

See discussions, stats, and author profiles for this publication at: <https://www.researchgate.net/publication/357208624>

Methodology for learning and acquiring clinical skills through simulation with artificial human models

Conference Paper · October 2021

DOI: 10.1145/3486011.3486461

CITATIONS

0

READS

40

5 authors, including:



Amaia Yurrebaso

Universidad de Salamanca

38 PUBLICATIONS 235 CITATIONS

SEE PROFILE



Raquel Guzmán Ordaz

Universidad de Salamanca

21 PUBLICATIONS 116 CITATIONS

SEE PROFILE



Picado Valverde

Universidad de Salamanca

40 PUBLICATIONS 39 CITATIONS

SEE PROFILE

Methodology for learning and acquiring clinical skills through simulation with artificial human models

Juan Antonio, Juanes Mendez
University of Salamanca, (Spain)
jajm@usal.es

Amaia, Yurrebaso Macho
University of Salamanca, (Spain)
amaia@usal.es

Raquel, Guzmán-Ordaz
University of Salamanca, (Spain)
r.guzman@usal.es

Eva, Picado - Valverde
University of Salamanca, (Spain)
evapicado@usal.es

Alexander L., Ward Mayens
University of Salamanca, (Spain)
alexander.ward@usal.es

ABSTRACT

A clinical simulation teaching experience is presented, which aims to place students in a context that imitates some aspect of everyday clinical reality, in order to establish in this environment, situations similar to those that they will have to face in the future in their professional work. The aim of this procedure is to test the possibility of students being able to acquire competencies and practical skills through the use of simulation in undergraduate nursing training, regardless of the prior performance of external care placements in hospital wards. This methodology was used to reproduce essential aspects of a clinical situation, with the aim of better understanding and managing the situation when it occurs in daily clinical practice. The experience showed that simulation is an effective method for the development of many competencies and skills for the practice of their profession.

CCS CONCEPTS

• **Applied computing** → Life and medical sciences; Life and medical sciences; Health informatics; Education; Computer-assisted instruction.

KEYWORDS

Clinical Simulation, Clinical training, Skill Learning

ACM Reference Format:

Juan Antonio, Juanes Mendez, Amaia, Yurrebaso Macho, Raquel, Guzmán-Ordaz, Eva, Picado - Valverde, and Alexander L., Ward Mayens. 2021. Methodology for learning and acquiring clinical skills through simulation with artificial human models. In *Ninth International Conference on Technological Ecosystems for Enhancing Multiculturality (TEEM'21) (TEEM'21)*, October 26–29, 2021, Barcelona, Spain. ACM, New York, NY, USA, 5 pages. <https://doi.org/10.1145/3486011.3486461>

1 INTRODUCTION

The first full-scale simulator was created in 1986 at the Universities of Florida and Stanford by David Gaba with the aim of combining

Permission to make digital or hard copies of all or part of this work for personal or classroom use is granted without fee provided that copies are not made or distributed for profit or commercial advantage and that copies bear this notice and the full citation on the first page. Copyrights for components of this work owned by others than ACM must be honored. Abstracting with credit is permitted. To copy otherwise, or republish, to post on servers or to redistribute to lists, requires prior specific permission and/or a fee. Request permissions from permissions@acm.org.

TEEM'21, October 26–29, 2021, Barcelona, Spain

© 2021 Association for Computing Machinery.

ACM ISBN 978-1-4503-9066-8/21/10...\$15.00

<https://doi.org/10.1145/3486011.3486461>

technical and non-technical skills and putting them into practice in the medical field [17]. Since then, the world of clinical simulation has evolved at the same pace as society itself, and is currently a media with a high degree of fidelity, with many and varied applications and simulation methodologies in the Health Sciences in general [2–5, 7–16].

An educational procedure that attempts to create real-world characteristics in a virtual work environment is clinical simulation [1].

Gaba, in 2007, defined simulation as "a technique for replacing or augmenting real experiences with guided experiences that evoke or reproduce substantial aspects of the real world in a fully interactive manner". Therefore, clinical simulation is understood as the artificial representation of a real-world process with sufficient authenticity to achieve a specific objective, which is none other than to try to promote student learning by representing as far as possible a more or less complex clinical scenario, and allowing the assessment of the training of a specific action or clinical competence [6, 18–22, 22–26, 38].

Among a wide variety of clinical simulation modalities used to recreate some clinical component for the purpose of training a student; for example, we have task trainers, virtual reality and augmented reality systems, standards patients, virtual patients and high-fidelity simulators, among many other possibilities [24, 27–33, 35]. Recently, medium and high fidelity simulators are being used in Spanish and European universities, such as the SimMan TM from Laerdal; or the METI Human Patient Simulator; the iStan and the Simman3G, from Comercial Medical Simulator. Any one of these simulators can be adapted to multiple clinical situations, being one of the advantages of the success of this clinical learning and training methodology.

Use of the simulator should not be rigid, as it should be adapted to the learning purpose and objectives and goals, as this methodology offers the possibility of combining several simulators with different or similar types of fidelity, with the possibility of using complete patient simulators or simulators that emulate some part of the human body [36, 37, 39–42].

The objective we have set ourselves, by means of a simulated protocol, has been to seek safety and efficacy in the students who carry out their practicals in the hospital services in order to avoid as far as possible any type of infectious affection for the students who carry out the practicals.

In addition, the aim of these simulations is to create a bridge between theoretical training and direct contact with the patient;



Figure 1: Setting the stage for the students to approach the clinical simulation experience. The picture shows a full-term newborn on whom the pair of students will have to act.

with these procedures proving practice in the use of techniques and tools necessary for clinical nursing actions.

2 METHODOLOGY

The teaching activity was carried out with a group of third year students from the Nursing School of Zamora, attached to the University of Salamanca.

In order to carry out the teaching activity under simulation environments, the aims and objectives to be achieved were first determined. The participants' level of experience; the knowledge, skills, attitudes or behaviours to be addressed; the degree of direct participation; the method of feedback was taken into consideration. The clinical scenarios were prepared in advance and were based on interventions and activities related to the students' own care situation. A clinical scenario was designed by defining a clinical case of a patient to approximate specific learning outcomes for student participants and viewers. This scenario is modelled on a real-life situation that includes a sequence of learning activities and involves decision-making, reasoning, and other cognitive skills.

To begin the learning protocol, we start with the following clinical scenario: a term newborn, 36 hours old, admitted to the Neonatal Intensive Care Unit for meconium aspiration syndrome, connected to mechanical ventilation and carrying central catheters, double lumen umbilical vein and umbilical artery (Fig 1).

The situation begins with the change of nursing shift at 8:00 a.m. The partner tells that the newborn has been stable, except that he has a lot of secretions from TET that need to be aspirated and that the neonatologist has scheduled a blood test at 9:00 a.m. to coincide with the determination of gentamicin levels.

The clinical simulation experience was carried out in pairs of students, but all the students in the class were able to always follow the procedure from a parallel room, using a camera and public address system in the simulation room (Fig 2).

The whole procedure is followed and evaluated by the teaching staff who involved in designing the didactic action. The assessment of the students included different items that evaluated both the work carried out by the student and the communication skills that they developed in their interaction with the patient (Fig 3).

Once the entire simulation process had been completed by the pair of students, a discussion was held in the classroom in order to assess the mistakes made and resolve the appropriate procedure that should have been carried out.

Before discussing the different procedures performed, the students were shown images and videos of the correct procedure that should have been applied, so that they could see and analyze the mistakes made during the entire performance protocol (Fig 4).

After viewing and discussing with the students the correct and adequate clinical action protocol, the pair of students were invited to perform the manoeuvres again, to assess the degree of improvement in all aspects.

3 RESULTS

Right from the start, an effort was made to motivate the students to adopt an active role in their learning process and participation in the simulation test. After introducing the clinical situation presented virtually and described above, the student proceeded to perform (Fig 5).

Throughout the simulation, the student had to verbally indicate their actions and the manoeuvres to be performed at each step. We sought to develop the student's capacity for analysis, synthesis, and decision-making, this being the fundamental axis of this pedagogical tool, in order to be able to work well on clinical reasoning.

Every student's performance was closely monitored by the teaching staff in order to evaluate each of the steps they carried out and the mistakes they made. Assessment strategies were developed from a rational and practical point of view, being structured around the concept of continuous and formative assessment, enabling the assessment of competences at the same time as the circumstance for which competence is required.

Simulation-based teaching methodology seems to improve the performance of practical skills; however, careful thought needs to be given to the selection of patient simulation as the instructional method of choice to meet the specific learning objectives.

The students learnt basic rules of action with the patient through this procedure; they were able to adopt attitudes to resolve difficulties that arose; it allowed them to assimilate the degree of responsibility required in these actions; they apply models and knowledge learnt in the theoretical classes; they seek advice and suggestions from their teachers; they become involved in the tasks to be performed; they learn from the experiences of other classmates; in short, this method allows them to acquire competencies and critical thinking in the students who use it. In this way, students manage to make decisions, solve problems, to organize and plan their work, to adapt to different clinical situations, to use clinical reasoning appropriately, etc.

Training in this area undoubtedly helps to promote the acquisition of clinical skills, which are an essential part of the healthcare professionals' training at both undergraduate and postgraduate



Figure 2: A couple of students access to the simulation room to carry out their practical exercise. Beforehand, a teacher explains to them what the test will consist of.



Figure 3: Systems of cameras installed in the simulation room to enable students and teachers to watch and evaluate the activities performed by the pair of students.

level, as they are essential for quality and comprehensive health-care. This will allow a specific clinical task to be carried out with a certain capacity or skill. Learning technical skills through clinical simulation enhances critical thinking; in other words, it teaches the student when to perform and put into practice a certain skill, under what conditions and what material is needed. In addition, it allows them to learn about the effects of performing the technique and the care required.

As a result of our teaching practice using clinical simulation, we have found that this training method combines knowledge, skills and human factors in order to provide us with an effective learning and training method to ensure that students develop a set of skills that make it possible to achieve superior modes of action, offering the opportunity to carry out a practice similar to that which they will develop in the reality of care. Simulation-based training makes it possible to correct the lack of clinical experience and failures in the coordination of the team, increasing the safety of the nurse and the patient.

Through this clinical simulation experience, those students who took part in it showed a high degree of satisfaction in relation to

the implementation of the knowledge acquired in theory and which was staged in the clinical simulation.

By means of the clinical simulation practised, in the way we have structured and developed it, it has been possible to promote independence, creativity, responsibility and critical thinking skills in the students. In addition, with these learning methodologies, students acquire security and self-confidence after repeating the most common clinical scenarios that they will face in their professional activity.

In summary, after our teaching experience in clinical simulation environments, we can deduce that this training methodology contributes to creating awareness in undergraduate nursing students of the importance of acquiring the technical skills studied and attitudes towards safety, teamwork, improving care, structured referral and proper recording in order to ensure quality in patient care.

4 DISCUSSION

The acquisition of professional competencies in any health sciences discipline has consisted of clinical practice based on the wise use of acquired knowledge and clinical reasoning, together with technical and communication skills, applied with positive attitudes and values. By acquiring the corresponding professional competencies, in the health area, this will enable the various practitioners to act for the benefit of patients. [5, 9, 11, 13, 14, 43–45].

Clinical practice involves a series of activities and tasks that can be identified in different complementary stages.

Firstly, the construction of knowledge is necessary, through the different disciplines or subjects of the academic degree, and always centred on the learning of body anatomy, physiology, and diseases, all of this through the more theoretical or master classes. In a second stage, the student must learn to design a work and action plan to deal with a pathology and learn to treat it appropriately. Subsequently, the student will have to get to know and become familiar with the action scenario in which the patient is to be found, i.e. a home, an emergency department or an operating theatre, as the most common ones. Finally, the patient will require not only good quality care, but also security and autonomy in their decisions, and must know how to offer a high level of professionalism together



Figure 4: Parallel Classroom to the simulation room, where other students and teachers can follow the evolution of the test in detail.

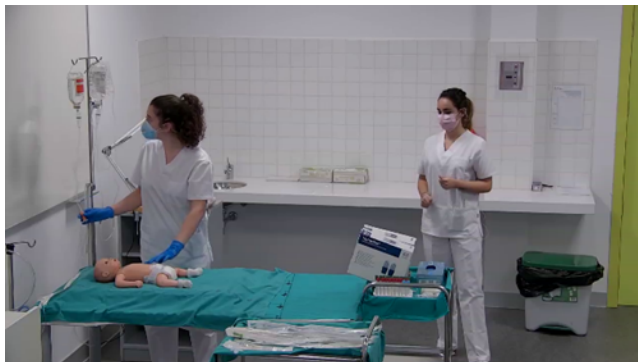


Figure 5: Pupils' performance on the newborn child

with excellent coordination between the different levels at which they will be cared for.

Without doubt, a powerful resource for the successful achievement of each of these stages can be simulation or clinical training systems. Clinical simulation is based on a set of procedures to recreate aspects and situations of the real world; to be replaced or amplified from real experiences. This type of teaching methodologies allows shortening the learning curve in the acquisition of clinical skills [15, 17–20, 22, 26, 34]. On the other hand, being able to carry out a simulated clinical experience, as many times as necessary, will undoubtedly help to acquire the trained skills, thus avoiding risk to the real patient.

In the whole methodological process based on the use of these teaching resources, feedback is one of the essential parts of the clinical simulation. Participants and the tutor or teacher will analyse the strengths of the student and the group in general, as well as the aspects to be reinforced and improved. In our didactic experience,

this aspect has been taken very much into account; in this way we have sought to correct errors and motivate the student to achieve the objectives set [31, 33, 46–48].

Simulation-based training involves a large investment of time to prepare and execute a good activity.

In Spain, clinical simulation is becoming increasingly important, and is being implemented in both undergraduate and postgraduate training, with medicine and nursing degrees being the areas of the health sciences where these simulation resources are most widely used. As pointed out by Riancho and Maestre, 2012, clinical simulation allows students to practice in a realistic environment without risk to patients, facilitating the standardisation of teaching content, helping to detect training deficiencies and promoting the integration of complex clinical knowledge and skills [49–51].

5 FINAL CONCLUSIONS

The use of these teaching resources in training has meant that the different students have gone through the same experience, within a safe and confidential environment, where it has been possible to develop a formative and summative evaluation of the activity carried out. The formative evaluation fostered personal and professional development and helped participants to move towards the achievement of objectives. Summative evaluation focused on the measurement of results and the achievement of objectives.

Our simulation procedure enabled students and participants to achieve the intended objectives and practical competencies necessary for the practice of their profession, through the simulation experience based on skills acquisition learning.

The clinical simulation design carried out provided the necessary framework for effective student learning.

ACKNOWLEDGMENTS

This study is part of the InovSafeCare Project - Educating Students for innovative infection prevention and control practices in healthcare settings (2018-1-PT01-KA203-047453). European Union program of the strategic framework for European cooperation in the field of education and training. KA2 Cooperation for innovation and the Exchange of Good Practices. KA203 Strategic Partnerships for higher education. co-funded by the Erasmus+ Programme of the European Union and with the support of the Agência Nacional Erasmus+ Educação e Formação (Portugal).

An acknowledgement also to the participation, management and support to the teaching staff of the Zamora School of Nursing, an affiliated centre of the University of Salamanca, for their constant collaboration in the project and for making it possible to carry out these training and research activities with their students.

REFERENCES

- [1] Adamson, K. (2010). Integrating human patient simulation into associate degree nursing curricula: faculty experiences, barriers and facilitators. *Clinical Simulation in Nursing*, 6 e75-e81.
- [2] Adamson, K., Kardon, S., & Willhaus, J. (2013). An Updated Review of Published Simulation Evaluation Instruments. *Clinical Simulation in Nursing*, 9, e393-e400.
- [3] Aebersold, M., & Tschannen, D. (2011). Simulation - based mock codes significantly correlate with improved pediatric patient cardiopulmonary arrest survival rates. *Pediatric Critical Care Medicine*, 12 (1), 33.
- [4] Aebersold, M., & Tschannen, D. (2013). Simulation in Nursing Practice: The Impact on Patient Care. *The Online Journal of Issues in Nursing*, 18 (2) Manuscript 6.
- [5] Alférez Maldonado, A. (2012). La comunicación en la relación de ayuda al paciente en enfermería: saber qué decir y qué hacer. *Esp. Comun. Salud*, 3(2);147-157.
- [6] Alimier, G. (2011). Developing high-fidelity health care simulation scenarios: a guide for educators and professional. *Simulation and Gaming*, 42:9.
- [7] Anderson, M., & Bond, M. (2012). Acquisition of Simulation Skills: survey of users. *Clinical Simulation in Nursing*, 8, e59-e65.
- [8] Awad, M. S., Abdullah, M. K., Ibrahim, R. H., & Abdulla, R. K. (2019). Nursing Students' Attitudes Toward Simulation Technology in Nursing Education. *IJET*, 14(14), 31-45.
- [9] Baker, C., Pulling, C., & McGraw, R. e. (2008). Simulation in interprofessional education for patient- centered collaborative care. *Journal of Advanced Nursing*, 64(4), 372-379.
- [10] Banks, S., Stanley, M. J., Brown, S., & Matthew, W. (2019). Simulation-based interprofessional education: A nursing and social work collaboration. *Journal of Nursing Education*, 58(2), 110-113.
- [11] Berg, B., Wong, L., & Vincent, D. (2011). Technology-enabled interprofessional education for nursing and medical students: a pilot study. *J. Interprof. Care*, 24 (5), 601-604.
- [12] Bryant, K., Aebersold, M. L., Jeffries, P. R., & Kardong-Edgren, S. (2020). Innovations in simulation: Nursing leaders' exchange of best practices. *Clinical Simulation in Nursing*, 41, 33-40.
- [13] Cannon - Diehl, M. (2009). Simulation in Healthcare and Nursing. *State of the Science. Crit Care Nursing*, 32 (2): 128-136.
- [14] Costello, M., Huddleston, J., Atinaja-Faller, J., Prelack, K., Wood, A., Barden, J., & Adly, S. (2017). Simulation as an effective strategy for interprofessional education. *Clinical Simulation in Nursing*, 13(12), 624-627.
- [15] Eyikara, E., & Baykara, Z. G. (2017). The Importance of Simulation in Nursing Education. *World Journal on Educational Technology: Current Issues*, 9(1), 2-7.
- [16] Foronda, C. L., Fernandez-Burgos, M., Nadeau, C., Kelley, C. N., & Henry, M. N. (2020). Virtual simulation in nursing education: a systematic review spanning 1996 to 2018. *Simulation in Healthcare*, 15(1), 46-54.
- [17] Gaba. (2007). The future of simulation in healthcare. *Simul Healthc*, 2:126-135
- [18] Gordon, R. M., & McGonigle, D. (2018). *Virtual simulation in nursing education*. Springer Publishing Company.
- [19] Horsley, T. L., O'Rourke, J., Mariani, B., Doolen, J., & Pariseault, C. (2018). An integrative review of interprofessional simulation in nursing education. *Clinical Simulation in Nursing*, 22, 5-12.
- [20] Issenberg, S., & Scalese, R. (2008). Simulation in health care education. *Perspectives in Biology and Medicine*, 51,31-47.
- [21] Jeffries, P. (2020). Simulation in nursing education: From conceptualization to evaluation. Lippincott Williams & Wilkins.
- [22] Kameg, K., Howard, V., Clochesy, J., & Mitchell, A. (2010). The impact of high fidelity human simulation on self-efficacy of communication skills. *Issues in Mental Health Nursing*, 31 (5), 315-323.
- [23] Kim, M., & Kim, S. (2017). Debriefing practices in simulation-based nursing education in South Korea. *Clinical Simulation in Nursing*, 13(5), 201-209.
- [24] Leann, T., Bensfield, L., Sojka, S., & Schmitt, A. (2014). Multiple-Patient Simulations. *Nurse Educator*, 39 (6)311-315.
- [25] Lioce, L. (2015). Standards of best practice: Simulation standar IX:simulation desing. *Clinical Simulation in Nursing*, 11:309-315.
- [26] Mariani, B., Cantrell, M., Meakin, C., Prieto, M., & Dreifuerst, K. (2013). Structured Debriefing and Students' Clinical Judgment Abilities in Simulation. *Clinical Simulation in Nursing*, 9 (5):147-155.
- [27] McGaghie, C., & Issenberg, S. (2006). Effect of practice on standardised learning outcomes in simulation-based medical education. *Med Educ*, 40:792-7.
- [28] Mikasa, A., Cicero, T., & Adamson, K. (2013). Outcome- Based Evaluation Tool to Evaluate Student Performance in High-Fidelity Simulation. *Clinical Simulation in Nursing*, 9, e361-e367.
- [29] Moule, F., Wilford, A., Sales, R., & Lockyer, L. (2008). Student experiences and mentor views of the use of simulation for learning. *Nurse Educ.Today*, 28 (7), 790-797.
- [30] Nestel, D. (2017). Ten years of simulation in healthcare: a thematic analysis of editorials. *Simulation in Healthcare*, 12(5), 326-331.
- [31] O'Rourke, J., Horsley, T. L., Doolen, J., Mariani, B., & Pariseault, C. (2018). Integrative review of interprofessional simulation in nursing practice. *The Journal of Continuing Education in Nursing*, 49(2), 91-96.
- [32] Owen, H. (2016). Simulation in healthcare education: an extensive history. Springer.
- [33] Padilha, J. M., Machado, P. P., Ribeiro, A., Ramos, J., & Costa, P. (2019). Clinical virtual simulation in nursing education: randomized controlled trial. *Journal of medical Internet research*, 21(3), e11529.
- [34] Pearson, E., & Mc Lafferty, I. (2011). The use of simulation as a learning approach to non-technical skills awareness in final year nurse students. *Nurse Educ. Pract*, 11 (6), 399-405.
- [35] Riancho, J., & Maestre, I. (2012). Simulación clínica de alto realismo: una experiencia en el pregrado. *Educ Med*, 15 (2):109-115.
- [36] Roberts, E., Kaak, V., & Rolley, J. (2019). Simulation to replace clinical hours in nursing: a meta-narrative review. *Clinical Simulation in Nursing*, 37, 5-13.
- [37] Rosen, M., Salas, E., & Wilson, K. (2008). Measuring team performance in simulation-based training. *Simulation in Healthcare*, 3(1),33-41.
- [38] Saaranen, T., Vaajoki, A., Kellomäki, M., & Hyvärinen, M. (2015). The simulation method in learning interpersonal communication competence-Experiences of masters degree students of health sciences. *Nurse Education Today*, 35 e8-e13.
- [39] Salas, E., & Burke, C. (2002). Simulation for training is ineffective when.. *Quality and Safety in Health Care*, 11(2),119-120.
- [40] Shin, S., Park, J., & Kim, J. (2015). Effectiveness of patient simulation in nursing education: meta-analysis. *Nurse Education Today*, 35 176-182.
- [41] Sittner, B., Hertzog, M., & Ofe, M. (2013). Enhancing labor and delivery learning experiences through simulation. *Clinical Simulation in Nursing*, 9, e521-530.
- [42] Smiley, R. A. (2019). Survey of simulation use in prelicensure nursing programs: Changes and advancements, 2010–2017. *Journal of Nursing Regulation*, 9(4), 48-61
- [43] Sofer, D. (2018). The value of simulation in nursing education. *AJN The American Journal of Nursing*, 118(4), 17-18.
- [44] Szpak, J., & Kameg, K. (2013). Simulation decreases nursing student anxiety prior to communication with mentally ill patients. *Clinical Simulation in Nursing*, 9, e13-19.
- [45] Tilbrook, A., Dwyer, T., Reid-Searl, K., & Parson, J. A. (2017). A review of the literature—The use of interactive puppet simulation in nursing education and children's healthcare. *Nurse education in practice*, 22, 73-79.
- [46] Titzer, J., Swenty, C., & Gale, W. (2012). An interprofessional simulation promoting collaboration and problem solving among nursing and allied health professional students. *Clinical Simulation in Nursing*, 8, e325-e333.
- [47] Tschannen, D., Aebersold, M., McLaughlin, E., & Bowen, J. (2012). Use of virtual simulation for improving knowledge transfer among baccalaureate nursing students. *Journal of Nursing Education and Practice*, 2(3), 15-24.
- [48] Wayne, D., & McGaghie, W. (2010). Use of simulation-based medical education to improve patient care quality. *Resuscitation*, 81-1455-6.
- [49] Wotton, K., David, J., Button, D., & Kenton, M. (2010). Third-year undergraduate nursing students' perceptions of high-fidelity simulation. *J. Nurs. educ*, 49 (11), 632-639.
- [50] Yukie, A., Chikako, K., Akira, Y., & Ryoji, T. (2013). Repeated scenario simulation to improve competency in critical care: a new approach for nursing education. *American Journal of Critical Care*, 22 (1) 33-40.
- [51] Zhang, C., Thompson, S., & Miller, C. (2010). A review of simulation-based interprofessional education. *Clinical Simulation in Nursing*, 7(4), el 17-el26.