



Published in final edited form as:

*J Acquir Immune Defic Syndr.* 2021 November 01; 88(3): 261–271. doi:10.1097/QAI.0000000000002770.

## COVID-19 related stressors, sex behaviors, and HIV status neutral care among Black men who have sex with men and transgender women in Chicago, USA

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### Abstract

**Background**—COVID-19 has disproportionately impacted vulnerable populations, including Black men who have sex with men (BMSM) and transgender women (BTW). We investigated associations of COVID-19 stressors and sex behaviors with pre-exposure prophylaxis (PrEP) and antiretroviral therapy (ART) among BMSM and BTW.

**Methods**—As part of the Neighborhoods and Networks (N2) study, we conducted virtual interviews during peak COVID-19 infectivity in Chicago among BMSM and BTW (April–July 2020). Survey questions included multi-level COVID-19 stressors, sex behaviors, and current PrEP/ART use and access. Poisson regressions were used to examining relationships between COVID-19 stressors, sex behaviors, and PrEP/ART use/access.

**Results**—Among 222 participants, 31.8% of participants not living with HIV reported current PrEP use and 91.8% of participants living with HIV reported ART use during the pandemic. Most (83.3% and 78.2%, respectively) reported similar or easier PrEP and ART access during the pandemic. Physical stress reaction to COVID-19 (aPR=2.1; CI 1.3–3.5) and being in close proximity with someone diagnosed with COVID-19 (aPR=1.7; CI 1.1–2.8]) were associated with current PrEP use. Intimate partner violence (aPR=2.7; CI 1.0–7.2) and losing health insurance (aPR=3.5; CI 1.1–10.7) were associated with harder ART access. Travel-related financial burden

was associated with harder access in PrEP (aPR=3.2; CI 1.0–10.1) and ART (aPR=6.2; CI 1.6–24.3).

**Conclusion**—Multiple COVID-19 stressors were found to interfere with PrEP and ART use and access among BMSM and BTW. Contextually relevant strategies (e.g., promoting telehealth, decreasing transportation burden) to address COVID-19 stressors and their sequelae should be considered to minimize disruption in HIV biomedical interventions.

### Keywords

COVID-19; Black; men who have sex with men; transgender women; HIV pre-exposure prophylaxis; HIV antiretroviral therapy

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### Introduction

COVID-19 has disproportionately impacted racial and ethnic minority groups. According to the U.S. Centers for Diseases Control and Prevention (CDC), at the time of this writing, Black people account for 14.6% of COVID-19 deaths and 26.7% of COVID-19 associated hospitalization in the U.S. while Black people only comprise 12.7% of the U.S. population.<sup>1,2</sup> The stark disparities in COVID-19 hospitalizations and deaths among Black people reflect the racist structures that impede engagement of health and social services among disadvantaged populations. Less is known about the impacts of COVID-19 on racial and sexual minority groups, although other disparities research has shown that public health problems are often compounded in people with multiple minority statuses, including BMSM (Black men who have sex with men) and BTW (Black transgender women) that bear the heaviest burden of HIV in the U.S.<sup>3–5</sup>

Uptake of and adherence to HIV biomedical interventions, including pre-exposure prophylaxis (PrEP) and antiretroviral therapy (ART) among BMSM and BTW have been sub-optimal due to social and structural inequities in the U.S.<sup>6–8</sup> These inequities in HIV biomedical interventions have been further exacerbated during the COVID-19 pandemic, especially for populations who are at higher risk for HIV.<sup>9–12</sup> A recent study in the U.S. found that more than 80% of the HIV clinics were either partially or completely interrupted during the COVID-19 pandemic, and this interruption was most severe in areas with lower insurance coverage.<sup>10</sup> The HIV care interruption has disproportionately impacted racial minority MSM during the pandemic. In a global sample of MSM in April to May 2020, there was a significantly higher number of racial and ethnic minority MSM who reported experiencing difficulty in accessing HIV care compared to non-minority MSM.<sup>9</sup>

The multiple minority identities and the long history of residential segregation have caused substantial stresses that put BMSM and BTW in a particularly vulnerable position in the COVID-19 pandemic in the U.S. In a sample of HIV-positive Black individuals in Los Angeles county, Bogart et al. found that 29% of participants reported not being able to pay bills or rent, 25% reported having transporting difficulties due to decreased access to public transportation, and 19% reported not having enough food to eat.<sup>13</sup> Additionally, mobility data have shown that Black residents of Chicago's south side still needed to leave their homes (e.g., because they are low wage workers, often deemed "essential"),

lived in multigenerational working-class households, and were especially vulnerable to COVID-19.<sup>14</sup> Black individuals are not only experiencing elevated economic insecurity, but they are also experiencing substantial barriers to COVID-19 related health services such as COVID-19 testing and COVID-19 vaccination. Based on the recent Kaiser Family Foundation analysis, during the first month of COVID-19 vaccine rollout in the U.S., Black individuals were vaccinated at a significantly lower rate than White individuals across 12 states.<sup>15</sup> Socioeconomic deprivation, structural racism, and the inequities in COVID-19 prevention and care have collectively led to devastating effects on BMSM and BTW in Brazil.<sup>16</sup> However, limited research has paid particular attention to the COVID-19 stress among BMSM and BTW who are confronting both the HIV epidemic and the COVID-19 pandemic under racialized systems, and how COVID-19 stress has impacted their HIV care engagement.

Changes in sex behaviors during the pandemic may be associated with changes in PrEP use.<sup>11,16,17</sup> Recent studies conducted among Australian gay and bisexual men found that not having sex with casual partners was significantly associated with discontinued PrEP use during the pandemic.<sup>11,17</sup> While less attention has been paid to COVID-19 stress among BMSM and BTW, even less research has examined how sex behaviors may be associated with PrEP use during the pandemic among BMSM and BTW. Discontinuation of PrEP use may be a sensible outcome from reducing sexual activities with casual sex partners or reducing numbers of sex partners.

The current study focuses on the impact of the pandemic in a cohort of BMSM and BTW, which are the populations experiencing profound health inequities that are likely to result in increased HIV infection and worse COVID-19 sequelae. The purpose of this study is to provide data specifically for BMSM and BTW on COVID-19 stress, sex behaviors, and HIV status neutral engagement (i.e., PrEP and ART engagement) during the pandemic. Additionally, we examined whether COVID-19 stress and sex behaviors were associated with engaging in care among BMSM and BTW. We used an HIV status neutral framework based on a person-first approach to the current HIV care environment regardless of an individual's HIV status.<sup>18</sup>

## Methods

### Sample and Data Collection

As part of the ongoing Neighborhoods and Networks (N2) cohort study in Chicago,<sup>19,20</sup> we collected data through a COVID-19 check-in survey among BMSM and BTW in the Chicago metropolitan area between April and July 2020, the peak of COVID-19 infectivity in Chicago to date. This COVID-19 check-in survey was developed by the Chicago Center for HIV Elimination (CCHE) and the Spatial Epidemiology Lab at Columbia University in late March 2020 when the “shelter-in-place” order was announced (March 21, 2020) and all N2 in-person data collection was halted. The N2 study team contacted all participants who completed the N2 baseline survey (February 2018 - October 2019) based on a random order through a variety of contact modes, including calling, texting, emailing, Facebook contact, and network proxy contact (participants provided contact information for friends or trusted persons in baseline data collection).

We conducted virtual 40-minute video interviews through Zoom to approximate in-person interviews. None of the participants rejected the interview due to limited Internet and mobile phone/device access. Participants were able to hear all choices before answering questions, received clarification as needed, and maintained focus on the survey task throughout the video interview process. By implementing this level of cooperation and attention, we were able to elicit accurate answers and overcome literacy issues. To minimize the potential video interview bias caused by the observable characteristics of the interviewer (e.g., social class), the interviewers were asked to dress neutrally and have a neutral interviewer video background, such as a blank wall or virtual Zoom background. Use of the neutral background is particularly pertinent, as many interviewers connect via Zoom within their own home, which increases exposure to class and other demographic indicators than an interview at a study site. We provided compensation of USD 35 through PayPal, Venmo, or CashApp. Staff delivered reimbursements in person directly to participants who did not have access to these applications.

Interviewers went through a list of resources with the participants and then shared the links with them for future use. Participants were directed to the CCHE resources and COVID-19 hotline for additional help and (e.g., mental health services, domestic violence agencies, and housing support).

The Institutional Review Board (IRB) approval has been obtained for all study procedures at the University of Chicago.

## Measures

### Outcomes

**HIV status neutral care outcomes:** We examined the outcomes by participants' HIV status. HIV status for the current study was determined by baseline diagnostic testing data and the self-reported data during the COVID-19 check-in survey. Participants who tested positive for HIV at baseline or who self-reported HIV positive were defined as HIV positive; participants who tested negative for HIV at baseline and self-reported HIV negative were defined as HIV negative. For participants not living with HIV, we asked, "Are you currently on PrEP?" For participants living with HIV, we asked, "Do you take any HIV medication?" We did not require HIV testing for participants during the COVID-19 check-in survey. Therefore, for participants living with HIV, we used self-reported data on ART use and were unable to assess their current viral suppression status.

**Access to HIV status neutral care outcomes:** The second set of outcomes for the study was access to HIV status neutral care during the pandemic. For participants with HIV-negative status, we asked, "Since the shelter-in-place order, has getting access to PrEP been harder, easier, or just the same as usual?" For participants living with HIV, we asked, "Since the shelter-in-place order, has getting access to your HIV medications been harder, easier, or just the same as usual?"

## Independent variables

**COVID-19 related stressors:** Based on the NIH repository of COVID-19 research tools, we developed questions on COVID-19 related stressors at different levels. At the *individual level*, we asked about physical stress reactions to social distancing, loss of income or work, concerns about infection in the past 14 days (“On how many of the past 14 days have you had a physical stress reaction to social distancing, loss of income or work, concerns about infection or other problems or worries related to COVID-19?”); thinking one has been infected with COVID-19 (“Do you think you’ve been infected with COVID-19?”); travel-related financial burden due to the shelter-in-place order (“Since the “shelter in place order”, how much of a financial burden has your travel been for you?”); economic hardships (i.e., loss of income [“Have you lost an income source because of the COVID-19 pandemic?”], loss of health insurance [“Have you lost health insurance because of the COVID-19 pandemic?”], and food insecurity since the shelter-in-place order [“Since the “shelter in place” order, have you had enough food?”]). At the *interpersonal level*, we asked about the number of days receiving emotional, material, or financial support from friends or loved ones in the past week; whether friends or loved ones experienced COVID-19 symptoms; being in close proximity to anyone diagnosed with COVID-19 in the past two weeks; whether knowing someone personally has been diagnosed with COVID-19; the perceived likelihood of having had sex with someone that had COVID-19; whether one had experienced intimate partner violence (IPV) since the “shelter-in-place” order. At the *structural level*, we asked about housing insecurity (i.e., loss of a place to stay due to the COVID-19 pandemic); level of concern about the COVID-19 pandemic in their neighborhoods in the past 14 days. The N2 study team developed a comprehensive list of COVID-19 related stressors. However, due to the small sample size stratified by HIV status, we have dropped some of them in the current analysis.

**Sex behaviors:** We asked about the number of sex partners in the past 14 days, changes in the frequency of sex with a casual sex partner during the pandemic, changes in the frequency of sex experiences with others using voice calls, messaging, or video chat during the pandemic, and changes in the frequency of masturbating during the pandemic.

**Covariates**—Based on our previous work on HIV care engagement among young BMSM and BTW,<sup>192021</sup> we controlled for several social demographic variables that were considered to be associated with the COVID-19 related stressors, sex behaviors, and PrEP/ART use outcomes. We controlled for social demographic variables assessed at the baseline N2 survey (February 2018-October 2019): age, sexual orientation, employment status, annual income, relationship status, housing stability, PrEP use, and ART use on a per outcome basis. We additionally controlled for the survey assessment period defined by the Illinois reopening phases, where June 2 and before represents the “shelter-in-place” order period and phase 1 (March 21, 2020-April 30, 2020)/phase 2 (May 1, 2020-June 2, 2020), and June 3 and after represents phase 3 (June 3, 2020-June 25, 2020)/phase 4 (June 26, 2020 and after). Due to the small sample size after stratification by HIV status, we did not control for gender identity and baseline educational attainment in any of the regression models. Per outcome, we did not control for the variables that had a cell size of less than two in the tabulation with

the outcome in the subsequent regression models, except for sexual orientation which was included in all models.

## Analysis

We excluded 4 participants due to missing HIV status information, yielding a 222 total sample size for the current study. Descriptive statistics of the COVID-19 stressors, sex behaviors, and HIV status of neutral care outcomes (i.e., PrEP use for participants not living with HIV and ART use for participants living with HIV) were summarized. Chi-square or Fisher's exact statistics were used to examine if the COVID-19 stressors, sex behaviors, and HIV status of neutral care outcomes differ between the reopening phases. Univariable and multivariable robust Poisson regressions were stratified by participants' HIV status to calculate prevalence ratios, where multivariable models with covariates included each variable of interest separately to increase the degrees of freedom, decrease multicollinearity, and to guide intervention. We conducted four robust Poisson regression models, one for each status of neutral outcomes (i.e., PrEP use, access to PrEP, ART use, access to ART).<sup>22</sup> For PrEP use and ART use outcomes, we examined the associations of each COVID-19 stressor and sex behavior with the outcomes. For access to PrEP and ART outcomes, we examined the associations of each COVID-19 stressor and the outcomes. We examined the association of each independent variable with the outcome due to multicollinearity and greater degree of freedom. Variables of interest with zero cells in the tabulation with the outcome were not included for analysis. The significance level was set at  $p < 0.05$ . All analyses were conducted using STATA 15.

## Results

Within the study sample, 59.5% were HIV-negative and 40.5% were HIV-positive (Table 1). Overall, 31.8% of participants with HIV-negative status reported current use of PrEP and 91.8% of participants living with HIV reported ART use during the N2 COVID-19 check-in survey (Table 2). 83.3% and 78.2% reported similar or easier access to PrEP and ART since the shelter-in-place, respectively. Almost four-fifths of study participants reported having no or one sex partner, and more than half reported having casual sex partners less frequently since the shelter-in-place order. Our study participants experienced substantial socioeconomic hardships during the COVID-19 pandemic. Since the shelter-in-place order, about 55.9% of study participants reported a loss of income, 8.7% reported a loss of health insurance, 12.6% reported a loss of housing, and 19.9% reported food insecurity. PrEP/ART use, access to PrEP/ART, COVID-19 stressors, and most sex behaviors were not significantly different between the reopening phases (i.e., shelter-in-place order period versus post-shelter-in-place order period) except for non-physical sex and masturbation. During the shelter-in-place order period, 26.3% reported more frequent sexual experiences with others using voice calls, messaging, or video chat compared to the pre-pandemic period. This number significantly decreased to 14.4% during the post-shelter-in-place order period. We observed the same pattern for the frequency of masturbation (53.3% vs. 37.7% reported engaging in more masturbation during and post the shelter-in-place order period, respectively).

Table 3 shows the unadjusted and adjusted associations of COVID-19 stress and sex behaviors with PrEP and ART use. After adjusting for baseline sociodemographic variables, baseline PrEP use, and reopening phases for survey completion, participants were more likely to use PrEP currently if they reported having physical reactions (e.g., sweating, pounding heart) to worries or problems related to COVID-19 (aPR=2.1 [95% CI 1.3–3.5]) and if they reported being in close proximity to a person who had been diagnosed with COVID-19 (aPR=1.7 [95% CI 1.1–2.8]). There were no COVID-19 stress and sex behaviors significantly associated with ART use among participants living with HIV.

Table 4 shows the unadjusted and adjusted associations of COVID-19 stress and sex behaviors with access to PrEP and ART. After adjusting for covariates, financial travel burden since the shelter-in-place was significantly associated with perceived difficulty in accessing PrEP (aPR=3.2 [95% CI 1.0–10.1]) and ART (aPR=6.2 [95% CI 1.6–24.3]) for participants with HIV-negative status and participants living with HIV, respectively. Among participants living with HIV, exposure to IPV since shelter-in-place (aPR=2.7 [95% CI 1.0–7.2]) and losing insurance (aPR=3.5 [95% CI 1.1–10.7]) were associated with greater perceived difficulty in accessing ART when controlling for covariates.

## Discussion

This study is among the first to present data specifically on COVID-19 stress, sex behaviors, and PrEP or ART use among BMSM and BTW during the COVID-19 pandemic. Almost one-third of participants with HIV-negative status were currently using PrEP and more than nine-tenths of participants living with HIV were using ART during the COVID-19 pandemic. Our study participants experienced a significant amount of stress due to the pandemic at the individual, network, and structural levels. Most of the study participants had no sex partner or only one sex partner since the start of the pandemic. Participants with HIV-negative status who had physical stress reactions to COVID-19 and were in close proximity with someone who was diagnosed with COVID-19 were more likely to use PrEP. Having financial travel burden was associated with more difficulties in accessing PrEP and ART. Participants living with HIV who experienced IPV and lost health insurance found more difficulties in accessing ART during the pandemic.

Similar to a recent study using a global online sample of MSM,<sup>9</sup> our participants continued to engage in HIV prevention and care (i.e., the prevalence of current PrEP use and ART use before and during the peak of the pandemic were similar based on the N2 baseline and N2 COVID-19 check-in surveys). This finding is encouraging, suggesting that the high-quality health care services for BMSM and BTW that have been recently introduced in Chicago have been providing accessible HIV health services to these particularly vulnerable groups even during the pandemic. At the time when the N2 COVID-19 study was implemented, the study team partnered with two health clinics that provided a wide range of healthcare services (e.g., COVID-19 testing, HIV/STI testing and care, prescription drop-off) and supportive services (e.g., social and financial services, clinical and specialized referrals) to BMSM and BTW in the south side Chicago.<sup>23,24</sup> Adaptation for care services (e.g., telehealth) among vulnerable populations who are at increased risk for HIV is key to continue HIV care engagement during the pandemic. However, we should note that even

more than 90% of participants living with HIV reported ART use during the peak of the pandemic, one-fifth of them reported having harder access to ART during the same period. Structural intervention is needed to scale up and incorporate structure barriers to HIV care (e.g., transportation burden, prescription pick-up).

Similar to other studies conducted among sexual minority men, we observed a substantial reduction of sex contacts among our study participants during the pandemic.<sup>16,17,25–29</sup> In our sample, only 3.6% reported having sex with casual sex partners more frequently and almost two-fifths of respondents reported having no sex partner since the start of the pandemic. Contrary to recent studies on the association between sex behaviors and PrEP use among white people,<sup>11,17</sup> we did not find significant associations between changes in sex behaviors with PrEP and ART use. The non-significant association between decreased sexual activities and PrEP use in our sample may be due to the reduced power with a limited sample size. It may also reflect the fact that BSM and BTW are at an elevated risk for HIV acquisition not because of their individual behaviors but because of the broader structural forces (e.g., stigma, access to care) that continue unabated. Changes in sex behaviors during the COVID-19 pandemic may be tied to situational and structural factors.<sup>27,30,31</sup> Future research is warranted to understand how the COVID-19 pandemic influences sex behaviors among BSM and BTW, and how the changes in sex behaviors may impact their risk for HIV infection.

Having had a physical stress reaction to social distancing, loss of income or work, or concerns about infection and having close contact with someone confirmed with COVID-19 were significantly associated with PrEP use. The observed relationship between physical stress reactions and concerns about COVID-19 with PrEP use may reflect a subgroup of BSM and BTW who had a higher perception of the severity of COVID-19 and HIV infection. Additionally, BSM and BTW may have a false understanding regarding the role of PrEP during the COVID-19 pandemic. In an online survey among MSM in Brazil and Portugal, one-eighth of respondents reported that they were taking PrEP to prevent COVID-19 infection.<sup>32</sup> Some MSM may believe that PrEP use could against COVID-19 infection through a similar mechanism whereas PrEP can prevent HIV infection,<sup>33</sup> however, this is likely a sentiment that was more popular earlier in the epidemic and less of a contemporary belief.

Similar to the previous reports on increasing IPV victimization among general populations in Australia and Italy,<sup>34,35</sup> we found a troubling high level of IPV among BSM and BTW. Since the start of the pandemic, nearly two-fifths of our study participants reported they were experiencing any form of IPV, including emotional, sexual, or physical violence. Furthermore, BSM and BTW living with HIV who experienced IPV were more likely to have difficulties in accessing ART during the pandemic. A recent study conducted among sexual minority men in the US indicated that one-eighth of sexual minority men reporting IPV victimization and almost half of the victims reported that the occurrence was their first-time experience.<sup>36</sup> These results warrant future public health research and intervention on increasing public awareness for the risk of IPV among BSM and BTW. Developing intervention strategies on increasing social protection and ensuring access to health and supportive services are particularly urged.<sup>37</sup>

Loss of health insurance due to the pandemic had a significant impact in accessing ART among participants living with HIV. In the U.S., under the Ryan White HIV/AIDS Program (RWHAP), people living with HIV can receive medical and other social services at no cost. Although ART cost-related concern for participants living with HIV is minimal, loss of health insurance may reflect other financial barriers (e.g., unemployment, lack of transportation) or lack of access to health care that our participants experienced during the peak of the pandemic.<sup>38,39</sup> Timely health and social services should be made available for BMSM and BTW (e.g., peers/patient navigator services) and be further incorporated in the telehealth services.

Our findings are subject to limitations. First, PrEP and ART use was based on self-report in the current study and were subject to social desirability bias. We were not able to measure viral suppression through lab testing on the viral load level due to the shelter-in-place order for people living with HIV.<sup>19</sup> However, past research indicates that self-report HIV care engagement measures correlated with pharmacologic measures.<sup>40,41</sup> Furthermore, the virtual interviews were conducted through “face-to-face” videos by highly trained interviewers from a professional survey center at the University of Chicago. The social desirability bias was minimized through such an interview method. Second, as only 20 of the 222 (9%) of the study participants were BTW, we grouped them with BMSM as we used common recruitment. It is unclear how the results would be generalized to the larger BMSM and BTW populations outside Chicago. Recruiting highly stigmatized populations such as BTW and BMSM has been challenging. However, we used respondent-driven sampling (RDS) approach to reach these highly marginalized populations in N2 and yielded a population-based sample that reflects the local context in Chicago. Third, only about 54% of the participants who had completed the baseline survey in the N2 cohort had completed the N2 COVID-19 study. By design, while participants not living with HIV continue to engage in the longitudinal N2 study every six months, participants living with HIV only engaged in the baseline survey. As a result of the limited engagement with participants living with HIV since the baseline survey, the response rate for participants living with HIV (44.1%) is lower than participants not living with HIV (65.9%) and the generalizability of the study may be limited. Finally, changes in behaviors, anxieties, and access to care may have been affected by the murder of George Floyd and the resulting community response, police brutality, and resulting closures in many establishments including pharmacies in Chicago during this difficult period.

## Conclusions

Our study is one of the first studies to examine the impact of COVID-19 on HIV status neutral care use outcomes among a cohort sample of BMSM and BTW, and among the first to examine the associations between COVID-19 stress and sex behaviors along the status neutral continuum. Our results identified several important future areas of research that address social and health inequities in HIV care engagement and COVID-19 sequelae. We must continue to build services and foster growth and opportunity for BMSM and BTW in real-time, as the structural forces expose the weakness of biomedical interventions and tools (e.g., telehealth) that can only be implemented successfully after core human functions and dignity are addressed.

## Acknowledgments

The authors have no conflict of interest to disclose regarding this paper. This study was supported by NIH grant R01MH112406-05, R03 DA053161-01A1, and CDC grant U01PS005122.

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**Table 1.**

Sociodemographic characteristics, PrEP and ART use, and HIV status among young BMSM and young BTW in Chicago, the N2 COVID-19 check-in survey (April to July, 2020)

	N(%)
<b>COVID-19 check-in survey variables<sup>a</sup></b>	
Age at COVID-19 check-in survey (mean, SD) <sup>b</sup>	27.9 (4.1)
HIV status <sup>c</sup>	
Negative	132 (59.5)
Positive	90 (40.5)
<b>Baseline survey variables<sup>d</sup></b>	
Gender	
Male	196 (88.3)
Trans Feminine	20 (9.0)
Other	6 (2.7)
Sexual Orientation	
Bisexual	61 (27.5)
Gay	129 (58.1)
Straight/other	32 (14.4)
Relationship Status	
Single	135 (61.6)
In a relationship	84 (38.4)
Educational attainment	
High school or above	199 (89.6)
Less than high school	23 (10.4)
Employment status	
Employed or Student	138 (62.2)
Unemployed	84 (37.8)
Annual Income	
< \$20,000 USD	140 (63.1)
\$20,000 USD	82 (36.9)
Stable Housing in the past 3 months	
No	60 (27.0)
Yes	151 (68.0)
Baseline PrEP use among HIV negative participants <sup>e</sup>	48 (37.5)
Baseline ART use among HIV positive participants <sup>f</sup>	55 (88.7)

<sup>a</sup>COVID-19 check-in survey was conducted between April and July 2020

<sup>b</sup>Age was calculated based on the baseline survey to reflect the current age at the time of the COVID-19 check-in survey

<sup>c</sup>HIV status was measured by baseline HIV testing data and the COVID-19 check-in survey self-reported data. Participants with a negative HIV testing result at baseline and self-reported HIV positive at the COVID-19 check-in survey were considered as HIV-positive.

<sup>d</sup> Sociodemographic characteristics were only asked during the baseline survey (2018–2019)

<sup>e</sup> HIV-negative at follow-up (n=128); 4 participants not living with HIV were missing in baseline PrEP information and excluded from the calculation

<sup>f</sup> HIV-positive at baseline (n =62)

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**Table 2:**

COVID-19 stress, sex behaviors, and PrEP/ART use and access among BMSM and BTW in Chicago, the N2 COVID-19 check-in survey (April to July 2020)

	Overall (n = 222)	Time of Participant Interview		P-value
		Shelter-in-place / Phase 1/ Phase 2 (April 20 – June 2) (n = 76)	Phase 3/ Phase 4 (June 3 – July 31) (n = 146)	
<b>PrEP/ART outcomes during COVID-19 check-in survey</b>				
Current PrEP use (yes) <sup>a</sup>	42 (31.8%)	17 (38.6%)	25 (28.4%)	0.23
Access to PrEP since shelter in place order <sup>a</sup>				0.69
Harder during COVID-19	7 (16.7%)	2 (11.8%)	5 (20.0%)	
Easier during COVID-19	5 (11.9%)	3 (17.6%)	2 (8.0%)	
Just the same during COVID-19	30 (71.4%)	12 (70.6%)	18 (72.0%)	
ART use (yes) <sup>b</sup>	78 (91.8%)	30 (96.8%)	48 (88.9%)	0.41
Access to ART <sup>b</sup>				0.92
Harder during COVID-19	17 (21.8%)	7 (23.3%)	10 (20.8%)	
Easier during COVID-19	12 (15.4%)	5 (16.7%)	7 (14.6%)	
Just the same as usual	49 (62.8%)	18 (60.0%)	31 (64.6%)	
<b>COVID-19 related stress</b>				
<i>Individual stressors</i>				
Income changes				0.26
Lost income since shelter-in-place	124 (55.9%)	43 (56.6%)	81 (55.5%)	
No income before shelter-in-place	44 (19.8%)	11 (14.5%)	33 (22.6%)	
Maintained income	54 (24.3%)	22 (28.9%)	32 (21.9%)	
Health insurance changes				0.45
Lost insurance since shelter-in-place	19 (8.7%)	9 (12.0%)	10 (7.0%)	
No health insurance before shelter-in-place	29 (13.3%)	9 (12.0%)	20 (14.0%)	
Maintained health insurance	170 (78.0%)	57 (76.0%)	113 (79.0%)	
Food Insecurity				0.59
Became food insecure since shelter-in-place	44 (19.9%)	16 (21.3%)	28 (19.2%)	
Food insecure before shelter-in-place	32 (14.5%)	13 (17.3%)	19 (13.0%)	
Maintained food security	145 (65.6%)	46 (61.3%)	99 (67.8%)	
1 days had a physical stress reaction to social distancing, loss of income or work, concerns about infection in the past 14 days (yes)	91 (41.2%)	31 (40.8%)	60 (41.4%)	0.93
Think you have been infected with COVID-19 (yes)	15 (29.4%)	7 (35.0%)	8 (25.8%)	0.54
Travel-related financial burden due to COVID-19				0.89
Not at all/A little	136 (62.4%)	36 (63.0%)	90 (62.1%)	
Moderate/high/extreme	82 (37.6%)	27 (37.0%)	55 (37.9%)	
<i>Network stressors</i>				
1 day receiving social support (yes)	129 (58.4%)	44 (57.9%)	85 (58.6%)	0.92
Intimate partner violence victimization (yes)	41 (18.6%)	13 (17.3%)	28 (19.3%)	0.72

	Overall (n = 222)	Time of Participant Interview		P-value
		Shelter-in-place / Phase 1/ Phase 2 (April 20 – June 2) (n = 76)	Phase 3/ Phase 4 (June 3 – July 31) (n = 146)	
Anyone you have been in close proximity has been diagnosed with COVID-19 in the past 2 weeks (yes)	16 (14.2%)	6 (16.2%)	10 (13.5%)	0.70
Have any of your friends or loved ones experienced any COVID-19 symptoms such as fever, coughing, upper respiratory distress, or shortness of breath (yes)	65 (30.1%)	25 (34.7%)	40 (27.8%)	0.29
Anyone you know personally has been diagnosed with COVID-19 (yes)	114 (51.8%)	39 (52.0%)	75 (51.7%)	1.00
Likelihood had sex with someone with COVID-19				0.26
Not likely	184 (82.9%)	60 (78.9%)	124 (84.9%)	
Somewhat/Very/Extremely Likely	38 (17.1%)	16 (21.1%)	22 (15.1%)	
<b>Structural stressors</b>				
Housing insecurity				0.09
Lost housing since shelter-in-place	28 (12.6%)	10 (13.2%)	18 (12.3%)	
Housing insecure before shelter-in-place	14 (6.3%)	1 (1.3%)	13 (8.9%)	
Maintained stable housing	180 (81.1%)	65 (85.5%)	115 (78.8%)	
Concerned about the COVID-19 pandemic in your neighborhood in the past 14 days				0.06
Not very/ not at all concerned	45 (20.3%)	10 (13.2%)	35 (24.0%)	
Very/somewhat concerned	177 (79.7%)	66 (86.8%)	111 (76.0%)	
<b>Sex behaviors during COVID-19 check-in survey</b>				
Number of sex partners				0.72
0	86 (38.7%)	30 (39.5%)	56 (38.4%)	
1	89 (40.1%)	28 (36.8%)	61 (41.8%)	
2	47 (21.2%)	18 (23.7%)	29 (19.9%)	
Changes in frequency of sex with a casual sex partner				0.08
Less	119 (53.6%)	47 (61.8%)	72 (49.3%)	
More/Same	103 (46.4%)	29 (38.2%)	74 (50.7%)	
Changes in frequency of sexual experiences with others using voice calls, messaging, or video chat				0.03
More	41 (18.5%)	20 (26.3%)	21 (14.4%)	
Less/Same	181 (81.5%)	56 (73.7%)	125 (85.6%)	
Changes in frequency of masturbation				0.03
More	95 (43.0%)	40 (53.3%)	55 (37.7%)	
Less/Same	126 (57.0%)	35 (46.7%)	91 (62.3%)	

<sup>a</sup>Only asked for HIV-negative participants (n = 132)

<sup>b</sup>Only asked for participants self-reporting their last HIV test was positive in the N2 COVID-19 check-in survey (n=85)

**Table 3:**

Bivariate and multivariable associations of COVID-19 stress, sex behaviors, with PrEP and ART use outcomes among BMSM and BTW in Chicago, the N2 COVID-19 check-in survey (April to July 2020)

Independent variables	PrEP use <sup>a</sup>		ART use <sup>b</sup>	
	Bivariate PR (95% CI)	Multivariable PR (95% CI)	Bivariate PR (95% CI)	Multivariable PR (95% CI)
<b>COVID-19 related stress</b>				
<i>Individual stressors</i>				
Income				
Lost income since shelter-in-place	0.5 <sup>**</sup> (0.3, 0.8)	1.0 (0.6, 1.7)	1.1 (0.9, 1.3)	1.2 (0.9, 1.4)
No income before shelter-in-place	0.6 (0.3, 1.3)	1.2 (0.5, 2.6)	1.0 (0.8, 1.2)	1.1 (0.9, 1.4)
Maintained income	REF	REF	REF	REF
Health insurance				
Lost insurance	0.6 (0.2, 1.8)	0.7 (0.2, 2.3)	1.1 <sup>*</sup> (1.0, 1.2)	1.1 (1.0, 1.2)
No health insurance before shelter-in-place	1.0 (0.4, 2.1)	1.0 (0.4, 2.2)	1.0 (0.8, 1.2)	1.0 (0.8, 1.3)
Maintained health insurance	REF	REF	REF	REF
Food Insecurity				
Became food insecure since shelter-in-place	0.4 (0.2, 1.1)	0.6 (0.2, 1.4)	1.0 (0.8, 1.2)	0.9 (0.8, 1.1)
Food insecure before shelter-in-place	1.1 (0.6, 2.1)	1.3 (0.6, 2.8)	1.1 (1.0, 1.2)	1.1 (1.0, 1.3)
Maintained food security	REF	REF	REF	REF
Number of days had a physical stress reaction to social distancing, loss of income or work, concerns about infection in the past 14 days				
1 days	1.8 <sup>*</sup> (1.1, 3.0)	2.1 <sup>**</sup> (1.3, 3.5)	1.0 (0.9, 1.1)	1.0 (0.9, 1.1)
0 days	REF	REF	REF	REF
Think you have been infected with COVID-19				
Yes	1.9 <sup>*</sup> (1.0, 3.7)	1.4 (0.8, 2.7)		
No	REF	REF		
Travel-related financial burden due to COVID-19				
Moderate/high/extreme	0.8 (0.5, 1.4)	1.2 (0.7, 2.0)	1.0 (0.8, 1.1)	0.9 (0.8, 1.0)
Not at all/A little	REF	REF	REF	REF
<i>Network stressors</i>				
Number of days receiving social support				
0 day	1.0 (0.6, 1.7)	1.0 (0.6, 1.7)	0.6 (0.1, 2.8)	0.2 (0.0, 1.3)
1 day	REF	REF	REF	REF
Partner Violence				
Yes	1.3 (0.7, 2.3)	1.4 (0.9, 2.4)	0.9 (0.7, 1.2)	0.9 (0.7, 1.2)
No	REF	REF	REF	REF
Have any of your friends or loved ones experienced any COVID-19 symptoms such as fever, coughing, upper respiratory distress, or shortness of breath				
Yes	1.9 <sup>*</sup> (1.2, 3.2)	1.44 (0.9, 2.4)		
No	REF	REF		

Independent variables	PrEP use <sup>a</sup>		ART use <sup>b</sup>	
	Bivariate PR (95% CI)	Multivariable PR (95% CI)	Bivariate PR (95% CI)	Multivariable PR (95% CI)
Anyone you know personally has been diagnosed with COVID-19				
Yes	1.8* (1.0, 3.3)	1.2 (0.7, 2.3)	1.0 (0.9, 1.1)	1.0 (0.9, 1.1)
No	REF	REF	REF	REF
Anyone you have been in close proximity has been diagnosed with COVID-19 in the past 2 weeks				
Yes	2.1** (1.3, 3.6)	1.7* (1.1, 2.8)		
No	REF	REF		
Likelihood had sex with someone with COVID-19				
Somewhat/Very/Extremely Likely	2.5*** (1.6, 3.9)	1.7 (1.0, 3.1)		
Not likely	REF	REF		
<b>Structural stressors</b>				
Housing Insecurity				
Lost housing since shelter-in-place	0.9 (0.4, 1.8)	1.2 (0.6, 2.4)	0.9 (0.7, 1.3)	1.0 (0.7, 1.3)
Unstable housing before shelter-in-place	0.7 (0.2, 2.3)	1.1 (0.2, 5.3)	0.9 (0.6, 1.3)	1.0 (0.9, 1.1)
Maintained stable housing	REF	REF	REF	REF
Concerned about the COVID-19 pandemic in your neighborhood in the past 14 days				
Very/somewhat concerned	1.0 (0.6, 2.0)	1.4 (0.7, 2.6)		
Not very/ not at all concerned	REF	REF		
<b>Sex behaviors during COVID-19 check-in survey</b>				
Number of sex partners during COVID-19 pandemic				
1	0.9 (0.5, 1.6)	1.1 (0.6, 1.9)	1.0 (0.9, 1.1)	1.0 (0.9, 1.2)
2 or more	1.5 (0.8, 2.7)	0.9 (0.5, 1.8)	1.0 (0.8, 1.1)	1.1 (0.9, 1.2)
0 (REF)	REF	REF	REF	REF
Changes in frequency of sex with a casual sex partner				
Less	1.2 (0.7, 2.1)	1.3 (0.8, 2.2)	0.9 (0.8, 1.1)	1.0 (0.9, 1.1)
More/Same (reference)	REF	REF	REF	REF
Changes in frequency of sexual experiences with others using voice calls, messaging, or video chat				
More	1.1 (0.6, 1.9)	0.8 (0.4, 1.5)		
Less/Same (reference)	REF	REF		
Changes in frequency of masturbation during COVID-19 pandemic				
More	1.0 (0.6, 1.7)	0.9 (0.6, 1.5)	1.0 (0.9, 1.2)	1.1 (1.0, 1.2)
Less/Same (reference)	REF	REF	REF	REF

<sup>a</sup>Controlled for: Baseline PrEP use, follow-up age, sexual orientation, relationship status, gender, time period, baseline housing, baseline employment, baseline income

<sup>b</sup>Controlled for follow-up age, sexual orientation, relationship status, baseline income, baseline employment, baseline housing

<sup>c</sup>Variables of interest with zero cells in the tabulation with the outcome were not included for analysis

\*  $P < 0.05$ ;

\*\*  
 $P < 0.01$ ;

\*\*\*  
 $P < 0.001$

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**Table 4.**

Bivariate and multivariable associations of COVID-19 stress, sex behaviors, with PrEP and ART access outcomes among BMSM and BTW in Chicago, the N2 COVID-19 check-in survey (April to July 2020)

Independent variables	Access to PrEP (harder vs other) <sup>a</sup>		Access to ART (harder vs other) <sup>b</sup>	
	Bivariate PR (95% CI)	Multivariable PR (95% CI)	Bivariate PR (95% CI)	Multivariable PR (95% CI)
<b>COVID-19 related stress</b>				
<i>Individual stressors</i>				
Income				
Lost income since shelter-in-place	2.0 (0.4, 9.8)	1.4 (0.3, 7.6)		
No income before shelter-in-place	1.5 (0.2, 14.1)	1.7 (0.2, 19.4)		
Maintained income	REF	REF		
Health insurance				
Lost insurance	0.7 (0.1, 4.9) <sup>d</sup>	0.5 (0.0, 5.6) <sup>d</sup>	2.4 (0.8, 7.2)	3.5* (1.1, 10.7)
No health insurance before shelter-in-place			0.9 (0.2, 3.4)	1.0 (0.3, 3.6)
Maintained health insurance	REF	REF	REF	REF
Food Insecurity				
Became food insecure since shelter-in-place	0.4 (0.1, 3.2) <sup>e</sup>	0.3 (0.0, 2.2) <sup>e</sup>	1.9 (0.8, 4.9)	2.5 (0.7, 9.5)
Food insecure before shelter in place			1.2 (0.3, 4.6)	0.3 (0.0, 1.5)
Maintained food security	REF	REF	REF	REF
Number of days had a physical stress reaction to social distancing, loss of income or work, concerns about infection in the past 14 days				
1 days	1.9 (0.4, 8.8)	1.7 (0.5, 6.7)	2.1 (0.9, 5.0)	1.6 (0.6, 4.3)
0 days	REF	REF	REF	REF
Travel-related financial burden due to COVID-19				
Moderate/high/extreme	2.6 (0.7, 10.1)	3.2* (1.0, 10.1)	4.5** (1.8, 11.6)	6.2** (1.6, 24.3)
Not at all/A little	REF	REF	REF	REF
Think you have been infected with COVID-19 <sup>4</sup>				
Yes	1.1 (0.2, 7.5)	2.2 (0.2, 24.9)	1.7 (0.5, 5.7)	1.2 (0.3, 5.2)
No	REF	REF	REF	REF
<i>Network stressors</i>				
Number of days receiving social support				
1 day	1.1 (0.3, 4.4)	0.8 (0.2, 4.2)	0.9 (0.4, 2.1)	0.9 (0.3, 2.4)
0 day	REF	REF	REF	REF
Partner Violence				
Yes	0.5 (0.1, 3.9)	0.5 (0.1, 3.2)	3.0** (1.4, 6.6)	2.7* (1.0, 7.2)
No	REF	REF	REF	REF
Have any of your friends or loved ones experienced any COVID-19 symptoms such as fever, coughing, upper respiratory distress, or shortness of breath				
Yes	0.4 (0.1, 1.9)	0.4 (0.1, 2.1)	1.0 (0.4, 2.9)	1.3 (0.5, 3.6)
No	REF	REF	REF	REF

Independent variables	Access to PrEP (harder vs other) <sup>a</sup>		Access to ART (harder vs other) <sup>b</sup>	
	Bivariate PR (95% CI)	Multivariable PR (95% CI)	Bivariate PR (95% CI)	Multivariable PR (95% CI)
Anyone you know personally has been diagnosed with COVID-19				
Yes	0.6 (0.1, 2.1)	0.5 (0.1, 2.4)	0.5 (0.2, 1.32)	0.5 (0.2, 1.4)
No	REF	REF	REF	REF
Likelihood had sex with someone with COVID-19				
Somewhat/Very/Extremely Likely	0.3 (0.0, 2.6)	0.29 (0.0, 2.0)	0.9 (0.3, 2.8)	0.7 (0.3, 1.8)
Not likely	REF	REF	REF	REF
<b>Structural stressors</b>				
Housing Insecurity				
Lost housing since shelter-in-place / Unstable housing before shelter-in-place	3.2 (0.9, 11.7)	4.7 (0.4, 57.5)	1.5 (0.5, 4.2)	1.4 (0.6, 3.5)
Maintained stable housing	REF	REF	REF	REF
Concerned about the COVID-19 pandemic in your neighborhood in the past 14 days				
Very/somewhat concerned	1.4 (0.2, 10.4)	2.0 (0.4, 9.4)	1.0 (0.4, 2.6)	0.7 (0.2, 2.1)
Not very/not at all concerned	REF	REF	REF	REF

<sup>a</sup>Controlled for: baseline PrEP Use, follow-up age, sexual orientation, relationship status, time period

<sup>b</sup>Controlled for follow-up age, sexual orientation, relationship status, time period, baseline employment, baseline housing, baseline income

<sup>c</sup>Variables of interest with zero cells in the tabulation with the outcome were not included for analysis

<sup>d</sup>Combined lost insurance and had no insurance prior to shelter-in-place zero cells in the tabulation with the outcome

<sup>e</sup>Combined became food insecure since shelter-in-place and shelter-in-place prior to shelter-in-place due to zero cells in the tabulation with the outcome

\*  $P < 0.05$ ;

\*\*  $P < 0.01$ ;