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Perceived Stress, Recent Stressors, and Distress in relation to Sleep Disturbance and Duration Among Middle-Aged and Older Asian Immigrants

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Abstract

Objectives: This study aimed to examine the associations of perceived stress, stressors, and distress with sleep disturbance and duration among Asian immigrants.

Design/setting/participants: The sample included 400 Asian immigrants aged 50 to 75 years old recruited from primary care physicians' clinics.

Methods: We fit multivariable regression models to examine the associations of perceived stress, stressors, and distress with self-reported sleep disturbance and duration. We tested effect modifications by language proficiency, years in the United States, acculturative stress, and social support.

Results: A total of 73 (18.3%) participants reported any sleep disturbance, and the average time in bed was 7.25 hours (SD =1.17). Higher perceived stress (PR =1.15, 95% CI=1.06,1.26), stressors (PR =1.32, 95% CI=1.13,1.59), and distress (PR =1.36, 95% CI=1.21,1.57) were associated with a higher prevalence of any sleep disturbance. These associations were not modified by language proficiency, years in the United States, acculturative stress, and social support. On the other hand, the associations of perceived stress and distress and time in bed were modified by years in the United States. Specifically, higher levels of distress were associated with shorter times in bed only among adults who have resided in the U.S. for less than ten years.

Conclusion—Perceived stress, stressors, and distress are associated with a higher prevalence of sleep disturbance. Moreover, perceived stress and distress had stronger associations with times in bed among recent immigrants. Future sleep health research in Asian Americans should consider the important role of stress and distress, especially among recent immigrants.

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Introduction

Sleep deficiency and sleep disturbance are highly prevalent among middle-aged and older adults and are associated with increased risk of morbidity and mortality.[1] It is estimated that about 40% – 70% older adults report chronic sleep problems.[2] Several age-related factors may have contributed to a high prevalence of sleep problems among middle-aged and older adults, including age-related physiologic changes (e.g., menopause for women), chronic conditions (e.g., obesity, heart disease), decreased physical activity, and major life changes (e.g., retirement, bereavement).[3] However, poor sleep health is not an integral part of the aging process, and sleep problems do not equally affect all adults. Existing research has documented higher rates of sleep disorder and shorter sleep duration among minority adults, especially African American adults, than among White adults.[4,5] Increasing research has suggested poorer sleep outcomes among Asian Americans relative to other racial and ethnic groups.[4,5] For example, in a study of 2,230 adults aged 54 to 93 years and older from Multi-Ethnic Study of Atherosclerosis Sleep Cohort, Chinese Americans had a higher prevalence of severe sleep-disordered breathing than White, Black, or Hispanic adults.[4] In another study of 1,664 community-dwelling adults aged 65 years and older, Black and Asian older adults had shorter sleep duration than Latino older adults.[5] Identifying factors contributing to sleep problems among Asian American adults will inform effective strategies to reduce sleep disparities and improve sleep health for all.

Research has identified stressors—that is, social or environmental demands, losses, or perceived threats that cause stress—and stress, referring to an individual's response to stressors, as important to sleep health.[6,7] Distress is a distinct but closely related construct, referring to a negative emotional response to severe or prolonged stress, that is also relevant to sleep. Stress (and distress) could activate the dysfunction of the hypothalamic-pituitary-adrenal axis and elevate cortisol levels, which can disrupt sleep cycles and lead to a sleep disorder.[8] Stress may also lead to increased heart rate reactivity and reduced vagal tones, which have been associated with poor sleep health.[9] Furthermore, stress may be related to unhealthy coping behaviors such as poor eating habits and drug or alcohol abuse, both of which are linked to sleep problems.[10,11]

Stressors, stress, and distress have been operationalized in various ways. Some sleep health studies have included reports of recent stressors or stressful events,[12] often assessing stress by counting the number of stressful events. Other research has characterized stress as a two-way process where individuals interact with the environment.[13] This type of studies typically use a general measure of *perceived stress* to ask individuals whether an individual perceives a given situation as stressful.[13] Distress, on the other hand, is often conceptualized as the psychosocial response to severe and prolonged stressors. Measures of stressors, perceived stress, and distress correlate, but their associated factors and health outcomes may be different. For example, previous research shows that psychosocial variables (e.g., social support) were associated with both perceived stress and stressful life events, whereas demographic factors (e.g., education, income) were associated with stressful life events only, suggesting that perceived stress and stressful life events may capture different aspects of stress.[14] These different measures of stress have also been shown to be differentially associated with health outcomes. For example, in a study of 5,313 middle-aged and older

adults, stressful life events were associated with higher odds of diabetes and hypertension, but these associations were not observed for perceived stress.[15] On the other hand, in this same study, perceived stress, but not stressful life events, was associated with greater odds of currently smoking. Taking together, these findings indicate that there is a value in examining different stress-related variables in a single study to achieve a comprehensive understanding of the stress-sleep relationship.

Mapping our understanding of various factors onto the Asian immigrants requires acknowledging that this group is heterogeneous in various aspects, including their length of stay in the U.S., language proficiency, and the degree of acculturative stress experienced. The acculturative stress theory postulates that adapting to a new society may lead to adjustment strain among immigrants, increasing their vulnerabilities to maladaptive behaviors.[16] Guided by the acculturative stress theory, one may hypothesize that immigrants with lower acculturation levels, or with high acculturative stress, may have more difficulty in coping with stress; thus, their stress (or distress)-sleep associations may be stronger than those with higher acculturation levels or with lower acculturative stress. Alternatively, the *healthy immigrant effect* theory suggests that immigrants are healthier than native-born residents, but their health advantages decrease with longer residency.[17] Following the healthy immigrant effect theory, one may hypothesize that immigrants who are more acculturated are more likely to adopt unhealthy behaviors, increasing their risk of stress and health problems. Despite the competing theories, limited empirical research has tested these two theories in relation to sleep problems among Asian immigrants.

Social support may also modify the associations of perceived stress, stressors, and distress with sleep duration and disturbance among Asian immigrants. According to the stress-buffering hypothesis, social resources may act as a buffer against the harmful effects of stress on health outcomes.[18] The trust, emotional support, advice, and information people receive from their support network may provide valuable resources for coping with stress, thereby weakening the stress-sleep associations. On the other hand, a lack of social support may exacerbate feelings of social isolation and loneliness among immigrants, increasing their vulnerability when facing stress and exacerbating their sleep problems. Social support has been identified as an important psychosocial resource among Asian immigrants for buffering against the impacts of stress on various health outcomes, but its modifying roles on the stress-sleep relationship are relatively understudied.[19]

This study aimed to assess whether perceived stress, stressors, and distress are associated with sleep disturbance and duration and whether levels of acculturation, acculturative stress, and social support moderate these associations among middle-aged and older Asian immigrants. We hypothesized that 1) higher levels of perceived stress, stressors, and distress would be associated with a higher prevalence of sleep disturbance; 2) higher levels of perceived stress, stressors, and distress would be associated with a shorter time in bed as a proxy for sleep duration, and 3) acculturation levels, acculturative stress, and social support would modify the associations, with more pronounced associations among immigrants who were less acculturated, who have a higher level of acculturative stress, and those with weaker social support.

METHODS

Data

Data were collected as part of a colorectal cancer screening randomized controlled trial. From August 2018 to June 2020, 400 community-dwelling Asian Americans (200 Chinese and 200 Korean) aged 50 to 75 years old were recruited from primary care physicians' clinics in the Washington, D.C. Metropolitan Area. Inclusion criteria were: (1) self-identified Chinese or Korean; (2) age between 50 and 75 years; (3) not completed stool blood test within the past year; and (4) not completed a colonoscopy within the past 10 years. We excluded adults who had a family history of colorectal cancer, a history of removing polyps, inflammatory bowel disease, or a history of colorectal cancer.

Ninety-two percent of data collection was completed in-person via a self-administered questionnaire, whereas the remaining 8% was collected by a research assistant-led phone survey due to the restriction on in-person research activities with the COVID-19 outbreak. The questionnaire was translated into Chinese and Korean, and the surveys were conducted in participants' preferred languages (Mandarin (49.5%), Korean (50%), or English (0.5%)). All participants gave written informed consent before participating. This study was approved by the Institutional Review Boards of the University of Maryland and the University of California, Irvine.

Measures

Perceived Stress.—Perceived stress was assessed using the Perceived Stress Scale (PSS),[20] which consists of ten questions querying the frequency of feelings and thoughts related to events and situations during the past month. Sample items include "In the last month, how often have you been upset because of something that happened unexpectedly" and "In the last month, how often have you felt that you were unable to control the important things in your life?" The responses range from 0 (never) to 5 (very often). The PSS has been well-validated among Chinese and Koreans.[21,22] In our study, the internal consistency was satisfactory with alpha=0.71.

Recent Stressors.—Questions related to recent stressors and distress were derived from the National Comprehensive Cancer Network Distress Thermometer and Problem List (DTPL).[23] The DTPL includes an overall distress scale and a list of problems that assess various domains of stressors. Specifically, participants were asked to indicate whether they have encountered problems in the past week pertaining to: 1) child or grandchild care (e.g., babysitting); 2) housing; 3) insurance/finance; 4) transportation; 5) work; 6) conflicts with children; 7) conflicts with partners; and 8) family health issues. All questions were rated by a yes or no response,[23] and we summed the number of yes responses to obtain a count of recent stressors (range: 0–8; mean, 1.24; standard deviation (SD), 1.61). The DTPL has been validated in Chinese and Korean populations.[22,24]

Perceived Distress.—We measured distress by the distress thermometer from DTPL, a 0–10 visual analogue scale vertically oriented in the form of a thermometer.[25] Participants were asked to rate how much distress they have been experiencing in the past week. This

scale has been widely used in psycho-oncology research across different cultures.[25] The range of the scale in this sample was 0–10 (mean, 3.65; SD, 2.42).

Sleep disturbance.—Sleep disturbance was assessed using the 8-item Patient-Reported Outcomes Measurement Information System (PROMIS) Sleep Disturbance questionnaire, which measures perception of sleep quality, depth, and restoration over the past seven days.[26] All items were scored on a 5-point Likert scale ranging from not at all or never (1) to very much or always (5). We summed the scores across the items to obtain a total raw score and then converted the sum score to a standardized T-score using a conversion table.[27] We classified the T-scores into four categories: none to slight, mild, moderate, and severe. Given that 81.2% of participants were in the 'none to slight' category, we further categorized sleep disturbance into a binary variable (0=none to slight, 1=any sleep disturbance).

Time in bed.—We used time in bed as a proxy for sleep duration. We assessed self-reported time-in-bed by asking participants their usual sleep and wake time in hours and minutes. Specifically, participants were asked, "What's your usual sleep and wake time?" We calculated the total time in bed by subtracting sleep time from wake time.

Acculturation levels.—We assessed acculturation levels through years in the U.S. and language proficiency. *Years in the U.S.* were measured by asking participants the number of years that they had been in the U.S. and were categorized as: 1) 0–10 years; and 2) more than 10 years. A cut-off of 10 years was used because prior research has suggested 10 years as a marker for assimilation and has shown threshold effects on health outcomes including obesity and depressive symptoms.[28,29] *Language proficiency* was assessed by asking participants how well they spoke English. Responses range from (1) fluent like a native speaker; to (5) not at all. Because of small sample sizes in some groups, we recategorized language fluency as 1) good (fluent like a native speaker, well); and 2) poor/so-so/not at all.

Acculturative stress.—We assessed acculturative stress using a 9-item scale with a dichotomized response to each item. Sample items include whether feeling guilty for leaving the family in a home country and whether having difficulty in interactions with others because of English proficiency. We summed up the scores of the nine items to create a compositive score. The scale has been widely used to assess acculturative stress among Asian immigrants.[30]

Perceived social support.—Perceived social support was measured by the DUKE-UNC Functional Social Support Questionnaire,[31] which includes eight Likert-scale items related to perceived functional support (e.g., get love and affection, get chances to talk to someone about problems). Responses range from much less than I would like (1) to as much as I would like (5). A composite score was created by taking the mean of the eight questions, with a higher score indicating greater social support.

Covariates.—Sociodemographic factors including income, education, employment status, and marital status have been linked to sleep problems.[32] Likewise, lower socioeconomic status, being unmarried, or being unemployed have also been shown to be associated with

a greater level of stress.[34] Informed by prior research, we included covariates for age (years), sex (female vs. male), Asian subgroup (Chinese vs. Korean), income (<$10K; $10K-$39,999; $40K-$69,999,>=$70K), education (less than high school; high school; some college; college or more), employment status (full-time, part-time, not employed), marital status (married/living as married vs. currently not married), and BMI (kg/m^2).

Statistical Analyses

We first conducted descriptive analyses for the overall sample and stratified by sleep disturbance status (none to light vs. mild/moderate/severe) and time in bed (7–9 hours vs. < 7 hours or > 9 hours). Second, we ran logistic regression models to determine the associations between stress and sleep disturbance. Prevalence ratios and 95% confidence intervals were estimated using the logistic models as implemented by the 'prLogisticBootMarg' function in R package 'prLogistic'.[33] Third, we fit linear regression models to estimate differences in time in bed (hours) per unit difference in stress (or distress). The main analyses involved three sets of models: age-adjusted (model 1); model 1 plus sex and Asian subgroup (model 2); and model 2 plus sociodemographic and socioeconomic variables and BMI (model 3). To determine whether the associations of stress, stressors, and distress with sleep problems were *separately* modified by level of acculturation, acculturative stress, and social support, we fitted additional models by adding the main effect of years in the U.S., language proficiency, acculturative stress, and social support and a multiplicative interaction term between each variable and stress. Notably, as only eight out of the 47 participants who lived in the U.S. for less than 10 years had any sleep disturbance, we did not examine effect modification by years in the U.S. for sleep disturbance due to a lack of statistical power. We performed stratified analyses when significant interactions were observed. All analyses were performed in R.

Sensitivity Analyses

In a sensitivity analysis, we treated time in bed as a categorical variable (< 7 hours, 7– 9 hours (reference), and > 9 hours) to understand which category has the strongest association with stress.

Results

The sample includes 400 Asian American immigrants (mean age: 58 years (SD= 6)). A total of 199 were born in China, 200 were born in Korea, and one was born in Indonesia. Of the participants, 52.8% were female, 31.4% had an annual income lower than $40,000, 33.6% had a high school or lower degree, 21.2% were not employed, and 85.2% were married or were living as married (Table 1). A total of 73 (18.3%) participants (26 Chinese and 43 Koreans) reported any sleep disturbance. The average time in bed was 7.25 hours (SD =1.17), and it was similar between Chinese (mean=7.41, SD=1.14) and Korean immigrants (mean=7.09, SD=1.18).

Compared with participants who reported no or slight sleep disturbance, those who reported mild/moderate/severe sleep disturbance were more likely to be female, with lower income, with a high school degree or lower, be working on a part-time job, currently unmarried, have

more acculturative stress, or have fewer social support. Compared with those who spent 7–9 hours in bed, those who spent < 7 hours or > 9 hours were more likely to be female, with lower education, with lower income, currently being unmarried, report more acculturative stress, or have fewer social support. The stress measures were moderately correlated, with a correlation of $r = .25$ ($p < .001$) for recent stressors and perceived stress, $r = .37$ ($p < .001$) for perceived stress and distress, and $r = .41$ ($p < .001$) for recent stressors and distress.

After adjusting for age in model 1, each one-unit increase in perceived stress was associated with 1.15 times the prevalence of any sleep disturbance (PR= 1.15, 95% CI= 1.08,1.24) (Table 2). The associations remained similar after adjusting for Asian subgroup, sex, and socioeconomic covariates, and BMI. Similarly, after adjusting for age, each additional stressor was associated with 1.32 times the prevalence of sleep disturbance (PR= 1.32, 95% CI= 1.14,1.53). The associations were slightly attenuated after adjusting for all covariates. Regarding distress, after adjusting for age, each one-unit increase in distress was associated with 1.33 times the prevalence of sleep disturbance (PR= 1.33, 95% CI= 1.18,1.52). The associations were slightly increased after adjusting for sex and Asian subgroup and then slightly decreased after further adjusting for socioeconomic covariates and BMI.

We found little evidence that perceived stress and distress were associated with time-in-bed (Table 3). For recent stressors, in the model adjusted for age, sex, and Asian subgroup, each additional stressor was associated with a decrease in time in bed of 4.8 minutes ($\beta = -4.8$, 95% CI= (−9, −0.6)); however, the association become null after further controlling for socioeconomic covariates and BMI.

We did not find evidence that the association of perceived stress, stressors, or distress with sleep disturbance were moderated by any of the acculturation variables or social support. For time in bed, we did not find evidence that the associations of perceived stress, stressors, or distress with time in bed were modified by language proficiency, acculturative stress, or social support. However, the associations of perceived stress ($\beta_{\text{perceived stress*sleep}} = 0.10$, 95% CI: 0.02,0.19) and distress ($\beta_{\text{distress*sleep}} = 0.20$, 95% CI: 0.06, 0.35) with time in bed were modified by years in the U.S. (Figure 1a–1c). Particularly, the associations between distress and time in bed were only evident among those who have resided in the U.S. for fewer than 10 years (Supplemental Table S2).

Sensitivity Analysis

We examined the three stress and distress variables in relation to time in bed as a categorical outcome. After adjusting for all covariates, associations of perceived stress, stressors, and distress with categorical time in bed were not observed (Supplemental Table S1).

Discussion

This study examined the associations of perceived stress, stressors, and distress with sleep disturbance and duration among 400 Chinese and Korean immigrants. Higher perceived stress, stressors, and distress were associated with a greater prevalence of sleep disturbance. Additionally, the associations between distress and time in bed were only evident among adults who have resided in the U.S. for fewer than 10 years.

Our findings regarding the positive associations of perceived stress, stressors, and distress with sleep disturbance are consistent with the broader literature. For example, a study of 306 medical students found a strong association between high psychological distress and poor sleep quality.[34] In a recent large study of 4,201 adults aged 65 years and older, higher perceived stress was independently associated with poorer sleep quality.[35] Our study advances the literature by considering perceived stress, stressors, and distress simultaneously and focusing on Asian immigrants, a fast-growing population understudied in sleep health research. Our findings indicate that stress and distress are important to consider when studying and possibly treating sleep disturbance in Asian Americans.

Our findings that perceived stress, stressors, and distress were not associated with shorter time in bed *in the overall population* add complexity to the unclear pattern of results on stress and sleep duration within the literature. Existing research on stress and sleep duration has yielded inconclusive findings, with some research showing that stress is associated with shorter duration, while other research fails to find evidence for a relation between stress and sleep duration.[36] Our consideration of years in the U.S. as an effect modifier suggests that the null findings might have been driven by immigrants who have lived in the U.S. for more than 10 years. For immigrants who had been in the U.S. for less than ten years, higher distress was strongly associated with shorter sleep duration. These findings contradict the healthy immigrant effect, which suggests that the health advantages of immigrants diminish over time. Our findings that language proficiency and acculturative stress did not modify the stress-sleep association suggest that we should consider factors beyond language or cultural barriers that may influence the stress and sleep problems among recent immigrants. Compared with immigrants who have been in the U.S. for a longer period, recent immigrants may be more likely to take low-skilled jobs with long working hours, non-standard schedules, and poor working conditions. As such, they might be more likely to be exposed to high stress and have shorter sleep duration. Although we accounted for employment status, we did not have information about occupation type or work hours. Future research should examine if occupational characteristics (e.g., schedule, demands and controls, etc.) influence the stress-sleep relationship among Asian Americans. Notably, since only four Korean participants had been in the U.S. for less than 10 years, we did not have sufficient power to evaluate whether the effect modifications by years in the U.S. differ between Korean and Chinese adults. Future research with larger sample sizes should replicate our analyses to assess the modifying role of acculturation factors on the associations between stress and sleep problems among Asian immigrants.

Our findings that the associations of perceived stress, stressors, and distress with sleep duration and disturbance did not differ depending on levels of social support are unexpected and are inconsistent with prior research which showed social support mitigates stress-sleep relationships.[37,38] Some research suggests that visible support may have unexpected negative consequences, including lowering one's self-esteem.[39] This might be especially true among older immigrants, as too much support received may induce feelings of "being a burden" to their family or relatives, and therefore the support they receive may not function as a buffer to protect them against sleep problems.

Our findings should be interpreted with limitations. First, given the cross-sectional design, reverse causation is possible as the presence of sleep problems may change the perception of stress and levels of distress. Sleep problems may disrupt family functioning and lead to a higher prevalence of stressful life events such as conflicts within families. Future longitudinal research should examine whether there are reciprocal relationships between stress and sleep problems among Asian Americans. Second, we used data from a non-probability sample of patients from primary care physicians' clinics, which included only Chinese and Korean immigrants whose life experiences may be different from other Asian immigrant subgroups. As such, our sample is not representative of the general Asian immigrant population and our findings have limited external validity. However, given the limited evidence available in the literature, our study represents an important first step to understanding stress and sleep health among Asian immigrants. Third, we relied on self-reported sleep measures, which might have been subject to reporting bias. Due to the self-report nature of the sleep measures, we were also unable to assess sleep onset latency and comprehensively capture sleep duration. Future studies should include objective sleep assessments to validate the findings of the present study. Last, although our stress measures have been widely used in the literature, they are not comprehensive and may be subject to measurement errors. For example, we did not have information about perceived discrimination, a type of stressors that have been associated with sleep problems.[40] However, our measures of perceived stress and distress might allow us to capture the negative effects of the stressful events that were omitted in the recent stressor measure used in the present study.

In sum, perceived stress, stressors, and distress were associated with a higher prevalence of sleep disturbance among Asian immigrants and the associations were not modified by levels of acculturation, acculturative stress, and social support. Further, distress was associated with shorter times in bed only among those who resided in the U.S. for less than ten years. The consistent associations of stress, stressors, and distress with sleep disturbance point to the importance of considering these constructs within sleep disturbance interventions among Asian immigrants. The different patterns of findings regarding the associations between stress (distress) and time in bed by years in the United States require further investigations. Specifically, research with larger sample sizes should replicate our study and move beyond acculturative stress and social support to explore other factors that contribute to the stress (distress) and sleep duration associations among recent immigrants.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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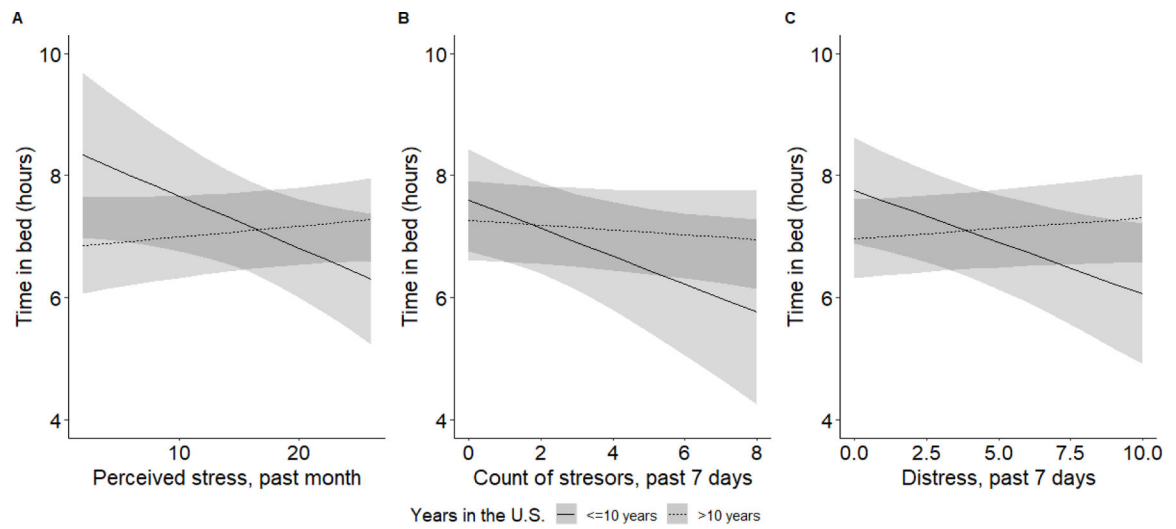
Figure 1.
Associations of perceived stress, stressors, distress with time in bed by years in the United States among 400 Chinese and Korean immigrants

Note. All models were adjusted for age, sex, Asian subgroup, education, income, marital status, employment status, and BMI.

Table 1.

Sample characteristics in the sample overall and by sleep disturbance and time in bed among Asian immigrants (N=400)

	Sleep Disturbance		Sleep Duration (Time in Bed)		
	None to light (N=327)	Any sleep disturbance (N=73)	7–9 hours in bed (N=269)	<7 hours or > 9 hours in bed (N=131)	Total (N=400)
Age					
Mean (SD)	58.4 (6.50)	58.5 (5.74)	58.3 (6.57)	58.6 (5.93)	58.4 (6.36)
Sex					
Male	164 (50.2%)	25 (34.2%)	131 (48.7%)	58 (44.3%)	189 (47.2%)
Female	163 (49.8%)	48 (65.8%)	138 (51.3%)	73 (55.7%)	211 (52.8%)
Asian subgroup					
Chinese	173 (52.9)	27 (37.0%)	147 (54.6%)	53 (40.5%)	200 (50.0%)
Korean	154 (47.1)	46 (63.0%)	122 (45.4%)	78 (59.5%)	200 (50.0%)
Income					
<$10K	17 (5.2%)	8 (11.0%)	15 (5.6%)	10 (7.6%)	25 (6.2%)
$10K-$39,999	83 (25.4%)	18 (24.7%)	76 (28.3%)	25 (19.1%)	101 (25.2%)
$40K-$69,999	124 (37.9%)	30 (41.1%)	91 (33.8%)	63 (48.1%)	154 (38.5%)
>=$70K	103 (31.5%)	17 (23.3%)	87 (32.3%)	33 (25.2%)	120 (30.0%)
Education					
Less than high school	35 (10.7%)	8 (11.0%)	29 (10.8%)	14 (10.7%)	43 (10.8%)
High school	73 (22.3%)	18 (24.7%)	63 (23.4%)	28 (21.4%)	91 (22.8%)
Some college	59 (18.0%)	9 (12.3%)	37 (13.8%)	31 (23.7%)	68 (17.0%)
College or more	160 (48.9%)	38 (52.1%)	140 (52.0%)	58 (44.3%)	198 (49.5%)
Employment status					
Full-time	190 (58.1%)	41 (56.2%)	151 (56.1%)	80 (61.1%)	231 (57.8%)
Part-time	66 (20.2%)	18 (24.7%)	62 (23.0%)	22 (16.8%)	84 (21.0%)
Not employed	71 (21.7%)	14 (19.2%)	56 (20.8%)	29 (22.1%)	85 (21.2%)
Marital status					
Married/living as married	286 (87.5%)	55 (75.3%)	233 (86.6%)	108 (82.4%)	341 (85.2%)
Not currently married	41 (12.5%)	18 (24.7%)	36 (13.4%)	23 (17.6%)	59 (14.8%)
BMI	24.6 (3.48)	24.7 (3.70)	24.6 (3.41)	24.8 (3.74)	24.6 (3.51)

	Sleep Disturbance		Sleep Duration (Time in Bed)		
	None to light (N=327)	Any sleep disturbance (N=73)	7–9 hours in bed (N=269)	<7 hours or > 9 hours in bed (N=131)	Total (N=400)
Years in the United States					
<=10 years	39 (11.9%)	8 (11.0%)	34 (12.6%)	13 (9.9%)	47 (11.8%)
>10 years	288 (88.1%)	65 (89.0%)	235 (87.4%)	118 (90.1%)	353 (88.3%)
Language proficiency					
Good	76 (23.2%)	15 (20.5)	63 (23.4%)	28 (21.4%)	91 (22.8%)
Poorly/So so/Not at all	251 (76.8%)	58 (79.5%)	206 (76.6%)	103 (78.6%)	309 (77.3%)
Acculturative stress	1.5 (1.5)	2.2 (1.8)	1.50 (1.49)	1.91 (1.63)	1.6 (1.6)
Social support	3.8 (0.8)	3.3 (1.0)	3.84 (0.84)	3.54 (0.94)	3.7 (0.9)

Note. SD: Standard Deviation

Table 2.

Associations of perceived stress, stressors, and distress with sleep disturbance among Asian immigrants (N=400)

	Model 1	Model 2	Model 3
	PR (95% CI)	**PR (95% CI)**	**PR (95% CI)**
Perceived stress (range: 2–26)	1.15 (1.08,1.24)	1.14 (1.06,1.23)	1.15 (1.06,1.26)
Stressors (range: 0–8)	1.32 (1.14,1.53)	1.28 (1.13,1.48)	1.32 (1.13, 1.59)
Distress (range: 0–10)	1.33 (1.18,1.52)	1.34 (1.21,1.55)	1.36 (1.21,1.57)

Note: PR: prevalence ratio; CI: confidence interval. Model 1 was adjusted for age; model 2 was adjusted age, sex, and Asian subgroup; model 3 was adjusted age, sex, Asian subgroup; income, education, marital status, employment status, and BMI.

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Table 3.

Associations of perceived stress, stressors, and distress with time in bed (in minutes) among Asian immigrants (N=400)

	Model 1	Model 2	Model 3
	β (95% CI)	β (95% CI)	β (95% CI)
Perceived stress (range: 2–26)	0.6 (−1.2,1.8)	0.6 (−0.6,2.4)	0.6 (−1.2,1.8)
Stressors (range: 0–8)	−5.4 (−9.6, −1.2)	−4.8 (−9.0, −0.6)	−3.6 (−7.8,0.6)
Distress (range: 0–10)	−0.6 (−3.6,2.4)	−0.6 (−3.0,2.4)	0.6 (−2.4,3.0)

Note: CI: confidence interval. Model 1 was adjusted for age; model 2 was adjusted age, sex, and Asian subgroup; model 3 was adjusted age, sex, Asian subgroup, income, education, marital status, employment status, and BMI.