PEER REVIEW HISTORY

BMJ Open publishes all reviews undertaken for accepted manuscripts. Reviewers are asked to complete a checklist review form (http://bmjopen.bmj.com/site/about/resources/checklist.pdf) and are provided with free text boxes to elaborate on their assessment. These free text comments are reproduced below.

ARTICLE DETAILS

<table>
<thead>
<tr>
<th>TITLE (PROVISIONAL)</th>
<th>THE CONTRIBUTION OF SHORT SLEEP DURATION TO ETHNIC DIFFERENCES IN CARDIOVASCULAR DISEASE: RESULTS OF THE HELIUS STUDY</th>
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<tr>
<td>AUTHORS</td>
<td>Anujuo, K; Agyemang, Charles; Snijder, Marieke; Jean-Louis, G; van den Born, Bert-Jan; Peters, Ron; Stronks, Karien</td>
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VERSION 1 – REVIEW

<table>
<thead>
<tr>
<th>REVIEWER</th>
<th>Luca Faconti</th>
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<td>King’s College London, United Kingdom</td>
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<tr>
<td>REVIEW RETURNED</td>
<td>24-Jul-2017</td>
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<table>
<thead>
<tr>
<th>GENERAL COMMENTS</th>
<th>The manuscript of Anujuo and colleagues provides a very interesting insight in the relationship between sleep duration and cardiovascular disease.</th>
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<td></td>
<td>The large sample size from the multiethnic HELIUS cohort allows the analysis of data from a well defined area and shows that sleep duration could account for ethnic differences in CVD.</td>
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<td>However, the main issue of the study (as clearly stated by the authors) is related to the use of self reported data for 1) sleep duration 2) cardiovascular disease 3) physical activity. All of them can be measured directly. Therefore, the way in which data have been collected makes very difficult to interpretate them since multiple bias can have an impact on the results. For example, patients could have reported as &quot;angina pectoris&quot; the retrosternal burning caused by gastroesophagel reflux disease which is associated with sleep disturbances such as shorter sleep duration, difficulty falling asleep, arousals and poor sleep quality.</td>
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<td>Other relevant issues are the followings :</td>
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<td>- The role of sleep apnea as a link between sleep duration and CVD should be addressed in the discussion.</td>
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<td>- Previous studies have investigated the the differences in</td>
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The objective of this study was to evaluate the association between self-reported short sleep duration and prevalent cardiovascular disease (CVD) in a multi-ethnic population of over 20,000 adults living in the Netherlands. The investigators found that short sleep was associated with CVD among all ethnic groups and that short sleep contributed to ethnic differences in prevalent CVD. Strengths of the study included its focus on a problem of significance, the large sample size, inclusion of a diverse population which has an increased burden of prevalent CVD. Although the findings are not particularly unique or innovative, the link between short sleep and CVD has not been previously been studied in this particular population and therefore the findings could have potential public health implications. Methodology is strong and the article is well written. However, there are several weaknesses. The study includes self-reported sleep duration and lacks more-in depth measures of sleep quality as well as objective measures of sleep. In addition, since long sleep is associated with adverse health outcomes, the manuscript would be strengthened by including an evaluation of this.

Other issues:
1) Introduction: there is an error on line 44-45. Should read “short sleep was associated with CVD in Hispanic and African Americans”
2) Methods/Results
a) Were depressive symptoms assessed? This potential confounder should be included in the multivariable model.
b) Sleep hypnotic and antidepressant medications are not reported in Table 1.
c) The authors make the point that the higher prevalence of short sleep in ethnic minorities contributes to the increased prevalence of CVD in these populations. However, it is not clear whether the strength of the association between short sleep and CVD is different in minorities vs the general Dutch population. The authors might consider evaluating ethnicity as an effect modifier of the association between short sleep and prevalent CVD.
d) The approach for calculating attributable risk seems somewhat atypical. Please justify or modify.
e) Table 1: verify that the 4.49% of Ghanians are current smokers.
3) Discussion
a) The discussion includes a discussion of the potential contribution of short sleep to increased allostatic load. Were there any measures of stress or the neighborhood environment? Both of these could contribute to sleep disturbances. Recommend citing literature which has demonstrated these types of associations (e.g., Chambers EC, Pichardo MS, Rosenbaum E. Sleep and the Housing and Neighborhood Environment of Urban Latino Adults Living in Low-Income Housing: The AHOME Study. Behav Sleep Med. 2016;14(2):169-8).
b) The potential role of genetic factors should also be taken into consideration and discussed.
GENERAL COMMENTS

This manuscript studies the relationship between sleep duration and cardiovascular diseases (CVD) within each of the ethnic groups included in this sample. It also studies the contribution of short sleep duration to the ethnic differences in CVD.

The great strength of this study is its large sample size, and the representativeness of six different ethnic groups in Amsterdam. HELIUS study is a longitudinal observational study of health. But, the sample included in this study should be described with more details.

In general, the introduction and discussion are well written, but I would like to see the methods described with more details. This will help to compare with other studies of similar design.

Methods:

1. A more detail description of the sample selected for this study is necessary. For example, what was the criteria to include or exclude participants in this sample if there were any? For example, current occupation and work schedule has not been mentioned in this study. Were night shift workers excluded from this sample? Were subjects suffering of insomnia and/or sleep apnea excluded from this sample?

2. It will be important to know the distribution of age of this population. We know only that the study included subjects between 18 and 70 years with a mean age of 40-46 years old. But, how is the distribution of age in the association of sleep with CVD and in the association of ethnicity with CVD?

3. Detail description of how outcomes were ascertained is missing. Please describe briefly the Rose questionnaire. How was any of the CVD outcomes assessed? Has the Rose questionnaire been validated among the minority groups included in this study?

4. What was the rational to choose these three CVD outcomes: angina pectoris, possible myocardial infarction and intermittent claudication? How was its distribution in this sample?

5. Ascertainment of sleep duration needs also a little more clarification. Did the survey questionnaire differentiate the sleep hour/night during weekends from during workday? Were there differences in the amount of hours of sleep/night during workday than during weekend?

6. How did the authors address the use of sleep medication in this sample?

7. Depression has been described as a confounder of the relationship of sleep duration with CVD and there may be differences of depressing symptoms in the different race/ethnic groups. How has depression been addressed in this sample?

8. Similarly, socioeconomic status has not been considering in any
of the associations studied sleep – CVD or ethnicity – CVD.

9. A sensitivity analysis stratifying first and second generation of non-Dutch ethnic origin is important to evaluate acculturation. There is the possibility that the first generation are in greater social disadvantage than the second generation when compared to the Dutch. On the other hand, first generation may still be following customs and culture from their country of origin whereas second generation are more adapted to the host country and to their food, probably with greater consumption of red meat and salt than that consumed by first generation. For example, it is known that Turks follow a Mediterranean diet (greater increase of olive oil in their diet), however, Turks in this study have the highest percentage of low HDL cholesterol among all ethnic groups.

10. Considering the large sample in this study, a different categorization of sleep duration would have brought more information about the distribution of sleep duration in this sample. For example, instead of categorizing sleep duration as binary, the following sleep duration would have been more descriptive:<6, 6-7, 7-8 and >=8. This is because 7 hours of sleep may not be necessary for some groups whereas for others may not be enough.

11. The authors should specify how they calculated the 95% CI for each group in Table 1, i.e. did they use the standard error of the mean. It may have been of interest to compared the confidence interval for the difference between each of the ethnic groups against the Dutch. Finally, how do they account for multiple comparisons?

Minor edits to correct:
1. In the abstract, it is missing the “95% CI” for one of the results.
2. Last line of page 7 and first line on page 8 have a repetitive phrase: “individuals with”

### VERSION 1 – AUTHOR RESPONSE

**Reviewer 1**

Comment 1: The manuscript of Anujuo and colleagues provides a very interesting insight in the relationship between sleep duration and cardiovascular disease.
Response: We are very pleased that the reviewer finds our study very interesting.

Comment 2: The large sample size from the multi ethnic HELIUS cohort allows the analysis of data from a well-defined area and shows that sleep duration could account for ethnic differences in CVD. However, the main issue of the study (as clearly stated by the authors) is related to the use of self-reported data for 1) sleep duration 2) cardiovascular disease 3) physical activity. All of them can be measured directly. Therefore, the way in which data have been collected makes very difficult to interpret them since multiple bias can have an impact on the results. For example, patients could have reported as “angina pectoris” the retrosternal burning caused by gastroesophageal reflux disease which is associated with sleep disturbances such as shorter sleep duration, difficulty falling asleep, arousals and poor sleep quality.

Response: We are grateful to the reviewer for this useful comment. Indeed, this study was based on self-reported data, which is inherent to most epidemiological studies. However, as the reviewer rightly emphasized, the analysis provide very interesting results, which will pave the way for further examination. This limitation has been emphasized in the limitation section as the reviewer acknowledged.

Comment 3: The role of sleep apnea as a link between sleep duration and CVD should be addressed in the discussion.

Response: Sleep apnea has been shown to be associated with CVD and cardiorespiratory problems [Jackson et al 2015, Netzer et al 2003]. Sleep apnea causes hemodynamic changes and significant sleep disturbances [Pinto 1993, Findley 1991]. Sleep apnea may confound the association between sleep duration and CVD. We did not investigate sleep apnea in our this study. This has been highlighted in the discussion in the limitation section on page 16.

Comment 4: In the model number 2 for the association between short sleep duration and prevalence of CV disease both BMI and WHR are present. Are they both used to define overweight status?

Response: Overweight was defined using BMI, whereas WHR is used to indicate fat distribution which is known to be associated with CVD independently of BMI.

Comment 5: Instead of using hypertension Model 2 can be adjusted for BP values?

Response: Our definition of hypertension in this study also captures BP measured values (both systolic and diastolic), and use of BP lowering medications, or self-reported hypertension (see page 7, last paragraph ), so by using hypertension in model BP has already been considered. When the analysis was done with continuous BP measures, the result essentially remain similar. However, if only BP values are adjusted for, the result may be incorrect because some participants may have low BP values due to the use of medication.

Comment 6: Previous studies have investigated the differences in cardiovascular risk in ethnic minorities group have highlighted a role of arterial stiffness and socio-economical circumstances. Those aspect should be added in the discussion.

Response: We thank the reviewer for this point. Indeed, our own work highlights the potential role of arterial stiffness and socio-economic circumstances to CVD risk among ethnic minority groups [Snijder et al., Int J Cardiol. 2015, Agyemang C et al., Stroke. 2014]. However, in this paper, we focus on sleep as an explanatory mechanism. Discussion on the role of alternative explanations such as mentioned by the reviewer are beyond the scope of our paper.

Reviewer 2
Comment 1: The objective of this study was to evaluate the association between self-reported short sleep duration and prevalent cardiovascular disease (CVD) in a multi-ethnic population of over 20,000 adults living in the Netherlands. The investigators found that short sleep was associated with CVD among all ethnic groups and that short sleep contributed to ethnic differences in prevalent CVD. Strengths of the study included its focus on a problem of significance, the large sample size, inclusion of a diverse population which has an increased burden of prevalent CVD. Although the findings are not particularly unique or innovative, the link between short sleep and CVD has not been previously been studied in this particular population and therefore the findings could have potential public health implications. Methodology is strong and the article is well written. However, there are several weaknesses. The study includes self-reported sleep duration and lacks more-in-depth measures of sleep quality as well as objective measures of sleep. In addition, since long sleep is associated with adverse health outcomes, the manuscript would be strengthened by including an evaluation of this.

Response: We agree that the findings could have potential public health implications. We are also grateful to the reviewer’s suggestions to further improve our manuscript. Indeed, we recognise that long sleep is associated with adverse health outcomes as reported in previous studies. Long sleep was thoroughly discussed by the team during the writing process. However, we decided not to include long sleep in this analysis because our previous studies show that the major problem of ethnic minority groups in our study is short sleep, as reported in our previous publications (Anujuo et al, 2014). In addition, the number of long sleepers are relatively small across the ethnic groups for a meaningful analysis. We have already clarified this in the text on page 5 (last paragraph) and page 6 (first paragraph).

Other issues:

Comment 1: Introduction: there is an error on line 44-45. Should read “short sleep was associated with CVD in Hispanic and African Americans”

Response: Correction has been effected, thank you.

Comment 2: Methods/Results
a). Were depressive symptoms assessed? This potential confounder should be included in the multivariate level.

Response: We have included the distribution of depressive symptoms in the descriptive analysis (table 1). We propose not to include depression in the multivariate analysis however. We agree with the reviewer that depressive symptoms could be considered a confounder of the association between sleep and CVD. At the same time, however, depressive symptoms could also be considered an intermediary factor. As such, it lies in the causal pathway B (Figure 1), indicating the impact of sleep on CVD independently of well-known cardiovascular risk factors, i.e. sleep might affect CVD through depression. We have clarified this in the method section on page 9.

b). Sleep hypnotic and antidepressant medications are not reported in table 1.

Response: We thank the reviewer for this point. Unfortunately, we do not have information on sleep hypnotic. We did not include antidepressant medications because it is not the focus of this paper. This limitation of sleep hypnotic has been included in the discussion (page 16)

c). The authors make the point that the higher prevalence of short sleep in ethnic minorities contributes to the increased prevalence of CVD in these populations. However, it is not clear whether the strength of the association between short sleep and CVD is different in minorities vs the general Dutch population. The authors might consider evaluating ethnicity as an effect modifier of the association between short sleep and prevalent CVD.
Response: We agree with the reviewer that ethnicity could function as an effect modifier of the association between short sleep and prevalent CVD. For that reason, we tested for interaction between short sleep and ethnicity. We did not find indications for this interaction, however. This point has been included in the method section, page 9, line 1-3.

d). The approach for calculating population attributable risk seems somewhat atypical. Please justify or modify.

Response: We calculated which part of the increased risk of CVD of ethnic minority groups could be attributed to inequalities in short sleep. A similar approach has been adopted/applied in previous studies on socio-economic inequalities in health. See, for example Psychosocial and behavioural factors in the explanation of socioeconomic inequalities in adolescent health: a multilevel analysis in 28 European and North American countries. Moor I, Rathmann K, Stronks K, Levin K, Spallek J, Richter M. J Epidemiol Community Health. 2014 Oct;68(10):912-21. This has been inserted in the text on page 9.

e). Table 1: Verify that the 4.49% of Ghanaians are current smokers

Response: Yes, 4.49% of Ghanaians being current smokers is correct. This population is known to have a very low prevalence of smoking (Brathwaite R et al. PLoS One. 2017;12:e0177291).

Comment 3: Discussion

a). The discussion includes a discussion of the potential contribution of short sleep to increased allostatic load. Were there any measures of stress or the neighborhood environment? Both of these could contribute to sleep disturbances. Recommend citing literature which has demonstrated these types of associations (e.g., Chambers EC, Pichardo MS, Rosenbaum E. Sleep and the Housing and Neighborhood Environment of Urban Latino Adults Living in Low-Income Housing: The AHOME Study. Behav Sleep Med. 2016;14(2):169-8).

Response: We are grateful to the reviewers for this comment. We have now included this reference in the introduction, as an explanation for the increased risk of short sleep among ethnic minorities.

b). The potential role of genetic factors should be considered and discussed.

Response: We thank the reviewers for this suggestion. Genetics may play a role in the association of sleep with CVD but this role is poorly understood. One study suggests that the interaction between sleep duration and genetics determines the (results of) association between sleep duration and CVD outcomes (Grandner et al 2013). This limitation has been inserted in the discussion (Page 16, line 14-18).

Reviewer 3

Methods

Comment 1: A more detail description of the sample selected for this study is necessary. For example, what was the criteria to include or exclude participants in this sample if there were any? For example, current occupation and work schedule has not been mentioned in this study. Were night shift workers excluded from this sample? Were subjects suffering of insomnia and/or sleep apnea excluded from this sample?
Response: We thank the reviewer for the very useful suggestions. We have now included information on occupational level and shift work in the study in table 1. In addition to the inclusion and exclusion criteria stated in the first paragraph of page 5, we did not assess insomnia and sleep apnea as we do not have the information. These points have been included in the limitation section (page 16).

Comment 2: It will be important to know the distribution of age of this population. We know only that the study included subjects between 18 and 70 years with a mean age of 40-46 years old. But, how is the distribution of age in the association of sleep with CVD and in the association of ethnicity with CVD?

Response: In the association of sleep with CVD and ethnicity with CVD, age was normally distributed and therefore treated as a continuous variable in the regression models.

Comment 3: Detail description of how outcomes were ascertained is missing. Please describe briefly the Rose questionnaire. How was any of the CVD outcomes assessed? Has the Rose questionnaire been validated among the minority groups included in this study?

Response: The Rose questionnaire was developed to detect ischemic heart pain, including angina pectoris and myocardial infarction and intermittent claudication (Rose et al 1997). Angina pectoris was indicated by responses to seven questions and possible myocardial infarction was indicated by responses to a single question. This has been described on page 6-7. Although the Rose questionnaire was not specifically validated for the ethnic groups included in this study, it has been used in similar manner in other studies (Fischbaker CM et al 2001).

Comment 4: What was the rational to choose these three CVD outcomes: angina pectoris, possible myocardial infarction and intermittent claudication? How was its distribution in this sample?

Response: The three CVD outcomes were chosen because they are components of Rose questionnaire regarded as a valid instrument for CVD measures (Rose et al 1997). Also these CVD endpoints (myocardial infarction, angina pectoris) have been used in similar manner in previous studies (Sabanayagam et al, 2010, Smith et al, 1993) We combined these three endpoints in order to ensure a more reliable result. The distribution of each endpoint is now reported in table 1.

Comment 5: Ascertainment of sleep duration needs also a little more clarification. Did the survey questionnaire differentiate the sleep hour/night during weekends from during workday?

Response: The survey questionnaire was specific on the hours of sleep/night as reported on the method section, page 5, last paragraph. There was no extra information on the sleep hour/night during weekends, so it was not possible to determine differences in the amount of hours of sleep/night during workday and weekend. This limitation has been highlighted in the discussion (page 16).

Comment 6: How did the authors address the use of sleep medication in this sample?

Response: We do not have information on the use of sleep medication in our dataset, and we have included this limitation in the discussion page 16.

Comment 7: Depression has been described as a confounder of the relationship of sleep duration with CVD and there may be differences of depressing symptoms in the different race/ethnic groups. How has depression been addressed in this sample?

Response: We acknowledge the reviewers comments. We have addressed this comment in our earlier response to comment 2 of Reviewer 2 above.

Comment 8: Similarly, socioeconomic status has not been considering in any of the associations studied sleep – CVD or ethnicity -CVD.
Response: Although the main focus of our study was on key CVD risk factors, yet, we have also included socio-economic status (educational and occupation) in the descriptive analysis (table 1). However, we did not adjust for socioeconomic status in the multivariate analysis because we consider socio-economic status to be a driving factor for the pattern of short sleep among ethnic groups. Therefore, adjusting for it would imply that we will underestimate the actual contribution of short sleep to ethnic differences in CVD.

Comment 9: A sensitivity analysis stratifying first and second generation of non-Dutch ethnic origin is important to evaluate acculturation. There is the possibility that the first generation are in greater social disadvantage than the second generation when compared to the Dutch. On the other hand, first generation may still be following customs and culture from their country of origin whereas second generation are more adapted to the host country and to their food, probably with greater consumption of red meat and salt than that consumed by first generation. For example, it is known that Turks follow a Mediterranean diet (greater increase of olive oil in their diet), however, Turks in this study have the highest percentage of low HDL cholesterol among all ethnic groups.

Response: With respect to evaluating acculturation, it is suggested that a difference may exist between first and second generations of non-Dutch ethnic groups as could be demonstrated in their cultural adaptation and eating behavior (convergence theory). However, investigating the role of acculturation in the association between short sleep duration and CVD is beyond the aim of this paper. It should be mentioned however, that previous results in the HELIUS study have not shown convincing evidence for this convergence theory. For example, the second generation did not adapt more to the host country than the first generation (Sturkenboom et al 2016). In addition, the number of the 2nd generation is relatively small for meaningful stratification in our current analyses on sleep and CVD.

Question 10: Considering the large sample in this study, a different categorization of sleep duration would have brought more information about the distribution of sleep duration in this sample. For example, instead of categorizing sleep duration as binary, the following sleep duration would have been more descriptive:<6, 6-7, 7-8 and >=8. This is because 7 hours of sleep may not be necessary for some groups whereas for others may not be enough.

Response: We recognize this relevant point mentioned by the reviewers, and have stated our reasons for the choice of sleep category for this study (please see response to comment 1 of Reviewer 2). Long sleep was thoroughly discussed by the team during the writing process. However, we decided not include long sleep in this analysis because our studies show that the major problem of ethnic minority groups in our study is short sleep, as widely reported in our previous publications (Anujuo et al, 2014). We also want to adopt the joint recommended classification guideline by NSF, AASM and SRS (Watson et al 2015; please see page 5, last paragraph). In addition, the number of participants with <6, or 6-7 hours/night are relatively small across the ethnic groups for a meaningful analysis.

Question 11: The authors should specify how they calculated the 95% CI for each group in Table 1, i.e. did they use the standard error of the mean. It may have been of interest to compared the confidence Interval for the difference between each of the ethnic groups against the Dutch.

Response: We used means and proportion command with STATA to generate 95% CI based on the standard error of the mean. Table 1 is descriptive table and we believe that the information provided is sufficient. It was not the main focus of our study to compare and test the differences between the ethnic groups.

Question 11b: Finally, how do they account for multiple comparisons?
Response: We thank the reviewer for this point. We presented 95% CIs for all the analysis and the main conclusions were drawn from these rather than relying on p-values.

Changes made to the original manuscript

Title
The title has been changed to: The contribution of short sleep duration to ethnic differences in cardiovascular disease: results of the HELIUS study.

Authors affiliations: Names and addresses were corrected

Abstract
Results: Line 2……1.62 (95%CI 1.20-2.18) in Dutch…. 95% CI was inserted.

Introduction
Line 17…… “and” was added to the sentence.
Page 4 first paragraph we added “Ethnic minority groups experience short sleep duration because they more frequently have a low socioeconomic status (education and occupation), are more frequently engaged in shift work, 21 or because of adverse living conditions such as crowding and stressful neighbourhood conditions. 23” to the sentence.

Method section
Cardiovascular disease: This was included on page 6, last paragraph: “The Rose questionnaire has three parts. Part A: include questions of experience of pain or discomfort in the chest during exercise, or walking fast or climbing stairs, and whether the pain stops or as the exercise or walking/running stops; and how long (less or more than 10 minutes), and the part of the body where pain was experienced. Part B: include questions of experience of severe chest pain lasting for half an hour or more, and Part C: include questions of experience of pains on either legs while walking uphill, or at ordinary pace, while standing still or sitting, and exact location of the pain (calf/calves), and whether the pain disappear when stopped walking, and how long (less or more than 10 minutes). Participants were classified as having angina pectoris, or possible myocardial infarction, or intermittent claudication based on their responses to these questions according to Rose et al 1977. 30 Although Rose questionnaire was not specifically validated for the ethnic groups in this study, however, Rose questionnaire has been shown to work well in other validated studies with similar ethnic group as in our study”. 31

Method section
Other measurements: Page 8, line 11-13, we added “Occupation was categorised into: elementary, lower, medium, higher and scientific levels depending on the type of work. Shift work was assessed with the item “do you work irregular hours including services during night hours” (yes/no)”. 

Data analysis
Page 9, line 1-3, we added “For the association of short sleep with CVD, we assessed interaction between short sleep and ethnicity. There was no significant interaction between short sleep and ethnicity”.

Page 9, line 6-12, we inserted “additionally, conventional CVD risk factors. Although we considered the inclusion of other potential confounders such as depressive symptoms and socio-economic status, we decided not to include these in the multivariate model, because of the risk of overadjustment. For depressive symptoms could also be considered as an intermediary factor in the
causal pathway between sleep and CVD, whereas factors such as socioeconomic status and shift work are factors that drive the pattern of short sleep among ethnic groups”.

Page 9, line 22, we added “This method of calculation has been used in previous study”. 35

Characteristics of study population

Page 10, line 6-8, we added “All ethnic minority groups have lower occupational levels compared with Dutch. African Surinamese and South-Asian Surinamese have higher prevalence of shift work compared with other ethnic groups”.

Page 10, line 13-14, we added: “The prevalence of depressive symptoms was higher in Turks, Moroccans and South-Asian Surinamese compared with other ethnic groups”.

Discussion

Page 14, last paragraph, we inserted “or through depressive symptoms”.

Last sentence of page 15 to line 1 of page 16, we included “sleep hours during weekends and on daytime sleepiness, use of sleep hypnotics, antidepressant medications and insomnia”.

Page 16, first paragraph, line 3-7, we added “Also, sleep apnea has been shown to be associated with CVD and cardiorespiratory problems. 44,45 and causes hemodynamic changes and significant sleep disturbances. 46,47 Sleep apnea may confound the association between sleep duration and CVD. However, we did not investigate sleep apnea in this study as we do not have the information in our dataset”.

Page 16, first paragraph, line 9-13, we included “Another important factor which may play a role in the association of sleep duration with CVD include genetics. 48 However, information on genetics was not available in our dataset, and was not investigated. Despite the lack of data on these factors, we were still able to answer our key research question”.

Authors contributions: We adjusted the text to include specific contribution: Karien Stronks contributed to acquisition of data, analysis and interpretation of data, critically reviewed the manuscript and gave final approval of the submission. Marieke B Snijder contributed to acquisition of data, analysis and interpretation of data, critically reviewed the manuscript and gave final approval for submission. Ron J Peters contributed to acquisition of data, critically reviewed the manuscript and gave final approval for submission. Charles Agyemang contributed to acquisition of data, analysis and interpretation of data, critically reviewed the manuscript and gave final approval for submission. Kenneth Anujuo contributed to analysis and interpretation of data, critically reviewed the manuscript and gave final approval for submission, KS, CA and Girardin Jean-Louis contributed to analysis and interpretation of data, critically reviewed the manuscript and gave final approval for submission. All authors agree to be accountable for all work ensuring integrity and accuracy

Funding

Additional funder was added: ‘The European Fund for the Integration of non-EU immigrants (EIF): 2013 EIF013.

References

We inserted new references


Table 1
We included angina, myocardial infarction, intermittent claudication, depressed mood, occupation and shift work in the table.

**VERSION 2 – REVIEW**

<table>
<thead>
<tr>
<th>REVIEWER</th>
<th>Luca Faconti</th>
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<td>King’s College London</td>
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<td>Cardiovascular Division,</td>
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<td>Department of Clinical Pharmacology</td>
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<td>United Kingdom</td>
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<td>REVIEW RETURNED</td>
<td>04-Oct-2017</td>
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<tr>
<td>GENERAL COMMENTS</td>
<td>Despite the study includes only self-reported sleep duration, the large sample size and the well performed statistical analysis provide interesting findings which should be further analysed.</td>
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| REVIEWER | Cecilia Castro-Diehl  
| Columbia University Medical Center  
| New York, New York, USA  
| No conflict of interest |
| REVIEW RETURNED | 26-Sep-2017 |
| GENERAL COMMENTS | I appreciate the authors addressed most of my comments and suggestions.  
| Only one observation: in line 43 (page 3) and line 47 (page 13), it should say: Non-Hispanic Whites, Non-Hispanic Blacks and other race/ethnicities. Hispanics were included in this last category. |
Correction: Contribution of short sleep duration to ethnic differences in cardiovascular disease: results from a cohort study in the Netherlands


Following a review of published research by researchers of the HELIUS study, conducted at the Universitair Medische Centra UMC (formerly Academic Medical Center AMC), University of Amsterdam, the authors wish to bring to your notice, a slight change in the results of a study that was published in BMJ Open.

Researchers of the HELIUS study discovered unintended errors in the coding of the original ROSE questionnaire, which was used to calculate three variables of cardiovascular disease (CVD) used in the study referenced above. The affected variables include Angina, Intermittent claudication, and the derived prevalent CVD variable (which additionally includes the unaffected variable myocardial infarction). The error led to a slight over-estimation of CVD prevalence in the various ethnic groups studied (table 1), and by extension, affected the prevalence ratios (PR) (table 2), and results of contributions of sleep to CVD in the concerned ethnic groups investigated (table 3).

### Table 1 Characteristics of study population by ethnicity

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Dutch</th>
<th>South-Asian</th>
<th>African-Surinamese</th>
<th>Ghanaians</th>
<th>Turks</th>
<th>Moroccans</th>
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<tbody>
<tr>
<td>n=4495</td>
<td>n=2933</td>
<td>n=4039</td>
<td>n=2181</td>
<td>n=3395</td>
<td>n=3687</td>
<td></td>
</tr>
<tr>
<td>Age (years)</td>
<td>46.2 (45.7 to 46.6)</td>
<td>45.5 (45.0 to 46.0)</td>
<td>47.9 (47.6 to 48.3)</td>
<td>44.7 (44.3 to 45.2)</td>
<td>40.4 (39.9 to 40.8)</td>
<td>40.4 (40.0 to 40.8)</td>
</tr>
<tr>
<td>Men (%)</td>
<td>45.8 (44.4 to 47.3)</td>
<td>45.3 (43.5 to 47.1)</td>
<td>39.0 (37.5 to 40.5)</td>
<td>39.4 (37.3 to 41.4)</td>
<td>45.4 (43.7 to 47.0)</td>
<td>38.9 (37.4 to 40.5)</td>
</tr>
<tr>
<td>Sleep duration (hours)</td>
<td>7.2 (7.2 to 7.27)</td>
<td>6.8 (6.7 to 6.81)</td>
<td>6.5 (6.49 to 6.58)</td>
<td>6.5 (6.38 to 6.55)</td>
<td>6.9 (6.92 to 7.04)</td>
<td>7.0 (6.99 to 7.09)</td>
</tr>
<tr>
<td>Short sleep (% yes)</td>
<td>16.2 (15.1 to 17.2)</td>
<td>39.4 (37.6 to 41.1)</td>
<td>45.6 (44.0 to 47.1)</td>
<td>44.2 (42.2 to 46.3)</td>
<td>29.5 (27.9 to 30.9)</td>
<td>27.0 (25.6 to 28.4)</td>
</tr>
<tr>
<td>Angina (% yes)</td>
<td>1.07 (0.81 to 1.41)</td>
<td>3.56 (2.95 to 4.30)</td>
<td>2.78 (2.32 to 3.34)</td>
<td>2.46 (1.89 to 3.21)</td>
<td>4.09 (3.48 to 4.82)</td>
<td>2.75 (2.27 to 3.33)</td>
</tr>
<tr>
<td>Myocardial infarction (% yes)</td>
<td>3.20 (2.69 to 3.72)</td>
<td>11.4 (10.3 to 12.6)</td>
<td>8.44 (7.58 to 9.30)</td>
<td>6.69 (5.64 to 7.74)</td>
<td>12.2 (11.1 to 13.3)</td>
<td>10.1 (9.14 to 11.1)</td>
</tr>
<tr>
<td>Intermittent claudication (% yes)</td>
<td>0.25 (0.14 to 0.44)</td>
<td>0.58 (0.36 to 0.93)</td>
<td>0.32 (0.19 to 0.56)</td>
<td>0.23 (0.10 to 0.55)</td>
<td>0.65 (0.43 to 0.98)</td>
<td>0.54 (0.35 to 0.84)</td>
</tr>
<tr>
<td>Prevalence CVD (%)</td>
<td>4.30 (3.74 to 4.93)</td>
<td>14.5 (13.2 to 15.8)</td>
<td>8.93 (7.79 to 10.2)</td>
<td>16.0 (14.8 to 17.3)</td>
<td>12.9 (11.9 to 14.0)</td>
<td>11.4 (10.3 to 12.4)</td>
</tr>
<tr>
<td>Hypertension (% yes)</td>
<td>29.5 (28.2 to 30.9)</td>
<td>42.4 (40.6 to 44.2)</td>
<td>50.2 (48.7 to 51.7)</td>
<td>55.8 (53.4 to 57.9)</td>
<td>29.1 (27.6 to 30.4)</td>
<td>24.4 (22.9 to 25.7)</td>
</tr>
<tr>
<td>Diabetes (% yes)</td>
<td>3.68 (3.03 to 4.12)</td>
<td>14.9 (13.9 to 15.8)</td>
<td>11.4 (10.0 to 12.8)</td>
<td>10.2 (9.4 to 11.2)</td>
<td>11.4 (10.3 to 12.4)</td>
<td>11.4 (10.3 to 12.4)</td>
</tr>
<tr>
<td>BMI (kg/m²)</td>
<td>24.7 (24.6 to 24.9)</td>
<td>26.3 (26.1 to 26.5)</td>
<td>27.8 (27.6 to 28.0)</td>
<td>28.4 (28.2 to 28.6)</td>
<td>28.5 (28.3 to 28.7)</td>
<td>27.6 (27.4 to 27.7)</td>
</tr>
<tr>
<td>WHR</td>
<td>0.88 (0.87 to 0.88)</td>
<td>0.92 (0.92 to 0.93)</td>
<td>0.89 (0.89 to 0.90)</td>
<td>0.90 (0.90 to 0.91)</td>
<td>0.89 (0.89 to 0.90)</td>
<td>0.89 (0.89 to 0.90)</td>
</tr>
<tr>
<td>Dyslipidaemia (% yes)</td>
<td>29.9 (28.5 to 31.2)</td>
<td>41.7 (39.9 to 43.4)</td>
<td>24.0 (22.7 to 25.3)</td>
<td>20.1 (18.4 to 21.7)</td>
<td>40.8 (39.1 to 42.4)</td>
<td>27.6 (26.1 to 29.0)</td>
</tr>
<tr>
<td>TG &gt;1.70 mmol/L</td>
<td>13.7 (12.7 to 14.7)</td>
<td>14.3 (13.0 to 15.5)</td>
<td>10.5 (9.58 to 11.5)</td>
<td>10.6 (9.35 to 11.9)</td>
<td>10.1 (9.09 to 11.1)</td>
<td>5.86 (5.10 to 6.62)</td>
</tr>
<tr>
<td>HDL-C &lt;1.04 mmol/L</td>
<td>9.77 (8.90 to 10.6)</td>
<td>22.9 (21.4 to 24.5)</td>
<td>11.0 (10.0 to 11.9)</td>
<td>6.75 (5.69 to 7.79)</td>
<td>26.5 (24.9 to 27.9)</td>
<td>18.7 (17.4 to 19.9)</td>
</tr>
<tr>
<td>LDL-C &gt;4.14 mmol/L</td>
<td>11.9 (10.9 to 12.8)</td>
<td>16.9 (15.5 to 18.2)</td>
<td>5.67 (4.96 to 6.38)</td>
<td>3.35 (2.59 to 4.10)</td>
<td>20.1 (18.8 to 21.5)</td>
<td>10.6 (9.59 to 11.6)</td>
</tr>
<tr>
<td>Depressive symptoms (%)</td>
<td>6.99 (6.24 to 7.73)</td>
<td>18.4 (16.9 to 19.8)</td>
<td>10.6 (9.67 to 11.6)</td>
<td>9.08 (7.87 to 10.3)</td>
<td>22.8 (21.3 to 24.2)</td>
<td>20.3 (18.9 to 21.6)</td>
</tr>
<tr>
<td>Education</td>
<td>First and second category (%)</td>
<td>17.3 (16.2 to 18.4)</td>
<td>47.8 (46.0 to 49.6)</td>
<td>40.8 (39.3 to 42.3)</td>
<td>68.0 (66.1 to 70.0)</td>
<td>55.9 (54.3 to 57.6)</td>
</tr>
<tr>
<td>Third category (%)</td>
<td>21.7 (20.5 to 22.9)</td>
<td>29.0 (27.4 to 30.7)</td>
<td>35.9 (34.4 to 37.4)</td>
<td>25.6 (23.7 to 27.4)</td>
<td>28.7 (27.1 to 30.2)</td>
<td>33.3 (31.8 to 34.9)</td>
</tr>
</tbody>
</table>
### Table 2 PRs for the relationship between sleep duration (short sleep vs healthy sleep) and the prevalence of CVD by ethnicity

<table>
<thead>
<tr>
<th>Ethnic group</th>
<th>PR (95% CI) Crude</th>
<th>PR (95% CI) Model 1</th>
<th>PR (95% CI) Model 2</th>
<th>PR (95% CI) Model 3</th>
<th>PR (95% CI) Model 4</th>
<th>Change in preva. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dutch</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>1.00</td>
<td>0.00</td>
</tr>
<tr>
<td>South-Asian Surinamese</td>
<td>3.38 (2.87 to 3.98)</td>
<td>3.02 (2.56 to 3.56)</td>
<td>3.00 (2.51 to 3.57)</td>
<td>2.72 (2.28 to 3.24)</td>
<td>28</td>
<td>12</td>
</tr>
<tr>
<td>African-Surinamese</td>
<td>2.41 (2.05 to 2.85)</td>
<td>2.11 (1.78 to 2.49)</td>
<td>2.08 (1.76 to 2.49)</td>
<td>1.86 (1.57 to 2.22)</td>
<td>39</td>
<td>16</td>
</tr>
<tr>
<td>Ghanaians</td>
<td>2.10 (1.73 to 2.54)</td>
<td>1.83 (1.51 to 2.23)</td>
<td>2.04 (1.66 to 2.52)</td>
<td>1.83 (1.48 to 2.25)</td>
<td>25</td>
<td>19</td>
</tr>
<tr>
<td>Turks</td>
<td>4.02 (3.44 to 4.71)</td>
<td>3.72 (3.17 to 4.35)</td>
<td>3.27 (2.73 to 3.92)</td>
<td>3.10 (2.59 to 3.72)</td>
<td>30</td>
<td>6</td>
</tr>
<tr>
<td>Moroccans</td>
<td>3.18 (2.71 to 3.73)</td>
<td>2.97 (2.53 to 3.49)</td>
<td>3.10 (2.57 to 3.73)</td>
<td>2.96 (2.45 to 3.56)</td>
<td>10</td>
<td>6</td>
</tr>
</tbody>
</table>

### Table 3 Prevalence ratio(s) for ethnic differences in prevalence CVD, adjusting for short sleep and CVD risk factors separately, and simultaneously

<table>
<thead>
<tr>
<th>Ethnic group</th>
<th>PR (95% CI)</th>
<th>Reduction in (%)</th>
<th>Difference in (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dutch</td>
<td>1.00</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>South-Asian Surinamese</td>
<td>3.38</td>
<td>3.02</td>
<td>3.00</td>
</tr>
<tr>
<td>African-Surinamese</td>
<td>2.41</td>
<td>2.11</td>
<td>2.08</td>
</tr>
<tr>
<td>Ghanaians</td>
<td>2.10</td>
<td>1.83</td>
<td>2.04</td>
</tr>
<tr>
<td>Turks</td>
<td>4.02</td>
<td>3.72</td>
<td>3.27</td>
</tr>
<tr>
<td>Moroccans</td>
<td>3.18</td>
<td>2.97</td>
<td>3.10</td>
</tr>
</tbody>
</table>

Data are presented as means and percentages with 95% CI.

BMI, body mass index; CVD, cardiovascular disease; HDL-C, high-density lipoprotein cholesterol; LDL-C, low-density lipoprotein cholesterol; TC, total cholesterol; TG, triglyceride; WHR, waist to hip ratio.
The error has now been corrected, and adjusted results are presented in the attached file (as shown above) while other results of the study remain unaffected. However, it is worthy to note that the error does not change the overall results and conclusion of the study. Also, the pattern of the key findings remains unchanged. We regret any inconvenience this may/may have cause(d), but we are glad to report this error to maintain research integrity. This correction has been communicated to all authors of the published paper, and they gave their consent to effect these corrections.

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