

Article details: 2013-0062	
Title	Site of Hospital Readmission and Mortality
Authors	John Staples, Deva Thiruchelvam, Donald A. Redelmeier
Reviewer 1	Christopher Fernandes
Institution	Hamilton Health Sciences/McMaster University, Emergency Medicine
General comments	<p>This paper addresses the hypothesis that alternate-hospital readmission is associated with increased mortality compared to original-hospital readmission. The authors generally address this hypothesis.</p> <p>Abstract: There are multiple potential causes for mortality associated with readmission, and would delete the last sentence from your interpretation.</p> <p>Methodology: eTable1 does not add much to the paper, and could be deleted.</p> <p>Was there a difference in patient addresses between original admission and readmission? Thus, could a patient present to a different hospital for readmission because they were now in a long-term care facility that was closer to the alternate hospital?</p> <p>eTables2-6 and 11/12 could be deleted and summarized in the text.</p> <p>eFigure 2 is summarized in the text and could be deleted.</p> <p>Limitations: Several limitations are not mentioned. Patients seen at alternate hospitals may have a higher mortality due to greater underlying severity of disease, but they may also truly reflect a situation where the alternate facility is unfamiliar with the intricacies of disease treated on the original admission, since the original records are less readily available. The effects of a confounding variable from transition to a long-term care facility rather than home, and then on to an alternate hospital are not addressed. One example would include patients diagnosed with malignant neoplasms on the original admission, transitioned to a facility other than home, then sent back to an alternate hospital closer to that facility.</p> <p>References: Not all references are useful or relevant e.g references 16 and 20.</p>
Reviewer 2	Alice Dragomir
Institution	McGill University, Surgery/Urology
General comments	<p>General comments:</p> <p>The manuscript "Site of Hospital Readmission and Mortality" is a study of a cohort of 198,149 patients having had a readmission to hospital through the emergency department between 1 Jan 1995 and 31 Dec 2010, with both primary and secondary admission occurred in Ontario's Greater Toronto and Hamilton Area hospitals. Several data sources were used: linked administrative databases, Ontario Health Insurance Plan database, Canadian Institutes for Health Information database, and other (official government records and 2006 Canadian census).</p> <p>The primary objective of this study was to perform a population-based retrospective cohort analysis using linked administrative databases to test whether alternate-hospital readmission were followed by a higher risk of death than original-hospital readmission. The topic is of contemporary interest and the cohort of 198,149 patients is a distinct strength of this investigation. In particular, having individual-level characteristics together with information on hospital-level and region characteristics is an important element of this study.</p> <p>The authors concluded that alternate-hospital readmission was associated with increased patient mortality.</p> <p>My specific comments about this manuscript include the following:</p> <p>Major concerns</p> <ol style="list-style-type: none"> 1. Methods section needs to begin with a description of data sources. In addition, Databases subsection lacks details on "linked administrative databases". Are these databases parts of the Ontario Health Insurance Plan or the Canadian Institutes for Health Information? 2. Methods section: Variables subsection needs reformulation to better reflect 3 aspects: 1) clinical outcomes definition; 2) main association factor (alternate-hospital readmission versus original-hospital readmission); and 3) Co-variables used for adjusted analyses. 3. Methods section: Statistical Analysis subsection needs to be restructured. There are broadly two type of analysis, the first at a patient-level, and the second at hospital-level. These need to be better distinguished. In addition, please specify for each adjusted analysis, what are the co-variables used (example: 1. The Cox model was adjusted for all covariables specified in co-variable subsection, or 2. The Cox model was adjusted for the following variables:....). Moreover, these need to be presented in tables or need to be mentioned in table footnote. 4. Please avoid to present results of univariate analyses as main findings. The unadjusted results are important to help interpreting the overall results. In contrast, the results obtained with adjusted models need to be presented and interpreted. Accordingly, the

	<p>patient subgroups subsection needs reformulation.</p> <p>5. Interpretation section. As per the comment above, the first paragraph of this section needs completely to be reformulated. In addition, I personally do not see how the unadjusted analyses in general can suggest an immediate effect, and particularly, of the impact of alternate-hospital readmission on the increase in mortality. Please provide clarification. Further, there is no evidence that the increase in mortality is substantial and sustained. The results of adjusted analyses with a hazard ratio for one-year mortality of 1.01, 95%CI: 0.99-1.02 looks contradictory to the interpretation. Please clarify.</p> <p>6. Table 3 present unadjusted analyses stratified by patient characteristics. Please specify what was the model used (in text and in table title). In addition, for each one of these variables it is not clear what the reference category was. Please provide clarification.</p> <p>Reviewed by: Alice Dragomir, MSc, PhD Assistant Professor, McGill University Scientist, The Research Institute of the McGill University Health Center</p> <p>Please note that I have no conflict of interest in reviewing this manuscript.</p>
Author response	<p>Editors' comments to Author:</p> <p>Methods:</p> <p>1. Please expand on your Methods section, as per Dr. Dragomir's comments.</p> <p>Please refer to the individual responses made under Dr Dragomir's comments.</p> <p>Interpretation:</p> <p>2. Please structure the Interpretation section into the following 4 main headings (i.e. insert the headings themselves): "Main findings" (discussing implications, not a repetition of results), "Comparison with other studies", "Limitations", and "Conclusions" (including implications for practice and future research).</p> <p>We agree and have incorporated this change.</p> <p>Table and Figures:</p> <p>3. Dr. Fernandes notes that a number of your e-Tables and Figures are unnecessary. We are able to accommodate these as supplementary material so there is no need to delete them.</p> <p>We agree and have made no change.</p> <p>Other points:</p> <p>4. Abbreviations: As per CMAJ Open style, please avoid using abbreviations and acronyms and instead spell them out in full at each occurrence in the main text and the abstract. CMAJ Open makes exceptions for only the most familiar and broadly recognized abbreviations (e.g., 95% CI, SD, OR, RR, HR), and even for these, please spell them out at first mention and include the abbreviation in parentheses.</p> <p>We have now addressed this in the manuscript.</p> <p>5. Please aim to keep your final word count below 2500 words (excluding abstract, figures, tables and references) and the abstract is below 250 words. Please supply exact word counts with the revision.</p> <p>Exact word counts have been supplied with the revision. The abstract is 244 words. The manuscript is now reduced to 3104 words.</p> <p>6. I attach a check-list of items for all authors to address. Careful attention to ensure that you are in compliance with each item may save another revision and will avoid delay at the copy-edit stage.</p> <p>We have now addressed the checklist points within the manuscript.</p> <p>Reviewers' Comments to Author: Reviewer: Dr. Christopher M.B. Fernandes, Hamilton Health Sciences/McMaster University This paper addresses the hypothesis that alternate-hospital readmission is associated with increased mortality compared to original-hospital readmission. The authors</p>

generally address this hypothesis.

1. Abstract: There are multiple potential causes for mortality associated with readmission, and would delete the last sentence from your interpretation.

We have softened the last sentence of our abstract to reflect the reviewers' comments.

2. Methodology: eTable1 does not add much to the paper, and could be deleted.

As directed by the Editors we have made no changes.

3. Was there a difference in patient addresses between original admission and readmission? Thus, could a patient present to a different hospital for readmission because they were now in a long-term care facility that was closer to the alternate hospital?

Unfortunately we do not have data on specific patient address changes to allow us to determine if a patient moved between the time of their admission and readmission. We agree that discharge to a chronic care facility is the most likely reason for a change in residential address between admission and readmission. We have attempted to account for this by adjusting for residency within a chronic care facility at readmission. We note that the unadjusted association between alternate hospital readmission and mortality was actually increased for those patients that were not a resident of a chronic care facility at readmission (see Table 3). This provides some evidence that our main findings are unlikely to be driven entirely by changes from independent living at admission to chronic care facility at readmission.

4. eTables2-6 and 11/12 could be deleted and summarized in the text.

As directed by the Editors we have made no changes.

5. eFigure 2 is summarized in the text and could be deleted.

As directed by the Editors we have made no changes.

6. Limitations: Several limitations are not mentioned. Patients seen at alternate hospitals may have a higher mortality due to greater underlying severity of disease, but they may also truly reflect a situation where the alternate facility is unfamiliar with the intricacies of disease treated on the original admission, since the original records are less readily available. The effects of a confounding variable from transition to a long-term care facility rather than home, and then on to an alternate hospital are not addressed. One example would include patients diagnosed with malignant neoplasms on the original admission, transitioned to a facility other than home, then sent back to an alternate hospital closer to that facility.

We agree that incomplete transfer of information from primary to secondary hospital may impede care during readmission. We describe this possibility in our introduction. We additionally refer to discontinuous care and failures of information transfer in our discussion and cite the relevant literature (see references 48 and 49).

As discussed in our response to Comment 3, limitations in our data preclude a spatial analysis accounting for the locations of the primary hospital, secondary hospital, and patient residence (including any changes in patient residence). As noted above, patients who were not a resident of a chronic care facility at readmission showed increased unadjusted associated between alternate hospital readmission and mortality.

7. References: Not all references are useful or relevant e.g references 16 and 20.

We are happy to remove these references at the Editor's request.

Reviewer: Alice Dragomir, MSc, PhD
Assistant Professor, McGill University
Scientist, The Research Institute of the McGill University Health Center

General comments:

The manuscript "Site of Hospital Readmission and Mortality" is a study of a cohort of 198,149 patients having had a readmission to hospital through the emergency

department between 1 Jan 1995 and 31 Dec 2010, with both primary and secondary admission occurred in Ontario's Greater Toronto and Hamilton Area hospitals. Several data sources were used: linked administrative databases, Ontario Health Insurance Plan database, Canadian Institutes for Health Information database, and other (official government records and 2006 Canadian census).

The primary objective of this study was to perform a population-based retrospective cohort analysis using linked administrative databases to test whether alternate-hospital readmission were followed by a higher risk of death than original-hospital readmission. The topic is of contemporary interest and the cohort of 198,149 patients is a distinct strength of this investigation. In particular, having individual-level characteristics together with information on hospital-level and region characteristics is an important element of this study.

The authors concluded that alternate-hospital readmission was associated with increased patient mortality.

My specific comments about this manuscript include the following:

Major concerns

1. Methods section needs to begin with a description of data sources. In addition, Databases subsection lacks details on "linked administrative databases". Are these databases parts of the Ontario Health Insurance Plan or the Canadian Institutes for Health Information?

We thank the reviewer for her comments. Information on outpatient clinic visits was obtained from the Ontario Health Insurance Plan database. Information on hospitalizations was obtained from the Canadian Institutes for Health Research database. We have modified the manuscript to make this clear and now also provide the relevant citations.

2. Methods section: Variables subsection needs reformulation to better reflect 3 aspects: 1) clinical outcomes definition; 2) main association factor (alternate-hospital readmission versus original-hospital readmission); and 3) Co-variables used for adjusted analyses.

We have now modified the manuscript to explain these distinctions more clearly.

3. Methods section: Statistical Analysis subsection needs to be restructured. There are broadly two type of analysis, the first at a patient-level, and the second at hospital-level. These need to be better distinguished. In addition, please specify for each adjusted analysis, what are the co-variables used (example: 1. The Cox model was adjusted for all covariables specified in co-variable subsection, or 2. The Cox model was adjusted for the following variables:....). Moreover, these need to be presented in tables or need to be mentioned in table footnote.

All analyses were performed at the level of individual patients. Some analyses stratified these patients by readmission (secondary) hospital in order to address possible confounding from intentional selection of an alternate-hospital for readmission (eg, a patient with cystic fibrosis might be instructed to return to a hospital with CF expertise should the need for readmission arise). We have modified the manuscript to make this clear.

We have clarified in the manuscript that adjusted analyses accounted for all listed patient- and hospital-level covariates. Analyses stratified by secondary hospital were adjusted for all patient-level covariates. Adjustment covariates are specified in a footnote to Table 2. As requested, we have added footnotes to Figure 2; eTables 7, 8, 9, and 11; and eFigure 4.

4. Please avoid to present results of univariate analyses as main findings. The unadjusted results are important to help interpreting the overall results. In contrast, the results obtained with adjusted models need to be presented and interpreted. Accordingly, the patient subgroups subsection needs reformulation.

We have reformulated this subsection to maintain the emphasis on adjusted results.

5. Interpretation section. As per the comment above, the first paragraph of this section needs completely to be reformulated. In addition, I personally do not see how the unadjusted analyses in general can suggest an immediate effect, and particularly, of the impact of alternate-hospital readmission on the increase in mortality. Please provide clarification. Further, there is no evidence that the increase in mortality is substantial

and sustained. The results of adjusted analyses with a hazard ratio for one-year mortality of 1.01, 95%CI: 0.99-1.02 looks contradictory to the interpretation. Please clarify.

We have reformulated the Interpretation section to better express the two potential interpretations of our results: The adjusted odds ratio of 1.06 (95%CI 1.02 – 1.10, p 0.003) yielded by our primary analysis might represents residual confounding and might represent a true causal relationship. We have also continued to emphasize the possibility that residual confounding explains our results.

6. Table 3 present unadjusted analyses stratified by patient characteristics. Please specify what was the model used (in text and in table title). In addition, for each one of these variables it is not clear what the reference category was. Please provide clarification.

Unadjusted univariate GEE analyses were used to calculate the odds ratios presented in Table 3. We have ensured that this is described in the text (see Statistical Analysis subsection) and added it as a footnote to Table 3.

The unadjusted odds ratios presented in Table 3 represent the odds of 30-day mortality following alternate-hospital readmission divided by the odds of 30-day mortality following original-hospital readmission, stratified according to patient characteristics. For example, the first row examines all patients <65 years and presents the odds ratio for 30-day mortality, comparing those patients undergoing alternate-hospital readmission to those undergoing original-hospital readmission. As for all analyses in this manuscript, the reference category for each of these strata is the group of patients within the strata who underwent original-hospital readmission.