Author’s response to reviews

Title: Area-aggregated assessments of perceived environmental attributes may overcome single-source bias in studies of green environments and health: results from a cross-sectional survey in southern Sweden

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Author’s response to reviews: see over
Response letter

Lund, 15 November 2010

Dear Editorial Team and reviewers,

This cover letter provides a response to the final concerns with regard to the manuscript we re-submitted in July this year. The reviewers underscore that the previous comments have been taken seriously and the manuscript has been remarkably improved, though still there are a few points of concern formulated by Prof. Dr. Peter Groenewegen and Dr. Sjerp de Vries. We are grateful for again very useful comments and suggestions and have followed these to a highly extent. In all other cases we have tried to clearly elaborate our rationale.

Peter Groenewegen

There is still one unresolved issue in my original comments, the one concerning a 2 or 3 level model. The authors argue in favour of separate 2-level models ‘because the five items of SGS do not necessarily measure the same underlying constructs ..’. I am not convinced by this argument. First of all, if you don’t analyse the data in a 3-level model you won’t know whether or not the assumption that the items are independent is true or not. Secondly, the authors use a sum score of the items. The reason for that is (I would say) that the items have at least some connection to each other. And finally, the authors report Cronbach’s alpha which is a measure of dimensionality. Given these arguments I am still strongly in favour of a 3-level model. I hope the authors are able to convince me that I am wrong. If they agree with me I would urge them to estimate a 3-level model or at least discuss the issue in the revised paper.

Reply: By treating the items (qualities; culture, lush, serene, spacious and wild) as measures of the same underlying construct in a 3-level model (item, individual and area), you lose the possibility to identify types (aspects, qualities) of natural environments that promote human health, an issue of great interest currently within landscape planning and environmental health. We have assessed health effects of the individual items in SGS in a previous paper (Björk et al. 2008; ref no. 12). Using objective GIS-based assessments of the items, we demonstrated that serene was more strongly associated with neighborhood satisfaction than the other characteristics. Furthermore, culture was not associated with physical activity; as opposed to the other characteristics. Thus, our previous work on these items suggests that they may not be equally associated with health indicators such as neighborhood satisfaction and physical activity, which is now mentioned in the Discussion on page 16.
Also from a conceptual viewpoint, e.g. *wild* environments (plants seem self-sown, lichen and moss-grown rocks, old paths etc.) are clearly different from e.g. environments rich in *culture* (a historical place offering fascination with the course of time; historical sights and remains etc.). This is now mentioned in the Discussion on page 16. Given that the items reflect different concepts that are not equally associated with important indicators of health, it would not be appropriate to use a 3-level model.

Although viewed as distinct concepts, the items (qualities) of SGS may of course coexist in natural environments and thus correlate. This notwithstanding, to avoid confusion with scales and items meant to measure the same construct, we have omitted Cronbach's alpha from the paper.

In the current paper, we restrict the analyses of concurrent validity to the index SGS. With equal weights for all five items in SGS, the inherent assumption is that the items are equally beneficial ("more is always better"), an assumption that indeed can be questioned given our previous results. For the purpose of the current paper, we still find it feasible to restrict the attention to the index score, but its limitations are now mentioned in the Discussion on page 16.

**Sjerp de Vries**

**Minor essential revisions**

1. Page 10. Cronbach's alpha is calculated for the SGS qualities. Elsewhere in the manuscript it is stated that the qualities are distinct entities (e.g. page 17). The authors have to make up their mind: is the SGS an index or a scale (with each item in essence meant to measure/to tap into the same construct)? And if it is an index, what does a high co-occurrence of the qualities mean?

   **Reply:** See our reply to Peter Groenewegen above. SGS is an index, but the individual items may of course coexist in natural environments. We have omitted Cronbach's alpha from the paper to avoid confusion.

2. Page 13, first sentence: among highly educated --> among the highly educated?

   **Reply:** Changed to ‘among the highly educated’ on page 12.

3. Page 13, first sentence below Concurrent validity: Perceived availability to --> perceived availability of

   **Reply:** Changed to ‘perceived availability of’ on page 12.

4. Page 16: “… susceptible individuals.” Susceptible to what?

   **Reply:** Results from various studies suggest that some population subgroups might be more susceptible for their neighborhood environment in relation to health and well-being than others (e.g. for non-employed residents: Cummins et al: JECH 2005, not cited in paper). More specifically in relation to green neighborhood environments de Vries and co-workers itself have shown that lower educated people, housewives and elderly (i.e. people who spend a larger amount of their time at home) were more sensitive for green space in their living environment (de Vries et al, 2003; ref no. 3). Additionally we have shown in our previous study (Bjork et al, 2008; ref no. 12) that the association
between the green qualities and neighbourhood satisfaction was more pronounced among tenants compared to house owners, which is likely related to access to an own garden.

To clarify this part in the paper (page 15) we have changed ‘groups of susceptible individuals’

Furthermore the most urbanized city areas are likely to accommodate large groups of individuals who could be more dependent on the (green) neighborhood environment they live in (i.e. people who spend a larger amount of their time at home (de Vries et al, 2003)) and tenants, who often lack access to an own garden (Björk et al, 2008).

5. Page 16: “… to assess cause-effect relations, i.e. predictive validity of the SGS”
A high predictive validity does not indicate that the relationship is causal in nature!

Reply: We agree and have therefore rephrased the sentence:
… to assess temporal associations, i.e. predictive validity of the SGS

6. Page 18 (bottom): “… suggesting that perceived attributes of the green environment are more important for neighborhood satisfaction.” See the previous comment. Predictive validity does not equal size of causal effect. (On page 17 the similar results are interpreted as suggesting that the use of the GIS-based assessment as ‘gold standard’ might not be valid.)

Reply: We agree and have therefore rephrased the sentence in a more cautious way, stressing that alternative explanations such as differences in spatial resolution (see also reply below) between GIS-based index score and area-aggregated SGS cannot be ruled out.

7. Table 1: subheadings for "Objectively assessed ..." are lacking

Reply: Subheadings of the three columns are added (0, 1 and 2-4 qualities respectively).

8. Table 3: Agreement between self-assessed: individual or area-aggregated?

Reply: ‘self-assessed’ changed to ‘individual-level self-assessed’

9. Appendix 1, note a: all included areas ... must either be located less than 1 km from a village ..”
Should not less be more (or explain)?

Reply: Included areas should either be located less than 1 km from a village or have a size above 15 ha. This criterion is based on the idea that the wild quality has a different meaning for children compared to adults. Therefore there have been formulated two types of wild, namely
1) The wild very close to dwellings where children can play their fantasy games, build their small houses and so on. For this purpose they do not need many hectares, and therefore there is no criterion for size.
2) Wild for adults covers larger areas (>15 ha), and does not necessary be located very close to their home, so therefore there is no distance criterion.
With regard to our study these criteria are less relevant because we have used wild as a quality criteria and determined availability based on our own distance criterion of either within 300m distance from the residence, GIS-based or self-reported within 5-10 minutes walking distance.

Discretionary revisions
1. Page 6, just below Assessment of green qualities. "Interview studies ... have revealed eight perceived qualities ..." --> "Based on interview studies among laypeople, carried out between 1995 and 2005, eight perceived qualities of green neighborhood environments have been identified"

Reply: This is changed as suggested. Rephrased sentence: ‘Based on interview studies among laypeople, carried out between 1995 and 2005, eight perceived qualities of green neighborhood environments have been identified’ page 6, below Assessment of green qualities.

2. On page 7 it becomes clear that the GIS-based availability scores are determined by using the residential address of the respondent as the centre of a circle, and therefore these scores can be considered to be unique to the individual. This brings me to the following question: if the GIS-scores were to be aggregated, following the same procedure as used for the self-reports, would this not lead to a higher interrelationship with the SGS-score? Isn’t there a spatial mismatch between the not-aggregated GIS-based index score and the area-aggregated SGS-score?

Reply: The GIS-based index score was primarily designated to be comparable with individual SGS. In order to restrict the number of indices, we decided not to aggregate the GIS-based index. It is certainly true that there is a difference in spatial resolution between the GIS-based index score and area-aggregated SGS, which is now mentioned in the Discussion on page 18 as an alternative explanation for the decreased effect of the GIS-based index score on neighborhood satisfaction when area-aggregated SGS was included in the model.

3. Page 11: the motivation for comparing the individual level only with the multilevel model results for the area-aggregated SGS is not given.

Reply: We have rephrased the sentence, and included a comment on the result: Effect estimates with confidence intervals associated with area-aggregated SGS were similar in single-level and multilevel models, suggesting limited clustering remaining in the outcome variables within areas after covariate adjustments.

4. Page 13, Concurrent validity. It strikes me as odd that any green quality is present when there is no green area available, given the formulation of the questions (see appendix 2). Are green qualities possible outside green areas? At least for some qualities this seems highly unlikely (see also appendix 1).

Reply: An explanation for this, seeming odd finding, could be that we investigated concurrent validity with a yes-no survey question concerning the perceived availability of a green open space (e.g. large park or comparable) or forest area within 5-10 minutes walking distance from the residence. It is quite likely that participants conceive qualities also of smaller green areas near the residence. We have clarified the phrasing of this question in Methods, pages 9 and 11, in Results pages 13 and 14 and in Discussion page 15. See also phrasing of the question in appendix 2. A green area has been changed to ‘a green open space’ because the latter better translates to the Swedish word ‘grönområde’ used in the questionnaire; the term ‘a green area’ is more diffuse.

5. Page 14: “Focusing on the ..... the effect on neighborhood satisfaction ..” Unnecessary causal language. I would prefer “Focusing on the ..., the relationship with neighborhood satisfaction ..”

Reply: This is changed to ‘the association with neighborhood satisfaction’. See page 13 first full paragraph.
6. Figure 1: It might be pointed out that the number of objectively assessed number of green qualities never reached the maximum of five.

Reply: We agree and therefore added the following sentence to the method section ‘None of the participants had access to all five objectively assessed qualities and the GIS based index score therefore ranged from 0 to 4.’ See Method - Assessment of green qualities, page 8. Additionally we added a sentence to the text of figure 1 ‘None of the participants had access to all five qualities as measured with GIS.’

Other minor changes

Minor changes in text marked with track changes:
Inserted ‘the latter’ in Abstract – background, page 2.
‘but also to validate’ → ‘Such models have also been used in studies to validate’ in Background, page 5.

Minor changes in the headings of tables 1, 4 and 5 and figure 1.

Edits suggested by the editorial team.

1. On page 4, the preposition of is awkward. Please re-read and re-work the sentence. (The sentence it is referring to the last one at the bottom of page 4 that continues on to the top of page 5. "Multilevel analyses have been used previously in studies of associations between green environments and health and physical activity, etc.")
We changed the word ‘of’ → ‘examining’, see Background, page 4-5.

2. Please separate the Authors’ contributions and acknowledgement section and make them two separate headings with their own sections.
This is changed as suggested. See page 21 and 22.

3. The references should be formatted a number, period, space (not tab) and reference. Please remove the issue numbers and be sure that all the text is aligned.
This is changed as suggested. See page 22-26.

4. When listing the authors, do not use et all, but list all authors of the publications in the references.
This is changed as suggested. See page 22-26.

5. The tables should be inserted before the figures.
This is changed as suggested. See page 26.

We have checked the Environmental Health website once more to ensure that the manuscript conforms to the journal style.
As stated above, we are grateful to the peer reviewers for their time and effort and we sincerely hope that their comments are sufficiently addressed in the manuscript and in this cover letter.

With kind regards,

Jonas Björk and Kim de Jong