Developing and Evaluating Simulation Learning Programs on Rescuing a Patient in Deteriorating Situations: A Programmatic Approach

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A simulation-based program, known as RAPIDS (Rescuing A Patient In Deteriorating Situations), was introduced into an undergraduate nursing program to develop nursing students' clinical competence in caring for a patient with clinical deteriorations. A programmatic approach to research was set from the beginning, at the time of performing need analysis to evaluating the long-term outcomes of the RAPIDS program in clinical practice. A mixed methods approaches were employed for evaluating the outcomes of the program targeting at different levels of the Kirkpatrick's model. Two important future innovations emerged that move forward the development of the RAPIDS program; multimedia resources (e-RAPIDS) in promoting retention of simulation learning and the use of simulated patients in preparing nursing students to manage their emotional responses in actual clinical practice. The ultimate goal of the RAPIDS program is to improve patient safety by enhancing nurses' abilities in recognizing and managing ward deteriorating patients.

INTRODUCTION

The number of patients requiring high acuity care is expected to continue to rise as result of advances in medical technologies, complex surgical procedure and aging population. These high acuity patients are at high risk of unexpected clinical deterioration and therefore, a failure to respond promptly or escalate care constitutes a "failure to rescue" and may lead to serious adverse events such as cardiac arrest and unexpected death [1]. Most of these events are preceded by clinically observable warning signs such as abnormal vital signs for minutes to hours. Therefore, in most cases, there is sufficient time to rescue the patient from serious adverse events by identifying patient at risk and providing immediate interventions [2]. Being the frontline healthcare personnel, nurses are in the optimal position to recognize warning signs, escalate these signs to appropriate healthcare staff and initiate actions before arrival of help [3].

Nursing students play a critical role in the detection of ward deteriorating patients as they are often involved in the ward routine monitoring of vital signs. Once qualified, they play an essential role in the assessment and management of the acutely ill patient until more senior help arrives. However, a study has identified a significant deficit in the abilities of nursing students, who were just before becoming qualified nurses, in recognising and managing patient deterioration [4]. The exposure to clinical deterioration situation cannot be guaranteed during clinical practice. Therefore, an alternative to relying on chance exposure to clinical deterioration situations during clinical practicum seems to be important to equip the students to practice safely on the wards following qualification [5]. The use of simulation for the development of knowledge and skills in the assessment and management deteriorating patient, has received much attention in nursing education program [6,7].

A simulation-based educational program known as RAPIDS (Rescuing A Patient In Deteriorating Situations) was introduced into an undergraduate nursing program at a university in Singapore to develop nursing students' performance in caring for a patient with clinical deteriorations. A holistic approach to developing and evaluating the RAPIDS simulation program was conducted. A program

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of research was set from the beginning, at the time of performing need analysis to evaluating the long-term outcomes of the program in clinical practice. A series of research studies had been published elsewhere by the authors [8-10]. They were brought together in this paper to demonstrate their inter-relatedness and iterative nature.

MAIN ISSUE

1. Review of Literature

The literature review revealed the educational need to develop nurses' roles further in recognizing, responding to and reporting deteriorating patients. Further analysis of these roles has identified specific training needs which include performing systematic assessment and management of deteriorating patient, applying effective communication skills when reporting to seek further help, and developing knowledge of pathophysiology on deteriorating conditions [11]. The literature review also revealed that the existing educational courses were initiated in hospital settings, targeted at registered nurses and medical doctors, and focused on inter-professional training [12-14]. The common learning strategies include ABCDE (Airway, Breathing, Circulation, Disability and Exposure) and SBAR (Situation-Background-Assessment-Recommendation) mnemonics, and experiential learning approaches. To enhance current educational effort further, the literature review recommended to start with educational courses at pre-registration nursing level and focused specifically on nurses' roles. This education could incorporate ABCDE and SBAR mnemonics to guide systematic nursing assessment and management of deteriorating patients before the arrival of appropriate help [11].

2. RAPIDS-Tool

An evaluation tool (RAPIDS-Tool) was developed to measure learning outcomes as well as to guide simulation learning. The ABCDE and SBAR mnemonics, identified from the analysis phase, were applied as organizing frameworks to guide the tool development. Supported by the Resuscitation of Council (2006)[15], the ABCDE mnemonic has been utilized as a systematic approach to assess and manage ward deteriorating patient in existing interprofessional programs. The SBAR was identified as the most frequently cited hand-off mnemonic in a systematic review [16]. Applying the ABCDE and SBAR mnemonics, a 42-item RAPIDS-Tool was developed to evaluate nurses' performances in assessing, managing and reporting of a deteriorating patient in a simulated clinical environment. The performance criteria within the mnemonics were identified from the review of literature and the content validity was established by a panel of international multidisciplinary experts. The psychometrics properties of the RAPIDS-tool were tested by determining the construct validity and inter-rater reliability [17].

3. RAPIDS Simulation Program

An experiential learning strategy, high-fidelity simulation, was chosen as a core educational method to deliver the RAPIDS program. Three core competencies (knowledge, clinical performance and communication skills) were identified which led to the development of general objectives for the program. In designing the simulation program, we incorporated most of the features that were identified by a BEME (Best Evidence Medical Education) systematic review as factors leading to effective learning in the use of high-fidelity simulation [18]. Kolb's experiential theory was selected as a framework for implementing the simulation scenario [19]. Applying Kolb's theory (1984) [19], the students went through the process of a hands-on experience, performing nursing assessment and management on the patient simulator. This was followed by a debriefing to enable the students to reflect on their experiences.

A four-level evaluation model (1994) developed by Kirkpatrick [20] was used as a guideline to evaluate the RAPIDS simulation program. An exploratory descriptive study was conducted at level one of the Kirkpatrick model to assess the students' reaction to the program. A randomized controlled trial (RCT) was conducted to evaluate the students' learning outcomes (level 2) in terms of level of self-confidence, knowledge and clinical performance. Pre and post-tests, using knowledge test, confidence scale and simulation-based assessment were undertaken immediately before and after the RAPIDS simulation program. The clinical performances, evaluated using simulation-based assessment, were videotaped and rated using the RAPIDS-Tool [9]. A qualitative study was conducted six months after the students had undertaken the RAPIDS program. The study examined the long-term effect of the RAPIDS simulation program on the students' behaviour (level 3) when encountered deteriorating patients in their clinical practice [8].

4. e-RAPIDS

The web-based simulation, e-RAPIDS, was developed

to provide opportunity for repetitive training following the hands-on simulation and thus, enables students to achieve retention of learning. It is made of three key instructional strategies including animation video, multimedia instructional material and virtual patient simulation. The animation video illustrated the physiological compensatory mechanism underpinning the vital signs changes. The multimedia instructional material covered the tasks for assessing and managing clinical deterioration within the ABCDE and ISBAR mnemonics. The virtual simulation incorporated five simulation scenarios associated with acute medical conditions. Kolb's experiential learning was applied to guide the learning process of each scenario in which students underwent a simulation scenario followed by self-reflection [21].

The effectiveness of the virtual patient simulation as a refresher training program for nursing students was evaluated by comparing it with mannequin-based simulation. Neither virtual simulation nor mannequin-based simulation was demonstrated to be superior. Both simulations were found to be effective learning strategies for improving nursing students' clinical performance [22]. Further RCT studies on the effectiveness of e-RAPIDS were conducted on registered and enrolled nurses in an acute tertiary hospital. These studies again supported the effectiveness of e-RAPIDS in enhancing hospital nurses' clinical performance and knowledge on clinical deterioration [23, 24]. A before-and-after study and a qualitative evaluation study provided further evidences on the effectiveness of e-RAPIDS in improving nursing practice with deteriorating ward patients [25,26].

CONCLUSION

A simulation-based educational program known as RAPIDS was introduced into an undergraduate nursing program to develop nursing students' performance in rescuing a patient with clinical deterioration. A programmatic approach to research was conducted from the beginning, at the time of performing need analysis, to evaluating the long-term outcomes of the simulation-based program in clinical practice. By illustrating the development of programmatic approach to research, this paper highlights how they could ultimately move the field of educational research towards best evidence-based education.

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