A PHASE 1 STUDY OF A KOLB-INFLUENCED, HIGH FIDELITY SIMULATION INTERVENTION IMPLEMENTED TO IMPROVE NURSING STUDENTS’ USE OF A CONFLICT RESOLUTION SKILL

By

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A thesis submitted in conformity with the requirements for the degree of Doctor of Philosophy

Graduate Department of Nursing Science

University of Toronto

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2016
ABSTRACT

Interpersonal task-related conflict that arises within nursing practice can contribute to issues regarding patient safety. Exposure to conflict within practice occurs as soon as the undergraduate nursing student’s first clinical placement. Yet studies have shown that students, as well as practitioners, are not utilizing a conflict management style conducive to safe patient care. Few educational interventions have incorporated the teaching of conflict resolution skills to nursing students. Therefore, a high fidelity simulation intervention (two scenarios, each followed by a debriefing session) was developed and refined to teach the two-challenge rule to Year 2 nursing students. The Medical Research Council Framework informed the intervention’s design and refinement strategy, while Kolb’s Experiential Learning Theory provided the foundation to implement the entire, refined intervention.

A Phase 1 study with two successive components, refinement and single-group post-test, was conducted to determine the feasibility for a future randomized controlled trial (RCT) of this high fidelity simulation intervention. Forty eligible Year 3 nursing students participated in the refinement phase during a 2-week period. For the single-group post-test component, 35 Year 2 nursing students participated in the entire, refined high fidelity simulation intervention which included a 5-week spacing period.

The refinement strategy improved the high fidelity simulation intervention’s overall design features. For Scenario 1, the Simulation Design Scale (SDS) mean score reached a high on Day 5 of 4.86 (SD = 0.14) in contrast to a score of 3.45 (SD = 0.17) on Day 1. For Scenario 2, the SDS specific mean score was 4.75 (SD = 0.16) on Day 5, which represented a mean score increase of 1.01 from the score on Day 1.
Of the Year 2 students who participated in the refined intervention, 88.7% rated its quality at 4 or higher on the Educational Practices Questionnaire. Year 2 nursing students (82.9%) also rated their satisfaction and self-confidence after participating in the entire refined intervention at 4 or higher on the Satisfaction and Self-Confidence in Learning scale. Additionally, the Year 2 students utilized the two-challenge rule 74.3% of the time after participating in the second high fidelity simulation scenario. Overall, the results of the Phase 1 study were favourable and will contribute to planning a future RCT.
I shall be telling this with a sigh
Somewhere ages and ages hence:
Two roads diverged in a wood, and I —
I took the one less traveled by,
And that has made all the difference.

Robert Frost (1916)

My Doctoral journey has made me examine my paradigmatic learning's in greater depth and breadth. Along the way, I realized the importance of being open-minded about different ontologies, epistemological stances and research design methodologies during the research process. It has definitely been a time of significant personal and academic growth for me. It is with humility and deep gratitude that I acknowledge those individuals who provided guidance and helped me academically and spiritually along the way.

To the members of my thesis committee, thank you for graciously sharing your time and knowledge. To Dr. Adam Dubrowski, my Advisor, thanks for accepting me as your Doctoral student and for giving me the space and opportunity to grow into a self-directed research investigator. Our collaboration has shown me that there is much more to the research process; it requires an Advisor with a great deal of patience. I also extend my sincere thanks to my two committee members, Dr. Ellen Hodnett and Dr. Elizabeth Peter. I appreciate Dr. Ellen Hodnett for questioning my paradigmatic bearings and for always setting my research compass; moreover, for providing constructive feedback in the exact moment that I needed it in order to move forward successfully. I have learned so much from you, Dr. Ellen Hodnett! Thanks to Dr. Elizabeth Peter for sharing your expertise, insights, time and support; all were invaluable and greatly appreciated.

Along the way, I also collaborated with interprofessional researchers who have challenged my thinking. I want to especially thank Dr. Delton Daigle for providing spiritual
comradery and for your relentless academic feedback; you did it so well. You always believed in me, even when I doubted myself, and thus made my academic journey so much more bearable. Warm thanks to Carolina Prado for your kind words and patience over the years.

I would also like to acknowledge all the undergraduate nursing students who participated in this study. It could not have happened without their generous giving of their time and the careful completion of the questionnaires and open-ended feedback.

I am very thankful to my parents, Alzira and Antonio, for their unwavering encouragement. They instilled in me a love of learning and celebrated every accomplishment. Likewise, I am grateful to my late grandmother, Maria Fagundes Pereira; you will always remain in my heart. To my sister Odile, my goddaughter Nicole, nephew Andrew, Isidro, Teddy, cousin Elizabeth, Ledo, Beatriz and Daniel, thanks for your patience and for listening to me about my research over the years. It is finally completed!

I could not have done this without my very special friends; Charles Anyinam, Barbara Bauer, Lorraine Betts, Dianne Diniz, Dr. Sarah Evans, Christine Houston, Dr. Andrea Lalonde-Goodfellow, Ruth Robbio, and Suba Sivaramalingam; each of whom contributed a listening ear, provided me feedback, supported me through challenging times, and celebrated my success. They have made this a truly enjoyable experience and I am richer for having them in my life. I would also like to acknowledge the Doctoral Fellowship that I received from the University of Toronto and the George Brown College Seed Funding award.

Most importantly, I dedicate this thesis to my husband, Manuel Oscar Da Silva and my son, Michael Da Silva. My husband encouraged me to undertake this challenge and was with me at every step along the way. For my son Michael, I will always be here for you, even though there were many days that I did not give you the attention you deserved. Mom loves you very much. Lastly, I thank God, for whom all things are possible.
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CHAPTER 1: INTRODUCTION AND LITERATURE REVIEW

Background

Conflict has been defined as a clash or struggle that occurs when a real or perceived threat or difference exists in the desires, thoughts, attitudes, feelings, or behaviours of two or more individuals (Cox, 2003). Conflict is common to all workplaces and is one of the drivers of improved teamwork. Managed well, conflict can lead to better decisions, more creative ideas, and higher quality teamwork (Wilmot & Hocker, 2001). Managed poorly, conflict can hinder teamwork and performance. Communication is central to conflict in the sense that communication often creates or reflects conflict and/or is the way conflict is productively and destructively managed (Wilmot & Hocker, 2001).

Healthcare teams experience interpersonal conflict that can be related to certain tasks, social interactions, and/or process-related issues. Task-related conflict arises from a perception of disagreement among team members about the content of their decisions, and involves differences of opinion, information, ideas, and viewpoints (Jehn & Mannix, 2001). Social conflict relates to interpersonal incompatibility and includes tension and hostility among team members (Jehn, 1994). Social conflict can manifest itself in disrespectful behaviour, such as a physician’s disrespectful behaviour toward a nurse (Rosenstein & O’Daniel, 2006; Warner, 2001) or nurses’ disrespectful behaviour toward each other (Farrell 2001; Freshwater, 2000; Rosenstein & O’Daniel, 2006). Such behaviour may include negative criticism of team members or an unwillingness to help one another. Process-related conflict relates to disagreements about how tasks should be accomplished by the team, including the distribution of responsibilities and delegation among members (Jehn, 1994; Jehn & Mannix, 2001). For example, a work group might have a conflict that arises from decisions about what strategy to pursue or how to allocate
responsibilities. Process conflict may be evident in healthcare teams when there are overlapping roles, such as those of registered nurse and registered nursing assistant. The result may be that patient care is neglected because of unclear role assignment within a team (Garman, Leach, & Spector, 2006; Kalisch & Lee, 2009). Not only are these types of conflicts unavoidable, but they are also often highly fruitful and rejuvenating if managed correctly.

Evidence has suggested that student nurses begin to experience interpersonal conflict when they enter clinical placements. These placements are fraught with struggles, which can also challenge students’ academic success. Students often experience communication and interpersonal problems with preceptors, which can lead to conflict if they are left unchecked (Lewis, 1986; Myrick & Barrett, 1994). Conflicts that occur in a clinical setting, between nurses, physicians, and other healthcare staff over patient care decisions, can adversely affect patient outcomes. Therefore, learning about effective communication skills to enable conflict resolution is essential for nursing students. Competence in the practical utilization of these skills is not necessarily acquired intuitively and must be considered a vital element of the educational process for nursing students.

Research has suggested that teaching conflict resolution skills to nursing students is more effective through a problem-based learning approach than a didactic lecture (Seren & Ustun, 2008), but problem-based learning lacks the experiential fidelity necessary to prepare students to manage a patient and their own interpersonal communications simultaneously. High fidelity simulation approaches have been used to teach teamwork and crisis management (Merchant, 2012; Robertson et al., 2010) and have also been used to teach medical residents and healthcare teams how to handle conflict with other members while they are performing psychomotor tasks under pressure (Pian-Smith et al., 2009; Sawyer, Laubach, Hudak, Yamamura & Pocrnic, ...
High fidelity simulation may also provide an opportunity to teach and evaluate the use of conflict resolution skills with undergraduate nursing students, as it forces students to engage in a social interaction they often avoid or are removed from because of a perceived lack of understanding of policies that may place patients at risk (Smith & Roehrs, 2009).

Healthcare is a conflict-ridden environment, and as challenges in this domain intensify, it grows increasingly crucial for nursing students to enter the workplace as independent and fully competent professionals (Durham & Alden, 2008); this preparation includes an ability to navigate conflict. Many nursing programs have incorporated high fidelity simulation activities into their curricula (Ontario Ministry of Health and Long-Term Care, 2005) that help students learn to think critically about scenarios that could occur in a clinical setting and to work safely and effectively in teams. To date, however, few studies have focused on a nursing curriculum that aims to reduce conflict and achieve resolution (Seren & Ustun, 2008). Although research has substantiated claims that nursing students who have been exposed to high fidelity simulation–based learning are better prepared for their profession than those who have not (Cant & Cooper, 2010; Lapkin, Levett-Jones, Bellchambers, & Fernandez, 2010; Solnick & Weiss, 2007), few studies have specifically examined conflict training with a high fidelity simulation learning approach (Calhoun, Boone, Porter, & Miller, 2014; Pian-Smith et al., 2009; Sawyer et al., 2013).

There is good evidence that high fidelity simulation with a human patient simulator—a complex, technologically sophisticated manikin—assists nursing students’ and healthcare teams acquisition of knowledge, clinical judgment, clinical skills, and critical thinking (Cant & Cooper, 2010; Cook et al., 2012; Cook et al., 2011; Harder, 2010; Lasater, 2007). Further, studies not directly addressing nursing students have noted the effects of high fidelity simulation training on conflict resolution communication skills that, in turn, may affect patient safety and help prevent
errors (Calhoun et al., 2014; Pian-Smith et al., 2009; Sawyer et al., 2013). The purpose of this study was to assess the feasibility of a high fidelity simulation intervention, which was informed by Kolb’s Experiential Learning Theory (KELT), involving a conflict management learning event. This Phase 1 study describes the components of the high fidelity simulation intervention (two scenarios each followed by a debriefing session) and the refinement process. In addition to addressing the general feasibility of the study, post-test estimates of the observed year 2 nursing student utilization of the prescribed approach to conflict resolution provided an indication of whether a randomized controlled trial (RCT) was warranted.

**Literature Review**

Published and unpublished materials in the English language, including grey data found within research theses and conference proceedings, were used during the discovery phase of this literature review. A search of the following databases was undertaken: CINHAL, MEDLINE (1948 to Week 1, October 2015), EMBASE (1980 to Week 1, October 2015), Sociological Abstracts, PsycINFO, ERIC, EBSCO, and Health and Business. The MEDLINE In-Process database was also used to find relevant articles whose cataloguing process had not been completed. The search terms were as follows: conflict, conflict (psychology), conflict management, conflict resolution, dissents and disputes, high fidelity simulation, high fidelity simulation design and refinement, patient simulation, nursing education, nursing students, intragroup conflict, interpersonal relations, interpersonal communication, communication, medication administration, medication errors, near miss, clinical judgment, clinical reasoning, and critical thinking.

A systematic review of the research literature was conducted with the following aims: (a) to examine conflict management styles utilized by undergraduate nursing students, (b) to assess
the impact of conflict in relation to nursing student and patient outcomes, (c) to examine conflict management programs designed for nursing students and allied healthcare professionals, (d) to examine the design features of high fidelity simulation interventions, (e) to examine the use of theory as a foundation in designing high fidelity simulation interventions, (f) to examine the educational benefits of high fidelity simulation training in healthcare education with a particular focus on undergraduate nursing students, and (g) to identify how this proposed study would address the gaps in the existing research.

**Conflict Management Styles Utilized by Nursing Students**

Appropriate socialization in the clinical settings of the nursing profession is necessary for nursing students to become competent and effective in the sphere of the nursing work environments, in which nurses rely on effective communication to accomplish a myriad of duties and responsibilities related to patient care. Conflict management and resolution are important elements of effective communication. Nursing students must learn to deal with conflict not only in their future clinical environments, but also during the course of their nursing education. According to one study on conflicts in nursing education, 63.6% of nursing students have experienced conflict with their clinical instructors (Kantek & Gezer, 2009). This finding provides a baseline for establishing that most nursing students will encounter conflict many times throughout their study program and that they need to be prepared for such situations when they occur. In order to handle these situations appropriately, conflict resolution skills are required, and these must be taught and performed in practical situations with relatively high frequency so that they integrate with the nursing process. To enable the teaching and proctoring of such skills, it is important to understand and classify the ways that nursing students respond to conflict.
The results from the five study’s findings, that examined conflict management styles used by nursing students have been listed in Table 1 below. Although these studies used different means of classifying conflict management styles, a closer look at the definitions showed the categories to be comparable; hence, it was preferable to use uniform nomenclature to avoid confusion. In this analysis, the principal styles of conflict management were (a) integrating (Rahim, 1983, 2000) or collaborating (TKI, 1978), referred to as collaborating in this section; (b) obliging (Rahim 1983, 2000) or accommodating (Kilmann & Thomas, 1977), referred to as obliging; (c) dominating (Rahim 1983, 2000) or competing (Kilmann & Thomas, 1977), referred to as competing; (d) avoiding, used in common in both classification systems; and (e) compromising, also used in common in both classification systems. The genesis of this classification system arises from Kilmann & Thomas (1977) conceptualization of conflict management as including two components: concern for self and concern for others. The interaction of these components produces the five conflict management styles outlined in this section.

Collectively, the studies delineated a set of overarching themes. The first such theme is that nursing students have a tendency to use avoiding and/or compromising as strategies when dealing with conflict in the workplace. Sportsman and Hamilton (2007) used the Thomas-Kilmann Conflict Mode Instrument in their cross-sectional survey study to compare the conflict-handling styles most commonly implemented by nursing and allied healthcare students. They found that nurses adopted the compromising style most frequently, followed by the avoiding style, and were least likely to use the competing and collaborating styles. Pines et al. (2012), who also used the TKI instrument in their correlational study, found that nursing students typically scored above the 60th percentile for avoiding behaviours and were less likely to use the
collaborating and competing styles. Kantek and Gezer (2009), on the other hand, reported that nursing students were most likely to use the *obliging* and the *collaborating* styles of conflict management and least likely to use the *competing* style. All three studies suggested that the competing style was uncommon (Kantek & Gezer, 2009; Pines et al. 2012; Sportsman & Hamilton, 2007).

Seren and Baykal’s (2007) investigation led to the discovery of a noteworthy difference between the conflict-resolving tendencies of female nursing college students and male (and some female) medical students in Turkey; female nursing students scored higher on conflict management, empathy, listening skills, and requirement-focused approaches than their male classmates. The authors suggested that conflict-resolving tendencies are naturally higher in women than in men (Akbalik, 2001) and that the nursing curriculum, which typically includes interpersonal relations, communication, and other topics related to social interactions, might have influenced this study’s outcome.

Kantek and Gezer (2009) observed that the longer nursing students were in the nursing program or the more conflict they experienced with members of faculty, the less frequently they used the obliging style, instead choosing another means of dealing with conflict. Students who experienced conflict less frequently tended to oblige the wishes of faculty more often (Kantek & Gezer, 2009). Similarly, Pines et al. (2012) found that students exposed to fewer semesters in a nursing program, scored higher on avoidance in the conflict management inventory.

Based on these studies, it may be inferred that nursing students tend to use the avoiding and compromising styles of conflict management more frequently than the collaborating and competing styles; the use of the obliging style is also seen frequently among inexperienced nursing students (Kantek & Gezer, 2009; Pines et al., 2012; Sportsman & Hamilton, 2007).
is especially relevant since obliging, avoiding, and compromising styles may not be appropriate in clinical situations where patient safety is at risk. Where a nursing student adjudges that patient care has been or is likely to be compromised due to the actions of peers or superiors, avoiding the conflict situation cannot be a prudent or reasonable choice, nor can obliging a member of the team whom the student believes is compromising patient care. Moreover, certain situations in the clinical environment often require a willingness to engage in conflict management techniques outside the usual comfort zone of nursing students (e.g., collaborating with healthcare providers and peers) when a risk to patient care is imminent.

It may also be inferred from these studies that nursing students are more likely to score higher in conflict-resolving tendencies than are medical students or allied health professionals (Seren & Baykal, 2007). However, this finding did not establish or demonstrate the adequacy of conflict-resolving skills in nursing students; it only indicated that perhaps medical students or allied health professionals have a greater need for conflict management training. Further, no firm conclusions could be drawn about the evolution of conflict management styles with level of education and personal experience of conflict, as the two studies that addressed this aspect of conflict management (Kantek & Gezer, 2009; Sportsman & Hamilton, 2007) differed in their findings.

In a recent descriptive survey by Hartman and Crume (2014), nursing students’ perceptions about conflict, the strategies they used for conflict resolution, and the communication skills they perceived as useful to manage conflict in healthcare teams were examined. The majority of nursing students perceived conflict as a negative experience and indicated that conflict should be avoided. The students also stated that they relied on strategies such as walking away from conflict situations, using the silent treatment, giving in, and venting.
A common theme in the nursing students’ responses was the recognition that they needed to improve their communication competencies in order to build their conflict management skills.

All five of the aforementioned studies were limited in scope in that they did not evaluate the effectiveness of conflict management styles in simulated or real situations. One of the chief methodological limitations was the reliance on respondents’ self-reports of conflict management styles. There could be significant differences between the conflict management styles that respondents reported and those they actually used in actual interpersonal conflict situations. Further, these studies were restricted in their ability to examine how styles may change over time; where this issue was addressed, conflicting findings were obtained. However, there is sufficient evidence to suggest that nursing students in particular and health professionals in general could benefit from conflict management training.

Table 1

<table>
<thead>
<tr>
<th>Author</th>
<th>Design and Purpose</th>
<th>Sample</th>
<th>Outcome Measure</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seren and Baykal (2007)</td>
<td>Cross sectional survey design</td>
<td>n = 359 nursing students; n = 367 medical students</td>
<td>Demographics Conflict Resolving Tendency scale</td>
<td>Conflict-resolving tendencies scores nursing students: x = 175.79, SD 17.21; medical students: x = 169.52, SD 17.89, t p &lt; .001. Nurses score higher across all subdimensions: empathy (M_nursing-M_medicine = 1.34, t = 3.393, p &lt; .001), requirement-based approach (M_nursing-M_medicine = 1.03, t = 3.215, p &lt; .001); listening skills (M_nursing-M_medicine = 1.81, t = 5.579, p &lt; .001); social adaptation (M_nursing-M_medicine = 1.41, t = 3.893, p &lt; .001).</td>
</tr>
<tr>
<td>Sportsman and Hamilton (2007)</td>
<td>Cross-sectional survey design</td>
<td>n = 126 out of 320 (39% response rate) n = 65 nursing students; n = 52 radiologic students; n = 45 licensed professional students pursuing a bachelor’s degree</td>
<td>Thomas-Kilmann Instrument reflects five conflict management styles Test-retest reliability ranges from 0.61—0.68</td>
<td>Conflict management styles chosen by overall sample: compromise style, M = 6.7, then avoidance style, M = 6.6. Preferred conflict management styles choice of learners are compromise and avoidance. Evidence that collaboration style increases as students ascend education levels. Results not statistically significant.</td>
</tr>
</tbody>
</table>
Kantek and Gezer (2009) | Cross-sectional survey design | $N = 151$ nursing students | ROCI(II); survey with questions on demographics, educational attainment, and recall measures for personal workplace conflict experiences | 63.58% of students experienced conflict with faculty. Differences across conflict management styles ($F = 32.026, p < .05$), driven by high relative scores for collaborating $M = 3.82$ and obliging $M = 3.81$. When differences compared across year in program, only obliging significant ($F = 3.446, p < .05$: Year 1, $M = 3.96$, SD = 0.635, $n = 45$; Year 4 $M = 3.52$, SD = 0.748, $n = 41$). Frequency experiencing conflict only emerge among those using an obliging conflict management style—the less often conflict is experienced, the more likely students are to oblige $M = 3.86$, SD 0.755, KW: 6.482, $p < .039$.

Pines et al. (2012) | Correlational study | $N = 166$ baccalaureate students | Stress resiliency profile; Psychological Empowerment Instrument; Conflict Mode Instrument: Thomas-Kilmann; demographic questionnaire | Students scored greater than the 60th percentile for avoiding and obliging behaviours to manage difficult situations and were less likely to use competing or collaborating strategies to manage conflict. Stress resiliency scores not statistically associated with conflict management styles; only the skill recognition subscale was related to the obliging conflict management style ($B = -0.21; p < .05$). Semester in school was inversely related to scores on the avoiding subscale; the fewer semesters in nursing, the higher the scores on avoiding on the conflict management inventory.

Hartman & Crume, (2014) | Descriptive survey method | N=68 undergraduate nursing students, registered in two nursing courses in a large mid-western university in the U.S.A. 83% were female, 9% were male, and 8% did not specify. Over half of the students were > 22yrs. Nursing students in year 1 = 37%; year 2 students =30 % and year 3 students =22% and 3% were | 68 surveys were distributed; 67 survey were completed (response rate 98%). Previous conflict resolution literature was used to identify topics areas for the open-ended survey questions. The final survey questions focused on the following categories 1)Seeking to | The findings were as follows:
1. Nursing student perceptions about conflict are negative and they indicate that conflict should be avoided.
2. Perceptions about how nursing students handled conflict included 3 categories: “last resort/least preference”, meaning that the student only resorts to engaging in conflict after exhausting all other methods to handle the situation. The “negative category” in that nursing students expect the situation to be a negative experience and that others will react in a poor manner. The “normal activity category” refers to conflict being viewed as a regular
After establishing the conflict management styles used by nursing students, a review of the impacts such techniques have on patients is necessary. Several studies have explored the nature of conflict experienced by nursing students and its impact on patient outcomes. These studies revealed that conflict is a persistent impediment to excellent workplace performance among nursing students. More broadly, conflict experienced by medical residents in healthcare...
teams impacted negatively on patient outcomes (Baldwin & Daugherty (2008). Table 2 provides a detailed overview of these studies.

The studies reviewed revealed several themes that are pertinent to this research. First, as was substantiated in the previous section, nursing students experience conflict on a regular basis. Mamchur and Myrick (2003) found that 51% of surveyed students frequently felt in conflict and that 35% felt that their relationships were strained because of it. Moreover, these students cited preceptors as the principal cause of the conflict, while personality and institutional issues also contributed (Mamchur & Myrick, 2003). These findings suggest that student–preceptor conflict hinders learning and may lead to the development of a destructive self-image. Over one-third of nursing students in McKenna, Smith, Poole, & Cloverdale’s (2003) study, regarding first-year interpersonal conflict, reported that the distress experienced stemmed mainly from feelings that their learning opportunities were blocked and neglected or that they had been given too much responsibility without proper support. Thirty-four percent of students (n = 188) reported experiencing rude, abusive, humiliating, or unjustly critical verbal behaviours, and 31% of students (n = 170) reported experiencing “most distressing” abusive and humiliating behaviour by charge nurses, nursing coordinators, supervisors, unit managers, and senior nurses. Notably, less than half of nursing students who experienced a “most distressing” conflict (n = 66 of 161, 41%) reported having received undergraduate training in addressing conflict (McKenna et al., 2003). These findings are not only disturbing, but can have severe implications for the effective care of patients due to medical errors influenced by conflict.

Reid-Searl, Moxham, Walker, and Happell (2009) found that improper supervision (i.e., either that which causes nursing students to hurry or that which leaves students without guidance during the administration of medications) can lead to the commission of medication
administration errors by undergraduate nursing students undertaking clinical placements. Students felt that an “internal conflict” with supervising nurses caused them to fear making medical administration errors and clouded their clinical judgment. The findings delineated a substantial gap in knowledge by noting that despite anxiety regarding patient safety, nursing students lacked the conflict resolution skills necessary to vocalize their concerns (Reid-Searl, Moxham, Walker, & Happell, 2008). As a result of conflict-based relationships and a deficiency of conflict resolution skills in the clinical domain, there was a distinct rise in medical errors that affected patient outcomes (Baldwin & Daugherty, 2008; Mamchur & Myrick, 2003; Reid-Searl, Moxham, Walker, & Happell, 2009). More broadly, in the medical domain, Baldwin and Daugherty (2008) found that out of a sample of 2,813 medical residents who reported no conflict with colleagues (e.g., nurses, doctors, and supervisory staff), 23.8% (n = 669) recorded having made a serious medical error (SME), with 3.4% of those resulting in an adverse patient outcome (APO). Notably, of the 523 residents who reported conflict with at least one colleague, the rate of SMEs was 36.4%, with 8.3% resulting in APO. Of the 187 residents who reported conflict with two or more other professionals, the SME rate was 50.5%, with 16% of those resulting in APO. Baldwin and Daugherty (2008) established that the rate of SMEs resulting in APOs increased when medical residents experienced interprofessional conflict.

The aforementioned studies all provide an interesting evidentiary link between conflict and negative patient outcomes. Nevertheless, they all lack the high level rigour of a randomized controlled trial, and thus the evidence is not causal. A frequently used method to examine conflict in the studies was by recall questions in surveys (Baldwin & Daugherty, 2008; Mamchur & Myrick, 2003). Such an approach is fraught with a variety of biases, for example, telescoping (Dillman, Smyth, & Christian, 2009). The studies also have sample selection issues, as they did
not rely on random sampling (Baldwin & Daugherty, 2008; Mamchur & Myrick, 2003; Reid-Searl, Moxham, Walker, & Happell, 2009). All that being said, combined there seems to be a preponderance of evidence that a link between conflict and medical errors exists, and as such it is reasonable to suggest that such a link, while not ideally established by this body of research, does in fact exist. It would certainly be useful for a future research study to empirically establish a causal link between conflict in the clinical domain and medical errors. Given the ethical considerations of such an enterprise, however, like the teaching of a conflict management skill, establishing such a link should be done only in a simulation environment.

Consequently, it is reasonable to assume from this set of studies that conflict occurs for nursing students during their clinical placements and in interprofessional teams. It is also evident that many nursing students are not receiving adequate training in the management of interpersonal conflict. Yet these studies suggested that conflict can contribute to medical errors; therefore, it logically follows that training in conflict management should be a component of undergraduate nursing education. What’s more, it is important that this training should take place early in a student’s academic program, as it seems likely students will experience conflict early, quite possibly often, and as soon as they enter the clinical phase of their education.

Table 2

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<tr>
<th>Author</th>
<th>Design and Purpose</th>
<th>Sample</th>
<th>Outcome Measures</th>
<th>Findings</th>
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<tr>
<td>Mamchur and Myrick (2003)</td>
<td>Modified, simultaneous quantitative/qualitative triangulated method To explore the nature of conflict in preceptorship experiences, the factors that contribute to conflict situations,</td>
<td>Mailback survey (42.7% response rate) undergraduate students (nursing, family medicine, and)</td>
<td>(a) Do students experience conflict in their relationships? (b) How often do students and preceptors feel in conflict? (c) To what degree does conflict strain the student–preceptor relationship? (d) What are the various stimuli (in practicum) that are related to conflict in the preceptorship experience? (e) To what degree are conflicts</td>
<td>Of a total n = 234, participants n = 66, or 28.2%, reported experiencing conflict (35 students across the disciplines and 31 preceptors). Of those experiencing conflict: Students: 51% feel frequently in conflict 35% feel relationship strained</td>
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<td>Author</td>
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<td>Reid-Searl, Moxham, Walker, and Happell (2008)</td>
<td>Grounded theory To explore students experiences of administering medications in an off-campus clinical setting</td>
<td>Sampled from a potential N = 135 student nurses in the final year of an undergraduate program in Queensland, Australia, across a variety of clinical contexts n = 28</td>
<td>Outcome measures derived from a semi-structured, in-depth interview process. Medication errors as a result of students not speaking up when they experienced conflict due to situations, such as a lack proper supervision by a Registered Nurse.</td>
<td>Source of conflict: 60% expectations of preceptors 49% personality issues 29% issues with institution Resolution: 31% students report conflict resolved to satisfaction 20% report conflict not acknowledged or resolved</td>
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<tr>
<td>Reid-Searl, Moxham, Walker, and Happell (2009)</td>
<td>Grounded theory To examine the emergent theme of conflict that is experienced by participants because of the theory–practice gap</td>
<td>Sampled from a potential N = 135 student nurses in the final year of an undergraduate program in Queensland, Australia, across a variety of clinical contexts n = 28</td>
<td>Outcome measures derived from a semi-structured, in-depth interview process. Perceptions of opposing expectations between what was learned in class and what was experienced in the clinical environment.</td>
<td>A theory–practice gap contributed to student experience of conflict. This gap compromised patient safety and was a property of the theme; students experienced internal conflict and feared making a medication error and harming the patient.</td>
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<tr>
<td>Baldwin</td>
<td>Descriptive survey Mailback Questionnaire:</td>
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<td>722 total residents (20%)</td>
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</table>
Author | Design and Purpose | Sample | Outcome Measures | Findings
---|---|---|---|---
and Daugherty (2008) | To report on the frequencies of residents’ experience with conflict with interprofessional colleagues during residency; additionally, to link the reports of interprofessional conflict to residents’ reports of making significant medical errors as a result of the conflict | survey sent to a random sample of residents reported to be in PGY1 and PGY2 physician programs nation-wide in the USA during summer of 1999  
PGY1: n = 1665  
PGY2: n = 1912 | Questions posed, such as “Did the responding physician experience ‘serious conflict’ with another resident, an attending physician or nursing staff?” and “Do you believe that sleep deprivation or fatigue caused you to make a significant medical error at any time during you current year of residency?” | reported having a serious conflict with a colleague.  
972 residents (27.1%) reported making a significant medical error during their current training year.  
Of the residents (n = 354), who reported a serious conflict with another resident, n = 148 (41.9%) reported making a significant medical error and n = 43 (12.4%) reported an adverse patient outcome.  
By contrast, among those residents (n = 2,371) who did not report any such conflict, only 25.6% were found to have made a significant medical error, with only 4.0% adverse patient outcome.  
For conflict involving nursing staff, residents (n = 313) reported 40.3% significant medical error and 11.1% adverse patient outcome, while those reporting no conflict had 25.9% significant medical error and 4.2% adverse patient outcome. |

McKenna, Smith, Poole, and Cloverdale (2003) | Descriptive survey | Mailed survey of recent nursing graduates in first year of practice. The study examines the prevalence rates in the first year of practice, the characteristics of the most distressing incidents experienced, as well as the consequences and psychological impact of such events. The final goal is an assessment of training that nurses receive to manage horizontal violence | McKenna et al. use a questionnaire on interpersonal conflict (modified from a questionnaire that assesses conflict experienced by trainee physicians). Survey includes a range of overt and covert interpersonal conflict as well as sexual harassment. Questions included perceptions of being undervalued, whether they experienced verbal threats or lacked supervision, etc.  
Impact of Event scale to determine how distressed nurses were by type of conflict experienced | Interpersonal conflict is common—58% perceived being undervalued, 46% claim they lacked supervision, 38% claimed they experienced distress as a result of conflict, 34% felt that they had learning opportunities blocked.  
Impact of event scores: 12 incidents scored 30 or above in scale, which reflects the means of participants with post-traumatic stress disorder. There was a negative, weak correlation between the scale and the number of weeks passed since the incident occurred (r = −.19, p = 0.03).  
Some nurses required days off work (24 of 170, or 14%). One in three respondents (58 of 170, or 34%) indicated that they
Effectiveness of Conflict Management Training for Nursing Students and Allied Healthcare Professionals

In consideration of the harmful effects that increased conflict without proper resolution can have on patient care, several studies have been conducted to research the effectiveness of current conflict management strategies taught in undergraduate nursing programs. The findings of these studies showed that although conflict management interventions have been integrated into some nursing curricula, there are significant limitations as to their effectiveness. Two studies evaluated educational interventions geared toward improving the use of conflict resolution skills among nursing students: a cross-sectional, quasi-experimental study by Seren and Ustun (2008) and a single-group pre- and post-study by Spickerman and Brown (1991). Additionally, six studies that included various designs, such as single-group pre- and post-training, a quasi-experimental design, and grounded theory, evaluated interventions aimed at teaching conflict resolution skills to graduate medical students, as well as, physician and nursing teams (Boone, King, Gresham, Wahl, & Suh, 2008; Calhoun et al., 2014; Pian-Smith et al., 2009; Robertson et al., 2010; Sawyer et al., 2013; Zweibel, Goldstein, Manwaring, & Marks, 2008).

The conflict training interventions varied in mode of delivery, dose, and instructional design elements. Some educational interventions did not focus only on conflict management and resolution, but on teamwork and other communication skills. Table 3 summarizes the major design features of these eight studies. Although some research highlighted the effectiveness of teaching conflict management to nursing students (Seren and Ustun, 2008; Spickerman and

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<td>considered leaving the profession as a result of the incident.</td>
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<th>Effectiveness of Conflict Management Training for Nursing Students and Allied Healthcare Professionals</th>
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<td>In consideration of the harmful effects that increased conflict without proper resolution can have on patient care, several studies have been conducted to research the effectiveness of current conflict management strategies taught in undergraduate nursing programs. The findings of these studies showed that although conflict management interventions have been integrated into some nursing curricula, there are significant limitations as to their effectiveness. Two studies evaluated educational interventions geared toward improving the use of conflict resolution skills among nursing students: a cross-sectional, quasi-experimental study by Seren and Ustun (2008) and a single-group pre- and post-study by Spickerman and Brown (1991). Additionally, six studies that included various designs, such as single-group pre- and post-training, a quasi-experimental design, and grounded theory, evaluated interventions aimed at teaching conflict resolution skills to graduate medical students, as well as, physician and nursing teams (Boone, King, Gresham, Wahl, &amp; Suh, 2008; Calhoun et al., 2014; Pian-Smith et al., 2009; Robertson et al., 2010; Sawyer et al., 2013; Zweibel, Goldstein, Manwaring, &amp; Marks, 2008). The conflict training interventions varied in mode of delivery, dose, and instructional design elements. Some educational interventions did not focus only on conflict management and resolution, but on teamwork and other communication skills. Table 3 summarizes the major design features of these eight studies. Although some research highlighted the effectiveness of teaching conflict management to nursing students (Seren and Ustun, 2008; Spickerman and</td>
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Brown, 1991), other research focused more on the effectiveness of teaching conflict management to medical and graduate students (Boone et al., 2008; Brockman, Nunez, & Basu, 2010; Pian-Smith et al., 2009; Robertson et al., 2010) and healthcare teams consisting of physicians, nurses and respiratory therapists (Calhoun et al., 2014; Sawyer et al., 2013).

A major theme that emerged from the reviewed research was that problem-based learning methods yielded higher conflict management skill competencies than the traditional didactic approach (Seren and Ustun, 2008). Although it was concluded by Seren and Ustun, (2008) that nursing students benefit from a problem-based learning approach to conflict management, there are no high quality studies that demonstrated the effectiveness of the training.

Other research suggested that there may (Pian-Smith et al., 2009; Robertson et al., 2010; Sawyer et al., 2013) or may not (Boone et al., 2008) be a significant effect on the learning outcomes of healthcare teams when they are given training in conflict management. Consensus among the studies indicated that when conflict resolution methods are taught, healthcare team members tend to shift their strategies from avoidance to collaboration (Pian-Smith et al., 2009; Sawyer et al., 2013; Zweibel et al., 2008). Similarly, it was observed that a strong positive and statistically significant relationship existed between training and willingness to adopt a conflict resolution strategy, which affected the students’ attitudes toward teamwork and their ability to recognize situations in which conflict management skills were required (Robertson et al., 2010). Further investigation into the correlation between structured teaching and acquired skill sets showed improvement in the participants’ scores on knowledge of team skills, attitudes toward teamwork, and the ability to recognize situations in which a team skill, such as conflict resolution, was required, thus leading to further collaboration among healthcare teams (Robertson et al., 2010).
Along similar lines, a study on the transfer of learning from a 2-day conflict resolution training workshop to the workplace indicated that residents gained a positive outlook toward conflict and their ability to solve interpersonal problems as outcomes of formal training in conflict management (Zweibel et al., 2008). The residents reported that they were applying the conflict resolution skills learned, that they had gained perspective regarding the issues involved in conflict, that they experienced reduced tension and increased mutual understanding, and that they had built relationships more effectively through their use of newly acquired conflict resolution skills.

The previous studies’ findings suggest that the possibility exists of transferring effective and useful knowledge to students through integrating conflict resolution strategies within a curriculum, such as nursing. Moreover, the findings confirm that the knowledge taught can be applicable and relevant to significant reductions in conflict, which may result in fewer medical errors. Although only three of the studies reviewed in this section used high fidelity simulation as a pedagogical approach to conflict management training (Calhoun et al., 2014; Pian-Smith et al., 2009; Sawyer et al., 2013), the evidence suggests that conflict resolution skills, such as those included in the TeamSTEPPS curriculum, can be taught as a regular component in the training of healthcare professionals and students by using high fidelity simulation. In light of Pian-Smith et al.’s (2009) and Sawyer et al.’s (2013) findings that conflict communication skills can be learned, it is a logical extension to state that conflict management education, in which a high fidelity simulation approach is used, can be included as an integral component of a typical healthcare professional curriculum. However, it has been a challenge to evaluate the effectiveness of extant conflict management interventions for nursing and allied healthcare students for the following reasons:
1. Many of the studies reviewed herein failed to provide an exhaustive outline of the content of the conflict management education interventions.

2. It was not evident if the educational interventions were grounded in a learning theory.

3. There have been no randomized controlled trials, and only one study (Boone et al., 2008) used a control group.


Table 3

*Studies of Conflict Management Intervention for Nurses and Other HealthCare Professionals*

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<tr>
<th>Author</th>
<th>Design and Purpose</th>
<th>Sample</th>
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<th>Findings</th>
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| Seren and Ustun (2008) | Descriptive, cross-sectional study (across independent samples) To examine the effectiveness of teaching conflict management in a PBL vs. a didactic teaching approach (a “conventional” teaching method) | Purposive sample of students in Years 2, 3, and 4 of a four-year nursing program: n = 255 students enrolled in conventional-method school; n = 141 in problem-based learning approach | 55-item Conflict Resolution Skills Scale | Comparison of conflict resolution scores: students with PBL method had higher scores (\(M = 184.74, \text{SD} +/-14.27\)) compared with those from conventional method (\(M = 176.65, \text{SD} +/-16.04\), \(t = 4.995, p < .001\))
Year 2: \(t = 2.824\) \((p = .005)\)
Year 3: \(t = 4.558\) \((p = .000)\)
Year 4: \(t = 1.478\) \((p = .142)\)
Conflict resolution scale scores were significantly higher for second and third-year students \((p < 0.01)\). Year 4: no |
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<tr>
<td>Spickerman and Brown (1991)</td>
<td>Quasi-experimental pre- and post-test design</td>
<td>Senior baccalaureate nursing students enrolled in a leadership course</td>
<td>Thomas Kilmann Instrument administered pre- and post-instruction</td>
<td>The Spearman’s rank correlation coefficient between the pre- and post-instruction rankings on the Thomas Kilmann Instrument was 0.55, suggesting that the training could promote improvement in conflict management skills. Pre-order ranking was: (1) compromise, (2) avoidance, (3) accommodation, (4) collaboration, and (5) competition. Post-order ranking was (1) compromise, (2) collaboration, (3) avoidance, (4) accommodation, and (5) competition.</td>
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| Pian-Smith et al. (2009) | Pre- and post-test design                                                            | N = 40 anaesthesia residents in hospital residency and fellowship programs affiliated with the Harvard University medical school | Use of the two-challenge rule paired with the advocacy and inquiry language. Video data completed on 36 (90%) residents (two scenarios, with six potential opportunities to challenge); scored on a five-point scale that runs from 1 (no challenge) to 5 (clear use of Advocacy and Inquiry [A/I] language) | Individual resident performances:  
  With anaesthesiologist: pre-debriefing score $M = 2.3$, $SD +/- 1.3$; post-debriefing $M = 3.6$, $+/ - 1.2$, $p = .004)$.  
  With attending faculty surgeon: pre-debriefing $M = 3.1$, $SD +/ - 1.0$, post-debriefing $M = 3.9$, $SD +/ - 1.0$, $p = .002$. |
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<tr>
<td>Zweibel, Goldstein, Manwaring, and Marks (2008)</td>
<td>Qualitative study using grounded theory To examine the effect of a two-day workshop in conflict resolution on conflict management skills immediately and after 12 to 18 months</td>
<td>Residents and faculty in workshops at the University of Ottawa (2001–2004) and the University of Alberta (2005).&lt;br&gt;&lt;br&gt;( n = 57 ) (residents)&lt;br&gt;( n = 45 ) (faculty)</td>
<td>Pre- and post-workshop surveys with closed-category questions using five-point Likert scales and open-ended response questions concerned with participants’ attitudes toward conflict and self-assessment of their conflict resolution skills Twelve months later, in-depth, semi-structured interviews of faculty physicians and scientists (( n = 18 )) and residents (( n = 6 )) probing attitude toward conflict resolution and use of conflict resolution knowledge and skills</td>
<td>Findings from the pre- and post-workshop surveys with closed-category questions using five-point Likert scales were not reported; however, pre- and post-survey perceptions of conflict in open-ended responses revealed that students and faculty viewed conflict as negative. Five themes were prominent in both time frames (immediate post-workshop focus group and 12 months later): (1) a new aspect on conflict as positive, instead of being viewed as negative; (2) permission to take a breath (to remain objective and not get emotionally involved); (3) the big eye opener was the power gained by understanding the needs and concerns interests of others that underlie points of view and positions; (4) knowing your hot buttons (increase self-awareness of one’s conflict management style); and (5) learning to listen</td>
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<td>Boone, King, Gresham, Wahl, and Suh (2008)</td>
<td>Quasi-experimental To evaluate the outcomes of a conflict resolution (management) training program on nurses’ perceptions of their collaboration with physicians with whom they work.</td>
<td>n = 9 Registered Nurses (RN’s) from the cardiovascular lab (experimental group); n = 18 RN’s (control group)</td>
<td>Intervention group: completed Collaborative Behaviour Survey pre-intervention and 1 and 3 months post-intervention; control group completed CBS survey at baseline and at 3 months post-intervention.</td>
<td>No significant differences were found between groups at baseline in the Collaborative Behaviour Survey, ( p &gt; .05 ). ANOVA showed no significant differences in mean scores between the two groups at baseline and 3 months’ interval on the Collaborative Behaviour Survey.</td>
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<td>Robertson et al. (2010)</td>
<td>Pre- and post-test design To test the hypothesis that participation in a team-training program using a modified TeamSTEPPS (4 hours) would positively affect the knowledge and attitudes toward teamwork skills, including conflict.</td>
<td>N = 213 first-year nursing students and third-year medical students at Emory University, Atlanta.</td>
<td>12-item teamwork knowledge test Attitudes were assessed using the 14-item Collaborative Healthcare Interdisciplinary Relationship Planning Scale Video vignettes were assessed using the Teamskills Checklist Video Rating; participants would identify if team skills were present, that is, conflict resolution skill, and then rate on a Likert scale, ranging from 1 (poor) to 5 (outstanding).</td>
<td>Team skills knowledge: after training, students had more knowledge (( p &lt; .001 )) of team skills. Statistically significant attitudes toward teamwork made post-training among nursing students (post-pre-training, ( M = 0.11, \ SD = 0.27, p &lt; .004 )) Recognition of team skills: Success video: 97.6% of team skills recognized, whereas for the opportunity video only 27.7% were recognized (( X^2 = 2163.3, df = 1; p &lt; .001 )).</td>
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<td>Sawyer, Laubach, Hudak, Yamamura &amp; Pocrnich (2013)</td>
<td>Prospective, pretest—posttest design. To determine the impact of interprofessional Team Strategies and Tools to Neonatal attendings (n=4), neonatal fellows (n=6), nurses (n=29)</td>
<td>TeamSTEPPS teamwork Attitudes Questionnaire (T-TAQ) which includes 30 statements on teamwork broken down into 5 teamwork competencies addressed in TeamSTEPPS course.</td>
<td>T-TAQ improved from a pretest average of 4.4± 0.8 to a post-test average of 4.7± 0.8 (95% CI 0.34 to -</td>
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<td>enhance Performance and Patient Safety (TeamSTEPPS) training on teamwork skills during neonatal resuscitation</td>
<td>respiratory therapists (n=3) working in the NICU at a 20-bed, Level IIIb NICU (total sample size n=42)</td>
<td>Teamwork Knowledge measured using TeamSTEPPS learning benchmarks (23 item multiple choice exam)</td>
<td>0.22, p &lt; .001. Effect size in teamwork attitudes was small to moderate with d=0.34 and r=0.17</td>
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<td>TeamSTEPPS Team Performance Observation Tool (T-TPOT) which includes 22 specific teamwork behaviours across the TeamSTEPPS core competencies.</td>
<td>Use of the two challenge rule by nurses. Observed by two trainers who independently scored the performance in real time.</td>
<td>T-TPOT: scores improved significantly across the following: team structure leadership, situation monitoring mutual support and communication. The number of times a nurse challenges the incorrect dose of epinephrine ordered by the physician doubled from 5 of 13 simulations (38.4%) before the training to 10 of 13 simulations (76.9%) after the training (p=.063).</td>
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<td>Comments regarding challenging the incorrect medication dose during the facilitated debriefing were noted but not quantitatively analyzed.</td>
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<td>Themes: Of those nurses who were concerned that the dose was incorrect during the first simulation, several cited their trust in the physician and hesitance to contraindicate their directions as reasons for not challenging the medication dose.</td>
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<td>Calhoun, Boone, Porter &amp; Miller (2014)</td>
<td>Descriptive study. Implementation of a high fidelity simulation with a hierarchy-related medication error that required healthcare team to speak up and address the information conflict. Three insitu high fidelity sessions were conducted in the PICU the two in the Pediatric Emergency Department (PED) over a one-month period.</td>
<td>Simulations had from 5 to 11 participants with a median of 3 (range=2-5) physicians and a median of 3 (range 2-8 nurses).</td>
<td>Team Performance During Simulated Crises Instrument (TPDSCI) and Crisis Resource Management (CRM) checklist. Unsuccessful challenge operationalized as: one in which the two necessary attempts did not occur and the incorrect dose of amiodarone administered.</td>
<td>Several who never challenged the dose stated they did not realize the dose was high or were too busy with the resuscitation to take time to check the dose. TPDSCI + Global score ranged from 3.4 to 4.1 (scores 3 to 5) considered good to excellent. CRM scores ranged from 60%-87%. Team unsuccessful at addressing the hierarchy error in 4 (80%) of 5 cases.</td>
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**Evaluating the Design Features of High Fidelity Simulation in Nursing Education**

Given that there is a body of evidence that establishes both the need for and successful training in conflict communication skills, it becomes important to consider the implications for doing so in a high fidelity simulation approach (Pian-Smith et al., 2009; Sawyer et al., 2013). The reasons for doing so, as mentioned above, include the ethics of training in conflict while not risking patient outcomes, and placing the student in a simulated clinical setting that allows for active learning and experimentation. High fidelity simulations, to operate optimally, are in need of refinement to ensure that students can suspend disbelief and work towards meeting their learning objectives in as near to a clinical environment as possible.

Several researchers have conducted pilot studies (Butler, Veltre, & Brady, 2009; Jeffries & Rizzolo, 2006) and pre- and post-tests with selected participants (Sittner, Schmaderer, Zimmerman, Hertzog, & George, 2009) to evaluate the impact of high fidelity simulation
scenario design as a measure of quality assurance within nursing education. All three of these studies utilized the Simulation Design Scale (SDS) and Educational Practices Simulation Scale to assess the design features and quality of their simulation scenarios (Table 4 contains an overview of these three studies). The design of simulation scenarios and features such as, the simulation fidelity, cueing the learner, and length of a simulation scenario can affect evaluation outcomes if they are not optimized during a refinement period (Kardong-Edgren, Adamson, & Fitzgerald, 2014).

Jeffries and Rizzolo (2006) conducted a broad study of 403 students to establish the value of simulation as a pedagogical approach in nursing education by comparing the same general scenario design across three different modalities: a high fidelity simulation scenario, a static manikin, and a pencil and paper–based simulation. Using the Simulation Design Scale (SDS), they confirmed the expectation that students in high fidelity simulation scenarios observed the fidelity to be higher than that experienced with static manikins or pencil and paper–based scenario exercises. Additionally, the lowest fidelity group (the pencil and paper group) claimed that there was less feedback given to students, that they did not think feedback was important, and that they felt there was less problem-solving employed in the scenario. It appears that exposure to differing levels of fidelity produced different perceptions about the learning experience, including increased student confidence and active learning (Jeffries & Rizzolo, 2006). Although Jeffries and Rizzolo’s (2006) study demonstrated favorable SDS scores related to the high fidelity simulation as compared to the low fidelity one, it is not clear whether the high fidelity simulation underwent a dry run phase, prior to evaluating it with the target group of learners in this study. Jeffries and Rizzolo (2006) indicated that simulation scenarios should be
refined during the development phase; however, Jeffries (2006) was not explicit about how to optimize simulations.

Butler et al. (2009) conducted a randomized, two-group experimental design study to assess some of the design features of the simulation scenarios. Using the SDS (that Jeffries & Rizzolo [2006] developed and used), Butler et al. compared student perceptions of the active learning process in low fidelity simulation with a static manikin and a high fidelity simulation in a pediatric fluid and electrolyte scenario. They found that SDS scores were higher for students exposed to simulations using a high fidelity approach than for students using the low fidelity approach with the static manikin. For example, the mean SDS score for the 16 students in the low fidelity simulation group was 90.25, and the mean SDS score for the 15 students in the high fidelity simulation group was 96.27. When these differences were examined using an independent samples t-test, this 6.02 difference in means produced a t-statistic of 2.96 ($p = 0.008$). Although the SDS scores were higher for the high fidelity simulation group, it was not evident if a refinement phase was applied to the simulations prior to testing with the students. The strengths of the Butler et al. study were that there was a clear research question, the type of randomization approach was indicated, and reliable measures were utilized. The weaknesses of this study were that there was no use of a power calculation to determine the number of participants needed and this was the first time the facilitators conducted a high fidelity simulation; however, they were certified to do so (Butler et al., 2009).

In another study, Sittner et al. (2009) tested the Simulated Training for Enhancing Patient Safety (STEPS) program as an intervention to improve nurses’ knowledge and clinical judgment (assessment, interventions, and prioritizing care). The authors used a single sample design, and thus lacked the ability to make comparisons across different scenarios. Sittner et al., however,
did report internal consistency measures for the various items included within the SDS and the Educational Practices Questionnaire (EPQ). They found that the SDS and the EPQ were highly reliable instruments, with Cronbach’s alpha scores of .93. What remains unknown is whether a refinement strategy was undertaken to determine the flow of the simulation scenario, prior to testing it with students which may have impacted the study’s evaluation outcomes.

A major limitation of the Butler et al. (2009) and the Sittner et al. (2009) studies was their small sample sizes. For example, Butler et al. used a sample of 31 students to examine the differences between perception of low and high fidelity scenarios. Sittner et al. used a group of 19 students in their research of STEPS’s effectiveness as a rapid response intervention method. Although these studies support the need for high fidelity simulation training by suggesting its potential in controlled circumstances, the participation level included in the studies is insufficient to come to a firm conclusion and may also skew results related to learning outcomes. Therefore, in order to obtain unbiased results with unmistakably conclusive and repeatable evidence, similar studies with larger sample sizes are required. Moreover, it was also unclear how the SDS scores were recorded at such a high level. For example were the SDS scores reflecting the assessment of a simulation scenario as originally conceived or altered in some way? Thus are the SDS scores reported in the research studies the end product of a scenario refinement process that preceded the research studies?

While the abovementioned studies exhaustively researched the merits and effectiveness of validated tools to assess high fidelity simulation scenario design, there was no indication that a systematic refinement process was applied to the simulation interventions prior to implementing with the participants. The three previously mentioned studies all provided interesting insights into the way in which we can evaluate the fidelity and quality of simulation scenario designs by
clearly showing the superiority of high fidelity approaches, yet they provided little insight into how to systematically refine simulations and adapt them to various curricula and situations in order to meet student learning outcomes. This relative scarcity and lack of breadth in the existing research means that there is a need for high fidelity simulations with more clearly articulated refinement methods and greater measurement rigor. A refinement process is a vital aspect of a high fidelity simulation intervention design, because without it, there is no measure by which to improve its design features. Currently no such system exists other than feedback provided by the students through the SDS and the EPQ immediately after participation in the simulation scenario. Given the findings that suggested an increase in active learning and confidence within students who experienced high fidelity simulations, it is important to indicate if a refinement process was undertaken. A refinement strategy contributes to accurately designing and fine tuning simulations as well as further enhancing the overall effectiveness, prior to implementing with learners and evaluating educational outcomes.

Table 4

<table>
<thead>
<tr>
<th>Author</th>
<th>Design and Purpose</th>
<th>Sample</th>
<th>Outcome Measures</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jeffries and Rizzolo</td>
<td>Phase I: To clarify the research purpose, study design and literature review and develop a simulation framework</td>
<td>Phase I: no sample required</td>
<td>Questionnaire on postoperative care (knowledge test), Educational Practices in Simulation Scale, Simulation Design Scale, and Self-Confidence Scale</td>
<td>Phase I: Framework generated.</td>
</tr>
<tr>
<td>(2006)</td>
<td>Phase II: To design a simulation scenario within the parameters of the proposed simulation framework, using a pencil and paper</td>
<td>Phase II: sample not stated</td>
<td></td>
<td>Phase II: The prominent educational practice revealed in the simulations was collaboration.</td>
</tr>
<tr>
<td></td>
<td>Phase III: n = 403 nursing students</td>
<td>Phase III (Part I): Knowledge scores significant ($p &lt; .001$) using a paired t-test.</td>
<td></td>
<td>Phase III (Part I): Knowledge scores significant ($p &lt; .001$) using a paired t-test.</td>
</tr>
<tr>
<td></td>
<td>Phase IV: n = 110 nursing students</td>
<td>Phase III (Part II): Paper and pencil case study simulation scored lower for problem solving features or opportunities as compared to patient simulations.</td>
<td></td>
<td>Phase III (Part II): Paper and pencil case study simulation scored lower for problem solving features or opportunities as compared to patient simulations.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Significant greater scores for the HFS group on satisfaction with learning experience versus the other two groups.</td>
</tr>
</tbody>
</table>
Author | Design and Purpose | Sample | Outcome Measures | Findings
--- | --- | --- | --- | ---
Butler, Veltre, and Brady (2009) | Randomized, two-group experimental design To examine if there is a difference in student’s perception of active learning process using LFS versus HFS in a pediatric scenario | $N = 31$ (convenience sample of nursing students enrolled in an associate nursing degree in the USA) LFS: $n = 16$ HFS: $n = 15$ | Simulation Design Scale Educational Practices Questionnaire Student Satisfaction and Self-Confidence in Learning | HFS group reported higher sense of reality, active and diverse ways of learning compared to the other two groups. Statistically significant greater scores for HFS on student's confidence scores. No difference between any groups on knowledge scores. Phase IV: EPSS revealed HFS group had higher scores for active learning and diverse ways of learning; however, the pencil and paper group reported higher scores for collaboration and higher expectations. Responses on the SDS revealed that fidelity, presence of feedback and support were prominent in HFS and students were more satisfied with this approach.

| Sittner, Schmaderer, Zimmermann, and Hertzog. | Pre- and post-test within-subjects design. To examine the | $N = 11$ Registered Nurses in a progressive care unit at a | (a) Rapid Response Team Knowledge and Clinical Judgment Pre-Post-Test (b) Educational | (a) No statistical difference over time on pre-test and post-test scores: immediately after the intervention and three month post $F(1,10) = 1.21$, $p < .29$ (b) Educational Practices Questionnaire: |
Use of Theory in Simulation Intervention Development

Researchers are beginning to analyze and evaluate simulation scenario design as a measure of quality assurance within nursing education; however, very few studies ground such an investigation within a theoretical framework. See Table 5 for a detailed overview of the studies. Two systematic reviews examined the use of theory in the design of nursing education simulations and addressed a clearly focused research question. Rourke, Schmidt, and Garga (2010) conducted a systematic review of empirical studies published between 1989 and 2009 with a view to examining the extent to which theoretical frameworks informed the design of high fidelity simulation interventions in nursing education. They classified the literature into three categories derived from Silva’s (1986) germinal work: adequate use of theory, minimal use of theory, and no use of theory. Using a different taxonomic approach, Kaakinen and Arwood (2009) conducted a review of the high fidelity simulation literature published between 2000 and 2007 to determine whether learning theories were used to design and assess learning in nursing simulation. Having identified studies that employed learning theories, Kaakinen and Arwood used an evidence table to present an overview of these studies with respect to the following
parameters: purpose of the simulation, evaluation methods, learning theory used, findings, and how the learning theory supported simulation design. Both systematic reviews discussed here included empirical studies with a variety of designs, including RCTs.

The two systematic reviews yielded a number of important findings. First, the literature indicated that simulation is viewed more commonly as a teaching modality than as a learning one. Of the 120 simulation studies Kaakinen and Arwood (2009) identified, 78% discussed simulation as a teaching strategy, but only 13% discussed the use of learning or educational theories as a foundation for simulation development. Therefore, an important observation is that investigators, educators and practitioners do not always rely on theory while designing simulation interventions. For example, Rourke et al. (2010) found that only 10% of the studies they identified met the inclusion criteria for adequate use of theory in simulation intervention development, while a further 45% of studies made only minimal use of theory. Nevertheless, the authors of both reviews noted that in the few instances where education- or learning-based theories were used in simulation design, KELT was most frequently employed for the development of high fidelity interventions. Kaakinen and Arwood and Rourke et al. broadly concluded that in the absence of a theoretical perspective, it is difficult to optimally investigate students’ learning processes and outcomes. Therefore, they called for further research and investigation of the use of theory in the design and evaluation of educational simulations, with a view to defining and improving learner outcomes.

The major strengths of both reviews were the clear inclusion criteria used to shortlist studies for analysis. The researchers noted that they had two or more independent reviewers scan the literature for the predetermined inclusion criteria; they also utilized quality criteria checklists to assess the risk of selection, detection, and attrition bias for each of the selected studies. On the
other hand, a methodological weakness noted was the lack of clarification over whether domain experts had been contacted for access to ongoing/unpublished trials. The researchers also did not specify if they had searched for studies published in languages other than English. It was also unclear whether agreement between the two independent reviewers on study selection was evaluated using a measure such as a kappa statistic. Further, Rourke et al. (2010) confined their search to the CINHAL database in an effort to identify studies specific to nursing education. A drawback of this approach, however, is that it ignores nursing education research published in other disciplines such as medicine or higher education. Rourke et al. also examined research published as early as 1989, when the shift in focus from teaching- to learner-centred approaches was yet to occur. Therefore, it was expected that they would find few studies that made use of educational theory. In other words, many of the studies Rourke et al. included were published at a time prior to widespread disciplinary calls for a focus on student-centred learning styles.

Table 5

*Studies on Use of Theory in Simulation Intervention Development*

<table>
<thead>
<tr>
<th>Author</th>
<th>Design and Purpose</th>
<th>Sample</th>
<th>Outcome Measures</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Kaakinen and Arwood (2009)</td>
<td>Systematic Review To conduct a systematic review of the simulation literature between 2000 and 2007 and determine how learning theory was used to design and assess learning that occurs in nursing simulations.</td>
<td>n/a</td>
<td>To determine how learning theory was used to design simulations. An evidence table was used to sort the according to authors and publication date, purpose of the simulation, evaluation methods, learning theory, findings, and how learning theory supported simulation design.</td>
<td>Out of the 120 simulation articles, 104 articles did not reference or mention a learning theory in the simulation design or assessment of student learning, and 94 articles discussed using simulation as a teaching method or strategy. Sixteen articles that used a theory were analyzed and presented in an evidence table. The following theories were used as the basis for designing simulations: social learning theory, experiential learning theory, adult learning theory, and social construct theory, also known as Constructivism</td>
</tr>
<tr>
<td>Rourke, Schmidt and Garga, (2010)</td>
<td>Systematic review To conduct a systematic review</td>
<td>n/a</td>
<td>Articles were classified into three categories of theory use derived from</td>
<td>Forty-seven research articles satisfied the main inclusion criteria for the review. Of the articles reviewed, 45% made no use of theory, 45% made minimal use of theory, and 10% made adequate</td>
</tr>
</tbody>
</table>
Effectiveness of the High Fidelity Simulation Approach

While a high fidelity simulation approach has been used for teaching practical conflict resolution, its effectiveness in terms of general educational benefits in nursing and medicine has yet to be fully assessed. To date, two systematic reviews (McGaghie, Issenberg, Petrusa, & Scalese, 2006, 2010) have focused on the benefits of using high fidelity simulation in medical education and four systematic reviews (Cant & Cooper, 2010; Cook et al., 2012; Cook et al., 2011; Harder, 2010) have examined its effectiveness as a teaching and learning modality. See Table 6 for a detailed overview of these studies.

McGaghie et al.’s (2010) systematic review offered evidence that simulation-based practice in medical education has a positive impact on effective learning, given the right conditions. Previously, McGaghie et al. (2006) examined 10 potential best practice elements (e.g., being given real-time educational feedback, debriefing, fidelity, etc.) and found that only one, “learners engaging in repetitive practice” (p. 793), was determined to be associated with improved learner outcomes and appeared to approximate a dose–response relationship in terms of yielding better learning outcome results. These findings pertained to a variety of clinical specialties and learners across all levels. However, the absence of unpublished studies based on
the research strategy in McGaghie et al.’s work (2006) increased the risk of publication bias, and the overall effect of the simulation interventions may have been overestimated. Further, no information was provided pertaining to assessment of the risk of bias within or across studies. In light of these methodological limitations, the results should be interpreted cautiously.

Cook et al. (2011) found that technology-enhanced simulation training tended to positively affect the knowledge and skills outcomes for students as compared to no intervention at all. Although 33 of 609 studies included in their meta-analysis were identified as having a communication and team-building component, they did not directly examine effect sizes of these outcomes. In their 2012 review, Cook et al. compared the effectiveness of high fidelity simulation with other methods of instruction in healthcare education, but they did not specifically examine team-building outcome skills. Of the 92 studies included in their later 2012 review, simulation-based educational interventions were associated with small to moderate positive effects compared to a wide variety of other educational modalities.

Reinforcing Cook et al.’s (2011, 2012) promising results showing the benefits of high fidelity simulation training, Cant and Cooper (2010) also found that simulation interventions contributed to positive learning outcomes. In particular, when high or medium fidelity simulations were compared to a control group, results indicated statistically significant educational gains (7% –11%) in learner outcomes related to critical thinking, knowledge, and perceived clinical confidence or satisfaction ($n = 6; 50\%$). Also of note, Harder (2010) reported an increase in study participants’ confidence scores and feelings of competence after having participated in high fidelity simulation interventions. Several important limitations to Harder’s review, however, illustrate the problems involved in comparing diverse high fidelity simulation research and assessments. The studies Harder included did not allow for a thorough meta-
analysis to illustrate the impact on learning outcomes for high fidelity simulation interventions in particular. The restrictions of the results included (a) an absence of concise descriptions of the characteristics and designs of individual studies and of the statistical analysis undertaken in these studies, (b) the risk of selection bias, (c) the risk of attrition bias, (d) the possibility of publication bias, (e) a lack of indication of what method was used to determine the validity of the primary studies, and (f) insufficient data in some of the studies to calculate an effect size. It is clear that greater standardization in simulation intervention sampling, design and refinement, and in the reporting of quantitative study findings are required in order to advance research in this area.

Based on the research evaluated in this section, the use of high fidelity simulation seems promising and offers educational benefits to nursing and medical students. However, there is a need for more rigorous and high-quality studies for nursing education that exemplify the overall impact of a high fidelity pedagogical approach on not only the ability of students to learn more effectively, but also on the development of skills in areas such as conflict resolution. The systematic reviews provide an appropriate foundation for future research studies and, when considered together, show that there is a need to develop research on high fidelity simulation that benefits from rigorous design, clear descriptions of the elements of the simulation intervention as well as development of simulations that teach communication skills in conflict resolution.

Table 6

*Studies of the Effectiveness of High Fidelity Simulation*

<table>
<thead>
<tr>
<th>Author</th>
<th>Design and Purpose</th>
<th>Sample</th>
<th>Outcome Measures</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>McGaghie, Issenberg, Petrusa, Gordon, and Scalese (2006)</td>
<td>Systematic review of 31 journal articles reporting 32 research investigations</td>
<td>Learners (i.e., students, residents, fellows, senior attending doctors)</td>
<td>Effect of hours of simulator practice on learning outcome</td>
<td>Repetitive practice involving medical simulations is associated with improved learner outcomes and appears to approximate a dose–response relationship in regards to achieving learning outcomes. There is a strong association, $r^2 = 0.46$, between</td>
</tr>
<tr>
<td>Author</td>
<td>Design and Purpose</td>
<td>Sample</td>
<td>Outcome Measures</td>
<td>Findings</td>
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<tr>
<td>To test the hypothesis that there is a quantitative association between hours of repetitive practice in simulation-based medical education (SBME) and standardized cognitive and psychomotor learning outcomes in a variety of disciplines.</td>
<td>Learners (i.e., students, residents, fellows, senior attending doctors)</td>
<td>The features of HFS that lead to effective learning.</td>
<td>HFS facilitate learning under the right conditions. These include providing feedback; repetitive practice; curriculum integration; range of difficulty; multiple learning strategies; simulators that capture a wide range of clinical variation; a controlled environment where learners can make, detect, and correct errors without adverse consequences; individualized learning in which participants are active; defined learning outcomes; and simulator validity.</td>
<td></td>
</tr>
<tr>
<td>McGaghie, Issenberg, Petrusa, Gordon, and Scalese (2010)</td>
<td>Systematic review of 109 journal articles To address the question “What are the features and uses of high fidelity medical simulations that lead to most effective learning?”</td>
<td>609 eligible studies enrolling N = 35,226 trainees</td>
<td>Instructional design (e.g., curricular integration, distributed training over multiple days, feedback, mastery learning, and repetitive practice) and outcomes. Skills performance in a test setting were coded separately for time, process, and product measures and patient behaviours.</td>
<td>In comparison with no intervention, pooled effect sizes were: knowledge outcomes: 1.20 (95% CI, 1.04-1.35) N = 118 studies; time skills 1.14 (95% CI,1.03-1.25), n = 210; process skills 1.09 (95% CI, 1.03-1.16), n = 426; product skills 1.18 (95% CI, 0.98-1.37), n = 54; time behaviours 0.79 (95% CI, .47-1.10), n = 20; other behaviours 0.81 (95% CI, 0.66-0.96); and direct effects on patients 0.50 (95% CI, 0.34 to 0.66), n = 32.</td>
</tr>
<tr>
<td>Cook et al. (2011)</td>
<td>Systematic review To summarize the outcomes of technology-enhanced simulation training for health professions learners in comparison with no intervention</td>
<td>92 eligible studies</td>
<td>Instructional design, outcomes and study quality</td>
<td>In comparison with non-simulation instruction, pooled effect sizes were: Satisfaction outcomes, 0.59 (95% CI, 0.36 to 0.81), n = 20 studies; Knowledge, 0.30 (95% CI, 0.16-0.43), n = 42; Time measure of skills, 0.33 (95% CI, 0.00-0.66), n = 14; Process measure of skills, 0.38 (95% CI, 0.4-0.52), n = 51; Product measure of skills, 0.66 (95% CI, 0.30-</td>
</tr>
<tr>
<td>Author</td>
<td>Design and Purpose</td>
<td>Sample</td>
<td>Outcome Measures</td>
<td>Findings</td>
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</tr>
<tr>
<td>Cant and Cooper</td>
<td>Systematic review</td>
<td>Final inclusion of 12 papers</td>
<td>Assessment measures varied and related to knowledge, critical thinking ability, satisfaction, and self-confidence (7 out of 12 studies included one validated assessment measure)</td>
<td>Six of the studies showed additional gains in knowledge, critical thinking ability, satisfaction, or confidence compared with a control group (range 7–11%). These gains were statistically significant.</td>
</tr>
<tr>
<td></td>
<td>To review the quantitative evidence for medium- to high fidelity simulation using manikins in nursing, in comparison to other educational strategies. The research question was “How effective is simulation as a method of teaching and learning compared to other educational strategies?” (1999–2009).</td>
<td>Sample undergraduate nursing students or newly graduated RNs Sample size ranged from 23 to 140 for the individual studies to 798 students in one multisite study</td>
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</tr>
<tr>
<td>Harder (2010)</td>
<td>Systematic review</td>
<td>23 studies included</td>
<td>Effect size calculated in 39% of the studies (n = 9)</td>
<td>In 91% (n = 21) of the studies, students evaluated their confidence levels higher than those who did not participate in a simulation. Use of simulation as opposed to other training methods increased students' clinical skills competency in n = 9 studies with p &gt; .05.</td>
</tr>
</tbody>
</table>
Summary of the Literature Review

High fidelity simulation research has only become professionalized over the last few decades in the health professions educational context. As such, we may think of the simulation discipline as being somewhere between the second and third stages of what Schneider (2009) describes as the evolution of a scientific discipline. In the first stage, a discipline develops a common language. In the second stage, a set of tools and techniques. In the third stage, the discipline’s specific knowledge is generated through research, and in the fourth stage the knowledge gains of the previous three stages are maintained (Schneider, 2009). Only recently have simulation evaluation tools been developed and validated (Jeffries & Rizzolo, 2006), and the evidence for many of simulation research knowledge claims are being generated and tested. Therefore, research in the high fidelity simulation domain is continuously evolving.

Only 10% of the studies found on simulation education within nursing grounded the interventions adequately in a theoretical framework (e.g., learning theory), while another 45% made only minimal use of a theoretical framework. Kolb’s Experiential Learning Theory was the theoretical framework high fidelity simulation researchers and practitioners most commonly employed though other theories have also been used. Additionally, no study has explicitly prescribed a refinement process for a high fidelity simulation intervention. While standardized instruments such as the Simulation Design Scale (SDS), and the Educational Practices Questionnaire exist to aid in the evaluation of simulation interventions (Jeffries & Rizzolo, 2006), these are subjective measures that have been used to evaluate simulations at one point in time. There is no evidence of a systematic approach to refining simulation interventions, prior to implementing with learners. Further, only a limited number of studies have investigated the effectiveness of high fidelity simulation in improving the conflict resolution skills of nursing and
allied healthcare students. Therefore, for research in this field to advance, a refinement method for simulation interventions and objective measures for communication competencies that are tightly linked to the nursing curriculum are required.

The introduction of higher fidelity levels in simulation interventions has been accompanied by increasing awareness of their educational benefits. Notwithstanding this increased awareness, systematic reviews addressing the benefits of high fidelity simulation with the human patient simulator in nursing education have indicated that the discipline is underdeveloped. These systematic reviews have highlighted problems with design and execution that, if addressed, could go a long way toward hastening the evolution of simulation education. There is also a clear need for research studies with well-articulated simulation intervention descriptions, methodologies and rigorous measurement. At present, high fidelity simulation interventions within nursing education are not standardized; consequently, there are variations in the characteristics, delivery and dose of such interventions among various nursing programs (Cant & Cooper, 2010; Harder 2010). The high fidelity simulation discipline would benefit from a well-constructed, programmatic research approach to high fidelity simulation intervention design and testing.

In sum, a number of conclusions can be drawn from the review of the literature:

1. Many student nurses utilize conflict management styles that fail to optimally protect patient safety.
2. Studies have linked interpersonal conflict to medication errors.
3. There is a lack of conflict resolution training for undergraduate nursing students.
4. High fidelity simulation scenarios are not systematically assessed and refined, in advance of exposing the learners, despite the existence of valid and reliable tools available to do so.

5. Few simulation studies are grounded in an educational theory, which is essential for developing an understanding of learning outcomes.

6. High fidelity simulation has shown to be an effective modality for the instruction of communication techniques, such as conflict resolution.

Historically, learning in healthcare programs has been facilitated both through classroom instruction and tactile clinical experiences. The research evidence has made it clear that high fidelity simulation interventions can provide the necessary buffers that lead to measurable improvement in educational outcomes. Research has also shown that there are deficiencies in the teaching of conflict resolution skills to nursing students while they are also caring for patients. An appropriate way to close these gaps would be to incorporate a conflict management learning event into a theory-driven, refined high fidelity simulation intervention with a view to mimicking a real-life healthcare environment.
CHAPTER 2: THEORETICAL FOUNDATION

The Modes of the KELT Learning Cycle

Over the course of the twentieth century, educationists and scholars have advanced a variety of learning theories. Until recently, the majority of these have employed traditional didactic and behavioural approaches to learning. Kolb’s Experiential Learning Theory (KELT), first published in 1984 by the noted philosopher and theorist David Kolb, represented a radical break from this tradition and relied conceptually on experiential learning (as the name suggests) to provide robust explanations for the process of learning as part of its four-stage learning cycle. In the three decades since its introduction, KELT has been adapted and applied to the pedagogy of higher education across a variety of subjects in the social, natural, and physical sciences (Healey & Jenkins, 2000; Holman, Pavlica, & Thorpe, 1997). The epistemological roots of KELT lie in constructivism, which, as applied to experiential learning, posits that learners derive meaning from their educational experiences and essentially “construct” their own learning process (Keeton & Tate, 1978). Viewed from this perspective, simulation-based education is similarly constructivist in its philosophical orientation and experiential in its approach, since it offers students a learning environment that provides both reflective observation and active experimentation as pathways to construct learning. Therefore, KELT is capable of providing a sound theoretical basis for a simulation-based educational intervention.

The KELT approach consists of three main components: (a) a theory of experiential learning; (b) a learning cycle graphical model; and (c) the Learning Styles Inventory (LSI), an instrument for testing and applying the theory (Bergsteiner, Avery, & Neumann, 2010). The present research is centred on using the first two KELT components, that is, the theory and the model, as foundations for designing and implementing the high fidelity simulation-based...
intervention (see Figure 1). Kolb defined learning as “the process whereby knowledge is created through the “transformation of experience” (Kolb, 1984, p. 38). Kolb’s Experiential Learning Theory posits that learning is a cognitive process that involves constant adaptation to and engagement with one’s environment. Learners create new knowledge from direct experience rather than from received instruction.

Kolb (1984) constructed the KELT learning cycle graphical model (see Figure 1). Kolb built upon this model by identifying learning abilities associated with, and then ascribing “learning styles” to, each of the stages of the loop. The KELT graphical model has four principal steps in the learning cycle: (a) concrete experience (a personal involvement in a particular experience); (b) reflective observation (reflecting on the experience from many perspectives); (c) abstract conceptualization (the drawing of logical conclusions or the creation of logically sound theories); and (d) active experimentation. Kolb suggested that learning in the four-step model requires certain abilities that are polar opposites. For instance, Kolb stated that the grasping of knowledge occurs either through apprehension (concrete experience) or through comprehension (abstract conceptualization), and that, similarly, transformation of knowledge occurs through learner intention (reflective observation) or through extension (active experimentation).

Therefore, whereas grasping via apprehension (the first step in the four-step KELT cycle) indicates awareness of the concrete experience without active thought, grasping via comprehension (the third step) involves complete cognitive awareness of the experience. Transformation by intention (the second step) links apprehension and comprehension. During the process of transformation by intention, the learner internalizes the concrete experience and conceptualizes attributes that lead to a better understanding of the experience. Transformation by
extension (the fourth step) results in an externalization of this understanding and awareness to testing and application to new situations.

The KELT model posits that the process of learning requires the application of a number of abilities that are polar opposites. More importantly, it states that learners must continually choose which set of opposites they will use in a specific learning situation (Sternberg & Zhang, 2000). Conflicts, disagreements, and differences drive the learning process as learners move among the modes of (a) concrete action, (b) reflection, (c) feeling, and (d) thinking. Learning in the KELT model can be expressed in terms of the following bipolar duality: an active and concrete learning situation gives rise to primary learning, whereas a passive and abstract learning situation gives rise to secondary learning.

Besides outlining the four stages of learning, Kolb (1984) also identified four learning styles associated with the KELT cycle: divergent, assimilative, convergent, and accommodative. He posited that learners adopt a learning style contextually, and that individual learning style preferences are fluid rather than rigid, changing in response to the situation. Kolb stated that, in order to effectively complete learning, learners ought to experience all four phases of the KELT learning cycle, since this familiarizes learners with all four learning styles and reinforces learning. However, the present study does not examine the impact of high fidelity simulation in relation to students’ learning styles.

To date, only a few studies employing high fidelity simulation interventions have used KELT as a theoretical basis, despite its eminent suitability (Kaakinen & Arwood, 2009). The present study adds to this small cohort of studies and advances the argument that high fidelity simulation interventions utilizing the KELT learning cycle should be investigated with a view to assessing the educational benefits for students.
Concrete Experience

The KELT learning cycle consists of an experience, that is, the learning event, as well as the process that enables the learner to become acquainted with the experience. Kolb (1984) viewed the experience as the most important aspect of learning. According to him, even though the experience is accessible by conscious thought, it possesses a pre-symbolic quality that exists prior to the attachment of any meaning to it. Concrete experience may be attained through the process of apprehension, that is, the learner senses what he or she feels in the environment. Through apprehension, the learner may know things “instantaneously without the need for rational inquiry or analytic affirmation” (Kolb, 1984, p. 43).

Reflective Observation

The reflective observation component of the KELT learning cycle involves the gathering and organizing of information by the learner with a particular intention, that is, to derive
meaning from the experience. This intention-driven process transforms the experience, and the participant learns the meaning of concrete experiences by reflecting on that experience’s presymbolic impact on his or her feelings (Kolb, 1984). Without reflective observation, true learning cannot take place since the learner may repeat mistakes in the future. Thus, the reflective observation stage enables the learner to make sense of the concrete experience through comprehension. This leads to the creation of personal and social connections, thereby increasing the learner’s knowledge (Wilson & Lee, as cited in Akella, 2010).

Abstract Conceptualization

The abstract conceptualization step in the KELT learning cycle involves the learner “thinking about, analyzing, or systematically planning rather than using sensation as a guide” (Sternberg & Zhang, 2000, p. 194). Through this process of comprehension, order is introduced to the learner’s understanding and models or schemata are constructed (Holman et al., 1997). During this stage of learning, the learner is presented with (or attempts to conceptualize) a theory or model that can explain the concrete experience and the learner’s observations of that experience.

Active Experimentation

Active experimentation allows the learner to apply newly acquired concepts and ideas in practice. This experimentation cements new knowledge and engenders long-term changes in practice (Zigmont, Kappus, & Sudikoff, 2011). For example, allowing students to engage in additional high fidelity simulation scenarios can generate more learning and can allow newly acquired ideas to be reinforced.

Fundamentally, the KELT learning cycle describes a process whereby new knowledge results from the following: (a) engagement in a concrete experience, (b) a reflection phase, (c) an
abstract conceptualization phase that facilitates the learning of new concepts or theories, and (d) the application of these concepts or theories in an active experimentation phase. The application of KELT to the design and implementation of a high fidelity simulation intervention is promising for several reasons. First, by engaging learners in the multiple ways that Kolb (1984) envisioned, a KELT-influenced high fidelity simulation intervention allows diverse individual learning styles to be accommodated. Second, a simulation intervention that targets all phases of the KELT cycle brings about complete learning as described by Kolb (1984). Third, the distinct stages of the KELT cycle result in learning that is driven by experience, observation, reason, and active experimentation thus rendering this form of learning robust and permanent rather than transitory.

**Criticisms of KELT**

Although Kolb has been extremely influential in shaping pedagogical strategies for adult and younger learners in the past few decades, his experiential learning theory is not without its detractors. According to some scholars, the KELT literature fails to fully clarify the methodology for making the concrete and abstract conceptualization learning stages operational (Bergsteiner et al., 2010; Coffield, Moseley, Hall, & Ecclestone, 2004). Some commentators believe that experiential learning modes in general lack depth, while others reject Kolb’s notion of distinct learning styles (Garner, 2000). Some critics have even questioned whether the KELT cycle represents four learning *styles* or four learning *stages*. Other scholars, including proponents of KELT, have attempted to respond to these criticisms. For instance, Bergsteiner et al. (2010) have suggested that the absence of operational definitions for the stages in the KELT cycle renders the model less holistic but does not affect its validity; the model only requires further development. With respect to Kolb’s (1984) characterization of learning styles, De Ciantis and Kirton (1996) have argued that these styles represent a learning process.
Despite these criticisms, KELT has come to enjoy wide acceptance as a learning theory. Kolb’s Experiential Learning Theory can guide the development of educational interventions that employ an experiential pedagogy. This acceptance extends across a wide range of academic disciplines. The literature review undertaken as part of this study has demonstrated that the incorporation of experiential approaches in academic curricula offers students learning opportunities that are not available in other educational modalities. Since high fidelity simulation training employs the experiential mode of pedagogy, it is necessary to adopt a compatible theoretical approach while designing and implementing the simulation intervention.

**Statement of the Problem**

Nursing students need appropriate professional orientation in order to become competent and efficient in the clinical practice environment. They must utilize effective communication skills, including the practice of conflict management strategies, to undertake their various duties safely and responsibly. This is especially relevant while performing critical duties like the administration of medication. Acquiring these competencies in actual clinical practice may present an unacceptable risk to patient safety and may compromise patient outcomes. High fidelity simulation training may provide a useful way for undergraduate nursing students to learn conflict resolution skills in an environment that does not risk patient safety or outcomes.

In the past, several researchers have examined the educational benefits of high fidelity simulation interventions and have identified statistically significant improvements to learning outcomes for nursing students and allied healthcare professionals. However, their studies often did not include an explicit description of the conflict training intervention components, as well as, the use of a theory as a foundation for the intervention and were not explicit if the simulation intervention was modelled and refined, prior to implementation with the learners. Similarly, no
account of the feasibility and acceptability criteria was available for many of these studies, thereby limiting the transferability and generalizability of the research evidence.

**Study Objectives**

Addressing these limitations of past studies, this Phase 1 study encompassed a refinement component and a single-group post-test study and had the following aims:

- To provide preliminary data about the refinement process of a high fidelity simulation intervention (two scenarios, each followed by a debriefing session) from the perspective of Year 3 nursing students.
- To test the acceptability and feasibility of the refined high fidelity simulation intervention from the perspective of target group of Year 2 nursing students.
- To determine the percentage of Year 2 nursing students in the single-group post-test who used the two-challenge rule of conflict resolution.

The following objectives guided this study:

1. To assess the design features of the high fidelity simulation intervention during the refinement period from the perspective of Year 3 nursing students, using a refinement algorithm, the Simulation Design Survey (SDS, student version) and one open-ended question.

2. To assess the feasibility outcomes of the high fidelity simulation intervention refinement component from the perspective of Year 3 nursing students and the facilitators with respect to the following:
   
   (a) percentage of eligible Year 3 students who agreed to participate;
   
   (b) compliance of Year 3 students with the refinement schedule (i.e., were alternate sessions required?);
(c) length of time taken to complete the two high fidelity simulation scenarios at the conclusion of the refinement period;

(d) length of time taken to complete the two debriefing sessions at the conclusion of the refinement period; and

(e) compliance of the facilitators with the high fidelity simulation intervention refinement protocol.

3. To evaluate the entire, refined high fidelity simulation intervention using the Educational Practices Questionnaire (EPQ, student version) with two appended open-ended questions and the Satisfaction and Self-Confidence in Learning survey (SSL) from the perspective of Year 2 Nursing students.

4. To assess the feasibility outcomes of the refined high fidelity simulation intervention from the perspective of Year 2 nursing students and facilitators with respect to the following:

   (a) percentage of eligible Year 2 students who agreed to participate;

   (b) attrition rate of Year 2 students in the two high fidelity simulation scenarios;

   (c) percentage of Year 2 students who utilized the two-challenge rule during the second scenario; and

   (d) compliance of the facilitators.
CHAPTER 3: RESEARCH DESIGN AND METHODS

Design

This Phase 1 study was focused on a high fidelity simulation intervention designed to teach a specific conflict resolution skill (the two-challenge rule) to Year 2 undergraduate nursing students. The study included two distinct and successive components: (a) a refinement component and (b) a single-group post-test study of the entire, refined simulation intervention. Although the components are distinct in terms of their objectives, methods, and nursing student participants, they progressively build upon each other. These components are depicted in Figure 2.

The refinement component of the study was conducted with Year 3 undergraduate nursing students, with the twin aims of improving the design features of the high fidelity simulation intervention and assessing the feasibility of the refinement process itself. The second component, the single-group post-test, evaluated how feasible and acceptable the refined high fidelity simulation intervention was to the target group of Year 2 undergraduate nursing students.

Figure 2. Study Schema Guiding the Feasibility Study
Phase 1 of the Medical Research Council (MRC) framework (2000, 2008) was used as the foundation to guide the development of this study and to assess how the design elements of the simulation intervention related to and interacted with each other (see Figure 3). The decision whether or not to move forward to a randomized controlled trial was based on the thoughtful examination of the feasibility and acceptability outcomes, in addition to the evaluation of the primary research outcome for the study, that is, Year 2 students’ willingness to use the two-challenge rule as a conflict management communication skill.
Operational Definitions

The operational definitions used in this Phase 1 study are as follows:

- **Confederate(s):** As defined by O’Regan (n.d.), a confederate is a collaborator who acts within the simulation, is directed from the control room, and has the role of promoting positive information. Confederates serve as assets to the simulation.

- **Conflict management:** The practice of “identifying and handling conflict in a sensible, fair, and efficient manner through effective communication techniques and negotiation with a focus on interests” (definition retrieved June 10, 2010, from http://www.cedanet.com/meta/conflict_management.htm).

- **Conflict management learning event (CMLE):** A social interaction in which a participant is required to successfully identify a difference in opinion or information and to recommend his
or her viewpoint to another team member using a conflict resolution skill (in this study, the two-challenge rule); the CMLE in this study occurred in the high fidelity simulation training environment.

- **Conflict resolution:** “An intervention aimed at alleviating or eliminating discord through conciliation” (definition retrieved June 8, 2010, from http://businessdictionary.com). The terms conflict resolution and conflict management are used interchangeably in the academic literature and are treated as essentially identical in this study.

- **Debriefing:** The critical period that follows a simulation, enabling critical self-reflection about what occurred, with a view to discovering the learner’s cognitive frames that were operative during the experience. Debriefing leads to the development of self-correcting habits because faculty members help the learner to recognize or resolve clinical and behavioural dilemmas that arose during the simulation (Rudolph, Simon, Dufresne, & Raemer, 2006).

- **High fidelity simulation:** The use of simulated patients and clinical environments, with a high degree of realism in the education of healthcare professionals. Rodgers (2007, p. 14) noted that high fidelity simulators, such as the human patient simulator, “provide adequate cues to allow for full immersion and [also] respond to treatment interventions.”

- **Human patient simulator:** A life-sized, computerized model of the human body with realistic anatomical structures and high-response functioning. This high fidelity simulation manikin can mimic diverse aspects of human physiology, such as changes in the cardiovascular, pulmonary, metabolic, and neurological systems, and it has the ability to respond to nursing or pharmacological interventions in real time. An example is the Laerdal SimMan Universal Patient Simulator (Lapkin et al., 2010).
**Learning objective:** A very specific, measurable articulation of the desired knowledge, skills, or attitudes to be acquired in a given learning activity. An example of a learning objective for conflict management might be the use of the two-challenge rule to advocate for a patient in labour who is experiencing frequent, strong contractions (Rosen, Massey-Beauregard, Collins, & Turner, n.d.).

**Refinement:** In this current study, refinement refers to the strategy used to improve design features of the high fidelity simulation intervention.

**Simulation:** A technique used to “to replace or amplify real experiences with guided experiences, often immersive in nature, that evoke or replicate substantial aspects of the real world in a fully interactive fashion” (Gaba, 2004, p. 2).

**Simulation realism (fidelity):** How well a simulation represents or replicates reality (Dieckmann, Gaba, & Rall, 2007; Maran & Glavin, 2003). The concept of fidelity includes many aspects, such as the simulation's attributes that impact on the learners sensory impressions, learning objectives, task-related demands and the environment of training (Cook et al., 2013).

**Spacing period:** The span of time that occurs between learning events. In this study, the spacing period is defined as the span of time between the two simulation scenarios with the CMLEs. According to Cepeda, Vul, Rohrer, Wixted, and Pashler (2008), a spacing period between learning events facilitates increased knowledge retention. No optimal spacing period has been strictly defined for this study. Future studies may be designed with an optimal spacing period for high fidelity simulation interventions.

**TeamSTEPPS:** An evidence-based teamwork system designed for healthcare professionals, providing ready-to-use materials and a training curriculum for the successful integration of
teamwork principles such as conflict management. The TeamSTEPPS program was developed in the United States by the Department of Defense’s Patient Safety Program, in collaboration with the Agency for Healthcare Research and Quality (definition retrieved June 18, 2010, from http://teamstepps.ahrq.gov/about-2cl_3.htm). The TeamSTEPPS curriculum is based on 25 years of research related to teamwork, team training, and change in work culture; it was developed after extensive field testing in the United States military and several civilian organizations (Agency for Healthcare Research and Quality, 2011). The TeamSTEPPS toolkit is now in the public domain and is a valuable resource for training healthcare providers in the adoption of better teamwork practices (Clancy & Tornberg, 2007).

- **Two-challenge rule:** The rule was developed by human factor experts to help airline captains prevent disasters caused when otherwise excellent decision makers experienced momentary lapses in judgment. In the healthcare context, team members should challenge colleagues if requesting clarification and confirmation on a viewpoint does not alleviate the concern regarding potential harm to a patient. It is important to voice a concern by advocating and asserting a statement at least twice, if the initial assertion is ignored (thus the name, “two-challenge rule”). These two-challenge attempts may come from the same person or two different team members. The first challenge should be in the form of a question. The second challenge should provide some support for the concern.

**Description of Study Setting and Site**

The study was conducted with Year 2 and Year 3 nursing students in the 4-year Collaborative Baccalaureate Nursing Program of an urban nursing education institution in Ontario. The Nursing Program is offered through the full partnership of three nursing schools’
Simulated Practice Centres that run active high fidelity simulation programs and are available at each of the school sites. The study was conducted exclusively at one of the collaboration sites.

**Recruitment Procedure, Consent, and Baseline Data Collection**

Recruitment procedures, nursing student consent, and baseline data collection were undertaken once approval from the requisite research ethics boards and committees was received in Fall, 2013. Two separate recruitment processes were undertaken: one for the Year 3 students involved in the refinement of the two simulation scenarios (each followed by a debriefing session) and another for the Year 2 students who evaluated the refined scenarios and debriefing sessions (see Figure 2).

Before the Research Assistant (RA) made an in-class recruitment presentation, potential nursing students were sent an email through the university listserv describing the study and explaining that participation was voluntary. The principal benefit of sending an advance email was to permit the RA to contact students who may have been eligible to participate but who would not have ended up attending class on the day of the presentation, while also giving the students more time to consider the invitation. The email included information about the nature of the study, a consent form, and details about when and where the in-class presentations would take place.

With the permission of the course professors, the RA delivered in-class recruitment presentations during Weeks 9–12 of the Fall 2013 semester for Year 3 Community Health Nursing Practice \((n = \sim 180)\) students, and during Weeks 2–4 of the Winter 2014 semester for Year 2 Nursing Theory \((n = \sim 180)\) students. As in the email, the RA provided an overview of the study and consent forms. Students were then invited to volunteer to participate in the study, either by returning the completed consent forms at the end of the RA’s information session.
(unsigned consent forms were also collected from the students at that point), or communicating with the RA online no later, respectively, than the end of Week 12 of classes in the Fall 2013 semester or of Week 4 of the Winter 2014 semester. At the end of the presentation, the RA announced that upon receipt of a valid, completed consent form and demographic questionnaire, the Principal Investigator (PI) would email an invitation through the survey research website SurveyMonkey (www.surveymonkey.com) that would (a) confirm receipt of the consent form and the demographic questionnaire, and (b) advise students about when they would be contacted and scheduled to participate in the simulation. Data from completed demographic questionnaires (see Appendix A) were used to characterize participants (Assman, Pocock, Enos, & Kasten, 2000).

Approximately one week after the in-class presentations, an email reminder was sent to all potential participants with a view to reaching students who may have been absent from class on the day of the presentation or who required more time to decide whether to volunteer for the study. Data collection related to participant recruitment was concluded by the end of Week 12 of the Fall 2013 semester and Week 4 of the Winter 2014 semester. Information about the study was made widely available (a) in the educational institute’s electronic monthly newsletter, (b) on the Year 2 Nursing Theory and Year 3 Community Health Nursing Practice Blackboard site, and (c) on the electronic information board in the School of Nursing. The RA also posted flyers in high-traffic locations frequented by nursing students, such as the cafeteria and the library, in order to increase awareness.

At the end of Week 12 of the Fall 2013 semester and the end of Week 4 of the Winter 2014 semester, the RA compiled two separate lists with the names of prospective Year 3 and Year 2 nursing students, respectively, who completed the demographic questionnaire and
consent forms. Students on these two lists were assigned a date for their participation in one of the two study components (refinement or single-group post-test), respectively. Each prospective student was assigned a date and time outside of times when the bulk of curricular content in the nursing program typically runs (i.e., late afternoon and early evening), which helped to minimize student time conflicts. If students could not participate at the time designated for them, they were offered the opportunity to reschedule relative to the spots available, or, alternatively, if no accommodation worked, they were dropped from the study.

**Pre-Refinement: Conceptualization of Intervention Design**

The PI designed a paper outline of the high fidelity simulation intervention (two scenarios, each followed by a debriefing session) to reflect the ideal circumstances for a CMLE geared to Year 2 students (see Appendix B). This pre-refinement conceptualization of the high fidelity simulation intervention was referred to as Iteration 0.

The high fidelity simulation intervention was mapped according to Kolb’s Experiential Learning Theory (KELT) cycle. The concrete experience phase of the KELT cycle involved participation in two high fidelity simulation scenarios (each followed by a debriefing session). Each of the two high fidelity simulation scenarios was designed so that participants would encounter a conflict management learning event that included a confederate acting as a senior nurse. The confederate’s role and training are detailed further below.

The reflective observation stage of the KELT cycle took place when students reflected on their high fidelity simulation experience during the debriefing session, which was conducted immediately after the completion of each simulation scenario. The debriefing session allowed participants to link theoretical concepts learnt from readings they received before engaging in the simulation scenarios and from their classroom lectures. The session also assisted them in
thinking critically and in discussing how to intervene professionally in complex situations (Jones, Cason, & Mancini, 2002; O’Connor, Albert, & Thomas, 1999; Rauen, 2001). During each debriefing session, facilitators provided feedback in order to encourage participants to discuss their own performance in the scenario. Participants were permitted to view videotaped sessions of their simulation scenarios in order to enhance their self-reflection.

The abstract conceptualization phase of the KELT cycle, which also took place during the debriefing session, occurred when the facilitator helped shape the students’ reflections and thinking (Zigmont et al., 2011). Questions asked in the course of the debriefing session following the first simulation scenario helped shape students’ thinking about how they might change their performance through active experimentation during the second simulation scenario.

The active experimentation phase of the KELT cycle allowed students to test new concepts or theories in order to make predictions about the concrete experience and then to act on those predictions (Akella, 2010). Thus, the first high fidelity simulation scenario represented the initial concrete learning experience, and the second high fidelity simulation scenario facilitated active experimentation and thereby completed the KELT cycle.

**Confederate Training**

High fidelity simulation may require the use of an actor, usually known as a confederate, to simulate the interaction of a number of participants with one another and with the high fidelity simulator (Kassab et al., 2010). For the present study, the introduction of a confederate into the simulation scenario was required to create a realistic clinical team experience for student participants. The interaction of the student participant and confederate initiated learning related to conflict management and resolution. Individuals interested in acting as confederates \((n = 2)\) were recruited from the nursing faculty of a different nursing program (Practical Nursing) and
were selected based on their availability. The confederates selected for the present study were expected to be Practical Nursing faculty members who were active in healthcare simulation and who, in addition to having several years of experience, had participated in the SimOne Program, Summer Simulation Institute (2012). Confederates did not participate in the debriefing session.

Confederates selected for the study received specific training to interact appropriately with student participants at critical points during the scenario and to create the same conflict management learning event at the same point in the simulation scenario for each student participant. Confederates also received instruction on navigating a hierarchy-based script that included words, gestures, and interventions. They were also prompted by the PI to interact with participants during the simulation scenarios (see Appendix B and Appendix C).

A 2-hour training workshop for confederates was conducted at the Simulated Practice Centre. The workshop covered a range of relevant cognitive, experiential, and observational activities. Previous research has already established that it is possible to train confederates to simulate the acting roles in an operating theatre in a single day (Kassab et al., 2010).

Before the workshop, the two confederates received supporting materials electronically, including scripts written specifically for the role of the confederate in the two scenarios. The scripts indicated character traits, verbal cues, and appropriate responses for the relief nurse and senior nurse roles. The confederate script served as a guide to enable the dynamic portrayal of a nurse who introduces conflict into the high fidelity simulation scenarios. Furthermore, potential confederates received an overview of the two high fidelity simulation scenario algorithms (taken from the facilitator package) in order to provide context.

The PI began the 2-hour confederate training workshop by outlining the session’s objectives. Then the PI defined the concept of conflict; reviewed the two-challenge rule; and
screened a 5-minute video on team conflict, based on the TeamSTEPPS program (Agency for Healthcare Research and Quality, 2011). Afterwards, the PI reviewed the two high fidelity simulation scenarios, algorithms, and scripts with the confederates. With the support of the PI, the confederates then participated in a targeted practice run of the two scenarios. These practice runs allowed the confederates to familiarize themselves with their principal task during the simulation—namely, to generate a conflict management learning event with the student participants, in line with the requirements of the scripts. After the practice runs, the PI engaged the confederates in reflection and feedback regarding their performance.

Component 1: Refinement

Eligibility Criteria

Participants had to be in Year 3 of a 4-year Collaborative Baccalaureate Nursing Program.

Sample Size

The sample size for each of the study’s components was calculated bearing in mind the study site’s (i.e., the Simulation Practice Centre) resource constraints, such as room availability and time. For the refinement component, two convenience samples of 20 Year 3 students (total \( n = 40 \)) who met the eligibility criteria and agreed to participate were selected to provide feedback that was used to refine the high fidelity simulation intervention’s elements (two scenarios, each followed by a debriefing session). Each scenario was refined over a 5-day period (Monday to Friday), with four students participating per day.

Year 3 nursing students were chosen to refine the high fidelity simulation elements for several reasons. First, Year 3 students had acquired the knowledge base necessary for participating in the intervention and for providing appropriate feedback. Second, the knowledge
application and feedback requirements preclude the inclusion of students at lower academic levels (e.g., Year 1 students cannot be used to refine Year 2 scenarios). Third, from a broader curricular perspective, involving the target Year 2 student group in the refinement process of an educational intervention prior to its implementation in the same student cohort would deprive the students involved in the refinement of an educational benefit that should be available to all students of their cohort. Thus, Year 2 students who formed the target student group for the simulation intervention in the current study were not used for the refinement component from an ethical standpoint.

**Research Design and Data Collection**

**Refinement design.** During the refinement component of the study, a high fidelity simulation intervention consisting of two comparable simulation scenarios was tested and evaluated using feedback from Year 3 nursing students in order to ensure that they operated as expected. Financial and logical constraints, chiefly the availability of laboratory resources, affected the refinement component of the study at this academic site. Therefore, the scope of the refinement exercise was limited to ensuring that a single, complex, high fidelity simulation intervention could be completed within a single academic semester.

The refinement process for each of the high fidelity simulation scenarios and debriefing sessions was undertaken over a period of 5 days in successive iterations. It would be difficult to estimate an optimal number of refinement iterations since this is dependent on multiple factors, including, for example, scenario and/or participant differences. Moreover, since no clearly articulated refinement process for high fidelity simulation scenarios has been published to date, benchmarks or established standards for refinements were not found in the high fidelity simulation literature. Since the current study utilized two separate simulation scenarios with
different conflict management learning events, each was put through a separate and unique refinement process.

**Setting.** The refinement process took place in the Simulated Practice Centre. Because Year 3 nursing students are typically in community practice placements and visit the study site once a week for a meeting with their faculty advisor, they were asked to sign a confidentiality agreement in order to discourage communication about the content of the simulated scenarios between groups. This agreement stipulated that students would not share any of the scenario information with other students in the program.

**Schedule.** The training workshop for confederates was conducted before Week 10 of the Fall semester. Refinement with the Year 3 students was undertaken during Week 13 for the first simulation scenario and during Week 14 for the second simulation scenario. The two high fidelity simulation scenarios were refined through the participation of four students per day (for each scenario) from Monday to Friday. Each successive day of refinement was deemed a sequential iteration (i.e., Monday was Iteration 1, Tuesday was Iteration 2, and so on until Friday). Given the complex nature of the high fidelity simulation intervention employed in the study, the limitation of refinement to four students per day per scenario, across 5 days, was intended to ensure that the scenarios were implemented in a manner that did not substantially increase the resource burden on the academic department or the study site. The scenario refinement process resulted in changes to the confederate script. The confederate script was reviewed daily with the confederates to inform them about the changes.

**Pre-simulation reading material prior to engaging in refinement sessions.** The PI appropriately directed and channelled the involvement of Year 3 nursing student participants in
the refinement process. Year 3 students electronically received the following pre-simulation reading material a week prior to their participation in refining the scenarios:

- Online TeamSTEPPS Mutual Support PowerPoint and video (Agency for Healthcare Research and Quality, 2011);
- Medication administration overview; and
- An overview of the high fidelity simulation scenarios, which included information detailing the patient’s diagnosis, medical history, medications, and treatment interventions (see Appendix B).

The email sent to Year 3 students also informed them that they would be oriented to the high fidelity simulation room a few minutes before the simulation scenario began to acquaint them with the human patient simulator and other clinical equipment. Year 3 students were additionally advised that the high fidelity simulation intervention was geared to meet the learning needs of Year 2 nursing students, for whom the intervention was intended.

**Participant preparation at the refinement sessions.** When Year 3 students arrived at the Simulated Practice Centre, the technologist oriented them to the human patient simulator and to the layout of the simulated patient room. Then the student participants proceeded to the conference room to be briefed by the PI, who informed them about the patient’s medical history and presenting diagnosis and who also presented the patient’s up-to-date medical report. In addition, the PI presented a broad overview of the learning objectives for the simulation scenario and students were informed that the simulation would be confidential. After the briefing period, student participants returned to the simulated patient room and were informed that the technologist would prompt them when the scenario commenced.
At the prompting of the technologist, nursing students were asked to undertake a practice run of either one of the two simulation scenarios, including the conflict management learning event. After the practice run, students attended the post-scenario debriefing session. During this debriefing, the PI and another facilitator posed a variety of questions, some of which were standard for all simulation participants regardless of scenario, and some of which were specific to the particular scenario that exposed them to the conflict. Following is the list of open-ended standard questions that the PI and the facilitator asked:

- Which elements of the simulation did you think went well?
- Which aspects of the simulation did not go well?
- Were you able to carry out all the steps and procedures you had planned to in the course of the medication administration process?

The PI and the facilitator also posed the following separate set of questions pertaining to the student’s behaviour in relation to the confederate during the conflict management learning event:

- How do you think you handled the conflict with the nurse?
- What did it feel like to be a student nurse challenging a senior nurse?
- Would you do anything differently in order to manage and/or resolve conflict of a similar kind in the future?

**Objective 1: SDS and Appended Open-ended Question.** To assess the features of the high fidelity simulation scenario from the perspective of Year 3 students and thereby facilitate the simulation refinement process, all Year 3 participants completed the Simulation Design Scale (SDS, student version) and answered an open-ended question after they participated in the debriefing session (see Appendix E). The academic literature on high fidelity simulation
interventions is largely silent about refinement methodologies. Despite this gap, survey instruments that have been validated, such as the SDS (student version), allowed for the effective evaluation of the simulation design features from the students’ perspective.

**Simulation Design Scale.** The Simulation Design Scale (student version) is a 20-item instrument that uses a 5-point measurement scale. It is structured to evaluate five design features related to simulation scenarios, as well as the participant’s perceptions of (a) the scenario’s objectives/information; (b) problem-solving; (c) feedback/guided reflection; and (d) scenario fidelity (realism). Some items on the instrument ask participants to rate specific features in the simulation, whereas others require participants to evaluate the self-perceived importance of those features. The reliability of the SDS instrument using Cronbach’s alpha is 0.92 for the presence of simulation features and 0.96 for the perceived importance of features (Kardong-Edgren et al., 2010).

**Open-ended question.** In addition to being asked to complete the SDS (student version) post the debriefing session, Year 3 participants were asked to respond to the following open-ended comment: “The goal of this high fidelity simulation scenario is to teach a conflict resolution skill (the two-challenge rule). Bearing this goal in mind, please recommend a maximum of two changes, regardless of whether these changes relate to the design of the scenario, the conduct of the debriefing session, or both.” The PI disregarded any recommendation recorded after the second recommended change, without further consideration. Refinements to the scenario were restricted so that score differences across iterations of the refinements were attributable to only a minimal daily set of modifications. More than two changes would complicate this difference attribution process. The open-ended question also
helped the PI gain a deeper understanding of possible beneficial modifications to the simulation scenarios and debriefing sessions based on the perceptions of Year 3 students.

**Scenario refinement based on data collected on each day.** The simulation scenarios were modified using the following algorithm for the Day 1 of refinement (see also Figure 4):

- If there was perfect agreement about a recommended change (as determined from the thematic coding) among three of the four students, or all four students involved on a single day of the refinement process, a maximum of two scenario modifications were permitted.

- No change was made when only two, or just one of the four students involved on a single day of the refinement process identified a feature of the scenario that needed to be modified.

Using the algorithm ensured that no more than two modifications were made per day. During the second iteration (Day 2), the same method was applied (three or four students had to agree for any change to be made), with some alterations. The themes from the previous day (Day 1 in this case) could carry over to Day 2. As a result, recommended revisions with some degree of agreement on the previous day would still be considered if there were fewer than two modifications recommended on that second day. These carryover recommendations were available for consideration at the PI’s discretion, such that a recommendation that had the agreement of two students on the previous day (and hence was rejected according to Day 1 criteria) was accepted on the subsequent day as long as the daily cap of two modifications had not been reached on that day. This carryover process was repeated on Days 3 and 4, with final modifications to the scenario completed after the conclusion of the refinement process on Day 5.

The results of all the categories(s) are summarized and presented in tabular format in the Results
chapter. The qualitative responses to the open-ended questions enhanced and contextualized the quantitative findings of the SDS instrument conducted with Year 3 students.

Large-scale modifications were not expected to be made to the scenario design, since the scenarios were developed based on evidenced-informed guidelines, carefully mimicked a real life conflict management event, and were carefully mapped according to Kolb’s Experiential Learning theory.

Figure 4. 5-Day Iterative Simulation Refinement Algorithm

<table>
<thead>
<tr>
<th>Scenario 1</th>
<th>5-Day Iterative Simulation Refinement Algorithm</th>
<th>Scenario 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1 (n=4)</td>
<td>First Refinement point</td>
<td>Day 1 (n=4)</td>
</tr>
<tr>
<td>Day 2 (n=4, 8 total)</td>
<td>Second Refinement point</td>
<td>Day 2 (n=4, 8 total)</td>
</tr>
<tr>
<td>Day 3 (n=4, 12 total)</td>
<td>Third Refinement point</td>
<td>Day 3 (n=4, 12 total)</td>
</tr>
<tr>
<td>Day 4 (n=4, 16 total)</td>
<td>Fourth Refinement point</td>
<td>Day 4 (n=4, 16 total)</td>
</tr>
<tr>
<td>Day 5 (n=4, n = 20 total)</td>
<td>Fifth Refinement point</td>
<td>Day 5 (n=4, n = 20 total)</td>
</tr>
</tbody>
</table>

**Decision Rules governing modifications to scenario:**

1. A maximum of 2 changes per day.
2. At least 3 thematic agreements necessitates a change.
3. 2 thematic agreements + agreement from the previous days totals warrants consideration for a change.
4. Fewer than 2 agreements will suggest that no changes are to be made.
5. At conclusion of all iterations, if any changes remain to be made, the “majority rule” may be employed (i.e.: if 11 out of 20 students recommend a change, and no other changes have the same level of agreement).
Objective 2: Assessing feasibility outcomes of the scenario refinement. The following procedures were undertaken to collect data to assess the feasibility outcomes of the simulation refinement process for Year 3 students and facilitators:

- To determine the percentage of eligible Year 3 students who agreed to participate, the PI maintained a record of the number of the eligible Year 3 students who were invited to participate out of the total who agreed to participate in the study.
- The following formula was used to arrive at an attrition rate for students who agreed to participate in the scenario refinement process. The PI kept records of the number of students who withdrew from the study prior to or during participation in the scenario refinement process.

\[
\text{Attrition Rate} = 1 - \left( \frac{\text{Students Completing Scenario Refinement}}{\text{Students Agreeing to Participate in Refinement}} \right)
\]

- Students who withdrew from the refinement process were also contacted with the following closed-ended question (administered via www.surveymonkey.com) to determine the reason for not completing the refinement:

What was your reason for [not participating in / withdrawing from] the conflict management simulation study?

(a) Conflict with an academic commitment (such as lecture/tutorial)

(b) Conflict with a personal commitment

(c) Unexpected event or circumstance

(d) Other ________________________________

(Please indicate your reason in the space provided above)
To determine the length of time taken to complete all the scenarios during each of the 5-day refinement periods, facilitators recorded the amount of time needed to complete each one in the Compliance Data Collection Form (see Appendix F) after each session. The average time to complete the scenarios was calculated and compared across daily iterations of the refinement process, in addition to the total mean of all students participating in the refinement. The final scenario iteration (on Day 5 of the process for each scenario) served as a baseline estimate of the length of time it took to complete each scenario.

To determine the length of time taken to complete all the debriefing sessions during each of the 5-day refinement periods, facilitators recorded the amount of time needed to complete each debriefing session in the Compliance Data Collection Form (see Appendix F) after each session. The average time to complete the debriefing sessions was calculated and compared across daily iterations of the refinement process, in addition to the total mean of all students participating in the refinement. The final debriefing session iteration (on Day 5 of the process) served as a baseline estimate of the length of time it took to complete the debriefing session.

To determine the compliance of facilitators with the refinement simulation intervention protocol and delivery, facilitators were asked to indicate on tick boxes in the Compliance Data Collection Form (see Appendix F) that they filled out after each completed session during the refinement period (a) whether the students were briefed prior to participating in the simulation scenario and (b) whether the students were debriefed after their participation in the scenario. If the tick boxes on the forms were not checked off, the
following open-ended question was posed: “Please identify the reason(s) why all the tick boxes were not checked off?”

Data Analysis

Objective 1: Methods of Analysis of SDS Data and Appended Open-ended Question.

Responses to the SDS (student version) provided by Year 3 student participants were analyzed and compared using descriptive statistics, means, medians, and standard deviations. The goal of the refinement component of this study was not the setting of a specific benchmark for the high fidelity simulation intervention (e.g., an SDS score > 4.0). In fact, doing so was neither philosophically nor mathematically defensible. In a simulation refinement process that considered only a small sample size of three or four participants in each iteration, the standard deviations derived from the mean scores would likely to be so large that an acceptable confidence interval of 90, 95, or 99% would cross a third of the entire scale. The latter would make any certain claim that improvement had in fact taken place near impossible to verify. For this reason, Jeffries and Rizzolo (2006), the creators of the SDS, did not indicate benchmarks in the literature for the SDS.

Given the absence of substantive discussion on refinement issues in the high fidelity simulation intervention literature, the goals of the refinement component were to provide a best-practices approach to simulation optimization and to improve the pedagogical validity of the intervention. Therefore, the refinement process would be considered as successful if, at the end of it, the SDS scores were higher than they were at the beginning of the refinement process, regardless of the magnitude of such differences.
A second criterion, namely, how much agreement there was that scenario characteristics needed changing, was assessed through the open-ended question appended to the SDS (student version), which provided a useful secondary approach to evaluate improved elements, such as fidelity. The written responses to the open-ended question were content-analyzed for emerging codes and categories using conventional content analysis (Hseih & Shannon, 2005). Conventional content analysis is a form of coding and categorizing data based on observation. The codes were defined during content analysis and were derived from the data itself (Hseih & Shannon, 2005). The nomenclature of the codes was based on the nursing students responses to the question. The PI and another rater performed the coding. During the coding and categorizing analysis phase, the two raters operated independently. At the end of each day’s analysis, the two raters compared the assignment of codes and categories. The PI and the rater then evaluated the codes and categories(s) assigned and made necessary changes for reconciliation before the next iteration of the refinement process was undertaken.

Objective 2: Assessing the feasibility outcomes of the simulation scenario refinement process. To assess the feasibility outcomes of the high fidelity simulation refinement process from the perspective of the Year 3 nursing students and the facilitators, the following analyses were undertaken:

Participation rate. The participation rate of Year 3 students was determined by calculating the percentage of eligible students who were invited to participate in the refinement component of the study out of the total who agreed to participate. The final list of participants was determined on a first come, first served “eligible student” basis; thus, the maximum participation rate was 40 / total eligible population.
**Analysis of attrition rates for Year 3 nursing students.** The attrition rates were analyzed to determine the primary explanations for students who failed to complete the refinement scenarios in order to establish which determinants of attrition were within the control of the researcher (design features) and which were external to the design. Although attrition endogenous to the design can be mitigated with design adjustments, attrition exogenous to the design cannot be controlled. Thus, it was important to understand how much of the attrition could be removed through refinement design improvements. The nature of the first three closed-ended options, in response to why the students withdrew from the study, were conflict with an academic commitment (such as lecture/tutorial), conflict with a personal commitment, and an unexpected event or circumstance. The fourth option allowed students to elaborate their own reason for not participating in the refinement process. The researcher coded and categorized responses for those who chose the latter option, and then used descriptive analysis to rank the reason for attrition by frequency and percent.

**Length of time in minutes needed to complete the scenarios.** Data regarding the length of time needed to complete the scenarios were analyzed using descriptive statistics such as mean, median, standard deviation, and range.

**Length of time in minutes needed to complete the debriefing sessions.** Data regarding the length of time needed to complete the debriefing sessions were analyzed using descriptive statistics such as mean, median, standard deviation, and range.

**Compliance of the facilitator with the refinement simulation process.** The PI monitored intervention compliance by the facilitator on a daily basis. Each day, the PI reviewed the Compliance Data Collection Forms (see Appendix F) and followed up with the facilitator in cases where the simulation refinement process was not completed, in order to track reasons for
not completing as instructed. The open-ended question on the Compliance Data Collection Forms was thematically coded. Refer to table 7 for an overview of the schedule for the refinement component of the study.

Table 7

Schedule for Refinement of the High Fidelity Simulation Intervention by Year 3 Participants

<table>
<thead>
<tr>
<th>WEEK</th>
<th>STUDY ACTIVITIES</th>
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<tr>
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<td>7</td>
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<td>8</td>
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</tr>
<tr>
<td>9</td>
<td>Send email invites for study recruitment</td>
</tr>
<tr>
<td>10</td>
<td>Email reminder to Year 3 students</td>
</tr>
<tr>
<td>11</td>
<td>Email reminder to Year 3 students</td>
</tr>
<tr>
<td>12</td>
<td>Consolidate invitations and send confirmation to participate in the study to students (refinement component of study); train confederates (one-day session)</td>
</tr>
<tr>
<td>13</td>
<td>REFINE: Scenario 1 and debriefing session (Year 3 students); four students per day over a 5 day period ($n = 20$)</td>
</tr>
<tr>
<td>14</td>
<td>REFINE: Scenario 2 and debriefing session (a different sample of Year 3</td>
</tr>
<tr>
<td>students)</td>
<td>four students per day over a five day period (n = 20)</td>
</tr>
<tr>
<td>-----------</td>
<td>--------------------------------------------------</td>
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<td>15</td>
<td></td>
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</tbody>
</table>

**Component 2: Single-Group Post-Test**

**Eligibility Criteria**

**Inclusion criteria.** Nursing students in Year 2 of a 4-year Collaborative Baccalaureate Nursing Program were eligible for this component of the study. Participants had to have completed the following courses: Year 1 Anatomy and Physiology, Year 1 Clinical Practice, and Year 1 Health Assessment. Participants also had to have covered curricular content related to the management of a patient with congestive heart failure in Year 2 Pathophysiology, as well as curricular content related to medication administration and intravenous therapy in Year 2 Clinical Practice.

**Exclusion criteria.** Participants with formal TeamSTEPPS (Agency for Healthcare Research and Quality, 2011) program training, or those undertaking such training at the time of sample selection, were excluded from the study.

**Sample Size**

The sample size for the single-group post-test component had similar logistical constraints as that of the refinement component. Consequently, the sample size was small, but large enough so that use of the two-challenge rule during a student’s participation in the second scenario could be clearly differentiated. Following the refinement process, 35 Year 2 baccalaureate nursing students from a single educational institution who meet the above criteria and agree to participate partook in the refined high fidelity simulation intervention.
Research Design

Single-group post-test design. Year 2 nursing students \( n = 35 \) participated in a simulation exercise consisting of the entire, refined high fidelity simulation intervention (two scenarios, each followed by a debriefing session). The principal difference between the refinement component and the single-group post-test component of the study was that Year 2 nursing students in the latter component did not engage with the PI’s pre-refined, paper conceptualization of the high fidelity simulation intervention. Instead, Year 2 nursing students participated in fully refined scenarios and debriefing sessions, preceded by refined pre-simulation reading materials. Moreover, unlike Year 3 nursing students, Year 2 nursing students engaged with the entire intervention, consisting of two scenarios and associated debriefing sessions, rather than being confined to a single high fidelity simulation scenario followed by the debriefing session. The following subsections present an overview of the entire intervention procedure specific to the Year 2 student group exposed to the refined scenarios.

Setting. This component of the study was conducted in the Simulated Practice Centre in a patient room that was furnished with a human patient simulator.

Timing. The evaluation of the complete, refined high fidelity simulation intervention took 8 weeks, from start to finish, within the single 15-week Winter 2014 academic semester. Year 2 students had one week to read materials sent before participating in the scenarios. After that review, Year 2 students participated in the first scenario, followed by a debriefing session. Thereafter, a 5-week spacing period was instituted so that students could reflect on their high fidelity simulation experience. Following the spacing period, the students were scheduled to
complete the second scenario and the subsequent debriefing session. Refer to table 9 for an overview of the schedule for the Single-Group Post-Test component.

Pre-simulation learning content and preparation of participants

A week prior to their participation in the complete, refined high fidelity simulation scenarios, all Year 2 nursing students were emailed a modified version of the online TeamSTEPPS Mutual Support PowerPoint presentation and video (Agency for Healthcare Research and Quality, 2011). The Year 2s were sent the refined pre-simulation reading materials and didn’t get the simulation iterations as the Year 3s did. This email also contained an overview of the simulation scenarios, which included information detailing the patient’s diagnosis, past medical history, medications, and treatment interventions (see Appendix B). Other readings included background content related to proper medication administration that is, how to administer intramuscular (IM) medications and how to care for a patient with intravenous (IV) therapy (see Appendix B).

The email instructed students to read the materials and actually print them in advance of their scenario participation. A printed checklist of all materials, which indicated that the student completed each of the readings and videos was required. Students handed their signed checklist to the PI on the date of participation. The email also informed students that they would be oriented to the high fidelity simulation room a few minutes before they participated in the simulation scenario, so that they could acquaint themselves with the human patient simulator and the equipment. In addition, students were advised about their role as Year 2 nursing students in the high fidelity simulation scenario.

Outline of high fidelity simulation Scenario 1. In the first high fidelity simulation scenario, there were three roles: the human patient simulator, the Year 2 nursing students and the
confederate (a Practical Nurse educator), who played the role of a senior relief nurse. The scenario required the students to manage an 80-year-old male with the diagnosis of congestive heart failure, who was awaiting a transfer from an acute care setting to a long term-care setting (see Appendix B).

The signs, symptoms, and responses of the human patient simulator were programmed in order to achieve a clinical diagnosis of congestive heart failure. The human patient simulator simulated cardiac conditions and displayed various physical symptoms, such as an occasional unproductive cough, thready radial pulses, and slightly elevated blood pressure, through a software program connected to a vital signs monitor. The first scenario required the student to administer the patient’s medications, such as an oral diuretic, and to hang an intravenous bag. The high fidelity simulation scenario was pre-programmed into the human patient simulator and provided immediate feedback regarding the nursing interventions, such as verbal responses.

Next, a conflict event was initiated by the confederate acting as a senior relief nurse. The primary learning objective specific to this simulation scenario was that the Year 2 nursing student would demonstrate the effective use of a conflict resolution skill (the two-challenge rule) when communicating with the relief nurse in order to manage an information conflict within the scenario. The ideal conflict management learning event was envisioned as one that required the student to manage both the information conflict and safe medication administration at the same time. Thus, the learning objectives related to the high fidelity simulation scenarios in this study were cross-referenced through an examination of the course syllabi of the Year 2 Clinical and Pathophysiology courses. This was done to ensure that students had the necessary baseline clinical knowledge related to both the assessment of and care for a patient with congestive heart failure and the process of medication administration.
Participating in high fidelity simulation Scenario 1. Nursing students were expected to arrive at the Simulated Practice Centre 15 minutes before their scheduled scenario session. At this time, the Simulation Practice Centre technologist oriented students to the human patient simulator and to the simulated patient room by, for example, showing students where the medication cart and nurse call bell were. After this orientation session, the Year 2 nursing students proceeded to a conference room, where the PI briefed them, informed them about the patient’s past medical history and presenting diagnosis, and gave them an up-to-date nursing report (the report already sent by email a few days prior to their participation). In addition, the learning objectives for the scenario were reviewed with the students, as recommended by Alinier (2011). The learning objectives were not revealed in detail to the students during the pre-simulation briefing, in order to allow for an element of surprise about the scenario outcomes (Alinier, 2011). For example, the briefing explained the use of a conflict resolution skill, the two-challenge rule, as intended for improving communication and teamwork skills (Alinier, 2011). After the pre-simulation briefing, the students returned to the simulated patient room and were informed that the technologist would prompt them when the scenario began.

The first scenario was run using software-programming instructions and programmed according to the time (minutes) outcome that resulted from the refinement process. The technologist, who was the voice of the human patient simulator used a script. It identified the frequency and the nature of the verbal responses that were to be provided by the human patient simulator, either independently or in reply to the student’s questions (e.g., responses to medication treatment). In addition, the technologist’s script indicated when the confederate (relief nurse) would enter the simulation scenario and initiate the conflict management learning event with the student (see Appendix C).
Once the scenario was running, the student was required to introduce himself or herself to the human patient simulator. The student’s introduction to the human patient simulator cued the confederate playing the role of a relief nurse to enter the scenario and introduce the conflict management learning event. The student was then required to manage the conflict, which was an uncomfortable social situation with a nurse confederate arising from the provision of inaccurate information during the medication administration process. In the first high fidelity simulation scenario, the nursing student was asked to hang an IV bag (2/3 & 1/3 with 20mmol/KCL/L). The student was expected to use a conflict resolution skill (the two-challenge rule) in order to ensure compliance with an important medication administration standard. Nurses administering medication are required to check the medication administration record (MAR) and are required to check that the IV bag is the correct one for the patient under their nursing care. The student was expected to challenge the relief nurse twice after noting that there was no IV bag information on the MAR. If there were two challenges, then the confederate, acting as the relief nurse, would agree to double-check the IV order in the patient’s chart.

**Post-Scenario 1 debriefing session.** The debriefing session was conducted immediately after the participants engaged in the high fidelity simulation scenario, as recommended by Decker (2007). The debriefing session was led by a facilitator, who provided the Year 2 nursing students with the time they needed to assess their decisions, actions, communication, and ability to deal with unexpected issues that may have arisen during the simulation exercise (Decker, 2007). The facilitator and students also discussed performance gaps. The aim of the debriefing session was to help students reconstruct and build on their existing knowledge in order to form mental representations of issues through pattern recognition and cognitive inference (Wotton, Davis, Button, & Kelton, 2010). The facilitator was either the PI or a back-up facilitator, both of
whom had extensive experience as simulation facilitators and had comprehensive training specifically related to the tasks of the debriefing.

A facilitator’s overview, which outlined the high fidelity simulation scenario algorithm and the learning objectives, was developed to help guide the debriefing session. The PI and the back-up facilitator reviewed the TeamSTEPPS facilitator’s guide regarding the two-challenge rule before the simulation. The following is a list of some standard, open-ended questions that the facilitators asked during the debriefing session:

- What went well in the simulation?
- What did not go so well?
- Were you able to get through everything you planned during the medication administration process?

The facilitators also posed a specific set of questions regarding the student’s performance during the conflict management learning event, including the following:

- How do you think you handled the conflict with the senior nurse?
- What did it feel like to be a student nurse challenging a senior nurse?
- Would you do anything differently the next time in order to manage and/or resolve the conflict?

**Five-week spacing period.** After a five week spacing period, Year 2 student participants returned to engage in the second high fidelity simulation scenario involving conflict. This period is consistent with the approach of Cepeda, Pashler, Vul, Wixted, and Rohrer (2006), who found that the spacing of effects over time leads to long-term retention of learning content that is superior to retention developed through continuous or massed practice. No studies have assessed the optimal spacing of high fidelity simulation interventions that teach conflict resolution skills;
however, the spacing effect Cepeda et al. (2008) noted suggests that, as the spacing gap increases, accuracy in learning increases steeply and then declines more gradually. Thus, a balance was sought between the benefits of more spacing and the logistics of the study, which reflected competing demands for time, space, and resources. An examination of the effects of spacing is not within the scope of this research; however, it is clear that there will be opportunities for future investigations that examine spacing issues and knowledge retention.

Outline of high fidelity simulation Scenario 2. The same context (an acute care setting) and human patient simulator were used in both the first and second high fidelity simulation scenarios, with similar patient symptoms being present. However, a different conflict event (an uncomfortable social situation with a confederate during patient care) was embedded in the second high fidelity simulation scenario.

Participating in high fidelity simulation Scenario 2. As in the first scenario, the Year 2 students were expected to arrive at the Simulated Practice Centre 15 minutes before their scheduled second scenario session. At this time, the technologist briefly oriented the students to the human patient simulator and to the simulated patient room. After the orientation session, the students proceeded to a conference room and were briefed by the PI, who informed them about the patient’s past medical history and presenting diagnosis and provided an updated nursing report (the last item was emailed to the students a week earlier). A broad overview of the learning objectives for the second scenario, which were identical to those for the first scenario, was presented in the manner Alinier (2011) recommended. After the pre-simulation briefing, the Year 2 students returned to the simulated patient room, where they were informed that they would be prompted by the technologist about when the scenario began.
The second scenario was also run using software-programming instructions and programmed according to the time (minutes) outcome that resulted from the refinement process. Once the scenario was running, the student was required to administer the patient’s afternoon medication. In this scenario, the student had to question incorrect information that the senior nurse was providing to the student regarding the landmarking of an intramuscular injection. The student also had to vocalize her or his concern a second time to ensure that the senior nurse heard her or him. Because team members have the responsibility to challenge a course of action that they believe might put a patient at risk, the student’s use of the two-challenge rule to manage the conflict was appropriate. If there were two challenges, the senior nurse took corrective action and allowed the student time to review the technique for administering intramuscular injections. Once the conflict was resolved, the senior nurse left the patient’s room.

**Post-Scenario 2 debriefing session.** The outline of the debriefing session for the second high fidelity simulation scenario was identical to that of the first and targeted the same scenario outcome objectives. The only difference was that the students were asked the following additional question: “Having participated in the high fidelity simulation scenario with a conflict management learning event a second time, how do you feel about your handling of the conflict with the nurse, as compared with your handling of the first scenario?”

The conflict management events in both scenarios were staged to occur during the medication administration process. The medication administration process was chosen as the focus for both scenarios because it is a common source of errors, and presented a natural occasion whereby students could be provided with a level of information that differed from the level of a confederate, in order to successfully launch the scenario.

**Data Collection**
Objective 3: Assessing the complete, refined intervention. In order to facilitate data collection that would allow the complete, refined intervention to be evaluated, two survey instruments were administered to the Year 2 students: the Educational Practices Questionnaire (EPQ, student version) and the Satisfaction and Self-Confidence in Learning survey (SSL, student version; Jeffries & Rizzolo, 2006; see Appendix E). Year 2 students were asked to complete both these instruments following the debriefing session after the second refined high fidelity simulation scenario.

Educational Practices Questionnaire (student version). Developed by Jeffries and Rizzolo (2006), the EPQ (student version) is a 16-item instrument that uses a 5-point measurement scale. The EPQ would evaluate whether the educational practices and benefits of a high fidelity simulation educational intervention were evident to students by asking them about their overall perception of the entire refined high fidelity simulation intervention. The EPQ applies the principles of active learning, which Chickering and Gamson (1987) advocated as optimal principles in adult education. As such, the EPQ has come to enjoy a wide acceptance in the field of higher education. The application of active learning principles increases students’ confidence, which in turn promotes critical thinking and improved clinical performance (Brown & Chronister, 2009; Jeffries & Rizzolo, 2006). In the present study, the EPQ (student version) required Year 2 students to answer questions related to active learning, collaboration, diverse ways of learning, expectations, and the importance of each of these to themselves. Reliability for the EPQ has been tested using Cronbach’s alpha; the score for the presence of specific practices was found to be 0.86, while the score for the importance of specific practices was found to be 0.91 (Jeffries & Rizzolo, 2006). Therefore, the EPQ can be regarded as a reliable instrument in the context of this study.
Two Likert items were inserted into a section appended to the EPQ in order to evaluate the efficacy of the entire high fidelity simulation intervention. These items were developed by the PI, but were not tested for reliability and validity. To complete these Likert items, Year 2 students were required to rate their level of agreement with the following two statements as either (a) strongly agree, (b) agree, (c) neither agree nor disagree, (d) disagree, or (e) strongly disagree:

- “Engagement in a second high fidelity simulation scenario has made me more likely to use the conflict resolution skill I have learned as a consequence of my involvement in the first scenario.”
- “The high fidelity simulation intervention consisting of two scenarios has taught me how to manage and resolve conflict more effectively in situations where the source of conflict is incomplete or inaccurate information.”

*Satisfaction and Self-Confidence in Learning survey (student version).* In addition to the EPQ, the study required Year 2 students to complete the Satisfaction and Self-Confidence in Learning survey (student version), a standard tool. The SSL is a 13-item instrument designed to measure participant satisfaction with the simulation activity as well as self-confidence in learning (8 items), using a 5-point measurement scale. As with the EPQ instrument, reliability for the SSL has been tested using Cronbach’s alpha; the score for the satisfaction items was found to be 0.94, while the score for the self-confidence items was found to be 0.87 (Kardong-Edgren et al., 2010). Of the 13 items on the SSL, 5 items address satisfaction with the teaching materials used in the simulation, while 8 self-confidence items address participants’ feelings about their mastery of the learning content.
Objective 4: Assessing feasibility outcomes of the complete, refined intervention. To assess the feasibility and acceptability outcomes of the refined high fidelity simulation intervention from the perspective of Year 2 nursing students and facilitators, the following data were collected:

Percentage of eligible students who agree to participate. To determine the percentage of eligible Year 2 students who agreed to participate, the PI maintained a record of the number of the eligible Year 2 students who were invited to participate out of the total who agreed to participate in the study.

Attrition rate. To be able to estimate attrition, the PI maintained a record of the number of Year 2 students who withdrew from the study prior to or at any time during their participation in the entire refined intervention.

\[
\text{Attrition Rate} = 1 - \left( \frac{\text{Students Completing Scenario 2}}{\text{Students Completing Scenario 1}} \right)
\]

Students who withdrew from the study were also contacted via email and asked to participate in a brief online survey administered through SurveyMonkey (www.surveymonkey.com). The survey included a brief closed-ended question followed by two open-ended clarification questions phrased as follows:

Thank you for agreeing to participate in this short survey. Your participation will be used to help us assess our design and performance in the creation of the simulation learning intervention in which you participated. We would like to ask you three questions that should take less than five minutes to complete.

1. What was your reason for not participating in the second conflict management simulation scenario of this study?
(a) Increased academic workload

(b) Personal or family issues

(c) No longer interested in participating in this study

(d) Other______________________________________________

(please indicate your reason in the space provided above)

2. Can you describe your feelings about participating in the first conflict management scenario?

3. How could we make this high fidelity simulation intervention better in the future?

*Utilization of the two-challenge rule by Year 2 participants.* Two blind assessors viewed videotaped sessions of the second high fidelity simulation scenario in order to assess the students’ accuracy and the frequency with which the two-challenge rule was applied in the videos.

*Compliance of the facilitator with the refined simulation intervention protocols and delivery.* The facilitators completed the Compliance Data Collection Forms (see Appendix G) after each simulation session that they completed and recorded on the tick boxes whether intervention protocols were correctly followed for each participant. The facilitators also indicated the following: (a) whether the students were briefed prior to participating in the simulation scenario and (b) whether the students were debriefed after their participation in the scenario. If the tick boxes on the Compliance Forms were not checked off, the following open-ended question was posed, “Please identify the reason(s) why all the tick boxes were not checked off?”

**Data Analysis**
Objective 3: Evaluating the complete, refined intervention. The responses of Year 2 participants to the EPQ represented ordinal-level data. They were summarized using descriptive statistics such as medians, interquartile ranges, frequencies, and percentages. The responses of Year 2 participants to the SSL survey also represented ordinal-level data. They were likewise summarized using descriptive statistics such as medians, interquartile ranges, frequencies, and percentages.

Objective 4: Evaluating feasibility outcomes of the complete, refined intervention. The following methods were used to analyze the feasibility outcomes of the high fidelity simulation intervention in the post-test component of the study:

Percentage of eligible Year 2 nursing students who agree to participate. The participation rate of Year 2 students was determined by calculating the number of students who were invited and agreed to participate out of the total number eligible to participate in the single-group post-test component of the study. No more than 40 Year 2 students were permitted to participate based on a first come, first served “eligible students” basis; thus, the maximum participation rate was 40 students of the eligible population of approximately $N = 180$.

Attrition rate of Year 2 nursing students. The Year 2 students’ attrition rates were analyzed to determine the primary explanations of students who failed to complete the second scenario, in order to establish which determinants of attrition were within the control of the researcher (design features) and which were external to the design. Attrition endogenous to the design could be mitigated with design adjustments, whereas attrition exogenous to the design could not be controlled in any multiwave design. Therefore, it was important to understand how much of the attrition could be removed through intervention design improvements. The responses to choices (a) to (c) offered in the first question of the brief survey were closed-ended.
The fourth option, (d), which allowed the students to elaborate their own reason for not participating in the second simulation scenario, was open-ended. The researcher thematically coded responses to that option, and then used descriptive analysis to rank the reasons for attrition by frequency and percent. Finally, the two open-ended questions in the follow-up survey used to determine attrition rate were coded and considered as evaluations were made of the intervention.

Utilization of two-challenge rule at completion of high fidelity simulation Scenario 2.

The utilization of the two-challenge rule in the complete refined simulation intervention was analyzed using frequencies and percentages of use during high fidelity simulation Scenario 2 (see Appendix G). In a study on medical resident trainees, Pian-Smith et al. (2009) found that 72% of their sample of anesthesiology residents ($n = 40$) used the two-challenge rule during the second simulation scenario following the first debriefing session. Assuming, conservatively, that the rules of probability sampling apply when estimating population parameters (and clearly they do not, because Pian-Smith et al. [2009] used a convenience sample), we could use the proportion and sample size to build a 95% confidence interval. Then, the lower-bound estimate of that interval could be used to establish an acceptable baseline by which the effectiveness of a simulation-based two-challenge rule intervention could be evaluated. Thus, the following calculations (equations 1:1) illustrate that a conservative baseline for intervention effectiveness would be approximately 58% of participants using the two-challenge rule in simulation Scenario 2.
\[ \sigma_p = \sqrt{\frac{pq}{n}} = \sqrt{\frac{(0.72)(1 - 0.72)}{40}} = 0.0709 \]

\[ 95\% CI \quad \bar{p} \pm z_{0.025} \sigma_p \]
\[ 95\% CI \quad 0.72 \pm (1.96)(0.0709) \]

\[ UB = 85.9\% \]
\[ LB = 58.1\% \]

Compliance of the facilitator with the refined simulation intervention protocol and delivery. The PI reviewed the Compliance Data Collection Forms (see Appendix G) completed by the facilitators for each participant’s sessions on a daily basis as needed. The PI followed up with each facilitator in situations where the refined simulation intervention was not completed to any degree to track reasons for not doing so. The responses to the open-ended question on the Compliance Data Collection Forms were coded and categorized.

Table 8

Schedule for Single-Group Post-Test Evaluation of the High Fidelity Simulation Intervention by Year 2 Participants

<table>
<thead>
<tr>
<th>WEEK</th>
<th>STUDY ACTIVITIES</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Send email invites for study recruitment</td>
</tr>
<tr>
<td>3</td>
<td>Email reminder to Year 2 students</td>
</tr>
<tr>
<td>4</td>
<td>Consolidate invitations and send confirmation to participate in the study to students (single-group post-test);</td>
</tr>
<tr>
<td>5</td>
<td></td>
</tr>
</tbody>
</table>
Ethical Considerations

Approval for the study was obtained from the Research Ethics Committee of the University of Toronto and from the Research Ethics Boards of Ryerson University and George Brown College before participant recruitment and data collection commenced. Several measures were taken to protect the rights of student participants. First, students got the recruitment email invite first. Then the RA initiated the participant recruitment process by introducing the study to prospective participants during in-class presentations—the familiar environment was chosen to maximize student comfort. Then, as part of the consent process, all prospective participants were informed of the following: (a) Participation is wholly voluntary, and non-participation will have absolutely no impact on grades or academic performance; (b) Students may withdraw their
participation at any time, whether before the study commences or after; (c) The study entails minimal risk to participants’ health and well-being; and (d) All appropriate measures will be taken to protect confidentiality of participant data, such as erasing simulation video tapes after the conclusion of the study.

Next, all eligible participants who indicated to the RA their consent to participate in the study were asked to fill out consent forms once they had read all briefing materials pertinent to the study. Finally, all prospective participants were informed that data stored on paper or electronically (except videotapes to be erased) would be suitably anonymized and stored for a period of 7 years from the conclusion of the study. It is important to note that students who participated in this study benefitted from their involvement because they were exposed to a high fidelity simulation intervention for a longer time on average compared to non-participants, with consequently more opportunities to acquire conflict resolution skills.

**Feasibility for a Randomized Controlled Trial**

The following criteria were set and needed to be met in this study for a future Randomized Controlled Trial (RCT) to become feasible:

1. At least 40 of the total number of eligible Year 3 nursing students ($N = \sim 180$) had to complete refinement of one scenario or the other.

2. At least 35 of all of the eligible Year 2 nursing students ($N = \sim 180$) who agreed to participate had to complete participation and evaluation of the entire refined high fidelity simulation intervention.

3. The Principal Investigator and back-up facilitator had to carry out the refined simulation intervention as per protocol 85% of the time.
4. At least 80% \((n = 35)\) of the eligible Year 2 nursing students had to rate the quality of the entire refined intervention at 4 or higher (using a 5-point Likert scale) on the EPQ.

5. At least 80% \((n = 35)\) of the eligible Year 2 nursing students had to rate their satisfaction with the entire refined intervention at 4 or higher (using a 5-point Likert scale) on the SSL.

6. At least 58% of the Year 2 nursing participants had to utilize the two-challenge rule after the second simulation scenario experience.
CHAPTER 4: RESULTS

The results of each major component of this Phase 1 study will be reported separately, with those for the refinement component followed by those from the single-group post-test. The samples of students in the refinement and single-group post-test components were independent of each other because the study objectives for the two components differed.

Component 1: Refinement

In this section, the Year 3 student sample size, demographic characteristics, and results of the refinement process of the high fidelity simulation intervention (2 scenarios, each followed by a debriefing session) will be presented. The following study feasibility outcomes will also be provided: a) percentage of eligible Year 3 students who agreed to participate, (b) attrition rate for those who agreed to participate, (c) length of time taken to complete the two scenarios, (d) length of time taken to complete the debriefing sessions associated with the scenarios, and (e) facilitators’ compliance with the intervention protocol.

Sample Size

The email-based and classroom visit strategies that were used to recruit Year 3 nursing students eventually yielded a convenience sample of 40 who met the eligibility criteria, agreed to participate, and provided feedback that was used to refine the high fidelity simulation intervention. Half of the sample participated in refining Scenario 1 and the other half, Scenario 2. Email addresses were provided for 97 of the 120 Year 3 students at the George Brown College site, all of whom had participated in the second year of the Ryerson, George Brown, and Centennial Baccalaureate Nursing Program. Of the recruitment emails sent via SurveyMonkey to
those 97 students, 8 did not send successfully for technical reasons, and 2 additional email invitations were bounced back. Eighteen of the remaining 87 students who received the SurveyMonkey email clicked through the email link and opened it and 69 did not. Thirteen of these 18 students completed the survey; 8 of them consented to participate in the refinement and 5 declined. These 5 students who declined cited that they did not have time to participate as the refinement component was scheduled to run during the exam weeks in the Fall, 2013 semester (see Figure 5).

The classroom visit strategy turned out to be a more successful recruitment pathway. After the Research Assistant (RA) visited 10 sections of the Year 3 Community Health Nursing Practice course (n = 120), 37 students volunteered to participate and completed consent forms in class. During the RA’s presentation, students were advised that they could access the SurveyMonkey email if they required more time to think about their decision to partake in the study and that the information letter and consent form were available on the SurveyMonkey site. During the in-class visits, several students indicated that they did not recall receiving the original email invitation from SurveyMonkey. A few days after the in-class presentations, an email reminder was sent via the blackboard shell to all potential participants with a view to reaching students who may have been absent from class on the day of the presentation or who required more time to decide whether to volunteer for the study. No students signed up as a result of the follow-up reminder.

Overall, 45 students (37.5 % of those eligible) consented to participate in the study. Five of them, however, ultimately declined to participate prior to the start of the study. Reasons they stated for not participating included that student workloads were too demanding and that part-time work duties conflicted with the study scheduling times (see Figure 5). Ten out of the 40
students who participated in the refinement component of the study had to have their original assigned date and time to participate rescheduled to accommodate their availability.

Figure 5

Flow Diagram of the Refinement Sample

(a) The total eligible Year 3 population is all students who are enrolled in year three but have transferred from George Brown College (exclusively) to the Ryerson University nursing program.

(b) The contact attempts are lower than the total student population due to incomplete email lists.

(c) The total eligible population is 120, but as there were no class toll calls taken during the visits, the actual number of students present in lectures is unknown.
Demographic Characteristics of the Year 3 Nursing Students

Each of the 40 nursing students enrolled in the refinement component of the study was asked to complete the demographic questionnaire after consenting to participate one of the two simulation scenarios and a debriefing session. The demographic characteristics for the two refinement groups were comparable (see Table 10). The mean age of participants was 21.6 years of age for Scenario 1 \((SD = 3, Mdn = 21, IQR = 1)\) and 20.3 years of age for Scenario 2 \((SD = 0.5, Mdn = 20, IQR = 1)\). The majority of nursing students held a high school diploma (Scenario 1 = 75%; Scenario 2 = 85%). The language spoken at home was primarily English (Scenario 1 = 80%; Scenario 2 = 75%), and the majority of students were female (Scenario 1 = 90%; Scenario 2 = 85%).

Table 9

Descriptive Statistics for Scenario Refinement Participants across both Conflict Scenarios

<table>
<thead>
<tr>
<th>Scenario 1 (n = 20)</th>
<th>M</th>
<th>SD</th>
<th>Mdn</th>
<th>IQR</th>
<th>Mode</th>
<th>Var. Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>21.6</td>
<td>3.0</td>
<td>21.0</td>
<td>1.0</td>
<td>21</td>
<td>0.53</td>
</tr>
<tr>
<td>Education Level</td>
<td>High School</td>
<td>0.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Language at Home</td>
<td>English</td>
<td>0.20</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>Female</td>
<td>0.10</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario 2 (n = 20)</th>
<th>M</th>
<th>SD</th>
<th>Mdn</th>
<th>IQR</th>
<th>Mode</th>
<th>Var. Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>20.3</td>
<td>0.5</td>
<td>20.0</td>
<td>1.0</td>
<td>20</td>
<td>0.54</td>
</tr>
<tr>
<td>Education Level</td>
<td>High School</td>
<td>0.15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Language at Home</td>
<td>English</td>
<td>0.25</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td>Female</td>
<td>0.15</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Refinement of Scenario 1

Simulation Scenario 1 and its debriefing session were evaluated over a 5-day period from November to December 2013 with four students participating per day. After the debriefing session, students completed the Simulation Design Scale (SDS, student version) and an open-
ended question. The same process was followed a short time later with 20 different students to refine Scenario 2. An open-ended question was used to determine which features of the scenario’s design or conduct of the debriefing session were in need of adjustment, and the SDS specific features index was used to judge whether the modifications had the intended effect of improving scenario features, such as fidelity. Because separate groups of Year 3 nursing students refined the scenario each day, agreement had to occur among three of the four daily student participants to mandate a scenario design modification (maximum of two per day), with the further expectation that changes to the simulation should measurably enhance the overall scenario design features.

On Day 1 of the refinement process, the SDS specific features index mean score was 3.45 ($SD = 0.168$) based on the evaluations from the first group of students (n=4). Two themes emerged on Day 1 that led to changes resulting in the second iteration of the simulation scenario and debriefing session. The first was that the confederate, acting as the Charge Nurse, could be more aggressive verbally, for example, by informing the student in a louder voice, “I am telling you to hang the intravenous (IV) bag, what is the problem?” The second theme was that the students wanted the TeamSTEPPS PowerPoint to be converted into a landscape version from its original portrait format so that it would be easier to view the content on their computers or in the printed version. The PI reviewed the changes with the confederates prior to Day 2.

The SDS specific features mean score for Day 2 of the refinement period was 3.588 ($SD = 0.347$). At the end of Day 2, the students recommended that the confederate, acting as the Charge Nurse, should appear more non-verbally aggressive by “crossing her arms.” The students also wanted a separate card with the two-challenge rule to refer to in the debriefing session. The
confederates were informed of the two changes that resulted in the third iteration of the simulation prior to engaging with the next day’s group of students.

At the conclusion of Day 3, the SDS specific features mean score was 4.087 (SD = 0.523). Thus the Day 3 score, like the Day 2 scores, continued to improve from the previous day, and it was clear that the refinement process was improving the student evaluation of the simulation intervention. Nevertheless, there was still agreement as to what changes were required to further improve the simulation. The first of the two changes students suggested was that they wanted to be advised that they could hang the IV with another team member, as they normally were assisted by their clinical instructor in the clinical domain (i.e., they wanted more clarity about their scope of practice in the scenario). Second, they requested that a case scenario in the pre-reading package be representative of a nursing-related information conflict, because the one provided was too generic. These changes were implemented prior to Day 4 and were reviewed with the confederates.

The SDS specific features mean score was 4.450 (SD = 0.091) on Day 4. Two themes resulted in changes being made to this iteration of the simulation scenario and debriefing session. The first was that students wanted a policy book to refer to, with an IV administration guideline. Then in the briefing session before the scenario, they wanted to be informed that they would have to react to a conflict in the scenario, instead of just being told that they would have to utilize the two-challenge rule. These changes were implemented prior to running the fifth version of the scenario and were reviewed with the confederates.

On the final day of the refinement process, the SDS specific features mean score was 4.68 (SD = 0.144). This score represented the furthest move in the direction toward greater refinement from the score on Day 1. The two eligible, identified themes that led to the changes
implemented were that students wanted a more realistic Medication Administration Record and that in the debriefing session, they wanted to be provided with other examples of conflict that may occur in the clinical domain. This final, fifth version of simulation Scenario 1 and its debriefing session was the one used in the single-group post-test component of the study (see Table 11 for an overview of the changes).

Table 10

*Participant Thematic Agreement for Scenario Modifications Across Days - Scenario 1 Refinement*

<table>
<thead>
<tr>
<th>Day 1</th>
<th>Rank</th>
<th># Agreements</th>
<th>Summarized Theme</th>
<th>Adopted Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>4</td>
<td>Actor should be more aggressive verbally.</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>3</td>
<td>TeamSTEPPS PowerPoint should be landscape format.</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1</td>
<td>Request for a memory aid in debrief.</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Day 2</th>
<th>Rank</th>
<th># Agreements</th>
<th>Summarized Theme</th>
<th>Adopted Change</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>1</td>
<td>4</td>
<td>Charge nurse should use more aggressive body language.</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Wanted memory aid card in debrief.</td>
<td>Yes</td>
</tr>
<tr>
<td>3 (t)</td>
<td>1</td>
<td>1</td>
<td>Pre-learning pkg. should identify nursing conflict scenarios.</td>
<td>No</td>
</tr>
<tr>
<td>3 (t)</td>
<td>1</td>
<td>1</td>
<td>Specify scope of practice for students in the scenario.</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Day 3</th>
<th>Rank</th>
<th># Agreements</th>
<th>Summarized Theme</th>
<th>Adopted Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (t)</td>
<td>3</td>
<td></td>
<td>During briefing want to be advised they will hang IV bag.</td>
<td>Yes</td>
</tr>
<tr>
<td>1 (t)</td>
<td>3</td>
<td></td>
<td>Pre-learning pkg. should identify nursing conflict scenarios.</td>
<td>Yes</td>
</tr>
<tr>
<td>3 (t)</td>
<td>1</td>
<td></td>
<td>Requested a policy book to refer too for skills.</td>
<td>No</td>
</tr>
<tr>
<td>3 (t)</td>
<td>1</td>
<td></td>
<td>Medication sheets should be in a separate binder.</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Day 4</th>
<th>Rank</th>
<th># Agreements</th>
<th>Summarized Theme</th>
<th>Adopted Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3</td>
<td></td>
<td>Wanted to be informed of participation in conflict during brief session.</td>
<td>Yes</td>
</tr>
<tr>
<td>2</td>
<td>2</td>
<td></td>
<td>Requested a policy book to refer too for skills.</td>
<td>Yes</td>
</tr>
<tr>
<td>3 (t)</td>
<td>1</td>
<td></td>
<td>Wanted to role-pay the conflict scenario in the debriefing session.</td>
<td>No</td>
</tr>
<tr>
<td>3 (t)</td>
<td>1</td>
<td></td>
<td>Medication sheets should be in a separate binder.</td>
<td>No</td>
</tr>
<tr>
<td>3 (t)</td>
<td>1</td>
<td></td>
<td>Ensure equipment (i.e. thermometer is readily available for scenario).</td>
<td>No</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Day 5</th>
<th>Rank</th>
<th># Agreements</th>
<th>Summarized Theme</th>
<th>Adopted Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (t)</td>
<td>3</td>
<td></td>
<td>Wanted a more realistic Medication Administration Record.</td>
<td>Yes</td>
</tr>
<tr>
<td>1 (t)</td>
<td>3</td>
<td></td>
<td>Wanted more examples of clinical conflict during debrief.</td>
<td>Yes</td>
</tr>
<tr>
<td>3 (t)</td>
<td>1</td>
<td></td>
<td>Mr. Sim Man eyes closed.</td>
<td>No</td>
</tr>
<tr>
<td>3 (t)</td>
<td>1</td>
<td></td>
<td>Role-play the conflict again in the debriefing session.</td>
<td>No</td>
</tr>
</tbody>
</table>

*Note.* (t) denotes a rank ties between the number of agreements.
Refinement of Scenario 2

Simulation Scenario 2 underwent the same systematic refinement process that was used for Scenario 1 over a 5-day period in December, 2013. Emerging themes were reviewed and consequent changes were implemented daily over a 5-day period. Four students participated in each day’s session.

On Day 1 of the analogous refinement process for Scenario 2, the SDS specific features mean score was 3.738 ($SD = 0.063$). The first of two changes that were implemented in response to student participants’ feedback was that the font in the pre-learning TeamSTEPPS PowerPoint was increased to 32pt from 22pt. The second change in response to the students’ feedback was that the patient (Mr. Sim Man) create more tension in the scenario by stating, “Do you know what you are doing?” The resulting second iteration of the scenario was reviewed with confederates before the next day’s session.

The SDS specific features mean score on Day 2, which increased slightly from Day 1, was 3.913 ($SD = 0.103$). Again, two thematic responses from this day’s student participants led to changes being made to the scenario. The first was that the confederate should appear more demanding by raising his voice. The second agreed upon scenario change was that students had access to a common clinical nursing skills book such as Potter and Perry’s *Canadian Fundamentals of Nursing* (2013). Both changes were reviewed with the confederate prior to running the third iteration of the scenario.

On Day 3, the SDS specific features mean score increased to 4.075 ($SD = 0.065$). Two themes led to changes that produced the fourth iteration of this simulation scenario. Participants requested that the intramuscular injection of vitamin B12, which was not familiar to them, be changed to iron IM (as they had administered this in the clinical domain). They also suggested
that the confederate, acting as the senior nurse, should administer the intramuscular injection regardless of whether the student challenged successfully. The consequent changes were reviewed with the confederates before the next session.

The SDS specific features mean score on Day 4 was 4.175 ($SD = 0.155$). The changes recommended for that day were (a) to have the confederate put more verbal pressure on the student to “hurry up” and (b) to have the confederate start challenging the student at the patient’s bedside and eventually to move away from the patient’s vicinity prior to a potential second challenge from the student. The PI updated the confederate regarding the changes to the script in the fifth iteration of the scenario.

The SDS specific features mean score of 4.750 ($SD = 0.158$) on the final Day 5 of the refinement process represented an increase of 1.01 from the mean score of 3.74 on Day 1. The first of two themes identified from student feedback was to separate the two-challenge rule on the pre-reading TeamSTEPPS PowerPoint, which would help students comprehend that the rule involved a two-step process. The second thematic suggestion was that more examples of information conflict should be provided in the debriefing session besides the one that occurred in the scenario. The changes that were implemented in response to the students’ feedback resulted in the final iteration of Scenario 2 and its debriefing session, which was the one, utilized with the Year 2 students in the single-group post-test component of the Phase 1 Trial (see Table 12).
Table 11

*Participant Thematic Agreement for Scenario Modifications Across Days - Scenario 2 Refinement*

<table>
<thead>
<tr>
<th>Day</th>
<th>Rank</th>
<th># Agreements</th>
<th>Summarized Theme</th>
<th>Adopted Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Day 1</td>
<td>1 (t)</td>
<td>3</td>
<td>Increase TeamStepps pre-reading powerpoint to 32pt from 22pt.</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>1 (t)</td>
<td>3</td>
<td>Mr. Sim Man should question “Have you given a needle before?”</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>3 (t)</td>
<td>1</td>
<td>Confederate should be more verbally demanding with the student.</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>3 (t)</td>
<td>1</td>
<td>Access to a policy book regarding IM injection.</td>
<td>No</td>
</tr>
<tr>
<td>Day 2</td>
<td>1</td>
<td>3</td>
<td>Confederate should be more verbally demanding with the student.</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Wanted access to a Fundamental Clinical Skills textbook.</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>3 (t)</td>
<td>1</td>
<td>Change IM injection to one commonly administered in clinical.</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>3 (t)</td>
<td>1</td>
<td>If student does challenge, allow to demonstrate the skill.</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>3 (t)</td>
<td>1</td>
<td>Elaborate on other types of conflict in the debriefing session.</td>
<td>No</td>
</tr>
<tr>
<td>Day 3</td>
<td>1</td>
<td>3</td>
<td>Confederate administers the IM even if student does not challenge.</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Change IM injection to iron IM versus Vitamin B12.</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>3</td>
<td>1</td>
<td>Confederate should pressure the student to complete the IM.</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>1</td>
<td>Two challenge rule- a two step process, separate in pre-reading.</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>1</td>
<td>If student challenges or not, allow to demonstrate the skill.</td>
<td>No</td>
</tr>
<tr>
<td>Day 4</td>
<td>1</td>
<td>3</td>
<td>Confederate moves away from the patient area if student challenges.</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>2</td>
<td>2</td>
<td>Confederate should put pressure on the student to hurry up.</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>3 (t)</td>
<td>1</td>
<td>Mr. Sim Man places pressure on the student; is impatient.</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>3 (t)</td>
<td>1</td>
<td>If student does challenge, allow to demonstrate the skill.</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>3 (t)</td>
<td>1</td>
<td>Medication administration record, requires patient hospital ID</td>
<td>No</td>
</tr>
<tr>
<td>Day 5</td>
<td>1 (t)</td>
<td>2</td>
<td>Separate two-challenge rule in pre-reading package slides.</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>1 (t)</td>
<td>2</td>
<td>Provide more examples of conflict in debriefing session.</td>
<td>Yes</td>
</tr>
<tr>
<td></td>
<td>3 (t)</td>
<td>1</td>
<td>If students does challenge, allow student to demonstrate IM mapping.</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>3 (t)</td>
<td>1</td>
<td>Have a family member present.</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>3 (t)</td>
<td>1</td>
<td>Teach an assertive communication skill in debriefing session.</td>
<td>No</td>
</tr>
<tr>
<td></td>
<td>3 (t)</td>
<td>1</td>
<td>Students should go through entire process of head to toe assessment.</td>
<td>No</td>
</tr>
</tbody>
</table>

Note. (t) denotes a rank tie between the number of agreements.
In summary, 40 Year 3 nursing students participated in the refinement of Scenarios 1 and 2 (and their associated debriefing session). Table 13 and figure 6 presents the means and standard deviations of the SDS (student version) from Day 1 to Day 5 of the two refinement periods. The SDS mean scores increased steadily over the 5-day refinement period, which suggested a progression toward a better quality scenario. For scenario 1, the SDS score after the first 4 students went through the scenario was 3.45. These scores increased to 3.588 on day 2, 4.087 on day 3, 4.45 on day 4, and 4.675 on day 5. Similarly, scenario 2 increased from a low of 3.738 on day 1, to 3.913 on day 2, 4.075 on day 3, 4.175 on day 4, and at the end of day 5, the average SDS score was 4.75. This trend can also be seen graphically in Figure 6. Therefore, there was a clear and consistent improvement of the scenarios, relative to the evaluative metric suggested by the Simulation Design Scale, that persisted across scenarios and days as the scenarios were systematically refined.

Table 12

<table>
<thead>
<tr>
<th>Day</th>
<th>Scenario 1</th>
<th></th>
<th>Scenario 2</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>M</td>
<td>SD</td>
<td>M</td>
<td>SD</td>
</tr>
<tr>
<td>Day 1</td>
<td>3.450</td>
<td>0.168</td>
<td>3.738</td>
<td>0.063</td>
</tr>
<tr>
<td>Day 2</td>
<td>3.588</td>
<td>0.347</td>
<td>3.913</td>
<td>0.103</td>
</tr>
<tr>
<td>Day 3</td>
<td>4.087</td>
<td>0.523</td>
<td>4.075</td>
<td>0.065</td>
</tr>
<tr>
<td>Day 4</td>
<td>4.450</td>
<td>0.091</td>
<td>4.175</td>
<td>0.155</td>
</tr>
<tr>
<td>Day 5</td>
<td>4.675</td>
<td>0.144</td>
<td>4.750</td>
<td>0.158</td>
</tr>
<tr>
<td>n</td>
<td>20</td>
<td>20</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Feasibility Outcomes of the Scenario Refinement Process

The second main objective of the refinement component of the study was to assess the following feasibility outcomes of the refinement process for participating Year 3 students and facilitators: (a) percentage of eligible Year 3 students who agreed to participate, (b) attrition rate for those who agreed to participate, (c) length of time taken to complete the two high fidelity simulation scenarios, (d) length of time taken to complete the debriefing sessions associated with the scenarios, and (e) facilitators’ compliance with the intervention protocol. The rate of participation of eligible Year 3 students was 56% (45 out of 79). The 5 students who withdrew from the study before the refinement process began represented an attrition rate of...
1.12%. The participants who withdrew were contacted with a follow-up closed-ended question used to determine their reasons for not completing the refinement process. Three students cited conflicts with their academic workloads, that is, they had numerous papers to write and had to study for the approaching exam week. The remaining 2 participants who withdrew said that they had to work extra shifts in their part-time jobs.

The facilitators, who also conducted the debriefing sessions, observed the length of time that it took each participating student to complete one of the two scenarios. There were 20 observations for the variable time (in minutes) for each scenario over the separate one-week refinement periods. For Scenario 1, each student participant spent a mean length of time of 15.1 minutes ($SD = 3.3$), median 15 minutes, ranging from 13.5 minutes to 18 minutes (IQR =4.5 minutes). During the refinement of Scenario 2, each student spent a mean length of time of 13.8 minutes ($SD = 2.15$), median 14.5 minutes, ranging from 12 minutes to 15 minutes (IQR=6 minutes). See Table 11 for details.

The facilitators also recorded the amount of time it took to complete each debriefing session for the two scenarios in the Compliance Data Collection Forms. On average, each student who participated in the debriefing following Scenario 1 spent a mean length of time of 26.3 minutes ($SD = 4$), median 26.5 minutes, ranging from 25 minutes to 30 minutes (IQR= 5 minutes). For the debriefing session that followed Scenario 2, each participant spent, on average, a mean length of time of 28.9 minutes ($SD = 3.4$), median 30 minutes, ranging from 25 minutes to 32 minutes (IQR= 7 minutes). See Tables 14 and 15 for details.
Table 13  
SIMCON Study - Refinement Time to Complete HFS Scenario Refinement

<table>
<thead>
<tr>
<th>Component</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>15.1</td>
<td>13.8</td>
</tr>
<tr>
<td>SD</td>
<td>3.3</td>
<td>2.15</td>
</tr>
<tr>
<td>Low</td>
<td>8</td>
<td>10</td>
</tr>
<tr>
<td>Q₁</td>
<td>13.5</td>
<td>12</td>
</tr>
<tr>
<td>Q₂ (MDN)</td>
<td>15</td>
<td>14.5</td>
</tr>
<tr>
<td>Q₃</td>
<td>18</td>
<td>15</td>
</tr>
<tr>
<td>High</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>IQR</td>
<td>4.5 Mins</td>
<td>6 Mins</td>
</tr>
</tbody>
</table>

Note. Cell entries are in minutes.

Table 14  
SIMCON Study - Refinement Time to Complete Scenario Debriefs

<table>
<thead>
<tr>
<th>Component</th>
<th>Scenario Debrief</th>
<th>Scenario 1</th>
<th>Scenario 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>26.3</td>
<td>28.9</td>
<td></td>
</tr>
<tr>
<td>SD</td>
<td>4.0</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>Low</td>
<td>16</td>
<td>22</td>
<td></td>
</tr>
<tr>
<td>Q₁</td>
<td>25</td>
<td>25</td>
<td></td>
</tr>
<tr>
<td>Q₂ (MDN)</td>
<td>26.5</td>
<td>30</td>
<td></td>
</tr>
<tr>
<td>Q₃</td>
<td>30</td>
<td>32</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td>30</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>IQR</td>
<td>5 Mins</td>
<td>7 Mins</td>
<td></td>
</tr>
</tbody>
</table>

Note. Cell entries are in minutes.

The facilitators’ compliance with the refinement protocol and delivery was noted in the Compliance Data Collection Form, which each facilitator filled out after each completed simulation of the scenarios. The facilitators indicated their responses in tick boxes labelled “yes” or “no” opposite to each of the following items:
• Technology issues with the Human Patient Simulator (HPS)

• Absent confederate (actor)

• Absent technologist

• A Year 3 student became upset after the simulation intervention experience and was referred to student counselling

• A Year 3 student complained about her or his research experience to the research ethics board/committee

Where the boxes were not ticked off, the following open-ended question was posed:

“Please identify the reason(s) why all the tick boxes were not checked off?” For the refinement period of Scenario 1, the facilitator was present for 100% of the days of the refinement period (5 out of 5 days), and the technician 60% (3 out of 5 days). On the days where the technician was not present, the PI filled in as the technician (2 out of 5 days). Although the PI had had a previous relationship with one of the students (as a professor) in the previous year, the only contact with this student was to provide a brief orientation to the simulation room and mannequin. The actor was present 100% of the days during the refinement of scenario 1.

During the second refinement, the facilitator, who was sick one day, participated 80% (4 out of 5 days). On the day the facilitator was sick, the PI filled in as the facilitator. The PI, therefore, had to conduct the session, but had no previous relationship with the students in the academic context. The actor was present 60% (3 out of 5 days) thus, the back-up actor participated in the second refinement period 40% (2 of the 5 days).
Component 2: Single-Group Post-Test

In this section, the Year 2 student sample size, demographic characteristics, and results of the Educational Practices Questionnaire (EPQ) and the Student Satisfaction and Self-Confidence in Learning (SSL) survey will be presented. The following study feasibility and acceptability outcomes will also be provided: (a) percentage of eligible year 2 students who agreed to participate, (b) attrition rate, (c) utilization of the two-challenge rule after students’ participation in the second high fidelity simulation scenario, and (d) facilitators’ compliance with the refined simulation intervention protocols and delivery.

Sample Size

For the email-based part of the recruitment strategy, addresses were provided for all of the 196 Year 2 nursing students enrolled in the George Brown Nursing Program. All of the recruitment emails were sent successfully via Survey Monkey; none bounced back. Of the 196 students, 84 clicked open the Survey Monkey link, and 112 did not respond. In total, 39 students consented online, 8 students declined participation, and 37 students initiated the consent process on Survey Monkey but did not complete it (see Figure 7).

For the in-class recruitment strategy, the Research Assistant (RA) for this study visited all four sections of the Nursing Theory course that all Year 2 students are required to take. In Sections A and B, 12 students were recruited and returned consent forms to the RA. Similarly, 13 students were recruited and consented from sections C and D to yield a total of 25 students from this recruitment approach. The RA discovered, however, that 2 of the 12 students from Sections A and B who consented to participate in the study had already done so via Survey Monkey, as had 3 of the 13 students from Sections C and D. Therefore, the in-class recruitment strategy actually yielded a total of 20 additional participants. A few days after the in-class
presentations, the RA sent an email reminder via the blackboard shell to all potential year 2 students with a view to reaching those who may have been absent from class on the day of the presentation or who required more time to decide whether to volunteer for the study. No students signed up as a result of the follow-up reminder.

Figure 7

Flow Diagram of the Single-Group Post-Test Sample

Figure 7. Flow diagram of the post-test sample. The total eligible Year 2 population for online and in-classroom recruitment was all students who were enrolled in the second year in the George Brown College nursing program, but as there were no class roll calls taken, the actual number of students present in lectures was unknown.

Overall, 59 (30.1%) of the 196 eligible students consented to participate in the single-group post-test study. As a result of an email sent to each of them to arrange a time for them to participate in the first simulation scenario, 30 students were successfully scheduled. After a second email reminder was sent to the remaining 29 students, 10 additional students were
booked successfully to make up a total convenience sample of 40 students. The final remaining 19 students who responded could not be scheduled for the following reasons: (a) conflicting work schedules and academic courses (7 students); (b) students responded late - after the 40 spots scheduled for the intervention convenience sample were already filled (7 students); and (c) students did not respond (5 students). A total of 40 students participated in the Scenario 1 of the post-test component of the study (see Figure 7), which was run in the simulation laboratory from February 14 through March 5, 2014.

Scheduling for the second scenario began on February 16, while students were participating in the first scenario. All students scheduled to participate in Scenario 1 were contacted individually via email to arrange their participation in Scenario 2, which ran from March 17 through April 4, 2014. Fifteen of them immediately responded and were scheduled to participate in the second scenario. After a reminder email was sent on March 4, to the remaining 25 unscheduled students, an additional 16 were successfully scheduled to participate in Scenario 2. In response to a second reminder email sent March 12 to the remaining 9 students, 4 additional students were scheduled. A final total of 35 students participated in Scenario 2. The circumstances of the 5 who were not successfully scheduled will be briefly discussed in the following section.

**Demographic Characteristics of the Year 2 Nursing Students**

Demographic data from the 40 Year 2 students in the single-group post-test component of the study were collected before they engaged in the first scenario and debriefing session. The mean age of students participating in Scenario 1 was 22.7 years ($SD = 5$, $Mdn = 21$, $IQR = 2$), with a minimum age of 20 years to a maximum of 41 years; 90% had a high school diploma; 92.5% were female; and 67.5% spoke English as a first language. After the data from the 5
students who did not participate in Scenario 2 was removed, the mean age of those who did participate rose to 23 years ($SD = 5.3$, $Mdn = 21$, $IQR = 2$), with a minimum age of 20 years to a maximum of 41 years; 88.6% had a high school diploma; 91.4% were female; and 74.3% spoke English as a first language (see Table 16). It is worth noting that the 5 students who did not participate in the second simulation scenario and debriefing session had the following characteristics: (a) none had attended college prior to attending George Brown, (b) all were female, (c) all were 21 years of age or younger, and (d) 4 out of the 5 spoke a language other than English or French at home.

Table 15

**Descriptive Statistics for Intervention Participants across both Conflict Scenarios**

<table>
<thead>
<tr>
<th>Scenario 1 (n=40)</th>
<th>M</th>
<th>SD</th>
<th>Mdn</th>
<th>IQR</th>
<th>Mode</th>
<th>Var. Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>22.7</td>
<td>5.0</td>
<td>21.0</td>
<td>2.0</td>
<td>20</td>
<td>0.53</td>
</tr>
<tr>
<td>Education Level</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Language at Home</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Scenario 2 (n=35)</th>
<th>M</th>
<th>SD</th>
<th>Mdn</th>
<th>IQR</th>
<th>Mode</th>
<th>Var. Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>23.0</td>
<td>5.3</td>
<td>21.0</td>
<td>2.0</td>
<td>20</td>
<td>0.54</td>
</tr>
<tr>
<td>Education Level</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Language at Home</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Single-Group Post-Test: Evaluating the Complete, Refined Intervention**

**Educational Practices Questionnaire.** The 35 students (87.5% of the original 40) who participated in scenarios 1 and 2 and debriefing sessions completed the student version of the Educational Practices Questionnaire (EPQ, Jeffries & Rizzolo, 2006) afterwards. In general, the student scoring of the EPQ components was high, with all components averaging better than 4.2 on a 5 point scale. The total averaged EPQ mean score was 4.42 ($SD = 0.45$, $Mdn = 4.57$, $IQR =$
Examining the individual components reveals some differences; the highest mean score was for the High Expectations component (M = 4.66, SD = 0.58), whereas the lowest mean score was for the Diverse Ways of Learning component (M = 4.21, SD = 0.84), with the active learning component occupying a middle ground (M = 4.42, SD = 0.51). Refer to Table 17 for an overview of the averaged mean scores across all the EPQ’s categories of items and also Figure 8, a histogram of the student based rating of the EPQ. It can be seen in the histogram that the distribution is very much clustered towards the upper end of the scale.

Table 16

*Mean Educational Practices scores*

<table>
<thead>
<tr>
<th>Component</th>
<th>M</th>
<th>SD</th>
<th>Mdn</th>
<th>IQR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active Learning</td>
<td>4.42</td>
<td>0.51</td>
<td>4.60</td>
<td>0.80</td>
</tr>
<tr>
<td>Diverse Ways of Learning</td>
<td>4.21</td>
<td>0.84</td>
<td>4.00</td>
<td>1.00</td>
</tr>
<tr>
<td>High Expectations</td>
<td>4.66</td>
<td>0.58</td>
<td>5.00</td>
<td>0.50</td>
</tr>
<tr>
<td>Total EPQ</td>
<td>4.42</td>
<td>0.45</td>
<td>4.57</td>
<td>0.64</td>
</tr>
</tbody>
</table>
Participants’ satisfaction and self-confidence in learning. The same 35 students also completed the student version of the Satisfaction and Self-Confidence in Learning survey (SSL) after they participated in the second simulation scenario and debriefing session. Overall, the majority of year 2 students reported being self-confident after participating in the entire refined simulation intervention with an overall mean score of 4.21 ($SD = 0.84$). Students also felt satisfied overall with their learning in the simulation ($M = 4.42$, $SD = 0.51$). The total mean score of the SLL was 4.66 ($SD = 0.58$). Refer to Table 18 for an overview of the averaged mean scores across all the SSL’s categories of items and also in Figure 9 which is a histogram of the student based rating of the SSL. The histogram shows that like the EPQ, the SSL is very concentrated on the upper end of the 5 point scale.
Table 18

*Mean SSL Scores*

*Mean Satisfaction and Self-Confidence in Learning (SSL)*

*Scores in each of the SSL Components (n=35)*

<table>
<thead>
<tr>
<th>Component</th>
<th>$M$</th>
<th>SD</th>
<th>$Mdn$</th>
<th>IQR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Satisfaction</td>
<td>4.42</td>
<td>0.51</td>
<td>4.60</td>
<td>0.80</td>
</tr>
<tr>
<td>Self-confidence</td>
<td>4.21</td>
<td>0.84</td>
<td>4.00</td>
<td>1.00</td>
</tr>
<tr>
<td>Total SSL Scale</td>
<td>4.66</td>
<td>0.58</td>
<td>5.00</td>
<td>0.50</td>
</tr>
</tbody>
</table>

Figure 9

*Histogram of Total SSL Scale*

Feasibility Outcomes of the Complete, Refined Intervention

Percentage of eligible students who agreed to participate. Of the 196 eligible Year 2 students invited to partake in the study, 40 students both agreed to participate and were successfully scheduled to participate in the first high fidelity simulation scenario of the
intervention. This result represented a percentage rate of 20.4% of the total eligible year 2 student population.

**Attrition rate.** Five of the 40 students dropped out of the study after they participated in Scenario 1 (followed by the debriefing session). The numerical attrition rate for the study between scenarios was 12.5%.

Structured follow-up questions were designed to capture the feelings about participation in the simulation intervention for those who dropped out. Three questions (one closed-ended and two open-ended) were emailed to the 5 students who dropped out of the study after participating just in Scenario1. Three of them replied (60% response rate).

In response to the first open ended question, students indicated that reasons for not participating in the second conflict management simulation scenario related to the following; (a) increased academic workloads (n=2) and (b) personal or family issues (n=1). In response to the second open-ended question that asked students to describe their feelings about participating in the first simulation scenario, they indicated that it helped them feel that they could be more assertive in addressing future information conflict in practice with a team member. Additional things they liked about the participation were the following: (1) “It calmed me down, and made me think before handling a conflict situation,” and (2) “It gave me the opportunity to learn and practice a conflict resolution communication skill.”

The student observations about the third open-ended question that asked them how we could improve the high fidelity simulation intervention in the future included the following: (1) To provide more available times to participate in the study during the day rather than in the evening, and (2) The second simulation scenario occurred too late in the semester, when their
academic workloads increased because of writing papers and taking tests. Overall, the students’ responses revealed that some of the determinants of attrition were within the researcher’s control (design features, e.g., booking more simulation sessions during the day vs. the evening, and timing of intervention within the winter semester because the simulation labs were in use).

**Utilization of the two-challenge rule.** Utilization of the two-challenge rule. An assessor and the Principal Investigator (PI) separately viewed the videotaped sessions of the second high fidelity simulation scenario in order to assess the accuracy and the frequency with which the year 2 students applied the two-challenge rule. The assessor was a nursing faculty member trained in simulation who had no previous teaching relationship with the participating students. Students utilized the rule correctly if the first challenge was in the form of a question and started with “I” and the second challenge provided a rationale for the concern, which had to be stated in terms of a patient safety issue. The assessor and the PI both viewed the first five videos collaboratively to estimate intercoder reliability. After viewing the first five videos the PI and the assessor compared observations on whether they felt that the student used the two-challenge rule correctly. They agreed that the student did or did not use the rule in 3 out of the 5 videos, (60% agreement). The PI and assessor discussed the findings and decided that if the student challenged the confederate in the form of a question without using an “I” statement, that this form of challenge was to be coded as an unacceptable challenge. After this initial meeting, intercoder reliability for the remaining 30 student participant videos was 100%. Out of the 35 nursing students who completed the second scenario, 26 (62.5 %) challenged the confederate in that scenario. Nine (37.5%) students did not challenge the confederate during the second scenario (see Table16).
Table 19

<table>
<thead>
<tr>
<th>Use of Two Challenge Rule</th>
<th>n</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Used Two-Challenge Rule</td>
<td>26</td>
<td>74.3</td>
</tr>
<tr>
<td>Did not use Two-Challenge Rule</td>
<td>9</td>
<td>25.7</td>
</tr>
</tbody>
</table>

Facilitators’ compliance with protocols and delivery. The simulation facilitators completed the Compliance Data Collection Form (see Appendix G) after each simulation and recorded on the tick boxes whether the intervention protocols were correctly followed for each student participant in Scenario 1 ($n = 40$) and Scenario 2 ($n = 35$). If the tick boxes on the form were not checked off, an open-ended question was posed to track reasons for not doing so. The responses to the Compliance Data Collection Form were coded and revealed that the following factors affected non-compliance: (a) absent facilitators, (b) absent technicians, and (c) absent actors. For Scenario 1, the facilitators were absent 3 times out of 40 simulation sessions (7.5%), the technicians 2 times out of 40 simulation sessions (5%) and the actor 2 times out of 40 simulation sessions (5%).

For Scenario 2, the facilitators were absent 2 times out of 35 simulation sessions (7.5%), the technicians 3 times out of 35 simulation sessions (5.7%), and the actor 3 times out of 35 sessions (8.6%). Absences were related to sick calls or having to attend to family emergencies. The absent personnel (technologist and facilitator) were replaced with the PI, and the absent actor was replaced with a back-up actor. The PI facilitated and conducted the debriefing sessions with students after ensuring that she had not had a previous teaching relationship with them. The PI also covered the role of the technician when he was absent. There was one back-up actor at all times to ensure coverage.
Feasibility for a Randomized Controlled Trial

The following criteria were met in this study for a Randomized Controlled Trial (RCT) to become feasible:

(1) Acceptability and feasibility of the study intervention:

(a) Forty of the total number of eligible Year 3 nursing students \((N = \sim 120)\) participated in the refinement component of the high fidelity simulation intervention.

(b) Thirty-five of the eligible Year 2 nursing students \((N = \sim 180)\) participated and evaluated the entire refined high fidelity simulation intervention.

(c) The Principal Investigator and facilitator carried out the refined simulation intervention as per protocol (including personnel replacement as anticipated) 100% of the time.

(d) Of the \(n = 35\) eligible Year 2 nursing students, 31 students (or 88.7%) rated the quality of the entire refined intervention at 4 or higher (averaged across all 16 items of the EPQ which uses five-point Likert scale questions) on the Educational Practices Questionnaire.

(e) Of the \(n = 35\) eligible Year 2 nursing students, 29 students (82.9%) rated their satisfaction with the entire refined intervention at 4 or higher (using five-point Likert scale questions averaged across 13 items) on the Satisfaction and Self-Confidence in Learning scale. Of the \(n = 35\) eligible Year 2 nursing students, 82.9% rated their satisfaction with the entire refined intervention at 4 or higher (using a five-point Likert Scale) on the Satisfaction and Self-Confidence in Learning scale.

(f) The student participants utilized the two-challenge rule after the second simulation scenario experience 74.3% (26 out of the 35 student
CHAPTER 5: DISCUSSION

This chapter builds on the results chapter by considering the strengths and limitations of the Phase 1 study, which included the refinement and the single-group post-test components. In addition, each research objective will be discussed individually in relation to the relevant literature. Where applicable, the Medical Research Council (MRC) framework and Kolb’s Experiential Learning Theory (KELT) will provide context from which to analyze the study results.

Overview of Strengths and Limitations of Refinement and Single-Group Post-Test

Strengths

This is the first study to evaluate the application of a systematic refinement strategy (an algorithm with corresponding decision rules) in the “dry run” phase of a high fidelity simulation intervention. The refinement strategy successfully optimized the design of the two high fidelity simulation scenarios (each followed by a debriefing session), as well as the training of confederates, facilitators, and the simulation technician. Moreover, the refined high fidelity simulation intervention was successful in achieving what it was intended to do, that is, have the Year 2 nursing students learn and then use the conflict resolution skill.

The reliability and validity of the instruments utilized in the refinement and single-group post-test components contributed to the study’s strengths. The Simulation Design Scale (SDS), the Educational Practices Questionnaire (EPQ), and the Satisfaction and Self-Confidence in Learning questionnaire (SSL) had been previously validated in studies of a similar population of undergraduate nursing students (Butler et al., 2009; Jeffries & Rizzolo 2006; Sittner et al., 2009). Additionally, the open-ended question that was appended to the SDS provided rich thematic description regarding the changes implemented to the high fidelity simulation intervention that the quantitative measure, the SDS, could not capture. Likewise, the two Likert items appended to
the EPQ yielded additional information that the EPQ could not capture. Overall, the nursing students rated their level of agreement as strongly agree in the two Likert items appended to the EPQ. While the appended items were not validated in this current study, their inclusion allowed the evaluation of some of the unique theoretical propositions of this high fidelity simulation intervention.

A critical strength of this study was that using KELT provided a way of structuring and sequencing the refined high fidelity simulation intervention’s design and implementation in the single-group post-test phase. Furthermore, relying on KELT also enhanced the overall study for several other reasons: (a) it ensured that a range of teaching approaches were used, for example, Year 2 students were provided with a pre-learning package regarding conflict management and resolution and they participated in two high fidelity simulations with a conflict management learning event; (b) it made explicit the importance of encouraging students to reflect on their performance; (c) it allowed for constructive feedback to be provided during the debriefing sessions in order to reinforce student learning; and (d) by having students engage in a second high fidelity simulation scenario, it provided the opportunity for them to practice the conflict resolution skill a second time.

Several design features contributed to the rigor of this study. First, the Research Assistant (RA) collected the completed and coded questionnaires in a sealed envelope from the Year 2 and Year 3 nursing students. The nursing students were isolated from others when they completed the questionnaires. Second, the Principal Investigator (PI) kept track of the open-ended written feedback provided by the Year 3 students during the refinement phase on a daily basis. This feedback was entered into a journal which was systematically assessed for codes and categories. Third, the PI and another faculty member reviewed the open-ended responses for accuracy and
came to a consensus regarding the analysis of the descriptive categories that contributed to the refinement of the high fidelity simulation intervention. Additionally, during the single-group post-test component, neither the PI nor the facilitator who reviewed the second high fidelity simulation scenario video had a teaching relationship with the Year 2 nursing students; thus, they could be objective raters of the students’ use of the two-challenge rule. To determine interrater reliability, the assessors examined the first 5 out of the 35 videos of the Year 2 nursing students’ use of the rule. After the assessors noted that they differed in their approach to scoring the two-challenge rule, they clarified the scoring approach. Then they evaluated the remaining 30 students and achieved 100% intercoder reliability.

The approaches implemented to ensure consistency in the delivery of the intervention during the refinement and single-group post-test components also strengthened the study. The PI held a 2-hour workshop with the faculty who facilitated the debriefing sessions, the simulation technologists, and the actors in advance of the refinement phase to review the paper version (iteration 0) of the two high fidelity simulation scenarios, the debriefing objectives, and the confederate scripts. The PI met daily with the faculty, simulation technologists, and actors to review the changes applied to the simulation intervention as suggested by the Year 3 students during the 2-week refinement periods. Before the single-group post-test phase of the intervention began, a 2-hour training session was held with the participating faculty, simulation technologists, and actors to review the final changes as well as participate in a dry run of the entire refined high fidelity simulation intervention.

Another strength was that the PI monitored the compliance of the facilitators with the simulation intervention protocol and reviewed the Compliance Data Collection Forms on a daily basis. The PI was also available throughout the duration of the study to provide extra support,
such as taking over the technologist’s role when there was a sick call. The strategies the PI employed were effective, feasible, and produced a more rigorous study by preventing incidences of non-compliance with the study protocol. Therefore, the high fidelity simulation intervention was implemented as intended.

A strong point of the study was that the Year 2 and Year 3 nursing students who dropped out of the study were contacted via email and asked to participate in a brief online survey administered through SurveyMonkey in order to explore the reasons for not completing the study. This step provided qualitative feedback that was used to comprehend the factors contributing to the student attrition rates.

Although the Year 2 and Year 3 nursing students represented a convenience sample, they were diverse in regard to ethnicity, which reflected the heterogeneous student population at this metropolitan college. Furthermore, the Year 3 nursing students understood where the Year 2 students were coming from in relation to the Year 2 curriculum and could envision what they might experience in the clinical practice domain. Thus they could provide realistic feedback during the refinement phase of the high fidelity simulation intervention.

**Limitations**

This study had several limitations. One was that the refinement and single-group post-test components were conducted in a single academic institution. Therefore, the ability to generalize the results beyond this organization is limited. A second challenge was the timing of the simulation intervention’s sessions. Students who consented to participate in the refinement component were scheduled for simulation scenarios commencing weeks 11 to 13 of the Fall 2013 academic semester; however, weeks 13 and 14 were exam weeks. Of the 45 students who consented to participate in the refinement phase, 5 students dropped out of the study, citing
increased workloads related to writing final papers and preparing for exams. Five of the 40 Year 2 students participating in the single-group post-test phase did not return to participate in the second high fidelity simulation scenario, which occurred just before midterm exams in the Winter 2014 semester. The majority of the students cited increased academic workloads and personal issues/challenges as the rationales for not returning.

Another drawback of the refinement component was that the Year 3 students had been out of clinical practice for several months, and were in community placements during the Fall 2013 academic semester. When the Year 3 students participated in the simulation scenarios, they were task-oriented rather than interpersonally oriented because they focused on technical skills, such as setting up an intravenous bag and mapping the intramuscular injection. As a result, the PI had to utilize the video recordings more than normally required during the debriefing session in order for students to review and reflect on the interpersonal aspects of the simulation so that they could provide adequate suggestions regarding refining the two high fidelity simulation scenarios (each followed by a debriefing session). In addition, the Year 3 students had to commute from the collaborative university site, where they attended nursing courses, and at times, they arrived late for their scheduled simulation sessions.

Several confounding variables were that the Year 3 nursing students were purposely booking times on the same day as their colleagues who were participating in the refinement component of the study and were discovered to be discussing the simulation scenarios in the staging area prior to participating in the simulation. The results of the refinement process, such as the written feedback from the open-ended question, may have been more varied if the students had been monitored more rigorously in the staging area and been prevented from sharing their
ideas. Consequently, the Year 3 student discussions may have masked the summative results of the mean scores of the SDS over the two separate one-week refinement periods.

**Study Objective 1: Assessing the Simulation Scenario Refinement Process through the Simulation Design Scale and the Open-ended Question**

The goal of the refinement process was to optimize and evaluate the components of the complex high fidelity simulation intervention (two scenarios, each followed by a debriefing session). The Medical Research Council framework (MRC, 2000, 2008) describes complex interventions as those that have multiple components, which interact to produce one or more outcomes. Best practice is to develop interventions systematically using the best evidence, an appropriate theory, then testing the intervention using a phased approach, through development and feasibility testing stages. The MRC framework provided an ideal approach to model and test the intervention and evaluate the multiple outcomes produced, such as the quality of the simulation intervention, student satisfaction with the intervention, student self-confidence after participating in the simulation, and ultimately the learning outcome, the use of a conflict mitigation strategy, that is, the two-challenge rule. Using the MRC framework addresses a research gap, as simulation interventions are typically not developed in a programmatic way. Maturation of the scientific discipline in simulation research is required in order to avoid poorly designed high fidelity simulation interventions that may lead to theoretical ambiguities and lack methodological transparency.

Designing, refining, and evaluating a complex intervention thus requires a phased approach in order to examine feasibility issues related to implementation (Haji, Da Silva, Daigle & Dubrowski, 2014; MRC, 2000, 2008). The MRC framework’s (2000, 2008) Phase 1 (development phase), which is divided into a theory and evidence identification and a modeling
sub-phase, guided the design and refinement of the intervention. In the theory and evidence identification sub-phase, the following elements were incorporated into the high fidelity simulation intervention’s design:

- the identification of a learning theory to ground the simulation intervention (KELT);
- a review of the Years 1 and 2 undergraduate nursing curriculum in order to identify where conflict resolution training in the program occurred for the target group of Year 2 nursing students;
- the inclusion of best practice standards related to simulation pedagogy;
- the inclusion and adaptation of the evidenced-based TeamSTEPPS curriculum; and
- the inclusion of evidenced-based practice guidelines related to caring for a patient with congestive heart failure.

In accordance with the MRC framework’s (2000, 2008) modeling sub-phase, the high fidelity simulation intervention’s components were mapped according to KELT and were then linked to the learning outcome, that is, the effective use of the two-challenge rule. The MRC framework’s Phase 1 informed the initial design of the high fidelity simulation intervention in a paper format, which was referred to as iteration 0.

Then a refinement strategy (an algorithm with corresponding decision rules) was applied to the high fidelity simulation intervention with the Year 3 students in the Simulation Practice Lab in order to understand its’ design features and possible effects, as well as to identify areas for further improvement through the use of the SDS and an open-ended question. The refinement process for the high fidelity simulation intervention resulted in an increase in the mean scores of the SDS (student version) by the ends of the two separate 5-day refinement periods. For Scenario
1, the SDS mean score after the first four students went through the scenario was 3.45. The scores increased to 4.68 on Day 5. Similarly, the scores for Scenario 2 increased from a low mean of 3.74 on Day 1 to 4.75 at the end of Day 5. Therefore, there was a clear and consistent improvement of the scenarios, relative to the evaluative metric suggested by the SDS, that persisted across scenarios and days as the scenarios were systematically refined. The refinement process also resulted in daily thematic changes being made to each of the high fidelity simulation scenarios and debriefing sessions.

The earlier review of the simulation research conducted for the current study revealed that the refinement of high fidelity simulation interventions do not appear to follow a formulaic and systematic approach. Yet, it is important to systematically refine high fidelity simulation interventions in order to gauge how easy or difficult they are to implement and to indicate any inconsistencies. Refining a simulation intervention determines the flow of the activities and the timing, so that there is an understanding of how students move through and progress over the events in that high fidelity simulation scenario. Moreover, there is a need to comprehend if the appropriate instructions are provided for students regarding their assigned roles and pre-learning activities, and if the objectives of the simulation are clearly articulated. Refining the debriefing session ensures that the learning objectives are clear. Ultimately, the final goal of a refinement process is to produce high fidelity simulation scenarios and debriefing sessions that can be delivered in a uniform fashion from student to student and/or from student group to student group.

Currently, few processes exist, other than self-report feedback provided by students through the SDS, to assess the design features of simulations that are usually administered after their participation in a simulation. Furthermore, in several research studies, it was unclear
whether the high fidelity simulation interventions had undergone a refinement period or whether
the favourable scores observed from the SDS at one measurement point had been preceded by a
dry run process (Butler et al., 2009; Jeffries & Rizzolo 2006; Sittner et al., 2009). An articulated
systematic refinement process is lacking, and Jeffries et al. (2006), who developed the SDS, did
not explicitly elaborate on one. In the current study, the SDS was used distinctively as an
evaluation tool in order to assess the high fidelity simulation intervention, in addition to the
appended open-ended question, over two separate 5-day refinement periods.

As stated earlier, research studies in nursing and medical education have advocated for
the use of conceptual frameworks to guide simulation design and refinement, the referral to best
practice standards in simulation pedagogy, the incorporation of evidenced-based guidelines in
simulation scenario development, and collaboration with subject matter experts, but none of
these studies developed or described a specific process for simulation scenario refinement.
Waxman (2010) identified the necessity for a testing phase for simulations once they had been
validated, but failed to elaborate on the refinement process. More recently, the Royal College of
Physicians and Surgeons of Canada (Vancouver conference, 2013) identified a six-step model
for simulation design and refinement that specifically enumerated scenario refinement as the last
step, but also failed to identify what such an approach would entail.

Best practice standards in simulation pedagogy and best practice guidelines have also
been used as a foundation for high fidelity simulation intervention development. In particular, a
list of best practice simulation standards has been generated from Issenberg, McGaghie, Petrusa,
Gordan, and Scalese’s (2004) systematic review. Their review highlighted 10 elements that
contribute to effective simulation design and learning, such as providing student feedback,
capturing clinical variation, and repetitive practice; however, a refinement element, as a best
practice standard, was not indicated. Additionally, numerous studies have commonly cited the inclusion of instructional design elements, such as the use of best practice guidelines and content experts (Adler, Trainor, Siddall, & McGaghie, 2007; Tun et al., 2012) to inform high fidelity simulation intervention design, but it is not clear if these simulation interventions underwent a systematic refinement process before they were implemented with the learners.

Current literature about simulation intervention design has highlighted pragmatic problems with development and refinement that, if addressed, could go a long way toward hastening its evolution. Simulation education interventions may be complex and have numerous components interacting in order to produce the intended learning outcomes. Research studies to date have provided insight about the development of simulation scenarios, however, information about refining simulations in advance of implementing them with learners, as well as evaluating their effectiveness, remains limited. Until methodological questions regarding simulation refinement are addressed, the evidence to determine its judicious and optimal use in order to improve learners’ performance remains ambiguous. In short, while there have been many scholars who recognize the importance of a refinement process, none so far has developed or advocated for a process that systematically reconciles the high fidelity simulation intervention’s design with a refinement phase. To be effective, any complex simulation intervention requires a precise configuration of its components in order to optimize it and to achieve best results related to the design elements.

The refinement process described in this study can be used to improve the reporting of high fidelity simulation interventions in enough detail to describe what was done and changed prior to implementing it with students and evaluating its effectiveness in relation to learning outcomes. More broadly, this refinement process can also be used as a foundation to optimize
other simulation interventions that focus on learning outcomes beyond interpersonal communication, such as clinical judgement and critical thinking. Additionally, this refinement approach can be adapted to other inter-sectoral disciplines. For example, in computer science it can be applied to the early design stages of serious games simulation interventions, in order to identify common pitfalls and development elements that require modification and/or additions. Moreover, tools such as the Questionnaire for User Inter-action Satisfaction, like the SDS used in this current study, could be used concurrently with the systematic refinement strategy (an algorithm with corresponding decision rules), along with an appended open-ended question, as an evaluation measure in order to assess the serious games intervention over two separate 5-day refinement periods. Furthermore, using the MRC framework in developing simulation interventions supports a systematic design reasoning process. By nature, high fidelity simulations are complex; thus, efforts to define an intervention, model it, and test it for feasibility and acceptability outcomes are important to ensure it works prior to moving to an RCT design. There is a need, therefore, to create more high fidelity simulation interventions with particular attention paid to the learner’s perceptions and application of learning in Phase 1 studies.

**Study Objective 2: Assessing Feasibility Outcomes of the Refinement Process**

The three major feasibility-related outcomes of the refinement component were (a) the Year 3 students’ participation and attrition rates, (b) the final timing of the simulation scenarios and debriefing sessions, and (c) the facilitators’ compliance with the refinement research protocol.

Having Year 3 nursing students participate in this study was significant for two main reasons. First, the Year 3 students had gained clinical and teamwork experience in the hospital setting in their previous academic year. These students also had the theoretical knowledge and
practice base to participate in this Year 2 level high fidelity simulation intervention in order to provide feedback regarding it.

Despite the PI’s extensive preliminary planning to evaluate the eligible Year 3 students, unforeseen recruitment and retention obstacles occurred and valuable lessons were learned. Although the numbers of students recruited per class visit were not tracked in this study, the RA’s classroom visits proved to be a more effective recruitment strategy than the use of the SurveyMonkey invitation. Therefore, the practicalities of relying solely on Internet recruitment through vehicles such as SurveyMonkey warrant further investigation. Studies of response rates for Internet recruitment, for example, in Internet-based questionnaires and survey studies, revealed mixed results (Hamilton & Bowers, 2006) The dropout rates from Internet-based questionnaires and survey studies revealed variables that impacted on recruitment, such as the complexity of informed consent procedures, the presence or absence of financial incentives, and asking personal questions (O’Neil, Penrod, & Bornstein, 2003). More studies are required that examine the effects of the variables that impact recruitment using Internet approaches such as SurveyMonkey.

Other logistical issues that affected the attrition rate were the timing of when the students participated in the scenarios (too close to exam times, etc.) and transportation problems. These issues may impact the design of future simulation intervention studies at this site. It would be more feasible to recruit in-class, as well as to schedule simulation sessions throughout the semester, rather than to book numerous simulation sessions prior to exam week. Moreover, scheduling simulation sessions later in the evening may be more beneficial and provide extra time for those students who commute from the collaborative university site.
The time needed to effectively complete the scenarios in the refinement component was feasible. According to the research literature, the length of a simulation scenario depends on how long it takes to meet the learning objectives, decision points, and skills required for its completion (Alinier, 2011; Arthur, Levett-Jones, & Kable, 2013; Waxman, 2010). On average, high fidelity simulation scenarios usually last 20 minutes (Waxman, 2010). The mean time to complete the scenarios in the current study was calculated and compared across daily iterations of the refinement process. For Scenario 1, each student spent a mean length of time of 15.1 minutes. During the refinement of Scenario 2, each student spent a mean length of time of 13.8 minutes.

The debriefing sessions were a critical component of the simulation intervention. The aim of the debriefing session was to reconstruct real-time representations of students’ interactions and to advance students’ knowledge in order to help them form a heuristic notion of clinical problems and interpersonal interactions through pattern recognition and cognitive thinking (Wooten et al., 2010). Thus, adequate timing was required to facilitate the debriefing session.

In an integrative review, Neil and Wotton (2011) illuminated some interesting findings related to the amount of time that should be allotted to the debriefing session. Their review revealed that the debriefing session should be two to three times longer than the simulation scenario itself. Moreover, they indicated that a 10-minute debrief is not sufficient in order to allow students the opportunity to reflect. Presently, however, there is no suggested optimal time to debrief. The final length of time to debrief in this study is in keeping with Neil and Wotton’s findings, as the debriefing sessions took approximately two times longer than the simulation scenarios. Each student who participated in the debriefing following Scenario 1 spent a mean length of time of 26.3 minutes. For the debriefing session that followed Scenario 2, each
participant spent a mean length of time of 28.9 minutes. The debriefing time was adequate for the purposes of meeting the scenario’s learning objectives. As with the scenarios in the refinement component, the final timing for the debriefing sessions was feasible. Therefore, the simulation scenarios and debriefing sessions were booked in the Simulation Practice Center schedule for the Winter 2014 semester in order to accommodate the single-group post-test component of the study.

The facilitators in this study used the good judgment conversational technique and a video-assisted approach during the debriefing sessions with students. In a systematic review of the effect of video-facilitated instructor debriefing, Leevett-Jones and Lapkin (2013) suggested that video replay enhances debriefing. However, Leevett-Jones and Lapkin have also indicated that it may distract students from focusing on the learning objectives. Moreover, the use of video-enhanced debriefing has not been shown to produce an improvement in learning outcomes. In the refinement component of the current study, video-enhanced debriefing was successful because it helped the Year 3 students consider their performance, especially the interpersonal interaction with the more senior nurse. When they could not recall details, such as when they were speaking to the nurse, they could review parts of the video. This allowed them to reflect on the nurse’s behaviours, such as her body posture, voice intonation, and position in the room, so that the student could provide feedback regarding the realism of the nurse’s attempt to portray high power behaviours.

Neil and Wotton (2011) also examined the impact of structured or unstructured debriefings on learning outcomes. Their supposition was that a structured approach, such as the Outcome Present State Test (OPT) may be optimal. However, further research is required to examine the dynamics of debriefing approaches and their impact on student learning outcomes.
In this study, the good judgement conversational technique and the video-assisted approach were used in the debriefings in order to cover the scenario’s objectives. The good judgement conversational technique is not considered to be a structured debriefing approach such as OPT. Nonetheless, the students appeared to be engaged, and they provided rich feedback regarding modifications that should be made to the simulation intervention.

The PI monitored intervention compliance on a daily basis by attending the study site and checking in with the faculty who facilitated the debriefing sessions. As well, the PI updated the Administration Data Forms to keep track of such issues as the technological ones that affected the human patient simulator’s functioning, as well as absent actors and technologists. The aim, which was to ensure 100% compliance with the high fidelity simulation intervention protocol, was met. In the simulation literature in the healthcare domain, it is not clear whether systematic compliance checks are being utilized (Butler et al., 2009; Jeffries & Rizzolo 2006; Sittner et al., 2009). The implications of monitoring compliance with the refinement process are that all students received the simulation intervention as intended. The compliance checks provided insight into what worked and did not, and validated that it is important to plan to have enough human resources support, such as simulation technologists and actors, as well as to check in daily to ensure compliance.

A key contribution of this study was that the refinement process (an algorithm with corresponding decision rules) used in conjunction with the SDS and an appended open-ended question, was successful in optimizing the high fidelity simulation intervention, as indicated by an increase in the SDS scores over the two separate 5-day refinement periods. Considering the complexities of high fidelity simulation intervention design, the refinement strategy may be useful in improving the design process. There are divergent approaches to the design of
simulation interventions; moreover, a uniform refinement strategy has not been clearly operationalized in the simulation research literature. The feasibility-related issues that occurred in the refinement component of this study regarded recruitment via SurveyMonkey, the timing of simulation scenarios and debriefing sessions, and transportation problems for students. Compliance of facilitators was important to examine because it ensured that the high fidelity simulation intervention was delivered as intended and implemented in the same manner from student to student. In the following section, I build on the discussion of the refinement component of the study and examine the findings from the single-group post-test phase, in which I tested the entire, refined simulation intervention with the target group of Year 2 nursing students.

**Study Objective 3: Evaluating the Complete, Refined Intervention**

The significance of using KELT to map and implement the refined high fidelity simulation intervention will be analyzed in this section. The main research outcome of the single-group post-test component, the use of the two-challenge rule by the target group of Year 2 nursing students, will also be discussed in light of the broader research findings related to teaching nursing students conflict resolution skills, and to the implications related to patient safety. Finally, results of the students’ use of the EPQ and SSL to evaluate the intervention will be analyzed.

**Use of KELT to Inform the Single-Group Post-Test Component**

Kolb’s Experiential Learning Theory (KELT) provided the critical foundation for the design and implementation of the entire, refined high fidelity simulation intervention during the study’s single-group post-test phase. The theory offered a conceptual way of structuring and sequencing the intervention according to KELT’s four stages of concrete experience, reflection,
abstract conceptualization, and active experimentation (Kolb, 1984). The concrete experience phase of the KELT cycle involved Year 2 nursing students participating in the two high fidelity simulation scenarios (each followed by a debriefing session). Each scenario was designed so that the Year 2 nursing students would encounter a conflict management learning event where they would have to speak their mind to a more senior nurse who was challenging them, as well as get their message out in a clear manner. The high fidelity simulation scenario conformed to Kolb’s concrete stage and allowed the students to experience a conflict when working with a more senior staff nurse in a simulated clinical environment that mimicked a realistic hospital setting.

The reflective observation stage of the KELT cycle took place during the debriefing sessions, which were conducted immediately after each high fidelity simulation scenario. The sessions gave students the opportunity to critically reflect on their actions and think abstractly using logic and reason to assess their skill in intervening professionally to challenge the senior nurse about an information conflict that would have impacted patient care and safety. These sessions also allowed students to link theoretical concepts regarding conflict management learned from their pre-reading and lectures to the high fidelity simulation laboratory experience. During the sessions, the Year 2 students developed insight into their nonverbal and verbal interactions with the more senior nurse. The majority of Year 2 students noted that during the first simulation scenario, they had low nonverbal power behaviours, such as not making eye contact with the senior nurse, clenching their hands, and speaking in a lower voice when attempting to challenge the senior nurse regarding their concern about patient safety. These behaviours changed during the second high fidelity simulation scenario. The reflective observation stage was effective in getting the students to think about their nonverbal actions and their conflict resolution communication skills. At the end of the first debriefing session, all Year
2 nursing students could summarize what they would do differently if they ever participated again in a similar simulation scenario or what they would do differently from now on in a real clinical situation.

The abstract conceptualization phase of the KELT cycle was incorporated into the design of the debriefing sessions and came into play when the facilitator helped to shape the students’ reflections so that they could have insight into the nonverbal actions and conflict resolution communication skills they used during the simulations. The questions the facilitator posed affected students’ thinking about how they might change their performance through active experimentation during the second simulation scenario.

The active experimentation stage of the KELT cycle provided in the second high fidelity simulation scenario gave the Year 2 students the opportunity to practice a second time in communicating with another senior nurse. They could also improve their nonverbal body language in the scenario, for example, by making eye contact with the senior nurse during the conflict situation, as well as by improving their posture by standing upright with their shoulders back and facing the nurse instead of clenching their hands or fiddling with their pen. Moreover, they practiced using the two-challenge rule skill a second time with a nurse who portrayed hierarchal, nonverbal behaviours. The Year 2 nursing students had to challenge the senior nurse twice in each of the two scenarios in order to get their message across in a clear manner and to advocate for safe patient care. Thus, the first scenario represented the initial concrete learning experience and the second scenario facilitated active experimentation, thereby completing the KELT cycle.

One benefit of having used KELT as a foundation to implement the refined intervention was that the theory describes learning as a continual process, whereby knowledge is created by
transforming the concrete experience into the students’ existing cognitive frameworks, thus changing the manner in which students think and behave. Research has suggested that student learning and retention are enhanced as more learning stages are used (Stice, 1987). This finding supports Kolb’s (1984) argument, and by extension the theory’s use in the current study that students should be encouraged to engage in all four stages of the learning cycle because of the educational consequences.

The use of a theory to guide the development of high fidelity simulation interventions has pedagogical implications because such interventions are complex by design and thus require a deep understanding of their educational effects. The previous literature has shown that the use of a theory in simulation intervention development has been problematic, even though it is often included as a key component. When addressing the issue, both Kaakinen and Arwood (2009) and Rourke et al. (2010) concluded that the lack of a theoretical perspective made it difficult to determine students’ learning processes and outcomes in simulation interventions. Kaakinen and Arwood found that simulation has been viewed more commonly as a teaching modality than as a learning one, while Rourke et al. observed that only 10% of the studies they identified made adequate use of theory in simulation intervention development. When a theory was employed, both reviews (Kaakinen & Arwood, 2009; Rourke et al., 2010) indicated that KELT was the most frequently utilized one. The implications of these systematic reviews are that further investigation of the use of theory in the design, implementation, and evaluation of simulation interventions is warranted, with a view to defining and improving learner outcomes. The current study has addressed this gap in knowledge about using a theory as a foundation for the design and implementation of a high fidelity simulation intervention. The simulation intervention was successful because a majority (74.3%) of the Year 2 nursing students utilized the conflict
resolution skill, the two-challenge rule, when they participated in the second high fidelity simulation scenario.

**Use of the EPQ and SSL to evaluate the refined intervention**

The Year 2 nursing students evaluated the entire refined high fidelity simulation intervention, and completed the SSL (Jeffries & Rizzolo, 2006) and the EPQ, at the end of the debriefing session that followed their participation in the second high fidelity simulation scenario. In keeping with previous research studies in which these measures were used to evaluate high fidelity simulation interventions, the majority of nursing students were satisfied with and self-confident about their performance after participating in the refined intervention (Abo & Ravert, 2006; Bearnson & Wiker, 2005; Bremner et al. 2006; Feingold, Calauce, & Kallen, 2004; Henrichs et al., 2002; Jeffries & Rizzolo, 2006; LeFlore et al. 2007; McCausland et al. 2004). The quality of the simulation intervention, as evidenced in the EPQ scores, was rated as high. The EPQ is guided by the principles of active learning, which Chickering and Gamson (1987) advocated as optimal principles in adult education. The application of active learning principles increases students’ confidence, which in turn promotes critical thinking and improved clinical performance (Brown & Chronister, 2009; Jeffries & Rizzolo, 2006). Two Likert items, whose content was not covered in the EPQ, were also appended to the EPQ in order to evaluate the entire high fidelity simulation intervention. Results from the two appended items, in which students reported that they would most likely use the two-challenge rule they learned in their subsequent clinical practice, confirmed the efficacy of using a high fidelity simulation intervention to teach this conflict resolution skill.
**Study Objective 4: Assessing Feasibility Outcomes of the Complete, Refined Intervention**

The three key feasibility-related outcomes that emerged from the study’s single-group post-test component, some of which corresponded to similar outcomes of the refinement process, concerned (a) participation and attrition rates of the Year 2 nursing students, (b) Year 2 students’ utilization of the two-challenge rule and (c) the facilitators’ compliance with the refinement research protocol.

As with the refinement component of the study, an important factor that made recruitment for this single-group post-test phase particularly challenging was that the Year 2 students also preferred the in-class presentation versus the SurveyMonkey approach. They indicated that they thought the Survey Monkey email was SPAM email, and that the information letter was too lengthy to read. The reasons that Year 2 students gave for dropping out of the study included, as with the Year 3 students, increased academic workload just prior to exams, and personal and/or family issues. Based on the student feedback, an implication is that the simulation sessions should also have been timed differently within the semester for the Year 2 students. Nonetheless, several strategies were implemented for the single-group post-test component in order to help minimize attrition as well as during the refinement component. A distinctive written acronym “SIMCON Study” was used on the recruitment posters, the study signs on the Simulation Practice Center, and on all email reminder communications with the nursing students who consented to partake in the study. As well, substantial efforts were made to ensure that research participation was convenient and pleasurable. For example, the study took place at the college where all classes occurred for the Year 2 nursing students, and a gift certificate was provided to students who participated in the study. According to previous research, attempts to reduce attrition in studies are not always successful; however, minimizing
participant attrition through the use of effective retention and tracking strategies may help (Ribisl et al., 1996). The attrition rate in this study was low and did not affect the quality of the results in the single-group post-test phase.

The results of the single-group post-test demonstrated that 74.3% of the Year 2 nursing students used the two-challenge rule after participating in the second high fidelity simulation scenario. This study’s outcomes also support the evidence from Pian-Smith et al.’s (2009) study that conflict resolution skills can be effectively taught. The refined high fidelity simulation environment, with the human patient simulator (HPS), the actor portraying a senior nurse, and its contextual realism, recreated a real-life clinical context into which a conflict management learning event was introduced. In it, the Year 2 nursing students were faced with the challenge of having to communicate their concerns with a senior nurse in order to provide safe patient care. Thus, they were able learn to use the two -challenge rule in an experiential way that did not put real patient safety at risk.

As was done during the study’s refinement component, the PI monitored the Compliance Data Collection Forms after each simulation scenario and debriefing session during the single-group post-test component. Once again, this approach garnered 100% compliance with the intervention protocol and ensured that all students received the entire simulation intervention as intended. Besides contributing to the feasibility and effectiveness of implementing the intervention, the compliance checks in the post-test component provided further insight into logistical issues comparable to those in the refinement component, such as sick calls, and reconfirmed the importance of having enough human resources support, such as simulation technologists and actors, to cover contingencies.
Chapter Summary

In sum, a number of conclusions can be drawn from this discussion. First, there is no research evidence of a systematic refinement process having been applied to high fidelity simulation interventions, despite the existence of valid and reliable evaluation tools, such as the SDS. It is also not evident in numerous studies whether the SDS results were the product of a refinement strategy that was not articulated, as it generally has been used only at one point in time, after students participate in a high fidelity simulation intervention (Butler et al., 2009; Jeffries & Rizzolo 2006; Sittner et al., 2009). The open-ended question appended to the SDS in this study allowed for the provision of richer qualitative responses that the SDS cannot capture. The high fidelity simulation discipline would benefit from a well-constructed and uniform approach to intervention refinement testing so that authentic, reliable, high fidelity simulations are developed before implementation with the targeted learners. The fact that the SDS scores in this study increased over the two separate refinement periods (5 days each) indicated that the refinement strategy used was effective. The strategy developed for this study could be applied to a variety of research and educational settings and constitutes one effective approach to testing high fidelity simulation interventions quantitatively and qualitatively, prior to implementing them with students.

Second, the results from this study’s single-group post-test phase also showed that the majority of the Year 2 nursing students utilized the two-challenge rule during the second high fidelity simulation scenario, indicating that the high fidelity simulation intervention’s educational objective was achieved. Moreover, an established theory, in this case KELT, provided the foundation in which to ground and implement the entire refined high fidelity simulation intervention in order to ensure that the Year 2 nursing students’ learning outcome was met.
Designing simulation interventions like the one in the current study may offer an effective approach to help students learn not only conflict resolution skills, but also skills in other areas, such as critical thinking, medical error management, and patient safety. High fidelity simulation interventions provide the means for exploring vulnerabilities in healthcare delivery and for using that information to improve the competency of learners, the systems of care, and the interface between the two (Ziv, Wolpe, Small, & Glick, 2003).
CHAPTER 6: SUMMARY, IMPLICATIONS, AND CONCLUSION

In this chapter, I conclude this dissertation by summarizing the key findings from this Phase 1 study and the study’s contributions to knowledge in the fields of high fidelity simulation pedagogy and conflict management training. Then I more broadly explore the empirical and theoretical implications of the study’s findings for conducting a randomized controlled trial (RCT) and for other future research in nursing education, and nursing practice.

Study Summary

Exposure to interpersonal conflict within nursing practice occurs as soon as undergraduate nursing students begin their first placement in the clinical environment. Nursing students often experience communication and interpersonal problems with preceptors and nurses, which can lead to conflict if left unchecked and thus impact patient safety (Lewis, 1986; Myrick & Barrett, 1994). Moreover, research has also suggested that when conflict occurs, rather than actively engage in a conflict resolution process, students tend to “grin and bear it” (Mamchur & Myrick, 2003, p. 194). Medication administration errors among undergraduate nursing students have also been attributed to unresolved conflict (Reid-Searl et al., 2008, 2009). High fidelity simulation presents a method of teaching conflict resolution skills to nursing students without putting patients at risk of harm. Many nursing programs have incorporated high fidelity simulation activities into their curricula (Ontario Ministry of Health and Long-Term Care, 2005) to help students learn to think critically about scenarios that could occur in the clinical setting and to work safely and effectively in healthcare teams. Nevertheless, few studies have focused on nursing education interventions that aim to reduce conflict and achieve resolution (Seren & Ustun, 2008), and few studies have specifically examined conflict training with a high fidelity simulation learning approach (Calhoun et al., 2014; Pian-Smith et al., 2009; Sawyer et al., 2013).
Since practicing conflict resolution in front of patients may put them at high risk, the best way to ethically replicate a conflict management learning event may be to teach these skills in the relative safety of a high fidelity simulation approach.

The purpose of this Phase 1 study was to assess key methodological issues in order to determine whether a high fidelity simulation intervention informed by Kolb’s Experiential Learning Theory (KELT) was feasible to conduct, and if it was effective in teaching Year 2 nursing students a conflict resolution skill. The objectives of the study were to (a) provide preliminary data about the refinement process of a high fidelity simulation intervention (two scenarios, each followed by a debriefing session) from the perspective of participating Year 3 nursing students; (b) test the acceptability and feasibility of the refined high fidelity simulation intervention from the perspective of participating Year 2 nursing students; and (c) determine the percentage of Year 2 nursing students in the single-group post-test who used the two-challenge rule of conflict resolution during the second high fidelity simulation scenario.

This single-site Phase 1 study encompassed a refinement phase and a single-group post-test component. The refinement phase of the study was conducted with Year 3 undergraduate nursing students in order to test and improve the design elements of the high fidelity simulation intervention. Forty of the total number of eligible Year 3 nursing students (N = ~120) participated in the refinement component of the high fidelity simulation intervention. The results of the refinement process revealed significant improvements to the simulation intervention (2 scenarios, each followed by a debriefing session). The Simulation Design Scale (SDS) scores and open ended responses also highlighted the daily thematic changes made to each of the high fidelity simulation intervention over each of the 5-day refinement periods.
In particular, during the 5-day refinement period for Scenario 1, the SDS specific features index mean score reached a high of 4.86 (SD= 0.14) on Day 5 in contrast to a score of 3.45 (SD= 0.17) on Day 1. Simulation Scenario 2 also underwent the same systematic refinement process that was implemented with Scenario 1. During the fifth day of Scenario 2’s refinement period, the SDS specific mean score of 4.75 (SD=0.16) represented a mean score increase of 1.01 from the score on Day 1. These results clearly showed that the refinement strategy works. The Principal Investigator and facilitators carried out the refinement as per protocol (including personnel replacement as anticipated) 100% of the time.

The single-group post-test component of the study was conducted to evaluate the feasibility and acceptability of the entire refined simulation intervention with Year 2 undergraduate nursing students, and to assess whether they were more disposed to use the two-challenge rule during the second simulation scenario. Thirty-five of the eligible Year 2 nursing students (N = ~180) participated and evaluated the entire, refined high fidelity simulation intervention. Of those, 31 students (88.7%) rated the quality of the entire refined simulation intervention at 4 or higher (averaged across all 16 items of the Educational Practices Questionnaire [EPQ], which uses five-point Likert scale questions). Twenty-nine (82.9%) of the Year 2 nursing students rated their satisfaction with the entire refined intervention at 4 or higher (using five-point Likert scale questions averaged across 13 items) on the Satisfaction and Self-Confidence in Learning scale. Of those Year 2 nursing student who participated, 74.3% (26 out of 35 students) utilized the two-challenge rule after the second simulation scenario experience, which represents a good result. The Principal Investigator and facilitator carried out the refined simulation intervention as per protocol (including personnel replacement as anticipated) 100% of the time.
Implications for Research

Conducting a Future RCT

The research outcomes generated by this study support the feasibility of conducting a future RCT comparing this refined high fidelity simulation intervention to a lower fidelity simulation intervention. Therefore, the next step will be to conduct a multisite RCT in the collaborative baccalaureate nursing program (a partnership between a university and two community colleges) in which the Phase 1 study was held. The RCT will evaluate whether teaching a conflict resolution skill in a high fidelity simulation modality is more effective than teaching it using a low fidelity approach (i.e., classroom with a didactic presentation and a role-play activity). Specifically, the primary aim of the RCT will be to examine the following research question, “Are Year 2 undergraduate nursing students who are taught the two-challenge rule in a high fidelity simulation modality more likely to use the rule than similar nursing students taught the same skill through a low fidelity approach (conventional classroom approach involving a didactic presentation and a role-play activity)?”

First the intervention group will participate in Scenario 1 (and its following debriefing session) of the refined high fidelity simulation intervention, whereas the control group will participate in the low fidelity approach. Then the intervention and control groups will return after a spacing period of 4–5 weeks to participate in the second refined high fidelity simulation scenario and debriefing session. The primary outcome measure for the intervention and control groups would be Year 2 nursing students’ utilization of the two-challenge rule, measured after participation in the second refined high fidelity simulation scenario. The RCT-related research outcomes are aligned with the Collaborative Baccalaureate Nursing Program’s goals, which
include the advancement of knowledge related to simulation-based education, patient safety, and teamwork. Moreover, the drive to improve patient safety are key educational and clinical priorities of global significance in the healthcare domain (Donaldson & Philip, 2004).

Conducting an RCT as the next step is justified because this high fidelity simulation intervention places emphasis on teaching a conflict resolution communication skill that can be used to address information errors related to the medication administration process with a view to ensuring patient safety.

Prior to conducting the RCT, however, a few issues regarding recruitment strategies and the timing of the intervention must be addressed to strengthen the methodology used. Because the results of the Phase 1 study indicated that the Year 2 students preferred the in-class approach to recruitment over the SurveyMonkey method, Year 2 students will be recruited into the RCT through an in-class approach in order to improve enrolment rates. The other problematic logistical issue in the Phase 1 study concerned the timing in which the simulation intervention was implemented. The Year 2 nursing students’ feedback indicated that implementing a simulation intervention prior to the exam weeks in a 15-week semester was not ideal. It may be more practical, therefore, to conduct the future RCT over two academic semesters rather than one in order to space out the scenarios in the simulation intervention well in advance of the final exam weeks.

**Other Future Research**

This Phase 1 study provides an example of how the Medical Research Council (2000, 2008) framework can be applied in the design and refinement phase of a complex high fidelity simulation intervention. Complex interventions encompass a number of components that may act both dependently and independently. Consequently, it is important to design, explicitly outline,
and refine high fidelity simulation interventions so that they can be replicated. Although the relevance of adapting interventions to an MRC framework has been emphasized by others, such as those in the public health discipline (Grocott, Browne & Cowley, 2000; Hardeman et al., 2005; Murchie, Hannaford, Wyke, Nicolson & Campell, 2007; Paul, Smith, Whitford, O’Kelly & O’Dowd, 2007), there are no examples of this having been done in the case of high fidelity simulation intervention design and refinement. The components of high fidelity simulation interventions are often addressed in simulation research but are poorly defined and theorized.

A systematic refinement process has not been applied to high fidelity simulation interventions. Yet this step is necessary in conducting the dry run of high fidelity simulations in order to evaluate their design elements and ensure that they are implemented in a uniform fashion from student to student. A future study may test if a refined versus an unrefined simulation intervention produces the same student learning outcomes. Furthermore, a research study may be conducted to determine if student interaction and group think in the waiting room prior to engaging in a high fidelity simulation provides better refinement outcomes. Future studies will also need to consider those simulation contexts in which resources are inadequate to refine simulation interventions over the 5-day period that was feasible for this study. In such cases, it may be more practical to revise the refinement strategy to cover a 3-day period.

Additionally, a longitudinal study following up with the Year 2 nursing students who participated in this simulation intervention may provide insight into whether the students in subsequent Years 3 and 4 utilize the two-challenge rule, and whether they experience conflict in the clinical setting. Lastly the findings of this study re-emphasize the importance of using an established theoretical foundation to guide the design and implementation of simulation interventions. According to evidence in two recent systematic reviews, the use of theory in
simulation intervention development has not been adequate (Kaakinen & Arwood, 2009; Rourke et al., 2010). Therefore, it can be difficult to gauge the extent to which theory is contributing to our understanding of simulation interventions and learning outcomes. More research is required about the effects of using theory in the development and implementation of high fidelity simulation interventions.

**Implications for Nursing Education**

High fidelity simulation interventions have been developed for and implemented in the curriculum at schools of nursing. At present in undergraduate nursing programs, and more broadly according to health professions simulation research, high fidelity simulation interventions do not appear to undergo a systematic refinement process (Butler et al., 2009; Jeffries & Rizzolo 2006; Sittner et al., 2009). Typically, dry runs of high fidelity simulation scenarios are conducted with nursing faculty over a few hours, and/or changes to the simulation interventions are made on the fly, for example, when nursing students complain about errors of perception during the scenario. As a result, nursing students are not getting a consistent experience from student to student or group to group. The lack of a systematic refinement process for simulation interventions has implications for students because what they experience in the context of high fidelity simulations will likely remain in their minds. Therefore, there is a risk of a miseducative experience for them when errors in simulation design go unacknowledged or uncorrected (Dunnington, 2013). These errors or omissions may become the reality that nursing students perceive to be correct and later transfer to the clinical setting (Dunnington, 2013). Applying a systematic refinement strategy to simulation interventions supports simulation pedagogical development and contributes to the efficacy of teaching and learning by promoting optimal learning outcomes.
Additionally, having an awareness of conflict and an understanding of communication behaviours that would lead to more competent conflict resolution skills would also strengthen nursing students’ ability to work effectively in healthcare teams and provide safe patient care. Educating nursing students in team conflict communication remains limited, as evidenced by research previously reviewed for this study (Hartman & Crume, 2014; Seren & Ustun, 2008; Spickerman & Brown, 1991). In baccalaureate nursing programs, nursing students are typically introduced to teamwork principles and are taught about conflict management and resolution through a didactic approach and role-playing exercises (Seren & Ustun, 2008). Communication skills such as conflict management and resolution can be reinforced throughout a four year undergraduate nursing program. Research has indicated that introducing conflict management training from the early years and then on in a 4-year baccalaureate program provides students with early opportunities to “practice” conflict resolution skills and familiarize themselves with conflict management events (Seren & Ustun, 2008). Opportunities to reinforce that learning throughout their program help students’ build confidence to handle subsequent conflict interactions that may arise in, for example, the clinical domain with nurses and preceptors. Simulation experiences that teach communication skills, such as conflict resolution, can be integrated into the nursing curriculum in courses such as clinical practice. Eventually, conflict training should be taught during high fidelity simulations that progress through a series of increasingly more complex scenarios throughout the 4-year undergraduate nursing program.

More broadly, much remains to be done to address the research gap about educational interventions aimed at teaching nursing students how to manage conflict situations that may impact on patient outcomes (Hartman & Crume, 2014). The realization that conflict is inherent in nursing and interprofessional teams is the first step in understanding the importance of optimal
curricular development in team conflict communication. Second, the awareness that if conflict is not managed professionally, it may lead to decreases in information exchange and poor communication, which in turn may impact patient care outcomes. Undergraduate nursing and other allied healthcare programs need to create educational curricula in conflict processes and management because they are necessary to comprehend the conceptions about the conflict process. In the case of nursing, faculty in colleges and universities should recognize, in general, that nursing students are being exposed to conflict early on in their programs (Hartman & Crume, 2014; Mamchur & Myrick, 2003; McKenna et al. 2003; Reid-Searl, et al. 2009). Faculty, consequently, should invest time to develop conflict management and resolution training interventions. Additionally, these interventions should be evaluated to assess how best to achieve the teaching of conflict communication skills, whether through a high fidelity simulation approach or by means of a lower fidelity approach (lecture and group work), which has typically been used.

Based on results from the two Likert items appended to the EPQ in this study, the participating year 2 students indicated that they would use the two-challenge rule in the clinical practice domain when they encountered conflict in the future. The PI was not present when the students filled out the questionnaire with the appended items. However, the student responses may reflect a socially desirable one. As previously discussed, a future longitudinal study that followed up with second year nursing students who participated in this refined simulation intervention may provide insight into whether the students utilized the two-challenge rule in subsequent Years 3 and 4 of their program and whether they experienced conflict in the clinical setting.
Implications for Nursing Practice

The clinical practice environment in which healthcare currently takes place is becoming a complex socio-technical system in which communication skills are imperative to resolve team conflict situations that may arise. Research findings have suggested that effective communication and collaboration reduces morbidity and mortality rates, reduces cost of care, reduces errors, and improves job satisfaction and retention of nursing staff (Donoghue et al., 2009; Falcone et al., 2008; Klipfel et al., 2014; Nishisaki, Keren & Nadkarni., 2007; Riley et al., 2011). Future studies are also needed to determine new graduate nurses’ awareness of conflict, its consequences, and how they managed and resolved it as they move into their first and subsequent professional nursing positions.

The findings of the current study suggest that a baccalaureate program in nursing may be the best place to provide opportunities to learn conflict management skills that would impact not only their student clinical experiences, but also their nursing practice in their first and subsequent nursing jobs. A future study could determine whether the nursing students who participated in the current study were able to carry over what they learned about conflict and conflict management skills to their first nursing position after graduation. Other studies could examine whether nursing students who had such training fare better regarding those conflict management skills in their first job than nurses who had to learn them while on those first jobs by hitting the ground running. Ultimately, nursing students and novice nurses will be in a better position to advocate for patient safety, especially if patient care is jeopardized by a fellow practitioner. Nursing students who are taught to speak up and address conflict, will act as the patient’s advocate and will protect patient safety outcomes and therefore prevent the occurrence of medical errors.
Conclusion

In light of this Phase 1 study’s findings and the wider implications outlined in this final chapter, I conclude this dissertation by emphasizing (a) the importance of designing, refining and implementing high fidelity simulation interventions in a programmatic way; and (b) the importance of teaching undergraduate nursing students conflict resolution skills, such as, the two-challenge rule. Combined, these two important findings advance our knowledge of the way in which high fidelity simulations are designed, conducted, and the pedagogical content that they contain. Moreover, given this study’s findings, it would seem that nursing education in particular, and medical education more broadly needs to incorporate this knowledge gain into a newly defined set of disciplinary best practices regarding simulation design.

First, undergraduate nursing programs are becoming increasingly reliant on the use of high fidelity as an educational tool and as a gateway to clinical practice. Recent research has shown that undergraduate nursing students who have replaced as much as 50% of their clinical placements with time in simulation domain perform equally as well as their traditionally educated peers (Hayden, Smiley, Kardong-Edgren & Jeffries, 2014). As simulations put no patients at risk and place the learner in an experiential educational environment there are substantial benefits to preferring simulation to clinical placements. Therefore, designing, refining and implementing high fidelity simulations must be done in a robust and systematic manner that replicates the reality of the clinical experience with such clarity and precision that the student learner can effectively focus on the educational task and not the artificial and simulated environment. In particular, applying a refinement process to the high fidelity simulation intervention prior to implementing it with students is an appropriate way to achieve the goal of
maximizing fidelity to ensure focus remains on the educational objectives. Moreover, as educators, it is vital to stress the ethical imperative to “first do no harm” in order to safeguard against nursing students transferring real errors from a miseducative simulation experience and applying it to actual clinical practice.

Additionally, the application of the Medical Research Council (2000, 2008) framework in this study was novel and demonstrated that using the framework can be appropriately applied to improve the rigor of complex simulation intervention design, despite the limitations of this study. The results from the refinement component demonstrated that the changes made to the high fidelity simulation intervention over 2 separate 5-day refinement periods resulted in a systematic increase of the SDS scores, and thus there is strong evidence that the refinement strategy improved the overall quality of the simulation design features. The single-group post-test component also established that the refined intervention informed by Kolb’s Experiential Learning Theory (KELT), was successful in teaching the two-challenge rule to year two nursing students. At a broader level, the process of applying the MRC (2000, 2008) framework to guide this study has demonstrated the framework’s applicability in the field of simulation education in health professions education, such as nursing.

Secondly, based on previous research, undergraduate nursing students are exposed early on to interpersonal conflict events during their clinical placements. Simulation based training provides the opportunity to force learning across a broad range of topics that would be unethical to create intentionally in a clinical placement (crisis, conflict, etc.). As challenges in clinical practice intensify, it grows increasingly crucial for nursing students to enter the workplace as independent and fully competent, regulated healthcare professionals who can communicate across hierarchies in an effective manner and resolve conflicts in teams in order to provide safe
patient care (Durham & Alden, 2008). As a result, a refined simulation intervention provides the ideal pedagogical tool for educators to prepare undergraduate nursing students for entering into and succeeding in their careers as practicing clinicians.
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Appendices

Appendix A: Demographic Baseline Questionnaire

The SIMCON Phase 1 Study

Demographic Baseline Questionnaire

Fill in bubbles like this: ☐ ☒ Not like this: ☐ ☒

A1. What is your date of birth?

____/____/____ 1

A2. What is your sex?

☐ Male 2 ☐ Female 3

A3. What is the highest level of education that you have completed?

College Diploma ☐ 4
University Degree ☐ 5
Post-Secondary Certificate ☐ 6

A4. Are you an international student?

Yes ☐ 7
No ☐ 8

A5. What language do you speak at home?

English ☐ 9
French ☐ 10

English and French ☐ 11

Other ☐ 12 specify____________

Date this form completed

Year Month Day
Appendix B: High-Fidelity Simulation Intervention

For Scenario 1: TeamSTEPPS PowerPoint converted into a landscape version from its original portrait format so that it would be easier to view the content on the student’s computers or in the printed version.

For Scenario 2: In response to student participants’ feedback, the font in the pre-learning TeamSTEPPS PowerPoint was increased to 32pt from 22pt. Also, separated the two-challenge rule on the pre-reading TeamSTEPPS PowerPoint, which would help students comprehend that the rule involved a two-step process.

Pre-Reading Content for Participants in HFS Scenarios 1 and 2 (conflict resolution)*
Mutual Support

TeamSTEPPS

Two-Challenge Rule

Invoked when an initial assertion is ignored...
- Medical professionals who feel that they disagree with information provided to them must feel that it is their responsibility to make their concerns heard.
- The member being challenged must acknowledge
  The two challenge rule requires that they ask a question of their colleague (first challenge), followed by an expression of concern (second challenge).
  If the outcome is still not acceptable
  Take a stronger course of action
  Use supervisor or chain of command

TeamSTEPPS

Two-Challenge Rule

"Empower any member of the team to "Stop the line" if he or she senses or discovers an essential safety breach." 
This is an action never to be taken lightly, but it requires immediate cessation of the process and resolution of the safety issue.
**Team STEPPS**

**Common Approaches to Conflict Resolution**
- Often used to manage conflict; however, typically do not result in the best outcome.
- Compromise—Both parties settle for less.
- Avoidance—Issues are ignored or sidestepped.
- Accommodation—Focus is on preserving relationships.
- Dominance—Conflicts are managed through directives for change.

**Collaboration**
- Achieves a mutually satisfying solution resulting in the best outcome.
- **All Win** (Patient Care Team, team members, the team, and the patient).
- Includes commitment to a common mission.
- Meets goals without compromising relationships.

*True collaboration is a process, not an event.*

---

**Team STEPPS**

**Mutual Support**

**BARRIERS**
- Personal Cultural Issues
- Poor Interpersonal Communication
- Ineffective Communication
- Conflict
- Time
- Fatigue
- Inadequate Feedback
- Inadequate Information
- Inadequate Resources
- Inadequate Training

**TOOLKIT and STRATEGIES**
- Brief
- Handoff
- Brief
- SHEP
- Communication
- Feedback
- Advocacy and Assertiveness
- Two-Step
- Role
- Collaboration

**OUTCOMES**
- Shared Mental Model
- Adaptable
- Team Orientation
- Mutual Trust
- Team Performance
- Patient Safety
IV Priming

Why do clients need an IV?
- Replacing fluids
- Correct or prevent nutritional imbalances
- Provide IV medication therapy

Nursing Responsibilities
1. Know the correct solution & equipment needed & how to initiate the infusion
2. Regulate the infusion (with or without a pump)
3. Care for and maintain the system
4. Identify and solve problems
5. Discontinue the infusion
Categories of IV solutions
1. Isotonic
2. Hypotonic
3. Hypertonic
   - Determined by serum electrolyte values and fluid volume balance
   - RN must understand the rationale for IV fluid administration and the type of solution ordered

Establish IV Access
- IV catheter can remain in place for 96 hrs (check hospital policy, most are 72 hours), IV solution replaced every 24 hours
- Palpate insertion site daily and prior to initiating infusion
- Inspect site if client is pain at site or developed SS&O of infection
- Change transparent dressing if becomes damp, soiled, loose
- Clean injection port with antiseptic before accessing system

Supplies
- Administration set (IV lines)
- Correct IV solution
- Antiseptic swabs
- Tape
- IV pole, rolling or ceiling mounted
- Hospital gown with snaps
- 1-3 ml normal saline, 5 ml syringe (or larger), pre-filled w/ syringes may be available, to flush IV catheter prior to initiating infusion
Nursing Diagnosis

- Risk for imbalanced fluid volume
- Deficient fluid volume
- Excess fluid volume
- Risk for infection

Assessment

- Review physician’s order (type, amount and/or rate)
- 5 medication rights (medication, dose, client, route, time, documentation, right reason & right response)
- Physical assessment pertaining to IV fluid administration
- Understood rationale and purpose of IV fluid, potential incompatibilities, and potential side effects

Implementation

- Change gown
- Prepare tubing and solution
  - Check solution (6 esites)
  - Color
  - Clarity
  - Expiration date
  - Leaks
**Implementation II**
- Open infusion set (maintaining sterility of each end)
- Place roller clamp 2-5 cm below drip chamber and move to OFF position
- Remove drape over port on IV solution bag
- Remove tubing spike (DO NOT TOUCH)
- Insert spike into IV bag

**Implementation III**
- Priming:
  - Compress drip chamber, fill 1/3 to 1/2
  - Remove cap on end of tubing, KEEP and maintain sterility
  - Slowly open roller clamp and prime tubing with fluid, return roller clamp to OFF position
  - Inspect for air bubbles, tap tubing where bubbles are visible, invert ports and top to fill and remove air
  - Replace cap on end of tubing
  - Label tubing and bag with date and time
Intramuscular Medication Administration

**SKILL 34-5 Administering Intramuscular Medications continued**

**STEPS**

29. Inspect the injection site, noting any bruising or inflammation.

30. Observe the client's response to medication at times that correlate with the medication's onset, peak, and duration.

31. Ask the client to explain the purpose and effects of the medication.

32. For intramuscular injections, use a skin pencil and draw a circle around the perimeter of the injection site. Read the site within an appropriate amount of time, which is determined by the type of medication or skin test administered.

**RATIONALITY**

- Intramuscular injections are often preferred over subcutaneous because the intramuscular route provides a more rapid onset and a greater amount of medication can be administered in a single injection.
- Subcutaneous injections are not absorbed as rapidly as intramuscular injections.
- Intramuscular injections are generally safer than subcutaneous injections because they are less likely to cause tissue damage.
- Intramuscular injections are often used to administer medications that are not absorbed well by the oral route.
- Intramuscular injections are often used to administer medications that are painful when administered by the oral route.

**Unexpected Outcomes and Related Interventions**

- **Reactions:** Reddened, or Hard Zone (Induration) Around Intradermal Test Site
  - Notify the client's health care professional.
  - Document the client's sensitivity to the injected allergen or the positive test if a skin allergy was completed.

- **Hypertrophy of Skin Resulting From Repeated Subcutaneous Injections**
  - Do not use the site for future injections.
  - Instruct the client not to use the injection site for 6 months.

- **Signs and Symptoms of Allergy or Side Effects**
  - Follow institutional policies or guidelines for the appropriate response to adverse reactions.
  - Notify the client's health care professional immediately.
  - Add allergy information to the client's medical record.

- **Complaints of Localized Pain, Numbness, Tingling, or Burning Sensation at Injection Sites, Indicating Possible Injury to Nerve or Tissues**
  - Assess the injection site.
  - Document your findings.
  - Notify the client's health care professional.

**Recording and Reporting**

- Chart the medication dose, route, site, time, and date of injection on the MAR immediately after giving medication, as per agency policy.
- Document if the scheduled medication is withheld and record the reason as per agency policy.
- Report any undesirable effects from the medication to the prescriber.
- Record the client's response to medications in the nurses' notes and report to the prescriber if required.

**Home Care Considerations**

- Assess the client's readiness to learn before instructing him or her on how to administer self-injections. Some clients are hesitant to administer injections to themselves; relieve any anxiety before teaching the skill to a client. Instruct the client to purchase or obtain a sharps box for home use if the client is not familiar with it. A sharps box is a plastic bottle that is nonpermeable (e.g., a fabric softener bottle or a detergent bottle) and may be used to safely store syringes, after use. Dispose of needles used in the home among communities. Check with local authorities to verify how to appropriately dispose of needles.

at least 1 month. The rate of insulin absorption varies depending on the site: the abdomen has the quickest absorption, followed by the arms, thighs, and buttocks (American Diabetes Association, 2004; Canadian Diabetes Association, 2008). For subcutaneous injections of insulin, pinch the skin and insert the needle at a 90-degree angle; inject the insulin, then release the pinched skin, count 5 to 6 seconds, and remove the needle.

Only small doses (0.5 to 1 mL) of water-soluble medications should be given subcutaneously because the tissue is sensitive to irritating solutions and large volumes of medications can collect within the tissues to cause sterile abscesses, which appear as hard and painful lumps under the skin.

A client's body weight indicates the depth of the subcutaneous layer. Therefore, choose the needle length and angle of insertion based on the client's weight and an estimation of the amount of subcutaneous tissue (Annestrom & Wilman, 2009). In general, medications can be injected in the subcutaneous tissue of a normal-size client using a 25-gauge, 1.5-cm needle inserted at a 45-degree angle (Figure 34-22) or a 1.3-cm needle inserted at a 90-degree angle. A child may require only a 1.3-cm needle. If the client is obese, pinch the tissue and use a needle long enough to insert through the fatty tissue at the base of the skinfold. The preferred needle length is one-half the width of the skinfold; the angle of insertion may be between 45 and 90 degrees. Thinner clients may have insufficient tissue for subcutaneous injections; the upper abdomen is the best injection site for these clients. To ensure a subcutaneous medication reaches the subcutaneous tissue, follow this rule: if you can grasp 5 cm of tissue, insert the needle at a 90-degree angle; if you can grasp 2.5 cm of tissue, insert the needle at a 45-degree angle (Bushby, 2004).

**Intramuscular Injections.** Intramuscular (IM) route provides faster medication absorption than the subcutaneous route because of a muscle's greater vascularity; however, intramuscular injections are associated with many risks. Therefore, when administering a medication by the intramuscular route, you must first verify that the injection is justified (Nicolson & Hasley, 2002; WHO, 2003). In many cases, such as influenza and pneumococcal vaccinations, no alternative routes exist to administer the medication.

Use a longer and heavier-gauge needle to pass through the subcutaneous tissue and penetrate the deep muscle tissue (see Skill 34-5). The client's body weight and the amount of adipose tissue can influence the selection of a needle size. For example, an obese client...
Assess the muscle integrity of the selected site before giving an injection. The muscle should be free of tenderness. Repeated injections to the same muscle can cause severe discomfort. Ensure that the client is relaxed, then palpate the muscle to rule out any hardened lesions. You can minimize discomfort during an injection by helping the client to assume a position that will help reduce muscle strain. Other interventions, such as distraction and applying pressure to the intramuscular site, may be used to decrease pain during an intramuscular injection.

Sites: When selecting an intramuscular site, consider the following: Is the area free of infection or scars? Do local areas show signs of bruising or abrasions? Where is the location of underlying bones, nerves, and major blood vessels? What volume of medication is to be administered? Each site has certain advantages and disadvantages. The characteristics of each intramuscular site and the indications for use of each site are listed in Box 34-24.

**Safety Alert:** Researchers who have investigated complications associated with intramuscular injection sites indicate that the ventrogluteal site is the preferred site for most injections administered to adults and children, including infants of any age (Cook & Murtagh, 2005; Hockenberry & Wilson, 2001; Nuckols & Healy, 2003).

Locate the ventrogluteal muscle by placing the heel of your hand over the greater trochanter of the client’s hip with the wrist perpendicular to the femur. Use your right hand for the left hip, and your left hand for the right hip. Put your thumbs toward the client’s gluteus maximus and your fingers toward the client’s head. Point your index finger to the anterior superior iliac spine, and extend your middle finger back along the iliac crest toward the buttocks. The index finger, the middle finger, and the iliac crest form a V-shaped triangle, the injection site is at the center of the triangle (Figures 34-22, 34-24). The client may lie on his or her side or back. Placing of the knee and hip helps the client to relax this muscle.

**Box 34-24**

**Characteristics of Intramuscular Sites and Indications for Usage**

**Vastus Lateralis Muscle**
- Looks smaller than gluteus muscle
- Covers large leg muscles
- Aids in rapid drug absorption
- Used with infants for injections
- May also be used for older children and toddlers receiving immuno-
  sensitization

**Ventronegluteal Muscle**
- Offers a deep site, situated away from major nerves and blood vessels
- Offers less chance of contamination in incontinent clients
- Identified easily by prominent bony landmarks
- Is preferred site for medications e.g., antibiotics that are larger in
to volume, more viscous, and irritating for adults, children, and infants

**Deltoid Muscle**
- A easily accessible muscle
- Muscle is not well-developed in most clients
- Used for small amounts of medications
- Not used in infants or children with undeveloped muscles
- Use of the muscle involves potential for injury to the brachial plexus
  and to the radial and ulnar nerves
- May be used for immunizations of toddlers, older children, and adults

- Recommended site for hepatitis B vaccine and rabies injections

---

*Figure 34-22: Sites recommended for subcutaneous injections*

*Figure 34-22: Giving subcutaneous heparin to the abdomen.*
Vastus Lateralis Muscle. This thick and well-developed muscle is located on the anterior lateral aspect of the thigh and extends in an adult from a bicipital bundle above the knee to a bicipital bundle below the greater trochanter of the femur (Figure 34-25). Use the middle third of the muscle for injection. The width of the muscle usually extends from the midpoint of the thigh to the midpoint of the thigh and outer side. When administering injections to young children or cachectic clients, grasp the body of the muscle during injection to ensure the medication is deposited in the muscle tissue. To help relax the muscle, ask the client to assume a sitting position or to lie flat with the knee slightly flexed. The vastus lateralis site is often used when infants,

Figure 34-25  A, Landmarks for the vastus lateralis site. B, Giving IM injection in the vastus lateralis muscle.
Facilitator Package for Principal Investigator and Back-Up Facilitator

Overview of HFS Scenario 1 with CMLE

Congestive Heart Failure (CHF)—Mr. Jones

Patient History/Data

80-year-old male with previous MI, swollen ankles, diagnosed with CHF, known NYHA class III HF on previous admissions (inability to do activities of daily living due to SOB, weight gain, and fatigue. Was admitted to Mount Sinai due to exacerbation of CHF, and Lasix increased to 40mg BID; was on 40mg OD, prior to admission. Mr. Jones is awaiting admission to a long-term care facility.

Scheduled Medications:

- Ramipril 10 mg PO daily
- Furosemide 40 mg PO BID
- Digoxin 0.125 mg PO daily
- KCL 20 mEq PO daily
- Metoprolol 50 mg PO BID
- Docusate (Surfak) 240 mg capsule PO daily (hold if patient is having diarrhea)
- PIV 2/3 and 1/3 at 50mls/hr

PRN Medications:

- Magnesium hydroxide (MOM) 15 ml oral suspension po hs prn
- Docusate (Surfak) 240 mg capsule PO daily (hold if patient is having diarrhea)
- Acetaminophen 325-650 mg PO Q4H PRN for pain
- Magnesium hydroxide (MOM) 15 ml oral suspension PO PRN at bedtime if no BM after 3 days

Weight – 78 kg; weight prior to transfer to Mount Sinai, 82 kg
- PIV inserted into left hand
- Titrate O₂ to maintain SPO² > 92%
- Daily weight – today’s weight 78 kg
Labs:
CBC – HGB 116, HCT 33%, WBC 14.5, PLTS 155, HGB LOW
Electrolytes: Na 133, K 4.5, Cl 106, CO₂ 30, BUN 10.5, CR 154

Electrolytes in AM
**Briefing Overview to Be Read by the Facilitator to the Student Prior to Engaging in HFS**

**Scenario 1**

In this scenario you will be expected to care for a patient and collaborate with a team member. Your role is that of a Year 2 student. Here is the nurse’s report on Mr. Jones:

“Mr. Jones is an 80-year-old male with previous myocardial infarction (MI), swollen ankles, diagnosed with congestive heart failure, inability to do activities of daily living due to shortness of breath (SOB), weight gain, and fatigue.

He is awaiting admission into a long-term care facility. He has been at Mount Sinai acute care hospital, where he required management of congestive heart failure. His oral Lasix dose has now been increased.

He has a peripheral intravenous running at TKVO.”

You are on the day shift. The unit is short-staffed. It is now 08:00 hrs and the nurse has taken the patient’s vital signs. Mr. Jones’s vital signs at 07:45 hrs were: BP 110/72, HR 90, RR 22, Temp 37 degrees Celsius (tympanic), and oxygen saturations are 95% on room air. His chest is clear, with an occasional congested-sounding cough and adventitious sounds. The nurse was not advised that a student was assigned to Mr. Jones; however, she is now aware. The nurse is expecting the student to administer the patient’s medications. He is due for his morning medications at 08:00 hrs. You will have to administer them.
Conceptual Overview of HFS Scenario 1: CHF with CMLE

Synopsis Overview

The following algorithm represents the potential interventions/actions that can be taken by students, and the consequential results of their actions, or lack thereof. Please note that this is a dynamic process and that not all possible outcomes are captured within this chart.

The patient is awaiting a transfer to a long-term care facility and is at Mount Sinai Hospital. The student will be advised during the brief that a full cardiac and respiratory assessment was completed by the registered nurse and that the patient is stable. It is 08:00hrs.

A) The student will introduce him- or herself to the patient. The student will proceed to review the MAR (medication administration record) on the medication cart that is inside the patient’s room at this time.

A) Ramipril 10 mg po daily
  Furosemide 40 mg PO BID
  Digoxin 0.125 mg PO daily
  KCL 20 mEq PO daily
  Metoprolol 50 mg PO BID
  PIV 2/3 & 1/3 at 50 mls/hr

Student has completed algorithm until B

Relief Nurse (RN) enters the room

RN: Your clinical instructor asked that I supervise you during medication administration as she is with another student. This patient has a few oral medications only.

NO-Student hangs IV bag without checking MAR.

CHALLENGE – Y/N

YES – Student: I must review the medication administration record to check the order. Can I have a moment to do that?

RN: Okay, but I really don’t have a lot of time, so can you just hang the IV bag?

CHALLENGE – Y/N

YES - Student: I am concerned because I need to complete my medication administration checks. I do not see the IV 2/3 & 1/3 with 20 KCL/L in the MAR.

RN: Okay, I will just hang the IV bag for now. We can check the Doctor’s order together afterwards and I will transcribe it.

RN exists the patient room; she returns stating the bag is 2/3 and 1/3 without the KCL; I need to change it scenario ends.
Overview of HFS Scenario 2 with CMLE

Congestive Heart Failure (CHF)—Mr. Jones

Patient History/Data

80-year-old male with previous MI, swollen ankles, diagnosed with CHF, known NYHA class III HF on previous admissions (inability to do activities of daily living due to SOB, weight gain, and fatigue.

Was admitted a few weeks ago to Mount Sinai due to exacerbation of CHF, and Lasix increased to 40mg BID; was on 40mg OD, prior to admission. Mr. Jones is still awaiting admission to a long-term care facility.

Scheduled Medications:

- Ramipril 10 mg PO daily
- Furosemide 40 mg PO BID
- Digoxin 0.125 mg PO daily
- KCL 20 mEq PO daily
- Metoprolol 50 mg PO BID
- Docusate (Surfak) 240 mg capsule PO daily (hold if patient is having diarrhea)

Iron dextran 50 mg IM q monthly (due today @ 12:00 hrs)

PRN Medications:

- Magnesium hydroxide (MOM) 15 ml oral suspension po hs prn
- Docusate (Surfak) 240 mg capsule PO daily (hold if patient is having diarrhea)
- Acetaminophen 325-650 mg PO Q4H PRN for pain
- Magnesium hydroxide (MOM) 15 ml oral suspension PO PRN at bedtime if no BM after 3 days

Labs:

CBC – HGB 116, HCT 33%, WBC 14.5, PLTS 155, HGB LOW
Electrolytes: Na 133, K 4.5, Cl 106, CO2 30, BUN 10.5, CR 154
Daily weight – today’s weight 80 kg
In this scenario you will be expected to care for a patient and collaborate with a team member. Your role is that of a Year 2 student.

This is the nurse’s report on Mr. Jones:

“Mr. Jones is an 80-year-old male with previous myocardial infarction (MI), swollen ankles, diagnosed with congestive heart failure, inability to do activities of daily living due to shortness of breath (SOB), weight gain, and fatigue.”

Mr. Jones is still awaiting admission to a long-term care facility and is at Mount Sinai acute care hospital. He was initially admitted for exacerbation of congestive heart failure. He has been doing well since his diuretic dose was increased.

You are on the day shift, it is 12:00 hrs, and you will administer Mr. Jones’s medications. His morning vital signs at 08:00 hrs were: BP100/70, HR 88, RR 20, Temp 37 (tympanic), and his oxygen saturations are 95% on room air (his vital signs are q8H). He is stable, and looking forward to lunch.
Conceptual Overview of HFS Scenario 2: CHF with CMLE

The following algorithm represents the potential interventions/actions that can be taken by students, and the consequential results of their actions, or lack thereof. Please note that this is a dynamic process and that not all possible outcomes are captured within this algorithm.

The patient had a good morning. It is almost lunchtime. His vital signs are stable

A) The student will introduce him- or herself to the patient. The senior nurse will enter the room.

A) Ramipril 10 mg PO daily
Furosemide 40 mg PO BID
Digoxin 0.125 mg PO daily
KCL 20 mEq PO daily
Metoprolol 50 mg PO BID
Docusate (Surfak) 240 mg capsule PO daily (hold if patient is having diarrhea)
Iron dextran 50 mg IM q monthly due at 1200hrs

SN: Let me show you how to landmark this injection. She maps the dorsal aspect of the buttock which is no longer used.

CHALLENGE – Y/N

YES – Student: I was wondering, should it be done this way instead?

SN: I have administered IM’s for a long time this way.

NO-Student administers the IM incorrectly

CHALLENGE – Y/N

YES - Student: I am concerned because I read the textbook and practiced a different mapping approach in the lab.

SN: The unit clerk is calling me to the nursing station. I haven’t got time for this; please get your clinical instructor.

NO-Student administers the IM incorrectly.

Student has completed algorithm until B

Senior Nurse(SN) enters the room

SN: Your clinical teacher is busy with another student. She asked that I observe while you administer the intramuscular injection(IM) to Mr. Jones. Can you administer it now as I am busy and have a few things to get done.

SN: exists the patient room and the scenario ends.
Discuss the objectives below based on the student’s performance in Scenarios 1 and 2 during the debriefing session

1. Evaluate communication skills—that is, use of or failure to use the conflict resolution skill (two-challenge rule).

2. Discuss medication administration process.

The TeamSTEPPS facilitator overview is to be utilized to guide the discussion regarding the two-challenge rule during the debriefing session.

TeamSTEPPS 06.1, Leadership 06.1 facilitator overview*

FACILITATING CONFLICT RESOLUTION
Conflict is inevitable and can be caused by differences in clinical knowledge, work approaches, values, opinions, or personality. Resolution of conflict is necessary in the delivery of safe, quality care. Leadership skill in conflict resolution can enhance team effectiveness and performance. An effective team leader does not allow interpersonal or irrelevant issues to negatively impact the team.

* taken from TeamSTEPPS 06.1, TeamSTEPPS Facilitator Binder, p. 19.

TeamSTEPPS 06.1, Mutual Support Facilitator Overview**

CONFLICT RESOLUTION OPTIONS
Let’s address the two types of conflict. Information conflict tends to be more impersonal. It involves differing views, ideas, and opinions. It could be a disagreement about the content of a decision. Personal conflict stems from interpersonal incompatibility and is usually not task related. Tension, annoyance, and animosity are common. It can be very argumentative. Attempts should be made to resolve both types of conflict before they interfere with work and undermine quality and patient safety. Information conflicts left unresolved may evolve into personal conflicts in the long run and severely weaken teamwork.

THE TWO-CHALLENGE RULE
The Two-Challenge rule was developed by human factors exerts to help airline captains prevent disasters caused when otherwise excellent decision makers experience momentary lapses in judgment. In the clinical environment, team members should challenge colleagues if requesting clarification and confirmation does not alleviate the concern regarding potential harm to a patient. It is important to voice your concern by advocating and asserting your statement at least twice if the initial assertion is ignored (thus the name, “two-challenge rule”). These two attempts may come from the same person or two different team members. The first challenge should be in the form of a question. The second challenge should provide some support for your concern. Remember this is about advocating for the patient. The “two-challenge rule” tactic ensures that an expressed concern has been heard, understood, and acknowledged.

There may be times when an initial assertion is ignored. If after two attempts the concern is still disregarded, but the member believes patient or staff safety is or may be severely compromised, the Two-Challenge rule mandates taking a stronger course of action or using a supervisor or chain of command. This overcomes our natural tendency to believe the medical team leader must always know what he or she is doing, even when the actions taken depart from established guidelines. When invoking this rule and moving up the chain, it is essential to communicate to the entire medical team that additional input has been solicited.

** taken from TeamSTEPPS 06.1, Mutual Support Facilitator Binder, pp. 18–20.
Appendix C: Confederate Training and Scripts

The following will be reviewed on the training day with the confederates:

(a) a brief overview of the study

(b) the Modified TeamSTEPPS PowerPoint that will be emailed to the students (see Appendix B)

(c) the confederate (actor) scripts for HFS Scenarios 1 and 2

(d) scenario algorithms for HFS Scenarios 1 and 2

(e) the times and dates that the confederates will be required to come in for the refinement component with Year 3 nursing students and the evaluation of the entire, refined intervention by Year 2 students

(f) orientation to the simulated practice room and the human patient simulator

(g) a dry run of Scenarios 1 and 2 in the SPC with the HPS and the PI
Confederate Script for HFS Scenario 1

The relief nurse says to Mr. Jones, “Hello, Mr. Jones, how are you today?”

Patient Mr. Jones replies, “I feel better, and I have this wonderful student nurse who is taking care of me today!”

The relief nurse says to the student, “Your clinical instructor asked me to observe you during medication administration as she is with another student at the moment. Mr. Jones only has a few oral medications. Can you start administering the medications now?”

Student nurse should begin to pour the oral medications while referring to the MAR.

The relief nurse states, “I also brought an IV bag (2/3 & 1/3 with 20mmol of KCL/L). His is running dry.” (There is no outer package on the IV bag.)

Then the relief nurse quietly says, “Can you hang it once you administer the oral medications, since his IV bag is running dry? The clinical instructor stated that you can hang IV bags.”

The nurse will remain in the room to observe the student.

1. The nursing student **challenges** the relief nurse (in the form of a question): “I must review the medication administration record to check for the IV order before hanging the bag. Can I have a moment to do that?”

The relief nurse sternly replies, “Okay, I really don’t have a lot of time, so can you hang the IV bag?”

2. If the student **challenges** the nurse a second time, the second challenge should provide some support for the student’s concern: “I am concerned because I need to do all my checks related to medication administration.”

The nurse will quietly state, “Okay, I will hang the IV bag; I do not have time for this!”

Patient Mr. Jones will ask the student nurse, “Can you get me my glass of water? It is on the bedside table.”

If the student does hang the 2/3 & 1/3 with 20mmolKCL/L IV bag, the relief nurse will return to the patient’s room and will call the student nurse aside and quietly say, “The IV bag that I just handed to you was not the correct one. There is another patient with the same surname, and I made a mistake; the IV order is for 2/3 & 1/3 only. I have the correct IV bag here and will change it now.”

The scenario ends.
Confederate Script for HFS Scenario 2

A Senior RN enters the patient’s room and precipitates a conflict with the student (uncomfortable social situation during the medication administration process).

The Registered Nurse enters with a vitamin B12 vial and syringe and quietly states, “Your clinical instructor is busy with another student and asked me to be with you as you administer the vitamin B12 intramuscular injection due for Mr. Jones. Your instructor also said that she has watched you do this before and that it went well. Can you administer it now because I am busy and have a few things to do?”

The nursing student will withdraw the vitamin B12 from the vial after having checked the MAR with the RN.

The RN, along with the student, will approach the patient, Mr. Jones (the HPS).

Registered Nurse: “Hello, Mr. Jones. I am Mary. You are due for your vitamin B12 injection. Is it okay if the nursing student administers it now?”

Patient Mr. Jones: “Of course; I like the care I receive from nursing students.”

Registered Nurse: “Can you turn onto your left side?”

Patient Mr. Jones: “Sure! I just need some help because I feel weak.” (The patientshifts to a side-lying position with assistance.)

The RN quietly states to the student nurse: “Let me show you how to landmark this injection.” (The Registered Nurse will landmark the injection site on Mr. Jones’s buttock region, more toward the dorsal aspect of the buttock. This site is incorrect and is no longer utilized.)

1. If the student challenges the RN (in the form of a question), such as, “I am wondering why you are mapping in that way?” the RN will abruptly reply, “I have administered enough IM injections in my time.”

2. If the student challenges the RN a second time (the second challenge should provide some support for the student’s concern) by stating that the student was taught that the dorsal approach is no longer used according to the textbook, the Registered Nurse will reply to the student, “I will just administer it then. Can you please get your clinical instructor to review IM injections in my time.”

If the student does administer the IM in the dorsal aspect of the buttock and not in the ventrogluteal site, the patient, Mr. Jones, will state loudly, “Ouch! That hurt a lot compared to the other needles I received before!” The scenario ends when the senior nurse leaves the patient’s room. The student will remain with the patient.
Appendix D: Pre-Programming Scenarios 1 and 2: Overview for the Technologist

Scenario Name:
Scenario 1 with
CMLE
80-year-old male:
congestive heart failure (CHF)

Learning/
Behavioural
Objectives

1. Administration of medications (KNOWLEDGE, SKILLS)
2. Communication skills (KNOWLEDGE, SKILLS)
a. patient–nurse
b. healthcare team

Patient History/Data
80-year-old male with previous MI, swollen ankles, diagnosed with CHF, inability to do activities of daily living due to SOB, weight gain, fatigue
patient in acute care setting awaiting transfer to long-term care.
Admitted a few days ago to Mount Sinai acute care hospital to medically manage CHF and dehydration, secondary diarrhea, and vomiting
Weight – 78 kg; on admission to Mount Sinai, 82 kg
PIV inserted into left hand

Materials:
Props/Equipment
GBC assessment form
b.p. cuff SimMan
Intravenous set-up, IV bags (500 ml) 2/3 & 1/3 with 20 KCL/L and 2/3 & 1/3
stethoscope
O₂ equipment
saturation monitor
Patient chart with MAR
Medication cart with Mr. Jones’s medications (oral pills)

**FRAME 1**

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<th>ECG</th>
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<td>96%</td>
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<td>NSR</td>
<td>22</td>
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**Interventions**

Student introduces him- or herself to patient, Mr. Jones.
Relief nurse enters the room.
Patient: “I enjoyed having student nurses.”
Nurse asks student to begin medication preparation.
Nurse asks student to hang IV bag (2/3 with 1/3 with 20KcL/L).
Student must challenge (twice).
When the nurse exits the room, patient asks the student: “Can you get me a glass of water? It is on my bedside table.”

**Debrief Notes** via advocacy/inquiry approach

Two objectives:

1. Demonstrates the use of the two-challenge conflict resolution skill with the relief nurse (interpersonal communication skill used in situations with information conflict).
2. Demonstrates knowledge and skills in safe medication administration.
Scenario Name:
Scenario 2 with CMLE
80-year-old male:
congestive heart failure (CHF)

Learning/Behavioural Objectives

1. Administration of medications (KNOWLEDGE, SKILLS)
2. Communication skills (KNOWLEDGE, SKILLS)
   a. patient–nurse
   b. healthcare team

Patient History/Data
80-year-old male with previous MI, swollen ankles, diagnosed with CHF, inability to do activities of daily living due to SOB, weight gain, fatigue
patient in acute care setting awaiting transfer to long-term care.
Admitted a few days ago to Mount Sinai acute care hospital to medically manage CHF and dehydration, secondary diarrhea, and vomiting
Weight – 78 kg; on admission to Mount Sinai, 82 kg

Materials:
Props/Equipment

b.p. cuff SimMan
saline lock
foley catheter
stethoscope
O₂ equipment
saturation monitor
Patient chart with MAR
Medication cart with Mr. Jones’s medications (IM

MD orders (2)
vitamin B12 and IM syringe and needle)

**FRAME 1**

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<td>96%</td>
<td>138/90</td>
<td>NSR</td>
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**Interventions**
Student introduces himself/herself to patient.
Senior Nurse comes into the room.
Nurse introduces herself to patient and student (will help student with administering IM injection vitamin B12 due at 12:00 hrs.)
Nurse asks patient, Mr. Jones, to turn onto his side.

Patient: “Sure! I need some help to turn because I feel weak.”
Nurse maps IM injection incorrectly.
Student nurse utilizes the two-challenge rule or, alternatively, does not use the two-challenge rule.
If student nurse does administer the IM injection
Patient states: “Ouch! That hurt a
lot compared to the other needles I received before!"

The Senior Nurse will exit the patient’s room after the injection is administered or after she is challenged a second time by the student. The student will have to call her instructor for help.

**Debrief Notes**  via advocacy/inquiry approach

Two objectives:

1. Demonstrates the use of the two-challenge conflict resolution skill with the senior nurse (interpersonal communication skill used in situations with information conflict).
2. Demonstrates knowledge and skills in safe medication administration.
Appendix E: Other Instruments

Simulation Design Scale (student version)

In order to measure if the best simulation design elements were implemented in your simulation, please complete the survey below as you perceive it. There are no right or wrong answers, only your perceived amount of agreement or disagreement. Please use the following code to answer the questions.

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Use the following rating system when assessing the simulation design elements:
1 - Strongly Disagree with the statement
2 - Disagree with the statement
3 - Undecided - you neither agree or disagree with the statement
4 - Agree with the statement
5 - Strongly Agree with the statement
NA - Not Applicable, the statement does not pertain to the simulation activity performed.

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<th>3</th>
<th>4</th>
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<td>1. There was enough information provided at the beginning of the</td>
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<td>simulation to provide direction and encouragement.</td>
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<td>2. I clearly understood the purpose and objectives of the simulation.</td>
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<td>O</td>
<td>NA</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
</tr>
<tr>
<td>3. The simulation provided enough information in a clear manner for</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>NA</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
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<tr>
<td>me to problem-solve the situation.</td>
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<tr>
<td>4. There was enough information provided to me during the simulation.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>NA</td>
<td>O</td>
<td>O</td>
<td>O</td>
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</tr>
<tr>
<td>5. The cues were appropriate and geared to promote my understanding.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>NA</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
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<tr>
<td>Support</td>
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<tr>
<td>6. Support was offered in a timely manner.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>NA</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
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</tr>
<tr>
<td>7. My need for help was recognized.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>NA</td>
<td>O</td>
<td>O</td>
<td>O</td>
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<tr>
<td>8. I felt supported by the teacher's assistance during the</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>NA</td>
<td>O</td>
<td>O</td>
<td>O</td>
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<td>O</td>
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<tr>
<td>simulation.</td>
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<tr>
<td>9. I was supported in the learning process.</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>O</td>
<td>NA</td>
<td>O</td>
<td>O</td>
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</tr>
</tbody>
</table>

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Simulation Design Scale (student version)

In order to measure if the best simulation design elements were implemented in your simulation, please complete the survey below as you perceive it. There are no right or wrong answers, only your perceived amount of agreement or disagreement. Please use the following code to answer the questions.

Use the following rating system when assessing the simulation design elements: 1 - Strongly Disagree with the statement 2 - Disagree with the statement 3 - Undecided—you neither agree or disagree with the statement 4 - Agree with the statement 5 - Strongly Agree with the statement NA - Not Applicable; the statement does not pertain to the simulation activity performed.

<table>
<thead>
<tr>
<th>Item</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>NA</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Problem Solving</strong></td>
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<tr>
<td>10. Independent problem solving was facilitated.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>NA</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11. I was encouraged to explore all possibilities of the simulation.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>NA</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12. The simulation was designed for my specific level of knowledge and skills.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>NA</td>
<td>1</td>
<td>2</td>
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</tr>
<tr>
<td>13. The simulation allowed me the opportunity to prioritize nursing assessments and care.</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>NA</td>
<td>1</td>
<td>2</td>
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</tr>
<tr>
<td>14. The simulation provided me an opportunity to goal set for my patient.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>NA</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
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<tr>
<td><strong>Feedback/Guided Reflection</strong></td>
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<tr>
<td>15. Feedback provided was constructive.</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>NA</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>16. Feedback was provided in a timely manner.</td>
<td>1</td>
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<td>3</td>
<td>4</td>
<td>5</td>
<td>NA</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>17. The simulation allowed me to analyze my own behaviour and actions.</td>
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<td>4</td>
<td>5</td>
<td>NA</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>18. There was an opportunity after the simulation to obtain guidance/feedback from the teacher in order to build knowledge to another level.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>NA</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td><strong>Fidelity (Realism)</strong></td>
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<tr>
<td>19. The scenario resembled a real-life situation.</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>NA</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>20. Real-life factors, situations, and variables were built into the simulation scenario.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>NA</td>
<td>1</td>
<td>2</td>
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<td>5</td>
</tr>
</tbody>
</table>

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**Open-ended question:**

“The goal of this high-fidelity simulation scenario is to teach a conflict resolution skill (the two-challenge rule). Bearing this goal in mind, please recommend a maximum of two changes, regardless of whether these changes relate to the design of the scenario, the conduct of the debriefing session, or both.”

1. 
2. 

203
Student Satisfaction and Self-Confidence in Learning (student version)

Instructions: This questionnaire is a series of statements about your personal attitudes about the instruction you receive during your simulation activity. Each item represents a statement about your attitude toward your satisfaction with learning and self-confidence in obtaining the instruction you need. There are no right or wrong answers. You will probably agree with some of the statements and disagree with others. Please indicate your own personal feelings about each statement below by marking the numbers that best describe your attitude or beliefs. Please be truthful and describe your attitude as it really is, not what you would like for it to be. This is anonymous; the results will be compiled as a group, not individually.

Mark:
1 = STRONGLY DISAGREE with the statement  
2 = DISAGREE with the statement  
3 = UNDECIDED—you neither agree or disagree with the statement  
4 = AGREE with the statement  
5 = STRONGLY AGREE with the statement

### Satisfaction with Current Learning

<table>
<thead>
<tr>
<th>Number</th>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>UN</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>The teaching methods used in this simulation were helpful and effective.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>2</td>
<td>The simulation provided me with a variety of learning materials and activities to promote my learning the conflict resolution content.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>3</td>
<td>I enjoyed how my instructor taught the simulation.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>4</td>
<td>The teaching materials used in this simulation were motivating and helped me to learn.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>The way my instructor(s) taught the simulation was suitable to the way I learn.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

### Self-confidence in Learning

<table>
<thead>
<tr>
<th>Number</th>
<th>Statement</th>
<th>SD</th>
<th>D</th>
<th>UN</th>
<th>A</th>
<th>SA</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>I am confident that I am mastering the content of the simulation activity that my instructors presented to me.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>7</td>
<td>I am confident that this simulation covered critical content necessary for the mastery in a conflict resolution skill (the two-challenge rule).</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>8</td>
<td>I am confident that I am developing the skills and obtaining the required knowledge from this simulation to perform necessary tasks in a clinical setting.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>My instructors used helpful resources to teach the simulation.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>10</td>
<td>It is my responsibility as the student to learn what I need to know from this simulation activity.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>11</td>
<td>I know how to get help when I do not understand the concepts covered in the simulation.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>12</td>
<td>I know how to use simulation activities to learn critical aspects of these skills.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>13</td>
<td>It is the instructor's responsibility to tell me what I need to learn of the simulation activity content during class time.</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
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</tr>
</tbody>
</table>

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Modified April 20, 2012 with permission from NLN, C. Da Silva.
Educational Practices Questionnaire (EPQ, student version)

In order to measure if the best practices are being used in your simulation, please complete the survey below as you perceive it. There are no right or wrong answers, only your perceived amount of agreement or disagreement. Please use the following code to answer the questions.

Use the following rating system when assessing the educational practices:

<table>
<thead>
<tr>
<th>Item</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>NA</th>
<th>1</th>
<th>2</th>
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</thead>
<tbody>
<tr>
<td><strong>Active learning</strong></td>
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<tr>
<td>1. I had the opportunity during the simulation activity to</td>
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<td>2</td>
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<td>4</td>
<td>5</td>
<td>NA</td>
<td>1</td>
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<tr>
<td>discuss the ideas and concepts taught in the course with the</td>
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<tr>
<td>teacher and other students.</td>
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<tr>
<td>2. I actively participated in the debriefing session after the</td>
<td>1</td>
<td>2</td>
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<td>5</td>
<td>NA</td>
<td>1</td>
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<tr>
<td>simulation.</td>
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<tr>
<td>3. I had the opportunity to put more thought into my comments</td>
<td>1</td>
<td>2</td>
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<td>4</td>
<td>5</td>
<td>NA</td>
<td>1</td>
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<tr>
<td>during the debriefing session.</td>
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<tr>
<td>4. There were enough opportunities in the simulation to find out if</td>
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<td>NA</td>
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<tr>
<td>I clearly understand the material.</td>
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<tr>
<td>5. I learned from the comments made by the teacher before, during,</td>
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<td>NA</td>
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<tr>
<td>or after the simulation.</td>
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<tr>
<td>6. I received cues during the simulation in a timely manner.</td>
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<td>NA</td>
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<tr>
<td>7. I had the chance to discuss the simulation objectives with my</td>
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<td>NA</td>
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<tr>
<td>teacher.</td>
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<tr>
<td>8. I had the opportunity to discuss ideas and concepts taught in</td>
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<td>NA</td>
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<tr>
<td>the simulation with my instructor.</td>
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<tr>
<td>9. The instructor was able to respond to the individual needs of</td>
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<td>NA</td>
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<td>learners during the simulation.</td>
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<tr>
<td>10. Using simulation activities made my learning time more</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>NA</td>
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<td>productive.</td>
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<tr>
<td><strong>Diverse Ways of Learning:</strong></td>
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<tr>
<td>11. The simulation offered a variety of ways in which to learn the</td>
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<td>NA</td>
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<tr>
<td>material.</td>
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<tr>
<td>12. This simulation offered a variety ways of assessing my learning.</td>
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<td>2</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>NA</td>
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<td>2</td>
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<td>5</td>
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<tr>
<td><strong>High Expectations</strong></td>
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<td>13. The objectives for the simulation experience were clear and</td>
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<td>5</td>
<td>NA</td>
<td>1</td>
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<td>easy to understand.</td>
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<td>14. My instructor communicated the goals and expectations to</td>
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<td>2</td>
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<td>4</td>
<td>5</td>
<td>NA</td>
<td>1</td>
<td>2</td>
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<td>accomplish during the simulation.</td>
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NA - Not Applicable; the statement does not pertain to the simulation activity performed.
Two Likert items were appended to the EPQ:

Each participant was required to either (a) strongly agree, (b) agree, (c) neither agree nor disagree, (d) disagree, or (e) strongly disagree with the statements.

The following statements were to the EPQ and presented to the Year 2 nursing students:

- “Engagement in a second high-fidelity simulation scenario has made me more likely to use the conflict resolution skill I have learned, as a consequence of my involvement in the first scenario.”
  (a) strongly agree, (b) agree, (c) neither agree nor disagree, (d) disagree, or (e) strongly disagree with the statements.

- “The high-fidelity simulation intervention consisting of two scenarios has taught me how to manage and resolve conflict more effectively in situations where the source of conflict is incomplete or inaccurate information.”
  (a) strongly agree, (b) agree, (c) neither agree nor disagree, (d) disagree, or (e) strongly disagree with the statements.
Appendix F: Compliance Data Collection Forms Year 3 Students

Simulation Data Collection Form: Year 3 Undergraduate Nursing Students

PLEASE NOTE: FORM TO BE COMPLETED BY THE PI OR THE BACK-UP FACILITATOR (for the Year 3 students ONLY).

Year 3 nursing student: 

Date: 

Please circle: Simulation Scenario 1 or Simulation Scenario 2

Please check box to indicate the areas that were completed in the implementation of the HFS intervention.

Year 3 student was orientated to the SPC and the HPS by the technologist

Year 3 student was briefed by facilitator prior to engaging in the simulation scenario

Year 3 student participated in the HFS scenario

Year 3 student participated in the debriefing session that followed the scenario

Time to complete scenario (in minutes)—video log

Time to complete debriefing session (in minutes)

Study Code Number

Please identify the reason(s) why all the tick boxes were not checked off?"
Administration Data Form: Year 3 Undergraduate Nursing Students

Please indicate if the following has taken place:

Technology issues with the Human Patient simulator (HPS)

Absent confederate (actor)

Absent technologist

A Year 3 student became upset after the simulation intervention experience and was referred to student counselling

A Year 3 student complained about her or his research experience to the research ethics board/committee

Please identify the reason(s) why all the tick boxes were not checked off?”
Appendix G: Compliance Data Collection Forms Year 2 Students

Simulation Data Collection Form: Year 2 Undergraduate Nursing Students

PLEASE NOTE: FORM TO BE COMPLETED BY THE PI OR THE BACK-UP FACILITATOR (for the Year 2 students ONLY).

Year 2 nursing student: Study Code Number
Date: ____________

Please circle: Simulation Scenario 1 or Simulation Scenario 2

Please check box to indicate the areas that were completed in the implementation of the HFS intervention.

Year 2 student was orientated to the SPC and the HPS by the technologist [ ]
Year 2 student was briefed by facilitator prior to engaging in the simulation scenario [ ]
Year 2 student participated in HFS Scenario 1 [ ]
Year 2 student participated in the debriefing session that followed Scenario 1 [ ]
Year 2 student participated in HFS Scenario 2 [ ]
Year 2 student participated in the debriefing session that followed Scenario 2 [ ]

Time to complete scenario (in minutes)—video log [__] [__]
Time to complete debriefing session (in minutes) [__] [__]

Did the student complete the two-challenge rule? (please check only one choice)

YES [ ] NO [ ]

Note: The Year 2 nursing student will have utilized the two-challenge rule correctly if the following communication technique is observed:

(a) The first challenge is in the form of a question.
(b) The second challenge provides some support for the student’s concern.

Administration Data Form: Year 2 Undergraduate Nursing Students

Please indicate if the following has taken place:

Technology issues with the Human Patient simulator (HPS)

Absent confederate (actor)

Absent technologist

A Year 2 student became upset after the simulation intervention experience and was referred to student counselling

A Year 2 student complained about his or her research experience to the research ethics board/committee

Please identify the reason(s) why all the tick boxes were not checked off?"