Author's response to reviews

Title: Changes in work situation and work ability in young female and male workers. A prospective cohort study

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Author's response to reviews: see over
Point-by-point answers to comments from reviewers on manuscript MS: 4977229736777081: Work ability in young male and female workers - influenced by changes in work. A prospective cohort study.

Maria Boström, Judith K Sluiter and Mats Hagberg, BMC Public Health

Referee 1

The authors have the work ability into four groups based on the one-year changes and then they explain the impact of one-year changes of work characteristics to the work ability groups. The main problem with this approach is that it omits totally the level of the measured variables. For instance in the table A the baseline values of the work ability measure are 9.2 in the reduced group, 6.1 on the improved, and 8.6 in the constant group. If work ability is at its height at the baseline, there is only one way to go, down. Likewise, if work ability is low at the baseline, the only way is upwards.

This is a relevant comment. We agree that ability that begins at a very high or a very low baseline can change in only one direction. To address this problem we performed separate analyses for the regression to the mean, both for reduced work ability and for improved work ability.

For reduced work ability, we compared the results for two groups, one with a baseline score of 10 and one with baseline 8. Reductions in work ability by two score levels or more (by our definition) in each group did not change our conclusion for the main results.

For improved work ability, the new analyses were more difficult to interpret due to power problems with a smaller subgroup. Although, as we can see, there are no major differences in improvements of work ability in the groups with baseline levels 7 and 8 (the group with baseline 6 of work ability contained too few individuals to allow for meaningful analyses).

We have now included text about this phenomenon in the discussion part. For improved work ability, on page 18, in the last paragraph:

However, separate post-hoc analyses to account for this phenomenon did not change the associations between improved work ability and changes in work.

We write in the same manner for reduced work ability on page 19, in the 1st paragraph:

Regression to the mean could also make the interpretation of associations between reduced work ability and changes in work difficult. As separate post-hoc analyses showed no differences in the main results between two groups with different baseline levels of work ability, the conclusions remain unchanged.

If a young person has low work ability there may be some health issues or living habits or over weight etc involved and these should be included in the analyses.

We are most concerned about the influence individual factors can have on work ability; however, the aim of this study was solely to assess associations between work and work ability, in order to suggest intervention strategies at work, as mentioned under the heading of Applications in the Discussion section, page 20, 1st paragraph: “Furthermore, in contrast to intervention suggestions aimed mainly towards improving the capacity and performance of workers [45], this study proposes the importance of intervention strategies aimed towards influencing work factors that may affect workers’ ability”.

Individual factors can be possible confounders for work ability. Yet, pain and depressive symptoms have been shown in studies not to correlate with exposure assessment, as mentioned in the Discussion, page 19, 3rd paragraph: “A change in pain was discussed as a possible confounder. However, it has been shown that people with musculoskeletal disorders do not over-report their exposure [42]. Further, little influence on reported job strain, in terms of negative affectivity, has been shown for depressive symptoms [43]. “

We believe that living habits and overweight are factors that of course can influence the level of work ability, but they likely do not correlate with reported work exposure.

_The language needs stylization._

The manuscript has now been corrected by a native British English speaker.

_The follow-up period is very short. The study was planned to cover a 10-year period, why publish one year results?_

Although the study had a 10-year design, we do not think one year is a short time. Workers in this age group experience many changes at work over the course of one year, as shown in Table B. For example, about every third young worker reported changes in social support at work, reward relative to effort, and influence of job demands on private life during this year. To avoid confusion, we have omitted the text about planning a 10-year follow-up; in the last sentence on page 5, we write instead “over time.”

_There are too much and too large tables. What is the meaning of the tables A and B? Why not include the characteristics of the subgroups in table 1? Concerning other tables, perhaps it is better to exclude from the tables the insignificant variables of the univariate analysis._

This is a relevant comment. Originally Table 1 included all of the subgroups, and it became very large. Table A, therefore is intended as an Appendix table for interested readers who wish to see the characteristics of the subgroups.

Table B is also intended to be an Appendix table showing the levels of exposure at baseline and changes during the year. This table may simplify the reader’s interpretation and appraisal of the results. We are also concerned about the size of these tables, but we would suggest that the Editor will decide whether or not they should be included as tables or appendix tables and how best to identify them depending upon their placement.

Insignificant variables in Table 2 and 3 could be excluded, but we wanted to show the reader the prevalence ratios and confidence intervals for all tested work factors in a succinct format, instead of listing them in the text.

However, to summarize for the reader, we have included in the text the number of significant work factors, the number of non-significant work factors with PRs 0.9–1.2, and the number of work factors with too few cases for meaningful analysis, for the sample. We have added, in the Results section, at the end of page 13 and on page 14, 1st paragraph:

_In total, 4 work factors were statistically significant in relation to change in work ability for the sample; the remaining 16 work factors had PRs between 0.9–1.2, and were not statistically significant in the univariate analyses. In total, 6 work factors were statistically significant in these analyses, 13 work factors had PRs between 0.9–1.2 and were not statistically significant, and 1 work factor had only 3 cases._
Referee 2

Major Compulsory Revisions

1. abstract: the authors must be careful in presenting causal associations, since changes in determinant and workability are measured simultaneously, so in essence it is about associations rather than 'predicting' or 'influencing'. This should be carefully phrased throughout the manuscripts.

We agree and have now changed this throughout the whole manuscript. The conclusion is changed, (the same in the abstract and in the end of the manuscript) page 2-3 and 20:

*Decreased job control and increased negative influence of job demands on private life over time seem to be the most important work factors associated with reduced work ability among young workers of both sexes. Increased social support at work, increased job control, and decreased negative influence of job demands on private life were also found to be the main work factors associated with improved work ability, although with possible gender differences.*

Still, we discuss the possibilities of prediction in the Discussion section, but we also discuss the limitations of causal interpretation in the Methodological considerations on page 17, in the last paragraph:

*Despite the power of the prospective design, the results should be carefully interpreted as prospective findings only, since change in work ability and change in work factors are measured simultaneously at the 1-year follow-up. However, the study design, with its aim to assess changes, contributes more to the research in this field than would a cross-sectional study with only baseline results.*

Neither do we emphasize this in the new title:

*Changes in work situation and work ability in young female and male workers. A prospective cohort study.*

2. The information on the study sample needs more clarification. The manuscript needs a clear overview of the selection over time. A flow chart with information on a) the number of individuals invited for the baseline measurements, b) the number of respondents at baseline, c) participation in the follow-up measurement, and d) inclusion in the analyses would help to have a clarify information on response. Was there selective drop-out in the study? A non-response analysis using baseline data for those individuals lacking the follow-up could be informative.

We have included a new total flow chart, Figure 1, which shows the selection of the study sample from invitation to participation.

We have also performed a non-response analysis of the total number of workers we lost from baseline to the 1-year follow-up (n=1500): those who did not answer the 1-year follow-up questionnaire (n=1490) and those who answered the 1-year follow-up questionnaire but did not answer the work ability score at the 1-year follow-up (n=10). We compared this group with the group that formed the study sample at the 1-year follow-up (n=1311) (not shown in the flow chart).

This analysis showed no major differences at baseline between the study sample and the drop-outs on any of several work factors of interest: job control, social support at work,
reward relative to effort, and influence of job demands on private life. Nevertheless, the group of drop-outs consisted of significantly more men (difference −0.0543; 95% CI −0.0913 to −0.0174) and had significantly less daily computer use in general at baseline (difference 0.0706; 95% CI 0.0367 to 0.1044). Also, we found a small statistically significant difference in work ability between the groups (0.1152 score levels, 95% CI 0.00130 to 0.2292). However, this difference of 0.1 score levels is very small in light of our definition of 2 score levels for a change in work ability, and consequently it is probably not of clinical interest. This is not discussed further.

We have included a new paragraph about this on pages 6–7:

The drop-out group of workers (not including students) consisted of 1500 individuals (not shown in the figure). Of these, 1490 workers did not answer the follow-up questionnaire. Another 10 individuals answered the follow-up questionnaire, but did not answer the work ability score.

A drop-out analysis showed that the lost group had similar scores to the study sample for several work factors at baseline, such as job control, social support at work, reward relative to effort, and negative influence of job demands on private life. However, the drop-out group consisted of significantly more men, (a 5% difference) than the study sample. Also, the workers in the drop-out group had a significantly lower daily use of the computer in general (a 7% difference) than workers in the study sample. For work ability, a statistically significant small difference (0.1 score levels) could be seen between the groups, but this is most likely not of clinical interest.

We also discuss this in the Discussion, in the Methodological consideration part, on page 18, in the 1st paragraph:

Because the drop-out group of non-student workers consisted of more men than women and had less daily computer use in general than the remaining sample, attention to the possibility of a selective study sample bias is important. Nevertheless, because we included gender stratification in the analysis, the difference in sex distribution is probably not a problem. The association between decreased daily computer use in general and improved work ability is not emphasized, due to a possible ceiling effect.

3. Please be aware that the technique of defining improvement or worsening if workability is subject to regression to the mean and ceiling effects. The problem can be seen e.g. with the overall prevalence of decreased and increased workability.

This is also a relevant comment. To handle these problems we have performed separate post-hoc analyses for both regression to the mean and for the ceiling effect, see below. The analyses for the regression to the mean were performed for both reduced work ability and improved work ability.

For reduced work ability, we compared the results for two groups, one with baseline of 10 and one with baseline 8. Reductions in work ability by two score levels or more (by our definition) in each group did not change our conclusion for the main results.

For improved work ability, the new analyses were more difficult to interpret due to power problems with a smaller subgroup. Although, as we can see, there are no major differences in improvements of work ability in the groups with baseline levels 7 and 8 (the group with baseline 6 of work ability contained too few individuals to allow for meaningful analyses). We have now included text about this phenomenon in the Discussion section. For improved work ability, on page 18, in the last paragraph:
However, separate post-hoc analyses to account for this phenomenon did not change the associations between improved work ability and changes in work.

We write in a similar manner for reduced work ability on page 19, in the 1st paragraph:

Regression to the mean could also make the interpretation of associations between reduced work ability and changes in work difficult. As separate post-hoc analyses showed no differences in the main results between two groups with different baseline levels of work ability, the conclusions remain unchanged.

The second comment concerned the ceiling effect. We performed new post-hoc analyses to consider this. We did the same analyses to assess associations between changes in work factors and improved work ability as earlier, but excluded those with work ability scores of 9 and 10, as they could not improve their work ability due to our definition. These analyses showed that the PRs were somewhat reduced, but by the same magnitude as for all major results associated with improved work ability with only one exception. For the work factor “decreased daily computer use in general” we saw a greater reduction in PR (PR 1.3, 95% CI 0.86 to 1.96), which can be explained by the ceiling effect. Because of the difficulties of interpreting this result, we have excluded decreased daily computer use in general from the conclusions, both in the abstract and in the manuscript.

In the Discussion, in the Methodological consideration part, we discuss this, on page 19, in the 2nd paragraph:

The possible ceiling effect for improved work ability was assessed with separate post-hoc analyses that showed, in contrast to earlier results, no significance for decreased daily computer use in general associated with improved work ability. The interpretation of this result was unsure and consequently not included in the conclusions of this study.

4. The description of the statistical analysis is not very clear:
   a) work factor treated: this is about coding, but it makes more sense to express that in the analysis on improvement a PR above 1 implies that...etc.

The text in the Statistical analysis part, on page 12, in the 1st paragraph, is now rewritten to make this clearer for the reader:

The work factor variables were coded so that a PR > 1 for reduced work ability meant that an increase in a work factor was hypothesized to have a negative effect on work ability. For improved work ability, a PR > 1 meant that an increase in a work factor was hypothesized to have a positive effect on work ability.

b) a PH model is usually applied to survival and I assume that this was done here to calculate PR, and time was constant for every observation

We have now included the phrase “with time set to 1” on page 11 in the 3rd paragraph in Statistical analyses.

c) the dependent and independent variables should be defined explicitly

New subheadings are now included on pages 7 and 8 to clarify this: The outcome and The explanatory variable (although the lay-out has to be discussed with two subheadings).

d) I do not think stratification by gender is the appropriate technique, a test for
interaction is much more informative. When interaction presents similar results, stratification can be presented.

We could have used a test for interaction in this study. However, we chose to use the gender stratification from earlier recommendations in research in occupational health [1] as men and women still meet different expectations and have different assumptions, opportunities, and resources in their working lives.

e) in order to investigate to regression to the mean problem, one could consider to analyse whether similar results are obtained for subjects who decrease from a high baseline value compared with those who decrease from a low baseline value.

We thank you for this good suggestion and we have now performed these analyses (see answer to question 3). We also performed new analyses to handle the possible ceiling effect (also explained in the answer to question 3).

f) could you please explain the reference groups in the analyses in table 2 and table 3. The numbers indicate that those with decreased work ability will be compared to those with no change + those with increased work ability. Would it not be more appropriate to compare those with decreased work ability only with those who had a constant work ability? [given the fact that one wants to distinguish between increase and decrease]

The reference groups are now described in the Statistical part, in the 4th paragraph, on page 11:

In the analyses of reduced work ability, the reference group consisted of those with either constant work ability or improved work ability at the 1-year follow-up (n = 880). The reference group in the analyses for improved work ability consisted of those with either constant work ability or reduced work ability at the 1-year follow-up (n = 1,213).

We are concerned about the difference between the reference groups, but we have no theories to suggest any specific problems with it. As we wanted as much power as possible in the analyses, it was important to use reference groups that were as large as possible.

5. I disagree with the term prospective relationships, since change was measured over the same time interval for both exposure and outcome.

This is now changed to ‘associations’ throughout the whole manuscript; see also the answer for question 1.

6. The statements on associations between change in exposure as well as workability should also be discussed within the context of associations at baseline. Are similar associations found?

We do understand this comment. Maybe cross-sectional associations at baseline could strengthen our results, but we are not sure how. Similar associations at baseline could not be found as, by definition, no changes had yet occurred at baseline. The focus of this manuscript
is on the changes over time. Most of the research on exposure and work ability has been performed at the baseline level of exposure, and very few studies have assessed changes in work ability in relation to changes in work over time. We wanted to contribute to the research that follows work ability over time. In this manuscript we do not investigate associations at baseline, as that was deliberately not a part of our aim.

7. Limitations: the prospective design is an advantage, but the type of analysis is essentially not prospective..this should be discussed more carefully.

We agree and have now changed this throughout the whole manuscript including the conclusions. See also answers to questions 1 and 5. Still, we discuss the possibility that results may be predictive in the Discussion. We also highlight the possibilities of causal interpretations in the Discussion, in the Methodological considerations part, on page 17, in the last paragraph:

    Despite the power of the prospective design, the results should be carefully interpreted as prospective findings only, since changes in work ability and changes in work factors are measured simultaneously at the 1-year follow-up. However, the study design, with its aim to assess changes, contributes more to the research in this field than would a cross-sectional study with only baseline results.

Minor Essential Revisions

1. It would help to understand the timeframe of the reported changes in workability in the studies cited in the introduction

Certainly; this is now included in the introduction on page 4, in the 1st paragraph: “..with a follow-up of 11 years,” and “...over 2–10 years”.

2. In the introduction it is stated that separate analysis for men and women are required, I would argue that that is not a good idea, one should investigate in the same sample potential interaction (a stratified analysis is not a good idea since many factors will differ between both strata)

See answer 4d: We could have used a test for interaction in this study. However, we chose to use gender stratification as earlier recommended in research on occupational health [1], because men and women still meet different expectations and have different assumptions, opportunities, and resources in their working lives. Gender stratification can be valuable, especially when there are differences between the strata [1].

3. Please note the response rate is an incorrect term, since it is definitely not a rate.

Although the term “rate” can have different meanings including frequency, the term has now been changed to only response to avoid misinterpretation on page 7, in the 1st paragraph in Data selection.

4. Table 2 includes the term cases, which is not explained in the text, and also a
rather odd term given the study population.

We do understand that the term “cases” may seem odd as there is no occurrence of disease in the manuscript. The term “cases” was used to describe those individuals among the exposed who reported reduced or improved work ability. This term has been used previously, as in the use of “exposed cases” for healthy persons by Lindberg [2]. We have chosen to keep this term, but we have explained it in the table text for Table 2 and 3:

Cases=exposed individuals reported reduced work ability and Cases=exposed individuals reported improved work ability.

5. I am not sure about the statement that possible gender differences were seen. where are these differences to be seen? (the PR of men must be outside the CI of the PR of women and vice versa, and in a quick check for most PRs this was not the case, so a more proper statement would be that there were no gender differences)

Although there were no gender differences among the univariate results, different gender results were shown in the backward stepwise multivariate regression analyses for improved work ability. We interpret this as a tendency to gender differences, with increased social support at work and reward relative to effort associated with improved work ability for female workers, and increased job control and decreased negative influence of job demands on private life associated with improved work ability for male workers.

6. A whole range of physical and psychosocial work factors are studied in relation with changes in work ability. How do the work factors correlate? In the methods it is described that all Spearman’s correlations were weaker than 0.8. However, they can still correlate moderate to strong. In my opinion more information on the correlation of the factors should be presented in the results section.

The association between different work factors is of course interesting, but it is not the main focus of this manuscript. The level of correlations between the work factors is not of direct interest in an investigation of multicollinearity. We wanted to identify only whether work factors correlated to a degree that would be problematic in the statistical analyses of the data of interest.

7. The conclusion, as stated in both the abstract as well as in the discussion section, needs further specification: ‘Consequently, several possible work factors could be suggested for the prevention and promotion of work ability in young workers’. Which work factors would you suggest in the prevention of reduced work ability or promotion of work ability?

To clarify the meaning of this, we have rewritten it. Also, we moved it from the conclusion section to the Application section where it fits better; page 19, under Applications:

Based on findings from the current study, there are many ways to promote good work ability and prevent loss of work ability, mainly through improvements in psychosocial work factors. Changes in job control and in the negative influence of job
demands on private life are the factors that most affect young workers. Supporting work ability primarily through improving those psychosocial conditions seems feasible, perhaps using somewhat different approaches for young women and young men.

8. Tables: Consistency is needed in the tables, e.g. in the number of decimals presented.

We have changed to two decimals throughout in Table 2: “decreased social support at work” is changed from 1.005 to 1.00 and “increased noise annoyance at the workplace” from 0.998 to 0.99 (in order not to suggest to the reader that this is a significant result, instead of using 1.00, but not bolded). In Table 3 we have changed the entry for “decreased daily computer use in general” from 0.999 to 0.99 for the same reason as above.

Reference list