Author’s response to reviews

Title: Associations between socioeconomic factors and fruit and vegetable consumption of children in grades five and six in British Columbia, Canada.

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Author’s response to reviews: see over
Dear Editor,

Attached is our revised research article, “Associations between socioeconomic, parental and home environment factors and fruit and vegetable consumption of children in grades five and six in British Columbia, Canada.” to be considered for BMC Public Health.

Following you will find our response to the reviewers. We appreciated the opportunity to enhance the manuscript based on the reviewer’s feedback. Thank you for your time and consideration of these revisions.

Kind regards,

Patti-Jean Naylor, PhD
Associate Professor
Response to Reviewers

Reviewer 1 Comment 1:
Major Compulsory Revisions

Introduction
1. The rationale is a bit weak – what are the gaps in the literature? Why grade 5-6 students? What is the rationale for the secondary objective? Is there previous research about the other social factors?

Response: a) Rationale: Thank you for the suggestions. We have re-organized the rationale to emphasize the lack of data on pre-adolescent children in Canada, the need for data across cultural and geo-political contexts and to highlight the literature that supported inclusion of the other social factors. We have also changed the title and research questions to more clearly reflect this.

We also hanged the phrase older children to pre-adolescent to help to clarify as well.

Addition: Page4/5 line 1-5: “Although studies conducted outside of Canada have shown a positive relationship between SES and nutrition in pre-adolescent children [24-26], there is limited information on Canadian children. Researchers have identified both that social factors associated with fruit and vegetable consumption may differ for adolescents and children, and that there was a need for studies involving populations from different political contexts [27].”

Addition: Page 5 “Beyond the socio-economic (income and education) determinants a number of other social factors have associated with healthy eating in children. These include gender, culture, family (parental modeling, family structure, parenting style, meal structure – family meals, positive attitudes/parental support for healthy eating), exposure to media - in particular television, watching TV while eating, and home and school availability and access to healthy food choices [4, 28-29]. Taylor, Evers and McKenna (2005) emphasized a need for studies on both the determinants of, and children’s eating behaviour, in Canada [4].”

Grades 5 and 6 were targeted because they are pre-adolescent children and also because these grades represent ages that can provide reliable estimations of their food intake (Baranowski and Domel 1994). The discussion highlights the limitations of measuring children and cites the age of 10 years as the minimal age for reliability. (In addition this study was a sub-study of an intervention trial targeting this age group).

Addition: Discussion page 15 Line 19-22 “However, this is likely true only if the children are ten years of age or older [49]. As the children in this study were
between the ages of ten and twelve, with an average age of 11.3 years, it is probable that most of the participating children were of an age where they could accurately complete the surveys used in this study.”

Methods
Reviewer Comment 2. There is a fair bit of missing data, particularly from the parent questionnaire (I’ll assume it’s from parents who declined to disclose this data). This should be discussed. Were only those with complete parent and child surveys included in the multiple regression model?

Response:
Thank you for these comments –We have added a further comment into the discussion limitations section about the bias that may be introduced by parents not completing the parent questionnaire. Yes using listwise entry the multiple regression reduces the sample.

Addition: Page 16 L1-4 A second limitation, highlighted by the response rates and descriptive statistics, was a potential sampling bias. As with all studies we depended on volunteers and although it appears that the SES of the adult participants was close to the reported population norms in 2011 [50, 51] our data showed that most reported caring about eating healthy foods.

Discussion
Reviewer Comment 3. Much of the discussion outlines relationships between income, education and other social variables, but these were not presented in the results section. Perhaps another table and another objective needs to be added to this paper about relationships between income, education and other social predictors of vegetable and fruit intake.

Response: Thank you for this advice. We added all of the relevant correlations into the results in Table 4 and added two sentences to direct the reader to the table and the fact that there were relationships among these variables. We didn’t add a research question about the relationship among the social predictors as this wasn’t the focus of the paper but do comment on it in the discussion related to the development of risk over time and highlight the need for longitudinal studies.

Additions Page 9 L 9-11: Although parent income and education were not significantly associated with child FV consumption they were associated with each other, child-reported family affluence, neighbourhood environment, access to FV, and eating at the table or in front of the television.

Page 9 L 1-2 “Relationships among all of the variables are shown in Table 4. Correlations between SES and the other social factors and fruit and vegetable intake are highlighted briefly below.”
“A number of social factors and SES were correlated with each other (see Table 4).”

Reviewer Comment 4. Why might FAS be related to V&F intake when other SES measures are not? FAS is supposed to be an indirect measure of SES. What else might it be measuring?

Response:
The family affluence measure asks about proxies for family income like vacations, car ownership and televisions. This may measure the concept of disposable income which is a relative measure (based on family size, living arrangement, etc.) while income is an absolute measure. We have added a comment to this effect in the discussion.

Addition: Page 13 L 6-10
“This may reflect subtle differences in the measures. The affluence measure is a relative measure, most closely associated with the concept of disposable income, while parent-reported income is an absolute measure, not adjusted for items like family size, housing costs, debt, etc. Nevertheless, the finding was in the trivial range in terms of effect size so the deviations between income and affluence may be negligible in terms of predictive utility.”

Minor Essential Revisions
Methods
1. What is the overall purpose of the SFVNP?

Response
Thank you for pointing out an oversight. We added a sentence to the research design section of the methods indicating the overall purpose of the SFVNP.

Addition: Page 5 L 20-23 “We conducted a cross-sectional descriptive analysis using baseline data from the British Columbia School Fruit and Vegetable Nutrition Program (SFVNP) study, a matched comparison trial evaluating the effectiveness of delivering local fruit and vegetable servings to classrooms twice a week in alternate weeks.”

2. Under “Dietary Intake”
a. Is this a web-based tool? Please clarify

Response:
We added the words web-based tool to the section on Dietary Intake

b. “Further, the need for abstract thinking is eliminated” This is vague. Is it the visual aids that decrease the need for abstract thinking? I think “eliminated” is too strong a word.
Response:
Thank you for noting this. We joined the two sentences to increase the clarity and specificity of the comment as well as removing the word eliminated.

Addition: Page 7 L 5-8 “The survey, which has been described elsewhere, and validated for this age group (29), was designed to minimize recall error and inaccurate estimation of portion size in younger populations by using built-in prompts and visual aids to reduce abstract thinking [30, 31].

c. Add “A previous validation study showed that” to the sentence starting “when compared with direct observation...”

Response: Thanks for this comment. Based on comments from the second reviewer we decided to remove the statement about the results from the Grade 9 and 10 study and just to include the results from the validation study with Grade 6-8. It now reads the following:

Addition: Page 7 L 8-10 “In the validation study with Grade 6-8 children there was good agreement for energy and key nutrient intakes when compared with dietitian-administered food recall interviews for the same 24-hour period [30].”

d. reference needed for Eating Well with Canada’s Food Guide

Response: Thanks for noting this missing item. We have added a reference.

e. How were mixed dishes classified? F. was juice classified as a vegetable or fruit? Were potatoes /French fries?

Response: We added a sentence into the methods about how mixed dishes were classified and juice and potatoes/French fries.

Addition: Page 7 L 14-17 “Mixed meals were broken down into their component foods appropriate to the serving sizes and based on standard foods in the Canadian Nutrient File database. Juice was classified as a fruit or vegetable depending on content (e.g. carrot versus orange) and potatoes and French fries were classified as vegetables.”

3. Under other social factors
a. More details needed about what was asked in terms of parents’ perception of their child’s eating behaviours

Response
Details about the descriptor categories in the 4 point likert scale are provided specifically in Table 3 and we added to the sentence in the data collection
section to indicate that it was their perception of whether the habits were healthy and that it was a 4 point likert scale.

**Addition:** “…parents’ perception of whether their child’s eating behaviours/habits were healthy, and how much they personally cared about eating healthy foods and exercising (all on 4 point likert scales). “

Results
4. What were the extreme food group cut-offs based on for your outlier analysis?

**Response**
The extreme food group cut-offs were based on the outlier analysis and a statement about this is included in the results section. Page 10 Line 13-15.

5. The correlation between FAS and fruit and vegetable intake should be reported in the text prior to the multiple regression model as this appears to be an important predictor.

**Response**
We added the correlation matrix into the tables (Table 4) so that the readers could see all of the significant and non-significant relationships plus we added the following statement into the text on Page 11 Line 7-8

“Child reported Family Affluence was significantly related to FV consumption (rs = 0.09, p< 0.05) but was below the lower limits for meaningfulness suggested by Cohen [42].”

Discussion
6. There is very little evidence from this study to suggest there is a direct effect of income and education on V&F intake – it may be the reason why other studies did find relationships between SES and vegetable and fruit intake – I think this is the point authors would like to make, but clearer wording is needed.

**Response:** Thank you we used your words to enhance the clarity of the statement. Page 12 L 21-22 now reads:

“Second our results provided little evidence to suggest that socio-economic status and other social determinants were associated with children’s fruit and vegetable consumption.”

7. A bit more information about what other factors influence V&F consumption in youth would be helpful.

**Response:** We added a paragraph about these factors to the introduction/rationale.
8. How representative was your sample of the general Canadian/BC population in terms of demographics (both children and adults) and dietary intake? Do a more thorough comparison.

Response: We included a statement comparing our means with Canadian data. “The proportion below the recommendations in our study (85%) was even higher than the 62% of boys and 68% of girls who were below recommendations in the nationally-representative Canadian Community Health Survey, Cycle 2.2 (CCHS 2.2) [21]. This may be because the recommended minimum number of servings at the time the CCHS 2.2 was conducted was 5 servings per day, which was subsequently increased to 6 servings per day in the 2007 food guide.”

9. What should future studies investigate?

Response: We expanded the discussion quite a bit to enhance the discussion of the developmental aspect and have added a sentence about the need for longitudinal data to the conclusions to reflect this discussion. See following.

Additions: Page 13 L 11-16 “Based on our correlation results however, it is possible that there is a developmental aspect to the relationships we explored. For instance parental income might be related to fruit and vegetable consumption through a set of behaviours that may aggregate and take time to fully manifest as measurable fruit and vegetable consumption effects. This could explain the significant relationship between SES and consumption found in adolescence and then more consistently in studies of adults.”

Page 17 L 9-12 The home environment, parental perceptions and habits, were weakly associated with fruit and vegetable consumption and also with parental income and education and the influence of these and other factors deserves further exploration using longitudinal designs to explore the development of fruit and vegetable consumption behaviours over time.

Tables/Figures
10. Outlier cut-offs not needed below Table 1

Response: We removed the outlier cut-offs from Table 1 and included them in the results section.

11. In table 1 It would be clearer if the recommended servings from Canada’s Food Guide had its own column and was labeled more clearly – perhaps “Recommended Food Group Servings”.

Response: Thank you for the suggestion. We changed the column label to read “Recommended Food Group Servings.”
12. In Table 2 the codes for the categorical variables are not needed

**Response:**
We take the reviewers point especially with a variable like gender. However, we included the codes so that the readers of the article could relate the mean scores to the scales and this was more efficient and easy to be clear than including it in text.

13. Figure 1 depicting FAS scale results is not terribly useful. I’d rather see the correlation between FAS score and vegetable and fruit intake.

**Response:** Once again thank you for the advice. We removed the Figure 1 and we included a 4th table with the correlation matrix. The correlation between FAS and VF intake was also highlighted in text.

Discretionary Revisions
1. Was there any effect of the neighbourhood construct about grocery store availability on vegetable and fruit intake? It might have a stronger link than the entire scale.

Response: We had a measure of neighbourhood access to stores that sold fruit and vegetables (FV access) that did not relate fruit and vegetable consumption. We show this in Table 4 and comment on this in the discussion related to access and availability as it is highlighted in the literature.

**Addition:** “this may reflect the level of access measured. Our measure was about neighbourhood access while the determinants literature identified access in the home. We also used perceived access rather than directly measured access which may reflect the awareness and attitudes of the parents rather than actual access.”

Level of interest:
An article of importance in its field
Quality of written English:
Needs some language corrections before being Published

**Response:** We conducted a further edit of the manuscript to enhance readability.

**Reviewer 2 Comment 1:**
1. Is the question posed by the authors well defined?
No - I have highlighted the problems with the questions. The authors could have made better use of the data. In fact, I believe that the manuscript the authors
may consider splitting the paper. For example, parental perceptions and health beliefs would make a nice paper on its own.

**Response:**
The reviewer accurately points out that the title and research questions aren’t clear in several places. We believe that the more comprehensive analysis of social factors provides a more significant look at fruit and vegetable consumption and thus have (as described in several responses) changed the title and rationale to reflect the more comprehensive approach.

**Reviewer 2 Comment 2.** Are the methods appropriate and well described? At first glance, it would seem that the methods are appropriate, but the methods are not well described - lacking detail and description. The formative work that was done (and in some instances appears to have not been done) is not explicitly addressed. The tools/instruments are identified but it is not clear whether the authors had permission to use these tools. Also, it is not clear that any validation work was done on the tools prior to launching it with participants (e.g., criterion validation, Web-based survey validated for use by elementary students since it was developed for adolescents, etc.). This is an important piece that is missing in the methods. If this evaluative work has not been done, it would weaken the credibility of the findings.

**Response:**
Thank you. We appreciate the request for this extra detail and feel it has significantly strengthened the methods section.

First, as this study was funded in response to a rapidly emerging population health intervention and thus we adopted existing validated instruments that were: a) previously used in Canada, b) with a similar age group to our research population and c) had evidence of validity and reliability where possible. We describe the validated instruments following:

The family affluence scale is validated and we include this information in the data collection section. The Health Behaviour in School Children study, which uses the FAS, is a large International study that has been implemented in Canada for more than a decade and thus with the context time constraints of a rapidly emerging population health intervention (see CIHR or NIH for definitions and description of these research initiatives) and an instrument that was being used currently with Canadian children we did not conduct more formative work.

The web-based 24 hour recall was validated with children as young as grade six (Hanning RM, Royall D, Toews JE, Blashill L, Wegener J, Driezen P: Web-based Food Behaviour Questionnaire: validation with grades six to eight students. Can J Diet Pract Res 2008, 70:172-8.). The exception is that our cohort was grade 5 and 6 while the youngest age group that the web-based 24 hour recall tool was validated with was in Grade 6. Based on the literature (e.g. Baranowski and
Domel 1994) however, we feel confident that with an average age of 11.3 years our cohort would have the cognitive capacity to answer the questions and in fact measured in the later grades because of this. Further, as grade is only a proxy for developmental age and stage it is likely that there will be a variety of capabilities in each grade grouping. We paid the University of Waterloo (PI Rhona Hanning) for the use of the web-based 24 hour recall system. We didn’t include this detail in the text as it wasn’t relevant to the methods, analysis or discussion.

We enhanced the details about the validation of the web-based survey (with grade 6s) to the methods section.

We obtained the Real Kids Alberta survey http://www.realkidsalberta.ca/research-tools from the Principal Investigator Dr. Paul Veugelers. (Carson V, Kuhle S, Spence AJ, Veugelers PJ. 2010; Z. Davidson, A. Simen-Kapeu, P.J. Veugelers 2010; Veugelers, Fitzgerald, Johnson 2005). It is also publicly available and thus, as above, we didn’t include explicit mention of permission to access in the text.

Within the Real Kids parent survey:

Most of the demographic information in the Real Kids survey which is a population based survey is standard population health survey practice.

The self-reported neighbourhood perceptions scale was drawn from items and environment scales validated by Echeverria, Diez-Roux and Link 2004 and cited in Carson, Kuhle, Spence and Veugelers 2010. We have modified the methods section to include reference to this. “The neighbourhood environment score for which excellent item correlations have been previously demonstrated (Carson, Kuhle, Spence and Veugelers 2010; Echeverria, Diez-Roux and Link, 2004) was generated by summing 8 scores... “

Home habits related to meal time were taken from the Harvard Food Frequency questionnaire for youth (the use of which was paid for by both the Real Kids team and our study)

The parental perceptions are single item questions with no published validation work. However, we contact Dr. Veugelers the PI on REAL Kids who indicated that the formative work (logical validity, pilot testing with a group of Grade 5 children and adjustment of the questions) was completed. We added the following to the methods section:

Additions:

“The neighbourhood environment score was generated by summing 8 scores (4-point likert scale with 1= strongly disagree and 4 = strongly agree) on previously validated items about neighbourhood [37-39] including items that
addressed: a) neighbourhood satisfaction and services (liking where they live, access to recreation programs and facilities and access to stores to purchase fresh fruits and vegetables); b) neighbourhood safety (safety to play outdoors during the day, safety of children related to crime and traffic); and c) neighbourhood parks and playgrounds (presence of parks, playgrounds and places to play, presence of sidewalks on most streets).

The access to stores question from the neighbourhood measure was used as an independent assessment of a supportive neighbourhood fruit and vegetable environment. The family dining questions were from the Harvard Food Frequency Youth Adolescent questionnaire [40] and the parent’s perception of their child’s eating and their personal caring about healthy eating and physical activity and PA were developed, piloted and adjusted by the REAL KIDS Alberta survey team for use with the parents of pre-adolescent children [41].

Reviewer 2 Comment 3. Are the data sound?
A more detailed description of the data analysis would strengthen this section. It is difficult to assess this section.

Response: We added details about the analysis. For instance we added details about how we identified outliers and whether only data from children with parent data was included in the multiple regression.

Reviewer 2 Comment 4 The discussion and conclusion needs to be flushed out - the authors need to talk more about the nuances of their data rather than simply backing up their findings what others have found.

Response: Thank you for noting this oversight. We added several sentences to the discussion that highlighted the nuances of our findings.

For example, we discussed why the Family affluence scale results may have differed from the results found for income. We also discussed why the access measure may not have been related to actual fruit and vegetable consumption.

Addition: However, reported access did not correlate with children’s consumption in our study, which may reflect the level of access measured. The lack of relationship may be because our measure was about neighbourhood access while the determinants literature identified access in the home [4, 27-28]. We also used ‘perceived access’ rather than directly measured access and thus our measure might reflect parental awareness and attitudes rather than actual access.

Reviewer 2 Comment 5. Do the title and abstract accurately convey what has been found?
Specifically the title should indicate a broader approach that includes the other factors that were also examined. Additional comment in our abstract indicates that Dr. Farmer prefers the sentence that says the purpose of the paper was to...
explore the relationship between socio-economic, family and home environmental factors

**Response:** Thank you for this comment. We changed the title to more accurately indicate to the reading audience that other social factors were also examined. We also expanded the rationale to include these factors.

**Reviewer 2 Comment 6**
The writing of the manuscript needs to be improved. There were several grammatical and syntax errors, and in addition to that, there were many sentences that were not clearly written. Also, I would suggest replacing colloquial terms and informal style of writing with one that is more technical and formal. As well, I would suggest having the manuscript reviewed by a copy editor to assist with some of the problems that I have identified.

**Response:** We conducted a thorough review of the manuscript to identify and change colloquial terms and to address sentence structure and grammar.