**Author’s response to reviews**

**Title:** Childhood sensorineural hearing loss and adult mental health up to 43 years later: Results from the HUNT study

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Response to reviewers. The changes is in the text are highlighted in yellow.

**Technical Comments:**

(1) Please amend your heading ‘Introduction’ to ‘Background’ in your main text.

The heading has now been amended (page 3, top of page).

(2) If abbreviations are used in the text they should be defined in the text at first use, and a list of abbreviations should be provided at the end of the 'Conclusions' section.

A list of abbreviations has been added at the end of the 'Conclusions' section (page 12).

(3) Please move your 'References' to below the Declarations section.

References are now moved to below the Declarations section (page 15).
Editor Comments:

- This study focuses on childhood hearing loss, therefore I suggest that you review literature on childhood/congenital hearing loss and not hearing loss acquired in adulthood in the introduction. Also more carefully introduce the studies among children with (congenital) deafness and children with mild hearing loss. Finally, this study measures depression/anxiety, subjective well-being and self-esteem among adults. Introduce to literature about this.

The paragraph on hearing loss and mental health among adults has been removed, and the introduction has now been updated and expanded.

- Sometimes you write hearing loss other times hearing problems, hearing impairments. Use hearing loss only.

We have now carefully searched the manuscript and replaced “hearing problems” and “hearing impairment” with “hearing loss”. We also replaced “slight hearing loss” with “mild hearing loss”.

- The method section is for the most clear. However, more information about the SHINT study is needed (for example reliability, tests used, who did the tests, and number participants. In the discussion we learn that only children from regular schools were included). Were only children with hearing loss tested or were all children tested? Did the 10,269 children with hearing loss (out of estimated 78,524) undergo specialist examination? Later you write that of the 10,269 with hearing loss 3,066 participated in the NTHLS and 67, 67, and 223 was classified with "disabling" (use severe-profound instead), moderate, slight hearing loss, respectively. What about the other 2,709 children with hearing loss?

The Sample section under the Method section has now been extensively re-written with a much more detailed and comprehensive description. Hopefully it helps clarify all the issues mentioned above. In short; yes, all children were tested, and all of those who tested positive at the screening (the 10,269) underwent specialist examination. Although 3,066 of these children also participated in the NTHLS, most of them had hearing loss due to ear infections or other reasons, and not due to a sensorineural hearing loss, and for the purpose of this study we only selected those with a sensorineural hearing loss. We have now replaced “disabling hearing loss” with “severe-profound hearing loss” as requested.

- You only selected those children with sensorineural hearing loss. How was the diagnosis of sensorineural hearing loss validated?
This has now been explained thoroughly in the Sample section. In short, Dr Fabritius defined SNHL as hearing loss in which the air-conduction thresholds followed those of the bone-conduction, although he did not include a maximum accepted air-bone gap in this definition. The children were examined up to several times depending on the diagnosis to ensure correct diagnoses were made. We use the diagnosis made by the ENT specialist.

- Also I suggest that you reorganize the Method section. Information about the SHINT procedure, for example, is partly given in Samples and partly in Measure.

Information about the SHINT procedure has now been restricted to the Samples section and not in Measures.

- You used the last audiogram. Was that at age 13?

Yes, for most children that was at age 13, this information is now included in Samples.

- Please explain "outcome variables were standardized" a little more. Do you mean standardized scores? This procedure might be problematic to use in this population of participants with hearing loss.

Yes, the scores for the outcome variables Self-esteem, SCL and Subjective well-being were standardized (but not the predictor variable, SNHL) so that the results are easier to interpret. When these scores are standardized, the beta corresponds to fractions of a standard deviation, as described under Design and statistical analyses. This is frequently done in order to facilitate interpretation of the results and we have thus chosen to keep it like this.

- The study control for mother's and father's education. What about examples of participants’ education, age, gender, and additional disabilities?

We have now eliminated cases with additional disabilities from the data set (three individuals that had been registered as “Retarded”, one that was registered with “Cerebral paralysis”, and one that was registered with “Down’s syndrome”). This is described in Samples in the Methods section. We have now included the participants’ age and education as control variables in the analyses. Instead of using sex as a control variable, we chose to split the data set into two new data sets; one including men only and one including women only. We have described this procedure under Design and statistical analyses. We then ran the analyses in these new data sets,
and the Results section and the Tables as well as the Discussion section and the Conclusions section have been updated accordingly.

- The sample size of people with hearing loss is low.

The sample size of people with hearing loss might seem low, but it resembles SNHL prevalences for children. We find that it would not be meaningful to include participants with other hearing disorders such as Otits media, since that would make for a different scope and a different paper. Power is often low in cohort studies, but still it is a strength of the study that it includes more than 30,000 participants and that diagnoses of hearing disorders have been made as long as 43 years before the outcome. We feel that it is important to use these data since they are, after all, rather unique. It is an unusual advantage to be able to follow children with hearing loss well into adulthood, and although there are always dangers of bias in terms of attrition when there is such a long time gap between measurements, we still feel that these data are valuable. We have mentioned the problem with attrition in the Sample section and also included some more reflections on this in the Discussion section under Strengths and limitations.

- The discussion needs to address existing literature more, and not all of the topics and suggested explanations are of relevance. For example inclusion, special schools, childhood support.

We have now rewritten the discussion and also removed the paragraphs about inclusion, special schools and childhood support.

PEER REVIEWER COMMENTS: Potentially a very exciting study which is, to my knowledge, without precedent in the literature. However, I have issues with the sampling, and the hearing tests conducted back in the 1950s, and the small samples. I am not sure that the study actually provides the answer we hope for.

REQUESTED REVISIONS: Firstly, why mention a sample of 32K plus, when actually it's only a small proportion of those in the actual analysis.

The actual analysis does include the sample of about 32K people, most of which are in the reference group (32,104 with normal hearing as opposed to 66 with profound-severe hearing loss, 66 with moderate hearing loss, and 220 with slight hearing loss). We have now included a sentence at the very end of the Samples section to clarify this.
Also, if the hearing tests in the 1950s were less good, with higher false positive rates for example, then the authors would need to discuss this point fully.

Hearing tests in the 1950s might have been less good, however, in this case the equipment used held international standards at the time and those pupils who tested positive where examined by a specialist one or more times to ensure correct classification. Still, it is of course important to be aware of the possibility of misclassification, and we do express this clearly. The procedures for the hearing tests are now more thoroughly described in the Methods section under Sample, and this has also been addressed in the Discussion section under Strengths and limitations.

In addition, the authors inserted missing values based on some unusual judgements. Why were those not reporting their level of education assumed to be in the lowest category? I can see no justification for this whatever.

It seemed reasonable to place missing values in the lowest category since these are parents of children born as early as 1941, which means that some of them probably received no education at all. However, we have now changed this and replaced missing values with the sample mean instead.

There is also an issue with time and culture changes etc, and the nature of stress and mental health, which often respond to year on year conditions, and thus whole generations might not tell us about subsequent generations.

We have now addressed this more clearly in the Discussion section under Strengths and limitations.

ADDITIONAL REQUESTS/SUGGESTIONS: None.