

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.

This paper was submitted to a another journal from BMJ but declined for publication following peer review. The authors addressed the reviewers' comments and submitted the revised paper to BMJ Open. The paper was subsequently accepted for publication at BMJ Open.

ARTICLE DETAILS

| | |
|----------------------------|---|
| TITLE (PROVISIONAL) | A cross-sectional analysis of the association between household food insecurity and mental health conditions in children aged 5 to 11 years in Canada |
| AUTHORS | Thielman, Justin; Orr, Sarah; Naraentheraraja, Saranya; Harrington, Daniel; Carsley, Sarah |

VERSION 1 – REVIEW

| | |
|------------------------|--|
| REVIEWER | Borja, Judith University of San Carlos, Office of Population Studies Foundation, Inc. |
| REVIEW RETURNED | 05-Dec-2023 |

| | |
|-------------------------|--|
| GENERAL COMMENTS | Associating food insecurity in the past year with children's diagnosed mental health conditions - that may have occurred for six months or more (would this include since early infancy? since birth?) may have temporal sequence issues, particularly in a cross-sectional study. This may be problematic in an age range of 5-11 years where exposure to the mental health condition may vary. The choice of ASD and ADHD as outcome does not seem appropriate. Psychological distress, acute anxiety, depression or other stress-related outcomes may be more appropriate. Furthermore, mental health status is affected not just by food security or nutrition, socio-economic status - but also by health status, cognitive capacity, schooling and environmental factors such as presence of stressors (in various domains), level of support received, household dynamics, etc - which are not reflected in the choice of covariates. |
|-------------------------|--|

| | |
|------------------------|--|
| REVIEWER | Elgar , Frank McGill University, Montreal, QC, Institute for Health and Social Policy |
| REVIEW RETURNED | 07-Feb-2024 |

| | |
|-------------------------|---|
| GENERAL COMMENTS | The study investigates the association of household food insecurity (FI) with child mental health in population-based sample of families in Ontario using data from the Canadian Health Survey on Children and Youth (CHSCY). The results showed that children from moderately to severely food insecure households were more likely to have a diagnosed mental health condition – either anxiety, mood, ADHD, or Autism Spectrum Disorder (ASD), which is mostly |
|-------------------------|---|

consistent with other studies in this area. The topic is important and a good fit to this journal, and there are several strengths of CHSCY. The paper is well written and organised, and the authors' attention to covariates helped isolate effects of FI that are not explained by other socioeconomic factors. However, there are a few minor issues in how the data were analysed and then interpreted that will need to be addressed.

1. The knowledge gap described in the background section seems overstated given previous Canadian studies that already reported on the association of FI and child mental health (some using CHSCY data). We recommend the authors try to square that body of work with their new analysis and try to clarify what's novel here. These are a few papers to help things along...

Food Insecurity is Associated with Poor Mental Health in Canadian Children and Adolescents

(<https://doi.org/10.1177/07067437231225938>)

Household food insecurity and health service use for mental and substance use disorders among children and adolescents in Ontario, Canada (<https://doi.org/10.1503/cmaj.230332>)

Food insecurity is associated with mental health problems among Canadian youth (<https://doi.org/10.1136/jech-2020-216149>)

Association of food insecurity with children's behavioral, emotional, and academic outcomes: a systematic review

(<https://doi.org/10.1097/DBP.0000000000000383>)

2. We did not see a justification for limiting the sample to Ontario children. Unless there was something distinct about the Ontario context in 2019, the findings seem less robust and less generalizable than they need to be. Using the full national sample in CHSCY might allow them to compare regions of Canada, or at least reduce the CIs around some of those odds ratios.

3. The paper examines 4 diagnosed (according to parents) mental health conditions – mood, anxiety, ADHD, and ASD. These are distinct and by no means comprehensive of all mental conditions in children, and the decision to study them was likely a pragmatic one (it's what was available in the dataset). The issue is with how the outcomes are combined. The outcome variable in the main analysis is having any 1 of the 4 mental health conditions, and the supplementary analysis shows 4 conditions collapsed into 2 groups: either mood or anxiety, and either ADHD or ASD (not a natural pairing). But why combine them at all? Running separate regression models for each of the four outcomes with mutual controls for the other 3 should help give their findings more precision and relevance. The 'more of something' outcome is difficult to translate into clinical practice or health policy.

4. A related point: the 4th paragraph of the background section mentions stress as a potential pathway in the effects of FI on child mental health. The paragraph could be developed to explain why they studied multiple child outcomes, with some having more obvious links to stress than others (ASD?). A scan of the literature should help identify social, biologic, and psychological mechanisms: family stress, gut-brain axis, social stigma, emotion dysregulation, etc.

Minor issues:

| | |
|--|--|
| | <p>5. Food insecurity is narrowly defined as a “lack of access to food as a result of financial struggles.” We recommend updating the definition to bring it in step with the literature, which defines FI as either inadequate or insecure access to food due to financial constraints and including concerns about running out of food, ability to buy more food, inability to afford a balanced diet, worries about missing meals, or skipping meals to shield children from having to. There's more to FI than just running out of food.</p> <p>6. The discussion section points to parent/caregiver reports of FI as weakness of the study, but we could not imagine who or what is a better source for this knowledge. The children were too young to complete a household assessment of FI on their own.</p> <p>7. The CHSCY datafile includes self-reported household income and tax-linked income data provided by Statistics Canada. Which did they use?</p> <p>8. Another minor revision is in Figure 1, which should be changed to show differences in mental disorder prevalence across levels of FI; i.e., group by the outcome first, then FI severity within each outcome group (in Excel, the x-axis and legend categories can be swapped using ‘switch row/column’). If they restructure their analysis to isolate the 4 outcomes (see #3 above), then the figure should be changed accordingly to show 4 clusters of 4 bars each.</p> <p>9. Finally, the statement of ethics approval should be expanded to acknowledge the federal agency and REB that oversaw CHSCY survey procedures, confidentiality of the data, data collection and storage, etc.</p> |
|--|--|

VERSION 1 – AUTHOR RESPONSE

Reviewer: 1

Dr. Judith Borja, University of North Carolina at Chapel Hill

Comments to the Author:

Associating food insecurity in the past year with children's diagnosed mental health conditions - that may have occurred for six months or more (would this include since early infancy? since birth?) may have temporal sequence issues, particularly in a cross-sectional study. This may be problematic in an age range of 5-11 years where exposure to the mental health condition may vary. The choice of ASD and ADHD as outcome does not seem appropriate. Psychological distress, acute anxiety, depression or other stress-related outcomes may be more appropriate. Furthermore, mental health status is affected not just by food security or nutrition, socio-economic status - but also by health status, cognitive capacity, schooling and environmental factors such as presence of stressors (in various domains), level of support received, household dynamics, etc - which are not reflected in the choice of covariates.

We thank the reviewer for these comments. We acknowledge that our ability to assess temporal sequence of this association due to the cross-sectional study design and questions asked is a limitation of this study. We have provided a description of this in the limitations section of our discussion. At the bottom of page 8, the text states “The study used a cross-sectional design and is therefore unable to determine causality or to detangle the potential bidirectional relationship between food insecurity and child mental health.”

We have also addressed the reviewer’s concern about including ASD and ADHD by improving the rationale for including these outcomes in the study background and thank the reviewer for highlighting this. We additionally separated ASD and ADHD as outcomes in the supplementary analysis to be

more precise about the relationships we are testing. At the bottom of page 3, the text now states “Research from the US has shown families of individuals with autism spectrum disorder and ADHD experience higher levels of food insecurity due to multiple social and biological mechanisms (Hatsu et al., 2022; Karpur et al., 2021). For example, parents of children with autism spectrum disorder spend more money in out-of-pocket health care expenses than those without autism spectrum disorder, impacting household finances (Rogge and Janssen 2019).”

The covariates included in this analysis were chosen a priori based on the current literature on food insecurity and child mental health, as well as the available data. Each potential confounding variable is referenced to previous literature showing both an association with food insecurity and child mental health that does not lie on a causal pathway. There are many risk factors for mental health therefore we were wary of over-controlling/specifying our model. We did include divorce/separation to address potential household dynamics.

Reviewer: 2

Dr. Frank Elgar , McGill University, Montreal, QC

Comments to the Author:

Note: This review was written with the assistance of Lovena Jacqdom, a graduate student at McGill University.

The study investigates the association of household food insecurity (FI) with child mental health in population-based sample of families in Ontario using data from the Canadian Health Survey on Children and Youth (CHSCY). The results showed that children from moderately to severely food insecure households were more likely to have a diagnosed mental health condition – either anxiety, mood, ADHD, or Autism Spectrum Disorder (ASD), which is mostly consistent with other studies in this area. The topic is important and a good fit to this journal, and there are several strengths of CHSCY. The paper is well written and organised, and the authors’ attention to covariates helped isolate effects of FI that are not explained by other socioeconomic factors. However, there are a few minor issues in how the data were analysed and then interpreted that will need to be addressed.

1. The knowledge gap described in the background section seems overstated given previous Canadian studies that already reported on the association of FI and child mental health (some using CHSCY data). We recommend the authors try to square that body of work with their new analysis and try to clarify what's novel here. These are a few papers to help things along...

Food Insecurity is Associated with Poor Mental Health in Canadian Children and Adolescents (<https://doi.org/10.1177/07067437231225938>)

Household food insecurity and health service use for mental and substance use disorders among children and adolescents in Ontario, Canada (<https://doi.org/10.1503/cmaj.230332>)

Food insecurity is associated with mental health problems among Canadian youth (<https://doi.org/10.1136/jech-2020-216149>)

Association of food insecurity with children’s behavioral, emotional, and academic outcomes: a systematic review (<https://doi.org/10.1097/DBP.0000000000000383>)

We thank the reviewer for providing these references and helping us to clarify the knowledge gap this study fills. We had previously referenced the two studies by Anderson et al. and Men et al. The study by Sharifi et al., which also uses CHSCY data, was published after our submission of this paper for peer-review; we appreciate the reviewer flagging and agree that the work and findings are relevant. We have now added the reference to our background with the following text, which appears on page 3: “Another recent cross-sectional study using population survey data shows poorer mental health among food insecure Canadian children and adolescents. However, this study classifies children as food insecure solely based on the child-referenced items in the household food insecurity questionnaire, which arguably misclassifies many children living in food insecure households (as indicated by an affirmative response to at least one adult-referenced item) as ‘food secure’.” Briefly, our study examines this association in middle childhood (5 to 11 years), an age group that traditionally has a dearth of data on health exposures and outcomes, but which is a distinct period in childhood.

As public health professionals, we were interested in investigating if an association that is often seen in adolescents and adults (as shown in the paper by Men et al.) or for different mental health outcomes (as shown in the paper by Anderson et al.) would be consistent at an earlier age with mental health conditions that are specific to that age group, and where potential interventions and preventive measures might be implemented. We have incorporated this in the background. The text on page 4 now states “This study builds on prior knowledge by examining a younger age group, multiple levels of food insecurity and the association with specific mental health conditions and developmental disorders.”

2. We did not see a justification for limiting the sample to Ontario children. Unless there was something distinct about the Ontario context in 2019, the findings seem less robust and less generalizable than they need to be. Using the full national sample in CHSCY might allow them to compare regions of Canada, or at least reduce the CIs around some of those odds ratios.

We thank the reviewer for this comment and agree the entire Canadian sample would improve our generalizability and narrow some confidence intervals. We have now expanded our analysis to include all of Canada. To do this we submitted an ethics amendment to the Public Health Ontario Research and Ethics Board, and were approved to conduct this broader analysis on March 18, 2024. The Canadian sample findings have replaced the Ontario findings throughout the manuscript.

3. The paper examines 4 diagnosed (according to parents) mental health conditions – mood, anxiety, ADHD, and ASD. These are distinct and by no means comprehensive of all mental conditions in children, and the decision to study them was likely a pragmatic one (it's what was available in the dataset). The issue is with how the outcomes are combined. The outcome variable in the main analysis is having any 1 of the 4 mental health conditions, and the supplementary analysis shows 4 conditions collapsed into 2 groups: either mood or anxiety, and either ADHD or ASD (not a natural pairing). But why combine them at all? Running separate regression models for each of the four outcomes with mutual controls for the other 3 should help give their findings more precision and relevance. The 'more of something' outcome is difficult to translate into clinical practice or health policy.

We appreciate this helpful feedback about our study's outcomes. We think it's important to keep our primary outcome consistent to reduce the risk of selective outcome reporting, so we have kept 'any of the 4 diagnosed mental health conditions' as our primary outcome. We carefully considered the reviewer's feedback and have now included the following secondary outcomes: 1. Diagnosed mood and/or anxiety disorder, 2. ADHD, 3. ASD. The sample size was too small to produce stable estimates for mood disorders alone, so we combined mood and anxiety disorders, which we think is an acceptable pairing due to shared risk factors. We agree with the reviewer that ADHD and ASD is not an ideal pairing and we were able to analyze these outcomes separately.

We added the following text to the Methods section on page 5: “We also analyzed three secondary outcomes. We assessed the associations between food insecurity and autism spectrum disorder and ADHD as two separate outcomes. We assessed anxiety disorder and mood disorder grouped together because small sample sizes of children with these outcomes precluded analyzing them separately. As a sensitivity analysis, we combined the three levels of food insecurity together to create a dichotomous exposure variable and analyzed its association with having any of the four mental health outcomes.”

We added the following text to the Results section at the top of page 7: “Regarding the secondary outcomes, in the unadjusted analysis of mood and/or anxiety disorders, each level of food insecurity was associated with over twice the odds of a mood and/or anxiety disorder. However, adjusting for confounding factors attenuated each association, especially the association with severe food insecurity, which was no longer statistically significant. In the analysis of ADHD, adjusting for confounding factors also attenuated the associations between each level of food insecurity and diagnosed ADHD, although in this case only participants with severe food insecurity remained significantly more likely to have ADHD. Similar to the other outcomes, the analysis of autism spectrum

disorder showed that adjusting for confounding factors attenuated the associations between each level of food insecurity and diagnosed autism spectrum disorder, although in this case the moderately food insecure group was the only one that remained statistically significant after covariate adjustment.”

4. A related point: the 4th paragraph of the background section mentions stress as a potential pathway in the effects of FI on child mental health. The paragraph could be developed to explain why they studied multiple child outcomes, with some having more obvious links to stress than others (ASD?). A scan of the literature should help identify social, biologic, and psychological mechanisms: family stress, gut-brain axis, social stigma, emotion dysregulation, etc.

We thank the reviewers for the comment as well as comment 1, and now believe our background section is much improved. We added some potential mechanisms to the association between food insecurity and mental health conditions. The text at the bottom of page 3 now states “Research from the US has shown families of individuals with ASD and ADHD experience higher levels of food insecurity due to multiple social and biological mechanisms (Hatsu et al., 2022; Karpur et al., 2021). For example, parents of children with ASD spend more money in out-of-pocket health care expenses than those without ASD, impacting household finances (Rogge and Janssen 2019).”

Minor issues:

5. Food insecurity is narrowly defined as a “lack of access to food as a result of financial struggles.” We recommend updating the definition to bring it in step with the literature, which defines FI as either inadequate or insecure access to food due to financial constraints and including concerns about running out of food, ability to buy more food, inability to afford a balanced diet, worries about missing meals, or skipping meals to shield children from having to. There’s more to FI than just running out of food.

We thank the reviewers for this comment. We have added more context on how food insecurity is defined and measured. The text on page 3 now states: “A key social determinant of health is food insecurity. Broadly defined, food insecurity is the inability or uncertainty about being able to acquire or consume an adequate diet quality or sufficient quantity of food in socially acceptable ways. In Canada, food insecurity is measured and monitored as a household’s financial ability to access adequate food, and encompasses a range of experiences from worrying about running out of food before there is money to buy more, to compromising on the quality or quantity of food due to lack of money, to not eating for whole days due to lack of money to buy food.”

6. The discussion section points to parent/caregiver reports of FI as weakness of the study, but we could not imagine who or what is a better source for this knowledge. The children were too young to complete a household assessment of FI on their own.

We thank the reviewers for highlighting that we need to clarify our limitations in this regard. At the top of page 9, the text now states: “Additionally, while parents/guardians are better positioned than younger children to provide accurate reporting of child health and household measures, the reliance on parental reports of both household food insecurity and health professional-diagnosed mental health conditions introduces a risk of information biases such as recall and social desirability biases.”

7. The CHSCY datafile includes self-reported household income and tax-linked income data provided by Statistics Canada. Which did they use?

We used self-reported household income, which is imputed for missing values, and have clarified this in our methods. The text on page 5 now states “parent/caregiver-reported household income adjusted for household size”.

8. Another minor revision is in Figure 1, which should be changed to show differences in mental disorder prevalence across levels of FI; i.e., group by the outcome first, then FI severity within each

outcome group (in Excel, the x-axis and legend categories can be swapped using 'switch row/column'). If they restructure their analysis to isolate the 4 outcomes (see #3 above), then the figure should be changed accordingly to show 4 clusters of 4 bars each.

We have changed figure 1 to reflect the suggestion from the reviewer by switching the rows and columns. Figure 1 now shows food insecurity status (4 bars) by any mental health diagnosis and each separately. As mentioned above, due to sample size issues, we retained anxiety and mood disorders as a single group.

9. Finally, the statement of ethics approval should be expanded to acknowledge the federal agency and REB that oversaw CHSCY survey procedures, confidentiality of the data, data collection and storage, etc.

As requested by the editors' as well, we have expanded our description of the ethics approval to acknowledge Statistics Canada (the federal agency that oversaw CHSCY procedures and informed consent). The text at the bottom of page 6 now states "This study was approved by the Ethics Review Board of Public Health Ontario. Our study is a secondary analysis of de-identified data that was previously collected by Statistics Canada. Informed consent was obtained by Statistics Canada, the federal agency that oversaw survey procedures and data collection for CHSCY. De-identified data was provided to Public Health Ontario confidentially through the Ontario Ministry of Health."

VERSION 2 – REVIEW

| | |
|------------------------|---|
| REVIEWER | Borja, Judith University of San Carlos, Office of Population Studies Foundation, Inc. |
| REVIEW RETURNED | 17-May-2024 |

| | |
|-------------------------|---|
| GENERAL COMMENTS | If CHSCY has data on the mental health status of the parents/caregivers - would be good to run a parallel analysis. |
|-------------------------|---|

| | |
|------------------------|---|
| REVIEWER | Elgar , Frank McGill University, Montreal, QC, Institute for Health and Social Policy |
| REVIEW RETURNED | 30-Apr-2024 |

| | |
|-------------------------|---|
| GENERAL COMMENTS | We thank the authors for their thoughtful responses and revisions. These changes have significantly improved the paper. Their expanded (national) analyses made the findings more relevant, and we appreciate the effort to present associations with the four outcomes in a more logical way. The authors seem to have struggled to identify causal links to ADHD and ASD, which is understandable. The added text about the financial strain of managing these conditions seems tangential and doesn't explain how FI affects onset. However, we leave it to the authors to decide whether to frame the study objectives as exploratory or hypothesis testing. Overall, this is a solid paper on a highly relevant topic in public health and deserves to be published. |
|-------------------------|---|