Author’s response to reviews

Title: Association of parental body mass index (BMI) with child's health behaviors and child's BMI depend on child's age

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Reviewer reports:

Jennifer L Kuk, PhD (Reviewer 1): The authors examine the differences in the relationship between parental body mass index with child health behaviors and BMI by the child's age. This is an interesting study, but I have suggestions to improve the clarity of the paper.

We thank Dr. Kuk for her helpful comments and we have used her suggestions to revise our manuscript. Below, we replicate her concerns, followed by our responses and revised text. The revised text is marked and changed using highlights in the revised manuscript.

1. %95th BMI is a bit of an awkward term and it was not very clear to me what this was until I read the CDC website. Please consider revising your description in the abstract and methods for clarity and choosing an alternative abbreviation. At first, I thought you were referring to the
prevalence of obesity in your abstract. Further, if you read the abbreviation as written it is not grammatically correct or meaningful (percent 95th BMI).

Response: We changed the abbreviation for the percentage of 95th BMI percentile as %BMIp95. We found this term used in other papers as the abbreviation for the percentage of 95th BMI percentile.

2. In the abstract, you conclude about an 'epidemic' but do not refer to what factor you are referring to. As written, it would appear to be healthy behaviours, but I assume you are referring to obesity?

Response: We added ‘childhood obesity’ as the word we are referring to.

3. Please use person first language regarding obesity (i.e. you should not use the term 'obese').

Response: We changed some sentences where this was a concern.

4. The Introduction is written to suggest that longitudinal follow-up will occur (ie. ‘behaviors and BMI would be expected to diminish as children grow older’). This should be revised.

Response: We revised the sentence by removing the phrase, ‘diminish as children grow older’ and changing with ‘vary as a function of children’s age’.

5. The other issue with the introduction is that you go into great lengths to speak of the mother-father differences in the relationship with child obesity and behaviors, but you do not actually examine it. In fact, it does not appear that parental sex was even adjusted for in the model.

Response: We have revised that section of the Introduction to clarify that child sex is the factor of interest. We did not evaluate effects of parental sex since >90% of the parents in our study self-described as the mother of the child (i.e., >90% were women).

6. Units should be included in the results text for all numbers presented.

Response: There are 150 values given all of the combinations of groups (by child sex), BMI for parent and child, and behaviors. We have included the magnitudes for the most pertinent statistically significant associations (see bottom of page 8). The magnitudes for all of the
differences between groups and associations among variables are provided in Tables 3, 4, and 5, and we have added the units of measurement to the table footers for clarification. All other numbers in the results text are p-values associated with the values in the tables.

7. This sentence makes a judgement that obesity and lifestyle factors are synonymous, and should be revised. "Due to the inclusion criterion in TX for children to be ≥85th BMI percentile, the TX children had a higher mean %95th BMI, less frequent FV intake, more frequent SSB intake, more hours of screen time, and a lower proportion participating every day in ≥60 min/day of PA, compared to the MA and CA children."

Response: We revised the sentence: Due to the inclusion criterion in TX for children to be ≥85th BMI percentile, the TX children had a higher mean %BMI. The TX children also had less frequent FV intake, more frequent SSB intake, more hours of screen time, and a lower proportion participating every day in ≥60 min/day of PA, compared to the MA and CA children.

8. I am a bit confused at how the authors arrived at the conclusion that 'In the present study, parental BMI was positively associated with FV intake in boys'. From table 4, it appears you are only reporting a significant P-BMI*age3 effect.

Response: That statement is the result of the test of the direct effect only (Figure 1(a) model), not the full mediation (path) model (Figure 1(b) model). The parent BMI effect in Table 4 is a reduced direct effect due to the variation accounted for by the indirect effect of the path from parent BMI to child behavior to child %BMI. These results of the direct effect model (Figure 1(a)) were not shown in the tables. We have also modified the wording in the Results to parallel the description of the analyses in the Methods.

9. In the conclusion "Higher FV intake in middle school boys with higher parental BMI could be explained by greater overall frequency of food consumption, including more fruit and vegetables, with larger parent body size". One of the issues with your measure is that you do not express the amount eaten, particularly relative to the recommended amount. In fact, one could conclude the opposite, that the parents with higher BMI may be more concerned with obesity in their sons and provide a better diet as reflected by their higher FV consumption.

Response: Thanks for providing the good point. We added the point you raised as another potential explanation.
10. "In the present study, parental BMI was positively associated with FV intake in boys and SSB intake in girls, but not with child's screen time and PA". Unless I am misreading table 4, parental BMI is associated with more PA in boys. This does not appear in the discussion.

Response: This statement refers to the average effect of parent BMI across all age groups (results at Line 158-162), which is followed by the tests of whether the parent BMI-child BMI association varied by age group (Line 163-166). Tables 4 and 5 do not show the average effects, those tables contain the regression coefficients for the paths shown in Figure 1(b). We have modified the text in the Results to clarify that the average effects across all age groups are not shown in the tables.

11. One of the main issues is that your conclusions do not appear to be entirely based on your findings, but are reinforcing your assumption that diet and exercise are the sole cause of obesity, and that the parents are to blame. However, you did not examine parental behaviours, only parental BMI and made the assumption that higher BMIs are reflective of poor lifestyles. Further, you show very few significant pathways that go from the behaviour to child BMI independent of the parental BMI. These generalized statements reinforce the negative stigma associated with obesity and your conclusions and statements need to be buffered in the context of your results and your data to substantiate your views. Specific examples are listed below, but are by no means exhaustive.

-"One potential explanation for our results is that long exposure to unhealthy parent behaviors in a shared unhealthy home environment may result in higher %95th BMI in older children and increase the association with parental BMI."

-"An assumption in interpreting our results is that parental BMI is an indicator of long-term parental dietary, PA, and sedentary behaviors, and that those health behaviors would influence their child's health behaviors and BMI [11, 12]."

-"These results indicate that childhood obesity may be affected by inheritable factors, parental behaviors, and a child's own unhealthy behaviors. Thus, interventions for the prevention and control of childhood obesity may consider focusing on simultaneously changing the health behaviors of both parents and children."

Response: We agree that causality and attributions such as blame are not supported by our analysis. Caution is warranted in interpreting that a direct or indirect association indicates that “blame” should be placed on individuals, such as viewing parents “the” causal agent of obesity in childhood. Our data do not suggest this. Instead, these associations should be viewed as opportunities to determine factors that may impact obesity in children. Because obesity is an
intractable disease with multiple etiologies, “blaming” individuals (either parents or children) is counterproductive and fails to consider the environmental, genetic, epigenetic, and biological aspects of obesity.

We modified several locations in the main text. Please see Lines 195-198, Lines 199-202, Lines 244-249, and Lines 272-275.

Your conclusions suggest that childhood obesity may be affected by parental behaviours, but you did not examine that. Given that you have looked at the child's behaviour, which was not generally significantly associated with child BMI, then what this would mean is that the parental BMI or behaviours as you suggest, influence their child's body weight more than what the child does. So in other words, are you suggesting that the parents tv viewing doesn't cause the child to watch more TV, but causes their child to gain weight?

"Our findings are also consistent with the notion that early life (before age 5) may be the best opportunity for interventions to prevent childhood obesity, before children develop their own unhealthy behaviors and weight status." However, for most of the behaviours, they are not significant predictors of Child BMI independent of parental BMI.

Response: Thank you for raising this excellent point. We agree that childhood obesity is the result of complex interactions across environmental and sociocultural contexts, as well as inheritable factors and possibly the behaviors of the parents. The parents’ behaviors and BMI are also likely affected by the environmental and sociocultural factors, such that the BMI and behaviors of both parents and children are effects by those higher-level influences. This would result in apparent associations between parent and child BMI and behaviors that may be due at least in part to those higher-level factors, rather than solely as a direct effect. The influence of higher level factors may also explain a lack of association between child behaviors and child BMI since, as you point out, the “other” factors (e.g., genetic, epigenetic, environmental and sociocultural factors) may be playing a large role in the development of childhood obesity, more so than child behaviors.