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POINT OF VIEW

PICU simulation: critical care training

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Abstract David Gaba was one of the first to use simulation in medicine. He defined it as a learning method used to replace or amplify real experiences by guided experiences that evoke or reproduce aspects of the real world in a completely interactive way.

In the past, learning process and professional improvement in the healthcare were carried out progressively with the patient himself, so the management of infrequent situations was conditioned to a prolonged training period. Tools such as simulation allow us to carry out this training prior to patient care, providing an experience that was not available before.

In the last decade, this methodology has experienced exponential growth, gaining more and more prominence in the field of paediatric intensive care. It has not only been consolidated as a pedagogical method, but also as an essential tool for the acquisition and improvement of technical and non-technical skills in healthcare practice. Nowadays, it's considered a fundamental part of patient safety improvement strategies, allowing to examine care environments and processes, train multidisciplinary teams and practice work algorithms.

In this review, we will focus on the usefulness of clinical simulation for the training of PICU staff, especially in non-technical skills such as effective communication and teamwork in critical situations.
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PALABRAS CLAVE
Simulación;
UCIP;
Cuidados intensivos pediátricos;
Entrenamiento;
Equipos multidisciplinares;
Trabajo en equipo;
Formación

Simulación en UCIP: formación en situaciones críticas

Resumen La simulación clínica surge en el ámbito médico de la mano de David Gaba, que la define como método de aprendizaje usado para sustituir o amplificar experiencias reales por experiencias guiadas que evoquen o reproduzcan aspectos del mundo real de forma completamente interactiva.

Clásicamente tanto el proceso de aprendizaje, como la mejora profesional en el entorno sanitario, se realizaban de forma progresiva con el propio paciente, por lo que el manejo de situaciones infrecuentes se veía condicionado a un tiempo de entrenamiento prolongado. Herramientas como la simulación, nos permiten realizar este entrenamiento previo a la atención del paciente, aportando una experiencia de la que antes no se disponía.

En la última década, esta metodología ha experimentado un crecimiento exponencial, ganando cada vez más protagonismo en el ámbito de los cuidados intensivos pediátricos. No solo se ha consolidado como un método pedagógico, sino también como una herramienta esencial para la adquisición y mejora de habilidades técnicas y no técnicas en la práctica asistencial. Actualmente, se considera una parte fundamental de las estrategias de mejora de la seguridad del paciente, permitiendo examinar entornos y procesos asistenciales, entrenar equipos multidisciplinarios y practicar algoritmos de trabajo.

En esta revisión, nos centraremos en la utilidad de la simulación clínica para la formación del personal de una UCIP (Unidad de Cuidados Intensivos Pediátricos), especialmente en habilidades no técnicas como la comunicación efectiva y el trabajo en equipo en situaciones críticas.
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Introduction

Clinical simulation emerged in the medical field through the work of David Gaba, who defined it as a learning method used to substitute or amplify real experiences with guided scenariosthat evoke or replicate aspects of the real world in a fully interactive way.[1]

The ability to reproduce a real clinical situation in a controlled and safe environment—one that does not affect the patient—provides the opportunity to train for and improve the management of rare or critical situations in clinical practice.[2]

It has been demonstrated that simulation is a useful tool for training and educating health care personnel. In situ simulation is being implemented in pediatric intensive care units (PICUs) in Spain, with significant growth in recent years. However, few units have an established educational program, with multiple limitations identified for carrying out and maintaining simulation activities over time (logistical issues, lack of time, lack of prior training, staffing difficulties, funding problems, etc.).[3–5]

Current State of the topic

Safety culture as a fundamental component of health care

Patient safety is an essential and cross-cutting element of health care and a fundamental component of quality care. The landmark report To Err is Human, published in 1999, revealed that up to 98,000 deaths per year could result from adverse events associated with health care delivery.[6] This marked a strategic shift in health care systems, particularly in the development of a safety culture that would act as thecentral pillar of quality of care.

Safe care is achieved through actions aimed at preventing, avoiding, and reducing adverse events during the provision of health services, such as:

- Promoting and developing awareness of a patient safety culture.
- Implementing information and reporting systems.
- Encouraging and applying safe practices.
- Promoting research in clinical safety.

The elements encompassed within the safety culture are multiple and varied, ranging from recognizing that humans are prone to error and must learn from mistakes, to training in the fundamentals of crisis resource management (CRM)—anticipation and planning, situational awareness, leadership, role allocation, workload distribution—teamwork, and simulation.[2,7]

Patient safety is essential across all areas but is particularly relevant in units caring for critically ill patients. The complexity of care, severity of illness, high technological support, polypharmacy, and the need for rapid decision-making all create situations that can compromise patient safety.[8]

Table 1 Key Points of CRM.

-Know the environment	-Mobilize all available resources	-Exercise leadership and know how to follow
-Anticipate and plan	-Use cognitive aids	-Communicate effectively
-Establish priorities dynamically	-Use all available information	-Ask for help early
-Prevent/manage fixation errors	-Distribute attention wisely	-Good teamwork
-Distribute workload	-Re-evaluate periodically	-Cross-checks

CRM: crisis resource management.

This underscores the need for continuous training, skill maintenance, and competency development among health care professionals working in such units. It is also crucial to integrate systems that implement appropriate barriers to prevent human error from affecting the patient.[9] Traditionally, medical learning occurred during direct patient care, meaning that training for infrequent situations required long periods of experience. The introduction of simulation in health care provides the opportunity to acquire and improve both technical and non-technical skills without putting patients at risk. Numerous ICU-related procedures have demonstrated the value of simulation-based training, including mechanical ventilation, vascular access insertion, and management of life-support devices.[10] Currently, simulation is considered a fundamental part of patient safety improvement strategies, allowing assessment of care environments and processes, training of multidisciplinary teams, and rehearsal of clinical algorithms.[3]

Clinical simulation can be performed in various ways (actors and/or manikins; low- or high-cost; online or in-person; low- or high-fidelity) and in different locations (simulation centers or real clinical environments). When simulation is conducted within the professionals actual workplace, it is known as in situ simulation, allowing them to train for rare clinical situations in their real working environment.[11] Performing these simulations within ICUs not only enhances realism but is also useful for detecting system-level errors (eg, equipment organization, technical failures).

Safety training is possible

Introduction to CRM

Although the concept of CRM originated in aviation, its value was later extended to many other fields. Gaba et al. adapted it to anesthesiology, referring to it as Crisis Resource Management in Anesthesia.[7]

In health care, the goal of CRM is to coordinate, utilize, and apply all available resources to optimize patient safety and clinical outcomes. Importantly, these principles should be applied before a critical situation occurs—not only to manage crises but also to prevent them.[12] Gaba, Howard, and Fish identified several key principles (Table 1) for anesthesiology that are applicable to other clinical fields and are designed to focus professionals attention on factors that enhance patient safety.[12]

Simulation-based training in CRM principles has been shown to improve the resolution of critical clinical situations.[2,7,13,14]

Although these may seem like obvious concepts in the management of critically ill patients, structured training and reinforcement of these elements are essential, and significantly improve the handling and resolution of complex situations.[15]

CRM training can be conducted in multiple ways: theoretical instruction, video analysis, debriefing of real-life situations, team dynamics, and simulation scenarios focused on key CRM objectives, even when the clinical cases vary (eg, difficult airway, cardiac arrest, cardiogenic shock, polytrauma).

Simulation methodology

Standards of Good practice in simulation

The implementation and development of clinical simulation are grounded in quality standards. Although simulation can be approached in many ways, achieving optimal outcomes requires a needs assessment and clear objectives. These objectives must be well defined, and the scenarios designed accordingly. Globally, standards of good clinical practice in simulation have been established for all types of scenarios and contexts, outlining key items that should be met.[16]

- Conduct a needs assessment to identify the purpose of the simulation.
- Define measurable objectives.
- Structure the simulation format based on its purpose, theory, and modality.
- Design a coherent scenario that provides context for the simulation experience.
- Employ multiple types of fidelity (conceptual, emotional, physical) to create the required realism.
- Maintain a participant-centered facilitation approach guided by objectives, participant's knowledge or experience, and expected outcomes.
- Begin with a pre-simulation briefing (prebriefing).
- After the simulation, conduct a case analysis led by instructors to allow participants to reflect on their actions (debriefing and/or feedback session).
- Include evaluation of participants, facilitators, the simulation experience, the facility, and support staff.
- Provide preparatory materials and resources to enhance participants' ability to meet objectives and achieve expected outcomes based on the simulation.
- Rehearse the simulation experience before full implementation.

Each unit or department should perform its own needs assessment. Although long-term goals may be broad, each scenario should focus on specific and attainable objectives (e.g., 1 or 2 CRM principles, a particular algorithm, or a specific clinical condition) to allow for in-depth discussion during debriefing and maximize the educational yield of each case. One of the main limiting factors for simulation development is often time availability.

Focusing specifically on simulation in pediatric intensive care, the objectives can be grouped into 6 broad categories:

To develop and refine clinical skills.

- Practice critical procedures: intubation, advanced cardiopulmonary resuscitation, vascular access placement, and mechanical ventilation.
- Manage specific critical conditions: sepsis, shock, pediatric trauma, asthma, anaphylaxis, poisoning, and others.
- Reinforce knowledge related to rare procedures, situations, or clinical cases (rare diseases).
- Facilitate training in new protocols, treatments, or equipment before implementation in clinical practice.

Strengthen clinical reasoning and decision-making.

- Train for early recognition of signs of clinical deterioration.
- Improve decision-making under pressure, considering various therapeutic alternatives.
- Develop critical thinking and the application of treatment protocols.

Optimize teamwork and communication.

- Practice role assignment and leadership within multidisciplinary teams.
- Promote efficient coordination and collaboration during critical situations.
- Improve effective communication through structured strategies such as closed-loop communication.
- Practice delivering bad news and using structured communication models for complete information transfer, such as:

a) SBAR: Situation, Background, Assessment, and Recommendation.
b) IDEAS: Identification, Diagnosis, Evaluation, Actions, and Alarm Signs/Symptoms.[17]

Enhance patient safety.

- Identify and correct errors in a simulated environment to prevent recurrence in real-life situations.
- Promote safe practices and adherence to safety protocols in the PICU.
- Simulate critical incidents to prepare for rapid and appropriate responses.

Manage stress and build resilience.

- Practice strategies to control emotional stress and maintain composure in critical situations.
- Improve confidence and emotional resilience among medical team members.

Evaluate individual and team performance.

- Identify strengths and areas for improvement in both technical and non-technical competencies, at the individual and team level.
- Facilitate constructive feedback to encourage continuous professional growth.

Structure of a simulation-based experience

Once needs have been assessed and objectives clearly defined, the next step is to design a clinical case that addresses those objectives. Simulation-based training experiences in health care typically involve 3 key dimensions:

- Creating a stimulating and participatory learning environment, widely referred to as the prebriefing.
- Developing a simulated scenario that enables participants to meet the proposed learning objectives.
- Conducting a debriefing, a post-scenario learning conversation aimed at analyzing performance and improving future practice.[18]

When instructors promote high participant engagement, knowledge retention and deeper learning are achieved, increasing the likelihood of transferring new or reinforced knowledge, skills, and attitudes to clinical practice or overall health care performance.[19] Prebriefing is an essential element for establishing a psychologically safe learning environment, which forms the foundation for knowledge acquisition and reinforcement.[20]

Debriefing plays a crucial role as the cornerstone of learning. It is a structured conversation between two or more people designed to review a simulated event or activity. During this discussion, participants explore and analyze their actions, thought processes, emotional states, and other relevant information to enhance performance in real-life situations.

Although there are multiple types and methods of conducting debriefings, they must always be guided (by one or more facilitators) and conducted in an organized manner, following a clear structure and defined learning goals.[21]

Debriefing models are classified according to various aspects. When focused on the participant's learning process, one can describe the double-loop debriefing model (Fig. 1), which aims to explore the participant's mental models—going beyond the specific action—to help them understand the underlying factors (values, assumptions, emotions, knowledge, or circumstances) that led to a particular decision or behavior, and to modify them if erroneous.[22] By contrast, single-loop debriefing focuses on changing specific actions to improve outcomes. These 2 models are useful depending on the goals and scenarios. If the objective is to train multidisciplinary teams, deepen decision-making, or address complex situations, the double-loop model may be more suitable; whereas, if the goal is to close knowledge

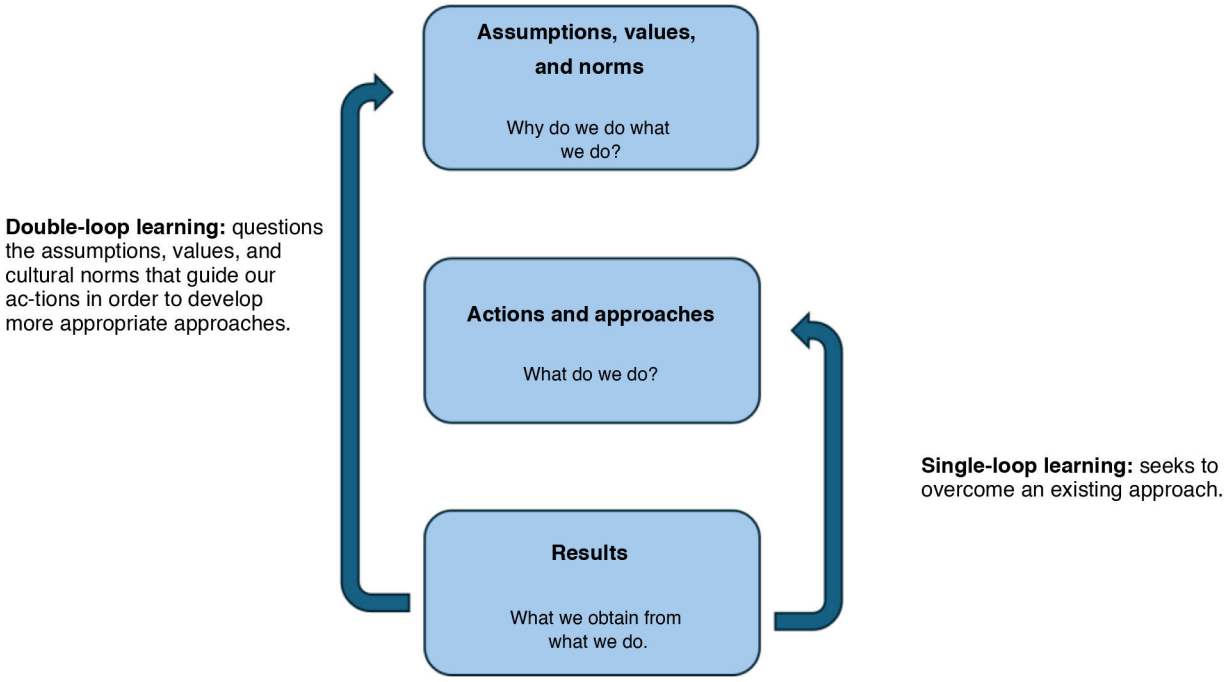

Figure 1 Double-loop learning. Adapted and translated from Roussin CJ and Weinstock P.[24]

gaps or practice clinical algorithms, the single-loop model may be preferable.

Beyond learning structure–based classifications, the debriefing with good judgment model has been described. This approach includes the instructor's assessment of actions, presenting their own mental model and offering an opportunity to close knowledge gaps without creating defensiveness among participants (''nonjudgmental debriefing'') (Fig. 2).[22]

Furthermore, this reflective discussion can be applied to real clinical situations (what is known as clinical debriefing). Providing a multidisciplinary team the opportunity to engage in a structured discussion about an event that occurred with a patient is a critical step in implementing improvements and fostering safety. Generally, clinical debriefings are shorter than educational ones and can be performed either ''hot'' (immediately after the event) or ''cold'' (some time later). It is important for team members to agree on the timing, as each approach has its advantages and limitations.[23]

Simulation zones

The SimZones framework was originally developed within the Simulator Program at Boston Children's Hospital. This approach categorized simulation scenarios into 5 zones based on their objectives, and establishes distinct strategies for each of them.[24]

Simulations are divided into 4 zones (Zones 0–3): Zone 0: includes self-directed exercises with automatic feedback, typically practiced individually. Zone 1: involves hands-on instruction in fundamental clinical skills (eg, intubation, vascular access, or high-quality chest compressions). Zone 2: Focuses on acute situational instruction such as simulated codes or algorithm practice (eg, CPR algorithm, sepsis code). Zone 3: involves authentic and native teams, emphasizing team and systems development (eg, teamwork, effective communication, CRM). Zone 4: involves debriefing of real (non-simulated) cases, allowing the recreation of real events within a Zone 3 framework to maintain continuous learning (Fig. 3).[24]

Evaluation of simulation

The scientific evidence published to date supports the usefulness of simulation for training multidisciplinary teams in the management of critical situations. Various scales have been developed for simulation evaluation—those assessing participant satisfaction, those focusing on non-technical skills such as teamwork or communication,[25,26] and those aimed at examining the clinical case *per se*.[27]

Globally, simulation evaluation can be structured across different levels according to Kirkpatrick's learning model[28]:

- Level 1: Reaction of participants.
- Level 2: Learning in terms of knowledge acquisition.
- Level 3: Learning in terms of behavioral change among professionals in their work environment.
- Level 4: Results measured in routine clinical practice.

When evaluating the impact of programs on patient safety, most of the available measures correspond to the lower levels of Kirkpatrick (perceived knowledge, skills, technical performance, confidence levels, etc.), since clinical outcomes such as mortality and morbidity are influenced by numerous confounding factors.[3,29]

	Instructor's Approach	Objective of the De-briefing	Instructor–Participant Relationship	Example of Instructor's Behavior
With judgment	Points out errors	Exposes correct and incorrect actions	Knows the truth / Does not understand	"I'm going to show you what's right and what's wrong, because I'm the one who knows."
Without judgment	Aims for the traineeto realize their own mistakes	Exposes correct and incorrect actionsacciones	Knows the truth / Does not understand	"I'm right, but I'm going to find a way to help you see that you're making a mistake."
With good judgment	Creates a learning environment	Explores the trainess and instructor's as-sumptions, values, and norms	Both have their own perspectives. The instructor seeks to understand the trainee.	"From my perspective, I don't understand some of the actions you took, so I need more information to understand what led you to take them. Let's reflect on this to-gether so we can reach a conclusion."

Figure 2 Debriefing models. Adapted from Maestre JM and Rudolph JW.[22]

	ZONE 0	ZONE 1	ZONE 2	ZONE 3	ZONE 4
Studends and focus	Skills- and abilities-centered approach: "How?" / "What?"			Inquiry- and curiosity-centered approach: "Why?"	
	Individual learning	Team training, but with partial teams — it is not necessary for participants to perform their usual roles		Complete teams that regularly work together, with each member performing their usual role	
Examples	Self-feedback Technical skills Virtual reality	Development of clinical skills Clinical orientation	Algorithm training	Team development Human factors and system development	Team development Human factors and system development

Figure 3 Simulation by zones. Adapted and translated from Roussin CJ and Weinstock P.[24] (CC BY-NC-SA license).

In 2022, a systematic review on in situ simulation in health care identified significant evidence gaps in this field, including:

- The need to dentify appropriate tasks that can be standardized and reproduced in simulation scenarios.
- Explore different methodologies to minimize bias and confounding factors.
- Develop and validate methods and tools for confidential data collection to capture the complexity of team and individual performance in real-world settings.
- Determine the optimal frequency and duration of simulations, considering feasibility and acceptability within the clinical environment.[3]

In some cases, when simulation is used to assess competencies, it is essential to employ methods that evaluate key attitudes such as leadership and teamwork. Several validated instruments exist for this purpose:

- TEAM Scale (Team Emergency Assessment Measure): a validated tool that assesses 11 behavioral aspects of the entire team on a 0–4 Likert scale, with an additional global team score ranging from 1 to 10. The behaviors assessed are divided into leadership, teamwork (including communication, cooperation, and situational awareness/supervision), and task management.[25]
- Concise Assessment of Leader Management (CALM) Scale: designed to evaluate and provide formative feedback to leaders of pediatric cardiopulmonary resuscitation teams.[30]

Simulation in critical situations

Below is the design of 3 cardiopulmonary resuscitation (CPR) simulation cases that can be used for training across different SimZones. Of note, a prebriefing must always precede case development:

a) Advanced CPR case: algorithm training. Zone 2 (Table 2).
b) Advanced CPR case: CRM training. Zone 3 (Table 3).
c) Case analysis of advanced CPR: Zone 4 (Table 4).

Table 2 Zone 2. Advanced Pediatric CPR Algorithm.

Prebriefing. 1. Introduction of instructor and participants. 2. Description of the objective (non-evaluative training): Training in the advanced pediatric CPR algorithm. Indicate that debriefing will take place after the clinical case. 3. Reality/fiction contract: clarify manikin/simulation limitations. Commitment to realism by participants. 4. Basic principle: do not judge your own or others' actions. Educational attitude. 5. Confidentiality agreement: ''what happens in simulation stays in simulation.'' 6. Explanation of equipment, environment, and manikin/monitor (if unknown). 7. Introduction to the case report.

Case report: 5-year-old child, 20 kg, admitted to PICU with suspected myocarditis (significant cardiomegaly, infectious symptoms in prior weeks: fever, cough, rhinorrhea, rash). Awaiting pediatric cardiology evaluation and blood test results. Two PIVs in place. Venous blood gas: lactate 3.2 mmol/L.The nurse calls due to decreased level of consciousness. Personal and family history: non-contributory.

Location: Simulation room.
Participants: 1 senior resident (specialty), 2 junior residents (2^{nd}–3^{rd} year), 2 NRs, 1 NA.
Roles: Specialty resident (leader–assistant), residents (usual role), NRs (circulation and airway nurses), NA.
Estimated case duration: 15 min.
Equipment: Junior manikin with monitor, intubation set (ventilator available), crash cart.

Documentation: Admission sheet, chest X-ray, venous blood gases, ECG.

Objective Zone 2
Training of the pediatric advanced CPR algorithm

Initial case situation: During a nursing shift change, the outgoing nurse reports that the child shows a decreased level of consciousness.
Vital signs: RR — rpm, SpO2 not detected, noninvasive BP —/—, the patient is unresponsive and pulseless. Monitor: VF.
Appropriate course: Early recognition of cardiac arrest and initiation of CPR. High-quality compressions and ventilations. Minimize pause times. Early and appropriate defibrillation. Adrenaline and amiodarone administered according to the algorithm. Intubation and IMV. Assessment of vascular access: unable to place a 2^{nd} PIV, intraosseous access established. Assessment of the 4 Hs and 4 Ts (± activation of the ECMO team). Recovers from the CA after 5 shocks and administration of adrenaline and amiodarone.
Critical points (no recovery): Delay in starting CPR maneuvers > 2 min. Ineffective basic CPR (inadequate compressions/ventilations, prolonged pauses). No or inadequate defibrillation. Incorrect medication administration. Fluid overload (> 20 mL/kg).

Gold standard: CPR algorithm 2021 ERC guidlines

A – Airway: no secretions. B – Breathing: not breathing. C – Circulation: pulseless. BP not measurable. VF on monitor. D – Neurological: unresponsive, isocoric nonreactive pupils. E – Exposure: no lesions. Other: 2 PIVs (1 infiltrated).

Debriefing: Explore emotions. Brief summary of the case report Case analysis (evaluation of appropriate evolution vs. critical points). The debriefing will focus on the advanced CPR algorithm, emphasizing critical steps and required actions. Identify knowledge gaps regarding the management of CA.
Conclusions Note: During debriefing, unplanned emergent objectives may arise. The instructor/facilitator should decide whether to address them based on importance and available time. If not covered, propose alternatives (post-session Q&A, future simulation focused on the topic, or an educational session to address identified knowledge gaps).

ECG: electrocardiogram; ECMO: extracorporeal membrane oxygenation; NR: nursing resident; ERC: European Resuscitation Council; RR: respiratory rate; VF: ventricular fibrillation; CPR: cardiopulmonary resuscitation; BP: blood pressure; NA: nursing assistant; PICU: pediatric intensive care unit; IMV: invasive mechanical ventilation; PIV: peripheral intravenous line; CA: cardiac arrest.

Table 3 Zone 3. CRM Training: Leadership and Teamwork.

Prebriefing: 1. Introduction of instructor and participants. 2. Objective (non-evaluative training): CRM training — leadership and teamwork. 3. Debriefing will follow the case report. 4. Reality/fiction contract: clarify manikin/simulation limitations. Commitment to realism. 5. Basic principle: do not judge your own or others' actions. Educational attitude. 6. Confidentiality agreement: ''what happens in simulation stays in simulation.''Explanation of equipment, environment, and manikin/monitor (if unknown). 7. Introduction to the case report

Case report: 5-year-old child, 20 kg, admitted to PICU with suspected myocarditis (significant cardiomegaly, prior infectious symptoms: fever, cough, rhinorrhea, rash). Awaiting pediatric cardiology evaluation and lab results. Two PIVs in place. Venous blood gas: lactate 3.2 mmol/L.Nurse reports decreased consciousness. Personal/family history: non-contributory.

Location: PICU.
Participants: 2 pediatric attendings, 1 resident, 2 nurses, 1 NA
Roles: standard clinical roles.
Duration: 15 min.
Equipment: Junior manikin with monitor, intubation set (ventilator available), crash cart.
Documentation: Admission note, chest X-ray, venous blood gases, ECG.

Objective: Zone 3
Training in CRM: leadership and teamwork.

Gold standard: CRM principles. TEAM evaluation scale (22).

Objective: Zone 3 Training in CRM: leadership and teamwork.
Initial case situation: During a nursing shift change, the outgoing nurse reports that the child presents with a decreased level of consciousness.
Vital signs: RR — rpm, SpO2 not detected, noninvasive BP —/—, the patient is unresponsive and pulseless. Monitor: VF.
Appropriate clinical course: 1. Early recognition of cardiac arrest and initiation of CPR. 2. High-quality compressions and ventilations, minimizing pause times. 3. Early and appropriate defibrillation; adrenaline and amiodarone administered according to the algorithm. 4. Intubation and IMV. 5. Assessment of vascular access: unable to place a 2nd PIV, intraosseous access established. 6. Assessment of the 4 Hs and 4 Ts (± activation of the ECMO team). 7. Recovers from the CA after 5 shocks and administration of adrenaline and amiodarone.
Appropriate actions: Assignment of roles before starting; clarification of who the leader is. The leader maintains an overall perspective of the case. Effective communication (closed loops, appropriate tone, clear and directed orders). Collaborative work to complete tasks. Positive attitude and control of the situation. Reassessment of the situation and adaptation to changes. Planning and anticipation of possible events, prioritizing key actions.
Critical clinical points (no recovery): Delay in starting CPR maneuvers > 2 min. Ineffective basic CPR (inadequate compressions/ventilations, prolonged pauses). No or inadequate defibrillation. Incorrect drug administration. Fluid overload (> 20 mL/kg).
Debriefing: Explore emotions. Brief summary of the case report. Case analysis (evaluation of appropriate evolution vs. critical points). The debriefing will focus on non-technical skills. Guide the discussion toward appropriate CRM actions (reflection on teamwork, essential elements, and areas for improvement). **Assess the need to address knowledge gaps regarding CA management. 4. Conclusions.

Gold standard: CRM principles. TEAM evaluation scale (22).
A – Airway: no secretions. B – Breathing: not breathing. C – Circulation: pulseless. BP not measurable. VF on monitor. D – Neurological: unresponsive, isocoric nonreactive pupils. E – Exposure: no lesions. Other: 2 PIVs (1 infiltrated).

Table 3 (*Continued*)

Debriefing: Explore emotions. Brief summary of the case report. Case analysis (evaluation of appropriate evolution vs. critical points). The debriefing will focus on non-technical skills. Guide the discussion toward appropriate CRM actions (reflection on teamwork, essential elements, and areas for improvement). **Assess the need to address knowledge gaps regarding CA management. 4. Conclusions.

CRM: crisis resource management; ECG: electrocardiogram; ECMO: extracorporeal membrane oxygenation; RR: respiratory rate; VF: ventricular fibrillation; CPR: cardiopulmonary resuscitation; SpO2: oxygen saturation; BP: blood pressure; NA: nursing assistant; TEAM: Team Emergency Assessment Measure; PICU: pediatric intensive care unit; IMV: invasive mechanical ventilation; PIV: peripheral intravenous line; CA: cardiac arrest.

Table 4 Zone 4. Analysis of a Case Report: CA in a Patient with Suspected Myocarditis.

Case report: 5-year-old child, 20 kg, admitted to PICU with suspected myocarditis (significant cardiomegaly, prior infectious symptoms: fever, cough, rhinorrhea, rash). Awaiting pediatric cardiology evaluation. CA (VF) during shift change. Arrest lasted 12 min; 5 shocks, 2 doses of adrenaline, 2 doses of amiodarone administered. Orotracheal intubation during CPR and connection to IMV. Personal and family history: non-contributory.
Clinical Debriefing 1. Explore emotions. 2. Case summary. 3. Case analysis: topics determined by participants; facilitator guides discussion to ensure appropriate flow and synthesis of overall information. 4. Conclusions.

VF: ventricular fibrillation; OTI: orotracheal intubation; CPR: cardiopulmonary resuscitation; PICU: pediatric intensive care unit; IMV: invasive mechanical ventilation; CA: cardiac arrest.

Development of medical simulation within the Spanish society of pediatric intensive care (SECIP)

In 2021, SECIP created the Simulation Working Group, named SimuSECIP. With more than 30 members, this group holds monthly meetings to share materials and experiences related to medical simulation organized within their respective departments. Furthermore, a nationwide survey was conducted aimed at determining how many Spanish PICUs regularly use simulation and, promoting its implementation in those that do not (results presented as a poster at the 36th National SECIP Congress). Over the past 3 years, the group has organized an annual 2-day simulation-based course that takes place at the end of the 4th-year residency rotation (R4) for pediatric intensive care trainees. This course is centered on simulation-based clinical scenarios and workshops focusing on both technical and non-technical skills.

The group's current goal is to design a simulation-based training model, endorsed by SECIP, that can be evaluated using an Objective Structured Clinical Examination (OSCE) and serve to certify the competencies of future pediatric intensivists. This project is primarily based on the CoBatrice program developed for adult intensivists in Europe.[31] Currently, several pilot simulations have been conducted with resident participation, during which scenarios were video-recorded, analyzed, and evaluated by various group members.

The objective is to ensure high-quality, updated, standardized, and internationally comparable learning, in contrast with the current training system, which is primarily based on completing a series of rotations and clinical stays in PICUs over 1 year. The new model proposes simulation-based education to develop both technical and non-technical competencies.

CRediT authorship contribution statement

- Lead author: Alicia Ogando Martínez.
- Reviewers: Amelia Martínez de Azagra and Vianor Pablo Silvero Enríquez.
- Reviewer and coordinator: Santiago Mencía Bartolomé.

Declaration of Generative AI and AI-assisted technologies in the writing process

The authors declare that no AI-assisted tools were used in the preparation of this manuscript.

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Declaration of competing interest

None declared.

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