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Advanced trauma life support training for hospital staff (Review)

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Advanced trauma life support training for hospital staff

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ABSTRACT

Background

Injury is responsible for an increasing global burden of death and disability. As a result, new models of trauma care have been developed. Many of these, though initially developed in high-income countries (HICs), are now being adopted in low and middle-income countries (LMICs). One such trauma care model is advanced trauma life support (ATLS) training in hospitals, which is being promoted in LMICs as a strategy for improving outcomes for victims of trauma. The impact of this health service intervention, however, has not been rigorously tested by means of a systematic review in either HIC or LMIC settings.

Objectives

To quantify the impact of ATLS training for hospital staff on injury mortality and morbidity in hospitals with and without such a training program.

Search strategy

We searched the CENTRAL, MEDLINE, EMBASE, PUBMED, CINAHL and ZETOC databases and the Cochrane Injuries Group's Specialised Register. For this update, the search strategy was expanded to include more parameters on research methodology and was run for all years to September 2008.

Selection criteria

Randomised controlled trials, controlled trials and controlled before-and-after studies comparing the impact of ATLS-trained hospital staff versus non-ATLS trained hospital staff on injury mortality and morbidity.

Data collection and analysis

One author applied the eligibility criteria to trial reports for inclusion, and extracted data.

Main results

There is a limited amount of literature about this topic. None of the studies identified by the search met the inclusion criteria for this review.
Authors’ conclusions

There is no clear evidence that ATLS or similar programs impact the outcome for victims of injury, although there is some evidence that educational initiatives improve knowledge of hospital staff of available emergency interventions. Furthermore, there is no evidence that trauma management systems that incorporate ATLS training impact positively on outcome. Future research should concentrate on the evaluation of trauma systems incorporating ATLS, both within hospitals and at the health system level, by using more rigorous research designs.

**PLAIN LANGUAGE SUMMARY**

More research needed to show whether ATLS training in hospitals can cut death rates and decrease disability in injured people

Training in ‘advanced trauma life support’ (ATLS) is increasingly used in both rich and poor countries. ATLS is intended to improve the way in which care is given to injured people, thereby reducing death and disability. Some research has been done that suggests ATLS programmes improve the knowledge of staff who have been trained, but there have been no trials to show the impact of ATLS-trained staff (or staff trained in similar programmes) on the rates of death and disability of injured patients themselves. The review calls for more research and puts forward suggestions about how future research might be conducted.

**BACKGROUND**

The Global Burden of Disease Study has repeatedly identified injuries as one of the top ten causes of death and disability worldwide (Murray 1997a, Murray 1997b, Murray 1997c, Lopez 2006). Injury is predicted to rise in the rankings by the year 2030 (Mathers 2006). While infectious diseases continue to be extremely important causes of death in low and middle-income countries (LMICs), there are increasing challenges posed by injury and non-communicable disease for premature mortality and morbidity globally (Gwatkin 1997). Injuries place a disproportionately large burden of disease on young people, causing premature loss of productive life, high medical care costs, significant degrees of disability, and a large socio-economic loss to society (WHO 2004).

Recently there have been calls by the public health community, professional associations and nongovernmental organisations for the formulation of a strategy to decrease the social burden from injuries. Responding to injuries requires considerable attention to preventive efforts (Berger 1996), as well as improvements in healthcare provision to reduce deaths, disability and costs to society (Sethi 2000). In many high-income countries (HICs), reductions in trauma mortality of 15-20% have been achieved in the last few decades (Cales 1984, Lecky 2000, Roberts 1996), largely as a result of improved healthcare interventions and trauma care systems. Training programmes such as Advanced Trauma Life Support (ATLS) established by the American College of Surgeons and introduced in North America, the United Kingdom and Australia, have presumably contributed to this reduction (Kirsch 1998, Reines 1988). Improvement in the organisation and delivery of trauma services, with ATLS-trained staff acting as coordinated trauma response teams, are thought to improve the timing and quality of the emergency response in the ‘golden hour’ (Calicott 1980), specifically through the appropriate use of acute interventions such as fluid replacement, endotracheal intubation, chest drainage and emergency surgery.

However, the evidence of effectiveness and impact of ATLS has not been rigorously tested for either HIC or LMIC settings. Currently, the evidence base for trauma services in LMICs is almost non-existent. Yet, despite this lack of evidence, the ATLS system is being promoted as a model for improving outcomes for trauma victims in LMICs (Ali 1994). In resource-constrained settings, models of trauma care developed in HICs need to be considered carefully based on effectiveness, affordability and appropriateness before they can be recommended for implementation in LMICs (Sethi 2000). One way of ensuring that trauma care interventions add value for money is to evaluate the evidence of supporting their effectiveness and impact. A previous systematic review has examined ATLS interventions in the pre-hospital setting (Sethi 2001). This review seeks to evaluate the impact of hospital-based ATLS training programmes on injury mortality and morbidity.
Why it is important to do this review

The aim of this systematic review is to quantify the effectiveness of an ATLS (or equivalent) programme in improving the trauma outcomes of mortality and disability.

OBJECTIVES

To quantify the impact of hospital-based ATLS training for medical staff on injury mortality and morbidity in hospitals with and without such training programs.

METHODS

Criteria for considering studies for this review

Types of studies

Eligible trials will include randomised controlled trials (RCTs), controlled trials (CTs), and controlled before-and-after (CBA) studies, each of which is defined as follows.

RCT: a study involving at least one intervention and one control treatment, with concurrent enrolment and follow up of the intervention and control groups, in which the interventions to be tested are selected by a random process such as the use of a random numbers table (coin flips are also acceptable). If the author(s) state explicitly (usually by using some variant of the term ‘random’ to describe the allocation procedure used) that the groups compared in the trial were established by random allocation, then the trial is classified as an ‘RCT’.

CT: a study in which treatment allocations are made using odd or even numbers, days of the week, or other such pseudo- or quasi-random processes. These are not truly randomised and a study employing any of these techniques for assignment is classified as a CT. If a trial has not been described as randomised, but either is a quasi-randomised study or may have been randomised or quasi-randomised, then it is classified as a ‘CT’. The classification is based solely on what the author has written, not on a reader’s interpretation. Efforts will, however, be made to contact the authors for confirmation, if necessary.

CBA: a study design with contemporaneous data collection before and after the intervention, and an appropriate control site or activity. Prospective studies were considered eligible for inclusion.

Types of interventions

- Trauma treatment at hospitals with an ATLS-trained medical staff (or equivalent such as early management of severe trauma) compared with hospitals without an ATLS-trained medical staff.

Types of outcome measures

- Death, as defined by the trial period, but usually in-hospital mortality, out-hospital mortality, 72 hour mortality and 30 day mortality.
- Morbidity, as defined by the trial period.

Search methods for identification of studies

Searches were not restricted by date, language or publication status.

Electronic searches

We searched the following electronic databases:

- CENTRAL (The Cochrane Library 2008, Issue 3);
- Cochrane Injuries Group’s Specialised Register (searched 17 Sept 2008);
- MEDLINE (1950 to Sept week 1 2008);
- EMBASE (1980 to Sept 2008);
- PUBMED (searched 17 Sept 2008);
- CINAHL (EBSCOHOST) (1937 to Sept 2008);
- ZETOC (searched 18 Sept 2008).

Full search strategies are given in Appendix 1.

Searching other resources

Additionally, all references included in identified trials and background papers were checked to identify relevant published and unpublished data. A general Internet search was carried out to identify any grey literature.

Data collection and analysis

Selection of studies

For the 2008 update, one author (SJ) examined the electronic search results for reports of possibly relevant trials. Study quality was assessed using the recommendations outlined by the Cochrane Handbook for Systematic Reviews Interventions 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. SJ categorised the studies as RCTs, CCTs and CBA s and applied these specific categories of quality assessment to the trial reports. Relevant reports were retrieved in full. For versions of the review through 2006, two authors (DS and SH) examined the electronic search results for reports of possibly relevant trials and these reports were retrieved in full. Both authors (SH and DS) applied the selection criteria independently to the trial reports.

Data extraction and management

The methodology outlined in the protocol for this review indicates that two authors (SJ and DS) would independently extract information on the following: type of study design (see above), stratification for effect modifiers, method of allocation concealment, number of randomised patients, type of participants and interventions, loss to and length of follow up. The outcome data sought were numbers of deaths and morbidity. The review authors would not be blinded to the authors of the trial reports or the journals in which they were published when undertaking the review. Results would be compared, and any differences resolved by discussion. Where there was insufficient information in the published report, authors would be contacted for clarification. As no studies for inclusion were found, these steps were not undertaken, but will be reserved for updates of the review should studies become available.

Data synthesis

The following comparisons would have been made: outcomes of treatment provided in hospitals with ATLS-trained staff versus hospitals without such training.

RESULTS

Description of studies

See: Characteristics of excluded studies.

Results of the search

2007 citations were screened for the review. This update included a more specific search using additional criteria on research methods and expanded the search to include all years until September 2008 (Appendix 1). (The search strategy used for previous versions of the review can be found in Appendix 2.)

Included studies

No studies met the inclusion criteria.

Excluded studies

The five studies reported in the table of excluded studies looked specifically at the acquisition and retention of knowledge and skills, the costs of running courses, and the subjective experiences of the trainees. Although these showed improvements in processes of care, they did not report on patient outcomes such as death and morbidity (Aboutanos 2007, Ali 1996, Ali 1998, Ali 2000, Williams 1997). Despite their encouraging results, these studies were not considered because they failed to fulfill the pre-set criteria.

Risk of bias in included studies

Since no studies met the inclusion criteria, consideration of risk of bias was not possible.

Effects of interventions

Since no studies met the inclusion criteria, the effects of interventions could not be considered.

DISCUSSION

We did not find any study that met the inclusion criteria, despite conducting a very thorough literature search in which a total of 2007 citations were screened to identify eligible trials. We believe it is unlikely that relevant trials have been overlooked.

Five studies looked specifically at the effectiveness of ATLS as an educational tool as well as the costs of running courses, and the subjective experiences of the trainees. Since none of these studies reported on patient outcomes such as death and morbidity, they were not included in this review.

At present, the evidence base for the impact of an ATLS training programme (or equivalent) on trauma outcomes is poor. This is not entirely unexpected, as ATLS training is an educational approach rather than a process approach per se, and the evaluation of initiatives that are entirely hospital or system-based is complex and difficult. In addition, as ATLS training is applied to an individual, and individuals change their places of practice, it is difficult to quantify which patients have been treated by ATLS-trained health professionals. However, there is some evidence that such educational interventions addressing emergencies and injury can increase knowledge of early and effective intervention (Aboutanos 2007, Ali 1996, Ali 1998, Ali 2000, Williams 1997).

In some hospitals, ATLS training forms part of a process approach to trauma care, of which the establishment of trauma teams is an example. In some cities, this has been taken further with the introduction of trauma systems that ‘stream’ patients to particular receiving hospitals. Needless to say, trying to separate the influence
of education, process approaches, experience related to higher patient volumes, and systems issues, is methodologically challenging and, to date, has not been completed. There is no evidence to conclude that educational interventions such as ATLS or similar training are not valuable. ATLS principles can be easily, and cost effectively, incorporated into undergraduate or post-graduate training programmes and teach an approach that is transferable to other critically ill patients. The more difficult questions revolve around the formal interaction between ATLS training and systems of care within hospitals and health care systems. This review highlights the lack of rigorous evidence to show that ATLS training results in improved outcomes from injury and highlights the complexity of conducting such research, in view of the systems-related issues.

We are aware that advocates for the expansion of ATLS programmes will point out that the aim of this training has always been to improve the knowledge and skills of individual doctors. In our inclusion criteria for this review we did not specify studies that attempted to assess whether such improvements were achieved, believing that reductions in mortality and morbidity are the ultimate goals of such interventions. It is also true that the number of doctors who have undergone ATLS training will vary considerably between hospitals, as training may often be done on an individual rather than an institutional basis. In our comprehensive literature search we did not identify any studies that compared outcomes of individual trained and untrained doctors.

It is possible that there may be studies of ATLS programmes which have examined outcomes falling outside our inclusion criteria. As with all systematic reviews, it is worth remembering that no evidence of effect, which is what we have found here, does not equal evidence of no effect. Nevertheless, we believe that our review highlights the lack of evidence on which to base current practice and policy in many HICs and LMICs.

This review emphasises the need to conduct well designed interventional studies to establish the effectiveness and impact of trauma services, in order to ensure that policies, particularly in LMICs, are based on firm supporting evidence. A number of factors need to be taken into account when planning evaluative and comparative research of the effectiveness of hospitals, or health systems with trauma systems, unless the trial is large, with cluster randomisation and a factorial design. A controlled, sequential before-and-after design (similar to the Ontario Prehospital Advanced Life Support Study (Stiell 1999)), conducted in a health system that currently does not have an organised trauma response is likely to be able to answer this question and the related question of the value of advanced life support interventions by pre-hospital health care providers.

**Authors’ Conclusions**

**Implications for practice**

There is no clear evidence that ATLS training (or similar) impacts on the outcomes of injury victims, although there is some evidence that educational initiatives improve knowledge of immediate emergency response and treatment of such patients (Kelly 1994, Driscoll 1998). Future research should concentrate on the evaluation of trauma systems with ATLS training, both within hospitals and at the health system level.

**Implications for research**

In view of the wide acceptance in high income countries that trauma systems incorporating ATLS programmes are beneficial to injury victims, and its widespread implementation, it may be difficult to conduct evaluative research in these settings. Future research should concentrate on the evaluation of trauma systems, both within hospitals and at the health system level. A controlled, sequential before-and-after design (similar to the Ontario Prehospital Advanced Life Support Study) conducted in a health system that does not currently have an organised trauma response is likely to be able to answer this question. This may be preferable to an RCT, given the problems of comparing different levels of training and differences in trauma systems, unless the trial is large, with cluster randomisation and a factorial design.

**Acknowledgements**

Shakiba Habibula and Anne-Maree Kelly were authors of this review for versions through 2006.

We are grateful to the staff of the Cochrane Injuries Group editorial base for their technical support.
References to studies excluded from this review

Ali 1996 (published data only)

Ali 1998 (published data only)

Ali 2000 (published data only)

Williams 1997 (published data only)

Additional references

Ali 1994

Berger 1996

Cales 1984

Calicott 1980

Driscol 1998
Driscol P. The relative effectiveness of three types of advanced life support training: a prospective randomised control trial. *University of Manchester, UK*.

Gwatkin 1997

Kelly 1994

Kirsch 1998

Lecky 2000

Lopez 2006

Mathers 2006

Murray 1997a

Murray 1997b

Murray 1997c

Reines 1988

Review Manager (RevMan)

Roberts 1996

Schulz 1995

Sethi 2000
Sethi 2001
Sethi D, Kwan I, Kelly AM, Roberts I, Bunn F. Advanced trauma life support training for ambulance crews. Cochrane Database of Systematic Reviews 2001, Issue 2. [DOI: 10.1002/14651858.CD003109]

Stiell 1999

WHO 2004

* Indicates the major publication for the study
**Characteristics of Studies**

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

<table>
<thead>
<tr>
<th>Study</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Aboutanos 2007</td>
<td>Looked specifically at the acquisition and retention of ATLS knowledge and skills, the costs of running courses, and the subjective experiences of the trainees. Did not report on patient outcomes such as death and morbidity, and thus did not meet the inclusion criteria.</td>
</tr>
<tr>
<td>Ali 1996</td>
<td>Evaluated teaching effectiveness of ATLS courses for physicians using Objective Structured Clinical Examination. Did not report on patient outcomes such as death and morbidity, and thus did not meet the inclusion criteria.</td>
</tr>
<tr>
<td>Ali 1998</td>
<td>Looked at the acquisition of ATLS knowledge and skills by medical students. Did not report on patient outcomes such as death and morbidity, and thus did not meet the inclusion criteria.</td>
</tr>
<tr>
<td>Ali 2000</td>
<td>Evaluated teaching effectiveness of ATLS courses for surgery residents using a trauma mannequin. Did not report on patient outcomes such as death and morbidity, and thus did not meet the inclusion criteria.</td>
</tr>
<tr>
<td>Williams 1997</td>
<td>Studied management of simulated trauma cases by ATLS and non-ATLS staff. Did not report on patient outcomes such as death and morbidity, and thus did not meet the inclusion criteria.</td>
</tr>
</tbody>
</table>
DATA AND ANALYSES

This review has no analyses.

APPENDICES

Appendix 1. Search strategy to 2008

Cochrane Injuries Group's Specialised Register (searched 17 Sept 2008)

((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 or “advanced life support” or ALS or basic life support or BLS

MEDLINE (1950 to Sept week 1 2008)

1. exp Emergency Medical Services/
2. exp Critical Care/
3. exp Emergency Treatment/
4. exp Resuscitation/
5. exp Emergency Medicine/
6. exp Emergency Nursing/
7. exp Life Support Care/
8. exp Traumatology/
9. Clinical competence/
10. exp First Aid/
11. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10
12. ((Advanced trauma life support or ATLS) not (ATLS adj3 syndrome*)).ti,ab.
13. (Advanced life support or ALS).ti,ab.
14. (basic life support or BLS).ab,ti.
15. ((emergency or trauma or critical) adj3 (care or treat*)).ab,ti.
16. ((trauma adj3 system*) or (life adj3 support*) or (primary adj3 survey*) or (golden adj3 hour) or (first adj3 aid*)).ab,ti.
17. EMST.ab,ti.
18. (early management adj3 trauma).ab,ti.
19. ((prehospital or pre-hospital or preclinical or pre-clinical) adj3 (care or support or treat*)).ab,ti.
20. 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19
21. exp health personnel/
22. exp allied health personnel/
23. Nursing staff/
24. Medical staff/
25. paramedic*.ab,ti.
26. exp Emergency Medical Technicians/
27. ((emergency or critical or trauma or triage or ambulanc*) adj3 (doctor* or nurse or nurses or nursing or crew or staff or team*)).ab,ti.
28. 21 or 22 or 23 or 24 or 25 or 26 or 27
29. randomised.ab.
30. randomized controlled trial.pt.
31. controlled clinical trial.pt.
32. placebo.ab.
33. clinical trials as topic.sh.
34. randomly.ab.
35. trial.ti.
36. or/29-35
EMBASE 1980 to Sept 2008

1. exp Emergency/
2. exp emergency health service/
3. exp Emergency Treatment/
4. exp intensive care/
5. exp resuscitation/
6. exp emergency medicine/
7. exp emergency nursing/
8. exp traumatology/or exp neurotraumatology/
9. exp neurotraumatology/
10. exp clinical competence/
11. 1 or 2 or 3 or 4 or 5 or 6 or 7 or 8 or 9 or 10
12. ((Advanced trauma life support or ATLS) not (ATLS adj3 syndrome*)).ti,ab.
13. (Advanced life support or ALS).ti,ab.
14. (basic life support or BLS).ab,ti.
15. ((emergency or trauma or critical) adj3 (care or treat*)).ab,ti.
16. ((trauma adj3 system*) or (life adj3 support*) or (primary adj3 survey*) or (golden adj3 hour) or (first adj3 aid*)).ab,ti.
17. EMST,ab,ti.
18. (early management adj3 trauma).ab,ti.
19. ((prehospital or pre-hospital or preclinical or pre-clinical) adj3 (care or support or treat*)).ab,ti.
20. 12 or 13 or 14 or 15 or 16 or 17 or 18 or 19
21. exp nursing staff/
22. exp medical staff/
23. exp paramedical personnel/
24. paramedic*.ab,ti.
25. ((emergency or critical or trauma or triage or ambulance* adj3 (doctor* or nurse or nurses or nursing or crew or staff or team*)).ab,ti.
26. 21 or 22 or 23 or 24 or 25
27. 11 and 26 and 20
28. exp Randomized Controlled Trial/
29. exp controlled clinical trial/
30. randomly.ab.
31. placebo.ab.
32. exp Clinical Trial/
33. randomly.ab.
34. trial.ti.
35. 28 or 29 or 30 or 31 or 32 or 33 or 34
36. exp human/
37. 35 and 36
38. 27 and 37
39. 11 and 20 and 28 and 38

CENTRAL (The Cochrane Library 2008, Issue 3)

#1 MeSH descriptor Emergency Medical Services explode all trees
#2 MeSH descriptor Critical Care explode all trees
#3 MeSH descriptor Emergency Treatment explode all trees
#4 MeSH descriptor Resuscitation explode all trees
#5 MeSH descriptor Emergency Medicine explode all trees
#6 MeSH descriptor Emergency Nursing explode all trees
#7 MeSH descriptor Life Support Care explode all trees
#8 MeSH descriptor Traumatology explode all trees
#9 MeSH descriptor Clinical Competence explode all trees
#10 MeSH descriptor First Aid explode all trees
Advanced trauma life support training for hospital staff (Review)

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Appendix 2. Previous search strategy to 2006

Cochrane Injuries Group's Specialised 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: ED
#3 MeSH descriptor First Aid explode all trees
#4 MeSH descriptor Critical Care explode all trees with qualifier: ED
#5 MeSH descriptor Emergency Medicine explode all trees with qualifier: ED
#6 MeSH descriptor Emergency Medical Technicians explode all trees with qualifier: ED
#7 MeSH descriptor Life Support Care explode all trees
#8 MeSH descriptor Traumatology explode all trees with qualifier: ED
#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 (ambulance* 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 [Education]
5. exp Emergency Medical Technicians [Education]
6. exp Emergency Medicine [Education]
7. exp Life Support Care/
8. exp Traumatology [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 Personel /
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: 16 September 2008.

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**HISTORY**


Review first published: Issue 3, 2004

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<td>9 June 2008</td>
<td>Amended</td>
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<tr>
<td></td>
<td>Converted to new review format.</td>
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<tr>
<td>12 July 2006</td>
<td>New search has been performed</td>
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<tr>
<td></td>
<td>New studies sought but none found. Conclusions remain the same.</td>
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<tr>
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<td>Search updated to 1 July 2006.</td>
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</table>

**CONTRIBUTIONS OF AUTHORS**

DS developed the protocol. For versions of the review through 2006, SH and DS performed the literature search and screened articles, extracted data and assessed study quality. SH contacted authors, entered data into Review Manager (RevMan) software. DS, AMK and SH wrote the review. For the 2008 update, SJ performed the literature search, screened articles, extracted data and assessed study quality. SH contacted trial report authors, and entered data into Review Manager (RevMan) software and updated the text of the review. DS approved the final version of the manuscript.
DECLARATIONS OF INTEREST
None known.

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• No sources of support supplied

External sources

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INDEX TERMS

Medical Subject Headings (MeSH)
Emergency Medical Services; Personnel, Hospital [*education]; Traumatology [*education]; Wounds and Injuries [mortality; *therapy]

MeSH check words
Humans