WORKSHEET for Evidence-Based Review of Science for Emergency Cardiac Care

Worksheet author(s)

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Date Submitted for review:
13 April 2008 initial search strategy
5 May 2008 on to ScholarOne
Presented 25 May Gent ILCOR meeting and updated
Discussed with Dana Edelson (EIT1A WSA) after Ghent meeting
Updated October 2.
Updated October 25 after Peter Morley and Beth Mancini feedback
Updated 1February2009 – CoSTR includes page numbers, updated search-no new papers
Updated search 10 January 2010 and I have also discussed WS with NRP033 WSA on similar question – 4 new studies, 15 LOE5 studies removed from the final CoSTR
Submitted 22 January 2010

Clinical question.

EIT001 For hospital resuscitation teams (P), do team briefings/debriefings (I), when compared to no briefings/debriefings (C), improve team performance (O)?

Is this question addressing an intervention/therapy, prognosis or diagnosis? INTERVENTION
State if this is a proposed new topic or revision of existing worksheet: **NEW TOPIC**

Conflict of interest specific to this question

Do any of the authors listed above have conflict of interest disclosures relevant to this worksheet?
Consultant In Anaesthetics & Intensive Care Medicine, North Bristol NHS Trust, Bristol UK. Chairman Resuscitation Council UK. EIT Task Force co-chair. Editor, Resuscitation. No relevant conflicts

Search strategy (including electronic databases searched).

Databases searched:

PubMed
ScienceDirect
Google Scholar
Scopus
AHA EndNote Library

Search terms

1. [Patient care team OR resuscitation team OR cardiac arrest team OR rapid response team OR emergency team OR trauma team] AND [heart arrest OR cardiac arrest OR cardiopulmonary resuscitation]

2. [Patient care team OR resuscitation team OR cardiac arrest team OR rapid response team OR emergency team OR trauma team] AND [debrief OR feedback OR brief]

3. [Team training] AND [heart arrest OR cardiac arrest OR cardiopulmonary resuscitation]

4. Video record* and [heart arrest OR cardiac arrest OR cardiopulmonary resuscitation OR resuscitation]

5. Review of related articles and references in any papers found

Term megacode team dropped from search strategy (Megacode itself - 11 hits – not relevant)

6. Review of non medical literature not done

• State inclusion and exclusion criteria

Will tighten inclusion and exclusion criteria based on initial search findings

Inclusions:
Adult and paediatric studies
Initially in and out of hospital studies (will focus on in hospital studies if sufficient papers)
Patient and manikin studies
Trauma team studies
Other acute emergency studies – e.g., anaesthesia studies

Exclusions
Non-english language studies
Non resuscitation team studies
Non-peer reviewed artcles

• Number of articles/sources meeting criteria for further review:

Search updated 2 October 2008 – No new papers found- 2 abstract studies published

PubMed
Patient care team 40658 hits

[Patient care team OR resuscitation team OR cardiac arrest team OR rapid response team OR emergency team OR trauma team] 45963 hits

[Heart arrest or cardiac arrest or cardiopulmonary resuscitation] 39942

1. [Patient care team OR resuscitation team OR cardiac arrest team OR rapid response team OR emergency team OR trauma team] AND [Heart arrest or cardiac arrest or cardiopulmonary resuscitation] 680 hits
10 articles for further review after scanning abstracts:
1 simulation training session followed by debriefing resulting in successful patient care – case report (Smith, Jacob et al. 2008)
1 simulation based training better than traditional with real patient performance (Wayne, Didwania et al. 2007)
1 before and after study (Adams, Zeiler et al. 2005)
1 simulation training plus debriefs improved performance (DeVita, Schaefer et al. 2005)
1 manikin cardiac arrest study (Marsch, Muller et al. 2004)
1 patient study before and after (Weng, Huang et al. 2004)
1 manikin critical care observational study (Lighthall, Barr et al. 2003)
1 survey after training (O'Brien, Haughton et al. 2001)
1 patient study identifying difficulties with staff as adverse factor (Cooper and Cade 1997)
1 hospital study showing audit and feedback improved adherence to guidelines (Whitcomb, Brierton et al. 1990)

[debrief* OR feedback OR brief] 174062

2. [debrief* OR feedback OR brief] AND [Patient care team OR resuscitation team OR cardiac arrest team OR rapid response team OR emergency team OR trauma team] 975 hits

7 further articles for review after scanning abstracts:

1 paper CRM improved perceived performance (Rudy, Polomano et al. 2007)
1 paper describes a simulator course using feedback (Muller, Hansel et al. 2007)
1 paper describes use of feedback data to improve shock care (Sebat, Musthafa et al. 2007)

1 paper –use of education and feedback increases MET call (Jones, Bates et al. 2006)
1 paper-system approach to improve performance (Foraida, DeVita et al. 2003)
1 paper showing improved team/system organization after mock scenarios in workplace (Bordley, Travers et al. 2003)
1 paper regarding feedback for breaking bad news (Farrell, Ryan et al. 2001)

[1 AND 2] 34 hits – no new papers

3. Team training AND [Heart arrest or cardiac arrest or cardiopulmonary resuscitation] 200 hits
1 further article showing use of simulation and debriefing (Abrahamson, Canzian et al. 2006)

4. Video record* and [heart arrest OR cardiac arrest OR cardiopulmonary resuscitation OR resuscitation]:
109 hits
1 study looking at trauma care (Hoyt, Shackford et al. 1988)

Science direct

Team feedback and resuscitation 8 hits
1 further articles:
1 study showing video feedback improved trauma team performance (Scherer, Chang et al. 2003)

No extra papers from Scopus or Google Scholar or AHA EndNote library, Cochrane library

Review of AHA Resuscitation Science Symposium 2007 abstracts found 1 abstract only study (Edelson et al. 2008, In Press –personal communication from author) Published 26 May 2008 and included in WS

Review of ERC congress abstracts (available on line 3 May 2008) found 1 abstract only study (Dine et al. 2008) – Study Published Critical Care Medicine 2008 and included in WS

One study found from looking at references – Salvodelli et al, 2006.

EMBASE and CINAHL not searched

Update 2 February 2009 – no new papers found

Update 10 January 2010

1 new reference found about impact of debriefing on anesthesia emergencies -
Morgan et al, 2009.

Discussion with other WSA and review of other 3 WS on this topic identified some new papers:

Falcone 2008
Townsend 1998
Wayne 2005

27 Papers in total looked at in more detail

15 of these papers were not included in Final CoSTR after discussion with other WSA as debriefing was not always an endpoint in the studies [in brackets in evidence tables]

12 studies in final CoSTR

NOTES

This worksheet was presented at the Ghent Resuscitation 2008 congress in the session on how the ILCOR process works – the feedback was that debriefings are standard practice in non clinical settings for teams so there is already strong evidence to support it.

The WS has subsequently been discussed with NRP033 WSA in Osaka March 2009 and by email exchange since.

After discussion relevant manikin/simulation studies (M) have been designated a LOE according to study design rather than all given LOE 5. Original LOE 5 designation was because they did not include real patient outcomes. This will mean that in the CoSTR we will need to make it clear that there is specific reference to the use of debriefing for real patient events (clinical) and manikin/simulation based systems.

Summary of evidence

Evidence Supporting Clinical Question

Good	**Dine 2008 2817 E – CPR quality (M)** **Morgan 2009 531 E – anaesthesia emergencies - performance score (M)** **Savoldelli 2006 279 E - non technical team skills (M)**				
Fair			**Edelson, 2008 1063 A, E-cpr quality** **Scherer 2003 516 E–trauma pt – time to treat** **Townsend 1993 133 – trauma team performance**	**Falcone 2008 1065 E- paed trauma task completion (M)** **Hoyt 1998 435 E – trauma team performance**	[Bordley 2003 E (M)] [Cooper 1997 E-staff skills at real arrests] **De Vita 2005 326 E-manikin survival (M)** [Jones 2006 E - MET calls] [Sebat2007 B-sepsis survival] **Wayne 2005 202 E-knowledge and confidence (M)** **Wayne 2008 56 E-adherence to guidelines real arrests**
Poor					[Adams 2005 E-time to ROSC] [Farrel 2001 E-breaking bad news] [Lighthall 2003 E-survey(M)] [Marsch 2004 E-cpr quality (M)] [O'Brien 2001 E- questionnaire/confidence(M)] [Rudy 2007 E-self reported performance(M)] [Smith 2008 B case report] **Weng 2004 137 A** [Whitcomb 1990 E-guideline compliance]
	1	**2**	**3**	**4**	**5**
Level of evidence					

A = Return of spontaneous circulation
B = Survival of event
C = Survival to hospital discharge
D = Intact neurological survival
E = Other endpoint
Italics = Animal studies

(M) = manikin/simulation study
Papers in [ ] not included in final CoSTR after TF discussions. Only **bold** studies included in CoSTR

Evidence Neutral to Clinical question

Good					
Fair					[Foraida 2003E – MET calls]
Poor					[Abrahamson 2006E-course design (M)] [Muller 2007 E-course design (M)]
	1	**2**	**3**	**4**	**5**
Level of evidence					

A = Return of spontaneous circulation
B = Survival of event
C = Survival to hospital discharge
D = Intact neurological survival
E = Other endpoint
Italics = Animal studies

(M) = manikin/simulation study
Papers in [ ] not included in final CoSTR after TF discussions

Evidence Opposing Clinical Question

Good					
Fair					
Poor					
	1	**2**	**3**	**4**	**5**
Level of evidence					

A = Return of spontaneous circulation
B = Survival of event
C = Survival to hospital discharge
D = Intact neurological survival
E = Other endpoint
Italics = Animal studies

REVIEWER'S FINAL COMMENTS AND ASSESSMENT OF BENEFIT / RISK:

Background

Team debriefs are common in other settings – sport, military etc.

Surveys of in the UK (Pittman, Turner et al. 2001; Morgan and Westmoreland 2002) and Canada (Hayes, Rhee et al. 2007) show that resuscitation teams rarely have formal pre and post event briefings. In the UK surveys 33% of respondents communicated before events, usually by chance. In these two surveys 7% and 12% achieved a formal debrief following a cardiac arrest. In the Canadian study only 5.9 % attended debriefings and 1.4 % received feedback.

A study of 28 UK interns (Marteau, Wynne et al. 1990) showed that as interns attended more arrests confidence grew. Confidence did not however correlate with actual skills when assessed on a manikin. This study concluded the interns required feedback to actually improve skills (although did not show evidence to support this)

Successful teams usually meet before and after events (e.g. sports teams). Logic would dictate this would be a good idea in the resuscitation setting. Clinical trials to answer whether team briefings and debriefs actually improve team performance are however difficult in this setting. Most studies are done in the simulated setting and look at the combination of training and feedback.

The terms feedback and debriefing have often been used interchangeably in many studies.

Studies in this area can be divided into debriefing used in Clinical settings and debriefing used during simulation based training

Clinical studies

A before and after study (Edelson, 2008, 1063 LOE3) with weekly team debriefs of actual cardiac arrest event data collected from the defibrillator showed improvement in ROSC for in-hospital cardiac arrests – 45 to 60% (LOE3, fair). The resuscitation team in the hospital used feedback from a smart defibrillator during arrests (control group). A new post event debriefing program was added to this – RAPID (Resuscitation with Actual Performance Integrated Debriefing). This consisted of a weekly 45 minute session reviewing cardiac arrest events. As well as an improvement in ROSC rate, there was also an improvement in CPR quality and interruptions to chest compression. The main weakness of this study is that the RAPID phase scanned the change in guidelines in 2005 – new guidelines had greater emphasis on CPR quality.

Three additional trauma resuscitation studies (Hoyt, 1988, 435; Townsend, 1993, 133; Scherer, 2003, 516), all using video-assisted debriefing sessions of actual trauma resuscitations, showed improvement in various aspects of team performance

The implementation of a cardiac arrest team with regular debriefings and video feedback increased ROSC compared to a period prior to team implementation, for out of hospital cardiac arrests presenting to an ED. (Weng 2004, 137). LOE5. This study does not tell us which part of the system actually improved feedback.

Wayne et al (Wayne, 2008 56) showed that simulator-trained residents showed significantly higher adherence to AHA standards (mean percent correct = 68%, sd = 20%); versus traditionally trained residents (mean percent correct = 44%, sd = 20%) p = .001. The odds ratio for an adherent ACLS response was 7.1 (95% CI = 1.8 -- 28.6) for simulator-trained residents compared to traditionally trained residents after controlling for patient age, ventilator, and telemetry status. The training intervention included debriefing but the study did not have a no debriefing group. Therefore LOE5.

Simulation based training

A manikin study (Dine, 2008 2817) showed improved CPR quality with a short 5 minute post event debrief was additive to the benefits of real time feedback during the cardiac arrest (LOE1, good). Participants were fed back a transcript of their CPR quality performance and areas for improvement highlighted. This led to improved CPR quality in subsequent CPR. This benefit was additive to that from feedback from the defibrillator during actual skill performance.

Salvoldelli et al. (Savoldelli, 2006 279) showed that team leader performance improved with either oral debriefing ($p<0.05$) or video-assisted oral debriefing ($p<0.01$) compared to a control group, with no significant difference between the two intervention groups.

Morgan (Morgan 2009 531) did a randomized, controlled study to determine if simulation-based debriefing improved performance of practicing anaesthetists managing high-fidelity simulation scenarios. The anaesthetists were randomly allocated to Group A: simulation debriefing; Group B: home study; and Group C: no intervention and secondary randomization to one of two scenarios. Six to nine months later, subjects returned to manage the alternate scenario. Facilitators blinded to study group allocation completed the performance checklists (dichotomously scored checklist, DSC) and Global Rating Scale of Performance (GRS). A significant improvement was seen between pre- and post-tests on the DSC in debriefed subjects (pre-test 66.8%, post-test 70.3%; $F(1,57)=4.18$, $P=0.046$). Both groups showed significant improvement in the GRS over time ($F(1,57)=5.94$, $P=0.018$), but no significant difference between the groups.

Other studies (DeVita 2005 326; Falcone 2008 1065) have looked at debriefings as part of a training intervention. These studies were given LOE 5 as they did not try and separate out the effects of debriefing from the whole intervention i.e. there were no control groups that were not debriefed.

(Wayne 2005 202) LOE5 showed that simulated emergencies followed by facilitated debriefings produced improvements in content knowledge and confidence when compared with clinical experience alone. This study does not specifically look at role of debriefings and cannot therefore look specifically at effect of debriefing – therefore LOE5, extrapolation

The studies used a variety of feedback techniques
- Immediate post event verbal debriefing
- Delayed debriefs
- Use of video
- Feedback of arrest data

Debriefing appears to be an effective method for improving resuscitation performance and potentially patient outcomes. The unifying feature of all the debriefing studies is that the objective data form the basis for the discussion. This can be achieved with video recordings, defibrillator downloads or trained observer feedback. The ideal format remains to be determined.

It is not entirely clear which method of debriefing is best. All used constructive debriefing techniques.

There are to date no studies showing debriefs are harmful.

The terms debriefing and feedback are often used interchangeably. Discussions with the other WSA involved in this topic led to the following:

- Briefings are distinct from debriefings and b) debriefings and feedback are two separate but somewhat related entities in that various forms of feedback are components of debriefing.

- Debriefing tends to be face to face and involves both parties engaging in discussion

- Feedback tends to provide information about prior events and can use a number of methods eg video, data downloads etc.

- **The literature shows that a variety of sources of feedback have been used during debriefings after real and simulated arrests**

Debriefing is an integral part of the actual training intervention in many studies. This makes it difficult to measure the effect of the debriefing.

KNOWELEDGE GAPS

Do (P)resuscitation teams who have (I) team work training compared to those who have (C) individual training (0) perform better

Are debriefings that include video, or other measures of feedback better than just verbal feedback for resuscitation training?

Effects of debriefing on technical versus non-technical skills.

Do mock codes in the clinical setting improve patient outcomes?

Acknowledgements:

Citation List

Abrahamson, S. D., S. Canzian, et al. (2006). "Using simulation for training and to change protocol during the outbreak of severe acute respiratory syndrome." Crit Care 10(1): R3.

Comments LOE 5, fair, neutral. Shows that training with debriefing will raise issues that help formulate training. No useful endpoint actually measured. Not included in final CoSTR.

A**dams, B. D., K. Zeiler, et al. (2005). "Emergency medicine residents effectively direct in hospital cardiac arrest teams." Am J Emerg Med 23(3): 304-10.**

Comments LOE5 Supporting Poor. This study shows that EM residents did as well as attendings in terms of ward cardiac arrest outcomes. One reason put forward for this was the fact that EM residents had supervised experience and debriefing when attending ED arrests enabling them to lead teams effectively for in hospital arrests. The study did not actually measure debriefing interventions or have any debriefing related endpoints. Therefore not included in final CoSTR.

Bordley, W. C., D. Travers, et al. (2003). "Office preparedness for pediatric emergencies: a randomized, controlled trial of an office-based training program." Pediatrics 112(2): 291-5.

Comment LOE5 supportive, fair. Does not really answer question. Shows mock codes with feedback help improve systems. Not included in final CoSTR.

Cooper, S. and J. Cade (1997). "Predicting survival, in-hospital cardiac arrests: resuscitation survival variables and training effectiveness." Resuscitation 35(1): 17-22.

Comments LOE 5, supporting, fair. This paper tells us that staff (team) skill problems during CPR have an adverse effect on ROSC- weak extrapolation to support hypothesis and debriefing not addressed. Not included in final CoSTR.

DeVita, M. A., J. Schaefer, et al. (2005). "Improving medical emergency team (MET) performance using a novel curriculum and a computerized human patient simulator." Qual Saf Health Care 14(5): 326-31.

Comment LOE 5, fair, supporting. Suggests that team training with debriefs improves team performance in simulated scenarios.

Dine JC, Gersh RE, Leary M, Bellini LM, Abella BS. Using real-time feedback and debriefing to improve CPR quality and performance. Resuscitation 2008; 77: S23. Available on-line 3 May 2008.

Published October 2008
Dine CJ, Gersh RE, Leary M, Riegel BJ, Bellini LM, Abella BS.
Improving cardiopulmonary resuscitation quality and resuscitation training by combining audiovisual feedback and debriefing. Crit Care Med. 2008 Oct;36(10):2817-22

Comment LO1 (manikin study), good, supportive. Manikin only study of nurses. Do not know their baseline training. Shows value of debriefing additive to real time feedback during CPR in terms of CPR quality. Need to repeat in real patients.

Edelson DP, Litzinger B et al. (2007) Resuscitation with actual performance integrated debriefing (RAPID) improves CPR quality and initial patient survival.
Presented at AHA ReSS, Orlando, November 2007. Abstract 62, page 29 proceedings book.

Published
Edelson DP, Litzinger B, Arora V, Walsh D, Kim S, Lauderdale DS, Vanden Hoek TL, Becker LB, Abella BS. Improving in-hospital cardiac arrest process and outcomes with performance debriefing. Arch Intern Med. 2008 May 26;168(10):1063-9

Resuscitation performance and patient outcome by cohort

	Baseline	RAPID	P value
Compression depth (mm)	44 (11)	50 (10)	0.0001
Compression rate (/min)	100 (13)	105 (10)	0.003
Ventilation rate (/min)	18 (8)	13 (7)	<0.0001
No-flow fraction	0.20 (0.13)	0.13 (0.10)	<0.0001
Pre-shock pause (sec)	16.0 (8.5-24.1)	7.5 (2.8-13.1)	<0.0001
Post-shock pause (sec)	7.1 (2.7-14.8)	2.4 (1.9-3.6)	<0.0001
Appropriate shocks	110/151 (72.8%)	104/117 (88.9%)	0.001
ROSC	45/101 (44.6%)	73/123 (59.4%)	0.03

Comments LOE3, supportive, fair. This is the best data to date supporting the use of debriefings for resuscitation teams with real patient data. Study used a historical control group and spanned the change in guidelines in 2005. The change to guidelines 2005 is a potential confounder as new guidelines emphasized the importance of many of the areas of improvement seen. The additive benefit of debriefing to that given by real time feedback during CPR by a defibrillator is new.

Falcone RA, Jr, Daugherty M, et al. Multidisciplinary pediatric trauma team training using high fidelity trauma simulation. J Pediatr Surg 2008; 43(6): 1065-71.

Comment: LOE 4, Quality Fair, Supporting. In this observational study (pre/post intervention, no controls) repeated simulated emergency situations followed by debriefings resulted in sequentially improved performance.

Farrell, M., S. Ryan, et al. (2001). "'Breaking bad news' within a paediatric setting: an evaluation report of a collaborative education workshop to support health professionals." J Adv Nurs 36(6): 765-75.

Comments LOE 5 , poor, supportive. Psychological debriefing after scenarios increases confidence. How much of the effect is attributed to debriefing is difficult to say. Not included in final CoSTR.

Foraida, M. I., M. A. DeVita, et al. (2003). "Improving the utilization of medical crisis teams (Condition C) at an urban tertiary care hospital." J Crit Care 18(2): 87-94.

Comment LOE5, fair, neutral. Study supports systems approach to improving use of rapid response team in terms of increasing MET calls. In this study feedback to medical staff did not change improvement in use of team. This study does not actually look at team performance. Actual team performance may have improved with feedback. Not included in final CoSTR.

H**ayes, C. W., A. Rhee, et al. (2007). "Residents feel unprepared and unsupervised as leaders of cardiac arrest teams in teaching hospitals: a survey of internal medicine residents." Crit Care Med 35(7): 1668-72.**

Comments – does not answer question. Paper tells us that most cardiac arrests are still run by residents with poor supervision and little post event feedback. Useful for introductory blurb on this topic.

Hoyt, D. B., S. R. Shackford, et al. Video Recording Trauma Resuscitations - an Effective Teaching Technique. Journal of Trauma-Injury Infection and Critical Care. 1988;28(4): 435-440.

Comment Level 4, fair, supportive. Observational trauma study, weekly video assisted debriefing (n=180 resuscitations) versus a group where the house officer was unable to attend (n=60 resuscitations)- no randomization. Outcomes – improvement in time to attendance and time wasted. No patient outcome data.

Jones, D., S. Bates, et al. (2006). "Effect of an education programme on the utilization of a medical emergency team in a teaching hospital." Intern Med J 36(4): 231-6.

Comments LOE5, fair, supportive, feedback increases use of MET team-does not directly answer question as no evidence of improved team performance. Not included in final CoSTR.

Lighthall, G. K., J. Barr, et al. (2003). "Use of a fully simulated intensive care unit environment for critical event management training for internal medicine residents." Crit Care Med 31(10): 2437-43.

Comments LO5, Poor study, supportive Simulator based survey of 181 ICU staff (multi-professional) who attended simulator course where intensive care unit scenarios included cardiac arrests. Scenarios followed by debrief. On post course questionnaire participants felt that debrief post scenario improved learning experience (96%) and knowledge(93%) . This does not answer question as whether subsequent performance improves. Not included in final CoSTR.

Marsch, S. C., C. Muller, et al. (2004). "Human factors affect the quality of cardiopulmonary resuscitation in simulated cardiac arrests." Resuscitation 60(1): 51-6.

Comments LOE 5 Poor study, supportive -small sample size, manikin based, simple scenario- does not directly answer questions but shows that team where tasks were assigned at start of simulated resuscitation attempt did better than those who did not. Not included in final CoSTR.

Morgan PJ, Tarshis J, LeBlanc V, Cleave-Hogg D, DeSousa S, Haley MF, Herold-McIlroy J, Law JA. Efficacy of high-fidelity simulation debriefing on the performance of practicing anaesthetists in simulated scenarios. Br J Anaesth. 2009;103(4):531-7. Epub 2009 Aug 2

LOE1, Good, Supportive, specifically looked at debriefing togther with simulation for anaesthesia emergencies – debriefing group had modest improvement performance using a performance checklist score. Good methodology but weak effect. Did not measure non – technical skills.

Muller, M. P., M. Hansel, et al. (2007). "Six steps from head to hand: a simulator based transfer oriented psychological training to improve patient safety." Resuscitation 73(1): 137-43.

Comments LOE5, poor, neutral. Authors describe simulation based CRM course with debriefing. No measure of outcome. Not included in final CoSTR.

O'Brien, G., A. Haughton, et al. (2001). "Interns' perceptions of performance and confidence in participating in and managing simulated and real cardiac arrest situations." Med Teach 23(4): 389-395.

Comment LO5 E Poor. This study shows again that combined simulation training/debriefing after increases confidence and reduce anxiety about performance at real arrest. Does not actually measure improved performance in cardiac arrest. Not included in final CoSTR.

Pittman, J., B. Turner, et al. (2001). "Communication between members of the cardiac arrest team--a postal survey." Resuscitation 49(2): 175-7.

Comment –does not answer question but highlights lack of team talks before and after event in UK. Now an old paper but I am not sure if things have improved since.

Rudy, S. J., R. Polomano, et al. (2007). "Team management training using crisis resource management results in perceived benefits by healthcare workers." J Contin Educ Nurs 38(5): 219-26.

Comments LOE 5, supportive. Self reported improved performance in real crisis after CRM training including feedback. Cannot say what the effect of feedback is or just doing the scenarios. Not included in final CoSTR.

Savoldelli, G. L., V. N. Naik, et al. (2006). "Value of debriefing during simulated crisis management: oral versus video-assisted oral feedback." Anesthesiology 105(2): 279-85.

Comments LOE 1 (manikin study), good quality, supportive. Simulated anaesthetic scenarios showing video feedback = verbal feedback is better than no feedback. Pre and post feedback scenarios were both cardiac arrest scenarios. Blinded evaluaters. Terms feedback and debriefing both used without proper defintion.

Scherer, L. A., M. C. Chang, et al. (2003). "Videotape review leads to rapid and sustained learning." Am J Surg 185(6): 516-20.

Comments LOE 3, fair, supportive. This paper shows that video feedback improves team performance in real trauma scenarios compared with verbal feedback i.e. there is no control group that received no feedback. This is one of the few studies that shows an effect of feedback in the clinical setting. Soft study endpoints however

Sebat, F., A. A. Musthafa, et al. (2007). "Effect of a rapid response system for patients in shock on time to treatment and mortality during 5 years*." Crit Care Med.

Comments LOE5, fair, supporting. This paper does not separate effects of feedback and hands on training. Feedback as part of system improved patient outcomes with sepsis. Not included in final CoSTR.

Smith, H. M., A. K. Jacob, et al. (2008). "Simulation education in anesthesia training: a case report of successful resuscitation of bupivacaine-induced cardiac arrest linked to recent simulation training." Anesth Analg 106(5): 1581-4

LOE 5, supportive, poor. This study links successful treatment of a rare real patient scenario to previous simulation based training on the same scenario which included a debrief. Not include din final CoSTR.

Townsend RN, Clark R, Ramenofsky ML, Diamond DL. ATLS-based videotape trauma resuscitation review: education and outcome. J Trauma. 1993 Jan;34(1):133-8.

LOE 3, favourable. Trauma observational study with historical control. Before (522 patients) and after (361 patients) use of video tape based feedback/debriefing. Team performance improved in terms of time spent in ER and interventions. Survival benefit did not occur.

Wayne DB, Butter J, et al. (2005). "Simulation-Based Training of Internal Medicine Residents in Advanced Cardiac Life Support Protocols: A Randomized Trial." Teach Learn Med 17(3): 202-208.

Comment: LOE 5, Quality Fair, Supporting. This study shows that simulated emergencies followed by facilitated debriefings produced improvements in content knowledge and confidence when compared with clinical experience alone. Study does not specifically look at role of debriefings and cannot therefore look specifically at effect of debriefing – therefore LOE5, extrapolation.

Wayne, D. B., A. Didwania, et al. (2008). "Simulation-Based Education Improves Quality of Care During Cardiac Arrest Team Responses at an Academic Teaching Hospital: A Case-Control Study." Chest. 2008 Jan;133(1):56-61.

Comment LOE5, fair. Supporting by extrapolation – training and debriefing in a simulator improves adherence to guidelines at real arrests. No randomization, looks at training and debriefing and not just debriefing. Therefore LOE5.

Weng, T. I., C. H. Huang, et al. (2004). "Improving the rate of return of spontaneous circulation for out-of-hospital cardiac arrests with a formal, structured emergency resuscitation team." Resuscitation 60(2): 137-42.

Comments LOE5, poor, supporting. Patient outcomes improved with improved team organization including debriefs and video feedback of real life resuscitations. The exact framework and whether this was a formal process is not discussed. The Utstein template is not used. The comparison is with historical group. This study is LOE 5 as does not specifically look at debriefing.

Whitcomb, J., D. Brierton, et al. (1990). "Code teams and the review of cardiac arrests." QRB Qual Rev Bull 16(4): 156-62.

LOE5, fair, supporting- feedback of code reviews improves compliance with guidelines. This is quality improvement work rather than a formal study. Therefore extrapolation. Some would argue that this is not debriefing in the real sense. Not included in final CoSTR

References (new refs in bold)

Abrahamson, S. D., S. Canzian, et al. (2006). "Using simulation for training and to change protocol during the outbreak of severe acute respiratory syndrome." Crit Care **10**(1): R3.

Adams, B. D., K. Zeiler, et al. (2005). "Emergency medicine residents effectively direct inhospital cardiac arrest teams." Am J Emerg Med **23**(3): 304-10.

Bordley, W. C., D. Travers, et al. (2003). "Office preparedness for pediatric emergencies: a randomized, controlled trial of an office-based training program." Pediatrics **112**(2): 291-5.

Cooper, S. and J. Cade (1997). "Predicting survival, in-hospital cardiac arrests: resuscitation survival variables and training effectiveness." Resuscitation **35**(1): 17-22.

DeVita, M. A., J. Schaefer, et al. (2005). "Improving medical emergency team (MET) performance using a novel curriculum and a computerized human patient simulator." Qual Saf Health Care **14**(5): 326-31.

Dine CJ, Gersh RE, Leary M, Riegel BJ, Bellini LM, Abella BS. Improving cardiopulmonary resuscitation quality and resuscitation training by combining audiovisual feedback and debriefing. Crit Care Med. 2008 Oct;36(10):2817-22

Edelson DP, Litzinger B, Arora V, Walsh D, Kim S, Lauderdale DS, Vanden Hoek TL, Becker LB, Abella BS. Improving in-hospital cardiac arrest process and outcomes with performance debriefing. Arch Intern Med. 2008 May 26;168(10):1063-9

Falcone RA, Jr, Daugherty M, et al. Multidisciplinary pediatric trauma team training using high fidelity trauma simulation. J Pediatr Surg 2008; 43(6): 1065-71.

Farrell, M., S. Ryan, et al. (2001). "'Breaking bad news' within a paediatric setting: an evaluation report of a collaborative education workshop to support health professionals." J Adv Nurs **36**(6): 765-75.

Foraida, M. I., M. A. DeVita, et al. (2003). "Improving the utilization of medical crisis teams (Condition C) at an urban tertiary care hospital." J Crit Care **18**(2): 87-94.

Hayes, C. W., A. Rhee, et al. (2007). "Residents feel unprepared and unsupervised as leaders of cardiac arrest teams in teaching hospitals: a survey of internal medicine residents." Crit Care Med **35**(7): 1668-72.

Hoyt, D. B., S. R. Shackford, et al. (1988). "Video recording trauma resuscitations: an effective teaching technique." J Trauma **28**(4): 435-40.

Jones, D., S. Bates, et al. (2006). "Effect of an education programme on the utilization of a medical emergency team in a teaching hospital." Intern Med J **36**(4): 231-6.

Lighthall, G. K., J. Barr, et al. (2003). "Use of a fully simulated intensive care unit environment for critical event management training for internal medicine residents." Crit Care Med **31**(10): 2437-43.

Marsch, S. C., C. Muller, et al. (2004). "Human factors affect the quality of cardiopulmonary resuscitation in simulated cardiac arrests." Resuscitation **60**(1): 51-6.

Marteau, T. M., G. Wynne, et al. (1990). "Resuscitation: experience without feedback increases confidence but not skill." BMJ **300**(6728): 849-50.

Morgan, R. and C. Westmoreland (2002). "Survey of junior hospital doctors' attitudes to cardiopulmonary resuscitation." Postgrad Med J 78(921): 413-5.

Morgan PJ, Tarshis J, LeBlanc V, Cleave-Hogg D, DeSousa S, Haley MF, Herold-McIlroy J, Law JA. Efficacy of high-fidelity simulation debriefing on the performance of practicing anaesthetists in simulated scenarios. Br J Anaesth. 2009;103(4):531-7. Epub 2009 Aug 2

Muller, M. P., M. Hansel, et al. (2007). "Six steps from head to hand: a simulator based transfer oriented psychological training to improve patient safety." Resuscitation **73**(1): 137-43.

O'Brien, G., A. Haughton, et al. (2001). "Interns' perceptions of performance and confidence in participating in and managing simulated and real cardiac arrest situations." Med Teach **23**(4): 389-395.

Pittman, J., B. Turner, et al. (2001). "Communication between members of the cardiac arrest team--a postal survey." Resuscitation **49**(2): 175-7.

Rudy, S. J., R. Polomano, et al. (2007). "Team management training using crisis resource management results in perceived benefits by healthcare workers." J Contin Educ Nurs **38**(5): 219-26.

Savoldelli, G. L., V. N. Naik, et al. (2006). "Value of debriefing during simulated crisis management: oral versus video-assisted oral feedback." Anesthesiology **105**(2): 279-85.

Scherer, L. A., M. C. Chang, et al. (2003). "Videotape review leads to rapid and sustained learning." Am J Surg **185**(6): 516-20.

Sebat, F., A. A. Musthafa, et al. (2007). "Effect of a rapid response system for patients in shock on time to treatment and mortality during 5 years*." Crit Care Med.

Smith, H. M., A. K. Jacob, et al. (2008). "Simulation education in anesthesia training: a case report of successful resuscitation of bupivacaine-induced cardiac arrest linked to recent simulation training." Anesth Analg **106**(5): 1581-4.

Townsend RN, Clark R, Ramenofsky ML, Diamond DL. ATLS-based videotape trauma resuscitation review: education and outcome. J Trauma. 1993 Jan;34(1):133-8.

Wayne DB, Butter J, et al. (2005). "Simulation-Based Training of Internal Medicine Residents in Advanced Cardiac Life Support Protocols: A Randomized Trial." Teach Learn Med 17(3): 202-208.

Wayne, D. B., A. Didwania, et al. (2008). "Simulation-Based Education Improves Quality of Care During Cardiac Arrest Team Responses at an Academic Teaching Hospital: A Case-Control Study." Chest. 2008 Jan;133(1):56-61.

Weng, T. I., C. H. Huang, et al. (2004). "Improving the rate of return of spontaneous circulation for out-of-hospital cardiac arrests with a formal, structured emergency resuscitation team." Resuscitation **60**(2): 137-42.

Whitcomb, J., D. Brierton, et al. (1990). "Code teams and the review of cardiac arrests." QRB Qual Rev Bull **16**(4): 156-62.