Reviewer’s report

Title: Association between ambient particulate matter concentration and fetal growth restriction stratified by maternal employment

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Reviewer: Xin Cui

Reviewer's report:

This is an interesting study. The authors examined the association between outdoor particulate matter and fetal growth restriction and how the association differed by maternal employment status. The data available to the authors represents unique strengths and makes this a valuable piece of work. It can be improved by more rigorous presentations of the results, as well as some explanations and clarification.

- In the abstract, the authors mentioned "Proportions were different for LBW (1.5% in employed and 1.6% in non-employed, P < 0.001) and similar for SGA (12.7% and 12.8%, P= 0.124).". In the main text results section, the authors stated "Proportions of both SGA and LBW were consistent between employed and non-employed mothers (12.7 and 12.8% for SGA, 1.5 and 1.6% for LBW).". It is confusing whether the authors wanted to interpret the percentages among the employed and non-employed as consistent or not. Also it is not clear whether 1.5% and 1.6% was considered as different but 12.7% and 12.8% was consider as similar because of the P-value.

- In the results the authors stated "At the time of birth, 35.5% (293,440) were employed and 66.4% (549,270) were non-employed (Table 1).". However, 35.5% + 66.4% is greater than 100% and the numbers do not seem to match, i.e. 816,661*35.5% = 289,915 and 816,661*66.4% = 542,263. Also numbers listed in this sentence do not seem to match with Table 1. In Table 1, the number of employed and non-employed are 277,482 and 539,179, respectively.

- Similarly, in the results the authors mentioned "In our study population of 816,661 singleton term births, SGA and LBW comprised 12.8% (104,142) and 1.6% (12,749), respectively". However, 816,661*12.8% = 104,533 and 816,661*1.6% = 13,067, which do not match with the sentence.

- Table 2 and 3 represent results for 2002-2012 (PM10) and 2008-2012 (PM2.5), respectively. However, based on the title the sample size was the same for these two tables. It is important to mention the sample size in 2008-2012 in the main text methods section since all analyses for PM2.5 were performed with this instead of the total of 816,661.

- The authors interpreted OR=1.02 as "2% higher probability"; however, this is incorrect. The 2% increase should be on the Odds scale, i.e. for every IQR increase of PM10, the
Odds of having the outcome was increased by 2%. If the authors want to interpret the OR on the probability scale they should transform Odds back to probability using the formula: Odds = P/(1-P).

- The authors concluded effect modification by employment status based on stratified analysis. In fact, stratified analysis along is not sufficient for effect modification because heterogeneity across strata may indicate different things, such as confounding, effect modification, both, or neither. To examine effect modification, the authors need to at least add interaction term between air pollution and employment status in the model and present the joint effect, the estimates of the interaction term, the effect of PM only, as well as the effect of employment only. Other approaches, such as relative excess risk due to interaction (RERI) are also often used in many studies.

- In this study, PM estimates were measured based on maternal residential addresses. There could be other sources of PM air pollution at workplace. I wonder whether the authors could refine the title and main text to make it clear that this study focused on outdoor PM near residential locations instead of occupational locations.

- In many epidemiological studies that use maternal residential address to estimate air pollution, residential mobility is an issue to be discussed as women could have moved during pregnancy, and if the air pollution level varied at different locations it may introduce measurement error by using incomplete residential address histories to estimate air pollution during pregnancy. I wonder whether the authors could elaborate in more details on this, i.e. whether they took into account multiple addresses per woman into account.

- In the discussion the authors mentioned that there is possible selection bias because mothers in this study are mostly residents in Seoul which less represent deprived socio-economic conditions which also contribute to poor fetal growth. However, this is more like an external validity problem, i.e. results in this study may not be extrapolated to other populations, such as populations that include all residents in both urban and rural areas.

- The authors mentioned healthy worker effect, i.e. in general employed mothers are likely to have a more favorable health status than general population. I wonder whether the authors examined the possibility that the effect of PM on growth restriction could be confounded by employment status. For example, mothers with higher SES status are more likely to be living in urban areas with higher levels air pollution, meanwhile these mothers are also more likely to work, have higher education level and better health status, therefore are less likely to develop growth restriction during pregnancy. If employment status was on the confounding pathway, controlling for it may change the effect estimates of PM on growth restriction.

- Employment status could be a proxy of many things, such as higher SES, more work demands and job stress. On the other hand, it is also possible that women who commute between home and work have higher chance to be exposed to traffic-related air pollution. If this is the case, when stratifying by (or adjusting for) employment status it could "over-
adjust" outdoor PM exposure and the effect of PM on growth restriction observed in this study could be diluted. I wonder if the authors could discuss some of the possible mechanisms of the impact of employment status on growth restriction in more details.

**Are the methods appropriate and well described?**
If not, please specify what is required in your comments to the authors.

Yes

**Does the work include the necessary controls?**
If not, please specify which controls are required in your comments to the authors.

Yes

**Are the conclusions drawn adequately supported by the data shown?**
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No

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