Reviewer’s report

Title: Locating Helicopter Emergency Medical Service Bases to Optimise Population Coverage versus Average Response Time

Version: 0 Date: 07 Jun 2017

Reviewer: Michael Dinh

Reviewer's report:

Thank you for the opportunity to review this interesting work.

This is a study that uses mathematical modelling to

There are a number of general issues that need to addressed to strengthen this work and bring it to publication standard.

Firstly there are concepts in the background such as HEMS that could be better explained to those unfamiliar with trauma or pre-hospital retrieval services. I assume that HEMs refers to ambulance retrieval services that have a physician as part of the retrieval team. It may be worth mentioning whether HEMS and normal ambulance services fall under the same governance structures or operate independently.

Although mathematical modelling may be understandably beyond the scope of this paper and the general readership of this journal, a simple explanation of the basis of the MCLP and ARTM would help readers understand the methods more and how it differs from say geo-spatial modelling, and why they are considered "advanced".

It could also be improved by the use of more exact language, such as "green field analyses, assuming clean slates" I would assume to mean "...assuming a hypothetical situation with no HEMS bases", and references to particular statements such as "faster response times".

Although this is essentially an exploratory analysis, the rationale for performing the analysis is somewhat unclear. Why was this analysis performed - have there been clinical issues relating to retrieval service coverage, would improving coverage times by x minutes improve outcomes, is the population distribution in NSW shifting in a particular way, was it to see whether the inclusion/exclusion of Careflight within the current HEMS framework results in improved coverage and response times? What are the actual HEMS response times for patients in various locations in NSW? These issues need to be clearly articulated in the introduction, so that the reader understands that this research wasn't performed out of mere curiosity.

As a result of this, I don't think the specific objective of the analysis is clear and a robust definition of the term "optimal" is required. It may be "ideal" to try and cover a higher proportion
of the population within 45 minutes but it may not be optimal or cost effective to do so. I would suggest that this study seeks to determine the effect of additional HEMS sites in terms of population coverage and response times.

The methods section needs to be better structured so it is understood which sections represent the setting, context, data sources, assumptions, modelling methods etc (it would appear that most of the methods is just trying to explain the context of the study rather than explaining the methodology) and data sources. A lot of this is circumstantial and relate to operational matters (airborne time..) that don't relate to the study methodology. Again the modelling methods used need better explanations so that the reader can at least refer to it if they are consulting with someone else who can do this type of analysis in another setting. Can other variables be included in the model to simulate external factors such as time of day, weather conditions, one or two helicopters being used simultaneously for different tasks etc. the modelling as it stands would appear to represent ideal best case scenarios and may not be realistic. There is a lot of assumed knowledge regarding the geography of NSW and a map of NSW with all the relevant locations (Narrandera, Wagga Wagga for instance) would help international readers.

I would go so far as deleting the greenfield analyses as this is purely hypothetical and won't be of any practical value to policy makers or clinicians alike, unless there are plans to completely overhaul the HEMS system.

Without some clarity regarding the above points, its very difficult to read the results section and work out what the author is trying to convey

The discussion could do with more explanation of the implications of the results of each modelling method - what is the trade-off between response time and coverage. Does a response time difference of 5-10 minutes matter? What would be the cost of installing a new HEMS base and the potential costs/benefits?

**Are the methods appropriate and well described?**
If not, please specify what is required in your comments to the authors.

No

**Does the work include the necessary controls?**
If not, please specify which controls are required in your comments to the authors.

Unable to assess

**Are the conclusions drawn adequately supported by the data shown?**
If not, please explain in your comments to the authors.

Yes
Are you able to assess any statistics in the manuscript or would you recommend an additional statistical review?
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