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# Persistent disparities in COVID-19-associated impacts on HIV prevention and care among a global sample of sexual and gender minority individuals

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## ABSTRACT

As COVID-19 continues to persist, there is a need to examine its impact among sexual and gender minority individuals, especially those with intersecting vulnerabilities. We conducted a cross-sectional survey with a global sample of sexual and gender minority individuals ( $n = 21,795$ ) from October 25, 2020 to November 19, 2020, through a social networking app. We characterised the HIV prevention and HIV treatment impacts of COVID-19 and the COVID-19 mitigation response and examined whether subgroups of our study population are disproportionately impacted by COVID-19. Many sexual and gender minority individuals reported interruptions to HIV prevention and HIV care and treatment services. These consequences were significantly greater among people living with HIV, racial/ethnic minorities, immigrants, individuals with a history of sex work, and socio-economically disadvantaged groups. These findings highlight the urgent need to mitigate the negative impacts of COVID-19 among sexual and gender minority individuals.

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## KEYWORDS

HIV; COVID-19; Health disparities; sexual and gender minority individuals; economic impact

## Background

The COVID-19 pandemic remains a serious health threat worldwide, with over 404.5 million confirmed cases and over 5.8 million deaths at the time of writing on February 10, 2022 (Dong et al., 2020). Despite the availability of highly efficacious vaccines, COVID-19 outbreaks and surges continue in settings with low vaccination rates due in part to uneven availability (Dong et al., 2020). Moreover, as novel variants of the COVID-19 virus have emerged, breakthrough infections among those vaccinated have also led to unpredictable COVID-19 surges worldwide (Callaway, 2021; El-Shabasy et al., 2022; Song & Masaki, 2021). Global efforts to curb the spread of COVID-19 have led to unprecedented disruptions in society, with vast social, economic, and health care consequences, including interruptions in HIV prevention and care services (Courtemanche et al., 2020; Gonzalez-Sanguino et al., 2020; Kawohl & Nordt, 2020; Yang & Ma, 2020). Health disparities and deepening

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social inequities among marginalised groups including sexual and gender minorities, living with or without HIV, historically excluded racial and ethnic groups, and other vulnerable populations have also been exacerbated (Bibbins-Domingo, 2020; Centers for Disease Control and Prevention, 2020; Laurencin & McClinton, 2020; Poteat et al., 2020).

Early studies on the impact of COVID-19 among sexual and gender minority individuals have demonstrated the unique concerns and challenges experienced among sexual and gender minority individuals during the COVID-19 pandemic. Anti-gay community backlash (i.e. scapegoating of sexual and gender minority individuals for COVID-19 cases), arrests under false pretexts (i.e. anti-gay related arrests under the guise of quarantine violations), and loss of privacy during contact tracing and monitoring for COVID-19 have had an impact on mental health (Bishop, 2020; UNAIDS & Global, 2020), provoking greater social isolation and loneliness (Holloway et al., 2021). Studies have also documented significant interruptions in HIV prevention and treatment services among sexual and gender minority individuals worldwide (Rao et al., 2021; Sanchez et al., 2020; Santos et al., 2021), and the disproportionate impact of mitigation efforts on the access to these services for marginalised and minoritised sexual and gender minority individuals (i.e. racial and ethnic minorities, sex workers, immigrants, and economically disenfranchised people) (Santos et al., 2021). Hence, the early wave of COVID-19 and efforts to mitigate its spread has amplified existing barriers that impede access to HIV prevention, testing, treatment, and care, potentially complicating efforts to achieve global HIV targets among sexual and gender minority individuals who remain disproportionately impacted by HIV infection (Ayala et al., 2018; Ayala & Santos, 2016; UNAIDS, 2019). As the COVID-19 pandemic continues, there is a need to examine whether the disproportionate impact of COVID-19 in sub-populations of sexual and gender minority individuals persists among people living with HIV, transgender and gender-diverse individuals, racial/ethnic minorities, immigrants, sex workers, and socio-economically disenfranchised groups persists, recognising that the impacts of COVID may be shaped by a multi-dimensional overlapping factors and identities (i.e. differential impacts due to intersecting vulnerabilities and stigmas). As the COVID-19 pandemic continues to evolve in unpredictable ways, we aim to understand where the gaps in HIV prevention and treatment occurred to ensure a more equitable response to recent and continuing COVID-19 disruptions.

## Methods

### Study design

This is the second cycle of the COVID-19 Disparities survey administered and implemented by the social networking app, Hornet, a free, smart phone-based 'Gay Social Networking' app with over 35 million users worldwide (Bourne et al., 2019). Hornet has been used as a means for conducting research on sexual and gender minority individuals worldwide (Ayala et al., 2018; S. Baral et al., 2018; Bourne et al., 2019; Torres et al., 2019). Data collection for the current study occurred from October 25, 2020 to November 19, 2020, during which time Hornet users were invited to participate in a 120-item questionnaire focused on the impact of COVID-19 on economic vulnerability, mental health status, HIV prevention, testing and treatment and care impacts. Details on the COVID-19 Disparities Survey have been previously described (Santos et al., 2021). In brief, Hornet users were eligible to participate in the survey if they were age 18 and over and provided informed consent. For this second wave of data collection, a total of 21,928 respondents participated. For this study, we excluded participants who identified as cis-gender women (i.e. female sex assigned at birth and female gender identity;  $n = 14$ ). Study procedures were reviewed by the Johns Hopkins Bloomberg School of Public Health Institutional Review Board, which determined that the protocol qualified for Exempt status. Specifically, it was deemed exempt since the information recorded by the study was completely

anonymous and collected in a manner that subjects cannot be identified, directly or through identifiers linked to the subjects.

## **Measures**

Eligible, consenting participants responded to general demographic questions on age, country of residence, sex assigned at birth (e.g. male, female, intersex), gender identity (e.g. Gender nonbinary/Gender-diverse, transgender woman [male to female], transgender man [female to male], man, woman), sexual orientation, urbanicity of their current location of residence, and education. We use country of residence to create an indicator variable for region, using World Bank region classifications, consistent with prior analyses (Ayala & Santos, 2016). Participants were also asked about their HIV serostatus; membership to a racial or ethnic minority group based on their perception of membership to a minority group in their country of residence (e.g. ‘Do you consider yourself a member of an ethnic or racial minority?’); citizenship status (e.g. ‘Do you have citizenship in, or a valid residence permit for, the country where you currently live?’); history of sex work (e.g. ‘Have you ever engaged in sex work (i.e. being paid to have sex)’); disability status (‘Do you identify as having a disability (i.e. a physical or mental condition that limits your movements, senses, or daily activities)?’). Additionally, participants were asked a series of questions on the following areas: (1) Economic Impacts of COVID-19; (2) Mental Health Status during the COVID-19 pandemic; (3) HIV Prevention Impacts of COVID-19; and (4) HIV Treatment and Care Impacts of COVID-19.

### **Economic impact measures**

The survey assessed the impact of the COVID-19 pandemic on participants’ economic status through questions regarding their employment status; ability to make ends meet (e.g. ‘Thinking of your household’s total monthly income, is your household able to make ends meet?’); income level (e.g. ‘How much are you expecting your income to reduce because of the COVID-19 crisis?’); and food security (e.g. ‘Since the COVID-19 crisis began, have you had to cut the size of your meals or skip meals because there was not enough money for food?’). These measures were adopted from economic status measures used in previous large observational studies and were also used in the first cycle of our COVID-19 study.(Angel et al., 2003; Artazcoz et al., 2021; Dasgupta & Robinson, 2022; Santos et al., 2021).

### **Mental health status during the COVID-19 pandemic**

The survey also asked participants regarding their mental health status in general, during the COVID-19 pandemic, using validated items from the Patient Health Questionnaire-4 (PHQ-4), a tool developed and validated by Kroenke et al. (2009) used to measure and screen for psychological distress, and particularly, depression and anxiety (Kroenke et al., 2009). PHQ-4 has also been translated and validated in research studies outside of the US, including Tanzania, Korea, Iran, Germany, and Columbia (Kim et al., 2021; Lowe et al., 2010; Materu et al., 2020; Mughal et al., 2020; Waqas et al., 2021). PHQ-4 scores were dichotomised using a cut-off of 3 or more to indicate psychological distress (Kroenke et al., 2009).

### **HIV prevention and testing impact measures**

HIV-negative participants were asked whether they experienced changes in access to HIV prevention interventions including condoms and lubricants, using Likert-type questions (e.g. ‘Do you feel you have access to [condoms and/or lubricants/lube] during the COVID-19 crisis’ with the following response options: ‘Yes, more access’, ‘Yes, the same access’, ‘Yes, but less access’, ‘No’). This question was re-coded as binary to compare responses of ‘Yes, the same access’/‘Yes, more access’, versus the other response options. Access to PrEP was measured using the question ‘Have you ever

taken PrEP? This is a pill that, when taken as prescribed, is effective at preventing HIV for someone who is not living with HIV' with the following response options: 'No'; 'Yes, and I'm still taking it'; 'Yes, but I'm no longer taking it because of COVID-19'; 'Yes, but I'm no longer taking it because of other reasons'; and 'Yes, but I contracted HIV'. Responses among individuals who were taking PrEP were dichotomised between 'Yes, but I'm no longer taking it because of COVID-19' versus the other 'Yes' responses.

### *HIV treatment and care impact measures*

Participants living with HIV were asked about their access to HIV providers (e.g. 'Since the beginning of COVID-19-related social isolation in your country, by that or any other name, have you been able to see your HIV provider if you needed to?' with the following responses which were dichotomised to either 'No' versus 'Yes': 'No, because of reduced hours'; 'No, because it is closed'; 'Yes, in person'; and 'Yes, via telemedicine') and antiretroviral treatment (ART; e.g. 'Do special measures related to COVID-19 impact your ability to access or refill your HIV medicine?' with the following responses which were dichotomised to either 'cannot access or refill' versus 'can access or refill' HIV medicine: 'I cannot access or refill my HIV medicine'; 'I can access or refill my HIV medicine but the process is burdensome or complicated'; and 'I can access or refill my HIV medicine without much or any complication').

### *Data analysis*

We performed descriptive analyses to characterise the economic impacts, mental health status, and HIV prevention and HIV-care impacts of COVID-19 on survey participants. Outcomes were also stratified by key characteristics, including HIV status, gender, urbanicity of area of residence, being a racial/ethnic minority, citizenship status, disability status, income level, food security, and engaging in sex work to examine sociodemographic and behavioural correlates. We examined between-group differences for these characteristics using Chi-Squared tests, with a significance level of  $\alpha = 0.05$ .

To examine correlates of access to HIV prevention and treatment services, we fitted multivariable generalised estimating equation (GEE) models with robust standard errors, adjusting for clustering by country. Additionally, in the same GEE models, we included the World Bank region as a co-variate with all the key characteristics above, consistent with prior analyses (Ayala & Santos, 2016). For this study, analyses were conducted using a complete case approach, whereby only the fully-completed survey responses were included in the analyses. All analyses were conducted in STATA 15.1 (College Stations, TX).

## **Results**

### *Sample characteristics*

The sample characteristics of participants are summarised in [Table 1](#). A total of 21,795 participants from over 150 countries were included in this analysis. Countries with the most respondents were Russia (20.1%), Turkey (19.9%), Brazil (14.2%), and France (6.6%). Sixty percent of the participants were from East Europe and Central Asia, followed by Latin American and Caribbean (17.3%). The mean age of the respondents was 35.03 (SD: 11.2, range from 18 to 95). A majority were self-identified as gay or bisexual (82.8%). Overall, nearly thirty percent (30.1%) reported being lower or lower-middle socio-economic status. About one third (35.7%) had at least some college degree. Forty point five percent lived in a capital city or a large city when the survey was administrated and 9.2% identified as a racial or ethnic minority (i.e. self-reported membership to a racial or ethnic minority group within their respective country of residence). In terms of self-reported HIV status, approximately 7.4% ( $n = 1613$ ) were self-

**Table 1.** Sociodemographic characteristics among a global sample of sexual and gender minority individuals, 2020.

	<i>n</i> (%)
<b>Age</b> (Mean, SD)	35.03 (11.2)
<b>Gender identity</b>	
Cis-gender man	18,072 (82.9%)
Transgender woman	255 (1.2%)
Transgender men	114 (0.5%)
Gender-diverse identity	3354 (15.4%)
<b>Sexual orientation</b>	
Gay or bisexual	18,054 (82.8%)
Pansexual	423 (1.9%)
Queer	234 (1.1%)
Heterosexual	326 (1.5%)
Different sexual orientation	2758 (12.7%)
<b>Socio economic status</b>	
Lower & lower middle	1255 (5.8%)
Lower middle	5291 (24.3%)
Upper middle	5316 (24.4%)
Upper	656 (3.0%)
Missing	9277 (42.6%)
<b>Highest education level</b>	
College and higher	7777 (35.7%)
Higher and lower	4815 (22.1%)
Missing	9203 (42.2%)
<b>Employment status</b>	
Employed	8181 (37.5%)
Unemployed due to the COVID-19 crisis	998 (4.6%)
Unemployed before the COVID-19 crisis	596 (2.7%)
Student	891 (4.1%)
Retired	413 (1.9%)
Unable to work	92 (0.4%)
Other employment	10,624 (48.7%)
<b>Living location</b>	
Capital city or a large city	8831 (40.5%)
Suburb or a small city	3072 (14.1%)
Rural area or village	686 (3.1%)
Missing	9206 (42.2%)
<b>Geographic region<sup>a</sup></b>	
Europe & Central Asia	13,084 (60.0%)
Latin American & Caribbean	3783 (17.4%)
East Asia & Pacific	2250 (10.3%)
Middle East & North Africa	844 (3.9%)
North America	443 (2.0%)
Sub-Saharan Africa	105 (0.5%)
South Asia	69 (0.3%)
Others	1217 (5.6%)
<b>Racial or Ethnic minority</b>	2016 (9.2%)
<b>Ever engaged in sex work</b>	1456 (6.7%)
<b>Living with a disability</b>	942 (4.3%)
<b>Self-reported HIV positive</b>	1613 (7.4%)
Currently taking ART	1472 (91.3%) <sup>b</sup>
<b>Taking HIV pre-exposure prophylaxis</b>	1513 (7.4%) <sup>c</sup>
<b>Moderate to severe psychological distress (PHQ4 ≥ 3)</b>	6623 (30.4%)

<sup>a</sup>Data do not add up to totals and 100% because of missing data. Geographic region was categorised according to The World Bank.

<sup>b</sup>Percentage among participants who self-reported HIV positive.

<sup>c</sup>Percentage among participants who self-reported HIV-negative or unknown status.

SD: standard deviation.

PHQ-4: Patient Health Questionnaire-4.

reported to be HIV positive. Among the overall number of people living with HIV, a large proportion reported being from Russia, Brazil, Turkey, and Mexico. Of these, 1472 (91.3%) were taking antiretroviral medications.

### **Impacts on economics and basic needs**

Over forty percent (40.2%) of all participants reported a 20% or more income reduction due to the COVID-19 pandemic. Substantial reductions in income were observed among those who were younger in age; identified as transgender or gender-diverse; residing in a city/urban area; engaged in sex work; reported being a non-citizen in the country of residence; identified as a racial and ethnic minority; did not have a college degree; and those who were living with a disability ( $p < 0.05$  for all; see Supplemental Table S1). Regardless of the changes in income, a large proportion (38.9%) of participants reported having difficulties covering basic needs such as food, clothing, shelter, transportation, and health. Thirty-seven percent (37.3%) of participants indicated they were cutting the size of meals or skip meals because there was not enough money for food.

### **Mental health status during COVID-19**

The PHQ-4 scale in the study had a Cronbach  $\alpha$  of 0.88. Overall, 30.2% of participants reported moderate to severe psychological distress measured by the PHQ-4 scale. Moderated to severe psychological distress was observed in greater proportion among those younger in age; identified as cis-gender males; had a history of engaging in sex work; identified as a racial or ethnic minority; had a college or higher education; had a significant income reduction during the COVID-19; those who cannot cover basic needs well, and those who had cut down meals during the pandemic ( $p < 0.05$  for all; see Supplemental Table S2).

### **Impacts on HIV prevention and sexual health services**

Study participants reported significant barriers to HIV prevention and sexual health services as a result of the COVID-19 pandemic. Among 1513 participants who were taking HIV pre-exposure prophylaxis (PrEP) before the pandemic, nearly twelve percent (11.6%) stopped taking PrEP due to the pandemic. No significant associations were found between socio-economic, behavioural, and demographic correlates and stopping the use of PrEP due to COVID-19 (data not shown).

In addition, 86.8% reported having the same or greater access to condoms and lubricants during the pandemic. Those who are younger in age; reported being a non-citizen in their country of residence; identified as transgender or gender-diverse; have depression; have disabilities; reported a history of sex work; experienced significant income reduction; reported that they cannot cover basic needs well; reported that they had cut down meals during the COVID-19 pandemic; are living with HIV; and those who are racial or ethnic minorities reported having no or less access to condoms or lubricants ( $p < 0.05$  for all) (Table 2).

In the GEE multivariable model, having access to condom and lubricants were associated with being older (adjusted odds ratio [aOR] = 1.01, 95%CI: 1.00–1.02) and residing in a city/urban area (aOR = 1.21, 95%CI: 1.06–1.38). Individuals identified as a racial and ethnic minority had less access to condoms and lubricants (aOR = 0.73, 95%CI: 0.63–0.86). Similarly, being unable to cover basics needs well and having to reduce meals were associated with less access to condoms and lubricants (aOR = 0.74, 95% CI: 0.62–0.87; aOR = 0.59, 95% CI: 0.52–0.66, respectively). Compared to sexual and gender minority individuals in Asia Pacific, those in Latin America & Caribbean and Middle East & North Africa reported lower access to condoms and lubricants (aOR = 0.49, 95% CI: 0.24–0.99; aOR = 0.45, 95% CI: 0.22–0.99, respectively).

### **Impacts of COVID-19 on HIV care services**

COVID-19 had a substantial impact on access to HIV treatment and care services among participants living with HIV, and it varies by different socio-economic characteristics. A total of

**Table 2.** Sociodemographic correlates of access to condoms and lubricants during COVID-19 among a global sample of sexual and gender minority individuals, 2020 ( $n = 13,259$ ).

		No or less condoms/ lubricant access $N = 1748$	Same or greater condoms/ lubricant access $N = 11,511$	$p$ - value
Age	Mean (SD)	34.3 (10.9)	36.4 (11.2)	<0.001
Gender	Transgender or gender-diverse	336 (18.6%)	1472 (81.4%)	<0.001
Resides in a city/urban area	Cis-gender Male	1412 (12.3%)	10,039 (87.7%)	<0.001
	No	539 (15.6%)	2909 (84.4%)	
Report depressive symptoms (PHQ-4 $\geq 3$ )	Yes	950 (11.5%)	7314 (88.5%)	<0.001
	No	864 (12.2%)	6191 (87.8%)	
Ever engaged in sex work	Yes	884 (14.2%)	5320 (85.8%)	<0.001
	No	1045 (11.6%)	7973 (88.4%)	
Non-citizen in country of residence	Yes	248 (18.2%)	1115 (81.8%)	0.001
	No	1159 (12.0%)	8499 (88.0%)	
Racial/Ethnic minority	Yes	145 (15.7%)	779 (84.3%)	<0.001
	No	992 (11.4%)	7688 (88.6%)	
Living with a disability	Yes	318 (17.0%)	1555 (83.0%)	<0.001
	No	1219 (11.9%)	9005 (88.1%)	
Completed college	Yes	151 (17.7%)	704 (82.3%)	<0.001
	No	690 (15.8%)	3673 (84.2%)	
Significant Income reduction during COVID-19 (>20%)	Yes	801 (10.9%)	6548 (89.1%)	<0.001
	No	707 (10.3%)	6146 (89.7%)	
Cannot cover basic needs well	Yes	730 (16.3%)	3759 (83.7%)	<0.001
	No	577 (8.9%)	5889 (91.1%)	
Has cut down meals during COVID-19 pandemic	Yes	806 (17.6%)	3765 (82.4%)	<0.001
	No	863 (10.1%)	7712 (89.9%)	
Region (World Bank)	Yes	467 (21.2%)	1734 (78.8%)	<0.001
	East Asia & Pacific	147 (11.6%)	1119 (88.4%)	
	Europe & Central Asia	1033 (12.5%)	7206 (87.5%)	
	Latin American & Caribbean	330 (13.5%)	2114 (86.5%)	
	Middle East & North Africa	106 (23.4%)	347 (76.6%)	
	North America	35 (10.6%)	294 (89.4%)	
	Sub-Saharan Africa	10 (19.2%)	42 (80.8%)	
	South Asia	4 (16.7%)	20 (83.3%)	
Living with HIV	Other	83 (18.4%)	369 (81.6%)	0.006
	No	870 (11.0%)	7013 (89.0%)	
	Yes	207 (13.5%)	1327 (86.5%)	

1,613 participants reported having an HIV-positive status. Among those, 16.2% reported not being able to see their HIV providers due to reduced hours or clinic closures. In bivariable analyses, being unable to see an HIV provider was associated with being younger in age; having a history of engaging in sex work; being a racial/ethnic minority; reporting income reduction; and having to cut down meals during the COVID-19 pandemic ( $p < 0.05$  for all). Those who live in Latin American & Caribbean, and Sub-Saharan African countries were more likely to have barriers to see HIV providers compared to PLWH in other regions ( $p < 0.05$ ) (Table 3).

In the multivariable GEE models accounting for clustering by country, participants living with HIV residing in a city/urban area were more likely to have access to their HIV provider during the pandemic compared to those who live in rural areas (aOR = 1.40, 95% CI: 1.03–1.90). Being unable to cover basic needs well and having to cut down meals during the COVID-19 pandemic was associated with lower odds of accessing to HIV providers (aOR = 0.67, 95% CI: 0.51–0.85; aOR = 0.68, 95% CI: 0.47–0.97, respectively). Sexual and gender minority individuals in Latin American &



**Table 3.** Sociodemographic correlates of Access to HIV Provider during COVID-19 among a global sample of sexual and gender minority individuals living with HIV, 2020 ( $n = 1404$ ).

		HIV provider not accessed $N = 227$	HIV provider accessed $N = 1176$	$p$ -value
Age	Mean (SD)	37.3 (9.6)	39.8 (11.1)	0.002
Gender	Transgender or gender-diverse	26 (17.8%)	120 (82.2%)	0.57
	Cis-gender Male			
Resides in a city/urban area	No	201 (16.0%)	1056 (84.0%)	0.51
	Yes	60 (17.3%)	286 (82.7%)	
Report depressive symptoms (PHQ-4 $\geq$ 3)	No	167 (15.8%)	888 (84.2%)	0.93
	Yes	106 (16.1%)	553 (83.9%)	
Ever engaged in sex work	No	121 (16.3%)	623 (83.7%)	0.029
	Yes	146 (14.7%)	848 (85.3%)	
Non-citizen in country of residence	No	49 (20.4%)	191 (79.6%)	0.024
	Yes	172 (14.6%)	1003 (85.4%)	
Racial/Ethnic minority	No	29 (22.1%)	102 (77.9%)	0.002
	Yes	154 (14.5%)	905 (85.5%)	
Living with a disability	No	54 (22.9%)	182 (77.1%)	0.58
	Yes	188 (15.7%)	1008 (84.3%)	
Completed college	No	23 (17.6%)	108 (82.4%)	0.13
	Yes	90 (18.2%)	405 (81.8%)	
Significant Income reduction during COVID-19 (>20%)	No	136 (15.0%)	768 (85.0%)	<0.001
	Yes	105 (12.7%)	724 (87.3%)	
Cannot cover basic needs well	No	117 (20.7%)	448 (79.3%)	<0.001
	Yes	101 (12.5%)	706 (87.5%)	
Has cut down meals during COVID-19 pandemic	No	115 (20.7%)	440 (79.3%)	<0.001
	Yes	137 (12.8%)	936 (87.2%)	
Region (World Bank)	yes	70 (27.9%)	181 (72.1%)	<0.001
	East Asia & Pacific	17 (11.3%)	133 (88.7%)	
	Europe & Central Asia	80 (11.1%)	641 (88.9%)	
	Latin American & Caribbean	123 (26.7%)	337 (73.3%)	
	Middle East & North Africa	3 (33.3%)	6 (66.7%)	
	North America	1 (2.8%)	35 (97.2%)	
	Sub-Saharan Africa	2 (25.0%)	6 (75.0%)	
South Asia	1 (5.3%)	18 (94.7%)		

Caribbean countries were significantly less likely to access their providers than those in the Asia-Pacific region (aOR = 0.14, 95CI: 0.06–0.33).

### Impacts of COVID-19 on HIV treatment access

Ninety-one percent (91.3%) of respondents living with HIV were currently taking ART. Of those taking ART, about 1 in 5 (18.9%) indicated they could not access or refill their medication. Those who were younger in age; have a history of sex work; identify as a racial/ethnic minority; have reported an income reduction; have cut down meals during the COVID-19 pandemic; and those who have been unable to cover basic needs well have reported being unable to access or refill ART in greater proportions. Additionally, individuals who identified as transgender or gender-diverse; reported having depression; and those who had a disability also reported significant barriers to access or to refilling ART (Table 4).

In the GEE model, older participants had higher odds of accessing ART (aOR = 1.03, 95%CI: 1.01–1.05). Less or no access to ART was significantly associated with being a non-citizen in their country of residence (aOR = 0.60, 95%CI:0.43–0.82) and inability to cover basic needs well (aOR = 0.56, 95%CI:0.44–0.72). Notably, sexual and gender minority individuals from Latin American & Caribbean countries were more likely to access to ART than those in the Asia-Pacific region (aOR = 2.57, 95CI: 1.05–6.29) (Table 5).

**Table 4.** Sociodemographic correlates of Access to Antiretroviral Treatment (ART) during COVID-19 among a global sample of sexual and gender minority individuals living with HIV, 2020 (n = 1404).

		Cannot Access or refill ART N = 266	Can Access or refill ART N = 1138	p-value
Age	Mean (SD)	35.7 (9.3)	40.5 (10.9)	<0.001
Gender	Transgender or gender-diverse	38 (26.6%)	105 (73.4%)	0.014
	Cis-gender Male			
Resides in a city/urban area	No	228 (18.1%)	1033 (81.9%)	0.7
	Yes	68 (19.6%)	279 (80.4%)	
Report depressive symptoms (PHQ-4 ≥ 3)	No	197 (18.7%)	858 (81.3%)	0.006
	Yes	104 (15.9%)	552 (84.1%)	
Ever engaged in sex work	No	162 (21.7%)	586 (78.3%)	<0.001
	Yes	173 (17.1%)	838 (82.9%)	
Non-citizen in country of residence	No	70 (30.7%)	158 (69.3%)	0.23
	Yes	216 (18.2%)	970 (81.8%)	
Racial/Ethnic minority	No	28 (22.6%)	96 (77.4%)	0.004
	Yes	181 (16.9%)	891 (83.1%)	
Living with a disability	No	57 (25.0%)	171 (75.0%)	0.007
	Yes	209 (17.2%)	1007 (82.8%)	
Completed college	No	32 (27.1%)	86 (72.9%)	0.21
	Yes	101 (20.8%)	385 (79.2%)	
Significant Income reduction during COVID-19 (>20%)	No	165 (18.0%)	751 (82.0%)	<0.001
	Yes	118 (14.3%)	708 (85.7%)	
Cannot cover basic needs well	No	144 (25.2%)	427 (74.8%)	<0.001
	Yes	103 (12.8%)	701 (87.2%)	
Has cut down meals during COVID-19 pandemic	No	155 (27.4%)	410 (72.6%)	<0.001
	Yes	155 (14.3%)	932 (85.7%)	
Region (World Bank)	East Asia & Pacific	89 (36.2%)	157 (63.8%)	<0.001
	Europe & Central Asia	45 (29.8%)	106 (70.2%)	
	Latin American & Caribbean	164 (22.2%)	575 (77.8%)	
	Middle East & North Africa	48 (10.8%)	397 (89.2%)	
	North America	3 (33.3%)	6 (66.7%)	
	Sub-Saharan Africa	0 (0.0%)	35 (100.0%)	
	South Asia	2 (33.3%)	4 (66.7%)	
	Other	4 (21.1%)	15 (78.9%)	
		266 (18.9%)	1138 (81.1%)	

## Discussion

In this study, we found that COVID-19 has significant negative effects on the economic status, as well as HIV prevention and treatment access of sexual and gender minority individuals. These effects were significantly greater among marginalised groups of sexual and gender minority individuals. Racial/ethnic minorities, immigrants, those with food insecurity, those with a history of sex workers, transgender and gender-diverse individuals, individuals with disabilities, and those with lower socio-economic status were disproportionately impacted by COVID-19 in those domains.

These findings mirror our earlier study and other studies, hence demonstrating how COVID-19's impact on deepening pre-existing health inequities have persisted, despite the increased attention to the drivers of health disparities among vulnerable populations at the first wave of the pandemic (Bibbins-Domingo, 2020; Centers for Disease Control and Prevention, 2020; Laurencin & McClinton, 2020; Poteat et al., 2020; Santos et al., 2021). The results from this study underscore the need for targeted and specific efforts to address the economic and HIV prevention and treatment needs of sexual and gender minority individuals, particularly those with intersecting vulnerabilities during the COVID-19 pandemic. Moreover, multi-level approaches to address the upstream social drivers of health inequities are also needed to

**Table 5.** Multivariable Logistic GEE Models on Access to Condoms, ART, HIV care provider during COVID-19 among a global sample of sexual and gender minority individuals, 2020.

		Access to condoms and lubricants ( <i>n</i> = 8,234)			Access to ART ( <i>n</i> = 984)			Access to HIV care provider ( <i>n</i> = 1003)		
		Adjusted Odds Ratio	[95% Conf. Interval]	<i>P</i> -value	Adjusted Odds Ratio	[95% Conf. Interval]	<i>P</i> -value	Adjusted Odds Ratio	[95% Conf. Interval]	<i>P</i> -value
Age		1.01	1.02–1.00	0.039	1.03	1.01–1.05	0.000	1.02	0.99–1.04	0.202
Cis-gender male	No (referent)									
	Yes	1.18	1.00–1.40	0.050	1.22	0.62–2.42	0.561	1.19	0.71–2.01	0.511
Resides in a city/urban area	No (referent)									
	Yes	1.21	1.06–1.38	0.004	0.99	0.61–1.60	0.961	1.40	1.03–1.90	0.030
Report depressive symptoms (PHQ-4 ≥ 3)	No (referent)									
	Yes	0.87	0.73–1.02	0.093	0.84	0.54–1.31	0.438	1.12	0.78–1.62	0.534
Ever engaged in sex work	No (referent)									
	Yes	0.81	0.60–1.10	0.173	0.85	0.53–1.36	0.498	0.84	0.62–1.13	0.253
Non-citizen in country of residence	No (referent)									
	Yes	0.96	0.78–1.19	0.727	0.60	0.43–0.82	0.002	1.05	0.74–1.48	0.778
Racial/Ethnic minority	No (referent)									
	Yes	0.73	0.63–0.86	0.000	0.88	0.58–1.35	0.556	0.68	0.45–1.01	0.056
Living with a disability	No (referent)									
	Yes	0.91	0.66–1.26	0.572	0.92	0.51–1.68	0.787	1.10	0.69–1.74	0.685
Completed college	No (referent)									
	Yes	1.05	0.82–1.34	0.704	0.84	0.54–1.30	0.431	0.99	0.76–1.30	0.947
Significant Income reduction during COVID-19 (>20%)	No (referent)									
	Yes	0.90	0.73–1.09	0.278	0.87	0.72–1.06	0.163	0.80	0.56–1.15	0.226
Cannot cover basic needs well	No (referent)									
	Yes	0.74	0.62–0.87	0.000	0.56	0.44–0.72	0.000	0.67	0.51–0.87	0.003
Has cut down meals during COVID-19 pandemic	No (referent)									
	Yes	0.59	0.52–0.66	0.000	0.70	0.48–1.03	0.067	0.68	0.47–0.97	0.032
Region (World Bank)	Asia Pacific (ref)									
	Europe & Central Asia	0.67	0.41–1.09	0.107	1.48	0.78–2.83	0.230	0.87	0.38–2.01	0.744
	Latin American & Caribbean	0.49	0.24–0.99	0.047	2.57	1.05–6.29	0.038	0.14	0.06–0.33	0.000
	Middle East & North Africa	0.45	0.22–0.92	0.028	0.87	0.08–9.09	0.907	0.27	0.05–1.42	0.121
	North America	0.96	0.50–1.82	0.895	1.00	n/a		1.72	0.77–3.85	0.188
	Sub-Saharan Africa	0.93	0.34–2.50	0.882	0.73	0.21–2.48	0.612	0.58	0.12–2.73	0.487
Living with HIV	South Asia	0.76	0.16–3.65	0.733	1.00	n/a		1.00	n/a	
	No (referent)									
	Yes	0.84	0.63–1.13	0.25	n/a			n/a/		

Note: All GEE Models accounted for clustering by country.

address the intersecting stigmas and systemic structural barriers faced by diverse sexual and gender minority individuals, including systemic racism, criminalisation of sex work, and anti-LGBT and xenophobic policies, all of which have been demonstrated to negatively impact HIV prevention and care efforts (Arreola et al., 2015; S. D. Baral et al., 2015; Martinez et al., 2020; Santos et al., 2014, 2017).

The cross-sectional findings of the present study along with findings from our prior study (Santos et al., 2021) may together suggest sustained disruptions in access to ART during the COVID-19 pandemic. These findings are also corroborated by other studies that have documented COVID-19's impact on the HIV care continuum (Pinto & Park, 2020). ART interruptions have important implications in excess morbidity and mortality associated with HIV infection, as well as HIV transmission (Jewell et al., 2020; Mitchell et al., 2020, 2021). In particular, mathematical models predict that the substantial increases HIV transmission and HIV-related deaths would result from reductions in virologic suppression rates due to ART treatment interruptions (Booton et al., 2021; Mitchell et al., 2021). Therefore, innovative strategies for sexual and gender minority individuals at risk for HIV acquisition and transmission are needed to mitigate the impacts not just of recent and future waves of COVID-19, but also future pandemics that may require mitigation approaches that require physical distancing and/or overwhelm health systems. Failure to adapt and develop these innovative solutions could result in additional set-backs in HIV prevention and care targets among sexual and gender minority individuals, which are already behind, and the exacerbation of HIV morbidity and mortality among more vulnerable groups, including historically marginalised groups with intersecting identities (Ayala et al., 2018; Ayala & Santos, 2016; Baggaley et al., 2016; Bavinton & Grulich, 2021). These strategies may include increasing scale-up of virtual and telehealth visits for PrEP (Quirke et al., 2021) and ART outpatient treatment services (Yelverton et al., 2021) and adherence support for self-management (Cote et al., 2015). Importantly, the successful implementation of these novel approaches would also require efforts to address the barrier to their uptake including the development of multi-level strategies to address the digital divide between technologically savvy and non-savvy, as well as disadvantaged populations, including those with little to no internet access (Yelverton et al., 2021).

Furthermore, our findings on the disproportionate impacts of COVID-19 among marginalised groups also underscore the need to shift current paradigms in HIV prevention and treatment to close the gaps among groups that experience greater barriers due to systemic inequalities. For example, there is increasing interest in the HIV differentiated service delivery (DSD) model – which endeavours to transition service delivery efforts from a 'one-size-fits-all approach' to tailored and diversified models that are patient-centred, considers the unique barriers and preferences, environmental contexts, clinical needs, and package of services of specific populations (International AIDS Society, 2016) – especially in the context of COVID-19 (Collins et al., 2021; Grimsrud & Wilkinson, 2021; Wilkinson & Grimsrud, 2020). Important components of the DSD model particularly relevant for COVID-19 include efforts to simplify and adapt service delivery – for example, modifications in frequency of visits, location of service delivery, and type of health worker delivering the service, based on the needs of different populations while also reducing unnecessary burdens on the health care system (Ehrenkranz et al., 2021). Studies of DSD in the context of COVID-19 indicate early success (e.g. no reductions in ART access despite COVID-19-related barriers (McGinnis et al., 2021)) and continuing to adopt these DSD approaches would be important given the ongoing and unpredictable nature of the COVID-19 pandemic. Additional innovations that hold promise and require more scale-up include home delivery of medications, refill flexibility to allow for 60- or 90-day ART treatment supplies, and early medication refills (Armstrong et al., 2021). In addition, documented lessons learned from prior epidemics also underscore the need for community-engagement and strength-based approaches to effectively meet the HIV prevention and care needs of marginalised communities during COVID-19 (Newman & Guta, 2020).

## Limitations

There are some limitations of this study that are important to note. First, individuals have to be users of Hornet to participate in the survey and therefore must have internet and smartphone access, which limit the generalisability of the study findings to the target population of interest. Moreover, we recognise the heterogeneity in the timelines of the pandemic between and within countries. Although we incorporated clustering within the country and a co-variate for region in our models to try to take these into account, our study may not have fully accounted for these variations and our cross-region comparisons should be interpreted with caution. In addition, the small sample size in some regions (e.g. sub-Saharan Africa, Middle East, and North America) may also limit the generalisability of our findings in these regions and our findings are likely to be more relevant for the regions with larger sample sizes. This is a convenience sample and is not necessarily representative of sexual and gender minority individuals globally. Based on the sociodemographic characteristics of our sample, those engaged with the app and willing and able to take the time to fill out the questionnaire may likely be sexual and gender minority individuals who are less affected by the negative consequences of COVID-19. Therefore, this study may be underestimating the true magnitude of the challenges faced by sexual and gender minority individuals as a result of COVID-19 pandemic. Alternatively, it is also plausible that some of the individuals more impacted by the COVID-19 pandemic may be more motivated to participate in this study, which may potentially counterbalance the underestimates noted above. Nevertheless, prior studies have also documented the ability of social networking platforms to efficiently reach hidden and stigmatised populations (S. Baral et al., 2018). Therefore, it is also plausible that this sample may have reached a more diverse group of sexual and gender minority individuals compared to venue-based sampling or other convenience sampling strategies. Additionally, a complete case analysis was performed, which excluded participants who did not have available data in the analyses. Although our survey was brief and anonymous, it is possible that certain factors, such as language barriers or stigma, may have led particular subgroups of participants to not complete the survey, which may result in non-response bias.

In addition, we recognise the limitations from our measure on history of engaging in sex work. Although lifetime history of sex work has been documented to be a proxy for heightened HIV risk across multiple epidemiologic studies (S. D. Baral et al., 2015), this measure is broad and does not distinguish between current/recent sex work and prior sex work and should be interpreted with this caveat. Moreover, our composite measure on access to condoms and lubricants did not differentiate between access to either condoms or lubricants, and our findings on access to these prevention tools should also be interpreted with this caveat. Another limitation stems from the limited information we collected regarding the factors that may be driving the disparities in access to services. Further studies, including intersectional qualitative methods, as well as novel quantitative methods (Hernandez & Sparks, 2020; Turan et al., 2019), are needed to explore the issues that may be contributing to the unequal levels of access and the cause of these disparities. Finally, the results rely on data that is cross-sectional in nature, which precludes our ability to examine temporal changes in the measures we analyzed.

## Conclusion

COVID-19 continues to have a negative impact on sexual and gender minority individuals financially, as well as on their ability to access HIV services. These consequences were significantly greater among sexual and gender minority people who are living with HIV, transgender and gender-diverse individuals, racial/ethnic minorities, immigrants, those with history of sex work, individuals living with disabilities, and socio-economically disenfranchised. These findings highlight the urgent need to mitigate the negative impacts of COVID-19 among sexual and gender minority

individuals and shift HIV prevention and treatment approaches that consider the unique needs of different populations.

## Disclosure statement

No potential conflict of interest was reported by the author(s).

## Data availability statement

Data available on request due to privacy/ethical restrictions. The data that support the findings of this study are available on request from the corresponding author, Glenn-Milo Santos (Glenn-Milo.Santos@ucsf.edu). The data are not publicly available due to sensitive information that could compromise the privacy of research participants.

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