Debriefing Approaches for High-Fidelity Simulations and Outcomes Related to Clinical Judgment in Baccalaureate Nursing Students

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ABSTRACT

Simulation followed by debriefing is increasingly common in clinical nursing education. Yet, limited studies have compared approaches to debriefing—the portion of simulations where participants re-examine and make sense of their experience. In this study, 120 baccalaureate nursing students in Quebec were randomized to receive one of two types of debriefing (self-assessment with Plus-Delta vs. guided reflection using a structured tool with REsPoND) after each of four simulations (a hemorrhage scenario, two sepsis scenarios, and a trauma simulation) during which their situation awareness was measured as a proxy for their clinical judgment. Unexpectedly, situation awareness scores showed little to no consistency across students or simulations and no clear improvements over time were noted, which rendered the comparison of the debriefing approaches across scenarios problematic. However, when comparing the two iterations of the sepsis scenario, students who participated in a reflective debriefing showed greater improvement in their recognition of abnormalities in patient vital signs and level of consciousness than students whose debriefing involved self-assessment.

KEYWORDS: debriefing, reflection, patient deterioration, clinical judgment, situation awareness, simulation

SUMMARY OF RELEVANCE

Problem: Little is known about how different debriefing approaches affect learning outcomes, especially nursing students' clinical judgment. **What is already known**: Simulation is used to prepare nursing students to recognize and respond to patient deterioration. Debriefing is essential to learning in simulation-based nursing education. **What this paper adds**: Learning related to situation awareness and clinical judgment in one simulation does not necessarily transfer to another simulation. Reflection using a structured observation tool seems to have a greater effect on students' ability to assess the deteriorating patient's vital signs than self-assessment of simulation performance.

Ethic statement

The manuscript involves human research. The Institutional Review Board of Université de Montréal (CÉRES) approved the study (14-073-CERES-D) on July 10, 2014.

Conflict of interest

There are no conflicts of interest to declare. All authors meet the criteria for authorship, have approved the final article, and abide by the copyright terms and conditions of Elsevier and the Australia College of Nursing. Furthermore, all those entitled to authorship are listed as authors. The first author received doctoral scholarships from the Quebec Nursing Intervention Research Network (RRISIQ), funded by the *Fonds de recherche du Québec – Santé*, (FRQS) from the *Fonds de recherche du Québec – Société et Culture* (FRQSC), and from the *Ministère de l'Éducation, de l'Enseignement supérieur et de la Recherche du Québec*. The *Équipe FUTUR*, funded by the FRQSC, funded the proofreading of this paper.

INTRODUCTION

Most hospitalized patients who are admitted to intensive care units or experience cardiac arrests present with signs and symptoms of deterioration in the hours leading up to their crises. These harbingers of crisis include quantifiable signs, such as alterations in vital signs and level of consciousness (Australian Commission on Safety and Quality in Health Care, 2010; Royal College of Physicians, 2012), and other less quantifiable findings, such as changes in breathing, circulation, and mentation (Douw et al., 2015). Nurses need to monitor and understand these signs and symptoms to identify clinically urgent situations and react appropriately. After noting changes in a patient's condition that demand attention, developing an understanding of those changes to decide on a course of action is referred to as clinical judgment (Tanner, 2006). The capacity for clinical judgment develops through clinical experience and practice. However, reliance on experience alone to prepare nurses for situations where patients deteriorate could pose risks to patient safety. Thus, educators use simulations to develop nursing students' clinical judgment in a safe and controlled environment (Fisher & King, 2013).

BACKGROUND

Simulation and Debriefing

Simulation has been widely adopted by schools of nursing around the world. Simulation involves "replac[ing] or amplify[ing] real experiences with guided experiences that evoke or replicate substantial aspects of the real world in a fully interactive manner." (Gaba, 2004, p. i2) It provides a clear opportunity for nurses or students to experience and manage a situation of patient deterioration without risking patient harm.

After a simulation, it has come to be standard practice that learners participate in a debriefing to re-examine, make sense of, and learn from their simulation experience (Gardner, 2013). Research has shown that debriefing is critical to improving learners' performance (Tannenbaum & Cerasoli,

2013) and that the absence of a debriefing after a simulation constrains learning outcomes (Shinnick, Woo, Horwich, & Steadman, 2011). It is also known that the guidance of a facilitator in analyzing a simulation increases the effectiveness of debriefing (Tannenbaum & Cerasoli, 2013). However, it is unclear how different approaches to debriefing affect learning outcomes (Tannenbaum & Cerasoli, 2013).

Among the existing approaches to debriefing, some favor guided reflection to promote experiential learning. One example of a reflective debriefing approach is ResPoND—Reflective dEbriefing after a PatieNt Deterioration (Authors, 2015). This approach is based on Dewey's (2007) account of reflection and Tanner's (2006) model of clinical judgment. Clinical judgment—the interpretation of a patient's needs or health problems and decisions regarding actions to be taken—depends on what the nurse notices in a situation and how he/she interprets these findings (Tanner, 2006). For Dewey (2007), reflection consists of observation of the elements of an experience followed by inference, corroboration, and testing of hypotheses to explain what happened. According to Tanner (2006), reflection allows nurses to build capacity for clinical judgment. The outcome of reflection is closer attention to certain elements of a situation and enhanced response to that situation. In practice, REsPoND (Authors, 2015) begins by asking students to describe their observations through the primary and secondary survey—the ABCDE-FGHI assessment. Next, students attempt to determine why the simulated patient presented various signs and symptoms by formulating and testing hypotheses. Once they identify a plausible hypothesis, students review and select appropriate interventions in light of the expected effects on the patient (see Table 1 for the lines of questioning of REsPoND).

In other approaches, debriefing focusses on participants' self-assessment of their performance. The Plus-Delta is a self-assessment debriefing approach that is similar to those used in commercial aviation (Gardner, 2013). It consists of students examining their simulation performance and listing

examples of good actions (Plus) and actions that require improvement (Delta). When debriefed with the Plus-Delta approach, students are free to discuss any points they believe are of importance to their simulation performance (see Table 1). In our experience, students typically address technical aspects of care, patient assessment, communication and collaboration with teammates and the physician, clinical meaning of the scenario (relationship to patient's illness), and approach to the patient.

Conceptually, reflection differs from self-assessment in that the former focuses on understanding a situation and the latter compares participants' behaviors against a standard (Eva & Regehr, 2008). Even if self-assessment debriefings appear to be the most common (Adam Cheng et al., 2014), there is some evidence that favors reflective debriefings (Dreifuerst, 2012; Mariani, Cantrell, Meakim, Prieto, & Dreifuerst, 2013) but further evidence is needed to answer the question more definitively.

Clinical Judgment and Situation Awareness

In this study, we aimed to compare the outcomes of two debriefing approaches on nursing students' clinical judgment regarding patient deterioration. However, measuring the effectiveness of any educational intervention on clinical judgment is notoriously difficult (Thompson, Aitken, Doran, & Dowding, 2013). Tanner (2011) recommends tests of performance in specific clinical contexts to assess students' capacity to marshal their knowledge in different clinical situations, as opposed to mastery of knowledge or skills taken out of context. However, most current tests of clinical judgment performance rely on observation of students' actions, which provide limited information on what students have noticed in a simulation and how they interpreted this data.

In this study we used a measure of situation awareness (SA) to assess clinical judgment. Originally developed in aviation safety, SA is defined as "knowing what is going on around [oneself]" (Endsley & Garland, 2000, p. 5) and has three levels: (1) perception of cues, (2)

comprehension of their meaning, and (3) projection of their status in the near future. In the case of patient deterioration, the first two levels of SA can be proxies of concepts relevant to clinical judgment: level one (perception of cues) for noticing the signs and symptoms of deterioration, and level two (comprehension of their meaning) for understanding those signs and symptoms. Scholars from other disciplines have empirically established a link between SA and human judgment (Strauss & Kirlik, 2006) and nurse researchers have identified a relationship between nurses' SA and decision-making (Sitterding, Broome, Everett, & Ebright, 2012; Stubbings, Chaboyer, & McMurray, 2012). Thus, we selected SA as the main outcome measure and the study question was: was the use of a reflective vs. a self-assessment approach to debriefing associated with improved SA in patient deterioration simulations?

METHODS

This was a pragmatic trial carried out in the context of an existing bachelor's-level nursing course. Pragmatic trials are implemented in usual—as opposed to ideal—conditions and allow for some flexibility in the delivery of the interventions under study (Thorpe et al., 2009). This was deemed suitable to the complexity of debriefing, which often requires on-the-spot adaptation to students' responses.

Context—Simulations in a Critical Care Course

This study was conducted in a mandatory 12-week critical care course in a French-language baccalaureate nursing program in Quebec, Canada. The course, taken in the final year of a three-year traditional prelicensure version of the program or in the second of two years in a post-licensure program, is intended to enhance students' abilities to recognize and interpret signs and symptoms of deterioration and respond appropriately. The first 140 hours of the course consist of a combination of lectures, problem-based learning, and labs. The last two weeks of the course consist of seven clinical placement days in critical care settings.

Students in the version of the course running at the time of the study were required to participate in five simulations. Three scenarios were used. The first was intra-abdominal hemorrhage secondary to a cardiac catheterization (HEMO), the second was a case of sepsis secondary to pneumonia and leading to atrial fibrillation (SEPSIS), and the third was a presentation of altered level of consciousness secondary to head trauma (TRAUMA). Students participated in HEMO once at the midpoint of the first 140 hours of the course (week 5); later in the semester students were led through SEPSIS and TRAUMA twice on simulation days that occurred in between clinical placement days (week 11 and 12). All scenarios were designed and validated by university educators and had been used with over four cohorts before the present study.

All simulations followed a similar structure. Two weeks before each simulation, students received a case history for the simulated patient. Before the simulations (during prebriefing), debriefers instructed students on the learning objectives of the simulation. Students participated in the simulations in groups of five to six—three students participated in the first half and switched to an observer role for the second half. The simulations began with a phase where the patient—a METIman^{TM} high-fidelity manikin—was clinically stable but showed early signs of deterioration. Once students completed an initial assessment and carried out admission orders (i.e., blood work and medications), the simulated patient started to deteriorate rapidly. If students recognized the signs of deterioration and initiated appropriate actions, the operator initiated a recovery phase where the patient's condition stabilized. The duration of each phase depended upon the pace of students' actions. All simulations occurred in university labs designed to mimicked the rooms of an intensive care unit.

There were some differences between the first simulation and the later ones (see Figure 1). The first simulation (HEMO) was 20-30 minutes long and was followed by a 30-minute debriefing; there were no other course activities following this simulation. The SEPSIS and TRAUMA

simulations were delivered in a similar manner: students ran through the scenarios twice on one simulation day. After the prebriefing, students experienced the SEPSIS-I simulation for 30-45 minutes followed by a 60-minute debriefing. Next, students experienced SEPSIS-II, a second 30-45-minute simulation with a slightly altered scenario (e.g., different drugs, slight differences in the initial vital signs), and they participated in a series of other activities (e.g., concept mapping, peer assessment of performance). The two TRAUMA simulations were delivered in a similar manner.

[*Insert Figure 1.* Sequence of simulations and debriefings.]

Participants

A convenience sample of students enrolled in the critical care course in the semester running from January to April 2015 was recruited at two campuses. Students had all previously experienced high-fidelity simulations and were familiar with the environment. All students were eligible and informed about the study at the first class of the course. Prospective participants met a research assistant who explained the study protocol and obtained written consent.

After enrollment, participants completed a socio-demographic questionnaire. Simple randomization was not possible since students participated in the simulations and debriefings in groups and schedules for HEMO were already established at the time of recruitment. A compromise providing for some randomness of allocations was to first form groups of six participants and then to randomize the groups to either one of two debriefing approaches using a random number table with a 1:1 ratio at each campus. Participants were blinded to their group assignment/debriefing type.

Ethics

The Institutional Review Board approved the study (14-073-CERES-D, 2014-07-10). All students in the course engaged in the simulations and were debriefed afterwards whether or not they participated in the study. Data collected in the study protocol was analyzed separately from

grading/assessments in the course. Participants had the right to withdraw from the study at any time. Because student participation in the debriefing after the first TRAUMA simulation was part of their grade, we ended the study protocol right before this point. We did not anticipate any special risks of participation.

Debriefings

The outcomes of two debriefing approaches (REsPoND and Plus-Delta) were compared in this study. Both debriefings were provided in a similar manner. Debriefers observed the simulations through a one-way mirror. After the simulations, debriefers sat with a group of participants outside the simulation lab. Debriefers clarified that the discussion was confidential, explored participants' reactions to the simulation, and expressed respect and support of the students.

Debriefers were nurses who had been involved in debriefing before and who had critical care experience. They were instructed to follow the questions and sequence of their respective debriefings; however, exact session content was tailored to explore each group's experience of the simulation. To balance the flexibility in the delivery of the debriefings, videotapes of the debriefing sessions were reviewed by research assistants to verify the fidelity of implementation of the two approaches (i.e. use of the questions characteristic of each debriefing approach). The same debriefers conducted the debriefings at both campuses and were aware of the group assignment; they only delivered one of the two debriefing approaches, were not trained in the other approach under study, and were not involved in collecting outcome measures.

Main Outcome Measure: Situation Awareness

To measure participants' SA, we used the Situation Awareness Global Assessment Technique (SAGAT; Endsley & Garland, 2000), a technique that was successfully used with nursing students in patient deterioration simulations (McKenna et al., 2014). The SAGAT involves interrupting a simulation and asking a series of fast-paced, short-answer questions at a particular point in the

situation. During the interruption, monitors, flow sheets, and other data sources that could be used to answer the queries are hidden. In previous research, interruptions in simulations conducted in a similar manner were found not to alter participants' performance or situation awareness (Endsley & Garland, 2000). Given that this technique relies on participants' responses rather than an observer's evaluation of their actions, it is believed to yield more objective and direct measures of performance (Endsley & Garland, 2000).

We used a paper instrument to deliver the SAGAT (see Table 2; Authors, 2016). The tool is divided into four sections: (1) perception of quantifiable signs of deterioration, i.e. vital signs and level of consciousness, (2) perception of less quantifiable signs of deterioration, (3) comprehension of the meaning of these signs, and (4) projection of likely evolution of the patient's condition. Before its use in the current study, the tool underwent two rounds of content validation; it obtained high content validity indices and showed satisfying difficulty, discrimination, and reliability properties. The questionnaire was pilot-tested in earlier courses with students participating in HEMO simulations and yielded a Kuder-Richardson coefficient (KR-20) of 0.64 (Authors, 2016).

Data Analysis

For each student, we computed a total SA score and scores for the four subscales for each simulation (one point/correct answer). SA scores in HEMO were considered the baseline outcome measures. As recommended in pragmatic trials, we used an intention-to-treat analysis and included data from all participants, except for those who had incomplete data because they missed a simulation.

To compare the effectiveness of the debriefings, we planned to perform repeated measures analyses of variance, controlling for variables that could influence the main outcome (e.g. baseline imbalance between groups, experience). However, as will be explained in the following sections, this was not possible due to violations of two major assumptions behind such an analysis. First, it

was expected that the subscales of the instrument would be intercorrelated in a manner suggesting that they tapped an underlying construct. Secondly, it was anticipated that students' SA scores would show some stability across the simulations such that individual students' scores in one simulation would predict their scores in the next.

As will be described, we found that repeated measures analyses were justified only in the case of the SA measures within the two sepsis simulations. The items comprising the subscale and total scores for SEPSIS were not well correlated and we concluded that comparisons of performance on individual item across the two iterations of SEPSIS would be more informative than examining total scores. To determine if there were differences in item success before and after participating in the debriefings, we used McNemar's tests. Similar to paired-sample t-tests, McNemar's tests are used in pretest-posttest study designs with dichotomous dependent variables. However, they do not allow cross-group comparison; they only evaluate whether there is a significant difference between sets of matched observations. Since we ran an extended series of McNemar's tests, we adjusted significance levels with a Bonferroni correction.

RESULTS

Participants and Recruitment

There were 279 eligible students, of whom 130 agreed to participate in the study (a 46.6% recruitment rate). We assigned 126 students to 21 groups of six students each; groups were evenly allocated to the two debriefing methods within each campus. On campus A, 13 groups were randomly allocated to REsPoND (n=7) or Plus-Delta (n=6). On campus B, eight groups were randomly allocated to REsPoND (n=4) or Plus Delta (n=4).

In total, there were 11 groups who received two REsPoND debriefings and 10 groups who received two Plus-Delta debriefings after HEMO and SEPSIS-I. Out of the nine questions in the REsPoND protocol, seven questions were addressed in all the debriefings. The question 'What was

learned through the simulation and debriefing' was missing from nine debriefings (41%) and the one addressing 'Objectives for the next simulation' was missing from three debriefings (14%), apparently because time ran out. All five questions in the Plus-Delta debriefings were delivered as planned.

Participants who missed one or more simulation (*n*=6) because of illness or work scheduling conflicts were excluded from further analysis. Socio-demographic data for the remaining participants are shown in Table 3. The groups were balanced on most characteristics, except for gender; there were disproportionately more male students in the Plus-Delta group (*n*=12) than in the REsPoND group (*n*=4). Approximately 1/3 of the students in the study had completed a junior-college prelicensure education (the great majority had less than 1 year of post-licensure experience and only about 1/3 of these had critical care experience). Prior clinical and critical care experience were evenly distributed across participants assigned to the two groups. Omitting the licensed nurse students and those with critical care experience from the analyses had no discernable impact on the results and therefore we report on our sample as a whole.

Situation Awareness Scores

Correlations between SA subscale scores within simulations showed no discernable pattern and ranged from low to moderate in strength (see Table 4). KR-20s ranged from 0.43 (SEPSIS-II) to 0.69 (HEMO). These results suggest that the four subscales of the instrument did not function together as expected; therefore, the first assumption—that the subscales of the instrument would show a certain degree of association and that scores on one subscale could predict scores on the other subscales within a simulation—was violated.

Mean SA scores are presented in Table 5. Means were similar across simulations. Intercorrelations of subscale scores across simulations with different scenarios were moderate to low. For the total SA score, the correlations between HEMO and SEPSIS-I (-0.11, p=0.23) and

HEMO and TRAUMA (0.18, p=0.83) were low; the correlation between SEPSIS-I and TRAUMA was moderate (0.44, p<0.001). The only high correlation between total SA scores was observed in the sepsis scenarios, where the correlation between SEPSIS-I and SEPSIS-II scores was 0.82 (p<0.001).

Similar patterns were observed for the subscales. The four subscale scores in HEMO showed low correlations with the same subscale scores in SEPSIS-I and TRAUMA (-0.07-0.12, p>0.05). Scores on the 'Perception of quantifiable signs' and 'Projection' subscales in SEPSIS-I correlated poorly with their associated scores in TRAUMA (0.04 and 0.06, respectively, p>0.05); scores on the 'Perception of less quantifiable signs' and 'Comprehension' subscales in SEPSIS-I correlated moderately with their associated scores in TRAUMA (0.48 and 0.42, respectively, p<0.001). It was only the correlations in scores of the repeated SEPSIS scenario that reached higher levels, with the 'Perception of quantifiable signs' being the lowest (0.48, p<0.001) and the three other subscales being similarly elevated (0.61-0.68, p<0.001). These results suggest that students' SA scores were not sustained through the scenarios; thus, the assumption that SA scores across scenarios would show stability within respondents that would allow detection of improvements with an analysis of variance was violated.

Comparison of the Debriefing Approaches

Under the circumstances, the most justifiable comparison was of item-by-item performance on the SA tool across the two iterations of the SEPSIS scenario. We began by examining the proportion of students who answered each question correctly. Approximately half of the items were answered correctly by the great majority of participants (≥70%) regardless of group or debriefing effect and were excluded from further analysis: (2) 'Heart rate'; (4) 'Oxygen saturation'; (6) 'Temperature'; (10) 'Need more oxygen'; (11) 'Agitation'; (14) 'Stating that something serious is

about to happen'; (17) 'Cardiac output'; (19) 'Hypothermia or hyperthermia'; (22) 'Bleeding'; (23) 'Infection'; (24) 'Need to administer a bolus'; (25) 'Need to call the doctor'; (27) 'Projection of blood pressure'; (28) 'Projection of heart rate'; (29) 'Projection of respiratory rate'; (30) 'Projection of oxygen saturation'; and (31) 'Projection of systemic circulation'.

Table 6 shows the proportion of students answering the remaining items correctly. For each group, we calculated the difference in probability of a correct response between SEPSIS-I and SEPSIS-II, omitting item (9) 'Difficulty breathing', since correct responses showed little difference or change over time in correct responses in either group (≤5%). McNemar's tests were performed on data from the remaining 14 items for each group using an adjusted significance level of $p<0.004$. For the REsPoND group, there was a significant improvement from SEPSIS-I to SEPSIS-II on the following items: (1.1) 'Systolic blood pressure' (a 25% increase in probability); (1.2) 'Diastolic blood pressure' (+29%); (3) 'Respiratory rate' (+27%); (5) 'Level of consciousness' (+40%); (12) 'Unusual pain' (+28%); and (16) 'Efficient respiration' (+21%). For the Plus-Delta group, there was a significant improvement of performance on item (7) 'Normality of breath sounds' (+25%).

DISCUSSION

This study was designed to compare the effect of a reflective and a self-assessment debriefing on nursing students' SA in patient deterioration simulations—SA was used as a proxy for clinical judgment. We were unable to identify clear differences across the two approaches on our outcome measures, which was likely related to several unexpected but potentially important patterns in the data.

Students' Situation Awareness and Clinical Judgment

Contrary to our expectations, the subscale scores reflecting the three levels of SA on which the instrument was based—perception, comprehension, and projection—showed little association with

each other. Interestingly, students excelled at answering queries that were highly relevant in the respective scenarios; for example, in SEPSIS-I scores showed that, before any intervention, students excelled in identifying the patients' temperature, hyperthermia, and signs of infection. Another interesting result was that students' predictions of how the patient vital signs would evolve were very similar for all scenarios; in all cases, students predicted that the patient's blood pressure, oxygen saturation, and systemic circulation would decrease, whereas heart and respiratory rates would increase. While this was true for HEMO and SEPSIS, it was not the case in TRAUMA—this likely explains why projection scores in TRAUMA were low (see Table 5). This suggests that students' expectations for the clinical scenarios were fixed, and unresponsive to the specifics of various patient situations.

These findings support the idea that students focused their attention on the cues that are most emblematic of a situation, sometimes to the detriment of other important findings. Tanner's (2006) clinical judgment model posits that nurses' expectations of a situation shape what they notice in a situation. These expectations take the form of mental models of clinical problems that are constructed with practical and theoretical knowledge. Because of their limited experiential base, novice nurses have a limited number of mental models stored in memory, which are not as comprehensive as those of expert nurses. Consequently, their understanding of clinical situations is often narrow and they tend focus on one problem at a time (O'Neill, Dluhy, & Chin, 2005). It is also possible that priming students with case histories before simulations, as was the case in this study, could have shaped their expectations and influenced the cues that they focused on. Students' construction of mental models of clinical problems and how they relate to their expectations in simulation is a topic that warrants further research.

Students' SA scores showed little to no consistency or stability across different simulation scenarios, but scores were more stable for SA in scenarios repeated twice in the same day. This

observation casts doubts on the transfer of learning from one simulation scenario to others and suggests that learners may approach new clinical scenarios without applying lessons from previous scenarios. The clinical judgment model (Tanner, 2006) and our results would appear to support exposing students to similar cases repeatedly rather than emphasizing exposure to multiple cases involving different underlying clinical conditions. After all, it seems unfair to expect students to show progression in their clinical judgment when they are presented with different, unfamiliar simulation scenarios. However, helping students to see patterns and similarities across scenarios could be important. To our knowledge, research to date has principally addressed transfer between simulations and clinical settings (Fisher & King, 2013; Kirkman, 2013). Transfer of knowledge across simulated scenarios, or conditions, also merits further exploration.

Comparison of the Debriefing Approaches

Based on our analysis of the data, the only reasonable comparison of the debriefing approaches was to examine specific aspects of SA when the sepsis scenario was repeated. Results suggested that students who received the REsPoND debriefing showed greater improvements in accuracy of recall of the patient's vital signs and level of consciousness than students who participated in the Plus-Delta debriefings. There could be different explanations for this result, but the impact of applying the primary and secondary survey appears as a plausible one. This approach to health assessment addresses the quantifiable signs of patient deterioration systematically, in the Breathing, Circulation, Disability, and the Full sets of vital signs sections. It is plausible that rehearsing the approach directed students' attention towards those signs in the next attempt at a similar simulation. While patient assessment was also discussed in the Plus-Delta debriefings, there is no evidence that these observations were examined as systematically and thoroughly as in the REsPoND debriefings. Considine and Currey (2015) discussed the value of the primary survey, arguing that an evidence-based and sequenced approach to patient assessment may promote

detection of patient deterioration. Research findings suggests positive learning outcomes accompanying use of the primary survey in patient deterioration simulations (Liaw, Rethans, Scherpbier, & Piyanee, 2011; Stayt, Merriman, Ricketts, Morton, & Simpson, 2015). While replication is needed, our results support the use of the primary and secondary survey in debriefing—and in clinical nursing education in general.

Another possible explanation for the improvements on specific aspects of performance associated with the REsPoND approach relates to the requirement in reflective debriefing to not only note abnormal findings but also explain them. This was not the case in the Plus-Delta, which focused on students' assessment of their performance. According to Dewey (2007), reflection involves a stepwise progression from making observations to finding meaning through deduction and validation of those meanings with the data at hand. Dewey argues that this iterative process leads to increased attention to the specific observations most important in explaining a situation. Students exposed to REsPoND may have been guided to understand the relationships between quantifiable signs and the underlying pathology that led them to give added weight to those signs and become more attentive to the same signs in the next simulation.

However, it is important to note that most items in the questionnaire showed similar responses to both debriefing approaches and that most changes in scores from SEPSIS-I to SEPSIS-II did not reach statistical significance, regardless of which debriefing approach was used. This raises questions regarding the fidelity and feasibility of the debriefing approaches. All Plus-Delta debriefings were delivered as planned; however, students in the REsPoND group were not systematically asked to describe their learning or to set objectives for the next simulation, thereby introducing some variability in the contents of the debriefings. In actuality, REsPoND included more questions and these questions required more time and skills on the part of the debriefer. Thus, it is reasonable to conclude that REsPoND was a longer, more complex debriefing approach that

was more difficult to deliver within the allocated time. Although the debriefers were experienced, they only received a three-hour training session, which may have been insufficient to master the skills involved in the approaches. This highlights the critical importance of educational preparation and monitoring of debriefers' skills, which has received very little attention to date (A. Cheng et al., 2015). That being said, this trial was pragmatic in essence and reflected the issues in preparing debriefers when large number of students are involved in simulation-based learning.

Limitations

Interpretation of our findings bears keeping a number of limitations in mind. First, it is possible that blinding was compromised because students may have guessed the arm of the study to which they were assigned based on differences from debriefing experienced in previous courses. Second, the study was not designed to identify differences across groups of any particular magnitude and used a relatively new outcome measure for which evidence of sensitivity to change is still emerging. Third, unmeasured variables related to participants' knowledge and experience of patient deterioration as well as teamwork may have influenced students' performance in recognizing and managing deteriorating patients (Bogossian et al., 2014). Finally, this study was conducted in a specialty course in a particular program. Because this study was designed as a pragmatic trial, educators must compare their contexts to the one described in this paper to evaluate if our findings could or should inform their practice.

CONCLUSION

Simulation is now a widely-used strategy in the clinical component of nursing programs and its use seems destined to increase. Debriefing is recognized as a crucial component of simulation and the National League for Nursing (2015) promotes the integration of reflective debriefing "across the curriculum—not just in simulation" (p. 2). There are different ways to debrief, and it is essential that faculty be cognizant of how these approaches to debriefing align with desired learning

outcomes. Our results suggest that improvements could be tied to repetition—rather than the variety—of scenarios that students experience and suggest a need to examine evidence for the transfer of simulation-based learning, or lack thereof. Perhaps most importantly, we noted variation in the implementation of the debriefing approaches in our study, which raises concerns for the optimal preparation and skill set of the debriefers. Finally, clarifications regarding the true mechanisms through which debriefing promotes simulation-based learning are needed. Once achieved, these understandings will assist nurse faculty to develop and facilitate simulation activities that produce learning outcomes effectively and efficiently.

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Table 1. Questions in REsPoND and in the Plus-Delta Debriefings

REsPoND	Plus-Delta
1. How do you feel the simulation went?	1. How do you feel the simulation went?
2. What did you know about this patient before entering the simulation?	2. What went right in the simulation?
3. Describe your primary and secondary assessment of the patient (ABCDE-FGHI)[a].	3. What went wrong in the simulation?
4. What were the important data?	4. How could you improve for the next simulation?
5. What hypotheses could explain these data? What could be the causes of the deterioration?	5. Any other themes or questions you wish to address?
6. How do the hypotheses explain the data? How do the hypotheses account for the data? What's the most plausible hypothesis?	
7. What effects did you expect to achieve with your interventions? What other interventions would be relevant and why?	
8. What did you learn through the simulation and debriefing?	
9. What are your objectives for the next simulation?	

NOTE. [a] Airway, Breathing, Circulation, Disability (neurologic status), Exposure (remove clothing and keep patient warm), Full set of vital signs, Five interventions (cardiac monitor, pulse oximeter, urinary catheter, gastric tube, laboratory studies) and Family, Give comfort measures, Head-to-toe exam, Inspect posterior surfaces.

Table 2. Situation awareness questionnaire (authors, 2016)

Level	Query	
1-Perception (quantifiable signs)	1.1	At the moment, what is the systolic blood pressure?
	1.2	At the moment, what is the diastolic blood pressure?
	2	At the moment, what is the heart rate?
	3	At the moment, what is the respiratory rate?
	4	At the moment, what is the oxygen saturation?
	5	At the moment, what is the level of consciousness? (AVPU)
	6	At the moment, what is the patient's temperature?
1-Perception (less quantifiable signs)	7	At the moment, are his/her breath sounds normal?
	8	At the moment, is his/her pulse regular?
	9	At the moment, does s/he have difficulty breathing?
	10	At the moment, does s/he need more oxygen?
	11	At the moment, is s/he agitated?
	12	At the moment, is s/he reporting unusual pain?
	13	At the moment, is s/he reporting increasing pain?
	14	At the moment, is s/he reporting that something serious is about to happen to him?
2-Comprehension	15	Do you think his/her airway is patent?
	16	Do you think his/her respiration is efficient?
	17	Do you think his/her cardiac output is normal?
	18	Do you think his/her peripheral perfusion is normal?
	19	Do you think s/he is hypothermic or hyperthermic?
	20	Is s/he showing signs of shock?
	21	Is s/he showing signs of neurological involvement?
	22	Is s/he showing signs of internal or external bleeding?
	23	Is s/he showing signs of infection?
3-Projection	24	In the next few minutes, will you have to administer a bolus?
	25	In the next few minutes, will you advise the doctor of your observations?
	26	In the next few minutes, will you ask the doctor to come to the patient's bedside STAT?
	27	In the next few minutes, what will happen to his/her blood pressure?
	28	In the next few minutes, what will happen to his/her heart rate?
	29	In the next few minutes, what will happen to his/her respiratory rate?
	30	In the next few minutes, what will happen to his/her oxygen saturation?
	31	In the next few minutes, what will happen to his/her systemic circulation?

Table 3. Sociodemographic Characteristics of Participants (*N*=120)

	REsPoND (*n* = 64)	Plus-Delta (*n* = 56)	Total (*N* = 120)
Mean age in years (SD)	23.6 (5.1)	24.9 (7.1)	24.2 (6.1)
Female	60 (93.8%)	44 (78.6%)	104 (86.7%)
Entry-to-practice program	43 (67.2%)	40 (71.4%)	83 (69.2%)
Students in post-diploma program with clinical experience	19 (90.5%)	13 (81.3%)	32 (86.5%)
Mean years of clinical experience (SD)	1.3 (1.0)	1.2 (0.6)	1.3 (0.9)
Students in post-diploma program with critical care experience	8 (38.1%)	4 (25.0%)	12 (32.4%)
Mean years of critical care experience (SD)	0.9 (0.7)	0.8 (0.3)	0.8 (0.6)
Canadian-born	43 (67.2%)	39 (69.6%)	82 (68.3%)

Note: Unless otherwise noted, figures are the numbers of subjects falling into the categories along with the percentages of the subjects in the assignment group or the total sample belonging to the category.

Table 4. Correlations Between Situation Awareness

Subscale Scores for Each Simulation (*N*=120)

	Perception (LQ)	Comprehension	Projection
HEMO			
Perception (Q)	.210[a]	.229	.333
Perception (LQ)		.457	-.002[b]
Comprehension			.180[a]
SEPSIS-I			
Perception (Q)	.456	.484	.213
Perception (LQ)		.490	.420
Comprehension			.375
SEPSIS-II			
Perception (Q)	.580	.483	.407
Perception (LQ)		.472	.397
Comprehension			.406
TRAUMA			
Perception (Q)	.432	.388	.042[b]
Perception (LQ)		.473	.253
Comprehension			.286

NOTE. All correlations significant ($p \leq 0.01$), except: [a] $p \leq 0.05$; [b] Non-significant. Q=Quantifiable signs, LQ=Less quantifiable signs.

Table 5. Mean Situation Awareness Total and Subscale Scores for the Four Simulations (N = 120)

	HEMO	SEPSIS-I	SEPSIS-II	TRAUMA
Total	21.8 (4.3)	21.9 (3.2)	24.7 (2.8)	19.55 (3.9)
Subscales				
Perception-Quantifiable signs	4.0 (1.7)	4.4 (1.7)	6.0 (1.0)	4.6 (1.8)
Perception-Less quantifiable signs	5.7 (1.7)	5.9 (1.4)	6.5 (0.9)	5.8 (1.4)
Comprehension	6.2 (1.7)	5.1 (1.2)	5.9 (1.4)	6.5 (1.6)
Projection	6.3 (1.6)	6.2 (1.9)	6.6 (1.9)	2.5 (1.5)

Table 6. Proportions of Subjects Correctly Answering Specific Questions in SEPSIS-I and SEPSIS-II Across Type of Debriefing

		REsPoND (*n*=64)		Plus-Delta (*n*=56)	
	Item	SEPSIS-I	SEPSIS-II	SEPSIS-I	SEPSIS-II
Perception-Quantifiable signs	1.1.	.69	.94[a]	.79	.93
	1.2.	.58	.87[a]	.52	.70
	3.	.23	.50[a]	.20	.25
	5.	.55	.95[a]	.59	.75
Perception-Less quantifiable signs	7.	.88	.70	.61	.86[a]
	8.	.56	.78	.62	.71
	12.	.52	.80[a]	.68	.80
	13.	.63	.78	.61	.79
Comprehension	15.	.61	.77	.57	.73
	16.	.17	.38[a]	.20	.30
	18.	.27	.31	.23	.36
	20.	.20	.30	.21	.36
	21.	.45	.53	.54	.64
Projection	26.	.56	.72	.61	.71

NOTE. [a] Significant improvement at the $p<0.004$ level from SEPSIS I to SEPSIS II.

Figure 1. Sequences of simulations and debriefings