Review

The effectiveness of education in the recognition and management of deteriorating patients: A systematic review

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ABSTRACT

Background: Survival from in-hospital cardiac arrest is poor. Clinical features, including abnormal vital signs, often indicate patient deterioration prior to severe adverse events. Early warning systems and rapid response teams are commonly used to assist the health profession in the identification and management of the deteriorating patient. Education programs are widely used in the implementation of these systems. The effectiveness of the education is unknown.

Aim: The aims of this study were to identify: (i) the evidence supporting educational effectiveness in the recognition and management of the deteriorating patient and (ii) outcome measures used to evaluate educational effectiveness.

Methods: A mixed methods systematic review of the literature was conducted using studies published between 2002 and 2014. Included studies were assessed for quality and data were synthesized thematically, while original data are presented in tabular form.

Results: Twenty-three studies were included in the review. Most educational programs were found to be effective reporting significant positive impacts upon learners, patient outcomes and organisational systems. Outcome measures related to: i learners, for example knowledge and performance, ii systems, including activation and responses of rapid response teams, and iii patients, including patient length of stay and adverse events. All but one of the programs used blended teaching with >87% including medium to high fidelity simulation. In situ simulation was employed in two of the interventions. The median program time was eight hours. The longest program lasted 44 h however one of the most educationally effective programs was based upon a 40 min simulation program.

Conclusion: Educational interventions designed to improve the recognition and management of patient deterioration can improve learner outcomes when they incorporate medium to high-fidelity simulation. High-fidelity simulation has demonstrated effectiveness when delivered in brief sessions lasting only forty minutes. In situ simulation has demonstrated sustained positive impact upon the real world implementation of rapid response systems. Outcome measures should include knowledge and skill developments but there are important benefits in understanding patient outcomes.

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1. Introduction

Survival to discharge from in-hospital cardiac arrest is between 16 and 20% globally (Cooper et al., 2006; Ebell and Afonso, 2011; Larkin et al., 2010; Peberdy et al., 2003; Sandroni et al., 2007). Clinical features, including abnormal vital signs, often indicate patient deterioration in the hours prior to cardiac arrest (Buist et al., 2004; Franklin and Mathew, 1994). These same indicators often precede severe adverse events and unscheduled intensive care admissions (McQuillan et al.,

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1998; Winters et al., 2007). One Australian multi-centred prospective follow-up study (Hillman et al., 2002) reported that 60% of 551 patients requiring unscheduled ICU admission had documented life-threatening observations in the eight hours preceding admission.

Ward doctors and nurses are responsible for the care of increasingly complex patients, identifying signs of physiological deterioration and managing deteriorating patients (Hodgetts et al., 2002; Jones et al., 2011; Odell et al., 2009). Patients are more demographically diverse and patients with high dependency needs are now cared for on general medical and surgical wards (McGillis Hall and Doran, 2007).

Ward nurses have been shown to have varying abilities to recognise, document, report and respond to physiological deterioration (Odell et al., 2009). Medical students and junior ward medical staff have also been shown to have significant shortfalls in the interpretation of the signs and symptoms of clinical deterioration (Smith and Poplett, 2002). Similarly experienced doctors can be underprepared to respond to medical emergencies and acutely unwell patients (Frankel et al., 2004).

For almost two decades rapid response systems (RRS) have evolved to manage the prevention, recognition, and stabilisation of clinical deterioration (Winters and DeVita, 2011). The impact of Medical Emergency Teams (MET) upon the incidence of mortality has been debated since the landmark work of Buist et al. in 2002. During this time educational support for these systems has also developed to address the increasing demands upon potentially underprepared ward staff. These educational interventions have been applied nationally (Smith, 2003), at regional level (COMPASS®) and locally (Buykx et al., 2011; Liaw et al., 2011).

The efficacy of rapid response systems is topical, well documented and has been systematically reviewed (Odell et al., 2009; Ranji, 2007; Winters et al., 2007). The effectiveness of educational programs that have been designed to prepare health professionals for using these systems has not received the same attention. This review aims to identify: (i) the evidence supporting educational effectiveness in the recognition and management of the deteriorating patient and (ii) the outcome measures used to evaluate educational effectiveness.

2. Methods

A systematic search of the literature was conducted during January 2014. The search was conducted to identify peer reviewed quantitative, qualitative or mixed methods studies that measured the effectiveness of educating health professionals to identify and manage the deteriorating in-patient.

A 4 phase decision process including study identification, screening, eligibility and inclusion to the study was used (see PRISMA statement) (Moher et al., 2009) which is shown in Fig. 1.

Databases searched included CINAHL Plus, Medline, Embase, Cochrane, Proquest, ERIC, Scopus and the search engine Google Scholar.

An initial search to identify relevant keywords, subject headings and MeSH terms was carried out on the following terms:

• Training OR Education AND Deterioration (deteriorat*)

This search yielded 6908 results. These articles were reviewed for further keywords and subject headings. The following searches were then performed on all databases.

• Training OR Education AND Deterioration (deteriorat*)
• Rapid Response Teams OR Critical Care Outreach Teams OR Medical Emergency Teams
• Early Warning Scores OR Modified Early warning Scores OR (track AND trigger)

A manual search of potentially eligible study reference lists, relevant article bibliographies, related journals and professional body websites was also performed. This manual search was combined with database

functions such as CINAHL's "find similar articles" function and a citation tracking (snowballing) approach.

The initial broad Boolean/Phrase search was limited to peer reviewed papers published in English between 2002 and January 2014 and where abstracts were available. The year 2002 was chosen as it coincided with the emergence of literature describing the implementation and outcomes of RRSs (Buist et al., 2002).

All duplicates were then removed and the Major Subject Headings were identified from the initial search and used to narrow the results. The abstracts of the remaining 794 results were read to identify any potentially eligible studies applying the following inclusion criteria:

• peer reviewed
• published between 2002–January 2014
• available in English language
• abstract available
• address the effectiveness of education in identifying and managing the deteriorating in-patient
• examine education provided to health professionals

The author and a second reviewer (JJ) read the resultant 47 studies. The second reviewer again applied the inclusion criteria. If there were conflicting opinions in the inclusion or exclusion of studies, the paper was discussed and the inclusion and exclusion criteria was reapplied. If the discrepancy was not resolved, expert third party (SC) opinion was sought. The process produced 23 studies for inclusion in the review.

26 studies were excluded. Some examples of the reasons for exclusion were:

• the study investigated the learners' perception of the education program and not the effectiveness of intervention,
• the study was designed to evaluate the tool used in measuring the participants' knowledge or confidence,
• the paper simply described the implementation of an education program with no evaluation of effectiveness,
• the study compared the application of specialised skills following two different modes of education.

The remaining studies (n = 23) were categorised by overall study methodology. The categories included quantitative, qualitative and mixed methods. Data for each study is presented at Tables 1, 2 and 3. The quality of the studies was evaluated based upon generalisability, reproducibility, relevance to the setting, appropriateness of sampling (size and methods) to study aim, risk of bias, use of validated measurement tools and appropriateness of the outcome measures. These quality indicators were guided by the Evaluation Tool for Quantitative Research Studies (Long et al., 2002b), Evaluation Tool for 'Mixed Methods' Study Designs (Long et al., 2002a) and the Critical Appraisal Skills Program (CASP, 2014) tool for the evaluation of qualitative research.

3. Results

The review included twenty quantitative studies (Buckley and Gordon, 2011; Cooper et al., 2013; Crofts et al., 2006, 2007; Featherstone et al., 2005; Fuhrmann et al., 2009; Gordon and Buckley, 2009; Harvey et al., 2014; Jones et al., 2006; Kelly et al., 2013; Kinsman et al., 2012; Lewis, 2011; Liaw et al., 2011, 2013; Lindsey and Jenkins, 2013; Ludikhuize et al., 2011; Sittner et al., 2009; Smith and Poplett, 2004; Straka et al., 2012; Theilen et al., 2013), two mixed methods (Hart et al., 2014; Wehbe-Janek et al., 2012) and one qualitative study (Unsworth et al., 2012). The study designs of the quantitative studies were predominantly quasi-experimental and prospective interventional with one time series analysis of patient records (Kinsman