REUE | Original Article

Emergency Crisis Resource Management course: a tool for transforming attitudes within Emergency Service teams

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OBJECTIVE. To know the perception of the influence of the human factor in emergencies, acquired by students after completing an E-CRM (Emergency Crisis Resource Management) course of the Spanish Society of Emergency Medicine and Emergency Medicine (SEMES) based on clinical simulation. E-CRM (Emergency Crisis Resource Management) course of the Spanish Society of Emergency Medicine (SEMES) based on clinical simulation.

METHODS. We analyzed responses to an ad hoc survey sent to participants 3 months after they completed the E-CRM course between 2017 and 2019. We analyzed their views of the influence the course had on their personal and professional development.

RESULTS. Responses were received from 147 course participants (73.5%, physicians; 20.4%, nurses; 5.4%, emergency medical technicians; and 1.4%, other). Sixty-five percent had more than 10 years of experience. The different groups of participants gave significantly different responses for the 5 question categories: seeking help, role clarification, effective communication, resource use, and overall evaluation. Respondents emphasized their use of cognitive aids, active listening, and team planning prior to starting a shift.

CONCLUSIONS. After the E-CRM clinical simulation course, respondents reported being more aware of how human factors influence their personal and professional approaches to carrying out their emergency service work.

Keywords: Emergency medicine. Educational activities, simulation. Multidisciplinary training. Training programs.

E-CRM como herramienta de cambio actitudinal en los equipos de urgencia

OBJETIVO. Conocer la percepción sobre la influencia del factor humano en urgencias que adquieren los alumnos trasla realización de un curso E-CRM (Emergency Crisis Resource Management) de la Sociedad Española de Urgencias y Emergencias (SEMES) basado en simulación clínica.

MATERIAL Y MÉTODO. Se analizaron las respuestas a un cuestionario *ad hoc* administrado a los 3 meses de las ediciones de los cursos E-CRM SEMES realizados entre 2017-19. El cuestionario valoraba la autopercepción sobre la influencia que ha tenido el curso en su desarrollo personal y profesional.

RESULTADOS. Se recogieron las encuestas de 147 participantes (73,5% médicos, 20,4% enfermeras, 5,4% TES (Técnico en Emergencias Sanitarias) y 1,4% otras profesiones. El 65% de los profesionales tenía una antigüedad de más de 10 años. Existieron diferencias significativas entre las diferentes profesiones y servicios en los 5 ejes E-CRM (petición de ayuda, claridad de papeles, comunicación eficaz, uso de recursos y evaluación global). Se destacó el uso de ayudas cognitivas, la escucha activa y la planificación previa al inicio del turno.

CONCLUSIONES. Tras la realización de un curso E-CRM basado en simulación, los participantes son conscientes de cómo el factor humano influye en el desempeño de su trabajo en los servicios de urgencias y emergencias, lo que pueder llevar a introducir cambios en su quehacer profesional y personal.

Palabras clave: Medicina de emergencia. Educación médica basada en simulación. Interprofesional. Educación y entrenamiento médico.

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Introduction

In emergency care, constantly changing and crisis situations are common, requiring rapid decision-making—not only for unstable patients but also in scenarios that may endanger both patients and responders. In an emergency coordination center, all kinds of calls come in: one might be from a father asking for the correct dose of paracetamol for his baby, and the next could be about a bus rollover. Meanwhile, an emergency medical team may be treating a patient with chest pain in a remote area far from the hospital, having to make decisions about deploying an advanced life support resource, possibly the only one available for many kilometers around. In the emergency department (ED), collapse may occur when multiple trauma victims arrive at once, along with a stroke code and another patient agitated from alcohol intoxication requiring several staff for restraint. It has been described that many of the errors committed are closely related to what is known as the human factor. For this reason, professionals must be familiar with the tools that influence patient safety, as well as the team's adaptability and coordination capacity.[1]

Clinical simulation has proven to be an invaluable training tool for health care professionals,[2,3] encompassing both technical skills (assessment, resuscitation, treatment, etc.) and non-technical skills (communication, leadership, situational awareness, among others). All of these influence patient safety, although further studies are needed to demonstrate real and sustained attitudinal change over time—that is, a level 4 evaluation according to Kirkpatrick[4] (which assesses training outcomes in four stages: reaction, learning, behavior, and results). The positive impact of this type of training has already been demonstrated in fields such as aviation, military submarines, and nuclear power plants.[5] Despite the obvious differences, there are striking similarities between the work environments of an aircraft cockpit, a hospital emergency room, or an advanced life support ambulance—each capable of producing similar error-prone situations.[6-8]

In January 2017, the Clinical Simulation Working Group of SEMES (Spanish Society of Emergency Medicine and Emergencies) developed a program called E-CRM (Emergency Crisis Resource Management). This program included training a group of professionals—physicians, nurses, and emergency medical technicians (EMTs)—as E-CRM instructors and developing a simulation-based course for both prehospital and hospital emergency professionals. The goal was for participants, by the end of the training session, to recognize the importance of non-technical skills that influence crisis management in emergency settings.

This represents a new educational model built on specific, measurable outcomes,[7,9,11] designed to drive change through understanding participants' mental models. The main objective of the project is to increase safety in the work environment—for both professionals and patients.

It is essential to promote SEMES E-CRM as a model of change rooted in understanding participants' mental models to strengthen workplace safety among professionals and, consequently, patient safety. The concept of change may be received positively, but it can also evoke instability, uncertainty, and even potential conflict. Combined with the constant crisis environment characteristic of emergency care, this implies that such changes must be trained, experienced, and agreed upon in simulated environments, where it is possible to act, redo, and verify the outcomes of these initiatives.[10,12]

Materials and methods

We conducted an observational, analytical, cross-sectional study measuring, through the SEMES E-CRM methodology, the ability to modify behavior using simulation-based sessions and subsequent assessment of learning retention. Three months after training, participants completed a survey specifically designed for this purpose.

Courses analyzed were held between October 2017 and June 2019, each with a maximum of 12 participants (no more than 6 from the same professional category), totaling 188 health care professionals.

The SEMES E-CRM course followed a hybrid format, with both in-person and online components. The in-person component lasted 8 hours, divided into 2 4-hour sessions. The online component involved reflective learning from video recordings of the simulation scenarios in which each participant took part. Participants could voluntarily review recordings and contact their instructors for clarification or guided reflection. Access to recordings was available for one month after course completion.

Course delivery required the collaboration of 2 simulation instructors, 2 simulation technicians, 1 special-effects technician, 1 administrative assistant, and the cleaning staff.

Simulation scenarios were designed by the SEMES E-CRM instructor team and compiled into a shared database. Each scenario included a general objective, aligned with one or two E-CRM pillars (Table 1), revealed to participants through a pre-simulation group discussion. During simulations, facilitators remained outside the scene, observing through a Gesell chamber[13] or via cameras recording the event, thus avoiding interference.

After each simulation, all participants met for a collective reflection session (debriefing) to identify factors that facilitated or hindered optimal performance and propose concrete improvements. Each instructor was free to use any debriefing model, provided it adhered to Rudolph's "Good Judgment" framework.[14]

Course evaluation included several components. At the end of the in-person session, participants completed a 15-question multiple-choice knowledge test. Afterwards, they filled out an anonymous satisfaction survey and assessed the quality of the debriefing using the DASH (Debriefing Assessment for Simulation in Health care)[15] form.

Three months after training, participants received an anonymous online survey via Google Forms® to assess self-perceived impact of the course on their professional and personal development through a series of commitment-based questions. The survey followed the E-CRM pillars using closed multiple-choice questions.

Table 1. Axes and key points of emergency crisis resource management[1]

Axes	E-CRM Key Points
Role clarity	• Identify a leader • Assign roles explicitly • Distribute workload • Perform cross-checks
Communication	• Communicate effectively through the leader
Assistance and help management	• Recognize severity and request help early
Resource utilization	• Be familiar with the environment • Mobilize all available and necessary resources • Use cognitive aids
Global vision	• Use all available information • Anticipate and plan ahead • Prevent and correct fixation errors • Reassess continuously • Maintain focus on ongoing tasks • Establish priorities dynamically

Of the 188 trained professionals, 147 participants (78%) completed the survey, reflecting through self-assessment whether they had integrated any "lessons learned" into their routine work.

The questionnaire was structured according to the E-CRM axes, transformed into categories, and analyzed using Categorical Principal Components Analysis (CATPCA), which quantifies categorical variables while reducing data dimensionality. Following the Kaiser-Guttman criterion, the most frequently answered items—those encompassing the greatest number of reported changes—were identified. For internal consistency, Cronbach's alpha was calculated and deemed acceptable. Data were analyzed using SPSS® v.25 (Statistical Package for the Social Sciences) under a license from the University of Valencia.

Ethical considerations

Participant data were processed in full compliance with current data protection legislation. Anonymity and confidentiality were guaranteed. All participants provided informed consent after being briefed on study objectives, confirming their voluntary participation. The study adhered to the ethical principles of the Declaration of Helsinki.[16]

Results

A total of 147 participants (78%) completed the survey from various E-CRM courses.

Key findings are summarized in Tables 3 and 4, presented by both service type and profession.

The majority profile was a physician aged 36–45, working in a hospital ED, with more than 15 years of experience (Table 2).

Nurses accounted for 20.4% of the sample, followed by EMTs (TES) with 5.4%, and other professions (1.4%).

The most relevant findings, summarized in Tables 3 and 4, are divided according to hospital service, SUAP (Primary Care Emergency Service), SEM (Madrid Emergency Service), and HEMS (Helicopter Emergency Medical Service), as well as by profession.

Table 2. Characteristics of participants (N = 147)

	n (%)
Professional category	
Medicine	30 (20.4)
Nursing	108 (73.5)
Emergency Medical Technician (EMT)	8 (5.4)
Other	1 (7)
Age range	
25–35 years	20 (13.6)
35–45 years	62 (42.2)
45–55 years	43 (29.3)
56+ years	21 (14.3)
Prefer not to say	1 (7)
Gender	
Male	58 (39.5)
Female	89 (59.9)
Prefer not to say	1 (7)
Workplace	
Hospital	70 (47.6)
Ground Emergency Service	44 (29.9)
Air Emergency Service	3 (2)
Primary Care Emergency Service	28 (19)
Other	2 (1.4)
Years of experience in emergency care	
0–5 years	23 (15.6)
6–10 years	29 (19.7)
10–15 years	30 (20.4)
15–20 years	32 (21.8)
20–25 years	14 (9.5)
25–30 years	11 (7.5)
30–35 years	7 (4.8)
36+ years	1 (7)

Discussion

The E-CRM-SEMES course identifies 15 key points (Table 1) related to what is known as the "human factor" which represents the most common source of error in our field. During the course, participants—guided by qualified simulation instructors and facilitators—discover the importance of each of these points, becoming aware of what is happening around them and gradually proposing solutions to integrate into their daily practice.

Most physicians attending the course showed strong interest in recognizing their own limitations and, therefore, in knowing the appropriate moment to ask for help. This is a key element of teamwork, where trust in expressing one's limitations fosters effective task performance.[17,18]

Nurses and EMTs (TES), on the other hand, emphasized the way they gave and received suggestions from other participants. Active listening is crucial to understanding proposed ideas,[19] and there is a positive relationship between active listening and team commitment.[20]

In our study, hospital-based professionals noted that after completing the training, they were more receptive to input from others—even from different professional categories. The communication technique known as "Constructive Intervention" is based on respect, encouraging participants to speak up or act when they notice a colleague making a mistake, regardless of their role or hierarchy.[21] Having the courage and confidence to correct a more senior or experienced colleague, always respectfully

Table 3. Most relevant results by profession

Profession/Category	Total N = 147 n (%)	% of Variance
Request for help		
Medicine: – Assess their limitations – Define situations in which to ask for help	Med: 76 (51.7) Nur: 16 (10.8) TES: 1 (0.68)	Med: 70.3 TES: 12.5 Nur: 53.3
Nursing: – Listen to suggestions – Assess their limitations	Med: 16 (10.8) Nur: 17 (11.51) TES: 1 (0.68)	Med: 14.8 Nur: 56.6 TES: 12.5
Emergency Medical Technician (EMT): – Listen to suggestions	Med: 3 (2.0) TES: 7 (4.7) Nur: 5 (3.4)	Med: 2.7 Nur: 16.6 TES: 87.5
Role/Task clarity		
All professions: – Emphasis on role clarity – Confirmation of assigned task – Respect for team members and their work – Importance of teamwork	Med: 98 (66.6) Nur: 23 (15.6) TES: 6 (4.08)	Med: 90.7 Nur: 76.6 TES: 75
Effective communication		
Medicine and Nursing: – Active listening – Paraphrasing to confirm understanding	Med: 69 (46.9) Nur: 22 (14.9) TES: 2 (1.36)	Med: 63.8 Nur: 73.3 TES: 25
Emergency Medical Technician (EMT): – Active listening	Med: 49 (33.33) Nur: 12 (8.2%) TES: 6 (4.08%)	Med: 45.3 Nur: 40 TES:75
Resource utilization		
Medicine and EMT: – Know the team they will work with – Know the competencies of team members	Med: 76 (51.7) Nur: 12 (8.16) TES: 8 (5.44)	Med: 70.3 Nur: 40 TES: 100
Nursing: – Use of mobile apps with protocols	Med: 45 (30.6) Nur: 27 (18.3) TES: 4 (2.72)	Med: 41.6 Nur: 90 TES: 50
Global assessment		
Medicine: – Assess the priority at each moment	Med: 63 (42.8) Nur: 12 (8.16) TES: 3 (2.04)	Med: 58.3 Nur: 40 TES: 37.5
Nursing: – Assess the overall situation, not only what concerns them – Avoid engaging in tasks outside their competence	Med: 45 (30.6) Nur: 26 (17.6) TES: 2 (1.36)	Med: 41.6 Nur: 86.6 TES: 25
Emergency Medical Technician (EMT): – Reassess the situation – Check whether the team shares the same mental model	Med: 18 (12.2) Nur: 6 (4.08) TES: 6 (4.08)	Med: 16.6 Nur: 20 TES: 75

Med: Medicine; Nur: Nursing; TES: Emergency Medical Technician.

Table 4. Results by service where participants work

Servicio	Total N = 147 n (%)	% de la varianza
Request for help		
Hospital and SEM: – Assess their limitations – Listen to suggestions	Hospital: 25 (17) SEM: 10 (6.8) HEMS: 0 SUAP: 6 (4.08)	Hospital: 35.7 SEM: 33.33 HEMS: 0 SUAP: 13.6
HEMS: – Use checklists	Hospital: 0 SEM: 1 (0.68) HEMS: 3 (2.04) SUAP: 0	Hospital: 0 SEM: 2.27 HEMS: 100 SUAP: 0
SUAP: – Listen to suggestions – Assess their limitations	Hospital: 0 SEM: 1 (2.27) HEMS: 0 SUAP: 3 (10.71)	Hospital: 0 SEM: 0.6802 HEMS: 0 SUAP: 2.040
Role/Task clarity		
Hospital and SUAP: – Importance of teamwork – Respect for team members and their work – Emphasis on role clarity	Hospital: 52 (35.3) SEM: 12 (8.16) HEMS: 1 (0.68) SUAP: 20 (13.6)	Hospital: 74.2 SEM: 27.27 HEMS: 33.33 SUAP: 71.4
SEM and HEMS: In addition to the above: – Confirmation of the assigned task	Hospital: 23 (15.6) SEM: 23 (15.6) HEMS: 3 (100) SUAP: 10 (6.8)	Hospital: 32.8 SEM: 52.2 HEMS: 100 SUAP: 35.7
Effective communication		
Hospital: – Active listening – Paraphrasing to confirm understanding	Hospital: 65 (44.21) SEM: 20 (13.6) HEMS: 1 (0.68) SUAP: 12 (8.1%)	Hospital: 92.8 SEM: 45.45 HEMS: 66.6 SUAP: 42.8
Out-of-hospital (SEM / HEMS / SUAP): – Active listening	Hospital: 25 (17) SEM: 40 (27.2) HEMS: 3 (100) SUAP: 20 (13.6)	Hospital: 35.7 SEM: 90.9 HEMS: 100 SUAP: 71.4
Resource utilization		
Hospital, HEMS, and SEM: – Know the team they will work with – Know the competencies of team members – Use mobile apps with protocols	Hospital: 53 (36.05) SEM: 29 (19.7) HEMS: 2 (1.36) SUAP: 9 (6.12)	Hospital: 75.7 SEM: 65.9 HEMS: 66.6 SUAP: 32.1
SUAP: – Know the team they will work with – Check the materials they will use – Know the competencies of team members	Hospital: 12 (8.16) SEM: 18 (12.2) HEMS: 1 (0.68) SUAP: 19 (12.9)	Hospital: 17.1 SEM: 40.9 HEMS: 33.3 SUAP: 67.8
Global assessment		
Hospital: – Assess the priority at each moment	Hospital: 60 (40.8) SEM: 20 (13.6) HEMS: 1 (0.68) SUAP: 12 (8.16)	Hospital: 85.7 SEM: 45.45 HEMS:3 3.33 SUAP: 42.8
HEMS / SEM: – Plan their work with the team – Listen to and consider suggestions from team members	Hospital: 6 (4.08) SEM: 22 (14.9) HEMS: 2 (1.36) SUAP: 2 (1.36)	Hospital: 8.57 SEM: 50 HEMS: 66.6
SUAP: – Listen to and consider suggestions from team members – Assess the priority at each moment	Hospital: 4 (2.72) SEM: 0 HEMS: 0 SUAP: 14 (9.52)	Hospital: 5.71 SEM: 0 HEMS: 0 SUAP: 50

SEM: Ground Emergency Service; HEMS: Air Emergency Service; SUAP: Primary Care Emergency Service.

and tactfully, lies at the core of assertive communication—a skill we must all support and encourage, because what truly matters is the patient. This requires overcoming barriers and "naming the elephant in the room",[22,24] as the saying goes.[23]

Training in E-CRM has shown improvements in participants' ability to perform cross-checks during cardiopulmonary resuscitation (CPR).[24] In our study, all professionals reported incorporating cross-checks into their routine practice during crisis situations.

About 37.4% of participants reported an increase in the use of medical apps in their daily work, reinforcing patient safety, as demonstrated in former studies[25]—for example, reducing medication administration errors in pediatric resuscitation.[26] These tools also enhance non-technical skills by reducing stress levels during crisis interventions.[27] Apps have been shown to support task distribution and team coordination.[28] Our participants demonstrated a stronger inclination to know their team members and their roles. According to Hopkins,[29] survival in cardiac arrest is higher when tasks are properly distributed, which aligns with CRM principles.

E-CRM trains participants through simulation-based scenarios in decision-making and prioritization, and post-course evaluations confirmed that learners became more attentive to priorities during decision-making. This is a positive change, as clear team goals and well-defined priorities are fundamental in emergency care.[30] This promotes efficient, rational, and ethical resource allocation,[31] helping to prevent cognitive fixation errors—when individuals or teams focus on one aspect of a situation while ignoring more critical information.

One notable finding from the survey was that EMTs reassessed situations to confirm shared mental models within their teams. This promotes stronger engagement in evaluating priorities.[32]

Among EMS professionals, a key change in routine practice was the implementation of cross-checks, a process endorsed by the World Health Organization (WHO) to ensure safe medication administration.[33] Despite ongoing efforts, many health care professionals still fail to apply this systematically—particularly when calculating dilutions or confirming drug-patient correspondence—which could substantially reduce medication error rates.[34]

The number of in-hospital deaths due to preventable errors in the United States ranges from 98,000 per year (as reported in To Err Is Human[35]) to more than 400,000 deaths annually, according to James[36]—equivalent to 2 passenger planes crashing every 24 hours. James categorized medical errors into 5 types: commission, omission, communication, context, and diagnostic errors. While many arise from a lack of knowledge or skill, the human factor is a major contributing element—estimated to be involved in 80–90% of adverse events, with leadership and communication being the main causes of sentinel events.[35] In Spain, the EVADUR study (2012), conducted by SEMES across 21 hospitals, identified latent risk conditions in EDs and established guidelines to enhance and promote patient safety. These focused on key risk areas: medication safety, infection prevention, communication improvement, and reduction of specific risks, as well as promotion of a safety culture.[37]

Therefore, both international and national studies highlight the importance of reporting and quantifying adverse events and of developing tools and barriers to mitigate them.

Error is inherent to human nature, and we must acknowledge that it will always accompany our decisions. E-CRM SEMES advocates the use of clinical simulation as a tool for change, in which experience and reflection[6] are used to explore the "why" behind actions that lead to certain outcomes. By examining participants' mental models and contrasting them with scientific evidence or the facilitator's model, we can develop tools to prevent future mistakes. In other words, we transform the errors[5] made during simulations into opportunities rather than punishments. From an ethical standpoint,[1] simulation ensures that a technique, treatment, or procedure is not tested for the first time on a real patient.

Although it has been shown that in aviation, crew resource management programs lead to positive behavioral and empowerment outcomes, such changes can take years to consolidate. In healthcare, we are still midway in establishing clinical simulation as a definitive tool for achieving concrete behavioral change among professionals.

Among this study's limitations, it should be noted that participants did not perform simulation scenarios with their actual work teams. However, during the debriefings, participants reflected on their real work environments, and the changes measured through the three-month follow-up survey were indeed applied in their real settings.

In conclusion, this study evaluated the outcomes of the E-CRM clinical simulation program, which achieved positive effects at Level 3 of the Kirkpatrick model[4]—that is, perceived behavioral change—supporting E-CRM training as a real and effective model for change.

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APPENDIX

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