Outcomes of a Simulation-Based Nurse Residency Program

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Abstract

Background: This novel nurse residency program extensively used human patient simulation to assist recent nurse graduates in becoming safe and competent clinicians.

Method: Novice nurses practiced clinical skills and developed competencies using scenario-based simulations specifically designed to replicate urgent clinical situations.

Results: The use of human patient simulators and simulated scenarios rapidly increased the competencies of the nurse residents and their confidence and self-assessed readiness to provide care to patients, as well as decreasing length of orientation and rate of turnover.

Conclusion: Nurse residency programs integrating simulation offer a consistent, replicable orientation process and support the ability to evaluate competency development, provide standardized experiences and evaluation, and detect and remediate learning needs.

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began to redesign a traditional nurse orientation program. The intent of the planning included the establishment of a nurse residency program that incorporated human patient simulation as a way to assist recent graduate nurses in medical—surgical and critical care specialties transition into professional practice. Duchesner (2008) has described this experience of moving from “the known role of a student to the relatively less familiar role of professionally practicing nurse” as “transition shock” (p. 1105). Addressing the recent graduate’s feelings of insecurity and inadequacy by bridging undergraduate experiences with escalating and increasing workplace expectations is critical. The objectives of the nurse residency program initially included (a) implementing a standardized approach to orienting recent graduate nurses, (b) reducing turnover of recent graduate nurses, (c) increasing the quality of nursing applicants, (d) decreasing the length and the associated costs of the orientation process, (e) creating a learning experience that would focus on experiential learning, and (f) supporting nurse residents in developing professional competence that supports safe, high quality patient care (Beyea et al., 2007).

One of the major innovations of the nurse residency program was the opportunity for novice nurses to practice clinical skills and develop competencies while using scenario-based simulations in a safe clinical laboratory setting. Using a human patient simulator facilitates learning, particularly as it allows the learner to assess and deal with a clinical issue without risk to an actual patient (Ackermann, Kenny, & Walker, 2007). These experiences were specifically designed to replicate high-risk clinical situations often encountered by nurses in an academic medical center. Furthermore, learning experiences focused on preparing recent graduate nurses to more successfully manage “first-time experiences” that they often reported as highly worrisome, stressful, or complex. Scenarios included a variety of medical—surgical skills but, more important, focused on urgent and emergent conditions often recognized as “failure to rescue” conditions. A panel of clinical experts, consisting of clinical nurse specialists and unit-based educators, identified the priority conditions for each program track through an iterative process. These events and scenarios were subsequently validated during a year of pilot testing. Scenario development focused on high-risk, low-volume events, as well as commonly occurring, error-prone procedures such as administering blood, managing a heparin protocol, and providing patient-controlled analgesia. Learning experiences, both didactic and experiential, emerged from a curricular framework that addressed the overarching concepts of health systems, information management, safety, and clinical/functional systems.

Groups for simulated, scenario-based clinical experiences generally consisted of three or four nurse residents. After each scenario, the nurse residents participated in a period of reflection that used inquiry-based discussion, sharing among group members, and self-discovery. Educators in the simulation center and specialty-based preceptors provided each nurse resident with individual performance feedback at the completion of every week. Learning experiences were specifically adapted or designed to ensure that essential skills and competencies were achieved. During the final week, nurse educators conducted a competency evaluation of each nurse in the simulation center. Nurse residents needed to achieve a minimal level of competency in order to continue working at Dartmouth-Hitchcock Medical Center without an extended probationary period.

**Program Tracks**

Nurse residents participated in one of four program tracks: medical—surgical, pediatrics/pediatric critical care, adult critical care, and neonatal intensive care. Experienced educators from each specialty worked in combination with the directors of practice and research to integrate overarching curricular concepts and themes. Each specialty group developed scenarios specific to its setting and population by using the same educational framework and scenario development process. Each program track varied in length but followed a similar framework in terms of process and content. For example, the medical—surgical residency program included 82 hours of lectures, hands-on skills stations, and self-directed learning exercises; 40 hours of hands-on experience with simulator-based clinical scenarios; and approximately 358 hours of clinical experience with a preceptor, delivered during a 12-week program. The nurse residency programs focused on a series of systematic and targeted experiences that used human patient simulators and computer-based scenarios designed to integrate specific learning opportunities and develop competencies in combination with a precepted clinical experience within their specialty. Each simulated learning experience integrated themes of professional development, continuous quality improvement, collaboration, teamwork, and patient safety (human factors, communication, resource management, and situational awareness). Additional elements of each scenario included medication safety, verbal orders, effective communication, patient identification, time-outs, policies and procedures, management of distractions and interruptions, and the Joint Commission’s National Patient Safety Goals. An overarching value related to professional development and self-directed learning within

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**Key Points**

- Human patient simulation creates reliable opportunities to for recent graduate nurses to develop competence.
- Repeated simulated scenarios assist in the development of curative and supportive nursing interventions.
- Nurse residency programs result in cost savings for acute care hospitals and improve recruitment and retention.

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the context of the curriculum and the entire residency program (Beyea et al., 2007).

The critical care specialty tracks offered recent graduate and experienced nurses who were transitioning between specialties an opportunity to learn critical care specialty skills. Simulation training and clinical experiences were structured in such a way that high levels of competence at the basic level of practice were established prior to learning opportunities at a more advanced level. Within the curricular framework, the critical care nurse residents received additional didactic content and participated in specialty-specific critical care clinical experiences. In addition, all critical care nurse residents participated in a Web-based or didactic, age-specific critical care course.

An example of this design, the Adult Critical Care Nurse Residency Program, was offered in conjunction with the Medical—Surgical Nurse Residency. Nurse residents in adult critical care participated in all the medical—surgical curriculum and scenarios. Concurrently, the critical care cohorts participated in the simulated experiences as their distinct specialty group. In addition, they received advanced lectures and simulations related to the care of critically ill patients. The flow of the critical care track can be seen in the following example of respiratory care. Early in the week, the nurse residents attended a medical—surgical lecture related to the care of the respiratory patient and simulations related to airway and respiratory distress. Later in the same week, the educational sessions for the critical care cohorts related to ventilator care. Following that class, the nurses (recent graduates or experienced nurses) participated in simulated experiences related to a ventilated patient. Each nurse resident in the adult critical care residency attended 8 hours of lecture each week and an additional 8 hours of high-fidelity simulation.

The Intensive Care Nursery Nurse Residency and the Pediatric/Pediatric Intensive Care Nurse Residency were offered as distinct programs. The Pediatric Nurse Residency Program used scenarios related to high-frequency patient populations commonly encountered on the pediatric unit and the pediatric intensive care unit (ICU), as well as low-frequency, high-risk events. The intensive care nursery developed scenarios using a human patient simulator (infant-sized) for all three portions of its nurse residency program: basic, intermediate, and critical. As with all the other nurse residency programs, medication safety, verbal orders, teamwork and effective communication, patient identification, time-outs, and other policies and procedures were included in the scenarios. All programs emerged from the underlying curricular framework and integrated the same themes and elements in a systematic and thoughtful manner.

**Evaluation Process and Outcomes**

The initial year of the nurse residency program served as a pilot period as the education and research team developed, implemented, and tested the various scenarios. During that year a total of 61 nurse residents completed the program (Beyea et al., 2007). Concurrently, the educator group developed and tested assessment and evaluation strategies for didactic sessions, competency measurements, the simulated experiences, and programmatic outcomes. Data from this 1st year provided useful information to make certain adjustments in the curricular flow and content. Outcome data from this pilot period demonstrated the value of the program in supporting recent graduate nurses in developing confidence, competence, and readiness for practice (Beyea et al., 2007). Additionally, a data management plan was developed and implemented and eventually expanded so that Dartmouth-Hitchcock Medical Center could participate in a national effort related to a Health Resources and Services Administration (HRSA)—funded nurse residency program evaluation.

Each nurse resident participating in the nurse residency program and HRSA evaluation project received detailed information about the data collection processes and methods. The program was deemed “exempt from further review” by the Committee for the Protection of the Human Subjects at Dartmouth College. During the 1st week of the nurse residency program, nurse residents received a letter explaining data collection processes and the confidentiality of their data. All data were managed by the nursing research coordinator, who had no direct knowledge of or contact with the nurse residents. Numerous other data were collected or provided by the Human Resource Department, including date of hire, years of employment at the medical center, and turnover data if and when an individual resigned or was terminated. The following discussion provides an overview of the data collected and the outcomes of 3 years of experience with the nurse residency program.

Several evaluation instruments were developed and tested to provide real-time feedback to nurse residents and monitor programmatic outcomes. Instruments measured nurse residents’ competence, confidence, and readiness for practice and their self-efficacy for practice. Data were collected during Week 1, Week 6, Week 12, and at completion of the nurse residency program. After each scenario-based simulation, nurse residents were asked to rate the effectiveness and pertinence of the specific learning experience. Nurse educators in the simulation center also completed a weekly evaluation of each nurse resident by using the Structured Simulation Clinical Scenario (SSCS) instrument. This instrument specifically assessed the nurse resident’s performance during the simulated scenarios.

**Description of the Sample**

From July 2005 through July 2008, 17 cohorts of recent graduate nurse residents were admitted to the nurse residency program, for a total of 260 participants (pilot data from the 1st year, 2004—2005, are not included). A complete description of the sample can be found in Table 1.
The majority of the participants were women (88%) and White (92%). Ages ranged from 20 to 55 years old, with a mean of 29.9 years ($SD = 9.1$). Participants represented more than 90 schools of nursing. A hiring preference existed for BSN-prepared nurse residents compared with those with associate’s degrees (53.5% vs. 44.6%), and four nurse residents with MSN degrees were hired. Many of the nurse residents ($n = 95, 37%$), including the associate’s degree graduates, had degrees in other fields prior to entering their nursing program. More than half (52.3%) of the participants reported their nursing program grade point average as 3.5 or higher.

Nurse residents reported a variety of previous health care experiences. A total of 222 participants (85%) had some form of health care experience prior to the nurse residency program. Those nurse residents had from one to seven types of experience; the most common was having been a nursing assistant (52.7%). A total of 71 of the participants (27.3%) had prior experience in the hospital in which the nurse residency program occurred. That experience included a prior work history ($n = 32$), summer externship ($n = 18$), clinical rotation ($n = 37$), or senior practicum ($n = 34$). Some of the nurse residents had more than one of those experiences (see Table 1).

### Major Findings

#### Nurse Residents’ Ratings of Global Confidence, Competence, and Readiness for Practice

The three-item global confidence, competence, and readiness for independent practice measurement instrument used a 10-centimeter visual analog scale, creating a possible score from 0 to 10. The instrument was administered during the 1st week of the program and then again at 10 weeks. Nurse residents’ ratings improved on all three measures from baseline to the end of the program (see Figure 1). Based on a paired $t$ test, the improvement was statistically significant ($p < .001$) on all three: confidence ($t = -21.61, df = 218$), competence ($t = -22.01, df = 218$) and readiness for practice ($t = -20.0, df = 218$).

#### Nurse Residents’ Weekly Ratings of Confidence, Competence, and Readiness for Practice

Nurse residents were also asked to rate on a weekly basis their levels of confidence, competence, and readiness to independently provide care to patients related to the disease processes or clinical situations studied that week. Consistent with the global ratings, nurse residents rated their levels of confidence, competence, and readiness to practice higher as they progressed through the entire nurse residency program.

#### Nursing Residents’ Readiness for Entry-Into-Practice (Self-Efficacy) Instrument

The Competency Questionnaire: Nursing Residents’ Readiness for Entry-Into-Practice contained 53 items that were rated on a Likert-type scale from 0 (not confident at all) to 100 (very confident). This questionnaire was adapted from the Self-Efficacy for Professional Nursing Competencies Instrument (Babenko-Mould, Andrusyszyn, & Goldenberg, 2004). Components of this adaptation of the questionnaire included: (a) nurse—client relationship (5 items), (b) illness—injury prevention (5 items), and (c)

### Table 1 Demographics of the Sample

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* Percentages do not add up to 100 because of missing data.
curative—supportive care (43 items). A total readiness-to-practice score was calculated as a mean of all 53 items. Reliability of the scale was established with a Cronbach’s alpha of .97 at baseline and .98 at 10 weeks. Based on the recommendations of Tabachnick and Fidell (1983), individuals who had more than 10% of items missing were removed from analyses. That resulted in removing 5 individuals from the baseline survey and 32 individuals from the 10-week results.

Baseline means for the total scale and each of the three subscales are presented in Table 2. Based on a paired t test, there was a significant improvement (p < .001) from baseline to completion of the program, both in the total score and in the three subscales. The greatest improvement was seen in the curative—supportive subscale (14.5 points), which included the items related to the technical and physiologic aspects of nursing care.

### Structured Simulation Clinical Scenario Evaluation

At the time of this study, no instruments were available that could be used to evaluate nurse residents’ performance with the simulation experiences. Over the course of the nurse residency, we developed the SSSCS instrument, which enabled the nurse educators to provide real-time, weekly feedback to nurse residents. The instrument was modified during the program on the basis of observations by the simulation educators and their experiences with the nurse residents in the simulation lab. A parallel instrument was also used by the unit-based educators and preceptors for weekly clinical evaluations. These instruments specifically addressed (a) patterns of proficiency and confidence, (b) the ability to “think on the fly,” (c) use of resources to problem solve complex clinical situations, (d) ability to use reflection as a learning tool, and (e) communication techniques and team performance. This instrument consisted of a checklist of critical and expected behaviors in the practice of recent graduate nurses and was used for weekly discussions with individual participants.

Although it is difficult to report on the outcomes of using this instrument, its development and analysis served as an important component of the nurse residency program. This instrument provided a foundation for discussions of performance with the nurse resident and other educators.

The refinement of this instrument occurred through an iterative process during which the facilitators independently evaluated the performance of a specific group of nurse residents. The instrument was not used until there was 100% agreement among expert nurse educators about definitions and how to evaluate performance. It appeared to us that the nurse residents’ self-evaluations and the scenario facilitators’ evaluations matched in terms of the development of the embedded skills and competencies.

### Recruitment, Retention, and Turnover

Since inception, the nurse residency program has been a powerful recruitment tool. The nurse residency program has more than doubled in size, with two to three applicants for each recent graduate position opening. During the first 4 years of the program, Dartmouth-Hitchcock Medical Center recruited and trained a total of 321 recent graduate nurses in the nurse residency program and continues to experience an applicant pool that exceeds the organization’s need by at least two to three for each position. As knowledge of the program grew, the number of recent graduate nurses who applied to Dartmouth-Hitchcock Medical Center and the nurse residency program more than tripled. When asked why they chose to work at Dartmouth-Hitchcock, newly hired recent graduate nurses consistently stated that the nurse residency program was the primary reason for their decision. The program has also had a significant impact on turnover rates previously experienced with recent graduate nurses at Dartmouth-Hitchcock. The 1-year turnover rate for the participants in the residency program was 9.2%, compared with our 1-year rate of 17% prior to implementing the program. Similarly, the 2-year turnover rate pre-residency program was 43%, compared with a postresidency program turnover rate of 33.7%. Although this rate is currently higher than the national average of 27%, it is a significant improvement, particularly given the challenges of our rural, relatively isolated social setting.

### Length of Orientation

Overall, these structured nurse residency programs have standardized the length of orientation while increasing clinical productivity. Preceptors and unit leaders reported an increased readiness for practice and a more consistent
process for skill acquisition. Orientation time for recent graduate nurses for all specialties decreased and has become more predictable. Prior to implementation of the nurse residency program, the orientation for each recent graduate was individualized and highly variable in duration. The length of medical—surgical specialties orientation ranged from a high of 42 weeks to a low of 21 weeks. With the implementation of the nurse residency program, the median time for orientation decreased to (a) 14.7 weeks for medical—surgical specialties, (b) 18 weeks for special care units, and (c) a mean of 26.5 weeks for ICUs, including adult ICUs (24 weeks), pediatric ICUs (22 weeks), and neonatal ICUs (34 weeks). Previously, these specialty and critical care orientations were routinely longer than 50 weeks. Orientation time decreased in all clinical areas, and informal feedback from clinical and administrative leadership indicated that the nurse residents were more predictably able to take a full patient assignment. Nurse leaders also reported that nurse residents came to the unit better prepared with skills and knowledge and that performance concerns were detected earlier and addressed more effectively. Recent graduate nurses who did not find a “best fit” initially were redirected to other specialties or units, often with successful outcomes.

In terms of the historic 2-year retention of recent graduate nurses, the nursing department experienced a turnover cost avoidance of $3,542,000 the first 3 years of the program. A number of important outcomes were related to the reduction in turnover: (a) Potential early problems were detected, and remediation could occur in a focused manner in simulation and clinical settings; (b) individuals who would later have become “problem” employees (through absenteeism, substandard care, etc.) were detected early and provided support early in their careers at Dartmouth-Hitchcock Medical Center (this did result in some mutually agreed-on departures); and (c) nurse residents appreciated the intensity of training and decided to stay and grow their careers within the organization.

**Nurse Residents’ Feedback**

Response to the program from the nurse residents was consistently positive, and each group of new nurse residents reported that the lifelike simulated crises provided them with an opportunity to gain skills and respond more effectively in actual clinical situations. More than 99% of the evaluations completed by nurse residents that specifically examined simulated experiences indicated that simulated experiences should be integral to a nurse residency program. A total of 229 nurse residents (89%) also reported that they would like more advanced training that used simulation.

Nurse residents’ feedback indicated that they were fortunate to participate in a transition program. They also reported how important simulated experiences were in helping them understand the importance of using resources and how to effectively identify and access appropriate resources. They described their learning experiences as “fun,” “extremely helpful,” and “an opportunity for hands-on learning.” Others commented that “it helped me put the pieces together” and “the same situation we had in the simulation lab happened to me on the unit!” Overall, 96.5% of respondents rated simulation sessions as “very good” or “good” on the SSCS evaluation tool.

**Discussion**

The use of human patient simulators and repeated, simulated scenarios for the development of clinical competency and skill in recent graduate nurses was a powerful and effective strategy. This technique rapidly increased not only the competencies of the nurse residents but also their perceived confidence and self-assessed readiness to assume the care of patients in their respective clinical areas. Human patient simulation has not been widely used and evaluated in the orientation of recent graduates to acute care practice. It has been used more widely in academic programs, with several reports of its effectiveness. Childs and Sepples (2006) reported that although students found simulated mock codes to be very stressful, they rated it most highly in terms of learning effectiveness.

The educators and nursing leaders in the clinical areas agreed that the method was superior to other previously tried methods in preparing recent graduate nurses for practice. Using repeated simulated scenarios as a teaching strategy appeared to specifically assist in the development of curative and supportive nursing care interventions, which the nurse residents indicated were the weakest elements of their practice in the earliest phases of the nurse residency program. Horan (2009) reported that human patient simulation helps learners understand didactic concepts, makes them feel more capable in caring for the patient, helps them make clinical decisions, enhances their confidence, provides a nonthreatening environment, and helps them develop critical thinking. Because nurse residents were evaluated weekly on collaboration and teamwork, the simulated scenarios were also effective in promoting communication and discussion among nurse residents regarding not only the care of patients but also how well they assisted each other in caring for the patient. Feedback is one of the most important features of simulation, closely followed by the level of complexity and fidelity, collaboration, active learning, and diverse learning opportunities (Childs & Sepples, 2006). These interpersonal techniques were important components of practice in promoting safe, high-quality care.

The nurse residency program proved to be a highly successful recruitment and retention strategy for Dartmouth-Hitchcock Medical Center. Within 1 year, the proportion of applicants far exceeded the available nurse
resident positions. Recent graduate applicants indicated their strategy for determining employment options was to do an Internet search for organizations that offered nurse residency or nurse intern programs. These organizations moved to the top of their list of desirable workplaces. The presence of the nurse residency program, in addition to the organization’s magnet status, virtually eliminated any barriers to attracting recent graduate nurses. The program also improved the retention of recent graduate nurses. Compared with the period prior to the residency program, turnover rates decreased for each year, and although they are still slightly higher than the national average, this was an important improvement. Given the acuity of the patient population and the rural nature of the medical center, a decreased turnover and vacancy rate was important in Dartmouth-Hitchcock Medical Center’s efforts to provide high-quality, safe patient care; ensure availability of services to rural patient populations; and manage the fiscal impacts of high turnover. Although some might think that the length of the orientation was long, the nurse residency program eliminated the variability in the length of orientation, as well as shortening the average length of orientation for recent graduate nurses. Given (a) the high acuity of the patient population, (b) the fact that many recent graduate nurses have never had clinical experiences with patients of such high acuity, and (c) the improved retention rate, the program has demonstrated a positive cost benefit to the organization.

The nurse residency program was also very powerful in engaging the recent graduate nurse. Most were young and very comfortable with high-tech equipment and techniques. The human patient simulator was powerful in helping the recent graduate nurses appreciate the impact of their decisions and, on occasion, understand how their actions led to the “death” of the “patient” within the simulated scenario. The repeated simulations also created a “rotelike” response to selected critical patient events, which made the new graduate nurse particularly skilled at managing respiratory and cardiac events that might lead to untoward patient outcomes.

Conclusion

These findings have helped Dartmouth-Hitchcock Medical Center identify significant gaps in the knowledge and abilities of recent graduates and how to deploy an effective teaching strategy for addressing these gaps. These findings have been shared with nursing school affiliates in an effort to address academic learning needs and to assist with the development of an effective nursing workforce. The Dartmouth-Hitchcock Medical Center Nurse Residency Programs offer a consistent, replicable orientation process and support the ability to evaluate competency development, provide standardized experiences and evaluation, and detect and remediate problems or learning needs early. They have also been financially beneficial by reducing costs associated with maintaining a competent, professional, and experienced nursing workforce.

Acknowledgments

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References