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RESEARCH ARTICLE

In Situ Simulation in support of Off-Site Simulation-Based Learning in Nursing: A Descriptive Exploratory Study

Nawar MOUSTARHFIR[1]*, Abdelghafour MARFAK [2,3], El Madani SAAD[1], Abderraouf HILALI[1], Ibtissam YOULYOUZ-MARFAK[1]

[1]Hassan First University of Settat, Higher Institute of Health Sciences, Laboratory of Health Sciences and Technologies in Settat, Morocco.
[2]Euro-Mediterranean University of Fez (UEMF), Fez, Morocco
[3]National School of Public Health, Ministry of Health and Social Protection, Rabat, Morocco

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***Corresponding Author**

n.moustarhfir@uhp.ac.ma

ABSTRACT

Patient safety and risk management are a global concern, so the High Authority for Health (HAS) has promoted healthcare simulation as an innovative teaching method to be adopted in the training of medical and paramedical staff who contribute to the management of risks associated with healthcare. This is a descriptive exploratory study which aims to argue for the use of in situ simulation to reinforce the skills acquired from an off-site simulation session among Undergraduate Nursing Students. The research team planned an off-site simulation session followed by an in-situ session. The simulation experiment involved undergraduate nursing students. Data were collected using Likert-scale observation grids and questionnaires. As for results, it was approved that an in-situ simulation appears to be effective after passing an off-site simulation to acquire skills necessary for the provision of care. According to the data collected from the students, the mean increase from 17.20(±5.80) to 26.86(±1.83) was significant ($t_{=}8.86$; ρ-value $_{=}$ .000). This improvement affected technical skills ($t_{=}7.23$; ρ-value $_{=}$ .000) and soft skills ($t_{=}5.42$; ρ-value $_{=}$ .000). To conclude, simulation is proving to be an effective teaching approach, and modelling a process from the off-site session to the in-situ session appears to be efficient and should be adopted.

1. INTRODUCTION

In 2017, the World Health Organisation (WHO) defined training as any type of activity or lecture that enables people to learn or improve skills, knowledge and behaviours by mobilising a learning experience that allows students to achieve a required level of competence (Organisation mondiale de la Santé, 2017).

In 2019, it was demonstrated by Safari et al. that simulation-based learning (SBL) is an approach that helps health sciences students to acquire the skills and refine the practice needed to manage the risk of error associated with the care of their future patients (Sarfati et al., 2019).

In 2020, Harder and colleagues argued that an effective pedagogical approach such as a SBL experience is recommended to support student learning in nursing (Harder & Turner, 2020). In this respect, the WHO has stated that simulation training develop, consolidate, test and evaluate the skills of emergency management systems, procedures and mechanisms needed to deal with emerging public health issues in national health systems (Organisation mondiale de la Santé, 2017).

The High Authority for Health (HAS) defined in 2012 and restated in 2019 that simulation in healthcare corresponds to «*the use of equipment (such as a mannequin or procedural simulator), virtual reality or a standardised patient, to reproduce healthcare situations or environments, to teach diagnostic and therapeutic procedures and to enable processes, clinical situations or decision-making*

to be rehearsed by a healthcare professional or a team of professionals. » (Haute Autorité de Santé, 2019)

Simulation, as a teaching method, can enhance both technical and non-technical skills essential for improving patient care quality, ensuring safety, and addressing global risk management concerns (Haute Autorité de Santé, 2019). It offers a safer experience for patients, reduces stress for learners by fostering a constructive attitude toward mistakes (Haute Autorité de Santé, 2019), and is often more cost-effective (Calhoun et al., 2011).

In 2015, Almagooshi noted that the examination of model design focuses on requirements discovery and the development of simulation scenarios (Almagooshi, 2015). Furthermore, there are many types of simulation (Haute Autorité de Santé, 2019), including Off-Site Simulation (OSS) and In-Situ Simulation (ISS) (Houzé-Cerfon et al., 2019; Sansregret et al., 2023).

In Morocco, simulation-based training in the healthcare sector is still in its early stages (Mouhaoui et al., 2012). Traditionally, nursing training has been organised according to the alternating teaching method, in which theoretical knowledge is taught in the classroom, while practical knowledge is mainly taught in real clinical situations, hence the need to create a new paradigm that is attractive to students (Mouhaoui et al., 2012).

As part of the introduction of the Licence-Master- Doctorate (LMD) system in nursing training at the Higher Institute of Nursing Professions and Health Techniques (HINPHT), teaching and learning quality requirements are forcing professors and decision-makers to adopt an innovative teaching approach (Khattabi et al., 2023). Practical SBL supports lectures, which remain the most important element of knowledge in any subject (Khattabi et al., 2023).

HINPHT is a training institute situated near a provincial hospital in Settat, Morocco. Building on the previously mentioned advantages of simulation, and considering its proximity to the hospital, the research team aimed to assess the impact of simulation on the development of both technical and soft skills. The study also sought to create a simulation process for future generalisation. To achieve this, an OSS session was organised, followed by an ISS session, to demonstrate the complementary nature of the two types and the role of OSS in acquiring ISS skills.

MATERIALS AND METHODS

- Study design

This is a descriptive exploratory study carried out among nursing students at HINPHT and the provincial hospital in Settat, Morocco. The study was conducted in May and June 2024.

The intervention chosen for observation was intramuscular (IM) injection, as it represents a basic practice that must be acquired and requested in this type of care provision.

The study utilised an observation checklist to evaluate the students' practices, along with a survey distributed to them to identify their knowledge and levels of satisfaction.

- Sample

A randomised sample could not be used due to participant limitations as final year learners were completing their final year projects and first year learners were receiving theoretical lectures. Following these constraints, the intervention was opened to second-year nursing students, option: Community and Family Health, who were available at the time of data collection.

The convenience sample was used to recruit participants for the present study. We approached a group of 30 students. The participants attended the two simulation sessions: off-site and in situ.

- Study procedure

Following the guidelines, a simulation experience goes through three phases: briefing, scenario development and debriefing (Bellahouel & Descatha, 2019; Jaffrelot & Pelaccia, 2016). About this study, the experience unfolded in four phases:

✓ Briefing: During this stage, the objective of the study and the clinical case were explained. The settings for the scenario both off-site and in-situ and the process for conducting the session were described.

✓ Scenario Execution: In this phase, participants engaged in the execution of the scenario. First, they participated in the OSS at HINPHT in a dedicated simulation room, equipped with all necessary materials to achieve the session's objectives (low-fidelity mannequin with an IM injection site, hospital bed, injection kit, etc.). Next, all participants took part in an ISS in a room designed to replicate the context and equipment of the emergency department at the provincial hospital. The research team observed the intervention using two observation checklists for each participant to generate scores for OSS and ISS.

✓ Debriefing: This final stage of the simulation allowed learners and instructors to freely share their feedback on the session's execution and interventions.

✓ Survey Distribution: Finally, a questionnaire was distributed to the learners to assess their level of satisfaction and knowledge acquisition from each type of simulation, as well as their preferences.

- **Measurement Instruments:**

✓ Practice Evaluation Checklist: Developed by the research team, this checklist is based on technical sheets and established protocols from nursing education institutes, considering the competencies outlined in the training programme at HINPHT. It comprises 14 items divided into 9 sections, using a Likert scale for scoring ("Performed = 2"; "Not performed correctly / not done at the right time" = 1; "Not performed" = 0).

✓ Survey: Created and distributed via Google Forms by the research team, it was completed online by participants. It includes a demographic section to confirm the gender and age reported during the simulation sessions, as recorded on the observation checklists. Additionally, it contains questions aimed at assessing the level of knowledge acquisition regarding the definitions and advantages of each type of simulation, participants' satisfaction with the sessions, and their preference for the most beneficial type of simulation.

- **Data analysis**

Statistical analysis of the data collected through the observation grids and questionnaires was carried out using Statistical Package for the Social Science (SPSS) version 20 (IBM corporation, Armonk, New York, USA).

To assess the normality of quantitative parameters, we performed the Shapiro-Wilk and Kolmogorov-Smirnov tests. Subsequently, a one-sample t-test was used to compare the OSS and ISS scores. A $p\text{-value} \leq 0.05$ was considered statistically significant. Moreover, a descriptive analysis of the data was conducted, presented in terms of frequency and percentage.

- **Ethical considerations**

All procedures carried out in studies involving human participants adhered to the principles established in the Declaration of Helsinki 1964 (Dennett, 1964) and complies with the legal framework law n° 09.08 of Moroccan legislation, which takes into account the protection of individuals with regard to data processing (Law 09-08 on the protection of individuals with regard to the processing of personal data, 209apr. J.-C.).

The research team verbally informed all participants about the study, its purpose, and the process involved. They emphasized that the objective was purely scientific, aiming to identify the most beneficial type of simulation for learning, rather than evaluating clinical practice.

Before participating in the study, participants provided their informed consent. Additionally, they were assured of their right to anonymity and confidentiality throughout the study. Participants were also informed of their right to freely and voluntarily choose whether to

participate. Participants were also made aware of their right to withdraw from the process at any time.

Furthermore, The Hassan First University Scientific Research Commission and The Pedagogical Department of HINPHT granted ethical permission as the study ensured fair and impartial treatment of the data, as well as neutrality and objectivity in the presentation and discussion of the results.

RESULTS:

- **Sociodemographic Data:**

The participants (N=30) are second-year undergraduate nursing students, specialising in community and family health. 63.3% are female and 36.7% are male. Age distribution is as follows: 87% are aged between 18 and 20 years, 10% between 20 and 22 years, and 3% between 22 and 26 years, with an average age of 19.33 years.

- **Results from the Observation Checklist**

In this section, the abbreviation m_1 refers to the average score for the OSS, while m_2 refers to the average score for the ISS.

Statistical analysis of the checklist results revealed a highly significant difference (*$t = 8.68$; p-value = .000*) between in situ and off-site simulations. The average score for the off-site simulation was $m_1 = 17.20$ (*±5.80*), whereas the average score for the in situ simulation was $m_2 = 26.86$ (*±1.83*). This suggests that the repetition effect generated by the ISS enhances the practical skills of nursing students. Therefore, we can conclude that in situ simulation appears to be effective and more beneficial following an off-site simulation.

To enrich our study, we grouped the items on the checklist into two categories: Technical skills (TS) and non-technical skills “Soft-Skills” (SS). According to the data analysis, there was an observed increase in the average scores for TS (*$m_1 = 14.90 \pm 5.23$; $m_2 = 22.77 \pm 1.90$; $t = 7.23$; p-value = .000*) and SS (*$m_1 = 2.30 \pm 1.53$; $m_2 = 3.93 \pm 0.36$; $t = 5.42$; p-value = .000*). This statistically validates that the ISS facilitates reliable and significant acquisition of both skill categories after undergoing an OSS.

- **Results from the Questionnaire**

The response rate for the questionnaire was 100%. Based on the participants' responses, we can conclude that:

- All participants indicated that the experience enhanced their understanding of the types of simulations used.
- 73.3% of the students defined in situ simulation as "organising simulation sessions in the training environment," while 80% described off-site simulation as "conducting training in facilities outside the patient care unit."
- 63.3% of participants chose off-site simulation as the best option for acquiring technical skills, whereas 86.7% regarded in situ simulation as the most effective for developing necessary soft skills.
- 96.7% expressed satisfaction with the experience, and 83.3% stated that in situ simulation is more beneficial for learning.
- Concerning the advantages, the percentages of responses to the common choices between the two types of simulation depend on the students' responses, as shown in the **Figure 1**. Moreover, 66.7% of students said that the SIS improved their ability to analyse critical situations.
- As for the inconveniences of each type, we have grouped the response percentages according to the type of each simulation, as following: **a) In Situ Simulation:** (Workload: 76.7%; High cost: 30%; Risk of infection: 93.3%; Need for a dedicated simulation space: 23.3%). **b) Off-Site Simulation:** (High cost: 60% ; Need for a dedicated simulation space: 66.7%; Low group

participation: 93.3%; Lack of communication: 93.3%; Lack of relational support: 73.3%; Absence of infection risk: 90%)

DISCUSSION

Simulation is indeed an essential pedagogical method for developing the skills necessary to manage risks in healthcare. Aligning with the guidelines set by the High Authority for Health (HAS), simulation helps create a safe environment for detecting and preventing errors, which is crucial for adhering to the ethical imperative of never exposing a patient to a first-time situation without adequate preparation (Haute Autorité de Santé, 2019).

Secondly, the study statistically confirmed the presence of a difference between ISS and OSS and explored the impact of ISS on the reinforcement of technical and soft skills acquired during OSS. In this respect, a study conducted by Sollid SJ et al in 2012 affirmed that ISS facilitates more learning through OSS (Sollid et al., 2016).

This effectively illustrates the efficacy of simulation as a training tool in the medical field, fostering not only the acquisition of practical skills but also the development of essential professional attitudes.

Regarding ISS, our study has shown that it has benefits for communication, self-confidence, learning and leadership. Similarly, the HAS defines simulation as an approach targeting communication and developing self-confidence through a positive culture based on the right to make mistakes (Haute Autorité de Santé, 2019). In the same vein, Allain at al showed in 2018 that SIS has a positive impact on improving performance (Allain et al., 2018).

Nevertheless, most of the participants presented their fears of the risk of infection by taking part in an ISS in care services (93.3%), unlike the OSS, which reduces the risk of nosocomial infections. Another limitation is the work overload (76.6%), as reported by Patterson et al in 2013 (Patterson et al., 2013).

Furthermore, OSS in turn makes it possible to strengthen technical and non-technical skills. It is therefore less costly than ISS. This reduction in costs was noted by Calhoun and colleagues in 2011, they assigned that the reduction is estimated at 3.5 times (Calhoun et al., 2011).

Strengths and Limitations

- This is an exploratory pilot study which has confirmed the complementarity between the two types of simulation, explaining a process to be followed to achieve the learning objectives effectively and efficiently.

- The experiment can be generalised to all HINPHT annexes and headquarters in Morocco, since they carry out the same training programmes predefined by the Ministry of Health and Social Protection.

- Simulation is a teaching approach that should be adopted in all HINPHT student training programmes.

- Time and the number of participants included were constraints in gathering more results.

CONCLUSION

Simulation is a pedagogical method used to acquire the technical skills and soft skills needed for clinical practice that guarantees patient safety, the quality of care provided, and the management of

risks associated with care. There are different types of simulation, of which we have focused on ISS and OSS. Both are innovative and contributory approaches to the learning process. However, the complementarity between them serves more to reinforce the technical and non-technical skills required in care environments.

Authors contribution:

Conceptualisation, Software, Formal Analysis, Investigation, Data curation, Supervision and Funding acquisition: Nawar MOUTARHFIR (First Author)**. Methodology, Writing and study design and Visualisation:** All authors**. Validation:** N.M, A.M, and IYM**. Resources:** NM; SM; AH, and IYM**. Project administration:** NM and IYM.

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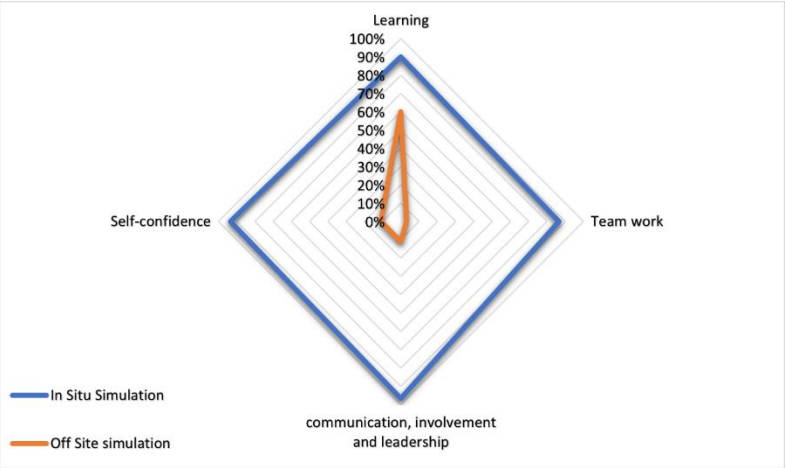

Figure 1: The benefits of OSS and ISS according to students