Author's response to reviews

Title: Volume, patterns, and types of sedentary behavior and cardio-metabolic health in children and adolescents: a cross-sectional study

Authors:

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Author's response to reviews: see over
### Editor

<table>
<thead>
<tr>
<th>1.1</th>
<th><strong>Abstract - Include information about the context of your study your abstract</strong></th>
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<td></td>
<td>Information about the context of the study was added to the background section of the abstract.</td>
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<table>
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<tr>
<th>2.1</th>
<th><strong>Age range of the children and adolescents: 6 - 19 years is a very broad age range. Analyses broken down into at least 2 age groups, e.g. 6 - 12 and 13 - 19, should be carried out. I doubt Tanner scores are available, but if they are, Tanner scores should be used as a covariate. If not, that should be mentioned as a limitation in the discussion</strong></th>
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<td></td>
<td>Given the age range, we were also concerned that the patterns of associations may be different in younger and older children. In light of this concern, we tested age - by - sedentary behavior interactions ((P = .27 \text{ to } .74)) and age - by - MVPA interactions ((P=.28)) for the cardio-metabolic risk score outcomes. The findings of the analyses that included these interaction terms indicated that age was not an effect modifier (or moderator) of the relationships. Therefore, from a statistical standpoint, it is appropriate to conducted the analyses and present the results for 6-19 year olds combined. We have commented on the lack of age interactions in the results section of the manuscript (see the top of pg. 11).</td>
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</table>

In addition to exploring interaction terms, we also performed a series of stratified analyses wherein the analyses in Tables 3 and 4 were conducted separately in children (6-11 year olds) and adolescents (12-19 year olds). The general patterns of findings were consistent in the two age groups. However, due to smaller sample sizes in the stratified analyses, the confidence intervals for the odds ratios increased and some of the key findings around TV and moderate-to-vigorous physical activity were no longer statistically significant. Furthermore, in order to present the stratified results in the paper, Tables 1 and 2 would need to be expanded, and 2 additional large tables would need to be added to present the age-specific data for Tables 3 and 4.

Therefore at this time, due to interest in minimizing the size of this paper (assuming space is a priority for your journal), and because of the aforementioned statistical issues, we have not presented the analyses separately for 6-11 year old children and 12-19 year old adolescents in the revised manuscript. Having said that, if presenting the age-stratified analyses is something that you feel is key for this manuscript, we would be willing to making the appropriate revisions.

Unfortunately, Tanner scores (or other measures of maturity) are not available in the NHANES dataset. We have added a sentence to the discussion section of the revised manuscript to acknowledge this limitation (see pg. 15).

<table>
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<th>3.1</th>
<th><strong>Although adiposity is rather closely associated with the variables used in the cardiometabolic score, it would be informative to include a model with adjustment by BMI. If the association of TV watching with the metabolic score is attenuated, that would mean that the association is largely mediated (or possibly confounded) by adiposity.</strong></th>
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<td>To clarify, adiposity is not only closely associated with the cardio-metabolic score, it was a part of the cardio-metabolic score using in our study. More specifically, in our study waist circumference was the adiposity variable used in our cardio-metabolic risk score. The use of</td>
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waist circumference as a component of a cardio-metabolic or metabolic risk score is consistent with what others have done in the literature in both children and adults.

We ran a partial correlation (controlling for sex and age) in our study sample and found that waist circumference and BMI were highly correlated ($r=.93$). As a result, because waist circumference was a component of the cardio-metabolic risk score, and because BMI and waist are so highly correlated, we do not feel it would be appropriate to include a model that adjusts for BMI.

4.1 The composite score that the reviewers used for cardiometabolic risk would certainly be predictive of major cardiovascular and metabolic outcomes, but it differs from the metabolic scores most frequently used. I think that it would be informative and important to present data also using the individual components of the scores. I recommend that the authors present a table showing the associations of explanatory variables with the metabolic score and separately its components. To concisely present the findings in a table, continuous variables can be used”.

A table was added to the revised manuscript showing the relationship between the explanatory variables and the individual components of the cardio-metabolic risk factor score. Please see Table 4 on page 26.

The results of these additional analyses are reported on page 11 of the revised manuscript, and were worked in to various parts of the discussion section (see highlighted text). It is noteworthy that the results for the individual cardio-metabolic risk factor components were extremely consistent to the results for the summary cardio-metabolic risk factor score.

We choose to use logistic regression models instead of linear regression models for these additional analyses since the TV and computer variables are not continuous variables. Furthermore, we feel that the odds ratios from the logistic regression models are generally easier for public health audiences to interpret than are beta coefficients from linear regression analyses based on continuous variables.

Reviewer #1

1.1 This investigation of cardio-metabolic health as a function of physical activity patterns in children from NHANES was novel in its approach. There are several suggested minor revisions in the methodology that aid in its understanding. The objectives and variables are well-described. More detail is needed concerning the logistic regression models. The authors should list the control variables used in the full and reduced models rather than referring to them with the general term ‘confounders’. The supplemental analysis (beyond the objectives) needs to be detailed. It is not sufficient to say “We also examined the association between objectively measured MVPA and CRS. The finding that MVPA was strongly and independently associated with cardio-metabolic risk factors ….” The test and parameters should be specified. Finally, more of a distinction should be made as to which variables were provided from NHANES and which variables were constructed by the investigators.

In the data analysis section, prior to describe the individual regression models, we state that “Multiple logistic regression models were used to address the study objectives. All regression
models predicted the highest CRS quartile and controlled for age, gender, ethnicity, SES, smoking, diet, and MVPA.” We feel having this initial sentence at the beginning of the data analysis section is more efficient than repeating the potential confounders every time we describe an individual model. However, to address comment 9.1 from reviewer 2 we added in the specific diet variables (total fat, saturated fat, dietary cholesterol, sodium) to this initial sentence. In addition, we added in the words “potential confounders” before listing them in this initial sentence, to make it more clear for the reader when they see the term “all confounders” in the description for the individual models. Please see pg. 9.

In the results section, the first time that we refer to adjusting for confounders we added a list of the confounders (see page 10). Again, for efficiency we do not think it is necessary to repeat this list throughout the results section. Also, the legends in the relevant tables (Tables 3 and 4) list all of the confounders that were controlled for in the analyses.

Some additional information was included in the data analysis section to better describe the supplemental analyses. Also, some additional analyses were described in this section to address comment 4.1 from the editor. Please see pg. 9 and 10.

The wording was changed throughout the methods section (please see highlighted text) to indicate which variables were provided directly within the NHANES database and which variables were derived by the authors.

2.1 Implications for public health is another area where minor revisions are necessary. The sentence regarding the interrelationships among volume and patterns of sedentary behavior and CRS is incomprehensible and speculator. Since an association of children’s physical activity patterns and cardio-metabolic health was not found, a public health implication of this behavior cannot be determined.

The sentence in question has been removed from the revised manuscript. The conclusion section of the manuscript has been re-worked to address this comment. Please see pg. 15.

Reviewer # 2

1.1 In this manuscript, the authors evaluate the cross-sectional association between volume, patterns, and types of sedentary behaviour with cardiometabolic risk factors (independent of moderate-vigorous physical activity) among 2527 youth aged 6-19 years participating in the 2003-04 and 2005-05 NHANES. The authors found type of sedentary behaviour (TV viewing time, but not computer viewing time) to be associated with a clustered cardiometabolic risk score, which remained independent after adjustment for time spent in moderate and vigorous physical activity. Volume, bouts, and break in bouts of sedentary behaviour were not associated with the clustered cardiometabolic risk score.

The manuscript is concise, well-written, and contains novel data. The novel aspect of this paper is the inclusion of information on volume, bouts, and breaks of/in sedentary behaviour and the consideration of moderate and vigorous PA in interpretation of any observed associations – in a population-based, representative sample of U.S. youth. For all these factors, the authors are to be commended. I have only minor remarks that the authors could consider for their manuscript. General and specific comments follow.
We would like to thank the reviewer for their positive comments and for their detailed review of our paper.

2.1 **INTRODUCTION** - You may also wish to consider a recently published paper by Sisson et al. J Adolesc Health. 2010 Sep;47(3):309-11 in addition to the papers mentioned in the introduction.

We agree with the reviewer that this is an interesting paper. However, the paper does not examine different types of sedentary behavior on overweight risk (they use a summary screen time measure). Nor does it use accelerometer data to examine overall volume or patterns. Therefore, we do not feel it would be a good fit for our introduction which is addressing overall volume, types, and patterns of sedentary behavior.

3.1 **METHODS** - Participants, 2527 was the subsample used for these analyses as they had all measures available, but what was the total N of the main population (i.e. all those measured). Are you able to say anything about differences (if they exist) between those in your subsample and those missing variables of interest (does the subsample differ in any way to the full representative sample?)

Information on the total N of the main population was added to the revised manuscript, as well as information on where participants were removed from the database because of missing data. We have also compared the missing subjects to those who were included in the analyses for age (not different), gender (not different), and ethnicity (slight difference). Please see pg. 5. A sentence was also added to the limitations since our final sample was not representative of the population in terms of ethnicity. Please see pg. 15.

3.2 **Accelerometer text, what was considered ‘unreasonable values’ – it would be useful to have additional text on this.**

Unfortunately, the documentation for the NHANES study does give specific details on what was considered an unreasonable value. These values are supposed to represent biologically implausible values. The documentation does say that the reasonable range of values was determined by published literature and expert opinion. A sentence was added to further explain the “unreasonable values.” Please see pg. 5.

3.3 **Was triglyceride data available? If so, why was it not considered in the clustered score?**

Triglyceride and glucose, commonly used variables for the metabolic syndrome, are available in the NHANES database. However, participants aged 11 years and younger were not required to fast prior to having their blood sample drawn. In addition, although asked to fast, many of the 12-19 years olds did not fast prior to having their blood sample drawn. Therefore, we could not use the triglyceride and glucose data in our study, as these variables should be based on fasting blood samples. A sentence was added to explain this, please see pg. 7.

4.1 **RESULTS** - Do the results differ if the continuous CRS score is used? Please add a sentence on these results

The results did not differ when a continuous CRS variable was used. A sentence was added to the results section stating this (see pg. 11).

4.2 - **Under heading ‘patterns of sedentary behavior’ – replace ‘predictor’ with ‘predict’**

This change was made (see pg. 10).

4.3 - **Under ‘additional analyses’ replace ‘forth’ with ‘fourth’, also, add the P for trend for MVPA analyses.**

The changes were made (see pg. 11).

5.1 **DISCUSSION** - Under discussion concerning ‘possible explanations’ for
observations of TV use but not volume being associated with CRS score – another plausible explanation could be that the catchment period of the sedentary behaviour differed between measures, e.g. accelerometer was 7-days, self report was based on ‘past 30 days’ – it may be that the self-report measure, covering a longer period of time, might better reflect the ‘normal’ behaviour.

A third possible explanation was added to address this point. Please see pg. 14.

6.1 -Conclusions should not only emphasise what was found to be important, but also what sedentary components were found to be not important – this is a key, I feel, as the component (TV) that was found to be significant.

A sentence was added to the conclusion section in the abstract (pg. 2) and the main body of the text (pg. 15) to elaborate on what components of sedentary behavior were not associated with cardio-metabolic risk factors.

7.1 REFERENCES -Reference 5 is missing the year.

The year was added to this reference.

8.1 Table 1 -Left-hand column, ‘TV’ and ‘Computer’ are missing units, presumably the units are hrs/day?

“Hours/day” was added to the column that reads “Questionnaire-derived variables” Please see Table 1 on pg. 23.

8.2 - Left-hand column, parentheses are used to denote units in the upper portion of the table, but a comma in the lower portion – choose one or the other.

Parentheses are now used to denote all units (see Table 1 on pg. 23).

9.1 Table 3 -Please define in the table footnote and also in the methods text how you defined ‘high CRS’

In our methods section, “high risk” was replaced with “high CRS” in the last sentence in the “cardio-metabolic risk factors” section. Please see pg. 8. In the data analysis section, we already have a sentence that states, “All regression models predicted the highest CRS quartile…” A sentence was added to define high CRS in the footnote of Table 3, please see pg. 25.

9.2 -Table footnote, ‘diet’ – please add the specific diet variables that were included in the model.

The specific diet variables were added to the footnote of Table 3, please see pg. 25. They were also added in the statistical analysis paragraph, please see pg. 9.