Author's response to reviews

Title: Road Traffic Noise Frequency and Prevalent Hypertension in Taichung, Taiwan: A Cross-Sectional Study

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Version: 2 Date: 4 March 2014

Author's response to reviews: see over
Dear Editors-in-Chief, 

March 4, 2014

On behalf of the co-authors, I would like to resubmit the revised version of our manuscript entitled “Road traffic noise frequency and prevalent hypertension in Taichung, Taiwan: a cross-sectional study” (MS ID: 1400894958115850). I attach to this mail a copy of the revised text with the changes marked (file name: EH_1400894958115850_redlined_revision_text) and a copy of the revised manuscript (file name: EH_1400894958115850_revised_text_final) as well as a supplementary data (Additional file 1) in MS Word for PC. Eight pages detailing our responses to the reviewer’s comments point-by-point are included in this letter.

In response to the reviewer’s helpful comments, we have re-analyzed our data and added more detailed information in this revision. Accordingly, the text has been updated and refined. We believe that all of the reviewer’s comments have been adequately responded to below and appropriately addressed in this revised manuscript. With these significant improvements, we hope that the revised manuscript is fit for publication in the Environmental Health. If you have any remaining queries about this work, please contact the corresponding author, the contact details of whom are as follows:

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Yours Sincerely,

Ta-Yuan Chang, PhD
Reviewer's report
Title: Road Traffic Noise Frequency and Prevalent Hypertension in Taichung, Taiwan: A Cross-Sectional Study
Version: 1
Date: 8 January 2014
Reviewer: Anna Hansell
Reviewer's report:
General comments
This is one of the first studies to look at frequency components of road traffic noise and health outcomes. Major flaws in design are that the study only included self-reported hypertension, it measured noise on weekday daytime when many if not most of the respondents are likely to have been elsewhere at work and also it was not clear if those with hypertension diagnosed prior to moving to current residence were excluded. While there is a generally good discussion of study limitations, the latter two issues are not discussed in the paper. I am also concerned that analyses did not take into account either total noise or total traffic flow – or at least investigate relationships between total noise/flow and different frequency noise.
Response: We have added the discussion of these two limitations in the revised version (Page 16, Paragraph 1st and Paragraph 3rd). In addition, the relationships between total noise/total traffic flow and different frequency noise are investigated to show in the modified Table 4 and Figure 1-3 in this revised version.

Major compulsory revisions except where otherwise stated
Introduction
1. This should state that the association with total noise has been assessed and published in a previous paper and that this study goes on to examine associations with specific noise frequencies.
Response: We have added the following statement in the revised version: “The association between total noise exposure and the prevalence of hypertension among inhabitants has been evaluated in a previous paper [11] and this study goes on to investigate associations with specific noise frequencies.” (Page 3, Paragraph 2nd, Lines 12-15).

Methods
2. Was more than one person per household recruited? If yes, did the analysis allow for clustering by household?
Response: Only one person per household was invited to participate in this study. We
3. Did the study take account of how long people had lived at current residence and whether hypertension was diagnosed while living at current residence? If information is available, only those diagnosed at current household should be included.
Response: We thank the reviewer for this thoughtful suggestion. We only required that residents had to live in the current address at least three years but did not collect the information about each subject’s living period at the current address. This limitation has been discussed in the revised manuscript (Page 16, Paragraph 1st, Lines 1-5). However, we defined subjects as hypertensive cases only when they were diagnosed with hypertension by a physician at the current household. We have added this information in the revised version (Page 6, Paragraph 2nd, Lines 1-3).

4. What were correlations like between low, medium and high frequencies? Were those exposed to high values exposed to high values of noise at any frequency?
Response: We have added a new supplementary table (Table S1) to show the correlations between total noise exposure and noise levels at low, medium and high frequencies. We found that total noise levels were significantly correlated with all frequencies (Spearman’s correlation coefficients ranged from 0.45 at 8000 Hz to 0.93 at 63 Hz, all $p$ values < 0.050) and the higher correlations (correlation coefficients > 0.85) were observed at low frequencies of 63, 125 and 250 Hz. Additionally, noise exposure at high frequencies of 2000, 4000 and 8000 Hz had moderate correlations with those at median frequencies of 250, 500 and 1000 Hz (rho ranged from 0.49 to 0.96, all $p$ values < 0.050) but lower correlations with those at low frequencies of 63 and 125 Hz (rho ranged from 0.39 to 0.64, all $p$ values < 0.050). We have added these results in the revised manuscript (Page 10, Paragraph 3rd and Page 11, Paragraph 1st, Lines 1-2).

5. Could the authors please elaborate on the rationale for the method chosen for statistical analysis? Why divide into high/low noise exposure groups – why not use continuous or a transformed value for continuous noise? And why not consider adjusting for total noise or total traffic volumes – exposure to high levels of low frequency noise may be a marker of traffic exposure rather than specific to low frequency noise. Also, statistical analyses that have been done could be described more clearly e.g. ‘For each of the nine frequencies of noise
considered from 31.5 Hz to 8000 Hz, the odds ratio of self-reported hypertension in those above vs. below the median exposure were calculated”.

Response: We thank the reviewer’s detailed suggestions. We have elaborated on the rationale for the method chosen for statistical analysis in the revised version:

“Continuous (i.e., 1-dB increase at each frequency) and categorical variables of road traffic noise in participants were used to examine the association with hypertension. Because participants had large variations in the noise intensity (from 19 dB at 31.5 Hz to 66 dB at 1000 Hz) and exposure ranges (from 10 dB at 125 Hz to 22 dB at 63 Hz) at nine frequencies (Additional file 1: Figure S1), the median values at different frequencies were used to separate subjects into high- and low-exposure groups with a similar number in each subgroup. For the same reason, the 820 subjects were divided into quartiles of noise exposure, stratifying by frequency, to investigate an exposure-response trend.” (Page 8, Paragraph 2nd, Lines 1-9)

We have used a continuous variable of traffic noise levels (i.e., 1 dB increase) for each frequency to study this association, but the results (as shown in the following table) were not adequate to be compared with each other due to large variations in the noise intensity and exposure ranges at nine frequencies. For instance, we cannot conclude that subjects exposed to noise at 250 Hz (ranged from 48 to 59 dB) may have the higher risk of hypertension compared with those exposed to noise at 31.5 Hz (ranged from 19 to 35 dB) because the number of participants within a 1-dB level at each frequency is different in the multiple logistic regression. Therefore, we just present these results in the supplementary table (Additional file: Table S2).

Table S2. Associations between hypertension and continuous exposure of traffic road noise (1-decibel increase) stratified by different frequency components

<table>
<thead>
<tr>
<th>Frequency component</th>
<th>Model 1&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Model 2&lt;sup&gt;b&lt;/sup&gt;</th>
<th>Model 3&lt;sup&gt;c&lt;/sup&gt;</th>
<th>Model 4&lt;sup&gt;d&lt;/sup&gt;</th>
<th>Model 5&lt;sup&gt;e&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
<td>OR (95% CI)</td>
</tr>
<tr>
<td>31.5 Hz</td>
<td>1.06 (0.97-1.16)</td>
<td>1.06 (0.96-1.18)</td>
<td>1.06 (0.95-1.17)</td>
<td>0.91 (0.79-1.06)</td>
<td>1.06 (0.94-1.19)</td>
</tr>
<tr>
<td>63 Hz</td>
<td>1.07 (1.01-1.13)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>1.10 (1.03-1.18)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>1.10 (1.02-1.18)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>1.03 (0.88-1.21)</td>
<td>1.15 (1.05-1.27)&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td>125 Hz</td>
<td>1.14 (1.01-1.30)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>1.23 (1.05-1.43)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>1.22 (1.04-1.42)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>1.12 (0.89-1.40)</td>
<td>1.25 (1.06-1.48)&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td>250 Hz</td>
<td>1.20 (1.05-1.37)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>1.28 (1.08-1.51)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>1.28 (1.08-1.51)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>1.21 (0.94-1.56)</td>
<td>1.29 (1.08-1.54)&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td>500 Hz</td>
<td>1.12 (1.00-1.25)</td>
<td>1.21 (1.05-1.40)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>1.20 (1.04-1.39)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>1.11 (0.92-1.35)</td>
<td>1.20 (1.04-1.39)&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td>1000 Hz</td>
<td>1.10 (0.98-1.22)</td>
<td>1.14 (1.00-1.30)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>1.13 (0.99-1.29)</td>
<td>1.04 (0.89-1.22)</td>
<td>1.13 (0.99-1.29)</td>
</tr>
<tr>
<td>2000 Hz</td>
<td>1.12 (0.99-1.25)</td>
<td>1.17 (1.02-1.35)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>1.16 (1.01-1.34)&lt;sup&gt;f&lt;/sup&gt;</td>
<td>1.07 (0.91-1.27)</td>
<td>1.16 (1.01-1.34)&lt;sup&gt;f&lt;/sup&gt;</td>
</tr>
<tr>
<td>4000 Hz</td>
<td>1.02 (0.93-1.12)</td>
<td>1.03 (0.93-1.14)</td>
<td>1.02 (0.92-1.13)</td>
<td>0.95 (0.85-1.07)</td>
<td>1.02 (0.91-1.13)</td>
</tr>
<tr>
<td>8000 Hz</td>
<td>1.04 (0.99-1.10)</td>
<td>1.06 (0.99-1.13)</td>
<td>1.06 (0.99-1.13)</td>
<td>1.05 (0.98-1.13)</td>
<td>1.06 (0.99-1.13)</td>
</tr>
</tbody>
</table>
dB = decibel; OR = odds ratio; 95% CI = 95% confidence interval. aSimple logistic regression model. bMultiple logistic regression models adjusted for significant factors between the case and control groups (such as age, gender, body mass index and family history of hypertension). cMultiple logistic regression models adjusted for all variables in model 2 and important risk factors of hypertension identified in the literature (i.e., current smoking, alcohol consumption, salt intake and physical inactivity). d Model 3 adjusted for the total noise exposure. e Model 3 adjusted for the total traffic flow rate. fP < 0.050.

In addition, the extended models (i.e., model 4 and model 5) were set up to show the results of the model 3 adjusted for the total noise exposure and the total traffic flow rate, respectively, in the modified Table 4. The associations were not significant for all frequencies after controlling for the total noise exposure. It might be over-adjusted in the logistic regression model because total noise exposure had the significant and positive correlation with each of frequency components (Spearman’s correlation coefficients ranged from 0.45 at 8000 Hz to 0.93 at 63 Hz, all p values < 0.050). However, the associations were pronounced at frequencies of 63 and 125 Hz after controlling for the total traffic flow rate, indicating the possible interaction with other traffic pollutants. We have modified the statistical analyses to be described more clearly (Page 8, Paragraph 3rd, Lines 2-4, 11; Page 9, Paragraph 1st, Lines 1-2) and added these results in the revised version (Page 11, Paragraph 3rd, Lines 7-12).

6. Page 7 ‘simple logistic regression models’ – it is not clear what is in these models. It is obvious from Table 1 that these factors need to be included as statistically significant there.
Response: We have modified the sentence as the following one: “Four variables of gender (male vs. female), age (years), BMI (kg/m2) and family history of hypertension (yes vs. no) were significant (all p values < 0.050) between the case and control groups; therefore, they were used to establish the model 2 in the analyses.” (Page 8, Paragraph 3rd, Lines 4-7).

7. Page 7 – the multiple logistic regression equation sentences do not add anything to the paper and could be omitted as this is a standard method (from “The multiple logistic regression can be expressed…..to….for the ith X variable”). (discretionary revision)
Response: We have deleted those sentences related to the multiple logistic regression equation in the revised version.

8. Page 9 Use of the Bonferroni correction is debated and other methods are
available. In the situation of male/female analyses where the Bonferroni correction is presented in this paper, I would be happier instead with presentation of with formal tests for interaction by sex – I suspect these would be non-significant as the dataset is not large and one will lose power by dividing into male and female. If the Bonferroni correction is used, then the number of comparisons needs to be stated. The number chosen is debatable here as it could include all comparisons made in all analyses and potentially the correction would need to be applied to all results. I would prefer it not to be used at all –there is already a good comment in the discussion about multiple comparisons.

Response: We thank the reviewer’s useful suggestion. The Bonferroni correction has been deleted and the formal tests for interaction by sex at different frequencies of road traffic noise have been done (Page 9, Paragraph 1st, Lines 2-4). Table S3 reveals that the significant effect modification by sex occurred at frequency components of 31.5, 250 and 500 Hz but not at other frequencies. Therefore, the significant associations between the prevalence of hypertension and road traffic exposure at frequencies of 63, 125 and 1000 Hz were not modified by sex, indicating no interaction with each other. We found that only males exposed to the high levels (above the median values) of road traffic noise at frequencies of 125, 250, 500 and 1000 Hz had significantly higher odds ratios of the prevalence of hypertension compared with those exposed to the low levels of noise exposure in the present study. The inconsistency is because the study population is not large that may lose power while being divided into male and female groups. We have added these results (Page 11, Paragraph 3rd, Lines 12-15) and discussed the multiple adjustments in the revised manuscript (Page 16, Paragraph 4th).

Results

9. Table 2 – the size of the correlation is important here as well as statistical significance and should be stated. My interpretation of table 2 is as follows. All types of road vehicles including motor cycles were statistically significantly but moderately correlated (rho=0.3 to 0.6) with low frequency noise and with the 250Hz band of medium frequency. Only motorcycles were also statistically significantly correlated with high frequency noise, again with moderate values of rho.

Response: We thank the reviewer’s suggestion. We have modified the description to mention the size of the correlation and the statistical significance as the following sentences: “All types of vehicles were significantly (all p values < 0.050) but moderately correlated (rho ranged from 0.31 to 0.63) with low frequency components
of traffic noise and with the medium frequency at 250Hz. Only the traffic flow rate of
motorcycles was also significantly (all p values < 0.050) correlated with high
frequency components of traffic noise and with the 500 Hz band of medium frequency
components, having moderate values of correlation coefficients (rho = 0.31 to 0.49).
Accordingly, the total traffic flow rate was significantly (all p values < 0.050) but
moderately correlated (rho ranged from 0.33 to 0.64) with most frequency
components except the frequencies of 1000 and 2000 Hz.” (Page 10, Paragraph 2nd,
Lines 2-10)

10. Table 3 – I am confused by ‘Median (Q1-Q3)’. Firstly why not just median,
secondly is this Q1 to Q3 or Q1 minus Q3.
Response: We present the median and range (Q1 to Q3) of road traffic noise among
study subjects to show their noise-exposure distributions at different frequencies. We
have modified the Table 3 to clarify the range (from Q1 to Q3) in this revised version.

11. Could the noise distributions be presented on an online
appendix?(discretionary revision)
Response: We have added a box-plot figure (Additional file 1: Figure S1) to show the
noise distributions of different frequency components on an online appendix. The
results were also described in this revised manuscript (Page 11, Paragraph 2nd, Lines
4-7).

12. Page 9. It is not clear whether the p-values for increasing trend were for
‘total’ or for male and female separately. Please could the p value for trend for
total, male and female be added to the figures.
Response: We only found the significantly increasing trend for the total subjects
(Page 12, Paragraph 1st, Lines 6-9) and male subjects (Page 12, Paragraph 2nd,
Lines 1-3). To clarify the trend for total, mal and female subjects, we have added the
p values to the modified Figure 1 to Figure 3.

Discussion
13. Page 11 Authors need to clarify that the OR of 2.15 for all frequencies
comes from a previous published analysis – this was not readily apparent on
first reading.
Response: We have modified the sentence to clarify this information as the following
one: “When adjusting for the same confounders in multiple logistic regression models
(model 3), the high-exposure group had an OR of 2.15 for all frequencies in a
previous study [11] compared with the findings in this study that they had an OR of
2.51 at 125 Hz, 2.14 at 63 Hz and 1.99 at 1000 Hz, respectively.” (Page 14, Paragraph 2\textsuperscript{nd}, Lines 5-9).

14. There is a generally good discussion of potential bias from using diagnosed hypertension and other limitations such as lack of adjustment for SES. However, there is also bias from only using daytime weekday measurements, which is potentially problematic given that the mean age suggested most are adults at work therefore are not likely to be exposed. This should be stated early on in the limitations section.
Response: We have discussed the lack of adjustment for socio-economic status and occupational noise exposure separately and moved them early in the revised manuscript (Page 16, Paragraph 2\textsuperscript{nd} and Paragraph 3\textsuperscript{rd}). Because this study included the shopping district and residential district in Taichung City, most participants are retailers, owners of grocery stores (who are running a business on the first floor and living on the higher ones at the current address) or housewives except some may be unemployed or retired. For retailers or owners of grocery stores, they expose to both road traffic noise and commercial noise during the studying periods. Therefore, only using measurements of road traffic noise at daytime on weekdays may underestimate their noise levels, producing the possible bias of exposure misclassification in this study. We have added the information (Page 5, Paragraph 1\textsuperscript{st}, Lines 15-18) and discussed this bias in the early limitation section (Page 16, Paragraph 3\textsuperscript{rd}, Lines 1-10).

15. This important exposure misclassification bias (above) and the bias from using diagnosed hypertension only should be included in the abstract.
Response: We have included the exposure misclassification bias and the bias from using diagnosed hypertension as the following sentence in the abstract: “With the possible bias of exposure misclassification and a bias from using diagnosed hypertension, these results suggest that exposure to road traffic noise at low and hearing-sensitive frequencies may be associated with hypertension and exposure to noise at 125 Hz may have the greatest risk for hypertension.” (Page 2, Abstract, Conclusions)

Layout of figures and tables (Minor essential revisions)
16. Table 1. Specify that case means previous diagnosis of hypertension.
Response: We have specified the cases as subjects had the previous diagnosis of hypertension while living at the current address in the modified Table 1 (Page 26).
17. Figures – please could the x-axis categories be better separated with extra space between each frequency grouping and the male/female/total results within each category be plotted closer together. Currently these look continuous at first glance.
Response: We have modified these three figures to show the results after adjustment for the total traffic flow rate. In addition, the results for male, female and total subjects have been plotted separately by noise categories for each frequency grouping in the revised version. We believe that the revised figures are clear to the readers.

**Level of interest:** An article of importance 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