The National Council of State Boards of Nursing (NCSBN, 2005) defines competence as the "application of knowledge and the interpersonal, decision-making and psychomotor skills expected for the practice role within the context of public health, safety and welfare" (p. 2) and acknowledges that further studies are needed to identify best practices for development of clinical competency. More specifically, an Institute of Medicine (2003, p.134) report stressed that health care disciplines "develop a compelling evidence base about what educational content matters for patient care and what works in teaching clinicians." A survey of newly licensed registered nurses by the NCSBN found that the nurses reported feeling most prepared to administer medications and provide care to a few clients after graduation but felt least prepared to provide care to multiple clients, supervise care by others, and know when and how to call physicians (Smith & Crawford, 2003).

It is not surprising that new nurses feel underprepared in these areas. Nursing schools struggle to provide students ample clinical experiences with qualified faculty supervision and face increasing restrictions and competition in securing appropriate clinical sites. In addition, the type of patient assignments and number of patients assigned to students must be balanced with demands to ensure safe and quality supervised care. Recent evidence has indicated the need for

student exposure to an even wider variety of health care practice situations, especially those including communication and collaboration (O'Daniel & Rosenstein, 2008). For example, the leading cause of sentinel events reported to the Joint Commission from 1995 to 2004 was communication failures (Joint Commission on Accreditation of Healthcare Organizations, 2005). Moreover newly licensed registered nurses reporting involvement with medical errors were also more likely to report inadequate educational preparation in collaborative activities such as supervising others and working effectively in teams (Smith & Crawford, 2003).

Clinical education in nursing is comprised of classroom, college and clinical laboratory experience to prepare students for practice. By graduation it is expected that nursing students have acquired entry into practice competency. To this end students must learn and gain comfort with many new skills in cognitive, affective and psychomotor domains during their educational program. Recognizing the magnitude of preventable medical errors and that health care provider education has not kept pace with a changing health care environment and shifting practice expectations, calls have been made to reform clinical education to focus on quality, safety, team-based skills, evidence-based practice, and informatics (Institute of Medicine, 2000; Institute of Medicine, 2003). Simulation

training is one way to increase exposure to these aspects and sharpen professional practice skills while still on the college campus.

Theoretical Basis of High Fidelity Simulation Training and Implications for Clinical Education

High fidelity simulation (HFS) training shows promise in preparing future clinicians for practice in the workplace. Human patient simulators are computer-based manikins providing lifelike responses that optimize exposure to realistic clinical situations. Students enact scenarios by providing direct patient care, evaluating patient data, and experiencing the consequences of decisions and actions without fear of harming an actual patient. Simulation training is generally structured with two basic elements: the scenario and the debriefing. The scenario sets the clinical context or problem providing the opportunity for drill and practice. The debriefing is a time for the student to reflect about the performance and receive faculty feedback in order to focus on improving practice and making refinements.

At its best, simulation training provides students with a wide variety of practice situations in a controlled laboratory setting wherein students demonstrate what they learned. Influenced by the work of educational psychologists including John Dewy and Benjamin Bloom, Wiggins and McTighe (2005) advise that enduring understanding comes from application of performance tasks such as simulation. Students reveal real learning, what they understand of the subject in a performance task, and teachers get evidence of understanding by how students transfer the knowledge and apply it each time they perform a simulation exercise. With HFS, the educational value is not only in the practice but also the assessment.

Educational simulations provide highly immersive experiences wherein skills, process and knowledge can be observed and enhanced. If planned carefully, simulations set up the common learning conditions termed deliberate practice that underlie how expert performance can be reached (Ericsson, 2004; Ericsson et al., 1993). Deliberate practice activities include setting well-defined tasks or skills to achieve, receiving detailed feedback on performance of the task, sufficient time to practice and repeat the task, and continued opportunities to refine performance (Ericsson, 2004). In providing deliberate practice activities, HFS can help students more readily acquire patterns and knowledge of the discipline.

Results from a study by Bjork and Kirkevold (1999) support the importance of expert feedback. The researchers videotaped four newly hired nurses performing procedures at about two, five and twelve months after graduation. One year later, the nurses were found to have performed faster and with better flow however they showed no improvement in technique even after performing the skills 30 times. The nurses received short orientation programs to the hospital units but no further formal training or feedback and subsequently made the same mistakes after a year of experience. Other research supports these findings, confirming the importance of faculty feedback to improve performance (Savoldelli et al., 2006).

Table I summarizes the educational features inherent in the simulation laboratory as compared the clinical laboratory or hospital setting; which has been traditionally considered the gold standard for student experience. Advantages of the clinical laboratory that are particularly important include the availability of multiple patient encounters with varying presentations, an interdisciplinary team-based environment and wide-ranging communication experience. Some disadvantages include the travel time, the long clinical day that is too often

comprised of routine activities, limited opportunity to give suitable feedback because of time constraints or privacy issues, difficulty in standardizing and repeating experiences across students, and agency restrictions that limit comprehensive experience (Decker et al., 2008; Tanner, 2006). Alternately, advantages of the simulation laboratory have been well described and include control of learning objectives, availability of comprehensive patient care and acuity levels, compressed time frame, immediate feedback, and standardized and repetitive experiences (Issenberg et al., 2005; Jeffries, 2005; Rauen, 2004). Disadvantages include the high start up expense (Nehring, 2008), maintenance costs, need for substantial training and extra preparation time (Nehring & Lashley, 2004; Rauen, 2004), and challenges with fidelity as it is never the *real* thing (Haskvitz & Koop, 2004; McCausland et al., 2004).

Table I.

Comparison between Selected Educational Features Inherent in College Simulation Laboratory Experiences and Clinical Laboratory Experiences.

Comparison - Educational Features		
Features	Simulation College Laboratory	Clinical Hospital Laboratory
Meet designated learning objectives	Yes, structured and controlled	Maybe, difficult to control
Time investment	Brief and condensed	Typically all day
Comprehensive experience	Yes	Depends on agency policies for students, limitations apply
Acuity level of assignment	Basic, advanced and emergencies	Basic, some advanced but emergencies usually observation only
Immediate faculty feedback	Yes, typically detailed	Depends on time, privacy, usually brief
Type of feedback	Oral, written or video assisted from faculty or students	Oral or written from faculty, staff and clients
Standardized experiences	Yes	Depends on availability
Option to repeat experience	Yes	Depends on availability
Location	On campus	Off campus
Resources needed	3-4 students/faculty per scenario simulation equipment, laboratory, supplies, maintenance, technician	8-10 students/faculty Hospital contracts

Despite acceptance of HFS training, research documenting its benefits is still preliminary. HFS training in the education of health professionals has received high satisfaction ratings and evidence of student engagement (Kardong-Edgren et al., 2008; McCausland et al., 2004; Wheeler et al., 2008). Several studies document improvement in performance or better skill retention using simulation training (Radhakrishnan et al., 2007; Steadman et al., 2006; Tuttle et

al., 2007; Wayne et al., 2005; Wayne et al., 2008; Yee et al., 2005). Recently evidence of skill decline in cardiopulmonary resuscitation skills was documented using simulation technology (Smith et al., 2008). Current use of simulation in the nursing curriculum occurs primarily in clinical courses probably because of the structured low student-faculty ratio (Nehring & Lashley, 2004).

The aim of this project was to incorporate high fidelity simulation exercises in the lecture portion of a face-to-face undergraduate nursing course. Student-based learning objectives were to identify and describe acute care best practices from lecture material and participate in a simulation exercise to more fully grasp the material. Student feedback and staff impressions about the project were assessed to determine satisfaction and achievement of learning objectives.

Planning and Development of Project

Adequate planning and time to develop the project were key to providing seamless simulation experiences using SimMan® by Laerdal Corporation, a high fidelity simulator. Planning began in the summer for implementation in the spring.

Additionally an interdisciplinary team approach facilitated reaching project goals. The team included faculty, simulation technician, instructional designer, as well as digital media specialist. Individuals with varied backgrounds and expertise could address the instructional, technological, and logistical concerns throughout each phase of the project. An institutional grant provided funding for the project.

Major considerations in constructing the project included to provide clear guidelines, video record the scenarios, limit number of students participating in a scenario, keep the scenario level congruent with student level and time allotment, and maintain a clinical decorum (Jeffries, 2005). Prior student use of simulation was identified as episodic focusing on isolated assessment skills rather than a scenario-based experience. In light of this fact an orientation video was developed to prepare students for the simulation experience and introduce the basic functionality of the manikin. The video depicted students performing a scenario that included a shift report, assessment of a post-operative client, and implementation of common post-operative interventions. Additionally simulation laboratory policies and assignment guidelines were developed.

Whether or not to digitally record the scenarios and whether review of these video recordings would enhance learning was debated. It was anticipated that the video recordings could distract from performance and increase anxiety. Conversely the class could review the videos and gain exposure to multiple scenarios rather than the one experience and this in turn might promote a collaborative experience. Research evidence regarding the educational benefits of video feedback as compared to oral feedback in simulation training is beginning to accrue but remains inconclusive (Birnbach et al., 2002; Savoldelli et al., 2006). In the end the team decided to video record the scenarios, convert the digital recordings to streaming video by the media department, and post the videos for the class to review in Blackboard, the online course management system.

Keeping a low student-faculty ratio during simulation was vital to enhance fidelity, active student participation and adequate supervision. The size of the simulation team was kept to the recommended 3 or 4 students (Rauen, 2004). Alternate meaningful assignments for the rest of the class not participating in the simulation were developed.

Scenarios were designed to be realistic drills to illustrate course concepts, reinforce prior content and demonstrate evidence-based practice. Consideration was given to match the complexity level of the scenario with the knowledge level of the student and time allotted. The project scenarios depicted realistic everyday situations to reinforce course principles and build performance (Kardong-Edgren et al., 2008) rather than complex scenarios that emphasize emergency procedures and are time intensive. Students were expected to maintain a clinical decorum during simulations by wearing uniforms and conducting safety checks, such as verifying two patient identifiers before beginning care to encourage best practice and enhance immersion.

Project Design

The project involved dividing the class into simulation teams composed of three to four undergraduate senior nursing students. Each team enacted a 20 minute scenario that was digitally recorded and received a debriefing after the simulation. Specific scenarios were designed for the project to correspond with course content portraying common clinical problems that demanded solutions. The themes of the scenarios included chest pain management, aspiration

precautions, deep vein thrombosis prophylaxis and electrolyte imbalance management. The didactic content was introduced in class several weeks prior to the simulation.

Students received their simulation assignment similar to a patient assignment in a hospital. Typical patient information such as reason for admission, past medical history, current status, allergies and medications was presented in Blackboard several days before the scenario along with objectives for the scenario. Student participants had the option to examine the equipment or practice skills in the simulation laboratory prior to the scenario. Students were instructed to treat the manikin just like a real patient and that the simulation technician would provide the voice of the patient. Similar to a clinical day, participants did not know what to expect as the scenario unfolded.

In order to expedite the delivery of care in a short period of time, student participants adopted a role in advance that included leader, documenter, or team member. The role of leader involved being in charge and making decisions based on team input. Suggested activities for the leader included reading the orders, prioritizing problems and delegating tasks to peers. The documenter recorded the

events in hand written notes and in the medical record. The team member helped out as needed and performed delegated duties. While the roles were preset before the scenario, all team members were encouraged to provide input and change roles during the scenario as desired.

Students accessed the videos via a link posted in Blackboard. After review of the video, students posted responses to reflection questions in the course on-line discussion board. All students discussed clinical questions related to the simulation content and commented on team performance. Part of the assignment also involved composing a narrative style progress note that summarized the care by the team in the scenario. The assignment was worth ten course points. See **Table II** for an example.

Table II.

Discussion Board Guidelines and Sampling of Questions.

Please answer the following questions and post your responses after viewing the scenario. *Remember to substantiate your statements with examples, classroom content, textbook material, or prior experience.* Your post is graded on documenting well thought out statements.
1. What risk factors did the patient have for a deep vein thrombosis or a thrombotic event?
2. List the skills (cognitive, attitudes, or psychomotor) that the team used in this scenario.
3. Was the decision making timely and appropriate? What factors influenced their choice of priorities? Explain.
4. What did the team do well and how did they perform as a team?
5. What would you do differently if this simulation was repeated? Why?
6. Document progress note (narrative format) to reflect what occurred during the simulation.

At the end of the semester students were asked to complete a survey to assess their satisfaction in regard to the simulation learning scenarios. An electronic survey was created that included open-ended questions. Some questions included: (1) Have you ever used simulation before? (2) What did you do to prepare for the scenario? (3) Do you feel you were adequately prepared for the scenario? (4) What did you learn about working with your peers during the simulation? (5) How can the instructor's cues help decision-making or prioritization during the simulation? (6) Was watching the tapes important in helping you to reflect about your performance? (7) What did you learn about your personal strengths and weaknesses? (8) Did these simulation exercises help prepare you to take care of real patients? Feedback from staff members was also collected.

Project Evaluation

Four simulation teams completed the digitally recorded scenarios and debriefings, two teams each of three and four participants. Half the class had little or no experience with SimMan® prior to this experience whereas the other half had performed one or two scenarios before. Students reported preparing for the simulation in advance by reviewing lecture notes and reference books in regard to diagnoses, past medical history, anticipated interventions and treatments. The orientation video and materials developed for the project were designed to reduce anxiety and prepare the students for the assignment. Given that this was the first scenario-based experience for many students, we were interested in learning if the orientation materials were effective in helping students to feel prepared for the exercise. Survey results reflected that by and large students felt prepared.

The project provided an opportunity for peer collaboration and a lesson in team work. In general students enjoyed the team experience and identified the need for trust, respect and communication when it comes to working as a team. Students clearly supported the use of faculty cues during the scenario. Survey

results indicated that faculty cues were important to guide the care and make timely decisions especially for this timed exercise.

Students reported that reviewing the video was helpful to reflect about performance even though the videotaping aspect made some students apprehensive throughout the simulation. All students reported learning more about performance from the project and clearly identified individualized strengths or weaknesses after viewing the video. Some students watched the videos several times and several students commented that the project provided an unusual opportunity to observe peer performance. Importantly, students reported that the simulation exercises helped prepare them to care for real patients. Students felt they could apply the lessons learned in the clinical setting.

Staff impressions were collected in addition to student feedback. The staff identified both benefits and challenges of the project. Benefits included providing shared immersive simulation experiences that provided opportunities for leadership, delegation, reporting and documentation skills as well as occasions for peer teaching in which stronger clinical performers helped weaker performers. The deliberate structuring of the scenarios to elicit performance of these skills

helped faculty clearly see the degree of skill attainment by students. Subsequently the feedback in the debriefing with students could consist of concrete steps to gain improvement. It was noted that strong student performers played an important role in demonstrating best practices to other students. Students could learn the patterns and knowledge of the discipline from observing good quality peer performance. Challenges included the substantial logistical considerations, lack of perceived realism in the patient's voice and the sometimes poor sound quality on the video.

Discussion

The small class size facilitated successful piloting of the project. It is still feasible to conduct simulations with large classes as long as the required resources are available such as staff assistance, multiple manikins, etc. In general the assignment provided active learning exercises that were different, challenging, engaging and at the same time structured to embed learning in a meaningful clinical context. The technical issues with the sound quality on video and fidelity of patient voice were workable and largely did not diminish the value of the assignment. This was not a research study and results of the project as

summarized by the authors reflected personal views from a small selected group. Nonetheless the evaluation provides initial support to validate use of teaching methodology and guide decisions about future applications of HFS training.

Overall students gained perspective about nursing care in certain situations that could transfer to practice. Students agreed that the exercise helped prepare them to take care of real patients and students felt they gained and refined skills in communication, teamwork, leadership, delegation, and priority setting that could shape future professional practice. They learned not only about how client care benefits from good communication and team work but also how poor communication and team work detract from the quality of care.

Whereas student apprehension about the video recordings was anticipated, there was an unanticipated reaction as well. Students expressed that they had few occasions to observe nursing performance and specifically had not observed their peers performing nursing. Students found this valuable as it provided opportunities to view and objectively evaluate other student performances. By identifying strengths and problems in performance, students gain a better

understanding of what constitutes best practices, thereby improving the possibility of aligning their performance with recommended practice guidelines.

Students also received important feedback in aspects of performance such as timing of actions, priority setting and team communication. These skills are difficult to assess in typical classroom activities. Participants reported that the exercise increased perspective and encouraged evidence-based reflection.

Conclusions

Use of high fidelity simulated learning exercises in the classroom was manageable and provided uncommon opportunities to observe future clinicians perform essential skills based on course concepts, reflect on performance and offer and receive feedback. Student preparation and orientation to the project were vital to ensure success. The review of the videos enhanced achievement of learning objectives and equipped students for performance. In the future, refinements to the project could include collaborating with other student health

professionals on campus to support scenarios designed to build skills in interdisciplinary communication and teamwork.

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