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Featured Article

Effectiveness of Education in Improving the Performance of Medical Emergency Team Nurses

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KEYWORDS

medical emergency team (MET);
rapid response team (RRT);
MET nurse;
education;
training

Abstract

Background: Numerous national safety organizations have recommended the use of a Medical Emergency Team (MET) system to improve hospital safety. However, there is little evidence regarding the effectiveness of the educational approaches used to train METs.

Objective: To evaluate how effective educational interventions are at improving the performances of MET nurses.

Methods: A systematic literature review was conducted in five multi-disciplinary databases. The studies were selected and independently assessed by two researchers. The analysis followed the principles of narrative synthesis.

Results: A lack of suitable studies meant that only two studies were analyzed. Nevertheless, they confirmed that simulation team training is an effective method and preferred among METs. The assumption of specific roles during training improved the task completion rate.

Conclusions: The effectiveness of MET educational interventions remains unclear due to a lack of published studies. Future studies on MET educational interventions should clarify and evaluate the roles of MET nurses and how they perform during emergency situations.

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The National Patient Safety Goals for American hospitals (Winters & DeVita, 2011), a consultation report from the Australian Commission on Safety and Quality in Health

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Care (2014), and the 2015 European Resuscitation Council Guidelines for Resuscitation (Soar et al., 2015) recommend the use of a medical emergency team (MET)—also known as a rapid response team—system to improve hospital safety and quality of care (Peberdy et al., 2007). In this article, the term MET refers to both rapid response team or MET.

A MET system aims to prevent cardiac arrests and unplanned intensive care unit (ICU) admissions by detecting and responding to deteriorating hospital ward patients (Soar et al., 2015; White, Scott, Vaux, & Sullivan, 2015). The part of the MET system that recognizes the deteriorating patient is called

the afferent limb, and the efferent limb is the responding team that is called to evaluate and treat the patient. Both these limbs need to function well on their own and work together for the system to be beneficial. The efferent limb team members share their critical care knowledge, early detection, and treatment skills with the afferent limb members during MET calls. The MET systems emphasize the importance of education in early detection. The team members of the efferent limb play an important role in a successful MET organization. Therefore, effective MET team education is of great significance (Winters & DeVita, 2011).

MET Education

Simulation-based education has been recognized as a MET training tool (Frengley et al., 2011; Sakai & DeVita, 2009) that can improve both participants' psychomotor skills (Kim, Park, & Shin, 2016) and nurses' abilities to recognize and treat instability (Hravnak, Beach, &

Tuite, 2007), as well as refine team skills (Niell et al., 2015; Wallin, Meurling, Hedman, Hedegård, & Felländer-Tsai, 2007). Moreover, high-fidelity simulation education has been shown to be superior to traditional methods of teaching in enhancing communication, teamwork, and leadership skills within resuscitation teams (Murphy, Curtis, & McCloughen, 2016; Warren, Luctkar-Flude, Godfrey, & Lukewich, 2016) by increasing participants' knowledge, confidence, and satisfaction (Warren et al., 2016). However, there is a lack of evidence regarding the effectiveness of simulation education for ICU nurses (Jansson, Kääriäinen, & Kyngäs, 2013).

As ICU nurses are regular members of METs (Jones, Drennan, Hart, Bellomo, & Steven, 2012; Tirkkonen, Nurmi, Oikkola, Tenhunen, & Hoppu, 2014), and these teams annually respond to hundreds of MET calls (Tirkkonen, Tamminen, & Skrifvars, 2017), the skills and attitudes of MET nurses can significantly impact the outcome of an MET event (Jones, King, & Wilson, 2009). In some MET systems, a sole ICU nurse can be the first responder (Tirkkonen et al., 2014; Winters & DeVita, 2011). During a MET call, MET nurses spend almost half of their time assessing the patient and re-evaluating risks; therefore, the education of MET nurses should support these roles (Santiano et al., 2011). The assessment and team leadership skills of MET nurses, along with their work attitude, play an important role in the effectiveness of METs (Topple et al., 2016a). However, the effectiveness of the MET education given to ICU nurses remains largely unstudied.

Therefore, the presented study used a systematic literature review to evaluate how MET educational interventions involve ICU nurses. The research focused on addressing the effectiveness of these educational interventions in improving the knowledge and skills of ICU nurses who are MET members. Only intervention studies were included in this systematic literature review.

Material and Methods

Search Strategy and Limitations

This systematic literature review was conducted according to study process guidelines from the Center for Reviews and Dissemination (Center for Reviews and Dissemination, 2009) and the Joanna Briggs Institute Reviewers' Manual (Joanna Briggs Institute, 2014). Data were collected from five different databases in December 2016. After an initial search, 338 studies were identified from the following databases: Scopus (n = 117), Web of Science (n = 53), Cumulative Index to Nursing and Allied Health Literature (n = 60), ProQuest (n = 98), and Medic (n = 10). Duplicates (n = 154) were removed to reduce publication bias (Center for Reviews and Dissemination, 2009). The selection process yielded a total of 184 studies (Table 1).

The library information specialist was consulted for advice about suitable databases, search strategies, terms, and limitations (Aromataris & Riitano, 2014). The search terms and the databases used in this study are shown in Table 1. Only original peer-reviewed articles were included. The research was broadened by using both English and Finnish sources. The publication year was left open. The search strategy was carefully documented, and original searches were maintained in the Web-based research management tool RefWorks (Higgins & Green, 2011).

Key Points

- Simulation is a recognized medical emergency team (MET) training tool that facilitates team training.
- There is no consensus about the most effective educational intervention for training METs. As intensive care unit nurses are frequently members of METs, their competence can significantly influence the performance of the whole team as well as hospital safety and quality.
- Randomized controlled trials could provide insight about the effectiveness of various simulation-based interventions by comparing them to other forms of education. This type of research is key to identifying the most effective education approach for MET training.

Table 1 Search Strategy, Terms, Limitations, and Number of Identified Studies for Five Databases

Database	Search Terms (Article Title, Abstract, and Keywords)	N
Scopus	"Medical Emergency" OR "Rapid Response" OR "Critical Care Outreach" OR "Patient at Risk" AND team* AND competenc* OR skill* OR training* OR education* OR capability* AND nurs*	116
Web of Science	"Medical Emergency" OR "Rapid Response" OR "Critical Care Outreach" OR "Patient at Risk" AND team* AND competenc* OR skill* OR training* OR education* OR capabilit* AND nurs*	17
Proquest	"Medical Emergency" OR "Rapid Response" OR "Critical Care Outreach" OR "Patient at Risk" AND team* AND competenc* OR skill* OR training* OR education* OR capabilit* AND nurs*	15
CINAHL	"Medical Emergency" OR "Rapid Response" OR "Critical Care Outreach" OR "Patient at Risk" AND team* AND competenc* OR skill* OR training* OR education* OR capabilit*	26
Medic	"Medical Emergency" OR "Rapid Response" OR "Critical Care Outreach" OR "Patient at Risk" AND team	10
Total number of studies identified in the selection process		184

Note. CINAHL = Cumulative Index to Nursing and Allied Health Literature.

Inclusion Criteria, Study Selection, and Quality Appraisal

The following inclusion criteria were adopted from PICoS (Center for Reviews and Dissemination, 2009) for this review: P = participants (MET or the equivalent team in a somatic hospital environment included ICU registered nurses), I = phenomena of interest (educational intervention), C = context (none), o = outcome (learning outcomes), and S = types of studies (peer reviewed, original study, published in English or Finnish, and publishing year open). The exclusion criteria were that an identified study focused on students, ward nurses, medical officers, or other emergency team members, the MET originated from a unit other than the ICU, and the MET was responsible for a ward other than an adult somatic ward (i.e., pediatrics, psychiatry, obstetrics, operation room, trauma, emergency department, dental, or a resuscitation team trained only in providing cardiopulmonary resuscitation).

The 184 studies selected for this review were screened with a three-phase selection process following the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement. The screening phases were titles (n = 184), abstracts (n = 48), and full text (n = 14). Two researchers (S.L. and M.J.) performed this process independently and objectively (Center for Reviews and Dissemination, 2009). The PRISMA study selection and exclusion process is illustrated in the Figure. Any disagreements between the researchers regarding study eligibility were resolved through discussion. During the full-text screening phase, the researchers sent an e-mail to one of the authors of a selected study (Fregley et al., 2011) to clarify whether their study population included MET personal. This study was excluded because of an unsuitable population.

The PRISMA study selection and exclusion process resulted in two studies that met the inclusion criteria. Because of the low number of identified studies, one researcher (S.L.) also screened the references of all the previously selected full-text articles (n = 14). This screening covered an additional 368 titles, 20 abstracts,

and two full-text articles. However, this screening did not identify any articles that were suitable for the review.

The two researchers then independently assessed the methodological quality of the relevant studies using the Joanna Briggs Institute Meta Analysis of Statistics Assessment and Review Instrument critical appraisal tool for descriptive studies (Joanne Briggs Institute, 2014). The researchers (S.L. and M.J.) assigned scores of 0 or 1 for each suitable checklist question, with 5/5 the maximum possible score. The included studies received scores of 3 to 4/5, with both receiving more than 50% of the total possible score. The reviewers agreed on the given quality scores.

Data Extraction and Analysis

The research material from the included study articles was processed (Center for Reviews and Dissemination, 2009), and an extraction table was created (Table 2) following instructions from Higgins and Green (2011) and the Center for Reviews and Dissemination (2009). This data extraction table was designed to answer the specific review questions (Center for Reviews and Dissemination, 2009), fulfill the study objectives (Joanne Briggs Institute, 2014), and ensure that all the necessary information from the included studies was obtained. Data extraction and analysis was conducted by one researcher (S.L.) and confirmed by the other researcher (M.J.) to minimize bias and errors in the data extraction process (Center for Reviews and Dissemination, 2009; Polit & Beck, 2012).

Findings from the included studies were summarized using the principles of narrative synthesis (Munn, Tufanaru, & Aromataris, 2014). Interrater reliability indices (Polit & Beck, 2012) were not calculated because the two researchers had achieved complete agreement during the final selection.

Results

The literature search identified a limited number of suitable studies, and, as a result, only two original studies were included in the presented review (Table 2). The included

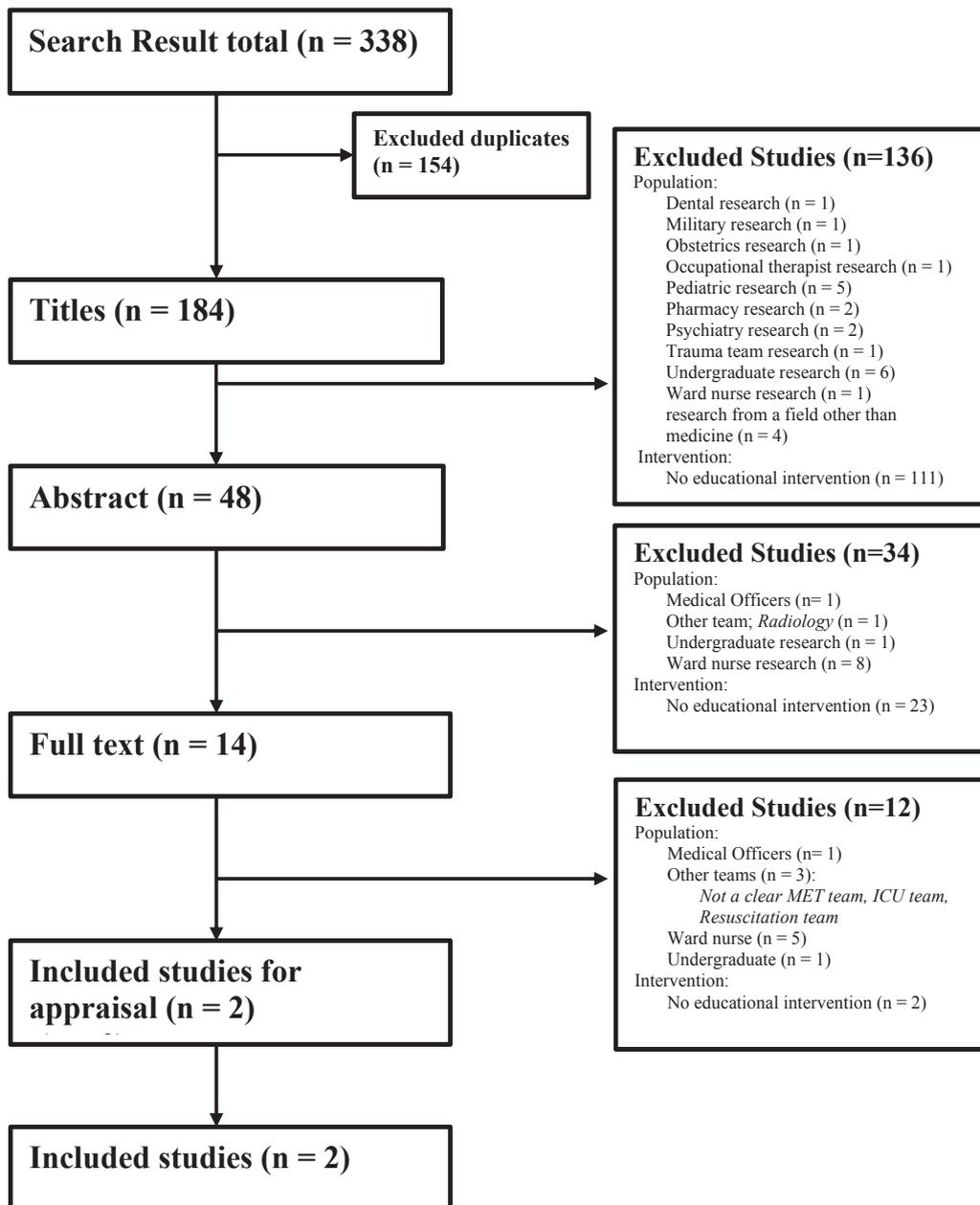


Figure Flowchart of the study selection process.

studies were prospective quasi-experimental intervention studies conducted in single centers in the United States during 2005 and 2014, respectively. Both studies included ICU nurses in the multidisciplinary teams that respond to medical crises in the form of METs.

Course Structures

Both studies used simulation-based education. The study by Paul and Lane (2014) included 23 ICU nurses, each participating in the same number of one-hour training session.

The study by DeVita, Schaefer, Lutz, Wang, and Dongilli (2005) included 69 critical care nurses, and two of these nurses had specific roles and goals during each training session. The two course structures are described in more detail in Table 2. All the scenario sessions in the study by DeVita et al. (2005) were video recorded to assist in debriefing, which focused on reinforcing organizational aspects of team performance. On the other hand, a criteria evaluation form and The American Heart Association Debriefing methodology were used to guide the debriefing sessions in the study by Paul and Lane (2014).

Table 2 Characteristics of Original Studies Included in the Review

Study, Country	Setting, Participants	Intervention	Outcome Measurements	Results
DeVita et al., 2005, USA	<p><i>Setting:</i> The University of Pittsburgh Medical Center Winter Institute for Simulation Education and Research</p> <p><i>Participants:</i> 69 critical care nurses, 48 physicians, and 21 respiratory therapists (n = 138). All ACLS certified within two years</p> <p><i>Team members:</i> Two ICU nurses, one floor nurse, one respiratory therapist, and three or four physicians, maybe one student</p>	<p>10 one-day courses, each with four parts:</p> <ol style="list-style-type: none"> 1. A web-based presentation and pretest before the course; the pretest covered the web curriculum 2. A brief reinforcing didactic session on the day of the course 3. Three to five randomly chosen simulated scenarios with predetermined roles for participants 4. Debriefing and analysis with the team 	<p><i>Primary outcome:</i> Successful crisis management results in SimMan survival</p> <p><i>Secondary outcomes:</i> Completion of organizational and patient care tasks</p> <p><i>Evaluations of:</i></p> <ol style="list-style-type: none"> 1. specific role assumption 2. completion of the tasks associated with a certain role 3. co-operation <p><i>The team's performance</i> rated by the team and the facilitator</p> <p><i>Objective measure:</i> specific task completion</p>	<p>SimMan survival improved from 0% to 90% during three sessions in a day's course.</p> <p>TCR improved from 31% to 89%, and each simulator role improved from 10% to 45% during the first session and to 80%-95% during the third session.</p> <p>TCR improved between both the first and second sessions ($p = .002$) and between the second and third sessions ($p = .011$)</p>
Paul & Lane, 2014, USA	<p><i>Setting:</i> St. Mary Corwin Medical Center together with Pueblo Community College</p> <p><i>Participants:</i> All staff, who either call MET or respond to the call; 12 resident physicians and 158 nurses (23 from ICU, 135 noncritical care nurses from various units around the hospital)</p> <p><i>Team members:</i> One ICU nurse, three noncritical care nurses, one ED nurse, and one physician</p>	<p>Simulation-based team training with manikins manufactured by Gaumard®</p> <p>56 one-hour courses with debriefing time included, eight different scenarios based on the most common MET calls. Not every session had a physician and/or ICU nurse. During a few of the sessions, the instructors had to play the RRT completely</p>	<p><i>Performance measured</i> by criteria evaluation form. In addition, anecdotal notes taken by the instructors during the scenario. Participants received informal and formal feedback</p> <p><i>Survey</i> sent to all participants to gauge their perception of the training vs. other instructional methods</p>	<p><i>Debriefing findings:</i> Need for additional training in communication, assessment, teamwork, critical thinking, timely initiation of MET calls, cardiopulmonary and resuscitation skill retention</p> <p><i>Participants survey:</i> Response rate 52%</p> <p><i>Instructional method:</i> Very or somewhat effective (91.4%)</p> <p>High-fidelity simulation was preferred (63.6%) to case studies, online learning modules, or lectures</p>

Note. ACLS = advanced cardiac life support; ED = emergency department; ICU = intensive care unit; MET = medical emergency team; RRT = rapid response team; TCR = task completion rate.

Effectiveness of the Training

DeVita et al. (2005) reported that the manikin survival rate increased 90% during the three sessions of the simulation-based one-day course ($p < .002$). Most of this improvement occurred between the first and second sessions ($p < .014$) rather than between the second and third sessions ($p < .180$). The task completion rate (TCR) improved by an average of 58% ($p < .001$). There was a 47% improvement in TCR between the first and second sessions ($p = .002$), followed by an 11% improvement between the second and third sessions. In addition, the performance

of each of the role-related tasks improved between sessions (DeVita et al., 2005).

The study by Paul and Lane (2014) reported that 92.1% of respondents found the simulated laboratory scenario training to be very or somewhat effective. The simulation-based method was preferred to other educational approaches by 63.6% of the trainees. Most of the participants stated that simulated sessions improved their critical thinking, assessment skills, teamwork, and understanding of each person's role during a rapid response as well as the importance of interteam communication (Paul & Lane, 2014).

Discussion

This literature review found that the effectiveness of MET nurse education remains unclear, and additional studies that compare how different educational interventions enhance patient safety and quality of care are needed.

The study by DeVita et al. (2005) demonstrated that simulation-based education is beneficial for the quality of care and patient safety based on significant improvements in manikin survival and TCRs during simulated medical emergency response call events. In the other included study, most respondents rated simulation-based methods to be effective, and they preferred high-fidelity education over case studies, online learning modules, or classroom lectures (Paul & Lane, 2014).

The included studies thus confirmed that MET simulation training for multidisciplinary hospital staff is feasible and preferred to other traditional methods by hospital staff. The improvements regarding communication, critical thinking skills, collaboration, and professionalism (Paul & Lane, 2014) were in line with the results from previous studies that found simulation-based education to improve communication, teamwork and leadership, and increase knowledge, confidence, and satisfaction (Murphy et al., 2016; Warren et al., 2016).

Previous research has demonstrated that simulation methods are effective for various health care contexts in which the staff must respond to emergency situations. Some examples of these methods are simulated clinical scenarios (Jacobson et al., 2010), role-playing (Ertmer et al., 2010), mock code simulations (Delac, Blazier, Daniel, & N-Wilfong, 2013; Hill, Dickter, & Van Daalen, 2010; Herbers & Heaser, 2016), e-learning (Ozekcin, Tuite, Willner, & Hravnak, 2015), humanistic simulation (Dwyer, Reid Searl, McAllister, Guerin, & Friel, 2015), and web-based programs (Cooper et al., 2016; Liaw et al., 2016) as an alternative to simulation methods. A recent meta-analysis of published controlled studies (1995-2013) suggests that simulation-based approaches are highly effective for the education of nurses and are especially important for psychomotor learning. The authors feel that health care institutions should concentrate on offering a variety of educational interventions that fulfill all the educational goals rather than focusing on the importance of fidelity level (Kim et al., 2016).

Unfortunately, the studies included in the presented literature review used quasi-experimental research designs rather than competing intervention or randomization approaches with pre- and postmeasurements to investigate how effective simulation education is in improving the performance of MET nurses. The areas being evaluated—covering knowledge, attitudes, skills, and satisfaction in the case of MET nurses—should be measured before and after training to accurately measure the effectiveness of a studied educational method (Guimond, Sole, & Salas, 2011; Hardcastle, 2004; Warren et al., 2016). It is also important to note that there is currently a lack of published

guidelines that describe the skills and training that nurses need to participate in a MET (Topple et al., 2016b). This, along with differences in training methods and team structures, makes the comparison of studies that assess MET nurses' skills, knowledge, and/or the effectiveness of their education challenging. Cooper S, Cant R, Porter J, Sellick K, Somers G, Kinsman L and Nestel D have recently created and tested the instrument TEAM™ for evaluation of teamwork performance in medical emergencies. This instrument could potentially be used as an assessment and/or debriefing tool for measuring MET performance in training and clinical settings (Cant et al., 2016).

However, this validated instrument has not been used in current research focusing on MET education. The presented systematic review did not identify any research that covered the retention and transfer of learned methods to the clinical environment. The Australian Commission on Safety and Quality in Health Care (2014) is currently mapping the skills, knowledge, and behaviors that all clinicians require to be able to recognize and respond to clinical deterioration. The published results will provide tools for future research and evaluation.

Conclusion

The effectiveness of MET educational interventions in providing the knowledge and skills that ICU-based nurses require responding to MET calls remains unclear because of a lack of published studies. Both studies included in the presented literature review confirmed that simulation team training is effective, feasible, and preferred over other methods by practicing MET members. The lack of relevant literature demonstrates that there is a need for innovative educational approaches that clarify and improve MET performance, the skills of team members, and role-specific tasks, as well as studies that evaluate the effectiveness of these new approaches.

Limitations

The search strategy only included studies published in English or Finnish. This may have led to language bias (Center for Reviews and Dissemination, 2009). No publication limits were applied to restrict publication bias (Joanne Briggs Institute, 2014). The results of this review clearly indicate that further research into the effectiveness of MET educational interventions is needed.

The primary study search yielded two original studies. The quality of these original studies was carefully assessed to ensure the validity of the review. Because of the limited study material, additional research was performed to cover as wide a scope of publication material as possible. The references of all the selected full-text articles were screened, but no further eligible studies were identified from the additional research.

Implications for Research

Further research is needed to outline effective educational interventions for training METs and to measure team members' skills, knowledge, tasks, and behaviors. Randomized controlled trial studies should be used to evaluate the effectiveness of different simulation-based interventions and compare them with other educational approaches. We feel that this would be the best way to determine which educational approach is the most effective and suitable for the studied MET system. The quality and safety systems in hospitals vary on a national and international level. This makes it difficult to compare MET-related research and apply findings from one setting to another. For this reason, the development and adoption of universal research methodology is crucial to standardizing and unifying this research field.

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