Author's response to reviews

Title: Environmental barriers, person-environment fit and mortality among community-dwelling very old people

Authors:

Merja Rantakokko (merja.rantakokko@jyu.fi)
Timo Törmäkangas (timo.tormakangas@jyu.fi)
Taina Rantanen (taina.rantanen@jyu.fi)
Maria Haak (maria.haak@med.lu.se)
Susanne Iwarsson (Susanne.iwarsson@med.lu.se)

Version: 2 Date: 3 June 2013

Author's response to reviews: see over
Dear Editor,

We appreciate the opportunity to resubmit our manuscript to BMC Public Health and we want to thank the reviewers for the valuable and constructive comments. We believe that the reviewer’s suggestions and comments helped us to improve the quality of our manuscript.

We give responses [R] to the reviewers’ questions and comments below. We have copy pasted and numbered the original questions. Below, we respond to each question. In addition to point-by-point revision, we also took the opportunity to revise or complement parts of the text where we identified additional need for optimization.

We look forward to your decision on our submission.

Sincerely,

Merja Rantakokko
Gerontology Research Center and Department of Health Sciences
University of Jyväskylä
Finland
Editor's comment:

1. I would only recommend rounding the figures in tables to two decimal places (not three).

[R]: This is done.

Reviewer 1: Dr. Eleanor Simonsick

1. My major methodological concern relates to the length of follow-up used in the analyses in a group at such an advanced age. It may be instructive to examine mortality risk more proximate to the environmental assessment – after 5 years of follow-up for instance. Even though barriers were examined as time-dependent covariates, the interval between the second and third assessments is quite long and thus for deaths that occurred just prior to the third assessment changes in environmental barriers would not have been taken into account.

[R]: It is true that the difference between time points 2 and 3 in this study is relatively long, and it is possible that the predictor value may change within this interval. The change remains censored from the observer, if the individual dies before the third measurement. We call this part of the sample as the sensitivity test group. We can explore the impact of these potential changes in the barrier variables by conducting sensitivity analysis\(^1\), where we consider, what would be the model hazard ratio, if we had actually observed a given predictor value for an imaginary third measurement point for those in the sensitivity test group. Since sensitivity analysis deals with “what-if” data, it is practical to refer to the hazard ratios obtained from this data as potential hazard ratios. In the present setting sensitivity analysis can take numerous forms, but we decided to focus on the two important dimensions: 1) the values the environmental values might change to, and 2) the timing of the potential change.

To account for 1) we must specify the magnitude of the change in the barrier variable. It is natural to focus on the range of potential hazard ratios by considering that the barrier variables change to values between either extreme value (minimum / maximum) for the individuals. Thus we can, for example, focus on the individuals in the sensitivity test group and consider, if the barrier variable had been measured some time before death and it had

\(^1\) We note that sensitivity analysis is not usually reported for survival analyses for gerontological data, although it is recommended by several authors (see e.g. Allison, Paul. (1995). Survival Analysis Using SAS: A Practical Guide. SAS Publishing: Cary, NC).
chanced for example to the minimum value of that variable for all test group individuals in
the third measurement.

To account for 2) we must specify when the change occurs. One way to examine this aspect
is to define a relative length of time (say, c) between measurement 2 (t_2) and death (t_d) as the
duration between the second measurement and change occurring in the barrier variable. Thus,
the change time (t_3) is given by t_3 = t_2 + c(t_d – t_2). For example, if we set c = \( \frac{1}{2} \), then the
change occurred mid-way between the second measurement and death. By utilizing this
equation a third measurement point can be calculated for each individual among those who
died between measurements 2 and 3.

Figure 1 shows the potential HR estimates for some values of indoor barriers, if all those in
the sensitivity test group had scored the value 0, 20, 40, 60, 80 or 100, respectively. We can
see that for values below 40 the protective effect of the indoor variable is retained. Had all
scored 40, there would be no protective effect. If the score was higher, the risk would be
higher for higher values of indoor barriers. It is notable that among those with observed score
from the third measurement the indoor barrier value\(^2\) ranged between 29 and 57.

\(^2\) There was one outlier with the value 2.
Figure 1. Potential hazard ratios and their 95% confidence intervals for different values of $c$ and six values for the indoor barrier predictor.

In addition, we have information also about dates of relocation, and we made the main analyses also taking this specific environmental change into account. Since relocation to ordinary housing had no effect on the association between environmental barriers and mortality, we decided not to include relocation in the present study. Other researchers using the same data concentrate in their studies specifically on relocation, and forthcoming studies will shed more light on environmental changes related to relocation patterns. However, we have added this as a possible study limitation (p.12), as follows:

“One study limitation to be noted when interpreting the results is the fact that the time between the second and third assessment was rather long (5-6 years) and therefore it is
possible that environmental changes occurring during that period would not have been taken into account for deaths that occurred just prior to the third assessment. However, since only 43 (three between the second and third assessment) participants relocated to ordinary housing during the follow-up, environmental changes incurred by relocation are not likely to influence the results."

2. After reviewing Table 4, it occurred to me that there could be a potential interaction between barriers. Specifically, it would seem that the absence of handrails would be particularly problematic for those for whom stairs constitute the only exit route.

[R]: This is a very good point. We tested interaction effects between having stairs as the only route outdoors and lack of handrails, and the p-value was 0.228 in the age- and sex-adjusted model. For other adjustments the p-values were even higher, indicating that there was no significant interaction. It seems that lack of handrails was problematic for all, and not depending on the other features of the environment. We also tested interaction effects between other environmental barriers which we considered to have potential associations, but none of these were statistically significant (smallest p-value was 0.153, which was for high threshold or level difference at the balcony and high threshold and/or steps at main entrance). We did not report these or other interaction effects between environmental barriers in the manuscript, since this would lead to a great number of p-values, which, in fact, are not statistically significant, and thus would not give an explanation for the findings.

3. It would be useful to engage the services of a native English speaker (who is also a good writer) to review and edit the final version before re-submission.

[R]: We have made a thorough text optimization, including professional editing by a native English-speaking editor.
Review 2: Dr. Margaret G. Stineman

1. A statistically significant association is noted between the absence of hand rails and lower mortality. This is maintained after adjustment. The importance of this seems clinically plausible however with multiple comparisons of many barriers to the single outcome (mortality), this could easily be statistically significant purely by chance. The authors recognize this appropriately and have taken a Bonferroni correction. Please specify more exactly how that correction is taken given there were so many independent variables.

[R]: We have added explanation of the Bonferroni corrections to the manuscript p.8-9. In the first version of the manuscript we had made Bonferroni corrections with multiplying the p-values with the number of set of analyses (3), which is now corrected to multiplying the p-values with the number of explanatory variables in the models (5). This changed the p-value for lack of handrails from .015 to .025, which is now corrected to the results.

2. An analysis of affect modification might also further clarify findings. The impact of person environment misfit/environmental barriers on mortality could depend strikingly on function.

[R]: We agree on this comment, as we do have a lot of experiences from earlier studies where we have explored different analytical pathways to deal with the challenges connected to the treatment of data that capture person-environment fit. To counteract the fact that P-E fit problems per definition to a major extent are explained by the presence of functional limitations, for the present study we did not use a composite P-E fit score but rather single environmental barrier variables. As part of our analyses, the interaction effect of number of functional limitations and number of environmental barriers (for outdoors, entrance and indoors) was calculated. As there was no interaction (smallest P-value .270, which was for indoor barriers) we decided to assess the confounding effect of functional limitations as a main effect in the analyses. We have added this to the Methods section under statistical analyses (p.8).

3. Limitations must be stated
[R]: We have added a study limitations paragraph to the Discussion section of the manuscript (p. 13).

- Minor Essential Revisions

4. In abstract “Among the specific environmental barriers that generate the most PE fit problems, lack of handrails in stairs at entrances was associated with the higher” the word higher should be “highest”.

[R]: This is done.

5. In the abstract, the study design and type of analysis should be stated.

[R]: This is done.

6. The PASW statistics version 18.0 (SPSS Inc., Chicago, IL) was used for baseline descriptive and to analyze the association between weighted environmental barriers and mortality please explain what that is.

[R]: The explanation on PASW statistics is offered in the comment 10. For weighted environmental barriers the explanation is offered in the comment 11. We have modified the statistics section for clarification, as follows: “Predictive Analytics SoftWare (PASW) version 18.0 (SPSS Inc., Chicago, IL) was used for the baseline descriptive and proportional hazard Cox regression analyses to analyse the association between environmental barriers generating the most P-E fit problems and mortality. The survival package (version 2.36-5) in the R programming environment (version 2.12.2) was used for the time-dependent Cox regression analyses of the association between the number of environmental barriers in each housing section and mortality [30].”

7. Some of the patient descriptive statistics (age, % women) under project contexts and participants on page45 should be listed in the results section.

[R]: We have now moved the descriptive information from the Methods to the Results section.
8. Why was the communication barrier collected but not used on page 5?

[R]: In the Housing Enabler (HE) instrument (version published 2001) there were 6 items about communication features. Several of those apply only to multi-family dwellings, and accordingly, there is substantial (valid) internal dropout. Moreover, based on previous methodological studies, we know that these items also may have low reliability. Accordingly, we made a slight revision of the Methods section text. p. 6: “...and communication (6 items; not used because of valid internal drop-out due to different housing type characteristics).”

9. How was use of mobility device recorded on page 6?

[R]: Use of mobility device was included in the Housing Enabler instrument as part of the assessment of functional limitations. The rater evaluated the use of mobility device (yes/no) after interviewing and observing the participant. We have added this information to the manuscript (p.7).

10. Please explain what the PASW statistic is?

[R]: We have used the name "PASW Statistics" (short from “predictive Analytics Software) to refer to the SPSS program version 18, because this is the correct citation for that version of the software. Up to version 17 the SPSS software was called "SPSS" (originally this was an acronym from "Statistical Package for the Social Sciences"). For version 18 the software name was changed to "PASW". From version 19 onwards IBM has used the name "IBM SPSS" for the software. The history of recommendations for the program citation can be found at http://www-01.ibm.com/support/docview.wss?uid=swg21476197. We have adhered to these guidelines for the software citation. We have written the full name (Predictive Analytics SoftWare, PASW) to clarify the abbreviation in the manuscript (p.9).

11. How the environmental barriers were weighted?

[R]: Weighted environmental barriers are those barriers that generate the most P-E fit problems. “Weighted environmental barriers” is one of several alternative ways to analyze data collected with the HE instrument. With this computation (using the HE software), the environmental barrier items are ranked according to the sample specific prevalence of
functional limitations in relation to the occurrence of environmental barriers. This computation generates environmental barrier item-specific P-E fit scores and results in a list ranking the environmental barriers from those generating the most P-E fit to the least. This ranking is based on each environmental barrier item’s relative contribution to the variance in the total HE score. We have explained this in the Methods section p. 6-7. In addition, for clarification we have now changed “weighted environmental barriers” to “environmental barriers generating the most P-E fit problems”, where appropriate.

12. P7. Clarify the following statement: “… all five environmental barriers generating the most P-E fit problems in each housing section were included in the models at once and the models were adjusted similarly as for the number of environmental barriers....” Was the same approach taken for all domains of the HE instrument i.e. all domains of barriers including outdoor?

[R]: We do acknowledge that this was not sufficiently clear in the original submission. We made a restructuring of the statistical analysis section under Methods, see p. 8-9 in the revised manuscript. In all analyses, outdoor, entrance and indoor sections were analyzed separately.

13. Tables: Fix label formats as example “Difficulty in interpreting information” should all be on one line in table 1.

[R]: This is done for Tables 1 and 2. Unfortunately for Table 4 we were unable to fit the labels on one line.

14. English language problems need editing.

[R]: We have made a thorough text optimization, including professional editing by a native English-speaking editor.

Reviewer 2 comment in additional material:

15. It would enhance relevance of the paper if challenges of living along were to be incorporated more into the study objectives and introduction. This is a distinct
characteristic of their studied population since living alone adds a significant challenge to the safe community integration of people.

[R]: The ENABLE-AGE Project targeted those who lived alone because it was already shown that single-living very old people are especially sensitive to environmental press. Those living alone have a pronounced risk of losing independence and becoming socially isolated. Thus, they constitute an important target for a research project aiming to study home and health along the process of ageing. This project background has now been added to the Introduction, and the study aim has been specified accordingly.

In addition, in the Discussion we now emphasize that this specific sampling criterion should be kept in mind when interpreting the results of the present study (p.14): “It should also be noted that owing to specific inclusion criteria based on the knowledge that single-living older people represent a segment of the ageing population that is particularly vulnerable to environmental demands [21], only those who lived alone were included in the ENABLE-AGE project. We cannot rule out the possibility that environmental barriers affect mortality differently among those living alone compared to among those who are co-habiting. Those who live alone have to face their environmental challenges alone, while those living with others may overcome such barriers with help from another person, or they can avoid performing challenging tasks and activities by asking someone else to take the responsibility for them. This topic also warrants further study. “

Other modifications to ensure that the revised manuscript conforms to the journal style and to clarify the content of the manuscript:
- Titles of the Tables (2, 3 and 4) have been modified to meet the journal guidelines; this includes giving title that summarized the whole table and is no more than 15 words.
- Number of environmental barriers is changed from Table 1 to Table 2.
- Title “Introduction” has been changed into “Background” according to journal guidelines.
- References are cited before the full stop.