Author's response to reviews

Title: Variation in the effects of family background and birth region on adult obesity: results of a prospective cohort study of a Great Depression-era American cohort

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Revision Memo

Variation in the effects of family background and birth region on adult obesity: results of a prospective cohort study of a Great Depression-era American cohort

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We thank the reviewers for their very helpful comments on our paper. In this memo, we describe how we have addressed each comment in the revised manuscript.

Response to Reviewer 1:

1. Details of the total sample should be given, including numbers of cases with missing data on outcomes and explanatory variables.

We have clarified sample inclusion criteria and the numbers of cases with missing data in the revised Methods section (pp. 7-8).

2. New England was used as the reference group, whereas the South Atlantic division would be more suitable.

We have changed the reference group to the South Atlantic division in our analyses (Tables 3 and 4) and have motivated this change further by noting that this division was least affected by the Great Depression (p. 6).

3. Multinomial logistic regression is fraught with difficulties of interpretation, and it was not clear how the regression analysis was performed or what software was used.

We have revised our analysis to model the outcome of obesity vs. normal and overweight as a combined reference group, and estimated this revised model using ordinary logistic regression. We have further clarified the plan of analysis, including the software used to fit the models, on p. 10.

4. It is unclear why health variables such as diabetes were included as covariates.

We agree with the reviewer that controlling for health outcomes that are caused by obesity may lead to overspecifying the model. Therefore, we have removed health variables from the model except those that may be considered behavioral risk factors for obesity (i.e., measures of smoking and physical activity).

5. The regional measures appear to be interrelated, and it is unclear what happens when they are simultaneously entered into a model.

In our revised analysis, we found per capita income and infant mortality to be related to individual odds of obesity in mid-late life (Table 4). In the text, we discuss a model in which both of these variables are included, finding that per capita income remains a significant
predictor of obesity net of regional infant mortality (p. 12).

6. *It is unclear how much of the results for regional indicators arise from the high obesity rate among women born in New England.*

In the revised text, we discuss results from fitting the same models as in Table 4 while excluding women born in New England. Infant mortality rate is significantly associated with women’s obesity risk in the subsample excluding women born in New England (p. 13).

7. *Selective mortality and attrition may explain the disappearance of the region effect in late life.*

In our revised analysis, we have found that the region effect does not disappear in late life (ages 66-77) among women, but persists even after controlling for covariates assessed at age 50-61 (Table 3).

8. *It would be informative to show the proportion who fall into each weight category at each time point.*

Following the reviewer’s suggestion, we now report proportions in the obese category at the baseline (ages 50-61) in the revised Table 1, and in late life (ages 66-77) on p. 10.

9. *The discussion does not clarify the role of ecological factors and does not adequately address the limitations of the work.*

We have revised our discussion to describe how ecological factors may explain birth region differences in adult obesity risk (pp. 14-15) and to identify opportunities for future research arising from the limitations of our data and analysis (p. 16).

**Response to Reviewer 2:**

1. *The background section is not sufficiently developed.*

We have thoroughly revised and expanded the background section to address the subsequent points raised by the reviewer.

2. *Early-life conditions related to region of birth should be identified.*

We have revised our introduction to clarify gendered effects of socioeconomic disadvantage in early life on later-life obesity risk (pp. 4-5). By focusing on a cohort born during the Great Depression, we expect variation in obesity risk across birth regions to be shaped by variation in regional economic conditions due to the uneven effect of the Great Depression (pp. 6-7).

3. *The role of gender differences and family background effects in the analysis is unclear.*

We have clarified theoretical reasons for expecting gender differences in early life effects on
later-life obesity on pp. 4-5. Furthermore, we have discussed the need for controlling for family background in the context of correctly estimating the effect of variation in regional characteristics (p. 6).

4. The relationship between regional variables and the Great Depression should be clarified.

Although it is beyond the scope of this paper to exhaustively analyze the causes and effects of the Great Depression, we have noted which regional indicators reflect causes of the Great Depression (e.g., crop failure), and which indicators reflect consequences of the Great Depression (e.g., mass unemployment) (pp. 6-7).

5. Results in Table 4 are not clear and should have been included in Tables 2 and 3.

We have clarified in the text that the analysis in Table 4 was meant to explore which specific regional factors may be related to obesity risk, and, due to the small number of birth regions, the set of birth region dummies and the specific regional factors could not be included in the same model due to multicollinearity (p. 12). In the text, we discuss additional models exploring the association between specific regional factors when multiple regional factors are entered into the model and when the region with the highest obesity rate (New England) is excluded from the sample (pp. 12-13).

6. The use of a multinomial logistic model was not justified, and the presentation of results from this model was unclear.

We have revised our analysis to use a logistic regression model where the outcome variable is coded as obese (1) or normal or overweight (0). We have further clarified that the models in Table 4 are the same as in Table 2 with the omission of birth region dummies and the inclusion of specific regional characteristics (p. 12).