PEER REVIEW HISTORY

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ARTICLE DETAILS

TITLE (PROVISIONAL)	Longitudinal Analysis of Short Sleep and Obesity in a Large National Cohort of Thai Adults
AUTHORS	Vasoonatara Yiengprugsawan, Cathy Banwell, Sam-ang Seubsman and Adrian Sleigh

VERSION 1 - REVIEW

REVIEWER	Daiki Kobayashi, St Luke's International Hospital, Japan. Conflict of interests: none
REVIEW RETURNED	08/11/2011

GENERAL COMMENTS	This study evaluated the relationship between short sleep duration and obesity with a large-scale cohort design. The study is interesting because it supported previous evidence adjusted with multi variables. However, there are some aspects to strengthen this study. Page 3, Methods and analysis, 1st paragraph Authors included large number of people, but did these people represent general population in Thai? Because all participants were distance learning adult students, they might have higher education or salary than general population. Page 4, Methods and analysis, 2nd paragraph How were participants' body weight measured in 2009? Authors mentioned that body weight in 2005 was self-reported. If both body weight measurements in 2005 and in 2009 were self-reported, main outcome had less reliable. Page 4, Methods and analysis, 2nd paragraph Main outcome is unclear. Did authors compare the number (ratio) of new onset obesity in 2009 to the number (ratio) of non-obesity in 2005? Or, the number (ratio) of obesity in 2009 to the number (ratio) of obesity in 2005? How did authors deal with people who had obesity in 2005, but not have in 2009. Page 5, Results, 1st paragraph Please show participants descriptive data in 2005. Because authors have a lot of data, such as smoking, exercise habit, education level, these data is helpful to compare study population to general population in Thai and those in the world. Additional table is needed. Page 5, Results, 1st paragraph Please show all data of result in cross-sectional design adjusted with multi-variables in 2009. It would be interesting if we can compare data in cross-sectional design to that in longitudinal design. Additional table is needed.

	Page 8, Discussion Please describe limitations in this study.

REVIEWER	Peppi Lyytikäinen PhD student Hjelt Institute, Department of Public Health Finland No conflict of interest
REVIEW RETURNED	15/11/2011

THE STUDY	- Number of excluded individuals is missing - More details on measurements of covariates are needed. - The abstract and key messages are slightly unclear. - English language should be revised all over the text. - The author should cite to some key prospective studies of sleep duration and obesity. There are prospective studies (for example Chaput et al. 2008, Hasler et al. 2004 and López-Garcia et al. 2008) and also, one review (Nielsen et al. 2010), they should refer to.
RESULTS & CONCLUSIONS	- Table on longitudinal analysis is missing. - The author should cite to some key prospective studies of sleep duration and obesity and discuss those studies in the introduction and also in the discussion section.
GENERAL COMMENTS	Comments to the Author "Longitudinal Analysis of Short Sleep and Obesity in a Large National Cohort of Thai Adults" Longitudinal studies are needed although there are large several cross-sectional studies about the association between sleep duration and obesity. Below I have comments that need to be addressed to improve this manuscript. Major comments 1) I had difficulties to follow the text. English language should be revised. Introduction: 2) There is actually only little evidence that short sleep duration has decreased, but you might want to look at for example Kronholm's (et al. J Sleep Res 2008), article, showing that sleep duration has only slightly decreased (page 3). Also, it could be useful look at for example Knutson's (et al. Sleep 2010) and Rowshan's (et al. J Sleep Res 2010) studies. 3) The author should cite to some key prospective studies of sleep duration and obesity. There are prospective studies (for example Chaput et al. 2008, Hasler et al. 2004 and López-Garcia et al. 2008) and also, one review

	(Nielsen et al. 2010), you should refer to. Results: 4) The strength of this study is obviously the large size of the cohort, and prospective study design. However, the authors refer in the text only to Table 1, which shows only the cross-sectional association between sleep duration and weight in 2009 (pages 5 and 13). There is no Table on longitudinal association between sleep duration and weight, even if the first aim of this study was to examine longitudinal associations. I think you should add a Table, which shows the longitudinal associations (2005-2009) between baseline sleep duration and subsequent BMI. Additionally, it would be helpful if the author add a descriptive Table including the distribution of the study variables. Minor comments Abstract: 5) The abstract is slightly unclear in the results section. I think that you should first mention the cross-sectional results in 2005 and then cross-sectional results in 2009. Please clarify the results section (page 1). 6) Key messages (2-3 in page 2) are unclear, please make them clearer. 7) The author mention (page 2) that “one limitation was the subjective nature of self-reporting sleep duration, a problem noted by many others conducting sleep research”. Also, the weight and height and other variables were self-reported, which can be limitations. Additionally, the results of this study cannot be generalized to all people. This should also be emphasised in the discussion. Methods and analysis: 8) The authors refer to covariates, which they used in all their models. However, it remained unclear, how did you measure variables like alcohol drinking? More details on the measurement of these and other covariates need to be included in the methods section (page 4). Additionally, I think that it could be useful to adjust also for baseline BMI when you examine the longitudinal association between sleep duration and BMI. 9) Please, mention the number of excluded individuals in the end of the following sentence: “Individuals with missing data were excluded from analyses” (page 5). Results: 10) Check the reference number 33. I think that the author doesn`t refer correctly to that study or the reference is wrong in discussion section (page 7

REVIEWER	Dae Jung Kim, Associate professor Department of Endocrinology and Metabolism Ajou University School of Medicine, Republic of Korea
REVIEW RETURNED	27/11/2011

GENERAL COMMENTS	This is very interesting and important data, but I am very wondering why the authors describe just one table. I think that baseline clinical characteristics of study population and follow up data should be clearly described according to the results.

VERSION 1 – AUTHOR RESPONSE

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Reviewer: Daiki Kobayashi, St Luke's International Hospital, Japan
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This study evaluated the relationship between short sleep duration and obesity with a large-scale cohort design. The study is interesting because it supported previous evidence adjusted with multi variables. However, there are some aspects to strengthen this study.
--------RESPONSE: Thank you for your comments, please see our responses below.

Page 3, Methods and analysis, 1st paragraph
Authors included large number of people, but did these people represent general population in Thai? Because all participants were distance learning adult students, they might have higher education or salary than general population.
--------RESPONSE: We have now included additional clarification as follows:
----------The STOU cohort is representative of the geodemographic, ethnic composition, income and household assets of the adult Thai population. Based on the results of the 2000 Population and Housing Survey, the median age was 29.2 years for the Thai population and 29.0 years among cohort members, and 51% of the Thai population were females compared with 54% of cohort members (refs 26, 28, 29).

Page 4, Methods and analysis, 2nd paragraph
How were participants' body weight measured in 2009? Authors mentioned that body weight in 2005 was self-reported. If both body weight measurements in 2005 and in 2009 were self-reported, main outcome had less reliable.
--------RESPONSE: Both weight and height of cohort members were reported at the baseline (2005) and the 4-year follow up (2009). We have now referred to our previous study validating self-reported weight and height among STOU students (ref 27 Lim LL, Seubsman SA, Sleigh A. Validity of self-reported weight, height, and body mass index among university students in Thailand: Implications for population studies of obesity in developing countries. Popul Health Metr 2009;7:15).

--------RESPONSE: We have also noted the issue of self-reported weight and height in the limitation section of the Discussion as follows:
----------Weight and height of cohort members were also self-reported but our previous validation study has found these numbers to be reliable.

Page 4, Methods and analysis, 2nd paragraph
Main outcome is unclear. Did authors compare the number (ratio) of new onset obesity in 2009 to the number (ratio) of non-obesity in 2005? Or, the number (ratio) of obesity in 2009 to the number (ratio) of obesity in 2005? How did authors deal with people who had obesity in 2005, but not have in 2009.
--------RESPONSE: Cross-sectional outcomes were the relative odds of obesity vs normal BMI at baseline and 4-year follow-up, comparing short sleepers and normal sleepers. Analyses were conducted separately (multinomial logistic regression) for each of the three weight comparisons (underweight vs normal; overweight-at-risk vs normal; and obese vs normal). The three resulting odds ratios were each adjusted for a wide array of covariates as listed in Table 1 and described in the Methods.
--------RESPONSE: Longitudinal outcomes were incident percent weight gain over the 4-year period of prospective follow-up (2005 and 2009), comparing the odds for each of the three weight gain categories (5-10%, 10 to <20%, and 20+%) to the odds of <5% weight gain, for short sleepers vs normal sleepers. The resulting odds ratios were adjusted for the same covariates as in the paragraph above.

--------RESPONSE: We have now revised the relevant section of the text in the 4th paragraph of Methods as follows:
----------For both 2005 and 2009 we used multinomial logistic regression models to assess the effect of sleep duration on the outcome of abnormal body size (underweight, overweight-at-risk, obese). Thus for short sleepers and normal sleepers, the relative odds for each 'abnormal' weight category vs normal were computed and adjusted for covariates (see below). We also used multinomial adjusted logistic regression to model the longitudinal 4-year incidence of weight gain in three increment categories (see Results).

--------RESPONSE: And we have now revised the last paragraph of the Results as follows:
----------For longitudinal analysis, we performed multinomial logistic regression of sleep duration on incident weight gain, adjusting for the same covariates as for the cross-sectional analyses. The dependent variable was substantive weight gain between 2005 and 2009, defined by three weight increase categories (5 to <10%, 10 to <20%, and 20+%). Each category of weight gain was separately compared to no weight increase (i.e., <5%) for calculation of odds ratios.

--------RESPONSE: We also draw attention to the footnote of Table 2 which reads as follows:
----------For each 'abnormal' category, multinomial logistic regression compares the outcome odds to the outcome odds of a 'normal' BMI, with the results expressed as an odds ratio.

Page 5, Results, 1st paragraph
Please show participants descriptive data in 2005. Because authors have a lot of data, such as smoking, exercise habit, education level, these data is helpful to compare study population to general population in Thai and those in the world. Additional table is needed.
--------RESPONSE: Thank you for your suggestion, we have now included a descriptive table providing cohort characteristics and covariates by weight categories and sex. Additional text was inserted in the 2nd paragraph of the Results as follows:
----------Among the cohort members responding in 2009, there is a parallel trend between increasing body mass index and older age, being married, and higher income (Table 1). Overweight and obesity increased in frequency with less than 4 daily serves of fruits and vegetables (especially among males), less than 3 physical activity sessions per week (especially among females), and more than 5 hours of screen time per day (both for males and females). Increased body mass index also was more prevalent among those with doctor diagnosed chronic conditions.

Page 5, Results, 1st paragraph
Please show all data of result in cross-sectional design adjusted with multi-variables in 2009. It would be interesting if we can compare data in cross-sectional design to that in longitudinal design. Additional table is needed.
--------RESPONSE: We agree with this approach and in Table 2 have tabulated all data in 2009 adjusted for multiple covariates. We also note in the text (1st paragraph of the Results) that the 2005 analysis yielded similar findings to those reported for 2009.
--------RESPONSE: In the final paragraph of the Results, we reported a detailed account of the longitudinal results for each of the three weight gain categories. For each category, we reported the odds ratio and 95% confidence interval adjusted for the influence of a wide array of covariates. We have not included a table as it would be redundant given the information reported in the text.

Page 8, Discussion
Please describe limitations in this study.
--------RESPONSE: We have now expanded our account of limitations in the last paragraph of the Discussion as follows:
----------One limitation of this study was the subjective nature of self-reporting sleep duration, a problem noted by many others conducting sleep research (refs 9, 19). Weight and height of cohort members were also self-reported but our previous validation study has found these numbers to be reliable (ref 27). We also noted the relatively higher level of education among cohort members but it is unclear how this could affect the results.

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Reviewer: Peppi Lyytikäinen, Hjelt Institute, Department of Public Health, Finland
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Longitudinal studies are needed although there are large several cross-sectional studies about the association between sleep duration and obesity. Below I have comments that need to be addressed to improve this manuscript.
--------RESPONSE: Thank you for your comments, please see our responses below.

Major comments
1) I had difficulties to follow the text. English language should be revised.
--------RESPONSE: We have now clarified text wherever possible and had an English native speaker read through the entire manuscript.

Introduction:
2) There is actually only little evidence that short sleep duration has decreased, but you might want to look at for example Kronholm's (et al. J Sleep Res 2008), article, showing that sleep duration has only slightly decreased (page 3). Also, it could be useful look at for example Knutson's (et al. Sleep 2010) and Rowshan's (et al. J Sleep Res 2010) studies.
--------RESPONSE: Thank you for your suggestions. We have now included additional references on short sleep prevalence (refs 1-3).

3) The author should cite to some key prospective studies of sleep duration and obesity. There are prospective studies (for example Chaput et al. 2008, Hasler et al. 2004 and López-Garcia et al. 2008)

and also, one review (Nielsen et al. 2010), you should refer to.
--------RESPONSE: Additional references were included and discussed, many thanks for your recommendations (refs 5, 21-23).

Results:
4) The strength of this study is obviously the large size of the cohort, and prospective study design. However, the authors refer in the text only to Table 1, which shows only the cross-sectional association between sleep duration and weight in 2009 (pages 5 and 13). There is no Table on longitudinal association between sleep duration and weight, even if the first aim of this study was to examine longitudinal associations. I think you should add a Table, which shows the longitudinal associations (2005-2009) between baseline sleep duration and subsequent BMI. Additionally, it would be helpful if the author add a descriptive Table including the distribution of the study variables.
--------RESPONSE: We have now included a table describing cohort characteristics and distribution of covariates across weight outcomes and sex in Table 1.
--------RESPONSE: Please note our comments above regarding tabulation of the longitudinal data (see response to Reviewer 1: Page 5 Results). In our view, an additional table would not provide new information given our description of the longitudinal findings in the last paragraph of the Results section.

Minor comments
Abstract:
5) The abstract is slightly unclear in the results section. I think that you should first mention the cross-sectional results in 2005 and then cross-sectional results in 2009. Please clarify the results section (page 1).
--------RESPONSE: We have revised the results section of the Abstract as follows:
----------At the last cohort follow-up in 2009, cross-sectional associations linked short sleep (<6 hours) and obesity: Adjusted Odds Ratios (AOR) = 1.49, 95% Confidence Intervals (CI) 1.32-1.68 for females and AOR = 1.36, 95% CI 1.21-1.52 for males. The earlier cross-sectional baseline results in 2005 were quite similar.

6) Key messages (2-3 in page 2) are unclear, please make them clearer.
--------RESPONSE: We have simplified key messages as follows:
• The odds ratios connecting short sleep to obesity were substantial and significant: 1.36 for males and 1.49 for females in 2009; corresponding odds ratios were similar in 2005.
• Longitudinal 2004-2009 cohort data confirmed a significant short sleep-weight gain relationship with a notable dose-response.

7) The author mention (page 2) that “one limitation was the subjective nature of self-reporting sleep duration, a problem noted by many others conducting sleep research”. Also, the weight and height and other variables were self-reported, which can be limitations. Additionally, the results of this study cannot be generalized to all people. This should also be emphasised in the discussion.
--------RESPONSE: We have now revised the limitation section in the Discussion as follows:
----------Weight and height of cohort members were also self-reported but our previous validation study has found these numbers to be reliable (ref 27). We also noted the relatively higher level of education among cohort members but it is unclear how this could affect the results.

Methods and analysis:

8) The authors refer to covariates, which they used in all their models. However, it remained unclear, how did you measure variables like alcohol drinking? More details on the measurement of these and other covariates need to be included in the methods section (page 4).
--------RESPONSE: We have now included additional explanation on covariates in the Methods as follows:
----------Covariates adjusted in all models included age in years, marital status (married, single, separated/widowed), personal income categories (Baht/month), rural-urban geographical residence, self-reported health risk behaviour including smoking (never, current, previous) or drinking (days/week), fruit and vegetable intakes (serves/day), vigorous or moderate physical activity (sessions/week), screen time (hours/day), doctor diagnosed depression, and doctor diagnosed chronic disorders including type I & type II diabetes, high cholesterol, high blood pressure, heart disease, stroke, cancers (liver, lung, stomach, colon, breast, others), goitre, epilepsy, liver disease, lung disease, arthritis, and asthma.

Additionally, I think that it could be useful to adjust also for baseline BMI when you examine the longitudinal association between sleep duration and BMI.
--------RESPONSE: We have found very high correlation between baseline BMI and 4-year follow-up BMI (correlation coefficient = 0.81). Baseline 2005 BMI is highly correlated with the most current BMI in 2009 and it is also non independent predictor of the 2009 BMI. As such we did not include baseline 2005 BMI as an explanatory variable in the model predicting 2009 BMI.
--------RESPONSE: We did test BMI 2005 in the longitudinal model and it was a very powerful predictor of current BMI. However, its presence in the model did not substantially change other odds ratios for the sleep variable or for other covariates. It is these other factors influencing BMI outcome that were of interest in this study, especially sleep duration.

9) Please, mention the number of excluded individuals in the end of the following sentence:
“Individuals with missing data were excluded from analyses” (page 5).
--------RESPONSE: We have now included percentage of missing data in the last paragraph of the Methods as follows.
----------Individuals with missing data (less than 10%) were excluded from multivariable analyses.

Results:
10) Check the reference number 33. I think that the author doesn`t refer correctly to that study or the reference is wrong in discussion section (page 7).
--------RESPONSE: We have now reworded this section, thank you.
----------Our data also showed some long-sleeping females were underweight and other reports suggest this may be related to comorbidity (ref 42).

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Reviewer: Associate Professor Dae Jung Kim, Ajou University School of Medicine, Republic of Korea
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This is very interesting and important data, but I am very wondering why the authors describe just one table. I think that baseline clinical characteristics of study population and follow up data should be clearly described according to the results.
--------RESPONSE: Thank you for your comments. We have now included a table describing cohort characteristics and distribution of covariates across weight outcomes by sex in Table 1. Additional text was included in the second paragraph of the Results as follows:

----------Among the cohort members responding in 2009, there is a parallel trend between increasing body mass index and older age, being married, and higher income (Table 1). Overweight and obesity increased in frequency with less than 4 daily serves of fruits and vegetables (especially among males), less than 3 physical activity sessions per week (especially among females), and more than 5 hours of screen time per day (both for males and females). Increased body mass index also was more prevalent among those with doctor diagnosed chronic conditions.