

SPECIAL REPORTS

QUALITY IMPROVEMENT IN CRIME SCENE ACCESS TRAINING FOR EMS FIRST RESPONDERS

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ABSTRACT

This article evaluates the effectiveness of specialized training for Emergency Medical Services personnel (EMS) and first responders in managing crime scenes without compromising forensic integrity. EMS personnel involved in this study came from Italian pre-hospital services. They were involved in two distinct simulation-based events.

The authors adopted a multidisciplinary approach to develop an evaluation grid that highlights problems, risks, and opportunities for staff training. The authors analyzed case reports and historical cases to create scenarios. The authors emphasize the need for a standardized solution to equip a wide range of first responders to handle crime scenes. Additionally, a VR (Virtual Reality) solution was tested to educate students. The article identifies critical gaps in crime scene recognition, contamination prevention, and inter-agency communication when first responders lack dedicated preparation.

The primary findings concern EMS first responders' ability to recognize and manage potential crime scenes. Comparing two simulation cohorts – untrained crews and trained crews – correct scene recognition increased from 28.5% to 60%. Accurate notification to the Dispatch Center and timely law-enforcement request rose from 36% in untrained teams to 80% in trained teams. Evidence handling benefited as well. Teams that moved victims while preserving evidence increased from 25% to 76.6%. Correct egress from the scene – considered scenario-dependent – reached 80% in the suicide scenario, 60% in the sexual-assault scenario, and 20% in the domestic-violence scenario. Together, these results indicate that structured, multidisciplinary training strengthens scene recognition, inter-agency communication, and preservation of forensic integrity during EMS operations. Without proper training, EMS first responders are at risk of compromising crime scenes and safety. Structured programs that combine theory, simulation, and inter-agency collaboration could improve these aspects. Priority training areas include dispatch communication, safety, evidence handling, and documentation. This study lays the groundwork for standardized national protocols and advocates for expanded use of Virtual Reality (VR) training technologies.

Acronym	Definition
First Responder	An EMS provider - professional or volunteer - trained to provide basic life support and trauma management. Usually called "soccorritore" in Italy. first responders involved in the trainings came from Red Cross, ANPAS, and Misericordie as volunteers (Metelmann, C. et al., 2025).
Crime scene	Any location containing physical evidence that can help to reconstruct past activities related to a criminal act or event (Miller, 2002).
Contamination	The unwanted alteration of evidence that could affect the integrity of the original exhibit or the crime scene. This unwanted alteration of evidence can wipe away original evidence transfer, dilute a sample, or deposit misleading new materials onto an exhibit(Gehl & Plecas, 2016).
VR (Virtual Reality)	Virtual Reality is a three-dimensional, computer-generated simulated environment, which attempts to replicate real world or imaginary environments and interactions, thereby supporting work, education, recreation, and health (Abbas et al., 2023).
Ambulance Nurse	Nurses specialized in critical care or emergency care involved in the EMS. The nurses involved in this study are registered in the SIIET scientific society (Società Italiana Infermieri di Emergenza Territoriale) (Baldini et al., 2020).
Trauma and ALS Doctors	Doctors specialized in anesthesiology or emergency care are usually involved in EMS. The doctors involved in this study are registered in the HEMS Association society (Bulger et al., 2014).

Table 1. Definition of acronyms.

INTRODUCTION

Emergency medical interventions represent a critical phase in rescue operations. Good performance requires meticulous preparation, adequate training, extensive experience, and the proper use of equipment and medical devices. In Italy, EMS teams are often the first to arrive at the scene in cases of medical emergencies (Commissione Consultiva Permanente Stato-Regioni, 2018), including crime scenes. The foremost priority for any first responder (medical or technical) is to assist the victim through life-saving measures such as Basic Life Support-Defibrillation (BLSD) (Daibes et al., 2025) or hemorrhage control (Gehl & Plecas, 2017). The responsibility of providing life-saving care while navigating the complexities of a crime scene presents unique challenges. Emergency first responders may unintentionally compromise the site, potentially erasing or altering evidence vital to legal proceedings (Gomes, 2021). Furthermore, inadequate preparation for a criminal scenario can lead to various challenges, including safety risks. These risks include the presence of weapons and violent individuals, as well as the high likelihood of contamination/destruction of evidence.

Due to the complexity of such scenarios, adequate training should be mandatory. The authors propose a simple approach to the crime scene for EMS first responders, grounded in specific training and multidisciplinary guidelines. This quality improvement article aims to suggest a standardized training schema on this topic.

The authors defined four scenario types to test First Responder capabilities. The training missions' focus has been on sexual assault, domestic violence, suicide, and disputes with injuries. The authors organized the assessment into five major domains: arrival on scene; recognition of a potential crime scene; movement of victims/objects; exit from the scene; and notification/reporting to law enforcement. Across these domains, we specified 20 item-level criteria and applied a simplified three-point scale (0 = not performed; 1 = performed; 2 = performed with risk anticipation) to quantify intervention effectiveness with respect to preserving the crime scene.

We developed an evaluation procedure following a scientific approach, even considering the lack of literature in emergency medicine and forensic sciences (Gunshin et al., 2020).

The authors highlighted the absence of a common pattern for practical instruction to improve access at crime scenes.

This quality improvement article aims to demonstrate the need for harmonized goals, to provide immediate medical care, and to preserve forensic evidence. In January 2023, the multi-professional group involved in this project began approaching the topic by designing a real-scale simulation training. Collaboration also facilitated the evaluation of alternative methods that enhance evidence preservation without compromising the distinct objectives of medical intervention (Figure 1).

This experience and the present article aim to serve the EMS community. The authors hope that the delicate aspect of training will find an appropriate place within interdisciplinarity through the application of generally accepted rules and procedures, distancing education from any form of self-referential approach.



Figure 1. Final group participating in crime scene training.

BACKGROUND

EMS first responders must be aware of the needs of a crime scene. To rescue and preserve the victim's health, these needs must be appropriately recognized and managed by the EMS first responders. The best way forward was collaboration between healthcare workers and law enforcement officers to define a single, shared course of action (Hayes, 2000). According to studies published in 2023 by the Institute for Economics and Pace, Italy ranks 32nd (out of 163 countries in the world) for safety and security (Imbriaco et al., 2025).

At first glance, emergency rescue procedures and crime scene preservation may seem irreconcilable: EMS operates with different objectives (International Coaching Federa-

tion, 2024) than Law Enforcement and Scientific Police Departments (James et al., 2014). However, alternative methods, modalities, and procedures that do not detract from the distinctiveness of rescue while still favoring the proper preservation or documentation of important evidence that will be subsequently handled and analyzed by forensic experts (Khan & Amyotte, 2004).

The frequency with which health and safety personnel find themselves operating in violent crime scenarios before law enforcement arrives is the starting point of the training organized by the authors of this article. In Italy, EMS first responders are present at the crime scene long before law enforcement arrives, who are often mobilized after the Medical Emergency crew departs (Noor et al., 2024). Therefore, it is difficult for EMS responders to determine whether they are dealing with a criminal event. Contributing factors to crime scene recognition are related to:

- knowledge of the situation by the caller;
- accuracy of information gathered by dispatch (Presidenza della Repubblica, 1992);
- EMS responders' ability to find and share information gathered appropriately on scene.

The greatest risk of intervening at a potential crime scene without adequate information concerns the safety of responders, bystanders, and the scene itself (Repetto et al., 1998).

Acting carelessly on a crime scene can modify it and potentially lead to the loss of information needed to identify the perpetrator. Having examined the meager literature on the subject and found that there are no standard guidelines for managing medical intervention at crime scenes in Italy (Sacco et al., 2024), the decision was made to conduct a specific test. Our article aims to investigate the most suitable techniques for approaching crime scenes to propose a qualitative improvement in training courses.

EMERGENCY SYSTEM ACTIVATION PHASE

Dispatchers' training is not part of this study, but it is important to note that, in the case of a crime scene, early recognition of an abnormal situation is crucial. Calling the unified emergency number (NUE112) usually triggers the activation of several entities that will operate concurrently at the event scene. Starting from a forensic perspective, crime scene intervention consists of two phases: first response and crime scene investigation activity. In Italy, ambulances often arrive at the target more quickly than other forces (Noor et al., 2024). To achieve these goals, the dispatcher must be aware of the mission's dynamics and, above all, remain open-minded enough to consider and recognize the need for multi-role activation.

RESPONSIBILITIES OF RESPONDERS AT THE SCENE OF THE CRIME

The first rule that medical first responders must follow concerns their own safety but the second concerns the medical rescue of the victim (Noor et al., 2024). Rescue maneuvers need to be proportional to the gravity of the situation and carried out as quickly as possible, especially when the injuries could result in life-threatening harm. Law enforcement is responsible – as soon as they reach the scene – for ensuring the protection of those present. Then, law enforcement is responsible for “bounding the scene, identifying those present, and taking into custody any material evidence” (Sharma, 2003).

Emergency medical personnel have an obligation to report any information they learn during a rescue. First responders must alert the operations center about the need for law enforcement. This task can also be supported by technology, with video footage and/or photographs (Repetto et al., 1998). As already mentioned, with the current organization of emergency systems for criminal events, the arrival at the scene of the crime generally happens in the following order:

1. BLS healthcare team (EMS ambulance response called “first responders” who can perform BLSD (Soar et al., 2022) and Trauma management (UN International Drug Control Programme, 2009).
2. Law enforcement (Carabinieri or Polizia di Stato)
3. Technical and/or advanced medical rescue crews (ALS medical response unit)

This occurs due to the distribution of operators, services, and ambulances in the area. In most cases, the first public service officer on the scene is, therefore, the BLS healthcare ambulance (Noor et al., 2024).

DESCRIPTION

In January 2023 the authors decided to conduct a simulation test to evaluate first responders' knowledge and competence in operating at a crime scene. The first training test was held in Borgotaro in June 2023 during the first responders exercise called “Tre Confini”. On that occasion, first responders did not receive specific training.

After the first training, the authors organized an extended second session in Salsomaggiore in December 2023. The EMS first responders who attended the session followed a training session with the Italian Forensic specialist from the Scientific Investigation Department of Carabinieri. During the lessons, authors adopted coaching education solutions, which the International Coaching Federation recognizes as optimal for content learning and fostering personal awareness and responsibility to improve performance (United Nations Office on Drugs and Crime, 2013). After the training, the authors compared the teams' approaches to the crime scene.

In June 2023, during the rescue exercise in Borgotaro (Figure 2), 15 EMS crews faced a scenario with criminal activities, taking inspiration from a real case. The reconstructed scene involved an argument between two acquaintances. The initial dispatch intentionally did not warn the crews that they would encounter a crime scene. This was done to assess the rescuers' ability to recognize the main elements of such a scenario. The objectives of the crews onsite were to:

- identify the elements that mark the event as a “crime scene”;
- alert the operations center appropriately regarding the situation;
- move the patient without contaminating the crime scene;
- correctly perform first aid to the victim;
- preserve the items at the crime scene correctly.

Out of 15 participating teams, 14 were included in the data collection. One team was excluded due to specific request of the team.

In December 2023 in Salsomaggiore Terme, five EMS crews were invited to participate in a crime scene exercise. This exercise was preceded by six online lectures by the Car-



Figure 2. Crime scene assessment in Borgotaro.

abinieri RIS of Parma on the main topics related to the crime scene, as well as a briefing lesson on the scene topics.

Crews were then administered 3 different simulation scenarios where crimes had been committed and one virtual simulation scenario, replicating the Borgotaro simulation with VR 360 technology. In both cases – Borgotaro and Salsomaggiore - it was possible to create high fidelity simulation cases with a crime scene using actors (from the Italian Red Cross of Parma and ANAPS Emilia-Romagna) following rules of high-fidelity simulation drill in EMS (Tartaglione et al., 2022) (Figure 4).



Figure 3. Training with the RIS in Salsomaggiore.

From this point, the evaluation assessed the rescuers' ability to identify the key elements of the crime scenario as quickly as possible. The objectives of the crews onsite were the same for both the exercises. All five participating teams in Salsomaggiore were included in the data collection. The crime scene scenarios created in Salsomaggiore's cases were:

- sexual assault
- domestic violence
- suicide
- disputes with injuries (crime scene performed in VR setting)

METHODS

The authors created an evaluation grid with elements that evaluated the approaches taken by the teams when facing a crime scene. The first groups of first responders did not receive specific training. The second group of first responders attended a specific course led by an Italian Forensic specialist from the Scientific Investigation Department of the Carabinieri (RIS).

The evaluation grid includes the following main topics and sub-topics:

- Arrival on scene:
 - appropriate PPE use
 - identification of people involved
 - assessment of the need for law enforcement
- Evaluation of a potential crime scene:
 - identification of evidence/visible weapons
 - warning Dispatch Center of a potential crime scene
 - define a standard entry route
 - assessing the victim without tampering with evidence
 - coordination between rescuers
 - moving the victim without contaminating the evidence
- Moving the victim:
 - preemptive scene recording
 - preemptive weapon removal
 - warning/update Dispatch Center on the situation
 - safeguarding evidence on the victim's clothing
 - victim transfer on the stretchers (log-roll or other maneuvers)
- Leaving the scene:
 - assessment of post-intervention scene changes
 - recovery of materials used
 - stretcher exit on standard entry route
- Providing information to law enforcement:
 - description of initial scene
 - report on actions taken and evidence present



Figure 4. Management of relatives during domestic violence scenario.

- description of witness behavior and statements

To evaluate the performance of individual rescue teams, the authors developed a unique table with three possible assessments: Action not performed (vote: 0), action performed (Vote: 1), and action performed with risk anticipation (Vote: 2). Despite the lack of specific training in the first group, there was minimal tolerance for delayed implementation of actions.

After the training, the authors compared access to the crime scene results in a single table to create a visual output of the main action that requires further improvements.



Figure 5. Correct movement of the suicide victim.

RESULTS

The crew performance evaluation was conducted on the scene through a visual check of the activity. authors played the role of referees during the examination, using the standard structure of a real scale simulation. In the following results, the first scenario (EMS crew with no training before the exercise) is called Borgotaro. The second scenario (EMS crew with training before and after the exercise) is called Salsomaggiore.

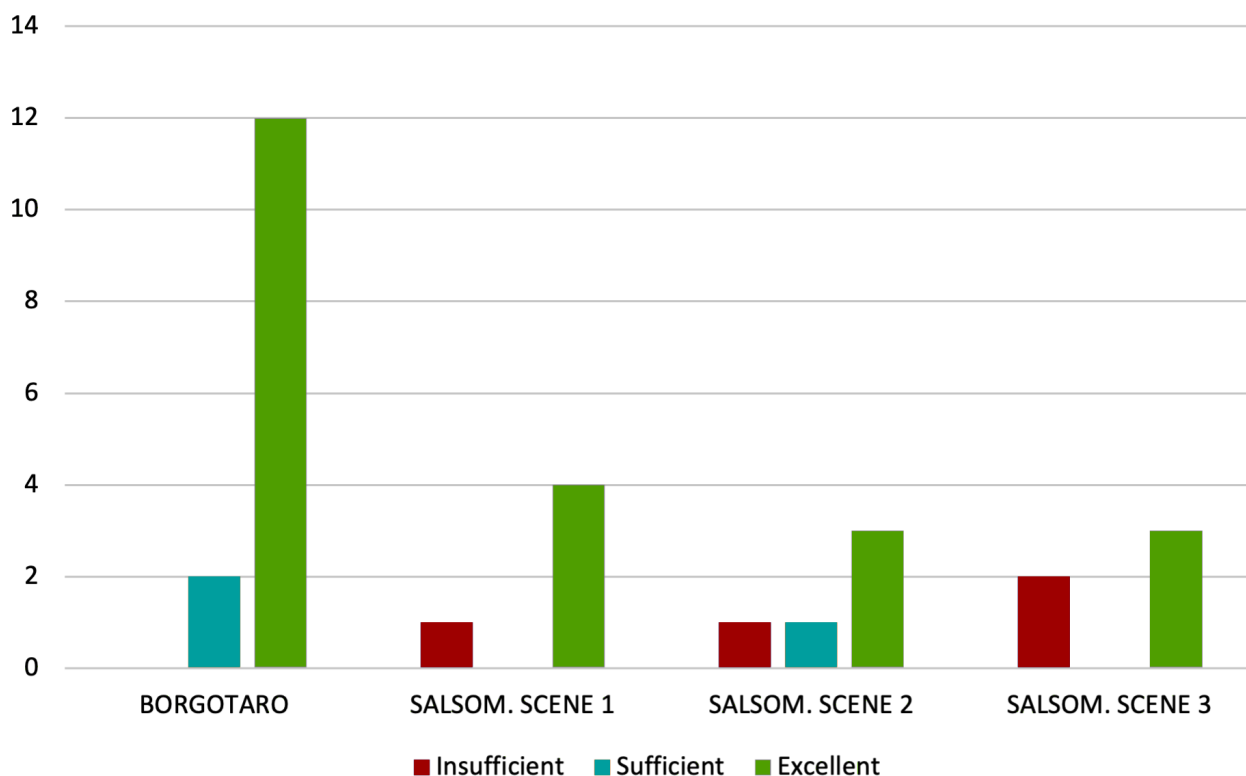


Figure 6. Identification of people involved.

ARRIVAL AT THE CRIME SCENE AND RECOGNITION OF THE CRIME SCENE

See Figure 6. Crews showed competence in identifying individuals present and using appropriate protective PPE. However, differences were observed in their ability to assess the crime scene risk. In Borgotaro, 28.5% of crews demonstrated proper access to the crime scene, whereas in Salsomaggiore, this figure increased to at least 60%.

COMMUNICATION WITH DISPATCH CENTER AND NOTIFICATION OF LAW ENFORCEMENT NEEDS

See Figure 7. 36% of the crews in Borgotaro had good communication with the Operations Center, while 28% had sufficient communication, and another 36% had poor communication. In Salsomaggiore, sexual harassment and suicide reach more than 80% of correct communication with the dispatch center. The domestic violence scenario was not included due to the presence of a law enforcement person close to the scene.

REDUCING CONTAMINATION OF THE CRIME SCENE

See Figure 8. In Borgotaro, 42.8% of the crews correctly assessed the crime scene, using a common entry-exit route to the scene. In Salsomaggiore the mean value was 73%. In Borgotaro, 64.2% of the crews assessed the victim without manipulating evidence or took pictures of the scene at arrival, while 80% of the crews in Salsomaggiore performed correctly. In Borgotaro, 25% of the crews moved the victim while preserving evidence at the scene. This value is 76.6% in Salsomaggiore.

BEHAVIOR ON LEAVING

See Figure 9. The behavior of crews observed by the authors when leaving the crime scene is complex but important information. It means:

- correct assessment of post-intervention changes
- scene recovery of materials used (managing contamination)
- exit from the scene on the previous route

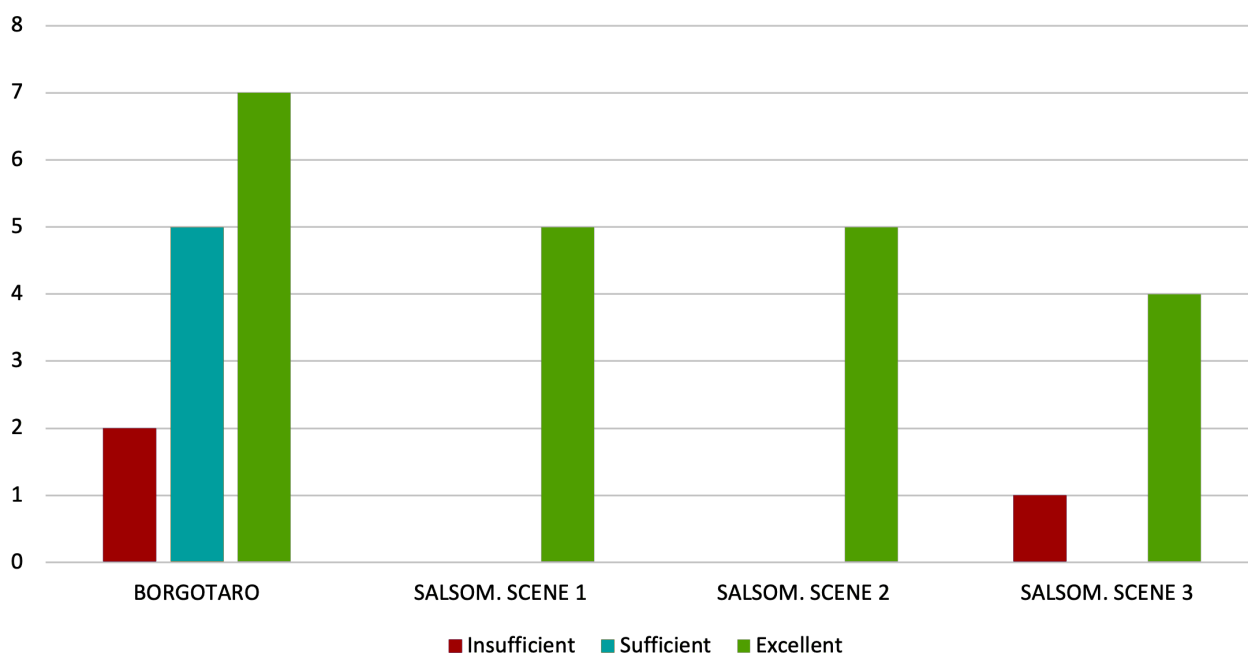


Figure 7. Warning dispatch of potential crime scenes.

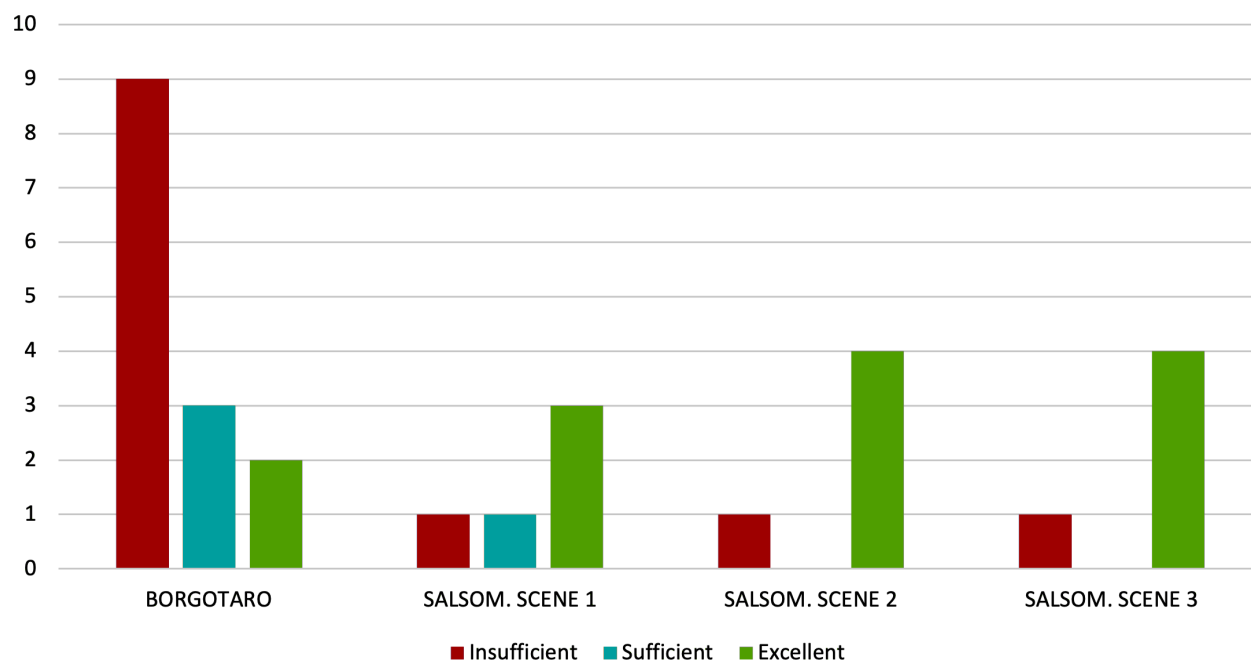


Figure 8. Reducing contamination of the crime scene.

Evaluation in Borgotaro was insufficient in 43% of the cases. In Salsomaggiore, the situation changed for each scenario. In domestic violence cases, 20% of the crews preserved the material correctly, without contamination or safety concerns. In suicide scenarios, 80% of participants left the scene correctly. In outdoor sexual assault scenarios, that percentage dropped to 60%.

LEARNING AND EVALUATION OF POST-INTERVENTION CHANGES

See Figure 10. Among the activities monitored, evaluating behaviors greatly interested the study group. According to the instructions, photographs of the crime scene could be

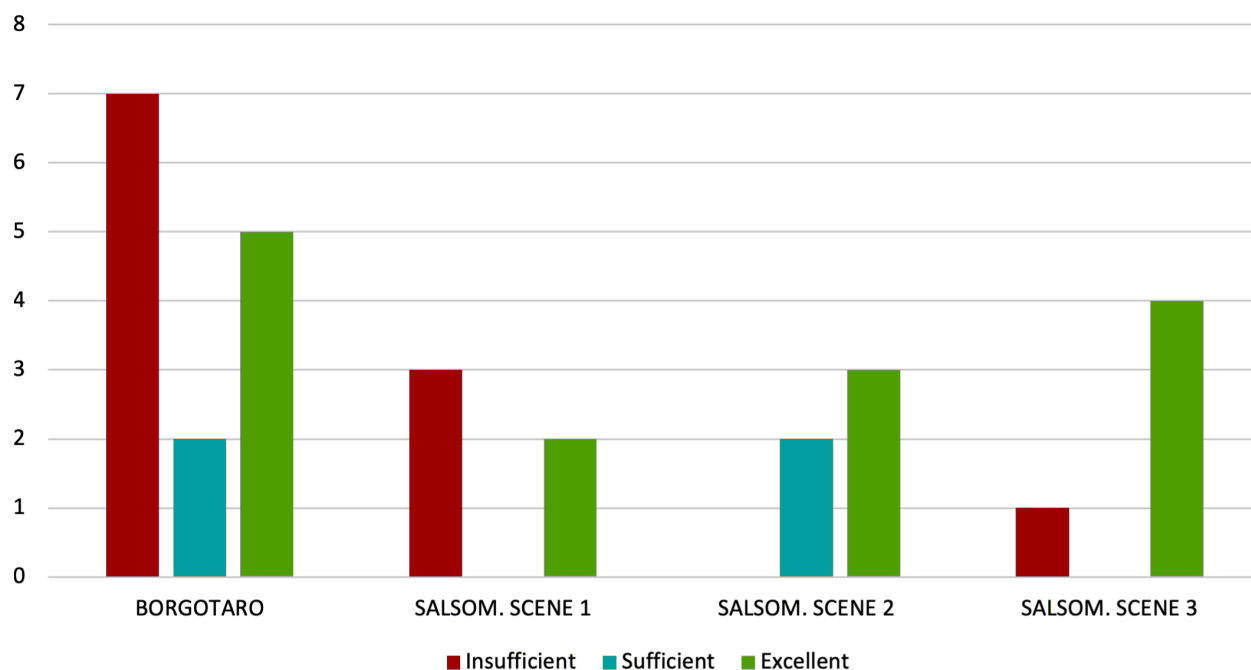


Figure 9. Safeguarding evidence on victim.

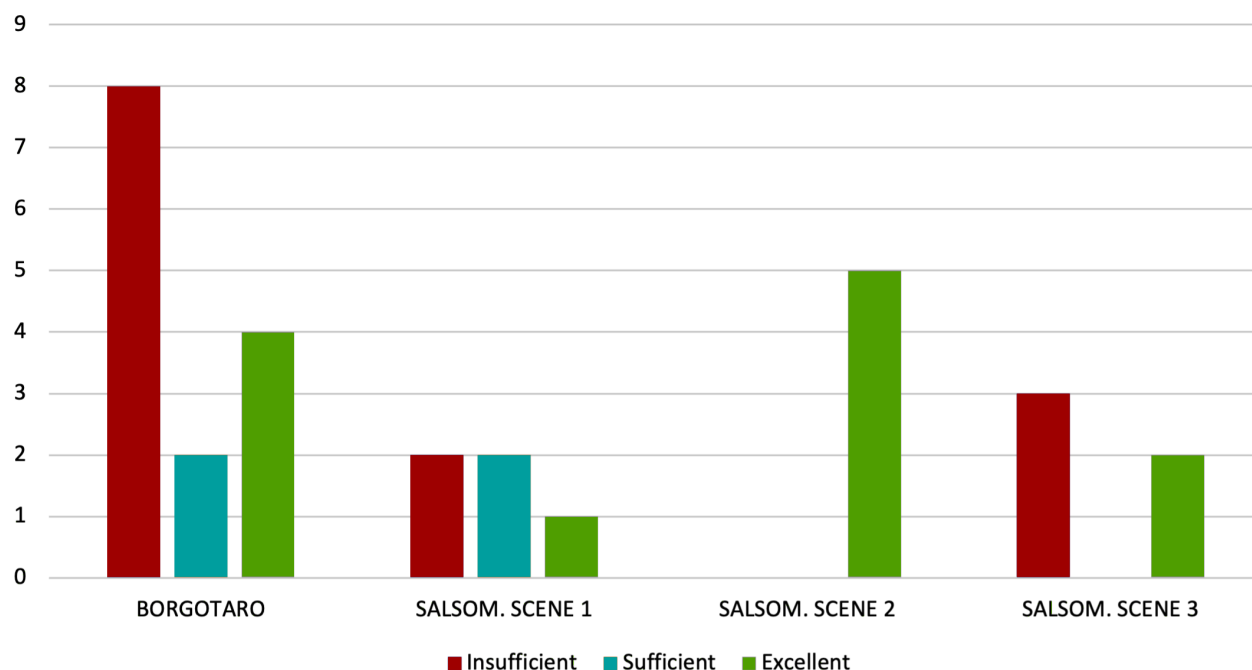


Figure 10. Correct assessment of post-intervention changes.

taken (Repetto et al., 1998). In Borgotaro, seven (50%) teams involved did not take photos, two (14%) teams took photos after making contamination, and four (28.5%) teams took pictures before entering the scene. One team was not rated on the topic as they pointed out the presence of highly restrictive privacy protocols. In Salsomaggiore, 60% of the teams took pictures correctly.

POST-TRAINING: ANALYSIS OF ERRORS AND LESSONS LEARNED

At the end of the Salsomaggiore activity, all 27 participating rescuers compiled a satisfaction survey. Data analysis of the multiple-choice questionnaire administered to the trainees shows the outcomes. 96.3% had a correct response rate of 70% or higher. Only 3.7% of the students made more than three errors and did not reach the target.

CONCLUSION

The complexity and challenges of keeping a potential crime scene intact during rescue operations are multiple. The exercise organized by the authors identifies key stressor points. Scenarios involving confrontational bystanders and unidirectional access routes are the main difficulty for EMS first responders. Analysis and discussion suggest that EMS first responders could threaten both the safety of responders, of the victims, and the integrity of crime scenes. Common errors observed during simulations - including improper handling of witnesses, contamination of evidence, and unsafe practices - highlight the need for targeted improvements in training and protocols. This article suggests that the EMS community must define an integrated approach to potential crime scenes for first responders. It establishes the necessity of shared, standardized procedures and protocols to address the identified gaps, from the dispatch center through communication with the forensic team. Training that combines theoretical instruction with practical, scenario-based exercises has proven to be efficient. Confrontation and real scenarios enable participants to develop the skills required for complex, high-stakes environments.

Crime scene operations are inherently stressful, demanding a balance between providing life-saving care and preserving forensic evidence. The importance of comprehensive training programs and the implementation of unified national protocols cannot be overstated. Even though the number of training sessions analyzed is limited, the critical need to improve communication skills emerged - both within rescue teams and between first responders and the Dispatch Center. Communication is a key factor to enhance decision-making and situational awareness (van Dijk et al., 2019).

It is also interesting to analyze the approach of the EMS crew to simulation using VR scenarios. The software presented by the authors represents the crime scenario based on footage recorded during the Borgotaro session. All the first responders played that scenario and appreciated the VR solution. The use of innovative tools, such as VR360 technology, demonstrated significant potential to advance training methods by enabling realistic, repeatable practice scenarios. Given the high resource demands of traditional training setups, VR should play a central role in future educational strategies. Finally, this qualitative improvement article highlights five priority areas for training development:

- strengthening communication between Dispatch Centers and first responders;
- enhancing team coordination during crime scene interventions;
- improving safety management and the handling of agitated individuals;
- establishing protocols for evidence preservation;
- ensuring accurate and detailed documentation of interventions, including the use of photographic and video evidence where appropriate.

By addressing these areas, EMS first responders could reduce critical errors and safeguard the integrity of legal proceedings. This experience lays the groundwork for a more structured approach to crime scene management by EMS teams. Ultimately, this contributes to enhancing the quality of care and pursuing justice.

What additional actions could be considered? After this experience, the authors are wondering what could improve education and safety in a crime scenario. There are many options we would like to suggest working on:

- implement a mandatory national training cascade model (Vannucci & Kras, 2013) on the crime scene for EMS first responders.
- build a database of standard scenarios, to offer a realistic and defined training, with pre-defined complexity, to better face risk and needs of crime scenarios.
- Build a practical guide for EMS first responders created and updated by law enforcement, lawyers, and prosecutors (James et al., 2014) .

LIMITATIONS

The authors acknowledge the limitations of the data collected in this article. The purpose of the paper is not to conduct a validated scientific study, but rather to identify and suggest the most critical areas for future investment. The authors also acknowledge the lack of in-depth analysis of communication within the crew operations center. Future work should also include an analysis of this type of communication.

Regarding methodology, they acknowledge that crews' approaches to crime scenes varied because some data were collected with untrained responders and others with responders who received training just a few hours beforehand. It would be appropriate

and necessary to reevaluate the various working groups at least six months after training. Another challenge in the study is harmonizing medical and forensic terminology, which can sometimes lead to misunderstandings. However, we are confident that the use of realistic simulations helps first responders stay focused on their primary role: saving lives, not collecting evidence.

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