Author's response to reviews

Title: Total hospital stay for hip fracture: measuring the variations due to pre-fracture residence, rehabilitation, complications and comorbidities.

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Author's response to reviews:

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The Editors
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We thank the journal for the opportunity to further review this paper. We particularly thank the reviewers for their thorough reading of the manuscript and for their helpful comments. Our responses to all comments are detailed below. We believe that the revision has given the paper a sharper focus and has helped to clarify the reporting of a complex situation.

The formatting of the Abstract, text, references and tables has been adjusted to meet our understanding of the Journal's guidelines.

We are willing to respond to any further comments or questions to ensure that this article conforms with the requirements for publication.

Faithfully
Anthony W Ireland
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Response to reviewers’ comments
Reviewer 1

Major compulsory revisions

(1) This study has three concomitant objectives which may impair consistency of the employed methodology for responding to every one of these. In addition this may impair message clarity for the reader. To my opinion, major goal was to explore the determinants of length of stay associated with hip fracture during all the care process, from acute phase to rehabilitation.
Response

We agree that having three objectives may have impaired the clarity of this paper for readers. We have now refocused the paper with two aims – these correspond to the first two aims of the original submission:

1. To summarise how the length of stay is proportioned into acute and rehabilitation treatment for hip fracture, as well as managing other non-hip fracture related problems.

2. To identify the patient-level determinants (patient characteristics and clinical services) of length of stay. This second aim corresponds to the main aim as stated by the reviewer.

The Title, Abstract and the final paragraph of the Background section (Line 86-89) have been revised accordingly.

Revisions to submitted document

Title:

Total hospital stay for hip fracture: measuring the component episodes and variations due to patient characteristics and clinical services.

Abstract

Line 6-8:

“This study identifies the frequency and mean duration of the component episodes within total hospital stay, and measures the impacts of patient-level and clinical service variables upon both acute phase and total LOS.”

Background

Line 86-89:

“This study has two aims. First, to identify the proportion of total hospital stay due to acute phase treatment, rehabilitation and the management of contingent problems. Second, to identify and quantify the patient-related and clinical service factors associated with acute phase and total LOS. For both aims, pre-fracture residential status is a major consideration.”

(2) The employed statistics are rudimentary. Especially, multivariate modelling should consider the clustered nature of the data in order to consider the variability of length of stay within and between individual hospitals. For example, using hierarchical model would allow to identify hospital characteristics associated with lengthen stay duration as fixed effects. Presented investigation is restricted to patient characteristics, while one may expect that hospital organization is strong predictor of length of stay.

Response:
The reviewer requests the inclusion of individual hospitals, presumably as a random effect in the regression models. We fully appreciate that many aspects of hip fracture management differ between hospitals and/or hospital groups and agree that hospital characteristics may explain some of the variability in LOS within and between hospitals or hospital groupings for studies such as ours.

This is evident in national audits such as the National HF Database (United Kingdom) and other studies from Scandinavia, North America, and New Zealand. However, it is uncommon for hip fracture studies using large datasets to identify hospital characteristics as a variable with or without clustering. Our paper references five such examples – references 3, 9, 10, 22, 24.

In our study there were 476 individual hospitals involved in 5,373 episodes of care. Patients were often treated in multiple hospitals: 43 per cent were managed in two hospitals and 9 per cent in three or more hospitals. One patient had total hospital stay of 132 days comprised of eight connected episodes in five different hospitals. Even with regard to “acute” or “rehabilitation” components, care was often provided by more than one hospital. We also have no additional information on these hospitals, such as size, location or level of service provision, etc. Thus inclusion of “hospital” as a random effect or hospital level variables for analysing LOS is not straightforward and beyond the scope of this paper. Our paper has therefore focused on patient-level factors, and our findings are important in and of themselves. We have revised our title and aim accordingly to clarify the focus of this paper.

Nevertheless, we recognise that not being able to include hospital variables in our analyses is a limitation and have added the following statement to the Discussion:

Revision to submitted document:

Line 347-352:

“It is recognised that the characteristics of individual hospitals or groupings of hospitals may contribute to differences in LOS. In this study more than half of all patients were treated in more than one hospital, with nine per cent treated in three or more hospitals. Identifying hospital-level determinants for LOS was therefore not attempted.”

(3) Quality of information extracted from hospital administrative databases is debatable. Especially, patient comorbidities and minor complications are frequently underreported. Do you have any arguments regarding coding exhaustiveness and accuracy in Australian databases?

Response:

(a) It is now widely accepted that administrative databases, while containing some errors of coding can be valid sources of patient-level data for health service utilisation and outcomes [1]. They are less suitable for epidemiological studies. The standard of coding accuracy in Australian databases has been shown to at
least equal that of other countries [2]. The data collected and validated by the Department of Veterans’ Affairs included at least 16 diagnosis and procedure fields and conform to best-practice principles for minimising bias in administrative data [3]. Detection rates for significant co-morbid diagnoses are discussed in the text: they are at least equivalent to rates reported from the English NHS and other national datasets. The lesser detection rate of comorbidity and complications relative to that in studies derived from personal clinical records is fully acknowledged in the text. The linkage of episode data, as in this study, enhances the detection rates compared to those from reports based upon single episodes [4]. Any underreporting of co-morbidities and complications will only bias our results towards the null (our significant results are therefore conservative).

In addition, is “present on admission code” available in those data in order to distinguish between patient comorbidities at admission and complications that may have occurred during the index stay?

(b) The study databases did not include a field for ‘present on admission’. As noted in Methods, (line 122-128) the study identified chronic co-morbidity diagnosed from episodes which preceded the index hip fracture within the previous six months (and including the index episode). Complications were only recorded from those episodes which comprised the index hospitalisation (total LOS).

(4) There in an error in references indexation on line 64. Indeed, the reference «9» was not only interested in acute phase of hip fracture care but has also investigated the patient's subsequent rehabilitation.

Response:
We accept that the context for reference (9) could imply that only acute phase data were examined by Duclos et al. This was not the intention. The wording and the referencing have been revised accordingly to remove any ambiguity.

Line 71-73:
“This phase has a wide range of reported LOS from two days to more than two weeks [8,9]. In the few studies which report total LOS, mean values lie between 17 days and six weeks [3, 9,10,11]. “

5) The reading of tables 3 and 4 is not easy. Perhaps the authors could limit the amount of numbers in order to facilitate understanding their content and underline the key factors influencing the length of stay.

We agree the tables were complex. We have simplified the tables by removing the results for the “All Patients” group and several variables which, though significant, do not generate substantial change to LOS. We believe this has greatly improved the clarity of the tables.

Reviewer 2
Minor revisions.

1. Line 295, page 13. Should IAC be RAC? If not, the abbreviation IAC should be explained.

Response:
Corrected. “IAC” changed to “RAC” at line 295 (now line 303)

2. Table 2 page 20. Mean LOS for Community Patients for Rehabilitation shown as 25.2, but in the calculations in the footnote b, the value given is 25.1 as it is also in the text page 8, line 165.

Response:
Corrected. Value for community patients altered to “25.1” in calculation below Table 2 and in Results at line 181-183 (previously line 174). (Calculation for total LOS at Table 2 remains 35.4 days)

Line 181-183:

“The resulting per capita contribution to total LOS was (1050* 25.1/1844) =14.3 days for community patients and (122*21.3/708)=3.7 days for patients from RAC (data in Table 2).”

Discretionary Revisions

1. Page 7, line 125. Was “transfer to RAC” permanent placement or could it also have included patients who went to RAC for respite or transition care?

Response:
Among patients from the community, 393 were separated to RAC: only 14 of these were identified as respite or low level care. Transition care was not separately coded in the dataset although “respite” may have indicated this function for some patients. We elected not to separately analyse the few “respite “ patients. An explanatory sentence on this point is now included in Methods.

Line 133-135:

“Details of the level of care provided in RAC for individual patients were not consistently available and were not separately analysed.”

2. The statistical analysis section is brief and I would like to see more explanation about how baseline reference values are obtained.

Response:
We agree that “baseline reference group” is a confusing term. The intercept value in a regression model is the mean value when the value of all predictor variables is set at zero or at the value of the referent group in a class variable. The sentence in Methodology has been revised to read:
Revision to submitted document:
Line 148-151:

“For each variable in a final model, the average number of days greater or less than the baseline value (mean LOS when all predictor variables are zero or the referent group within a class variable) was calculated.”

3. Page 8, line 167. It is not obvious from Table 2 how the figures 14.4 vs 3.6 days were calculated.

Response: The data for the calculations are shown in Table 2. The text, now at line 181-183 has now been modified to include the formulae:

Revision to submitted document:
Line 181-183:

“..... contribution to total LOS was (1050* 25.1/1844) =14.3 days for community patients and (122*21.3/708)=3.7 days for patients from RAC (data in Table 2).”

4. It would help the reader, when reporting results to refer to the Table where they can be found. For example page 9, line 189 refers to information in Table 4, but Table 4 is not mentioned until line 203, page 10.

Response:
Noted and agreed in respect of both Tables 3 and 4.. Reference to Table 3 is now inserted at line 204 and Table 4 is referenced at lines 206, 214 and 220.

References
(2) Henderson T, Shepheard BS, Sandararajan V. Quality of diagnosis and procedure coding in ICD-10 administrative data. Medical Care 2006; 44:1011-1019
(3) Van Waldaren C, Austin P. Administrative database research has unique characteristics that can risk biased results. J Clin Epidemiol 2011; 65: 126-131