



Contents lists available at ScienceDirect

# Sleep Health

Journal of the National Sleep Foundation

journal homepage: [sleephealthjournal.org](http://sleephealthjournal.org)

## The Sleep Health Index: Correlations with standardized stress and sleep measures in a predominantly Hispanic college student population

Grant Benham, PhD\*

Department of Psychological Science, The University of Texas Rio Grande Valley, EIEAB 3.208, 1201 West University Drive, Edinburg, TX 78539, USA

### ARTICLE INFO

#### Article history:

Received 5 April 2019

Received in revised form 6 July 2019

Accepted 11 July 2019

#### Keywords:

Sleep health  
Sleep quality  
Insomnia  
Stress  
Wellness

### ABSTRACT

**Objectives:** The Sleep Health Index was developed to address limitations with existing sleep scales, particularly in the measurement of healthy sleep in non-clinical populations. The purpose of the current study was to examine this measure in relation to two widely-used sleep scales and two standardized stress scales. **Methods:** A sample of 416 undergraduate students completed an online survey that included the Sleep Health Index, Pittsburgh Sleep Quality Inventory, Insomnia Severity Index, Perceived Stress Scale, and Index of College Students' Recent Life Events.

**Results:** Sleep health was negatively correlated with self-perceived stress and life-events ( $-.41$  and  $-.45$ , respectively), insomnia severity ( $-.59$ ), and poor sleep quality ( $-.58$ ).

**Conclusions:** Although other measures assessing sleep health exist, there is a paucity of data-driven support for their validity. Our findings provide support for the Sleep Health Index as a measure of healthy sleep and demonstrate an association between psychological stress and sleep health in an undergraduate student population.

© 2019 National Sleep Foundation. Published by Elsevier Inc. All rights reserved.

### Introduction

In 2013, the National Sleep Foundation established a taskforce to develop a new Sleep Health Index (SHI) in order to address several limitations with existing sleep scales.<sup>1</sup> The taskforce developed the SHI as a research tool to assess “sleep health”<sup>2</sup> in the general population, rather than focusing on disordered sleep, daytime sleepiness, or clinical populations. Over the course of two years, the initial 28-item measure was administered via telephone interview to nationally-representative samples of adults. The data obtained from these 2503 participants was used to refine the SHI to a 14-question measure comprising 3 factors (sleep quality, sleep duration, and disordered sleep) in addition to an overall sleep health score.

Although the concept of sleep health has received increased attention (e.g.,<sup>3</sup>), and there is emerging consensus on how to define healthy sleep, both in terms of quantity<sup>4</sup> and quality,<sup>5</sup> the original SHI paper remains the only source of data on this particular measure.

To date, the SHI has not been validated against existing self-report measures of sleep. Additionally, while the 2017 report included a negative correlation ( $r = -0.37$ ) between self-reported stress and SHI scores, the stress measure was limited to a single question. The goal of our study was therefore to examine the SHI in relation to established measures of both stress and sleep, based on an independent sample.

### Method

#### Participants

Four hundred and sixteen college students from a large university in the southwestern United States participated in the study. Participants ranged in age from 18 to 52 ( $M = 22.69$ ,  $SD = 5.51$ ), 76% were female, and 94.7% identified as Hispanic. The majority (85.1%) reported generally sleeping in bed alone.

#### Measures

Sleep Health Index (SHI).<sup>1</sup> The SHI contains 14 questions that are used as the basis for measuring three dimensions of sleep health:

*Abbreviations:* SHI, Sleep Health Index; PSS, Perceived Stress Scale; ICSRLE, Inventory of College Students' Recent Life Events; PSQI, Pittsburgh Sleep Quality Inventory; ISI, Insomnia Severity Index.

\* Corresponding author. Tel.: +1 956 665 2807.

E-mail address: [grant.benham@utrgv.edu](mailto:grant.benham@utrgv.edu).

sleep quality, sleep duration, and disordered sleep and an overall sleep health index. Individuals are asked to respond with reference to the prior seven days. Where appropriate, computed scores are tied to expert recommendation on sleep. For example, weekday time-in-bed values (calculated as the difference between the time individuals reported going to bed and waking up) were transformed to standardized scores based on recommendations developed by a panel of sleep health experts. This Weekday Sleep Score was then averaged with a calculated Sleep Deficit Score and a Social Jetlag/Sleep Variability Score to produce the Sleep Duration sub-index score. Each of the three sub-indexes and the overall SHI are scored from 0 to 100, with higher scores representing better sleep health.

Inventory of College Students' Recent Life Experiences (ICSRLE).<sup>6</sup> The ICSRLE is comprised of 49 items that reflect everyday stressors or hassles commonly experienced by college students. For each item, respondents rated the intensity of their experience with the stressor over the past month. Possible scores range from 49 to 196, with higher scores represent greater stress. Cronbach's  $\alpha$  was 0.94 for the present sample.

Perceived Stress Scale (PSS).<sup>7</sup> The PSS contains 10 items asking respondents how frequently they have had stress-related feelings/thoughts during the past month. Sample items are "...felt nervous and stressed?", "...felt that you were unable to control the important things in your life?" with response choices ranging from (0) "Never" to (4) "Very Often". Possible scores on the PSS range from 0 to 40, with higher scores indicating greater stress. Cronbach's  $\alpha$  was .85 in the present study.

Pittsburgh Sleep Quality Index (PSQI).<sup>8</sup> The 19-item PSQI provides a global score based on seven components: subjective sleep quality, sleep latency, sleep duration, habitual sleep efficiency, sleep disturbances, use of sleeping medication and daytime dysfunction over the last month. Scores on the PSQI range from 0–21 with higher scores indicating poorer sleep quality. Based on the seven PSQI component scores, Cronbach's  $\alpha$  was .64 for the current study.

Insomnia Severity Index (ISI).<sup>9</sup> The ISI is a self-report measure that assesses participants' perceptions of their insomnia. It includes seven items related to the extent of difficulties with sleep onset and sleep maintenance during the previous two weeks. Total scores range from 0–28, with higher scores representing greater insomnia. Cronbach's  $\alpha$  was 0.86 for the current study.

### Procedure

Participants took part in the study on a voluntary basis in return for course credit. All participants completed an online survey hosted through Qualtrics ([www.qualtrics.com](http://www.qualtrics.com)) which included an informed consent statement, a number of demographic questions, including ethnicity/race, age, and sex, followed by the aforementioned stress and sleep measures presented in the order indicated above. The university's Institutional Review Board approved the study prior to recruitment.

### Data analysis

We performed statistical analyses using SPSS 25 (IBM Corp., 2017). First, we carried out missing data analysis to examine if data were missing completely at random (MCAR). Across all the variables, 1.7%–4.6% of data were missing. Values were missing completely at random,  $X^2(4531) = 0.000, P = 1.00$ , and were substituted with values using the expectation-maximization (EM) algorithm. Second, based on the acceptable criteria for skewness ( $< 1$ ), and kurtosis ( $< 3$ ) we determined that all study variables were normally distributed except for age (positively skewed [4.00] and leptokurtic [22.61]), BMI (positively skewed [1.15]), SHI Sleep Disorder (negatively skewed [ $-3.60$ ] and leptokurtic [13.80]) and SHI Sleep Duration

(negatively skewed [1.04]). We used Spearman's rho to test correlations with these non-normally distributed data. All other correlations were based on Pearson's  $r$ . Lastly, a two-step hierarchical linear regression analysis was conducted to clarify whether our two stress measures would remain associated with sleep health after controlling for participants' age and sex. Age and sex were entered at the first step, with self-perceived stress and stressful life events entered at the second step. An  $\alpha$  of .05 was used for all tests of statistical significance.

### Results

Descriptive statistics of the sample and between-group comparisons are presented in Table 1. Correlations between each measure are presented in Table 2.

#### Sleep health scores

Our sample scored significantly lower on the SHI ( $M = 73.6$ , range 31–100) than the NSF's national sample, based on both their entire sample ( $76; t(415) = 3.52, P < .001$ ) or limited to 18–29 year old respondents ( $78; t(402) = 6.09, P < .001$ ). Sleep health was significantly higher in men (76.0) relative to women (72.8;  $t(414) = 2.01, P = .046$ , 2-tailed), but this difference appeared to be largely based in differences between SHI sleep quality and failed to meet the threshold for significance when age was controlled for using ANCOVA ( $F(1, 413) = 2.28, P > .05$ ).

#### Association between sleep health and stress

Sleep health was negatively correlated with self-perceived stress and life-events ( $-.41$  and  $-.45$ , respectively). We conducted a hierarchical linear regression to further examine the sleep health-stress relationship, controlling for age and sex at the first step. Age and sex accounted for a non-significant 1% percent of the variance in SHI scores ( $F(2, 413) = 2.8, P > .05$ ). The addition of the stress measures to the model accounted for an additional 22% of the variance in SHI scores ( $F(2, 411) = 57.3, P < .001$ ). In the final model, both self-perceived stress and past-month stressful events were statistically significant predictors of sleep health, ( $\beta = -0.31$  and  $\beta = -0.22$ , respectively, both  $P < .001$ ).

#### Association between sleep health and established sleep measures

Sleep health was negatively correlated with insomnia severity and poor sleep quality ( $-.59$  and  $-.58$ , respectively;  $P < .001$ ). The SHI sleep quality sub-index score was negatively correlated with the PSQI sleep quality factor score ( $-.66, P < .001$ ; not shown in Table 2).

#### Association between sleep health and physical health-related measures

Although our study did not include a physical health measure, we included a single question about doctor's visits and also calculated body mass index (BMI) using self-reported height and weight. Participants who had visited the doctor for illness during the past six months reported significantly poorer sleep health (71.5) than those who had not (74.9),  $t(394) = 2.37, P = .009$ . The correlation between SHI and BMI was not statistically significant ( $r_s(414) = -.04, P > .05$ ), even when excluding those who were below healthy weight ( $r_s(393) = -.06, P > .05$ ). However, between-group comparisons based on established weight classifications indicated that obese and underweight individuals had significantly poorer sleep health than individuals with healthy weight ( $t(301) = .189, P = .042$  and  $t(212) = 1.68, P = .047$ , respectively, one-tailed independent t-test).

**Table 1**  
Descriptive statistics for the stress and sleep measures

	N	%	SHI Overall	SHI Quality	SHI Duration	SHI Disorder	PSS	ICSRLE	PSQI	ISI
Total Sample	416	100	73.6 (13.9) [72–75] *	58.4 (18.6) [57–60] **	67.6 (29.0) [65–70]	94.8 (15.2) [93–96]	20.1 (6.9) [19–21] ***	228.1 (76.0) [221–235] ***	6.8 (3.2) [7–7] **	9.9 (6.0) [9–10] **
Gender										
Male	100	24%	76.0 (12.8)	63.7 (18.1)	67.6 (29.2)	96.9 (11.1)	16.6 (6.8)	199.3 (82.3)	5.9 (3.0)	8.2 (5.3)
Female	316	76%	72.8 (14.2)	56.7 (18.5)	67.7 (28.9)	94.2 (6.3)	21.2 (6.6)	237.2 (71.7)	7.1 (3.3)	10.5 (6.1)
Ethnicity										
Hispanic	394	95%	73.6 (13.6)	58.0 (18.3)	67.8 (29.1)	95.1 (14.4)	20.2 (6.9)	230.0 (75.5)	6.9 (3.2)	9.9 (6.0)
Non-Hispanic	22	5%	72.8 (18.4)	64.0 (22.8)	65.3 (26.9)	89.2 (25.9)	17.6 (7.6)	202.7 (83.8)	6.0 (3.8)	9.9 (6.5)
Age										
18–29	402	97%	73.8 (13.8)	58.5 (18.5)	67.6 (29.1)	95.4 (14.3)	20.1 (7.0)	227.7 (75.9)	6.8 (3.2)	9.9 (5.9)
>29	14	3%	67.4 (16.4) *	53.8 (21.6) **	69.6 (25.0)	78.9 (27.9) *	18.9 (6.2) *	240.0 (82.4) ***	8.1 (3.7) *	10.9 (7.5) *
Visited a doctor for illness										
Yes	169	41%	71.7 (14.5)	55.4 (20.3)	67.2 (27.2)	92.5 (19.0)	21.0 (7.0)	244.3 (75.4)	7.3 (3.5)	10.7 (6.2)
No	247	59%	74.9 (13.4)	60.4 (17.1)	67.9 (30.2)	96.4 (11.8)	19.5 (6.8)	217.0 (74.6)	6.5 (3.0)	9.4 (5.8)
BMI										
Underweight (<18.5)	21	5%	69.9 (15.3)	56.2 (18.9)	59.8 (33.4)	93.9 (13.8)	22.5 (7.1)	245.4 (75.5)	6.6 (3.2)	10.2 (5.7)
Healthy weight (18.5–24.9)	194	47%	74.9 (12.4)	60.3 (17.9)	68.6 (26.3)	95.9 (13.4)	19.7 (7.0)	217.5 (75.9)	6.4 (3.2)	9.6 (5.8)
Overweight (25–29.9)	91	22%	73.7 (14.1)	57.3 (18.8)	69.9 (29.4)	94.0 (15.4)	20.3 (6.0)	226.7 (73.4)	7.1 (3.1)	10.1 (6.1)
Obese (30+)	110	26%	71.8 (15.7)	56.3 (19.5)	65.5 (32.2)	93.7 (18.2)	20.2 (7.6)	244.9 (76.0)	7.4 (3.4)	10.3 (6.3)

Note: For each measure, the mean (standard deviation, and [confidence interval] is provided. Significant differences between males and females and those who have/ have not visited a doctor are indicated in the corresponding column, all two-tailed tests. \* =  $P < .05$ , \*\* =  $P < .01$ , \*\*\* =  $P < .001$ ; SHI = Sleep Health Index; PSS = Perceived Stress Scale; ICSRLE = Inventory of College Students' Recent Life Events; PSQI = Pittsburgh Sleep Quality Inventory; ISI = Insomnia Severity Index; Visited a doctor for illness is based visits during past 6-months; BMI=Body Mass Index in kg/m<sup>2</sup>, calculated from participants' self-reported height and weight.

**Discussion**

Our findings indicated that the SHI is negatively correlated with two well-established measures of disordered sleep. As a measure of sleep health, the association is in the expected direction: negatively correlated with both measures. It is noteworthy that, of the SHI subscales, Sleep Quality appears to be the most highly correlated with both the PSQI and ISI scores. However, the smaller correlations of the Sleep Duration and Sleep Disorder subscales might be explained by the significantly negatively skewed distribution of scores (particularly in the case of Sleep Disorders, where the overall sample mean was 95/100). In relation to stress, our data show that less stress (as assessed by both a past-month life events scale and a past-month self-perceived stress scale) is associated with better sleep health. As

with the PSQI and ISI sleep measures, the association of stress with SHI subscale scores is greatest with SHI Sleep Quality. These results extend the previously reported correlation between the SHI and a single-question stress index, “Overall how stressed have you felt in the past month?”, and are in keeping with the expanding literature on the bidirectional association between stress and sleep.<sup>10</sup>

Our college sample had poorer sleep health than the NSF nationally-representative sample, even when bracketing the 18–29 year-old age range. This finding is not particularly surprising, given the short sleep durations, poor sleep quality, and daytime sleepiness, experienced by undergraduates.<sup>11,12</sup> However, given that those who have graduated from college appear to have better sleep health than those who have “some college”,<sup>1</sup> there may be hope for our beleaguered students post-graduation. Although based

**Table 2**  
Correlations between primary variables

MEASURE	SHI Overall	SHI Quality	SHI Duration	SHI Disorder	PSS	ICSRLE	PSQI	ISI	Age
SHI Quality	.67***								
SHI Duration <sup>+</sup>	.78***	.23***							
SHI Disorder <sup>+</sup>	.38***	.30***	-.03						
PSS	-.43***	-.55***	-.22***	-.15***					
ICSRLE	-.41***	-.45***	-.24***	-.15***	.63***				
PSQI	-.56***	-.73***	-.24***	-.28***	.51***	.49***			
ISI	-.58***	-.76***	-.31***	-.21***	.55***	.50***	.71***		
Age <sup>+</sup>	-.04	-.03	.03	-.15***	-.11**	-.12***	.03	.003	
BMI <sup>+</sup>	-.04	-.06	.01	-.05	-.02	.08	.12**	.01	.20**

Note: <sup>+</sup> = Spearman's rho correlation used; Statistical significance of correlations between variables are based on 1-tailed tests; SHI = Sleep Health Index; PSS = Perceived Stress Scale; ICSRLE = Inventory of College Students' Recent Life Events; PSQI = Pittsburgh Sleep Quality Inventory; ISI = Insomnia Severity Index.

on a single-item measure of doctor visits, we also supported the notion that better sleep health may be associated with less physical illness. Similarly, based on BMI classifications, we found that individuals who were obese or underweight had significantly poorer sleep health than those who had healthy weight. Overweight individuals did not differ from healthy weight individuals on this measure, nor was there a direct association between BMI values and sleep health even when excluding underweight individuals from the analysis. Our findings support previous studies that have demonstrated associations between poor sleep and worse physical health (e.g.,<sup>13</sup>), but it would be prudent to further examine the sleep health – wellness relationship with more sophisticated metrics of physical health and body composition. Although prior research suggests that inadequate sleep may contribute to both physical illness and obesity risk, it remains likely that (as with stress) the relationships are better understood as bidirectional in nature.<sup>10,14</sup>

Our study employed a number of well-established measures and to our knowledge is the first study to administer the SHI through an online survey platform, but we acknowledge a number of limitations. We relied on a convenience sample of college students, a population that has been criticized for its lack of generalizability.<sup>15</sup> However, data obtained from undergraduates on stress and sleep measures has previously been shown to be equivalent to data obtained from Amazon's Mechanical Turk workers,<sup>16</sup> a population significantly more diverse.<sup>17</sup> Our sampled population also had limited racial/ethnic diversity, with 95% of participants identifying as Hispanic. Although the homogeneity of our sample limits the generalizability of findings, this can be balanced against having provided important data on a population frequently underrepresented in sleep research.<sup>18</sup> Given that prior research has demonstrated shorter sleep duration in Hispanics relative to non-Hispanic whites,<sup>19</sup> it is tempting to suggest our sample's lower SHI scores may be due in part to the large percentage of Hispanic participants. However, an accurate understanding of the relationship between ethnicity and sleep is complicated by numerous factors. For example, a recent actigraph-based study found that Hispanic males had significantly shorter sleep duration than non-Hispanic whites, but this was not true for Hispanic females.<sup>20</sup> Additionally, Hispanic/Latino heritage (e.g., Mexican vs. Puerto Rican)<sup>21,22</sup> and level of acculturation stress experienced by Hispanic/Latino individuals appear to be important considerations when defining norms within this population.<sup>23,24</sup>

Prior research has tended focus on those with problematic sleep, whether diagnosed clinically or through high scores on commonly-used measures, rather than those who report good sleep health. In line with the philosophy of positive psychology, an argument can be made for studying those who thrive.<sup>25</sup> For example, dispositional traits, behaviors, or sociocultural factors that are associated with good sleep health as assessed by the SHI. Understanding these variables may, in turn, help to identify novel approaches to treating those who suffer from inadequate or disordered sleep. Although other measures assessing sleep health currently exist, such as the 5-item SATED measure<sup>2</sup> and the Sleep Health Composite measure for adolescents<sup>26</sup>, there is a paucity of data-driven support for the validity of such scales. Nevertheless, the increased interest in such measures within the clinical and academic communities, and the development of related measures such as the NSF's Sleep Satisfaction Scale,<sup>27</sup> suggest that there is a recognized need to examine sleep from the perspective of healthy sleep in non-clinical populations.

## Acknowledgments

The Sleep Health Index®, © 2017, is a US registered trademark and proprietary instrument of the National Sleep Foundation. All rights reserved. Use of the Sleep Health Index for the purposes of this study was granted by the National Sleep Foundation through

an official licensing agreement. The author thanks R. Gonzalez, G. Martinez, and J. Chavez for their assistance with development of SPSS scoring syntax for the measures.

## References

1. Knutson KL, Phelan J, Paskow MJ, Roach A, Whiton K, Langer G, Hillygus DS, Mokrzycki M, Broughton WA, Chokroverty S, Lichstein KL, Weaver TE, Hirshkowitz M. The National Sleep Foundation's Sleep Health Index. *Sleep Health*. 2017;3(4):234–40. Epub 2017/07/16. doi: <https://doi.org/10.1016/j.sleeh.2017.05.011>. PubMed PMID: 28709508.
2. Buysse DJ. Sleep health: can we define it? Does it matter? *Sleep* 2014;37(1):9–17. doi: <https://doi.org/10.5665/sleep.3298>. PubMed PMID: PMC3902880.
3. Allen SF, Elder CJ, Longstaff LF, Gotts ZM, Sharman R, Akram U, Ellis JG. Exploration of potential objective and subjective daily indicators of sleep health in normal sleepers. *Nat Sci Sleep* 2018;10:303–12. doi: <https://doi.org/10.2147/NSS.S168841>. PubMed PMID: 30310337.
4. Hirshkowitz M, Whiton K, Albert SM, Alessi C, Bruni O, DonCarlos L, Hazen N, Herman J, Adams Hillard PJ, Katz ES, Kheirandish-Gozal L, Neubauer DN, O'Donnell AE, Ohayon M, Peever J, Rawding R, Sachdeva RC, Setters B, Vitiello MV, Ware JC. National Sleep Foundation's updated sleep duration recommendations: final report. *Sleep Health*. 2015;1(4):233–243. <https://doi.org/10.1016/j.sleeh.2015.10.004>.
5. Ohayon M, Wickwire EM, Hirshkowitz M, Albert SM, Avidan A, Daly FJ, Dauvilliers Y, Ferri R, Fung C, Gozal D, Hazen N, Krystal A, Lichstein K, Mallampalli M, Plazzi G, Rawding R, Scheer FA, Somers V, Vitiello MV. National Sleep Foundation's sleep quality recommendations: first report. *Sleep Health*. 2017;3(1):6–19. <https://doi.org/10.1016/j.sleeh.2016.11.006>.
6. Kohn PM, Lafreniere K, Gurevich M. The inventory of college Students' recent life experiences: a decontaminated hassles scale for a special population. *J Behav Med*. 1990;13(6):619–630. <https://doi.org/10.1007/bf00844738>.
7. Cohen S, Spacapan S, Oskamp S. In: Spacapan S, Oskamp S, editors. *Perceived Stress in a Probability Sample of the United States*. Newbury Park, CA: Sage Publications, Inc; 1988. p. 31–67. *The Social Psychology of Health*.
8. Buysse DJ, Reynolds CF, 3rd, Monk TH, Berman SR, Kupfer DJ. The Pittsburgh Sleep Quality Index: a new instrument for psychiatric practice and research. *Psychiatry Res*. 1989;28(2):193–213. Epub 1989/05/01. doi: [https://doi.org/10.1016/0165-1781\(89\)90047-4](https://doi.org/10.1016/0165-1781(89)90047-4). PubMed PMID: 2748771.
9. Morin CM, Belleville G, Bélanger L, Ivers H. The insomnia severity index: psychometric indicators to detect insomnia cases and evaluate treatment response. *Sleep* 2011;34(5):601–8. doi: <https://doi.org/10.1093/sleep/34.5.601>. PubMed PMID: PMC3079939.
10. Zee PC, Turek FW. Sleep and health: everywhere and in both directions. *Arch Intern Med* 2006;166(16):1686–8. doi: <https://doi.org/10.1001/archinte.166.16.1686>. PubMed PMID: 16983044.
11. Hershner SD, Chervin RD. Causes and consequences of sleepiness among college students. *Nat Sci Sleep*. 2014;6:73–84. Epub 2014/07/16. doi: <https://doi.org/10.2147/nss.s62907>. PubMed PMID: 25018659.
12. Lund HG, Reider BD, Whiting AB, Prichard JR. Sleep patterns and predictors of disturbed sleep in a large population of college students. *J Adolesc Health* 2010;46(2):124–32. doi: <https://doi.org/10.1016/j.jadohealth.2009.06.016>. PubMed PMID: 20113918.
13. Benham G, Charak R. Stress and sleep remain significant predictors of health after controlling for negative affect. *Stress Health* 2019;35(1):59–68. Epub 2018/10/06. doi: <https://doi.org/10.1002/smi.2840>. PubMed PMID: 30289608.
14. Vgontzas AN, Bixler EO, Basta M. Obesity and sleep: a bidirectional association? *Sleep* 2010;33(5):573–4. doi: <https://doi.org/10.1093/sleep/33.5.573>. PubMed PMID: 20469796.
15. Henrich J, Heine SJ, Norenzayan A. The weirdest people in the world? *Behav Brain Sci* 2010;33(2–3):61–83. Epub 2010/06/15. doi: <https://doi.org/10.1017/S0140525X0999152X>. PubMed PMID: 20550733.
16. Briones EM, Benham G. An examination of the equivalency of self-report measures obtained from crowdsourced versus undergraduate student samples. *Behav Res Methods* 2017;49(1):320–34. Epub 2016/02/26. doi: <https://doi.org/10.3758/s13428-016-0710-8>. PubMed PMID: 26907746.
17. Buhrmester M, Kwang T, Gosling SD. Amazon's Mechanical Turk: a new source of inexpensive, yet high-quality, data? *Perspect Psychol Sci* 2011;6(1):3–5. doi: <https://doi.org/10.1177/1745691610393980>. PubMed PMID: 26162106.
18. Loredro JS, Soler X, Bardwell W, Ancoli-Israel S, Dimsdale JE, Palinkas LA. Sleep Health in US Hispanic Population *Sleep* 2010;33(7):962–7. doi: <https://doi.org/10.1093/sleep/33.7.962>. PubMed PMID: PMC2894438.
19. Carnethon MR, De Chavez PJ, Zee PC, Kim K-YA, Liu K, Goldberger JJ, Ng J, Knutson KL. Disparities in sleep characteristics by race/ethnicity in a population-based sample: Chicago Area Sleep Study. *Sleep Med*. 2016;18:50–5. Epub 2015/07/26. doi: <https://doi.org/10.1016/j.sleep.2015.07.005>. PubMed PMID: 26459680.
20. Dietch JR, Taylor DJ, Smyth JM, Ahn C, Smith TW, Uchino BN, Allison M, Ruiz JM. Gender and racial/ethnic differences in sleep duration in the North Texas heart study. *Sleep Health*. 2017;3(5):324–7. Epub 2017/08/15. doi: <https://doi.org/10.1016/j.sleeh.2017.07.002>. PubMed PMID: 28923187.

21. Dudley KA, Weng J, Sotres-Alvarez D, Simonelli G, Cespedes Feliciano E, Ramirez M, Ramos AR, Loredo JS, Reid KJ, Mossavar-Rahmani Y, Zee PC, Chirinos DA, Gallo LC, Wang R, Patel SR. Actigraphic Sleep Patterns of U.S. Hispanics: The Hispanic Community Health Study/Study of Latinos. *Sleep*. 2016;40(2):zsw049. doi: <https://doi.org/10.1093/sleep/zsw049>. PubMed PMID: 28364514.
22. Whinnery J, Jackson N, Rattanaumpawan P, Grandner MA. Short and long sleep duration associated with race/ethnicity, sociodemographics, and socioeconomic position. *Sleep*. 2014;37(3):601–11. doi: <https://doi.org/10.5665/sleep.3508>. PubMed PMID: 24587584.
23. Alcántara C, Gallo LC, Wen J, Dudley KA, Wallace DM, Mossavar-Rahmani Y, Sotres-Alvarez D, Zee PC, Ramos AR, Petrov ME, Casement MD, Hall MH, Redline S, Patel SR. Employment status and the association of sociocultural stress with sleep in the Hispanic Community Health Study/Study of Latinos (HCHS/SOL) 2019. doi: <https://doi.org/10.1093/sleep/zsz002>. PubMed PMID: 30649533.
24. Alcántara C, Patel SR, Carnethon M, Castañeda S, Isasi CR, Davis S, Ramos A, Arredondo E, Redline S, Zee PC, Gallo LC. Stress and sleep: results from the Hispanic community health study/study of Latinos sociocultural ancillary study. *SSM - population health* 2017;3:713–21. doi: <https://doi.org/10.1016/j.ssmph.2017.08.004>. PubMed PMID: 29104908.
25. Park N, Peterson C, Szvarca D, Vander Molen RJ, Kim ES, Collon K. Positive psychology and physical health. *Am J Lifestyle Med*. 2016;10(3):200–206. <https://doi.org/10.1177/1559827614550277>.
26. Dong L, Martinez AJ, Buysse DJ, Harvey AG. A composite measure of sleep health predicts concurrent mental and physical health outcomes in adolescents prone to eveningness. *Sleep Health*. 2019;5(2):166–174. <https://doi.org/10.1016/j.sleh.2018.11.009>.
27. Ohayon MM, Paskow M, Roach A, Filer C, Hillygus DS, Chen MC, Langer G, Hirshkowitz M. The National Sleep Foundation's sleep satisfaction tool. *Sleep Health*. 2019;5(1):5–11. <https://doi.org/10.1016/j.sleh.2018.10.003>.