Effectiveness of Education in Improving Medical Emergency Team (MET) Nurses' Performance

A Systematic Literature Review

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Abstract

Background:

The National Safety Goal recommendation for American hospitals, the Australian Commission on Safety and Quality in Health Care and The European Resuscitation Council Guidelines for Resuscitation recommend the use of a Medical Emergency Team (MET) – system to improve hospital safety and quality of care through preventing cardiac arrests and unplanned ICU admissions. However, there is little evidence of its effectiveness.

Objective:

To evaluate the effectiveness of educational interventions in improving MET nurses' performance.

Methods:

The systematic literature review was conducted in five multi-disciplinary databases without any time constraint during the autumn 2016. The studies were selected and assessed by two researches independently. The analysis was conducted by following the principals of narrative synthesis.

Results:

Due to a lack of suitable studies only two studies were included in the review. They confirmed simulation team training to be effective and preferred method amongst MET team. Specific role assumption and tasks completion increased MET effectiveness.

Conclusion:

The effectiveness of MET educational interventions remains unclear due to the lack of published studies. There is a need for new innovative educational intervention studies to clarify, educate, evaluate and improve MET nurses' performance and their assigned tasks and roles.

Keywords

Medical Emergency Team (MET); Rapid Response Team (RRT); MET nurse; Education; Training

Key Points:

1. Simulation provides opportunities for team training, and simulation is a recognized MET training tool.
2. The most effective educational interventions for MET are still questionable. As ICU nurses are frequent members in MET, their effective education can influence the whole team performance as well as the hospital safety and quality.
3. Randomized controlled trial studies are needed to evaluate the effectiveness of different kinds of simulation-based interventions as well as to compare them to other educations to determine the most effective education for the MET system.

Highlights:

- The effectiveness of education on MET nurses' performance remains unclear.
- Simulation education is preferred method for MET.
- Efficiency improves by assuming specific roles and performing role delineated tasks.
- New educational intervention studies are needed to evaluate MET performance.

Background

The National Safety Goal recommendation for American hospitals (Winters & DeVita, 2011), the Australian Commission on Safety and Quality in Health Care (2014) consultation report and The European Resuscitation Council Guidelines for Resuscitation in 2015 (Soar et al., 2015) recommend the use of a Medical Emergency Team (MET) – also known as Rapid Response Team (RRT) – system to improve hospital safety and quality of care (Peberdy et al., 2007). In this paper, however, the term MET is used either meaning RRT or MET.

The purpose of MET system is to detect and response to deteriorating hospital ward patients to prevent cardiac arrests and unplanned ICU admissions (White, Scott, Vaux, & Sullivan, 2015; Soar et al., 2015). MET systems also emphasize the importance of educating in early detection (Winters & DeVita, 2011). Even though the MET system has been in place in many hospitals, there is little evidence of its effectiveness (White et al., 2015).

Education of MET

Simulation-based education has been recognized as a MET training tool (Sakai & DeVita, 2009; Frengley et al., 2011), which has strong educational effects specifically on participants' psychomotor skills (Kim, Park, & Shin, 2016), in improving nurses' skills in recognition and treatment of instability (Hravnak, Beach, & Tuite, 2007), and refining team skills (Wallin, Meurling, Hedman, Hedegård, & Felländer-Tsai, 2007; Niell et al., 2015). Moreover, high fidelity simulation education has been superior to traditional methods of teaching in enhancing resuscitation teams' communication, teamwork and leadership skills (Murphy, Curtis, & McCloughen, 2015; Warren, Luctkar-Flude, Godfrey, & Lukewich, 2016) by increasing participants' knowledge, confidence, and satisfaction (Warren et al., 2016). However, the effectiveness of simulation education in intensive care unit (ICU) nurses' continuing education is lacking (Jansson, Kääriäinen, & Kyngäs, 2013).

As ICU nurses (Jones,Drennan, Hart, Bellomo, & Steven, 2012; Tirkkonen, Nurmi, Olkkola, Tenhunen, & Hoppu, 2014) are regular members in METs and these teams respond annually to hundreds of MET calls (Tirkkonen, Tamminen, & Skrifvars, 2017), the skills and attitudes of MET nurses can make an impact during the MET event (Jones, King, & Wilson, 2009). In some MET systems ICU based MET nurse can be alone 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 their risks, therefore, MET nurse education should support these roles (Santiano et al., 2011). Met nurses' assessment and team leadership skill as well as their work attitude play an

important role in the effectiveness of MET – event (Topple et al., 2016a). However, the effectiveness of MET education involving ICU nurses being part of the MET team is unknown.

Therefore, the aim of the present study was to evaluate MET educational interventions involving ICU nurses as team members by performing a systematic literature review. The main question addressed in the study was "What is the effectiveness of MET educational interventions in improving the knowledge and skills of ICU based nurses while responding to MET calls?" Only intervention studies were included in this systematic literature review.

Material and Methods

Search Strategy and Limitations

This systematic literature review was conducted by the following study process guidelines from Centre for Reviews and Dissemination (Center for Reviews and Dissemination, 2009) and Joanna Briggs Institute User guide (Joanne Briggs Institute, 2014). The data was collected from five different databases in December 2016. Initially 338 studies were found from different databases as follows: Scopus (n=117), Web of Science (n=53), CINAHL (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 final number of studies for the selection process formed to be 184 (Table 1).

The library information specialist was consulted to determine suitable databases, search strategies, terms and limitations (Aromataris & Riitano, 2014). Search terms of the databases explained in Table 1. Only original peer reviewed articles in English or Finnish were included. The publication year was left open. The search strategy was carefully documented and original searches maintained in the Web-based research management tool RefWorks (Higgins & Green, 2011).

Table 1. Search strategy, terms, limitations and number of studies

Database	**Search terms** (Article title, abstract, keywords)	**N**
Scobus	"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*	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 for the selection process		184

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 (ICU Registered Nurse members of MET or equivalent team of adult somatic hospital environment), I = phenomena of interest (Education intervention), C = context (none), O = outcome (Learning outcomes), S = types of studies (Peer reviewed, original study, published in English or Finnish, publishing year open). The exclusion criteria of participants ruled out conducted researches of students, ward nurses, medical officers, other emergency team members, MET originating from other units than ICU, MET for other than adult somatic wards: Paediatrics, psychiatry, Obstetrics, Operation Room, Trauma, Emergency Department, Dental and Resuscitation Team study merely of CPR training.

The 184 selected studies for this review were screened in a three-phase selection process. Screening phases were: titles (n=184), abstracts (n=48) and full text (14). This process was carried out by two researchers (SL, MJ) independently and objectively (Center for Reviews and Dissemination, 2009). Figure one clarifies the PRISMA study-selection and exclusion process. Researchers' disagreements regarding study eligibility were resolved through discussion. During the full text screening phase an e-mail was send to one author of the selected study (Frengley et al., 2011) to question whether their study population included MET personal. This study was excluded due to unsuitable population.

Due to a minimal study result (n=2) one researcher (SL) additionally screened the references of all the selected full text articles (n=14). The total number of references screened from these articles was 368, twenty abstracts and two full texts were read. This extra screening did not increase the literature search result.

Finally, the two researchers independently assessed the methodological quality of the relevant studies using the JBI MAStARI critical appraisal tool for descriptive studies (Joanne Briggs Institute, 2014). The quality was calculated by the reviewers (SL, MJ) assigning scores 0 or 1 for each suitable checklist question, maximum possible score was 5/5. The included studies received 3 – 4/5, being more than 50 % of the total possible score. There was a common consensus between the reviewers regarding the quality scores.

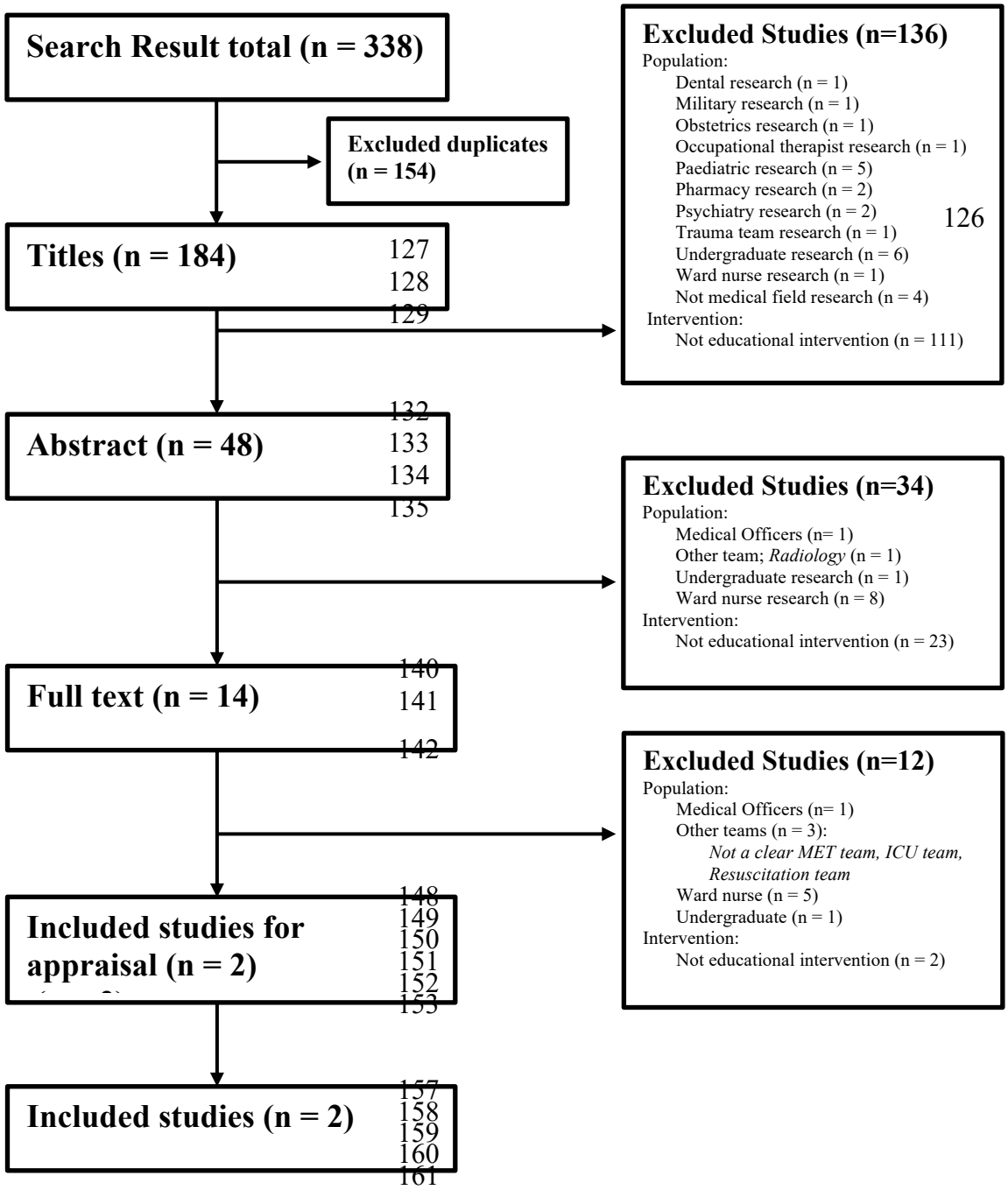

Figure 1. Flowchart of the study-selection process

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) by following instructions from Higgins and Green (2011) and Centre for Review and Dissemination (2009). This data extraction table was designed to answer the specific review questions (Center for Reviews and Dissemination, 2009) and objectives (Joanne Briggs Institute, 2014) to attain all the necessary information from the

included studies. The data extraction and analysis was conducted by one researcher (SL) and confirmed by the other researcher (MJ) to minimize bias and errors in the data extraction process (Center for Reviews and Dissemination, 2009; Polit & Beck, 2012).

The summarized findings of the included studies were created by using the principles of narrative synthesis (Munn, Tufanaru, & Aromataris, 2014). The indexes of the inter-rater reliability (Polit & Beck, 2012) were not calculated due to the complete agreement achieved by the two researchers regarding the final selection.

Table 2. Study characteristics of included original studies

Study, Country	Setting, Participants	Intervention	Outcome Measurements	Results
Devita *et al.*, 2005 USA	**Setting:** The University of Pittsburgh Medical Center Winter Institute for Simulation Education and Research **Participants:** 69 critical care nurses, 48 physicians, and 21 respiratory therapists (n=138). **8 Team members:** 2 ICU nurses,1 ward nurses, 1 Respiratory therapist, and 3 - 4 physicians, maybe one student	10 one day courses, each had 4 parts: 1. A web based presentation and pre-test before the course; The pre-test covering the web based curriculum. 2. A brief reinforcing didactic session on the day of the course 3. Three of five different simulated scenarios, each followed by 4. Debriefing and analysis with the team. Scenario was random. In scenarios predetermined roles were assumed.	**Primary outcome:** Successful crisis management results in SimMan ‘‘survival’’ **Secondary outcomes:** Completion of organizational and patient care tasks **Evaluations of:** 1. specific role assumption 2. tasks completion those associated with the role 3. co-operation **The team’s performance** rated by the team and the facilitator. **Objective measure:** specific task completion.	SimMan ‘‘survival’’ improved from 0% to 90% during 3 sessions in a day’s course. TCR improved from 31% to 89%, and each simulator role improved from 10 - 45% during the first session, 80 – 95% during the third session. TCR improved between both the 1st and 2nd sessions ($p = 0.002$) and between the 2nd and 3rd sessions ($p = 0.011$).
Paul & Lane 2014 USA	**Setting:** St. Mary Corwin Medical Center together with Pueblo Community College **Participants:** All staff, who either call MET or respond to the call; 12 resident physicians and 158 nurses (23 from ICU and rest from various units around hospital). **6 Team members:** 1 ICU nurse, 3 ward nurses, 1 ED nurse, and 1 physician.	Simulation based team training with Gaumard* manikins 56 one hour courses, debriefing time included in one hour, 8 different scenarios, which were based on most common MET calls.	**Performance measured** by criteria evaluation form. Additionally, anecdotal notes taken by the instructors during the scenario. Participants received informal and formal feedback. **Survey** sent to all participants asking their perception of the training versus other instructional methods.	**Debriefing findings:** Need for additional training: Communication; assessment skills; teamwork; critical thinking; timely initiation of MET calls; cardiopulmonary and resuscitation skill retention. **Participants survey:** Response rate 52% Instructional method: Very or somewhat effective (91.4%). High-fidelity simulation a preferred method (63.6%) versus case studies, online learning modules, or lecture.

Intensive Care Unit (ICU); Medical Emergency Team (MET); The task completion rate (TCR)

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Results

Due to lack of suitable studies only two original studies were included in this review (Table 2). Included studies were prospective, quasi experimental intervention studies, conducted in single-centres in the USA during 2005 and 2014. Both studies included ICU nurses as members of multidisciplinary teams responding to medical crises in the form of METs.

Course structures

Both studies used a simulation-based education. The participants in the Paul and Lane (2014) study included 23 ICU nurses, one of them taking part at the time in one hour training session. The DeVita Schaefer, Lutz, Wang and Dongilli (2005) study included 69 critical care nurses of whom two had specified roles and goals in each training session. These course structures are explained in table 2. All scenario sessions in the DeVita et al. were video recorded to assist in debriefing, which focused on reinforcing organizational aspects of team performance. Respectively, the criteria evaluation form and The American Heart Association Debriefing methodology were utilized to guide the debriefing sessions in the Paul and Lane study (2014).

Effectiveness of the training

In the study of DeVita et al. (2005), the manikin survival percentage change rate increased 90% across the three sessions within the one day course ($p < 0.002$) in simulation environment. Most of the improvements occurred between the first and the second sessions ($p < 0.014$) rather than between the second and the third sessions ($p < 0.180$). The overall mean improvement of the task completion rate (TCR) percentage increased 58 % ($p < 0.001$). The TCR was noticed to improve 47% between the first and the second ($p = 0.002$) and 11 % between the second and the third sessions ($p = 0.011$). In addition, the performance of each of the role related tasks improved between sessions (DeVita et al., 2005).

In the study of Paul and Lane (2014), 92.1% of respondents found that the simulated lab scenario training to be very or somewhat effective. It was preferred by 63.6 % of the trainees, when compared to other methods. Most the participants stated that simulated sessions improved their critical thinking, assessment skills, team work, understanding each person's role during a rapid response, and the importance of communication with the team. (Paul & Lane, 2014.)

Discussion

The main findings of this literature research were that the effectiveness of education on MET nurses' performance remains unclear and that there is a need for future studies comparing the effectiveness of different educational interventions to enhance patient safety and quality of care.

The study of DeVita et al. (2005) demonstrated significant advantages of simulation-based education in quality of care and patient safety through improvements in manikin survival and TC rates during simulated medical emergency response call -events. Respectively, majority of the respondents rated the instructional methods effective and they preferred high-fidelity education rather than case studies, online learning modules or classroom lectures (Paul & Lane, 2014).

Included studies confirmed that MET simulation training for multidisciplinary hospital staff is feasible and is the preferred training method when compared to other traditional methods. The improvements regarding communication, critical thinking skills, collaboration and professionalism (Paul & Lane, 2014) were in line with other studies stating that simulation-based education improves communication, teamwork and leadership and increases knowledge, confidence, and satisfaction (Murphy et al., 2016; Warren et al., 2016).

Previous literature has demonstrated various effective simulation methods used in context of other health care education when confronting and responding to emergency situations. These methods have included 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, McAllister, Guerin, & Friel, 2015) and web-based programs (Liaw et al., 2016; Cooper et al., 2016) as an alternative to simulation methods. Recent meta-analysis of published, controlled studies (1995 – 2013) suggests that simulation-based nursing educational interventions have strong educational effects, especially in the psychomotor learning area. A variety of educational interventions should be used to meet all the educational goals rather than press importance of fidelity level of the used simulation. (Kim et al., 2016.)

Unfortunately, quasi experimental research designs without competing intervention or randomization and pre- and post-measurements were used to measure the effectiveness of simulation education in improving MET nurses' performance. The evaluations areas, covering knowledge; attitudes; skills and satisfaction, should be measured preferably before and after training to provide tools for evaluating used educational methods (Hardcastle, 2004; Warren et al., 2016; Guimond, Sole, & Salas, 2011). In addition, there is a lack of published guidelines in describing the necessary skills and training requirements for nurses participating in MET (Topple et al., 2016b). This, as well as the variety of training methods and various team structures used, creates a challenge in comparing studies

assessing MET nurses' skills, knowledge and the effectiveness of their education. The recently created and tested TEAM™ instrument could potentially be used as an assessment and or debriefing tool when measuring MET performance in training and clinical settings (Cant et al., 2016). Current literature involving MET education does not report the use of this validated instrument. This systematic review did not reveal any studies with research covering the retaining and transferring of the learned methods to the clinical environment. The Australian Commission on Safety and Quality in Health Care (2014) is currently mapping the skills, knowledge and behaviours required of all clinicians who are needed to recognise and respond to clinical deterioration. These mapping results will provide tools for future research and evaluation.

Conclusion

The effectiveness of MET educational interventions on ICU based nurses, regarding improving knowledge and skills required when responding to MET calls, remains unclear due to the lack of published studies. Both included studies confirmed that simulation team training is effective, feasible and even the preferred educational method amongst the practising MET members. There is clearly a need for new innovative educational intervention studies to clarify, educate, evaluate and improve the MET performance, team members' skill levels and their assigned tasks and roles.

Limitations

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

The primary study search result was two original studies. The quality of the original studies was carefully assessed to ensure the validity of the review. Due to the minimal result, additional research was performed to cover as wide a scope of publication material as possible. The references of all selected full text articles were screened, but no more eligible studies were included.

Implications for Research

Further research is needed to outline effective educational interventions for MET as well as to measure team members' skills, knowledge, tasks and behaviours. Randomized controlled trial studies should be used to evaluate the effectiveness of different kinds of simulation-based interventions as well as compare them to other educational interventions to determine the most effective and suited

education for the studied MET system. The quality and safety systems in each hospital setting vary on a national and international level. This creates a challenge for MET related researches. Therefore, universal research methods are required to standardize and unify this research area.

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