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Simulation in nursing and midwifery education





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ABSTRACT

Simulation has been used widely in the clinical training of health-care students and professionals. It is a valuable strategy for teaching, learning and evaluating clinical skills at different levels of nursing and midwifery education. Literature shows that simulation in nursing and midwifery education provides benefits for both students and patients and can be used to train health professionals about safer and timeous interventions that comply with international recommendations, thereby increasing students' responsibility towards clinical practice and improving overall quality of care. This guide aims to support nursing and midwifery educators who want to initiate the use of simulation as an educational strategy. It offers an overview of the main features of simulation, defines key concepts, provides the rationale for simulation, identifies types of simulation, and explains how simulations should be planned, implemented and evaluated. It also provides some recommendations for educators and managers who wish to use simulation in nursing and midwifery curricula or in continuous/in-service education and training.

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1. INTRODUCTION

Simulation has been used widely in the clinical training of health-care students and professionals. It is a valuable strategy for teaching, learning and evaluating clinical skills at different levels of nursing and midwifery education: undergraduate, postgraduate and lifelong education (Park et al., 2016; Martins, 2017).

Simulation has a positive impact on students, educators, and the individuals, groups and communities they care for, as well as on education and health organizations. The principal aims of simulation as a teaching method are to improve quality of care and ensure patient safety.

The WHO document *Transforming and scaling up health professionals' education and training* (WHO, 2013) strongly recommends the use of simulation. Recommendation 5 states:

Health professionals' education and training institutions should use simulation methods (high fidelity methods in settings with appropriate resources and lower fidelity methods in resource limited settings) of contextually appropriate fidelity levels in the education of health professionals.

A large proportion of nursing and midwifery education curricula worldwide is dedicated to the acquisition of clinical skills. At the beginning of the learning period in clinical settings, students should be able to develop safe and timely evidence-based interventions without being interrupted by supervisors due to technical errors that may jeopardize patients' and students' safety. In clinical practice with actual patients, students should be self-confident and feel that others trust them; they should feel capable of performing tasks without errors and be confident that the supervisor and other team members believe in their abilities.

From an ethical perspective, invasive procedures should not be taught or practised on real people; instead, trainees should be able to train in simulated, controlled and safe environments, allowing them to make errors and learn from them with no harmful consequences to any person. This ensures absolute respect for human rights by protecting patients' dignity and guarantees the quality of nursing care, even during health professionals' learning processes.

Simulation as an active pedagogical strategy helps students to consolidate and value knowledge, develop technical and relational skills, and create rules and habits for thinking and reflection, thereby contributing to the training of competent professionals. In addition, the process is developed within a safe environment for students, teachers and patients (Martins, 2017).

Despite international recommendations to include simulation in nursing and midwifery education and the evidence of its benefits, many institutions have difficulties in integrating simulation methods in their curricula. Reasons for this include the lack of national incentives to transform and scale up nursing and midwifery education, available funding, existing facilities, curriculum management, and the readiness and disposition of school faculties and management.

The way that simulation is integrated in the curriculum varies widely across institutions and countries. Simulation can be integrated into several course units, into theoretical course units as a practical component, or into clinical training course units; simulated practice can also comprise a course unit. Students have the opportunity through some curricula to train in different techniques in different scenarios, while in others, students remain mostly as observers. Simulation can be used almost entirely for the purpose of learning and training specific techniques or can focus on developing more comprehensive and cross-cutting skills (such as patient and team communication, teamwork, decision-making, management of adverse events and leadership) by gradually incorporating techniques in complete scenarios of increasing complexity.

In line with the *European strategic directions to strengthen nursing and midwifery towards Health 2020 goals* and the priority action area of scaling up and transforming education (WHO Regional Office for Europe, 2015), this guide aims to support nursing and midwifery educators who want to initiate the use of simulation as an educational strategy. It offers an overview of the main features of simulation, which can be adapted to specific cultural, educational and professional realities.

The guide is divided into four main chapters defining the key concepts, providing the rationale for the use of simulation, identifying types of simulation, and explaining how simulations should be planned, implemented and evaluated. It also provides some recommendations for educators and managers who wish to use simulation in nursing and midwifery curricula or in continuous/in-service education and offers a brief conclusion.

2. CORE CONCEPTS

The use of standard terminology is a key aspect for all those using simulation. The concepts proposed in this guide are based on Meakim et al. (2013) and the International Nursing Association for Clinical Simulation and Learning (2016). These are shown in Table 1.

Table 1. Core concepts in this guide

Concept	Definition
Briefing	A guided information session immediately prior to the start of a simulation-based experience, with the purpose of orienting trainees on the scenario and objectives. It can include information about the equipment, environment, mannequin, trainees' roles, time allotment and clinical situation.
Clinical reasoning	A process that involves both thinking (cognition) and reflective thinking (metacognition) to gather and comprehend data while recalling knowledge, skills and attitudes about a situation as it unfolds. After analysis, information is brought together into meaningful conclusions to determine alternative actions in new situations.
Clinical scenario	The plan that provides the context for the simulation based on actual or potential situations and which includes the objectives, target population, description and progress of the situation, actions expected from the students, and items to be discussed in the briefing and debriefing.
Clinical simulation centre	A physical location that has the resources necessary to implement a simulated clinical experience. Sometimes called simulation lab, it includes a realistic setting with materials and equipment relevant to the objectives and creates a safe atmosphere to facilitate and foster sharing and discussion without negative consequences.
Clues/prompts/cueing	Information that helps students to process and progress through the scenario to achieve the objectives. Cueing comprises two types: conceptual cues help students to achieve expected outcomes in a simulation-based experience; and reality cues help students to interpret the simulated reality through clues/information delivered by the simulated patient or role character.
Debriefing	An activity that follows a simulation experience and which is: based on a predetermined structure and objectives; led by a teacher; and encourages students' reflective thinking. The purpose of debriefing is to learn by reflecting on action and to transfer learning to future situations.

Table 1 contd

Concept	Definition
Assessment	Process that provides information or feedback about individual students, groups or programmes. Assessment refers to observations of progress related to knowledge, skills and attitudes. Findings of assessment are used to improve future outcomes.
Feedback	During the activity or during the debriefing, feedback is provided by the teacher regarding the appropriateness of students' behaviours, skills and emotions.
Fidelity (also known as realism/ authenticity)	The degree to which a simulated clinical experience approaches reality. The level of fidelity is determined by the environment, the materials and equipment used, and factors associated with the students.
Moulage	A set of techniques used to increase the realism of the situation regarding sensory perception, thereby increasing the simulated clinical immersion. It can include smells, makeup, wound treatment, drainages and penetrating objects, among other artefacts.
Psychomotor skill	The ability to carry out a predetermined task efficiently and effectively using correct movements. It is more than the ability to perform; it also includes the ability to perform proficiently and consistently under varying conditions.
Safe learning environment	A positive emotional climate that is created by teachers through high-quality interaction with students, inspiring trust and allowing for mistakes and trial-and-error learning.
Simulated clinical experience	A set of structured activities that represent actual or potential situations, played by students in a simulated realistic environment and using real materials and equipment to develop or enhance knowledge, skills and attitudes, or analyse and respond to realistic situations.
Simulation	A pedagogical strategy using one or more educational methods or types of equipment to provide a simulated experience to promote or validate students' progression from novices to experts.

3. RATIONALE

The literature describes several theoretical contributions that support the use of simulation as a pedagogical strategy to promote learning. The purpose of this guide is not to provide a comprehensive analysis of these contributions; only the main theoretical references will therefore be cited. The benefits of using simulation are highlighted in the second part of this chapter.

Based on Piaget's constructivist theory, learning is a constructive process, as it requires students to construct knowledge (Hmelo-Silver et al., 2007). Learning occurs when new knowledge is incorporated into existing knowledge and when the teacher facilitates or guides this learning. In simulation, the principles of constructivism are applied when learning is based on real-world cases, when it fosters reflection on the experience, when students collaborate with each other, and when prior knowledge is integrated into the development of simulated practices (Jonassen, 1994).

Vygotsky's social constructivist theory suggests that development and learning are dynamic processes that occur simultaneously (Cato, 2013). There are three stages or levels of skill development at any point of development (Berragan, 2011):

1. potential, represented by what the student is able to perform with the help of others;
2. proximal, represented by the presence of a facilitator who fosters the student's potential and transforms it into actual ability or development; and
3. actual, represented by everything that the student is able to perform independently.

Social constructivism applies to simulation because learning can occur only through the interaction among students in the different scenarios they experience as a group (Cato, 2013) and in the presence of the teacher, who encourages actual development (Wink & Putney, 2002).

Simulation is part of the pedagogical models that prioritize experiential learning. It is a strategy that provides a truly clinical, albeit simulated, experience that allows balancing experiences (both in terms of quantity and quality) among different students and which incorporates variability. The whole training process has an anticipatory nature as it allows for simulating an experience before intervening in an actual clinical situation.

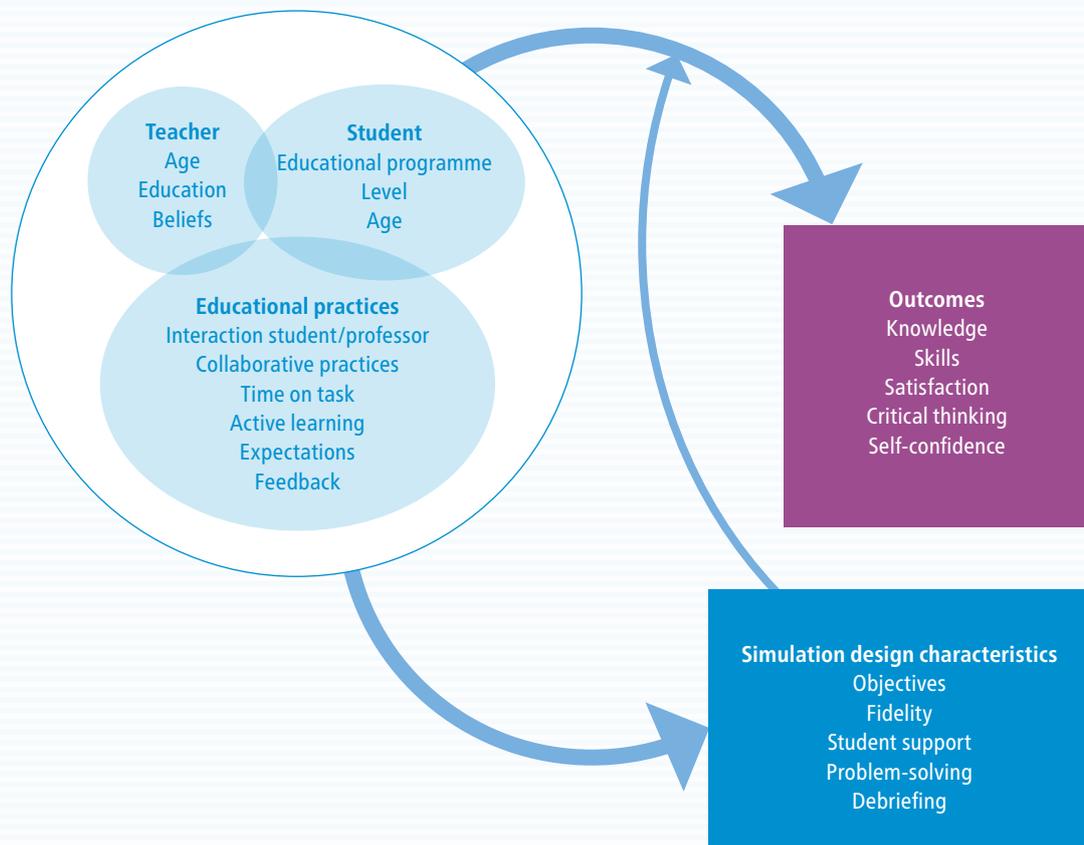
Kolb's experiential learning theory (1984) provides support to simulation-based learning. According to Kolb, knowledge is built by transforming experience in a recursive cycle among four adaptive learning modes: concrete experience (feeling), reflective observation (observing), abstract conceptualization (thinking) and active experimentation (doing). Through reflection, students assign a meaning to an experience, conceptualizing and incorporating it into their cognitive structure. This enhanced knowledge, when replicated in a new experience followed by another reflection, will produce new knowledge (Cummings & Connelly, 2016). Students therefore learn not only from the experience, but also from reflection on the experience, continuously expanding their knowledge (Kolbe et al., 2015).

Simulation allows students to understand the experience through apprehension (concrete experience) and comprehension (abstract conceptualization) and prepare themselves to transform the experience by intention (reflective observation) and extension (active experimentation). According to Kolb (1984), the complexity and integration of dialectic conflicts between adaptive learning modes are divided into three key stages of development: acquisition (basic skills), specialization (ability to apply concepts to reality) and integration (continuous reflection and improvement).

The process of learning through experience may or may not always follow Kolb's cycle of development because the whole process is influenced by the individual's favourite learning model and what the environment provides or stimulates. These aspects are consistent with the guiding principles of simulation. In simulation, the actual experience concerns students' clinical experience and subsequent reflection facilitated by the teacher. Afterward, the step of abstract conceptualization allows students to reflect on the experience, identify knowledge gaps and further explore the topic based on the simulated practice. In a new simulated clinical situation or in a clinical setting (active experimentation), students use the developed guidelines to advance within the new experience. A new learning cycle begins.

Jeffries was the first author to propose a theoretical model to support simulation-based clinical teaching. (Fig. 1).

Fig. 1.
Jeffries Simulation Model



The model allows for testing the impact of simulation on students and acts as a guide to help nursing and midwifery faculty in designing, implementing and evaluating high-fidelity simulations (Jeffries & Rizzolo, 2006).

The main components of the model are the teacher, the student, the educational practices, the simulation design characteristics and the outcomes (Jeffries, 2007). It is based on the following assumptions:

- well-designed simulations using educational best practices increase students' satisfaction and self-confidence;
- students must be self-motivated and willing to be responsible for their learning;
- simulation-based clinical experiences should be adapted to the student's level of learning; and
- teachers should use what they perceive to be the best educational practices in the learning environment.

Simulation outcomes depend on multiple factors, according to each component.

The development of skills for nursing interventions is a complex process because professionals need to know not only how to perform a set of technical actions, but also how to apply the best available knowledge, collect and process information, make correct decisions in various contexts, and adopt attitudes that ensure respect for the person and build a helping relationship (Meakim et al., 2013). The International Nursing Association for Clinical Simulation and Learning uses the Nursing Skill Development and Clinical Judgment Model to illustrate the complexity of the development of higher-level clinical judgement and reasoning ability used in decision-making (Meakim et al., 2013).

The Nursing Skill Development and Clinical Judgment Model is composed of five key dimensions – psychomotor skills, problem-solving, clinical reasoning/critical thinking and clinical judgement – which are mutually interacting and affect one another to achieve the abilities for safe and effective nursing practice.

Miller's Pyramid (Miller, 1990) also offers a framework for assessing clinical competence and helps understanding of the process of learning skills. Miller argues that assessing students' knowledge or even their know-how is insufficient to predict how they will act when face to face with a patient. Clinical competence (behaviour) must be supported by cognition (know and know how to perform), but assessment strategies should also require that students show how they do it before they can finally perform (do) in the clinical context.

Miller's schematic model represents students' progression from knowledge (knows) to interpretation/application (knows how), performance (shows how) and, finally, action (does) as they develop from novices to experts.

Benefits

Literature shows the benefits associated with the use of simulation in nursing and midwifery education. Evidence from the most recent literature and, whenever possible, systematic reviews is presented below. Simulation has benefits for both students and patients.

Knowledge

Simulation contributes to expanding and consolidating students' knowledge, building bridges for action, assigning value and promoting its relevance (Dillard et al., 2009; Weaver, 2011; Martins et al., 2012; Foronda et al., 2013). Studies in different clinical areas using a range of research methodologies show clear benefits in the cognitive and psychomotor domains (Yuan et al., 2012; Lee & Oh, 2015). The best results at this level are associated with high-fidelity simulation (Weaver, 2011; Yuan et al., 2012; Lee & Oh, 2015).

Knowledge is enhanced to the extent that students have the possibility, through simulation, to apply previously acquired knowledge, put theoretical notions into practice and, finally, reflect on the action and explain and justify it during the debriefing, thereby assigning value to the concrete action and identifying necessary changes to improve subsequent actions. The transferability of obtained knowledge into real clinical settings has also emerged in different studies (Weaver, 2011; Baptista et al., 2014a). Learning by simulation also improves students' critical thinking and clinical reasoning in complex care situations (Bagnasco et al., 2014).

Technical skills

A historical review of nursing education shows that learning technical skills such as venepuncture, intubation and intravenous therapy through simulation is becoming increasingly important (Martins et al., 2012). The repetition of these skills in a controlled environment is widely recognized as being useful in ensuring safe clinical practice (Berragan, 2011; Cummings & Connelly, 2016).

Attitudes

Simulation is an excellent educational strategy for helping nursing and midwifery students in developing ethical attitudes and behaviours, and in applying ethical principles in clinical practice. An example of these principles is respect for the person's autonomy and will (Buxton et al., 2014). Simulation performance outcome measures provide valid assessments of empathy (Bagnasco et al., 2014) and simulation exercises increase self- and cultural awareness (Adamson, 2015).

The ability for decision-making in situations where resources are scarce or in extreme circumstances may be trained in simulation-based learning experiences (Buxton et al., 2014). Simulation also contributes to building nursing students' and professionals' identity (Berragan, 2011), relationships with their peers, and expectations of and for future practice (Foronda et al., 2013; Baptista et al., 2016).

Motivation and satisfaction

Simulation increases students' motivation for learning and improves learning itself (Baptista et al., 2014a). The need for a supportive learning environment is widely recognized in education; simulation provides a unique opportunity to ensure that training addresses affective issues, as it deliberately places the student's needs at the centre of attention and creates conditions for the best teaching practices. Student satisfaction is also referred to as a variable with clear positive results from the use of the simulation (Dillard et al., 2009; Zulkosky, 2010; Foronda et al., 2013). A learning environment that promotes students' satisfaction enhances their motivation for study and increases achievement of expected learning outcomes.

Simulation promotes the creation of such environments (Dupont et al., 2009; Mason, 2012; Baptista et al., 2014a). The best outcomes are associated with high-fidelity simulation (Weaver, 2011; Lee & Oh, 2015). The level of satisfaction relates not only to the available materials, instruments and interactive simulators, but also to the trainer's expertise, approachability and communicativeness (Bagnasco et al., 2014).

Self-confidence

Self-confidence is an important variable in students' learning in clinical practice. Evidence shows that low self-confidence is associated with high levels of anxiety, greater delay in the implementation of expected actions and more errors (Martins et al., 2014a, 2014b). Students' self-confidence has an impact on their clinical skills and ability to respond to patients' needs (Larue et al., 2015). Repeated simulation experiences increase students' self-confidence levels (Blum et al., 2010; Buckley & Gordon, 2011; Weaver, 2011; Foronda et al., 2013; Martins et al., 2014b; Lee & Oh, 2015).

Reflection

A conscious and intentional analysis of practices is essential for students to identify what they have done and become aware not only of the difficulties, limitations and capabilities, but also the effects of their decisions on patients (Baptista et al., 2014a). When simulation is integrated in the curriculum and students are accustomed to the approach, it also improves students' participation in debriefing and the relevance of their comments. Students become more open and reflective in their comments and questions (Cummings & Connelly, 2016). In general, reflection on performed or observed interventions allows students to become more confident in their performance, develop their ability to make the right decisions and improve their critical thinking (Baptista et al., 2014b).

Patient safety

In the light of scientific evidence, the purpose of nursing and midwifery education and training is to prepare highly qualified and competent professionals who are capable of providing an effective response to the various needs of patients and their families. Health-care safety is a current and relevant problem, and a concern to international and national health organizations (Martins, 2017). Safety must be a constant goal throughout the care-delivery process, to which simulation provides a significant contribution.

Despite measures to improve patient safety, many patients continue to suffer and die as a result of health professionals' errors. The high incidence of adverse events in health institutions, health-care-associated infections, errors in medication therapy management, gaps in professionals' training and ineffective communication requires that more emphasis be placed on patient safety in nursing education (National League for Nursing, 2015).

WHO dedicates an entire area of its website to patient safety and defines it as a worldwide priority area in care delivery (WHO, 2017). The *Patient safety curriculum guide: multi-professional edition* points to simulation as a useful educational approach for teaching about patient safety (WHO, 2011). Simulated practice can be used effectively to train health professionals about safer and timeous interventions that comply with international recommendations to reduce errors, thereby increasing students'

responsibility towards clinical practice and improving overall quality of care (McGagie et al., 2011; Martins et al., 2012; Durham, 2014; Martins et al., 2014a; Baptista et al., 2014b).

Leadership

The development of leadership skills has been assessed based on variables such as self-confidence to lead, leadership effectiveness, team communication, teamwork, compliance with the leader's decisions, mutual assistance, organization, authenticity, self-control, moral judgement, and processing and use of information (Shapira-Lishchinsky, 2014; Baker et al., 2015; Castelao et al., 2015; Watters et al., 2015; Wong et al., 2015; Figueiroa et al., 2016). Simulation-based training has proved to be effective in the education and training of leaders in different health settings (Martins, 2017).

Efficiency and effectiveness

Efficiency and effectiveness of care are improved with the development of knowledge and skills for clinical judgement, definition of priorities, decision-making, performance of concrete actions, teamwork and delivering safe patient care (Dillard et al., 2009; Martins et al., 2012; Foronda et al., 2013; Martins et al., 2014c). Training programmes using simulation significantly improve the response to critically ill patients in terms of surveillance, identification of severity criteria and response readiness, reducing the number of failure-to-rescue events (Schubert, 2012; Foronda et al., 2013).

Clinical settings and domains in which studies have found very positive results in performance include:

- patient assessment (Yuan et al., 2012);
- home births attended by midwives (Kumar et al., 2016);
- cardiorespiratory resuscitation (Hamilton, 2005) and neonatal cardiorespiratory resuscitation (Rakshasbhuvankar & Patole, 2014);
- responses to emergency situations (Martins et al., 2017);
- preparation to respond to disaster situations (Jose & Dufrene, 2014);
- end-of-life care delivery to children (Brock et al., 2017) and adults (Lippe & Becker, 2015);
- communication with end-of-life patients (Kortes-Miller et al., 2016); and
- responses in intensive care settings (Brunette & Thibodeau-Jarry, 2017).

The ability to work and be part of a multidisciplinary team is also enhanced through simulated-based learning experiences (Baptista et al., 2014b).

4. TYPES OF SIMULATION

Simulation is an active teaching–learning methodology that is performed in a controlled, protected and safe environment. It allows for the development of more or less complex scenarios, depending on the objectives. Different types of simulators may be used for different levels of fidelity.

In a given clinical situation, the simulation method may involve a student or a group of students performing a series of care interventions to either a manikin or simulated patient.

There are several types of simulators (Akaike et al., 2012):

- inert simulators
- anatomic or mechanical models
- high-fidelity simulators
- virtual-reality simulators
- simulated patients.

5. PLANNING, IMPLEMENTING AND EVALUATING SIMULATIONS

Simulation requires careful planning, implementation and evaluation to be a successful learning experience. The role of the facilitator (often the teacher) is to set the scene, direct scenarios and participants (clues, timing), provide clinical parameters, assess candidates' performance and debrief.

Planning a simulation

Planning includes building the scenarios and preparing the environment. It is important to write a script for the simulation scenario (see template ([Annex 1](#)) and examples ([Annex 2](#))). The script should include the learning objectives, the scenario description, the roles required (including patient's voice), the equipment required, clinical parameters of the patient (including baseline, triggers and changes), exit strategies/exception planning and points to be discussed in the debriefing.

Building scenarios is essential when using a simulation-based pedagogical strategy. It requires knowledge of the characteristics of students, their level of education, the expected objectives from using simulation and the most appropriate type of simulation for the learning objectives (McGaghie et al., 2011; Norman et al., 2012).

The first step in building a scenario is identifying students' level and educational needs and, consequently, setting out the objectives.

Objectives should be clear, appropriate to students' knowledge and experience, target specific learning skills, and be reasonable in number to be feasible. In general, a scenario may have 2–4 primary objectives that should focus on knowledge, skills, and behaviours or teamwork (Huffman et al., 2016). The objectives are expected to be attained during the scenario, but secondary objectives may also be set out and discussed during the debriefing.

The objectives' definitions should guide the choice of the simulator and simulated practice (Adamson, 2015). Generally, objectives are set out as follows:

- in low-fidelity simulation, objectives focus on knowledge and psychomotor skills;
- in medium-fidelity simulation, they focus on more complex knowledge and techniques; and
- in high-fidelity simulation, they focus on non-technical skills such as communication, decision-making, teamwork, clinical judgement and leadership.

Consideration should be given to the type of scenario that can be used for simulation, along with the equipment that is available. In midwifery education, this may involve low- (for example, doll and pelvis) or high-fidelity equipment (such as a birthing simulator like SimMom (Laerdal Medical)) or hybrid simulation (such as the use of role play with models like MamaNatalie/NeoNatalie (Laerdal Medical)).

The scenario should include a focus on decision-making and teamworking, as well as the knowledge and clinical skills required to manage the situation.

After the objectives are set out, the situation to be managed is designed: the patient, including signs and symptoms, and how the scenario should evolve are briefly described.

This description will help the teacher to understand the conditions in which students will find the patient and how they will progress throughout the scenario. The context is then described, including details of the location, available resources, patient's medical history and the situation to be managed. The situation may be fully or partially presented, depending on the student's level.

The realism or fidelity of a simulated practice, both in the simulator and the surrounding environment or situation presented to the trainees, is as strong as the trainee's perception that the simulated clinical experience transports them into the real context. Simulations should be as realistic as possible for students to feel more confident in transferring their skills to real-world situations (Lindsey & Berger, 2009), but should not be so realistic that they deviate attention from the original pedagogical objectives (Lampotang, 2008). The use of real clinical cases for building scenarios is recommended for the simulated clinical experience to represent the real context as accurately as possible (Black et al., 2006).

The necessary materials and equipment must be described when building the scenario. Material and pieces of equipment similar to those used in real contexts should be used as they enhance the realism of the scenario, allow for the acquisition of more accurate psychomotor skills and improve students' self-confidence for future clinical practice (Huffman et al., 2016). This approximation to real-life contexts should be controlled to provide only the necessary resources to implement the scenario and achieve the objectives, without the risk of overloading students with unnecessary stimuli that may distract or confuse them (Huffman et al., 2016).

The number of teachers or facilitators needed to implement the scenario must be planned in advance. In high-fidelity simulation, in which pre-programming can be used and the patient's condition may be changed throughout the scenario based on the student's evolution, the presence of another teacher/facilitator to guide the scenario and support achievement of the objectives may be important.

It is also important to select the location in which the scenario will be implemented. As patients are not always confined to bed, the possibilities for realistic contexts are endless. Scenarios can be implemented in the hallway or outside the simulation centre, in a consultation office, in the bathroom, or even in students' workplaces (called in situ simulation), thereby enriching simulated practices, encouraging students to play a more active role in their learning and increasing their satisfaction.

When designing the scenario, it is important to identify which simulator is the most appropriate to meet the needs identified and the most important specificities to meet the objectives. The potential of each simulator should be adapted to the simulation; an expensive high-fidelity simulator should not be used to develop specific skills that can be acquired using low-fidelity inert or mechanical simulators that would be more appropriate due to their robustness and price. Although simulators have a human physiognomy, most of them are not suitable for the situations that can materialize in different scenarios; moulage is therefore important, as it can enhance realism and provide cues to the patient's physical condition (Huffman et al., 2016).

Topics to be discussed during the debriefing should be defined at this stage to enhance learning possibilities.

After designing the scenario, preparing the environment well is an important step. If the environment in which the scenario takes place during the simulation does not accurately replicate reality, students will not experience it as simulated clinical practice.

Preparing the environment includes ensuring the availability of realistic materials and equipment that are similar to those used in an actual clinical setting, such as (depending on the scenario) medical gas wall outlets (suction, oxygen and air), a fully supplied emergency cart, results from diagnostic exams, patient charts (in paper or digital format) and a phone, among others. Other elements, such patients, relatives or other health professionals, who can act as facilitators or barriers to scenario resolution, may be added to the environment to reflect the objectives.

Implementing a scenario

To implement a scenario, the teacher needs to take into account the required material and equipment to accomplish the pedagogical objectives, the venue and/or context in which the simulation will occur, the required technological resources, the availability of elements that guide and contribute to the student's decision-making (patient charts and diagnostic exams), and the possible need for more than one teacher/facilitator.

Before beginning the scenario, students should become familiarized with the space, the simulator's potential, and the available resources to help them in their clinical judgement and decision-making. This may be designated as prebriefing. The clinical scenario then unfolds in three steps: exposition, which is often designated as briefing; action; and reflection on and for action, also known as debriefing ([Table 2](#)).

Debriefing is the final step in a guided reflection cycle of experiential learning. It is in itself a teaching and learning strategy (Cantrell, 2008) that facilitates students' reflection

Table 2. Steps of clinical scenario

Step	Definition
Briefing	Corresponds to the initial exposition that is done in the first approach to simulation. The details on the patient and their physical condition are provided to students. The situation to be managed is presented to students, allowing them to understand what they are expected to do. The steps should be clearly, objectively and briefly presented (Filho & Romano, 2007).
Action	Begins only after the students have understood the situation to be managed. The scenario should not last more than 10–15 minutes and ends when the students have achieved the defined objectives. Debriefing starts afterwards.
Debriefing	Has been integrated with simulation for several decades now, but the concept has changed in the past 15 years. It gives priority to a nonjudgemental approach of positive regard, moving away from a feedback approach focused on error (Kolbe et al., 2015).

on the clinical issues raised during the simulated event (Fanning & Gaba, 2007). It consists of the student's self-critical review of the interventions performed during the simulated clinical experience. Several studies have shown that debriefing, if conducted by a technologically advanced and prepared team, improves students' performance (Guhde, 2010).

Debriefing requires a two-way communication process between the trainee and trainer. In addition to feedback on performance, it implies a communication process that focuses on and explains performance so students can develop strategies to improve. A well-structured and well-built debriefing produces positive reflective outcomes (Buykx et al., 2011).

Debriefing occurs after the simulation and provides greater proximity between trainees and instructor, allowing them to discuss positive and less positive aspects and representing a key element of the teaching and learning process (Fanning & Gaba, 2007; Flanagan, 2008; Morgan et al., 2009). In guided reflection, the instructor provides the student with time to explore the results based on the objectives and decisions (Shinnick et al., 2011).

Debriefing in simulated practices provides a key opportunity for students to structure their thinking processes during and after the simulated event and reflect on action, thereby helping them to consolidate knowledge and change behaviours (Coutinho et al., 2014). Wazonis (2015) emphasizes the importance of the timing and duration of the debriefing, physical and relational environment, experience of a qualified faculty, focus on objectives, method used and steps in the process.

Structured debriefing can be done in different ways, one of which (proposed by Coutinho et al. (2016)) follows four phases:

1. meeting: allowing students to describe what happened and expose how they felt in simulated clinical practice;
2. positive reinforcement: allowing observers to reflect on the positive aspects related to the performance of the students who participated in the simulated clinical practice (without value judgements) and take advantage of positive reinforcement, particularly focused on the objectives;
3. analysis: facilitating the structured thinking of the students who participated in the simulated clinical experience and, through critical analysis, helping students find the least positive aspects during the action, discussing them and finding correction strategies for future actions (reflection on action and action); and
4. synthesis: reinforcing learning aspects, clarifying doubts that emerged in the group and presenting key points (action plan), linking and theoretically grounding the action.

Compliance with these four phases of structured debriefing involves the creation of a safe environment for debriefing that includes confidentiality, trust, open communication, self-analysis and reflection. It also takes into account the norms of the International Nursing Association for Clinical Simulation and Learning (2016).

Some strategies can be used to reinforce debriefing with the purpose of allowing students to refer to the exact moment of discussion by using video recordings, but this should be

limited to a small part of the scenario so that students can watch and discuss a given moment with the facilitator (Iglesias & Filho, 2015).

In summary, to conduct the debriefing, the teacher must observe behaviour and clinical practice, use the learning outcomes, and consider selecting and viewing a video sequence if this is available. Debriefing should take place in a comfortable, private room with a supportive climate in which students feel free to learn in an open and honest manner.

Evaluating a simulation

Evaluation is a two-fold process that focuses on the assessment of students' performance and the simulation process.

Assessment is the process through which information is obtained on the evolution of individual students or groups of students concerning the acquisition of knowledge, skills and attitudes in relation to the objectives defined.

Students' assessments result from facilitator observations and the perception of other students in the session. To this end, the observers (students) and the facilitator should use separate templates that integrate the assessment of clinical and non-clinical skills, acquired knowledge, and attitudes (punctuality, initiative, respect for team partners, communication) during students' action and debriefing (Díaz et al., 2016).

Students' assessments include formative and summative evaluations. Formative evaluation fosters personal and professional development and aims to provide feedback on students' progress during the simulation in a safe and supportive way, helping them to achieve the objectives. Summative evaluation, on the other hand, provides an accurate view of students' final performance and ability to acquire technical and clinical skills (Sando et al., 2013; Díaz et al., 2016) and enables students to be given a score. Simulation-based evaluation of technical and clinical skills may be a better choice than evaluation in a clinical setting; in addition to the ethical reasons mentioned above, it also has a lower operational cost and is less demanding of examiners (Park et al., 2016).

There are several requirements for an effective assessment of simulated practice (Raymond & Usherwood, 2013):

- students and teachers should have clear understandings of what simulation is intended to achieve, the objectives and learning outcomes;
- simulation should be aligned to the evaluation methodology used in the curriculum, as simulations occur in unusual learning environments in which students may have difficulty grasping the purpose of simulation; and
- evaluation should be designed with a strong element of debriefing and feedback through oral debriefing and written reflection, as simulation-based learning requires externalization of students' reflections.

Evaluation also focuses on the programme or simulation process; these data are used to improve future simulations (International Nursing Association for Clinical Simulation and Learning, 2016).

Several methods can be used: students' reports, to obtain information on their experience; teachers' objective assessment of the interventions' effectiveness; and data collection to support continuous quality assessment of the curriculum (Foronda et al., 2013) and make decisions on teaching processes (Raymond & Usherwood, 2013). There is a need to assess objectively the students' level of knowledge and performance at the beginning and end of the training programme, rather than evaluating students' perceptions only (Edwards et al., 2015).

Evaluating the usefulness and cost-effectiveness of integrating simulation in the curriculum or continuous education programmes requires that research be designed from the start to allow monitoring of the effects of the strategy on the clinical skills of students and staff. Learning outcomes, such as students' knowledge, attitudes and skills, serve not only to assess individual students, but also to evaluate the simulation programme. To evaluate the effectiveness of simulation as an educational strategy, however, other variables, such as students' self-confidence, self-awareness, self-efficacy and satisfaction, must be included. Many tools have been designed for this purpose.

Studies on the evaluation of simulation-based practice consider it important to:

- create standardized tools to evaluate the events that occur during clinical simulation (Díaz et al., 2016);
- design and validate instruments to measure clinical judgement or critical thinking dimensions (Larue et al., 2015);
- design instruments that make a clear distinction between knowledge, competency and performance assessment (Larue et al., 2015);
- demonstrate the effectiveness of simulation in several learning areas (Yuan et al., 2012; Foronda et al., 2013; Adamson, 2015);
- use mixed-method approaches to evaluate the effectiveness of interventions (Foronda et al., 2013); and
- use other instruments besides self-reports and perceived improvement and satisfaction questionnaires (Foronda et al., 2013; Larue et al., 2015).

For simulation to achieve creative outcomes and perspectives, evaluation should integrate the simulation design from the start, along with the definition of specific learning outcomes (knowledge acquisition, skills development or group socialization) and outcome measurements (Foronda et al., 2013; Raymond & Usherwood, 2013).

6. RECOMMENDATIONS

The integration of simulation in nursing and midwifery curricula is widely recommended, particularly in a constructivist approach, to combine theoretical contents, practice of technical skills and development of generic clinical skills for solving increasingly complex scenarios and preparing for future clinical practice.

To this end, simulation should not be limited to technical-skills training or exclusively be seen as a means of reducing the clinical practice component of the curriculum, although it has been noted that simulation effectively can replace up to 50% of clinical contact hours in nursing education (Hayden et al., 2014; Larue et al., 2015).

Educators and managers who wish to use simulation in nursing and midwifery curricula or in continuous/in-service education should consider the following recommendations. They should:

1. be aware of the theoretical underpinnings of using simulation as an educational strategy;
2. understand the benefits of integrating simulated clinical experiences in the curriculum or in continuous education;
3. identify the available or required resources (space, simulators and teaching staff with adequate training who are committed to designing and implementing scenarios and continuously evaluating their outcomes);
4. define the purpose of using simulation (to improve the acquisition of students' skills, evaluate technical skills and offer skills-training opportunities, for example);
5. understand that simulation does not need to be high-fidelity: low-fidelity simulation using well-designed and well-implemented scenarios may be very effective in achieving learning outcomes; and
6. recognize that if resources are limited, starting with low- and medium-fidelity simulation may be more appropriate (as they incur lower costs) until staff become proficient in the process of planning, implementing and evaluating simulation.

7. CONCLUSION

The quality of higher education has received increased attention over the past few decades, particularly in relation to the qualification of the faculty, quality of outcomes and monitoring of variables associated with training processes.

The attention in nursing and midwifery education inevitably will continue to focus on educational strategies, physical structures, materials and equipment, as well as on absolute respect for the moral and ethical principles and social demands of a profession that is strongly influenced by the principles of humanism. Evolution is towards student-centred educational strategies that integrate the principles of the profession and the strongest scientific evidence to improve quality of care and ensure patient safety.

Evidence from multiple studies shows that simulation is a highly valuable strategy for training nurses and midwives. It is part of a constructivist educational approach and helps students to develop more effectively their psychomotor and problem-solving skills, think and act as nurses or midwives, and acquire skills to communicate in a more assertive and therapeutic manner.

For simulation to deliver consistent results and the overall value of the experience to be strengthened, however, there should be intentional, systematic, flexible and cyclical planning, and the design of a simulated practice should provide a structure for development that combines the best pedagogical and evaluation practices with the best clinical guidelines.

Building scenarios is essential when the pedagogical strategy is based on simulation. To this end, it is important to consider the students' characteristics, level of education, expected objectives from using simulation and the most appropriate type of simulation for the pedagogical objectives.

When implementing a scenario, the teacher needs to take into account the necessary material and equipment to accomplish the pedagogical objectives, the space and/or context in which the simulation will take place, the necessary technological resources, and the availability of elements that guide and contribute to students' decision-making processes and human resources (teacher/facilitator). These are key elements to implementing the three steps of simulation – briefing, action and debriefing – and achieving the best outcomes.

Finally, as a pedagogical strategy that promotes more solid learning experiences and leads to the development of knowledge, skills and attitudes, simulation is and should continue to be at the core of the continuous improvement of care delivery to those who seek health services.

The integration of simulation in the curriculum is possible in low-resource settings through the use of low- and medium-fidelity simulation, with excellent results.

By encouraging and assigning importance to simulated practice before clinical practice, schools reflect profound respect for human beings and their dignity in all clinical practice settings as part of their education philosophy.

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ANNEX 1. TEMPLATE FOR SIMULATION SCENARIOS

Course:

Learning objectives

Clinical:

Non-technical skills:

Setting the scene

Candidate role(s):

Clinical setting:

Brief to candidate:

Scenario description (summary of scenario progression)

Staff required to run scenario (who? behaviour? prompts?)

Environment set-up including props:

Essential medical equipment:

Drugs:

Test results:

Guidance for standardized patient

Presentation:

Past medical history:

Triggers and responses:

Exit strategies

Debriefing points

ANNEX 2. SIMULATION SCENARIOS

SCENARIO 1, PROVIDED BY NURSING SCHOOL OF COIMBRA, PORTUGAL

Course: Nursing – first-year bachelor students

Learning objectives

Clinical:

- obtain patient history
- conduct physical examination
- recall steps of clinical interview
- recall key health indicators
- recall steps of physical examination
- perform patient health record

Non-technical skills:

- demonstrate effective communication
- demonstrate confidence and initiative
- demonstrate critical thinking
- recall ethical procedures

Setting the scene

Candidate role(s):

- nurse
- patient
- facilitator (teacher) who will provide debriefing

Clinical setting:

- hospital ward or community health centre

Brief to candidate:

- you are the nurse who admits a patient to a hospital ward

Scenario description (summary of scenario progression)

Male patient, 66 years old, is admitted to a hospital ward with an infected wound in his right big toe. The nurse interviews the patient, performs physical examination and records the information.

Staff required to run scenario (who? behaviour? prompts?)

Senior student (third, fourth grade of the course) as standardized patient

Environment set-up including props:

- patient room

Essential medical equipment:

- stethoscope

Drugs:

- none

Test results:

- none

Guidance for standardized patient

Presentation:

- you are being admitted to a surgical ward with an infected wound in your right big toe
- your toe is painful

Past medical history:

- heavy smoker and diabetic

Triggers and responses:

- patient is in pain and very worried because his grandfather was diabetic and suffered an amputation of his foot

Exit strategies

- Patient history includes key health indicators
- Patient complaints are identified
- Patient worries are identified
- Health records are complete

Debriefing points

Debrief should follow with all involved.

The student talks about the experience, technical difficulties as well as emotions. Receives feedback from the standardized patient (senior student) and the teacher. Students may share their knowledge and experiences about interacting with patients in clinical settings and strategies to perform the clinical interview and physical examination successfully.

SCENARIO 2, PROVIDED BY CARDIFF UNIVERSITY WHO COLLABORATING CENTRE FOR MIDWIFERY DEVELOPMENT, UNITED KINGDOM (WALES)

Course: Midwifery**Learning objectives**

Clinical:

- identify emergency: baby in need of resuscitation
- apply Resuscitation Council algorithm for assessment and actions
- recall steps in the management of newborn resuscitation

Non-technical skills:

- demonstrate effective communication
- demonstrate leadership in managing the emergency

Setting the scene

Candidate role(s):

- midwife
- assistant (may be midwife/support worker)
- distraught mother
- facilitator who will provide debriefing

Clinical setting:

- midwifery-led unit (could be rural health centre?)

Brief to candidate:

- you are the midwife who admits a woman in advanced labour who progresses rapidly to a spontaneous vaginal delivery of a male baby

Scenario description (summary of scenario progression)

You are working as a midwife in a midwifery-led unit. A woman arrives in a distressed state who appears to be in advanced labour and there is some bleeding apparent per vagina. She progresses rapidly to deliver a male baby vaginally. Baby appears pale and “floppy”, makes one weak cry only.

Staff required to run scenario (who? behaviour? prompts?)

Staff to set up scenario and manage simulation

Environment set-up including props for hybrid simulation**Equipment:**

- resuscitation area: flat clean surface/resuscitaire if available
- baby manikin
- towels

Essential medical equipment:

- stethoscope
- bag and mask
- Guedel airway

Drugs:

- rarely used and, if used, should be by medical staff via umbilical venous catheter
- adrenaline (1 : 10 000)
- sodium bicarbonate (4.2%) – not recommended during brief resuscitation
- glucose (10%)

Test results:

Not applicable as no information available

Guidance for standardized patient**Presentation:**

- baby delivered vaginally spontaneously
- appears pale and lacks muscle tone/reflex responses
- gave one gasp at birth
- heart rate 58 beats per minute (bpm)

Past medical history:

- mother reports being in labour with this, her first baby, for “two days” and has had some bleeding over last two hours
- came as fast as she could to the unit
- delivered on arrival

Triggers and responses:

- Mother distraught and crying

Exit strategies

- Resuscitation algorithm followed
- When successful inflation of baby's lungs with bag and mask
- Baby's heart rate > 100 bpm
- Colour pink and respiration established

OR

- If candidate unsure of steps to follow – facilitator will step in

Debriefing points

Debrief should follow with all involved.

The student talks about the experience, technical difficulties as well as emotions. Receives feedback from facilitator about the performance. Identifies learning needs.

SCENARIO 3, PROVIDED BY RECANATI SCHOOL FOR COMMUNITY HEALTH PROFESSIONS, BEER-SHEVA, ISRAEL

Course: Nursing**Learning objectives**

Clinical:

- perform patient assessment and obtain patient's medical history (suffering from congestive heart failure (CHF))
- be able to recognize patient deterioration
- respond rapidly and well organized
- help connect bilevel positive airway pressure (BiPAP) and do patient counselling
- give intravenous (IV) medications

Non-technical skills:

- effective communication with patient and staff
- demonstrate critical thinking
- demonstrate decision-making

Setting the scene

Candidate role(s):

- nurse
- second nurse
- doctor
- facilitator

Clinical setting:

- hospital room, acute care

Brief to candidate:

- you are a nurse responsible for the care in this hospital room

Scenario description (summary of scenario progression)

Female patient, 72 years old, mother of three, admitted yesterday evening because of fatigue and dyspnoea. She resides in a home for older people and up to two weeks ago was fully independent. Since then she has been more tired and gradually limiting her activity. She has gained 6 kg and has difficulty getting up, even for the bathroom. She denies any chest pain or a recent history of flu or disease. The patient was admitted with a diagnosis of CHF. She received furosemide IV 40 mg in emergency department and a urinary catheter was inserted.

Staff required to run scenario (who? behaviour? prompts?)

Two nursing students, medium-fidelity mannequin, doctor

States:

- initial assessment
- assess medical history and check medical records
- reassessment and introduction of BiPAP with doctor (played by facilitator)
- preparation of IV isosorbide dinitrate
- patient education and evaluation

Exit strategies

- Patient is stable, breathing easier with BiPAP
- The treatment is explained to the patient

Debriefing points

- Students' feelings and reactions to the situation
- Signs of CHF, possible deterioration
- Organization of response
- Indications for BiPAP
- Preparation of IV medications drip, cardiac monitoring

SCENARIO 4, PROVIDED BY NURSING SCHOOL OF COIMBRA, PORTUGAL

Course: Nursing – final-year bachelor students

Steps	Item	Rationale
Scenario	Title	Respiratory distress due to secretions in older adult with asthenia
	Rationale, justification	Respiratory distress is a common condition, especially in older people, and can be aggravated by malnutrition, asthenia and comorbidities
	Objectives	Identify respiratory distress and its degree of severity Implement measures for airway permeability and improvement of oxygen saturation Ensure safety

Skills	<p>Auscultate and identify breath sounds</p> <p>Suction secretions according to the technique</p> <p>Communicate effectively with the patient and multidisciplinary team</p> <p>Follow standard safety precautions in case of secretions</p>
Problem situation	<p>Man, 75 years old, 95 kg, 1.70 m, with asthenia caused by secretions, improves after suctioning, head-of-bed elevation and use of high concentration non-rebreathing oxygen mask with reservoir bag</p>
Setting, context	<p>Medical inpatient unit, 22 hours</p>
Medical history	<p>Man, 75 years old, admitted three hours ago due to respiratory distress</p> <p>Receiving 40 drops/minute of 5% dextrose in peripheral vein</p> <p>Receiving oxygen through a nasal cannula at 2 L/minute</p> <p>Waiting for results of laboratory tests, blood gas testing and chest X-ray</p>
Family history	<p>Type 2 diabetes compensated with diet plus oral antidiabetic drug (metformin)</p> <p>Mentioned two episodes of atrial fibrillation, controlled with oral amiodarone</p> <p>Hypertensive, controlled with oral extended-release nifedipine, 30 mg</p>
Scenario setup	<p>Documentation, clinical record</p> <p>Standard documentation available to the student during the scenario:</p> <ul style="list-style-type: none"> • medical and family history • medical diary • medical prescriptions • nursing history • nursing diary • nursing care plan • vital signs chart (blood pressure, pulse, respiratory rate, temperature, pain) • fluid balance
Material and equipment	<p>Simulator: iStan</p> <p>Emergency trolley</p> <p>Suction machine prepared</p> <p>O2 source and peak-flow meter</p> <p>Non-rebreathing mask with reservoir bag</p> <p>Nasal cannula</p> <p>Stethoscope</p> <p>Telephone</p>

Pre-scenario	<p>Characterization of the environment and the simulated patient</p> <p>Initial information for the student</p>	<p>Simulator with nasal cannula connected to an oxygen tank set to 2 L/minute</p> <p>IV access with 5% dextrose, slow (40 drops/minute)</p> <p>Face and chest sweating</p> <p>Peripheral cyanosis</p> <p>Noisy breathing, gurgling, fast and difficult</p> <p>Mentions shortness of breath; broken speech; low voice</p> <p>Man, 75 years old, admitted three hours ago due to respiratory distress</p> <p>Receiving 40 drops/minute of 5% dextrose in peripheral vein in right upper limb (right radial)</p> <p>Receiving oxygen through a nasal cannula at 2 l/minute</p> <p>Waiting for results of laboratory tests, blood gas testing and chest X-ray</p> <p>He has diabetes and is being followed up in the cardiology unit due to hypertension and arrhythmia</p>
Scenario (step 1)	<p>Initial information for the student</p> <p>What the student finds</p>	<p>Directly observable:</p> <ul style="list-style-type: none"> • noisy breathing, gurgling, fast and difficult • mentions shortness of breath; broken speech; low voice – directly observable • peripheral cyanosis • face and chest sweating <p>Observable via simulator assessment:</p> <ul style="list-style-type: none"> • airway secretions • respiratory rate (RR): 22 breaths/minute, superficial • blood oxygen saturation (SpO₂): 84% • pulse: 110 bpm, rhythmic • if monitored: sinus rhythm • capillary blood glucose: 152 mg/dL • disoriented in time and space <p>Information obtained from patient records:</p> <ul style="list-style-type: none"> • nurses' notes on evolution in the emergency department • time of admission to the unit; vital parameters; nursing interventions; assessment of the results of the intervention; time of discharge to inpatient unit (medicine) • he still has no records in the inpatient unit file (hospital length of stay – three hours)
Scenario (step 2)	<p>Data to be searched</p>	<p>Nurses' notes on the evolution in the emergency department: a 75-year-old man came to the emergency department, accompanied by his son, due to respiratory distress, cough, and abundant secretions.</p> <ul style="list-style-type: none"> • RR: 24 breaths/minute, superficial • pulse: 120 bpm, rhythmic • capillary blood glucose: 134 mg/dL • SpO₂: 91% • capillary refill time: 4 seconds

Scenario (step 2)	Data to be searched (contd)	<p>At admission and triage, the patient showed signs of exhaustion and respiratory work, with periods of disorientation in time and space.</p> <p>Triaged as orange with the Manchester triage system.</p> <p>Interventions:</p> <ul style="list-style-type: none"> • high-concentration mask • peripheral puncture in the right upper limb with 5% dextrose in water <p>Family history:</p> <ul style="list-style-type: none"> • the son mentions that Mr X has diabetes and cardiac problems and is being followed-up in consultations
Expected actions	<p>Uses safety measures (gloves and mask)</p> <p>Performs structured assessment (ABCD)</p> <p>Places patient in head-of-bed elevation (25–300)</p> <p>Performs suctioning</p> <p>Assesses SpO₂</p> <p>Replaces nasal cannula by high-concentration mask</p> <p>Assesses glycaemia and vital parameters</p> <p>Contacts assistant doctor</p> <p>Gives and receives information effectively</p>	
Scenario evolution	<p>The patient's medical condition worsens until he is suctioned, receives high-concentration oxygen, and is put in head-of-bed elevation.</p> <p>After these interventions, the patient's medical condition gradually improves.</p>	
Scenario (step 3)	Expected actions	<p>Keeps head-of-bed elevation</p> <p>Manages oxygen therapy based on SpO₂ values and respiratory work</p> <p>Keeps monitoring</p> <p>Stores material</p> <p>Washes hands</p> <p>Records all information</p>
Debriefing	Notes for debriefing	<p>How did the student feel?</p> <p>Positive aspects identified by the observers</p> <p>Aspects to be improved identified by the students as caregivers</p> <p>Rationale for decision-making</p> <p>Discuss the signs and symptoms of respiratory distress</p> <p>Discuss the need for safety in case of a potential risk (secretions)</p> <p>Discuss the effects of oxygen supply and Fowler's elevation (reducing preload) on the clinical condition of the patient</p>

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