Pak. j. life soc. Sci. (2024), 22(2):18962-18975 E-ISSN: 2221-7630;P-ISSN: 1727-4915

Pakistan Journal of Life and Social Sciences
www.pjlss.edu.pk

https://doi.org/10.57239/PJLSS-2024-22.2.001390

RESEARCH ARTICLE

Promoting the Establishment Of In Situ Simulation in the Training of Healthcare Professionals: A Systematic Review

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 [2]Technologies in Settat, Morocco.
[3]Euro-Mediterranean University of Fez (UEMF), Fez, Morocco
[4]National School of Public Health, Ministry of Health and Social Protection, Rabat, Morocco

ARTICLE INFO

Received: Sep 14, 2024

Accepted: Dec 8, 2024

Keywords

In Situ Simulation

Training

Nursing Students

Review

Healthcare

Skills

***Corresponding Author:**

n.moustarhfir@uhp.ac.ma

ABSTRACT

Simulation is a valuable teaching method that has demonstrated its effectiveness. Additionally, recent studies indicate that in situ simulation is more effective for enhancing skill development. This study aimed to Promote in situ simulation in healthcare training by highlighting its proven benefits for skill acquisition. A systematic review of studies published between 2013 and 2023 was conducted following PRISMA guidelines. The search covered the databases: Scopus, Web of Science, ScienceDirect, and PubMed. After a final screening, 16 articles were selected for analysis. All studies indicate that in situ simulation is a crucial approach for training healthcare professionals, facilitating the development of skills necessary for handling patients with both straightforward and complex clinical scenarios. As a conclusion, learning should ideally be centred around in situ simulation in the training of nursing students as this vital method has proven its benefits in both skills acquisition and cost-effectiveness.

INTRODUCTION

Simulation is recognised as a technique for learning by practicing. It can be used in a variety of fields and with many different types of trainee (Shojania et al., 2001). Simulation-based learning (SBL) can be considered as a solution for developing the knowledge and skills of healthcare professionals (Lateef, 2010).

In addition, simulation training centres, equipped with new equipment, offer crucial opportunities to practice and learn how to manage dynamic situations and care scenarios that healthcare professionals may encounter on the service (Gaba, 2004; Lateef, 2008).

In recent years, a number of centres dedicated to medical simulation have opened in several countries to train healthcare professionals in a wide range of fields (Mouhaoui et al., 2012). In Morocco, the first high-fidelity medical simulation teaching session took place in Casablanca on 19 February 2009 (Mouhaoui et al., 2012). After 2 years, the Faculty of Medicine and Pharmacy in Casablanca mobilised its resources to open a large medical simulation centre (Mouhaoui et al., 2012). Subsequently, several training institutes for paramedical staff in the health sciences used this method in centres organised as part of their training, including the Higher Institute of Health

Sciences (HIHS), and the Higher Institute of Nursing Professions and Health Technologies (HINPHT).

Otherwise, simulation classifications include in situ simulation (ISS) and off-site simulation (OSS), which refers to training in centres away from the workplace, either in rooms located in the hospital, but set up for this purpose (Sørensen et al., 2013). Concerning ISS, it consists of mobilising scenarios in the clinical environment to promote learning and improve clinical care (Martin et al., 2020). It is increasingly used in emergency and resuscitation management training (Martin et al., 2020).

National paramedic training institutes are equipped with simulation centres that enable OSS learning. However, learning by ISS remains a necessity, given the proximity of the training environments and the inescapable benefits of this method.

The aim of this review is to promote the establishment of in situ simulation in the training of healthcare professionals by summarising and analysing the international literature demonstrating the benefits of this method and its contribution to the acquisition of the skills required for clinical practice.

MATERIALS AND METHODS

Study design and inclusion criteria:

This review focuses on the collection and study of relevant articles that reflect the training of healthcare professionals using In Situ Simulation (ISS). This review was carried out according to the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) guideline, Edition 2020 (Page et al., 2021).

The research is based on the use of online bibliographic and citation databases, namely, PUBMED, Web of Science, Scopus and Sciences Direct, with a time limit between 2013 and 2023.

“Literature reviews and meta-analysis”, “conference abstracts”, “case reports and series”, and studies that did not address the contribution of ISS to the training of healthcare professionals or its impact on their skills/practice were excluded from the selection.

Literature search and strategy

Relevant studies were searched using online scientific databases available through IMIST/CNRST. The whole process is shown in the following flow diagram (**Figure1**).

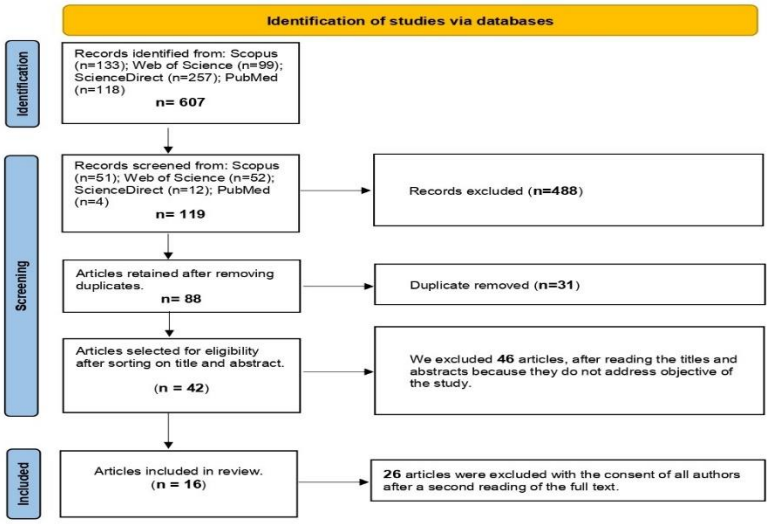

Figure 1: PRISMA diagram flow of studies selected.

The keywords used during the search were: ("In Situ Simulation") AND ("health professions education" OR "medical education" OR "nursing education" OR "midwifery education").

The recording through database searching was n=607. a hundred and nineteen studies were found potentially relevant following the screening, of which 42 articles were identified from the title and the abstract screening. Finally, 16 articles were retained for inclusion in this review based on the consent of the entire reading committee after double reading.

The sixteen articles are summarised in **Table 1**, quoting: the first author, year of publication, objective of the study, materials and methods, and findings.

Data extraction

The following three biases were assessed to eliminate the risk of data collection: **selection bias, detection bias and interpretation bias**.

In addition, at the final step of the selection process, the quality analysis was assessed using a model grid for analysing scientific documents developed by Marc and his colleagues in 2010 (Tanti et al., 2010). The quality study process is based on 7 steps: Determination of document form, translation, theme control, content summary, originality analysis, defence application studies and scientific validity analysis (Tanti et al., 2010).

RESULTS

Article selection:

As shown in the flow diagram, 16 articles were selected. The characteristics of the selected studies with the details: Author(s) and year publication, title, aim, material and methods, and main points are summarised in the table (**Table 1**).

The studies selected were published in English between 2013-2023 and addressed the objective of the study. The purpose of this review is to highlight the contribution of ISS in training of healthcare professionals.

After reviewing the selected publications, we can process them and summarise the results as follow:

Simulation benefits

According to the Healthcare Simulation Dictionary, simulation is: “a technic that creates a situation or environment to allow persons to experience a representation of a real event for the purpose of practice, learning, evaluation, testing, or to gain understanding of systems or human actions (Finstad et al., 2023; Lioce, 2020 in)”. As for benefits, selected studies stated that:

Team simulation training is used to support the acquisition of knowledge and skills, as well as attitudes, in view of optimum team performance (Arul et al., 2021). The simulation methodology, based on a well-conducted debriefing, enables team training with a focus on patient safety (Aggarwal et al., 2010 in; Arul et al., 2021).

Simulation helps to develop the ability to work effectively with other healthcare professionals as part of a multidisciplinary team, ensuring medical education and patient safety at the same time (Atamanyuk et al., 2014).

In addition, Mangayarkarasi V Babu and his colleagues have reported that simulation tools offer an alternative to real patients (Babu et al., 2021). They report that simulation-based education is increasingly being used for the teaching, training and assessment of healthcare professionals, so much so that it reduces the discomfort of care by mobilising their skills while eliminating the risks that patients may encounter (Babu et al., 2021).

In 2021, Benlolo and his research team noted that the simulation-based teaching approach is particularly relevant in high-risk situations where a malfunctioning workflow algorithm exists and may endanger the safety of patients and healthcare providers (Benlolo et al., 2021). This view was also stated by Luciana Bihain Hagemann De Malfussi and her colleagues (de Malfussi et al., 2021; Negri et al., 2019 in).

In 2023, Anne Strand Finstad et al. reaffirmed this rating, stating that Simulation-based team training enables difficult situations to be managed successfully and patient injuries to be anticipated (Brattebø et al., 2019 in; Finstad et al., 2023).

In Situ Simulation contribution, impact, and benefits

In 2015, Jette Led Sørensen et al. conducted a study to explore the influence of in situ (ISS) and off-site (OSS) simulation-based training on healthcare professionals' perceptions and expertise while learning. They were able to demonstrate that ISS participants described more experiences that could lead to organisational changes than OSS participants (Sørensen et al., 2015).

In the context of traumatology, in 2018, Alexander Knobel and colleagues assessed the clinical impact of a real intervention using in situ simulation and were able to deduce that it enables the acquisition of personal skills and knowledge and the improvement of time management from the moment the patient is admitted to the department and throughout the care pathway (Knobel et al., 2018).

In the same year but in pneumatology, another study by Owain Michael Leng et al. reported participants' intention to modify their own practice after simulation training, positive patient care outcomes, and emphasised that debriefing after the simulation scenario is an essential and much-appreciated step (Leng et al., 2018).

One year on, a study leaded by Roshana Shrestha et al. in the emergency services revealed that ISS is an educational approach that can be adopted to identify and remedy security threats when financial resources are limited (Shrestha et al., 2019). In the same vein, Barbara M. Walsh et al. argued that community-based ISS is cost-effective due to its high acceptability in a variety of clinical situations and recommended that programmes should be encouraged to consider this technique(Walsh et al., 2019).

In addition, Uttley Elizabeth and her research team have announced that ISS helps to: educate multi-professional teams in their working environment and improve self-confidence and recognition of one's own role (Uttley et al., 2020). This was also proven by Sharara-Chami Rana et al. in the same year in the emergency department (Sharara-Chami et al., 2020).

In 2021, the relevant studies have shown that ISS offers beneficiaries a realistic experience in a constructive and safe learning environment that encourages empowerment, multi-disciplinary team learning and knowledge sharing. It serves to learn from national experts and adjust to different contexts, ensuring that pre-established training programmes are carried out while guaranteeing patient safety (Arul et al., 2021; Babu et al., 2021; Benlolo et al., 2021; de Malfussi et al., 2021; Schram et al., 2021).

DISCUSSION

The review aimed to advocate for in situ simulation as a training tool for healthcare professionals, emphasising its benefits and its role in developing the critical skills necessary for clinical practice in the health sciences.

Summary of results:

Overall, the review found that in situ simulation provides healthcare professionals with a valuable opportunity to practice and hone their skills in a setting that closely mirrors their day-to-day working environment, ultimately improving patient care and safety.

In situ simulation provides immediate feedback, helps identify systemic issues, and enhances learning outcomes by offering a realistic and practical training experience.

ISS enables: Realistic Setting, Integrated Training, Immediate Feedback, Identification of Systemic Issues, Enhanced Learning, and Team Collaboration.

Discussion of the findings

Several studies already conducted share the ideas outlined in this review. In particular that of Martin and colleagues who noted, in 2020, that ISS improves team skills and understanding across all specialties, adapting to local and organisational needs, and that the key is to tailor simulations to available resources, educational needs and patient numbers (Martin et al., 2020).

Moreover, a study mentioned in 2015 that ISS is widely used in various acute clinical specialities. It is used as a multidisciplinary teaching tool, involving a range of healthcare professionals. It is an effective way of detecting latent safety events and improving clinical skills, teamwork and behaviour. This can lead to a reduction in morbidity and mortality following its implementation (Fent et al., 2015).

In the field of education, a study published in 2022 cited that **In Situ Interprofessional Simulation-based Education** (ISISE) programmes are effective in strengthening interprofessional teamwork (Ju et al., 2022). The authors also added that the gaps that exist between the ideals of the ISISE and the realities of implementation can be reduced by greater buy-in from simulation participants (facilitators and institutions), greater allocation of resources, the development and sharing of instruments to evaluate learners and programmes, and recognition of their impact on learning (Ju et al., 2022).

Strengths and Limitations of the Study

The review highlights the importance of the ISS in training healthcare professionals in a well-established programme, generated under specific objectives.

This pedagogical method enables the reinforcement of theoretical knowledge and the acquirement of competencies in patient handling, from the simplest to the most complex situations.

Regarding the limitations, grey literature was excluded from the selection process as the present work targeted indexed and medically relevant databases for a better representativeness of the results. However, it can be introduced according to the researcher's objectives. Furthermore, we've used a publication period of 10 years, since 2013, to obtain up-to-date data, which can be adjustable.

CONCLUSION:

In-situ simulation is a teaching and training method for healthcare professionals that has been shown to be essential for acquiring the skills needed to practise in a specialised field, such as interdisciplinary group work, stress management, situation management, collaborative leadership and others, which in turn ensures the well-being and safety of patients.

Moreover, it would be preferable to include this approach in the curricula of all training institutes for healthcare professionals, particularly in nursing, given its benefits in terms of acquiring simple and complex basic skills, with expertise in a limited timeframe.

Implications for nursing practice, health and social care policy, and future research:

For nursing practice: - Our study provides a list of knowledge on simulation in general and on in situ simulation in specific in the fields of health and nursing by highlighting its contributions and achievements when it is introduced in the training of health professionals and nursing actors. - Nurses can adopt a more personalised and efficient approach to monitoring, treating and providing care to patients.

For policy: - The results of our research can help policy makers to develop nursing and health technical training programmes that are based on in situ simulation as a teaching pedagogy and policy strategies to improve the adoption of digital health technologies. - Aware of its advantages, policy decision-makers can conceive more funding plans for the generalisation of simulation centres in the various health structures for educational purposes.

For research: The information summarised and analysed is valuable in guiding future research, highlighting the limitations that have constrained this review.

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.

ACKNOWLEDGMENTS: Nil.

REFERENCES

Aggarwal, R., Mytton, O. T., Derbrew, M., Hananel, D., Heydenburg, M., Issenberg, B., MacAulay, C., Mancini, M. E., Morimoto, T., Soper, N., Ziv, A., & Reznick, R. (2010). Training and simulation for patient safety. *Quality & Safety in Health Care*, *19 Suppl 2*, i34-43. https://doi.org/10.1136/qshc.2009.038562

Arul, N., Ahmad, I., Hamilton, J., Sey, R., Tillson, P., Hutson, S., Narang, R., Norgaard, J., Lee, H. C., Bergin, J., Quinn, J., Halamek, L. P., Yamada, N. K., Fuerch, J., & Chitkara, R. (2021). Lessons learned from a collaborative to develop a sustainable simulation-based training program in neonatal resuscitation : Simulating success. *Children*, *8*(1). Scopus. https://doi.org/10.3390/children8010039

Atamanyuk, I., Ghez, O., Saeed, I., Lane, M., Hall, J., Jackson, T., Desai, A., & Burmester, M. (2014). Impact of an open-chest extracorporeal membrane oxygenation model for in situ simulated team training : A pilot study. *Interactive Cardiovascular and Thoracic Surgery*, *18*(1), 17-20. Scopus. https://doi.org/10.1093/icvts/ivt437

Babu, M., Arumugam, M., & Debnath, D. (2021). Simulated Patient Environment : A Training Tool for Healthcare Professionals in COVID-19 Era. *ADVANCES IN MEDICAL EDUCATION AND PRACTICE*, *12*, 579-585. https://doi.org/10.2147/AMEP.S297536

Benlolo, S., Nensi, A., Campbell, D., Assouad, C., Taylor, T., & Shore, E. (2021). The Use of In Situ Simulation to Enhance COVID-19 Pandemic Preparedness in Obstetrics. *CUREUS JOURNAL OF MEDICAL SCIENCE*, *13*(1). https://doi.org/10.7759/cureus.12906

Brattebø, G., Ersdal, H. L., & Wisborg, T. (2019). Simulation-based team training works. *Tidsskrift for Den Norske Laegeforening: Tidsskrift for Praktisk Medicin, Ny Raekke*, *139*(18). https://doi.org/10.4045/tidsskr.19.0565

de Malfussi, L. B. H., Do Nascimento, E. R. P., Baptista, R. C. N., Lazzari, D. D., Martini, J. G., & Hermida, P. M. V. (2021). IN SITU SIMULATION IN THE PERMANENT EDUCATION OF THE INTENSIVE CARE NURSING TEAM. *Texto e Contexto Enfermagem*, *30*. Scopus. https://doi.org/10.1590/1980-265X-TCE-2020-0130

Fent, G., Blythe, J., Farooq, O., & Purva, M. (2015). In situ simulation as a tool for patient safety : A systematic review identifying how it is used and its effectiveness. *BMJ Simulation & Technology Enhanced Learning*, *1*(3), 103-110. https://doi.org/10.1136/bmjstel-2015-000065

Finstad, A., Aase, I., Bjorshol, C., & Ballangrud, R. (2023). In situ simulation-based team training and its significance for transfer of learning to clinical practice-A qualitative focus group interview study of anaesthesia personnel. *BMC MEDICAL EDUCATION*, *23*(1). https://doi.org/10.1186/s12909-023-04201-8

Gaba, D. (2004). The future vision of simulation in health care. *Quality & safety in health care*, *13*(Suppl 1), i2-i10. https://doi.org/10.1136/qshc.2004.009878

Ju, M., Bochatay, N., Robertson, K., Frank, J., O'Brien, B., & van Schaik, S. (2022). From ideal to real : A qualitative study of the implementation of in situ interprofessional simulation-based education. *BMC Medical Education*, *22*(1), Article 1. https://doi.org/10.1186/s12909-022-03370-2

Knobel, A., Overheu, D., Gruessing, M., Juergensen, I., & Struewer, J. (2018). Regular, in-situ, team-based training in trauma resuscitation with video debriefing enhances confidence and clinical efficiency. *BMC MEDICAL EDUCATION*, *18*. https://doi.org/10.1186/s12909-018-1243-x

Lateef, F. (2008). What's new in emergencies, trauma, and shock? Role of simulation and ultrasound in acute care. *Journal of Emergencies, Trauma and Shock*, *1*(1), 3-5. https://doi.org/10.4103/0974-2700.41779

Lateef, F. (2010). Simulation-based learning : Just like the real thing. *Journal of Emergencies, Trauma and Shock*, *3*(4), 348-352. https://doi.org/10.4103/0974-2700.70743

Leng, O., Rothwell, C., Buckton, A., Elmer, C., Illing, J., & Metcalf, J. (2018). Effect of In Situ High-Fidelity Simulation Training on the Emergency management of Pneumonia (INSTEP) : A mixed-methods study. *BMJ SIMULATION & TECHNOLOGY ENHANCED LEARNING*, *4*(4), 190-195. https://doi.org/10.1136/bmjstel-2017-000228

Lioce, L. (Éd.). (2020). *Healthcare Simulation Dictionary* (Second). Agency for Healthcare Research and Quality. https://doi.org/10.23970/simulationv2

Manggala, S. K., Tantri, A. R., Sugiarto, A., Sianipar, I. R., & Prasetyono, T. O. H. (2022). In situ simulation training for a better interprofessional team performance in transferring critically ill patients with COVID-19 : A prospective randomised control trial. *Postgraduate Medical Journal*, *98*(1162), 617-621. https://doi.org/10.1136/postgradmedj-2021-141426

Martin, A., Cross, S., & Attoe, C. (2020). The Use of in situ Simulation in Healthcare Education : Current Perspectives. *Advances in Medical Education and Practice*, *11*, 893-903. https://doi.org/10.2147/AMEP.S188258

Mouhaoui, M., Moussaoui, M., Yaqini, K., Khaleq, K., & Louardi, H. (2012). *La simulation médicale au Maghreb : État des lieux et perspectives*.

Negri, E. C., Pereira Júnior, G. A., Cotta Filho, C. K., Franzon, J. C., & Mazzo, A. (2019). CONSTRUCTION AND VALIDATION OF SIMULATED SCENARIO FOR NURSING CARE TO COLOSTOMY PATIENTS. *Texto & Contexto - Enfermagem*, *28*, e20180199. https://doi.org/10.1590/1980-265X-TCE-2018-0199

Page, M. J., McKenzie, J. E., Bossuyt, P. M., Boutron, I., Hoffmann, T. C., Mulrow, C. D., Shamseer, L., Tetzlaff, J. M., Akl, E. A., Brennan, S. E., Chou, R., Glanville, J., Grimshaw, J. M., Hróbjartsson, A., Lalu, M. M., Li, T., Loder, E. W., Mayo-Wilson, E., McDonald, S., … Moher, D. (2021). The PRISMA 2020 statement : An updated guideline for reporting systematic reviews. *BMJ*, n71. https://doi.org/10.1136/bmj.n71

Schram, A., Paltved, C., Christensen, K. B., Kjaergaard-Andersen, G., Jensen, H. I., & Kristensen, S. (2021). Patient safety culture improves during an in situ simulation intervention : A repeated cross-sectional intervention study at two hospital sites. *BMJ Open Quality*, *10*(1). Scopus. https://doi.org/10.1136/bmjoq-2020-001183

Sharara-Chami, R., Lakissian, Z., Farha, R., Tamim, H., & Batley, N. (2020). In-situ simulation-based intervention for enhancing teamwork in the emergency department. *BMJ Simulation and Technology Enhanced Learning*, *6*(3), 175-177. Scopus. https://doi.org/10.1136/bmjstel-2019-000473

Shojania, K. G., Duncan, B. W., McDonald, K. M., Wachter, R. M., & Markowitz, A. J. (2001). Making health care safer : A critical analysis of patient safety practices. *Evidence Report/Technology Assessment (Summary)*, *43*, i-x, 1-668.

Shrestha, R., Shrestha, A. P., Shrestha, S. K., Basnet, S., & Pradhan, A. (2019). Interdisciplinary in situ simulation-based medical education in the emergency department of a teaching hospital in Nepal. *International Journal of Emergency Medicine*, *12*(1). Scopus. https://doi.org/10.1186/s12245-019-0235-x

Sørensen, J. L., Navne, L. E., Martin, H. M., Ottesen, B., Albrecthsen, C. K., Pedersen, B. W., Kjærgaard, H., & van der Vleuten, C. (2015). Clarifying the learning experiences of healthcare professionals with in situ and off-site simulation-based medical education : A qualitative study. *BMJ Open*, *5*(10), e008345. https://doi.org/10.1136/bmjopen-2015-008345

Sørensen, J. L., Van der Vleuten, C., Lindschou, J., Gluud, C., Østergaard, D., LeBlanc, V., Johansen, M., Ekelund, K., Albrechtsen, C. K., Pedersen, B. W., Kjærgaard, H., Weikop, P., & Ottesen, B. (2013). « In situ simulation » versus « off site simulation » in obstetric emergencies and their effect on knowledge, safety attitudes, team performance, stress, and motivation :

Study protocol for a randomized controlled trial. *Trials*, *14*(1), 220. https://doi.org/10.1186/1745-6215-14-220

Tanti, M., Hupin, C., Boutin, J.-P., & Hassanaly, P. (2010). Un modèle de grille d'analyse des documents scientifiques : Application à la veille sanitaire de défense: *Documentaliste-Sciences de l'Information*, *Vol. 47*(1), 4-12. https://doi.org/10.3917/docsi.471.0004

Uttley, E., Suggitt, D., Baxter, D., & Jafar, W. (2020). Multiprofessional in situ simulation is an effective method of identifying latent patient safety threats on the gastroenterology ward. *Frontline Gastroenterology*, *11*(5), 351-357. Scopus. https://doi.org/10.1136/flgastro-2019-101307

Walsh, B. M., Auerbach, M. A., Gawel, M. N., Brown, L. L., Byrne, B. J., Calhoun, A., Katz-Nelson, J., Tay, K.-Y., Whitfill, T., Kessler, D., Dudas, R., Nishisaki, A., Nadkarni, V., & Hamilton, M. (2019). Community-based in situ simulation : Bringing simulation to the masses. *Advances in Simulation*, *4*(1). Scopus. https://doi.org/10.1186/s41077-019-0112-y

Wang, Y., Liu, D., Wu, X., Zheng, C., & Chen, X. (2023). Effect of in situ simulation training for emergency caesarean section on maternal and infant outcomes. *BMC MEDICAL EDUCATION*, *23*(1), 781. https://doi.org/10.1186/s12909-023-04772-6

* BIOGRAPHIES:

Nawar MOUSTARHFIR: A doctoral student affiliated to the Health Sciences and Technologies Laboratory at the Higher Institute of Health Sciences. She is also a certified midwife with a professional degree in midwifery and a master's degree in advanced nursing practice. She teaches and trains students at the Higher Institute of Nursing Professions and Health Techniques.

Abdelghafour MARFAK: A professor of higher university education at the Euro-Mediterranean University of Fez (UEMF), and the National School of Public Health, part of the Ministry of Health and Social Protection in Rabat.

El Madani SAAD: The Director of the Higher Institute of Health Sciences and the Health Sciences and Techniques Research Laboratory. He is a professor of higher university education at Hassan First University.

Abderraouf HILALI: A professor of higher education at Hassan Premier University and former director of the Higher Institute of Health Sciences.

Ibtissam YOULYOUZ-MARFAK: A qualified university lecturer and former coordinator of the Advanced Health Practice Masters at the Institut Supérieur des Sciences de la Santé and Director of Research at Hassan Premier University.

Table 1: Features of the studies obtained

Title	Auteur, Year	Country	Objectif	Study design	Setting	Outcomes
Lessons Learned from a Collaborative to Develop a Sustainable Simulation-Based Training Program in Neonatal Resuscitation: Simulating Success (Arul et al., 2021)	Nandini Arul et al. 2021	U-S (California)	developing a permanent training program based on simulation in neonatal resuscitation	Case study	The 15-month training program based on in-situ simulation	The ISS makes it possible to: - provide beneficiaries with a realistic experience and a constructive and safe learning environment. - encourage empowerment, multidisciplinary team learning and knowledge sharing. - learn from national experts and adapt to different contexts. - Debriefing is a key step in the SSI learning process.
Impact of an open-chest extracorporeal membrane oxygenation model for in situ simulated team training: a pilot study (Atamanyuk et al., 2014)	Iryna Atamanyuk et al. 2013	UK	Development of an open-chest extracorporeal membrane oxygenation model essential for interprofessional in situ training to manage the resources required for post-surgical paediatric cardiac emergencies.	Pilot study	Programming of simulation sessions using a high-fidelity mannequin named (Laerdal Simbaby™), based on a cardiac tamponade/ECMO standstill scenario	The simulation had an impact on practice, teamwork, self-confidence, and communication skills.
Simulated Patient Environment: A Training Tool for Healthcare Professionals in COVID-19 Era (Babu et al., 2021)	Mangayarkarasi V Babu et al. 2021	India	Anticipate health professionals and control measures to manage epidemics causing respiratory infections and provide good patient care and safety.	Quasi-experimental study	A pre- and post-intervention among a range of healthcare professionals using a training programme on COVID-19.	The ISS provides a means of achieving pre-established training programs. It enables safe learning by allowing mistakes and developing perspectives and inter-professional cooperation.

The Use of In Situ Simulation to Enhance COVID-19 Pandemic Preparedness in Obstetrics (Benlolo et al., 2021)	Samantha Benlolo et al. 2021	Canada	Anticipating the admission of an obstetric patient by deploying a high-fidelity simulation exercise, considering labour with suspected COVID-19 in a labour delivery room, an urgent transfer to the operating department and neonatal resuscitation.	Qualitative research study	11 Simulation sessions was carried out in a labour and delivery clinical unit.	The ISS is a risk-free experiment with no consequences. It helps prepare for obstetric emergencies and ensures workflow while ensuring patient safety.
In situ simulation in the permanent education of the intensive care nursing team (de Malfussi et al., 2021)	Luciana Bihain Hagemann de Malfussi 2021	Southern Brazil	Determine how nursing professionals perceive in situ simulation in intensive care training.	Descriptive, exploratory and qualitative study	semi-directive interviews, was carried out with nursing professionals working in an intensive care unit, after in situ simulation sessions.	The ISS enables: -the acquisition of professional knowledge, skills, and competences, real-time training, -the right to make mistakes.
In situ simulation-based team training and its significance for transfer of learning to clinical practice—A qualitative focus group interview study of anesthesia	Anne Strand Finstad 2023	Norway	Explore the anaesthetic staff's experience of in situ simulation-based team training on the acquisition of soft skills and the importance of transferring this learning to clinical practice.	Qualitative descriptive study	Focus group interviews.	The ISS allows: -the possibility of adaptation within a group and the exchange of professional knowledge, -improving clinical practice by becoming more aware of it, -the clarification of one's own role, -maintaining active and accurate communication.

personnel (Finstad et al., 2023)						
Regular, in-situ, team-based training in trauma resuscitation with video debriefing enhances confidence and clinical efficiency (Knobel et al., 2018)	Alexander Knobel et al. 2018	Germany	Evaluate the clinical impact of an intervention on real traumatic resuscitations through an in-situ simulation, with video debriefing among a trauma team. The training programme was also evaluated using a survey.	Quantitative research study	retrospective analysis of a monthly team trauma simulation, using the Laerdal® Resusci Anne® manikin, with video debriefing, in a fully functional intensive care unit in the Trauma Department. In addition, a quality assessment survey was conducted.	The ISS is a reproductive and realistic method for acquiring personal skills and knowledge and improving time management from the moment of admission.
Effect of In Situ High-Fidelity Simulation Training on the Emergency management of Pneumonia (INSTEP): a mixed-methods study (Leng et al., 2018)	Owain Michael Leng et al. 2018	UK	Assess the impact of an in situ high-fidelity simulation training session on the community care management of pneumonia in the ambulatory care unit stated in a general hospital.	Mixed-methods study	Programming an in situ high-fidelity simulation training sessions among healthcare professionals. A semi-structured follow-up interviews before and after the simulation session were carried out.	-The participants expressed their intention to modify their own practice after the simulation training, -The positive results show that patients are being cared for appropriately, -The debriefing following the simulation scenario was much appreciated.

In situ simulation training for a better interprofessional team performance in transferring critically ill patients with COVID-19: a prospective randomised control trial (Manggala et al., 2022)	Sidharta Kusuma Manggala et al. 2022	Indonesia	Examine whether in situ simulation training using a high-fidelity mannequin could enhance skills such as interprofessional communication and teamwork when transferring patients with COVID-19.	Single-blind randomised controlled trial	Two groups, one equipped with a standard low-fidelity simulator (LFS) and the other with a high-fidelity simulator (HFS), benefited from an interactive online conference, two in situ simulation sessions and a debriefing session.	ISS training is performed to improve skills, communication and interprofessional cooperation during the transfer of patients with COVID-19.
Patient safety culture improves during an in-situ simulation intervention: A repeated cross-sectional intervention study at two hospital sites (Schram et al., 2021)	Schram, Anders et al. 2021	Denmark	Study staff perceptions of the patient safety culture within two Danish hospitals before and after having experienced an in situ simulation session.	Repeated cross-sectional Intervention study	ISS sessions were carried out in hospitals and perception surveys were administered among participants.	Staff perceptions of patient safety culture improved after the ISS sessions.
In-situ simulation-based intervention for enhancing teamwork in the emergency department (Sharara-Chami et al., 2020)	Sharara-Chami Rana et al. 2020	Lebanon	Create standardised in situ simulation scenarios and assess their impact on team performance during simulated patient care.	Quantitative research study	The study was based on a prospective and monocentric intervention through the performance of a pre-in-situ and post-in-situ simulation.	ISS contributes significantly to improving skills such as clinical and resource management and teamwork among emergency staff.
Interdisciplinary in situ simulation-based medical education in the emergency	Roshana Shrestha et al. 2019	Nepal	Bring a cost-effective ISS in the Emergency Service due to its impact on the	Prospective cross-sectional study	The study relied on a mixed approach involving ISS sessions and a survey designed to	ISS is a cost-effective educational solution that can be implemented in financially constrained environments to

department of a teaching hospital in Nepal (Shrestha et al., 2019)			perception and educational experience among multidisciplinary healthcare professionals and its role in identifying and anticipating safety threats.		determine the basic knowledge, attitude and confidence of staff enrolled in the study.	identify and remediate security threats.
Clarifying the learning experiences of healthcare professionals with in-situ and off-site simulation-based medical education: a qualitative study (Sørensen et al., 2015)	Jette Led Sørensen et al. 2015	Denmark	Explore how in situ (ISS) and off-site (OSS) simulation-based training impacts the perceptions and experience of learning of healthcare professionals.	Qualitative study / Randomised trial.	Analysing the content retained from the focus groups, where the participants were exposed to both types of simulation in the context of multidisciplinary obstetric emergencies.	Participants enabled better collaboration with healthcare professionals and shared their individual and collective reflections on learning. ISS participants described more experiences that could lead to organisational changes than OSS participants.
Multiprofessional in situ simulation is an effective method of identifying latent patient safety threats on the gastroenterology ward (Uttley et al., 2020)	Uttley Elizabeth et al. 2020	UK	recognise, categorise, and handle patient safety threats. Improve the team's confidence by recognising its own role.	Mixed-methods study	Conducting 22 unannounced ISS sessions for members of a multi-professional team. Identifying an action plan for correcting latent errors after the debriefing sessions.	The ISS enables: -training multi-professional teams in their work environment, -identifying and dealing with patient safety threats. -improving self-confidence and recognition of one's own role.
Community-based in situ simulation: bringing simulation to the masses (Walsh et al., 2019)	Barbara M. Walsh et al. 2019	US	To describe the process of implementing an SSI awareness programme at community sites, citing four	Qualitative research study	A description of the process and the obstacles encountered in setting up example programmes in providing a	Community ISS is cost-effective and can be implemented due to its high acceptability in a variety of clinical settings. It is preferable to encourage programmes to consider this

			examples of such programmes.		framework that can be used to create similar simulation programmes and partnerships.	technique can serve the community.
Effect of in situ simulation training for emergency caesarean section on maternal and infant outcomes (Wang et al., 2023)	Yin Wang et al. 2023	China	Assess the impact of in situ simulation training, in the case of emergency caesarean sections, on outcomes for mother and child.	Quantitative research study	Comparison of maternal and infant data on emergency caesarean sections, using pre-established criteria, in two different hospital areas.	ISS training is an efficient and effective tool for training in emergency caesarean section procedures. ISS deserves to be encouraged as a pedagogical training method.