Author's response to reviews

Title: Variations of 10 common medical conditions on unplanned readmission, length of hospital stay, mortality, and medical cost: A retrospective analysis of hospital episode statistics in Hong Kong

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Author's response to reviews: see over
27 April 2011

Editor-in-Chief
BMC Health Service & Research

Dear Sir/Madam,

**Re: Manuscript MS: 1987061455482610**

“Variations of 10 common medical conditions on unplanned readmission, length of hospital stay, mortality, and medical cost: A retrospective cohort study of hospital episode statistics in Hong Kong”

We are very grateful for your email on 13 Apr 2011 concerning this manuscript, and the offer to allow us to revise it in accordance with the comments of the reviewers and editorial team. The paper has been edited and revised in response to reviewer’s comments. The changes in the text are underlined and highlighted in red, together with a point-by-point response to reviewer’s comments.

We appreciate this opportunity to resubmit a revised manuscript and trust that you and your reviewer will find it sufficiently improved to justify publication in the *BMC Health Service & Research*. Thank you very much for your kind consideration.

Yours sincerely,

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Response to the comments of the reviewers and editorial team in relation to the manuscript:

**Manuscript MS: 1987061455482610**

“Variations of 10 common medical conditions on unplanned readmission, length of hospital stay, mortality, and medical cost: A retrospective cohort study of hospital episode statistics in Hong Kong”

Comments are written in italics and responses in normal text. Sections taken from the manuscript are marked by parentheses.

**Reviewer 1**

**Q1.** This study was designed to determine the variation in unplanned readmission rates for 10 common medical conditions. This is a clear question, although comparison across medical conditions limits the extent to which the study can contribute to comparison of populations, services, and costs. Appropriate use of routinely collected data is described. The reliability and validity of coding is key to the study and there is potential for systematic differences as well as error in the data. The authors note that the heart disease code includes a number of heart diseases but do not comment on the potential for similar problems in the other conditions included in the study. Coding can be a low level administrative activity and there is potential for variation between reporting centres [Audit Commission, 2010 #5113]. A minor essential revision is for the authors could describe the information available about the reliability and validity of the coding in their dataset.

Response: Thanks, for the reliability and validity concern, I have added a sentence on this issue under the section of “strengths and weakness of the study” as follows (p.15, line 13-18):

“First, disease codes based on the primary discharge diagnosis were used, and the severity of disease and other co-morbidities were not available. Also, there may be a potential systematic difference or error for data entry but it was believed that the difference or error would be minimal because all of the diagnostic codes were entered by physician.”

**Q2.** There is potential for the soundness of the data to be affected by factors in addition to the coding issues identified above. The authors acknowledge that information about the severity of disease and other comorbidities was not available. It is not clear whether the data accounts for mortality during admissions. A minor essential revision is to identify whether index admissions in which the patient died in hospital are included or whether these were all live discharges. This could influence the interpretation of data since differences in in-hospital mortality between conditions, hospitals and populations could affect the calculation of readmission rates. A minor essential revision is to note the limited usefulness of the cost data (if it is to be included) because of the potential
for substantial variation in demand on human and other resources (eg intensive care) across conditions.

Response: All admission episodes in the year of 2007 was included in the data analysis. Thus, the index admissions in which patients died in hospital care and alive discharge were all included.

Thanks for the suggestion and I have emphasized the limited usefulness of the cost data into the section of “Strengths and weakness of the study” as follows (p.15, line 21-23; p.16, line 1-2):

“Finally, the cost data are incomplete because we were unable to access other ward follow-up, outreach community services, demand on human and other resources across various medical conditions; the overall costs may be higher than calculated. Nevertheless, the hospital cost which contributed to the major portion of total cost was included.”

Q3. The following minor essential additions are required for the manuscript to adhere to the relevant standards for reporting and data deposition: a statement about whether data were missing and if so how these were handled; and details of data deposition and availability. A discretionary revision would be the publication of more detailed data, for example the distribution of diagnostic and demographic characteristics across the clusters.

Response: The patients with missing data were included for data analysis. I have added the denominators in the Table 1 for your information.

The distribution of diagnostic and demographic characteristics across the clusters is provided in the attached table for your reference (p.9 of this covering letter). However, we did not include in this paper because it is another angle of result discussion and we would like to further explore the relationship between readmission and geographical issues in next paper.

Q4. The discussion and conclusions are generally well balanced and adequately supported by the data. The extent to which conclusions can be drawn is limited by comparison across conditions. The interventions required to avoid readmissions are likely to be very different across the range of conditions included in the study. It is also notable that readmissions were more common in those receiving public assistance, living in residential accommodation and a little higher in men than women. This suggests that it is important to compare demographic characteristics within diagnostic groups. A minor essential revision is to identify why multivariate analysis was not conducted, which limits the potential to compare services and populations.

Response: Sorry for the confusion. The patient characteristics including age, gender, received any public assistant, whether lived in elderly home, living district, and cluster of admitted hospital were included in the multivariate analysis for adjustment. Please see the remark under the Table 3 for your information.

Q5. Limitations of the work are clearly stated, although additional limitations are identified elsewhere in this review.
Response: the limitation section is supplemented by reliability & validity of code and limitation of usefulness of cost as follows (p. 15, line 13-23; p. 16, line 1-2):

“Several limitations of this review should be considered. First, disease codes based on the primary discharge diagnosis were used, and the severity of disease and other co-morbidities were not available. Also, there may be a potential systematic difference or error for data entry. Also, there may be a potential systematic difference or error for data entry of coding as error rates are higher with more specific diagnosis codes (ref13). However, it was believed that the difference or error would be minimal because all of the diagnostic codes were entered by discharged physician. Second, while exploring the health outcome in various medical conditions in relation to the readmission, the patients’ quality of life scores, health status, functional status and satisfaction were unavailable. Finally, the cost data are incomplete because we were unable to access other ward follow-up, outreach community services, demand on human and other resources across various medical conditions; the overall costs may be higher than calculated. Nevertheless, the hospital cost which contributed to the major portion of total cost was included.”

Q6. The authors acknowledge work upon which they are building. Some of the essential revisions identified above these would build on the following which should be acknowledged: Callery, P., Kyle, R.G., Campbell, M., Banks, M., Kirk, S. & Powell, P. (2010) Readmission in children's emergency care: an analysis of hospital episode statistics. Archives of Disease in Childhood, 95(5), 341-346.

Response: Thanks for your suggestion and the reference is very good. It is included as no. 51 in the reference list; and cited in the text as follows (p. 15, line 15-17):

“Also, there may be a potential systematic difference or error for data entry of coding as error rates is higher with more specific diagnosis codes [51].”

Q7. The writing is generally acceptable but a minor essential revision is proof reading to correct English errors, including the incorrect spelling of principal throughout.

Response: The manuscript is further edited and the spelling of “principal” is corrected.
Reviewer 2

This manuscript reports a study to examine unplanned hospital readmissions attributed to ten medical conditions and their implications in mortality and hospital cost. The study addressed an important topic in health policy and services. The manuscript is generally well-written although there are some confusing issues and wordings that needed to be clarified.

Major compulsory revisions:

Q1. Since age, sex, public assistance, lived in elderly home and health outcome are all patient level variables, the authors should clarify the denominators of the percentages reported in Table 1. Also, it is better to present the number of subjects in each category as well.

Response: The number of subjects in each category is added in the Table 1.

Q2. The authors indicated their study population was all the patients admitted to the wards of the department of internal medicine of all public hospitals in Hong Kong in 2007 (stated in the “Study Population” part). They retrieved all eligible subjects from the CMS database; their sample was actually the study population. They don’t need to do the statistical comparisons!

Response: Sorry for the confusion, as you said that all patients admitted to the wards of the department of internal medicine of all public hospitals in Hong Kong is our study population, so we did not perform any statistical comparisons. But we just perform the comparisons between readmission cases and all other admissions cases.

Q3. On page 6, the last sentence of the “Definition of unplanned readmissions” part: “Thus, we used 30-day as one of the criteria to define the unplanned readmission.” Please clarify what other criteria have been used to define the unplanned readmission in the study.

Response: The 30-day timeframe is commonly used in the United States while the 28-day timeframe is commonly used in the United Kingdom. The 30-day was an optimal choice for identifying readmission based on statistical modeling. This information was included as follows (p.6, line 18-23):

“The 30-day timeframe is commonly used in the United States studies,[29-32] whereas the 28-day timeframe is commonly used in the United Kingdom.[33-36] Based on statistical modeling, such as survival analyses as well as sensitivity and specificity analyses, two studies had mathematically demonstrated that 30-day was an optimal choice for identifying readmission.[37, 38] Thus, we used 30-day as one of the criteria to define the unplanned readmission.”

Q4. The authors also need to clarify the reference group of the disease-specific odds ratio of 30-day unplanned readmission, whether it is the 9 remaining diseases grouped together for comparison, or all other diseases, or what other else. They
should also disclose what methods have been used to estimate the adjusted odds ratios and how the multiple admission episodes are accounted.

Response: The reference group is all other diseases including 9 remaining diseases. This information is shown as remark below Table 3.

Logistic regression models generate adjusted odd ratios for the risk / likelihood of unplanned readmission. The information under the statistical analysis section is supplemented as follows (p.7, line 21-23; p.8, line 1-2):

“In order to explore the excess risk of unplanned readmission caused by each medical condition, the disease-specific odds ratio (OR) of 30-day unplanned readmission were estimated using logistic regression model and all ORs were adjusted for age, gender, received any public assistant, whether lived in elderly home, living district and cluster of admitted hospital in Hong Kong.”

For the counting multiple admission episodes, readmission is counted when the admission is 30 days within the previous discharge date. The calculation is done on the basis of admission episodes. This information is supplemented in the statistical analysis section as follows (p7, line 17-19):

“Any admission which was 30-day within the previous discharge (index admission) was counted as unplanned readmission; and hospital transfer was not considered as discharge case.”

Q5. On pages 12 and 13, the last three sentences of the second paragraph under the subheading of “Comparison with other studies” of the “Discussion” part are contradicted to Table 3 and the second and third sentences of the third paragraph of the same section.

Response: Sorry for the mistake. The paragraph is revised as follows (p.12, line 23; p.13, line 1-9):

“While this medical condition has the longest hospital stay, the OR of hospital readmission was however less than one. To maximize the quality of care, future studies need to determine why patients with cerebrovascular disease require longer hospital stay and had lower unplanned readmission rates, and whether longer hospital stay facilitate better discharge planning, the community support for psychosocial and rehabilitation care and subsequently contributed to lower readmission. Echoing this thought, while patients with heart diseases had the shortest hospital stay in both acute and rehabilitation period, the OR of hospital readmission for heart diseases was greater than one. Thus, future studies may need to review whether immature discharge contributed to hospital readmission in some diagnosis.”

Q6. It is unsure how the authors come up with the conclusion: “Our findings showed that the care process for the patients with aortic aneurysm, pneumonia, cerebrovascular disease, liver and heart disease is needed to be reviewed.”

Response: Sorry for the confusion. The sentence is revised with details as follows (p.16, line 16-19):

“Our findings showed that the care process for the patients with malignant neoplasms, chronic liver disease and cirrhosis, septicaemia, heart disease and pneumonia which are more likely to have readmission is
Minor essential revisions:

**Q1. On page 6, “Definition of unplanned readmission” part, the authors indicate that 30-day and 28-day timeframe are commonly used in United States and United Kingdoms respectively. However, they report some confusing findings from these two countries (the first sentence under the subheading of “Comparison with other studies” in the “Discussion” part).**

Response: Sorry for the mistake. I have double-checked and the paragraph is revised as follows (p.11, line 10-14):

“A moderate 30-day unplanned readmission rate of 16.7% was identified, compared to an overall 30-day readmission rate of 5-29% in the United States [40] an overall 28-day readmission rate of 15.3% in the United Kingdom [41] which is new reference D27 and a 42-day readmission rate of 39-59% for patients discharged from a department of internal medicine in Switzerland.[42]”

**Q2. A number of figures in the first two paragraphs of the “Results“ part do not match with those in Table 1 (e.g. the mean age and its SD, mean LOS).**

Response: Sorry for the typo. The paragraph is double-checked and one sentence is revised as follows (p.9, line 8-10):

“For health outcomes, the mortality rate of unplanned readmission was 8.9% and the average hospital stay was 6.6 days (SD 9.8 days).”

**Q3. On page 12, the first sentence of the second paragraph under the subheading of “Comparison with other studies”, “… between 30-day unplanned readmissions and all other readmissions.” Please clarify what actually all other readmissions refer to or whether it is a typo.**

Response: Sorry for the typo. The word “readmissions” is revised to “admissions” as follows (p.12, line 7-8):

“Our finding shows that there was a significant difference in length of stay and mortality rate between 30-day unplanned readmissions and all other admissions.”
### Extra Table for Q3 of Reviewer 1

**Characteristics of patients across Cluster**

<table>
<thead>
<tr>
<th></th>
<th>Cluster 1 n(Col %)</th>
<th>Cluster 2 n(Col %)</th>
<th>Cluster 3 n(Col %)</th>
<th>Cluster 4 n(Col %)</th>
<th>Cluster 5 n(Col %)</th>
<th>Cluster 6 n(Col %)</th>
<th>Cluster 7 n(Col %)</th>
<th>P-value†</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age (n)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
<tr>
<td>(mean, SD)</td>
<td>70.8(17.3)</td>
<td>68.9(17.6)</td>
<td>71.1(16.2)</td>
<td>71.9(16.7)</td>
<td>72.4(16.1)</td>
<td>70.4(17.1)</td>
<td>68.1(18.2)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Sex</strong></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>32,510(51.8)</td>
<td>56,112(53.4)</td>
<td>26,113(54.7)</td>
<td>23,859(50.5)</td>
<td>28,096(53.8)</td>
<td>20,714(52.9)</td>
<td>20,068(53.6)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Female</td>
<td>30,248(48.2)</td>
<td>49,050(46.4)</td>
<td>21,614(45.3)</td>
<td>23,369(49.5)</td>
<td>24,162(46.2)</td>
<td>18,461(47.1)</td>
<td>17,384(46.4)</td>
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<tr>
<td><strong>Public assistance‡</strong></td>
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<tr>
<td>Yes</td>
<td>20,764(33.1)</td>
<td>34,668(33.0)</td>
<td>15,353(32.2)</td>
<td>10,707(22.7)</td>
<td>17,105(32.7)</td>
<td>8,942(22.8)</td>
<td>15,331(40.9)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>No</td>
<td>41,994(66.9)</td>
<td>70,494(67.0)</td>
<td>32,374(67.8)</td>
<td>36,521(77.3)</td>
<td>35,153(67.3)</td>
<td>30,233(77.2)</td>
<td>22,121(59.1)</td>
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<tr>
<td><strong>Lived in elderly home</strong></td>
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<tr>
<td>Yes</td>
<td>14,009(22.3)</td>
<td>20,323(19.3)</td>
<td>7,157(15.0)</td>
<td>9,108(19.3)</td>
<td>12,449(23.8)</td>
<td>7,041(18.0)</td>
<td>8,791(23.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>No</td>
<td>48,749(77.7)</td>
<td>84,839(80.7)</td>
<td>40,570(85.0)</td>
<td>38,120(80.7)</td>
<td>39,809(76.2)</td>
<td>32,134(82.0)</td>
<td>28,661(76.5)</td>
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<tr>
<td><strong>Length of stay</strong></td>
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<tr>
<td>Acute bed (n)</td>
<td>62,729</td>
<td>105,112</td>
<td>47,712</td>
<td>47,208</td>
<td>52,245</td>
<td>39,155</td>
<td>37,393</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(mean, SD)</td>
<td>4.9(7.6)</td>
<td>5.3(9.3)</td>
<td>4.5(7.2)</td>
<td>4.8(8.1)</td>
<td>5.2(9.7)</td>
<td>6.0(10.7)</td>
<td>5.6(14.1)</td>
<td></td>
</tr>
<tr>
<td>Sub-acute bed (n)</td>
<td>62,758</td>
<td>105,162</td>
<td>47,727</td>
<td>47,228</td>
<td>52,258</td>
<td>39,175</td>
<td>37,452</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(mean, SD)</td>
<td>2.7(11.2)</td>
<td>2.2(13.8)</td>
<td>2.5(12.1)</td>
<td>2.5(13.8)</td>
<td>3.9(13.5)</td>
<td>1.3(14.6)</td>
<td>1.9(15.7)</td>
<td></td>
</tr>
<tr>
<td>Total (n)</td>
<td>62,729</td>
<td>105,112</td>
<td>47,712</td>
<td>47,208</td>
<td>52,245</td>
<td>39,155</td>
<td>37,393</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>(mean, SD)</td>
<td>7.5(11.2)</td>
<td>7.5(13.8)</td>
<td>6.9(12.1)</td>
<td>7.2(13.8)</td>
<td>9.1(13.5)</td>
<td>7.3(14.6)</td>
<td>7.4(15.8)</td>
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<tr>
<td><strong>Health Outcome</strong></td>
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<tr>
<td>Live</td>
<td>59,146(94.3)</td>
<td>99,018(94.2)</td>
<td>45,199(94.7)</td>
<td>44,549(94.4)</td>
<td>48,465(92.8)</td>
<td>37,162(94.9)</td>
<td>34,757(93.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Dead</td>
<td>3,585(5.7)</td>
<td>6,094(5.8)</td>
<td>2,513(5.3)</td>
<td>2,659(5.6)</td>
<td>3,780(7.2)</td>
<td>1,993(5.1)</td>
<td>2,636(7.1)</td>
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<tr>
<td><strong>Type of Admission</strong></td>
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<tr>
<td>Unplanned</td>
<td>9,018(17.5)</td>
<td>16,467(16.8)</td>
<td>7,826(18.2)</td>
<td>6,260(14.9)</td>
<td>6,290(16.6)</td>
<td>4,423(14.2)</td>
<td>6,045(17.9)</td>
<td>&lt;0.001</td>
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<tr>
<td>Readmission</td>
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<tr>
<td>Other Admission</td>
<td>42,536(82.5)</td>
<td>81,699(83.2)</td>
<td>35,170(81.8)</td>
<td>35,727(85.1)</td>
<td>31,615(83.4)</td>
<td>26,824(85.6)</td>
<td>27,794(82.1)</td>
<td></td>
</tr>
</tbody>
</table>

†Chi-square tests / ANOVA tests

‡only include those who are receiving assistance from the government such as Comprehensive Social Security Assistance (CSSA) in Hong Kong