





## RESEARCH ARTICLE

# COVID-19 related distress and sleep health among trauma-exposed South Asians: Does generational status matter?

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**Abstract**

The COVID-19 pandemic has resulted in substantial changes in individual and socio-economic factors that may negatively impact sleep health. We examined associations between COVID-19 related distress and sleep among trauma-exposed South Asian adults in the United States. Since a health advantage among foreign-born individuals has been previously noted in the literature (the 'immigrant paradox'), we also explored if generational status (number of generations one's family has been in the U.S.) moderated associations between COVID-19 related distress and sleep health. Participants were 196 trauma-exposed South Asian adults residing in the U.S. (54% male, 63% U.S.-born citizens, average age = 34.51 years), who completed measures of generational status, COVID-19 related distress, trauma exposure, sleep-related impairment (SRI), and sleep disturbances. Greater COVID-19 distress was associated with more sleep disturbances ( $b = 0.15, p < 0.001$ ) and SRI ( $b = 0.24, p < 0.001$ ). Generational status was not associated with sleep, nor did it modify associations between COVID-19 distress and sleep. Findings highlight the potential importance of developing interventions to reduce stress and sleep difficulties during the pandemic. Our results did not support the immigration paradox. Future studies are needed to better understand the role of generational status on sleep health across immigrant subgroups.

**KEYWORDS**

COVID-19, generational status, immigrant paradox, sleep, South Asian Americans, stress, trauma

## 1 | INTRODUCTION

The Coronavirus Disease 2019 (COVID-19) global pandemic has affected nearly every aspect of people's lives since its outbreak in December 2019. With more than 280 million cases and 5 million deaths reported worldwide as of January 2022 (World Health Organization, 2022), the COVID-19 pandemic continues to be a major threat to people's physical and emotional well-being. Sleep is an important modifiable health behaviour that has been impacted by the stressful events surrounding the COVID-19 pandemic (Morin et al., 2020). Examining the associations between COVID-19 related

stressors and sleep health within communities of colour and other marginalised subgroups (e.g., immigrants, trauma-exposed individuals) may be especially important, given the unique stressors these individuals face that can impair their sleep health (e.g., discrimination, marginalisation). Poor sleep health is also associated with an increased risk for a variety of health outcomes such as diabetes and cardiovascular disease (Engeda et al., 2013; Shankar et al., 2010), which are highly prevalent among South Asian individuals (Palaniappan et al., 2018). Gaining a better understanding of the specific psychosocial factors associated with sleep health during the COVID-19 pandemic may have implications for combatting the

current global health crisis and for understanding health disparities more broadly.

Sleep health has been conceptualised as a multidimensional construct comprising at least five distinct but related dimensions: *duration* (number of hours of sleep obtained per 24 h), *efficiency* (the ratio of total sleep time to time in bed), *timing* (the placement of sleep within the 24 h day), *alertness* (the ability to maintain attentive wakefulness), and *quality* (subjective satisfaction with one's sleep; Buysse, 2014). Good sleep health is characterised by high levels of satisfaction or quality, appropriate timing, adequate duration (i.e., 7–9 h for adults), high efficiency (i.e., >85%), and sustained alertness during waking hours (Buysse, 2014; Hirshkowitz et al., 2015). Despite the fact that sleep health is an individual-level behaviour, it is also situated in a larger social-ecological context. The socio-ecological model of sleep health suggests that sleep may be impacted by various factors at the *individual level* (e.g., genetics, health status, behaviours, physiology), the *social level* (e.g., home, family, work, race/ethnicity, socioeconomic status), and the *societal level* (e.g., public policy, racism and discrimination, economics; Grandner, 2019).

The COVID-19 pandemic has caused disruptions across all levels of the socio-ecological context, which may heighten stress and arousal that negatively impact sleep health. For example, across 6882 participants from 59 countries, changes in daily life during the pandemic (e.g., transitioning to working from home, losing a job, financial insecurity, quarantine, increase in domestic conflicts) have been associated with poorer sleep health (Yuksel et al., 2021). Similarly, among adults from Israel and the U.S., COVID-related stressors have been associated with increased anxiety and depression, and these associations were mediated by sleep disturbances (Coiro et al., 2021). Although some studies have shown improved sleep or no effects during the pandemic (e.g., Benham, 2021; Rezaei & Grandner, 2021), other studies have shown that maintaining healthy sleep patterns has become more challenging, particularly for those facing high levels of stress (Gao & Scullin, 2020; Yuksel et al., 2021).

The COVID-19 pandemic may exacerbate racial/ethnic sleep health disparities previously described in the literature (Alcántara, Patel, et al., 2017; Hale & Do, 2007). Researchers have highlighted that sleep health disparities may be due to an abundance of potentially underreported life stressors and traumatic events among racial/ethnic minorities (Hale & Do, 2007), particularly among those who are also immigrants (Lee et al., 2019). For instance, immigrants in the U.S. are more likely to engage in manual labour and shift work occupations (John et al., 2012; Lee et al., 2019), live in noisy and/or unsafe neighbourhoods (Lee et al., 2019), be socially isolated (Lee et al., 2019), be exposed to racial discrimination (Lee et al., 2019), and experience traumatic events (Li, 2016). A recent study on racial discrimination during the COVID-19 pandemic among Asian Americans found that 30% reported an increase in experiences of racial discrimination during the pandemic, which was in turn associated with higher levels of anxiety, depression, physical symptoms, and poor sleep quality (Lee & Waters, 2021). Similarly, a large national study showed that all racial/ethnic minorities, including Asian adults, have had disproportionate rates of infection, hospitalisation, and

death compared to White adults (Boserup et al., 2020). It is worth noting that the above-mentioned studies have treated Asian adults as a monolith, and little is known about how sub-groups of Asian adults (e.g., South Asian adults or immigrants) may be disproportionately affected by the COVID-19 pandemic.

Although immigrants face multiple stressors and are more likely to experience potentially traumatic events, previous studies have also shown that first-generation (i.e., foreign-born) immigrants in the U.S. paradoxically tend to have better physical and mental health when compared to their non-immigrant (i.e., U.S. born) counterparts (Alcántara et al., 2017). This health advantage observed in immigrants is referred to as the 'Immigrant Paradox,' and extends to a variety of health outcomes, including sleep health. For example, being born in a different country appears to be a protective factor for sleep problems, including difficulty falling asleep and maintaining sleep, early morning awakenings, daytime sleepiness, and non-restorative sleep (Grandner et al., 2013). Other studies similarly have shown that U.S.-born adults report more sleep problems than their first-generation immigrant counterparts (Seicean et al., 2011). Among Asian individuals specifically, a recent study on acculturation and sleep found that foreign-born Asian adults who have lived in the U.S. for up to 5 years were less likely to have sleep difficulties than U.S.-born Asian adults (Ryu et al., 2021).

Despite being extensively studied among Hispanic/Latinx adults, our understanding of the impact of generational status on sleep health in other underrepresented groups (e.g., South Asian individuals) and in specific social contexts is still limited. In the sleep literature, Asian adults in the U.S. are one of the most understudied racial/ethnic minority groups, and most studies involving the Asian American population do not consider participants' specific countries of origin (Johnson et al., 2019). The South Asian community is a uniquely distinct subgroup of the Asian American population that includes people with ancestry from Bangladesh, Bhutan, India, Nepal, Pakistan, Sri Lanka, and the Maldives. Not only are they one of the fastest growing racial/ethnic subgroups in the U.S. (United States Census Bureau, 2021a), they also endorse some distinct cultural characteristics such as collectivistic cultural ideals and community interdependence (Sue & Sue, 1987), higher levels of acculturative stress (Roberts et al., 2016), and reluctance in seeking mental health resources due to stigma (value in enduring hardship; Karasz et al., 2019). South Asian individuals also report distinct health profiles and stressors. For example, previous studies have found that South Asian individuals are disproportionately affected by cardiovascular diseases compared to Whites, Blacks/African Americans, and other subgroups of Asians in the U.S. (Palaniappan et al., 2018), which may have overlapping comorbidity with sleep disturbances (Knutson, 2010). Given these distinct cultural and health characteristics, studying sleep health within this population is imperative, especially in times of a global pandemic, when additional stressors may compound the risk for sleep disturbances. Furthermore, generational status may either buffer or exacerbate the effects of COVID-19 stress on sleep health among South Asian adults. Increasing our understanding of the associations between COVID-19 related distress

and sleep health in a diverse sample of South Asian adults living in the U.S. may help bring attention to this growing and understudied population, and potentially inform culturally sensitive sleep and stress interventions for this group.

## 1.1 | The present study

The purpose of the current study was to examine the associations between COVID-19 related distress, generational status, sleep-related impairment (SRI), and sleep disturbances in a sample of trauma-exposed South Asian individuals residing in the U.S. We conceptualised sleep disturbances as any complaints in relation to sleep quality/satisfaction and duration (e.g., difficulty falling or staying asleep, poor sleep quality, insufficient sleep duration) and SRI as any complaints in relation to day-time functioning derived from poor sleep; Buysse et al., 2010). We hypothesised that (1) higher COVID-19 related distress would be associated with more SRI and sleep disturbances, and (2) second- and third-generation South Asian adults would report worse sleep (i.e., more SRI and sleep disturbances) than their first-generation counterparts. On an exploratory basis, we also examined whether generational status moderated the association between COVID-19 related distress and SRI and sleep disturbances.

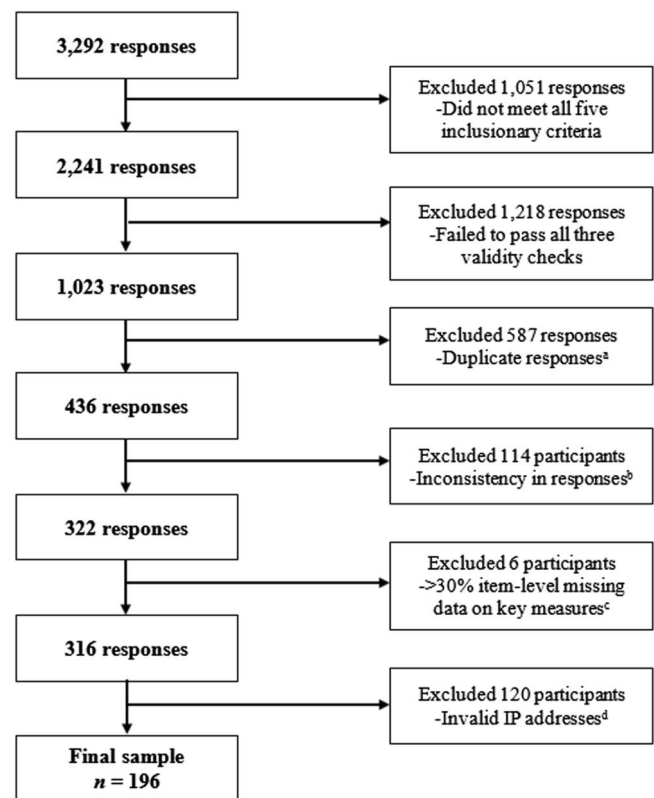
## 2 | METHOD

### 2.1 | Procedure

The current study used secondary data collected from a larger study that received approval from the Institutional Review Board at the University of North Texas. The larger study involved an online survey examining the impacts of the COVID-19 pandemic among individuals of South Asian origin who had been exposed to trauma. Trauma exposure was a criterion for the larger study, as the primary focus was investigating the impact of the COVID-19 pandemic on post-traumatic stress disorder symptoms and post-trauma outcomes. Participants were recruited through Amazon's Mechanical Turk (MTurk) platform and compensated \$3.00 for their time completing the study (anticipated time to complete = 90 min). Several best-practice recommendations for research using MTurk were implemented to enhance data quality and integrity (Aguinis et al., 2021). First, only MTurk workers living in the U.S. (based on IP addresses) and with a >90% approval rate (percentage of MTurk studies completed and approved by researchers) were allowed access to the survey. Second, three validity checks—one comprehension and two attention checks—were included throughout the survey. The comprehension check asked 'Please click on the little blue circle on the bottom of the screen. Do not click on the scale items that are labelled 1 to 5.' The attention checks asked participants to report their level of agreement (on a 1 to 5 scale) with the following statements: (1) 'I am paid biweekly by leprechauns' and (2) 'All of my friends are aliens.'

### 2.2 | Participants

Participants were eligible if they were  $\geq 18$  years of age, were able to read and write English fluently, were currently residing in the U.S., had experienced a traumatic event in their lifetime, and reported being of South Asian ancestry (i.e., they or at least one of their parents/grandparents were born in either India, Pakistan, Bangladesh, Sri Lanka, or Nepal). We received 3292 responses from potential participants who provided informed consent. Of those initial responses, 3096 total participants were excluded for any of the following reasons to ensure data integrity (see Figure 1): (1) did not meet inclusionary criteria, (2) failed to pass all three validity checks, (3) had duplicate responses, (4) had inconsistent generational status, immigration status, and/or country of birth responses, (5) had >30% item-level missing data on any of the key measures, or (6) had invalid



**FIGURE 1** Participant Exclusion Process. <sup>a</sup> For participants with duplicate responses, only the first original attempt was kept in the dataset according to date and time of completion. <sup>b</sup> Inconsistent responses included endorsing: (1) being born in the U.S. and a first-generation immigrant; (2) being second- or third-generation and born outside the U.S.; or (3) being second- or third-generation and a naturalised citizen, permanent resident holder, or immigrant visa holder. <sup>c</sup> Two people were missing responses for all items on both the PROMIS sleep disturbances and Sleep-Related Impairment (SRI) scales, and four people were missing responses to the generational status question. <sup>d</sup> Invalid IP addresses were determined by an automated IP evaluation service which identifies if participants' IP addresses were associated with the use of a Virtual Private Network (VPN) or a BOT network

internet protocol (IP) addresses. Invalid IP addresses were flagged by an automated IP evaluation service which determined if the IP address of the participant was associated with the use of a Virtual Private Network or a robot (BOT) network (Price et al., in review). We used IPHub (iphub.info) to determine if a participant had a US non-residential IP address (hosting provider, proxy, etc.) that suggested the IP address was either a blocked or bad IP address. IPHub was selected because it has been shown to perform well in prior studies in which IP evaluations were used (Dennis et al., 2020; Price et al., in review). Other studies using MTurk samples have taken similar approaches to ensure data integrity, and show that such approaches enhance data quality and validity (Forkus et al., 2021; Hauser & Schwarz, 2016; Paolacci et al., 2010; Price et al., in review; Tobar-Santamaria et al., 2021). Our final analytic sample consisted of 196 participants. The majority of the sample identified as male (54%) and U.S.-born citizen (63%), with an average age of 34.51 ( $SD = 9.12$ ) years. Additional participant characteristics by generational status for the entire sample are displayed in Table 1.

We compared individuals in the larger sample ( $N = 436$ ; i.e., sample applying the first three exclusion reasons described above) versus the restricted final sample after applying all validity checks ( $N = 196$ ) on key study variables. We found that the final sample reported fewer mean number of traumatic events (8.24 vs. 11.26,  $p < 0.01$ ), lower COVID-19 distress (64.15 vs. 74.18,  $p < 0.01$ ), and lower SRI (53.65 vs. 56.95,  $p < 0.01$ ) compared to the larger sample. There were no mean differences between the reduced sample and the larger sample in terms of age (34.51 vs. 35.92,  $p = 0.12$ ) or sleep disturbances (50.39 vs. 51.18,  $p = 0.38$ ).

## 2.3 | Measures

### 2.3.1 | COVID-19 stress scale (CSS; Taylor et al., 2020)

The COVID-19 Stress Scale (CSS) was used to measure COVID-19 related distress. The CSS includes 36 items distributed across 5 subscales, with the first subscale (worry about the danger of COVID-19) being the central feature. Because some items in the fourth and fifth subscales overlap with sleep measures, and our main interest was to assess COVID-19 related distress, we only summed responses to 24 items from the first three subscales: (1) fears about danger and contamination (e.g., 'I am worried that if someone coughed or sneezed near me, I would catch the virus'; 12 items), (2) fears about the socioeconomic consequences (e.g. 'I am worried about grocery stores running out of water'; 6 items), and (3) COVID-19 related xenophobia fears (e.g. 'I am worried that foreigners are spreading the virus in my country'; 6 items). Items are rated on a 5-point Likert scale ranging from 0 (not at all) to 4 (extremely). Total scores range from 0 to 96, with higher scores indicating higher levels of COVID-19 distress. The CSS has good internal consistency for all subscales ( $\alpha > 0.80$ ), as well as good convergent validity with health anxiety, obsessive-compulsive contamination, and checking symptoms (Taylor et al., 2020). In the

current study, the scale demonstrated excellent internal consistency ( $\alpha = 0.97$ ).

### 2.3.2 | PROMIS™ sleep-related impairment and sleep disturbances (Yu et al., 2012)

The short form versions of the Patient-Reported Outcomes Measurement Information System (PROMIS™) sleep-related impairment (SRI) and the PROMIS™ sleep disturbances scales were used. These scales assess qualitative aspects of sleep and wake on a continuum, and do not assess symptoms of specific sleep disorders (Yu et al., 2012); therefore, they are useful for samples with or without sleep disorders. Each scale contains 8 items on either SRI (i.e., daytime sleepiness, fatigue, and cognitive difficulties) or sleep disturbances (i.e., trouble falling asleep, low sleep quality, insufficient sleep time) over the past 7 days (Yu et al., 2012). Examples of the items include: 'My sleep was restless (not at all; a little bit; somewhat; quite a bit; very much);' 'My sleep quality was... (very poor; poor; fair; good; very good);' 'I had problems during the day because of poor sleep (not at all, a little bit, somewhat, quite a bit, very much)' (Yu et al., 2012). All items for both scales are rated on a 1 to 5 scale, with possible raw scores ranging from 8 to 40 and higher scores indicating more sleep problems. Raw scores are then converted into t-scores using a published conversion table (Yu et al., 2012). A t-score of 50 reflects the mean of the reference population, with a standard deviation of 10 in that population. The short form of both scales has good convergent validity with the longer forms ( $r = 0.96$  to  $0.98$ ) and with other similar measures, such as the Pittsburgh Sleep Quality Index (PSQI;  $r = 0.68$  to  $0.83$ ). In the current study, the scales demonstrated good internal consistency (sleep disturbances  $\alpha = 0.88$ ; SRI  $\alpha = 0.92$ ).

### 2.3.3 | Generational status

Generational status was assessed through the question: "What is your generational status (number of generations your family has been in the US)?" Answer choices included: (1) First-generation (you are born outside the United States), (2) Second-generation (you are U.S.-born with one or both of your parents born outside the United States), (3) Third-generation or higher (both you and your parents were born in the United States), (4) Other, please specify, (5) Do not wish to disclose. To facilitate statistical analyses, we excluded people who responded with option 4 ('Other, please specify') or option 5 ('Do not wish to disclose'). Based on participants responses and the United States Census Bureau (2021a)'s definition, generational status was then dummy coded into three variables: first-generation (i.e., foreign-born immigrants; reference group; 1 = yes, 0 = no); second-generation (i.e., U.S.-born children of one or two foreign-born parents; 1 = yes, 0 = no); and third- or higher generation (i.e., U.S.-born children of U.S.-born parents; 1 = yes, 0 = no). This approach towards categorising generational status was taken in alignment with other similar studies on acculturation and sleep health (e.g., Hale et al., 2014; Martinez-Miller et al., 2018).

TABLE 1 Demographics and descriptives for the overall sample and by generational status

	Overall sample M (SD) or n (%)	1 <sup>st</sup> generational status M (SD) or n (%)	2 <sup>nd</sup> generational status M (SD) or n (%)	3 <sup>rd</sup> + generational status M (SD) or n (%)
<i>n</i>	196	72	97	27
Age	34.51 (9.12)	34.83 (9.15)	34.40 (9.12)	34.00 (9.36)
COVID-19 distress	64.15 (22.88)	60.12 (22.40)	64.59 (22.75)	73.33 (22.67)
Sleep-related impairment	53.65 (12.38)	52.14 (12.50)	54.11 (12.57)	56.02 (11.24)
Sleep disturbance	50.39 (10.54)	50.66 (11.21)	50.41 (10.48)	49.59 (9.13)
Count of trauma types	8.24 (5.92)	8.08 (5.37)	7.91 (6.25)	9.89 (6.05)
Trauma type				
Natural disaster	147 (75.0%)	56 (77.8%)	71 (73.2%)	20 (74.1%)
Fire or explosion	119 (60.7%)	46 (63.9%)	56 (57.7%)	17 (63.0%)
Transportation accident	155 (79.1%)	61 (84.7%)	72 (74.2%)	22 (81.5%)
Serious accident at work, home, or during recreational activity	98 (50.0%)	37 (51.4%)	46 (47.4%)	15 (55.6%)
Exposure to toxic substance	73 (37.2%)	25 (34.7%)	34 (35.1%)	14 (51.9%)
Physical assault	110 (56.1%)	39 (54.2%)	55 (56.7%)	16 (59.3%)
Assault with a weapon	80 (40.8%)	25 (34.7%)	39 (40.2%)	16 (59.3%)
Sexual assault	102 (52.0%)	40 (55.6%)	48 (49.5%)	14 (51.9%)
Other unwanted or uncomfortable sexual experience	89 (45.4%)	36 (50.0%)	38 (39.2%)	15 (55.6%)
Combat or exposure to a war-zone	71 (36.2%)	16 (22.2%)	36 (37.1%)	19 (70.4%)
Captivity	69 (35.2%)	20 (27.8%)	35 (36.1%)	14 (51.9%)
Life-threatening illness or injury	93 (47.4%)	34 (47.2%)	43 (44.3%)	16 (59.3%)
Severe human suffering	78 (39.8%)	26 (36.1%)	38 (39.2%)	14 (51.9%)
Sudden violent death	88 (44.9%)	34 (47.2%)	40 (41.2%)	14 (51.9%)
Sudden accidental death	90 (45.9%)	36 (50.0%)	40 (41.2%)	14 (51.9%)
Serious injury, harm, or death you caused to someone else	61 (31.1%)	17 (23.6%)	32 (33.0%)	12 (44.4%)
Any other very stressful event or experience	93 (47.4%)	34 (47.2%)	44 (45.4%)	15 (55.6%)
Place of birth				
India	38 (25.5%)	38 (59.4%)	0 (0.0%)	0 (0.0%)
Pakistan	7 (4.7%)	7 (10.9%)	0 (0.0%)	0 (0.0%)
Bangladesh	4 (2.7%)	4 (6.2%)	0 (0.0%)	0 (0.0%)
Sri Lanka	8 (5.4%)	8 (12.5%)	0 (0.0%)	0 (0.0%)
Nepal	6 (4.0%)	6 (9.4%)	0 (0.0%)	0 (0.0%)
United States	85 (57.0%)	0 (0.0%)	69 (100.0%)	16 (100.0%)
Other or do not wish to disclose	1 (0.7%)	1 (1.6%)	0 (0.0%)	0 (0.0%)
Gender				
Male	106 (54.1%)	33 (45.8%)	58 (59.8%)	15 (55.6%)
Female	89 (45.4%)	39 (54.2%)	38 (39.2%)	12 (44.4%)
Other	1 (0.5%)	0 (0.0%)	1 (1.0%)	0 (0.0%)

(Continues)

TABLE 1 (Continued)

	Overall sample M (SD) or n (%)	1 <sup>st</sup> generational status M (SD) or n (%)	2 <sup>nd</sup> generational status M (SD) or n (%)	3 <sup>rd</sup> + generational status M (SD) or n (%)
Immigration status				
U.S. born citizen	124 (63.3%)	97 (100.0%)	27 (100.0%)	97 (100.0%)
Naturalized citizen	47 (24.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)
Permanent resident/immigrant visa	25 (12.8%)	0 (0.0%)	0 (0.0%)	0 (0.0%)

Note: For count of trauma types, frequencies reflect the percentage of participants endorsing that event either 'Happened to me,' 'Witnessed it,' 'Learnt about it, or experienced it as 'Part of my job.' All percentages reflect valid percentages (i.e., missing data excluded from the total in calculations).

### 2.3.4 | The life events checklist for DSM-5 (LEC-5; Weathers et al., 2013)

The LEC-5 is a 17-item self-report measure that evaluates experiences of lifetime trauma (e.g., natural disaster, transportation accident, physical assault, sexual assault, combat). An 18<sup>th</sup> item evaluated the most distressing trauma. Participants rated the degree of exposure to each trauma with a 6-point nominal scale: *happened to me*, *witnessed it*, *learnt about it*, *part of my job*, *not sure*, and *does not apply*. Endorsing either of the first four response options was considered a positive trauma endorsement. Positive endorsement of the 17 trauma types was summed together to create a total count of trauma types.

## 2.4 | Statistical analysis plan

All analyses were conducted using R (R Core Team, 2013). After exclusions and validity checks (Figure 1), all participants had complete item-level data for all key variables, except for one participant who was missing one item from the CSS scale. For this person, the prorated total CSS scale was calculated using the available 23 items; Internal consistency values for the CSS did not change when this person was excluded versus when their prorated values were used. Zero-order correlations among the primary variables were calculated. Multiple linear regression analyses were then conducted using the R packages *apaTables* (Stanley & Spence, 2018) and *sjPlot* (Lüdtke, Bartel, et al., 2021). Regression model assumptions (e.g., normality of residuals, homogeneity of variance) were inspected using the R package *performance* (Lüdtke, Ben-Shachar, et al., 2021); all models met key assumptions. To examine main effects, we ran regression models with COVID-19 distress and generational status predicting SRI or sleep disturbances. Next, to test for moderation, we examined the interaction terms between COVID-19 distress and generational status predicting SRI or sleep disturbances. In all regression models, we covaried for count of trauma types because of its potential confounding role in psychological distress and sleep health (Gerber et al., 2018). Semi-partial correlation coefficients squared ( $sr^2$ ; i.e., percentage of variance in the dependent variable which is uniquely associated with each independent variable, accounting for the associations among the dependent variable and all other independent variables) was used as a

measure of effect size. The following Cohen (1988) heuristics were used: small effect size,  $sr^2 = 0.02$ ; medium effect size,  $sr^2 = 0.13$ ; and large effect size,  $sr^2 = 0.26$  (Cohen, 1988).

## 3 | RESULTS

### 3.1 | Descriptive results

Bivariate correlations are displayed in Table 2. Examination of t-scores for PROMIS™ SRI ( $M = 53.65$ ,  $SD = 12.38$ ) and sleep disturbances ( $M = 50.39$ ,  $SD = 10.54$ ) revealed our sample endorsed slightly higher values than the general U.S. population.

### 3.2 | Main effects of generational status and COVID-19 distress on sleep

In multivariate models, greater COVID-19 distress was statistically significantly associated with both greater SRI ( $b = 0.24$ ,  $p < 0.001$ , medium to large effect size of  $sr^2 = 0.17$ ; Table 3; Figure 2) and sleep disturbances ( $b = 0.15$ ,  $p < 0.001$ , small to medium effect size of  $sr^2 = 0.09$ ; Table 4; Figure 3). Count of trauma types was also statistically significantly associated with both greater SRI ( $b = 0.59$ ,  $p < 0.001$ , small to medium effect size of  $sr^2 = 0.07$ ; Table 3) and sleep disturbances ( $b = 0.32$ ,  $p = 0.01$ , small effect size of  $sr^2 = 0.03$ ; Table 4). Generational status was not statistically significantly associated with SRI (Table 3; second-generation status:  $b = 1.00$ ,  $p = 0.52$ , small effect size of  $sr^2 < 0.01$ ; third-generation status:  $b = -0.36$ ,  $p = 0.88$ , small effect size of  $sr^2 < 0.01$ ) or sleep disturbances (Table 4; second-generation status:  $b = -0.86$ ,  $p = 0.57$ , small effect size of  $sr^2 < 0.01$ ; third-generation status:  $b = -3.65$ ,  $p = 0.10$ , small effect size of  $sr^2 = 0.01$ ).

### 3.3 | Interactive effects of generational status and COVID-19 distress on sleep

There were no significant interactions between generational status and COVID-19 distress on either SRI (Table 3) or sleep disturbances (Table 4).

TABLE 2 Correlations between key study variables

Variable	1	2	3	4	5	6
1. COVID-19 distress						
2. Sleep-related impairment	0.54** [0.43, 0.63]					
3. Sleep disturbances	0.37** [0.24, 0.49]	0.82** [0.77, 0.86]				
4. First generational status	-0.13 [-0.27, 0.01]	-0.09 [-0.23, 0.05]	0.02 [-0.12, 0.16]			
5. Second generational status	0.02 [-0.12, 0.16]	0.04 [-0.10, 0.18]	0.00 [-0.14, 0.14]	-0.75** [-0.81, -0.69]		
6. Third generational status	0.16* [0.02, 0.29]	0.08 [-0.06, 0.21]	-0.03 [-0.17, 0.11]	-0.30** [-0.43, -0.17]	-0.40** [-0.51, -0.27]	
7. Count of trauma types	0.35** [0.22, 0.46]	0.43** [0.31, 0.54]	0.28** [0.15, 0.41]	-0.02 [-0.16, 0.12]	-0.06 [-0.20, 0.08]	0.11 [-0.03, 0.25]

Note: Values in square brackets indicate the 95% confidence interval for each correlation. The confidence interval is a plausible range of population correlations that could have caused the sample correlation. \*indicates  $p < 0.05$ . \*\*indicates  $p < 0.01$ . First, second, and third generational status are dummy coded (1 = endorses that status; 0 = does not endorse that status).

TABLE 3 Main and interactive effects of generational status and COVID-19 distress on sleep-related impairment

Predictors	PROMIS sleep-related impairment (t-scores)			PROMIS sleep-related impairment (t-scores)		
	Estimates	CI	<i>p</i>	Estimates	CI	<i>p</i>
(Intercept)	32.93	28.45–37.41	<0.001	31.32	24.55–38.09	<0.001
2 <sup>nd</sup> generational status	1.00	-2.07–4.08	0.521	2.02	-7.05–11.09	0.660
3 <sup>rd</sup> + generational status	-0.36	-4.88–4.16	0.876	9.28	-5.42–23.97	0.214
COVID-19 distress	0.24	0.17–0.31	<0.001	0.27	0.16–0.37	<0.001
Count of trauma types	0.59	0.34–0.85	<0.001	0.58	0.32–0.84	<0.001
2 <sup>nd</sup> generational status * COVID-19 distress				-0.02	-0.16–0.12	0.799
3 <sup>rd</sup> + generational status * COVID-19 distress				-0.14	-0.34–0.06	0.181
Observations	196			196		
$R^2/R^2$ adjusted	0.363/0.350			0.370/0.350		

Note: Bold values represent statistically significant ( $p < 0.05$ ) effects. Reference group for generational status is first generation (born outside the U.S.). Second-generation (U.S.-born with one or both parents born outside of the U.S.) and third-generation or higher (both participant and parents were born in the U.S.) are dummy coded. The left side of the table represents the uncentered main effects of generational status and COVID-19 distress, and the right side of the table represents their interaction. PROMIS = Patient-Reported Outcomes Measurement Information System. Estimate = unstandardized regression estimate. CI = 95% confidence interval.  $p$  =  $p$ -value.

### 3.4 | Sensitivity analyses covarying for age, sex, and income levels

When we conducted sensitivity analyses covarying for age, gender, and income levels, the general pattern of main effect and interaction results did not change. COVID-19 distress and count of trauma types were still significant predictors of sleep disturbances and SRI in main effect models (Tables S1-S2).

## 4 | DISCUSSION

In this sample of trauma-exposed South Asian adults, we found that greater COVID-19 distress was associated with more sleep disturbances and sleep-related impairment (SRI). Generational status was not directly associated with sleep, nor did it modify associations between COVID-19 distress and sleep. These results add to the literature on factors associated with sleep health among racial/ethnic

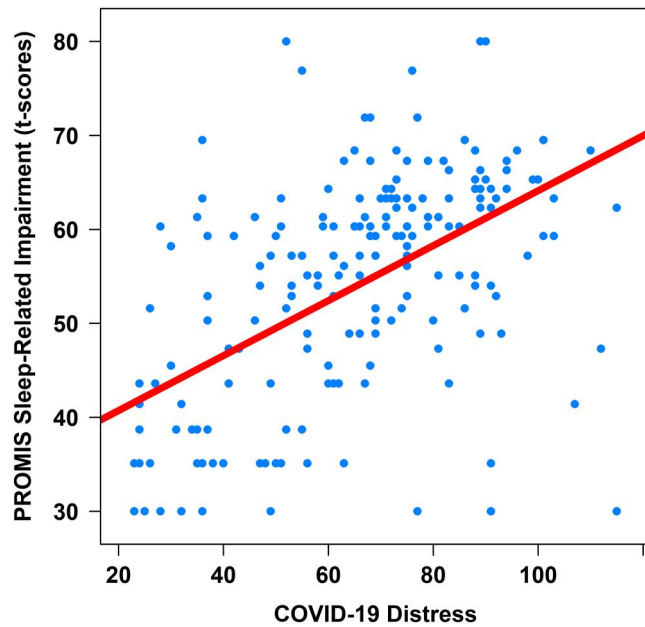


FIGURE 2 Bivariate association between COVID-19 distress and sleep-related impairment

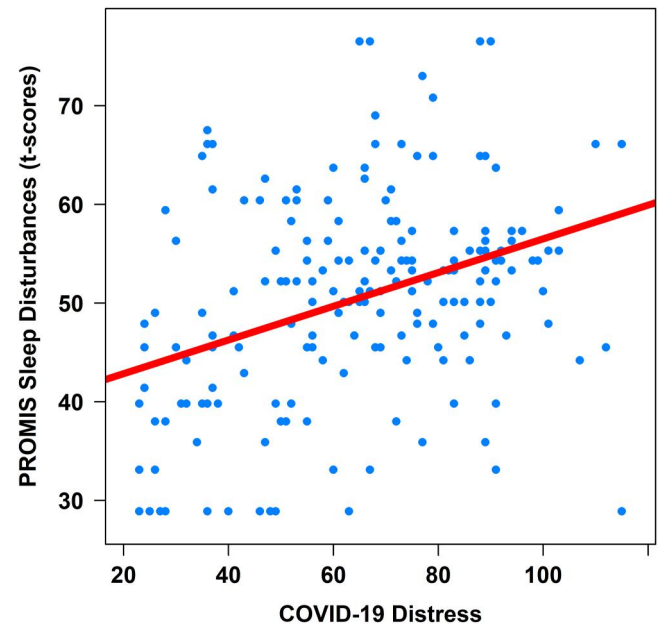


FIGURE 3 Bivariate association between COVID-19 distress and sleep disturbances

TABLE 4 Main and interactive effects of generational status and COVID-19 distress on sleep disturbances

Predictors	PROMIS sleep disturbances (t-scores)			PROMIS sleep disturbances (t-scores)		
	Estimates	CI	<i>p</i>	Estimates	CI	<i>p</i>
(Intercept)	38.97	34.63–43.31	<0.001	36.79	30.24–43.33	<0.001
2 <sup>nd</sup> generational status	–0.86	–3.84–2.12	0.568	1.04	–7.73–9.81	0.815
3 <sup>rd</sup> + generational status	–3.65	–8.03–0.73	0.102	7.09	–7.12–21.31	0.326
COVID-19 distress	0.15	0.09–0.22	<0.001	0.19	0.09–0.29	<0.001
Count of trauma types	0.32	0.07–0.57	0.011	0.31	0.06–0.56	0.015
2 <sup>nd</sup> generational status * COVID-19 distress				–0.03	–0.16–0.10	0.634
3 <sup>rd</sup> + generational status * COVID-19 distress				–0.15	–0.35–0.04	0.120
Observations	196			196		
<i>R</i> <sup>2</sup> / <i>R</i> <sup>2</sup> adjusted	0.176/0.159			0.187/0.161		

Note: Bold values represent statistically significant ( $p < 0.05$ ) effects. Reference group for generational status is first generation (born outside the U.S.). Second-generation (U.S.-born with one or both parents born outside of the U.S.) and third-generation or higher (both participant and parents were born in the U.S.) are dummy coded. The left side of the table represents the uncentered main effects of generational status and COVID-19 distress, and the right side of the table represents their interaction. PROMIS = Patient-Reported Outcomes Measurement Information System. Estimate = unstandardized regression estimate. CI = 95% confidence interval.  $p$  =  $p$ -value.

minorities during the COVID-19 pandemic, as well as to the literature on generational status effects on sleep. Our findings tentatively suggest the stressful context of the ongoing pandemic may be more impactful for sleep health than other social identity factors such as generational status. Also, our findings indicate that trauma-exposed South Asian adults may report more SRI than the general U.S. population. Together, these results highlight the unique role of COVID-19 distress in an understudied sample at increased risk for poor sleep health.

Our results suggest a statistically significant association between COVID-19 distress and SRI (medium to large effect) and between

COVID-19 distress and sleep disturbances (small to medium effect), which supports our first hypothesis. Worry, rumination, or stress about the ongoing pandemic may be associated with arousal of the sympathetic nervous system and hypothalamic-pituitary-adrenal axis, and more difficulty in falling asleep, staying asleep, or obtaining restorative sleep. For example, studies have shown that stressor-related rumination predicts longer subsequent sleep onset latency (Zoccola et al., 2009) and increased pre-sleep arousal (Tousignant et al., 2019). However, given the cross-sectional nature of the current study, it may also be that sleep disturbances and related daytime impairment exacerbate stress and limit one's ability to cope with the



pandemic. For example, studies have shown that nights characterised by shorter sleep and poorer sleep quality than one's individual average sleep predict subsequent increases in exposure and emotional reactivity to daily stress (Sin et al., 2017).

Our second hypothesis that second- and third-generation South Asian adults would report worse sleep health than their first-generation counterparts was not supported. Generational status was not associated with sleep, nor did it moderate the association between COVID-related distress and SRI and sleep disturbances. These results are inconsistent with the immigrant paradox literature, which suggests that first-generation immigrants tend to have better health outcomes than their U.S.-born counterparts (Alcántara et al., 2017; Ryu et al., 2021; Seicean et al., 2011).

A possible explanation for these null results is that among trauma-exposed individuals, the immigrant paradox may operate differently. On the one hand, newly migrated (first-generation) individuals are more likely to have experienced recent trauma (Kaltman et al., 2010), which may be a risk factor for negative mental and physical health outcomes, including poor sleep health. For example, in a study where the majority of the sample had reported traumatic experiences, having lived for fewer years in the U.S. was associated with having a mental disorder (Kaltman et al., 2010), which contradicts the immigrant paradox. Similarly, some studies have found that immigrants who have experienced pre-immigration trauma report higher post-migration acculturative stress than those who have not experienced any traumatic event (Li, 2016), which suggests that the post-immigration experience may be different for those who have experienced trauma. On the other hand, consistent with the immigrant paradox, second- and third-generation immigrants, particularly South Asians, may struggle when navigating two cultures with different values, beliefs, and languages (i.e., acculturative or bicultural stress; Tummala-Narra & Deshpande, 2018). This struggle may lead to family disagreement and conflicts, increasing psychological distress, and the chances of experiencing intimate partner violence (IPV; Tummala-Narra & Deshpande, 2018). It may be the case that in our sample, first-generation immigrants who experienced recent and/or pre-immigration trauma cancelled out typical immigrant paradox effects, generating the null effects of generational status observed in our analyses.

It is also important to note that the rate of trauma was high across our entire sample, with participants endorsing an average of 8.24 trauma types. This is an expected number of traumas given the trauma exposure criterion to participate in the parent study, and the high prevalence of trauma experiences worldwide. For instance, previous studies in the U.S. and across different countries have shown that 90% of people experience at least one traumatic event in their lifetime (Kilpatrick et al., 2013), with most people also experiencing multiple trauma types (Benjet et al., 2016; Kilpatrick et al., 2013). Among South Asian adults in the U.S., previous research has found that IPV rates are higher among South Asian women when compared to other cultural groups (Tummala-Narra & Deshpande, 2018), and when compared to South Asians living in their countries of origin (Tripathi & Azhar, 2022). The higher rates of IPV among South Asians in the U.S. are believed to be linked to cultural

norms, such as rigid gender roles, beliefs that reporting IPV may bring dishonour to the family, and a patriarchal system. For second- and third-generation individuals in particular, being raised in the American culture, while also trying to maintain close ties to their cultures of origin becomes a struggle that may place them at a higher risk for experiencing abuse (Tripathi & Azhar, 2022).

Overall, our results align with research suggesting the immigrant paradox may not exist among vulnerable or disadvantaged immigrant subgroups, such as undocumented immigrants (Young & Pebley, 2017), or that it may be an oversimplification of a very complex sociocultural phenomenon (John et al., 2012). For example, in a study of Asian adults, although foreign-born status had a protective effect on mental health, results varied depending on the method used to measure mental health (i.e., self-rated survey vs. diagnostic criteria), and associations were no longer significant after controlling for financial (i.e., lack of insurance, perceived financial need) and psychosocial (discrimination, social support, acculturative stress) factors (John et al., 2012). As a result, the authors concluded that indiscriminate use of the term 'immigrant paradox' could mask important health disparities in systematically disadvantaged immigrant populations, where foreign-born individuals may not always have a health advantage.

Other studies have similarly suggested a complex interplay of factors such as the developmental period of when an individual migrates and time living in the U.S. For example, in a study of Asian American college students, the association between racism-related stress and poor mental health was only significant for first-generation participants and not for second- or higher-generations (Liu & Suyemoto, 2016). The authors of this study argued that young adults who have recently migrated may not have developed skills to cope with racism. Further, since most of this study's participants migrated to the U.S. as adolescents, they might have been exposed to developmental stressors that are more potent than those experienced in adulthood (Liu & Suyemoto, 2016). Therefore, it appears that under specific stressful situations, first-generation immigrants may be more vulnerable to negative mental health outcomes than their U.S.-born counterparts. In our study, it is possible that the overall high levels of stress due to the COVID-19 pandemic masked any differences in sleep health by generational status.

Another possible reason for our null results with generational status is that most individuals in our sample (63%) were second or third-generation citizens, which may have resulted in limited variability to detect statistically significant results. Lastly, another important aspect to consider is the lack of consensus when defining generational status, which may yield inconsistent results in the literature. For instance, some authors argue foreign-born individuals who arrived in the U.S. before the age of 10–12 years exhibit fundamental differences in adaptation compared to those who immigrated as adults and those born in the U.S. and should be considered in a different category (Rumbaut, 2004). Other scholars argue that these individuals have similar characteristics to second-generation immigrants and prefer to include them in this category (Liu & Suyemoto, 2016). In our study, we used the U.S. Census Bureau's definition of generational status, and all foreign-born

individuals were categorised as first-generation immigrants regardless of age at immigration, which might have also impacted our results. Future work may benefit from a more precise and nuanced categorisation of generational status (Rumbaut, 2004).

#### 4.1 | Limitations and future directions

The present study has several limitations that warrant mention. First, we used self-report measures that may be subject to self-report and recall bias. Future work needs to supplement self-measures with more objective measures of stress and sleep (e.g., actigraphy, biological markers of stress). Second, in our study, we did not measure stress levels or sleep difficulties before the beginning of the COVID-19 pandemic. Therefore, we are unable to establish a temporal or causal association between COVID-19 distress and sleep difficulties. Future studies should adopt a longitudinal design to assess the directionality of the effects.

Third, our sample was composed exclusively of trauma-exposed South Asian individuals with legal status (i.e., U.S. citizen, permanent resident, or visa holder) and who were able to read and write in English, which might have excluded a segment of first-generation South Asian immigrants who are more comfortable with their native languages (vs. English). Therefore, our results should not be generalised to other subgroups such as undocumented and non-English speaking immigrants, who may face greater barriers to healthcare, and are at higher risk of experiencing daily stressors (Young & Pebley, 2017). More work is needed to better understand how the association between generational status and sleep health varies across different immigrant subgroups, as well as possible pathways that mediate or moderate these associations. Further, given the relatively small sample size, and the fact most of our sample was born in the U.S., we may have been somewhat underpowered to examine moderation effects of generational status.

Lastly, our participants were recruited from Amazon's Mechanical Turk (MTurk). Although previous studies have found MTurk produces valid and reliable data (Lu et al., 2022), some concerns have been noted about data quality (Aguinis et al., 2021). To ensure quality control in our study, we included several validity checks and conducted additional data screening procedures. When we conducted attrition analyses, we found that participants who were excluded based on these procedures reported more psychological impairment than the final sample. Future studies should seek to replicate our results in other MTurk and non-MTurk samples of South Asian adults.

## 5 | CONCLUSION

Our study adds to the literature examining the associations between COVID-19 related distress and sleep health by including a unique sample of trauma-exposed foreign-born and U.S.-born South Asian individuals residing in the U.S. Consistent with previous studies, we found that psychological distress triggered by the pandemic (e.g., fear

of contamination, fear of the dangerousness of the virus, socioeconomic worries) is associated with greater sleep impairment and sleep disturbances. Our results generally did not support the immigration paradox: stress and sleep health associations were similar regardless of generational status. Overall, our findings highlight the potential importance of developing targeted interventions to reduce stress levels and sleep difficulties during a pandemic, particularly among vulnerable groups, such as those that have experienced trauma. Addressing sleep health may also have beneficial downstream effects on vaccine response and infectious disease risk during the COVID-19 pandemic and on health more broadly (Madison et al., 2021). Our findings also highlight the need for future studies to examine the effects of generational status on sleep health across different immigrant subgroups and explore the underlying mechanisms that help explain the immigrant paradox. Such studies can inform culturally sensitive interventions and public health activities to prevent and treat sleep difficulties among people of colour. Given the increased risk for sleep health-related outcomes such as cardiovascular disease among South Asian individuals (Palaniappan et al., 2018) and the exponential growth expected in the U.S. Asian population (United States Census Bureau, 2021b), South Asian adults are an important population to include in future sleep research.

#### CONFLICTS OF INTEREST

Dr. Slavish reports grant funding from Canopy Growth Corporation which is outside the scope of the current work.

#### DATA AVAILABILITY STATEMENT

Data will be made available upon request. All R code for analyses are included in Supplementary Materials.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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