PEER REVIEW HISTORY

ARTICLE DETAILS

TITLE (PROVISIONAL)	Disparities in Multiple Sleep Characteristics among Non-Hispanic Whites and Hispanic/Latino Heritage Groups by Birthplace and Language Preference: Cross-sectional Results from the United States National Health Interview Survey
AUTHORS	Gaston, Symielle; Martinez-Miller, Erline; McGrath, John; Jackson II, W. Braxton; Napoles, Anna; Pérez-Stable, Eliseo; Jackson, Chandra

VERSION 1 – REVIEW

REVIEWER	Hege, Adam Appalachian State University, Department of Health & Exercise Science, Public Health
REVIEW RETURNED	Appalachian State University, Department of Health & Exercise Science, Public Health

GENERAL COMMENTS	Overall, this is a really well-performed study and manuscript exploring differences/disparities in sleep characteristics among U.S. born and foreign-born non-Hispanic whites and Hispanic/Latino groups in the U.S. Further, the researchers examined the role of language and birthplace as an influencing factor on the relationships as well. However, the reviewer has some minor suggestions for improvement of the manuscript, specifically in the introduction and discussion sections, that are provided below. Introduction: The reviewer would suggest breaking the current two paragraphs into 4-5 paragraphs. It feels/reads like the concepts could be organized more effectively and the reviewer had challenges following it (after the first 1-2 sentences). - 1st paragraph - poor sleep as a public health issue (the broad implications) - 2nd paragraph - disparities that exist based on the evidence - 3rd and 4th paragraph - focus on the issues found among the larger Hispanic/Latino population in the U.S. broadly and then specific to sleep - 5th paragraph - what hasn't been done prior to the current study and then what the present study intends to accomplish Methods and Results: - The methods and results sections are very thorough and the approach is appropriate. The tables and results are clear and easy

	to follow. The reviewer has no suggestions or recommendations - well done! Discussion: Overall, really good. With the authors mentioning environmental factors in paragraph 4 and providing some examples, the reviewer would suggest that the authors provide a few example solutions at the conclusion of the manuscript. The conclusion provides the example of culturally tailored interventions - what about policy/structural changes (work conditions, SES, housing, etc.) to address the environmental factors/determinants (maybe 2-3 sentences to conclude the manuscript)?

REVIEWER	Ratcliff, Chelsea G Sam Houston State University, Psychology
REVIEW RETURNED	13-Feb-2021

GENERAL COMMENTS	Summary Using pooled 2004-2017 National Health Interview Survey data, this study examines differences in self-reported sleep (duration, number of times/week they had trouble falling asleep, trouble staying asleep, awoke not feeling rested, and sleep medication use) stratified by ethnicity (i.e., non-Hispanic White vs. a variety of heritage within the Hispanic/Latino ethnicity) and birthplace (US vs. non-US born) and language preference (used as a proxy for acculturation). Study findings (by and large) replicate what has been found in other studies, namely that individuals of Hispanic/Latino heritage fair better on a number of health measures (including sleep) compared to non-Hispanic White individuals. However, this study examined birthplace and separate heritage groups within the Hispanic/Latino ethnicity, which previous studies have not done. Though these findings may make an important/novel contribution to the literature and be used to inform clinical practice (e.g., targeting sleep interventions to those in greatest need), changes to the way which the authors frame their findings will help readers to better understand and make use of this study's findings. Major Points As the authors note in the limitations, there are many comparisons being made in this study. To make sense of the purpose and implications of these many comparisons, it would help readers greatly for the authors to state the study's hypotheses in the introduction and to note how the findings fit within hypotheses in the discussion. The introduction does not state the direction of the effects found in previous research (with 1 exception on p. 7 line 18). For example, on p. 7 line 26, it would help to clarify if foreign- or US-born NWH report poorer sleep. Similarly, on p. 7 line 40, to clarify if previous research found that acculturation is related to better or worse health behaviors. It would also help to frame this study design, (presumed) hypotheses, and findings in the context of the larger phenomenon known as the "Hispanic paradox," in which Hispanic individuals, especially those who are less acculturated and/or not born in the US tend to report better health outcomes, including sleep (the authors cite several papers that frame their findings in the context of the Hispanic paradox) and even mortality (e.g., Ruiz et al., 2013, Am J Public Health) compared to non-Hispanic White individuals, despite experiencing greater risk factors for poor health. It seems that the findings of

	this study are basically in keeping with this phenomenon, with a few exceptions (e.g., the findings related to Puerto Rican participants). Minor Points • Analyses related to language preference as a proxy for acculturation is not in the abstract. If possible, would be helpful to include, though word limits may prevent this. • Would be helpful to mention why sleep outcomes were not kept continuous. • Please clarify how participants were asked about their language preference in the methods section. • Please clarify if the survey inquired about sleep disorders (e.g., sleep apnea) and how sleep disorders may factor into the findings. • Is there any precedent for language preference being used as a proxy for acculturation? Also, some additional justification for the decision to use language as a proxy for acculturation would be helpful. • The description of the potential confounders could be streamlined. • Page 13, lines 39-46: these two sentences (starting with "Overall, adults of Cuban heritage…") seem contradictory. Would help to clarify the meaning here. • As noted above, the discussion section could potentially frame these findings in the larger context of the Hispanic health paradox. Even if the authors choose to not reference this larger phenomenon, it would be helpful for the author to more clearly state the implications of this study (i.e., what exactly they want readers to take away from this study). • Similar to the introduction, the direction of effects mentioned as being found in previous literature is often not stated. For example, it's not clear what references 13, 32-38 (mentioned in the discussion) found or how exactly they relate to this study. • P16, the paragraph starting at line 46 seems to be in contrast to many of the study's findings. It notes that lower SES, etc. may explain why foreign-born NWH have poorer sleep than US-born NWH, but this does not explain why foreign-born Mexican, Cuban, and Central American individuals reported better sleep than US-born NWH. • The discussion may also want to mention that (it seems, looking at Table 1) that the differences in percentages of individuals reporting different sleep categories is not that dramatic, other than Puerto Ricans. • In Table 1, the "sleep duration" variable seems to be broken down into different categories than those described in the manuscript text (text refers to "very short sleep" as being <5 hours, and "short sleep" as being <7 hours, but table has a <7 and <6 category). Additionally, it would help to clarify if the <7 category includes those in the <6 category (I believe so, because the percentages add to greater than 100). clearer to present the categories of "short sleep" and "very short sleep" as the manuscript mentions.

REVIEWER	Smith, Jonathan P. Yale University, Health Policy and Management
REVIEW RETURNED	01-Mar-2021

GENERAL COMMENTS	Dear Natasha Leeson, Managing Editor, BMJ Open:

	Thank you for inviting me to review the submitted manuscript, titled, “Disparities in Multiple Sleep Characteristics among US-born and Foreign-born Non-Hispanic Whites and Hispanic/Latino Heritage Groups in the United States: Modification by Birthplace and Language Preference,” written by Symielle A. Gaston et al. I do not have any conflict of interest nor do I know any of the authors personally or work with them professionally. I reviewed this manuscript with delight. In this very well-constructed and well-written analysis the authors aim to compare sleep characteristics between racial/ethnic groups, taking the unique step of investigating both U.S. born and foreign-born non-Hispanic whites and Hispanic/Latino heritage groups. To my knowledge, this is the first study which has so carefully documented heterogeneity in heritage and its impact on sleep characteristics, illustrating these differences with Poisson regression with robust variance. In my opinion, this analytic approach is preferred in the analysis of these cross-sectional data and thus was a good choice to address the specific study questions. In contrast to the overwhelming literature in this subject matter, which lumps Hispanic and Latino respondents into a homogenous category, the authors took on the challenge of teasing out specific heritage groups among survey respondents. Though their analysis and results are complex, given the marked heterogeneity in cultural practices and influences among Hispanic and Latino heritage groups, elucidating such differences is invaluable. I have no doubt this analysis will prove useful in its contribution to the evolving field of sleep research. I have a few broad comments, none of which are of overly great concern and none of which should preclude the publication of this manuscript. (1) A consequence of the great complexity of this work is that the message is slightly diffused. The authors did an excellent job of clearly stating the broad takeaway points in the discussion, though from a practical standpoint many of the results and figures are easy to gloss over. a. For instance, while Table 1 provides a wealth of information, from an outside reader it is quite overwhelming – so overwhelming in fact that I got frustrated trying to read through it. Bluntly, I can’t imagine a lay reader taking anything meaningful away from this table - when I’m jotting down “row 72, column 15,” and not even at the end of the table, that is just too much information for the primary manuscript in my opinion. Perhaps there is a copyediting/layout solution to this or consider moving the larger tables to a supplemental (as with many of the PR results). (2) While it is commonplace for analyses to fully adjust for possible confounders, I am often leery of models with such a large number of covariates. I would encourage the authors to better justify the need for each confounder in the model, not only as they relate to the exposures and outcomes, but also how they relate to each other. I find it hard to believe that there would not be some spurious association between the covariates when the model is so complex coupled with so many comparisons. One approach may be to select the fewest number of covariates that have the strongest association with the outcome. Or, although not a causal

	interpretation, it may be worthwhile creating a directed acyclic graph for the supplemental or some other justification for the inclusion of each confounder (i.e., bivariate analysis for the supplemental). (3) In that vein, multiple comparisons in the same dataset is always a concern and this analysis is an exquisite example of this issue. The authors address this briefly in the discussion ("…we tested for many associations and did not adjust for multiple comparisons due to the novelty of our study and our interest in identifying potential associations that may warrant further investigation."). This, however, does not sufficiently justify to me the authors choice for omitting correction in their analysis (i.e., Bonferroni confidence interval, or some more elegant method). In direct opposition to the author's statement, one could argue that due to the novelty of the study more attention must be paid to this limitation. Reporting associations that may be due to chance may send talented researchers on a wild goose chase for causal mechanisms that do not exist. The authors have clearly invested considerable effort in ensuring this analysis is strong and informative, and I want to reiterate that fully evaluating the above issues is not a requirement for my positive recommendation for publication; they simply may help strengthen the manuscript and the science of the matter at large. Overall, this manuscript presents an extremely strong, well-rounded analysis that contributes greatly to the field of sleep epidemiology and provides new insight into scientific inquiry on the matter. Sincerely, Jonathan P. Smith, PhD, MPH

VERSION 1 – AUTHOR RESPONSE

Reviewer: 1
Dr. Adam Hege, Appalachian State University

Comments to the Author:
Overall, this is a really well-performed study and manuscript exploring differences/disparities in sleep characteristics among U.S. born and foreign-born non-Hispanic whites and Hispanic/Latino groups in the U.S. Further, the researchers examined the role of language and birthplace as an influencing factor on the relationships as well. However, the reviewer has some minor suggestions for improvement of the manuscript, specifically in the introduction and discussion sections, that are provided below.

RESPONSE: Thank you.

Introduction:

The reviewer would suggest breaking the current two paragraphs into 4-5 paragraphs. It feels/reads like the concepts could be organized more effectively and the reviewer had challenges following it (after the first 1-2 sentences).

- 1st paragraph - poor sleep as a public health issue (the broad implications)

- 2nd paragraph - disparities that exist based on the evidence
- 3rd and 4th paragraph - focus on the issues found among the larger Hispanic/Latino population in the U.S. broadly and then specific to sleep
- 5th paragraph - what hasn't been done prior to the current study and then what the present study intends to accomplish

RESPONSE: Thank you for the suggestion, which further clarifies the text. We have revised the introduction so that the introduction outline is now as follows:

- Paragraph 1: Sleep is a public health problem.
- Paragraph 2: Disparities exist in poor sleep; however, there are limitations related to defining populations in sleep disparities research.
- Paragraph 3: We describe the socioecological framework as the basis for our current research question.
- Paragraph 4: We describe important gaps in the literature, how we will address those gaps, and we state the aims as well as the hypotheses.

We hope that our revised approach satisfies the reviewer's concern.

Methods and Results:

- The methods and results sections are very thorough and the approach is appropriate. The tables and results are clear and easy to follow. The reviewer has no suggestions or recommendations - well done!

RESPONSE: Thank you!

Discussion:

Overall, really good. With the authors mentioning environmental factors in paragraph 4 and providing some examples, the reviewer would suggest that the authors provide a few example solutions at the conclusion of the manuscript. The conclusion provides the example of culturally tailored interventions - what about policy/structural changes (work conditions, SES, housing, etc.) to address the environmental factors/determinants (maybe 2-3 sentences to conclude the manuscript)?

RESPONSE: The Reviewer has brought up an excellent point. We agree that there are structural changes that may also address sleep disparities. As suggested, we have added additional text to the conclusion, which is provided below for your reference.

"Further, coupling culturally tailored interventions with structural changes related to environmental justice such as equitable social, economic, and housing policies may further improve sleep health while reducing sleep health disparities."

Reviewer: 2
Dr. Chelsea G Ratcliff, Sam Houston State University

Comments to the Author:
Summary

Using pooled 2004-2017 National Health Interview Survey data, this study examines differences in self-reported sleep (duration, number of times/week they had trouble falling asleep, trouble staying asleep, awoke not feeling rested, and sleep medication use) stratified by ethnicity (i.e., non-Hispanic White vs. a variety of heritage within the Hispanic/Latino ethnicity) and birthplace (US vs. non-US born) and language preference (used as a proxy for acculturation). Study findings (by and large) replicate what has been found in other studies, namely that individuals of Hispanic/Latino heritage fair better on a number of health measures (including sleep) compared to non-Hispanic White individuals. However, this study examined birthplace and separate heritage groups within the Hispanic/Latino ethnicity, which previous studies have not done. Though these findings may make an important/novel contribution to the literature and be used to inform clinical practice (e.g., targeting sleep interventions to those in greatest need), changes to the way which the authors frame their findings will help readers to better understand and make use of this study's findings.

Major Points
As the authors note in the limitations, there are many comparisons being made in this study. To make sense of the purpose and implications of these many comparisons, it would help readers greatly for the authors to state the study's hypotheses in the introduction and to note how the findings fit within hypotheses in the discussion.

RESPONSE: Thank you for the suggestion. We have added hypotheses to the introduction, and the text is provided below for your reference:

"We hypothesized better sleep among foreign-born vs. US-born NHWs and that Hispanic/Latino-NHW sleep disparities would vary by both nativity (i.e., US-born vs. foreign-born) and birthplace (e.g., Mexico, Puerto Rico). In a secondary aim, we investigated language preference, a marker of acculturation, as a modifier. We hypothesized that Hispanic/Latino-NHW sleep disparities would be greater if Hispanic/Latino adults completed surveys in English vs. Spanish."

Also, the following text is now in the discussion:

"In a nationally representative sample of NHW and Hispanic/Latino adults, we found sleep disparities between foreign-born and US-born NHWs, and differences in sleep characteristics varied by Hispanic/Latino heritage, birthplace/nativity, and language of interview among Hispanics/Latinos compared to NHWs. Although results among NHWs were counter to our hypothesis, results for Latinos were congruent with our hypothesis."

The introduction does not state the direction of the effects found in previous research (with 1 exception on p. 7 line 18). For example, on p. 7 line 26, it would help to clarify if foreign- or US-born NWH report poorer sleep.

RESPONSE: We now state the direction of associations found in prior studies. The text, with newly inserted text underlined, is provided below for your convenience:

"However, heterogenous heritage groups within the Hispanic/Latino community are often combined into one category [4, 8-10]. Further, the reference group of NHWs is also heterogenous and usually comprises both US-born and foreign-born NHWs despite evidence of sleep disparities between the two groups [9, 11]. These studies suggested a lower unadjusted prevalence of habitual sleep duration of <7 hours among foreign-born compared to US-born NHWs [9] and that in the overall population of US adults, foreign-born individuals had higher odds of self-reported 7-8 hours of habitual sleep duration than US-born individuals after adjustment for sociodemographic characteristics, health behaviors, and clinical characteristics [11]."

Similarly, on p. 7 line 40, to clarify if previous research found that acculturation is related to better or worse health behaviors.

RESPONSE: Thank you for requesting clarification. We have now provided the direction of associations pertaining to acculturation. The text, with newly inserted text underlined, is provided below for your reference:

“For instance, language acculturation is a strong indicator of overall acculturation that is hypothesized to influence disparities in health behaviors [13, 14]. However, results regarding acculturation are mixed and generally suggest negative associations for certain health outcomes (e.g., diet) but protective associations with other outcomes (e.g., sleep) [13, 14].”

It would also help to frame this study design, (presumed) hypotheses, and findings in the context of the larger phenomenon known as the “Hispanic paradox,” in which Hispanic individuals, especially those who are less acculturated and/or not born in the US tend to report better health outcomes, including sleep (the authors cite several papers that frame their findings in the context of the Hispanic paradox) and even mortality (e.g., Ruiz et al., 2013, Am J Public Health) compared to non-Hispanic White individuals, despite experiencing greater risk factors for poor health. It seems that the findings of this study are basically in keeping with this phenomenon, with a few exceptions (e.g., the findings related to Puerto Rican participants).

RESPONSE: As suggested, we have now explicitly discussed the “Hispanic Paradox”, which was originally recognized in the cardiovascular disease literature, in the context of our study. Text from the introduction now reads:

“Relatedly, the lack of sleep disparities observed among Mexican Latinos compared to NHWs is hypothesized as due to lack of acculturation (e.g., being born in Mexico and speaking Spanish at home) among Mexican adults [14]. These findings relate to the “Hispanic Paradox” that was originally observed in the cardiovascular disease (CVD) literature in which adults of Mexican origin in the US were likely to have risk factors for CVD yet were less likely to have CVD compared to their NHW counterparts. It has been hypothesized that acculturative factors like use of the Spanish language, of which the linguistic intricacies promotes emotional identification and connection, may limit cumulative stress thus tempering the impact of those risk factors on CVD outcomes [15]. This exemplifies the “Hispanic Paradox” which suggests that cultural characteristics shape perceptions and response to stressors, which may also be true in relation to sleep, and investigation is necessary.”

Text within the discussion, with newly inserted text underlined, now reads:

“Several environmental and cultural factors that influence sleep behaviors and sleep health likely explain our findings. The negative acculturation effect, which has been observed as associated with sleep, posits that adoption of Western lifestyles leads to unhealthy behavior practices and declines in health [39]. Negative acculturation coupled with stress related to immigration status among foreign-born NHWs likely drive the unexpected disparity in sleep quality among foreign-born NHWs compared to US-born NHWs. Replication and further investigation of this possibility is warranted. The “Hispanic Paradox” likely explains our observations among all Latino heritage groups except for Puerto Rican adults in which all remaining heritage groups tended to have better sleep than NHWs, and Spanish language preference, a proxy measure for low language acculturation, appeared as a protective factor related to sleep health [14, 16]. The likely mechanism may be the greater ability to express emotions and reduce stress, which carries positive health impacts, when using the Spanish versus the English language [16]. Further, variation in sleep by birthplace and Hispanic/Latino heritage is likely due to differentially experienced environments and unique cultural backgrounds that influence health and coping behaviors. Risk factors for poor sleep including, for instance, low socioeconomic housing

environments, color-related stigma and discrimination, social (including acculturation) stressors, structural barriers, and health behaviors like smoking vary by Hispanic/Latino heritage groups with individuals of Puerto Rican descent usually more negatively affected compared to other heritage groups, which may manifest as differences in sleep health [13, 40-46]."

Minor Points
• Analyses related to language preference as a proxy for acculturation is not in the abstract. If possible, would be helpful to include, though word limits may prevent this.

RESPONSE: We have now included the analyses and results related to language preference in the abstract.

• Would be helpful to mention why sleep outcomes were not kept continuous.

RESPONSE: We now state why sleep outcomes were not kept continuous with the following text, "We defined sleep characteristics categorically based on evidence so that results could serve as potential intervention targets."

• Please clarify how participants were asked about their language preference in the methods section.

RESPONSE: Participants were not asked about language preference but were asked which language they preferred to complete the NHIS interview. The language of interview was the assumed language preference. The text states, "Participants selected the language in which they wanted to complete the NHIS interview. Language of interview was the assumed language preference, and we derived a proxy three-level language acculturation variable: English (high acculturation), English and Spanish (medium acculturation), or Spanish (low acculturation)."

• Please clarify if the survey inquired about sleep disorders (e.g., sleep apnea) and how sleep disorders may factor into the findings.

RESPONSE: Sleep disorders were not assessed in the NHIS. We now state the lack of measurement of sleep disorders as a limitation. The text is provided below for your reference:

"Third, sleep disorders such as insomnia and sleep apnea were not measured by the NHIS; however, these disorders may explain our results. Further study inclusive of sleep disorders is warranted."

• Is there any precedent for language preference being used as a proxy for acculturation? Also, some additional justification for the decision to use language as a proxy for acculturation would be helpful.

RESPONSE: Language used at home or with friends is often used as a measure of acculturation. We provide additional text in the introduction that further discusses the importance of language in acculturation, which reads:

"For instance, language acculturation is a strong indicator of overall acculturation that is hypothesized to influence disparities in health behaviors [13, 14], and has been widely used as a proxy for overall acculturation. However, results regarding acculturation are mixed and generally suggest negative associations for certain health outcomes (e.g., diet) but protective associations with other outcomes (e.g., sleep) [13, 14]. Relatedly, the lack of sleep disparities observed among Mexican Latinos compared to NHWs is hypothesized as due to lack of acculturation (e.g., being born in Mexico and speaking Spanish at home) among Mexican adults [14]. These findings relate to the "Hispanic Paradox" that was originally observed in the cardiovascular disease (CVD) literature in which adults of Mexican origin in the US were likely to have risk factors for CVD yet were less likely to have CVD

compared to their NHW counterparts. It has been hypothesized that acculturative factors like use of the Spanish language, of which the linguistic intricacies promote emotional identification and connection may limit cumulative stress thus tempering the impact of risk factors on CVD outcomes [16]. This exemplifies the “Hispanic Paradox” which suggests that cultural characteristics shape perceptions and response to stressors, which may also be true in relation to sleep, and investigation is necessary.”

• The description of the potential confounders could be streamlined.

RESPONSE: We are unsure of how to streamline the description of potential confounders to less than the one paragraph in which we currently describe them. However, we have edited the text for clarity. The paragraph that describes potential confounders now reads:

“Parameterizations of each potential confounder are listed in Table 1. Sociodemographic characteristics included age category, sex/gender, annual household income, educational attainment, unemployed/not in the labor force, 2000 Standard Occupational Classification categories for longest held occupation, marital/cohabitating status, time in the US, and Census region of residence. Health behaviors included smoking status, physical activity based on the Guidelines for Americans [25], and alcohol consumption. Clinical characteristics included body mass index (BMI) category calculated from self-reported height and weight [26], serious psychological distress [27], and self-report of physician-diagnosed dyslipidemia (available for survey years 2011-2017), hypertension, prediabetes or diabetes, and cancer. We additionally adjusted for “ideal” cardiovascular health (yes vs. no), a dichotomized version of the American Heart Association’s metric that includes meeting all of the following criteria: never smoker/quit smoking in the prior 12 months,normal BMI, and no report of physician diagnosis of dyslipidemia, hypertension, or prediabetes/diabetes [28].”

• Page 13, lines 39-46: these two sentences (starting with “Overall, adults of Cuban heritage…”) seem contradictory. Would help to clarify the meaning here.

RESPONSE: The text refers to both foreign-born and US-born adults of Cuban heritage. We have reordered the text to improve clarity. The text now reads, “Adults of Cuban heritage, overall, were less likely to report non-recommended sleep duration and poor sleep quality characteristics compared to US-born NHWs.”

• As noted above, the discussion section could potentially frame these findings in the larger context of the Hispanic health paradox. Even if the authors choose to not reference this larger phenomenon, it would be helpful for the author to more clearly state the implications of this study (i.e., what exactly they want readers to take away from this study).

RESPONSE: In the discussion, we now frame relevant findings in the larger context of the “Hispanic Paradox.” The newly inserted text as well as the implications of this study are provided below for your reference:

“The “Hispanic Paradox” likely explains our observations among all Latino heritage groups except for Puerto Rican adults in which all remaining heritage groups tended to have better sleep than NHWs, and Spanish language preference, a proxy measure for low language acculturation, appeared as a protective factor related to sleep health [14, 16]. The likely mechanism may be the greater ability to express emotions and reduce stress, which carries positive health impacts, when using the Spanish versus the English language [16]. Further, variation in sleep by birthplace and Hispanic/Latino heritage is likely due to differentially experienced environments and unique cultural backgrounds that

influence health and coping behaviors. Risk factors for poor sleep including, for instance, low socioeconomic housing environments, color-related stigma and discrimination, social (including acculturation) stressors, structural barriers, and health behaviors like smoking vary by Hispanic/Latino heritage groups with individuals of Pueto Rican descent usually more negatively affected compared to other heritage groups, which may manifest as differences in sleep health [13, 40-46]."

"In conclusion, consideration of variation in birthplace/nativity, heritage, language, and other cultural factors in future studies of racial/ethnic disparities in sleep health is important. Sleep disparities studies in the US often consider NHWs as the reference group despite heterogeneity in birthplace, which may lead to inaccurate conclusions about racial/ethnic disparities in sleep health. Studies also often combine Hispanic/Latino heritage groups despite cultural heterogeneity. Future studies should consider within group heterogeneity and disentangle cultural contributors in the social environment that influence sleep health and sleep health behaviors. Findings from such studies have the potential to inform culturally tailored public health interventions designed to improve sleep health among racial/ethnic subpopulations. Further, coupling culturally tailored interventions with structural changes related to environmental justice such as equitable social, economic, and housing policies may further improve sleep health while reducing sleep health disparities."

• Similar to the introduction, the direction of effects mentioned as being found in previous literature is often not stated. For example, it's not clear what references 13, 32-38 (mentioned in the discussion) found or how exactly they relate to this study.

RESPONSE: Thank you for requesting clarification. We now state that each example listed in the referenced sentence is a risk factor for poor sleep, which should now explain how the cited studies are related to the current study. Due to word limits, we cannot expand upon how each study finding is related to the current study; however, by reviewing the cited literature, readers can obtain the details regarding each study. The edited sentence is provided below for your reference:

"Risk factors for poor sleep including, for instance, low socioeconomic housing environments, color-related stigma and discrimination, social (including acculturation) stressors, structural barriers, and health behaviors like smoking vary by Hispanic/Latino heritage groups with individuals of Puerto Rican descent usually more negatively affected compared to other heritage groups, which may manifest as differences in sleep health [13, 40-46]."

• P16, the paragraph starting at line 46 seems to be in contrast to many of the study's findings. It notes that lower SES, etc. may explain why foreign-born NWH have poorer sleep than US-born NWH, but this does not explain why foreign-born Mexican, Cuban, and Central American individuals reported better sleep than US-born NWH.

RESPONSE: We believe the additional text related to the "Hispanic Paradox" that we describe in a prior response addresses the reviewer concern.

• The discussion may also want to mention that (it seems, looking at Table 1) that the differences in percentages of individuals reporting different sleep categories is not that dramatic, other than Puerto Ricans.

RESPONSE: While it is true there was little variation in the prevalence of sleep outcomes by birthplace/nativity within racial/ethnic/heritage groups, prevalence differed when comparing Hispanic/Latino heritage groups to NHWs. Although we performed within racial/ethnic group comparisons among NHWs, Hispanic/Latino heritage groups were compared to their NHW counterparts. Due to the comparisons of interest in the study, we chose not to compare

the unadjusted prevalences of the sleep parameters within racial/ethnic groups in the text. We do now, however, devote more text in the results to unadjusted prevalence of sleep. Newly inserted text is provided below for your reference:

“The prevalence of health behavior and clinical characteristics are presented in Tables 2 and 3. The prevalence of short sleep was highest among adults of Puerto Rican descent (39%). Although similar to the prevalence of short sleep among NHWs (29%) who showed little variation by nativity (28%- US-born vs. 27% foreign-born), short sleep prevalence was lowest among adults of Mexican descent (28%). Each Hispanic/Latino heritage group except adults of Puerto Rican descent were less likely than NHWs to report poor sleep quality indicators (e.g., trouble falling asleep) except nonrestorative sleep.”

We hope that our revised approach satisfies the reviewer’s concern.

• In Table 1, the “sleep duration” variable seems to be broken down into different categories than those described in the manuscript text (text refers to “very short sleep” as being <5 hours, and “short sleep” as being <7 hours, but table has a <7 and <6 category). Additionally, it would help to clarify if the <7 category includes those in the <6 category (I believe so, because the percentages add to greater than 100). clearer to present the categories of “short sleep” and “very short sleep” as the manuscript mentions.

RESPONSE: We have relabeled the sleep duration categories in Table 1. We have added a footnote to tables to indicate that the very short and short sleep duration categories are non-mutually exclusive. The manuscript text states, “Using evidence-based recommendations [23], we defined two non-mutually exclusive levels of short sleep duration: very short (≤5-hours) and short (<7-hours).”

Reviewer: 3
Dr. Jonathan P. Smith, Yale University, Emory University

Comments to the Author:
Dear Natasha Leeson, Managing Editor, BMJ Open:

Thank you for inviting me to review the submitted manuscript, titled, “Disparities in Multiple Sleep Characteristics among US-born and Foreign-born Non-Hispanic Whites and Hispanic/Latino Heritage Groups in the United States: Modification by Birthplace and Language Preference,” written by Symielle A. Gaston et al. I do not have any conflict of interest nor do I know any of the authors personally or work with them professionally.

I reviewed this manuscript with delight. In this very well-constructed and well-written analysis the authors aim to compare sleep characteristics between racial/ethnic groups, taking the unique step of investigating both U.S. born and foreign-born non-Hispanic whites and Hispanic/Latino heritage groups. To my knowledge, this is the first study which has so carefully documented heterogeneity in heritage and its impact on sleep characteristics, illustrating these differences with Poisson regression with robust variance. In my opinion, this analytic approach is preferred in the analysis of these cross-sectional data and thus was a good choice to address the specific study questions.

In contrast to the overwhelming literature in this subject matter, which lumps Hispanic and Latino respondents into a homogenous category, the authors took on the challenge of teasing out specific heritage groups among survey respondents. Though their analysis and results are complex, given the marked heterogeneity in cultural practices and influences among Hispanic and Latino heritage

groups, elucidating such differences is invaluable. I have no doubt this analysis will prove useful in its contribution to the evolving field of sleep research.

I have a few broad comments, none of which are of overly great concern and none of which should preclude the publication of this manuscript.

RESPONSE: Thank you! We are delighted that you enjoyed reviewing the manuscript and are grateful for the helpful comments.

(1) A consequence of the great complexity of this work is that the message is slightly diffused. The authors did an excellent job of clearly stating the broad takeaway points in the discussion, though from a practical standpoint many of the results and figures are easy to gloss over.
a. For instance, while Table 1 provides a wealth of information, from an outside reader it is quite overwhelming – so overwhelming in fact that I got frustrated trying to read through it. Bluntly, I can't imagine a lay reader taking anything meaningful away from this table - when I'm jotting down "row 72, column 15," and not even at the end of the table, that is just too much information for the primary manuscript in my opinion. Perhaps there is a copyediting/layout solution to this or consider moving the larger tables to a supplemental (as with many of the PR results).

RESPONSE: We agree that the breadth of the information provided in the manuscript may overwhelm a lay reader, particularly the information presented in Table 1. Having published similar-sized tables in the past, we believe the original Tables 2 and 3 will not appear as daunting after copy editing. For Table 1, however, we have now created three separate tables that include sociodemographic, health behavior, and clinical characteristics separately. We hope that our revised approach satisfies the reviewer's concern.

(2) While it is commonplace for analyses to fully adjust for possible confounders, I am often leery of models with such a large number of covariates. I would encourage the authors to better justify the need for each confounder in the model, not only as they relate to the exposures and outcomes, but also how they relate to each other. I find it hard to believe that there would not be some spurious association between the covariates when the model is so complex coupled with so many comparisons. One approach may be to select the fewest number of covariates that have the strongest association with the outcome. Or, although not a causal interpretation, it may be worthwhile creating a directed acyclic graph for the supplemental or some other justification for the inclusion of each confounder (i.e., bivariate analysis for the supplemental).

RESPONSE: Thank you for the suggestion. Due to the cross-sectional nature of the study and our inability to infer directionality/causality, we adjusted for important sociodemographic characteristics that are commonly adjusted for in the sleep literature and are independently associated with each other, nativity, and sleep in prior literature (i.e., age, sex, annual household income, educational attainment, employment, occupational class, marital status, and region of residence); alcohol consumption; serious psychological distress; a composite measure of health behavior and clinical characteristics that reflect cardiovascular health as defined by the American Heart Association; and cancer. We now cite studies that provide further justification for adjusting for these confounders in the methods section. We hope that our revised approach satisfies your concern.

(3) In that vein, multiple comparisons in the same dataset is always a concern and this analysis is an exquisite example of this issue. The authors address this briefly in the discussion ("…we tested for many associations and did not adjust for multiple comparisons due to the novelty of our study and our interest in identifying potential associations that may warrant further investigation."). This, however, does not sufficiently justify to me the authors choice for omitting correction in their analysis (i.e., Bonferroni confidence interval, or some more elegant method). In direct opposition to the author's

statement, one could argue that due to the novelty of the study more attention must be paid to this limitation. Reporting associations that may be due to chance may send talented researchers on a wild goose chase for causal mechanisms that do not exist.

RESPONSE: We understand the perspective of the reviewer and have now applied the false discovery rate multiple comparison procedure to all models as a sensitivity analysis. The results are described in Table 6 and are provided in supplemental material. As described in Table 6, after applying the false discovery rate procedure, 80% of our results that were statistically significant remained statistically significant.

Due to the novelty of our study, we did not aim to perform a confirmatory analysis but instead sought to identify associations that may guide further research. Rather than statistically penalize our findings or separate the different, although related, research questions into separate manuscripts, we chose to retain the original results as the main results and the multiple comparison correction as a sensitivity analysis. We hope that our approach satisfies the reviewer's concern.

The authors have clearly invested considerable effort in ensuring this analysis is strong and informative, and I want to reiterate that fully evaluating the above issues is not a requirement for my positive recommendation for publication; they simply may help strengthen the manuscript and the science of the matter at large. Overall, this manuscript presents an extremely strong, well-rounded analysis that contributes greatly to the field of sleep epidemiology and provides new insight into scientific inquiry on the matter.

RESPONSE: Thank you for the favorable and thorough review.

We hope that we have adequately addressed all reviewer suggestions. We look forward to your decision.

VERSION 2 – REVIEW

REVIEWER	Ratcliff, Chelsea G Sam Houston State University, Psychology
REVIEW RETURNED	30-Apr-2021

GENERAL COMMENTS	The authors have done a wonderful job responding to reviews and revising the manuscript accordingly.

REVIEWER	Smith, Jonathan P. Yale University, Health Policy and Management
REVIEW RETURNED	21-Apr-2021

GENERAL COMMENTS	Dear Natasha Leeson, Managing Editor, BMJ Open: Thank you for the opportunity to provide a reevaluation of the manuscript entitled, "Disparities in Multiple Sleep Characteristics among Non-Hispanic Whites and Hispanic/Latino Heritage Groups by Birthplace and Language Preference: Cross-sectional Results from the United States National Health Interview Survey," written by Dr. Symielle A. Gaston et al (bmjopen-2020-047834.R1).

	In this revision, the authors greatly strengthened both the context and methodology of this body of work. In the introduction, the authors better justified the necessity for this analysis by adding a more in-depth discussion regarding the motivation for this work (i.e., articulating the “Hispanic Paradox”). They also more overtly and discretely stated their hypotheses. Although less conservative than other procedures controlling for Type I error, the authors’ use of false discovery rate (FDR) struck a reasonable balance between exploration of the data and statistical inference. The authors also justified model covariate selection using empirical evidence. These revisions satisfy my largest concerns stated in my previous review. Other than a few minor typographical errors, I have no additional substantive concerns with this manuscript. My sense continues to be that this work will prove useful in sparking new avenues of inquiry that will ultimately improve the health of vulnerable populations. Sincerely, Jonathan P. Smith, PhD, MPH