

ORIGINAL ARTICLE

SHOULD NEW SOUTH WALES HOSPITAL DISASTER TEAMS BE SENT TO MAJOR INCIDENT SITES?

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Background: The aim of the present review was to assess the suitability of hospital disaster medical teams' training, personal safety and medical equipment for site casualty work at multiple casualty incidents (MCI), and to compare this with retrieval teams who routinely provide pre-hospital trauma care. The options for the provision of a site medical response based upon international and Australian disaster planning guidelines are also reviewed.

Methods: A questionnaire was mailed to all doctors dispatched to the 1997 Thredbo disaster as part of trauma service (TS) hospital medical teams, medical commanders or Helicopter Emergency Medical Service (HEMS) crew. Doctors with Sydney retrieval services (SRS) experience were compared with those without SRS experience in regard to the reported level of relevant training and experience as defined by current Australian guidelines and the Education and Training in Disaster Medicine Curriculum, Scientific Committee of the International Society of Disaster Medicine. Familiarity with medical equipment was assessed, as was level of compliance with Australian guidelines for personal protective clothing and equipment.

Results: Responses were obtained from all 25 doctors. Nine had SRS experience. None of the 16 doctors without SRS experience met the criteria of the Education and Training Curriculum, compared with four of nine doctors with SRS experience (44%). All six SRS doctors using SRS equipment had personally used or checked their equipment within 2 weeks prior to dispatch to Thredbo, compared with none of the 19 doctors using hospital equipment. Of the 11 areas of personal safety equipment and clothing assessed, all SRS doctors using SRS equipment complied with the guidelines in five areas (45%). There was no area assessed in which all the doctors using hospital equipment complied.

Conclusion: Hospital medical teams suffer from the same problems of inadequate training, experience and personal safety equipment that are identified in previous reports from disasters overseas. The continued focus on hospital medical teams in counter-disaster planning as the primary source of on-site medical services is inappropriate because, with the exception of retrieval doctors who routinely provide pre-hospital trauma care, appropriately trained and experienced doctors are unlikely to be available from within the hospital system.

Key words: disaster planning, disaster site medical response, disaster training, hospital disaster medical teams, mass casualty incident.

INTRODUCTION

In July 1997, the Thredbo disaster resulted in 19 persons being buried under earth and building debris in a ski resort village, 400 km from Sydney, New South Wales (NSW). There were 18 fatalities and one survivor, who was located and extricated on the 3rd day. The rescue efforts spanned 8 days. Medplan (the NSW medical disaster plan) was activated and the response involved 29 doctors (25 from trauma service (TS) hospitals) and five nurses. The first TS hospital team was held at a town near Thredbo and was returned without having actually been at the incident site. The second TS hospital team arrived at the site ~ 9 h after the incident, with a further four rotated to the site during the following 7 days. The second and subsequent teams consisted of doctors only.

Medical teams for routine scene response to trauma in Sydney and adjacent regional areas are provided by two retrieval services, the NSW Medical Retrieval Service and the Sydney Aero-medical Retrieval Service. The authors postulated that, due to

their routine involvement in pre-hospital trauma management, doctors from the Sydney retrieval services (SRS) had more appropriate training and experience for disaster site work than teams drawn from hospitals or other services that do not routinely provide pre-hospital care. The present study reviews and compares the training, experience and equipment of doctors with and without SRS experience who were sent to Thredbo. Because the disaster produced only a single live casualty who was not severely injured, a review of medical team performance under multiple casualty incident or disaster conditions was not possible. Similarly, no review of nursing staff involvement was undertaken because only a single nurse attended the incident scene.

METHODS

In November 1997 a questionnaire was mailed to all doctors and nurses who attended the Thredbo disaster. Those from whom a reply had not been received within 3 weeks were contacted by phone and either encouraged to return the questionnaire or the information was obtained by telephone interview. Telephone interviews were also performed when information on the returned questionnaire was incomplete or unclear. Responses from doctors who were dispatched as part of TS hospital teams, medical commanders or helicopter emergency medical service (HEMS) crew have been reported in the present study.

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The responses were compared with the Education and Training in Disaster Medicine Curriculum of the Scientific Committee, International Society for Disaster Medicine (ISDM)¹ to assess the levels of training and experience. The ISDM is the only international disaster medicine organization that produces training guidelines for medical personnel who may be required to attend disaster sites. This curriculum divides the level of knowledge and practical skills into four tiers, from 0 (no knowledge or skill required) to 3 (essential, requiring detailed knowledge, competence and experience). It also lists the level of knowledge and skill required for each grade, from medical commander through specialists and other doctors at the scene to nursing and ambulance staff. Only areas in which the knowledge and skill is defined as level 3, namely essential, have been assessed. The commanders at Thredbo have been compared with the coordinator grade in the curriculum, that is, doctors in overall medical control at the scene; and other doctors from TS hospitals with the specialist grade.

Level 3 requirements for commanders and specialist doctors include classification of patients and triage, on-scene advanced trauma management including rescue equipment and tools, command and coordination, dispatch and transportation, communication techniques, and equipment and drugs. Criteria used to establish adequacy of training and experience in these areas were: (i) knowledge of the Ambulance Service of NSW triage and casualty tagging system; (ii) completion of the Early Management of Severe Trauma Course² (or equivalent) plus attendance at

five or more accident scenes; (iii) completion of the Major Incident Medical Management and Support course³ (the only formal course in scene management of mass casualty incidents available in NSW as at July 1997) or equivalent and the type of disaster exercises attended; (iv) medical retrieval experience, minimum of 20 transports; and (v) previous experience in radio operation and radio voice procedure.

The degree of familiarity of the respondent with their medical equipment was assessed.

Personal safety equipment and protective clothing supplied by either hospitals or the retrieval services were assessed for adequacy based on Australian guidelines for disaster medical team equipment.⁴

Doctors with Sydney retrieval service experience (SRS doctors) were compared with all other doctors sent as part of TS hospital teams or medical commanders. The results were subdivided by dispatch to the scene within, or after, the first 24 h of the incident. The medical and personal protection equipment used by SRS doctors is grouped with the non-SRS doctors if they were dispatched as part of a hospital team with hospital equipment.

RESULTS

Twenty-two of 25 questionnaires (88%) were returned by mail and further information was sought from 10 (40%) of these respondents by telephone interview. Three (12%) failed to return the ques-

Table 1. Comparison of training and experience of SRS and non-SRS doctors

	SRS doctors 1st 24 h (n = 5)	SRS doctors after 24 h (n = 4)	Total SRS doctors (n = 9)	Non-SRS doctors 1st 24 h (n = 5)	Non-SRS doctors after 24 h (n = 11)	Total non-SRS doctors (n = 16)
Knowledge of triage protocol	4 (80%)	2 (50%)	6 (67%)	1 (20%)	2 (18%)	3 (19%)
Knowledge of tagging system	4 (80%)	3 (75%)	7 (77%)	1 (20%)	3 (27%)	4 (25%)
EMST training	5 (100%)	4 (100%)	9 (100%)	3 (60%)	9 (82%)	12 (75%)
Pre-hospital trauma experience	5 (100%)	4 (100%)	9 (100%)	0 (0%)	4 (38%)	4 (25%)
MIMMS training	2 (40%)	2 (50%)	4 (44%)	1 (20%)	2 (18%)	3 (19%)
Exercises completed						
Paper exercise	4 (80%)	3 (75%)	7 (78%)	3 (60%)	4 (38%)	7 (44%)
Table top exercise	3 (60%)	3 (75%)	6 (67%)	1 (20%)	3 (27%)	4 (25%)
Hospital exercise with casualties	4 (80%)	2 (50%)	6 (67%)	1 (20%)	8 (73%)	9 (56%)
Practical site exercise without casualties	4 (80%)	2 (50%)	6 (76%)	2 (40%)	3 (27%)	5 (31%)
Interservice site exercise with casualties	3 (60%)	1 (25%)	4 (44%)	2 (40%)	1 (9%)	3 (19%)
Medical retrieval experience	5 (100%)	4 (100%)	9 (100%)	1 (20%)	2 (18%)	3 (19%)
Radio experience	5 (100%)	4 (100%)	9 (100%)	3 (60%)	6 (55%)	9 (56%)

SRS, Sydney retrieval services; EMST, early management of severe trauma; MIMMS, major incident medical management and support.

Table 2. Familiarity with medical equipment

	SRS doctors using SRS equipment (n = 6)	SRS doctors using hospital equipment (n = 3)	Non-SRS doctors using hospital equipment (n = 16)
Had not seen the equipment previously	0 (0%)	2 (67%)	8 (50%)
Had seen the equipment previously but had never personally used or checked it	0 (0%)	0 (0%)	3 (19%)
Had personally used or checked the equipment but > 6 months prior	0 (0%)	0 (0%)	4 (25%)
Had personally used or checked the equipment between 6 months and 2 weeks prior	0 (0%)	1 (33%)	1 (6%)
Had personally used or checked the equipment < 2 weeks prior	6 (100%)	0 (0%)	0 (0%)

SRS, Sydney retrieval services.

Table 3. Personal protection equipment and clothing

	Equipment provided by SRS, 1st 24 h (n = 5)	Equipment provided by SRS, after 24 h (n = 1)	Equipment provided by SRS, total (n = 6)	Equipment provided by hospital, 1st 24 h (n = 5)	Equipment provided by hospital, after 24 h (n = 14)	Equipment provided by hospital, total (n = 19)
Adequate warmth	4 (80%)	1 (100%)	5 (83%)	1 (20%)	9 (64%)	10 (53%)
Proper fit	5 (100%)	1 (100%)	6 (100%)	4 (80%)	12 (86%)	16 (84%)
Constructed of fire-retardant fabric	5 (100%)	1 (100%)	6 (100%)	2 (40%)	3 (21%)	5 (26%)
High visibility	5 (100%)	1 (100%)	6 (100%)	1 (20%)	11 (79%)	12 (63%)
Correctly fitting boots with ankle support	5 (100%)	1 (100%)	6 (100%)	2 (40%)	2 (14%)	4 (21%)
Leather gloves	5 (100%)	1 (100%)	6 (100%)	2 (40%)	5 (36%)	7 (37%)
Eye protection	2 (40%)	1 (100%)	3 (50%)	2 (40%)	2 (14%)	4 (21%)
Hearing protection	3 (60%)	1 (100%)	4 (67%)	0 (0%)	0 (0%)	0 (0%)
Respiratory protection	1 (20%)	0 (0%)	1 (17%)	0 (0%)	1 (7%)	1 (5%)
Helmet	2 (40%)	1 (100%)	3 (50%)	2 (40%)	11 (79%)	13 (68%)
Head torch	2 (40%)	0 (0%)	2 (33%)	2 (40%)	0 (0%)	2 (11%)

tionnaire and had all information obtained by telephone interview. A completed questionnaire was therefore obtained from all 25 doctors.

Table 1 compares the training and experience of SRS doctors with all other TS hospital doctors or commanders. No non-SRS doctor had both pre-hospital trauma management and medical retrieval experience. In addition no non-SRS doctor had worked on all three commonly used modes of patient transport, namely road ambulance, helicopter and fixed wing aircraft.

Familiarity with medical equipment is compared in Table 2, and personal protection equipment and clothing is compared in Table 3.

Two non-SRS respondents commented that they were unfamiliar with their medical equipment, another two stated that they did not know what their role was and a further two stated that they were not aware that there was a medical commander at the site. Six doctors using hospital equipment and one doctor using SRS equipment indicated that their clothing was inadequate for cold weather and required supplementation from sources such as ski shops and the ambulance service.

DISCUSSION

Experience from disasters overseas has demonstrated that the efficiency of medical personnel is impaired when performing unfamiliar tasks. Personnel performing their usual duties, the 'doctrine of daily routine',⁵⁻¹⁰ are seen as the basis for efficient medical operations. For this reason the value and practicality of hospital medical teams that are not regularly involved in pre-hospital trauma care have been questioned,⁷⁻¹² because skills acquired in the hospital do not necessarily translate to the scene of a disaster.¹³ Hospital teams often lack experience and training in the pre-hospital environment,^{8,14-20} may become a liability to other emergency service personnel,²¹ and may inhibit other emergency service personnel from performing their duties.⁸ The number of doctors actually required on scene is usually small, and by the time hospital teams arrive, doctors commonly outnumber remaining live casualties.^{14,15,21-24} These teams often have no established relationships with police, ambulance and firefighters,^{8,12,16} resulting in breakdowns in communication and discipline at the scene.^{14,25} Hospital teams may deplete receiving hospitals of staff when they are receiving peak casualty loads,²⁴

and frequently are unfamiliar with radios,²⁶ disaster triage principles¹⁸ and their own equipment.¹⁴ Medical equipment may be inadequate, resulting in depletion of ambulance service equipment.²⁷ Injuries to rescue workers are common,^{24,28} but many hospital teams have inadequate safety clothing and equipment.^{10,14-16,20,21,29,30} Major deficiencies in personal safety equipment have recently been identified as a problem in British hospital disaster medical teams.³¹ A nurse was killed by falling masonry at the site of the 1995 Oklahoma City bombing,³² and 60 people working on the Thredbo site required medical treatment.³³

The present study has demonstrated that these problems of inadequate training, experience and personal safety equipment in hospital teams documented at overseas disasters also occur in NSW. Surprisingly these problems continued to occur when hospital medical teams were dispatched more than 24 h after the incident, and with the benefit of detailed televised reports of conditions at the incident site to correct deficiencies in their clothing and equipment. In addition, the dispatching hospitals would have had time to locate and assemble teams that comprised only appropriately trained and experienced doctors who may not initially have been available.

The present study was unable to identify a single non-SRS doctor sent to Thredbo who met the criteria of the international guidelines. This suggests that, with the exception of those with SRS experience, doctors with appropriate training and experience may not be available from within the hospital system. Although SRS doctors were more likely to have appropriate training and experience, there were deficits in this group also.

In the present study 25% of non-SRS doctors had not completed the Early Management of Severe Trauma Course (EMST)² or equivalent, which has been accepted as the basis of trauma care at disasters in Australia.⁴ At the time of the Thredbo disaster, the only qualification necessary for doctors in hospital medical teams was current registration as a medical practitioner in NSW. Under Healthplan (the revision of Medplan issued in December 1997), doctors must now be senior practitioners with experience in anaesthesia, emergency or intensive care medicine. While this should improve the numbers with EMST training, it will not improve the numbers with pre-hospital trauma management knowledge and experience. Only three of 10 non-SRS specialist doctors (30%) in the present study had pre-hospital trauma management experience.

The lack of pre-hospital experience in the non-SRS doctors was also reflected in the level of familiarity with radios and radio voice procedure. Communication problems are a recurrently documented problem at disaster scenes.^{10,14,22-24,30,34,35} Poor radio voice procedure can compound these problems. Paramedics working at the Thredbo site reported delays of up to 30 min contacting non-SRS doctors by radio (K. Thompson, pers. comm. 1998). At times this resulted in these doctors being unaccounted for on a dangerous site with resources having to be diverted to locate them.

The NSW *Occupational Health and Safety Act (OHS) Act 1993* mandates that employers provide appropriate training and personal protective equipment to persons who may be required to work in a hazardous environment. Without such training and equipment, medical staff who treat patients in hazardous situations are at considerable risk of injury and are in contravention of the OHS Act. Given the mobility and turnover of medical and nursing staff within hospitals it would be difficult and expensive to provide ongoing training to enough staff to ensure a hospital could maintain a 24-h disaster response capability. Such training would also lack the real-life experience which is gained by those who regularly provide pre-hospital care.^{15,17}

Medical staffing of the SRS consists of doctors with specialist qualifications in anaesthesia, emergency or intensive care medicine or advanced trainees in addition to Special Casualty Access Team paramedic ambulance officers. There are two teams available for immediate dispatch and a further two teams on standby, 24 h a day, from a pool of ~ 30 specialists and seven registrars. Medical teams are trained in helicopter winch deployment and other rescue techniques to access patients in difficult locations. They have established relationships with the emergency services which are enhanced by having paramedics as team members. This combination of teams and vehicles provides the operational flexibility to respond immediately to accident scenes,³⁶⁻³⁹ remote or wilderness areas⁴⁰ or urgent interhospital transports. Physician-staffed teams that provide scene response to trauma also operate in other Australian states, notably Queensland and South Australia. State disaster medical plans should preferentially task these teams as the initial disaster site response. These teams could be targeted for more intensive training in disaster medicine to eliminate the remaining training deficits identified in the retrieval doctors in the present study. Similarly, their equipment stores could be enlarged to accommodate this expanded role, enabling routine retrieval activities to continue simultaneously.

The use of retrieval teams is an extension of the 'doctrine of daily routine' by maintaining the regular working relationship of the retrieval teams along with their medical equipment. This could not be achieved if traditional hospital medical teams had retrieval specialists included in them. Two of the three SRS doctors in the present study who were sent to Thredbo with hospital medical equipment had no previous experience with that equipment.

Improvements in extrication techniques have resulted in an on-site surgical presence at disasters rarely being required.^{7,8} If field amputation is required, it may not be possible to perform an amputation with a surgeon assisted by a second doctor with anaesthetic skills, due to limitations of space. Field amputation can also be taught to physicians⁴¹ and where access to trapped patients is severely limited, such as in an urban search and rescue situation like the Thredbo disaster, a physician experienced in resuscitation, analgesia and anaesthesia trained to perform field amputation can provide comprehensive care.⁴² At the

1995 Oklahoma City bombing a conscious trapped victim had a through-knee amputation performed by an orthopaedic surgeon with 10 mg of intramuscular midazolam when intravenous access could not be established.³² The patient remained conscious throughout.

Levels of safety equipment and clothing available to hospital medical teams in the present study were below the current Australian recommendations.⁴ This placed them at risk of serious injury, potentially making them a liability for other emergency services. The increased personal safety equipment which hospitals are now required to purchase under Healthplan, in accordance with these recommendations, carries significant cost implications. The cost of equipping a single staff member to the level of personal safety equipment and clothing currently used by one of the SRS (NSW Medical Retrieval Service) is > \$2000 per person. Equipment includes aramid fibre suits, Gortex® rainwear and thermal jackets plus all other equipment contained in the current Australian guidelines. Under Healthplan, TS hospitals in NSW must now provide two teams, that is, 12 people, and will have to carry extensive stocks of equipment to ensure that they have enough clothing of each size to cater for all possible combinations of staff members. Selectively improving SRS equipment where necessary would produce significant cost savings compared with the total cost of duplicating medical equipment and personal protective clothing in each of Sydney's six Area Health Services.

CONCLUSION

New South Wales hospital medical teams suffer from the same problems of inadequate training, experience and personal safety equipment identified in previous reports from disasters overseas. The continued focus on hospital medical teams in counter-disaster planning as the primary source of on-site medical services is inappropriate given legal and financial implications for hospitals facing increasing cost and resource pressures. Medical retrieval services who routinely provide pre-hospital trauma care can be developed to provide a more appropriate medical support to incident sites.

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