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In situ Clinical Simulations in Primary Care applied to emergency training: advanced results of a mixed methods study

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Abstract

This study explores the effectiveness of in situ simulation (SIM) methodologies in Primary Care, focusing on knowledge retention, professional satisfaction, and confidence. It aims to assess SIM's impact on non-clinical skills, such as communication, leadership, and teamwork, and its applicability across various professional profiles. The research utilizes the Kirkpatrick Evaluation Model to evaluate SIM's effectiveness and feasibility within Primary Care settings, particularly in Acute Myocardial Infarction (AMI) and Stroke Code training. Results indicate significant improvements in technical and interpersonal skills, with 88.4% of participants reporting enhanced expertise and 83.5% noting better leadership abilities. Qualitative findings highlight increased team coordination, confidence, and improved clinical practice transferability. Despite some resistance to workplace observations, participants viewed in situ simulations positively, advocating for their extension beyond emergency scenarios. These findings support SIM's integration into Primary Care continuing education, suggesting its potential in optimizing both technical and non-technical competencies.

Keywords: *Clinical Simulation; Continous training; Primary Care.*

1. Introduction

1.1. What are clinical simulations (SIM)?

The continuous updating of knowledge and skills is a fundamental pillar in the practice of Primary Care (PC). This enables professionals to maintain appropriate management of prevalent pathologies and ensure an efficient response to urgent, albeit infrequent, but severe clinical situations, such as acute myocardial infarction (AMI) and cerebrovascular accident (CVA). In Catalonia, annual training in the action protocols for AMI and CVA, known as the IAM Code and Stroke Code respectively, is a mandatory requirement within the Healthcare Quality Standards for all PC healthcare professionals. This training is usually provided by healthcare professionals, either in person through theoretical sessions or through online training platforms.

The relationship between teaching methodology and the long-term retention of skills is a fundamental concept in pedagogy. Edgar Dale's learning pyramid posits that the effectiveness of knowledge acquisition is intrinsically linked to the role assumed by the student during the learning process (Dale et al., n.d.). Maximum assimilation is achieved through the simulation of real-world scenarios or, optimally, through practical execution in an authentic context. Consequently, the fidelity of the learning methodology to the real-world situation is positively correlated with the degree of knowledge retention.

According to the Center for Medical Simulation, simulation (SIM) is defined as the creation of an environment or scenario that allows individuals to experience a representation of a real-world event. This is done for the purpose of practicing skills, acquiring knowledge, conducting assessments and tests, or understanding the functioning of biological or human systems. SIM is presented as an innovative response to the current needs in health science education. Its primary objective is for both students and professionals in the field to develop and refine essential competencies, such as clinical, communication, and teamwork skills.

Clinical simulation is conceived as a structured process comprising three distinct phases: the initial briefing session, the development of the simulated scenario, and the feedback session.

In the initial briefing session, learning objectives are established, the simulation environment is described, and roles are assigned to participants. A safe learning environment is fostered, and the confidentiality of information is guaranteed.

During the development of the simulated scenario, participants interact with simulated patients, who have been designed to replicate the characteristics of a real patient with the highest possible fidelity. Participants assume their professional roles and act as they would in an authentic clinical situation, while the rest of the group observes the development of the simulation.

The feedback session is a fundamental stage of the process. It takes place in a separate space from the simulation environment. In this phase, participants reflect on their performance, analyze their actions, and consider the influence of their cognitive processes, psychomotor skills, and emotional states on their decision-making and behavior. The primary objective of this session is to identify areas for improvement and optimize future clinical performance.

Ultimately, the experiential learning acquired through simulation is transferred to daily clinical practice through the modification of behaviors and attitudes, which translates into a continuous improvement of the quality of patient care.

1.2. Current use of Clinical Simulations.

Clinical simulation, as a pedagogical tool, has experienced a growing adoption in both undergraduate (Fitch, 2007; Seybert et al., 2008) and postgraduate training, with a special emphasis on the field of medical emergencies, whether of an in-hospital or out-of-hospital nature (Martin et al., n.d.). The scientific literature provides evidence of favorable results associated with its implementation, including an increase in student satisfaction (4), greater self-confidence in the management of diverse clinical scenarios (Theilen et al., 2013; van Schaik et al., 2011), an improvement in long-term knowledge retention (Houben et al., 2011), a greater transfer of learning to the real clinical context (Sánchez et al., 2013), an optimization of patient safety (Abdulmohsen H, 2010; Lavelle et al., 2017; Wang et al., 2019), and a strengthening of communication and teamwork skills (Garden et al., 2010; Patterson et al., 2013).

While the use of clinical simulations is a common practice in the teaching of Basic Life Support with Automated External Defibrillation (BLS+AED), a lack of a structured and clearly defined methodology is frequently identified. However, the potential of simulation transcends this specific area, encompassing other domains of medical emergencies (codes for Acute Myocardial Infarction [AMI] and stroke, convulsive crises, hypoglycemia, among others), as well as the management of patients with chronic pathologies, home care, and the development of communication skills in the healthcare setting.

1.3. In situ clinical simulations.

On-site simulation, defined as that which takes place in the usual physical and professional context, stands as a pedagogical strategy with the potential to optimize learning, particularly in the development of essential competencies such as effective communication and collaborative work. This training modality facilitates the identification of deficiencies in the application of clinical protocols that, otherwise, could remain hidden until their manifestation in real patient care situations. In this sense, Motola et al. (2013) suggest that on-site simulation represents a pragmatic alternative for those institutions that do not have a dedicated simulation center, and that its implementation can contribute to improving the safety and reliability of care processes, particularly in areas of high complexity or in environments subjected to high care pressure, especially when applied to the training of interdisciplinary teams (Cook et al., 2013; Kurup et al., n.d.; Riley et al., 2010; Sørensen et al., 2017).

Despite the advantages offered by on-site simulation in terms of organizing training activities, by avoiding the displacement of professionals to an external center and the consequent interruptions in regular care activity, there are certain limitations related to its feasibility. The main one is the need to have the emergency service available for the development of these training activities, a requirement that cannot always be met due to the demands of caring for critically ill patients.

1.4. How SIMs are evaluated.

The Kirkpatrick Model, a cornerstone in evaluating the efficacy of both formal and informal training programs, proposes a four-level framework. According to the updated 2019 version (Kirkpatrick & Kirkpatrick, n.d.), the first level focuses on measuring participant reactions, assessing their satisfaction, interest, and perceived value of the training. The second level evaluates the acquisition of knowledge, employing tools such as pre- and post-tests, as well as direct observations. The third level concentrates on behavioral changes, determining whether the learning has translated into new practices or skills. Lastly, the fourth level analyzes the long-term impact of the training, evaluating outcomes in practice, such as improvements in patient safety or quality of care. According to Liao and Hsu (2019), the results of the third level are a robust predictor of the final outcomes, which, due to their complex nature, are often more difficult to quantify.

1.5. Justification of the study

Empirical evidence substantiates the efficacy of simulation (SIM) methodologies in enhancing both technical and non-technical skills acquisition among healthcare professionals. However, the literature on the application of SIM within the context of Primary Care, particularly within the actual clinical setting (in situ), remains relatively limited.

This study seeks to address several key questions surrounding the implementation of SIM in Primary Care:

1. Does SIM effectively facilitate long-term knowledge retention and enhance professional satisfaction and confidence?
2. What is the level of professional acceptance for SIM-based training methodologies?
3. Does the effectiveness of SIM vary across different professional profiles, or is it universally applicable?
4. What other areas within the scope of Primary Care practice can benefit from the integration of SIM-based training?
5. Is it feasible to seamlessly integrate SIM-based training into the routine workflow of healthcare professionals, with the ultimate goal of transitioning all continuing education activities towards this modality?

To address these critical inquiries, this research project aims to evaluate the effectiveness of SIM methodologies in the Primary Care setting, utilizing the Kirkpatrick Evaluation Model as a framework, while concurrently assessing the feasibility of implementing such methodologies within the existing Primary Care infrastructure.

2. Hypothesis

The implementation of in situ simulation methodologies within the context of Acute Myocardial Infarction (AMI) and Stroke Code training in the Primary Care setting demonstrates feasibility and effectively enhances both clinical and non-clinical competencies among Primary Care professionals.

3. Objectives.

3.1. General objective.

To assess the effectiveness and viability of a training program in IAM Code and Stroke Code based on the SIM in situ methodology.

3.2. Specific objectives.

- Analyze the improvement in non-clinical skills: communication, leadership, and teamwork.
- Examine the improvement in knowledge retention over time through this methodology.
- Analyze how the acquired learning results in changes in the clinical practice of professionals and in teamwork.
- Evaluate the satisfaction level of professionals regarding the use of this methodology.
- Assess the feasibility of implementing this training methodology in the Primary Care training program (interference in the daily activities of the center and necessary resources).

4. Methodology

4.1. Type of study.

Implementation study using mixed methods.

- Quantitative study in the form of an analytical observational study based on a pre-post questionnaire with a comparison group, evaluating both technical and non-technical skills, as well as the Simulation-Based Training Quality Assurance Tool (SBT-QA10), which analyzes the simulation experience from the learner's perspective.
- Qualitative study based on the principles of Grounded Theory, involving:
    - Focus groups with healthcare and non-healthcare professionals.
    - Observations during the development of the training activity.

4.2. Determinations

A comprehensive analysis will be conducted of: pre- and post-intervention questionnaires, SBT-QA10 results administered after each training session, transcripts of focus group data, and observations made during simulations.

4.3. Statistical analysis

4.3.1. Quantitative data

To compare and objectify the differences in results obtained before and after the intervention, the paired t-test were used for continuous data, and the McNemar test were applied if variables were binary.

4.3.2. Qualitative data

To generate an in-depth understanding of the phenomenon under investigation and address the research question, we have adopted Grounded Theory as the primary analytical framework. This approach facilitates the inductive generation of a theory of change that underpins the intervention, enabling the identification of critical barriers and facilitators to its successful implementation. By prioritizing the emergent perspectives of study participants, Grounded Theory allows for a data-driven exploration of the intervention's dynamics, minimizing the influence of pre-existing assumptions held by the research team.

5. Results

5.1. Quantitative study

A total of 207 professionals answered the survey, of which 84% were women, 47% aged between 31 and 50, 39% over 50 and 14% under 30. By occupation, 24% were specialists in family medicine, 29% were nurses, 22% administrative staff and the rest other professional profiles.

A majority of the participants (88.4%) reported that the methodology enhanced their technical expertise, while 83.51% perceived improvements in their interpersonal and leadership competencies. Furthermore, 90.72% believed that the methodology facilitated sustained knowledge acquisition, and a similar proportion (90.11%) reported increased self-efficacy in managing similar critical situations.

There is a significant improvement in pre- and post-intervention confidence ($p<0,001$), serenity ($p<0,001$) and a perception of having improved their training ($p<0,001$). In summary, 84.3% recommended using this methodology in future training activities (see Table 1).

Table 1. Results of the quantitative analysis.

N: 95. 88% women. 55% between 31 and 50 years old. 27% phisicians, 22% nurses, 18% administrative support		
88,4% Improve theoretical knowledge	87,3% Improve non-technical skills	92,7% Improve long-term learning
Improve confidence pre-post (p=0,028)	Improve serenity (p=0,05)	Perception of agree with this methodology (p=0,012)
84.3% recommend on-site SIM for future training.		

5.2. Qualitative study

Four focus groups were carried out, with a total of 38 interviewees, among whom there were 13 family doctors and 14 nurses, while the rest were other types of professionals, such as nursing assistants, administrators and psychologists.

All of the interviewees expressed their satisfaction with this training methodology, since it was more fun, dynamic and active, and required greater involvement on the part of the professional.

In the various group interviews conducted, the utility of clinical simulations to enhance the acquisition of theoretical knowledge and the learning of non-technical skills has been repeatedly emphasized. Among these, improvements in team coordination and leadership in emergency situations have been highlighted, which foster improved group cohesion. At the individual level, numerous interviewees have emphasized improvements in the serenity and confidence with which they approach these types of situations thanks to the use of this methodology, emphasizing that the learning has been effectively transferred to real clinical practice in the days following the training activity (see Figure 1).

Regarding the implementation of clinical simulations in the professional's own workplace (in situ), in most cases it has been considered a very positive aspect because it allows for improved knowledge of the different team members and their roles in emergency care, as well as optimizing internal protocols by identifying errors. In addition, it is widely considered that conducting training in the usual work environment improves the confidence with which the training activity is approached, a key aspect to maximize learning. Despite this, some professionals have stated that feeling observed by their own colleagues is a barrier for them. To overcome that difficulty, there are different strategies, such as allowing familiarization with the simulation environment and equipment, prior practice without observation and focus on learning, without judgment.

The professionals expressed the opinion that this methodology should be extended to other clinical situations, not only in the field of emergencies (anaphylaxis or management of aggressive psychiatric patients), but also other situations specific to a Primary Care consultation (management of chronic diseases, mental disorders, communication skills...).

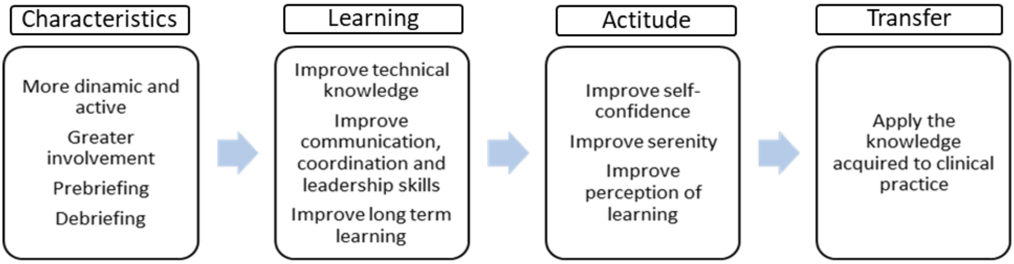

Figure 1. Results of the qualitative analysis.

6. Discussion

This study's findings corroborate the existing evidence supporting the efficacy of in situ simulations as a pedagogical tool in primary care. By simulating real-world clinical scenarios within the actual workplace, we have successfully identified and addressed gaps in professional competencies, thereby facilitating continuous improvement in clinical practice. Our results align with previous research (Sahin-Bayindir & Buzlu, 2022) highlighting the role of in situ simulations in developing both technical and non-technical skills, as well as fostering collaborative teamwork among healthcare professionals.

Moreover, our findings are consistent with those of Kyrkjebø et al. (2006), who underscore the importance of in situ simulations in optimizing care processes and facilitating the transfer of learning to clinical practice, ultimately enhancing patient safety, efficiency of care processes, and professional satisfaction (see Table 2).

It is important to note that these results were observed in the field of primary care, where existing scientific evidence on this training methodology is limited. Furthermore, its implementation was evaluated in a real-world setting, i.e., incorporating the activity into the daily routine of a health center, so that the results of the analysis regarding usefulness, acceptance and feasibility are close to reality. Strategies to overcome the limitations of our research include augmenting the number of participants, designing a more detailed knowledge evaluation questionnaire, or conducting a longer-term analysis (6 or 12 months). Our study supports the use of in situ clinical simulations in continuing education in Primary Care, not only in the field of emergencies but probably also in other training areas.

7. Conclusions

In situ clinical simulations applied to primary care emergency training (AMI code, Stroke code, and CPR) have demonstrated improvements in both knowledge and teamwork skills among healthcare professionals. This methodology holds promise for enhancing continuing education across a broader range of clinical areas.

Table 2. Key points of the investigation. Benefits of SIM in situ.

Identify gaps in professional competencies.
Facilitate continuous improvement in clinical practice.
Develop technical and non-technical skills.
Foster collaborative teamwork.
Transfer of learning to clinical practice.
Enhance patient safety, efficiency of care processes and professionals' satisfaction.

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