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**Inequalities in Young Adult College Students' Sleep Quality During the COVID-19
Pandemic**

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20

1 **Abstract**

2 **Objective:** To document sleep quality and inequalities in sleep quality by gender, sexual
3 orientation, race/ethnicity, and socioeconomic position (SEP), in college students across the
4 United States during the COVID-19 pandemic.

5 **Participants:** 707 full-time college students aged 18-22 completed an online survey.

6 **Methods:** The Pittsburgh Sleep Quality Index (PSQI) was used to measure sleep quality in late
7 April 2020.

8 **Results:** 78% of students reported poor sleep quality. Women, transgender and gender diverse
9 (TGD), and LGBTQ+ (non-heterosexual) youth reported worse sleep quality. Low- and middle-
10 SEP students also reported worse sleep quality.

11 **Conclusions:** As the COVID-19 pandemic continues, colleges should work to reduce
12 inequalities in sleep health among their students by offering students located in different time
13 zones the option to take courses fully asynchronously and providing skills-based education for
14 enhancing sleep hygiene. Finally, it is important to monitor the ongoing presence of sleep
15 disparities disproportionately experienced by members of marginalized communities.

16 *Keywords:* sleep, COVID-19, college students, gender, health disparities

1 overall sleep quality is crucial to understanding the impacts of the COVID-19 pandemic on
2 young adult college students' sleep.

3 Existing research underscores the importance of sleep duration and quality for college
4 student well-being. College students with lower sleep quality have significantly more physical
5 and mental health problems than peers with higher sleep quality.⁷ For example, low sleep quality
6 among college students predicts depression,⁹ and students who experience sleep disturbances are
7 more likely to engage in other risky health behaviors, including physical inactivity, smoking,
8 and, for men, heavy drinking.¹⁰ Sleep disturbances and poor sleep quality also have negative
9 impacts on academic performance, course progress, and academic self-efficacy.¹¹ Importantly,
10 sleep deprivation can lead to impaired immune function and increased risk of illness,¹² which can
11 put students at a higher risk of contracting COVID-19.¹³

12 **Sleep Quality in the Context of COVID-19**

13 Research predating the pandemic has found that large-scale social stressors (e.g.,
14 elections)¹⁴ and traumatic events (e.g., the September 11 terrorist attacks),¹⁵ can lead to declines
15 in sleep quality and greater sleep disturbances, suggesting that the COVID-19 pandemic may
16 have similar effects. College students, in particular, may be at higher risk of experiencing sleep
17 problems because their media consumption has increased over the course of the pandemic,¹⁶ and
18 exposure to news and media coverage of the pandemic has been linked to a greater number of
19 sleep problems.¹⁷ Indeed, emerging research suggests that the COVID-19 pandemic has had
20 broad impacts on sleep health among college students. A study of U.S. students found greater
21 sleep disruptions and lower quality of sleep during the pandemic, with most students in this
22 sample (86%) reporting disruptions to their sleep patterns and over one-third (38%) describing
23 these disruptions as severe.⁹ Others have found significant changes in sleep duration, bedtime,

1 and wake times as compared to before the pandemic.¹⁸ Declines in sleep quality at the start of the
2 COVID-19 pandemic may be explained by campus closures, which contributed to the loss of in-
3 person support networks¹⁹ and a sense of loss of independence among students who returned to
4 their familial homes,⁹ potentially increasing interpersonal conflict which is associated with worse
5 sleep quality.²⁰ Furthermore, the COVID-19 pandemic introduced additional stressors into the
6 lives of college students, including financial insecurity,²¹ increased fear for their health and the
7 health of their loved ones,⁹ future career uncertainty,²¹ and increased stress and anxiety,²¹ all of
8 which can impact sleep quality.⁹

9 It is worth noting, however, that other research to date suggests that the pandemic caused
10 no change in college students' sleep quality as compared to pre-pandemic reports,¹⁸ or even
11 contributed to increases in sleep duration.²² Given these inconsistent findings, it is crucial to
12 understand factors affecting the dimensions of sleep quality in college students during the
13 COVID-19 pandemic.

14 **Inequalities in Sleep Among College Students**

15 While all college students experienced sudden and unexpected changes as a result of the
16 COVID-19 pandemic, inequalities in sleep quality by students' sociodemographic characteristics
17 have been well-documented prior to the pandemic. There is evidence that college-going women
18 experience worse sleep quality than college-going men,^{2,4,23} however, both men and women
19 report PSQI global scores that indicate poor sleep quality.²³ When comparing the components of
20 sleep quality, women report longer sleep latency, lower sleep efficiency, and more frequent sleep
21 disturbances, use of sleep medication, and daytime dysfunction than men.⁴ Possible explanations
22 for these inequalities include higher stress among college-going women than men⁷ and more
23 frequent use of maladaptive coping methods such as rumination among women, resulting in

1 decreased sleep quality.²⁴ Findings, however, are mixed, as others have reported no significant
2 pre-pandemic gender differences in sleep quality.²⁵ The COVID-19 pandemic may also be
3 widening gendered sleep inequalities; one study of nursing students in Spain found that women
4 and men reported similar sleep quality, but that stay-at-home orders caused significant decreases
5 in sleep quality only in women.²⁶

6 Transgender and gender diverse (TGD) individuals are shown to be at a greater risk of
7 experiencing disruptive sleep than their cisgender peers, with 60% reporting using medications
8 as a way to cope with their sleep problems.²⁷ Poor sleep quality among TGD college students
9 may be exacerbated by experiences of gender-identity discrimination and stigmatization.²⁸
10 Lesbian, gay, bisexual, queer, and other sexual minority (LGBQ+) young adults are also at a
11 higher risk for sleep problems than their heterosexual counterparts.⁵ Lack of parental support²⁹
12 and poor social relationships³⁰ are associated with poor sleep health in LGBQ+ young adults.
13 Therefore, returning to households with poor parental support while simultaneously losing peer
14 support networks on campus during the COVID-19 pandemic could have deleterious effects on
15 TGD and LGBQ+ students' sleep health.

16 Sleep disparities also exist by socioeconomic position (SEP). On average, lower-SEP
17 students have a higher rate of sleep problems than middle- or higher-SEP students.³ Furthermore,
18 lower-SEP college students are more likely to encounter various environmental factors that
19 negatively affect sleep, such as excess noise or household crowding,³¹ potentially exacerbating
20 sleep disparities. Lower-SEP students are also more likely to experience greater financial
21 stress,³² which can further impede sleep quality.³

22 There is mixed empirical support for racial/ethnic differences in sleep quality among
23 college students. Some research has found that racial/ethnic minority students report greater

1 sleep difficulties than their White² or Asian peers³³ and that Black college students report poorer
2 sleep outcomes compared to White students.^{1,2,34} Black students' experiences of institutional and
3 interpersonal discrimination³⁵ and Asian-American students' experiences of racial
4 microaggressions³⁶ have also been found to contribute to poor sleep. Meanwhile, other work has
5 found no significant differences in sleep duration between White, Asian, and Hispanic/Latino
6 students and no differences in insomnia symptoms across groups.¹ People of color, however,
7 have been disproportionately affected by the COVID-19 pandemic,³⁷ which may create or further
8 exacerbate sleep inequalities between racial/ethnic minority students and their White peers.

9 **The Current Study**

10 This descriptive, quantitative study examines perceived sleep quality in a diverse,
11 national sample of students in colleges in the U.S. during the first peak of COVID-19 in late
12 April 2020. We examine inequalities in overall sleep quality and seven dimensions of sleep
13 across gender, sexual orientation, race/ethnicity, and SEP.

14 **Methods**

15 **Participants and Procedure**

16 Full-time college students aged 18-22 were recruited through targeted advertisements on
17 Instagram, which is an effective method for recruiting diverse young adults. In 2019, 67% of
18 adults ages 18-29 and over 80% of college students used Instagram.^{38,39} Recent research shows
19 that paid advertisements on Instagram are highly successful in recruiting those who view ads to
20 participate as compared to other social media sites,⁴⁰ and are particularly effective in recruiting
21 harder-to-reach participants, such as gender or sexual minority young adults.⁴¹ Our Instagram
22 advertisements led participants to a screening questionnaire that verified that they were currently
23 enrolled full-time at an institution of higher education in the U.S. and that they were between the

1 ages of 18 and 22. Participants who met eligibility criteria were asked to enter a “.edu” email
2 address to which the link to the full survey was sent. To further confirm eligibility, we excluded
3 participants whose screener age did not match the age they provided in the demographics section
4 of the survey ($n = 7$). Data were collected between April 25 and April 30, 2020. Upon
5 completion of the survey, all participants received a \$10 Amazon.com gift card. An extensive
6 description of the study design, along with a comparison of the sociodemographic characteristics
7 of the study sample to national data on full-time college students in the U.S., can be found
8 elsewhere.⁴² The [BLINDED] Institutional Review Board approved the study.

9 The final sample consisted of 707 students (mean age=20.0, SD=1.3) from 374 different
10 U.S. college campuses. The majority of participants identified as women (61.0%); with the
11 remaining participants identifying as men (34.4%) or TGD (4.6%), which includes transgender,
12 gender non-binary, and genderqueer participants. In terms of sexual orientation, 71.2% of
13 students identified as heterosexual, 12.6% bisexual, 6.8% gay or lesbian, and 9.4% reported
14 another sexual orientation (e.g., queer, questioning). The majority of the sample was non-
15 Hispanic White (54.3%), followed by Asian/Asian American or Pacific Islander (AAPI; 20.4%),
16 Hispanic/Latinx (8.9%), Black/African American (5.2%), Middle Eastern/North African (1.1%),
17 and multiracial (10.1%). We used participant’s pre-COVID-19 household income as a proxy for
18 SEP; 12.9% of students in our sample had a household income less than \$26,000/year
19 (approximately the federal poverty line for a family of four in 2020), 20.9% lived in households
20 earning between \$26,000 and \$53,999 per year (approximately 200% of the FPL), and 28.7% in
21 households earning between \$54,000 and \$99,999. The remaining participants came from higher-
22 income homes, earning at least \$100,000 but less than \$250,000 (31.7%) or \$250,000 or more
23 (5.8%) per year.

1 **Measures**

2 We used the PSQI⁶ to measure college students' total perceived sleep quality. The PSQI
3 is a widely-used measure that assesses various dimensions of sleep over the past month and has
4 been validated for use with college students.²⁵ The PSQI measures seven components of sleep:
5 sleep quality, sleep latency, sleep duration, sleep efficiency, sleep disturbance, use of sleep
6 medication, and daytime dysfunction. Responses for each component are scored on a scale of
7 zero to three, with higher scores indicating worse sleep. Component scores are then tallied,
8 yielding a global score that can range from 0 to 21. A global score greater than 5 indicates poor
9 sleep quality.

10 Participants reported their gender identity by selecting their current gender from a list of
11 seven different gender identities (man, woman, trans man, trans woman, genderqueer/gender
12 non-conforming, non-binary, different identity), or writing in their response. For analysis, we
13 collapsed responses into three categories: men, women, and TGD. For sexual orientation,
14 participants indicated their current sexual identity by either choosing from among six choices
15 (straight/heterosexual, gay or lesbian, bisexual, asexual, queer, pansexual, or questioning), or
16 writing in their response. For analysis, we collapsed responses into two categories: heterosexual
17 and LGBTQ+.

18 For race/ethnicity, participants were instructed to select all racial/ethnic identities that
19 applied from a list; we collapsed responses into six groups: White (including Middle
20 Eastern/North African), Black or African American, Hispanic or Latinx, Native American or
21 American Indian or Alaskan Native, Asian or Asian American and/or Pacific Islander and/or
22 Native Hawaiian (AAPI), and multiracial (identified with two or more racial/ethnic groups).

1 We found that women reported worse sleep quality, latency, and disturbances than men,
2 as well as more frequent medication use and daytime dysfunction, which aligns with previous
3 research finding that women college students may be experiencing more significant disturbances
4 in sleep quality than men during the COVID-19 pandemic.²⁶ Furthermore, previous research has
5 found that when examining sleep quantity and quality in college students, women were
6 significantly more likely to report stress-related sleep troubles than men.^{7,24} The women college
7 students in our sample disproportionately experienced increased pressure to take on household
8 responsibilities and domestic workloads upon returning home,²¹ which may have increased daily
9 stressors and therefore exacerbated sleep disturbances.

10 TGD students reported lower sleep quality, duration, and efficiency, and more frequent
11 medication use than their cisgender peers, aligning with trends before the COVID-19
12 pandemic.²⁷ This may be due to the fact that college closure led to TGD students returning to
13 unsupportive households,²⁹ while simultaneously losing supportive staff and peer networks from
14 their college campuses.⁴⁶ LGBQ+ youth similarly experienced poor sleep quality, latency, and
15 duration, as well as more frequent sleep disturbances, medication use, and daytime dysfunction
16 than their heterosexual peers. This is consistent with work predating the pandemic, which found
17 that LGBQ+ young adults are at higher risk for sleep problems.⁵ During the implementation of
18 lockdown of policies, LGBQ+ youth in our sample presented higher levels of perceived stress
19 and anxiety compared to their heterosexual peers,²¹ much of which may have been exacerbated
20 by shelter-in-place experiences with parents who are unaffirming of youth's LGBQ+ identities.⁴⁶

21 Consistent with previous findings, low- and middle-SEP students reported worse sleep
22 quality than higher-SEP students.³ These inequalities may be attributed to low-SEP students'
23 experiences of financial stress which is known to be detrimental to sleep quality.³ Low-SEP

1 participants in our sample also described physical barriers (e.g., lack of designated sleeping
2 space) during the COVID-19 pandemic,²¹ which could also negatively impact sleep quality.^{3,47}

3 Few racial/ethnic differences in sleep quality emerged. Notably, AAPI participants
4 experienced better sleep quality and fewer sleep disturbances or daytime dysfunction than White
5 peers, which is surprising given the rise in racism, discrimination, and xenophobia against AAPI
6 communities during the pandemic,⁴⁸ and the well-documented negative impacts of these
7 experiences on sleep quality.³⁶ Black students, however, reported poorer sleep quality and lower
8 sleep efficiency, which is consistent with previous work finding that Black college students
9 report worse sleep compared to their White peers,^{1,2,4} often attributed to experiences of
10 discrimination.³⁵

11 **Limitations**

12 Some limitations to our study should be noted. Data collection for our study occurred in
13 April 2020, during the first peak of the COVID-19 pandemic. Our data do not include measures
14 of pre-pandemic sleep quality in this sample. Therefore, we cannot infer directly the extent to
15 which the inequalities observed in our sample existed pre-COVID-19, and if and how severely
16 they were exacerbated by COVID-19. However, we are able to compare similar research done by
17 others pre-COVID-19. A sample of 7,626 college students before the COVID-19 pandemic
18 found that men had a total PSQI score of 6.44 and women 7.05;⁴ we found higher PSQI scores
19 for both men and women (indicative of worse sleep quality), but women's scores had increased
20 more than men. These suggest widening inequalities may be emerging due to the COVID-19
21 pandemic. Future research using prospective, longitudinal data should continue to examine how
22 the pandemic exacerbates gender disparities over time.

1 The PSQI is one of the most widely utilized measures of sleep quality in research,
2 however, PSQI uses self-report measures, and can be influenced by the participant's recall bias.⁴⁹
3 Furthermore, PSQI is used to measure symptoms, not to offer an official diagnosis. Finally, there
4 are limitations in our sampling design and measures. While our sample consisted of a diverse set
5 of college students from across the country, it is not necessarily representative of all college
6 students.

7 **Conclusion**

8 This study provides novel data about the sleep inequalities experienced by college
9 students ages 18 to 22 during the first wave of the pandemic. Many of the interventions and
10 prevention mechanisms used to curb the spread of COVID-19 significantly altered college
11 students' ability to maintain adequate sleep quality; many were thrust into unstable home-life
12 environments which increased stressors for students who simultaneously lost the structure and
13 in-person peer support networks provided to them on campus. As the COVID-19 pandemic's
14 wide reach persists, it is essential that colleges, when designing their policies that are used to
15 reduce COVID-19 transmission, are also cognizant of the ongoing presence of sleep disparities.

16 The CDC has suggested colleges promote "getting sleep" among students to foster
17 resilience during COVID-19.¹³ As we continue through this new COVID-19 era, there are
18 several steps that colleges ought to take to help promote sleep health among college students.
19 Colleges should offer students the option to take courses fully asynchronously, as students may
20 need to sleep at different times due to unique family responsibilities, work schedules, or time
21 zones (if they are currently living in a different state or country) during the pandemic. Further,
22 universities should encourage professors to offer office hours during times that accommodate

1 students in alternate time zones. Colleges should also provide skills-based education for
2 enhancing sleep hygiene and strategies to support sleep health.

3 Sleep is essential for students' health and well-being amidst the COVID-19 pandemic as
4 it plays a vital role in both mental and physical health.^{7,12} As the pandemic persists, it is
5 imperative that students have ample ability to achieve high-quality sleep in order to both cope
6 with stressful lifestyle changes²¹ and the virus itself.¹³ Thus, it is important that the healthcare
7 sector continue to monitor the presence of sleep disturbances disproportionality experienced by
8 those of marginalized communities, particularly those most likely to suffer from poor sleep
9 quality based on our findings: women, TGD, LGBTQ+, and lower SEP students.

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Table 1. Descriptive statistics for Pittsburgh Sleep Quality Index (PSQI)

Variable	N	Mean	SD	Min	Max
Sleep quality	707	1.38	.74	0	3
Sleep latency	707	1.67	1.02	0	3
Sleep duration	706	.43	.77	0	3
Sleep efficiency	706	.62	.90	0	3
Sleep disturbances	707	1.26	.61	0	3
Sleep medication use	707	.52	.87	0	3
Daytime dysfunction	707	2.43	.91	0	3
PSQI global score	707	8.31	3.58	0	20
Poor sleep ¹	707	.78	.42	0	1

¹Refers to participants with PSQI global score > 5.

Table 2. Pittsburgh Sleep Quality Index sleep classification by sociodemographic characteristics

	% Good Sleep	% Poor Sleep	Total N
Gender			
Man	27.98	72.02	243
Woman	19.95	80.05	431
TGD ¹	9.09	90.91	33
Sexual orientation			
Straight/heterosexual	26.44	73.56	503
LGBQ+ ²	11.76	88.24	204
Race/ethnicity			
White ³	18.88	81.12	392
Black	27.03	72.97	37
AAPI ⁴	29.17	70.83	144
Hispanic/Latinx	23.81	76.19	63
Multiracial ⁵	22.54	77.46	71
SEP ⁶ (pre-COVID-19 household income)			
Lower-SEP (<\$54,000)	18.41	81.59	239
Middle-SEP (\$54,000-99,999)	19.21	80.79	203
Higher-SEP (\$100,000 and over)	27.92	72.08	265

Note. ¹TGD includes gender non-binary, genderqueer, and transgender; ²LGBQ+ includes bisexual, gay/lesbian, questioning, pansexual, asexual, or another sexual identity; ³White includes Middle Eastern/North African participants; ⁴AAPI is Asian/Asian American or Pacific Islander; ⁵Multiracial includes all students who reported two or more racial and/or ethnic groups; ⁶SEP refers to socioeconomic position.

Table 3. Regressions predicting Pittsburgh Sleep Quality Index (PSQI) global and subscale scores from demographic characteristics

	Global PSQI score (B)	Poor sleep quality (OR)	Longer sleep latency (OR)	Short sleep duration (OR)	Poor sleep efficiency (OR)	Frequent sleep disturbances (OR)	Frequent medication use (OR)	Greater daytime dysfunction (OR)
Gender								
Woman	1.06***	1.46**	1.55**	0.97	1.14	1.95***	1.42†	1.83***
Trans and Gender Diverse (TGD) ¹ (Man)	2.46***	2.77**	1.62	2.26*	3.44**	1.84	2.38*	1.83
	-	-	-	-	-	-	-	-
Sexual orientation								
LGBQ+ ² (Heterosexual)	1.13***	1.64**	1.67**	1.39†	1.32	1.90**	1.46*	1.82**
	-	-	-	-	-	-	-	-
Race/ethnicity								
Black	0.41	1.80†	0.68	1.79	2.52**	0.63	0.81	0.77
AAPI ³	-0.70*	0.88	0.76	0.99	1.21	0.52**	1.00	0.38***
Hispanic/Latinx	-0.56	1.00	0.72	0.96	1.26	0.57†	0.89	0.64
Multiracial ⁴ (White ⁵)	-0.51	0.91	0.71	0.83	0.82	0.87	0.90	0.72
	-	-	-	-	-	-	-	-
SEP ⁶ (pre-COVID-19 household income)								
Lower-SEP (<\$54,000)	1.05**	1.05	1.20	1.49*	1.10	2.38***	1.46†	1.94**
Middle-SEP (\$54,000-99,999)	0.79*	0.89	1.10	1.32	0.95	2.00**	1.70**	1.60*
(Higher-SEP)	-	-	-	-	-	-	-	-

Note. *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, † $p < 0.1$. Multivariable linear regression was used for global PSQI score (reported in unstandardized beta coefficients) and multivariable ordered logistic regression was used for PSQI subscale scores (reported in odds ratios); reference group in parentheses. ¹TGD includes gender non-binary, genderqueer, and transgender; ²LGBQ+ includes bisexual, gay/lesbian, questioning, pansexual, asexual, or another sexual identity; ³AAPI is Asian/Asian American or Pacific Islander; ⁴Multiracial includes all students who reported two or more racial and/or ethnic groups; ⁵White includes Middle Eastern/North African participants; ⁶SEP refers to socioeconomic position.