

Impact of helicopter emergency medical services in major incidents: systematic literature review

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ABSTRACT

Introduction: Helicopter emergency medical services (HEMS) aim to bring highly specialised crews to the major incident for triage, treatment and transport. When the site is difficult to access, HEMS may be the only mode of transportation of both personnel and patients. This systematic review will identify, describe and appraise literature regarding the role of HEMS in medical response to major incidents. We aim to improve knowledge on HEMS role in a major incident and provide a basis for future research.

Methods and analysis: A systematic literature review will be conducted with search phrases that combine HEMS and major incidents to identify when and how HEMS have been used. Included literature will be subject to quality appraisal and data extraction.

Ethics: No ethical approval is sought because this is a literature review. It will be submitted to a peer-reviewed journal and the PRISMA guidelines will be followed.

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INTRODUCTION

A major incident is any incident where the location, number, severity or type of casualties requires extraordinary resources.¹ In 2011, an estimated 332 natural disasters killed over 30 000 people, affected more than 240 million people and caused economic damages for over US\$300 billion, with the Tohoku earthquake and tsunami in Japan being the most expensive natural disaster ever recorded.²

Helicopter emergency medical services (HEMS) aims to bring a highly specialised crew to the incident for triage, treatment and provide a time-efficient way of transporting patients directly to trauma centre for definitive care.³⁻⁴ When the site is difficult to access, HEMS may be the only mode of transportation that is viable for both personnel and patients.⁴⁻⁵ The triage system in use has to be valid and reliable to prevent both overtriage and undertriage.⁶⁻⁷ When specially trained personnel perform the triage, hospitals may avoid reaching their surge capacity.⁶⁻¹⁰ The HEMS crew may also provide an overview of

ARTICLE SUMMARY

Article focus

- We aim to identify, describe and appraise relevant literature regarding the role of helicopter emergency medical services (HEMS) in medical response to major incidents.

Key message

- Collecting and reviewing data from previous experiences may improve the role of HEMS in medical response to major incidents.

Strengths and limitations of this study

- The major strength of this article is that it is a systematic literature review.
- The main limitation is that only English and Scandinavian languages are included.

in-hospital resources, thereby increasing the probability of getting the right patient to the right place in the right time.¹¹ However, HEMS crew combinations may differ from country to country.¹²

In previous literature, death and disease have been the most common outcomes evaluated, while discomfort, disability, dissatisfaction and depth (cost) were infrequently measured.¹³ Earlier reviews have tried to determine whether HEMS, compared to ground emergency medical services (GEMS), improve mortality and morbidity, although morbidity was difficult to assess.³⁻¹⁴ A meta-analysis on the percentage of HEMS patients transported with non-life-threatening injuries has been performed.¹⁵ Other reviews, with non-systematic design, have aimed to determine outcomes in literature,¹⁶⁻¹⁷ identify patients that will benefit from HEMS,¹⁸ costs¹⁹ and survival benefits.²⁰ Assessment of results is difficult because of the heterogeneity of literature.

This systematic review will identify, describe and appraise literature regarding the role of HEMS in medical response to major incidents. We aim to improve knowledge on HEMS role in a major incident and provide the basis for future research.

**Box 1** Quality appraisal

Internal validity (yes, no, not applicable)

Is the author a person directly involved in the major incident medical response?

Does the literature provide reference to where the data were obtained?

Does the literature provide reference to how the data were obtained?

Do the authors have conflicts of interest?

Has an ethics committee approved the reporting?

External validity

Does the literature describe the local emergency medical services (EMS) and helicopter emergency medical services (HEMS) structure before the incident?

Is the major incident clearly described?

Are the medical resources used in the major incident response clearly described?

Does the literature report the type, number and capacity of HEMS?

Are there indications on missing data?

Are other limitations discussed?

Is the study design clearly explained?

METHODS**Study selection**

Search terms include 'Air Ambulance' AND 'Major Incidents' (see additional file I for search strategy). The search will include papers published in the period from 1946 to date of search.

Databases:

- ▶ MEDLINE
- ▶ EMBASE
- ▶ Cochrane
- ▶ Web of Knowledge
- ▶ Swemed
- ▶ Norart
- ▶ Scopus
- ▶ CINAHL
- ▶ PsycINFO

Grey literature will not be included. Previous experience has shown that this generates a large workload without results.²¹

Inclusion criteria:

- ▶ Literature describing the role of HEMS in medical response to major incidents.
- ▶ Original manuscripts.

Exclusion criteria:

- ▶ Articles in languages other than English and Scandinavian.
- ▶ Articles without abstract.
- ▶ Book chapters.
- ▶ Letters to the editor, comments and editorials.

One author (ASJ) will scan titles and abstracts and exclude articles clearly not meeting the inclusion criteria. Uncertain articles based on abstract will be subjected to consensus among all the authors. The remaining articles will be derived in full-text and divided

Box 2 Different terms and characteristics that will be extracted from the included articles.

Data extraction—does the included literature report the following:

Pre-incident data on affected area

- ▶ Basic information on affected area?
- ▶ Basic information on affected population?
- ▶ Accessibility in the region?
- ▶ Other preincident data on the affected area?

Helicopter emergency medical services (HEMS) characteristics

- ▶ Population covered by HEMS?
- ▶ HEMS service area?
- ▶ Type of helicopter?
- ▶ Crew combination
 - In everyday operations?
 - During a major incident?
- ▶ Operating hours?
- ▶ Previous experiences with major incidents?
- ▶ Other HEMS characteristics?

Incident characteristics

- ▶ Time, date and place?
- ▶ Description of incident and the damage it caused?
- ▶ Number of dead?
- ▶ Number of injured
 - Severely, moderately, slightly?
- ▶ Total number of victims involved?
- ▶ Scene access?
- ▶ Distance to hospitals?
- ▶ Other incident characteristics?

Incident response

- ▶ How the major incident was declared?
- ▶ The timeline for the medical response?
- ▶ Who participated
 - Personnel (health, fire, police, military)?
 - Transports?
 - Voluntary organizations?
- ▶ What tasks they preformed?
- ▶ Which prehospital resources were lacking?
- ▶ Prehospital surge capacity?
- ▶ Patient logistics?
- ▶ Hospital surge capacity?
- ▶ HEMS
 - Number of crews involved?
 - Time from alarm to arrival at scene?
 - Information received from scene and ambulance dispatch centre?
 - Did they bring extra crew?
 - Did they bring extra equipment?
 - Number of patients transported by HEMS?
 - Which hospitals received the patients?
 - Were other responsibilities described?
 - Were other tasks preformed?
- ▶ Communication?
- ▶ Scene safety?
- ▶ Other incident response data?

Patient characteristics

- ▶ All age groups involved?
- ▶ Classification of injury?
- ▶ Triage at first evaluation?
- ▶ Triage before transport?
- ▶ Injury score reported?
- ▶ Medical illnesses reported and classified?
- ▶ Other patient characteristics?

Other relevant information reported?

among the authors in pairs (ASJ and MR, SF and SJMS) and screened further for eligibility according to inclusion and exclusion criteria listed above. The articles excluded in this phase will be listed with reason in the final article. Reference lists of included literature will be scanned to identify relevant literature. Authors of included articles with email listed will be contacted if necessary. ASJ will perform a quality appraisal (box 1) to depict the internal and external validity of the literature at hand and extract pre-defined data from included articles. Data extraction (box 2) will aim to describe the incident background and how HEMS contribute on the scene of the major incident with resources and transportation. Data extraction variables will be entered into a template²² (box 2) which has been pilot tested on four randomly selected articles. The results of quality appraisal and data extraction will be double-checked by another author. Included articles will be described separately, but articles describing the same major incident will be compared and grouped.

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REFERENCES

- Advanced Life Support Group. Major Incident Medical Management and Support (MIMMS). 2nd edn. BMJ Publishing Group, 2002.
- Guha-Sapir D, Vos F, Below R, *et al*. Annual Disaster Statistical Review 2011. Brussels, Belgium: Centre for Research on the Epidemiology of Disasters (CRED), Institute of Health and Society (IRSS), Université catholique de Louvain, 2012:1–52. http://www.cred.be/sites/default/files/ADSR_2011.pdf (accessed 30 May 2013).
- Butler DP, Anwar I, Willett K. Is it the H or the EMS in HEMS that has an impact on trauma patient mortality? A systematic review of the evidence. *Emerg Med J* 2010;27:692–701.
- Assa A, Landau D-A, Berenboim E, *et al*. Role of air-medical evacuation in mass-casualty incidents—a train collision experience. *Prehosp Disaster Med* 2009;24:271–6.
- Lyon RM, Sanders J. The Swiss bus accident on 13 March 2012: lessons for pre-hospital care. *Crit Care* 2012;16:138.
- Hasler RM, Kehl C, Exadaktylos AK, *et al*. Accuracy of prehospital diagnosis and triage of a Swiss helicopter emergency medical service. *J Trauma Acute Care Surg* 2012;73:709–15.
- Aylwin CJ, König TC, Brennan NW, *et al*. Reduction in critical mortality in urban mass casualty incidents: analysis of triage, surge, and resource use after the London bombings on July 7, 2005. *Lancet* 2006;368:2219–25.
- Frykberg ER, Tepas J. Terrorist bombings. *Ann Surg* 1988;208:569–76.
- Hirshberg A, Scott BG, Granchi T, *et al*. How does casualty load affect trauma care in urban bombing incidents? A quantitative analysis. *J Trauma* 2005;58:686–95.
- Lenquist S. *Medical response to major incidents and disasters*. Heidelberg: Springer-Verlag, 2012:78.
- Stohler SA, Jacobs LM, Gabram SG. Roles of a helicopter emergency medical service in mass casualty incidents. *J Air Med Transp* 1991;10:7–13.
- Krüger AJ, Skogvoll E, Castrén M, *et al*. Scandinavian pre-hospital physician-manned emergency medical services—same concept across borders? *Resuscitation* 2010;81:427–33.
- Brice JH, Garrison HG, Evans AT. Study design and outcomes in out-of-hospital emergency medical research: a ten year analysis. *Prehosp Emerg Care* 2000;4:144–50.
- Galvagno SM Jr, Thomas S, Stephens C, *et al*. *Helicopter emergency medical services for adults with major trauma (review)*. The Cochrane Library, 2013.
- Bledsoe BE, Wesley AK, Eckstein M, *et al*. Helicopter scene transport of trauma patients with non life-threatening injuries: a meta-analysis. *J Trauma* 2006;60:1257–65.
- Thomas SH, Harrison TH, Buras WR, *et al*. Helicopter transport and blunt trauma mortality: a multicenter trial. *J Trauma Inj Infect Crit Care* 2002;52:136–45.
- Thomas SH. Helicopter emergency medical services transport outcomes literature: annotated review of articles published 2004–2006. *Prehosp Emerg Care* 2007;11:477–88.
- Thomas SH, Biddinger PD. Helicopter trauma transport: an overview of recent outcomes and triage literature. *Curr Opin Anaesthesiol* 2003;16:153–8.
- Taylor CB, Stevenson M, Jan S, *et al*. A systematic review of costs and benefits of helicopter emergency medical services. *Injury* 2010;41:10–20.
- Ringburg AN, Thomas SH, Steyerberg EW, *et al*. Lives saved by helicopter emergency medical services: an overview of literature. *Air Med J* 2009;28:298–302.
- Fattah S, Rehn M, Reiherth E, *et al*. Templates for reporting pre-hospital major incident medical management: systematic literature review. *BMJ Open* 2012;2:e001082.
- Higgins JP, Green S, eds. *Cochrane handbook for systematic reviews of interventions* [Internet]. 5th edn. The Cochrane Collaboration; [cited 2013 Jan 30]. <http://handbook.cochrane.org>

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