Author's response to reviews

Title: Minute ventilation of cyclists, car and bus passengers

Authors:

Moniek Zuurbier (m.zuurbier@uu.nl)
Gerard Hoek (g.hoek@uu.nl)
Peter Van den Hazel (peter.van.den.hazel@hvdgm.nl)
Bert Brunekreef (b.brunekreef@uu.nl)

Version: 2 Date: 16 September 2009

Author's response to reviews: see over
Response to reviewers' comments

Manuscript number: 1673199625294752

Title: Minute ventilation of cyclists, car and bus passengers

Authors: Moniek Zuurbier, Gerard Hoek, Peter Van den Hazel and Bert Brunekreef

Response to comments of Mr. Magnus Svartengren:

1. The aims could be more clearly written

   We rewrote the aims of the study in the last part of the 'background' section.

2. In background it is stated 'This paper reports on differences in estimations of minute ventilation between using individual and average regression coefficients. In conclusion in abstract it is said 'Minute ventilation levels of cyclists are on average two times higher than of bus and car passengers, and differences vary between individuals.' What does this mean for risk estimates. The knowledge that there are individual relationships is not new. I guess that for population risks average values would be ok? Please comment on this.

   In our opinion the use of mean values can indeed be used for population studies and population risk assessment. Some lines have been added to the conclusion of the abstract, to the first paragraph of the discussion and to the conclusions to state this more clearly.

3. Page 7 results: Why state that there where no participants with low education?

   This information is indeed not essential for the outcomes of the paper, we removed the sentence.

4. Page 10 discussion 9 row from bottom ad re 13? (11-14)
We added reference 13.

5. Check table numbers in text, table 6?
   Table 6 was erroneously missing in the document. It is added now, and gives the regression coefficients of our study and two previous studies.

6. Page 13 use SI units km/h
   We changed km/hr into km/h.

7. Table 2: upper intercept range should be 1.69?
   The upper range of the intercept of men should indeed be 1.69, we changed this.

Response to comments of Mrs. Judith A Leech

8. I am not convinced as to what is actually new in this study that has not been previously addressed in the papers cited in the bibliography. Studies which are mainly confirmatory of previous findings may always be acceptable but perhaps of lower priority.
   This study adds information to the very limited information on minute ventilation during commuting and the estimation of minute ventilation from heart rate data. The study of Samet et al (1993) gave average equations for men and women for the relation between heart rate and minute ventilation. Our study strengthens the idea that these equations can be used in other, similar populations, to estimate minute ventilation on population level.
   The difference in minute ventilation between cyclists and car drivers/passengers was only studied once before, by Vrijkotte et al (1990). She found that the minute ventilation of cyclists was 2.3 times that of car drivers. This factor 2.3 has been cited by several other studies (Van Wijnen et al, 1995; Rank et al, 2001). However, the study of Vrijkotte et al (1990) is not easily accessible (it is only published in a Dutch Master students' report,
only available through a request to the author), and the measurements were done in a small group of young adults (nine people, average age 25). The findings of our study are in line with these previous findings and therefore give more certainty about the use of a factor of a little more than 2 for differences in minute ventilation between commuting by bicycle or car or bus.

We added this information to the discussion and the abstract.

9. The population studied: This was a volunteer sample from government workers. Presumably only individuals who could bicycle for two hours would volunteer, depending upon how the original ad was written but in any assessment of heart rate/ventilatory response relationship we should be aware of the general level of fitness of the participants. If indeed very fit individuals participated (as say all ten women were very fit trained cyclists) then the heart rate rise would not be as might be expected in the general poplulation, even the general cycling to work population and the differences in women could be attributed to differences in level of fitness alone. Is a 2 hour commute by any mode actually frequent? Not, I think, in North America.

In the Netherlands most people will be able to cycle for 2 hours on a slightly less than normal speed, as the vast majority of the Dutch cycle regularly. The majority of the study participants did not consist of highly trained people. This is also partly illustrated by the body mass index of the participants: the mean body mass index of the entire group was around the same as the Dutch average body mass index. To the text we added information about the majority of the people not being highly trained.

10. It is not clear from the way the methods are written whether it was designed that each individual would have heart rate measured by bus, car and bicycle as this would be the contrast of interest to remove inter-individual variability. The text refers to "the three groups of commuters" which would make me think this did not actually happen?
All study participants commuted by all three modes of transport. To make this more clear, we changed the sentence about 'the three group of commuters'.

11. The bicycle ergometry test from which the heart rate /minute ventilation relation ship is drawn is a maximal exercise test which is easier to fit a line to but is actually not representative of the commuters' exercise pattern which is more of a submaximal/sustained exercise than a sprint/maximal exercise test. These two types of exercise have very different patterns of muscle and calorie use, heart rate and ventilation especially over the course of two hours and so that analysis and particularly in comparison to the maximal exercise test scenario would have been a new way of thinking about exercise and air pollution and added to the literature. We agree that a maximal exercise test may produce a relation between heart rate and minute ventilation at high heart rates which is different from the relation during submaximal exercise as during the 2-hour cycle commute. Therefore we performed sub-maximal exercise tests, we stopped the test when 80% of the maximum heart rate was reached. We now described more clearly in the abstract and methods section that the test was submaximal, and we added in the method section that part of the reason for not performing a maximal test was that the relation between heart rate and minute ventilation may be different at high heart rates.

12. There were some sentences which I could not quite understand, possibly due to the absence of participles and prepositions. We improved the English throughout the paper.

13. Some details were added which I did not see the necessity of or misunderstood. If heart rate was sampled every second why was it sampled every 5 seconds on the first 6 days of the study?
During the first 6 fieldwork days, the heart rate monitors erroneously measured per 5 seconds instead of per second. We added the word ‘erroneously’ in the text to make this clear.