

Simulation Based Nursing and Paramedical Education

Lt Col Aprajita Shukla

Abstract: Introduction: The purpose of this presentation was to study and compare the use of simulation versus nursing and paramedical education in promoting self-confidence and improve skills among nursing and paramedical graduates. Nursing and paramedical simulation is a cross-disciplinary realistic and economical training and feedback method, in which learners can repeatedly practice and review tasks and processes in lifelike circumstances, using physical or virtual reality models, ranging from low to high fidelity, to identify and understand those factors which control the system and/or predict its future behaviour. Goal for using simulations: Optimal Student Learning for High Quality Patient Care. This presentation is based on secondary data to find out use of integrating simulation in nursing and paramedical education to develop and improve skills of health care providers until proficiency is achieved, without harming patients. This presentation provides significant information regarding the uses, benefits, history, future possibilities, advantages, limitations of simulation in nursing and paramedical education and it answers the following questions: Why integrate simulation? Where is improvement needed? What should be the goals? A brief discussion on application of simulation to teaching situations, steps of planning, culture in simulation— important characteristics, simulation-environment, key values for simulation, an eco-system for simulation and ways to adapt simulation. Findings: Improved proficiency in advanced life support following simulation training compared to clinical experience alone. Hospital resuscitation teams trained in advanced life support using simulation can improve patient outcomes following cardiac arrest. Simulation helps in developing and demonstrating critical thinking skills. Providing students with “real-world” experiences and examples. The future is bright for the use of simulations in nursing and paramedical education. Simulation centers are being built all around the world. Conclusion: It changes faculty assumptions about how students learn and think and to become an essential teaching/assessment evaluation strategy in education of nurses. The incorporation of clinical simulations in nursing and paramedical curriculum is one approach for change in nursing and paramedical education. The main benefits of simulation can be summarized as: experimentation in limited time, reduced analytical requirements and easily demonstrated models. The main limitations are: simulation cannot give accurate results when the input data are inaccurate, cannot provide easy answers to complex questions and cannot solve problems by itself.

Keywords: simulation, nursing and paramedics students, improved patient outcomes and improved proficiency

Simulation Based Nursing and Paramedical Education

-Lt Col Aprajita Shukla

“Tell me, and I will forget. Show me, and I may remember. Involve me, and I will understand.”

-Confucius, 450 BC

1. Introduction

Simulation is derived from the Latin word ‘simulare’ which means ‘to copy’^[1]. Simulation has been defined as a situation in which a particular set of conditions is created artificially in order to study or experience something that is possible in real life; or a term that refers to the artificial representation of a real world process to achieve educational goals via experimental learning^[2]. Simulators have been an instrumental part of nursing and paramedical training and education for nearly 400 years since birthing mannequins were first developed in the 17th century^[3]. Once limited to basic task trainers for the rehearsal of basic skills, simulation now aims to increase task proficiency and patient safety, reduce nursing and paramedical errors and enhance professional communication and team management skills. The use of simulation in medicine dates back to 9th Century when Madame du Coudray, a French midwife created anatomically correct, life-size mannequin pelvis and mannequin babies and used those to train midwives in childbirth and management of childbirth-related complications. There have been reports of simulation in some form or the other being used in various places at different times. The first mannequin for commercial use is reported to have been marketed in 1911. Anaesthesia was

the first speciality to have created a simulated training environment for anaesthesia administration. Simulation has come a long way with the introduction of versatile human patient simulators in the late 1990s & early 2000s^[4]

Simulation-based education is a rapidly developing discipline that can provide safe and effective learning environment for students. Clinical situations for teaching and learning purposes are created using mannequins, part-task trainers, simulated patients or computer-generated simulations. Human patient simulation is a relatively new teaching strategy that allows learners to develop, refine, and apply knowledge and skills in a realistic clinical situation as they participate in interactive learning experiences designed to meet their educational needs. They represent a reality within which students interact. ... Students experience the reality of the scenario and gather meaning from it. A simulation is a form of experiential learning. It is a strategy that fits well with the principles of Student-Centred and constructivist learning and teaching. Healthcare simulation is a range of activities that share a broad, similar purpose – to improve the safety, effectiveness, and efficiency of healthcare services. Simulation education is a bridge between classroom learning and real-life clinical experience. We cannot comprehend scope of simulation without the concept of Fidelity.

“Fidelity is the extent to which the appearance and behaviour of the simulator/simulation match the appearance and behaviour of the simulated system⁽²³⁾.” It is a system that presents a fully interactive patient and an appropriate clinical work environment

- Low-fidelity simulators are focused on single skills and permit learners to practice in isolation.
- Medium-fidelity simulators provide a more realistic representation but lack sufficient cues for the learner to be fully immersed in the situation.
- High-fidelity simulators provide adequate cues to allow for full immersion and respond to treatment interventions

Trends in Nursing Education

- Providing more experiential learning opportunity than instruction
- Increased use of learning technology
- More emphasis on outcome-based then process-based education
- More evidence-based education strategies and curriculum

Need for simulation in nursing and paramedical education

- Immersive learning: The simulated scenarios are realistic enough to engage the students emotionally, thus providing a unique learning experience. Eg: the high fidelity simulator "patient" actually talks, breathes, blinks, and moves like a real patient ^[10].
- Experimental learning: It has been said that learning is always better if it can be practical. Simulation gives the students a chance to practice the skills and also apply the knowledge that they have acquired.
- Better understanding of abstract concepts: Simulation at the very beginning of the undergraduate nursing and paramedical curriculum can improve understanding of basic concepts of nursing and paramedical science, such as Pharmacology and Physiology because these simulated experiences help students to understand abstract concepts of basic science that are difficult to perceive with regular discourse. Eg: Effect of drugs on the blood pressure would be difficult to understand through static images or by demonstrations using traditional methods but can be better understood through simulation ^[11].
- Skill acquisition and maintenance: Acquisition of clinical skills is better when students are trained using simulations than didactic lectures alone. In a study conducted by Langhan *et al*, 19 residents were educated about critical resuscitation procedures by using simulators. The evaluation process consisted of 2 stages, after 8 hours of simulation, and the other after 3 months. The residents showed improvement immediately and continued to demonstrate the skills after the 3-month washout period. In a randomized crossover study, McCoy *et al* evaluated 28 medical students in the management of myocardial infarction after training with a human patient simulator or a PowerPoint lecture. Significant percentage of students demonstrated better assessment and management skills after simulation training than after power-point lecture ^[12, 13].
- Student satisfaction and confidence: Simulation training prior to the actual performance of a procedure boosts the students' confidence. In one of the studies, simulation was incorporated into a training session of nursing and paramedical students to manage resuscitation during severe shock. The students reported that it gave a boost to their confidence level to handle similar cases in the future. A study conducted by Ten Eyck *et al* also showed similar results in the student satisfaction scores ^[14, 15].

- Rare event training: Simulation is used when the real system cannot be engaged, because it may not be accessible, or it may be dangerous or unacceptable to engage. Simulation provides educators with the ability to deliver controlled training environments under a variety of circumstances including uncommon or high-risk scenarios ^[2].
- Classroom based training: Simulation-Based Nursing and paramedical Education is one form that allows students to learn for educational purposes in a classroom. This can help them understand the concepts better than learning in crowded hospital settings.
- Patient safety: Nursing and paramedical students cannot experiment on the human subjects without prior practice of procedures. Training by simulation provides a safe environment for training that does not expose patients to risk by procedures performed by inexperienced trainees. A study conducted by Graber *et al* surveyed patients in an Emergency department on whether they would agree to be a student's first procedure after that student had mastered the skill on simulator training for the procedures. The results were compared with those of a prior study regarding patients' willingness to be a student's first procedure without simulation training. Comparison of the 2 surveys showed a higher percentage of patients reporting that they would agree to be a student's first procedure if the student had mastered the procedure in simulation ^[16].
- Planning of training: Simulator based clinical training can be planned with predesigned clinical encounters rather than relying on random case availability ^[17].
- Standardised training: Simulation based training can provide a standardised training for all students
- Training and retraining: Simulation based training allows students to repeat procedures as often as necessary in order to correct mistakes and fine tune their skills. It also allows for feedback and comparison of the performance of individuals at the same level ^[4].
- Assessing performance: Simulators have been also proposed as an ideal tool for assessment of students for clinical skills. Such a simulator meets the goals of an objective and standardized examination for clinical competence. This system permits the quantitative measurement of competence, as well as reproduces the same objective findings ^[4].
- Analysis of training: The training provided can be analysed by trainees and trainers. A simulation can be frozen to allow discussion, and then repeated or alternative techniques demonstrated. Video and audio recordings of simulation scenarios provide the facilitators with unique opportunities to review the training ^[18].
- Team training: Multidisciplinary team training and specific behavioural and communication skills can be taught using simulated environments as it also provides educators with opportunities to observe participants. In a study by Small *et al*, high-fidelity simulation was used to introduce emergency medicine residents to multiple patient scenarios. This type of simulation was shown to improve team coordination and leadership

Reasons for integrating simulation based training in nursing and paramedical curriculum

- Traditional method of teaching results in lower achievement
- Increase in need for nurses to make sound clinical judgment
- Health insurance
- Patient awareness
- Emphasis on result oriented and not process oriented
- Nursing and paramedical is a practice based profession
- Changes in the health care environment
- Controlled environment
- Consumer protection act
- Simulation helps bridge gap between theory and practice
- Ensures safety of patients
- It is an effective technique to learn psychomotor skill
- Helps the learner to develop critical thinking, clinical decision making and problem solving skills
- Opportunity to repeat clinical skills
- Education is learner-centered
- Learning of core clinical competencies
- Offers opportunity to practice rare and critical situations
- Can achieve a range of difficulty levels
- Multiple learning strategies
- Reduces training inconsistency
- Learn and visualize physiological responses
- Reduce anxiety in the actual patient care setting

Scope of simulator training in Nursing and paramedical education and training

- Skill learning
- Assessment of students learning
- Summative assessment
- Researches
- Simulation Nursing and paramedical services
- In-service and continuing education programs
- Staff development program
- When new technology is introduced in practice
- Research
- Assessment of staff
- Uniform experience
- Decrease dependency
- Success rather than failure
- Permit peer interaction
- Immediate feedback
- Motivation rather than competition
- Repetitions of practice

Types of simulators to be used for training for Nurses and paramedics

1) Standardized Patient simulator/Simulated Patients/ Real or living human being /actor act as simulator in scenario of clinical field

- a) Can be used at basic level students
- b) Can help to understand feelings reaction pain etc.
- c) Event can be audio video recorded and reused
Clinical procedures like
 - History taking
 - Physical assessment,
 - Psychiatric assessment,

- Delivering health education,
- Admission and discharge instruction

2) Behavior Rehearsal

Nursing and paramedical student themselves play and act exactly what they would with actual patient this is rehearsal for nurse patient interaction or teaching session. Feedback from teacher helps student to modify their behavior

- Managing aggressive patient in the hospital
- Managing confused patient
- Fire explosion in the neonatal unit

3) Case-study method

Case studies are stories or scenarios, often in narrative form, created and used as a tool for analysis and discussion, useful where situations are complex and solutions are uncertain.

- They can serve as starting point for class discussion. It is used as a project for individuals or small groups.
- A single case may be presented to several groups, with each group offering its solutions.
- Stimulates ideas through problem analysis of actual or hypothetical situations
- Applying theoretical principles in practice.
- Develop clinical judgment. diagnostic skills assume responsibility for their own learning
- Case studies promote active learning; the application of case studies helps students to understand complex concepts
- Breaks the monotony of traditional method of lecturing students and transferring knowledge from teacher to learner

Benefits of case study

- Students develop Problem solving skills
- Develop decision making in critical situation
- Coping with ambiguities
- Student will find out solution
- Can be used in another similar situation

4) Role-Playing

In Role playing learners are asked to act out an event or situation

- It is helpful to conduct role playing in a realistic setting, Elaborate, mock set-ups or other props are not necessary
- Real clinical situation helps students to react as they would in a real-life scenario.
- Low fidelity
- Benefits, especially in the realms of team training and/or change in attitudes

5) Other type of simulation

- Written simulation
- Audiovisual simulation
- Simulated Clinical Environments
- Simulated game
- Task Trainer Simulation.
- Manikin-based Simulation.
- Standardized Patient Simulation.
- Virtual Reality Simulation.
- Tissue-based Simulation

2. Main advantages of simulation include

- Study the behavior of a system without building it.
- Results are accurate in general, compared to analytical model.
- Help to find un-expected phenomenon, behavior of the system.
- Easy to perform "What-If" analysis.
- Patient safety: Patients are to be protected from all avoidable harm. They are not commodities to be used for training. Simulation based nursing and paramedical education aims to provide correct attitude and skills among nursing and paramedical students to cope with critical situations in a planned manner, while avoiding harm to actual patients due to procedures done by inexperienced trainees.
- Ethical sensitivities about patients: A patient's consent for participation in teaching programmes becomes invalid if prompted by a compromise in care following refusal. Any payment to the patient for participating in teaching programmes may constitute an inducement. Also, confidentiality about a patient is lost if the clinical and non-clinical staff has access to the data information of the patients used for teaching purpose. These ethical issues too hint towards alternatives to real patients for nursing and paramedical teaching.
- Depleted resources: Patients on whom accepted nursing and paramedical concepts can be demonstrated may not always be available or willing to become a part of teaching programmes. Another example is regarding the non-availability of experimental animals for teaching students due to ethical and legal constraints.
- Changing medico-legal milieu: This has impacted training practices by limiting skills training in real patients.
- Reduction in teaching time coupled with rapid explosion of knowledge: Busy schedules of physicians leave them with less time for teaching nursing and paramedical students.

3. Limitations of simulation based training

- Incomplete mimicking of human systems: Human systems are very complex and diverse. Lots of information is gained from humans, not instruments. Models and instruments can never match humans completely.
- Defective learning: Poorly designed simulation can promote negative learning. Eg: if physical signs are missing in the simulation, students may neglect to check for these. Simulation based learning may also encourage shortcuts, such as omitting patient consent and safety procedures, and may foster artificial rather than genuine communication skills^[20].
- Attitude of learners: Participants will always approach a simulator differently to real life. Two common changes in attitude can occur: (a) hypervigilance which causes excessive concern because one knows an event is about to occur (b) cavalier behaviour which occurs because it is clear no human life is at stake^[21].
- Cost factor: Simulators especially the high fidelity ones are available at considerable costs; both in terms of initial purchase prices as well as maintenance charges.

Hence, they are not affordable to many teaching hospitals.

- Time factor: Incorporating time-slot for simulation in already burdened nursing and paramedical curriculum is difficult.
- Infrastructure: Dedicated and exclusive resource personals are not always available. An instructor to learner ratio of 1:3-4 is ideal which is not feasible in the current nursing and paramedical curriculum where each session consists of a batch of 10-15 nursing and paramedical students.
- Technical difficulties: Some physical findings like skin colour cannot be taught in simulators.
- Programming difficulties: The simulation models have to be manipulated by facilitators and simulation engineers in such a way as to replicate a physiological response that may be desired under specific circumstances. Manipulating these systems in accordance with desired simulation goals is often cumbersome.
- Learner specific teaching not possible: Instructors may wish to present optimally circumstances according to the abilities of different learners (advanced tasks for proficient students while basic tasks to new or slow learners). This individualized approach is not possible in simulation based teaching.
- Supporting evidence insufficient: There is only limited amount of good quality evidence on the effect and validity of simulation based training.
- Limited realistic human interaction
- Students may not take it seriously
- No/incomplete physiological symptoms

Key points to remember for creating simulation environment

1) Resources - equipment

- Right equipment
- Quality / duration
- Concept – provide value
- Maintenance & disposables

2) Resources – space / facilities

- Needs based
- Flexibility
- Plan for volume/use

3) Resources - funding

- Needs based
- Multiple solutions
- Anchoring, strategies, planning

4) Key values for simulation

- Competent colleagues are training for improving practice
- Principles for adult learning
- I'm OK, You're OK – different but equal
- Clearly defined and presented objectives
- Transparency
- Don't know the perfect answer as you don't know all the pieces in the puzzle
- Mutual wish to help each other becoming better in all elements
- Strong connections - your style of communication and ethics applied

4. Conclusion

“The full effect of simulation-based intervention is probably only released when the entire system is integrated into the intervention. Otherwise the intervention might stay subthreshold of impacting the patient safety.”

-Sollid, S.J.M., et al.

Various types of simulators have its benefits and limitation. Different methods are used as per level of the students and availability of resources. Educator can use her creativity in using type of simulation. Every student should be provided adequate skill practice and other clinical expertise before posting in actual clinical fields. Simulation is one of the most widely used techniques in operations research and management science... No longer the approach of “last resort”!

References

- [1] National League for Nursing (2005). The scope and practice for academic nurse educators. New York, NY: National League for Nursing. National League for Nursing (2012).
- [2] A Nursing Perspective on Simulation and Interprofessional Education (IPE): A report from the National League for Nursing’s Think Tank on using simulation as an enabling strategy for IPE.
- [3] Retrieved from NCLEX-RN Detailed Test Plan (2010) NCLEX-RN Detailed test plan. Chicago, IL: National Council of State Boards of Nursing
- [4] Polit, D. F., & Beck, C. T. (2008). Nursing research: Generating and assessing evidence for nursing practice (8th ed.).
- [5] Philadelphia: Lippincott Williams & Wilkins .
- [6] Rowles, C. J., & Russo, B. L. (2009). Strategies to promote critical thinking and active learning. In D. M. Billings & Halstead, J. A. (Eds.),
- [7] Teaching in nursing: A guide for faculty (3rd ed., pp). St. Louis, MO: Saunders Elsevier. The Joint Commission (2013).
- [8] National patient safety goals. Retrieved from Witt, S., Borden, S., & York, N. L. (2010).
- [9] Simulating rapid response in undergraduate critical care education. Dimensions of Critical Care Nursing, 29(1):33-39.
- [10] Aebersold, M. & Tschannen, D., 2013. Simulation in nursing practice: the impact on patient care.
- [11] OJIN: The Online Journal of Issues. Available at: <http://www.nursingworld.org/MainMenuCategories/ANAMarketplace/ANAPeriodicals/OJIN/TableofContents/Vol-18-2013/No2-May-2013/Simulation-in-Nursing-Practice.html>
- [12] Ahn, H. & Kim, H.Y., 2015. Implementation and outcome evaluation of high-fidelity simulation scenarios to integrate cognitive and psychomotor skills for Korean nursing students.
- [13] Alexander, M. et al., 2015. NCSBN Simulation Guidelines for Prelicensure Nursing Programs. Journal of Nursing Regulation, 6(3), pp.39–42. Available at: <http://linkinghub.elsevier.com/retrieve/pii/S2155825615307833>
- [14] Ballangrud, R. et al., 2014. Exploring intensive care nurses’ team performance in a simulation-based emergency situation, – expert raters’ assessments versus self-assessments: an explorative study.
- [15] Barbosa, S. & Marin, H., 2009. Web-based simulation: a tool for teaching critical care nursing. Available at: <http://www.scielo.br/scielo.php?pid>
- [16] Berragan, L., 2011. Simulation: an effective pedagogical approach for nursing? Nurse Education Today. Available at: <http://www.sciencedirect.com/science/article/pii/S0260691711000384> [Accessed July 22, 2016].
- [17] Bogossian, F. et al., 2014. Undergraduate nursing students’ performance in recognising and responding to sudden patient deterioration in high psychological fidelity simulated environments: An. Nurse Education. Available at: <http://www.sciencedirect.com/science/article/pii/S0260691713003602> [Accessed July 22, 2016].
- [18] Bradley, C., 2011. The role of high-fidelity clinical simulation in teaching and learning in the health professions. , pp.33–42.
- [19] Brady, D., 2011. Using Quality and Safety Education for Nurses (QSEN) as a pedagogical structure for course redesign and content. International Journal of Nursing Education Scholarship. Available at: Melba Sheila D’Souza et al.
- [20] High Fidelity Simulation in Nursing Education International Journal of Health Sciences & Research (www.ijhsr.org) 347 Vol.7; Issue: 7; July 2017
- [21] Bultas, M. et al., 2014. Effectiveness of high-fidelity simulation for pediatric staff nurse education. Pediatric nursing. Available at: <http://search.proquest.com/openview/a1f74b4696b0a03fd6d938d4f156b55/1?pq-origsite=gscholar> [Accessed July 22, 2016]. □
- [22] Comparative study of baccalaureate nursing student self-efficacy before and after simulation. CIN: Computers, Informatics, Nursing. Available at: http://journals.lww.com/cinjournal/Abstract/2012/03000/Comparative_Study_of_Baccalaureate_Nursing_Student.5.aspx
- [23] d’Souza, M., Karkada, S. & Parahoo, K., 2015. Perception of and satisfaction with the clinical learning environment among nursing students. Nurse education. Available at: <http://www.sciencedirect.com/science/article/pii/S026069171500074X> [Accessed July 22, 2016].
- [24] D’Souza, M.S., Venkatesaperumal, R., et al., 2013. Engagement in clinical learning environment among nursing students: Role of nurse educators. Open Journal of Nursing, 03(01), pp.25–32. Available at: <http://www.scirp.org/journal/PaperInformation.aspx?PaperID=28714>.
- [25] D’Souza, M.S., Isac, C., et al., 2013. Exploring nursing student engagement in the learning environment for improved learning outcomes. Clinical Nursing Studies, Available at: <http://www.sciedupress.com/journal/index.php/cns/article/view/2894> [Accessed July 22, 2016].
- [26] DeBourgh, G. & Prion, S., 2011. Using simulation to teach prelicensure nursing students to minimize patient risk and harm. Clinical Simulation in Nursing.

- Available at:
<http://www.sciencedirect.com/science/article/pii/S1876139909005799> [Accessed July 22, 2016].
- [27] Edward, K. et al., 2007. Simulation to Practice: Developing Nursing Skills in Mental Health--An Australian Perspective. *International Electronic Journal of Health Education*, 10, pp.60–64. Available at: <http://search.ebscohost.com/login.aspx>
- [28] Fisher, D. & King, L., 2013. An integrative literature review on preparing nursing students through simulation to recognize and respond to the deteriorating patient. *Journal of Advanced Nursing*, 69(11), pp.2375–2388.
- [29] Garbee, D.D. et al., 2013. Effectiveness of teamwork and communication education using an interprofessional high-fidelity human patient simulation critical care code., 3(3), pp.1–12.
- [30] Goodstone, L., Goodstone, M. & Cino, K., 2013. Effect of simulation on the development of critical thinking in associate degree nursing students. *Nursing education*. Available at: http://journals.lww.com/neonline/Abstract/2013/05000/Effect_of_Simulation_on_the_Development_of.5.aspx
- [31] Grossman, S., Mager, D. & Oheim, H., 2012. A bi-national simulation study to improve cultural awareness in nursing students. Available at: <http://www.sciencedirect.com/science/article/pii/S1876139911000065>
- [32] Guhde, J., 2011. Nursing Students' Perceptions of the Effect on Critical Thinking, Assessment, and Learner Satisfaction in Simple Versus Complex High-Fidelity Simulation Scenarios. *Journal of Nursing Education*, 50(2), pp.73–77
- [33] Hallin, K. et al., 2016. High-fidelity patient simulation: Assessment of student nurses' team achievements of clinical judgement. *Nurse Education in Practice*, 19, pp.12–18. Available at: <http://www.scopus.com/inward/record.url>
- [34] Hanan. M. Soliman., Amani. M. shelba., W. shari., 2014. Effectiveness of simulation training on clinical nursing education. *The international journal of advanced research*, 2(4), pp.387–393. □ Handwerker, S., 2012. Transforming nursing education: a review of current curricular practices in relation to Benner's latest work. *International journal of nursing education*. Available at: <http://www.degruyter.com/dg/viewarticle.fullcontentlink:pdfeventlink>
- [35] Harder, B.N., 2010. Use of simulation in teaching and learning in health sciences: a systematic review. *The Journal of nursing education*, 49(1), pp.23–28.
- [36] Hayden, J., Jeffries, P. & Kardong-Edgren, S., 2012. The NCSBN national simulation study. *Clinical Simulation in Nursing*. Available at: [http://www.anselm.edu/Documents/Academics/Departments/Nursing/Continuing Education/SESSION H JEFFRIES Simulation Study-MA-NLN\(0\).pdf](http://www.anselm.edu/Documents/Academics/Departments/Nursing/Continuing Education/SESSION H JEFFRIES Simulation Study-MA-NLN(0).pdf)
- [37] Henneman, E. a & Cunningham, H., 2005. Using clinical simulation to teach patient safety in an acute/critical care nursing course. *Nurse educator*, 30(4), pp.172–177.
- [38] Howard, V., Ross, C. & Mitchell, A., 2010. Human patient simulators and interactive case studies: A comparative analysis of learning outcomes and student perceptions. *CIN: Computers*. Available at: http://journals.lww.com/cinjournals/Abstract/2010/01000/Human_Patient_Simulators_and_Interactive_Case.10.aspx
- [39] Jeffries PR, 2012. Simulation in nursing education: from conceptualization to evaluation, *National league for Nursing*.
- [40] Kaddoura, M. & Williams, C., 2012. Comparison of Generic Accelerated Nursing Students. *Educational Research Quarterly*. Available at: <http://eric.ed.gov/?id=EJ1061972>
- [41] Kaddoura, M., 2010. New graduate nurses' perceptions of the effects of clinical simulation on their critical thinking, learning, and confidence. *The Journal of Continuing Education in Nursing*. Available at: <http://www.healio.com/nursing/journals/jcen/2010-11-41>
- [42] Kaddoura, M. et al., 2015. Perceived benefits and challenges of repeated exposure to high fidelity simulation experiences of first degree accelerated bachelor nursing students. *Nurse education today*, 36, pp.298–303. Available at: <http://www.sciencedirect.com/science/article/pii/S0260691715002841>.
- [43] Krautscheid, L.C., 2008. Improving communication among healthcare providers: preparing student nurses for practice. *International journal of nursing education scholarship*, 5(1), p.Article40. Available at: <http://www.ncbi.nlm.nih.gov/pubmed/18976237>.
- [44] Lapkin, S. et al., 2010. Effectiveness of Patient Simulation Manikins in Teaching Clinical Reasoning Skills to Undergraduate Nursing Students: A Systematic Review. *Clinical Simulation in Nursing*, 6(6), pp.e207–e222.
- [45] Lavoie, P., Pepin, J. & Cossette, S., 2015. Development of a post-simulation debriefing intervention to prepare nurses and nursing students to care for deteriorating patients. *Nurse Education in Practice*, 15(3), pp.181–191. Available at: <http://dx.doi.org/10.1016/j.nepr.2015.01.006>.
- [46] Lestander, Ö., Lehto, N. & Engström, Å., 2016. Nursing students' perceptions of learning after high fidelity simulation: Effects of a Three-step Post-simulation Reflection Model. *Nurse Education Today*, 40, pp.219–224. Available at: <http://dx.doi.org/10.1016/j.nedt.2016.03.011>.
- [47] Lewis, R., Strachan, A. & Smith, M., 2012. Is high fidelity simulation the most effective method for the development of non-technical skills in nursing? A review of the current evidence. *The Open Nursing Journal*. Available at: <http://benthamopen.com/FULLTEXT/TONURSJ-6-82>
- [48] Liaw, M. & Ying, S., 2007. The Integration of Simulation into Undergraduate Nursing Curriculum Deepening Students' Learning Facilitating the Transition from Classroom to Clinical Practice. , pp.2002–2005.
- [49] Liaw, S., Scherpbier, A. & Rethans, J., 2012. Assessment for simulation learning outcomes: a comparison of knowledge and self-reported confidence with observed clinical performance. *Nurse Education*. Available at:

<http://www.sciencedirect.com/science/article/pii/S0260691711002681>

- [50] Loke, J. et al., 2014. High fidelity full sized human patient simulation manikins: Effects on decision making skills of nursing students. Journal of Nursing Education. Available at: <http://sciedupress.com/journal/index.php/jnep/article/view/4250>