Dear Editor,

We were pleased to learn that you encouraged us to submit a revised version of our manuscript (MS 1973882951029258). We feel that the editorial comments and the comments that were provided by the two reviewers dealt with important issues, leading us to revise the manuscript in accordance with those comments.

Please see below for a point-by-point response to concerns raised by the reviewers. We have highlighted all new text in the revised manuscript. We hope that our response adequately addresses all the concerns raised.

We look forward to hearing from you.

Sincerely,
The Authors

Editorial comments:

The editor asked us to give an indication of how long the effect lasts. "The proportional hazards assumption was tested using the method of Lin and Wei, in which the observed score process is compared with the simulated score process for each covariate. The p-value was obtained by performing a Kolmogorov-type supreme test. We performed 1000 simulation for these tests, and the maximum absolute value for intermediate stress was 1.38 and for high stress 0.74. Because all p-values were >0.05, we can assume that the hazard was stable throughout the follow-up." (Pages 7-8, lines 164-167.)

Reviewer 1

Major Compulsory Revisions

1. Page 6 paragraph 1: This section should be presented as a flow diagram at the beginning of the results. The flow diagram should show the number of potentially
eligible participants, number of eligible participants, number that completed the questionnaire, number excluded due to missing data, previous injury etc. This is important for assessing the generalisability of the data and sources of potential bias especially in regards to the number of participants with missing data.

Our response 1: Thank for this excellent suggestion. The flow diagram depicting the number of potentially eligible participants, the number of eligible participants, the number of participants who completed the questionnaire, and the number of participants who were excluded due to missing data or previous injury is now presented in a new Figure 1.

2. Page 7 paragraph 2 Statistical analysis: Inconsistent terminology has been used throughout the manuscript to describe the type of multivariable modelling used. There are two ways of modelling: these types of data: 1. Predictive modelling, in which a range of factors are included in the model to determine factors are most associated with the outcome of interest and; (2) modelling in which the association between a specific risk factor and an outcome are examined and adjusted for known confounders. It is the second method that is reported in this study i.e. the authors have examined the association between stress and subsequent injury and adjusted for a range of confounders. On this basis the so called predictor variables are confounding variables and the study has shown that stress is independently associated with injury (not a predictor of injury).

Our response 2: The reviewer is correct that in the present study we examined the relationship between stress and injury adjusting for known confounders. We have now corrected the terminology and do not use the term predictor anywhere in the text. We are also happy to amend the title if requested.

3. A comparison of the demographic characteristics of those that did or did not respond to the survey, including those excluded due to missing data should be provided.

Our response 3: A comparison of the demographic characteristics of the final analytic sample and the missing population is now presented at the end of first paragraph of the results section as follows:

"The final study population included a higher proportion of women (23% versus 21%, p<0.001), white-collar workers (34% versus 27%, p<0.001), employees aged <50 years (66% versus 52%, p<0.0001), and those who were married (66% versus 61%, p<0.0001) than the missing or otherwise excluded population." (Page 8, lines 180-184)

4. The results from table 4 should be interpreted with caution. Four models were run to show the impact of including various confounders on the hazard ratio between stress and injury. The final model, which includes all of the confounders, should be the definitive model when reporting whether or not there is an association between repeated exposure to stress and being hospitalised for injury. On this basis there is no significant association between repeated
exposure to stress and sustaining a serious injury. Although though the hazard ratio is large the wide confidence intervals and lack of statistical significance means that these results are likely subject to type 2 error.

Our response 4: Based on the reviewer’s helpful comment, we have amended the description of the results presented in Table 4 and now write as follows:

"Table 4 shows that the employees who experienced high stress at both measurement points with a four year interval had more than a 1.7 fold risk of severe injury during the follow-up (HR 1.74; 95% CI 1.01-2.99, in Model 2). This result attenuated slightly and became non- significant when physical work environment was included into the model (HR 1.65; 95% CI 0.96-2.84)." (Page 9, lines 212-215)

"Although the hazard ratios were rather large the wide confidence intervals and lack of statistical significance mean that these results are likely subject to type 2 error." (Page 11, lines 246-247)

5. The discussion is overly brief and the focus on the association between repeated stress and injury, derived from a partial model and not the full model (see comment above), is misleading. This is also the case in the abstract. It is the results from table 2 that are most robust and showed a significant 30-40% increase in injury risk for all three models in high stress compared to those with low stress. This should be the focus of the discussion.

Our response 5: Following this important point made by the Reviewer, we have re-written and expanded Discussion and amended Abstract accordingly, focusing on the results presented in Table 2. Please see the revised Abstract and pages 10-11.

Revised sections in the Abstract:

"Results: Highly stressed participants were approximately 40% more likely to be hospitalised due to injury over the follow-up period than participants with low stress. This association remained significant after adjustment for age, gender, marital status, occupational status, educational level, and physical work environment.

Conclusions: High stress is associated with an increased risk of severe injury.”

The Discussion section:

“Thus we can conclude that high stress is a risk factor hospitalised injuries.” (Page 10, lines 223-224)

"On the basis of stress theories and meta-analyses [17] we expected that long-lasting stress will have an adverse impact of employees’ well-being and increase the risk of injury. Some of our models suggested an elevated risk of injury among those who had reported stress at two measurement points but generally speaking there was no clear significant association between repeated exposure to stress and risk of serious injury. Although the hazard ratios were
rather large the wide confidence intervals and lack of statistical significance mean that these results are likely subject to type 2 error. However, it is possible that the fact that there were only a small number of injury cases (n=14) among those who reported high stress at both measurement points has increased the confidence intervals and produced non-significant results. Additional studies are therefore needed to examine to role of chronic stress in elevating the risk of severe injuries in different populations.” (Page 11, lines 242-251)

Minor essential revisions

6. Page 4 Paragraph 2: Demographic characteristics of the cohort should be presented in the results section of the manuscript.

Our response 6: We have moved the description of the demographic characteristics of the cohort from the Methods section to the start of the Results section.

7. Page 5 paragraph 3: The authors state that the stress measure has been validated for survey research. Has it also been validated for the subcategories used in the study? If not on what basis were the low, intermediate and high sub categories decided.

Our response 7: “We merged the first and the second, and the fourth and the fifth category as the numbers of participants in categories 1 and 5 were very small”. (Page 5, lines 110-11).

8. Page 6 paragraph 2: Please provide a reference, or justification for why a 2 year wash out period was chosen for the exclusion of hospitalisation due to previous injuries.

Our response 8: The two-year period for exclusion of injury cases is based on the assumption that an older injury, that is, an injury experienced more than 2 years ago, would not anymore affect the new injury risk. (Page 6, lines 121-122).

9. The last three lines of this paragraph should be reported in the results section.

Our response 9: We have moved these lines to the Results section (Page 8, lines 177-180)

10. Page 7 paragraph 3: On what basis where the confounding variables chosen for inclusion in the model? Also, the model in table 3 included a different set of confounder variables to the model in table 2. Why?

Our response 10: These confounders were selected because they have been associated with injury risk in earlier studies as references 8 (Salminen) and 9 (Cheung) showed. This point has now been added to methods section (page 7, lines 148-149). In addition, the identical set of confounders has now been adjusted for in all analyses (tables).

11. It is not clearly explained how the repeated exposure to stress was measured? In paragraph 2 of the methods the authors state that those that had
responded in previous years were excluded in the subsequent years so that only the first questionnaire completed by each participant was included. I assume that table 4 results refer to a nested cohort of participants that completed the questionnaire at two time points? Please clarify this in the methods.

Our response 11: “We measured repeated exposure to stress by including those participants who completed the questionnaire and responded to the stress question both in 1996 and 2000.” (Page 5, lines 114-115)

We included these years as the number of responses was much higher in 1996 and 2000 compared to 1986 and 1996.

12. When data were analyses for those with measurements over two time points results may be limited by small sub group numbers (n=14 injuries).

Our response 12: The fact that the number of injuries among those who reported high stress at two measurement points was very low has now been noted in Discussion:

"However, it is possible that the fact that there were only a small number of injury cases (n=14) among those who reported high stress at both measurement points has increased the confidence intervals and produced non-significant results.” (Page 11, lines 248-250)

Discretionary Revisions

13. Page 4 Paragraph 2: The data presented in this paragraph would be better presented as a flow diagram.

Our response 13: See our earlier Response #1.

14. It would be interesting to see the results broken down by injury type eg, occupational, motor vehicle, home/leisure injuries.

Our response 14: Unfortunately our data did not allow to present the results by injury type.

15. The strengths associated with the prospective nature of this study should be emphasised.

Our response 15: We have now added the strengths of this study to the same paragraph as limitations and consequently changed title of this section to “Strengths and limitations”. This section now reads as follows:

"Previous studies reviewed suffered from common method bias because both stress and safety outcomes were self-reported. The major strength of this study is its prospective design and a long register-based follow-up period, up to 22 years. The outcome used in the study, injury diagnosis derived from a hospital discharge register, covers all hospital admissions in Finland, and gives an objective clinical endpoint with concrete consequences. The data on severe injuries were complete and the use of independent national register data for
exclusion, adjustment, and assessment of the outcome helped us to avoid common method bias. However, our measure may be confounded by factors that influence whether or not the person seeks treatment for the injury. Our findings may provide conservative estimates, because some clinical injuries may go untreated and their effects tend to become diluted during a long follow-up period. In addition, in the final sample, male, younger, and non-manual workers were somewhat overrepresented compared to those excluded.” (Pages 11-12, lines 263-273)

Reviewer 2:

The paper reports a very nice study on relationship between stress and injuries in a large Finnish cohort. The data are interesting and new and the follow-up design permits to better evaluate the factors studied.

Minor essential revisions

1. Table 1: please report in the table the meaning of HR and N of cases (of injuries I think) p-value of HR in age is 0.639 but looking to 95%CI it seems wrong: please verify

   Our response 1: We have now spelled out the acronym HR and specified that the number of cases refers to the number of injury events in Table 1. In addition, based on the reviewer’s comment, the values in Table 1 were checked. HR values for age (1.03) and gender (1.68) and their CIs were corrected, but the p-value for age was correct (0.63).

2. Please report the relationship between this paper and J Occup Health. 2013 Oct 26. [Epub ahead of print] Occupational Burnout and Severe Injuries: An Eight-year Prospective Cohort Study among Finnish Forest Industry Workers. Ahola K, Salminen S, Toppinen-Tanner S, Koskinen A, Väänänen A. I think that results must be discussed also considering burnout (I understand that is the same cohort)

   Our response 2: “Using data from the Still Working cohort, Ahola and her co-workers [18] showed that occupational burnout increased the risk of injury. It is not surprising that our results are in line with that study, because burnout is a chronic work-related stress syndrome. However, we used a larger dataset and had a longer follow-up period, and we measured stress in general rather than just work-related stress. Taken together, it seems that both severe work-related stress and general non-specific stress can lead to an increased risk of severe injuries that require hospital treatment.” (page 11, lines 254-259)