Author’s response to reviews

Title: Injury death certificates without specification of the circumstances leading to the fatal injury - the Norwegian Cause of Death Registry 2005-2014

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Version: 1 Date: 22 Mar 2018

Author’s response to reviews:

To the Editor

Dear Sir/Madam

We are grateful for the effort put down by the reviewers and the suggestions for improving the manuscript.

In the following, we will answer their questions and comments point-by-point. In the revised manuscript, the changes are highlighted for easier identification.

Reviewer #1

1. X59 in the ICD

The authors do not fully describe the meaning and place of X59 in ICD-10 and do not explain the change to the category made in the 2006 edition of ICD-10, which is very relevant to their project. It is noteworthy that one of the new sub-categories introduced in 2006, X59.0, is very similar to the ICD9 category E887, "Fracture, cause unspecified", which was placed in the accidental falls part of the external causes chapter. Closer attention to these details is warranted because it makes clear that, by design, X59 is the code that one should expect to be used if a death is due to an injury, but without specification of the external cause. Moreover, the framing
of E887 and its successor X59.0 reflect the long-standing recognition that cases like the ones that account for the bulk of X59 codes in Norway occur and need to be coded. These categories are the means provided in the ICD to allow this poorly-specified type of case to be recorded statistically.

A related point that could usefully be made more clearly is that the fall/fracture in old age type of X59 case, so dominant in Norway, is far from being the only type of case that can properly be coded to X59. Indeed any death due to an external cause (which is taken to include all deaths due to injury) should be coded to X59 if this is all that is known about it. The circumstances that can result in this particular degree of knowledge about the cause of a death (i.e. it is due to injury, but that's all we know) may vary widely. Hence, while the finding that X59 cases in Norway were nearly all fall/fracture cases is not surprising, it is possible that X59-coded records elsewhere could predominantly refer to other types.

RESPONSE: We have expanded on the use of X59, in general and in Norway, in the introduction (lines 62-64) and in the discussion (lines 248-266).

2. Variation in use of X59

The authors report that X59-coded cases in Norway are numerous and nearly all are deaths in old age following an injurious fall. They reached that conclusion by modelling Norwegian unit-record deaths data and by consulting with the doctors who certified the X59 cases. The authors cite work done in several other countries, which used various other methods but came to the same conclusion: in those countries, too, the bulk of deaths with UCOD X59 followed fractures in old age and were largely attributed to falls.

They mention a couple of studies that found variation between countries in use of X59 (8,9). However, they do not consider directly the extent to which the performance of their modelling method might be affected by such variation. The authors could, with some justification, argue that this doesn't matter, since their study focuses on only one country. I would counter by saying that much of the value of this paper, and the main reason to publish it in an international journal, is that it has implications for work in other countries and for international work such as GBD. Hence, I think that the authors should give more attention to whether the method is likely to be robust in the face of patterns of use of X59 that differ from that in Norway.

What are the patterns, and how could the authors find out about them? The papers cited as references 8 and 9 go some way, but the more direct route is to examine national cause of death data freely available from the WHO Mortality Database. I looked at the most recent annual set for all countries for which data were available at ICD-10 3-character (e.g. X59) or 4-character (e.g. X59.0) level. I downloaded data for 107 territories and assessed the proportion of all external causes deaths that had been coded to X59. I did that for deaths at all ages, and separately
for deaths at 0-74y and 75+y. Given the circumstances, this had to be a quick look, not a thorough analysis.

A couple of hours’ work revealed a lot that contextualises the findings of the manuscript. For example, considering all-ages external causes deaths, Norway ranked high (5th; 25.9%) in prevalence of X59. In 10/107 territories prevalence was >20% and in 31/107 it was less than 2%. Prevalence varied widely in countries near Norway: Sweden 18.7%, Denmark 12.0% and Finland 1.4%. Considering the 90/107 territories for which data were available for both of the age bands considered, the prevalence of X59 was higher (often much higher) in the older group in most places, but the opposite was so in a few countries. Norway ranked 11th, one of 13/90 places in which more than half of all external causes deaths at 75+ were coded to X59. At the other extreme, in 20/90 place the proportion was below 2%, including Finland, New Zealand and Estonia. While the prevalence of X59 among external deaths at ages younger than 75 was low in most places (below 2% for 32/90) it was 10% or higher in 13/90.

Such wide variation in the use of X59 suggests differences in data sources, quality and processing. That might well result in differences in the proportion of included cases that are of the fall/fracture type. More could be learned from this source. I didn't look at the use of other residuals, both within the external causes chapter, and elsewhere in the ICD. Nor did I check systematically for use of the post-2006 ICD-10 version of X59, though I did notice that the Norwegian data for the year that I examined (2014) appeared to be coded in that way.

RESPONSE: We have performed some analyses on the variation in the use of the codes X59 and Y34 as underlying cause of death for the years 2005-2014. This is presented at the end of the results section (lines 228-236). We agree that an exploration of the pattern of use of X59 and other non-informative codes relating to external causes of death would be very interesting, but we also think that an in-depth investigation is somewhat outside the scope of this study.

3. Generalizability

Flowing from the previous points is the question of generalizability, about which I hope that the authors will say more. I see two aspects to this.

First, are the specific findings of this study safely generalizable to other places? These authors provide compelling evidence that nearly all X59 deaths in Norway are fall/fracture cases. Is it safe to conclude that the same is true of X59 coded cases elsewhere? My notes on the two previous points are my argument against that being a safe generalisation. I think that the authors should state their view on this matter in the discussion.

Second is the _method_ presented here safely generalizable? By that I mean: if it is practicable to apply the same method, or a very similar one, in any other place - including places in which
available data indicate very different use of X59 to the use in Norway - is there reason to think that it will perform reliably?

I don't see a strong reason why it should not perform well in a fairly wide range of circumstances, but I would not be confident to say that it does until it has been used in at least a few other places, including some where use of X59 appears to differ from use in Norway. What do the authors say?

RESPONSE: We agree that a discussion regarding the generalizability of the results is warranted, and we have expanded on this in the discussion (lines 339-349).

Specific comments

Table 1, External causes: Range X40-X49 is incorrectly included in group 4 (and correctly in 3).

Table 1, Nature of injury: category number 2 is repeated.

Categories T71 and T75.1 are incorrectly included in group 8 (and correctly in 7)

RESPONSE: The table is corrected.

Lines 108-10: Consider expanding on the model-building logic. E.g. on what grounds were all of the independent variables included in the final model? Is the final model well-specified?

RESPONSE: We have expanded on the model building in the methods section (lines 119-122).

Line 117: The choice of this particular set of target categories is not explained.

RESPONSE: We have explained the choice of target groups in the methods section (lines 133-138).

Line 126-7: Are overall accuracy and kappa suitable measures here? (I don't know, and no source is given on this point).

RESPONSE: Overall accuracy and kappa statistics are commonly used measures for the performance of classification models. We have included a reference in the text (lines 146-147 and reference 18).
Line 142: Statistical analysis: There is no mention near here of the binary logistic regression.

RESPONSE: We have expanded on this in the methods section (lines 164-166).

Reviewer #2

1- In the injury chapter of ICD10 there are 2 important ill-defined code, one is X59: "Exposure to unspecified factor" and other one is Y34: "Unspecified event, undetermined intent". Conceptually these are 2 separate codes one of them for assignment to unintentional unspecified event and one of them for undetermined intent for unspecified event. Assignment death to the X59 or Y34 is different by the countries. Then is it possible in some countries some part of X59 included in the Y34 or vice versa. It was much better if author's included Y34 for this analysis, unless they have a very good reason for do not include this code. As we see in the result of commination with the doctors they got numbers of suicide that cannot be under X59.

RESPONSE: The code Y34 is very seldom used in Norway, only in 2 cases out of nearly 25,000 deaths from external causes during this ten-year period. In Norway, the range Y10-Y34 is only used where it is explicitly stated on the death certificate that the intent is unknown. Where the information on the circumstances is simply missing, X59 is used. It is therefore not implausible that some cases could be redistributed to suicides. We recognize that in some countries Y34 fulfils much of the same function as X59 in Norway (and a range of other countries). We have in the methods section explained why we have not included Y34 in our analyses (lines 102-104).

2- Age pattern of X59 is very important and correction of miss assignment have to be by age. In many countries some death in young age assigned to X59 and Y34. Then correction of miss assignment have to explain by age. Certainly possibility of reassignment of X59 by fall cannot be correct in under50 and 50-59. In other word reassignment of X59 is very different between age under60 with reassignment of X59 by age over 80. If we consider different age specific mortality rate due to X59 and Y34 in the different countries we can understand applicability of this aggregated age group for different countries is not enough and useful. Then highly recommend to present this result by age.

RESPONSE: We have made a new table (Table 6) where we present the redistribution results both according to age group and according to injury type.

3- Authors have used individual record of multiple causes of death in Norway for this analysis. Accessibility to multiple causes of death in many countries is restricted. Just there are 2 or
three countries in the world that individual record with multiple causes of death is publicly available. Then results of this study can be very effective for other country with no accessibility to individual record of multiple causes of death. Based on this reasons any detail of result by age and wider grouping of S and T can be very useful.

RESPONSE: See response to item #2.

4- In the paper is not clear; what they did with the severity of nature of injuries in the death chain. Usually in the other causes (death chain) there are more than one N code. For example if somebody had Head/neck injury with hip injury they included which one in analysis and why?

RESPONSE: If more than one injury is mentioned on the death certificate, all the injuries are coded in the Cause of Death Registry, but the presumably most serious code is selected as the main injury according to the rules in ICD-10 vol 2, section 7.7. In the methods section, we have made it clear that it is the main injury that is used in the analyses (lines 100-102).

5- Based on table 3, 21% of injured people had non Hip/thigh injury. What was the reassignment for these people? For example we have 6 person with Suffocation/drowning, but we do not see related external cause for this sever N code.

RESPONSE: See response to item #2.

6- Grouping of S and T codes is crude, I think reorganized this grouping based on pathology of injury will help to get correct result. Here example of ICD code under Hip/thigh shows this grouping is just based on Anatomy not based on trauma pathology

S70  Superficial injury of hip and thigh
S71  Open wound of hip and thigh
S72  Fracture of femur
S73  Dislocation and sprain of joint and ligaments of hip
S74  Injury of nerves at hip and thigh level
S75  Injury of blood vessels at hip and thigh level
S76  Injury of muscle, fascia and tendon at hip and thigh level
S77  Crushing injury of hip and thigh

S78  Traumatic amputation of hip and thigh

S79  Other and unspecified injuries of hip and thigh

RESPONSE: In our material, $\frac{6415}{6495} = 98.7\%$ of the cases with injuries in the hip/thigh region had a fracture of the femur (S72.X). We therefore do not think that a further subdivision of the material would be useful.