Human patient simulation (HPS) refers to the use of life-size full-body mannequins capable of electronically interacting with humans. In nursing education, it can be used to provide students with realistic opportunities as they practice skills learned in theory. From the simple setting of a single patient in bed to the larger setting of a whole hospital ward with multiple patients, simulation can provide students a chance to act in a role that they are, as yet, unprepared to hold. Traditionally, these skills were learned at the bedside of real patients; however, these individuals potentially could be at risk while being cared for by unskilled students. Additionally, caring for an ill person under the supervision of an instructor or preceptor poses an intimidating task for students who wish to do everything right the first time, an impossible goal. Alternatively, an actor or classmate can play the part of a patient. Limitations of this method include knowledge that the physical manifestations of a particular condition are not really present. For example, an actor cannot really present an irregular heartbeat. Neither method is ideal for patient safety and for student learning. HPS provides another option and is being utilized widely in nursing education. Used in medical instruction since the 1990s, HPS has only become more commonly used in nursing education within the past 5 years.

HPS provides benefits for both learners and instructors. For students, there is no fear of harming a living patient. Pressure to perform quickly and efficiently without mistake is loosened as students may repeat skills as many times as needed. The simulation laboratory is a controlled environment free from distraction and interruption. Students may interact as a group, promoting teamwork, as they would in the workplace. Mannequins may be programmed by instructors to perform in a desired manner, demonstrating or reinforcing specific learning opportunities. For instance, when teaching cardiac arrhythmias, HPS can be programmed to manifest multiple clinical conditions, making it an excellent vehicle to use for student recognition of abnormalities. Through their interactions, students may engage in clinical judgment, problem solving, and critical thinking. Benefits for nursing instructors include consistency in curriculum, as every student may experience assessing, planning, implementing, and evaluating nursing care of identical patients. Theory can
be turned into practice. The National League for Nursing (2005) core competency task statements recommend that nursing instructors employ advanced technologies in the educational process. Finally, the shortage of clinical sites for the student population is lessened.

However, even the benefits of HPS are not without limitation. As with most innovative changes, there are challenges to successful implementation, and HPS is no exception. Evaluation of learning can be problematic. Use of HPS must be incorporated into the curriculum, and instructors must become proficient in its use. The focus of this integrated review was to examine effective techniques of implementing HPS into nursing education.

Methodology

A review of the literature was completed using the Cumulative Index to Nursing and Allied Health Literature (CINAHL) with full text and PubMed databases to find studies that examined the use of simulation in nursing education. Search terms were used in various combinations with the Boolean word and. The search terms included simulation, evaluation, nursing, education, simulation laboratory, learning laboratory, advantages, and study. Thirty-seven studies were reviewed. Inclusion criteria included research articles published in English within the past 5 years that examined the use of simulation in postsecondary nursing education. The time period of 5 years was chosen due to the 2005 National League for Nursing core competency recommendation to use more advanced teaching technology. Additionally, with rapid technological advances, older studies did not consistently reflect current practices. Included studies also followed a deliberate research design to discover the effectiveness of HPS in nursing education. Finally, studies were included only if the resulting data were analyzed and reported, providing evidence to support research conclusions. Because these studies provided some evidence of achievement in each case, it can be concluded that methods used in the studies may be beneficial techniques to incorporate in other simulation curricula. Because the focus of this review was on nursing education, five studies that used HPS in staff development or medical education were excluded. Other exclusion criteria included generalized information about HPS (n = 9), lack of analysis of descriptive data (n = 12), primary focus on testing a theory or model instead of HPS as educational technique (n = 7), reviews of previous research (n = 5), primary focus on instructor proficiency (n = 9), and focused testing of single aspect of HPS without evaluation of overall effectiveness (n = 15). All excluded articles were deemed unsuitable on the basis of two or more exclusion criteria. The techniques used in the reviewed studies were the focus for the synthesis of this integrated review. Ten studies met inclusion criteria and are presented in chronological order by year of publication.

Studies

Simulation training usually produced higher scores in clinical evaluations in the pretest-posttest study conducted by Alinier, Hunt, Gordon, and Harwood (2006) that sought to determine the effect of scenario-based HPS on clinical skill and competence. Ninety-nine 2nd-year undergraduate nursing students volunteered to participate in the study. Results of the study showed that students in the experimental group received statistically significant higher scores than those of the control group. However, there was no statistically significant change on perceptions of stress or confidence identified by the study. The researchers concluded that although the use of human patient simulation did not significantly alter confidence or stress, benefits were appreciably associated with simulation use. Strengths of the study included triangulation through data collection from three consecutive student cohorts, anonymity, randomization of groups, and Statistical Package for the Social Sciences (SPSS Inc., Chicago, IL) data analysis. Additionally, student performance was measured through the use of an Objective Structured Clinical Examination reducing examiner bias. Finally, of the three variables in the study (examiner, student, and patient), one variable was eliminated by using a standardized patient. The study was limited by the large number of people required to evaluate student performance and the fact that the simulation experience was not included in the nursing curriculum.

Scenarios are often used in nursing education. Likewise, scenario-based instruction is widely used with HPS education. A qualitative, descriptive study was conducted by Mikkelsen, Reime, & Harris (2007) using a convenience sample of 141 2nd-year nursing students. This study compared three scenario-based strategies to identify the most effective educational method and instructor role in cross-infection management. Results of the study showed that the students thought that simulation training increased awareness of the complexity of care situations. Strengths of the study include randomization into both the educational method groups and, later, the focus groups. Researchers collaborated with a hospital-based department of infection control to promote realism of the scenarios. An established format was used to guide focus group discussions. Information collected was confidential and anonymous. Data from the focus groups were coded and triangulated for interpretation and validity. Finally, direct student quotes added to the richness of the study. Limitations of the study include difficulty in quantifying
The insertion of a new learning activity into an existing curriculum can lead to conclusions of its efficacy. This is the case in a posttest-only descriptive study conducted by Kait, Mei, Nagammal, & Jonnie (2007) in a school of nursing with a convenience sample of 260 2nd-year student nurses. The goal of the study was to determine the effectiveness of HPS training and to evaluate the student learning experience. From this information, recommendations for HPS training would be developed. Ninety-five percent of the students felt positively about HPS use in instruction. Strengths of the study include the relatively large sample size and participant anonymity. The survey tool was tested by a student sample and refined for clarity. Tables clearly illustrate the study results as percentages. Student quotes added to the vividness of the text. Limiting factors of the study include instructors still learning about the use of HPS and restricted hours of student participation.

Implementing unfocused simulation exercises into curriculum would serve little purpose. Radhakrishnan, Roche, and Cunningham (2007) used a sample of 12 2nd-year baccalaureate students and completed a blinded, quasi-experimental pilot study of evaluation for simulation in nursing education for specific clinical performance parameters. Researchers sought to evaluate the influence of HPS on clinical practice and components of practice that might show improvement with HPS exercises. The areas of interest included safety, basic assessment, prioritization, problem-focused assessment, ensuing interventions, delegation, and communication. Results of the study showed that student participants in the intervention group achieved significantly higher scores for safety and basic assessment skills. Strengths of the study include participant randomization, time triangulation of the clinical exercises, and statistical analysis of data. Also, the evaluating faculty were blinded to control or intervention group membership. The study is limited by the small, homogeneous sample with limited generalization potential. Additionally, there was no alternate activity for the control group to balance instruction opportunity, nor was there any preintervention data to evaluate prior experience that could skew study results.

The theory that simulation exercises can benefit student knowledge and confidence levels was also tested in a quasi-experimental study completed by Scherer, Bruce, and Runkawatt (2007). This study compared the educational effectiveness of HPS and case study presentation. The participants were 23 nurse practitioner students enrolled in an acute care clinical practicum. It was hypothesized that students would have higher scores in knowledge and confidence after participating in a cardiac event simulation exercise. Results from the study showed that both experimental and control groups improved scores in both knowledge and confidence with little statistical difference evidenced. Both methods of instruction worked. Strengths of the study include randomization of participants into groups, use of standardized instruments for data collection, and statistical analysis using SPSS software. Student quotes added to the richness of the article. Limitations include small sample size, the lack of a third group that received no additional instruction, no objective structured examination, and no evaluation of long-term knowledge retention. Additionally, the psychometric properties of the instruments were not tested, nor was the scenario assessed for validity or the ability to help students meet the objectives of the exercise.

Evaluating learner performance in simulation exercises can be problematic. An exploratory qualitative-quantitative-qualitative study by Lasater (2007) sought to describe learner reaction to simulation exercises using Tanner’s Clinical Judgment Model and to develop an effective evaluation tool—a rubric that described levels of clinical judgment performance. The study also included a pilot trial of the rubric. The convenience sample was composed of 24 3rd-year baccalaureate students in an adult medical-surgical clinical course. No significant findings were identified on student score improvement. However, the student focus group was able to identify strengths and weaknesses of high-fidelity simulation in learning. Strengths of the study include data collection at more than one time and use of a focus group after the study to further test the initial results of the study. An established method of focus group moderation, data organization, coding, and theme identification was used. Results were statistically analyzed. The development and refinement of the scoring rubric during the study was a potential limitation of the study as it presented a large opportunity for skewing of study result consistency.

A study that demonstrated more effectively the benefits of simulation learning was completed by Bambini, Washburn, & Perkins (2009). The integrated, quasi-experimental, repeated measures study took place over four semesters in a college of nursing. The participants were a convenience sample of 112 baccalaureate student nurses preparing for their first clinical rotation. The purpose of the study was to evaluate perceived improvement in self-efficacy. The study showed a significant increase in student perception of self-efficacy. Strengths of the study include time triangulation over four semesters and content validity review by an expert panel. Data were statistically analyzed. Attempts were made to minimize social response bias by using anonymity during data collection; however, the study
was limited by the inexperience of nursing faculty in the use of HPS in education.

Simulation can be used to improve proficiency regardless of previous skill level. Gordon and Buckley (2009) completed a descriptive study with a convenience sample of 50 graduate nursing students. The students had an average of 9 years' experience as registered nurses. Goals of the study were twofold: (a) to determine the level of improvement in practice and confidence after HPS exercise, and (b) to identify the components of HPS most helpful to learning. Results of the study demonstrated that, regardless of previous nursing experience and perception of ability, all the students self-reported an increase of skill and confidence in managing the care of an acute patient emergency. The study concluded that the use of immersive simulation with realistic patient emergency scenarios was helpful in making the simulation exercise successful. The study results were strengthened by the fact that none of the participants had prior experience with HPS. A standardized, Likert-type instrument was used, and results were statistically analyzed using SPSS software. A study limitation was the lack of evaluation of theoretical knowledge and technical abilities before student participation.

Students are individuals with differing learning styles. Fountain and Alfred (2009) conducted a descriptive, posttest-only study to determine if student learning style had an influence on the satisfaction level associated with HPS activities. The convenience sample was composed of 76 baccalaureate nursing students. The study showed that satisfaction with the simulation activity was associated with two learning styles—social learning and solitary learning styles. Seventy-six percent of the students preferred social learning styles, which are facilitated by listening, networking, comparing, and interacting with others. However, simulation was shown to be an effective learning mode for students of differing learning styles. Strengths of the study include triangulation of space with data collected on three different campuses even though it was a single school of nursing. Anonymity was provided for participants. An established instrument was used for data collection, and results were statistically analyzed. A table illustrated the findings. Limitations of the study include the use of only descriptive data subject to group perception bias and the small sample size limited to a single school of nursing.

Critical thinking is imperative to effective nursing but very hard to assess in the nursing student. Fero and colleagues (2010) conducted a quasi-experimental, crossover designed study to examine critical thinking skills and performance in clinical simulation exercises with a convenience sample of 36 student nurses in their last academic semester. The study had two goals: (a) a comparison of student performance scores between video-taped vignette and high-fidelity human simulation activities, and (b) the inspection of the relationship between critical thinking skill scores and simulation activity scores. There was no statistically significant difference between educational methods. The majority of participants, regardless of educational modality, did not meet overall expectations on assessment rating. The study also established a statistically significant relationship between strong critical thinking skills (as scored by the commercially prepared tool) and high scoring during the simulation scenario. Strengths of the study include use of an established, commercially prepared tool for evaluation of critical thinking. Student participants were randomly assigned to the educational method. To improve quality of results, after the first exercise, participants reversed educational methods and completed another exercise. Performance was evaluated by raters blinded to group affiliation. Data were statistically analyzed.

Discussion

Human patient simulation is being initiated in the curriculum at many schools of nursing. Doing it successfully presents a challenge. This integrated review is directed at discovering techniques used in studies that have examined HPS as an instructional tactic. The focus is to identify those strategies to suggest future use in nursing education. Research findings are summarized in the Table.

A common strategy used in all the studies is the preparation for a simulation activity. With many facets, preparation can be lengthy. Preparation included the activity setting, unveiling clear faculty expectations for the exercise, scenario development, correlation to related curriculum, and completion of preclass assignments.

Students prepare for simulation activities in the same manner as other learning activities—by completing all preclass work such as reading, written work, or worksheets (Bambini et al., 2009; Fountain & Alfred, 2009; Kait et al., 2007). Results showed a statistically significant increase of both factors after HPS activities. A second instance of this practice was revealed in the study by Fountain and Alfred (2009) on influences of student learning style on the satisfaction associated with HPS. Kait et al. (2007) conducted a study in which the students themselves identified the benefit of introductory written work before participation in simulation activities. While not a focus of the study, it was an important incidental finding of the research team introduced by student participants themselves.

Instructors hold the primary role in preparation. They prepare the setting and scenario, set expectation
guidelines, and determine the degree of synergy with other classes. Each reviewed study prepared a realistic setting most often a simulated hospital room—encouraging students to fully engage in the realism of the situation. To maximize the realistic atmosphere, in one study students were even required to dress in uniform as though they were in the clinical setting (Bambini et al., 2009). Scenarios were created for each study that portrayed a
real patient situation. One tactic was to begin with a commercially prepared scenario modified to complement the prescribed daily instruction plan (Radhakrishnan et al., 2007). Three studies clearly linked the simulation activity to didactic instruction, promoting knowledge retention and understanding (Fountain & Alfred, 2009; Mikkelsen et al., 2007; Radhakrishnan et al., 2007). A benefit to HPS scenario development is the fact that it can change to fit curriculum or student needs. Additionally, planned manipulation of the scenario can make the patient condition become more or less serious just as patient conditions do in real life. In multiple studies, students participated in nursing report and team communication comparable with what is expected in the hospital setting (Bambini et al., 2009; Fero et al., 2010; Fountain & Alfred, 2009; Gordon & Buckley, 2009; Mikkelsen et al., 2007; Radhakrishnan et al., 2007; Scherer et al., 2007).

Instructors should develop clear evaluation criteria to evaluate student performance, and students need to have a clear understanding of what is expected of them. This was accomplished through several different mechanisms in the studies. Alinier and colleagues (2006) outlined clear focused clinical performance parameters that were evaluated during the clinical activity. Over half of the researchers used a qualitative, descriptive method of evaluation (Alinier et al., 2006; Bambini et al, 2009; Fountain & Alfred, 2009; Gordon & Buckley, 2009; Kiat et al., 2007; Lasater, 2007; Mikkelsen et al., 2007; Scherer et al., 2007). Likert-type scales were the common method of obtaining student critiques of HPS as a method of instruction. While student input is important, in evaluation of student performance, qualitative data are not sufficient. It is necessary to have more objective data on which to base a grade. Four studies examined different methods of student evaluation designed to supply that objective data (Alinier et al., 2006; Fero et al., 2010; Lasater, 2007; Radhakrishnan et al., 2007). Each contained either a rubric or a checklist that was used for student assessment. Radhakrishnan et al. used the checklist to add points each time a student completed an action successfully. The others counted off each time an action was not done. The fact that there is not a single accepted means of student evaluation during HPS exercises creates a large opportunity for further research.

After preparation is complete, the HPS activity may begin. Techniques for simulation exercises observed in the reviewed studies include student participation, team interaction, cooperative learning, and documentation of the session. Students in the studies frequently worked in teams, mimicking the way care is delivered in real life (Bambini et al., 2009; Fero et al., 2010; Fountain & Alfred, 2009; Gordon & Buckley, 2009; Mikkelsen et al., 2007). This teamwork provided an opportunity for students to role-play in different positions of the healthcare team, to delegate, to share information, and to develop communication skills. It provided an opportunity for student participants to discover and identify areas of knowledge deficit. Incidentally, students realized that patients are part of the team and witness the care they receive (Mikkelsen et al., 2007). In two of the studies, students expressed the thought that mistakes made in simulation activities were permissible to a degree that they would not be in a real patient setting (Kiat et al., 2007; Mikkelsen et al., 2007). Students enjoyed participating in the simulation activities. Fountain and Alfred examined the relationship between learning style and satisfaction with simulation exercises. The conclusion was that over 75% of the students preferred either solitary or social learning styles and that both styles were associated with simulation activities. One can conclude that minimally three out of four students will benefit from simulated exercises. Finally, in some studies the simulation sessions were videotaped (Radhakrishnan et al., 2007; Scherer et al., 2007). Additionally, in the study by Alinier et al. (2006), students participated in the sessions by observing classmates’ performance. In this manner, student participation, teamwork, learning, and documentation occurred during simulation exercises.

Lastly, post-simulation chores involve evaluation of the session and student learning. In three of the studies, students related that they had increased self-efficacy and confidence after simulation training (Bambini et al., 2009; Kiat et al., 2007; Scherer et al., 2007). Journaling was incorporated in some of the studies as part of reflective learning (Kiat et al., 2007; Radhakrishnan et al., 2007). The largest postsimulation activity was debriefing.

Similar to hospital postclinical conferences, the term debriefing was used to describe the conference with students after a simulation exercise, either individually or as a group. It is here that instructors have the opportunity—and responsibility—to lead guided reflective discussion about student performance. The study by Mikkelsen et al. (2007) divulged that students felt discussion sessions without faculty assistance were not helpful at all. Guided discussion helped students assimilate information, develop critical thinking, and relate the exercise to real-life experiences (Bambini et al., 2009; Gordon & Buckley, 2009; Kiat et al., 2007; Mikkelsen et al., 2007; Radhakrishnan et al., 2007; Scherer et al., 2007). Feedback through focused open-ended questions in a timely manner was observed to be one of the most beneficial aspects of simulation training (Alinier et al., 2006; Lasater, 2007).
Conclusions

Simulation training is becoming commonplace in nursing education. However, HPS use has not yet developed to its fullest potential. While viewed positively by students and faculty, there is scarce quantitative research to validate its value. Indeed, there is a shortage of proven tools to use for validation. Most of the research thus far is qualitative, and although this is valuable, to justify the cost of equipment, faculty time involvement, and student investment, more research is needed to document the true worth of this promising educational method.

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Clinical Resources

- International Nursing Association for Clinical Simulation and Learning: http://www.inacsl.org/INACSL2010/index.php
- Society for Simulation in Healthcare: http://www.ssim.org/ssim/Home
- Simulation Innovation Resource Center: http://sirc.nln.org/
- Association for Standardized Patient Educators: http://www.aspeducators.org/index.htm
- Bay Area Simulation Collaborative: www.bayar-eanrc.org/rsc

References


