Reviewer’s report

Title: The role of multilevel factors in geographic differences in bicycle crash risk: a prospective cohort study

Version: 2 Date: 28 October 2013

Reviewer: Bas de Geus

Reviewer’s report:

Comments to the Authors
2nd VERSION

The 2nd version of this manuscript is identical to the first submitted version, except for 3 small additions in the text.

The answers that were given to my questions are mostly not answered and not taken into account in the new version of the manuscript.

As the manuscript did not change, I will respond to your responses in the same document.

Major Compulsory Revisions

The title of the manuscript is misleading. 1. To which extend is this an ‘prospective cohort study’? 2.

The only ‘geographical’ variable I see in this manuscript is the difference between Auckland and the rest of NZ and the use of mesh blocks (although the mesh blocks only seem to be used to make a difference between Auckland and the rest of NZ).

In the Taupo Bicycle Study, the majority of participants were recruited in 2006 and followed up through linkage to four national databases up to 30 June 2011. It is a prospective cohort study as baseline data were collected well in advance of crash outcomes. A follow-up survey was also conducted in 2009 to assess changes in exposure over time.

Our previous analysis (published in Preventive Medicine 2013, volume 57, pages 152-161) shows that the risk of on-road crashes is higher in Auckland (New Zealand’s largest urban region) than in Wellington (New Zealand’s capital region) and the rest of the country but the risk of off-road crashes
is similar across the regions. As shown in Figure 1, many factors at individual, neighbourhood and broader environmental levels may contribute to the higher risk of on-road crashes in Auckland.

This paper therefore assessed the relative contribution of these factors using a mediation analysis. As such we believe that the title of the manuscript is not misleading.

Meshblocks are the smallest geographical units defined by Statistics New Zealand and they were used in this study to categorise the study participants by region, urban-rural status and neighbourhood deprivation.

# Why bothering with the meshblocks if you only use Auckland and the rest of NZ?

This manuscript is a combination of 2 (or even 3) very different topic: 1. Accidents statistics; 2a. factors that would influence cycling; 2b. perception of environmental factors. Could the authors give a rational for including both topic into one study?

Part 2a and 2b will have an influence on bicycle usage, but I do not see the link with accidents. Will a ‘barrier to cycling’ e.g. too hilly (Table 4) cause an increased risk for bicycle accidents?

We apologise for any confusion but we feel this manuscript is not a combination of different topics.

Rather it focuses on the question of which factors contribute to the excess risk of on-road crashes in Auckland.

The manuscript first presents the incidence and risk of on-road vs. off-road crashes in the Auckland region vs. the rest of New Zealand (Table 2), suggesting that Auckland had a higher risk of on-road crashes but has a similar risk of off-road crashes compared to the rest of the country. The manuscript then presents the results of the mediation analysis (Table 3), indicating that demographics, residential factors, cycling characteristics and risk behaviours (that is, information collected from the study participants at baseline) accounted for 53% of the excess risk in Auckland. We speculated that the remaining risk differential (47%) could be attributed to environmental factors not measured in
the study. Our speculation was supported by differences in perceptions toward environmental factors between the Auckland participants and others (this information is collected in the follow-up survey conducted in 2009) (Table 4). The Auckland participants were significantly more concerned about traffic volume, speed and drivers' behaviour, but perceptions of other factors such as weather and topography were similar to those in the rest of New Zealand. We therefore concluded that Auckland’s car dominated transport environment may have contributed to the remaining risk differential. This does not mean that factors presented in Table 4 such as “too hilly” influence the risk of bicycle crashes.

# Can the authors tell me where in the manuscript you explain that you used a ‘mediation analysis’?

Study 1: bicycle accidents
- This study has a very detailed and rich database (crash data, insurance, police, …) that was already be used in other manuscripts from the same authors. The only novelty for this manuscript is the analyses between Auckland and ‘the rest of NZ’. The manuscript does not give any indication of the (geographical) differences between both that could be interesting to conduct a study on. Is Auckland a large built-up area and the rest of NZ part of the country side? Does NZ only has one large city?
- What is the incentive to look for a difference between Auckland and the rest of NZ?
As mentioned in the manuscript, Auckland is the largest urban region in New Zealand (this does not mean that the rest of New Zealand is a countryside or New Zealand has only one large city). The region also has a higher level of car use and a lower level of active travel, compared to the country average (Additional file 2).
As mentioned above, our previous analysis shows a higher risk of on-road
crashes in Auckland,
compared to Wellington and other regions. This provided the impetus to employ
a mediation analysis to identify factors that may have contributed to this risk
differential. Using this method we were able also to quantify the relative
contribution of different behavioural and environmental variables. This
manuscript therefore is not about geographic differences in crash risk (the
subject of the previous analysis published in Preventive Medicine) but about why
there are geographic differences in crash risks, using Auckland as an example.

# “This manuscript therefore is not about geographic differences in crash risk”,
but why does the title of your manuscript is: “… geographical differences in
bicycle crash risk…”?

- The novelty of this manuscript could have been an analyses using the
meshblocks. Unfortunately,
the results section does not mention anything about the mesh blocks, except that
they are use to
differentiate between Auckland and the rest of NZ.
As mentioned in the manuscript, meshblocks are the smallest geographical units
defined by Statistics
New Zealand (containing an average of 100 people and 40 dwellings). If we were
to conduct analyses
at the meshblock level, study power would be very limited and the results would
be difficult to
interpret. Therefore we aggregated meshblocks in this study and categorised the
study participants
by region, urban-rural status and neighbourhood deprivation.

# You did not aggregate meshblocks in this study and categorized the study
participants by region, urban-rural status and neighbourhood deprivation. You
took Auckland and the rest in NZ as two groups.

- The results section on the accidents only deal with on- en off-road. Poor for a
manuscript and not
original.
We presented the incidence and risk of on-road vs. off-road crashes in the
Auckland region vs. the
rest of New Zealand to highlight the fact that the risk of on-road crashes is higher
in Auckland but the
risk of off-road crashes is not. Table 2 also presents differences in crash risk
between Auckland and
other regions in more detail than our previous paper in Preventive Medicine.

# So the only novelty is that you looked into ‘more detail’ the crash risk between
Auckland and the other regions.

# Table 2 only gives the difference in absolute numbers of crashes between Auckland and the rest.

Study 2: there is no reference to which questionnaire were used. Where these existing questionnaires? Were these questionnaires validated? On which previous research are they based?

We assume that study 2 means our analyses presented in Table 4. This information was collected in the follow-up survey. We mentioned this in the second paragraph of the “design, setting and participants” section as well as the last paragraph of the “analyses” section. This follow-up questionnaire was developed based on the study’s baseline questionnaire and pilot-tested (we did not use baseline information because perceptions toward barriers to cycle commuting were not asked in the baseline questionnaire).

# All put my question in a different way: are your questionnaires validated?

- The Methods section describes in great detail which were the databases (crash data, insurance,...) that were used and describes the statistical procedures. What is missing is a (detailed) description of the parameters that your used for your models.

We mentioned the variables measured in the second paragraph of the “design, setting and participants” section and also described how participants’ addresses were categorised by region, urban-rural status and neighbourhood deprivation in the first paragraph of the “analyses” section.

More detailed information about study recruitment can be seen in our previous paper (Injury Prevention 2008, volume 14, pages 11-18).

# In the second paragraph, you write that you asked for demographic characteristics, general cycling activity, crash experience and habitual risk behavior.

# Could the authors give a rational for including these parameters into your analysis?
The results section:
- Table 2 gives absolute numbers of crashes
- Table 3 the risk of on-road accidents without any ‘geographical’ characteristic
- Table 4 environmental factors perceived as important in influencing cycling for transportation

Where is the ‘link’ between bicycle accidents and the rest of the study?
Please see our responses mentioned above.

Minor Essential Revisions
- Abstract, Results and further on in the manuscript: “Of the 2554 participants whose ….”. In the Methods section (page 6) the authors indicate that “a total of 1537 participants completed the questionnaire”. Page 8: “all the data were completed for 2435 participants”. And on page 9 the authors write that “… 1511 participants were used…”. Does the study include 2554, 1537 or 1511 participants?

As mentioned in the Methods, the baseline questionnaire was completed by 2628 participants, of whom 2590 were resident in New Zealand (overseas participants were excluded as their crash outcome data were not available through record linkage). Of 2590 participants, 36 were further excluded as their addresses could not be mapped. As such, analyses presented in Tables 1, 2 and 3 were based on 2554 participants, of whom 2435 had complete baseline data. The missing values for the remaining participants were computed using multiple imputation.

The follow-up questionnaire was completed by 1537 participants. As before, 26 participants were excluded as they stayed overseas or their addresses could not be mapped. Analyses presented in Table 4 were based on 1511 participants.

# Maybe that a flowchart in attachment could make this more clear.

- What is meant with ‘baseline differences? The authors should indicate this in the Methods section.
This means differences in baseline characteristics between the Auckland participants and the rest of
the cohort. We mentioned this in the second paragraph of the “analyses” section and presented the results in Table 1.

# Now I know that the baseline characteristics are presented in Table 1. You do not mention this in the text of the manuscript. The only time you refer to Table 1 is in the results section, without mentioning that these are the baseline characteristics.

- Conclusion of the manuscript, last sentence. Would you promote cycling in an unsafe environment like Auckland (if I know that 322 Auckland participants experienced 538 bicycle crashes, is 2 per person in 4.6 years)? Or would you rather first advocate for building a cycling friendly environment and ‘educate’ car drivers for respecting the vulnerable road users?

We are not persuaded that public health advocates must choose between promotion of cycling and environmental change. In practice, both are required. Strategies for a healthier and more sustainable transport mix include not only behavioural change programmes but also engineering measures such as creating a bicycle-friendly environment and multi-faceted policies such as traffic calming, driver education, and restriction of car use. We have not described these matters in greater detail here, because they are beyond the scope of the present study.

Discretionary Revisions
- Page 4: “…level of active travel.[16]” should be “…level of active travel [16].” This has been amended. Thank you.
- Page 8: what is meant with: “The participants were censored on 30 June 2011 or date of death.”?

Censoring is essential in survival analysis. As we performed survival analysis for repeated events and there was minimal loss to follow-up (as the crash outcome data were collected through record linkage), we censored the participants on the closing date of follow-up, that is, 30 June 2011. Those who died prior to 30 June 2011 were censored on their date of death.
Level of interest: An article of limited interest

Quality of written English: Acceptable

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