Author’s response to reviews

Title: Modelling optimal location for pre-hospital helicopter emergency medical services

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Author's response to reviews: see over
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Revisions overview for paper entitled: Modelling optimal location for pre-hospital helicopter emergency medical services (MS # 1831023456237805)

To the Scientific Editor,

We have addressed the suggested revisions to this manuscript – within only a few exceptions that are well-documented in the letter below. We have outlined major and minor revisions below.

Major changes:

- Reviewer 2 asked for clinical data to quantify the value of the expansion of the HEMS. He legitimately questioned the assumption that earlier arrival times translate into better outcomes for injury patients. Substantiation of this assumption rests on two axes. First it requires that the Golden Hour concept is still legitimate – despite some recent interrogation. Second, that mortality is not the only factor that affects outcome. In this case, we are indeed making the assumption that faster transport translates into better outcomes.. This has been supported elsewhere (e.g. Branas 2000). This is now referenced in the discussion (page 7).

- In our case, the HEMS expansion must be located at one of the two Interior Health Authority hospitals. This is because of the type of flying in BC: we need the helicopters situated at airports with weather reporting and instrument departures as well as infrastructure to support re-fueling and aircraft maintenance. At present, the BCAS does not operate from remote bases. Nor does the BC system= have the ability move paramedics around so we must design our resources to be situated where we have critical care paramedics.

- Reviewer 2 notes that we use patient home postal codes to estimate population density. Actually we used Canada Census data to give us population density. We use the home postal codes only to geocode major injury (ISS over 12) in the province over a 5-year aggregate. We have ground-truthed many incident locations – in conjunction with residential address to verify that they tend to occur in the same catchment. This is clarified in the text by adding the following sentence “Based on available hospital records with corresponding incident location and home residence data for each patient (51% of all records) over 95% of all patients treated at either KGH or RIH lived and were injured within the IHA catchment.”

- Reviewer 1 notes that there is intense discussion at present on the relative merits of an inclusive trauma system. We have added text in the background section as well as in the discussion section to briefly outline these debates and note the province of British Columbia remains committed to an inclusive system.

- In the 2nd paragraph in the background section, we clarified that in non-auto launch
areas in BC, a helicopter is only dispatched if ground EMS deem it necessary. By contract auto-launch is activated based on 911 interrogation protocols – for which operators are trained. Test data from BC Ambulance Service indicates that 911 interrogation is an effective basis for auto-launch. We have clarified this issue in the text.

- We appreciate Reviewer 1’s concern that the arguments about the practice of auto-launch confound the spatial analysis results of the paper – by undermining the premise. In this case, we should note that auto-launch is used only when trauma patients are outside a 20 minute driving range and that the province is unusually mountainous – making ambulance transport less reliable and slower. Given that there are only two tertiary trauma hospitals in the interior of the province, the vast majority of trauma happens outside a 20 minute catchment around each of these hospitals.

- Reviewer 1 raises an excellent point about the reliability of computer-generated models. It reminds me of the axiom that “all models are wrong; some are useful.” To respond, we added the following at the end of the first paragraph of the discussion: “We caution that computer generated models cannot account for all variables in complex situations. We believe, however, that the model is the basis for supporting decision making in resource-constrained environments.”

- We added a final sentence to the paper to support Reviewer 1’s point that future studies must investigate the efficacy of the newly located system: Future research must focus on review of utilization statistics as well as qualitative investigation of the purported improved efficiency of the system – given the use of evidence-based decision making to locate the service.

Minor changes:

- Reviewer 2 asked that we add references to support the view that clinical and cost effectiveness of HEMS programs may be overstated. This is clearly the case and we have addressed this need within the discussion section as well as emphasizing that utilization review of the potential benefit of early activation/auto launch versus HEMS services after the expansion of air medical services in BC will be needed.

- We agree that the sentence asserting that “the potential for auto launch to decrease time to advanced resuscitation is ultimately more important to achieving better patient outcomes than the ability to improve transport times while in flight” is somewhat strong. We have replaced this sentence with the following: “Auto launch has the potential to decrease overall time to advanced resuscitation. As such, it may have a more positive effect on outcome than decreasing in-flight times.”

- Reviewer 2 was astute in noticing that we did not include patients triaged to non-trauma hospitals. Unfortunately the BC Trauma Registry does not provide a mechanism for capturing patients who have been triaged to a non-trauma hospital.
In this province, however, virtually the complete population of patients assessed with ISS above 12 are transferred to designated trauma facilities. All transport patients are captured in the BCTR. We clarified this in the text. In addition, we noted that in the text that “Approximately 8% (71/874) of injury patients were transferred out of province over a three year period. All of these patients were proximate to the border with the province of Alberta.”

• We replaced the last sentence of the first paragraph of the Methods section with the following: “For the purposes of this analysis, however, we do not include third-party resources given that their participation in transport is unreliable and unpredictable.”

• The reference to 20 minutes driving time was with respect to current early activation in the Vancouver Metropolitan area and is based on visual inspection of maps as well as past experience by the dispatchers. This is an estimated time period – for a large urban area that does not have relevance in the rural and remote interior of the province where our study is located. We gave clarified this in the text.

• We have changed all references to ER to ED – as suggested by Reviewer 1.

• All minor writing suggestions have also been incorporated.

We found both reviewers’ comments very helpful, and feel that they have helped make this a stronger research paper. Please advise if you require any further changes.

Yours sincerely,

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