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Development and psychometric testing of a Clinical Reasoning Evaluation Simulation Tool (CREST) for assessing nursing students' abilities to recognize and respond to clinical deterioration

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ABSTRACT

Background: The development of clinical reasoning skills in recognising and responding to clinical deterioration is essential in pre-registration nursing education. Simulation has been increasingly used by educators to develop this skill.

Objective: To develop and evaluate the psychometric properties of a Clinical Reasoning Evaluation Simulation Tool (CREST) for measuring clinical reasoning skills in recognising and responding to clinical deterioration in a simulated environment.

Design: A scale development with psychometric testing and mixed methods study.

Participants/Settings: Nursing students and academic staff were recruited at a university.

Method: A three-phase prospective study was conducted. Phase 1 involved the development and content validation of the CREST; Phase 2 included the psychometric testing of the tool with 15 second-year and 15 third-year nursing students who undertook the simulation-based assessment; Phase 3 involved the usability testing of the tool with nine academic staff through a survey questionnaire and focus group discussion.

Results: A 10-item CREST was developed based on a model of clinical reasoning. A content validity of 0.93 was obtained from the validation of 15 international experts. The construct validity was supported as the third-year students demonstrated significantly higher ($p < 0.001$) clinical reasoning scores than the second-year students. The concurrent validity was also supported with significant positive correlations between global rating scores and almost all subscale scores, and the total scores. The predictive validity was supported with an existing tool. The internal consistency was high with a Cronbach's alpha of 0.92. A high inter-rater reliability was demonstrated with an intraclass correlation coefficient of 0.88. The usability of the tool was rated positively by the nurse educators but the need to ease the scoring process was highlighted.

Conclusions: A valid and reliable tool was developed to measure the effectiveness of simulation in developing clinical reasoning skills for recognising and responding to clinical deterioration.

1. Introduction

Failure to recognize and respond to patient deterioration is a global problem in acute healthcare settings (Watkinson and Tarassenko, 2012), with research reporting that this results in 23% of patient safety-related hospital deaths (Donaldson et al., 2014). In contemporary healthcare, there are increasing numbers of older and acutely ill patients with complex health problems who are at risk of adverse events, being cared for in general wards (Kyriacos et al., 2011). Adverse events are defined as unintended complications and injuries that lead to cardiopulmonary arrests, unplanned intensive care unit admissions, and mortality (Taenzer et al., 2011). These adverse events are often

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preceded by signs of deterioration (Franklin and Mathew, 1994) and thus, timely detection and appropriate interventions are important in ensuring safe patient care (Hillman et al., 2002). Although Rapid Response Systems (RRS) have been widely implemented to manage critical patient deterioration (Gao et al., 2007), a failure to recognize clinical deterioration in the early stages frequently results in suboptimal activations of the response teams (Sandroni and Cavallaro, 2011).

Poor clinical reasoning skills have been identified as one of the key reasons that nurses fail to recognize and respond appropriately to deteriorating patients. Banning (2008) defines clinical reasoning as the process of utilising one's knowledge and expertise to seek a solution in a clinical situation. Hoffman (2007) conceptualises clinical reasoning as a process where one gather cues, interprets them, understands the clinical problem, plans and performs interventions, evaluates the effectiveness of the interventions, and learns from the whole process through reflection. The ability to collect and cluster cues is essential for a nurse to identify patient problems (Hoffman et al., 2009). Although previous exposure to similar experiences results in 'pattern recognition' or intuition and play a key role in helping nurses to recognize and respond to clinical deterioration (Cioffi, 2000), overreliance on intuition can increase the likelihood of errors (Odell et al., 2009). The ability to apply clinical reasoning in providing evidence-based rationale to explain physiological changes and guide nursing actions is crucial in helping nurses to recognize and respond appropriately (Preston and Flynn, 2010).

A study by Cooper et al. (2010) reported a significant deficit in nursing students' clinical reasoning skills and ability to recognize and manage patient deterioration. Although clinical placements provide valuable learning experiences, opportunities for exposure to patient deterioration situations cannot be guaranteed. Additionally, when these types of critical situations occur, students are often relegated the role of passive observer without hands-on experience (Levett-Jones et al., 2010). To address these issues, educators have increasingly using simulation (Buykx et al., 2011). Simulation offers a hands-on experiential learning approach where manikins and other modalities can be used to facilitate students' learning in the assessment and management of patient deteriorations (Liaw et al., 2011a).

Although a number of studies attest to the effectiveness of simulation in enhancing nursing students' confidence, knowledge and clinical skills, the evaluation of clinical reasoning skills is often inconsistent or neglected (Fisher and King, 2013). Further, most reported studies use self-report measures or knowledge acquisition as outcomes. The use of multiple choice knowledge tests may not be sufficient for detecting any change in clinical reasoning abilities (Carter et al., 2015). Although there are available tools to measure clinical reasoning skills in nursing simulation (Lasater, 2007; Doolen, 2012), the measurement of such skills does not address the complexity of nursing practice in clinical deterioration. A systematic review on evaluation tools to measure critical thinking development highlighted the need to develop a discipline specific instrument that evaluates the application of critical thinking to practice (Carter et al., 2015). This study aims to develop a valid and reliable tool known as the Clinical Reasoning Evaluation Simulation Tool (CREST) for examining nursing students' ability to recognize and respond to clinical deterioration in a simulated learning environment.

2. Methods

A three-phase prospective study was conducted from August to December 2015. Phase 1 included the development and content validation of the CREST; Phase 2 involved psychometric evaluation of the parallel scales; Phase 3 involved usability testing.

2.1. Phase 1: Development and Content Validation

2.1.1. Development of Subscales and Items

A literature search was conducted on existing conceptual frameworks and tools related to clinical reasoning. The clinical reasoning cycle, developed by Levett-Jones et al. (2010), which described the clinical reasoning processes undertaken by nurses was considered to be the most appropriate basis for the CREST development. This cycle includes eight linked processes integral to clinical reasoning: 1) considering the patient situation, 2) collecting cues, 3) processing information, 4) identifying problems, 5) establishing goals, 6) taking action, 7) evaluating outcomes, and 8) reflecting on the process and new learning (Levett-Jones et al., 2010). These processes were used as subscales for the CREST. Items and their descriptors were formulated for each subscale based on existing instruments (Lasater, 2007; Orrock et al., 2014) and the developers' clinical experiences and inferential reasoning. A total of 11 items grouped under the seven subscales were constructed using a five-point Likert rating scale (1–5). These items were to allow the raters to appraise students' simulation performance or verbal responses to questions. Using the anchors of best and worst performances or responses, descriptors were constructed at each of the five-point ratings.

2.1.2. Content Validation

An expert panel comprising 15 international clinicians, researchers, and educators from Singapore, Sweden, and Australia with expertise in critical care or clinical deterioration was established to assess the content validity of the initial 11-item CREST. An email invitation requested each expert panel member to review and rank each item according to its relevancy on a four-point scale (1 = not relevant to 4 = very relevant). They were also asked to provide comments and recommendations for additional tool items.

Using the ratings, an item-level content validity index (I-CVI) was computed for each item. The I-CVI was computed by the number of experts giving a rating of either 3 or 4 and divided by the total number of experts. The computation revealed that one out of the 11 CREST items yielded an I-CVI of 0.75, five items had an I-CVI of 0.88, four had an I-CVI of 0.94, and only one had an I-CVI of 1.00. All 11 items were retained based on Lynn's recommendation that a minimum I-CVIs of 0.78 is required for from six or more experts. However, one item with an I-CVI of 0.94 was removed as the experts commented that it was not an important element of clinical reasoning and it would be difficult to evaluate. Additionally, some wording and phrases were revised based on feedback from the expert panel. The revised 10-item CREST was sent to the same fifteen experts for a second round of validation, which yielded a minimum I-CVI of 0.75 for each item and a scale-level CVI (S-CVI) of 0.93 for the overall scale.

2.1.3. Pilot Testing

The 10-item CREST was pilot tested by three expert simulation facilitators who observed and rated a video recorded simulation performance of a nursing student responding to patient deterioration. Prior to the observation, the raters discussed the CREST scoring method and the nursing care expected of a student based on the clinical scenario. After they had rated the video performance independently using the CREST, the raters reconvened to discuss their rating experiences. The performance descriptors of the five-point ratings were further refined to ensure a clear differentiation between the ratings. An additional global rating item was included to allow the rating of each performance as a whole. For this item students could be scored as 0 (unsatisfactory) to 10 (outstanding). The psychometric properties of the final 11-item CREST (see Appendix) was then tested.

2.2. Phase 2: Psychometric Testing

Psychometric testing was conducted to evaluate the 11-item CREST for construct validity, concurrent validity, predictive validity, internal consistency, and inter-rater reliability. Ethical approval for the study was given by the university's institutional review board.