Reviewer's report

Title: Meteorologically estimated exposure but not distance predicts asthma symptoms in schoolchildren in the environs of a petrochemical refinery

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Reviewer: Joachim Heinrich

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Meteorologically estimated exposure but not distance predicts asthma symptoms in schoolchildren in the environs of a petrochemical refinery
by White N et al.

Obviously there is severe public concern about whether emissions from petrochemical refinery might cause asthma exacerbation and asthma development in particular in children in Cape town, South Africa. This study is an attempt to collect data which could be used to support or reject this public health concern.

The authors used GIS based distance data to the point source of the petrochemical refinery and in addition meteorological trajectories which are mainly based on wind direction and wind speed. These two approaches lead to individualized exposure assessment although they have clear limitations. However, these exposure surrogates have the great advantage to be intuitive, easily feasible and cheap compared to a large spatial measurement program.

This paper has a limitation that no air pollution data was used. Nevertheless, the results of this study could be used to reject or to support the idea, that emissions from a petrochemical refinery might be harmful for respiratory tract in children.

The paper is well written, but has several severe limitations which could be avoided by a modified data analyses.

Major

1. The title of the paper and the key finding seems to support the notion that the meteorological derived trajectories are more important than a simple distance to the point source. This notion is mainly derived from the results of table 3. This conclusion from table 3 is not correct because the effect sizes in table 3 are related to an increment of one for each of the two exposure metrics. This is not fair to compare an increment of one mile or one km with an increment of a unit of 1 for the meteorologically estimated exposure. The effect estimates should be expressed here as inter-quartile range effects. This might have a strong effect of the general conclusion of the paper and also the title needs to be eventually rephrased.

2. A second major concern is related that the results are not adjusted for socio economic status. This potential confounding factor is extremely important and needs to be included in the study and if the authors do not have data on the socio economic status their finding is strongly devaluated and this needs a
cautious discussion.

3. Although no spatial data on ambient air pollution is obviously available, the reader wants to know first which specific air pollutants might be emitted by petrochemical refinery on the bases of the literature and the current knowledge. Furthermore, any data on the annual average of the criteria air pollutants in that area might help the reader to evaluate the health problem. The given exceedance fraction of certain limits of ambient air pollutants is not sufficient. The reader wants to know at least a few annual means of ambient air pollutants.

4. The paper contains data on three questions in the current version. One is related to the question whether living close to the petrochemical refinery is associated with an increased risk of asthma, the second question whether children of the refinery area have a similar prevalence of asthma compared to other areas of Cape Town, and the third question is related to temporal changes of asthma prevalence in that area. The paper would be strengthened if the authors could restrict themselves to the first question. This would also improve the readability of this paper. Time trends in prevalence of asthma are not an issue here, so far the emissions of the petrochemical refinery is constant over the time. The data to answer question 2 seems to be poor because the data are not adjusted (see table 4).

Minor

5. Abstract
   The abstract needs a revision recording to the previous major comments.

6. The background could provide at least a few data on those ambient air pollutants which are probably highly emitted by a petrochemical refinery. Also some data on the area in terms of the size, the geography and average ambient air pollution levels including meteorological data would be informative. The last part of the section three and the section 4 would be better placed in the methods chapter. The last section of ‘background’ is mostly a repetition of that what was written before. The background chapter could be started with a reference of several other epidemiological studies which analysed potential health effects of industrial emissions by living close to point source with epidemiological methods. There are several studies published in the peer reviewed literature which are ignored. The author also could draw conclusion whether their approach revealed as a promising approach in previously published papers.

7. Methods
   Last sentence on p. 4: In how many cases a GIS match could not be made? The numbers should be given here.

P. 5, 2nd section: meteorological data which were used for deriving the trajectories are based to the year prior the study. Is there any temporal variation of meteorological data from year to year in the study area? If this is the case, the authors should have better used average of meteorological data for more than 1 year. The entire methods chapter should be more strictly organised following the
following substructure: study subjects and design, outcome measures, exposure assessment approaches, and statistics.

8. Results
1st section of the chapter results contains data on inclusion/exclusion criteria. This criteria needs to be mentioned in the method section.

P. 7, 2nd section: Obviously the association with several health outcomes are rather inconsistent. Do the authors have any idea about the reasons for these inconsistencies? These inconsistencies should also be discussed.

P. 8, 1st section: What was the reason to combine objective and subjective measure for living close to a busy road? How do both estimates correlate? Are there any associations between living close to major road estimated by questionnaire or a GIS based distances with any of the health outcomes? Traffic as a potential further source of the exposure of ambient air pollutants needs a much more cautious analyses and data needs also to be presented here. Section 2 and 3 on p. 8 need a revision according to the revised statistical analyses using the inter-quartile range increments. Section 4 and 5 on p. 8 and 1 and 2 on p. 9 were suggested to be cancelled.

Did the authors make any attempt to study the type of the association? Are the reported associations between the exposure estimates and the health outcomes linear?

9. Discussion
The 3rd section on p. 9 together with the last section on p. 9 could be summarized and shortened. The 4th section on p. 9 could be deleted because it is a very general statement and did not substantially add to understand and to interpret the results.

2nd section on p. 10 needs a revision.

3rd section on p. 10 did not reference recent papers on ambient air pollution and the development on asthma.

4th section on p. 10: Atopy was considered as a potential confounding factor ignoring that the onset of parental atopy might be also associated with living close to the refinery. In addition parental atopy is a strong risk factor for the onset of asthma in the off-spring and is part of the causal chain. It needs a more cautious analyses. A sensitivity analyses stratifying for those children whose parents have and have not an atopy would be one option. In addition, as written previously the socio-economic status is a potentially major confounder.

P. 11, 1st section could be substantially shortened.

2nd section needs to be moved to the beginning.

3rd and 4th section could be better placed together with a few annual data on ambient air pollutants in the background chapter.

P. 12, 1st section: Instead of exceedance frequencies a few annual means of ambient air pollutants might be more informative. The 2nd section is more related to potential short-term effects of air pollutants which is not an issue for this paper.
A section on strength and limitations of the study could be added.

10. The references are not appropriate because several studies which are performed in vicinity to industrial emission sources were ignored. Also the most recent papers on the association between ambient air pollutants and the development of asthma are missing.

11. Table 1 and 2: the prevalence of hay fever of more than 60% seems to be extremely high. Are there other data showing that hay fever is so common in South Africa. This is also the case for the category ‘family atopy’. Also the prevalence of asthma is extremely high. Are there any prevalence data from other areas in South Africa which could be used for comparison purpose.

A footnote explaining what is ever recent and frequent would be helpful.

Table 3: Table 3 did not report any association for hay fever and physician diagnosed asthma or use of inhalers. What is the reason for that? As previously mentioned these effect estimates should be expressed per inter-quartile range.

A footnote on recent and frequent might help the readability because each of the table should stand by itself.

Table 4 presents crude odds ratios? However, table 4 was a candidate for deletion as commented previously. A footnote on recent and frequent might help the readability because each of the table should stand by itself.

12. The formula on page 5 is not clear to me. The authors should double check whether the denominators are correct. The denominators $v$ could be possibly better replaced with $1/v$? The unit of the current formula would be $s/m^2$, which looks strange to me.

**Level of interest:** An article of outstanding merit and interest in its field

**Quality of written English:** Acceptable

**Statistical review:** No, the manuscript does not need to be seen by a statistician.

**Declaration of competing interests:**

I declare that I have no competing interests