Author’s response to reviews

Title: Injury coding in a national trauma registry: A one-year validation audit in a Level 1 trauma centre

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Dear Editor,

Thank you for your e-mail of July 30. We appreciate the comprehensive review, and hereby submit a revised version of the manuscript.

We have taken all comments and recommendations from the reviewers into consideration, and performed supplementary analysis and improvements of the manuscript accordingly. All changes are indicated by using the track changes functionality in Word except for changes in the tables which are indicated by using highlighting.

Point by point, we have addressed the comments and recommendations as follows:
Reviewer 1

1. The review of the original data in the trauma registry was undertaken during a one-year period, from March 2016. This has been clarified in the section Reference standard in the Methods chapter.

2. The reviewer asks about our justification for the sample size. This study was undertaken to audit the quality of our data entry into the Norwegian national trauma registry during its first year. Accordingly, a power analysis with sample size analysis was not done. This is now addressed in the Limitations and strengths section of the Discussion chapter.

3. The reviewer addresses our reassessment of diagnostic imaging. The same question is raised more specifically by Reviewer 3’s comment no. 4, ref. our comment to this. Further, this reviewer asks about the concordance between the initial and reassessed radiology interpretations. This information is already included in Table 3 under the subheading Related to the radiology report.

4. The reviewer refers to our suggestion in the Discussion chapter that “routine audit by trauma responsible clinicians seems necessary to achieve satisfying coding quality”, and encourages us to clarify whether we suggest limited sampling. We do not. This has been clarified in the section AIS coding quality in the Discussion chapter.

5. The reviewer encourage us to suggest other pragmatic solutions for improving data quality. We have included a short description of measures undertaken in our hospital in the same section (question 4).

6. The reviewer hint that more examples of differences in coding than those already mentioned in the forth paragraph of the section AIS coding quality in the Discussion chapter may help illustrate the significance of the findings. We have not given priority to this, as the reviewer did not consider it essential.

Reviewer 2

1. The same concern is raised more specifically by Reviewer 3’s comment no. 19 and 20, ref. our comment to this.

2. The reviewer asks whether patient characteristics predicted the amount of discordant coding. We did not register other patient characteristics than age and sex, in addition to the AIS codes. In univariate logistic regression analysis, age and sex did not influence the coding. One could hypothesize that increasing injury severity and/or complexity is associated with a higher proportion of discordant coding. This is an interesting topic for future studies.

3. The reviewer asks whether any injuries found on the review were not coded originally. This appears from Table 3, in which the 64 codes overlooked by the coder and 12 not described in the radiology report, were not coded originally.

4. Ref. answer to Reviewer 1, question 1.

5. The reviewer asks whether medians for ISS and NISS are sensitive to changes in a few AIS severity values for individual patients. They were not. This appears from the section Agreement between ISS/NISS, where we in paragraph two clarify that correction of 58 discordant injury
grades among 40 patients did not influence the medians. Further, sensitivity analyses in which we changed severity scores from 1 to 6 in random individuals, did not influence the medians.

6. The reviewer has an impression that we changed the values of 38 patients in the reference standard. This is a misunderstanding. We have rephrased the sentences at the end of paragraph 2 in the section Agreement between ISS/NISS of the Results chapter to clarify this.

7. The reviewer asks why we aggregated severity values in three categories. We agree this does not add value, and have omitted it.

8. The reviewer asks whether the proportion of discordant codes increased as a function of total number of codes per patient. We have analyzed this with a scatterplot and linear regression, and it did not. We consider this analysis challenging, since the number of possible concordant/discordant combinations increase with the number of codes per patient. Accordingly, we recommend this analysis is not prioritized for presentation.

9. This question is about the possible bias introduced by the expert coders involvement in the original data entry into the registry. First, AB was not involved in the original coding. This appears from the final paragraph in the section Injury coding in the Methods chapter. We have further clarified by adding the initials of the one expert coder (IL) who participated in this paragraph. IL participated both in the original coding and in the consensus part of the recoding. We have added information in the Limitations and strengths section of the Discussion chapter to clarify this (ref. question 10 below).

10. The reviewer suggests a sensitivity analysis to explore the possible bias caused by expert coder IL’s role in the review (ref. question 9 above). This has been done, and we found no tendency towards such bias. We have elaborated on the expert coders roles, and explained the sensitivity analysis in in the Limitations and strengths section of the Discussion chapter to clarify.

11. As a minor issue, the reviewer suggests we provide examples of low inter-rater variability between registrars coding the same patients in the Background chapter. To clarify, we have added “between coders for actual AIS codes” in the second sentence in the second paragraph of the Background chapter.

12. We have omitted the abbreviation for diffuse axonal injury.

Reviewer 3

1. We agree that the term “registrar” used by us synonymously with “coder” can be misinterpreted. We have consistently changed it to “trauma registry coder” (short; “coder”), and provided information about their employment and role in the sections Study type, population and region and Injury coding in the Methods chapter.

2. The reviewer asks when the coding was done, and whether it was done retrospectively. Patients were identified prospectively, but the coding was done after discharge or dead, in accordance with the AIS convention. This too has been clarified in the second paragraph in the section Injury coding in the Methods chapter.
3. We confirm that AB re-coded later, and that the consensus process, in which IL participated, occurred later, ref. the answer to Reviewer 1, question 1.

4. The reviewer comment that coding based on re-assessment of diagnostic images (and not only the written report), is not consistent with the AIS convention. We agree. However, one of the aims of the present study was to identify all injuries in the studied population, and not specifically to study adherence to the convention. We have clarified this in paragraph 2 under the section Reference standard in the Methods chapter.

5. Ref. Reviewer 1, question 2.

6. We confirm that our term “lacking code” refers to a code allocated by the reference standard, but not registered by the coder in the regular data entry into the register. We agree that “missing” is a better term, and have consistently changed the phrasing throughout the manuscript.

7. The reviewer asks what is the rationale for categorizing the ISS to apply kappa statistics for inter rater agreement, when a Bland Altman analysis has been done. We agree this is redundant, and that Bland Altman analysis is the appropriate method, and have omitted the kappa statistics in the last paragraph of the Results chapter. In consequence, we have omitted the description of the kappa statistics also in the Abstract and the Statistics section of the Methods chapter. The two references to this method have been omitted in References.

8. We agree that use of kappa statistics is incorrect also for assessment of inter rater agreement analysis of the number of AIS codes registered per patient, and have omitted the second sentence in the first paragraph in the Quality of registered AIS codes section in the Results chapter. In the Abstract, the sentence referring to results from the kappa statistics has been replaced with a sentence describing the actual numbers. We have considered applying Bland Altman analysis also to this comparison. This is, however, not appropriate because this method does not manage the combination of missing and discordant observations. Other methods, such as intra class correlation analysis could be used, but we consider the descriptive statistics provided sufficient.

9. The first sentence in the Results chapter has been revised to clarify how many patients died.

10. The reviewer asks why age is presented as median (IQR) and then again as a categorical variable with three categories. We agree the categorization is redundant. However, we find it important do display the distribution of children and adults, and have revised Table 1 to include only two age categories (0-16 and > 16 years).

11. We agree the word “accident” is unfavorable, and have rephrased to “incident”, as recommended, in Table 1.

12. The reviewer objects to our crude categorization of injuries in Table 1. We have refined the categorization by replacing the previous crude category with two new (“hit by blunt object” and “explosion/fire”) categories.

13. The reviewer comments that our phrasing of the new coding in the reference standard as “correct” and “accurate” as compared to the original data entry into the registry is an
exaggeration. Accordingly, the language has been softened throughout. We have changed “correct” to “concordant” and “incorrect” to “discordant”, and omitted unwarranted use of the words “accuracy” and “true”. The last sentence in the section Missing AIS codes in the Results chapter has been revised to clarify that that the original coders complied with the AIS manual when coding from the radiology report only.

14. In the last two sentences in the section Quality of registered AIS codes in the Results chapter, we have clarified that the proportion referred to is the proportion of the patients.

15. The reviewer asks about the meaning of the word “complementary” (radiology exams). We agree this term is misleading, as results from all examinations during the hospital stay is included in the coding. The coders had access to all radiology reports. We have omitted the word “complementary” in the Missing AIS codes section in the Results chapter.

16. Ref. comment no. 13 above.

17. The reviewer comments that ISS and NISS have a valid range of 1-75, and asks why the floor of our range is zero. In the original publication from 1974, in which Baker et al introduced the ISS (ref. no. 7 in our article), a score of 0 is included as a classification for uninjured patients. The subsequent literature is inconsistent with regard to whether the range of the scale is 0-75 or 1-75. The aim of the present study was to validate the injury codes for all patients registered in the Norwegian Trauma Registry after trauma team activation. This population includes, by definition, a smaller proportion of patients who are not injured. For this purpose, we consider it appropriate to use the full range of the scale. We have added “for the total population” in the last sentence in the Results section of the Abstract and in the first sentence in the section Agreement between ISS/NISS in the Results chapter. We recognize, however, that this approach could bias measures of central tendency for ISS and NISS among the injured patients. For completeness, we have added two sentences describing median (range, IQR) after exclusion of the uninjured patients (ISS/NISS score 0) in the section Agreement between ISS/NISS in the Results chapter.

18. We have omitted the use of kappa statistics, ref. comment no. 7 above.

19. We commend the reviewer for contrasting our focus on discordant coding with the fact that our data show complete agreement between the original data entry in the registry, and the reference standard, in many patients. We have revised the Title, the first and third paragraphs in the Discussion chapter and the Conclusion in accordance with this.

20. The reviewer notes lack of power and concerns about generalizability as limitations. We agree, and have revised the Limitations and strengths section of the Discussion chapter accordingly.

21. We have done the two minor spelling corrections suggested by the reviewer in paragraphs one and two in the Background chapter. With regard to the term “audit registrar”, ref. our comment to this reviewer’s question 1.
Best regards

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