



White Paper

Can Virtual Patient Simulation Be Used in Substitution of Traditional Clinical Hours in Undergraduate Nursing Education? A Review of the Evidence



CAN VIRTUAL PATIENT SIMULATION BE USED IN SUBSTITUTION OF TRADITIONAL CLINICAL HOURS IN UNDERGRADUATE NURSING EDUCATION? A REVIEW OF THE EVIDENCE

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One of the main purposes of undergraduate nursing education is to prepare new professionals to address the growing need for competent nurses in the United States. According to the US Bureau of Labor Statistics (2022), employment of registered nurses (RN) is projected to grow 9% over the next decade. The demand for healthcare services will increase due to a rapidly aging population, an increase in the number of patients with chronic conditions, and a greater need for long-term and outpatient care facilities. In addition, the availability of appropriately trained nurses is critical to establishing a rapid, focused, and effective response to health crises such as the one imposed by the COVID-19 pandemic (Roush, 2020).

In recent years, undergraduate nursing education has faced numerous challenges as the demand for nurses continues to rise, including increased student enrollment without capacity to accept them, faculty shortages, and lack of clinical placements. According to data released by the American Association of Colleges of Nursing (AACN) in 2021, nursing programs offered at the prelicensure level have seen more than 15 years of continuous enrollment growth. AACN's annual survey findings showed that student enrollment in prelicensure programs increased by 5.6% in 2020 despite concerns that the COVID-19 pandemic might negatively impact interest in the nursing profession (American Association of Colleges of Nursing, 2021, April 1). In another survey conducted by the National League of Nursing (NLN) in 2020, 18.1% of programs mentioned faculty shortage as one of the primary impediments for program expansion capacity (Mazinga, 2021). Results from that survey also indicated that 46.1% of prelicensure programs cited the lack of clinical placement settings as the primary obstacle in the admission of qualified applicants. Moreover, the COVID-19 pandemic forced traditional settings to limit or directly refuse clinical experiences to nursing students, which placed nursing schools in a struggle to meet their respective clinical hour requirements.

To mitigate these challenges, many nursing programs started substituting students' traditional clinical hours with some form of simulation a few years ago. In 2014, the National Council for State Boards of Nursing (NCSBN) Simulation Study provided evidence that substituting high-quality simulation experiences for traditional clinical hours results in comparable educational outcomes in undergraduate nursing clinical courses (Hayden et al., 2014). Subsequent studies have demonstrated that simulation offers a more concentrated and efficient learning experience than traditional clinical experiences and suggest that one hour of simulated clinical time may account for at least two hours of traditional clinical time (Curl et al., 2016; Haerling & Prion, 2021; Sullivan et al., 2019). With most nursing programs being forced to transition fully online due to COVID-19, in several states, because of executive orders, nursing programs were allowed to use up to 100% simulation, including virtual patient simulation, to replace clinical experiences in which students provide direct patient care (NCSBN, 2020, Summer).

As the field of nursing education continues to improve this educational strategy, several studies have examined the effects of simulation on student outcomes when used in substitution for traditional clinical hours. The purpose of this white paper is to examine evidence on the effectiveness of this strategy, identify best practices for its implementation across the undergraduate nursing curriculum, and discuss the role that Elsevier's Shadow Health Digital Clinical Experiences could potentially play in improving the preparation of students as faculty adopt virtual patient simulation into their course.

THE VALUE OF VIRTUAL PATIENT SIMULATIONS

Nursing students must develop and practice a combination of clinical judgment skills based on structured patient assessment, critical reasoning, and communication skills to elicit the most important aspects of patient symptomatology, psychomotor skills to facilitate hands-on examination, and affective skills to help guide these processes (Abdulla & Chen, 2018; Tanner, 2006). As an integral component of undergraduate nursing education, simulation allows for a safe, timely, and prescriptive approach to meet learning objectives at various program levels (i.e., scenarios, courses, and academic programs; Franklin & Blodgett, 2020). The use of simulation offers several aspects of training that real patient encounters cannot, including repeating scenarios, highlighting specific diseases and scenarios, and allowing students to make mistakes in a controlled environment without fear of patient harm (Roberts et al., 2019). In this context, simulation has evolved to become a major component of undergraduate nursing education as the field strives for developing practice-ready professionals (Bryant et al., 2019).

In nursing education, simulation is usually defined as the most accurate possible representation of a care situation and can be categorized relative to its degree of clinical fidelity: high, intermediate, or low (Laure et al., 2015). When integrated with clinical placements, simulation provides students with key clinical behaviors and concepts in a safe environment, which in turn promotes the transferability of learning to actual care situations facilitated in clinical practice (Roberts et al., 2019). As a type of simulation modality, virtual patient simulation can be considered high-fidelity simulation because it is "extremely realistic and provide a high level of interactivity and realism for the learner" (Meakim et al., 2013, p 6). After an extensive review of the literature on virtual simulation, Foronda et al. (2020) suggested that virtual patient simulation should not be used as a wide umbrella term to describe any virtual modality, but it rather should be used to refer to partially immersive, screen-based experiences. To provide clarity and a shared understanding regarding virtual simulations, Foronda (2021) defined virtual simulation as the "use of partial immersion through a digital learning environment (e.g., computer, tablet, phone, screen, etc.) to foster a perceived lived experience for an intended outcome (e.g., learning, entertaining, etc.)".

Virtual patient simulations have been found to be comparable or superior to other high-fidelity traditional simulation methods due to a variety of reasons. In an integrative review of 12 studies published between 2008 and 2015, Duff et al. (2016) found that virtual patients and simulated scenarios were comparable or superior to traditional simulation methods for teaching diagnostic reasoning and assessment skills in terms of increased student learning, satisfaction, and engagement. Among other benefits, Duff et al. concluded that these patient scenarios were more realistic and challenging than manikins or standardized patient actors due to the ability to create virtual scenarios including physical findings (e.g., abnormal heart rhythms or breath sounds) that were impossible for standardized patient actors to simulate (Gesundheit et al., 2009; Lin et al., 2012; Pucher et al., 2014; Tan et al., 2013).

Kononowicz et al. (2019) conducted a systematic review on the effectiveness of virtual patient simulations compared with traditional education, blended with traditional education, compared with other types of digital education, and design variants of virtual patients in health professions education. Findings indicated that, when compared to traditional education, virtual patient simulation can more effectively improve various types of skills (i.e., clinical reasoning, procedural skills, and a mix of procedural and team skills) and at least as effectively improve knowledge outcomes.

In a systematic review spanning over 20 years of peer-reviewed research, Foronda et al. (2020) found that virtual patient simulation positively impacts various nursing student learning outcomes. Most research (86%) showed that virtual patient simulation was an effective pedagogy to support learning (knowledge), skills/performance, critical thinking, self-confidence, and provide learning satisfaction. Furthermore, learning outcomes from virtual patient simulation were similar to those of manikin-based simulation in several studies, both in the cognitive and psychomotor domains.

In the same way, other studies have found that students become more engaged with virtual patient scenarios and value having a safe environment to practice reasoning skills before seeing real patients in a clinical setting (De Gagne et al., 2013; Gesundheit et al., 2009; Lin et al., 2012; Poulton et al., 2009). By using asynchronous, computer-based simulations students can receive immediate and timely feedback that can be more directly linked to the skills being practiced (Gesundheit et al., 2009). Virtual patient scenarios can also provide transformative learning experiences for students by challenging their prior knowledge and assumptions in light of a deeper and more meaningful patient interaction (Kleinheksel, 2014). In a quantitative cross-sectional study that included prelicensure students, Brown et al. (2021) evaluated the effects of participating in a virtual patient simulation experience using the System Usability Scale (SUS)[®], the Clinical Learning Environment Comparison Survey (CLECS 2.0), and the Simulation Effectiveness Tool-Modified (SET-M). Overall, prelicensure students rated the usability of the virtual patient simulation better than average. Results from the CLECS tool indicated that students' perceived experience was relatively similar for face-to-face simulation and virtual patient simulation. Finally, the SET-M results showed that students rated the virtual simulation experience positively. These findings supported virtual patient simulation as an effective tool for delivering experiential simulation learning.

The ease of access, flexibility, and cost-effectiveness of virtual patient simulations also stand out as being benefits in comparison to other high-fidelity simulations methods (Brown et al., 2021; Duff et al., 2016; Kleinheksel & Ritzhaupt, 2017). Because simulation laboratories usually require multiple high-fidelity manikins as well as specialized faculty and technicians, setup and maintenance costs can be very high. Moreover, for face-to-face nursing programs that have 100 or more students, scheduling can also be complicated as working groups are normally made up with no more than eight students in simulation laboratories (Verkuyl et al., 2017). For online or blended programs, high-fidelity manikins may not be the most effective alternative to account for hours of clinical instruction. The use of virtual patient simulations could free faculty from having to go to multiple clinical sites to meet up with students and preceptors since student performance evaluation, and even debriefing, can occur asynchronously (Foronda & Bauman, 2014; Verkuyl et al., 2020a, 2020b).

TRADITIONAL CLINICAL HOURS SUBSTITUTED FOR SIMULATIONS

Despite being the preferred model for clinical education in nursing, there is still weak evidence supporting the effectiveness of traditional settings (Leighton et al., 2021; Sullivan et al., 2019). From a misalignment between expectations and realities of the clinical setting (Papathanasiou et al., 2014), to an excessive focus on task completion versus problem solving or clinical reasoning (Ironside et al., 2014), to gaps in quality and safety education competencies

(Pauly-O'Neill & Cooper, 2013), whether traditional clinical experiences provide learners with the learning, skills, and competences necessary for safe practice and optimal patient outcomes is a claim that yet needs to be rigorously validated.

The NCSBN conducted a large-scale, nationwide, randomized study comparing educational outcomes between student groups where simulation was substituted for up to 50% of traditional clinical experiences (Hayden et al., 2014). Results showed that there were no significant differences in nursing knowledge, clinical competency, NCLEX® pass rates, and overall readiness for professional practice when simulation was substituted for up to 50% of traditional clinical experiences. This landmark NCSBN study also showed that the benefits of using simulation in lieu of traditional clinical hours in prelicensure nursing programs expanded to their students' first clinical position as there were no significant differences in clinical competency and readiness for practice at six weeks, three months, and six months after graduation.

Other research studies have showed that undergraduate students perceived simulation as a valuable clinical teaching model, as well as reported higher confidence when compared to their peers who only experienced traditional clinical hours (McCabe et al., 2015; Rodriguez et al., 2017). McCabe et al. (2015) evaluated undergraduate students' self-confidence in clinical practice under a model replacing 50% of traditional clinical hours by high-fidelity simulation in a large, urban, research-intensive university in the US. Between the midpoint (second semester) and end of the program (fourth semester), changes in students' perceived self-confidence were assessed relative to the eight clinical practice competences established by the Student Self-Assessment of Breadth of Nursing Education (ANE). Results indicated that program time had a significant effect on students' self-confidence on each of the eight clinical practice competences, with students showing increases in their confidence levels from the midpoint to the end of the program.

Rodriguez et al. (2017) examined undergraduate nursing students' assessment of learning in a clinical teaching model that replaced 50% of traditional clinical hours with high-fidelity simulation in four core medical-surgical courses at the NYU Meyers College of Nursing. In their teaching model, simulation sessions were guided by Jeffries' educational practices model (Jeffries, 2005), which focuses on the principles of active learning, collaboration, diverse ways of learning, and high expectations. In their innovative clinical teaching model, NYU Meyers College of Nursing faculty were able to gain greater control over the range of patient scenarios and exposure to specific clinical skills that students practice, shifting the focus to key outcomes such as therapeutic communication, care planning and goal setting, interprofessional collaboration, and reflective practice (Richardson et al., 2014). In their study, Rodriguez and colleagues evaluated students at two time points within their two-year undergraduate program (i.e., midpoint and end of program) using a validated measure that assessed aspects of simulation-based learning which included the four domains of Jeffries' educational practice model. Results showed that, from midpoint to end of the program, students indicated increases in exposure to simulation activities focused on active learning and high expectations domains, as well as the importance of the collaboration domain.

Smiley (2019) conducted a national survey of all US prelicensure programs to explore the current state of simulation and determine the impact of the NCSBN study as well as NCSBN's National Simulation Guidelines. Survey findings revealed that the majority of RN and LPN/LVN programs substituted simulation for clinical hours, and 77.8% of RN programs and 79.9% of LPN/LVN programs used a 1:1 ratio of simulation to clinical hours. During a seven-year period (2010-2017), the use of both high-fidelity simulations also increased substantially, and 61% of respondents identified a need for an increase in the use of simulation in their respective programs. Some of the barriers identified to the use of more simulation included lack of faculty resources, limited faculty training in both conducting simulation and debriefing, and lack of simulation scenarios (Smiley, 2019).

Although nursing programs have long begun to integrate simulation to substitute traditional clinical hours in prelicensure education, there is still a large variability in terms of regulations and guidelines among Boards of Nursing (BONs) in the US. Bowling et al. (2018) reviewed the clinical hour replacement requirements for prelicensure nursing education across all 50 BONs in the US and found that 26 states (52%) provided a definition of the nature of clinical experiences, but only 10 states (20%) required a specific number of clinical hours. Additionally, 24 states (48%) allowed simulation to replace a portion of clinical hours and 15 BONs (30%) offered systematic guidance as to how much simulation could fulfill traditional clinical hours. Bradley et al. (2019) also explored how BONs in the US and the District of Columbia defined and regulated the use of simulation in prelicensure nursing education, including the amount of traditional clinical hours that could be replaced with simulation. They found that 25 BONs (50%) had documented regulations defining a percentage of clinical hours that could be replaced with simulation, with over half of them allowing up to 50% of the clinical hours to be replaced with simulation (i.e., FL, IA, KY, LA, MN, NH, NM, SC, SD, TN, TX, WA, and WI). Other BONs allowed for smaller percentages of replacement of clinical hours with simulation, including 30% (DC and OK) and 25% replacement (CA, IL, IN, MS, NV, VT, and VA). Only four BONs identified regulations for the use of simulation but did not specify an exact allotted percentage of replacement (AL, GA, MO, and RI; Bradley et al., 2019).

USING VIRTUAL SIMULATIONS AS A REPLACEMENT FOR CLINICAL HOURS

Although undergraduate nursing education accrediting agencies such as the Accreditation Commission for Education in Nursing (ACEN) or The Commission on Collegiate Nursing Education (CCNE) outline the competencies that new graduates should achieve by the time they complete their nursing program, they fall short of providing clear guidelines or reference specific evidence for the different types of clinical experiences and settings nursing programs should provide for their learners. In a descriptive comparative study conducted across four prelicensure nursing programs (two ADN and two BSN) to identify the number of clinical and simulation hours within certain courses (i.e., Foundations, Medical-Surgical, Psychology, Pediatrics, Obstetrics/Gynecology, Capstone, and Critical Care for the two BSN programs), Cipher et al. (2021) found a wide range of total program and simulation hours allocated to each course. For instance, BSN programs reported slightly higher total hours (900 and 948 versus 796 and 896 for the ADN programs), and total simulation hours ranged between 140 and 224. However, when compared on NCLEX performance, the two combined ADN programs did not significantly differ from the two combined BSN programs, even after adjusting for race and age. Their findings showed that prelicensure NCLEX performance did not correspond with clinical hours, which indicates that identifying the optimum range of clinical and simulation hours as well as its appropriate distribution may be a difficult task for decision-makers in nursing programs.

In a study aimed at comparing prelicensure students' perception of learning across traditional clinical, face-to-face simulation, and virtual simulation environments, Leighton et al. (2021) found that learners rated traditional clinical environments higher than face-to-face and virtual simulation in all eight dimensions of the Clinical Learning Environment Comparison Survey (CLECS): communication, nursing process, holism, critical thinking, self-efficacy, teaching-learning dyad, and medication administration and care documentation. Additionally, certain items in the communication, nursing process, critical thinking, and teaching-learning dyad dimensions indicated that learners thought their learning needs were better met by face-to-face simulation than by virtual simulation. The authors suggested that the findings were concerning in light of the discussion on whether simulation-based experiences can replace traditional hours.

While studies have specified that the simulation used in place of traditional hours must be “high-quality” (Hayden et al., 2014), there are several modalities of simulation that can be used in lieu of clinical hours. Research has concluded that asynchronous, virtual patient simulation experiences can lead to increases in students’ knowledge and self-confidence in a similar fashion to face-to-face traditional simulations (Cobbett & Snelgrove-Clarke, 2016; Cummings & Connelly, 2015; Verkuyl et al., 2017). For instance, Cobbett and Snelgrove-Clarke (2016) compared the effectiveness between a virtual clinical simulation and a face-to-face high fidelity manikin scenario for two different maternal-newborn clinical simulations in third year undergraduate nursing students. Results showed no significant differences in student learning outcomes between the two simulation modalities. Given that the implementation of face-to-face simulations can be costly and their standard equipment resource intensive, the authors suggested that online, virtual simulation experiences cannot only be less costly but also provide students with repeated practice opportunities in a safe, standardized, and easy-to-access environment.

Simulation activities have a positive impact on important student learning outcomes for undergraduate nursing students when virtual simulation is used in place of traditional clinical hours. Cummings and Connelly (2015) conducted a study where eight hours of observation were replaced with eight hours of online simulation time for junior and senior undergraduate nursing students. The simulation scenarios covered what students were being taught in class (i.e., Adult Health I and II for junior students and Professional Nursing Integration for senior students); involved pre- and post-quizzes, detailed patient information, and a documentation system; and were delivered in groups of three to four students at the time. After one year, students reported higher levels of self-confidence and active learning. As they went through simulations in place of traditional clinical hours over time, students were able to identify an improved belief in mastery of the content and confidence in their knowledge base for skills and critical content related to adult health nursing. Students also reported improvement of their debriefing, including their opportunities for making comments, understanding of content, and productivity.

Verkuyl et al. (2017) conducted an experimental study comparing a pediatric nursing virtual gaming simulation and a laboratory simulation among second-year BSN and RN-BSN students. Students in both groups were compared regarding pediatric knowledge, self-efficacy, and satisfaction. The pediatrics case study used was identical for both groups in terms of learning objectives, story script, and decision points; yet feedback on the students’ progress was built into the virtual gaming simulation. Results showed comparable gains in pediatric knowledge and self-efficacy as well as high satisfaction scores across both groups, which suggests that similar outcomes may be achieved with virtual gaming simulations in comparison with traditional laboratory simulations. Further research work by Verkuyl et al. (2019, 2020a, 2020b, 2021) has suggested that positive debriefing experiences and comparable gains in knowledge and self-efficacy can be achieved through self-debrief (by itself or followed by small- or large-group debrief), virtual debrief, and in-person debrief after a virtual gaming simulation, which shows how the unique features of virtual simulation can promote the assessment of knowledge, identification of learning needs, and change in behaviors to achieve educational goals through meaningful reflection.

Foronda and Bauman (2014) suggested that virtual simulation may be used to count for a portion of clinical hours, replicate high-risk clinical experiences, and act as clinical makeup. Clinical placements are increasingly scarce and difficult to arrange, and sometimes students are even required to pay extra fees to attend clinicals. In addition, using virtual simulations in lieu of traditional clinical hours may exempt faculty from the burden of driving out to multiple clinical sites to meet up with students and preceptors as evaluation of student performance and debriefing can occur

asynchronously. On the other hand, situations involving high-risk training scenarios (e.g., premature newborn care in pediatrics, a patient presenting with PTSD in mental health, or end-of-life situation in gerontology) may require students to practice in a low-risk, low-anxiety environment due to safety, liability, and ethical reasons (Foronda & Bauman, 2014). Virtual patient simulations may complement the existing undergraduate nursing curriculum by incorporating these difficult and high-risk clinical experiences as well as provide an important curriculum standardization in nursing education so that all students can have access to high-quality, comparable educational opportunities (Baillie & Curzio, 2009; Foronda & Bauman, 2014; Laure et al., 2015).

Virtual patient simulation provides a unique opportunity for students to experience the complexities of delivering safe patient care as well. To facilitate completion of nursing education clinical experiences during the COVID-19 pandemic, many states were allowed to replace up to 100% of their traditional clinical hours with simulation, including virtual patient simulation National Council of State Boards of Nursing (2020, Summer). Findings from the NLN Deans' and Directors' Survey regarding COVID-19 showed that 72.2% of nursing schools provided clinical experiences through virtual clinical simulation because of limited access to clinical agencies during the pandemic (National League of Nursing, 2021). In terms of strategies implemented to address their students' clinical experiences, some nursing schools (32%) purchased virtual simulation as their new simulation equipment of their choice. Shea and Rovera (2021) presented the strategies used to replace up to 50% of the required direct patient care hours with virtual patient simulation activities during the COVID-19 pandemic. In their undergraduate nursing program, the use of virtual patient simulation, along with telehealth with standardized patients (SP), accounted for 18,403 hours completed by 244 students across courses such as Fundamentals/Health Promotion, Reproductive Health, Mental Health, Pediatrics, Medical-Surgical, and Community Health. Based on their enlightening experience, Shea and Rovera recommended nursing programs to include virtual patient simulation and remote simulation encounters as permanent components of the curriculum, especially as part of a plan to address campus closure due to emergencies such as a pandemic.

WHAT IS A GOOD REPLACEMENT RATIO?

Several studies demonstrate that simulation may offer a more focused and efficient learning environment than traditional clinical experiences (Haerding & Prion, 2021). Pauly-O'Neill et al. (2013) used a sample of junior-level BSN students to compare the actual number of minutes students spent addressing Quality and Safety Education for Nurses (QSEN) competencies between a traditional pediatric clinical and a pediatric simulation rotation. Pauly-O'Neill and colleagues found that, even though students spent more time on the QSEN competencies in the traditional clinical than in the simulation rotation, they were more consistent in the amounts of time spent on a given activity in simulation compared to traditional. Another interesting finding was that students spent less than 10 minutes during a 3.5-hour clinical period or simulation laboratory engaging in quality improvement, evidence-based practice, and informatics, which indicated that students may not be effectively developing these skills during traditional clinical experiences. Lastly, students were more engaged in meaningful work as well as observing other students in the simulation laboratory.

Breymier et al. (2015) examined the ratios of simulation to supervised clinical hours per nursing course used, as well as the rationale for substituting simulation in place of traditional clinical hours in over 400 prelicensure nursing programs in the US. In their study, 77.5% of participants indicated that their nursing program uses simulation in place of supervised clinical instruction. Regarding the standardized versus unstandardized ratio of simulation substitution for clinical, 45% of participants indicated that their nursing program used the same ratio of simulation hours to supervised

hours for each course (i.e., standardized ratio), while 55% indicated that their program did not (i.e., unstandardized ratio). The most common simulation to clinical time ratio among nursing programs using standardized replacement was 1:1, with over 60% of participants reporting it. For nursing programs reporting unstandardized ratios, the 1:1 simulation to clinical time ratio was also most commonly reported for core courses throughout the curriculum (e.g., Fundamentals, Medical-Surgical/Adult Health, Women's Health, Mental Health and Pediatrics).

Curl et al. (2016) also examined the effectiveness of using high-fidelity simulations in place of 50% of traditional clinical experiences in four clinical specialty areas: Obstetrics, Pediatrics, Critical Care, and Mental Health. Students from three associate degree nursing programs were assigned to either an experimental intervention group combining simulation and clinical experiences or a control group using only traditional learning experiences. Student learning during four hours of high-fidelity simulations (including pre-lab and debriefing activities) was equivalent to or better than eight hours of traditional clinical experiences (i.e., 1:2 simulation to clinical time ratio). At the end of the research study, students in the high-fidelity simulation group performed as well as, if not better than, students who participated in the traditional hours group on a standardized measure of Medical-Surgical knowledge. Both groups also yielded comparable NCLEX-RN® pass rates. Over 95% of the students in the high-fidelity simulation reported that the simulation experience improved their critical thinking and increased their confidence in technical skills. Faculty's evaluation of students' performance also reported that near 50% of the students showed above average critical thinking competency.

In a multisite study conducted across four prelicensure nursing programs, Mancini et al. (2019) compared clinical competence and NCLEX results between an intervention cohort with a redesign of the use of simulation, a redistribution of clinical hours, and an implementation of new educational approaches into simulation experiences. These cohorts were compared over time on clinical competency after simulation in certain clinical courses as well as before, during, and after traditional clinical experiences in the same courses. After comparing the clinical competencies of a cohort receiving traditional clinical instruction relative to a cohort receiving reduced traditional instruction and increased simulation, findings showed that both performed similarly on clinical competence assessments. In addition, students' clinical competence was compared right after a course's simulation module versus at the end of the course. For Medical-Surgical, Psychiatric, and Capstone courses, no differences in clinical competence were found between assessments done at the end of the course and immediately after simulation. Even though for Pediatrics and Obstetrics students assessed at the end of the course performed significantly better than those assessed immediately after simulation, effect sizes were small. Finally, no significant differences between the cohorts on NCLEX pass rates were found.

Early evidence towards a 2:1 clinical to simulation ratio has been supported by the research of Sullivan et al. (2019). They conducted a multisite observational study comparing traditional clinical time to simulation on the type, number, and level of educational activities as determined by Miller's Pyramid in prelicensure nursing students. Study results showed that skills, physical assessment, teaching and critical thinking activities (i.e., data gathering, discussion of care plan, debriefing, performing nursing interventions, and patient teaching activities) occurred more frequently in simulation, whereas safety interventions were more commonly observed in traditional clinical time. In simulation, prelicensure students performed a greater percentage of activities in higher levels of Miller's Pyramid (i.e., "Knows How" and "Does") in comparison to clinical (12.8% vs. 8.6% and 66.3% vs. 46.2%, respectively). In addition, activities in the "Does" level were completed in one-fifth of the time in simulation compared to clinical (440 minutes vs. 2,137 minutes). Apart from indicating a greater focus on clinical reasoning in simulation as compared to traditional clinicals, Sullivan et al.'s (2019) findings provided emerging evidence suggesting a 2:1 clinical to simulation ratio.

CONCLUSIONS AND RECOMMENDATIONS FOR PRACTICE

Nursing education and simulation experts who have further discussed the results and significance of the NCSBN Simulation Study agree on the fact that this study provided the building blocks of the use of simulation as replacement of traditional clinical experiences in undergraduate nursing education (Rutherford-Hemming et al., 2016). Since the publication of that landmark study, additional studies have contributed to an emerging body of research evidence regarding the value of simulation-based approaches in improving learner preparation and practice when used in place of traditional clinical hours. Even though there are inconsistencies in how policymakers at the state level and decision-makers at the nursing program level apply the evidence on clinical to simulation ratio, the consensus is that some combination of supervised clinical experience, in conjunction with simulation, will yield positive student learning outcomes (Cipher et al., 2021; Haerling & Prion, 2021).

Several conclusions can be drawn from this white paper. First, virtual patient simulation can be defined as high-fidelity given their degree of realism and high level of interactivity for the learner. However, not every virtual patient simulation can be considered high-fidelity. Elsevier's Shadow Health Digital Clinical Experience is an online, asynchronous virtual patient clinical simulation that allows undergraduate nursing students to demonstrate and practice their clinical reasoning skills through life-like interactions with Digital Standardized Patients. Through an immersive experience powered by a conversation engine, students can practice taking a detailed health history, perform physical assessments in single-system exams, and conduct focused exams to rule out causes of a chief complaint. In addition, each assignment provides students with immediate feedback on several aspects of their performance using the Student Performance Index, which measures students' clinical reasoning skills as they relate to subjective data collection, objective data collection, care plan, and the students' ability to identify opportunities to engage in therapeutic communication.

Second, virtual patient simulation is comparable, if not superior, to other forms of high-fidelity simulation. This white paper shows that undergraduate nursing students have found virtual patient simulations to be more realistic and challenging than manikins and standardized patients. In addition, the use of simulation leads to increases in student engagement, self-confidence, and satisfaction. Foronda et al. (2014, 2020) indicated that virtual simulation can be used in a complementary way to support the existing undergraduate nursing curriculum. Besides providing students with a low-risk environment where students can practice new skills and apply new knowledge, virtual patient simulation like Shadow Health's Digital Clinical Experiences allows educators to foster student outcomes through a uniform learning experience, and as a result, students can be more in control of their learning (Laure et al., 2015).

Third, Shadow Health's Digital Clinical Experiences also addresses the challenges brought up by other forms of high-fidelity simulation, especially in these times when there is a deficiency in the clinical hours available to nursing students and quality clinical placements are difficult to secure for traditional and nontraditional students. During the COVID-19 pandemic, traditional clinical environments were inaccessible to students. Learners no longer had opportunities to practice in a supervised environment with their clinical instructors or preceptors, or even in skills laboratories and face-to-face simulation settings with a facilitator (Leighton et al., 2021). Relative to manikins, task trainers or standardized patients, virtual patient simulations offer several benefits in terms of cost-effectiveness, flexibility, and ease of access (Duff et al., 2016). Virtual patient simulations do not require the financial investment or clinical lab space of high-fidelity patient simulators, which becomes an advantage for online and blended nursing programs (McKeon et al., 2009; Kleinheksel & Ritzhaupt, 2017). Virtual patient simulations do not require the time and costs associated to training a

standardized patient actor, or the schedule and space restrictions posed by large sections of students having to work with a single standardized patient actor (Kleinheksel & Ritzhaupt, 2017). Should other simulation modalities become unavailable for learners, virtual patient simulation could continue to be offered with little, if any, alteration (Leighton et al., 2021).

Finally, there is emerging evidence towards a 2:1 clinical to simulation ratio. Sullivan et al.'s (2019) research showed that students completed more activities in less time during simulation. When it came down to functioning independently in both simulation and clinical settings, students completed activities in approximately one-fifth of the time in simulation as compared to clinical. Moreover, students achieved more activities and spent more time in the application of critical/clinical reasoning skills in simulation as compared with clinical. Until this new evidence arose, national surveys showed that the most common simulation to clinical time ratio among nursing programs using the simulation-based replacement approach was 1:1 (Breymier et al., 2015). Cipher et al. (2021) indicated that there is no general agreement to the type, quantity, and quality of the clinical experiences that are necessary to prepare a competent nursing graduate. There is still a large variability across BONs in terms of specific requirements for traditional clinical experiences for undergraduate education and most prelicensure programs use a 1:1 simulation to clinical ratio (Breymier et al., 2015; Smiley, 2019). However, the intense and efficient learning environment of simulation provides suggests that students may independently complete more patient care activities at higher levels of functioning when two hours of clinical time are replaced with one hour of simulation time.

Several research studies now support that exposure to simulation up to 50% results in increases in clinical knowledge, critical thinking, debriefing skills, self-confidence, NCLEX pass rates, and overall readiness for professional practice. Unlike other forms of high-fidelity simulation, Shadow Health's Digital Clinical Experience provides an off-campus learning environment that allows students to engage in open-ended conversations to practice patient-centered communication. In addition, Shadow Health's Digital Clinical Experiences offers a wide variety of clinical scenarios and patient cases for core courses in the undergraduate nursing curriculum like Fundamentals, Health Assessment, Pharmacology, Medical-Surgical, Mental Health, Maternal Health, Pediatrics, Gerontology, Community Health and Leadership. In each of these experiences, students can gather subjective data, practice collecting and interpreting objective patient data, apply therapeutic communication skills, and create and evaluate patient care plans. These virtual patient simulations allow students in a variety of undergraduate programs and prelicensure expertise levels to practice the nursing skills needed to prepare for the Next Generation NCLEX® and to care for patients in a safe and standardized environment. Even for distance education students who do not have access to a simulation lab or clinical sites, faculty can use Shadow Health's Digital Clinical Experience as a summative assessment to count for hours of clinical and evaluate the competency of their students (Kleinheksel & Ritzhaupt, 2017).

This white paper report explores the multiple advantages for nursing students, instructors, and administrators when virtual patient simulation is used in place of traditional clinical hours. Beyond relocating how clinical hours are spent, an opportunity also arises to address how state BONs, accrediting bodies and nursing schools should re-conceptualize hands-on clinical experiences considering the evidence supporting the use of simulation in lieu of traditional hours. Student outcomes such as clinical competency, critical thinking, content knowledge and self-confidence can be successfully achieved through meaningful use of virtual patient simulation scenarios like Shadow Health's Digital Clinical Experiences. As the field of nursing education moves forward with this replacement trend, it becomes critical to promote the value of simulation by translating its importance in terms of providing better, quality care and patient outcomes.

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