Author's response to reviews

Title: Comparison of ICD code-based diagnosis of obesity with measured obesity in children and the implications for health care cost estimates

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Author's response to reviews: see over
Reviewer 1

Major Compulsory Revisions
1) Throughout the manuscript, the authors are vague about the timing of measurements relative to one another, and at times change the definitions. If weight is measured in 2003 at age 10/11, the sensitivity or specificity of identifying a diagnosis of obesity can only truly be interpreted very close to that measured “gold standard”. If a child was not obese before that measurement, or the obesity resolved afterwards, a diagnosis of obesity would not be appropriate at these other times. This analysis is particularly troubling when the authors extend the analysis back to the participants’ birth, and note that 27% of those with an obesity diagnosis were diagnosed during the first 2 years of life. While interesting in terms of potential longevity of obesity, this does not really speak to "sensitivity and specificity" of diagnosing current obesity in these children. Greater focus on timing of diagnosis vs. timing of measurement would aid in interpretation.

We have now focussed the manuscript on the period from 2002 to 2004 and have removed all results from outside that time frame. We have also added a study period descriptor at various points in the manuscript to clarify the time frame. We agree that a head to head comparison of 2003 ICD codes with 2003 measured BMI would have been preferrable. The 2002-2004 time frame was chosen because for some analyses the number of children with an ICD diagnosis in 2003 would have been too small to be released under the privacy protection guidelines of our institution.

As stated in the Strengths/Limitations section of the Discussion, obesity is the result of long-term lifestyle habits. Changes in body weight status within a year of measurement will be quite unlikely and would not change the study conclusions. Moreover, with the prevalence of obesity increasing throughout childhood, one would expect more children to become obese than vice versa. Consequently, the period prevalence of obesity between 2002 and 2004 can be expected to be at least as high as the prevalence of obesity based on the 2003 measurement.

2) The examination of the number of physician visits in diagnosed vs. not diagnosed obese patients begs the question of whether more visits led to the diagnosis, or the converse (that with identification of obesity, physicians wanted to see the patients for more frequent evaluations). Examining the temporal relationship between visits and obesity may help disentangle which scenario is likely to be true.

We compared the number of visits before and after the ICD diagnosis of obesity. There was no difference in the number of visits (p=0.91) before and after. This finding supports the hypothesis that more visits led to the diagnosis. We have added a statement to the Discussion.
3) The estimates from the logistic regression model of the impact of BMI on ICD 9 diagnosis seem too large. The authors are implying that for each unit increase of BMI, the probability of ICD-9 diagnosis increases by 26%. This raises the question of how, in fact, the probability of ICD-9 diagnosis of obesity increases with increasing BMI—a figure may help show whether this relationship is linear or exponential. Also, it is unclear from the results whether all children were included in this analysis, or only the measured-obese children, with respect to ICD-9 diagnosis.

In line with the focus on the 2002 to 2004 time period, we have removed this analysis from the manuscript as it was based on the time period from 1992 to 2006. Repeating the analysis for the children who received an ICD code for obesity between 2002 and 2004 was unfortunately not feasible as only 1.5% of children had an ICD diagnosis during that period.

Minor Essential Revisions
1) The term "diagnostic properties" of the ICD code is not defined and confusing, and should be replaced with another term throughout

The term "diagnostic properties" has been replaced by "sensitivity and specificity" throughout the manuscript.

2) The authors indicate that they calculated 95% confidence intervals on the Kappa, sensitivity and specificity, but do not provide those CIs in the table, which would be helpful.

The 95% confidence intervals have been added to the text.

3) Methods/Statistical analysis: It is unclear what the authors mean when they indicate that "results from the models...were compared qualitatively". What qualitative comparisons were made? Why weren't models compared quantitatively?

We apologize for the confusion. We had meant to say that the two cost ratios were compared without any hypothesis testing for differences between the two ratios. We have removed the sentence.

4) In the table, for the "measured obese" children, what data formed the basis for the health care cost ratio? 2003 expenditures only, or what year(s)?

For both the ICD code-based obesity and the measured obesity model the outcome was total health care costs 2003 to 2006. The corresponding sentence in the "Statistical analysis" section has been reworded for clarity.
5) The section in the discussion regarding the "all ICD codes" and the ROC curve should be moved to the results. Also, it is unclear what was included in the "all ICD code" analysis.

The ROC analysis used data outside the 2002 to 2004 study period and was removed.

6) The final sentence of the manuscript should be altered to something like the following to express the conclusions of the paper: "Children with measured obesity have higher health care costs than non-obese children, but not as high as would be estimated using administrative data". This would be consistent with your abstract, as well.

The conclusion has been reworded.

Discretionary Revisions
1) Page numbers are missing

Page numbers have been added.

2) Methods section, under "Administrative Health Data", near the bottom of the page--there seems to be a missing reference: "[, 13]"

The formatting error has been fixed.

3) Some additional information would be helpful about the anthropometric measurements--were these done in duplicate, were weight measurements done with full clothing, were items removed from pockets, etc.

Only one measurement each was performed. Weight was measured with full clothing. This information was added to the text.

4) Results: the abbreviation "excl." should be spelled out.

Done.
MAJOR COMPULSORY REVISIONS

1. Information from administrative databases were almost complete, however, the participation rate in CLASS, for measured obesity, was only 51%. Although at an expected level, the potential bias from selection bias should be discussed in some detail. This is important for the implementations of the findings.

We have added a discussion of the potential selection bias to the Strengths/Limitations section of the Discussion.

2. The findings have substantial implication for the capture of ICD codes for administrative databases and this should be discussed.

The ICD codes in administrative databases in Canada are collected by physicians and hospitals solely for billing purposes (see 2nd to last paragraph of the Discussion). This practice differs, if I am not mistaken, from how administrative data are collected in the Scandinavian countries. In Canada, the coding is done at the discretion of the physician. Researchers cannot influence the choice, completeness, or correctness of ICD codes collected in the database. Therefore, our results have no implications for the capture of ICD codes for these databases.

3. “Body weight” and “body height” should rather be used instead of just weight and height.

We have replaced "height" with "standing height" and "weight "with "body weight".

MINOR ESSENTIAL REVISIONS

1. Discussion, first line: "obesity for identifies" should rather be “obesity identifies”.

Fixed.

Editor

- Abstract
Can you expand the background section of your abstract to include both the context and purpose of your study.

Done.
- **Permission**
  
  *Can you please include a statement in your methodology which states whether the databases are publicly available and if not, what permission was obtained to access them.*

  We apologize for the omission of this information. The corresponding paragraph has been added at the end of the Methods section.

- **Formatting**
  
  *Please also ensure that your revised manuscript conforms to the journal style ([http://www.biomedcentral.com/info/ifora/medicine_journals](http://www.biomedcentral.com/info/ifora/medicine_journals)). It is important that your files are correctly formatted.*

  The manuscript has been formatted according to the BMC guidelines.