Reviewer’s report

Title: Economic Valuation of Health Benefits from Using Geologic Data to Communicate Radon Risk Potential

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Reviewer: Tony Denman

Reviewer's report:

This is an interesting paper, and is worthy of publication. However, in its current form it needs review and improvement. In addition, there are a number of minor corrections and improvements required.

Title
I would suggest that the title should include "Health Benefits", for example "Economic and Health Benefits of Using Geological Data to Communicate Radon Risk Potential".

Methodology
In places the authors' choice of wording could imply that it is just the availability of the fine detail radon maps that will lead to the increased testing (for example, line 32 of the abstract and lines 232, 235 and 251), while the pilot study of 15 counties appears to include 8 workshops, and careful dissemination of the maps and other education materials. Thus by line 193 the maps have achieved a net present worth of their own in equation 3, when the equation should be refer to whole process of dissemination, as used in the pilot study. (see also comments below on spelling out the timescale and events of the projects more clearly.)
The analysis looks purely at testing rates. But the dissemination of information may also have influenced mitigation rates. This is not considered in this paper. Moreover, the mitigation rates mentioned in lines 171 - 174 give no indication of when these were measured, or whether the range quoted was temporal or geographical. Is there any data on whether the pilot study has increased mitigation rates in the 15 counties yet ? It should be noted that an improved mitigation rate would increase the health and economic benefits, and might balance to some extent a reduction, not noted by the authors, due to the fact that fewer smokers are likely to mitigate (as shown by other studies).

Cost Modelling
As far as I can see, the authors have not offset the cost of radon testing and mitigation of the houses which are mitigated during the pilot study and the state-wide extension against the economic benefits they estimate. This needs to be clearly stated, as many other international studies offset such costs. It might be useful for the authors to state the cost of testing, and the average cost of mitigation to help readers who wish to make some comparison with other papers.
There are challenges of modelling the benefits of a one-off mitigation which has benefits which only fully accrue 15 or more years in the future, and where the elevated risk of lung cancer is from long-term exposure to radon. In their modelling, the authors have chosen a non-standard approach which reduces the potential to compare with other studies. Other studies, such as Gray et al, 2009, model the cost effectiveness over the lifetime of the mitigated building (100 years for Gray, 40 years for most other studies), and include children. The inclusion of children is on the basis that, although lung cancers do not appear in children, they are still being exposed to radon (which may or may not be the same degree of risk as in adulthood) which builds up their risk for radon-induced lung cancer. Such modelling ensures that the reduced risk to future occupants of the house is included.
Gray et al.'s methodology also handles the balancing of future benefits against current costs more neatly than the authors do in lines 210 to 225. Gray et al.'s approach may not be appropriate to this study, because of the public health campaign is likely to result in a short-term peak in new mitigations, but I would urge the authors to review their paper, and ensure all their assumptions, exclusions and costs are clearly stated and dated, so that readers can be clear how the conclusions are achieved.

Cost information
The authors should ensure that each reference to costs is qualified by their date, and that all are the same date - except where the authors specifically consider inflation.

Use of References
I am concerned that the reference for percentage risk is an EPA public information leaflet. Whilst it is acceptable to use such a simple formula for this high-level analysis, it would be much more appropriate if the values were referenced from a primary source for the values used - such as BEIR VI, Darby et al, or the UK report on Radon and Public Health.

There are a number of international studies (from Canada, UK, Spain, Switzerland, Austria, etc) considering radon remediation which could be referenced at line 62, which show that in general radon remediation is cost effective. All these references would support the value of this project to increase householder response to radon risk. Further there have been studies looking at other reasons why uptake is generally low internationally which could be added at line 68 - for example UK studies have shown there is an unwillingness to pay, which is more apparent in lower income groups. Finally, for inclusion in the discussion, there are two UK studies, which show that smokers are less likely to test and remediation their homes, which could reduce the benefits of this study - if the response from Kentucky residents was similar.

Specific Comments
Abstract - line 30 - 33 - this should be reworded to reflect that the communication strategy is essential to the dissemination of the maps.

Abstract - line 34 - this should refer to the pilot study in 15 counties. Line 35 - should then indicate the estimated change would be as a result of rolling out the communication strategy and maps to all 120 counties in Kentucky.

Abstract - line 39 - the communication strategy "would result" in an estimate 288…..

Abstract - line 43 - again, it is a communication strategy linked to the dissemination of fine-detail geological maps that has economic and health benefits.

Keyword - I would suggest that Smoking is also a keyword.

Line 54 - reference 3 relates to tobacco smoke and not skin and breast cancer, and should be moved.

Line 55 - my reading of the two papers is that they both "suggest" an association between radon and these cancers (and that therefore further studies are needed.). The lower limits of probability for skin cancer are very close to 1, and the breast cancer study only showed a significant difference if the lowest and highest radon levels were considered, but not if the whole dataset was analysed.

Line 59 - I assume that this is for all lung cancers treated in a year (please state when) in Utah. The cost also needs a date, as noted above.

Line 76 - I would prefer this sentence to read "All this contributes to a continuing unnecessary health risk."

Line 85 - state the 42% of houses over the US Action Level here (rather than leave it til line 171)

Line 86 - the percentage of smokers requires a date of measurement.

Line 88 - do you mean exposure to second-hand smoke to workers in the workplace, or to customers/public in restaurants, cafes, and other public buildings (or both ?).
Line 90 -91 - presumably the increased risk to Kentucky residents is compared to the US as a whole.
Lines 115-123, 145 - The chronology of the pilot study, and any future work is rather confused. Was the pilot study in 15 counties, with its outreach activities conducted first, and then the other counties maps published on BREATHE. It may help readers to place significant dates and activities in a table.
Line 143 - I am not sure why the FRESH database [24] is referenced here, when it is unpublished data and part of the data for the paper. It would be more appropriate to describe FRESH in more detail in the text.
Line 171 - As noted above, the 42 % figure should be quoted in the introduction.
Line 173 - As the local mitigation rates were determined from the FRESH database, a more detailed description would be appropriate (see line 143), with qualifications about whether the FRESH database is comprehensive, and if any local variations are significant.
Line 179 -181 - see comments above about the use of references, and the need to replace reference 6 with a primary peer-reviewed reference.
Line 183 - See the comment about the exclusion of children above. The smoking incidence is this sub-group is irrelevant or a minor issue, as there is no lung cancer incidence in this age group. BEIR VI suggests that although there is no incidence, modelling of risk should assume the risk is similar to adults.
Line 216 - the 30% should be referenced (to reference 26 ?)
Line 233 - the number 686.8 does not make sense. Firstly, you can't have a fractional person; and the number yields a fractional number of houses, whether the average number of occupants is 2.49 or 1.92. I appreciate that the authors have derived this number from (1.89 - 1.71) * 10,000 *12, but they need to reduce the number of significant digits, rounding to whole numbers of houses, and stating this here (it is otherwise only stated in the Abstract, line 39). This would also allow readers to confirm whether 1.92 or 2.49 was applied to give the additional people occupying the tested homes. The wording also needs to be revised, as only one person in each home - presumably the householder - would test their home; while the number of occupants would be higher (Sorry to be pedantic.)
Line 234 - this would better read - "Given that an average of 42% of homes in Kentucky.......levels, a public health campaign using the geological radon maps would result in additional...."
Line 237 - The statement that 57.7 people would avoid harmful exposure directly contradicts line 40 of the abstract which refers to 58 homes.

Figure
Whilst it is interesting to see the maps as used in the public health campaign, it would be useful for reader to know the scale and ranges of each coloured band - perhaps as part of the title of each figure. It would be easier to put split the image into two separate figures, which might also help make the very small text in the EPA map becoming readable.

References

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