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Sleep characteristics among black cisgender sexual minority men and black transgender women during the COVID-19 pandemic: The role of multi-level COVID-19-related stressors

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ABSTRACT

Objectives: To determine the association between individual, network, and structural COVID-19-related stressors and changes in sleep duration and quality among Black cisgender sexual minority men (SMM) and Black transgender women during the COVID-19 peak infectivity rate in Chicago.
Methods: From April 20, 2020 to July 31, 2020, we conducted the N2 COVID Study in Chicago (n = 226). The survey included questions regarding multi-level COVID-19-related stressors (eg, food unavailability, partner violence, housing instability, concern about neighborhood COVID-19), sleep duration, and sleep quality.
Results: About 19.5% of our sample reported a shorter duration of sleep during the initial peak COVID-19 infectivity, while 41.2% reported more sleep and 38.9% reported about the same. Compared to the prepandemic period, 16.8% reported that their sleep quality worsened in the COVID-19 pandemic, while 27.9% reported their sleep quality had improved and 55.3% reported it was about the same. In multivariable models, we found that ≥1 day of physical stress reaction, worrying about being infected with COVID-19, traveling during COVID-19 being a financial burden, not having enough medication, knowing someone who was diagnosed with COVID-19, partner violence and housing instability were associated with poor sleep health in the COVID-19 pandemic (adjusted risk ratio: 1.82-3.90, $p < .05$).
Conclusions: These data suggest that COVID-19-related stressors impacted poor sleep duration and quality during the pandemic among this cohort. Multi-level interventions to reduce COVID-19-related stressors (eg, meditation, intimate partner violence prevention and housing programs) may be useful for improving sleep health among Black cisgender sexual minority men and Black transgender women.

Introduction

Sleep, like nutrition and physical activity, is a critical determinant of health and well-being across populations, including among sexual and gender minority populations[1,2] and in the COVID-19 pandemic period.[3,4] Notably, among gay, bisexual and other sexual minority

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men (SMM), previous work has shown that poor sleep quality and short sleep duration were associated with depressive symptoms, the use of alcohol, marijuana and other drugs as well as engagement in condomless anal intercourse.[5,6]

Research on sleep by sexual orientation has generally found that poor sleep characteristics are more likely to be reported by sexual minority populations as than their heterosexual counterparts,[2,7] potentially as a consequence of multiple co-occurring psychosocial health conditions (syndemics)[8] as well as due to experiences of discrimination and minority stress. For example, a study using nationally representative data from the National Health Interview Survey found that, compared to heterosexual men, gay men were more likely to report short sleep duration, feeling unrested, and experiencing difficulties falling asleep.[9]

Emerging data indicate that sexual and gender minority populations from communities of color (eg, Black gay men and Black transgender women [TW]) are more prone to poor sleep, highlighting the importance of using an intersectional approach for studying sleep health.[10,11] It is, therefore, essential to understand the experiences of Black cisgender SMM and Black TW who experience societal disadvantages in order to assess the intersectional impacts of race, sexuality, and gender on sleep health.

Research on pandemic-related changes in sleep among sexual minority populations has shown some alarming trends. For instance, an online survey of 477 SMM (49.3% White, 27.7% Black) in early May 2020 found that almost 75% of participants reported some level of restless sleep in the past week, 42.6% reported worse-than-usual sleep quality since the pandemic and 16.1% reported sleeping longer than usual but not feeling better rested.[12] Although emerging sleep research for general sexual minority groups has been conducted in response to the COVID-19 pandemic, no studies so far have examined such effects within Black cisgender SMM or Black TW, representing a major gap in the literature.

Black cisgender SMM and Black TW may be at an elevated risk for sleep disturbances due to syndemic conditions and a concomitance of the new and existing (but exacerbated) multi-level (an organizational framework that recognizes that multiple levels of an environment can influence health, ie, individual, network and structural) ramifications of the COVID-19 pandemic. First, as an example of individual factors, sleep disturbance is prevalent in people living with HIV.[13] An estimated 1 of 2 Black cisgender SMM will be infected with HIV during their lifetime,[14] and an estimated 44% of Black TW are living with HIV.[15] Second, stress due to employment instability and financial hardship was already prevalent among Black SMM and TW,[16] and additional (and disproportionately higher) burden of such factors stemming from the pandemic may be implicated in poor sleep among these populations.[17,18]

In addition, network-level stressors may increase poor sleep health. For instance, partner violence may also be increased due to lockdown measures in the COVID-19 pandemic,[19] including due to the economic and psychological stressors that come with managing COVID-19, along with fewer resources to seek help. A nation-wide sample of SMM in the United States reported decreased connection to family in April 2020,[20] suggesting increased partner violence, already a problem in SMM. In another sample of cisgender SMM in New York City, 44.3% reported lifetime intimate partner violence (IPV) experience, with 39.2% reporting victimization.[21] Transgender women, especially Black TW, are also more likely to experience IPV,[22,23] with the prevalence of lifetime IPV in one racially diverse sample of TW being 42%.[24] The concurrence of these various stressors as well as structural stressors (such as poor housing and neighborhood conditions) may increase poor sleep in this population, who has already been shown to exhibit unhealthy sleep characteristics.[1,2]

The current study aimed to examine changes in sleep duration and quality among Black cisgender SMM and Black TW during the COVID-19 peak infectivity rate in Chicago. Given that little research has examined multi-level COVID-19-related stress correlates of sleep among sexual and gender minority populations, including those with intersecting marginalized identities such as being Black while being a gender minority, we examined multi-level COVID-19-related correlates of sleep duration and quality among a sample of Black cisgender SMM and Black TW in Chicago, a city with a high COVID-19 prevalence. Based on past theoretical (ie, multi-level,[25] intersectionality,[26] and syndemics[8]) research as well as empirical research on stress and sleep,[27,28] including a study focused on SMM,[27] we hypothesized that increased multi-level COVID-19 stress would be associated with greater risk of having a decline in sleep duration and quality during the pandemic among our sample Black cisgender SMM and Black TW.

Methods

The Neighborhoods and Networks (N2) Cohort Study is an ongoing cohort study investigating the impact of neighborhood- and network-level factors on HIV prevention and care behaviors in Black cisgender SMM and Black TW in Chicago, Illinois and in the Deep South (Jackson, Mississippi and New Orleans and Baton Rouge, Louisiana). The study has been previously described in detail.[29]

Setting

The current study took place in Chicago given ongoing sleep research at this study site and because we had achieved a high retention rate between waves among participants there as of mid-March 2020. For the Chicago site, we used respondent-driven sampling and seed participants were drawn from a cluster of cohort, intervention and service projects. Baseline data collection in Chicago began January 2018 and ended December 2019. We halted all in-person N2 regular surveys from mid-March 2020 to August 2020 due to COVID-19; however, in response to the COVID-19 pandemic, we conducted the N2 COVID Study in Chicago from April 20, 2020 to July 31, 2020 (n = 226).[30] The N2 COVID Study was developed quickly using symptoms and stressors known at the beginning stages of the pandemic while being mindful of COVID-related living conditions of many of the participants which could have included reduced privacy. We contacted 405 of the 412 N2 baseline participants in Chicago and were able to reach 226 of them for the N2 COVID Study. Survey interviews were conducted via Zoom by highly trained interviewers at the Survey Lab at the University of Chicago. Verbal informed consent was obtained from all study participants. In particular, the interviewers read a consent script at the beginning of the interview, asked if the participants had any questions, and then received verbal consent that they would like to participate and it was okay to begin. The interview time lasted forty minutes on average. At the conclusion of the interview, participants were given a $35 incentive. Referrals to social and health services (eg, unemployment benefits and COVID-19 testing) were also provided as needed. The Biological Sciences Division/University of Chicago Medical Center Institutional Review Board (IRB) at the University of Chicago has reviewed and approved all protocols to be implemented at the Chicago Center for HIV Elimination. In addition, the Columbia University Mailman School of Public Health IRB has reviewed and approved all protocols for the N2 Study.

For this study, we selected 2-time frames of the pandemic to disaggregate the data: April 20, 2020 to June 2, 2020 (Lockdown/Phase1/2) and June 3, 2020 to July 31, 2020 (Phase 3/post). These

timelines were chosen based on "Restore Illinois," the gubernatorial mandated public health reopening schedule for the state of Illinois, which corresponded to the differential in degrees of restriction that residents of Chicago experienced during the pandemic. See our Appendix which includes a detailed description of the lockdown stages in Chicago.

Sleep characteristics

The N2 COVID Study included 2 questions on sleep characteristics. The first question assessed sleep duration: "Since the "shelter in place" order, have you been getting more sleep, less sleep, or about the same amount of sleep as before?" The second question assessed sleep quality: "Since the "shelter in place" order, has the quality of your sleep gotten better, gotten worse, or is it about the same as before?" Responses for the sleep duration item were "More sleep"; "Less sleep" and "About the same" and were collapsed as "More sleep" and "About the same" vs. "Less sleep." The response items for the sleep quality item were: "Gotten better"; "Gotten worse"; and "About the same" and were collapsed as "Gotten better" and "About the same" vs. "Worse sleep." For both questions, therefore, no comparison across time was made. The baseline wave of N2, from 2018 and 2019, included a single question regarding sleep: "During the past week, you had trouble falling or staying asleep, or sleeping too much."[31] Response options were: "Rarely or none of the time (Less than 1 day)"; "Some or a little of the time (1-2 days)"; "Occasionally or a moderate amount of time (3-4 days)"; and "All of the time (5-7 days)." Our pre-COVID sleep question was based on a validated measure.[31] However, questions regarding sleep duration and quality on our COVID-19 questionnaire were not previously validated for this population or psychometrically evaluated, given the desire to rapidly capture responses as a global pandemic was unfolding. We developed the COVID-19 sleep questions based on theory of sleep health and in particular Big Events theory.[32]

Multi-level COVID-19-related stressors

COVID-19-related stressors were selected from the NIH repository database in March 2020, at the beginning stages of the pandemic and included based on multi-level theory.[25,33] For this study, we included hypothesized multi-level COVID-19-related stressors on individual, network, and structural levels. For the individual level, measures included: (1) the number of days the participant had a physical stress reaction (eg, sweating, trouble breathing, or nausea) to social distancing, loss of income or work, or concerns about infection in the past 14 days; (2) thinking the participant had been infected with COVID-19; (3) the participant's perceived chance that they will get COVID-19 in the next 3 months; (4) experience of travel related financial burden since the shelter in place order; (5) whether the participant lost income was lost due to COVID-19; (6) the participant's perceived chance they will experience economic challenges (ie, job loss in the next 3 months) due to COVID-19; (7) whether the participant lost health insurance due to COVID-19; (8) whether the participant had enough food since the shelter in place order; and (9) whether the participant had enough medication to last a month since the shelter in place order. For the network level, measures included: (1) the number of days the participant received emotional, material, or financial support from friends or loved ones in the last 7 days during the COVID-19 pandemic; (2) whether the participant's friends or loved ones experienced COVID-19 symptoms such as fever, coughing, upper respiratory distress, or shortness of breath; (3) whether the participant knew someone personally diagnosed with COVID-19; (4) whether the participant was in close proximity to anyone diagnosed with COVID-19 in the last 2 weeks; (5) the participant's perceived likelihood of having had sex with someone who had COVID-19; and 6) whether the participant had experienced partner violence. For the structural level, measures included: (1) housing instability, ie, whether the participant lost a place to stay due to the COVID-19 pandemic; (2) the participant's perceived percent chance that they would lose their place to stay due to COVID-19 within the next 3 months; and (3) the participant's level of concern about the COVID-19 pandemic in their neighborhood in the past 14 days. These variables and how they were operationalized were included in a complimentary study examining HIV status neutral care.[30]

Socio-demographic characteristics

From the baseline survey, we included the following socio-demographic characteristics: age in years, gender identity, sexual orientation, relationship status, education (binary coded as high school or higher vs. no high school and nothing higher), being employed, annual income (binary coded as $\geq$\$20,000 USD vs. $<$\$20,000 USD), and housing stability ("history of housing stability").

Statistical analyses

First, we conducted descriptive statistics for the full sample of participants, including by phase of the COVID-19 pandemic in Chicago. We used Mann-Whitney *U*-test, chi-square test or Fisher's exact test to examine differences by lockdown phase. After descriptive statistics were computed, following the analytic plan of our past research,[30] bivariable and multivariable associations between multi-level (individual, network, and structural) COVID-19-related stressors and sleep characteristics during the peak of the COVID-19 pandemic in Chicago were performed, which is consistent with multi-level theory. To examine bivariable associations, we used Mann-Whitney *U*-test, chi-square test or Fisher's exact test to examine differences in sleep duration and quality changes during the pandemic by socio-demographic characteristics, baseline sleep (frequency of trouble falling or staying asleep, or sleeping too much), and COVID-19-related stressors. Multivariable associations estimated adjusted risk ratios (ARRs) using modified Poisson regressions for less sleep and worse sleep quality adjusting for baseline socio-demographic characteristics, baseline sleep health and survey assessment time period. The time period was included as a confounding covariate due to the changes in levels of restriction set by the lockdown phases; there may be a difference in both social and physical factors that may affect sleep health. Modified Poisson regressions were chosen as this technique robustly estimates ARRs rather than the odds ratio. We did not include all COVID-19 stressors in a single multivariable model, but ran models separately for each COVID-19 stressor due to multicollinearity and for intervention planning. Moreover, we only have one multivariable model for each aspect of sleep characteristic and did not further stratify the analysis by pandemic phases (before or after June 2), due to lack of power for such analyses.

Results

Seventy-seven participants were sampled from April 20 to June 2, 2020, while 149 were sampled from June 3 to July 31 2020. In total, 88.1% identified as male while 9.3% were trans feminine; 2.7% as "other" (Table 1). About one-fifth (19.5%) of our sample reported a shorter duration of sleep during the initial COVID-19 peak infectivity rate in Chicago, while 41.2% reported more sleep and 38.9% reported about the same. Compared to the pre-pandemic period, 16.8% reported that the quality of their sleep worsened in the COVID-19 pandemic while 27.9% reported their sleep quality had improved and

Table 1
Socio-demographic characteristics, COVID-19-related stressors and sleep health among Black cisgender sexual minority men and Black transgender women in the N2 COVID study (April 20, 2020 to July 31, 2020), n = 226

	Overall n = 226 N (%)	Lockdown/Phase 1/Phase 2 April 20-June 2, 2020 n = 77 N (%)	Phase 3/ Post June 3-July 31, 2020 n = 149 N (%)	*p* value[a]
Baseline				
Age (years), mean ± SD; median (IQR)	25.72 ± 4.03; 25.0 (23.0, 29.0)	26.38 ± 3.91); 25.0 (23.0, 30.0)	25.39 ± 4.07); 25.0 (22.0, 28.0)	.10
Age				
16-22	51 (22.6)	13 (16.9)	38 (25.5)	.14
23-24	49 (21.7)	19 (24.7)	31 (20.1)	
25-28	63 (27.9)	18 (23.4)	45 (30.2)	
29-36	62 (27.4)	27 (35.1)	35 (23.5)	
Missing	1 (0.4)	0 (0.0)	1 (0.7)	
Gender identity				
Male	199 (88.1)	67 (87.0)	132 (88.6)	**.03**
Trans feminine	21 (9.3)	5 (6.5)	16 (10.7)	
Other	6 (2.7)	5 (6.5)	1 (0.7)	
Sexual orientation				
Gay	131 (58.0)	49 (63.6)	82 (55.0)	.64
Bisexual	62 (27.4)	20 (26.0)	42 (28.2)	
Straight/other	27 (12.0)	8 (10.4)	19 (12.8)	
Missing	6 (2.7)	0 (0.0)	6 (4.0)	
Relationship status				
Single	138 (61.1)	43(55.8)	95 (63.8)	.24
In a relationship	85 (37.6)	33 (42.9)	52 (34.9)	
Missing	3 (1.3)	1 (1.3)	2 (1.3)	
Education				
Less than high school	23 (10.2)	5 (6.5)	18 (12.1)	.19
High school or higher	203 (89.8)	72 (93.5)	131 (87.9)	
Employed				
No	96 (42.5)	26 (33.8)	70 (47.0)	.06
Yes	130 (57.5)	51 (66.2)	79 (53.0)	
Annual income				
<$20,000 USD	140 (62.0)	44 (57.1)	96 (64.4)	.23
≥$20,000 USD	84 (37.2)	33 (42.9)	51 (34.2)	
Missing	2 (0.9)	0 (0.0)	2 (1.3)	
History of housing stability				
No	67 (29.7)	23 (29.9)	44 (29.5)	.91
Yes	155 (68.6)	52 (67.5)	103 (69.1)	
Missing	4 (1.8)	2 (2.6)	2 (1.3)	
Baseline sleep health (trouble falling/staying asleep, sleeping too much)				
Rarely/none of the time (less than 1 day)	108 (47.8)	36 (46.8)	72 (48.3)	.91
Some/a little of the time (1-2 days)	57 (25.2)	20 (26.0)	37 (24.9)	
Occasionally/a moderate amount of the time (3-4 days)	37 (16.4)	14 (18.2)	23 (15.4)	
All of the time (5-7 times)	24 (10.6)	7 (9.1)	17 (11.4)	
COVID-19 sleep health				
Amount of sleep				
More sleep	93 (41.2)	35 (45.5)	58 (38.9)	.66
Less sleep	44 (19.5)	14 (18.2)	30 (20.1)	
About the same	88 (38.9)	28 (36.4)	60 (40.3)	
Missing	1 (0.4)	0 (0.0)	1 (0.7)	
Sleep quality				
Gotten better	63 (27.9)	25 (32.5)	38 (25.5)	.38
Gotten worse	38 (16.8)	10 (13.0)	28 (18.8)	
About the same	125 (55.3)	42 (54.6)	83 (55.7)	
COVID-19-related stressors				
Individual				
During the last 14 days, umber of days had physical stress reaction to social distancing, loss of income/work, concerns about infection				
0 days	131 (58.0)	46 (59.7)	85 (57.1)	.74
≥1 days	94 (41.6)	31 (40.3)	63 (42.3)	
Missing	1 (0.4)	0 (0.0)	1 (0.7)	
Think you have been infected with COVID-19				
No	36 (15.9)	13 (16.9)	23 (15.4)	.45
Yes	17 (7.5)	8 (10.4)	9 (6.0)	
Missing	173 (76.6)	56 (72.7)	117 (78.5)	
Percent perceived chance you will get COVID-19 in next 3 months				
0%	117 (51.8)	33 (42.9)	84 (56.4)	.03
≥1%	94 (41.6)	40 (52.0)	54 (36.2)	
Missing	15 (6.6)	4 (5.2)	11 (7.4)	
Travel-related financial burden due to COVID-19				
Not at all	91 (40.3)	27 (35.1)	64 (42.9)	.51
A little bit	47 (20.8)	20 (26.0)	27 (18.1)	

(*continued*)

Table 1 (*Continued*)

	Overall n = 226 N (%)	Lockdown/Phase 1/Phase 2 April 20-June 2, 2020 n = 77 N (%)	Phase 3/ Post June 3-July 31, 2020 n = 149 N (%)	*p* value[a]
A moderate amount	37 (16.4)	10 (13.0)	27 (18.1)	
A high amount	26 (11.5)	10 (13.0)	16 (10.7)	
An extreme amount	21 (9.3)	7 (9.1)	14 (9.4)	
Missing	4 (1.8)	3 (3.9)	1 (0.7)	
Lost an income source because of pandemic				
No	55 (24.3)	23 (29.9)	32 (21.5)	.31
Yes	127 (56.2)	43 (55.8)	84 (56.4)	
Missing	44 (19.5)	11 (14.3)	33 (22.2)	
Percent chance you will lose your job in next 3 months because of pandemic				
0%	32 (14.2)	10 (13.0)	22 (14.8)	.06
≥1%	21 (9.3)	12 (15.6)	9 (6.0)	
Missing	173 (76.6)	55 (71.4)	118 (79.2)	
Lost health insurance because of pandemic				
No	174 (77.0)	58 (75.3)	116 (77.9)	.44
Yes	19 (8.4)	9 (11.7)	10 (6.7)	
Don't know	4 (12.8)	1 (1.3)	3 (2.0)	
Missing	29 (12.8)	9 (11.7)	20 (13.4)	
Had enough food since SIP order				
No	62 (27.4)	23 (29.9)	39 (26.2)	.52
Yes	163 (72.1)	53 (68.8)	110 (73.8)	
Don't know	1 (0.4)	1 (1.3)	0 (0.0)	
Had enough medication to last a month since the SIP order				
No	19 (8.4)	4 (5.2)	15 (10.1)	.20
Yes	138 (61.1)	54 (70.1)	84 (56.4)	
Missing	69 (30.5)	19 (24.7)	50 (33.6)	
Network				
During the last 7 days, number of days received emotional, material, or financial support from friends or loved ones				
0 days	94 (41.6)	32 (41.6)	62 (41.6)	.96
≥1 days	131 (58.0)	45 (58.4)	86 (57.7)	
Missing	1 (0.4)	0 (0.0)	1 (0.7)	
Have any of your friends or loved ones experienced any COVID-19 symptoms, such as fever, coughing, upper respiratory distress, or shortness of breath				
No	153 (67.7)	47 (61.0)	106 (71.1)	.24
Yes	67 (29.7)	26 (33.8)	41 (27.5)	
Missing	6 (2.7)	4 (5.2)	2 (1.3)	
Has anyone you know personally been diagnosed with COVID-19				
No	107 (47.4)	37 (48.1)	70 (47.0)	.84
Yes	117 (51.8)	39 (50.7)	78 (52.4)	
Missing	2 (0.9)	1 (1.3)	1 (0.7)	
Has anyone you have been in close proximity with been diagnosed with COVID-19 in last 2 weeks				
No	97 (42.9)	31 (40.3)	66 (44.3)	.66
Yes	16 (7.1)	6 (7.8)	10 (6.7)	
Missing	113 (50.0)	40 (52.0)	73 (49.0)	
Likelihood of having had sex with someone who had COVID-19				
Not likely	187 (82.7)	60 (77.9)	127 (85.2)	.09
Somewhat/very/extremely likely	34 (15.0)	16 (20.8)	18 (12.1)	
Missing	5 (2.2)	1 (1.3)	4 (2.7)	
Experiencing partner violence during pandemic				
No	181 (80.1)	63 (81.8)	118 (79.2)	.57
Yes	43 (19.0)	13 (16.9)	30 (20.1)	
Missing	2 (0.9)	1 (1.3)	1 (0.7)	
Structural				
Lost a place to stay due to pandemic				
No	184 (81.4)	66 (85.7)	118 (79.2)	.99
Yes	28 (12.4)	10 (13.0)	18 (12.1)	
Missing	14 (6.2)	1 (1.3)	13 (8.7)	
Percent chance of losing your place to stay in next 3 months due to pandemic				
0%	128 (56.6)	37 (48.1)	91 (61.1)	**.01**
≥1%	51 (22.6)	26 (33.8)	25 (16.8)	
Missing	47 (20.8)	14 (18.2)	33 (22.2)	
Concerned about the pandemic in your neighborhood in the past 14 days				
Very/somewhat concerned	180 (79.7)	67 (87.0)	113 (75.8)	**.048**
Not very/not at all concerned	46 (20.4)	10 (13.0)	36 (24.2)	

SIP, shelter in place. . Pandemic refers to the COVID-19 pandemic. Bold indicates significance.

[a] Mann-Whitney *U*-test, chi-square test, or Fisher's exact test.

55.3% reported it was about the same. In terms of baseline sleep, 47.8% reported trouble falling or staying asleep, ie, sleeping rarely or none of the time (Less than 1 day), while 25.2% reported some or a little of the time (1-2 days); 16.4% reported occasionally or a moderate amount of the time (3-4 days) and 10.6% reported all of the time (5-7 days).

Multi-level (individual, network, and structural) COVID-19-related stressors and changes in sleep duration and sleep quality during the initial peak of the pandemic

Tables 2 and 3 show the bivariable and multivariable associations of multi-level (individual, network, and structural) COVID-19-related stressors with sleep duration and quality among our sample of Black SMM and Black TW during the COVID-19 peak infectivity rate in Chicago.

In multivariable models, we found that some of individual stressors were positively associated with worsening of sleep quality and experiencing a decline in sleep duration during the COVID-19 pandemic ($p < .05$): ≥1 day of physical stress reaction, worrying about being infected with COVID-19 in the next 3 months, traveling during COVID-19 being a financial burden, and not having enough medication. In particular, we found that ≥1 day of physical stress reaction (ARR: 2.07; 95% CI: 1.12, 3.80), traveling during COVID-19 being a financial burden (ARR: 2.01; 95% CI: 1.03, 3.89), and not having enough medication (ARR: 3.47; 95% CI: 1.37, 8.80) were positively associated with worsened sleep quality during the pandemic. Not having enough medication was also significantly associated with experiencing a decline in sleep duration (ARR: 2.89; 95% CI: 1.35, 6.18).

Network stressors were also positively associated with poor sleep: knowing someone who was diagnosed with COVID-19 was associated with worsening of sleep quality during the pandemic (ARR: 2.20; 95% CI: 1.04, 4.65, $p < .05$), and partner violence was positively associated with experiencing a decline in sleep duration (ARR: 1.82; 95% CI: 1.01, 3.31, $p < .05$).

In terms of structural stressors, losing a place to stay due to the COVID-19 pandemic was significantly associated with both getting less sleep (ARR: 2.01; 95% CI: 1.02, 3.94, $p < .05$) and worsening of sleep quality (ARR: 3.90; 95% CI: 1.73, 8.79, $p < .05$) in the COVID-19 pandemic. No other significant associations were found between network and structural stressors and sleep.

Discussion

This is also one of very few overall studies to examine sleep in among Black cisgender SMM and Black TW even outside the context of the COVID-19 pandemic.[1,2,11] In the N2 COVID survey among participants in Chicago (n = 226), 61% of our participants reported significant changes to their sleep duration (19.5% reported less sleep) since March 2020 and 16.8% reported that their sleep quality has worsened in the COVID-19 pandemic. This study was conducted during significant local and national unrest due to the murder of George Floyd, which could be a source of anxiety and stress in our study population along with potential racialized policing during the COVID-19 pandemic.

Notably, this study examined different phases of the lockdown, whereas most studies simply observe the effects during a single phase of lockdown or speak broadly to restriction measures generally. To our knowledge, this is also the first study to examine 2 key aspects of sleep, duration and quality among Black sexual and gender minorities during the COVID-19 pandemic, which are linked to multiple health outcomes. Our findings are consistent with the limited literature on sleep during the COVID-19 pandemic, including in SMM, demonstrating that the pandemic substantially altered sleep characteristics. For example, in a study of 477 racially diverse SMM in early May 2020 found that almost 75% reported some level of restless sleep in the past week, 42.6% reported worse-than-usual sleep quality since the pandemic, and 16.1% reported sleeping longer than usual but not feeling better rested.[12] Further, we found that 41% and 28% of our participants reported improvements in their sleep duration and quality during the pandemic. This finding is also consistent with a growing body of evidence showing that some individuals experienced improvement in their sleep, particularly increases in sleep duration, during the pandemic.[34-36] This may be because more individuals were unemployed, underemployed, or had less job responsibilities during the initial shutdown in the peak of the COVID-19 pandemic. In addition, the flexibility of remote working arrangements may have contributed to these observed increases in total sleep time. However, the impact of the pandemic on sleep quality is more nuanced and varies greatly by prepandemic sleep quality and participant characteristics.[34] Indeed, in the present study, a greater percentage of participants experienced improvements in their sleep duration than in their sleep quality.

Our results also show that multi-level COVID-19 stressors, ie, ≥1 day of physical stress reaction, worrying about being infected with COVID-19, traveling during COVID-19 being a financial burden, not having enough medication, knowing someone who was diagnosed with COVID-19, partner violence and housing instability, were associated with poor sleep health during the COVID-19 peak infectivity rate in Chicago. These findings are consistent with the existing literature on stress-related correlates of poor sleep characteristics, as well as the limited literature on sleep in the COVID-19 pandemic. For example, among a racially diverse sample of SMM recruited in May 2020, of the participants reporting worse-than-usual sleep or feeling not rested, almost 85% reported that worry about the pandemic had been contributing to their troubles with falling or staying asleep.[12] In addition, rates of worsened sleep were highest among those whose financial situation had been adversely affected and those not in full-time employment and greater emotional distress was associated with sleep.[12] This is consistent with a prior study on financial hardship and poor sleep among SMM as well as a study on financial hardship in the COVID-19 pandemic and overall health in a general (ie, nonsexual or gender minority) population.[37-40] Another study found that perception of being infected with COVID-19 and anxiety triggered the chance of developing sleep disturbance among a nonsexual or gender minority sample that is similar to our finding of being worried about being infected with COVID-19 associated with poor sleep in our sample.[40] In a study of 5461 individuals from mainland China, increased risk of contracting SARS-CoV-2 was associated with a significant increase in insomnia and stress.[41] While COVID-19 prevention requires social distancing and isolation, this may not be possible for many Black cisgender SMM and Black TW.

Due to structural and social factors,[29] Black cisgender SMM and Black TW often have high rates of housing instability and may engage in in-person sex work due to job loss during the pandemic despite stay-at-home orders.[15] Moreover, many Black SMM and Black TW are in low wage positions that require frequent contact with the public (ie, transportation, food service industry/fast food, shipping), and have less of an economic safety net that would allow them to temporarily leave these jobs (or work from home), further placing them at risk for COVID-19. A global systematic review and meta-analysis of general populations, domestic conflict was associated with poorer sleep.[39] One US study found among a sample of 696 cisgender SMM, between March and May of 2020, 12.6% of participants reported experiencing any IPV.[42] Of those who reported IPV victimization during lockdown, for almost half this was their first experience.

Table 2
Bivariable associations between COVID-19-related stressors and COVID-19 sleep health, N2 COVID study

	Sleep amount			Sleep quality		
	More sleep and about the same (N = 181)	Less sleep (N = 44)	*p* value	Gotten better and about the same (N = 188)	Worse sleep (N = 38)	*p* value[a]
COVID-19-related stressors						
Individual						
	N (%)	N (%)		N (%)	N (%)	
During the last 14 days, number of days had physical stress reaction to social distancing, loss of income or work, concerns about infection						
0 days	110 (60.8)	20 (45.5)	.09	116 (61.7)	15 (39.5)	**.02**
≥1 days	71 (39.2)	23 (52.3)		72 (38.3)	22 (57.9)	
Missing	0 (0.0)	1 (2.3)		0 (0.0)	1 (2.6)	
Think you have been infected with COVID-19						
No	27 (14.9)	9 (20.5)	.73	25 (13.3)	11 (29.0)	.18
Yes	14 (7.7)	3 (6.8)		15 (8.0)	2 (5.3)	
Missing	140 (77.4)	32 (72.7)		148 (78.7)	25 (65.8)	
Percent perceived chance you will get COVID-19 in next 3 months						
0%	100 (55.3)	16 (36.4)	**.048**	104 (55.3)	13 (34.2)	**.04**
≥1%	71 (39.2)	23 (52.3)		74 (39.4)	20 (52.6)	
Missing	10 (5.5)	5 (11.4)		10 (5.3)	5 (13.2)	
Travel-related financial burden due to COVID-19						
Not at all/A little	116 (64.1)	22 (50.0)	.20	124 (66.0)	14 (36.8)	**.003**
Moderate/high/extreme	64 (35.4)	19 (43.2)		63 (33.5)	21 (55.3)	
Lost an income source because of pandemic						
No	45 (24.9)	10 (22.7)	.47	49 (26.1)	6 (15.8)	.15
Yes	97 (53.6)	29 (65.9)		102 (54.3)	25 (65.8)	
Missing	39 (21.6)	5 (11.4)		37 (19.7)	7 (18.4)	
Percent chance you will lose your job in next 3 months because of pandemic						
0%	28 (15.5)	4 (9.1)	.46	30 (16.0)	2 (5.3)	.37
≥1%	16 (8.8)	5 (11.4)		18 (9.6)	3 (7.9)	
Missing	137 (75.7)	35 (79.6)		140 (74.5)	33 (86.8)	
Lost health insurance because of pandemic						
No	141 (77.9)	32 (72.7)	.41	143 (76.1)	31 (81.6)	1.00
Yes	14 (7.7)	5 (11.4)		16 (8.5)	3 (7.9)	
Missing	26 (14.4)	7 (15.9)		29 (15.4)	4 (10.5)	
Had enough food since SIP order						
No	47 (26.0)	14 (31.8)	.45	47 (25.0)	15 (39.5)	.07
Yes	133 (73.5)	30 (68.2)		140 (74.5)	23 (60.5)	
Missing	1 (0.6)	0 (0.0)				
Had enough medication to last a month since SIP order						
No	11 (6.1)	8 (18.2)	**.007**	12 (6.4)	7 (18.4)	**.008**
Yes	115 (63.5)	22 (50.0)		120 (63.8)	18 (47.4)	
Missing	55 (30.4)	14 (31.8)		56 (29.8)	13 (34.2)	
Network						
	N (%)	N (%)		N (%)	N (%)	
During last 7 days, number of days received emotional, material, or financial support from friends or loved ones						
0 days	76 (42.0)	18 (40.9)	.99	80 (42.6)	14 (36.8)	.60
≥1 days	105 (58.0)	25 (56.8)		108 (57.5)	23 (60.5)	
Missing	0 (0.0)	1 (2.3)		0 (0.0)	1 (2.6)	
Have any friends or loved ones experienced any COVID-19 symptoms, such as fever, coughing, upper respiratory distress, or shortness of breath						
No	128 (70.7)	24 (54.6)	**.03**	131 (70.0)	22 (57.9)	.09
Yes	48 (26.5)	19 (43.2)		51 (27.1)	16 (42.1)	
Missing	5 (2.8)	1 (2.3)		6 (3.2)	0 (0.0)	
Anyone you know personally diagnosed with COVID-19						
No	89 (49.2)	17 (38.6)	.19	95 (50.5)	12 (31.6)	**.03**
Yes	90 (49.7)	27 (61.4)		91 (48.4)	26 (68.4)	
Missing	2 (1.1)	0 (0.0)		2 (1.1)	0 (0.0)	
Anyone with whom you have been in close proximity diagnosed with COVID-19 in the last 2 weeks						
No	77 (42.5)	20 (45.5)	.14	78 (41.5)	19 (50.0)	.11
Yes	10 (5.5)	6 (13.6)		10 (5.3)	6 (15.8)	
Missing	94 (51.9)	18 (40.9)		100 (53.2)	13 (34.2)	
Likelihood of having had sex with someone who had COVID-19						
Not likely	154 (85.1)	32 (72.7)	**.04**	156 (83.0)	31 (81.6)	.88
Somewhat/very/extremely	23 (12.7)	11 (25.0)		28 (14.9)	6 (15.8)	
Missing	4 (2.2)	1 (2.3)		4 (2.1)	1 (2.6)	
Experiencing partner violence during the pandemic						
No	149 (82.3)	31 (70.5)	.11	156 (83.0)	25 (65.8)	**.03**
Yes	31 (17.1)	12 (27.3)		31 (16.5)	12 (31.6)	
Missing	1 (0.6)	1 (2.3)		1 (0.5)	1 (2.6)	

(*continued*)

Table 2 (*Continued*)

	Sleep amount More sleep and about the same (N = 181)	Less sleep (N = 44)	*p* value	Sleep quality Gotten better and about the same (N = 188)	Worse sleep (N = 38)	*p* value[a]
Structural						
	N (%)	N (%)		N (%)	N (%)	
Lost a place to stay due to the pandemic						
No	150 (82.9)	33 (75.0)	.12	158 (84.0)	26 (68.4)	**.02**
Yes	19 (10.5)	9 (20.5)		19 (10.1)	9 (23.7)	
Missing	12 (6.6)	2 (4.6)		11 (5.9)	3 (7.9)	
Percent chance of losing your place to stay in next 3 months due to pandemic						
0%	109 (60.2)	19 (43.2)	.25	113 (60.1)	15 (39.5)	.47
≥1%	39 (21.6)	11 (25.0)		43 (22.9)	8 (21.1)	
Missing	33 (18.2)	14 (31.8)		32 (17.0)	15 (39.5)	
Concerned about the pandemic in your neighborhood in the past 14 days						
Very/somewhat concerned	144 (79.6)	35 (79.6)	1.00	147 (78.2)	33 (86.8)	.23
Not very/not at all concerned	37 (20.4)	9 (20.5)		41 (21.8)	5 (13.2)	

SIP, shelter in place. Pandemic refers to the COVID-19 pandemic. Bold indicates significance.
[a] Mann-Whitney *U*-test, chi-square test, or Fisher's exact test.

Regarding our interesting key finding of not having enough medication being associated with poor sleep, we suspect that access to care was reduced during the lockdown period.[43] Our finding of an association between housing and sleep is in line with past research documenting the association, including in marginalized populations.[11] We were surprised not to find an association between being concerned about COVID-19 in their neighborhoods and the worsening of sleep duration and quality. Given that Chicago is a city with extreme residential segregation and that COVID-19 cases were often concentrated in Black neighborhoods,[44] we expected that concern about COVID-19 spread in local neighborhoods would exacerbate sleep problems. The lack of heterogeneity of N2 participants across different Chicago neighborhoods may help to explain these null results.

Future research

Future studies with objective and subjective sleep health measures should be conducted among Black cisgender SMM and Black TW to better understand the impact of the ongoing COVID-19 pandemic on multidimensional sleep health in this population. Longitudinal sleep health data, including throughout the COVID-19 pandemic, is also necessary to provide critical data on sleep trajectories and inform future sleep health promotion interventions and would benefit from an assessment of a wide range of sleep health conditions.[4] COVID-19-related stressors can be assessed using standard scales, such as the Coronavirus Impact Scale,[45] an 11-item scale that measures the psychosocial impact of COVID-19[45] increasing comparability across studies, as well as other COVID-19-related stressors such as potential stress from COVID variants, including the Omicron variant. These studies should focus on larger samples of Black TW for power and to recognize the unique experiences of this population. Further, additional research is warranted surrounding multi-level intersectional stigma (including during the COVID-19 pandemic) facing sexual and gender minorities with intersectional identities such as Black SMM and TW.

Limitations

Notwithstanding the novel findings and strengths, the study has a number of limitations, including the use of self-reported sleep data, which is associated with social desirability bias and same-source bias. The questions about sleep during the pandemic were not validated or psychometrically evaluated, due to the rapid implementation during a COVID-19 peak. There can be misclassification, therefore, in the response of the COVID-19 sleep questions. We have no reason to be believe there is differential misclassification. Not controlling for Type 1 error is also a concern. While we controlled for frequency of trouble falling or staying asleep or sleeping too much at baseline, we only have one self-reported measure of baseline sleep characteristics. However, the wide range of covariates in the multivariable models may reduce potential confounding. In addition, residual confounding also exists in this study, in part, because the pre-COVID and COVID sleep measures are not consistent. However, our ability to control for pre-COVID sleep health is a major strength. Similar to all observational studies, including cross-sectional datasets, causal inference cannot be established. Finally, we had a large nonresponse rate, which reduces the generalizability of our findings, and due to the small sample size, we were also not able to examine the differences between TW and SMM. These results may not be generalizable to all Black cisgender SMM or Black TW in Chicago or other urban regions, due to the small sample size, particularly the Black TW.

Conclusions and implications

These data suggest that COVID-19-related stressors impacted poor sleep duration and quality in the pandemic among Black cisgender SMM and Black TW. Multi-level interventions to reduce COVID-19-related stressors (eg, meditation, intimate partner violence prevention and housing programs) may be useful for improving sleep health among Black cisgender SMM and Black TW.

Declaration of conflict of interest

The authors have declared no conflicts of interest.

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Table 3
Multivariable associations[a] between COVID-19-related stressors and COVID-19 sleep health, N2 COVID study

COVID-19-related stressors	Less sleep amount ARR (95% CI)	Worse sleep quality ARR (95% CI)
Individual		
In the past 14 days, number of days had a physical stress reaction to social distancing, loss of income or work, or concerns about infection		
0 days	Ref	Ref
≥ 1 days	1.63 (0.94, 2.83)	**2.07 (1.12, 3.80)***
Think you have been infected with COVID-19		
No	Ref	Ref
Yes	2.87 (0.76, 10.91)	0.23 (0.04, 1.28)
Percent perceived chance you will get COVID-19 in the next 3 months		
0%	Ref	Ref
≥1%	1.56 (0.84, 2.88)	1.91 (1.00, 3.66); p=0.051
Travel-related financial burden due to COVID-19		
Not at all/a little	Ref	Ref
Moderate/high/extreme	1.55 (0.88, 2.73)	**2.01 (1.03, 3.89)***
Lost an income source because of pandemic		
No	Ref	Ref
Yes	1.62 (0.86, 3.02)	2.36 (0.98, 5.69)
Percent chance of losing your job in next 3 months because of pandemic		
0%	Ref	Ref
≥1%	0.96 (0.16, 5.77)	0.30 (0.03, 2.68)
Lost health insurance because of pandemic		
No	Ref	Ref
Yes	1.18 (0.44, 3.22)	0.63 (0.20, 1.99)
Had enough food since SIP order		
No	Ref	Ref
Yes	0.74 (0.40, 1.35)	0.74 (0.38, 1.45)
Had enough medication to last a month since SIP order		
No	**2.89 (1.35, 6.18)****	**3.47 (1.37, 8.80)****
Yes	Ref	Ref
Network		
During last 7 days , number of days received emotional, material, or financial support from friends or loved ones		
0 days	Ref	Ref
≥1 days	1.22 (0.71, 2.09)	1.30 (0.69, 2.43)
Have any friends or loved ones experienced any COVID-19 symptoms, such as fever, coughing, upper respiratory distress, or shortness of breath		
No	Ref	Ref
Yes	1.46 (0.85, 2.49)	1.38 (0.77, 2.48)
Anyone you know personally has been diagnosed with COVID-19		
No	Ref	Ref
Yes	1.28 (0.72, 2.27)	**2.20 (1.04, 4.65)***
Anyone with whom you have been in close proximitydiagnosed with COVID-19 in the last 2 weeks		
No	Ref	Ref
Yes	1.31 (0.56, 3.11)	1.18 (0.43, 3.29)
Likelihood of having had sex with someone who had COVID-19		
Not likely	Ref	Ref
Somewhat/very/extremely	1.56 (0.83, 2.96)	0.91 (0.36, 2.29)
Experiencing partner violenceduring pandemic		
No	Ref	Ref
Yes	**1.82 (1.01, 3.31)***	1.65 (0.80, 3.42)
Structural		
Lost a place to stay due to pandemic		
No	Ref	Ref
Yes	**2.01 (1.02, 3.94)***	**3.90 (1.73, 8.79)****
Percent chance of losing your place to stay in next 3 months due to pandemic		
0%	Ref	Ref
≥1%	2.00 (1.00, 4.01); p=0.051	1.44 (0.57, 3.61)
Concerned about pandemic in your neighborhood in the past 14 days		
Very/somewhat concerned (n = 180)	1.29 (0.70, 2.38)	1.95 (0.87, 4.34)
Not very/ not at all concerned (n = 46)	Ref	Ref

ARR, adjusted risk ratio; CI, confidence interval; SIP, shelter in place. Pandemic refers to the COVID-19 pandemic. Bold indicates significance.

[a] Adjusted for age, gender identity, sexual orientation, relationship status, education, employment, income, history of housing stability, baseline sleep health and survey assessment time period.

Bold indicates significance.

* $p < .05$.

** $p < .01$.

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Author contributions

D. T. Duncan conceptualized the study, interpreted the results and drafted the article. S.H. Park conducted all statistical analysis. Y-T. Chen, H. Mountcastle, L. Timmins, and J. A. Schneider assisted with the study design. All authors critically reviewed the manuscript and have read and approved the final article.

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Supplementary materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.sleh.2022.06.006.

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