Published in final edited form as:

Womens Health Issues. 2012 January ; 22(1): e99–e109. doi:10.1016/j.whi.2011.07.004.

Predictors of Sleep Characteristics Among Women in Southeast Texas

Alisa B. Kachikis, MD^a and Carmen Radecki Breitkopf, PhD^{b,*}

^aEmory University School of Medicine, Atlanta, Georgia

^bMayo College of Medicine, Rochester, Minnesota

Abstract

Purpose—This study examined psychological and sociodemographic predictors of self-reported sleep characteristics including sleep duration, quality, and perceived adequacy of sleep among Hispanic and non-Hispanic women of low socioeconomic status.

Method—Cross-sectional survey data were analyzed from 2,670 women ages 18 to 55 (74% Hispanic, 18% non-Hispanic White, 8% non-Hispanic Black) participating in a cancer prevention study in southeast Texas.

Results—Women reported sleeping 7.1 hours per night on average; however, nearly 45% were short (≤ 6 ; 35.3%) or long (≥ 9 ; 9.5%) sleepers. Sleep quality was rated less than “good” for 43.7% of the total sample, and 22.5% reported adequate sleep “none” or “a little” of the time. Multivariable analyses identified different demographic and psychological predictors for the sleep characteristics; decreased sleep adequacy was associated with parity, depressive symptoms, stress, and anxiety ($R^2 = 0.11$); short sleep duration with age, education, and depressive symptoms ($R^2 = 0.07$); and poor sleep quality with ethnicity, marital and employment status, public housing accommodation, smoking status, income, acculturation, social desirability, depressive symptoms, stress, and anxiety ($R^2 = 0.18$). Separate analyses of the Hispanic subsample born in the United States versus elsewhere revealed differences in all sleep characteristics. In multivariable analyses, similar predictors of sleep quality and duration emerged, but only depressive symptoms, anxiety, and age were associated with sleep adequacy.

Conclusion—Women of lower socioeconomic groups and Hispanic ethnicity may suffer poor quality sleep. A complex and distinct array of factors are associated with sleep quality, duration, and adequacy. The relationship between sleep and health and the growing U.S. Hispanic population highlight the importance of this and future research.

Introduction

Sleep is necessary for health. Disturbances in sleep have been recognized as a public health problem related to catastrophic human errors that cost billions of dollars and compromise productivity (Committee on Sleep Medicine and Research Board on Health Sciences Policy, 2006). A recent meta-analysis identified both short and long sleepers at increased risk of all-cause mortality (Gallicchio & Kalesan, 2009) and clear associations have been established between sleep disturbances and serious medical conditions such as diabetes mellitus, cancer, cardiovascular disease, and hypertension (Ayas et al., 2003; Buxton & Marcelli, 2010;

Quan, 2009). Other related, negative health outcomes such as increased body mass index, coronary events, and altered immune function have been linked to inadequate sleep (Dew et al., 2003; Gangwisch et al., 2006; Gangwisch, Malaspina, Boden-Albala, & Heymsfield, 2005; Imeri & Opp, 2009; Kohatsu et al., 2006; Steptoe, Peacey, & Wardle, 2006; Watanabe, Kikuchi, Tanaka, & Takahashi, 2010). In addition to physical health, it is widely accepted that sleep has an impact on mental health and well-being (Ford & Kamerow, 1989; Kaneita et al., 2006; Vandeputte & de Weerd, 2003; Zee & Turek, 2006).

Inadequate sleep is an important women's health issue. Several population-based studies abroad have shown that insufficient sleep is more common in women than men (Hublin, Kaprio, Partinen, & Koskenvuo, 2001; Sallinen, Harma, Kalimo, & Hakanen, 2000; Ursin, Bjorvatn, & Holsten, 2005). In the United States, women are reporting decreasing hours spent sleeping (U.S. Centers for Disease Control and Prevention, 2008; Committee on Sleep Medicine and Research Board on Health Sciences Policy, 2006). It is unclear whether behavioral choices result in fewer hours of sleep or physiologic events primarily underlie disturbances in sleep patterns. For instance, among young, healthy women, perceived sleep quality is altered by the menstrual cycle, with poorer sleep quality perceived during the 3 premenstrual days and 4 days of menstruation relative to other days of the cycle (Baker & Driver, 2004; Shechter & Boivin, 2010). In addition, increased difficulty sleeping has been found among menopausal women, indicating that hormone levels affect sleep (Baker & Driver, 2004; Kravitz et al., 2003).

Sleep may also be a factor underlying some health disparities, as complex relationships emerge with regard to sleep characteristics and indicators of socioeconomic and minority status. For instance, individuals belonging to racial/ethnic minority groups are more likely to report sleep durations that are associated with increased mortality, including "short" or "long" versus mid-range sleep (Hale & Do, 2007). Further, in a U.K. study, quantity of sleep was greater among more socioeconomically -deprived women relative to more advantaged/educated women, an effect that did not hold for men (Adams, 2006). These studies suggest that although quantity of sleep may be higher among socioeconomically deprived women and minorities, multiple measures of sleep reflecting both quantity and quality are important to sufficiently evaluate sleep among individuals.

Sleep characteristics have been broadly addressed in terms of duration, quality, and adequacy. Relative to duration and quality, which can both be studied in sleep laboratories, perceived sleep adequacy is more subjective despite efforts to translate feelings of adequacy into objectively measurable units (Ursin et al., 2005). Because of its subjective nature, perceived sleep adequacy may, in part, reflect satisfaction with sleep as well as more general social and psychological influences on an individual's perceptions. In a Finnish study of adults 40 to 45 years of age, subjective sleep need—the number of hours of sleep that an individual perceived him- or herself as needing—was shown to demonstrate large inter-individual differences and pronounced gender differences (Ursin et al., 2005). In addition to gender and socioeconomic influences on sleep characteristics, psychological characteristics such as mood, anxiety, and stress reflect complex and bidirectional associations with sleep (Benca & Peterson, 2008; Breslau, Roth, Rosenthal, & Andreski, 1996; Peterson & Benca, 2006).

The goal of the present study was to examine sleep characteristics among an ethnically diverse sample of women of primarily lower socioeconomic status. Associations between multiple sleep characteristics, demographic, and psychological factors including symptoms of depression, state anxiety, and perceived stress are evaluated. As stated in a recent review, very little is known about sleep in Hispanics, and Hispanics are a rapidly growing population in the United States (Loredo et al., 2010). Thus, this investigation also explores

differences in sleep characteristics among Hispanic women (primarily of Mexican background) born in the United States versus elsewhere. This study builds on the existing literature by examining racial and ethnic differences in a variety of sleep indices while attempting to further our understanding of the complex relationships between sleep characteristics, socioeconomic factors, behavioral measures, and important psychological constructs, including acculturation among Hispanic women.

Methods

Subjects and Setting

Participants were women who were invited to participate in a randomized clinical trial addressing cervical cancer prevention (NCT00575510). The trial is ongoing at multiple University of Texas Medical Branch (UTMB) Regional Maternal & Child Health Program (RMCHP) clinics. The UTMB RMCHP clinics provide patient-centered, culturally sensitive, reproductive health care to low-income women and their children (Anderson, Nelson-Becker, Hannigan, Berenson, & Hankins, 2005). Women attending clinic appointments for well-woman or annual examinations were approached in the clinic waiting room and invited to participate in the study. Eligibility criteria for the randomized clinical trial included being between 18 and 55 years of age and of Hispanic/Latina, White/non-Hispanic, or Black/non-Hispanic race/ethnicity. Women who were pregnant or currently had a diagnosis of cervical cancer were excluded from participation.

Procedure

All women provided written informed consent to participate. Data for the present investigation were obtained as part of a baseline survey instrument that addressed a variety of health behaviors and psychological constructs. The self-administered paper-and-pencil survey was available in English and Spanish translations. A bilingual research assistant was available to assist in administering the survey (reading and/or marking responses) if women were willing to participate but unable to read or complete the survey independently. Women were reimbursed \$5 for their time. The study was approved by the UTMB Institutional Review Board.

Measures

Sleep—Sleep duration was assessed using the open-ended question: “On average, how many hours did you sleep each night (or day if you work nights) during the past 4 weeks?” Sleep duration was examined as a continuous variable as well as divided into the three ordinal-level categories of short- (≤ 6 hours), mid- (> 6 and < 9 hours), and long-range (≥ 9 hours) sleep based on previous research (Hublin et al., 2001; Knutson, Van Cauter, Rathouz, DeLeire, & Lauderdale, 2010). Sleep quality was assessed with the question: “How would you rate the overall quality of your sleep?” Response options included a 5-point Likert-type scale ranging from “poor” (coded 1) to “excellent” (coded 5). Sleep adequacy was assessed using the question: “How often during the past 4 weeks did you get the amount of sleep you felt you needed?” Responses ranged from “none of the time” (coded 0) to “all of the time” (coded 5). This question was derived from the sleep scale presented in the Medical Outcomes Study (Hays, Martin, Sesti, & Spritzer, 2005).

Demographic and behavioral characteristics—Self-reported race/ethnicity (White/non-Hispanic, Black/non-Hispanic, Hispanic), birthplace (United States, Mexico, other), and age were recorded. Questions assessing highest education achieved (less than a high school diploma; high school diploma/GED; more than a high school diploma; college degree or beyond), employment status (employed, unemployed), annual household income ($< \$5,000$, $\$5,000$ – $\$14,999$, $\$15,000$ – $\$34,999$, or $> \$35,000$), and residence in a public housing project

(yes, no, or don't know) were included to reflect the socioeconomic status of the sample. Gravidity, parity, and smoking behavior (never smoked, former smoker, or current smoker) were also assessed using standard questioning.

Psychological measures—Depressive symptoms were measured using the 20-item Center for Epidemiologic Studies Depression Scale (CES-D) in English and Spanish (Radloff, 1977; Soler, Perez-Sola, Perez-Blanco, Figueres, & Alvarez, 1997). The CES-D is widely administered and demonstrates good psychometric properties when used among the general population and among ethnically diverse samples (Radloff, 1977; Roberts, 1980). In our sample, Cronbach's alpha was 0.88. Scores on the CES-D range from 0 to 60, with higher scores indicating greater depressive symptomatology. Scores of 16 or higher are generally accepted to indicate possible depression (Weissman, Sholomskas, Pottenger, Prusoff, & Locke, 1977). Because of the relatively high number of items in this scale, scores can be imputed when up to five items are missing by taking the sum of the completed items, dividing the sum by the number of items answered and dividing the total score by 20 (Sayetta & Johnson, 1980). In this study, scores were imputed if one item was missing, because there were a relatively small number of participants who missed more than one item compared with those who answered 19 or 20 of the items.

The 6-item Spielberger State-Trait Anxiety Inventory (STAI) in English and Spanish language versions was used to measure state anxiety symptoms (Marteau & Bekker, 1992). Responses to each item were summed and prorated to correspond with the range of 20 to 80 for the original 20-item STAI scale, with higher scores reflecting greater state anxiety. Response sets with unanswered items were not included in the analysis. Cronbach's alpha for the 6-item scale in our sample was 0.77 (Marteau & Bekker, 1992).

The Perceived Stress Scale (PSS) was used to assess each woman's current general stress level (Cohen & Williamson, 1988). The PSS contains 10 items that are scored to yield a possible range of 0 to 40, with higher scores reflecting increased perceived stress. In our study, scores were generated for participants who answered all 10 items. Cronbach's alpha was 0.83 in the present sample.

Acculturation—Because of the large number of Hispanic participants and the known heterogeneity within Hispanic populations, the survey instrument included a short scale to measure language-based cultural adaptation. The 5-item scale published by Marín and Marín (Marín, Sabogal, Marín, Oterosabogal, & Perezstable, 1987) yielded scores ranging from 1 to 5, with lower values reflecting greater use of the Spanish language and higher values reflecting greater use of the English language. Cronbach's alpha was 0.98 in the current sample.

Social desirability—The subjectivity of self-reported sleep and psychological characteristics was balanced by including a measure of social desirability in the baseline survey instrument. The five-item Socially Desirable Response Set (SDRS-5) was included to estimate the tendency of each participant to select answers that she perceived as being more desirable and not necessarily true of herself (Hays, Hayashi, & Stewart, 1989). Possible scores on the SDRS-5 can range from 1 to 5, with higher scores reflecting a greater tendency toward a socially desirable response pattern. Cronbach's alpha for the SDRS-5 was 0.68, which is consistent with reported values (Hays et al., 1989).

Missing Data

Missing data analyses were performed alongside the scale analyses. Published literature on imputing missing data for the depression, anxiety and stress scales used in the survey was

found only for the CES-D scale (Sayetta & Johnson, 1980). Because much of the missing data was due to participants neglecting to fill out one or more question within a scale, missing data could not always be imputed.

Statistical Analysis

Two separate sets of analyses were performed, one on the total sample and one on the Hispanic subsample. Descriptive statistics are presented as frequencies (*n*), percentages (%), and mean (*M*) $\pm$ standard deviation (*SD*). Relationships between the sleep characteristics and each of the demographic and psychological characteristics are evaluated using the chi-square test statistic, independent group *t*-tests, one-way analysis of variance, and Pearson correlation coefficients (*r*), as appropriate. Bonferroni adjustments were applied to control for errors associated with conducting multiple comparisons. Several demographic variables are categorized to facilitate interpretation of the analyses, including race/ethnicity (White/non-Hispanic, Black/non-Hispanic, Hispanic), place of birth (United States, Mexico, other), marital status (married versus unmarried), education (less than high school, high school/GED, more than high school), employment status (employed versus unemployed), annual household income (<\$5,000, \$5,000–\$14,999, >\$15,000), residence in public housing (yes versus no, don't know), parity (0 versus ≥ 1 children), and smoking status (current smoker versus nonsmoker [never or former smoker]). Gravidity and parity were highly associated ($r = 0.91$); thus, parity was selected to include in the multivariate regression analyses to avoid problems owing to multicollinearity. Variables that showed significant relationships with the three sleep characteristics on univariate analyses were included in multivariate linear regression models. Reference groups in the models were White/non-Hispanic for the total sample or U.S.-born Hispanic within the Hispanic subsample, married, high-school/GED degree, unemployed, annual household income of \$5,000 to \$14,999, lived in public housing (yes), and smoker.

All analyses were performed using SPSS 15.0 (SPSS Inc., Chicago, IL). An alpha level of less than 0.05 was used to determine significance.

Results

Sample Characteristics (Total)

Responses from 2,670 women were analyzed for the total sample. Descriptive statistics, stratified by race/ethnicity are presented in Table 1. A greater proportion of Hispanic, relative to non-Hispanic (White and Black), women were married, had less than a high-school degree, were unemployed, reported less than \$5,000 in annual household income, and had three or more pregnancies and three or more children. A greater proportion of White, non-Hispanic women smoked and a higher proportion of Black/non-Hispanic women reported that they lived in public housing.

As expected, lower acculturation scores were observed among Hispanic women (2.2 ± 1.4) as compared with non-Hispanic White (4.9 ± 0.5) and Black (4.9 ± 0.4) women (both $p < .001$); White and Black women did not differ. With regard to social desirability, Hispanic women had higher scores (2.4 ± 1.6) as compared with non-Hispanic White (1.7 ± 1.5) and Black (1.9 ± 1.6) women (both $p < .001$); however, White and Black women did not differ.

In our sample of women of lower socioeconomic strata, non-Hispanic White women evidenced poorer scores (relative to non-Hispanic Black and Hispanic women, who did not differ) on psychological measures of depressive symptoms (higher CES-D scores), perceived stress (higher PSS scores), and state anxiety (higher STAI scores; Table 2). In fact, 37.8% of White, non-Hispanic women achieved a CES-D score of 16 or higher.

Sleep characteristics were moderately and positively correlated, and negatively associated with depressive symptoms, perceived stress, and state anxiety (Table 3). In addition, whereas more advanced age was associated with decreased sleep duration, the association was modest in strength. Higher scores on the language-based acculturation measure were associated with shorter sleep duration and lower sleep quality ratings.

Sleep Duration

Women reported sleeping, on average, 7.1 ± 1.4 hours per night over the past 4 weeks with 53.1% of women reporting mid-range sleep durations (7–8 hrs/night; Table 2). In univariate analyses, sleep duration was associated with race/ethnicity, marital status, education, employment, and smoking status (all $p < .05$). With regard to race/ethnicity, Hispanic women reported longer sleep durations, on average, (7.2 ± 1.3 hrs/night) than non-Hispanic White (6.9 ± 1.4) and Black women (6.8 ± 1.5), who did not differ. Approximately 42% of non-Hispanic Black and non-Hispanic White women reported short sleep durations (≤ 6 hrs/night), compared with only 27% of Hispanic women. Longer sleep durations were associated with being married, having less than a high school education, being unemployed, and being a nonsmoker (versus current smoker). Women who lived in public housing reported longer sleep durations as compared with women who did not; however, this did not reach statistical significance ($p = .06$).

A multiple regression model that included demographic and psychological measures associated with sleep duration in univariable analyses and controlled for socially desirable response tendencies explained 7% of the variance in sleep duration scores (Table 4). In the multivariable context, only age, education (greater than high school), and depression scores remained significant.

Sleep Quality

Nearly 44% of the sample reported “poor” or “fair” quality of sleep (13.9% and 29.8% for “poor” and “fair”, respectively). In univariable analyses, sleep quality was associated with race/ethnicity, marital status, education, employment, annual household income, public housing, and smoking status (all $p < .05$). Over half of non-Hispanic White (54.3%) and non-Hispanic Black women (51.4%) reported “poor” or “fair” sleep quality, relative to 40.3% of Hispanic women.

The multiple regression analysis for sleep quality accounted for 18% of the variance; higher (better) quality sleep was associated with Hispanic ethnicity, being married, employed, living in public housing, being a nonsmoker, earning less than \$5,000 (relative to $> \$15,000$), having lower scores on the acculturation measure, and having lower scores on each of the psychosocial measures (less perceived stress, lower state anxiety, fewer depressive symptoms; Table 5).

Sleep Adequacy

Less than 20% of the sample reported getting adequate sleep “most” or “all” of the time and nearly 6% of the sample indicated “none of the time.” Perceived sleep adequacy was independently associated with race/ethnicity, marital status, gravidity, parity, and smoking status (all $p < .05$).

When simultaneously entered into a multiple regression model along with the psychological measures, greater sleep adequacy was associated with lower parity, fewer depressive symptoms, less perceived stress, and lower state anxiety (Table 6). Together, these factors accounted for 11% of the variance in perceived sleep adequacy scores. The effects of race/

ethnicity, marital status and smoking were reduced to nonsignificance in the multivariable analysis.

Sample Characteristics (Hispanic Subsample)

Descriptive statistics for the Hispanic subsample ($n = 1,966$) are shown in Table 7. In contrast with U.S.-born and “other”-born Hispanic women, a greater proportion of Mexican-born Hispanic women were married, had less than a high school education, and were unemployed. A greater proportion of U.S.-born Hispanics reported an annual household income of less than \$5,000 (25.2%) relative to Hispanics born in Mexico (12.3%) or elsewhere (11.3%). Also, U.S.-born Hispanic women in our sample had a higher rate of nulliparity (18.7%) relative to Hispanic women born in Mexico (4.6%) or elsewhere (3.1%) and higher rates of former or current smoking.

As anticipated, language-based acculturation scores were higher among U.S.-born Hispanics (4.0 ± 0.9) relative to those born in Mexico (1.4 ± 0.6) or elsewhere (1.4 ± 0.7 ; the latter two groups did not differ; $p < .0001$; Table 8). Social desirability scores, which were associated with sleep quality, were lower among U.S.-born Hispanic women (1.9 ± 1.5) relative to Hispanic women born in Mexico (2.5 ± 1.6) or elsewhere (2.8 ± 1.5 ; the latter two groups did not differ; $p < .0001$). U.S.-born Hispanics reported greater depressive symptomatology and perceived stress relative to both foreign-born Hispanic groups. Importantly, 31.8% of U.S.-born Hispanics had a CES-D score of 16 or higher. State anxiety scores were similar within the Hispanic subsample with the exception of small differences noted between U.S.- and Mexico-born Hispanics (39.7 vs. 36.3, respectively; $p < .0001$).

Sleep Characteristics

The mean sleep duration within the Hispanic subsample was 7.2 ± 1.3 hours per night; Hispanic women born in Mexico reported slightly longer sleep durations than U.S.-born Hispanics (7.4 vs. 7.0, respectively; $p < .05$). With regard to sleep quality, 1.7% of U.S.-born Hispanics relative to 4.5% and 4.6% of Hispanics born in Mexico or elsewhere reported “excellent” sleep quality. In contrast, a larger percentage of U.S.-born Hispanic women reported getting adequate sleep “most” or “all” of the time (26.4%) relative to Hispanic women born in Mexico (12.3%) or elsewhere (10.8%; $p < .001$).

Multivariate models for sleep duration and sleep quality showed few differences between the Hispanic subsample and the total sample. Both overall models were significant and explained similar proportions of variance in sleep duration and quality as was observed in the total sample (data not shown), although direct model comparisons would not be appropriate given different sets of predictors. With regard to differences, although income and acculturation were significant in the sleep quality model for the total sample, they were not significant in the model including only Hispanic women; sleep quality was associated with marital status (married), employment (unemployed), public housing (yes), smoking status (smoker), and lower scores on the social desirability, depressive symptoms screener, perceived stress, and state anxiety scales. Significant predictors for sleep duration in the multivariate analysis of the Hispanic subgroup were age and lower depressive symptoms (CES-D) score.

The sleep adequacy model for the Hispanic subsample is shown in Table 9. Parity, a significant independent predictor of sleep adequacy in the total sample, did not meet criteria for inclusion in the multivariable model for the Hispanic subsample; however, age did, and was positively associated with sleep adequacy while accounting for other demographic and psychological characteristics. Finally, scores on the PSS, although negatively related to sleep adequacy in the total sample, were reduced to nonsignificance in the multivariate

model including only Hispanic women. Thus, only age, depressive symptomatology, and state anxiety were associated with sleep adequacy among Hispanic women.

Discussion

According to the American Academy of Sleep Medicine, most women need 7 to 8 hours of sleep each night; however, sleep can be a low priority among competing demands. In fact, more than one third of women we surveyed reported sleeping 6 hours per night or less. Our study differs from previous studies in that our sample primarily reflects women of lower socioeconomic status who are present in the health care setting and therefore represent potential recipients of health messages. The women we surveyed represent an important group, because they may already be at greater risk for health challenges owing to reduced ability to afford needed medications, attend regular health care visits, or maintain a healthy, balanced diet that includes fresh fruits and vegetables. Although adequate sleep is not a panacea, increasing evidence points to the importance of identifying and mitigating the causes of poor sleep. Understanding factors that are associated with key sleep characteristics is the first step toward identifying those at risk for poor sleep and assisting them in recognizing inadequate sleep as an important health problem.

Our data among women 18 to 55 years of age showed 14% of women reporting “poor” sleep and an additional 30% rating only “fair” sleep quality. Our analyses also provide further support for the detrimental effect of psychological distress on sleep quality, as measured by validated instruments of depressive symptoms, anxiety and stress. In comparison, the 2007 “Sleep in America” poll ($n = 959$ women) identified poor health, psychological distress, having a sleep disorder, consuming more than four caffeinated beverages per day, and having more than one job as independent risk factors for poor sleep quality. In this study, poor sleep quality was reported by 27% of women surveyed, who were 18 to 64 years of age (Baker, Wolfson, & Lee, 2009). Screening for poor sleep quality could be easily incorporated into brief assessments of psychological health and well-being that may already occur in primary care settings. The effective use of a single question addressing “sleep difficulty” or “problems with sleep” has been demonstrated in the literature (Kravitz et al., 2003; Strine & Chapman, 2005; Weissman, Greenwald, Nino-Murcia, & Dement, 1997) and should be examined in practice.

With regard to demographic characteristics, whereas the Sleep in America poll found multiple jobs interfering with sleep quality, our data showed an association between being unemployed and reporting lower sleep quality. Together these findings show the importance of employment status among women with regard to sleep quality; in fact, in our study, the relationship between employment status and sleep quality remained over and above the effect of income and psychological characteristics. The relationship between income and sleep quality however, was less clear; relative to women who reported an income of more than \$15,000 per year, those with an annual income of less than \$5,000 reported better sleep quality in the total sample. When we isolated only Hispanic women in our subgroup analyses, income was not a significant predictor of sleep quality. Finally, household income was unassociated with sleep duration and sleep adequacy; we cannot conclude that they are unassociated, because it is possible that the restricted range for income in our sample reduced our ability to detect an association. The finding that sleep quality was higher among women who resided in public housing is new and somewhat difficult to explain. Although data from other countries have identified gender differences in the relationship between housing tenure and sleep problems, the differences reflect a failure to find a relationship among women, and a negative relationship among men such that public housing is associated with poorer sleep quality (Lallukka, Arber, Rahkonen, & Lahelma, 2010; Li, Wing & Fong, 2002). More studies from the United States are needed to explore the

relationship between various sleep indicators and housing tenure. Hale, Hill, and Burdette (2010) found that living in a neighborhood that was described as noisy, unclear, or crime ridden was associated with a decrease in self-perceived health. They found that this association was at least partially mediated by sleep quality. It remains unclear whether housing tenure exerts its effect purely as a socioeconomic indicator, or whether more detailed exploration of the conditions of public housing (e.g., crowding, noise) contributes to the nature or explanation of the effect. National household telephone survey studies may not readily reach this group, yet government statistics indicate that 7.1 million people live in federal housing. Sleep characteristics as well as other key health indicators may be less well studied in this sector of the population.

Similar to previous studies, non-Hispanic Black women had a decreased percentage of mid-range sleep durations and Hispanic women, particularly those born in Mexico, reported increased mid-range and long sleep. (Knutson et al., 2010). Whereas a national study showed Blacks (relative to Whites) to have an increased risk of short or long duration of sleep (Hale & Do, 2007), our data including only women showed no significant difference between the groups on sleep duration. Differences in sleep quality existed by race/ethnicity in multivariable analyses whereby relative to non-Hispanic White women, Hispanic women as a group reported lower sleep quality. Upon further examination of only Hispanic women, country of origin (United States, Mexico or other) was not associated with any of the sleep characteristics on multivariate models. Nevertheless, there were significant differences in sleep within Hispanic respondents when compared by country of origin in the descriptive analyses. The results of our subgroup analyses raise the question of whether some of our initial findings suggesting ethnic differences in sleep are associated more with nativity than ethnicity. Careful assessment of nativity and time in the United States as well as approaches that include subgroup analyses in future research can only further our understanding of these relationships.

Our data suggest that each of the three sleep characteristics, although correlated, has a unique set of demographic, behavioral, and psychological predictors. For instance, each of the three sleep characteristics we measured was associated with depressive symptoms, whereas only sleep quality and adequacy (not duration) were associated with stress and anxiety measures. Also, smokers (past or current) reported poorer sleep quality (independent of psychological influences), but not differences in sleep adequacy or duration. These findings are in contrast with those of Lauderdale et al. (2006), who used wrist actigraphy methods and reported longer sleep latency (time it took to fall asleep) and lower sleep efficiency (percentage of time in bed spent sleeping), resulting in a shorter total sleep duration, among current smokers. In a more comprehensive, prospective study, additional sleep characteristics such as daytime sleepiness, napping, and actual sleep hours, captured using diaries or ecological momentary assessment methodology, may be beneficial.

The idea that responses regarding sleep patterns may be susceptible to socially desirable responding has not, to our knowledge, been previously introduced or examined. In our study of multiple sleep characteristics including quality, duration, and adequacy, only sleep quality was associated with a validated measure of socially desirable responding, namely, the SDRS-5. Scores on the SDRS-5 remained significant in the multivariable models for the total and Hispanic subsample, showing an association independent of the effects of demographic and psychological variables. The negative association that was found would suggest that as women were more concerned about socially desirable responding, sleep quality was rated lower. As women strive to increase the efficiency of their time in response to increasing demands on it, restorative, solitary activities such as sleep may be compromised. How this is presented to others may be worthy of further consideration.

Sleep adequacy was associated with only a small number of variables, which included depressive symptoms, perceived stress, and anxiety. In our study, a large amount of unexplained variance exists, particularly when analyzing only Hispanic women. Other investigations have reported even more modest amounts of explained variance for women with regard to subjective sleep need (1.6% explained variance) and sleep duration (3.4%) among women (Ursin et al., 2005). Efforts toward measurement development and construct validation are needed to better understand what it means to have adequate sleep. Some studies have defined sleep sufficiency or adequacy by classifying sleep as insufficient if an individual's reported hours of sleep needed and actual sleep hours differ by 1 hour or more (Hublin et al., 2001; Ursin et al., 2005).

Finally, on the multivariate analysis of perceived sleep adequacy, although the analysis of the total sample revealed associations between parity, depressive symptoms, perceived stress, and anxiety, parity was not associated with perceived sleep adequacy in the Hispanic subsample. This difference may be partly explained by the increased social support available for Hispanic women with children, often through a rich family network.

There are several limitations of the current work that are important to note. First, the study reports secondary analyses of baseline survey data from an ongoing trial; the data are therefore cross-sectional and causal relationships cannot be determined. Second, the data are self-reported, retrospective accounts of sleep characteristics; objective measures of sleep duration collected prospectively in a sleep laboratory would confer greater validity. Measures of perceived sleep quality and adequacy are subjective by nature; thus, they are unlikely to be improved by laboratory methodology. Furthermore, subjective assessments of sleep quality are correlated with objective measures (Moore, Adler, Williams, & Jackson, 2002). Third, the sample was composed of a convenience sample of women who were attending a health screening visit in an outpatient clinic facility; therefore, the generalizability of the findings may be limited. Fourth, the sample included a disproportionate number of Hispanic women of Mexican descent owing to the clinic locations in southeast Texas; the findings may not generalize to Hispanic women who are not of Mexican background. Fifth, missing data resulted in a substantial decrease in sample size in multivariable analyses. To minimize the effect of missing data, we imputed values where supported by the literature (i.e., the CES-D). In addition, the large initial sample size also served to mitigate the effects of missing data, because multivariate models were estimated on sample sizes exceeding 1,000 women despite missing data. Finally, although the sleep questions were extracted from existing studies, not all women answered the open-ended question regarding sleep duration in a similar way; this resulted in greater than anticipated missing data for that variable. As suggested by Morin, Savard, Ouellet, and Daley (2003), prospective assessments of sleep conducted using sleep diaries may provide more accurate and complete information regarding sleep characteristics. As a topic of secondary interest on the survey instrument, additional questions regarding sleep that could have potentially provided additional information for analysis were not included. Although we measured a number of variables, we did not inquire about perceived general health status, shift work status, or use of over-the-counter or prescription sleep aids. Finally, this study did not include physical health indicators or menopausal status of participants. As stated in the introduction, physical health and sleep are closely related. The assessment of physical health including menopausal status is complex and worthwhile as they relate to sleep characteristics, although beyond the scope of this study.

In conclusion, the importance of sleep for physical and mental health is well-documented. Several theories have been proposed on the biologic need for sleep, including the inactivity theory, the energy conservation theory, and the restorative theory (Quan, 2009). The tenability of these theories as well as the various functions of sleep throughout a woman's

lifespan and reproductive stages requires further exploration. In addition, few studies have explored sleep among Hispanics, specifically Hispanics in the United States (Loredo et al., 2010). The studies that do exist, however, suggest that there is a negative effect of acculturation on health and, by extension, on sleep. Our data showed a negative effect of acculturation, but only for sleep quality. In light of the growing Hispanic population within the United States, it is clear that additional studies on health and other factors related to sleep among various Hispanic communities across the United States are needed; two large studies are underway (Loredo et al., 2010). Translating research findings on sleep among socioeconomically disadvantaged Hispanic and non-Hispanic women into the clinical setting is a critical next step toward improving the health and well-being of women.

Acknowledgments

This research is part of a larger study funded by the National Institutes of Health, National Cancer Institute, R01CA107015 awarded to Carmen Radecki Breitkopf. Dr. Radecki Breitkopf has full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

References

- Adams J. Socioeconomic position and sleep quantity in UK adults. *Journal of Epidemiology and Community Health*. 2006; 60:267–269. [PubMed: 16476759]
- Anderson GD, Nelson-Becker C, Hannigan EV, Berenson AB, Hankins GDV. A patient-centered health care delivery system by a university obstetrics and gynecology department. *Obstetrics and Gynecology*. 2005; 105:205–210. [PubMed: 15625165]
- Ayas NT, White DP, Manson JE, Stampfer MJ, Speizer FE, Malhotra A, et al. A prospective study of sleep duration and coronary heart disease in women. *Archives of Internal Medicine*. 2003; 163:205–209. [PubMed: 12546611]
- Baker FC, Driver HS. Self-reported sleep across the menstrual cycle in young, healthy women. *Journal of Psychosomatic Research*. 2004; 56:239–243. [PubMed: 15016584]
- Baker FC, Wolfson AR, Lee KA. Association of sociodemographic, lifestyle, and health factors with sleep quality and daytime sleepiness in women: Findings from the 2007 National Sleep Foundation “Sleep in America Poll”. *Journal of Womens Health*. 2009; 18:841–849.
- Benca RM, Peterson MJ. Insomnia and depression. *Sleep Medicine*. 2008; 9(Suppl. 1):S3–S9. [PubMed: 18929317]
- Breslau N, Roth T, Rosenthal L, Andreski P. Sleep disturbance and psychiatric disorders: A longitudinal epidemiological study of young adults. *Biological Psychiatry*. 1996; 39:411–418. [PubMed: 8679786]
- Buxton OM, Marcelli E. Short and long sleep are positively associated with obesity, diabetes, hypertension, and cardiovascular disease among adults in the United States. *Social Science & Medicine*. 2010; 71:1027–1036. [PubMed: 20621406]
- Cohen, S.; Williamson, GM. Perceived stress in a probability sample of the United States. In: Spacapan, S.; Oskamp, S., editors. *The Social Psychology of Health*. Newbury Park, CA: Sage; 1988.
- Committee on Sleep Medicine and Research Board on Health Sciences Policy. Sleep disorders and sleep deprivation: An unmet public health problem. Washington, D.C: National Academies Press; 2006.
- Dew MA, Hoch CC, Buysse DJ, Monk TH, Begley AE, Houck PR, et al. Healthy older adults’ sleep predicts all-cause mortality at 4 to 19 years of follow-up. *Psychosomatic Medicine*. 2003; 65:63–73. [PubMed: 12554816]
- Ford DE, Kamerow DB. Epidemiologic study of sleep disturbances and psychiatric disorders. *Journal of the American Medical Association*. 1989; 262:1479–1484. [PubMed: 2769898]
- Gallicchio L, Kalesan B. Sleep duration and mortality: A systematic review and meta-analysis. *Journal of Sleep Research*. 2009; 18:148–158. [PubMed: 19645960]

- Gangwisch JE, Heymsfield SB, Boden-Albala B, Buijs RM, Kreier F, Pickering TG, et al. Short sleep duration as a risk factor for hypertension: Analyses of the first national health and nutrition examination survey. *Hypertension*. 2006; 47:833–839. [PubMed: 16585410]
- Gangwisch JE, Malaspina D, Boden-Albala B, Heymsfield SB. Inadequate sleep as a risk factor for obesity: Analyses of the NHANES I. *Sleep*. 2005; 28:1289–1296. [PubMed: 16295214]
- Hale L, Do P. Racial differences in self-reports of sleep duration in a population-based study. *Sleep*. 2007; 30:1096–1103. [PubMed: 17910381]
- Hale L, Hill TD, Burdette AM. Does sleep quality mediate the association between neighborhood disorder and self-rated physical health? *Preventive Medicine*. 2010; 51:275–278. [PubMed: 20600254]
- Hays RD, Hayashi T, Stewart AL. A 5-item measure of Socially Desirable Response Set. *Educational and Psychological Measurement*. 1989; 49:629–636.
- Hays RD, Martin SA, Sesti AM, Spritzer KL. Psychometric properties of the Medical Outcomes Study Sleep measure. *Sleep Medicine*. 2005; 6:41–44. [PubMed: 15680294]
- Hublin C, Kaprio J, Partinen M, Koskenvuo M. Insufficient sleep: A population-based study in adults. *Sleep*. 2001; 24:392–400. [PubMed: 11403523]
- Imeri L, Opp MR. How (and why) the immune system makes us sleep. *Nature Reviews: Neuroscience*. 2009; 10:199–210.
- Kaneita Y, Ohida T, Uchiyama M, Takemura S, Kawahara K, Yokoyama E, et al. The relationship between depression and sleep disturbances: A Japanese nationwide general population survey. *Journal of Clinical Psychiatry*. 2006; 67:196–203. [PubMed: 16566613]
- Knutson KL, Van Cauter E, Rathouz PJ, DeLeire T, Lauderdale DS. Trends in the prevalence of short sleepers in the USA: 1975–2006. *Sleep*. 2010; 33:37–45. [PubMed: 20120619]
- Kohatsu ND, Tsai R, Young T, VanGilder R, Burmeister LF, Stromquist AM, et al. Sleep duration and body mass index in a rural population. *Archives of Internal Medicine*. 2006; 166:1701–1705. [PubMed: 16983047]
- Kravitz HM, Ganz PA, Bromberger J, Powell LH, Sutton-Tyrrell K, Meyer PM. Sleep difficulty in women at midlife: A community survey of sleep and the menopausal transition. *Menopause: The Journal of the North American Menopause Society*. 2003; 10:19–28.
- Lallukka T, Arber S, Rahkonen O, Lahelma E. Complaints of insomnia among midlife employed people: The contribution of childhood and present socioeconomic circumstances. *Sleep Medicine*. 2010; 11:828–836. [PubMed: 20817599]
- Lauderdale DS, Knutson KL, Yan L, Rathouz PJ, Hulley SB, Sidney S, et al. Objectively measured sleep characteristics among early-middle-aged adults: The CARDIA study. *American Journal of Epidemiology*. 2006; 164:5–16. [PubMed: 16740591]
- Li RHY, Wing YK, Ho SC, Fong SYY. Gender differences in insomnia: A study in the Hong Kong Chinese population. *Journal of Psychosomatic Research*. 2002; 53:601–609. [PubMed: 12127178]
- Loredo JS, Soler X, Bardwell W, Ancoli-Israel S, Dimsdale JE, Palinkas LA. Sleep health in U.S. Hispanic population. *Sleep*. 2010; 33:962–967. [PubMed: 20614856]
- Marín G, Sabogal F, Marín BV, Oterosabogal R, Perezstable EJ. Development of a Short Acculturation Scale for Hispanics. *Hispanic Journal of Behavioral Sciences*. 1987; 9:183–205.
- Marteau TM, Bekker H. The development of a 6-Item Short-Form of the State Scale of the Spielberger State Trait Anxiety Inventory (STAI). *British Journal of Clinical Psychology*. 1992; 31:301–306. [PubMed: 1393159]
- Moore PJ, Adler NE, Williams DR, Jackson JS. Socioeconomic status and health: The role of sleep. *Psychosomatic Medicine*. 2002; 64:337–344. [PubMed: 11914451]
- Morin, CM.; Savard, J.; Ouellet, MC.; Daley, M. Insomnia. In: Nezu, AM.; Nezu, CM.; Geller, PA.; Weiner, IB., editors. *Handbook of Psychology*. Hoboken, NJ: John Wiley and Sons; 2003. p. 317–338.
- Peterson MJ, Benca RM. Sleep in mood disorders. *Psychiatric Clinics of North America*. 2006; 29:1009–1032. [PubMed: 17118279]
- Quan SF. Sleep disturbances and their relationship to cardiovascular disease. *American Journal of Lifestyle Medicine*. 2009; 3:55s–59s. [PubMed: 20161354]

- Radloff LS. The CES-D Scale: A self-report depression scale for research in the general population. *Applied Psychological Measurement*. 1977; 1:385–401.
- Roberts RE. Reliability of the CES-D Scale in different ethnic contexts. *Psychiatry Research*. 1980; 2:125–134. [PubMed: 6932058]
- Sallinen, M.; Harma, M.; Kalimo, R.; Hakanen, J. Proceedings of the European Conference on Safety in the Modern Society. Helsinki, Finland: Finnish Institute of Occupational Health; 2000. The prevalence of sleep debt and its association with fatigue, performance and accidents in the modern society; p. 140-143.
- Sayetta, R.; Johnson, D. Basic data on depressive symptomatology, United States 1974–75 (Rep No DHEW [PHS]). Washington, D.C.: United States Government Printing Office, Public Health Services; 1980.
- Shechter A, Boivin DB. Sleep, hormones, and circadian rhythms throughout the menstrual cycle in healthy women and women with premenstrual dysphoric disorder. *International Journal of Endocrinology*. 2010:1–17.
- Soler J, Perez-Sola V, Perez-Blanco J, Figueres M, Alvarez E. Validation study of the Center for Epidemiological Studies-Depression of a Spanish population of patients with affective disorders. *Actas Luso Esp Neurol Psiquiatr Cienc Afines*. 1997; 25:243–249. [PubMed: 9412163]
- Septoe A, Peacey V, Wardle J. Sleep duration and health in young adults. *Archives of Internal Medicine*. 2006; 166:1689–1692. [PubMed: 16983045]
- Strine TW, Chapman DP. Associations of frequent sleep insufficiency with health-related quality of life and health behaviors. *Sleep Medicine*. 2005; 6:23–27. [PubMed: 15680291]
- Ursin R, Bjorvatn B, Holsten F. Sleep duration, subjective sleep need, and sleep habits of 40- to 45-year-olds in the Hordaland Health Study. *Sleep*. 2005; 28:1260–1269. [PubMed: 16295211]
- U.S. Centers for Disease Control and Prevention. Perceived insufficient rest or sleep—four states, 2006. *MMWR Morbidity and Mortality Weekly Report*. 2008; 57:200–203. [PubMed: 18305450]
- Vandeputte M, de Weerd A. Sleep disorders and depressive feelings: A global survey with the Beck depression scale. *Sleep Medicine*. 2003; 4:343–345. [PubMed: 14592308]
- Watanabe M, Kikuchi H, Tanaka K, Takahashi M. Association of short sleep duration with weight gain and obesity at 1-year follow-up: A large-scale prospective study. *Sleep*. 2010; 33:161–167. [PubMed: 20175399]
- Weissman MM, Greenwald S, Nino-Murcia G, Dement WC. The morbidity of insomnia uncomplicated by psychiatric disorders. *General Hospital Psychiatry*. 1997; 19:245–250. [PubMed: 9327253]
- Weissman MM, Sholomskas DIAN, Pottenger MARG, Prusoff BA, Locke BZ. Assessing depressive symptoms in five psychiatric populations: A validation study. *American Journal of Epidemiology*. 1977; 106:203–214. [PubMed: 900119]
- Zee PC, Turek FW. Sleep and health: Everywhere and in both directions. *Archives of Internal Medicine*. 2006; 166:1686–1688. [PubMed: 16983044]

Biographies

Dr. Kachikis received a doctorate in medicine from the University of Texas Medical Branch in 2009 and is currently completing postgraduate training at Emory University's Department of Gynecology and Obstetrics. Her interests include epidemiology, infectious diseases, and obstetrics.

Dr. Radecki Breitkopf is an Associate Professor of Health Sciences Research at The Mayo Clinic, Rochester, Minnesota. She is a research psychologist with interests in cancer prevention, women's health, and health disparities.

Table 1

Demographic Characteristics by Race/Ethnicity, Total Sample

Characteristic	Total (n = 2,670) %	White, Non-Hispanic (n = 490) %	Black, Non-Hispanic (n = 214) %	Hispanic (n = 1,966) %	p
Age, in years (M ± SD)	30.1 ± 8.7	29.0 ± 9.8*	28.2 ± 8.4*	30.6 ± 8.4 [†]	<.001
Marital status					<.001
Married	41.4	21.0	10.7	49.8	
Single, never married	35.1	46.7	72.9	28.0	
Separated	9.5	7.8	7.0	10.2	
Divorced	9.2	20.4	7.5	6.6	
Widowed	1.1	1.8	1.4	0.9	
Education					<.001
Less than HS	41.9	11.6	11.2	52.8	
HS diploma/GED	25.2	35.9	33.2	21.7	
More than HS	17.5	32.4	36.0	11.8	
College degree or more	3.9	4.7	7.0	3.4	
Employment					<.001
Employed	43.2	58.6	60.3	37.5	
Unemployed	50.3	40.4	38.3	54.1	
Household income (\$U.S.)					<.001
<\$5,000	18.9	21.8	36.9	16.2	
\$5,000–\$14,999	31.9	32.7	29.9	32.0	
\$15,000–\$34,999	29.7	30.4	21.0	30.4	
>\$35,000	4.4	5.9	4.7	4.0	
Live in public housing					<.001
Yes	8.3	3.9	17.3	8.4	
No	73.1	88.2	75.7	69.1	
Don't know	12.6	7.3	6.1	14.6	
Number of pregnancies					<.001
0	12.3	26.7	22.9	7.5	
1	17.5	23.1	20.6	15.8	

Characteristic	Total (n = 2,670)		White, Non-Hispanic (n = 490)		Blacks, Non-Hispanic (n = 214)		Hispanic (n = 1,966)		p
	%		%		%		%		
2	22.9		17.6		21.5		24.4		
≥3	42.2		31.4		32.2		46.0		
Number of children									<.001
0	14.5		32.2		26.2		8.9		
1	20.8		24.3		26.2		19.3		
2	27.0		22.4		19.2		29.0		
≥3	36.0		19.8		26.6		41.0		
Smoking status									<.001
Never smoked	66.0		33.5		70.1		73.6		
Former smoker	14.3		21.2		10.7		13.0		
Current smoker	15.2		42.0		16.8		8.4		

Abbreviations: HS, high school; SD, standard deviation.

Percents that do not total 100 reflect missing data.

^{*,†} Bonferroni-adjusted pairwise comparisons. Between-group differences are reflected by different superscripts.

Table 2
Descriptive Statistics for Sleep Characteristics and Psychological Measures by Race/Ethnicity, Total Sample

Characteristics	Total (n = 2,670), %	White, Non-Hispanic (n = 490), %	Black, Non-Hispanic (n = 214), %	Hispanic (n = 1,966), %	p
Sleep duration					
M ± SD (hrs/night)	7.1 ± 1.4	6.9 ± 1.4*	6.8 ± 1.5*	7.2 ± 1.3 [†]	<.001
Short (≤6)	35.3	41.6	41.6	27.4	<.001
Mid (>6, <9)	55.2	46.3	40.7	50.2	
Long (≥9)	9.5	7.3	7.0	8.8	
Sleep quality					<.001
Poor	13.9	18.4	12.6	13.0	
Fair	29.8	35.9	38.8	27.3	
Good	42.6	34.5	33.6	45.6	
Very good	9.1	7.8	13.1	9.1	
Excellent	3.4	2.7	1.9	3.7	
Sleep adequacy					<.001
None of the time	5.8	10.0	7.0	4.6	
A little bit of the time	16.7	16.5	15.9	16.8	
Some of the time	32.5	33.1	34.1	32.1	
A good bit of the time	22.1	15.3	13.1	24.8	
Most of the time	13.0	19.6	20.6	10.5	
All of the time	5.9	4.7	7.9	6.0	
CES-D ^{‡,§} (M ± SD) sample range 0 to 60	12.2 ± 9.7 (n = 2,480)	14.5 ± 10.9* (n = 473)	12.2 ± 8.6 [†] (n = 207)	11.6 ± 9.4 [†] (n = 1,800)	<.001
≤15	66.1	58.8	68.7	67.6	<.001
≥16	26.8	37.8	28.0	24.0	
PSS ^{§,¶} (M ± SD) sample range, 0–39	14.5 ± 7.0 (n = 2,397)	16.6 ± 7.3* (n = 452)	14.4 ± 7.1* (n = 190)	13.9 ± 6.8 [†] (n = 1,755)	<.001
STA1 ^{§,¶} (M ± SD) sample range, 20–80	38.2 ± 12.7 (n = 2,300)	41.7 ± 13.8* (n = 455)	35.5 ± 12.7 [†] (n = 186)	37.5 ± 12.1 [†] (n = 1,659)	<.001

Abbreviation: SD, standard deviation.

^{*,†} Bonferroni-adjusted pairwise comparisons revealed differences between groups with different superscripts.

[‡] Center for Epidemiologic Studies Depression Scale; higher scores indicate greater depressive symptomatology.

[§] Percents that do not total 100 reflect missing data; sample sizes for psychological measures are depicted directly.

Perceived stress scale; higher scores indicate greater perceived stress.

// Spielberger State-Trait Anxiety Inventory; higher scores indicate greater state anxiety.

Table 3

Zero-Order Correlation Coefficients Between Sleep Characteristics, Age, Acculturation, and Psychological Measures in the Total Sample

	Sleep Duration	Sleep Quality	Sleep Adequacy	Age	Acculturation	SDRS	CES-D	PSS
Sleep quality	0.45* (n = 2,342)							
Sleep adequacy	0.41* (n = 2,287)	0.52* (n = 2,541)						
Age	-0.07* (n = 2,356)	-0.02 (n = 2,639)	0.02 (n = 2,561)					
Acculturation	-0.15* (n = 2,353)	-0.19* (n = 2,636)	0.01 (n = 2,558)	-0.16* (n = 2,659)				
SDRS	0.04 (n = 2,272)	0.07* (n = 2,533)	0.03 (n = 2,464)	0.15* (n = 2,552)	-0.22* (n = 2,549)			
CES-D	-0.17* (n = 2,212)	-0.34* (n = 2,457)	-0.28* (n = 2,395)	0.03 (n = 2,480)	0.17* (n = 2,479)	-0.19* (n = 2,419)		
PSS	-0.14* (n = 2,140)	-0.30* (n = 2,377)	-0.26* (n = 2,317)	-0.02 (n = 2,397)	0.24* (n = 2,394)	-0.28* (n = 2,338)	0.71* (n = 2,290)	
STAI	-0.15* (n = 2,049)	-0.27* (n = 2,280)	-0.26* (n = 2,221)	0.07* (n = 2,300)	0.13* (n = 2,298)	-0.23* (n = 2,245)	0.60* (n = 2,200)	0.55* (n = 2,118)

Abbreviations: CES-D, Center for Epidemiologic Studies Depression Scale; PSS, perceived stress scale; STAI, Spielberger State-Trait Anxiety Inventory; SDRS, socially desirable response scale.

Sample size appears below each correlation coefficient.

* $p < .01$.

Table 4

Selected Multiple Regression Results for Sleep Duration, Total Sample

	Model (<i>n</i> = 1,242)	Model <i>F</i> = 7.64	<i>R</i>² = 0.07	<i>p</i> < .001
	B (SE)	Beta	<i>t</i>	<i>p</i>
(Constant)	8.25 (0.29)		28.19	<.001
Race/ethnicity*				
Black, non-Hispanic	−0.16 (0.15)	−0.03	−1.06	.29
Hispanic	−0.08 (0.12)	−0.03	−0.65	.52
Age	−0.01 (0.00)	−0.08	−2.78	<.01
Marital status (married)	0.04 (0.09)	0.02	0.47	.63
Education*				
<HS diploma	0.02 (0.11)	0.01	0.17	.86
>HS diploma	−0.19 (0.09)	−0.07	−2.04	.04
Employment (unemployed)	0.10 (0.08)	0.04	1.23	.22
Public housing (yes)	0.11 (0.13)	0.02	0.88	.38
Smoking status (smoker)	−0.07 (0.11)	−0.02	−0.66	.51
Acculturation	−0.05 (0.04)	−0.06	−1.30	.19
CES-D [†]	−0.02 (0.01)	−0.14	−3.38	<.01
PSS [‡]	−0.01 (0.01)	−0.04	−0.89	.37
STAI-6 [§]	−0.01 (0.00)	−0.07	−1.85	.06

Abbreviations: HS, high school; SE, standard error.

* All multivariate linear regression models of the total population are relative to White, non-Hispanics, high school degree/GED, and annual household income >\$15,000.

[†] Center for Epidemiologic Studies Depression Scale where higher scores indicate greater depressive symptomatology.

[‡] Perceived stress scale where higher scores indicate greater perceived stress.

[§] Spielberger State-Trait Anxiety Inventory where higher scores indicate greater state anxiety.

Table 5

Selected Multiple Regression Results for Sleep Quality, Total Sample

	Model (<i>n</i> = 1,176)	Model <i>F</i> = 16.86	<i>R</i>² = 0.18	<i>p</i> < .001
	B (SE)	beta	t	<i>p</i>
(Constant)	3.70 (0.18)		20.28	<.001
Race/ethnicity*				
Black, non-Hispanic	−0.09 (0.10)	−0.03	−0.89	.37
Hispanic	−0.24 (0.08)	−0.12	−3.00	<.01
Marital status (married)	0.19 (0.07)	0.10	2.86	<.01
Education*				
<High school diploma	0.05 (0.07)	0.03	0.77	.44
>High school diploma	0.05 (0.06)	0.02	0.71	.47
Employment (unemployed)	−0.13 (0.06)	−0.07	−2.19	.03
Public housing (yes)	0.28 (0.08)	0.09	3.29	<.01
Smoking status (smoker)	−0.18 (0.07)	−0.07	−2.49	.01
Income* (\$US)				
<5,000	0.18 (0.08)	0.08	2.34	.02
5,000–14,999	0.05 (0.06)	0.02	0.77	.44
Acculturation	−0.06 (0.02)	−0.10	−2.31	.02
SDRS [†]	−0.04 (0.02)	−0.06	−2.07	.04
CES-D [‡]	−0.02 (0.00)	−0.20	−4.79	<.001
PSS [§]	−0.01 (0.00)	−0.11	−2.66	<.01
STAI-6 [¶]	−0.01 (0.00)	−0.12	−3.58	<.001

Abbreviation: SE, standard error.

* All multivariate linear regression models of the total population are relative to White, non-Hispanics, high school degree/GED, and annual household income >\$15,000.

[†] Socially Desirable Response Set where higher scores reflect greater tendency to respond in a desirable manner.

[‡] Center for Epidemiologic Studies Depression Scale where higher scores indicate greater depressive symptomatology.

[§] Perceived stress scale where higher scores indicate greater perceived stress.

[¶] Spielberger State-Trait Anxiety Inventory where higher scores indicate greater state anxiety.

Table 6

Selected Multiple Regression Results for Sleep Adequacy, Total Sample

	Model (n = 1834)	Model F = 28.47	R² = 0.11	p < .001
	B (SE)	beta	t	p
(Constant)	3.64 (0.13)		27.84	<.001
Race/ethnicity*				
Black, non-Hispanic	0.05 (0.11)	0.01	0.48	.63
Hispanic	−0.03 (0.08)	−0.01	−0.35	.73
Marital Status (married)	0.01 (0.06)	0.00	0.07	.94
Parity (+)	−0.29 (0.08)	−0.09	−3.66	<.001
Smoking status (smoker)	−0.07 (0.08)	−0.02	−0.80	.42
CES-D [†]	−0.02 (0.00)	−0.14	−4.34	<.001
PSS [‡]	−0.02 (0.01)	−0.09	−2.80	<.01
STAI-6 [§]	−0.01 (0.00)	−0.14	−4.72	<.001

Abbreviation: SE, standard error.

* Relative to white, non-Hispanic.

[†] Center for Epidemiologic Studies Depression Scale where higher scores indicate greater depressive symptomatology.

[‡] Perceived Stress Scale where higher scores indicate greater perceived stress.

[§] Spielberger State-Trait Anxiety Inventory (6-item) where higher scores indicate greater state anxiety.

Table 7

Demographic Characteristics of the Hispanic Subsample

	Total (<i>n</i> = 1,966) *		U.S. Born (<i>n</i> = 604)		Mexican-born (<i>n</i> = 1,150)		“Other” Born (<i>n</i> = 194)		<i>p</i>
	%		%		%		%		
Age, in years (<i>M</i> ± <i>SD</i>)	30.6 ± 8.4		29.2 ± 9.1 [†]		31.1 ± 7.9 [‡]		32.1 ± 8.9 [‡]		<.001
Marital status									<.001
Married	49.8		23.5		64.3		46.9		
Single, never married	28.0		48.2		16.8		31.4		
Separated	10.2		13.9		8.3		10.8		
Divorced	6.6		12.3		4.1		3.6		
Widowed	0.9		0.8		0.6		2.6		
Education									<.001
<HS	52.4		25.7		67.0		53.6		
HS diploma/GED	21.7		36.6		14.3		18.6		
>HS	11.8		22.5		7.0		7.7		
College degree or more	3.4		1.0		3.8		8.2		
Employment									<.001
Employed	37.5		60.3		24.3		43.3		
Unemployed	54.1		36.4		64.5		50.5		
Household income (\$US)									<.001
<5,000	16.2		25.2		12.3		11.3		
5,000–14,999	32.0		33.1		30.2		38.7		
15,000–34,000	30.4		26.7		33.6		25.3		
>35,000	4.0		4.5		3.4		5.7		
Live in public housing									<.001
Yes	8.4		6.6		9.5		7.7		
No	69.1		85.4		61.7		63.9		
Don't know	14.6		6.6		18.5		16.0		
Number of pregnancies									<.001
0	7.5		15.6		4.0		3.1		
1	15.8		17.9		15.0		15.5		

	Total (n = 1,966) [*]	U.S. Born (n = 604)	Mexican-born (n = 1,150)	"Other" Born (n = 194)	p
	%	%	%	%	
2	24.4	22.7	25.6	22.7	
≥3	46.0	41.6	47.5	50.5	
Number of children					<.001
0	8.9	18.7	4.6	3.1	
1	19.3	21.5	17.8	22.2	
2	29.0	25.2	31.0	29.4	
≥3	41.0	33.4	44.7	42.3	
Smoking status					<.001
Never smoked	73.6	52.5	82.7	86.1	
Former smoker	13.0	22.7	8.9	7.7	
Current smoker	8.4	19.7	3.6	2.1	

Abbreviations: HS, high school; SD, standard deviation.

Percents that do not total 100 reflect missing data.

* Eighteen Hispanic subjects did not indicate their birthplace.

^{†,‡} Bonferroni-adjusted pairwise comparisons revealed differences between groups with different superscripts.

Table 8
Descriptive Statistics for Sleep and Psychological Variables, Hispanic Subsample

Characteristics	Total (n = 1,966), %	U.S. Born (n = 604), %	Mexico Born (n = 1,150), %	"Other" Born (n = 194), %	p
Acculturation (M ± SD); sample range, 1–5	2.2 ± 1.4 (n = 1,942)	4.0 ± 0.9* (n = 604)	1.4 ± 0.6 [†] (n = 1,145)	1.4 ± 0.7 [†] (n = 193)	<.001
SDRS (M ± SD), sample range, 0–5	2.4 ± 1.6 (n = 1,852)	1.9 ± 1.5* (n = 593)	2.5 ± 1.6 [†] (n = 1,084)	2.8 ± 1.5 [†] (n = 175)	<.001
Sleep duration					
M ± SD (hrs/night)	7.2 ± 1.3	7.0 ± 1.4*	7.4 ± 1.3 [†]	7.1 ± 1.3*, [†]	<.001
Short (≤6)	31.7	40.6	26.6	30.9	<.001
Mid (>6, <9)	58.1	49.9	62.4	58.1	
Long (≥9)	10.3	9.5	11.0	10.3	
Sleep quality					<.001
Poor	13.0	5.7	10.3	18.6	
Fair	27.3	42.4	21.6	15.5	
Good	45.6	32.9	52.8	44.8	
Very good	9.1	7.1	9.3	13.4	
Excellent	3.7	1.7	4.5	4.6	
Sleep adequacy					<.001
None of the time	4.6	5.8	3.8	5.2	
A little bit of the time	16.8	16.9	16.9	16.5	
Some of the time	32.1	34.6	31.0	33.0	
A good bit of the time	24.8	15.6	29.2	27.3	
Most of the time	10.5	21.9	5.7	3.6	
All of the time	6.0	4.5	6.6	7.2	
CES-D [‡] (M ± SD), sample range, 0–60	11.6 ± 9.3 (n = 1,787)	13.8 ± 9.9* (n = 583)	10.6 ± 8.9 [†] (n = 1,035)	10.4 ± 8.9 [†] (n = 169)	<.001
≤5	67.6	64.7	69.7	65.5	<.001
≥16	24.0	31.8	20.3	21.6	
PSS [§] (M ± SD), sample range, 0–39	13.9 ± 6.8 (n = 1,740)	16.2 ± 6.8* (n = 556)	12.9 ± 6.4 [†] (n = 1,023)	12.8 ± 7.3 [†] (n = 161)	<.001
STAI [¶] (M ± SD), sample range, 20–80	37.5 ± 12.2 (n = 1,643)	39.7 ± 12.4* (n = 542)	36.3 ± 11.9 [†] (n = 950)	37.1 ± 12.1 (n = 151)	<.001

Abbreviations: SD, standard deviation; SDRS, socially desirable response set.

Percents that do not total 100 reflect missing data; sample sizes provided directly for continuous variables.

- *[†] Bonferroni—adjusted pairwise comparisons revealed differences between groups with different letter superscripts.
- [‡] Center for Epidemiologic Studies Depression Scale where higher scores indicate greater depressive symptomatology.
- [§] Perceived stress scale where higher scores indicate greater perceived stress.
- [¶] Spielberger State-Trait Anxiety Inventory where higher scores indicate greater state anxiety.

Table 9

Selected Multiple Regression Results for Sleep Adequacy, Hispanic Subsample

	Model (<i>n</i> = 1,290)	Model <i>F</i> = 17.99	<i>R</i>² = 0.08	<i>p</i> < .001
	B (SE)	beta	t	<i>p</i>
(Constant)	2.81 (0.17)		16.58	<.001
Age	0.01 (0.00)	0.08	2.89	<.01
Marital status (married)	−0.03 (0.07)	−0.01	−0.39	.69
Smoking status (smoker)	−0.14 (0.12)	−0.03	−1.23	.22
CES-D [†]	−0.02 (0.00)	−0.16	−4.18	<.001
PSS [‡]	−0.00 (0.01)	−0.02	−0.48	.63
STAI [§]	−0.01 (0.00)	−0.11	−3.32	<.01

Abbreviation: SE, standard error.

[†] Center for Epidemiologic Studies Depression Scale where higher scores indicate greater depressive symptomatology.

[‡] Perceived stress scale where higher scores indicate greater perceived stress.

[§] Spielberger State-Trait Anxiety Inventory where higher scores indicate greater state anxiety.