**Reviewer's report**

**Title:** Association between exposure to traffic-related air pollution and pediatric allergic diseases based on modeled air pollution concentrations and traffic measures in Seoul, Korea: A comparative analysis

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**Reviewer:** Gudrun Weinmayr

**Reviewer's report:**

This is an interesting large study investigating the association of childhood prevalence of asthma and allergic disease with long-term exposure to PM and NO2 in Seoul, therefore a large densely populated Asian city, where traffic is a (the) prominent source.

So far European and NorthAmerican-studies seem to be predominant, so an Asian study would be a welcome addition.

The manuscript is overall clearly and well written, although English needs some polishing in several places.

A strength is the information of school exposure; and data on SES as potential confounders, while a certain weakness is the absence of other potential confounders: no ETS, indoor air pollution sources, dampness, parental allergy, (older) siblings, day care (?) - I guess these were not available.

Care has to be taken regarding the terminology and especially the corresponding interpretations, taking into account that the paper seems to investigate general rhinitis and eczema and not allergic rhinitis or eczema. The ISAAC symptoms to investigate the latter two would be rhinoconjunctivitis and flexural eczema in the absence of any allergy testing. If indeed the whole ISAAC symptoms questionnaire was used this could be investigated (see the ISAAC papers).

Another interesting addition would be to investigate asthma in children with other allergic disease as done in a Canadian study (Dell et al., reference 17): test rhinitis and also rhinoconjunctivitis which is more indicative of allergy, similarly flexural eczema: more specific than eczema. Indeed, Asthma has a large non-allergic component, and it would be worthwhile to investigate whether the relation of asthma with air pollution is modified by rhinitis or excema - as it has been done in (Dell et al). Although number of children in the analysis will deacrease, it will still be comparable to the numbers in the Canadian study where a clear effect was found.

The authors emphasize the findingS on eczema which are statistically significant, but also positive associations that are only nearly statistically significant should receive more attention (rhinitis and PM2.5).
More specific comments:

Title:

The "using traffic measures and surrogate air pollutants" is a bit misleading as modelled pollutants are investigated. Also not only traffic geographic indicators are used for modelling therefore, I suggest to use the term traffic related air pollution (TRAP) in a more cautious way and mention it only in the discussion (but not as it is in the first sentence there), to contrast it to studies where explicitly only the traffic-component has been modelled.

Abstract:

In the Results, the positive association of rhinitis with PM2.5 should also be mentioned with ORs, and that no association was found for the others. To keep the word count the Introduction could be shortened (e.g. by deemphasizing TRAP).

In the conclusions: the first sentence using the formulation TRAP and its surrogates is misleading (as the title) - rather the pollutants that were investigated should be named.

Introduction:

p4, line 79-80: should be made clear that reference 17 does not investigate this but only discusses this mechanism.

p.5, line 105-112: this paragraph seems not very consequential in its logical argumentation. I think it would be more stringent to omit (or place elsewhere) the 2nd and 3rd sentence and the "Thus" of the fourth sentence. It would be also helpful to introduce here which of the "surrogate pollutants" the authors expect to be most strongly to be associated with traffic - generally this is NO2 and much less PM, esp. PM2.5 - similar in Seoul?

Methods:

Study population and Fig1: numbers should be checked - they do not add up correctly in Fig1 and do not correspond to the 16,962 mentioned in the text

Allergic diseases: please check the wordings of the questions given: they are not the same as in the ISAAC questionnaire and not the same as in the corresponding Korean publication (reference 27: Hong et al, and ref 56). Were the questions backtranslated into English for a check as it was done in the ISAAC-study?

p.9, line 186-187: Were breastfeeding and adiposity the only individual characteristics assessed? Is there no information on additional potential(ly) important confounders such as indoor air
pollution sources, dampness in the home, pets, parental allergic disease? Was BMI reported or measured? Was breastfeeding exclusive? Or with other foods added?

p.10. lines 205 to 209: random effect: why was adjustment not for the 25 districts but 8 "district areas" - generally random effects modelling performs better with more level2 units - unless they are too numerous to affect convergence, which would surprise me in this case. And how was it determined which adjacent districts should be aggregated? Was also adjusted for regional income?

p.11 line 219: what is meant by "consistent" data?

Results:

I suggest to give the results of Fig 2 (which are the main results) in a Table to avoid emphasis on statistically significant values which are given in the text and to facilitate future potential meta-analyses. This Table could also contain additional useful information such as the number of children in each analyses. In addition, it would be nice to show there also the results of the sensitivity analysis taking into account school/kindergarten addresses (model 3 only). Where do children typically spend more time outdoors? At home or kindergarten?

I miss a Table which reports the prevalences estimated by asking for the diagnosis

Paragraph on SES, line 287 onwards: while I can support the 1st sentence to some extent, I think the following lines become more and more speculative based on differences in effect estimates that have largely overlapping confidence intervals and seem to be oversimplifying a complex and uncertain pattern. In this context it is very unfortunate that the reader cannot instantly crosscheck with the figures as they are given in the online supplement. Overall, I suggest to deemphasize this part of the study.

Line 295: add "statistically" in front of the significant, in fact there is already an increased OR for rhinitis in relation to PM2.5 (the exact magnitude and CIs one would be able to see from a Table rather than the Fig).

Discussion:

Line 309: what is meant by "different severities"? Which data is that?

Line 319: rather write "symptom prevalence"

Line 335: reference(s) for studies that did not find this association with PM2.5 should be given

Line 344: I suggest to amend the sentence to: which were not adjusted FOR in this study, COULD would act as confounders and MAY lead to different results
Line 350-352: Reference 55 gives a rather limited view on worldwide rhinitis, it is better to look e.g. at the world wide ISAAC study in particular Björkstén et al 2008, and compare it to the respective outcome: it can be seen there that a prevalence of rhinitis (which is the equivalent to the question in this article i.e. not reflecting allergic rhinitis) above 40% occurs in several regions of the world, therefore the data here are not that outstanding. Also the argumentation is not stringent: 1) the prevalence in other countries is typically also given by questionnaire response (and it is not necessarily higher in South Korea) and 2) the authors highlight earlier that the consistence between the effect estimates "indicating that the influence of potential misclassification would be minimal" (line322) - and this consistence is also given for rhinitis.

Line 357: what does this imply that it is the centroid: what area is covered by that? And in how much would this be different from the spatial resolution for the childrens' homes? This would be useful to mention.

Line 359 onwards: It should be mentioned that this is very speculative as confidence intervals are widely overlapping and pattern not very consistent across pollutants.

Line 369-70: "high prevalence of allergic rhinitis" see comment above

Line 375-376: ?? PM10 reflects better the larger particles, PM2.5 would be preferable for smaller particles!

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