Advanced trauma life support training for ambulance crews (Review)

Sethi DD, Kwan I, Kelly AM, Roberts IG, Bunn F

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[Intervention Review]

Advanced trauma life support training for ambulance crews

Dinesh D Sethi[1], Irene Kwan[2], Anne-Maree Kelly[3], Ian G Roberts[4], Frances Bunn[5]

[1]WHO European Centre for Environment and Health, Rome 00187, Italy. [2]National Collaborating Centre For Women's and Children's Health, Royal College of Obstetricians & Gynaecologists, London, UK. [3]Department of Emergency Medicine, Western Hospital, Footscray, Australia. [4]Cochrane Injuries Group, London School of Hygiene & Tropical Medicine, London, UK. [5]Centre for Research in Primary and Community Care, University of Hertfordshire, Hatfield, UK

Contact address: Dinesh D Sethi, WHO European Centre for Environment and Health, Via F Crispi 10, Rome 00187, Italy. din@ecr.euro.who.int .

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ABSTRACT

Background

There is an increasing global burden of disease from injuries. Models of trauma care initially developed in high-income countries are also being adopted in low and middle-income countries (LMIC). Amongst these, ambulance crews with Advanced Life Support (ALS) training are being promoted in LMIC as a strategy for improving outcomes for victims of trauma. However there is controversy as to the effectiveness of this health service intervention, and the evidence has yet to be rigorously appraised.

Objectives

To quantify the effectiveness of ambulance crews with ALS training versus crews with any other level of training in reducing mortality and morbidity in trauma patients.

Search strategy

We searched CENTRAL (The Cochrane Library issue 2, 2006), the Injuries Group's Specialised Register, MEDLINE, EMBASE, CINAHL, PubMed and the National Research Register. We checked references of background papers and contacted authors to identify additional published and unpublished data. The search was last updated in July 2006.

Selection criteria

Randomised controlled trials, quasi-randomised controlled trials and controlled before-and-after studies comparing effectiveness of ambulance crews with ALS training versus crews with any other levels of training in reducing mortality and morbidity in trauma patients. Studies which compared crews staffed by physicians versus others were excluded.

Data collection and analysis

Two reviewers independently applied eligibility criteria to trial reports for inclusion and extracted data.

Main results

We found one randomised controlled trial from the original search (Nicholl 1998), which included 16 trauma cases. However, outcome data were added to the main non-randomised cohort in the analysis, and data on these 16 cases cannot be included in this review.

Authors' conclusions

In the absence of evidence of the effectiveness of advanced life support, strong argument could be made that it should not be promoted outside the context of a properly concealed and otherwise rigorously conducted randomised controlled trial.

PLAIN LANGUAGE SUMMARY

No evidence to show the effect of advanced trauma life support training for ambulance crews on people with trauma from injury

Injury is one of the top ten causes of death and disability worldwide. It results in an early loss of life for many young people and ongoing high medical care costs. Advanced Life Support (ALS) for ambulance officers is believed to have contributed to the reduced number of deaths from injury in countries where this service is available. ALS services are also being adapted for low and middle-income countries. The review of trials found there is no evidence to show the effect of ALS on people with trauma from injury. More research is needed.

BACKGROUND

The epidemiological, demographic, and socio-political transitions underway in many countries are associated with a substantial burden of disease from injuries. These findings have been highlighted by the Global Burden of Disease Study, that identified injuries as one of the top ten causes of death and disability world wide, and also predicted that their importance was likely to increase by the year 2020 (Murray 1997a, Murray 1997b, Murray 1997c). Although infectious diseases are still extremely important causes of death in low and middle income countries (LMICs), added to these are the increasing challenge of trauma and non-communicable disease as important causes of premature mortality and morbidity (Gwatkin 1997). Injuries place a disproportionately large burden of disease on young people (Murray 1997a, Murray 1997b), and consequently are a leading cause of premature loss of productive life, of high medical care costs, of significant degrees of disability and of large socio-economic loss to society (Berger 1996).

There have been recent calls by the public health community and civil organisations to formulate a strategy to decrease the burden from injuries. While responding to injuries requires considerable attention to preventive efforts (Berger 1996), improvements in health care provision which reduce deaths, disability and societal costs are also required (Sethi 2000). In many high income countries (HIC), reductions in trauma mortality of 15-20% have been achieved in the last few decades (Cales 1984, Roberts 1996, Lecky 2000), which may be partly as a result of improved systems for trauma care. Advanced Life Support (ALS) training for ambulance officers is considered to have made an important contribution to the reduction in trauma mortality (Kirsch 1998, Reines 1998).

ALS trained ambulance crews receive extra training in endotracheal intubation, intravenous cannulation, the administration of intravenous fluids and the use of selected drugs (Calicott 1980). In high-income countries a substantial proportion of ambulance crews now include an ALS trained officer. For example, in the UK, Department of Health policy requires that all emergency ambulances include an ambulance officer trained in ALS.

In response to the increasing global burden of injury, models of trauma care initially developed in high-income countries are also being adopted in low and middle-income countries, such as ALS training to improve outcomes in trauma victims (Ali 1993, Sethi 2000). In these countries, the majority of patients arrive by private transport, however, many are now considering developing pre-hospital care services further (Hauswald 1997, Areola-Risa 2000). Various models are being considered, and amongst these the use of ambulance crews with ALS training is being debated (Sklar 1988, VanRooyen 1999).

Why it is important to do this review

The evidence for the effectiveness of ALS trained ambulance crews has yet to be rigorously appraised. The aim of this systematic review is therefore to quantify the effect of ambulance crews with ALS training on outcome following trauma.

OBJECTIVES

To quantify the effectiveness of ambulance crews with Advanced Life Support (ALS) training versus crews with any other level of training in reducing mortality and morbidity following trauma.

METHODS

Criteria for considering studies for this review

Types of studies

Randomised controlled trials (RCTs), quasi-randomised controlled trials, and controlled before-and-after studies (CBAs).

Types of participants

All trauma patients of any age.

Types of interventions

Ambulance crews with ALS training versus ambulance crews with any other level of training. Pre-hospital crews including physicians are excluded.

Types of outcome measures

- Death from all causes at the end of the follow up period scheduled for each trial.
- Morbidity.

Search methods for identification of studies

The searches were not restricted by date, language or publication status. The search was last updated in July 2006.

Electronic searches

We searched the following electronic databases;

- CENTRAL (The Cochrane Library issue 2, 2006);
- Cochrane Injuries Group's Speicalised Register (searched July 12, 2006);
- MEDLINE (1966 to July 2006);
- EMBASE (1980 July, 2006);
- CINAHL (1982 to July 2006);
- Dissertation Abstracts (1987 to 1999);
- Science Citation Index (1998 to 2000);
- National Research Register (issue 2, 2006).

Details of some of the search strategies can be found in Appendix 1.

Searching other resources

We checked reference lists, and contacted authors to identify additional published or unpublished data. We also handsearched a number of relevant journals. A full list of journals handsearched by the Cochrane Injuries Group can be found in the Injuries Group Module (CIG 2000).

Data collection and analysis

Selection of studies

Two reviewers (DS, IK) independently examined the electronic search results and selected reports of possibly relevant trials. These reports were retrieved in full. Two reviewers (IK, DS) applied the selection criteria independently to the trial reports, resolving disagreements by discussion with the third (AMK).

Data extraction and management

Two reviewers (IK, AMK) independently extracted information on the following: type of design, stratification for effect modifiers, method of allocation concealment, number of randomised patients, type of participants, interventions and outcomes. The outcome data sought were mortality and morbidity. The reviewers were not blinded to the authors or journal when doing this, as evidence for the value of this is far from conclusive (Berlin 1997). Results were compared and any differences resolved by discussion with the third reviewer.
Where there was insufficient information in the published report we attempted to contact the authors for clarification.

Assessment of risk of bias in included studies

Study quality was assessed to determine the degree to which systematic bias may have been introduced, such as: bias through selection, performance, exclusion or detection; the method of allocation; the degree of follow-up, and the soundness of the assessments. Two reviewers (IK, AMK) categorised the studies as RCTs, CCTs and CBAs. For randomised controlled trials, the reviewers scored quality of allocation concealment on the scale used by Schulz (Schulz 1995) assigning C to poorest quality and A to best quality.

- A=trials deemed to have taken adequate measures to conceal allocation (i.e. central randomisation; serially numbered, opaque, sealed envelopes; or other description that contained elements convincing of concealment).
- B=trials in which the authors either did not report an allocation concealment approach at all or reported an approach that did not fall into one of the other categories.

- C=trials in which concealment was inadequate (such as alternation or reference to case record numbers or to dates of birth)

Where the methods are not clearly reported, such as how allocation was concealed or other design attributes, the author(s) was contacted, if possible, for clarification. We then compared the scores allocated and resolved differences by discussion.

Assessment of heterogeneity

The groups of trials will be examined for statistical evidence of heterogeneity using a chi squared test. If there is no obvious heterogeneity on visual inspection or statistical testing, pooled relative risks and 95% confidence intervals will be calculated using a fixed effects model.

Subgroup analysis and investigation of heterogeneity

The following comparisons were planned:
Mortality and morbidity for victims of trauma treated by ambulance crews with ALS training versus crews with any other level of training.
The intended analysis was the calculation of relative risk of death and 95% confidence interval for each trial, such that a relative risk of more than 1 indicates a higher risk of death in the first group named. The relative risk was chosen as it was more readily applied to the clinical situation.

Sensitivity analysis

The effect of excluding trials judged to have inadequate (scoring C) allocation concealment will be examined in a sensitivity analysis.

RESULTS

Description of studies

See: Characteristics of included studies; Characteristics of excluded studies.
The search strategy identified 2034 potential eligible papers but we found only one small randomised controlled trial which met our inclusion criteria.
Nicholl 1998
This trial compared outcomes of victims of trauma treated by ambulance crews with ALS training to crews without ALS training. Participants were trauma (road traffic accidents, falls, work/chemical/sport accidents, self-harm, assaults and drowning) patients of all ages. People with superficial injuries were excluded. Follow up was six months after the original incident and was made using the SF-36 questionnaire. Protocol compliance was poor. The author did not recruit sufficient numbers because of practical difficulties. The mortality and morbidity data of the randomised group were aded to the main non-randomised cohort in the original analysis. Therefore specific analysis of the randomised patients cannot be performed for this review.
The characteristics of this trial is included in Characteristics of included studies.

Risk of bias in included studies

Nicholl 1998
The dispatch of ambulance crews was randomised by opening a sealed numbered envelope when a potential eligible emergency call was received by the dispatcher. Blinding of outcomes assessments was not stated.

Effects of interventions

Not known.

DISCUSSION

We found only one small study which met the inclusion criteria. This is in spite of conducting a very thorough literature search where 2034 citations were screened to identify eligible trials. We believe it unlikely that relevant trials have been overlooked. In the one trial we identified (Nicholl 1998), the number of participants was small (n=16) and it may not be possible to draw reliable conclusions from such a small sample.

At present the evidence base for ALS training of ambulance officers for the care for victims of trauma is poor. This finding highlights the lack of evidence on which current practice and policy in many high income countries is based, where pre-hospital care is often provided by ambulance crews with ALS training. It emphasises the need to conduct well designed intervention studies to establish this effectiveness and inform policy making in trauma services. Several non-randomised studies have suggested that outcomes with ALS trained crews may be worse or no better than outcomes with other crew types (Cayten 1993, Potter 1988, Rainer 1997, Fortner 1983, Sampalis 1993, Nicholl 1998, Liberman 2000).

The lack of rigorous research may not be easily rectified in settings where ALS-based services have already been established. There is conviction among the public, media, and health professionals, including ambulance service staff, that ALS interventions are beneficial in serious trauma. However, despite the practical problems experienced during research conducted in the UK (Nicholl

1998, Rainer 1997) and in Canada (Steill 2005), randomised controlled trials remain the most rigorous research design for evaluating health care interventions.

A number of other factors need to be taken into account in planning evaluative and comparative research in pre-hospital care of victims of trauma. These include the impact of ALS interventions on scene time, the impact of scene time on outcomes, the mechanism of trauma (blunt versus penetrating), geographical location (distance from hospital care), injury severity, injury pattern (presence and severity of head injury) and mode of pre-hospital transport. In addition the configuration of pre-hospital services needs to be considered. For example in some countries ambulances are staffed by doctors, many of who have intensive care or anaesthetic specialist postgraduate training, which may affect outcomes. The model of pre-hospital services, therefore, may be a significant component in future studies and may limit comparability of studies.

AUTHORS' CONCLUSIONS

Implications for practice

In the absence of evidence of the effectiveness of advanced life support, argument could be made that it should not be promoted outside the context of a properly concealed and otherwise rigorously conducted randomised controlled trial.

Implications for research

In view of the wide acceptance in high income countries that ALS trained ambulance crews are beneficial to victims of serious trauma, and its widespread implementation, it may be difficult to conduct evaluative research in these settings. Despite these constraints, randomised controlled trials remain the most rigorous research design for this question and provide the most reliable evidence on the effectiveness of interventions.

ACKNOWLEDGEMENTS

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Nicholl 1998 ***{published data only}***
Nicholl J, Hughes S, Dixon S, Turner J, Yates D. The costs and benefits of paramedic skills in prehospital trauma care. *Health Technology Assessment* 1998;**2**(17):72.

References to studies excluded from this review

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Baxt WG, Moody P. The impact of a physician as part of the aeromedical prehospital team in patients with blunt trauma. *JAMA* 1987;**257**(23):3246–50.

Potter 1988 ***{published data only}***
Potter D, Goldstein G, Fung SC, Selig M. A controlled trial of prehospital advanced life support in trauma. *Ann Emerg Med* 1988;**17**(6):582–8.

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Hauswald M, Yeoh E. Designing a prehospital system for a developing country: estimated costs and benefits. *Am J Emerg Med* 1997;**15**:600–3.

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Liberman 2000
Liberman M, Mulder D, Sampalis J. Advanced or basic Life Support for trauma: meta-analysis and critical review of the literature. *J Trauma* 2000;**49**(4):584–99.

Murray 1997a
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Murray 1997b
Murray CJL, Lopez AD. Global mortality, disability, and the contribution of risk factors: Global Burden of Disease Study. *Lancet* 1997;**349**:1436–42.

Murray 1997c
Murray CJL, Lopez AD. Alternative projections of mortality and disability by cause 1990-2020: Global Burden of Disease Study.. *Lancet.* 1997;**349**:1498–1504.

Potter 1988
Potter D, Goldstein G, Fung SC, Selig M. A controlled trial of prehospital advanced life support in trauma. *Ann Emerg Med* 1988;**17**(6):582–8.

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Rainer TH, Houlihan KP, Robertson CE, Beard D, Henry JM, Gordon MW. An evaluation of paramedic activities in prehospital trauma care. *Injury* 1997;**28**(9-10):623–7.

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Sklar 1988
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Steill 2005
Steill, I. Ontario Pre-hospital Advanced Life Support (OPALS) Study. Canadian Health Services Research Foundation. Ottawa: Canadian Health Services Research Foundation, February 2005.

VanRooyen 1999
VanRooyen MJ, Thomas TL, Clem KJ. International emergency medical services: assessment of developing prehospital systems abroad. *J Emerg Med* 1999;**17**:691–6.

* *Indicates the major publication for the study*

CHARACTERISTICS OF STUDIES

Characteristics of included studies *[ordered by study ID]*

Nicholl 1998

Methods	Randomised controlled trial (of dispatch of paramedics and technicians by opening sealed numbered envelopes when a potentially eligible emergency call was received). Decisions about whether to include a patient were made after randomisation according to whether the inclusion criteria was met
Participants	16 trauma patients of all ages (road traffic accidents, falls, work/chemical/sport accidents, self-harm and drowning) Inclusion and exclusion criteria retrospectively applied: Included: 1. Length of hospital stay =/> 3 days, 2. Admissions to ICU/HDU, 3. Deaths between ambulance arrival on scene and arrival at hospital. 4. Transfer to another hospital or hospital's ICU/HDU with stay =/> 3 days, 5. Re-admission within 2 days of the incident, 6. All deaths within 6 months of the incident. Excluded: 1. Poisonings, 2. Transported by helicopter, 3. Attended by doctors on scene, 4. Deaths before ambulance arrival, 5. Superficial skin injuries and burns, 6. Simple fracture of femur in patients > 65 years old, 7. Simple spinal strain with no fracture, 8. Patients involved in 'major incidents'.
Interventions	• Pre-hospital trauma care provided by ALS trained paramedic (n=8). • Pre-hospital trauma care provided by BLS trained emergency technicians (n=8).
Outcomes	1. process of care, 2. morbidity as in general health perception and quality of life by 6-month follow up postal questionnaire (SF-36), 3. death within 6 months of the incident.
Notes	Poor protocol compliance. Mortality and morbidity data of these 16 cases were added to main non-randomised cohort for analysis. Author contacted and data will be available in due course

Risk of bias

Item	Authors' judgement	Description
Allocation concealment?	Yes	A - adequate

Characteristics of excluded studies *[ordered by study ID]*

Study	Reason for exclusion
Baxt 1987	Comparison was between air ambulance crews staffed by nurse/physicians vs nurse/paramedics
Potter 1988	This is not a randomised, quasi-randomised controlled trial or a controlled before after study

DATA AND ANALYSES

This review has no analyses.

APPENDICES

Appendix 1. Search strategy

Cochrane Injuries Group's specialized register

((emerg* or trauma) and (prehospital or pre-hospital or preclinical or pre-clinical)) or "life support" or "Primary survey" or "golden hour" or "first aid" or "early management" or EMST or "advanced trauma life support" or ATLS

CENTRAL (The Cochrane Library issue 2, 2006)

#1 MeSH descriptor Emergency Medical Services, this term only
#2 MeSH descriptor Resuscitation explode all trees with qualifier
#3 MeSH descriptor First Aid explode all trees
#4 MeSH descriptor Critical Care explode all trees with qualifier
#5 MeSH descriptor Emergency Medicine explode all trees with qualifier
#6 MeSH descriptor Emergency Medical Technicians explode all trees with qualifier
#7 MeSH descriptor Life Support Care explode all trees
#8 MeSH descriptor Traumatology explode all trees with qualifier
#9 (#1 OR #2 OR #3 OR #4 OR #5 OR #6 OR #7 OR #8)
#10 nurse or nurses or nursing or paramedic* or ((ambulanc* or hospital) and (crew or team* or staff))
#11 (emerg* or trauma*) near (care* or treat*)
#12 (trauma* next system*) or (life next support*) or (primary next survey) or (golden next hour) or (first next aid*)
#13 (early next management) near (severe next trauma)
#14 EMST
#15 prehospital or pre-hospital or preclinical or pre-clinical
#16 advanced next trauma next life next support
#17 (ATLS not syndrome*)
#18 educat* or train* or teach* or course*
#19 (#11 OR #12 OR #13 OR #14 OR #15 OR #16 OR #17)
#20 (#18 AND #19)
#21 (#9 AND #20)
#22 (#10 AND #21)

MEDLINE (1966 to July 2006)

1. exp Emergency Medical Services/
2. exp Critical Care/
3. exp Emergency Treatment/
4. exp Resuscitation/ed [Education]
5. exp Emergency Medical Technicians/ed [Education]
6. exp Emergency Medicine/ed [Education]
7. exp Life Support Care/
8. exp Traumatology/ed [Education]
9. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8
10. Advanced trauma life support.ab,ti.
11. (ATLS not syndrome$).ab,ti.
12. 10 or 11
13. 9 and 12
14. ((emergenc$ or trauma) adj3 (care or treat$)).ab,ti.

15. ((trauma adj3 system) or (life adj3 support$) or (primary adj3 survey)) or (golden adj3 hour)).ab,ti.
16. EMST.ab,ti.
17. (early adj3 management adj3 (severe adj3 trauma)).ab,ti.
18. (prehospital or pre-hospital or preclinical or pre-clinical).ab,ti.
19. (educat$ or train$ or teach$ or course$).ab,ti.
20. 12 or 14 or 15 or 16 or 17 or 18
21. 12 and 20
22. 13 or 21
23. ((ambulanc$ adj3 (crew$ or staff$ or team$)).ab,ti.
24. paramedic$.ab,ti.
25. (hospital$ adj3 (team$ or staff$)).ti,ab.
26. (nurse$ or nurses or nursing or paramedic$).ab,ti.
27. 23 or 24 or 25 or 26
28. 22 and 27
29. 28 and Cochrane RCT filter (2006)

EMBASE (1980 to July 2006)

1. exp Emergency Health Service/
2. exp Intensive Care/
3. exp Emergency Treatment/
4. exp RESUSCITATION/
5. exp Rescue Personnel/
6. exp Emergency Medicine/
7. exp TRAUMATOLOGY/
8. 1 or 2 or 3 or 4 or 5 or 6 or 7
9. advanced trauma life support.ti,ab.
10. (ATLS not syndrome$).ab,ti.
11. 9 or 10
12. 8 and 11
13. ((emergenc$ or trauma) adj3 (care or treat$)).ab,ti.
14. ((trauma adj3 system) or (life adj3 support$) or (primary adj3 survey) or (golden adj3 hour) or (first adj3 aid$)).ab,ti.
15. early management of severe trauma.ab,ti.
16. (prehospital or pre-hospital or preclinical or pre-clinical).ab,ti.
17. EMST.ti,ab.
18. 11 or 13 or 14 or 15 or 16 or 17
19. (educat$ or train$ or teach$ or course$).ab,ti.
20. 18 and 19
21. 12 or 20
22. (ambulanc$ adj3 (crew$ or staff$ or team$)).ab,ti.
23. paramedic$.ab,ti.
24. (hospital$ adj3 (team$ or staff$)).ti,ab.
25. (nurse or nurses or nursing or paramedic$).ab,ti.
26. 22 or 23 or 24 or 25
27. 21 and 26
28. 27 and RCT filter (2006)

WHAT'S NEW

Last assessed as up-to-date: 30 June 2006.

Date	Event	Description
10 July 2008	New search has been performed	New studies sought but none found. Search date 1 July 2006.

HISTORY

Protocol first published: Issue 2, 2001

Review first published: Issue 2, 2001

Date	Event	Description
9 July 2008	Amended	Converted to new review format.
5 January 2003	New search has been performed	New studies sought but none found.

CONTRIBUTIONS OF AUTHORS

DS helped to design the protocol, examined search results, applied inclusion criteria and wrote the review. IK helped design the protocol, examined search results, applied inclusion criteria, obtained papers, extracted data, contacted authors and helped to write the review. AMK applied inclusion criteria, extracted data and helped to write the review. IR and FB commented on the protocol and helped to write the review.

DECLARATIONS OF INTEREST

None known.

SOURCES OF SUPPORT

Internal sources

- Institute of Child Health, University of London, UK.

External sources

- Global Programme on Evidence of Health Policy (GPE), World Health Organisation, Switzerland.

INDEX TERMS

Medical Subject Headings (MeSH)

*Life Support Care; Controlled Clinical Trials as Topic; Emergency Medical Technicians [*education]; Randomized Controlled Trials as Topic; Traumatology [*education]

MeSH check words

Humans