Author's response to reviews

Title: Current ICD10 codes are insufficient to clearly distinguish acute myocardial infarction type: a descriptive study

Authors:

Roxana Alexandrescu (r.alexandrescu@imperial.ac.uk)
Alex Bottle (robert.bottle@imperial.ac.uk)
Brian Jarman (b.jarman@imperial.ac.uk)
Paul Aylin (p.aylin@imperial.ac.uk)

Version: 2 Date: 26 July 2013

Author's response to reviews: see over
Dear Sir/Madam,

Thank you for your answer and for the reviewer suggestions.

Please accept our responses to reviewer suggestions including the page numbers on which the revisions appear. The revised manuscript has been read and approved by all authors.

Thank you for your time and consideration. I look forward to hearing from you.

Sincerely,
Roxana Alexandrescu

Dr. Foster Unit at Imperial College,
Department of Primary Care and Public Health,
Imperial College London, London W6 8RP, UK
Tel: +44 (0)20 7332 8843
Fax: +44 (0)20 7332 8888
Email: r.alexandrescu@imperial.ac.uk
Reviewer's report

Title: Current ICD10 codes are insufficient to clearly distinguish acute myocardial infarction type: a descriptive study

Version: 1 Date: 29 March 2013

Reviewer: Alessandro Barchielli

Reviewer's report:

The authors carried out a retrospective analysis of hospital records in England to determine the feasibility of distinguishing AMI type on the basis of ICD10 codes.

The topic of this article is of some interest to your Journal, because:
- Hospital discharge data are extensively used in health research.
- Given the clinical differences between ST segment elevation myocardial infarction (STEMI) and non-ST segment elevation myocardial infarction (NSTEMI) in terms of treatment and prognosis, it is important to distinguish between them and consequently it is also important to record them appropriately in medical records.
- ICD-10 codes I21* (AMI) and I22* (subsequent AMI) make no explicit mention of ST elevation or non-elevation. As specified in the paper the code I21.4 is referred to Acute subendocardial myocardial infarction (a definition partially overlapping with NSTEMI) whereas I22* codes do not have any mention of subendocardial MI or NSTEMI.

In my opinion some aspects could improve the paper.

Major suggestions.

Authors reported a high prevalence of I21.9 (43%) and I22.9 (61.4%), non-specific codes used only when no further information about the condition is known. These two subcategories showed also low values of angioplasty performed the same/next day. The conclusion is to consider them as NSTEMI. In my opinion this aspect need to be better analysed, investigating age of patients, hospital and ward (cardiology/medicine) of treatment, socio-economic aspects etc.. In other words, it should be investigated if the use of unspecified codes and the low angioplasty rates are markers of poor diagnosis and treatments.

The Table below presents the descriptive data for the I21.9, I22.9 and the rest of the AMI codes.

<table>
<thead>
<tr>
<th>Table Socio-demographic characteristics of the study population</th>
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<tbody>
<tr>
<td><strong>Variable</strong></td>
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<tr>
<td>Age, mean ±SD, year</td>
</tr>
<tr>
<td>Male gender, (%)</td>
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<td>Ethnic group, (%)</td>
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</table>
It can be seen that patients with non-specific codes tend to be older and have more comorbidity conditions. A number of studies have shown that NONSTEMI vs STEMI patients are older and have higher comorbidity scores including Abbott JD et al (reference 3); a finding that supports further our assumption related to the I21.9 and I22.9 codes. However, it can be observed a fewer proportion of I21.9 and I22.9 patients have been treated in a cardiology ward compared with the rest of the AMI patients that might suggest poor diagnosis or explain the lower rates of angioplasty performed within these two categories.

In the comparison between MINAP records (England and Wales) and HES records (England), rates could be added to number of cases, to exclude differences in the data coverage and selection in the hospital inclusions.

We agree rates would allow a better comparison. While for the HES data computation of these rates is straightforward (denominator available), the MINAP data covers England and Wales, Welsh data being incomplete (some hospitals did not enter data). Add to the fact data are available in an aggregate format (England and Wales), for this reason there is no alternative of defining an accurate denominator for MINAP.

The Discussion and Conclusions sections could be updated on the basis of results on the previous points.

We have made some comments within the discussion part at page 9 first paragraph.

Minor suggestions. Figure 3. The temporal pattern of STEMI cases is different between MINAP data (flat) and HES (decreasing)

This has been corrected at page 7 middle paragraph.

Reviewer’s report

Title: Current ICD10 codes are insufficient to clearly distinguish acute myocardial
infarction type: a descriptive study

Version: 1 Date: 27 March 2013

Reviewer: Amy Metcalfe

Reviewer's report:

Major compulsory revisions

• While the objective of the manuscript is important, the data used for this study does not seem sufficient to answer the stated research objective. Assessing trends in angioplasty and in 4-digit ICD-10 codes is insufficient to determine trends in STEMI vs. N-STEMI, as even though most N-STEMI patients will not receive PCI, higher risk patients might; and not all STEMI patients receive angioplasty.

We agree the data does not seem sufficient, but there is no other data available (based on ICD10) to answer this question. Moreover, the hospital data has already been employed to classify STEMI-NSTEMI (Pereira et al; Hakkinen et al.)- the authors making use of different categorisations, and we hope with this article to underline the issues associate with any empirical classification.

Indeed, assessing trends in angioplasty and in 4-digit ICD-10 codes is insufficient to determine trends in STEMI vs. N-STEMI, but was sufficient to suggest the issues associate with any empirical classification as well as minimum criteria /best sets of codes to select STEMI cases.

• There is a disconnect between the results and the conclusion. While it is clear that it is difficult to differentiate STEMI and N-STEMI AMI based on ICD-10 codes alone, the rationale for selecting specific codes as STEMI is not clearly supported by the data (and contradicts another statement used by the authors in the discussion (p6, last line of second paragraph in discussion section).

We have amended the entire discussion part providing more information related to the rationale for selecting specific codes as STEMI.

To sum up, one main reason relates to the expected increase in NSTEMI cases and the second reason concerns angioplasty use in STEMI cases. In this context, we refer to a previously published classification.

With regard to page 6, last line of second paragraph in discussion section, we don’t see any contradiction as these are codes further categorised in our article as STEMI.

‘The results show several AMI subcategories appear to have undergone a significant increase in the number of angioplasty procedures same day/same or next day of admission, either starting with the second part of the study period (I210 to I213, I220 and I221) or only over the last two study years (I228).’ The remaining part of the paragraph has also been clarified at page 8.

Minor essential revisions

Overall

• Throughout the manuscript, the decimal place should be included as part of the ICD codes (i.e. I21.0 not I210)

We have done this.

Background

• The background section should be expanded, particularly in relation to:
  o The definition of STEMI vs. N-STEMI. More information is needed on what clinical parameters distinguish these subtypes of AMI and the treatment differences (particularly with regards to angioplasty).
The incidence of STEMI and N-STEMI AMI subtypes

What proportion of STEMI and N-STEMI patients typically receive angioplasty

We have extended the background section to reflect the previous suggestions, page 3 and page 4.

• I would suggest replacing the statement “We will discuss how this [ICD-10-CM] fits with our findings within the conclusions” be rephrased as “However, ICD-10-CM is not currently in use in all countries and retrospective studies that include data prior to 2013 will still need to differentiate STEMI and N-STEMI AMI subtypes using the original ICD-10 coding framework.”

Methods

• A description of the angioplasty procedure codes should be included in Table 1

The angioplasty OPCS codes have been included in Table 1 which is part of the method section, page 5.

Discussion

• Results comparing the HES and MINAP data should be moved to the results section

The results section includes now HES - MINAP comparison, page 7.

• The discussion should be expanded to include comments on misclassification bias and how the lack of a gold standard with individual level data prevented a true validation of ICD-10 codes to differentiate STEMI vs N-STEMI

This has been done at page 10.

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Reviewer's report

Title: Current ICD10 codes are insufficient to clearly distinguish acute myocardial infarction type: a descriptive study

Version: 1 Date: 12 April 2013

Reviewer: Wilm Quentin

Reviewer’s report:

This is a well-written study with a clear objective and result, which may be of interest to researchers specializing in routine inpatient data analyses of AMI patients. Currently, different ICD-10 codes have been used for the identification of STEMI patients across studies. For researchers working in this area, it is important to know which ICD-10 codes can be used as a proxy. This study tells them that they should consider one additional ICD-10 code as an indicator of ST-elevated myocardial infarction: I213 – which might be relevant to this specialist group of readers.

However, I have a number of comments that may help to improve the paper:

(1) Abstract: in the abstract it is not clear what the development in the use of ICD-10 codes has to do with the ability of the codes to identify STEMI. Later in the paper it becomes clear that you use the performance of an angioplasty
procedure as a proxy for STEMI – but in the abstract this is not clear.  
*This has been corrected, page 2.*

(2) Background: I think it would be useful to insert Table 1 as material in the background section – otherwise it is difficult to know what the codes are standing for.  
*We inserted (part of the) Table 1 in the methods (the ICD 10 codes), as it includes now also information on angioplasty codes that we refer in the method section, page 5.*

(3) Background: concerning the use of ICD-10 codes in prior research: you could also refer to other studies, e.g. Häkkinen et al.: PATIENT CLASSIFICATION AND HOSPITAL COSTS OF CARE FOR ACUTE MYOCARDIAL INFARCTION IN NINE EUROPEAN COUNTRIES. They use a different definition for STEMI — which would support your argument that it is important to have a more reliable definition.  
*Thank you for the reference, this has been included in the manuscript (ref11). Also we have commented on the (appropriate) inclusion of the code I21.3 in STEMI category, page 8.*

(3) Methods: the study is based on the (reasonable) hypothesis that angioplasty procedures are performed primarily on STEMI patients. Basically it is assumed that those ICD-10 codes, where a large number of patients are treated with angioplasty are STEMI patients. – This hypothesis is explicitly mentioned in the discussion section. However, it would be good to make this clear already in the methods section. I was wondering for quite a while how looking at the development in the number of different AMI patients and angioplasties would contribute to answering your research question.  
*This has been corrected at page 5.*

(4) Figure 2a and 2b are very similar: is it important to look at the two groups separately? (not well explained in the paper)  
*We look at these two groups separately as they both represent angioplasty procedures carried out in emergency scenarios. The ‘same or next day’ data represents a sensitivity analysis for the ‘same day’ data on angioplasty procedures. We explain this in the manuscript now at page 5.*

(5) Results: I would frame the results in the opposite way: last paragraph p. 5: mention the codes, where there has been a significant increase # these are the ones that you consider to be STEMI.  
*We decided not to amend the results part as it relates to trends first and then angioplasty use as a more in-depth analysis.*

(6) Discussion: maybe you should mention that according to European guidelines for the treatment of non-ST elevated MI, the use of PCI is also indicated. So, if there is an increase, for example in ICD-219 this does not necessarily mean the patients treated with PCI are STEMI – and I228 could also be non-STEMIs.  
*We mention now from the beginning, in the background section the use on angioplasty for NSTEMI, page 3 and page 4.*

(7) In fact, I am not as convinced that I228 is a STEMI code as I am about the other codes. Also, it’s surprising that I21.3 was not included previously as a STEMI code as it refers to “transmural” myocardial infarction, which is generally considered to be the pathological correlate to ST-elevation.
I22.8 seems to be a STEMI code based on the figure 2 – slight increase in angioplasty use and also on the figure 1 – decreasing trend starting with 2005. The widespread use of troponin as a (more sensitive) marker for diagnosing AMI since 2005 determined an increase of NSTEMI cases which was not the case with I22.8.

We agree it is surprising I21.3 was not previously considered STEMI by Pereira et al (it is STEMI in the article by Hakkinen et al)

(8) you could mention that ICDS-10-CM is the coding system used/developed in the United States, so the existence of these codes does not mean that in the UK, they will be implemented some time soon.

This has been done, page 9.

Minor comments:

(1) Abstract: Please avoid using ICD-10 codes without explanation of what they stand for in the abstract. This makes it difficult to read the abstract.

We have corrected this.

(2) Abstract, results section, second line, the first ICD-10 code in the bracket should probably be: I210 (instead of I220)

Yes, thank you for the correction.

(3) Background: concerning the use of ICD-9 in Europe: also Portugal and Spain still use ICD-9-CM codes. (See Kobel et al. 2011 – DRG systems and similar patient classification systems in Europe).

We have amended the background, page 4.

(4) I do not understand the last sentence on page 5, starting from: in particular stating with the second part of the study…

It has been corrected to ‘starting with the second part of the study’, page 7.