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## Racial/ethnic disparities in self-reported short sleep duration among US-born and foreign-born adults

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### Abstract

**Objective**—Racial/ethnic health disparities are infrequently considered by nativity status in the United States, although the immigrant population has practically doubled since 1990. We investigated the modifying role of nativity status (US- vs. foreign-born) on racial/ethnic disparities in short sleep duration (<7 h), which has serious health consequences.

**Design**—Cross-sectional data from 23,505 US-born and 4,326 foreign-born adults aged 18 years from the 2012 National Health Interview Survey and multivariable log-linear regression were used to estimate prevalence ratios (PR) for reporting short sleep duration and their corresponding 95% confidence intervals (CI).

**Results**—After controlling for sociodemographic covariates, short sleep was more prevalent among blacks (PR 1.29, 95% CI: 1.21–1.37), Hispanics (PR 1.18, 95% CI: 1.08, 1.29), and Asians (PR 1.37, 95% CI: 1.16–1.61) than whites among US-born adults. Short sleep was more prevalent among blacks (PR 1.71, 95% CI: 1.38, 2.13) and Asians (PR 1.23, 95% CI: 1.02, 1.47) than whites among the foreign-born.

**Conclusion**—Among both US- and foreign-born adults, blacks and Asians had a higher likelihood of short sleep compared to whites. US-born Hispanics, but not foreign-born Hispanics, had a higher likelihood than their white counterparts. Future research should aim to uncover mechanisms underlying these disparities.

### Keywords

Sleep; nativity; immigration; race; ethnicity; stress

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### Disclosure statement

No potential conflict of interest was reported by the authors. The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.

## 1. Introduction

Sleep is an important determinant of overall health and well-being (Institute of Medicine 2006). Short sleep duration, often defined as less than 7 h of sleep in an average 24-h period, is associated with metabolic syndrome, cardiovascular disease, diabetes, hypertension, obesity, and all-cause mortality (Grandner et al. 2010; Liu et al. 2013; Xi et al. 2014). *Healthy People 2020* calls for increasing the proportion of adults who get sufficient sleep in the United States. Therefore, identifying groups at high-risk and offering preventive measures to those who get insufficient sleep is critical to achieving this *Healthy People 2020* objective.

Though a number of epidemiologic studies have previously described racial/ethnic disparities in short sleep duration, prior research has suggested that immigrant adults typically have better health than US-born adults, including those of the same race/ethnicity (Argeseanu Cunningham, Ruben, and Narayan 2008; Adenekan et al. 2013; Grandner et al. 2016). Further evidence suggests that being a member of a racial/ethnic group or a US immigrant can be stressful due to experiences of racial/ethnic discrimination and acculturation to US culture, and might interfere with sleep (Hale and Rivero-Fuentes 2011; Knutson 2013; Hale et al. 2014; Slopen, Lewis, and Williams 2016). Equally, socioeconomic factors are likely to have an important role, because members of some racial/ethnic groups and immigrants are often segregated to low-skilled employment in the American labor market (Chung-Bridges et al. 2008; Ertel, Berkman, and Buxton 2011; Jackson, Hu, et al. 2014). Nonetheless, only a few US studies that were representative of the national population have examined whether racial/ethnic disparities in short sleep duration differ by nativity status. Moreover, most of the epidemiologic literature on sleep duration that has considered how nativity status interacts with race/ethnicity to date has only included three or fewer racial/ethnic groups (Jackson, Hu, et al. 2014; Jackson, Kawachi, et al. 2014).

In this epidemiologic study, we examined racial/ethnic disparities in short sleep duration by nativity status among non-Hispanic white, non-Hispanic black, Hispanic, and non-Hispanic Asian adults. Additionally, we examined whether frequent stress and anxiety helped to explain racial/ethnic differences. This study is particularly timely given the growing number of US immigrants and increase in racial/ethnic diversity. The current US immigrant population is nearly double the number in 1990 and nearly triple the number in 1980 (Grieco et al. 2012). Thus it is imperative to understand patterns of sleep duration by race/ethnicity and nativity.

## 2. Methods

### 2.1. Data

Cross-sectional, publicly available, population-based data were analyzed from the 2012 National Health Interview Survey (NHIS), a nationally representative household interview survey of noninstitutionalized US population (U.S. Centers for Disease Control and Prevention). Participants were selected through a multistage probability sample survey. Sampling weights were constructed on the basis of probabilities of selection with adjustments for nonresponse and post-stratification. The analytic sample included 23,512

US-born and 4326 foreign-born adults aged 18 years. This study was exempt from human subjects review as the data were obtained from public-use surveillance datasets.

## 2.2. Measures

NHIS participants self-identified their race/ethnicity by their answer to the following question: ‘What race or races do you consider yourself to be?’ Participants were also asked about their national origin or family ancestry. In this analysis, participants were categorized as one of five racial/ethnic categories: non-Hispanic white (white), Hispanic, non-Hispanic black or African-American (black), non-Hispanic Asian (Asian), or non-Hispanic other race/ethnicity adults. Participants may have specified other specific racial group. Additionally, the other race/ethnicity category includes non-Hispanic American Indians and Alaska Natives and people of multiple races. Participant characteristics also included nativity status (US-born or foreign-born), age groups (18–44, 45–54, 55–64, or 65 years), gender (men or women), marital status (married, previously married, or never married or member of unmarried couple), educational attainment (less than high school, graduated high school or completed the general educational development certificate, some college, or college graduate), employment status (currently employed, not employed, or not in the labor force), class of worker (private wage, government, self-employed, or missing), household income ( \$34,999, \$35,000, or missing) health insurance coverage (yes or no), frequent stress (yes or no), and frequent anxiety (yes or no). Frequent stress was measured as a response to the question ‘During the past 12 months, have you frequently felt stressed?’ Frequent anxiety was measured as a response to the question ‘During the past 12 months, have you frequently felt anxious, nervous, or worried?’ Participants were asked to self-report their usual sleep duration during a 24-h period. For this study, short sleep duration was defined as <7 h of sleep (Hirshkowitz 2015). Among foreign-born participants only, length of US residence (<5, 5 to <10, 10 to <15, 15, or missing) and US citizenship (yes, no, or missing) were considered.

## 2.3. Statistical analysis

We used SAS statistical software (SAS Institute, Cary, NC, USA) and SAS-callable SUDAAN version 11.0 (Research Triangle Institute, Research Triangle Park, NC, USA) to analyze the 2012 NHIS data. Estimates were weighted using weights provided to account for the complex sampling design. Data were analyzed using a complete case analysis method unless otherwise specified where missing indicators were used. We used Chisquare tests to examine selected categorical characteristics and differences in these characteristics by nativity status. The age-adjusted prevalence of the short sleep duration by nativity status within the five racial/ethnic groups were estimated and standardized to the 2000 US projected population according to the four age groups; statistical significance was determined by using *t*-tests.

We used log-linear regression models to estimate prevalence ratios (PRs) for the relative likelihood of reporting short sleep duration and their corresponding 95% confidence intervals (CIs) among US-born and foreign-born adults in three sets of models. Prior to stratification, we first considered main effects models to examine the mutually adjusted independent associations of race/ethnicity and nativity status with short sleep duration. Next,

we tested whether nativity status moderated the association between race/ethnicity and short sleep duration using log-linear regression. Results were considered significant at  $p < 0.05$ . Model 1 included only race/ethnicity as an independent variable. Model 2 included the following relevant covariates that were expected to impact the dependent variable: age group, gender, marital status, educational attainment, and health insurance coverage. Length of US residence and US citizenship were exclusively assessed among foreign-born respondents and were included in model 2 for foreign-born adults. Finally, in addition to the previously mentioned relevant covariates, we included separate measures for frequent stress and anxiety in model 3 to explore whether these psychosocial factors represented pathways between race/ethnicity and short sleep duration. A reduction in the significance level and/or magnitude of race/ethnicity across models might suggest a potential pathway.

### 3. Results

#### 3.1. Descriptive statistics

Our analytic sample included 23,505 US-born (85.9%) and 4326 foreign-born (14.1%) adults. The distributions of selected characteristics by nativity status are presented in Table 1. The majority of US-born adults were white (78.6%), were married (54.7%), had more than high school education (64.7%), and had health insurance coverage (95.2%). The majority of foreign-born adults were Hispanic (38.7%), were married (64.7%), had more than high school education (58.4%), and had health insurance coverage (93.9%). Compared to US-born adults, foreign-born adults were less likely to be white, had a significantly younger average age, and were more likely to be married, to be a college graduate, employed, and work for private wage, and have income \$35,000.

Overall, the age-adjusted percentage of short sleep duration was 27.8% for whites, 35.8% for blacks, 30.6% for Hispanics, and 30.0% for Asians. Percentages were 29.4% for US-born adults and 28.2% for foreign-born adults overall. Figure 1 shows that the age-adjusted percentage of short sleep duration varied significantly by foreign-born status among Hispanics (34.3% US-born vs. 26.7% foreign-born;  $p = 0.0002$ ) and Asians (38.2% US-born vs. 27.9% foreign-born;  $p = 0.0076$ ), but not among whites and blacks.

#### 3.2. Log-linear models

The interaction between race/ethnicity and nativity status was significant at  $p < 0.01$ . Table 2 shows the results of the multivariable log-linear regression models separately for US-born and foreign-born adults and examines the extent to which frequent stress and anxiety may account for these differences. Model 1 shows significant differences by race/ethnicity; these differences persisted in model 2. Controlling for frequent stress and anxiety in model 3 did not attenuate the racial/ethnic disparities in short sleep duration. Among US-born adults, blacks (PR 1.29, 95% CI: 1.21–1.37), Hispanics (PR 1.18, 95% CI: 1.08, 1.29), and Asians (PR 1.37, 95% CI: 1.16–1.61) had a higher likelihood of short sleep duration compared to US-born whites. Among foreign-born adults, blacks (PR 1.71, 95% CI: 1.38, 2.13) and Asians (PR 1.23, 95% CI: 1.02, 1.47) had a higher likelihood of short sleep duration compared to foreign-born whites.

## 4. Discussion

This epidemiologic study indicates that racial/ethnic disparities in short sleep duration exist, and that they vary by nativity status. Our study has three main findings that deserve particular attention. First, foreign-born Hispanics (26.7% vs. 34.3%) and Asians (27.9% vs. 38.2%) had a lower age-adjusted prevalence of short sleep duration compared to their US-born comparison groups. However, no differences by nativity status were found in whites and blacks. Second, short sleep duration was more prevalent among US-born blacks (PR 1.29), US-born Hispanics (PR 1.18), and US-born Asians (PR 1.37) than among US-born whites. Third, foreign-born blacks (PR 1.71) and foreign-born Asians (PR 1.23) had a higher likelihood of short sleep duration than foreign-born whites.

Our findings reinforce previous studies that have observed less favorable sleep health among US-born adults than foreign-born adults. In a study of 1436 adults who participated in the 1990 NHIS, Mexican-born US immigrants were significantly less likely to report being short sleepers than US-born Mexican Americans (Hale and Rivero-Fuentes 2011). Likewise, in a study of 5160 adults who participated in the National Health and Nutrition Examination Survey, Mexican-born US immigrants were significantly less likely to report short habitual sleep, insomnia, and sleep-associated functional impairments than US-born Mexican Americans and the general US population (Seicean et al. 2011). Additionally, among 1180 women who participated in the Study of Women's Health Across the Nation (SWAN), a multisite study in California and New Jersey, foreign-born Chinese and Japanese women were significantly less likely to report sleep complaints than their US-born counterparts (Hale et al. 2014).

Mechanisms underlying the racial/ethnic disparities in short sleep duration among US-born and foreign-born adults are not clearly understood. We posit that frequent stress and anxiety lead to short sleep duration, however, these concepts are vague and controlling for frequent stress and anxiety did not attenuate the racial/ethnic disparities in short sleep duration in this study. Thus, a focus on more precise socioeconomic and psychosocial factors might hold the key to better understanding the heterogeneity in short sleep duration by race/ethnicity and nativity.

While we controlled for length of US residence and US citizenship, acculturation or the process by which immigrants and some racial/ethnic groups undergo to adjust to mainstream US culture may be especially relevant to disparities in short observed in our study. Acculturation may contribute to the erosion of an individual's traditional attitudes and behaviors related to sleep, which may in turn increase susceptibility to stress and anxiety. Controlling for language acculturation in the previously mentioned SWAN study of 1180 women was shown to attenuate the association between immigrant status and any sleep complaint for Hispanic/Latina and Japanese women, but not for Chinese women (Hale et al. 2014). Likewise, in the 1990 NHIS study of 1436 adults, controlling for stress, smoking, and body mass index was shown to attenuate disparities in short sleep duration between Mexican immigrants and US-born Mexican Americans (Hale and Rivero-Fuentes 2011).

Additionally, if one adopts a viewpoint that Hispanics and Asians are racialized groups like blacks in the United States, whose race/ethnicity constitutes a basis for experiences of discrimination, then it is evident that discrimination could also explain some of the racial/ethnic disparities in short sleep duration observed in our study. In a study of 2983 adults who participated in the Chicago Community Adult Health Study (CCAHS), the difference in sleep duration between black and white adults and the difference in sleep difficulty scores between US-born Hispanic and white respondents was attenuated after the data were adjusted for the following variables: racial/ethnic everyday and major experiences of discrimination, nonracial/ethnic everyday discrimination, and workplace harassment and incivilities (Slopen and Williams 2014). Likewise, in another analysis of the CCAHS, racism-related vigilance was associated with sleep difficulty among black, white, and Hispanic adults and racism-related vigilance was shown to attenuate black–white disparities in sleep difficulty (Hicken et al. 2013). Furthermore, in a study of people born in Spain and Spanish immigrants from a range of countries, discrimination, culturally related factors, and poor living conditions in the country of origin and host country were associated with poorer sleep among Bolivian men, while acculturation explained similar sleep health patterns among the Spanish-born and long-term immigrants (Villaruel and Artazcoz 2016).

Socioeconomic factors appear to be important determinants of variation within and between racial/ethnic groups (Cunningham et al. 2015). Although we controlled for educational attainment, employment status, class of worker, and income, differences in occupational characteristics by race/ethnicity and nativity such as working the night shift or rotating shifts may still contribute to the disparities in short sleep duration observed in our study. For example, working the night shift and a greater number of hours predicted reduced sleep duration in a study of 340 African/Caribbean immigrant and white adults employed in four extended care facilities in Massachusetts (Ertel, Berkman, and Buxton 2011).

Notably, our results suggested that foreign-born adults had a significantly younger average age, were less likely to be white, to be a college graduate, employed, work for private wage, and have income < \$35,000 compared to US-born adults. Certainly, the US foreign-born population has experienced dramatic changes since 1960, transitioning from an older, predominately European population to a younger population predominately from Latin America and Asia (Grieco et al. 2012). Therefore, the differences in these factors that we observed might reflect differences across immigrants groups in their age of arrival or birth-cohort differences (Alegria et al. 2007). Due the cross-sectional design of our study, however, we are unable to parse out these differences from immigrant cohort effects (Riosmena, Wong, and Palloni 2013). Future longitudinal studies might allow us to better understand this heterogeneity.

The burden of insufficient sleep is not evenly distributed among US-born and foreign-born adults. Recognizing these disparities among racial/ethnic groups by nativity status, our findings point toward a number of new avenues that deserve further exploration. Additional factors such as childhood socioeconomic status, financial hardship, neighborhood deprivation, urban residence, residential segregation, and racial/ethnic identity should also be considered (Fischer et al. 2004; Hale and Do 2007; Slopen and Williams 2014; Gamaldo et al. 2015).



Our analyses are subject to a number of limitations. First, the question on sleep duration only asked about total sleep duration in an average 24-h period. It does not differentiate between nighttime sleep and daytime naps. Second, information on sleep quality, sleep disturbances, sleep disorders were not included in this analysis. Third, because the information in this study is based on self-reported data and sleep duration was not validated by actigraphy or polysomnography, it might be subject to recall and other response biases. A previous study among black and white adults assessing agreement between self-reported data and data from actigraphy and polysomnography found a moderate correlation ( $r = 0.47$ ) that was systematically biased by a number of demographic characteristics. Fourth, our data are cross-sectional and preclude any causal interpretation. Fifth, the findings are based on a large sample of US adults, but they cannot be generalized to other populations. Sixth, the questions for stress, anxiety, and sleep duration were designed for NHIS and were not validated elsewhere. Finally, our finding that foreign-born Hispanics and foreign-born Asians had a lower age-adjusted prevalence of short sleep duration than their US-born counterparts might be attributable in part to US immigrants being healthier than their counterparts who remain in their country of origin (Argeseanu Cunningham, Ruben, and Narayan 2008).

This study provides new evidence on racial/ethnic disparities among both immigrants and native-born US adults. In summary, foreign-born Hispanics and Asians had a lower age-adjusted prevalence of short sleep duration compared to their US-born comparison group, short sleep duration was more prevalent among US-born blacks, US-born Hispanics, and US-born Asians than among US-born whites, and foreign-born blacks and Asians had a higher likelihood of short sleep duration than foreign-born whites. Only by uncovering the mechanisms underlying these disparities and offering preventive measures will Americans meet the *Healthy People 2020* objective of increasing the proportion of adults who obtain sufficient sleep.

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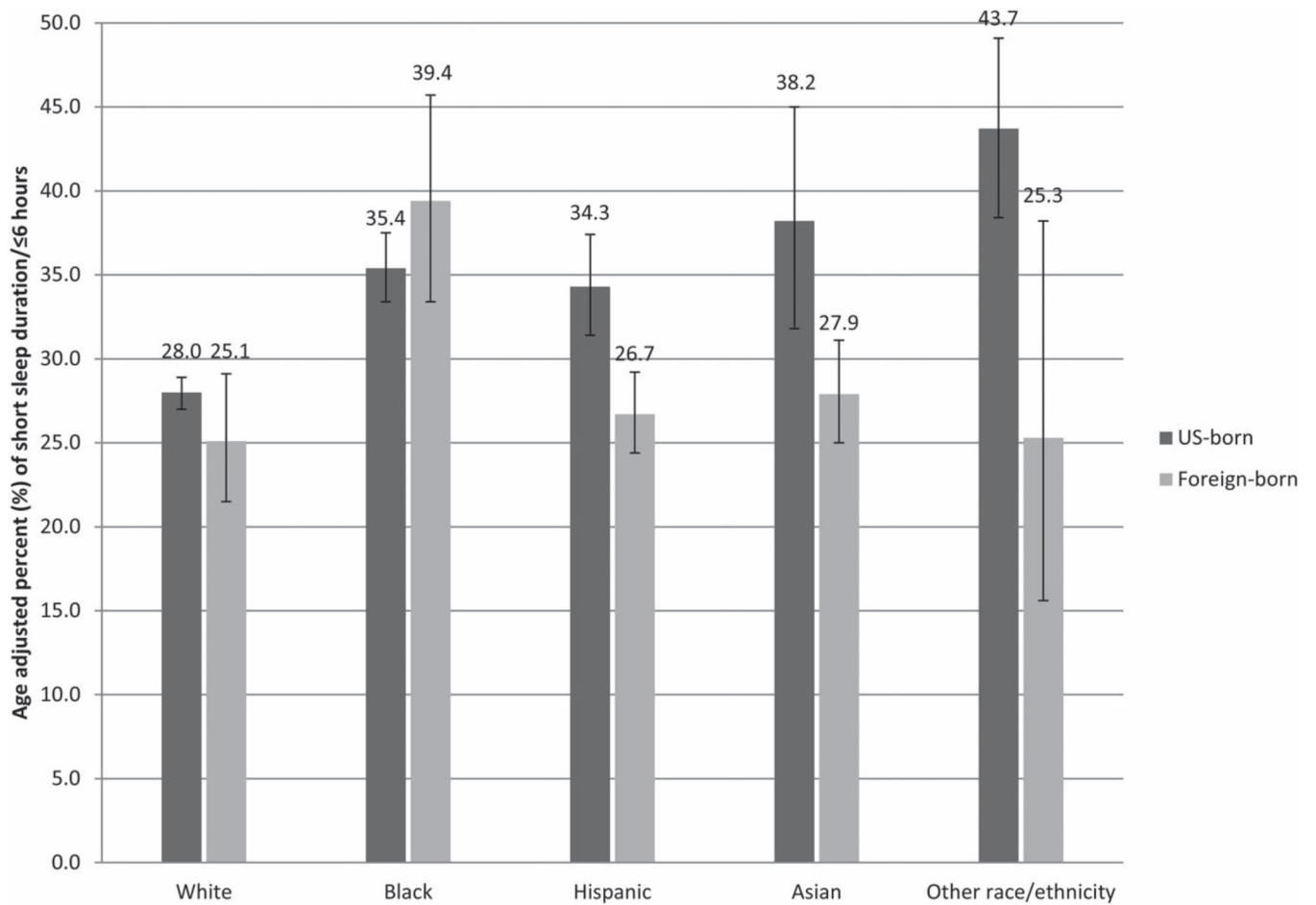
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**Key messages**

- (1) Compared to whites, blacks and Asians had a higher likelihood of short sleep among both US-and foreign-born adults.
- (2) US-born Hispanics, but not foreign-born Hispanics, had a higher likelihood of short sleep compared to their white counterparts.
- (3) In other words, racial/ethnic disparities in short sleep duration vary by nativity status.



**Figure 1.** Age-adjusted percentage of short sleep duration (<7 h) among adults 18 years by nativity status and race/ethnicity. Source NHIS 2012.

**Table 1**

Distribution of selected characteristics among adults 18 years by nativity status.

Characteristic	<i>n</i>	US-born % (standard error)	<i>N</i>	Foreign-born % (standard error)	Wald Chi-square <i>p</i> -value
Race/ethnicity					
White	17,004	78.6 (0.30)	784	24.9 (0.92)	<.001
African-American	3658	11.2 (0.22)	359	8.0 (0.53)	
Hispanic	1745	6.5 (0.18)	1858	38.7 (0.89)	
Asian	476	1.5 (0.09)	1271	27.3 (0.82)	
Other race/ethnicity	622	2.2 (0.12)	54	1.1 (0.18)	<.0001
Age group					
18–24 years	2222	12.4 (0.33)	267	7.3 (0.62)	
25–44 years	6976	30.3 (0.39)	1662	38.7 (0.94)	
45–65 years	8160	35.6 (0.41)	1440	36.2 (0.94)	
65 years and over	6147	21.6 (0.32)	957	17.7 (0.68)	
Gender					
Men	10,101	47.0 (0.43)	1864	45.8 (0.97)	0.24
Women	13,404	53.0 (0.43)	2462	54.2 (0.97)	<.0001
Marital status					
Married	10,382	54.7 (0.42)	2,322	64.7 (0.90)	
Previously married	6570	17.9 (0.27)	1041	15.8 (0.60)	
Never married	6553	27.4 (0.39)	963	19.5 (0.78)	
Educational attainment					
< High school	2693	9.9 (0.24)	1053	21.3 (0.74)	<.0001
High school graduate or GED	6007	25.4 (0.37)	860	20.2 (0.78)	
Some college	7691	33.1 (0.40)	947	22.8 (0.85)	
College graduate	7114	31.6 (0.39)	1466	35.6 (0.92)	
Employment status					
Currently employed	13,338	60.5 (0.41)	2588	63.2 (0.93)	<.01
Not employed	892	4.0 (0.17)	172	4.4 (0.42)	
Not in labor force	9275	35.6 (0.40)	1562	32.4 (0.89)	
Class of worker					

Characteristic	<i>n</i>	% (standard error)	US-born % (standard error)	<i>N</i>	Foreign-born % (standard error)	Wald Chi-square <i>p</i> -value
Private wage	15,953		69.0 (0.39)	3037	70.7 (0.88)	<.0001
Government	4761		18.9 (0.32)	516	12.1 (0.66)	
Self employed	1659		7.2 (0.22)	279	7.1 (0.50)	
Missing	1132		4.9 (0.20)	494	10.1 (0.54)	
Household income						.04
\$34,999	6,707		30.7 (0.39)	1132	29.9 (0.91)	
\$35,000	5,798		24.7 (0.37)	1182	27.1 (0.86)	
Missing	11,000		44.7 (0.42)	2012	43.0 (0.95)	
Years living United States; <sup>a</sup>						
<5				358	7.5 (0.48)	
5 to <10				375	8.6 (0.55)	
10 to <15				507	12.8 (0.67)	
15				3063	70.6 (0.89)	
US citizenship <sup>b</sup>				2724	65.5 (0.89)	
Health insurance coverage	22,355		95.2 (0.18)	4062	93.9 (0.47)	<.01
Frequent stress	6959		29.1 (0.38)	1011	23.4 (0.84)	<.0001
Frequent anxiety	4682		18.8 (0.33)	727	15.8 (0.68)	<.001
Short sleep duration/<7 hours	7040		29.4 (0.39)	1299	28.2 (0.85)	0.19

Source: NHIS 2012.

Notes: Sample sizes are not weighted, percentages are weighted to reflect US population estimates.

<sup>a</sup>Data of 23 participants are missing.

<sup>b</sup>Data of 12 participants are missing.

**Table 2** Relative likelihood of short sleep duration (<7 h) with race/ethnicity among adults 18 years by nativity status.

Race/ethnicity	US-born			Foreign-born		
	Unadjusted PR (95% CI)	Adjusted model 1 PR (95% CI)	Adjusted model 2 PR (95% CI)	Unadjusted PR (95% CI)	Adjusted model 1 PR (95% CI)	Adjusted model 2 PR (95% CI)
White	1.00	1.00	1.00	1.00	1.00	1.00
African-American	1.27 (1.19, 1.36)	1.23 (1.15, 1.32)	1.29 (1.21, 1.37)	1.58 (1.27, 1.97)	1.58 (1.26, 1.97)	1.71 (1.38, 2.13)
Hispanic	1.20 (1.09, 1.31)	1.17 (1.07, 1.29)	1.18 (1.08, 1.29)	1.08 (0.91, 1.28)	1.05 (0.87, 1.26)	1.06 (0.89, 1.27)
Asian	1.28 (1.08, 1.52)	1.36 (1.15, 1.60)	1.37 (1.16, 1.61)	1.10 (0.92, 1.32)	1.15 (0.96, 1.38)	1.23 (1.02, 1.47)
Other race/ethnicity	1.49 (1.30, 1.70)	1.49 (1.31, 1.70)	1.50 (1.33, 1.71)	1.08 (0.64, 1.80)	1.04 (0.62, 1.75)	1.08 (0.65, 1.80)

Source: NHIS, adult sample files, 2012.

Notes: Adjusted model 1 obtained from multivariable log-linear regression stratified by nativity status including race/ethnicity, age group, gender, marital status, educational attainment, employment status, class of worker, income, and health insurance coverage and adjusted model 2 obtained from previously listed covariates and also frequent stress and frequent anxiety. Among foreign-born adults, length of US residence and US citizenship was also included in both adjusted models.