JOURNAL OF Surgical Simulation

Journal of Surgical Simulation (2022) **9,** 19–30
DOI: https://doi.org/10.1102/2051-7726.2022.0003

REVIEW ARTICLE

Multi-disciplinary team-based simulation training in acute care settings: a systematic review of the impact on team performance

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Date accepted for publication: 16 December 2021

Abstract

Background: Teamwork plays an essential role in providing quality health care and ensuring good outcomes and safe practices in any health care system. This has been demonstrated in several studies in emergency care where resuscitation teams perform at a high level to achieve desired outcomes in life-threatening situations. Simulation has been identified as an effective way of improving team performance skills, especially in acute care settings where team dynamics change rapidly and require good collaboration. In addition to clinical competence, the members of the team need to be conversant with non-technical skills such as team leadership and communication. **Methods:** The MEDLINE, EMBASE and Cochrane Library databases were searched for original articles from the last 20 years investigating team performance in multi-disciplinary team-based simulation training in acute care settings. The research questions were developed using the participants, intervention, comparisons, outcome (PICO) framework. The review was designed and reported in accordance with PRISMA guidelines. The articles were then assessed by independent reviewers using the Critical Appraisal Skills Program (CASP) to standardize the assessment process. **Results:** Of the 1260 articles identified, 12 primary research articles representing a variety of team-based simulation training in various acute care settings were included. The studies were published between 2002 and 2020 and included 679 participants >18 years of age. All articles were original research papers with a combination of pre-/post-test, observational, randomized, and prospective designs; 11 were single-site studies and one was a multi-site study. Six studies used a pre-/post-test interventional method, four used a post-interventional method and one was an observational study. One study used a prospective blinded controlled observational method. Most of the articles reviewed did not provide high-level evidence and the control aspect of PICO was not applied because the review focused mainly on the intervention and outcome with no comparator. This study shows that 72.2% of the reviewed articles demonstrated a positive impact of team-based simulation training on team performance. **Discussion:** This review has demonstrated some evidence that team-based simulation training used in various emergency and acute care clinical settings does improve team performance. However, how that translates to improvement in patient safety and clinical outcomes was not fully addressed by most of the articles reviewed and other previous studies. Simulation enhances team training; the evidence to support multi-disciplinary team training is positive although limited and will require further research to fully develop and validate simulation-based team training programmes.

Keywords: *simulation; medical education; team-based training; multi-disciplinary training; acute care; team performance*

Introduction

The outcomes and results of patient care in critical care settings depend on the effectiveness of coordination and teamwork. Teamwork plays a key role in the delivery of quality health care and ensures good outcomes and safe practice in all health care settings. This has been demonstrated in several emergency studies where activated teams have achieved desired outcomes in dangerous situations.[1] Synchronising strong leadership, clinical and non-clinical skills of all colleagues should assist in crisis management.

Multi-disciplinary teams regularly include specialist physicians, physician assistants and other health care partners.[2]

The team-based approach is applicable in all areas of health care, including crisis care, acute care, palliative care and other non-regulatory areas. Simulation has been shown to be an excellent method for improving team effectiveness, particularly in critical care settings where team members change rapidly and a high degree of collaboration is required.[3] In addition to clinical skills, presenters must have unskilled management and interpersonal skills. These skills are referred to as crisis resource management (CRM), untrained skills, or emotional skills, and help teams adapt to challenging clinical environments that can change gradually without warning.[4] To reduce errors and inconsistent outcomes in crisis situations, there is now an emphasis on using untrained skills to predict important outcomes.[5]

In multi-disciplinary team training, it is important to look at the non-technical skills as well as the technical skills because these are required for effective teamwork. There is evidence demonstrating that positive attitudes towards interpersonal aspects of their work have an impact on effective team performance and consequently on patient safety.[6]

The past approach focused on individuals adjusting to a team and acquiring competencies without formal training.[7] However, the provision of health care can be complex and requires teamwork, and hence educational learning through a multi-disciplinary approach is fast being adopted. Simulation is one educational strategy that is known to be effective in team-based training. The simulation strategy uses a setting that provides virtual environments, staff, devices, and situations that duplicate real clinical environments or events as would be found in a professional situation.[8]

Despite the increase in the use of simulation as an educational strategy, there is limited evidence on how this strategy applies to acute medical care settings compared with emergency settings.[9] This review aimed to systematically synthesize the evidence base for simulation training in various health care settings and its impact on team performance to promote the effective use of such an educational approach.

Method

The systematic review was carried out on primary studies that describe team-based simulation training and its impact on team performance in various clinical settings, including emergency medicine, trauma and orthopaedics, critical care, obstetric emergencies, paediatrics, and acute medical care.

The research questions were established using the participants, intervention, comparisons, outcome (PICO) framework[10] as highlighted in Table 1. The review was planned and carried out using the Preferred Reporting Elements for Systematic Reviews and Meta-Experiments (PRISMA) guidelines. The research questions included:

- What are staff perceptions of multi-disciplinary simulation-based training?
- Does multi-disciplinary team simulation-based training improve the performance of the team and outcome?
- Does teamwork lead to productivity in acute medical care management?
- What is the evidence that team-based simulation training improves team performance?

Search strategy

Primary searches were conducted on all individual glossaries and keywords in MEDLINE, EMBASE and Cochrane Library databases (Table 1). Only studies published between 1999 and 2019 were searched because simulation in medicine has become more important over the last 20 years. The search period was January 2019 to June 2020. Cross-interactions included standard MEDLINE, EMBASE and Cochrane searches. In addition, unpublished papers such as conference presentations, grey literature, theses, research network and research citations were searched. Some of the search terms included multi-disciplinary learning, group simulation, group action, simulation-based learning, intensive review, and crisis intervention. The language of dissemination was limited to English and there were no age restrictions for the population. Reference lists for all articles were also reviewed for further suitable articles for the study.

Searches were loaded into the footnote form, using predefined exclusion and inclusion criteria to retrieve all content (Table 2). Different types of inclusion criteria were used, such as single search and edit control; articles were excluded and reviews done using the PRISMA guidelines (Fig. 1).

Assessment of quality

Articles were then reviewed by independent reviewers (CA and SK), using the Critical Appraisal Skills Program (CASP) to standardize the review cycle. The CASP is a 10-question research review process and provides a simplified method for independent reviewers to critically appraise methods. The CASP uses various randomized control trials, cohorts, qualitative and quantitative protocols that are deemed appropriate for each study. The included articles were then reviewed for similarity and comparability of content and examples. Relevant studies were extracted in their

Table 1. PICO Illustration of the search

Patient/population and/or problem	Intervention	Comparison/control (if applicable)	Outcomes (or effects)
Multi-disciplinary acute care settings	Simulation training	N/A	Team performance
Multi-disciplinary	Simulation training		Team confidence
Multi-professional	training, simulation		Staff confidence
Acute care team	Simulation based training		Skills staff
Critical care team	Simulation teaching		Staff knowledge
Emergency care team	Teaching, simulation		Attitude, staff
Urgent care team	Education, simulation		Teamwork
Multi-professional, team	Simulation education		Team leadership
Multi-disciplinary acute care	Simulation-based education		Team outcome
Health care professional, acute care	Team-based simulation		Team result
Obstetrics team, acute	Team-based training		Team effort
Trauma team, acute	High-fidelity simulation		Situational awareness, team
Obstetric emergency team	Low fidelity simulation		
Paediatric emergency team	Simulation training, high fidelity		
Paediatric urgent care team	Simulation training, low fidelity		
Medical acute team	Team simulation training		
Acute surgical team	In situ simulation training		
Anaesthetics emergency team	Team simulation teaching		
Urgent care medical team	Simulation learning		
Medical team, acute	Learning, simulation		
Acute medical team	Simulation-based team teaching		
Surgical team, acute	Team-based training		
Acute surgical team	Teaching, team		
Acute trauma team	Education, team		
Emergency trauma team	Simulation based learning		
Paediatric multi-disciplinary team, acute	Team simulation		
Acute paediatrics multi-disciplinary team	Simulation, team		
Emergency paediatric multi-disciplinary team			
Emergency multi-professional team			
Acute care settings			
Emergency admission			
Emergency care			
Accident and emergency casualty			
Hospital admission			
Hospital admissions			
Urgent care			
Emergency admission unit			
Acute medical unit			
Emergency assessment unit			
Emergency admission unit			
Emergency department			
Emergency unit			
Admission unit			
Critical care unit			
Acute care unit			
Acute care			

Table 2. Selection criteria for this review article

Inclusion criteria	Exclusion criteria
Type of study: randomized controlled trial, observational, prospective/retrospective, clustered	Uni-professional simulation training
Type of participants: multi-professional team including doctors, nurses at different levels	Literature review and editorials
Type of intervention: team-based simulation training in acute settings	Traditional team training
Type of outcome: teamwork performance, e.g. communication, leadership, situational awareness	Non-English articles
	Articles on communication tools and clinical handover techniques

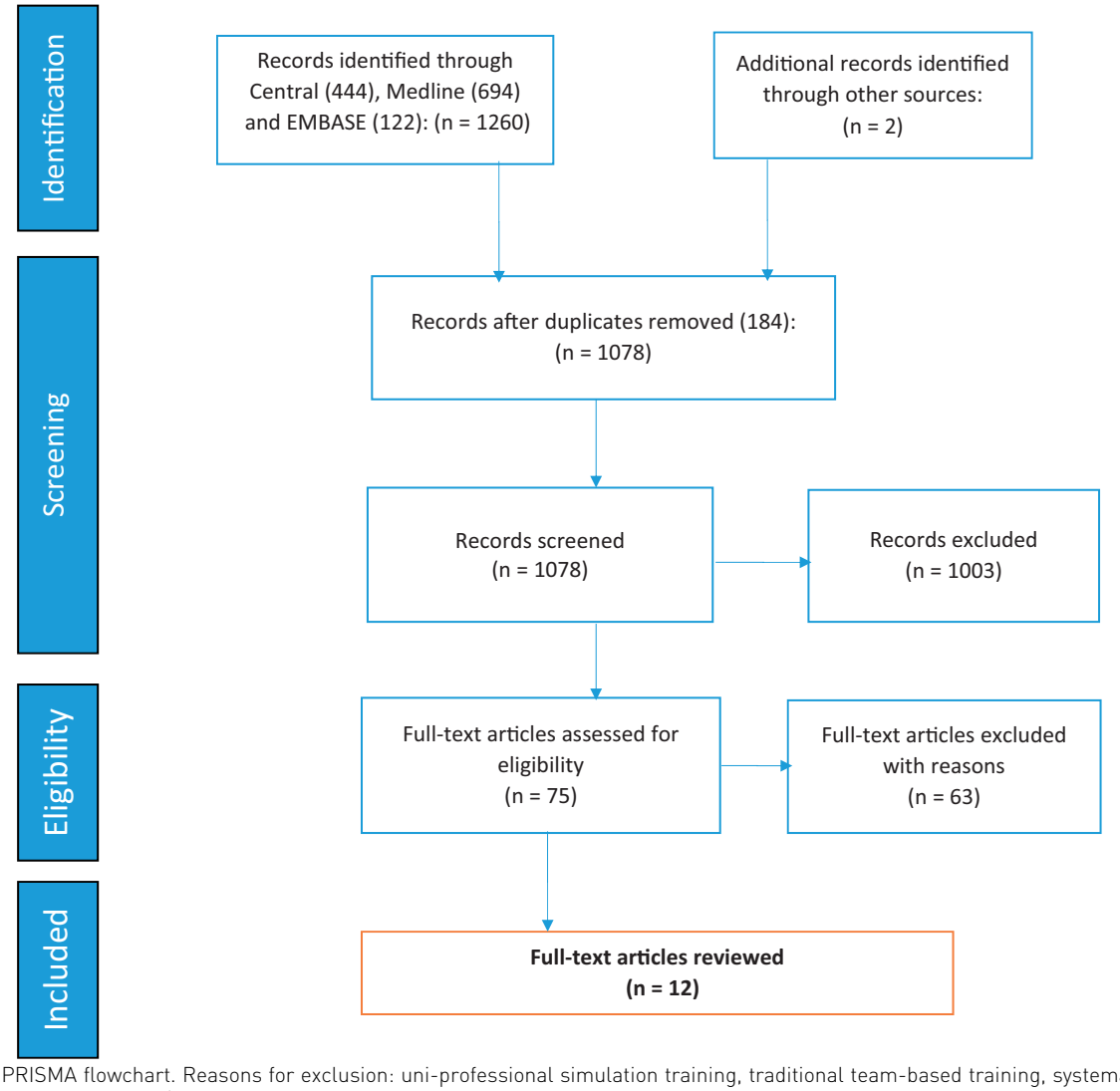

Figure 1. PRISMA flowchart. Reasons for exclusion: uni-professional simulation training, traditional team-based training, systematic review articles, non-acute care settings.

entirety, and 12 articles remained for reviewers to extract key information and narrative summaries of results.

Results

Study characteristics

Of the 1261 distinguishable items, 12 surveys met the review criteria (Fig. 1, Table 3). The surveys were conducted between 2002 and 2019 and included 679 participants aged 18 years or older. Eleven studies were single-site studies with a mixture of pre-test, post-test, observational, randomized, and planned studies; and one was a multi-site study. Six studies used a pre-test and post-test, four studies used a post-test, and one was an observational study. One study used a structured, controlled perception system. Most of the articles required a large amount of evidence, and this information was not available because the studies mainly focused on the intervention and its outcomes, without using a PICO control component.

Eight studies were conducted in the United States, one each in Australia and New Zealand and two in the United Kingdom. Six investigations involved emergency and trauma treatment centres for adults and children. Two surveys involved paediatric intensive care and an adult anaesthetic room, one in the operating room, one in obstetric duty rooms and maternity wards, and two surveys were in adult acute care wards. The articles were categorized using three main themes as shown in Table 4.

The details of the 12 articles reviewed are presented in Table 5 showing summaries of the literature review findings according to the settings. All surveys were conducted in collaboration with a multi-disciplinary team and in an acute clinical environment.

The systematic review showed that 72.2% of the studies showed a positive impact of simulation training on team performance, 16.7% showed a negative impact on team performance and 11.1% did not demonstrate any impact on team performance (Table 6).

Main themes that emerged from the data synthesis

We identified three classes of articles that used hospital intensive care units to train multi-disciplinary teams. We reflected on the outcomes of the training under these three themes.[11] These categories included the experience of CRM facilitating the group; critical care dynamics with acceptable outcomes or clinical consequences; and appropriate retraining or training of the specific multi-disciplinary team.

Do CRM skills promote team performance?

Eleven of the 12 studies reported essential CRM skills to promote team performance. CRM skills refer to non-technical skills, also known as soft skills, that support a team in managing a demanding clinical situation that can vary in real-time without warning.[12]

The use of multi-disciplinary simulation-based training was demonstrated (in 11 of the 12 studies) as a tool that could improve and maintain team functions. Two studies reported benefits observed after the CRM training in terms of the team's dynamic in performing complex tasks and responding to unpredictable or rapidly changing situations.[12,13] The team behaviours that were found effective were situation responsiveness, monitoring of mutual performance, adaptability and collaboration.[12,15] The role of effective communication among multi-disciplinary team members was emphasized in five studies.[13,17,19,20] In a dynamic environment of emergency care settings, studies have described communication with a common understanding and in a clear manner about the crisis as it evolves. According to these studies, this strategy proved to enhance team decision-making, knowledge sharing and understanding of individual team members' roles.[12,15,20,21]

Table 3. Distribution of the review articles by clinical settings

Emergency department/ trauma bay	Intensive care unit	Operating room	Obstetrics birthing room	Acute care ward
Murphy et al., 2019[20] (A)	Figuerora et al., 2013[17] (P)	Undre et al., 2007[8] (A)	Robertson et al., 2009[21] (A)	Klipfel et al., 2011[3] (A)
Falcone et al., 2008[2] (P)	Weller et al., 2008[19] (A)			Slater et al., 2012[18] (P and A)
Shapiro et al., 2004[15] (A)				
Capella et al., 2010[16] (A)				
France et al., 2013[12] (A and P)				
Holcomb et al., 2012[13] (A)				

A, adult; P, paediatrics.

Table 4. Groups and categories

Study	CRM skills promotes team performance			Decision-making impacts outcomes		Suitability of simulation for team training	
	Teamwork	Communication	Leadership	Decision-making	Patient outcome	Participant evaluation	Education model
Shapiro et al., 2004[15]	✓	✓	✓	✓	✓	✓	✓
Murphy et al., 2019 [20]	✓	✓	✓	✓		✓	✓
Undre et al., 2007[8]	✓	✓	✓	✓	✓	✓	✓
Robertson et al., 2009[21]	✓	✓	✓	✓		✓	✓
Falcone et al., 2008[2]	✓				✓		✓
Figueroa et al., 2013[17]	✓	✓	✓	✓	✓		✓
Capella et al., 2010[16]	✓	✓	✓		✓		✓
France et al., 2013[12]	✓	✓	✓			✓	✓
Holcomb et al., 2012[13]	✓	✓			✓		✓
Klipfel et al., 2011[3]	✓			✓			✓
Slater et al., 2012[18]					✓	✓	✓
Weller et al., 2008[19]	✓	✓		✓	✓		✓

The leadership domain of CRM skills was described in seven papers.[12,15–17,20,21] A synergy of leadership–followership has proven effective and has been described as a catalyst for teamwork.[20] Simulated multi-disciplinary training is an operational way to progress leadership skills and surge confidence amid team leaders during a crisis.[17] The team leader role was assigned to a team member at the start of the simulation when individual roles were being allocated. Other benefits of leadership skills included a decrease in the time required to perform time critical interventions after simulated team training and greater efficiency in patient care.[17]

Decision-making in acute care situations: how does it impact clinical outcomes?

Some of the elements that influence this dynamic are the limited exchange of information between colleagues, the group's limited contribution to critical thinking, and the order of choices.[19,20] The perception of hierarchy in the nursing group means that the pioneering medical group's decisions are often not challenged by the normal working relationship between doctors and nurses. This strong tendency or assumption that older people do not make mistakes can create problems. Studies have used several determinants of successful group dynamics at baseline, including brief problem identification, sharing of risks, and initiating a management plan when reviewing, observing and testing the impact of care provided by providers on clinical outcomes.

Multi-disciplinary crisis and critical care teams demonstrated the benefits of group training reform (in 9 of the 12 studies). The outcome evaluation used was largely based on repeated clinical interventions. Repeated training appears to increase reaction time, group situational awareness of potential triggers, and adherence to set plans to identify the subject of the clinical problem. The dynamic nature of the crisis promotes collaboration among multi-disciplinary teams and better alignment with best practice. In these settings, teams are prepared to achieve better outcomes and promote better care. Casual team training has also been shown to improve wellbeing and lead to sustainable outcomes; however, only one study directly identified these outcomes.[18] Multi-disciplinary teams were able to identify and report baseline conditions earlier, leading to safer patient care. Teams were better able to assess and continue to care for patients who were truly affected,[12,15,20] and team training led to the initiation of delegation to manage and perform a wider range of medical tasks and interventions.[17]

Simulation: is it suitable for training specialized multi-disciplinary teams?

A review of the articles found that the reconstruction approach was the learning strategy of choice (in 9 of the 12 articles), and three studies used traditional learning tools (didactic instruction and skills training, including online) supplemented with simulation.[12,13,15] All the research used a mixture of practice systems and organizational contexts, with varying degrees of complexity in fidelity to practice system plans and validity of contexts, and different classes

Table 5. Summary of literature review findings

Reference and location	Study design	Data collection	Study aim	Specialty	Findings	Recommendation	Limitations
Emergency department/trauma bay							
Murphy et al. (2019)[20] Australia	Post-test intervention, single site	n = 15 (female 12); doctors, nurses, allied health professional, various specialties; only those who attended trauma team training	To evaluate trauma team (TT) members' perspective and experience of teamwork in simulated multi-disciplinary team training	Emergency, trauma, intensive care, anaesthesia, allied health, adults	(1) Team training improves team performance; (2) leader–follower synergy promotes TT work; (3) instability and Inconsistency threaten TT work; (4) clear communication enhances TT decision-making	Larger studies required to assess the impact on team performance and clinical outcome	It focuses on a small number and the sample was overwhelmingly female. The inclusion of a single site means local contextual issues may influence the results. The TT training was done 2–6 years previously so will depend on retentive memory of individual team members
Falcone et al. (2008)[2] USA	Post-intervention study, single site	n=160	Evaluate the impact of multi-disciplinary trauma team training	Trauma centre, paediatrics	Improvement in team performance	Need to explore simulation transferability to clinical practice	No control group; there was no assessment of intervention variables
Shapiro et al. (2004)[15] USA	Single centre, prospective, blinded, controlled observational study	n=20 (4 resident physicians, 4 attending physicians, 12 nurses); selected at random from 32 residents and 120 nurses	Determine if simulation-based team training can improve clinical team performance when added to an existing didactic teamwork curriculum	Emergency department, adult, staff	No significant difference between the two groups at baseline; experimental group showed a trend towards improvement in the quality of team behaviour	Larger sample size and emergency care provider to ensure regular team skill training is done for a significant outcome	Small sample size may have affected the statistical significance of the study. All participants had already attended a teamwork course so the impact of simulation-based training as a single intervention tool may be difficult to establish
Capella et al. (2010)[16] USA	Pre-test/post-test, single site	n=33 (pre- test); n=40 (post-test)	Establish if trauma team training improve team performance	Trauma centre, adult	Simulation-based team training improves team performance by time to definitive treatment	Large study required to assess its impact on clinical outcome	Small sample size, uncontrolled design, variation in timing and team composition
France et al. (2005)[12] USA	Pre-/post-intervention study	n=182	Evaluate team reaction to crisis resource management (CRM) training	Trauma centre, adult and paediatric	There was a positive impact towards CRM	Research required to establish if CRM translates to clinical outcome	There was no outcome measure (quantifiable) of improvement in team or patient outcomes
Holcomb et al. (2002)[13] USA	Pre-/post-test design, singe site	n=10 (pre- test); n=10(post- test)	Evaluate month-long team-based resuscitation training	Trauma centre, adult	There was improvement in both technical and non-technical skills	Ability to transfer skills into clinical practice	Small sample size and measurement tool used was not validated
Intensive care unit							
Figueroa et al. (2013)[17] USA	Pre-/post-intervention study, single site	n=37 (23 nurses, 5 respiratory therapists, 5 doctors, 4 unspecified)	Evaluate the impact of simulation on teamwork, confidence and communication	Intensive care, paediatrics	Simulation improves communication and increases confidence among members of the multi-disciplinary team	Translating outcome from simulation to real clinical practice; it will be an excellent tool for teaching and implementing new processes	No sufficient data to assess the impact of the training on patient outcome. The course instructors and the participants work together so element of bias

Table 5. Continued.

Reference and location	Study design	Data collection	Study aim	Specialty	Findings	Recommendation	Limitations
Weller et al. (2008)[19] New Zealand	Qualitative post-intervention, singe-site design	n=20	Explore the interaction between different professional groups in critical clinical situations	Anaesthetics, adult	There was limited understanding of the role of the team members, decision-making and information-sharing	Assess how team performance has an impact on clinical outcome	No objective measures were used and participants' perceptions of team performance not assessed
Operating room							
Undre et al. (2007)[8] UK	Single-site, observational crossover study in two stages	n=80	Evaluate simulation training for multi-disciplinary surgical team	Surgical, operating room, adult	The performance of non-technical skills by nurses and doctors were compared. Leadership and decision-making were scored lower than communication, team skills and vigilance. Surgeon and anaesthetist scored lower than nurses on leadership	Further study required to assess the impact of simulation-based team training on team performance	Lacks evidence on clinical outcome measures. There is methodological difficulty in assessing its specific effect on clinical practice
Obstetrics birthing room							
Robertson et al. (2009)[21] USA	Pre-test, post-test design, single site	n=22	Evaluate the impact of simulated team training on performance	Obstetrics birthing room, adult	Improvement in the attitude towards handling obstetrics emergencies, individual and team performances	There is a need to have a more frequent team-based training with a large sample size	Small sample size. The study did evaluate the long-term crisis knowledge skills and attitude retention after training, so no comment on optimal frequency of training
Acute care ward							
Slater et al. (2012)[18] UK	Post-interventional study, multiple sites	n=55	To evaluate the impact of multi-disciplinary team-based training on patient safety	Hospital-based multi-disciplinary team, adults, paediatrics	There was improvement in patient safety and outcomes	There is a need to translate this to clinical practice. Team performance will also need to be assessed	There was no control group, more of an uncontrolled design because team composition and experience differed
Klipfel et al. (2011)[3] USA	Pre-/post-test design, single site	n=38	To determine if multi-professional simulation training improves teamwork	Urology, adult	Significant impact on team cohesion and decision-making	The influence of various learning styles needs to be explore further	No control group or use of random selection

Table 6. Summaries of impact on team performance

Reference	Findings	Outcome (positive/ negative/neutral)
Murphy et al. (2019)[20] Australia	(1) Team training improves team performance (2) Leader–follower synergy promotes trauma teamwork (3) Instability and Inconsistency threaten trauma teamwork (4) Clear communication enhances trauma team decision-making	Positive Positive Negative Positive
Undre et al. (2007)[8] UK	(1) Leadership and decision-making were scored lower (2) Communication, team skills and vigilance scored higher (3) Surgeon and anaesthetist scored lower than nurses on leadership	Negative Positive Neutral
Robertson et al. (2009)[21] USA	Improvement in the attitude towards handling obstetrics emergencies, individual and team performances	Positive
Falcone et al. (2008)[2] USA	Improvement in team performance	Positive
Shapiro et al. (2004)[15] USA	(1) No significant difference between the two groups at baseline. (2) Experimental group showed a trend towards improvement in the quality of team behaviour	(1) Neutral (2) Positive
Figueroa et al. (2013)[17] USA	Simulation improves communication and increases confidence among members of the multi-disciplinary team	Positive
Capella et al. (2010)[16] USA	Simulation-based team training improves team performance by time to definitive treatment	Positive
France et al. (2005)[12] USA	There was a positive impact towards crisis resource management	Positive
Holcomb et al. (2002)[13] USA	There was improvement in both technical and non-technical skills	Positive
Klipfel et al. (2011)[3] USA	Significant impact on team cohesion and decision-making	Positive
Slater et al. (2012)[18] UK	There was improvement in patient safety and outcome	Positive
Weller et al. (2008)[19] New Zealand	There was limited understanding of team members' roles, decision-making and information-sharing	Negative

of experts to test models of team collaboration in a crisis situation. None of these studies used humans as the test system.

Interestingly, all these studies use simulation-based teaching methods rather than the traditional (didactic) style. Professionals chose re-enactment as a teaching strategy in part for several reasons, such as robust face legitimacy, recognition in various activities such as flying and the military, and the increasing acknowledgement that medical errors are often caused by work pressure, inadequate staffing, or breaks in group communication.[22]

In seven studies we reviewed, team-based training had an impact on group performance.[13,15,17–21] Group members were presented with a redesign situation in which the developers identified weaknesses in group performance and dynamics. This was then used as a learning experience in a repeat exercise. Significant performance improvements were observed during this re-exposure session, suggesting that re-exposure skills are useful and convincing in preparing multi-disciplinary teams for technical and non-technical skills.[13,21] All studies suggested that re-exposure is useful and a convincing training tool in preparing multi-disciplinary teams for technical and non-technical skills.

Discussion

This evaluation has provided a great deal of information into the emerging relationships among simulated multi-disciplinary team performance, essential skills, and factors that have an impact on patients or clinical outcomes in various acute care settings. Simulation training is a powerful learning technique that simulates real-life experiences and teaches skills that are embedded in the information, thinking and practices of participants,[26] both lay and professional. Research has shown that group simulation training applied to various crisis and clinical scenarios can improve group performance.[24] However, how this improves patient well-being and clinical outcomes has not been fully addressed in most review articles and other previous studies. There are no reliable studies comparing the effects of simulation and group learning on group performance. It will be interesting to find out if different educational strategies have variable

impacts on team performance; most of the reviewed articles used simulation-based training.

One can argue that the choice of simulation-based training, as seen in most studies, compared with the conventional teaching method may be because simulation as a teaching technique mimics the features of a real-world situation. This allows multi-disciplinary teams to train and learn together without fear of making mistakes and at no clinical risk. Most of the studies in this review were performed in various emergency and acute care settings, including trauma, emergency medicine, surgical, intensive care, obstetric emergency, paediatrics, and other acute care speciality teams in the hospital. These studies have described similar skills, especially non-technical skills. learnt from team-based simulation training across various specialities. It is acknowledged that the training in each speciality team would provide an enabling platform for learning and team performance because most of the team members would then have some degree of familiarity with one another.

On the other hand, the outcome may vary in a random emergency with no pre-existing team, such as cardiac arrest calls, where the standard practice is to identify the lead from the onset and assign individual roles to encourage team cohesion. However, the cohesion of an intensive care team, surgical team, etc., in managing a crisis is important irrespective of the whether the teams are regular or intermittent groupings. In such events, the outcome depends largely on the abilities of the individuals to function collectively. This review suggests that the abilities or skills needed for such tasks are similar across different specialities and can be acquired through simulation team-based training. Multi-disciplinary training provides opportunities to learn how to team up, strengthen and sustain positive effects on group cohesion.

A criticism of the traditional model of professional development in health care is that it tends to focus on technical, mainly single-speciality skills, emphasizing individual competence and ability to treat patients. The assumption that individuals can only acquire appropriate team skills through experience without formal training is no longer the case; the emphasis is now on an interdisciplinary model of learning (bringing health care professionals together).[25] This study supports the idea that appropriate team training improves team performance and shows why non-technical skills training is important. The importance of non-technical skills was first recognized in aviation and had all the characteristics that should also be important in managing clinical crisis scenarios, including the management of complex patients under stress. Key non-technical skills or team behaviours are communication, dynamism, authority, situational awareness, hazard recognition, organization, attention, and accountability.

The review confirmed that teamwork is not spontaneous but follows a dynamic process that is formed and requires practice. Simulation makes this faster and reinforces the way multi-disciplinary teams are taught, practised, and broken down. With the goal of having a trigger point for an intensive care unit event that requires team participation, the simulation practice plan is followed in a systematic way. This provides significant learning opportunities and includes a recognizable cycle and execution plan. This is usually followed by a question and answer session; this is an important part of the simulation learning strategy because most of the simulation's learning and experience takes place during this cycle. Teams can determine which cycles work best and identify ways to improve implementation in the future.

Team training and practice is now a fundamental part of training in many fields such as aviation, business and the military and is increasingly important in the day-to-day training of anaesthetists and emergency medicine professionals. Simulation is also used in the clinical setting for other specialities. Many of the studies we evaluated focused on team training and how it affects performance rather than patient safety as an outcome measure. In any case, better team performance is thought to consistently lead to better patient outcomes.[26] Most reviews emphasized the link between team preparation and team performance. It is conceivable that preparation is associated with an overall desirable dynamic, because teams are more likely to recognize baseline cases and regularly organize mediation on a baseline basis.[16] Most studies have not shown that simulated team training can be adapted to clinical practice, and virtually none have shown how the skills learned can be applied to real clinical situations and with what results. This is an area for future research, to demonstrate the extent to which clinical outcomes are realistic.

The main limitation of this study is the small sample size of several of the studies. In addition, some studies did not include clinical outcome measures. The scope of the studies and follow-up were not sufficient to ensure continuous updating of data and skills needed to make significant changes. These studies did not clarify the relationship between team-based training and patient outcomes. Further definitive studies are awaited to fully assess the relationship between staff training, group dynamics and patient outcomes. There is a need to consider the flexibility of modelling results in real clinical situations, which was not done in this review. Training and testing of these untrained simulation skills should be an integral part of the simulation

team training. Further research into the impact of simulation training on non-technical skills, clinical outcomes, error rates and patient safety would be important at both clinical and evaluative levels. The review consistently showed that simulation-based, interprofessional team training does have an impact on team performance.

Conclusion

Training multi-disciplinary teams in emergency and acute care can improve the quality of communication, teamwork, and alignment, with implications for team performance and patient outcomes. Simulation supports team learning; evidence supporting multi-disciplinary team learning is positive but limited, and further research is expected to fully establish and update simulation-based team learning programmes. Bringing together talented professionals or meeting privately to care for patients in crisis or in an intensive care unit provides an adequate learning environment. However, unless the facilitator has an idea of how to organize a combination of different specialities, recognize their roles and inspire teamwork, the benefits of the training for the whole team will not be fully realized.

Simulation-based team training is a powerful tool for health systems to recruit technically gifted and team champion specialists. The combination of good skills and satisfactory team competencies will always maintain good team performance and clinical outcomes leading to an improvement in the quality of care delivered. Our review suggests that establishing measures of team performance in simulation-based training is crucial to achieving simulation-based team training, because feedback, health, and learning depend on the adequacy of the assessment framework established or used. It has been shown that effective use of team performance assessment and team learning can improve communication and decision-making in complex and dynamic or critical situations. Research suggests that widespread use in training shows some promise, but more conclusive evidence is needed to demonstrate a real impact on learning and patient outcomes. Recommendations for future research include larger studies to assess the impact on team performance and clinical outcome, as well as the need to explore simulation transferability in clinical practice. Future studies may be required to establish if CRM translates to clinical outcomes because there was no outcome measure (quantifiable) of improvement in team performance directly on patient outcome such as patient safety and patient satisfaction.

Conflict of interest

The authors declare no conflicts of interest.

Acknowledgements

This work was presented at the ASPiH 2020 Virtual Conference, 10–11 November 2020.[27]

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