

# SLEEP PATTERNS AMONG US LATINOS BY NATIVITY AND COUNTRY OF ORIGIN: RESULTS FROM THE NATIONAL HEALTH INTERVIEW SURVEY

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**Background:** Sparse data exist to describe national population-level trends in short sleep duration among Latinos. Because short sleep duration is associated with several health conditions that are common in Latinos, such as obesity, diabetes, and hypertension, understanding sleep trends among this population may be key to reducing their disease burden. This study aimed to document Latino subgroup differences in self-reported sleep duration by nativity and country of origin relative to Whites.

**Design and Setting:** Pooled cross-sectional analysis of self-reported data from the National Health and Interview Survey (NHIS), 2004-2017.

**Participants:** 303,244 respondents, aged 18 to 84 years, who self-identified as non-Latino US-born White, US-born Mexican, foreign-born Mexican, US-born Puerto Rican, island-born Puerto Rican, US-born Cuban, foreign-born Cuban, US-born Dominican, foreign-born Dominican, US-born Central/South American, foreign-born Central/South American, US-born "other" Latino, and foreign-born "other" Latino.

**Methods:** Multinomial logistic regression models were used to predict sleep duration controlling for demographics, acculturation, socioeconomic, and health-related factors.

**Results:** We found that all Latino subgroups (except US-born Cubans) were more likely to report poor sleep duration relative to non-Latino Whites, net of demographic, acculturation, socioeconomic, and health-related characteristics. However, the magnitude of disadvantage varies by Latino subgroup. We also found that poor sleep duration is concentrated among certain age groups for the various Latino subpopulations.

## INTRODUCTION

Sleep is critically important for well-being. Previous research has linked short sleep duration, or sleeping six or fewer hours, to various health conditions such as obesity,<sup>1</sup> diabetes,<sup>2</sup> cardiovascular disease,<sup>3</sup> Alzheimer's disease,<sup>4</sup> and premature mortality.<sup>5</sup> Given the serious adverse health implications of short sleep duration, it is especially troubling that Latinos generally report shorter sleep duration than non-Latino Whites (hereafter, White[s]).<sup>6,7</sup> Short sleep duration has been linked to greater insulin resistance and weight gain, which can increase the risk for developing diabetes and cardiovascular disease.<sup>8</sup> It is no surprise then that Latinos have a high prevalence of chronic conditions

most strongly linked to poor sleep such as diabetes and hypertension.<sup>9-11</sup>

Previous research has documented considerable differences among Latinos by country of origin and time living in the United States in health behaviors, access to medical care, levels of educational attainment, and levels of reported discrimination.<sup>10,12-14</sup> These differences invariably exert influence in the morbidity patterns that have been observed in the Latino population by country of origin.<sup>15-17</sup> Moreover, nearly half of Latinos in the United States are foreign-born, an important modifier that has implications for understanding the effects of place exposures on health. For instance, research suggests that foreign-born Mexicans are generally healthier than Mexicans born in

**Conclusions:** Given that Latinos in the United States are at higher risk for obesity, diabetes, and hypertension, understanding the patterns of sleep among this population can help identify strategies to improve sleep habits in order to reduce disease burden. *Ethn Dis.* 2020;30(1):119-128; doi:10.18865/ed.30.1.119

**Keywords:** Sleep Duration; Hispanics/Latinos; Latino Heterogeneity

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the United States, while Puerto Ricans born on the island are generally less healthy than Puerto Ricans born on the mainland United States.<sup>16</sup> As sleep is linked to chronic conditions<sup>2</sup> and is socially patterned,<sup>18</sup> sleep could be a key physiological mechanism explaining within and between group differences in health for Latino subgroups. These subgroup differences may influence specific stressors associated with their minority status in the United States that influence poor sleep. Prior research on Lati-

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nos has found that acculturation and ethnic stress, which are likely driven by the disadvantaged minority status of Latinos in the United States, are associated with poor sleep.<sup>19</sup>

Studies examining sleep duration among nationally representative samples of Latinos are scarce. However, emerging evidence indicates there are heterogeneous sleep patterns among Latino subgroups by country of origin. For instance, research using data from the Hispanic Com-

munity Health Study/Study of Latinos (HCHS/SOL) documented that Puerto Ricans and “other” Latinos had the highest levels of self-reported short sleep duration compared with other Latino subgroups.<sup>17</sup> This study also suggested that sleep systematically varied by nativity status among Latinos with US-born Latinos having worse sleep than their foreign-born counterparts. Moreover, the Sueño Ancillary Study from the HCHS/SOL used actigraphy (an objective measure of sleep duration) and found that South Americans and Puerto Ricans had fewer hours of sleep relative to Mexicans, Cubans, Dominicans, and Central Americans.<sup>20</sup> While these studies highlight key differences in sleep within the Latino population, a key limitation to these studies is that they are based on regional samples and do not provide a comprehensive documentation of US Latino subgroup differences in sleep by nativity and country of origin.

Most of the literature on sleep among Latinos has assessed Latinos as a pan-ethnic group,<sup>6,7,21</sup> ignoring the different social and cultural backgrounds, immigration histories, settlement patterns, acculturation, and socioeconomic factors that characterize Latino subgroups and that could uniquely influence their overall sleeping patterns. Indeed, it is important to distinguish among Latino subgroups since group membership influences exposure to stress, discrimination, living arrangements, economic disadvantage, social support, and health beliefs and practices that affect sleep patterns. Although Latinos refer to the people born in Latin America and the Caribbean, their experiences in

the United States differ substantively by nativity and country of origin. Thus, it is imperative to document subgroup differences among Latinos and examine if specific characteristics (eg, acculturation or socioeconomic status) can explain any observed subgroup differences. We expect differences in these characteristics to be reflected in differences in sleep among Latino subgroups because individuals in these groups have such different conditions of living and experiences.

The objective of our study is threefold: 1) to use a nationally representative survey of US adults to document Latino subgroup differences in self-reported sleep duration by nativity and country of origin compared with Whites; 2) to examine whether demographic, acculturation, socioeconomic, and health-related characteristics account for the observed subgroup differences in sleep; and 3) given that previous work has shown considerable differences in health patterns among Whites and Latino subgroups by age,<sup>16</sup> to examine age patterns in sleep. Overall, we aim to provide a comprehensive understanding of the heterogeneity of sleep among Latinos and how it varies by nativity, country of origin, and age group.

## METHODS

### Data

The data for this investigation comes from the National Health Interview Survey (NHIS), an annual, cross-sectional, and nationally representative survey of the civilian noninstitutionalized population aged  $\geq 18$  years of the United States. We used the harmo-

nized version of the NHIS prepared by Integrated Public Use Microdata Series (IPUMS).<sup>22</sup> We pooled NHIS surveys from 2004, the first year when sleep duration was collected, to the most recent release of the NHIS at the time of analysis (2017). Our sample included adults aged 18-84 years who identified as Latino (n=69,362) or US-born non-Latino White (n=249,830). We excluded respondents aged  $\geq 85$  years because their ages were top-coded (n=9,590). Additionally, we excluded individuals who were missing data on sleep duration (n=6,358), giving us an analytic sample of 303,244 adults. Results from logistic regression models predicting whether the respondent was missing data on sleep duration did not show any statistically significant differences in their characteristics compared with respondents in the analytic sample. There was very little missing data on covariates but about 9% of respondents were missing data on household income. NHIS provides imputed income in five imputed data sets. However, increasingly utilizing only five datasets is viewed as inadequate. Thus, we decided to use Bodner's (2007)<sup>23</sup> approach of generating the number of imputed datasets equivalent to the total percent missing; in our case with about 10% missing data we generated 10 imputed data sets. We used multiple chained equations in Stata to generate the imputed datasets and Rubin's rule for combining across datasets.

## Measures

### *Dependent Variable*

For sleep, we used self-reported sleep duration of the respondent. Respondents were asked to report on av-

erage how many hours of sleep they got in a 24-hour period; the responses were then rounded to the nearest hour. We coded sleep duration following the American Academy of Sleep Medicine and Sleep Research Society's recommendations for adult sleep duration.<sup>24</sup> We coded those who slept 7-8 hours as normal sleep duration (reference), those who slept 6 or fewer hours as short-sleep duration (or, poor sleep), and those who slept 9 or more hours as long-sleep duration. We revisit the limitations of this measure in the discussion section.

### *Main Independent Variables of Interest*

Race/ethnicity, birthplace, and country of origin categories were based on self-reports, which include: US-born Mexicans, foreign-born Mexicans, US-born Puerto Ricans, island-born Puerto Ricans, US-born Cubans, foreign-born Cubans, US-born Dominicans, foreign-born Dominicans, US-born Central/South Americans, foreign-born Central/South Americans, US-born "other" Latinos, foreign-born "other" Latinos, and US-born Whites (reference). While finer ethnic origin classifications are desirable (eg, Salvadoran instead of Central American), this level of detail was not available in the NHIS public use data.

### *Demographic Characteristics*

Our models accounted for important demographic characteristics that are linked to sleep such as age, age-squared, sex, Census region of residence, and marital status. Age is a continuous variable that ranges from 18-84 years. Given that past work<sup>25</sup>

has shown that the association between age and sleep is non-linear, we included a quadratic (ie, age-squared) term of age. Sex is a dichotomous variable that included females (reference) and males. Census region of residence is coded categorically as Northeast (reference), Midwest, South, and West. Marital status is coded categorically as married/partnered (reference), divorced/separated, widowed, and never married. We also included a measure for the number of children the respondent has.

### *Acculturation*

Given the importance of acculturation for the health and sleep of Latinos,<sup>26</sup> which may vary considerably by nativity and country of origin, we accounted for measures of acculturation that include citizenship status, tenure in the United States, and language of interview. We used a dummy variable to account for the citizenship status of the respondent (with non-US citizen as the reference). We also included a measure of the number of years the respondent has spent in the United States based on the finest categories reported to the NHIS: Not foreign-born (reference), <1 year, 1 year to <5 years, 5 years to <10 years, 10 years to <15 years, and  $\geq 15$  years. Interview language distinguished respondents who took the interview in English (reference), Spanish, English and Spanish, or some other language.

### *Socioeconomic Factors*

As socioeconomic factors are linked to sleep and vary considerably between Whites and Latinos, and within the Latino subpopulation, we also adjusted for education,

household income, hours worked, and homeownership. Educational attainment is coded categorically as less than a high school education (reference), high school education, some college, and college or more. Household income is a categorical variable that included respondents with the following income cutoffs: \$0-\$34,999 (reference), \$35,000-\$74,999, and \$75,000 or more. Hours worked classified respondents as having worked 40 hours (reference), zero-hours (including the unemployed), 1-39 hours, and 41+ hours. Homeownership is a dichotomous variable determining if the respondent is a homeowner or not a homeowner (reference).

*Health Behaviors*

We also accounted for two health behaviors that are linked to sleep and vary among Latino subgroups: smoking and drinking. Smoking status is coded categorically as never-smoked (reference), former smokers, current some day smoker, and current everyday smokers. Drinking status is coded categorically as never drank (reference), former drinkers, and current drinkers.

**Analytic Strategy**

We first present the descriptive statistics of the entire sample. Next, multinomial logistic regression models were used to document the association between race/ethnicity, nativity, and country of origin and sleep duration with normal sleep (7-8) as the base category, and short sleep (6 or fewer) and long sleep (9 or more hours) as the other categories. The coefficients are presented as odds ratios with their 95%CI. In Model 1, we

accounted for demographic characteristics. In Model 2, we added acculturation characteristics. In Model 3, we added controls for socioeconomic characteristics. Lastly, in Model 4, health behaviors were added. Next, we fit fully adjusted age stratified models that included young adulthood (aged 18-44 years), middle adulthood (aged 45 to 64 years), and older adulthood (aged 65+) years to gauge in which age groups any observed nativity and country of origin differentials were concentrated. We account for the complex survey design of the NHIS by using Stata’s complex survey procedures, which adjusts for population stratification, primary sampling unit, and sample weights. Analyses were conducted using Stata version 15.<sup>27</sup>

the study population (n=235,924), with the remaining 18.3% comprising Latinos (n=67,320). Foreign-born Mexicans make up the largest Latino subgroup in the sample (n=28,003), followed by US-born Mexicans (n=13,232), foreign-born Central/South Americans (n=9,247), US-born Puerto Ricans (n=3,369), and island-born Puerto Ricans (n=3,241). Although we include a diverse sample of Latinos, we must note that some nativity and country of origin groups have small sample sizes such as: US-born Dominicans (n=383), US-born Cubans (n=731), and foreign-born “other” Latinos (n=433). A table illustrating age-adjusted sleep duration for US-born Whites and Latino subgroups is available from the corresponding author.

**RESULTS**

**Descriptive Statistics**

Characteristics of the study population are presented in Tables 1 and 2 as weighted percentages and means. US-born Whites make up 81.7% of

**Subgroup Differences in Sleep**

Table 3 presents results from the multinomial models that show the association between race/ethnicity, nativity, and country of origin and sleep duration. While there are some exceptions, in general, the re-

**Table 1. Race/ethnicity and nativity of the study population, N=303,244 (weighted %, unweighted Ns)**

	%	N
US-born non-Latino White	81.7%	235,924
US-born Mexican	3.6%	13,232
Foreign-born Mexican	7.8%	28,003
US-born Puerto Rican	.9%	3,369
Island-born Puerto Rican	.8%	3,241
US-born Cuban	.2%	731
Foreign-born Cuban	.6%	2,647
US-born Dominican	.1%	383
Foreign-born Dominican	.5%	1,884
US-born Central/South American	.5%	1,463
Foreign-born Central/South American	2.6%	9,247
US-born “Other” Latinos	.6%	2,687
Foreign-born “Other” Latinos	.1%	433

Source: National Health Interview Survey, 2004-2017.

sults are stable across models and suggest that many of the Latino subgroups are more likely to report poor sleep relative to US-born Whites.

We find that US-born Mexicans (OR: 1.09; 95% CI: 1.04, 1.13), foreign-born Mexicans (OR: 1.08; 95% CI: 1.01, 1.15), US-born Puerto Ricans (OR: 1.31; 95% CI: 1.22, 1.42), island-born Puerto Ricans (OR: 1.80; 95% CI: 1.62, 2.01), foreign-born Cubans (OR: 1.43; 95% CI: 1.28, 1.61), US-born Dominicans (OR: 1.29; 95% CI: 1.04, 1.61), foreign-born Dominicans (OR: 1.54; 95% CI: 1.36, 1.74), US-born Central/South Americans (OR: 1.27; 95% CI: 1.13, 1.42), foreign-born Central/South Americans (OR: 1.53; 95% CI: 1.41, 1.66), US-born “other” Latinos (OR: 1.24; 95% CI: 1.14, 1.35), and foreign-born “other” Latinos (OR: 1.47; 95% CI: 1.17, 1.85) are more likely to report short sleep relative to US-born Whites, net of demographic, acculturation, socioeconomic, and health-related characteristics (Model 4). However, the magnitude of disadvantage relative to US-born Whites varies by Latino subgroup. For instance, while island-born Puerto Ricans are 80% more likely to report short sleep relative to US-born Whites, foreign-born Mexicans have an 8% increased likelihood. In addition, all foreign-born groups (except for Mexicans) had an increased likelihood of reporting short sleep relative to US-born Whites than their US-born counterparts.

In terms of long sleep duration, US-born Mexicans (OR: 1.10; 95% CI: 1.03, 1.17), foreign-born Mexicans (OR: 1.17; 95% CI: 1.06, 1.29), and island-born Puerto Ri-

**Table 2. Other characteristics of study population, N=303,244 (weighted %, means)**

	% or Mean (SE)
Demographic characteristics	
Age	46.0 (.08)
Male	49.1%
Region	
Northeast	17.5%
Midwest	25.0%
South	34.7%
West	22.9%
Marital status	
Married/partnered	57.3%
Divorced/separated	13.4%
Widowed	5.0%
Never married	24.3%
Number of children	.73 (.00)
Acculturation	
US citizen	93.4%
Years in the United States	
Not foreign born	89.3%
Less than one year	.1%
One year to less than five years	.9%
Five years to less than ten years	1.5%
10 years to less than 15 years	1.7%
15 years or more	6.5%
Interview language	
English	92.9%
Spanish	4.4%
English and Spanish	2.6%
Other	.0%
Socioeconomic factors	
Educational attainment	
Less than high school	12.1%
High school	29.2%
Some college	30.6%
College or more	28.2%
Household income	
\$0-\$34,999	31.1%
\$35,000-\$74,999	32.9%
\$75,000+	36.0%
Hours per week worked	
0	18.5%
1 to 39	26.6%
40	35.8%
41+	19.1%
Owens home	70.7%
Health behaviors	
Smoking status	
Never smoker	57.5%
Former smoker	23.3%
Current someday smoker	4.0%
Current everyday smoker	15.2%
Alcohol consumption	
Never drinker	18.2%
Former drinker	14.3%
Current drinker	67.5%

Source: National Health Interview Survey, 2004-2017.

cans (OR: 1.34; 95% CI: 1.13, 1.61) had an increased likelihood in reporting long sleep duration than US-born Whites (Model 4).

**Subgroup Differences in Sleep by Age Groups**

Past work has shown considerable differences in sleep by age group, thus in Table 4, we present fully adjusted models by age group. We

present stratified models but tested for differences across age groups and race/ethnic, nativity, and country of origin subgroups using interaction terms. We find that at older age groups inequality in short sleep is particularly pronounced for foreign-born Latinos. More precisely, for foreign-born Mexicans, island-born Puerto Ricans, foreign-born Cubans, foreign-born Dominicans, foreign-

born Central/South Americans, and foreign-born “other” Latinos, the association varied among the older two age groups (45 to 64 and 65 to 84) compared with the younger age group (18 to 44). Generally, the likelihood of short sleep increased among older age groups relative to the younger age group, suggesting that older foreign-born Latinos are at greater odds of reporting poor sleep.

**Table 3. Odds ratios (OR) and 95%CI reported from multinomial logistic regression models, N=303,244**

	Sleep Hours ≤6 vs 7-8											
	Model 1 <sup>a</sup>			Model 2 <sup>b</sup>			Model 3 <sup>c</sup>			Model 4 <sup>d</sup>		
	OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
US-born non-Latino White (ref)												
US-born Mexican	1.11	1.07	1.16	1.12	1.07	1.16	1.03	.99	1.07	1.09	1.04	1.13
Foreign-born Mexican	.72	.70	.75	1.11	1.04	1.18	1.02	.96	1.08	1.08	1.01	1.15
US-born Puerto Rican	1.42	1.32	1.52	1.42	1.32	1.53	1.27	1.18	1.37	1.31	1.22	1.42
Island-born Puerto Rican	1.40	1.30	1.51	1.96	1.77	2.19	1.75	1.58	1.95	1.80	1.62	2.01
US-born Cuban	1.05	.89	1.23	1.07	.91	1.25	1.12	.96	1.32	1.16	.99	1.36
Foreign-born Cuban	.82	.75	.90	1.33	1.19	1.49	1.40	1.25	1.57	1.43	1.28	1.61
US-born Dominican	1.24	1.00	1.53	1.26	1.01	1.56	1.22	.98	1.51	1.29	1.04	1.61
Foreign-born Dominican	.97	.88	1.07	1.54	1.37	1.74	1.42	1.26	1.61	1.54	1.36	1.74
US-born Central/South American	1.19	1.07	1.33	1.20	1.07	1.34	1.21	1.08	1.35	1.27	1.13	1.42
Foreign-born Central/South American	.89	.85	.93	1.48	1.37	1.61	1.45	1.33	1.58	1.53	1.41	1.66
US-born “Other” Latinos	1.29	1.18	1.40	1.29	1.19	1.40	1.21	1.11	1.32	1.24	1.14	1.35
Foreign-born “Other” Latinos	.92	.74	1.14	1.41	1.13	1.77	1.44	1.14	1.80	1.47	1.17	1.85
	Sleep Hours ≥9 vs 7-8											
	Model 1 <sup>a</sup>			Model 2 <sup>b</sup>			Model 3 <sup>c</sup>			Model 4 <sup>d</sup>		
	OR	95% CI		OR	95% CI		OR	95% CI		OR	95% CI	
US-born non-Latino White (ref)												
US-born Mexican	1.22	1.15	1.30	1.21	1.14	1.29	1.05	.98	1.12	1.10	1.03	1.17
Foreign-born Mexican	1.17	1.11	1.23	1.27	1.16	1.40	1.12	1.01	1.23	1.17	1.06	1.29
US-born Puerto Rican	1.08	.94	1.25	1.08	.94	1.25	.89	.77	1.03	.91	.78	1.05
Island-born Puerto Rican	1.31	1.15	1.49	1.74	1.46	2.07	1.33	1.11	1.58	1.34	1.13	1.61
US-born Cuban	.73	.53	1.00	.73	.53	1.01	.77	.55	1.06	.79	.57	1.09
Foreign-born Cuban	.58	.49	.68	.74	.61	.90	.80	.65	.98	.82	.67	1.00
US-born Dominican	.75	.48	1.17	.75	.48	1.17	.64	.40	1.00	.67	.42	1.05
Foreign-born Dominican	.98	.81	1.18	1.18	.95	1.46	1.05	.84	1.31	1.12	.90	1.39
US-born Central/South American	.80	.65	.99	.80	.65	1.00	.79	.64	.98	.82	.66	1.02
Foreign-born Central/South American	.82	.75	.90	.94	.82	1.07	.95	.83	1.09	.99	.86	1.14
US-born “Other” Latinos	1.15	1.00	1.32	1.15	1.00	1.32	1.02	.89	1.17	1.04	.90	1.19
Foreign-born “Other” Latinos	.94	.65	1.36	1.11	.76	1.62	1.15	.78	1.68	1.18	.80	1.72

Source: National Health Interview Survey, 2004-2017.

a. Model 1 adjusts for demographic characteristics: age, age2, region, marital status, number of children, and survey year.

b. Model 2 additionally adjusts for acculturation measures: citizenship status, years in the United States, and language of interview.

c. Model 3 additionally adjusts for socioeconomic characteristics: educational attainment, household income, hours worked per week, and home ownership.

d. Model 4 additionally adjusts for behavioral health characteristics: smoking status and alcohol consumption.

## DISCUSSION

Most of the research on sleep in the Latino population has focused on the pan-ethnic (Hispanic or Latino) categorization, which obscures considerable differences by nativity and country of origin. Differences in the historical, geographical, sociocultural, economic, and political contexts

have lasting effects that accumulate across the life course, which may contribute to sleep disparities among Latinos. Given the importance of sleep for health, understanding nativity and country of origin differences in sleep within the Latino population may be key to understanding the underlying processes that contribute to variations in health and disease.

Limited research suggests that there is heterogeneity in sleep patterns among Latinos by country of origin.<sup>17,20,28</sup> Generally, these studies find that Mexicans exhibit favorable sleep patterns in mean sleep duration<sup>20</sup> and a lower prevalence of short sleep<sup>17,29</sup> compared with other country of origin groups. In contrast, Puerto Ricans,<sup>17,20,28</sup> South Ameri-

**Table 4. Odds ratios (OR) and 95%CI reported from multinomial logistic regression models, by age group, N=303,244**

	Sleep Hours ≤6 vs 7-8								
	18 to 44		45 to 64		65 to 84				
	OR	95% CI	OR	95% CI	OR	95% CI			
US-born non-Latino White (ref)									
US-born Mexican	1.13	1.07	1.19	1.03	.95	1.12	1.09	.97	1.23
Foreign-born Mexican	1.12	1.03	1.20	1.07	.94	1.22	1.13	.91	1.41
US-born Puerto Rican	1.29	1.18	1.41	1.46	1.27	1.68	1.31	.91	1.88
Island-born Puerto Rican	1.55	1.31	1.83	1.92	1.57	2.34	1.72	1.28	2.31
US-born Cuban	1.23	1.02	1.48	1.00	.70	1.43	1.54	.52	4.57
Foreign-born Cuban	1.09	.89	1.34	1.39	1.13	1.71	1.31	.98	1.75
US-born Dominican	1.37	1.09	1.73	1.26	.61	2.59	.96	.18	5.00
Foreign-born Dominican	1.39	1.17	1.66	1.56	1.26	1.95	1.41	.99	2.02
US-born Central/South American	1.29	1.14	1.47	1.40	1.00	1.97	1.41	.66	3.00
Foreign-born Central/South American	1.53	1.38	1.70	1.52	1.28	1.79	1.46	1.10	1.93
US-born "Other" Latinos	1.29	1.15	1.45	1.14	.98	1.32	1.25	1.01	1.54
Foreign-born "Other" Latinos	1.50	1.09	2.06	1.24	.82	1.88	1.54	.87	2.71
	Sleep Hours ≥9 vs 7-8								
	18 to 44		45 to 64		65 to 84				
	OR	95% CI	OR	95% CI	OR	95% CI			
US-born non-Latino White (ref)									
US-born Mexican	1.13	1.04	1.24	1.13	1.07	1.19	.93	.79	1.08
Foreign-born Mexican	1.19	1.06	1.34	1.12	1.03	1.20	1.04	.80	1.36
US-born Puerto Rican	.98	.83	1.16	1.29	1.18	1.41	.57	.30	1.08
Island-born Puerto Rican	1.43	1.08	1.91	1.55	1.31	1.83	1.24	.85	1.83
US-born Cuban	.69	.47	1.02	1.23	1.02	1.48	.84	.18	3.96
Foreign-born Cuban	.77	.54	1.11	1.09	.89	1.34	.75	.51	1.12
US-born Dominican	.68	.42	1.10	1.37	1.09	1.73	1.00 <sup>a</sup>	1.00	1.00
Foreign-born Dominican	1.40	1.05	1.87	1.39	1.17	1.66	1.00	.59	1.67
US-born Central/South American	.84	.67	1.06	1.29	1.14	1.47	.55	.13	2.37
Foreign-born Central/South American	1.08	.91	1.28	1.53	1.38	1.70	.70	.47	1.04
US-born "Other" Latinos	1.09	.89	1.33	1.29	1.15	1.45	.80	.60	1.08
Foreign-born "Other" Latinos	1.09	.62	1.94	1.50	1.09	2.06	1.88	.97	3.67
N=303,244		136,530		104,953		61,761			

Source: National Health Interview Survey, 2004-2017.

All models are adjusted for: age, age2, region, marital status, number of children, citizenship status, years in the US, language of interview, educational attainment, household income, hours worked per week, and home ownership, smoking status, alcohol consumption, body mass index, self-reported health, Kessler-6 scale, and survey year. More detailed results available from corresponding author.

a. Small cell size make estimation difficult for this group.

cans,<sup>20</sup> and “other” Latinos<sup>17</sup> are more likely to exhibit poorer sleep patterns. However, these studies do not further classify these groups by nativity status (eg foreign-born and US-born) and do not make any direct comparisons to non-Latino groups (eg non-Latino Whites). In this study, we used a nationally representative survey of US adults, with large samples of Latinos, to document differences

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*Notably, foreign-born groups such as Puerto Ricans, Dominicans, Cubans, Central/South Americans, and “other” Latinos exhibited greater odds for poor sleep relative to Whites.*

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in sleep patterns among the Latino population by nativity and country of origin compared with Whites.

Our results are consistent with previous research showing that poor sleep among Latinos varies by country of origin. Including nativity status in the classification of Latino subgroups, however, revealed more nuanced patterns of poor sleep than what has been previously shown. Notably, foreign-born groups such as Puerto Ricans, Dominicans, Cu-

bans, Central/South Americans, and “other” Latinos exhibited the greatest odds for poor sleep relative to Whites. The greater odds of poor sleep among foreign-born groups appears to contradict previous research findings that foreign-born Latinos have more favorable sleep patterns than their US-born counterparts.<sup>17</sup> Although, it is important to consider that the general pattern of favorable sleep patterns found among foreign-born Latinos has been based on primarily Mexican samples.

Our results also suggest that the sleep differences observed by nativity and country of origin were largely concentrated at specific age groups. This is important as past research has suggested that chronic conditions among Latino subgroups vary by age group.<sup>16</sup> For instance, we found that most Latino subgroups were more likely to report poor sleep than Whites at younger ages (18-44), with the majority of foreign-born groups exhibiting the greatest odds. The increased likelihood of poor sleep among foreign-born Latinos is also evident at older ages for island-born Puerto Ricans, foreign-born Cubans, and foreign-born Central/South Americans.

Among Latinos born outside the United States, it has been found that longer duration of residence in the United States is associated with a greater likelihood of poor sleep, which is consistent with hypotheses that acculturation has an adverse effect on sleep patterns.<sup>30</sup> When we adjusted our models for measures of acculturation, the odds for poor sleep was especially high for foreign-born Latinos, which likely reflects increased levels of acculturative stress and increased adoption of unhealthy

habits such as poor diet, smoking, or drinking that adversely affect sleep.<sup>31</sup> Furthermore, the evidence of poor sleep patterns being pronounced at older ages for some foreign-born Latinos may be related to their longer exposure of living in the United States and the increased risk of these unhealthy habits. The addition of socioeconomic factors weakened the relationship between foreign-born Latino status and poor sleep, suggesting socioeconomic status may explain some of the Latino variation in sleep. However, we were unable to statistically explain the differences across subgroups. More research is needed to further examine other critical factors that are associated with poor sleep. While this study included key covariates that are associated with sleep, we were unable to assess other causes of poor sleep such as environmental and social contexts (eg, discrimination).

### Study Limitations

This research has important limitations that should be considered. First, we used a self-reported sleep duration measure that has reliability issues compared with measured sleep duration that may vary systematically between Latinos and Whites. However, we are unaware of any research that suggests this bias varies systematically between Latino subgroups. It is worth noting that self-reported sleep duration has been linked to health conditions at the population level, and specifically among Latinos.<sup>30</sup> Second, the measures of acculturation in our study do not adequately capture the conceptualization of acculturation as a multi-dimensional process that in-

volves language, cultural beliefs and values, and structural assimilation that may vary by Latino subgroups. We used what was available in the NHIS – citizenship status, tenure in the United States, and language of interview – as proxies for acculturation. Third, while we had country of origin information on Mexicans, Puerto Ricans, Cubans, and Dominicans, we were unable to include finer classifications within the Central/South American region. Therefore, the findings related to Central/South Americans may not generalize to Latinos whose country of origin is masked within this category. Finally, this is a cross-sectional study and thus we were unable to determine a causal relationship between race/ethnicity, nativity, and country of origin and sleep.

## CONCLUSION

The identification of disparities in sleep patterns by nativity and country of origin provides a novel opportunity to develop clinical interventions to improve sleep habits in high-risk Latino subpopulations. Our results suggest that these interventions should not be targeted at Latinos as a group, but rather should be specifically developed for subgroups and based on nativity status. Given that Latinos in the United States are at higher risk for sleep-related chronic conditions, understanding the determinants of poor sleep among the Latino population, and helping clinicians to promote tailored sleep promotion strategies may help reduce the onset and burden of chronic conditions among Latinos more broadly.

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## CONFLICT OF INTEREST

No conflicts of interest to report.

## AUTHOR CONTRIBUTIONS

Research concept and design: García, Sheehan; Acquisition of data: García, Sheehan; Data analysis and interpretation: Garcia, Sheehan, Flores-Gonzalez, Ailshire; Manuscript draft: García, Sheehan, Flores-Gonzalez, Ailshire; Statistical expertise: García, Sheehan, Ailshire; Acquisition of funding: García; Administrative: Flores-Gonzalez; Supervision: Sheehan, Flores-Gonzalez

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