Title: US acculturation and poor sleep among an intergenerational cohort of adult Latinos in the Sacramento, California region

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INTRODUCTION

Sleep is a multidimensional vital neurophysiologic state that changes across the lifecourse and facilitates biological functions for health maintenance, longevity, and restoration.[1-5] Poor sleep has been linked to harmful health behaviors and conditions, including mortality.[2,6-9] In the United States (US), poor sleep is a public health crisis[10,11] where 50-70 million suffer from a chronic sleep disorder[12] and one-third of adults report sleeping less than the recommended amount.[5] Some Latino populations may be disproportionately burdened by poor sleep when compared to other race/ethnicities,[13-17] which is not surprising since they face higher proportions of risk factors like obesity and depression.[18-23] Yet the underlying mechanisms driving poor sleep in Latinos remain poorly understood as these associations are complex, interdependent, and rooted in cultural and sociodemographic context.[18,21,22]

Culture is comprised of beliefs, traditions, language, and social interactions that shape health. Knowledge of one's broad cultural orientation provides insight about these compositional cultural factors and how they influence downstream health behaviors and conditions.[24] The Latino population has diverse ancestral origins (e.g. Mexico, Puerto Rico, etc) and a large foreign-born population, leading to rich cultural variation that is often guided by the dynamic process of acculturation.[25] Acculturation, or cultural change, takes place over time and across generations after exposure to culturally dissimilar people, groups, and social influences.[25-29] US acculturation may play a role in patterning sleep among Latinos as a cultural orientation towards the US (vs. orientation towards another birth or ancestral country) has been linked to many harmful health behaviors and conditions that predict poor sleep.[18,21,22] This concept is known as negative acculturation,[25-28,30-33] but socioeconomic factors like education and occupation can modify how new cultures are internalized and influence health via mechanisms of differential

knowledge, values, and opportunities established by each.[25-29] Understanding how US acculturation, along with socioeconomic factors, patterns sleep among Latinos may identify an over-arching cultural framework with specific underlying mechanistic pathways to explore in future research, the results of which would provide targetable points of intervention and inform the development of efficacious prevention and intervention efforts.

A growing body of literature has found that proxies of US acculturation are associated with worse sleep (e.g. too short or long sleep durations, sleep complaints) among Latinos.[18,21,22,34-38] However, unidimensional acculturative measures like immigration status, language use and competency, and length of residence are of limited utility as they do not capture the complexities of acculturative change that measure adherence to American values and guide pathways between acculturation and health.[26,28,29] Varying measures of sleep and limited exploration of sociodemographic context (e.g. education, adult age) also make it challenging to draw clear conclusions of how US acculturation influences sleep.

While a genetic contribution to sleep is known,[39] the acculturative experiences of preceding generations may impact sleep and health through separate mechanisms that a single-generation snapshot cannot capture.[25,28,40] For example, a US-born Latino may have one, both, or no parents born outside the US, resulting in varying degrees of acculturation and cultural transmission. First, acculturation can become biologically embedded and be transmitted to offspring via fetal programming (e.g. acculturative stress leads to elevated cortisol levels during pregnancy that impact offspring outcomes[41,42]) to shape subsequent generation health regardless of present life conditions.[40] Second, post-natally, parental acculturative behaviors and practices, including healthcare utilization, can be learned, reinforced, and shape offspring development to ultimately influence offspring health and sleep (e.g. parental sleep behaviors, diet, breastfeeding

practices).[25,40] Therefore, single-generation cultural measures do not stand alone and intergenerational acculturation assessments provide context into how the culture and health of previous generations can become biologically embedded and shape the culture and health of subsequent generations.

In this study of predominately Mexican-descent US Latinos, we sought to estimate the association between US acculturation and poor sleep in two generations: parents of older age at study onset and their offspring and other biological relatives of middle-age at study onset. We used a validated multidimensional acculturation measure,[43] acculturative proxies,[26,28,29] and several subjective sleep measures for an in-depth exploration of US acculturation and sleep. We hypothesized that high US acculturation, in single generations and across two generations, would be associated with measures of worse sleep quality and sleep apnea among US Latinos.

METHODS

Participants

We utilized baseline data from two separate studies for an intergenerational cohort of community-dwelling predominately Mexican-American adults representative of Latinos in the Sacramento Valley region of California.[44] The first generation was drawn from the Sacramento Area Latino Study on Aging (SALSA), a 10-year longitudinal cohort study of N=1,789 Latinos aged 60–101 years at baseline (1998–1999). The second generation was drawn from the Niños Lifestyle and Diabetes Study (NLDS), which consists of N=728 biological relatives (N=534 offspring; 73.4%) of SALSA participants aged 48-60 years at baseline (2013). Participants reported health conditions, lifestyle, and sociodemographic factors via interviewer-administered surveys in self-selected Spanish or English language; clinical and cognitive assessments were collected at home visits. Analyses were conducted in sub-samples with acculturation and sleep

data: N=1716 older SALSA participants and N=670 midle-age NLDS participants for single-generation analyses to explore differences between acculturation and sleep,[45,46] and N=534 NLDS offspring linked to SALSA parents to explore the intergenerational influence of acculturation on sleep.[40] The sub-sample of parent-linked offspring pairs were similar in sociodemographic and cultural factors to full SALSA and NLDS samples (**Table 2**).

Measures

Acculturation measures. Acculturation was measured using the Acculturation Rating Scale for Mexican-Americans–Version II (ARSMA-II), an established measure of language use and ethnic identity and interaction. The scale consists of two subscales totaling 30 items to measure Anglo orientation (AOS) and Mexican orientation (MOS). The subscales are then averaged and subtracted (AOS-MOS) for an overall mean score. AOS and MOS have strong internal reliability (Cronbach's alpha=0.83 and 0.88, respectively), test-retest reliability at 1-week intervals (correlation coefficient=0.94 and 0.96, respectively), and concurrent validity (correlation coefficient with original ARSMA=0.89). We modified Cuellar et al. (1995)'s suggested cutpoints for a dichotomous US acculturation measure where ≥0 indicates "high" US cultural orientation and <0 indicates "low" (or "high" Mexican orientation). We had a small sample size of bicultural (score=0) participants (<1%) and combined them with participants scoring >0 for a high US acculturation score because the study is US-based.[43,47,48]

Intergenerational acculturation. We linked NLDS offspring to SALSA parents and created a three-level intergenerational parent/offspring US acculturation measure: stable-high intergenerational US acculturation (high parent US acculturation/high offspring US acculturation); upwardly mobile (low parent/high offspring); and low, which was a combination

of stable-low (low parent/low offspring) and downwardly mobile (high parent/low offspring) as downwardly mobile pairs constituted <2% of the parent-linked offspring sample.

Immigrant generation. In SALSA, participants reported their nativity and the nativity of their parents. We used this information to create a three-level immigrant generation variable[49] as a proxy of intergenerational US acculturation. A foreign-born participant was categorized as a first generation immigrant; a US-born respondent with at least one foreign-born parent was categorized as second immigrant generation; and US-born participant with two US-born parents was categorized as third generation.

Sleep. Briefly, availability of sleep measures differed between SALSA and NLDS. SALSA had more measures and different measures than NLDS, though an identical measure of restless sleep was available for both (see **Table 1** for a summary comparison of SALSA and NLDS sleep measures). In SALSA, we used five dichotomous (yes/no) measures of poor sleep: restless sleep; overall fatigue (a wake-time measure linked to sleep quality)[50]; waking up far too early; trouble falling asleep; and waking up several times a night. We examined restless sleep and overall fatigue as individual outcomes due to the literature base and interpretable connection to daily functioning and health[10,51] and all measures were used in a latent class analysis. In NLDS, we used five dichotomous (yes/no) measures of poor sleep: restless sleep; three duration variables; and a self-reported sleep apnea medical diagnosis. Participants answered how long they sleep on weekdays and weekends and we created a weighted average of sleep per night throughout a week. We created three separate duration variables with the average dichotomized at informative cutpoints (averages of <5,<6, and <7 hours of sleep/night) based on sleep recommendations and sleep duration-health literature.[7,12,52-54] In NLDS, restless sleep data was collected via phone survey for all participants; sleep duration and sleep apnea data were collected

at home visits by a sub-sample of NLDS participants consenting to a home visit (N=483). NLDS participants who agreed to a home visit were similar in sociodemographic and cultural factors to the total NLDS population (**Supplemental Table 1**).

Covariates. We considered the following factors in directed acyclic graphs (DAGs)[55] of the association between US acculturation and poor sleep: sociodemographic variables (nativity, age, sex, income, education, employment, major lifetime occupation, language use, duration in the US, immigrant generation), lifestyle factors (diet, physical activity, smoking status, alcohol), and other health indicators (self-reported health, mental health disorders [e.g. depression, anxiety], body mass index [BMI], medication use, and insurance status). Education. We used different cutpoints for "high" and "low" education in SALSA and NLDS to account for cohort and location differences that relate to educational attainment.[48] In SALSA, we dichotomized education as "low" for <12 years and "high" as ≥12 years, a recurring cutpoint in SALSA research and studies with similar populations.[56,57] In NLDS, "low" education was categorized as <13 years and "high" as ≥13 years. Major lifetime occupation. Participants were asked "what job did you do most of your life?" and responses were categorized with census codes: manual, non-manual, and other (which included housewives and unemployed).[58,59]

Effect measure modifiers. Acculturation, sleep, and related health factors are embedded in socioeconomic context.[27] We examined educational attainment and major lifetime occupation as effect measure modifiers in the larger SALSA population to determine whether cross-sectional acculturation-sleep associations varied in direction and magnitude. While education and occupation are interrelated, each provides insight into different individual and societal dynamics. Education can indicate skillset and predict socioeconomic trajectory, while occupation can indicate factors like workplace responsibility and daily activity.[60,61]

Statistical analysis

All analyses were conducted in SAS 9.3 (SAS Institute, Inc., Cary, North Carolina). We explored descriptive characteristics of SALSA, NLDS, and the sub-sample of parent-offspring linked pairs. We then explored the interdependence of restless sleep across generations, the only sleep measure available in both cohorts, with a chi-square test of independence in parent-offspring linked pairs to inform our interpretation of the intergenerational results.

Cross-sectional multivariable regression analysis. First, we used log-binomial regression to assess associations between single-generation US acculturation and poor sleep measures (SALSA and NLDS cohorts examined separately) and then intergenerational US acculturation and poor sleep measures (SALSA parent-linked NLDS offspring). General estimating equations were used to account for within family clustering in intergenerational analyses.[62,63] Results were exponentiated to report prevalence ratios (PRs) and 95% confidence intervals (CIs). If models did not converge, we used a modified log-Poisson approach to approximate PRs.[64] We ran a model adjusted for demographics (Model 1: age, sex) and a sociodemographic-adjusted model (Model 2: age, sex, education) where we added education as the direction of influence between acculturation and education is debatable and likely bi-directional.[25,27]

Second, in parent-offspring linked pairs, we conducted an *intergenerational sleep sensitivity assessment* to explore whether parental sleep accounted for any association between intergenerational US acculturation and offspring sleep. Parental sleep can directly influence offspring sleep as a learned and reinforced behavior and we sought to determine if any acculturation-sleep association was driven by parental sleep rather than other acculturative or mediating health factors. We additionally adjusted for parental restless sleep (SALSA), the only sleep measure in both cohorts for comparability, in an intergenerational US acculturation-NLDS

offspring restless sleep analysis to isolate a measure of parental sleep measure from the same measure in offspring (i.e. restless sleep) and observe any changes in association.

Latent class analysis (LCA). Second, in SALSA we conducted a LCA[65] with five sleep measures (**Table 1**) to create latent sleep classes. LCA provides an opportunity to capture the complex, interrelated, and perhaps unobservable, components of sleep that are difficult to measure.[10] We fit baseline models for a range of two to five latent sleep classes and chose the final number of classes based on the best statistical fit (G^2 relative to the degrees of freedom [*df*]; Akaike information criterion [AIC]; Bayesian information criterion [BIC]). We used multinomial logistic regression and reported odds ratios (ORs) and 95% CIs for the odds of latent sleep class membership given US acculturation status in demographic- and sociodemographic-adjusted models.[66]

Effect measure modification. Fourth, in SALSA we explored the modifying roles of education and major lifetime occupation as both socioeconomic factors confer different levels of values, knowledge, opportunities, and experience that may modify the direction and magnitude of US acculturation-poor sleep associations.

RESULTS

Descriptive characteristics

Table 2 displays participant descriptive characteristics. In SALSA, the median age was 69.5 years and 58.3% were female. Education was low (<12 years) for 70.3% and 59.8% worked in manual occupations. Less than half were highly acculturated to the US (35.1%), and 54.4% were first generation immigrants. Restless sleep and overall fatigue were reported by 23.5% and 28.9%, respectively. In NLDS, the median age was 54.0 years (IQR: 48.0, 60.0) and 62.4% were female. Education was low (<13 years) for 36.8% of participants and 67.8% had high US

acculturation. Restless sleep, average sleep duration of less than 6 hours/night, and sleep apnea were reported by 39.9%, 16.9%, and 12.0%, respectively. In parent-offspring linked pairs, intergenerational US acculturation was low for 32.8%, upwardly mobile for 34.1%, and stable-high for 33.2%. As shown in **Table 2**, parent-offspring linked pairs were similar in culture and sociodemographic factors and sleep to the overall populations. We examined how sleep relates across generations with a chi-square test for independence between parental restless sleep (SALSA) and offspring restless sleep (NLDS). We rejected the null hypothesis of independence (p=0.03) and concluded parental and offspring restless sleep were statistically associated.

Cross-sectional multivariable analyses

In SALSA (**Table 3a**), single-generation high US acculturation (vs. low US/more oriented towards Mexico or other origin/ancestral country) was associated with less restless sleep (PR[95%CI]: 0.67[0.54, 0.84]), even when adjusting for age, sex, and education. Participants of third and greater immigrant generation reported less restless sleep than first generation immigrants (PR[95%CI]: 0.60[0.39, 0.91]); we observed no association for second immigrant generation participants (vs. first generation immigrants). We did not find an association between overall fatigue and US acculturation or immigrant generation. For example, high US acculturation-overall fatigue Model 2 estimates were null (PR[95%CI]: 1.03[0.87, 1.23]).

In NLDS (**Table 3b**), single-generation US acculturation and sleep outcomes were not associated. For example, high US acculturation-restless sleep Model 2 estimates were null (PR[95%CI]: 1.06[0.86, 1.31]). *Parent-linked offspring*. Participants with stable-high intergenerational US acculturation had a higher prevalence of <5 hours of sleep/night than participants with low intergenerational US acculturation (PR[95%CI]: 2.86[1.02, 7.99]), but this estimate was imprecise. Upwardly mobile intergenerational US acculturation (vs. low

intergenerational US acculturation/more culturally oriented towards Mexico or other origin/ancestral country across generations) was not associated with sleep durations.

Intergenerational sleep sensitivity assessment. We explored the role of parental sleep in intergenerational US acculturation-offspring sleep associations with restless sleep. Though associations between intergenerational US acculturation and offspring restless sleep were null (**Table 3b**), we explored how additional adjustment for parental restless sleep influenced results (**Supplemental Table 2**). The estimate changed by <10% and we concluded that parental restless sleep was not an important explanatory variable for the observed intergenerational US acculturation-offspring restless sleep results.

Latent class analysis (LCA)

Baseline latent classes. In SALSA, three latent classes of sleep were the best statistical fit for the data (**Supplemental Table 3**) and each class had clear interpretability: best sleep, 36.9% (standard error[SE]: 0.05) of the study population; average sleep, 40.7% (SE: 0.11); and worst sleep, 22.4% (SE: 0.10). **Figure 1** presents conditional probabilities of a "yes" response for each of the five measures of poor sleep given latent class membership (**Supplemental Table 4**). Participants in the worst sleep class had the highest probability of a "yes" response to all poor sleep measures, and those in the best sleep class had the lowest, except for responses to waking up several times a night. The probability of "yes" response to waking up several times a night was higher for participants in the best sleep class (probability[SE]: 0.063[0.016]) than the average sleep class (probability[SE]: 0.027[0.127]), but this did not substantially detract from the meaningfulness of the latent class labels.

LCA classes and covariates. We examined whether US acculturation level or immigrant generation predicted latent sleep class membership when adjusting for age, sex, and education

(**Table 4**). Acculturative level was a significant predictor of latent class membership (p=0.00), while immigrant generation was not (p=0.11). When compared to low US acculturation participants, high US acculturation participants had a higher odds of membership in the best sleep class than the worst sleep class (OR[95%CI]: 1.62[1.09, 2.40]) and a higher odds of membership in the average sleep class than the best sleep class (OR[95%CI]: 1.86[1.00, 3.48]).

Effect measure modification by educational attainment level

In SALSA (**Table 5**), there was some evidence that education modifies the relationship between immigrant generation and restless sleep. Though CIs overlapped slightly, low education-third and greater immigrant generation participants reported a lower prevalence of restless sleep than low education-first generation immigrants (PR[95%CI]: 0.35[0.17, 0.72]), and the association was null for high education participants (PR[95%CI]: 1.31[0.67, 2.58]). We did not observe significant effect modification for restless sleep among second immigrant generation participants compared to first generation immigrants. For fatigue, the education stratified estimates were not statistically signiticant and CIs overlapped. However, the direction of the point estimates suggested high education-third and greater immigrant generation individuals reported more fatigue than high education-first generation immigrants (PR[95%CI]: 1.30[0.82, 2.04]), while low education-third and greater immigrant generation participants reported less fatigue than low education-first generation immigrants (PR[95%CI]: 0.67[0.42, 1.09]).

Effect measure modification by major lifetime occupational category

In SALSA (**Table 6**), we did not observe modification between acculturative measures and restless sleep. Conversely, we did observe modification of immigrant generation-fatigue associations by occupational category. When adjusting for age, sex, and education, non-manual labor-third and greater immigrant generation participants reported more fatigue than non-manual

labor-first generation immigrants (PR[95%CI]: 1.86[1.11, 3.10]); the same associations for manual laborers and other laborers were null (PR[95%CI]: 0.74[0.46, 1.20] and 0.61[0.28, 1.32], respectively). We did not observe modification by occupational category for reported fatigue among second immigrant generation participants when compared to first generation immigrants.

DISCUSSION

This is the first study, to our knowledge, to examine the association between a validated acculturation scale and multiple measures of sleep among two generations of Latinos. Overall, associations between US acculturation and poor sleep varied by generational cohort, acculturation status of previous generations (i.e. intergenerational acculturation), and socioeconomic context. Specifically, among the older Latino cohort, those with high US acculturation had better sleep outcomes than those with low US acculturation overall, but we then found associations were modified by educational and occupational status. Conversely, among the middle-age Latino cohort, high intergenerational US acculturation was associated with shorter sleep durations (i.e. worse sleep) than low intergenerational US acculturation. Results for middle-age Latinos supported a negative acculturation hypothesis for sleep, while associations among older Latinos refuted a negative influence. The differential results by generational cohort may be attributable to differing sociocultural profiles and trajectories, differing age groups, or both.

More specifically, older Latinos with single and intergenerational (i.e. number of immigrant generations) measures of high US acculturation reported better sleep (i.e. less restless and more likely to be in the best sleep class than the worst) than participants with low US acculturation measures. We used immigrant generations as a proxy of intergenerational US acculturation whereby more familial US generations indicated higher intergenerational US

acculturation. When compared to first generation immigrants, the lowest measure of intergenerational US acculturation, an acculturative advantage for sleep was observed among third and greater immigrant generations, but not among second immigrant generation participants. This highlights the importance of intergenerational measures to fully capture the range of acculturative influence on health and sleep. It also suggests that an acculturative advantage for sleep may not extend to more bicultural orientations like that of second immigrant generation Latinos (i.e. US-born participants with at least one foreign-born parent).

Multiple factors may explain these findings. First, poor sleep is associated with psychosocial stress[67,68] and poor mental health,[23,69] and these factors may be more prevalent among individuals residing in the US with low US acculturation due to more daily acculturative stressors (e.g. low community integration and social support, language barriers).[70-74] Perceived discrimination is an acculturative stressor that may mediate this association as it is linked to low acculturation towards a country where one resides, poor mental health,[70,71] and worse sleep.[68,75,76] In the context of high US acculturation, the same opposing factors (i.e. strong social support and community integration)[25] may improve sleep by the reverse mechanisms (i.e. enhanced mental health, and less stress and loneliness).[23,77]

Second, these results may be a function of age as some studies exploring US acculturation and health among older Latinos have found no associations or improved outcomes.[78-80] For example, in our study population, Lopez et al. identified better cardiovascular outcomes among the highly acculturated,[78] and an extensive body of literature has linked poor cardiovascular health to poor sleep.[81] Those highly acculturated are also likely to have a higher socioeconomic position (SEP) and more healthcare access to better manage the chronic illnesses and disabilities that are characteristic of older age.[23,79] Third, findings may also be attributable to

sociocultural characteristics specific to SALSA as the cohort can be characterized by generally low SEP (e.g. **Table 2**: 70.3% had <12 years of educational attainment), and some research has shown high US acculturation may associate with better health in low SEP settings.[78,82-86] Thus, we may not expect to see these same associations in the NLDS cohort at older age due to differences in sociocultural profiles and trajectories. For example, at middle-age, NLDS already had a higher SEP and acculturative level than the older SALSA cohort (**Table 2**), indicating that at middle-age SALSA and NLDS were not socioculturally similar. Each cohort has a unique sociocultural trajectory that is likely to differentially influence lifecourse health.

Results for middle-age Latinos were in line with the negative acculturation hypothesis and previous literature.[18,21,22,34-38] High intergenerational US acculturation participants reported shorter sleep durations than low intergenerational US acculturation participants. There are multiple underlying health behaviors (e.g. poor diet, more alcohol use and smoking) and outcomes (e.g. obesity, diabetes, cardiovascular disease) associated with both high US acculturation and poor sleep that may explain our findings.[18,21,31,33] We found that restless sleep among parents was statistically associated with restless sleep among offspring, but our sensitivity assessment provided little evidence that parental sleep was an important explanatory variable between intergenerational US acculturation and offspring sleep in our study population. Future studies should first seek to replicate these results and to understand the mechanisms underlying the intergenerational contributions, and then explore mediating health factors and the sociocultural mechanisms that facilitate these pathways. For example, if we found that poor diet and obesity mediated these findings and that familial and social networks facilitated diet, poor sleep prevention and intervention efforts could target these factors.

Among middle-age Latinos, we found associations between intergenerational acculturation and sleep duration, but we did not find single-generation acculturation associations, again highlighting the importance of intergenerational assessments. As with intergenerational measures among older Latinos, though in the opposite direction, we did not observe clear differences in sleep between upwardly mobile (i.e. the intermediate level) and low intergenerational acculturation participants. When cultural orientations are more bicultural in nature (i.e. influenced by the country where they reside and the origin or ancestral country), the positive and negative influences of acculturation on sleep may counteract.

We then explored the socioeconomic context of acculturation and sleep among the larger study population of older Latinos with measures of educational attainment and major lifetime occupational category. There was evidence that both education and occupation modified associations between immigrant generations, our proxy for intergenerational acculturation, and poor sleep measures, but we did not observe modification for single-generation acculturation. Among lower education participants, high intergenerational US acculturation (i.e. three or more immigrant generations in the US) was associated with better sleep (i.e. less restless), but among higher education participants, the association was null among higher education participants, providing further support for a beneficial association between high US acculturation and sleep in a low SEP setting.[78,82-86]

Among participants with non-manual lifetime occupations, high intergenerational US acculturation participants (i.e. three or more immigrant generations in the US) reported more fatigue, an indicator of worse sleep quality, than low intergenerational US acculturation participants (i.e. first generation immigrants); the same association was null for other occupational categories. Among older Latinos, this is the only finding that aligns with the

negative acculturation hypothesis.[25-28,30-33] Non-manual labor may capture a higher SEP in our population that we were unable to capture with education given the low attainment overall in the cohort, providing support for the negative acculturation hypothesis with sleep outcomes in a higher SEP setting.[78,82-86] Non-manual laborers often have more workplace responsibilities and resulting work-related psychosocial stress than manual laborers,[87,88] which when combined with poor health behaviors associated with high US acculturation (e.g. alcohol use, smoking)[25-28,30-33] may jointly impact sleep negatively.[18,21,22,67] The sedentary nature of non-manual labor may also partially bias our findings as fatigue can be prolonged, more noticeable, and thus more reportable in sedentary settings.

This study had several limitations. First, we used cross-sectional data and were therefore unable to determine temporality or discount reverse causality, as sleep can also influence the adoption of cultural behaviors and trends. However, the intergenerational findings provide some confidence that we are measuring temporal changes with parent to offspring acculturation. Second, the scope of our multidimensional acculturation measure was limited as we were unable to assess biculturalism and downwardly mobile intergenerational acculturation due to limited sample sizes in both categories. Third, subjective unidimensional measures are not the gold standard for sleep,[10] but we used latent class methods to create a multidimensional measure that also captured underlying and unobservable sleep characteristics.[66] Fourth, comparability between our two cohorts is limited as each cohort can be characterized by unique sociocultural characteristics that have accumulated over time to differentially shape health. Differing results between the two cohorts may be partially attributable to differing sociocultural cohort profiles rather than age-related differences, or both factors. However, our exploration of socioeconomic context in SALSA provided some insight into how acculturation and sleep may associate among

older Latinos in a high SEP setting (i.e. non-manual labor) that was more comparable to the socioeconomic make-up of the NLDS cohort.

Our study had several strengths. First, we used a well-validated multidimensional measure of acculturation to account for the intricacies of culture across multiple domains of identity, behaviors, and interpersonal relationships.[43] Second, we examined acculturation and sleep within a rich intergenerational cohort to account for acculturative shifts across generations and to explore how parental sleep may contribute to this association. We were then also able to examine cohort and age-related differences between acculturation-sleep associations. Third, we used sseveral unidimensional measures and created a multidimensional latent class measure for an in-depth exploration of the different dimensions and complexities of sleep.[10,66] Fourth, our use of PRs provided conservative and consistent estimates for intepretation.[89]

Overall, our results suggest that US acculturation may pattern sleep differentially by socioeconomic context and by age cohort, and that the acculturative status of previous generations (i.e. intergenerational acculturation) is a contributing factor. Among middle-age Latinos, high intergenerational US acculturation was associated with shorter sleep durations (i.e. worse sleep) than low intergenerational US acculturation. Conversely, among older Latinos, single and intergenerational measures of high US acculturation were associated with better sleep (i.e. less restless and more likely to be in the best sleep class the worst) than low acculturation measures. However, among higher SEP older Latinos, we found some evidence of a negative acculturation association with sleep (i.e. more reported fatigue among non-manual laborers), which was also consistent with findings for middle-age Latinos.

In conclusion, our findings add to our understanding of the ways in which cultural orientation shapes Latino sleep across generations. Associations varied by generational cohort,

the acculturation status of previous generations, and socioeconomic context. Future research should utilize prospective and intergenerational designs to parse out the temporal relations between acculturation, SEP, and sleep over time and to elucidate the specific mechanisms underlying these associations to guide prevention and intervention efforts.

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Abbreviations:

AIC, Akaike information criterion; ARSMA, Acculturation Rating Scale for Mexican-Americans; AOS, Anglo orientation subscale; BIC, Bayesian information criterion; BMI, body mass index; CI, confidence interval; DAG, directed acyclic graphs; df, degrees of freedom; IQR, interquartile range; LCA, latent class analysis; MOS, Mexican orientation subscale; NLDS, Niños Lifestyle and Diabetes Study; OR, odds ratio; PR, prevalence ratio; SALSA, Sacramento Area Latino Study on Aging; SE, standard error; US, United States.

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