Author's response to reviews

Title: Helicopter Emergency Medical Services (HEMS) over-triage and the financial implications for major trauma centres in NSW, Australia

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Author's response to reviews: see over
1st February 2013

Dr Tom Rowles
Executive Editor, BMC Emergency Medicine

Dear Dr Rowles,

Re: Revision of original article – MS: 1632908222810326

Please find attached our revised original manuscript entitled ‘Helicopter Emergency Medical Services (HEMS) over-triage and the financial implications for major trauma centres in NSW, Australia’. We thank the reviewers for their comments and we have provided responses for each comment in red below (including any changes to the manuscript). It is intended that this article will be included in a PhD by publication for the primary author which will be submitted shortly. Hence, if possible – an expedient response would be much appreciated. We look forward to hearing from you.

Yours Sincerely,

Colman Taylor, on behalf of the authors.
Editorial comments.

Please ensure that your abstract is formatted in accordance with our formatting guidelines. Information on these can be found through the following link:

http://www.biomedcentral.com/bmcemergmed/authors/instructions/researcharticle#formatting-abstract

*We have adjusted the formatting in our manuscript.*

Reviewer #1.

**Major revisions:**

Page 2 (Abstract) “HEMS over-triage was estimated based on injury severity (ISS≥12 or #15) and hospital length of stay (LOS<24hrs).” This does not make sense. The American College of Surgeons lists minor injuries as ISS < 15. How can you have both # 12 and # 15?

*As stated in our article: “we used the local definition of minor to moderate injury (ISS≤12 \(^1\)) as well as more generally used criteria in the HEMS literature (ISS≤15 \(^2\)).” In doing so – we have provided a sensitivity analysis regarding the definition of major trauma. We have added some additional wording in the abstract to clarify this: “including two thresholds: ISS≤12 or ≤15”.

Page 3 (Introduction) “NSW trauma centres (referred to as major trauma centres) receive proportionally higher volumes of trauma and currently admit more trauma patients than any other state/territory in Australia [4].” This needs to be better defined. Does NSW have more trauma patients than VIC, SA, or QLD because there is a greater population in NSW or is the number truly greater proportionally (number of trauma patients per population). Please clarify.

*The sentence has been altered to state “NSW trauma centres (referred to as major trauma centres) receive higher volumes of trauma and currently admit more trauma patients than any other state/territory in Australia due to its greater population size”*

Page 6 (Methods) The use of two definitions of severe injury is certainly confusing and a limitation of this paper.

*As the suitability of an ISS>15 threshold is yet to be demonstrated for the current AIS version, we believe our analysis should include both the local threshold and – given international the journal audience – the more commonly used threshold in the literature. Although a threshold of ISS >15 (using previous AIS versions) is commonly used in the literature to define severe injury, a threshold of ISS>12 (using current AIS versions) is believed to perform similarly, as changes in patient classification occur when adopting the current AIS version \(^3\). We have included the following sentence in our methods “As the suitability of the ISS>15 threshold to represent major trauma remains controversial \(^4\), the analysis included both thresholds as a sensitivity test.”*

Page 8 (Results) Need 95% confidence intervals for patient characteristics.
We have added 95% CI for appropriate patient characteristics including age, ISS and LOS in Table 1.

Page 9 (Results) Because this will be an international paper, clarify that monetary values are in Australian Dollars. Confidence intervals also needed.

We have clarified that monetary values are specified in Australian dollars in the sub-heading of the results (wording: ‘2009 AUD’ added). We have also added 95% CI to mean values presented in Table 3.

Page 9 and 10 (Cost variance) The authors need to complete the necessary statistical tests two show the comparative values are statistically significant based upon the alpha value chosen.

The purpose of our analysis was to describe average and total funding discrepancies between actual hospital costs and peer group average costs (as a proxy for hospital reimbursement) for patients transported by HEMS, stratified by injury severity. A test of statistical significance related to the differences between average (or median) hospital costs and average (or median) peer group averages would be ambiguous and not would provide an assessment of the actual financial impact on trauma centres that receive HEMS patients (as is provided in our current analysis). Our analysis lets the reader draw their own conclusions from the means and confidence intervals presented.

Page 13 (Conclusion) Needs confidence intervals.

The conclusion includes a reference to the proportion of patients transported by HEMS who were classified as having minor injuries according to the two definitions used in the manuscript. As previously stated, including two definitions provides a sensitivity test regarding the definition of major trauma. We do not believe including a confidence interval for both definitions would provide additional or necessary information for the reader.

Summary: Overall, this is a good paper addressing a valuable issue. The state of NSW is certainly similar to other modern EMS systems. In comparison to the United States, the NSW populace generally does not have to pay for HEMS while US residents do. That said, there is applicability to trauma systems worldwide. The biggest limitation of this paper is the statistical analysis. The presented percentages and differences require the necessary statistical analyses to determine whether the findings and differences are significant or just due to chance. It is unclear from reading the paper whether patients with ISS scores between 12 and 15 (which can be a large number of patients in our trauma system) are included in this analysis. This is one of the biggest criticisms of this paper. If NSW uses # 12, then use that despite the national use of # 15

Our paper includes an analysis of both thresholds – please refer to our comment above regarding this.

Reviewer #2.

Major revisions:
1) Methods section/data capture – first paragraph: this paragraph should start with details on the selection process and a clear list of the in- and exclusion criteria. How were the patients identified?

_We have added information to the first paragraph concerning the inclusion criteria. We have also linked this paragraph to the ‘data capture’ and ‘variable definition’ paragraphs which provide additional details as to how patients were identified in the dataset._

2) Methods section/costing methods and linkage: could it be that the control group was confounded by eligible patients not transported by HEMS (under-triage)? And if so, did the authors correct for this? It would be worth mentioning this in a bit more detail, or add it as limitation to the discussion section.

_Our paper focuses on patients transported by HEMS only, during a defined period and stratifies by injury severity and LOS to provide estimates of over-triage. Patients not included in our analysis may have been eligible to receive a HEMS intervention however our data did not allow an assessment of this. Reference is made to this in our discussion as follows:_

_“our data did not allow assessment of transport protocol adherence. In NSW, HEMS are currently activated either by emergency call information (via a rapid launch coordinator) or via on-scene paramedic according to service protocols, which rely on criteria such as patient physiology and mechanism of injury. In terms of discriminative accuracy, previous research has shown currently used criteria (including injury mechanism, physiology and anatomy of injury) to rely on a limited evidence base⁵. Our results confirm the advanced diagnostic capability and oversight which is possible in inter-hospital transfers lead to patients with a higher acuity being transferred by HEMS. Although such capabilities are not available in the pre-hospital environment and a degree of over-triage is always likely to exist, there remains scope for further research in this area. However, more comprehensive data are needed (linking ambulance to trauma registry and long-term outcomes) to understand which patients benefit from a HEMS intervention and why.”_

3) Result section/treatment costs – second paragraph: The authors stratified by ISS score. Gender as well as body area injured (e.g., head trauma) may also affect costs. Did the authors look into this in more detail? ISS is an accepted way of discriminating between injury groups, but may not be sensitive enough to detect all relevant effects.

_We generally agree, although the purpose of this paper was not to investigate predictors of cost. We have utilised ISS groups and LOS to provide an assessment of over-triage which is consistent with previous literature on this subject⁶. Utilising other criteria from our dataset (such as head injury) in isolation would not provide a more accurate representation of over-triage._

4) Results section/sensitivity analysis: the authors use an ISS level of 12 as cut point. How does the analysis look if the more generally accepted level of >= 16 is used?

_We have used both cut points in our analysis._
5) Discussion – first paragraph: “...Specifically, in terms of potential funding discrepancies, over-triaged HEMS patients can be as costly to a trauma centre as correctly triaged patients...”. I would be hesitant to state this so firmly. Propagating to change the system into funding based on dispatch numbers has the downside that it may reduce the trigger for optimizing the dispatch protocol. Instead of asking for more money, optimizing the dispatch protocol (after studying protocol adherence) should of course receive the highest level of attention.

*We agree and have amended the specified wording as follows: “Specifically, in terms of potential funding discrepancies, over-triaged HEMS patients may be as costly to a trauma centre as correctly triaged patients”*

**Minor Essential Revisions**

6) Abstract – Methods section: financial year is not very indicative, mentioning the study months makes more sense.

*We have adjusted the wording as follows: “1 July 2008 to 30 June 2009”*

**Discretionary Revisions**

7) Discussion – third paragraph: here, the authors list a major point, that should be indicated as a clear limitation of the study. Protocol adherence and correctly identifying the patient that would benefit for on-scene advanced medical assistance by a HEMS team is a critical issue. Given the high rate of over-triage (and an unknown rate of under-triage), optimization of the dispatch protocol seems warranted.

*We believe this point is clearly mentioned as a limitation – see our comment above regarding this.*

**Reviewer #3.**

**Minor Essential Revisions:**

1. As all abbreviations also the term "NSW" Australia should be, at least ones, fully written in the article and mentioned in the list of abbreviations as this article will be published in an international journal.

*We have added wording to the introduction (“New South Wales (NSW”)). NSW has also been added to the list of abbreviations.*

**Discretionary Revisions**

1. The major problem which is discussed by the auteurs in this paper is the over-triage in the HEMS prehospital trauma patients in relation to transport- and hospital costs. The auteurs are, however not mentioning recently published paper on this subject with a specific attention to the use of the ISS as a triage tool for HEMS trauma patients. It is advisable to include the content of this publication (Giannakopoulos G.F. and others Eur J Emerg Med 2011;18:197-201) in the discussion and references.

*Thank you for this suggestion.*
2. What also should get more attention is the relevance of a single "live threatening injury" which is, in some cases, included in the group of minor to moderate injury ISS#12 or ISS#15. These patients should not be classified as over-triaged even if this has financial implications for major trauma centres in New South Wels because the Episode Funding Policy 2008/2009-NSW, Australia.

We agree – however limitations in our dataset precluded assessment of this.


