Author’s response to reviews

Title: Greenness, civil environment, and pregnancy outcomes: perspectives with a systematic review and meta-analysis

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Author’s response to reviews:

Reviewers’ comments and Responses

We deeply appreciate reviewers’ comments. We have highlighted in yellow or blue color text that has been revised.

Reviewer reports:

Reviewer #1: This manuscript is an interesting meta-analysis covering greenness and pregnancy outcomes while taking into account ambient air pollution and related factors such as population density. As the climate change and air pollution are linked, and possible remedies such as greenness are important to understand the impacts on health such as pregnancy outcomes as in this study. Although the methods appear well thought out, it is at times difficult to understand. I think this manuscript would benefit from significant technical writing support to help clarify what gaps in the literature this research is addressing, how this is novel and clarify the methodology. The other major question I had is how can low birth weight and small for gestational age be combined into one outcome for the metaanalysis - could/should these outcomes be separated?
By section:

Background:
1. Do the authors wish to comment that preconception health is linked with birth outcomes? Or health during the pregnancy? or both? In fact, the entire first paragraph seems not to be necessary to be included in the intro?

Response: Thank you for pointing out this to us; we have deleted the complete first paragraph of the Introduction section (Page 5).

2. Define greenness.
Response: This article focused on the effects of the level of greenness and greenness-related proximity of air pollutants on the birth outcomes. We have added the required information in the Study selection subsection of the manuscript, as follows:

(Compiled highlighted text; page 7)

"Greenness is an environmental feature and access to green space is often not equitably distributed with regard to socioeconomic background of city residents. The normalized difference vegetation index (NDVI) is commonly used as an indicator of the presence and level of greenness."

3. Replace growth restriction instead of "growth retardation"
Response: We have revised “growth retardation” with “growth restriction”, as shown in the text highlighted in blue.

4. The gaps in the literature are not well defined—what gap is this study addressing?
Response: Thank you for raising this pertinent point. As suggested, we have clarified the “gaps” in literature, as follows:

(yellow-highlighted text; page 18)

“In table 1, the difference between the publication dates and the study period in papers has been showing almost 10 years. There was no publication bias, but the research findings (pregnancy outcomes) should be interpreted cautiously in consideration of the development of medical technology, changes in the greenness environment, and the development of urban civilization."

5. The authors' research objective needs to be clarified/re-written. I believe the intention is to look at greenness in the setting/context of air pollution….if so this should be stated more explicitly.

Response: Thank you for this suggestion. We have made the following revisions in the Abstract and the Introduction section:

(Abstract: blue-highlight text, page 3)
“This study aimed to qualitatively and quantitatively investigate the association between pregnancy outcomes and the surrounding living environment including greenness, air pollution and civilization.”

Introduction: with yellow highlight, page 5

we sought to investigate the current evidence for pregnancy outcomes and the surrounding living environment, especially greenness and air pollution and civilization. Our research questions were “what is the evidence that greenness affects pregnancy outcomes?” and "how does exposure to greenness affect the improvement of maternal and neonatal health?”

was revised to

=> “we sought to investigate the association between pregnancy outcomes and the surrounding living environment, especially greenness and air quality and urbanization. Our research questions were “what is the evidence that exposure to greenness addressing air pollution and related civilization impact on maternal and neonatal health?”

Methods:
1. Please clarify exclusion criteria and avoid using "irrelevant" or "inappropriate"

Response: Thank you for the valuable comment. As suggested, we have revised the exclusion criteria in the text and in Figure 1, as follows:

(blue-highlighted text; page 7)

“The exclusion criteria for studies were as follows: ineligible study types (review articles, editorials, commentaries, letters without new data analyses, meta-analyses, and abstracts only); irrelevant interventions used(intervention is not greenness with NDVI such as percentage of green space in each urban or rural census area unit (CAU), tree-canopy cover, amount of total natural space, etc.); irrelevant outcomes measured ( in cases of gestational diabetes, gestational hypertension, preeclampsia); inappropriate publication type; duplicated publication; and inconsistent or methodologic challenges.”

was revised to

=> “ The exclusion criteria for studies were as follows: articles without original data such as review articles, editorials, commentaries, letters without new data analyses, meta-analyses, and abstracts only; studies that is not presented greenness with NDVI such as percentage of green space in each urban or rural census area unit (CAU), tree-canopy cover, amount of total natural space, et al. ; articles that did not report on outcomes of interest in cases of gestational diabetes, gestational hypertension, preeclampsia; incorrect publication type; duplicated publication; and studies with inconsistent methodologic challenges.”
2. Civilization should be defined—this could be done by moving the following statement from the Results section to Methods "The degree of civilization was mainly expressed by population density and by traffic density, town of residence, noise, or walkability."

Response: We agree with your viewpoint. We have moved the specified sentence to the Methods section, as shown text highlighted in yellow on page 9.

3. Please clarify if LBW and SGA were combined and justify or clarify how they were separated.

Response: Thank you for raising this point. We have defined “LBW and SGA” and have explained our intention for conducting the analysis in the Data extraction subsection, as follows:

(blue-highlight text; page 8)

“term birthweight means full-term births, was defined the same as term appropriate size for more than 10% birth weight at over 37 weeks gestational age; Epidemiologically various estimated small for gestational age based on the reference population, SGA was defined below 10% of birth weight for a specific gestational age; Preterm birth was defined as before 37 completed gestational age of weeks; Low birth weight (LBW) was defined as less than 2500 g birth weight; very LBW was defined as less than 1500g birth weight.”

In the Data and statistical analyses, we have explained the outcomes analyzed, as follows:
“Outcomes for our quantitative synthesis were summarized into (1) term birthweight, (2) low birthweight-related (LBW, VLBW, or SGA), and (3) preterm birth (PTD or VPTD).”

We have used the term “low birthweight-related outcomes” to clarify our results and in consideration of the content of the article.

The subtitle in the Results section was also revised to “Low birthweight-related pregnancy outcomes”

Results:
1. See above comments

Discussion:
1. Limitations should be expanded. One example should be including specific limitations of NDVI such as the lack of determining what type of vegetation and for what use (eg private garden or public park)

Response: We agree with your comment. We have discussed the limitations in more detail, as follows:

(yellow-highlighted text; page 18)
This study has some limitations. This systemic review focused on the greenness effect during pregnancy and included observational studies. The diversity of intervention types (greenness measurement methodologies) with respect to pregnancy outcomes caused some difficulties in the selection of eligible studies and might remain as a barrier for further research. In addition, the term “pregnancy outcomes” itself is broad, and the use of this term may result in studies being pooled together even if they are too diverse to include in a single analysis. Another limitation is the nearly 10-years time interval between the publication dates of the articles and the study period. Our study had no publication bias, but improvements in medical technology, changes in green space, and development of civilization can lead to bias in pregnancy outcomes.

was revised to

=> In this study, there is evidence that a positive effect between green and pregnancy outcomes has certain limits on the diversity of intervention types. The greenness measurement methodologies associated with pregnancy outcomes has made some difficulties in the selection of eligible studies and might remain a barrier to further research. As a method of greenness measurement, NDVI is not sufficient to determine the type of plant and its use, such as a private garden or public park. Focused on the green effect during pregnancy and included in the observational study, there is another limitation that the green properties are considered not to affect viability in the outcome process. Tracking results from conception or prior to conception will help to address this limitation. In table 1, the difference between the publication dates and the study period in papers has been showing almost 10 years. There was no publication bias, but the research findings (pregnancy results) should be interpreted cautiously in consideration of the development of medical technology, changes in the greenness environment, and the development of urban civilization.

2. List more explicit strengths in a paragraph

Response: We have described the strengths of this study at the beginning of the Discussion section, as follows:

(blue-highlighted text; pages 14 and 18)

“We performed a meta-analysis to investigate the impact of green and civil environments on pregnancy outcomes, considering related factors such as ambient air pollution and civilization. To our knowledge, this is the first study to extend the work to develop greenness effects in connection with the proximity to air pollution sources on birth outcomes. This study was provided stratification of greenness and adjusted air quality for the investigation of poor pregnancy outcomes such as LBW, SGA, and preterm birth, showing a weak positive influence and a significant association based on a pooled standardized regression coefficient.”
This study may be challenge to assemble an evidence base on the impact of greenness and related air pollution on birth outcomes, more research should need to validate and explore health outcomes, and identify their mechanisms. Although air pollution and civilization have been considered as some of the features as potential mediators in this study, it should be revealed that other factors, such as physical activity and social interaction, mediate roles for health outcomes. Future research with robust randomized clinical trials is required to evaluate the effect of the greenness environment related to air pollution and civilization on diverse maternal health and birth outcomes.

3. Why is this study unique and novel and an important contribution to the literature? Although the authors write one sentence saying: "To our knowledge, this is the first study to provide stratification of greenness and adjusted air quality for the investigation of pregnancy-related outcomes such as LBW, SGA, and preterm birth" it seems the controlling for both civilization and air pollutants to assess birth outcomes may also be novel? Please clarify.

Response: Thank you for raising this point. We have clarified the unique contributions of this study, as follows:

We performed a meta-analysis to investigate the impact of green and civil environments on pregnancy outcomes, considering related factors such as ambient air pollution and civilization. To our knowledge, this is the first study to extend the work to develop greenness effects with regard to the proximity to air pollution sources on birth outcomes. This study was provided stratification of greenness and adjusted air quality for the investigation of poor pregnancy outcomes such as LBW, SGA, and preterm birth, showing a weak positive influence and a significant association based on a pooled standardized regression coefficient.

Reviewer #2: I find this approach an intriguing extension of the work that has developed regarding the impact of pollution on health. There is more and more research addressing air pollution, proximity to pollution sources and the impact on newborn health. This article takes the associations further by looking at the effect of environmental greening. It is a novel approach and
one that needs further investigation. I am not a statistician but appreciate the meta-analysis and selection of articles for inclusion. I believe this article will challenge other investigators. I also believe that in terms of mitigating adverse environmental factors it is important to see research that suggests we can mitigate with positive environmental changes

Response: Thank you for the encouraging comments. We completely agree with you.