexual partners (95% CI –4.04, –1.40;  $p < 0.001$ ) during the plateau phase compared to the pre-COVID-19. Patients also reported 1.66 fewer oral sex partners (95% CI –3.07, –0.25;  $p = 0.02$ ) during the emerging phase and 2.88 fewer oral sex partners (95% CI –4.01, –1.75;  $p < 0.001$ ) during the plateau phase.

Importantly, they also reported 1.65 fewer condomless anal sex partners (95% CI  $-2.78, -0.53$ ;  $p=0.004$ ) during the plateau phase. The median number of sexual partners during the plateau phase dropped to one, representing a statistically significant reduction in the average number of sex partners [median = 1, (IQR 1,3),  $p < 0.001$ ].

### Changes in Psychosocial Functioning: Adherence, Mood, and Alcohol Use

We did not observe any significant difference in PrEP adherence, depression, or alcohol use over time. We conducted a secondary analysis to look more closely at behaviors of those who endorsed heavy drinking and found that there was a significant positive association between heavy alcohol use and sexual partners. Those with a positive AUDIT-C screen reported, on average, a significantly larger number of sexual partners [Beta coefficient = 1.26, 95% CI (0.20, 2.32),  $p=0.02$ ]. Too few individuals in the sample reported substance use to examine the effects on sexual partners or behavior. For full model results, see Table 1.

## Discussion

This is among the first studies to evaluate sexual behavior and psychosocial functioning among MSM engaged in PrEP care during the COVID-19 pandemic. We observed significant decreases in the number of sexual partners reported by MSM engaged in PrEP care during both the emerging and plateau stages of COVID-19, compared to baseline levels. This was true for oral sex partners, anal sex partners, and condomless sex partners. However, the number of condomless sex partners was not significantly decreased at the plateau stages, indicating that decreases observed in other phases may be better accounted for by overall decreases in sexual partners. We did not observe significant worsening of PrEP adherence, depression, or alcohol use over the time periods observed. The limited number of PrEP patients who reported current drug use prevent us from conducting any meaningful analyses on changes in substance use behavior.

Our findings can be contextualized within several studies conducted using online convenience samples of MSM during the pandemic which have explored self-reported sexual behavior and associations with mental health and substance use. Findings have been mixed. For example, early in the pandemic, several studies showed that MSM reported fewer sexual partners and decreases in sexual HIV transmission behavior [23–25]. A different study based in the U.S. found MSM continued to report high levels of sexual activity, substance use, and binge drinking during the pandemic [26]. In our sample, we observed decreases in the number of sexual partners; however, we did not collect data on frequency of

sexual behavior with each partner. Thus, it is possible that individuals in our sample were still engaging in similar levels of sexual behavior, but with fewer partners. If true, this would be consistent with public health recommendations to limit the number of social contacts to reduce the spread of SARS-CoV-2 throughout the population [27].

Our findings for alcohol and depression were counterintuitive. As a group, individuals in our sample did not report depressive symptoms or heavy alcohol use at higher rates during COVID-19 at rates higher than pre-COVID-19. However, we did find that individuals who were heavy alcohol users (based on AUDIT-C scores) reported more sexual partners. This finding is consistent with prior studies demonstrating strong relationships between alcohol consumption, sexual behavior, and potential for HIV transmission [28–30]. A study conducted by Starks and colleagues (2020) during the pandemic observed amplified relationships between substance use and sexual behavior during the pandemic such that individuals who are using substances are also engaging in higher risk sexual behaviors [31]. According to cognitive behavioral treatment models, substance use and sexual behavior can be broadly conceptualized as “avoidance behaviors” used to cope with negative affective states characteristic of emotional disorders [32]. Both substance use and sex provide short-term relief for feelings of loneliness, depression, and anxiety; all of which have been noted to be on the rise during the COVID-19 pandemic [33, 34]. However, within this sample, we did not observe higher levels of depression or alcohol use over time.

Our study strengths must be interpreted in light of the limitations. Patients self-reported number of sexual partners, which is subject to the typical limitations of retrospective self-report. We recognize that social desirability bias and demand characteristics may have affected accurate reporting of mental health symptoms and substance use behavior in a medical clinic setting. Additionally, in order to make comparisons over time, we restricted analyses to those patients who had completed at least two visits across the three phases of interest. However, that also means that we may have selected for a more highly engaged group of patients. This may be one possible explanation for not observing changes in mood or alcohol is that those that were presenting to care were functioning well and those whose mood or alcohol has worsened may not present to care. This is substantiated by prior research demonstrating the impact of mood and substance use on poor engagement in health care [35] including sexual health and HIV related care [36].

In conclusion, on average, patients in our sample reported fewer sexual partners in the emerging and plateau phases of COVID-19 compared to prior to COVID-19. Of note, in the plateau phase, the median number of sexual partners patients reported was one. Reducing the number of sexual partners likely reduced the number of social contacts individuals

**Table 1** Mixed effect models to assess sexual behavior, PrEP adherence, depressive symptoms, and alcohol use over time

COVID-19 phase	Median (IQR)	Crude beta coefficient and 95% confidence interval (CI)	P value	Adjusted beta coefficient and 95% CI	P value
<b>Total number of sex partners</b>					
Pre-COVID-19	3 (2,5)	Reference			
Emerging	3 (1,4)	− 0.60 (− 2.15, 0.96)	0.45	− 0.77 (− 2.42, 0.87)	0.35
Plateau	1 (1,3)	− 2.60 (− 3.87, − 1.35)	<0.001	− 2.72 (− 4.04, − 1.40)	<0.001***
<b>Total number of oral partners</b>					
Pre-COVID-19	4 (2,7)	Reference			
Emerging	3 (2,4)	− 1.23 (− 2.56, 0.11)	0.07	− 1.66 (− 3.07, − 0.25)	0.02*
Plateau	2 (1,3)	− 2.45 (− 3.52, − 1.36)	<0.001	− 2.88 (− 4.01, − 1.75)	<0.001***
<b>Total number of condomless anal sex</b>					
Pre-COVID-19	2 (1,4)	Reference			
Emerging	2 (1,3)	0.01 (− 1.27, 3.29)	0.99	− 0.29 (− 1.65, 1.00)	0.67
Plateau	1 (1,2)	− 1.34 (− 2.41, − 0.26)	0.02	− 1.65 (− 2.78, − 0.53)	0.004***
<b>No. of missing doses in the previous week</b>					
Pre-COVID-19	0 (0,0)	Reference			
Emerging	0 (0,0)	0.01 (− 0.27, 0.29)	0.94	0.05 (− 0.24, 0.35)	0.81
Plateau	0 (0,0)	− 0.11 (− 0.34, 0.11)	0.32	− 0.09 (− 0.33, 0.14)	0.43
<b>No. of missing doses in the previous month</b>					
Pre-COVID-19	0 (0,1)	Reference			
Emerging	0 (0,1)	− 0.17 (− 1.27, 0.94)	0.77	− 0.0004 (− 1.16, 1.16)	0.99
Plateau	0 (0,1)	− 0.63 (− 1.52, 0.26)	0.17	− 0.54 (− 1.46, 0.39)	0.26
COVID-19 phase	Positive screen for depression (N)	Crude odds ratio (cOR) and 95% confidence interval (CI)	P value	Adjusted odds ratio (aOR) and 95% CI	P value
<b>Screened depression (PHQ-2)</b>					
Pre-COVID-19 <sup>a</sup>	7	Reference			
Emerging <sup>b</sup>	2	0.79 (0.15, 4.09)	0.78	0.52 (0.16, 4.29)	0.81
Plateau <sup>c</sup>	3	0.38 (0.09, 1.57)	0.18	0.38 (0.09, 1.58)	0.18
<b>Screened drinking problem (AUDIT-C)</b>					
Pre-COVID-19 <sup>d</sup>	101	Reference			
Emerging <sup>e</sup>	57	1.13 (0.50, 2.60)	0.76	0.81 (0.35, 1.89)	0.63
Plateau <sup>f</sup>	80	0.76 (0.40, 1.44)	0.40	0.72 (0.38, 1.38)	0.32

<sup>a</sup>20 patients had missing values<sup>b</sup>5 patients had missing values<sup>c</sup>5 patients had missing value<sup>d</sup>19 patients had missing value<sup>e</sup>19 patients had missing value<sup>f</sup>4 patients had missing value\* $p < .05$ , \*\*\* $p < .005$ 

had, which was consistent with public health messaging during this time. We observed relatively few individuals in our sample endorsing high rates of depressive symptoms or substance use, although we acknowledge that this was an engaged sample of patients and those who are experiencing more psychosocial challenges may not be represented in this data set. Practice implications involve continuing to screen those who do present for care and reaching out to patients who may have fallen out of care during COVID-19, as they

may be those at highest risk for behavioral health and sexual health consequences of the pandemic.

**Author contributions** All authors contributed to the conception of the paper idea. BGR wrote the initial draft of the manuscript. SCD and JT contributed to the writing. JT conducted analyses. All authors reviewed the final manuscript.

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## Declarations

**Conflict of interest** MM and BGR receive funding from Gilead Sciences Grant #IN-US-276-5463. There are no other relevant financial or non-financial interests to disclose.

**Ethical approval** Approval was granted for review of de-identified clinical data by the Institutional Review Board at The Miriam Hospital.

**Consent to participate** A waiver of consent was granted for review of de-identified clinical data for research purposes.

**Consent for publication** A waiver of consent was granted for review of de-identified clinical data for research purposes.

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