Implementation of team training in medical education in Denmark

H T Østergaard, D Østergaard, A Lippert

....

In the field of medicine, team training aiming at improving team skills such as leadership, communication, co-operation, and followership at the individual and the team level seems to reduce risk of serious events and therefore increase patient safety. The preferred educational method for this type of training is simulation. Team training is not, however, used routinely in the hospital. In this paper, we describe a framework for the development of a team training course based on need assessment, learning objectives, educational methods including full-scale simulation and evaluations strategies. The use of this framework is illustrated by the present multiprofessional team training in advanced cardiac life support, trauma team training and neonatal resuscitation in Denmark. The challenges of addressing all aspects of team skills, the education of the facilitators, and establishment of evaluation strategies to document the effect of the different types of training on patient safety are discussed.

....

Patient safety is an important issue, and initiatives that can efficiently increase patient safety are of interest. Although failures and hazards in the process and structure of care are the main causes of events, the human factor is a key component, as ineffective or insufficient communication is a contributing factor in 60–80% of events in medicine.[1–3] The focus is therefore on the performance of medical teams, where potentially catastrophic results may occur when teamwork fails, especially in situations where time is an important factor. Anaesthesia, intensive care, and emergency medicine are areas characterised by complexity, dynamism, major time pressure, rapidly evolving and changing information load with high information ambiguity, and high workload and risk. These characteristics are shared with domains such as aviation, where the concept of crew resource management (CRM) has been developed and refined over the years. A broad definition of CRM is the utilisation of all available human, informational, and equipment resources toward a goal of safe management.[4] The concept has been transferred to the medical domain, where clinical programmes previously had not included management of crisis situations.[5 6] Gaba and co-workers were pioneers within this area, and developed courses in crisis management for anaesthetic and surgical teams based on the CRM concept. In both medicine and aviation, team training seems to reduce the risk of serious events.[7–10] According to the literature, simulation based training is a valuable educational method for the training of team skills, and this is now advocated in medicine in Denmark.[4–6 9] The hypothesis is that patient safety can be improved by optimising team skills such as communication, leadership, and co-operation, both at the individual and at the team level. Furthermore, decision making abilities may be improved if the individual team member understands his/her role. Previously, medical team training has been sporadic and focused mainly on the emergency teams. However, if these skills are of importance for patient safety, the concept could also be used in non-emergency situations, thus all healthcare personnel should be trained.

The purpose of this paper is to describe the development of multiprofessional team training in Denmark and its connection to patient safety. We also discuss the further development needed in team training, with a focus on educational methods and evaluation strategies.

TEAM FUNCTION

The literature defines a team as a set of two or more individuals, who must interact and adapt to achieve specific shared, valued objectives.[11 12] Two aspects of the teams are important: the individual's ability to function as a member of the team and the entire team's ability to function as an efficient collective entity. Several factors, such as task demands, team composition and the organisational context, influence team performance.[13] Medical teams have a variety of tasks and the teams consist of many different team members, changing from task to task and from day to day. This implies that each of the team members should possess general team competencies or generic team skills, which can be transferred from task to task, and from team to team. A prerequisite for participation in team training might be that the individual member has the knowledge and skills to perform as an individual group member.

The main team skills that we focus on are leadership, communication, co-operation, and followership (table 1). We emphasise the importance of leadership and train the team leader to take charge, avoid getting too involved in practical issues, and the ability to step back and

....

See end of article for authors' affiliations
....

Correspondence to:
Dr H Østergaard, Danish Institute for Medical Simulation, Department of Anaesthesia, Herlev University Hospital, 75 Herlev Ringvej, DK-2730 Herlev, Denmark; hets@ herlevhosp.kbhamt.dk
....

Abbreviations: ANTS, Anaesthetists Non-Technical Skills system; ATLS, advanced trauma life support; CRM, crew resource management

have a "bird's eye" view on the situation. Equally important is followership, meaning that each team member understands his or her role in the team, ranging from doing as requested to actively participating in problem solving and decision making, and if necessary decrease the workload on the team leader. The team leader might focus on an incorrect diagnosis and apply the wrong rule (treatment) owing to a fixation error, or be incapacitated, hence everyone in the team should always be alert.

HOW TO DEVELOP A TEAM TRAINING COURSE

In the development of a team training course the recommended elements in course design should be considered in the following order: needs assessment, identification of the target group, defining the learning objectives, choosing educational methods and tools, and finally the evaluation methods.[15] In some situations, the target group is identified before the needs assessment takes place.

Needs assessment

According to the literature about continuing professional development, learning is more likely to lead to a change in practice when needs assessment has been conducted.[16] A needs assessment can be performed in several ways, such as an evaluation of clinicians' own experience in patient care (looking at mistakes, "blind spots"), experience from mentoring, clinical meetings, results from audit, adverse events and/or clinical incident surveys, peer reviews, and nonclinical activities such as research.[17] Based on this information, the target group is chosen.

Learning objectives

Learning objectives is a statement of what the course participants have to learn. They are based on a task analysis and have to be carefully defined. In the development of a team training course it is important to distinguish between individual and team learning objectives.

The educational methods and the tools

The educational methods and teaching strategies are chosen from the viewpoint of the learning objectives. The methods should be rooted in adult learning principles such as activation of the learner, building on prior knowledge, possibilities for selfreflection, and feedback. A variety of different tools and methods exist, and the best result is usually obtained if a combination of these methods is chosen. Educational methods such as lectures, video triggers, case based small group discussions, computer based learning, role play, and full scale simulation are useful in team training. Independent of the method used, it is important to stimulate the participants to read material in advance in order to activate prior knowledge and to achieve a more homogeneous knowledge for the individual team members. Box 1 provides an example of the content of a 1 day course for team training.

Full scale simulation

A simulator is an artificial representation of the real world with sufficient fidelity to achieve a particular goal in training.

BOX 1: Content of course for training

- Mini lecture on ATLS principles and action cards
- Video based discussion on aspects of poor and good communication, teamwork and leadership
- Skill station on teamwork skills, log rolling and inline stabilisation for endotracheal intubation
- Case based discussion. Interactive discussions on trauma case management and triage
- Two full scale simulations in the emergency room followed by video based debriefing

In this paper, simulation refers to a lifesize patient manikin or to a simulated patient and a patient monitor system. A simulated patient is an actor who plays a role according to a script. The vital signs are simulated on a personal computer, which is interfaced with the patient monitor. The simulation environment is a duplicate of the real world, including items such as ventilators, infusion devices, defibrillators and x ray equipment, depending on the case to be trained. It can be situated in the emergency room, delivery ward, intensive care ward, or operating theatre.[18]

All simulation sessions are divided into three parts: (a) the briefing, in which the participants get acquainted with the environment and the case, (b) the scenario that is taking place in the full scale simulator; and finally (c) the debriefing session, in which the participants get feedback from peers and the facilitator. The scenario in the simulator is important because the participants act and get emotionally involved, as in a real case. The scenario is video recorded for use in the debriefing session, in which the learning is connected to the participant's prior knowledge and there is a chance for reflection on treatment and behaviour. The video recording gives the participants the opportunity to "hold up a mirror" to themselves and to see how personal abilities affect the team and vice versa. At the end of the debriefing, new personal learning goals are defined. From an educational point of view, the debriefing session may be the most important part of a simulation based course, as it gives the participant a possibility to reflect on behaviour and receive feedback. During team training courses, it is extremely important that the team has the opportunity to participate in at least two scenarios in the simulator, in order to receive training in the team skills several times and experience an improvement.

Evaluation: assessment

Evaluation of team training courses and the use of simulation can be carried out at several levels:[19] (a) the trainee reaction (did they like it); (b) the extent of learning (effectiveness of course); (c) the extent of performance/attitude change; and (d) the impact on organisation effectiveness and patient safety

Most studies present results at the reaction level. The evaluation of simulation based training is generally very positive, and the simulations are regarded as realistic and perceived as useful in helping the learner to reflect. There is limited evidence of the effect on learning in medicine, especially on team skills, but this does not necessarily imply that simulation based training has no effect; it might be due to insufficient evaluation methods. Several studies have tried to evaluate the effect of CRM training using different scoring systems,[20][21] and recently Fletcher et al[14] have developed a checklist for individual nontechnical skills, which may prove useful. Selfreported improvements in skills and knowledge have indicated an effect of training;[22][23] but ideally, CRM

Table 1	Important CRM abilities
Team leader	**Team members**
Full overview	Situational awareness
Prioritisation	Assertiveness
Distribution of workload	Flexibility
Use of all available data	Conveyance of important data
Clear communication	Clear communication
Respect	Respect
Summarise and re-evaluate	Listen[5][14]

training should be shown to have an effect on organisational practice and patient safety; however, methods for detecting such an effect have yet to be developed and put into practice.

TEAM TRAINING IN COPENHAGEN COUNTY
Training of team skills starts in early in the formal education of anaesthetists and anaesthesia nurses with training for the anaesthesia team (a doctor and a nurse) working together with a relatively uncomplicated anaesthesia. These courses provide generic team skills that can be trained and enhanced in larger teams such as neonatal resuscitation teams consisting of paediatricians and anaesthetists, advanced cardiac life support courses and trauma team training courses (see below).

Advanced cardiac life support
Previous studies have indicated that there is little consistency regarding the use of advanced cardiac life support guidelines.[24–26] A theoretical test presented to staff involved in resuscitation at our hospital demonstrated that the theoretical knowledge of the individual members of the team was insufficient and that guidelines were not followed consistently. A focus group interview with the members of the cardiac resuscitation team revealed that the communication and leadership skills in the teams were inadequate. A course was developed for the team, in which the learning objectives were training in algorithms and in team skills such as leadership, communication, and co-operation. The educational tools used were computer based algorithm training, a resuscitation manikin for manual skills training and two full scale simulator scenarios for training of team skills. Evaluation methods were a theoretical test before and after the course, and selfevaluation of theoretical knowledge and team skills. All participants preferred the active team training course to a traditional cardiopulmonary resuscitation course. At both levels (theoretical test and selfevaluation) participants increased their theoretical knowledge. Table 2 shows the results of the selfevaluation of the team skills. As judged from the participants' evaluation of their own performance, communication and co-operation skills were better after than before the course.

Based on these results, future ALS courses in Copenhagen county will include training algorithms and practical skills together with team skills.

Trauma team training
The treatment of multitraumatised patients demands a co-ordinated effort of the trauma team. This requires knowledge of aspects of treatment as well as leadership, communication, and co-operation. The aim in the advanced trauma life support (ATLS) course is to teach the individual physician the stepwise assessment and treatment of trauma victims, but the multidisciplinary trauma team approach is currently not addressed. Based on the feedback from team members at our hospital, we decided to address these competencies in a local

project. Consequently, a team training course was developed to emphasise the importance of the team approach to the severely injured patient. The aim of this multidisciplinary training is to co-ordinate and optimise the trauma team's treatment and assessment of the severely injured patient in the emergency room, with the emphasis on teamwork, communication, and leadership. The course is for the full trauma team, comprising anaesthetists, surgeons, nurses, radiologists, secretaries, and orderlies, a total of 10–12 people. The full scale simulations take place in one of the hospital's emergency rooms, and the action cards, trauma manual, and normal procedures are followed. Before the course we expect the participants to have acquired a basic knowledge of the trauma manual, and to be familiar with the ATLS principles, as team members' individual knowledge and skills are crucial components of team performance and a prerequisite for training the entire team. An example of the content of a trauma team training course is given in the box. To evaluate the course, we used a questionnaire at the end of the course and selfevaluation forms after the first and second debriefing, respectively. The training was well received by the participants; 90% were satisfied or very satisfied with the course elements and 98% completely agreed or agreed that this course will change their behaviour in the future treatment of trauma patients. Judged by the selfevaluation forms, the course participants increased their competence in communication skills and the teams improved in teamwork skills, ability to use clear messages, and leadership (table 3). As a consequence, these courses are available for new staff members several times a year at the hospital and the concept is being adapted at by other hospitals in the area. To obtain the same effect, the courses take place at each of the local hospitals using local trauma manuals and action cards.

Neonatal resuscitation
An audit of perinatal deaths in the Copenhagen county conducted over a 10 year period showed that insufficient ventilation and fluid resuscitation could have been be the cause of death in 13 of 552 perinatal deaths. The insufficiency of treatment could be due to lack of knowledge or clinical skills, but could also be due to lack of decision making skills and absence of teamwork, such as use of all available resources. The target group consisted of midwives, obstetricians, paediatricians, and anaesthetists. We decided to train the paediatricians and the anaesthetists first and later the other team members. The aim was to focus on knowledge of resuscitation guidelines, practical skills, and other aspects of competence such as decision making and team skills. The course content was based on a mixture of practical skills training (ventilation, endotracheal intubation, and insertion of umbilical cord catheters and chest tubes), full scale simulations and debriefing, and plenum discussions on ethical issues. Evaluation consisted of an evaluation form and a theoretical test before and after the course. All participants were satisfied or very satisfied with the course, and improved theoretical and clinical skills substantially.

Finally, courses addressing team training skills only have been developed for the full team of midwives, obstetricians, paediatricians, and anaesthesiologists.

FUTURE DEVELOPMENT
It is a huge challenge to improve teamwork in medical teams, and clearly, no single approach is likely to address all the problems in team training. The lesson learned at our institution is that a systematic approach to course development, which is pedagogically rooted, is necessary. A condition for proper team training is to train the entire team, not only a part of the team. Careful consideration is needed to choose which educational methods should be used for different

Table 2 The individual team members selfevaluation of communication, co-operation and leadership (CCL) before and after the advanced cardiac life support team training course (n = 66)

Communication/ cooperation/ leadership	Very satisfactory	Satisfactory	Poor	Very poor
Before course	2	46	16	2
After course	25	41	0	0

Table 3 The individual team members' selfevaluation of communication skills, teamwork skills, ability to use clear messages, and clear leadership in the team after the first and second debriefing in the trauma team training course (n = 168)

	Debriefing	Very good (%)	Good (%)	Poor (%)	Very poor (%)
Own communication	First	7	76	16	1
	Second	20	76	4	0
Teamwork	First	14	68	17	0
	Second	51	49	0	0
		Never (%)	Rarely (%)	Most of the time (%)	All of the time (%)
Clear messages	First	13	63	23	1
	Second	39	60	1	0
Clear leadership	First	25	43	29	3
	Second	45	54	1	0

learning objectives/team skills in order to make the education most cost-effective. Full scale simulation seems to be a valuable educational tool for team training, as it triggers the emotional engagement of the participant in an environment close to clinical reality. Further, the debriefing sessions make it possible to build on what the participants already know, as well as make room for reflection and selfevaluation.[6 27 28]

The major challenge, however, is educating the facilitators in how to use active participation methods and facilitate debriefing. This role is quite different from the traditional teacher or lecturer role in medicine. The evaluation and continuous personal development of the facilitators using, for example peer assessment and video recording, are not described at all in literature.

The evaluation strategies used at our team training courses currently address the participant's reactions and selfevaluation of knowledge and team skills. There is a huge need for development of additional evaluation strategies, and in relation to that there is a need for more accurate performance measures. A few behavioural marker systems have already been developed to support the assessment of team skills (nontechnical skills), such as the Anaesthetists Non-Technical Skills (ANTS) system, which is an individual rating scale, and also a few team rating scales.[6 18 29 30] It has previously been shown that cultural differences at the organisational, professional or national leveal have a huge impact on team attitudes and behaviours.[31] This has to be taken into consideration before an existing system is used.

Does team training have an impact on patient safety? The literature indicating the value of team training is scarce.[7 8]

The reactions from the participants and the facilitators are positive and the training of team skills seems to be valuable as indicated from selfassessment. However, more research is needed both on performance measures and other evaluation strategies, which should result in more knowledge about the interconnection between team training and patient safety. New ways of evaluating the effect of team training are necessary and most probably a combination of evaluation methods should be used.

....

Authors' affiliations
H T Østergaard, D Østergaard, A Lippert, Department of Anaesthesiology, Herlev University Hospital, Copenhagen, Denmark

REFERENCES

1 **Cooper JB**, Newbower RS, Kitz RJ. An analysis of major error and equipment failures in anesthesia management: Considerations for prevention and detection. *Anesthesiology* 1984;**60**:34–42.
2 In: **Bogner MS**, ed. *Human error in medicine*. Hillsdale, New Jersey: Laurence Erlbaun Associates Publishers, 1994.
3 **Kohn LT**, Corrigan JM, Donaldson MS. *To err is human: building a safer health system*. Washington DC: National Academy Press, 1999.
4 **Salas E**, Prince C, Bowers C, et al. A methodology for enhancing crew resource management training. *Hum Factors* 1999;**41**:161–72.
5 **Gaba D**, Fish KJ, Howard SK. *Crisis management in anesthesiology*. New York: Churchill Livingstone, 1994.
6 **Howard SK**, Gaba DM, Fish KJ, et al. Anesthesia crisis resource management training: teaching anesthesiologists to handle critical incidents. *Aviat Space Environ Med* 1992;**63**:763–70.
7 **Morey J**, Simon R, Jay G, et al. Error reduction and performance improvement in the emergency department through formal teamwork training: Evaluation results of the MedTeams project. *Health Serv Res* 2002;**37**:1553–81.
8 **Risser DT**, Rice MM, Salisbury ML, et al. The MedTeams Research Consortium. The potential for improved teamwork to reduce medical errors in the Emergency Department. *Ann Emerg Med* 1999;**34**:373–83.
9 **Salas E**, Burke CS, Bowers CA, et al. Team training in the skies: Does Crew Resource Management (CRM) training work? *Hum Factors* 2001;**41**:641–74.
10 **O'Connor P**, Flin R, Fletcher G. Techniques used to evaluate Crew Resource Management training: a literature review. *Hum Factors Aerospace Saf* 2002;**2**:217–33.
11 **Salas E**, Dickinson TL, Converse SA, et al. Toward an understanding of team performance and training. In: Sweezey WR, Salas E, eds. *Teams: their training and performance*. Norwood, NJ: Ablex, 1992:3–29.
12 **Salas E**, Cannon-Bowers J. The anatomy of team training. In:Tobias S, Fletcher JD. *Training and retraining*. Woodbridge, CT: Macmillan Reference USA, 2000:312–34.
13 **Sweezey WR**, Salas E. Guidelines for use in team training development. In: Sweezey WR, Salas E, eds. *Teams: their training and performance*. Norwood, NJ: Ablex, 1992:219–45.
14 **Fletcher G**, Flin R, McGeorge P, et al. Anaesthetists' non-technical skills (ANTS): evaluation of a behavioral marker system. *Br J Anaesthesia* 2003;**90**:580–8.
15 **Posner GJ**, Rudnitsky AN. *Course design: A guide to curriculum development for teachers*. Boston: Addison Wesley Longman, Inc, 1997.
16 **Grant J**, Stanton E. *The effectiveness of continuing professional development*, ASME medical education booklet. Edinburgh: Association for the Study of Medical Education, 2000.
17 **Grant J**, Chambers G, Jackson G, eds. *The good CPD guide*. Sutton: Reed Healthcare, 1999.

Key messages

- A framework is necessary for the development of a team training course based on need assessment, learning objectives, educational methods and evaluations strategies.
- Full scale simulation seems to be a valuable educational tool for team training, as it triggers the emotional involvement of the participant.
- Research within performance measures and evaluation strategies in team training is needed. Most probably, a combination of evaluation methods should be used.
- If team skills can be optimised and training can improve patient safety, it should be considered as part of the training of healthcare personnel at all levels.

18 **Lippert A**, Lippert FK, Nielsen J, *et al.* Full-scale simulation in Copenhagen. *Am J Anesthesiol* 2000;**27**:221–5.

19 **Kirckpatrick DL**. Evaluation of training. In: Cragi RL, eds. *Training and development handbook. A guide to human resources development*. New York: McGraw Hill, 1996.

20 **Schwid HA**, Rooke GA, Carline J, *et al.* Evaluation of anesthesia residents using mannequin-based simulation: A multiinstitutional study. *Anesthesiology* 2002;**97**:1434–44.

21 **Blum RH**, Raemer DB, Carrroll JS, *et al.* Crisis resource management training for an anaesthesia faculty: a new approach to continuing education. *Med Educ* 2004;**38**:45–55.

22 **Flanagan B**, Nestel D, Joseph M. Making patient safety the focus: Crisis ressource management in the undergraduate curriculum. *Med Educ* 2004;**38**:56–66.

23 **Vallebo N**, Lippert A, Østergaard, et al. *Trauma team training*, Presented at Society for Technology in Anesthesia Meeting (STA 2004).

24 **Lindekaer AL**, Jacobsen J, Andersen A, *et al.* Treatment of ventricular fibrillation during anaesthesia in an anaesthesia simulator. *Acta Anasthesiol Scand* 1997;**41**:1280–4.

25 **Lippert A**, Østergaard HT, White J, *et al.* The knowledge and performance of the cardiopulmonary team. *ASA Annual Meeting of Anaesthesiology.* 2000;October: Abstract).

26 **Irola T**, Lund VE, Katila AJ, *et al.* Teaching hospitals physician's skills and knowledge of resuscitation algorithms are deficient. *Acta Anaesthesiol Scand* 2002;**46**:1150–4.

27 **Christensen UJ**, Heffernam D, Barach P. Microsimulators in medical education. *Simulation Gaming* 2001:250–62.

28 **Murray WB**, Foster P. Crisis resource management among strangers: principles of organizing a multidisciplinary group for crisis resource management. *J Clin Anesth* 2000;**12**:633–8.

29 **Small SD**, Wuerz RC, Simon R, *et al.* Demontration of high fidelity simulation team training for emergency medicine. *Acad Emerg Med* 1999;**6**:312–23.

30 **Gaba DM**, Howard SK, Flanagan B, *et al.* Assessment of clinical performance during simulated crisis using both technical and behavioural ratings. *Anesthesiology* 1990;**89**:123–47.

31 **Helmreich RL**, Merritt AC. *Culture at work in aviation and medicine.* Aldershot: Ashgate, 1998.