Utilisation of helicopter emergency medical services in the early medical response to major incidents: a systematic literature review

Anne Siri Johnsen, Sabina Fattah, Stephen J M Sollid, Marius Rehn

ABSTRACT

Objective: This systematic review identifies, describes and appraises the literature describing the utilisation of helicopter emergency medical services (HEMS) in the early medical response to major incidents.

Setting: Early prehospital phase of a major incident.

Design: Systematic literature review performed according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. MEDLINE, EMBASE, the Cochrane Central Register of Controlled Trials, the Web of Science, PsycINFO, Scopus, Cinahl, Bibsys Ask, Norart, Svemed and UpToDate were searched using phrases that combined HEMS and ‘major incidents’ to identify when and how HEMS was utilised. The identified studies were subjected to data extraction and appraisal.

Results: The database search identified 4948 articles. Based on the title and abstract, the full text of 96 articles was obtained; of these, 37 articles were included in the review, and an additional five were identified by searching the reference lists of the 37 articles. HEMS was used to transport medical and rescue personnel to the incident and to transport patients to the hospital, especially when the infrastructure was damaged. Insufficient air traffic control, weather conditions, inadequate landing sites and failing communication were described as challenging in some incidents.

Conclusions: HEMS was used mainly for patient treatment and to transport patients, personnel and equipment in the early medical management of major incidents, but the optimal utilisation of this specialised resource remains unclear. This review identified operational areas with improvement potential. A lack of systematic indexing, heterogeneous data reporting and weak methodological design, complicated the identification and comparison of incidents, and more systematic reporting is needed.

Trial registration number: CRD42013004473.

INTRODUCTION

Major incidents remain a major global health challenge. In 2013, natural-triggered disasters killed more than 20 000 people, created almost 100 million victims and caused enormous economic damage worldwide. These numbers are only for natural disasters and do not take into account other types of major incidents. Major incidents are characterised by the need for an extraordinary medical response. They are heterogeneous by nature and their unexpectedness remains a challenge for emergency medical services (EMS). Fundamental for an effective major incident response is a robust and resilient EMS system. These systems can provide rapid access to advanced major incident management to improve patient outcome and optimise resource allocation as demand often exceeds capacity.

Helicopters are obvious resources in major incident management through their capacity to bring specialised teams and equipment to incident scenes. They can also transport patients, provide search and rescue services, and perform overhead surveillance. When a site is remote or difficult to access, helicopters may be the only way to transport personnel, equipment and patients in and out of it. Following the first organised use of helicopters for military medevac during the Korean War, the use of helicopters for civilian patient transport was introduced in the USA in the early 1970s. It was later integrated as helicopter EMS (HEMS) in most high-income countries. Although HEMS is embedded in most emergency response plans, the optimal...
use of this limited resource in the early medical management of major incidents remains unclear.

We aimed to systematically identify, describe and appraise the literature that describes the utilisation of HEMS in the early medical response to major incidents, to better address common challenges and to facilitate future research.

METHODS

Study identification

The protocol was published prior to conducting the literature search and registered in PROSPERO (CRD42013004473). A comprehensive literature search was performed to identify all relevant articles available as of 19 March 2015. The following databases were searched: MEDLINE, EMBASE, the Cochrane Central Register of Controlled Trials, the Web of Science, PsyINFO, Cinahl, Bibsys Ask, Norart, Svemed and UpToDate. An additional search was performed in PubMed in order to retrieve articles that had not yet been entered into MEDLINE. The search was designed using Medical Subject Headings and related terms as keywords. This search was then adapted for use in the other databases (see online supplementary additional file I). In the absence of universally accepted nomenclature, literature that defined their incident as a major incident or disaster was included.

Study eligibility and selection

Inclusion criteria:

Articles that describe the use of HEMS in the early medical management of a major incident.

Exclusion criteria:

▸ Articles in languages other than English and Scandinavian

▸ Articles without abstracts

▸ Book chapters, conference abstracts, letters to the editor and editorials

▸ Inclusion of commentaries

▸ Exclusion of literature where:
  – Only fixed-wing aircraft were used
  – Helicopters without dedicated medical capacity were used
  – Incidents were considered to be part of military conflicts
  – HEMS was used in the later recovery phase of the response.

The reason for the inclusion of commentaries was that these did not provide less relevant information than case reports. Exclusion criteria were adjusted to better target civilian medical helicopter response to major incidents in the acute phase.

Search findings

All studies were collected in an Endnote bibliographic database (2011; Thomson Reuters, USA). One author (ASJ) scanned the titles and abstracts, and excluded articles that clearly did not meet the inclusion criteria. Full-text versions of the remaining articles were obtained and divided among pairs of authors (ie, ASJ and MR, SF and SJMS) for further screening, using the criteria listed above. Excluded articles were listed with the reason(s) for exclusion. If there was any uncertainty about whether a study should be included, there was a discussion until a consensus was reached among all of the authors. The reference lists of the studies that were included initially were examined individually to identify the additional relevant literature.

Data extraction and appraisal

ASJ appraised the quality of the included studies and extracted predefined data from the included articles into an Excel spreadsheet (2010; Microsoft, USA). Data extraction included the demography of incident area and characteristics regarding HEMS, major incident, incident response and patient characteristics. The data extraction variables were pilot-tested on four randomly selected articles before the protocol was published. The appraisal items were selected by the authors, and aimed to describe the internal and external validity of the included studies. All data extraction and appraisal results were agreed on by another co-author.

RESULTS

Literature search

The search identified 4948 records (2763 after duplicates were removed), and the full-text versions of 96 articles were obtained. Of these, 37 articles were included in the study, and an additional 549–53 were identified by searching through the reference lists of the 37 articles. Thus, the review included a total of 42 articles (table 1), with 59 articles excluded for various reasons (see online supplementary additional file II). The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) diagram (figure 1) shows the inclusion and exclusion of articles in the different phases of this review.

Data extraction

None of the included articles contained all of the items on the data extraction list (figure 2). Basic information about the affected area was described in 12 articles (29%), information about the affected population in 24 (57%) and scene access in 29 articles (69%). Most papers described the characteristics of the incident. A timeline for the incident response was present in 25 articles (59%) and a description of personnel in 35 (85%) articles. In 12 (29%) of the articles, there was a lack of resources, prehospital surge capacity was reported in 2 (5%), and the response time was documented in 19 articles (45%). Communications and coordination were described in 34 articles (81%), and were in most cases failing. Scene safety was reported to...
| Method                      | Described use of HEMS                                                                                                                                                                                                 |
|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Afzali et al\(^6\)          | Brought extra equipment for advanced life support. HEMS doctor was Medical Incident Officer in three major incidents                                                                                                  |
| Almersjø et al\(^9\)        | Performed search and rescue and secondary transfers                                                                                                                                                                    |
| Ammons et al\(^7\)          | Evacuated the most severely injured patients to hospitals and brought extra equipment to the scene. Air-medical crews assisted ground units in triage and treatment. Transportation of casualties from the remotely located scene to trauma centres. Allowed distribution of patients between various centres in the region |
| Assa et al\(^7\)            |                                                                                             |
be an issue in 18 reports (43%), and this was related to issues such as inadequate air traffic control, active shooters, inadequate landing sites and bad weather. HEMS tasks included patient evacuation and transport from scene as well as transport of supplies, personnel and equipment to the scene. The literature also described HEMS being used for secondary transport, treatment, leadership and on-scene triage. In addition, HEMS was

| Table 1 Continued |
|-------------------|
| Method | Described use of HEMS |
| Leiba et al | Case report describing the same incident as Assa. The DISAST-CIR methodology of reporting also used by Schwartz |
| Primary transport of injured to different hospitals ensuring that the closest hospital did not reach surge capacity |
| Lockey et al | Case report describing the same incident as Bland |
| Deployed staff and equipment to the scenes and staff from home to the hospitals. Allowed rapid deployment in difficult traffic conditions |
| Lyon and Sanders | Commentary of a case report |
| Brought pre-hospital doctors to the scene for medical incident command and advanced interventions. Transported the patients directly to specialist paediatric trauma centres |
| Malik et al | Observational study of scoring systems in a major incident in remote area |
| Transformed personnel to the incident. Secondary transport of priority I patients to trauma centre |
| Marchenke et al | Case report, interviewing all participating HEMS members involved |
| Triage, treatment and transport of patients from earthquake |
| Martin | Case report |
| Helicopter and personnel present at event. Tasks not specified |
| Matsumoto et al | Case report |
| Mainly used for patient transportation and evacuation. Also transported food, water and generators to destroyed hospitals |
| Nates | Case report and review of literature. Describing same type of incident as Bovender and Cocanour |
| Transport of patients from damaged hospital, vital in evacuation because of damaged roads |
| Nia et al | Case report and survey of survivor’s opinions about health response |
| Evacuated injured from the earthquake zone and brought resources and equipment to affected area |
| Nicholas and Oberheide | Case report describing the same incident as Ammons |
| Transport from primary to secondary health care facility. Brought supplies to scene |
| Nocera and Dalton | Two case reports |
| Transport of experienced crew to the scene. Performed advanced life-saving procedures in one of the incidents |
| Oestern et al | Case report describing the same incident as Iselius |
| Transported patients to more remote hospitals |
| Pokorny | Case report |
| Evacuation of victims in flooded area, otherwise not specified. |
| Romundstad et al | Case report |
| Arriving HEMS doctor was appointed Medical Incident Commander and organized medical resources in teams. Transported some of the patients to more remote hospitals |
| Schwartz and Bar-Dayan | Case report presented in DISAST-CIR methodology for uniform presentation. Leiba 2009 used same methodology |
| Patient transport of the most seriously injured patients |
| Sollid et al | Case report |
| Flew out extra personnel and stretchers. Triaged and treated patients acted as medical incident commander and transported the most severely injured from one of the incident sites |
| Spano et al | Case report |
| Brought personnel and equipment to site and evacuated the patients when weather allowed |
| Stohler et al | Retrospective review of four major incidents. Same incidents as Jacobs |
| The responses included bringing extra personnel and equipment to scene, triage, medical treatment, air surveillance and transport |
| Urquieta and Varon | Case report |
| Triage and transport of severely injured victims |
| Yi-Szu et al | Case report, analysing patterns and outcomes of patients with chest injuries |
| Secondary transport of patients from field hospitals in earthquake zone. |
in some incidents utilised for search and rescue, and for air surveillance (table 1).

**Appraisal**

We sought to identify data items related to internal and external validity. Of the included articles, 19 (45%) contained references to where the data were obtained. We found 5 articles (12%) that reported no conflicts of interests and 1 (2%) that reported a conflict of interests. No articles reported they had ethical approval, although 1 (2%) stated that such approval was not needed. The description of both the HEMS and EMS structure before the incident was described in 12 (29%), whereas 7 articles (17%) described HEMS alone. The incident itself was clearly described in 40 articles (95%). Study limitations were discussed in 5 (12%), and the study design was described in 32 articles (76%). The quality appraisal findings are shown in figure 3. The study methodology was as follows: Of the 42 included studies, 37 (88%) were case reports, 2 (5%) observational studies, 2 (5%) reviews, and 1 (2%) was a summary of the use of HEMS combined with a case report (table 1).

**DISCUSSION**

This systematic literature review found little or no systematic reporting of the utilisation of HEMS in the early medical management of major incidents. HEMS were most often reported to be used in patient evacuation and transport from the scene, and in transport of supplies and personnel to the incident scene (table 1). Data relevant to depict internal and external validity, such as reference to data source and handling of missing data, were lacking (figure 3). Further, the heterogeneity of the literature and the overall weak methodological design made it difficult to evaluate the contribution of HEMS to the management of major incidents.

The included incidents had various logistical and geographical challenges. In the 7/7 London terrorist bombings in 2005, a helicopter was used to deploy staff and equipment to urban scenes when road access was difficult. Use of a helicopter also allowed the deployment of staff from home at a time when public transportation was inaccessible in the city. In the 22/7 Utøya terrorist shootings in 2011, additional medical personnel were brought to the scene, which this time was a rural area with overloaded provincial roads. Other studies described how HEMS facilitated the transport of victims to the hospital, especially when the scene of the incident was difficult to access. HEMS also helped in secondary transfers of patients with particular needs, such as transporting patients to dedicated burns units. Although scene safety remains a foremost priority in major incident management, this was discussed in less than half of the studies. The inability to fly due to bad weather and the lack of designated landing sites were described as operational hazards. Further, HEMS involvement in major incident management often
involved multiple aircraft operating in uncontrolled airspace, indicating insufficient air traffic control. Future improvements in aviation traffic awareness systems, navigation, and crew training may mitigate the aviation risks. Crew training may also reduce the risk of human errors. Future improvements in aviation traffic awareness systems, navigation, and crew training may mitigate the aviation risks. Crew training may also reduce the risk of human errors.

Figure 2
Data extraction.

| Johnsen AS, et al. | BMJ Open 2016;6:e010307. doi:10.1136/bmjopen-2015-010307 |
|------------------|-------------------------------------------------|
|                  | Basic info on affected area                     |
|                  | Basic information on affected population        |
|                  | Accessibility in the region                     |
|                  | Other relevant pre-incident information         |
|                  | Population covered by HEMS                     |
|                  | Type of helicopter                              |
|                  | Crew combination - in everyday operations and in major incidents |
|                  | Operating hours                                 |
|                  | Previous experiences with major incidents      |
|                  | Other HEMS characteristics                      |
|                  | Time, date and place of major incident          |
|                  | Description of incident and the damage it caused|
|                  | Consequences: number deceased                   |
|                  | Consequences: number patients with major, moderately and slightly injured |
|                  | Total number of victims involved                |
|                  | Scene access                                    |
|                  | Distance to hospital                            |
|                  | Other incident characteristics                  |
|                  | All age groups involved                         |
|                  | Classification of injury severity               |
|                  | Triage at first evaluation on scene             |
|                  | Triage before transport to next immediate level of care |
|                  | Median/mean injury score reported               |
|                  | How medical illness was reported and classified |
|                  | Other patient characteristic descriptors        |
The heterogeneous nature of major incidents is reflected by the lack of a common nomenclature. Several definitions of a major incident have been proposed that differ slightly from each other. To avoid excluding relevant articles, literature that defined their incident as a major incident or disaster was included.

How was the major incident declared?
- The timeline for the medical response
- Who participated – personnel (health, fire, police, military, voluntary organizations)
- Who participated – transport
- What tasks did they perform?
- Which prehospital resources were lacking?
- Prehospital surge capacity
- HEMS: number of crews
- Estimated arrival time from alarm
- Information received
- Bring extra crew
- Extra equipment
- Number of patients transported by HEMS
- Which hospitals received patients?
- Did HEMS have other responsibilities?
- Did HEMS have other tasks?
- Communication and coordination described
- Scene safety described
- Other incident response data described
Our findings emphasise that a universally accepted definition of major incident is needed to facilitate comparative studies and to improve the accuracy of database indexing.

Our appraisal found that the majority of the included articles provided detailed descriptions of the incidents but that there was a tendency towards inadequate descriptions of the everyday HEMS system. The lack of...
baseline data made it difficult to evaluate the deployment and utilisation of extraordinary resources during major incidents. The methodological designs were generally weak and dominated by retrospective observational case reports. This is not surprising considering the difficulties in planning and executing prospective studies on major incidents. With an established template of standardised variables, a prospective study design can, however, be established to collect data from major incidents. If similar data are collected from major incident exercises in similar systems, a case–control design can even be applied to future studies. Such studies can be further strengthened by including other data sources such as focus group interviews from involved personnel in the sense of method triangulation. We also found that some incidents were described by several reports, indicating possible skewedness in the literature regarding high-profile incidents. As with all unstructured reporting, establishing a denominator for HEMS involvement proved difficult, again highlighting that future research should build on systematically collected data with uniform variable definitions to allow better comparisons.

Limitations
The authors selected items for use in data extraction and appraisal that they assumed were relevant. However, these items do not represent a reference standard, since such a standard does not exist, to our knowledge.

Many major incidents occur in non-English-speaking countries; accordingly, it is a weakness that only articles in English and the Nordic languages were included. However, the included articles described incidents on different continents, which improve the generalisability of the findings. Further, we may have failed to identify some relevant studies, since articles without abstracts were not included, and a single author performed the initial screening.

Conclusion
This systematic literature review identified, described and appraised the literature on the utilisation of HEMS in the early medical management of major incidents. Heterogeneous data reporting complicated our efforts to identify and evaluate the overall utilisation of HEMS in such incidents. To address such shortcomings, systematic uniform reporting of HEMS in major incidents is called for.

Author affiliations
1Department of Research and Development, Norwegian Air Ambulance Foundation, Drobak, Norway
2Department of Health Studies, Faculty of Social Sciences, University of Stavanger, Stavanger, Norway
3Department of Anaesthesiology, Oslo University Hospital, Oslo, Norway
4Anesthesia and Critical Care Research Group, Faculty of Health Sciences, University of Tromsø, Tromsø, Norway
5London’s Air Ambulance, Royal London Hospital, Barts Health Trust, London, UK

Acknowledgements The authors thank Marie Isachsen, Ullervå University Hospital Library, Oslo, Norway, who designed and conducted the literature search.

Contributors ASJ and MIR conceived the study. ASJ, MIR, SJMS and SF took part in study design, data analysis and writing of the manuscript, and approved the final version of the manuscript.

Funding All of the authors are employed by the Norwegian Air Ambulance Foundation, which played no part in the study design, data collection, data analysis, or manuscript preparation processes.

Competing interests None declared.

Provenance and peer review Not commissioned; externally peer reviewed.

Data sharing statement No additional data are available.

Open Access This is an Open Access article distributed in accordance with the Creative Commons Attribution Non Commercial (CC BY-NC 4.0) license, which permits others to distribute, remix, adapt, build upon this work non-commercially, and license their derivative works on different terms, provided the original work is properly cited and the use is non-commercial. See: http://creativecommons.org/licenses/by-nc/4.0/

REFERENCES
1. Guha-Sapir D, Hoyois P, Below R. Annual disaster statistical review 2013: the numbers and trends. Brussels: Cred, 2014. http://www.cred.be/sites/default/files/ADSR_2013.pdf (accessed 3 Sep 2015).
2. Sasser S,Varghese M, Kellermann A, et al. Prehospital trauma care systems. Geneva: World Health Organization, 2005.
3. Aylwin C, 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.
4. Sasser S. Field triage in disasters. Prehosp Emerg Care 2006;10:322–3.
5. 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.
6. Furukawa K, Kubo K. Accident of Japan Air Lines Flight 123 Boeing 747. Aircraft and dealing with the disaster. J Med Leg Droit Med 1994;37:157–56.
7. Assa A, Landau DA, Berenboim E, et al. Role of air-medical evacuation in mass-casualty incidents—a train collision expense. Prehosp Disast Med 2009;24:271–6.
8. Stohler SA, Jacobs LM, Gabram SGA. Roles of a helicopter emergency medical service in mass casualty incidents. J Air Med Transp 1991;10:7–13.
9. Spro S, Campagne D, Stroh G, et al. A lightning multiple casualty incident in Sequoia and Kings Canyon national parks. Wilderness Environ Med 2015;26:43–53.
10. Driscoll RS. New York chapter history of military medicine award. U.S. Army medical helicopters in the Korean war. Mil Med 2001;166:290–6.
11. Jacobs LM, Bennett B. A critical care helicopter system in trauma. J Natl Med Assoc 1989;81:1157–67.
12. Taylor C, Jan S, Curtis K, et al. The cost-effectiveness of physician staffed Helicopter Emergency Medical Service (HEMS) transport to a major trauma centre in NS, Australia. Injury 2012;43:1843–9.
13. Salimi J, Khaji A, Kashayar P, et al. Helicopter emergency medical system in a region lacking trauma coordination (experience from Tehran). Emerg Med J 2009;26:361–4.
14. Krüger AJ, Skogvoll E, Castrén M, et al. Scandinavian pre-hospital physician-managed Emergency Medical Services—Same concept across borders? Resuscitation 2010;81:427–33.
15. Johnsen AS, Fattah S, Solid SJM, et al. Impact of helicopter emergency medical services in major incidents: systematic literature review. BMJ Open 2013;3:e003335.
16. Afzali M, Hessefeldt R, Steinmetz J, et al. A helicopter emergency medical service may allow faster access to highly specialised care. Dan Med J 2013;60:1–5.
17. Ammons MA, Moore EE, Pons PT, et al. The role of a regional trauma system in the management of a mass disaster: an analysis of the Keystone, Colorado, chairlift accident. J Trauma 1998;28:1449–71.
18. Bland SA. HEMS training and the 7th July 2005: a personal perspective. J R Nav Med Serv 2006;92:130–5.
Open Access

19. Bovender JO Jr, Carey B. A week we don’t want to forget: lessons learned from Tulane. Front Health Serv Manage 2006;23:3–12.; discussion 25–30.

20. Brandstrom H, Sedig K, Lundalv J, Kamedo 77. MS Sleipners försörjning. Socialstyrelsen. 2003:1043-2003-123-7_20031238.pdf (accessed 1 Oct 2015)

21. Buerk CA, Batdorf JW, Cammack KV, et al. MGM Grand Hotel Fire: lessons learned from a major disaster. Arch Surg 2004;139:999–1006.

22. Buhrer S, Tilney P. Blast lung injury in a 20-year-old man after a home explosion. Air Med J 2012;31:10–12.

23. Carlasco DR, McSharry MC, LeJeune CJ, et al. Air medical response to the 1990 Will County, Illinois, Tornado. J Air Med Transp 1991;10:7–16.

24. Cassuto J, Tarnow P. The discotheque fire in Gothenburg 1998. Burns 2003;29:405–16.

25. Cocanour CS, Allen SJ, Mazabob J, et al. Lessons learned from the evacuation of an urban teaching hospital. Arch Surg 2002;137:1415–5.

26. Eckstein M, Cowen AR. Scene safety in the face of automatic fire detection—lessons learned from the MGM Grand Hotel Fire. J Emerg Med 2004;108–99.

27. Felix Jr WR. Metropolitan aeromedical service: state of the art. Scand J Trauma Resusc Emerg Med 2012;20:253–6.

28. Franklin JA, Wiese W, Meredith JT, et al. Hurricane Floyd. N C Med J 2000;61:384–9.

29. Iselius L, Kamedo—79. Tägolyckan i Tyskland 1998. Socialstyrelsen. 2004:123-3_20041233.pdf (accessed 1 Oct 2015)

30. Jacobs LM, Gabram SGA, Stohler SA. The integration of a helicopter emergency medical service in a mass casualty incident response system. Prehosp Disaster Med 1991;6:451–4.

31. Lavery GG, Horan E. Clinical review: Communication and logistics in mass-casualty incidents in Israel. Prehosp Disaster Med 2004;19:179–84.

32. Schwartz D, Bar-Dayan Y. Injury patterns in clashes between citizens and security forces during forced evacuation. Emerg Med J 2008;25:695–6.

33. Sollid SJ, Rosstad R, Renn M, et al. Oslo government district bombing and Uglya island shooting July 22, 2011: the immediate prehospital emergency medical service response. Scand J Trauma Resusc Emerg Med 2012;20:23–5.

34. Urquieta E, Varon J. Mexico City’s Petroleos Mexicanos explosion: disaster management and air medical transport. Air Med J 2015;33:309–13.

35. Yi-Szu W, Chung-Ping H, Tzu-Chi L, et al. Chest injuries transferred to trauma centres after the 1999 Taiwan earthquake. J Emerg Med 2003;29:405–16.

36. Almersjø O, Ask E, Brandeø K, et al. Brandon on passagerafjæran Scandinavian Star den 7 april 1990. Socialstyrelsen, 1998:1–51. https://www.socialstyrelsen.se/Lists/Artikelkatalog/Attachments/12697/1997-3-15.pdf (accessed 01 Oct 2015)

37. Brandsø, Haggmark T, Kulling P, et al. Kamedo-68. Estoniakatastrofen. Socialstyrelsen. SoS-rapport 1997:15. 2010:1–172.

38. Martin TE. The Ramstein Airshow Disaster. J R Army Med Corps 1990;136:19–26.

39. Nicholas RA, Oberheide JE. EMS response to a ski lift disaster in the Colorado mountains. J Trauma 1988;26:672–5.

40. Nocera A. Australian major incident nomenclature: it may be a ‘disaster’ but in an ‘emergency’ it is just a mess. ANZ J Surg 2001;71:162–6.

41. Advanced Life Support Group. Major incident medical management and support, the practical approach. Plymouth, UK: BMJ Publishing Group, 2011.

42. Lennquist S. Medical response to major incidents and disasters. Berlin Heidelberg: Springer, 2012.

43. Fattha S, Rehn M, Lockey D, et al. A consensus based template for reporting of pre-hospital major incident medical management. Scand J Trauma Resusc Emerg Med 2014;22:5.

44. Nickerson S, Davies JM, Maltby JR. Qualitative research in health care. Br J Anaesth 2000;84:552–5.

45. Hardy S. Major incidents in England. BMJ 2015;350:1712.