

The first Urban Search and Rescue (USAR) Tuscany mission for the earthquake in Turkey: the perception of the work of a mixed team and nursing care provided directly under the rubble in the red zone

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ABSTRACT

Introduction: the study focuses on emergency response in urban settings, with particular attention to integrating Firefighters and Medical Components into a single team, known as USAR (Urban Search and Rescue). After the team's training in Tuscany, there was an opportunity to apply the skills acquired during the earthquake in Turkey in February 2023.

Materials and Methods: a specific questionnaire was used to assess the perception of work within a multidisciplinary team and the benefits of advanced healthcare in rescuing people trapped under rubble. Additionally, the questionnaire investigated the need for improvements after the first experience of the Tuscan USAR team in Turkey.

Results: the results of the study highlighted the importance of the role of nurses within the USAR team and the psychological support provided during stressful and uncertain situations. Furthermore, the group benefited from the communication skills of emergency nurses, which contributed to concentration and efficiency. It was also observed that less experienced members of the team showed a greater predisposition to burnout syndrome, emphasizing the importance of ongoing training and skill development.

Conclusions: In conclusion, the healthcare operator with USAR training was considered crucial in rescuing people trapped under rubble. However, deficiencies in the preparation of the USAR team and the need for further training to address extreme scenarios emerged. Additionally, psychological support and non-technical skills of emergency nurses were found to be fundamental.

Key words: Urban Search and Rescue (USAR), Turkey, earthquake, emergency nurse, non-technical skills in emergency.

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Introduction

On February 6, 2023, a devastating earthquake measuring 7.8 and 7.6 on the Richter scale struck Turkey and the surrounding areas, causing more than 57,000 confirmed deaths and over 121,000 injuries.^{1,2} This event led to the need for a coordinated international response, involving the deployment of Urban Search and Rescue teams for rescue and recovery operations, as well as the intervention of the United Nations (UN), the Red Cross, and various Non-Governmental Organizations (NGOs) for the management of humanitarian aid.

In this context, the Tuscan USAR (Urban Search and Rescue) team operated for the first time only two months after completing its training program, contributing to rescue operations and demonstrating the importance of an integrated and multidisciplinary approach to emergency management. The USAR team is composed of technical personnel from the Fire Brigade and health care professionals, including nurses and physicians, who cooperate by combining their skills in rescue, recovery, and medical support for missing persons following explosions or earthquakes in urban environments.^{3,4} The USAR system is divided into three operational levels—USAR Light, Medium, and Heavy—each with specific capabilities and resources to respond to different types of structural collapses and disasters.⁴

The concept of USAR originated in the United States in the 1980s, developing as an organized and specialized response to address urban collapse scenarios and natural disasters.⁴ In Italy, the USAR system has been structured in accordance with the international INSARAG (International Search and Rescue Advisory Group) guidelines, which define operational standards and classifications based on response capacity, and it was officially recognized and registered in 2018.^{5,6} The Tuscan USAR team, in particular, was established through an agreement between the Tuscany Regional Directorate of the Fire Brigade and the Tuscany Regional Authority, initiating a collaboration aimed at promoting the integration of the technical and health care components.³ This development followed the adoption of European and international directives for the creation of the team. In Italy, as in other recognized countries, the USAR system is divided into three levels: USAR Light, USAR Medium, and USAR Heavy. USAR Light is designed for rescue operations in less complex scenarios, with limited resources and a focus on rapid interventions. USAR Medium is equipped to manage more complex situations, with greater resource capacity and personnel trained for prolonged operations. USAR Heavy represents the most advanced level, with the capability to respond to complex and prolonged collapse scenarios, requiring a wide range of equipment and specialized skills.⁵

The national and Tuscan USAR system is designed to operate in complex emergency scenarios, with the aim of providing rapid and effective rescue. The team's tasks include searching for and rescuing people trapped under rubble, managing rescue operations in hazardous environments, and providing medical support to victims. USAR personnel undergo rigorous training, which includes instruction in search and rescue techniques, the use of specialized equipment, and the management of medical emergencies. The main objectives of the USAR team are to improve the quality of care provided to victims, increase operator safety, and optimize the effectiveness of rescue operations.⁷

The international literature on the work of USAR teams is mainly focused on the integration of technologies, both during simulation phases and operational activities, aimed at supporting and optimizing the work of professionals.^{7,8}

The literature landscape is limited with regard to research articles on the Italian USAR team, as it was established more recently

compared to other international teams. It is therefore considered necessary to further investigate the role and work of these professionals in order to obtain relevant data from their lived experience, given the unique contexts in which they operate, with the aim of supporting the continuous development and improvement of these roles within a framework of continuous quality improvement. For the reasons outlined above, a qualitative approach was chosen to analyze the experiences of the Tuscan Urban Search and Rescue team during the earthquake in Turkey, through the lived experience of each team member, seeking to understand individual professionals' perceptions regarding the value of an integrated and cohesive approach among different roles in a non-routine, high-stress working context.

Objectives and aims

The study aims to explore the experiences of the Italian USAR team during the earthquake in Turkey, focusing on the integration of technical and medical components within the team. It seeks to understand the roles, challenges, and contributions of medical personnel in disaster scenarios and to assess the effectiveness of interdisciplinary collaboration in improving rescue operations.

Materials and Methods

The study adopted a qualitative phenomenological approach and was conducted between July 1 and September 30, 2023. Data were collected using a specifically designed questionnaire consisting of both closed- and open-ended questions, allowing the collection of quantitative and qualitative data. Qualitative analysis was performed by two independent evaluators using a blinded methodology to ensure objectivity and validity.

Ethical considerations

The study was conducted with institutional approval, ensuring confidentiality and voluntary participation. Participants were informed of their right to withdraw at any time without consequences. Data were anonymized to protect participants' identities.

Participants and Settings

The study involved 17 participants: 5 health care professionals (1 physician and 4 nurses) and 12 firefighters, all with USAR Medium training and all deployed in the rescue mission in Turkey. The sample was predominantly male (88.2%), with a substantial proportion having more than 10 years of professional experience. The response rate was 100%.

Data analysis

Data analysis used descriptive statistical methods for quantitative data through SPSS software and qualitative content analysis for open-ended responses using QCAmap software. The analysis focused on identifying key themes and patterns in participants' experiences and perceptions.

Results

Data analysis provided an in-depth understanding of the experiences and perceptions of members of the Italian USAR team during the rescue mission in Turkey. The results were divided into several key categories, each highlighting crucial aspects of the intervention and the integration between technical and health care components.

Characteristics of the interviewed population

The study sample consisted of 17 participants, including 5 health care professionals (1 physician and 4 nurses) and 12 firefighters. The gender distribution was predominantly male, with 88.2% men and 11.8% women. Participants' age was mainly concentrated in the 41–50 year range (47.1%) and 51–60 year range (29.4%). In addition, 82.4% of participants had more than 10 years of professional experience, indicating a high level of competence and preparedness.

Inter-rater agreement

A key aspect of the study was the high level of agreement between independent evaluators. Cohen's Kappa coefficient showed good to excellent agreement across all main categories: Skills ($\kappa=0.762$, $p<0.001$), Environment and equipment ($\kappa=0.848$, $p<0.001$), Health care roles within the USAR team ($\kappa=0.701$, $p<0.001$), and Emotions ($\kappa=0.685$, $p<0.001$). These results highlight the reliability of the assessments and the methodological consistency of the study, supporting the validity of the conclusions drawn.

Agreement and response rates

Agreement percentages for similar subcategories were generally high, with perfect agreement for "Satisfaction/fulfillment" (100%). Other notable agreement percentages included: Preparation/training (82.4%), Hostile environment (88.2%), Insufficient/inadequate resources (94.1%), Stress/anxiety (76.5%), and Helplessness/frustration (82.4%).

Health care roles within the USAR team

The data highlighted the crucial role of health care personnel within the USAR team. All participants (100%) positively evaluated the effectiveness of health care staff in the red zone, emphasizing benefits such as early pain management, improved patient outcomes, and psychological support provided to both victims and rescuers.

Correlations between subcategories

Spearman correlations revealed strong associations between the subcategories assessed by the two evaluators within the team. All reported correlations were statistically significant ($p<0.05$). For example, the correlation between stress/anxiety assessed among Firefighters (F) and Nurses (N) showed a strong positive association ($\rho=0.725$, $p<0.05$), while the correlation between helplessness/frustration (F) and helplessness/frustration (N) demonstrated an even stronger relationship ($\rho=0.839$, $p<0.05$). These findings indicate good consistency in evaluations and suggest that these emotional factors are closely interconnected in participants' experiences, regardless of their specific professional role.

Areas for improvement

Despite the positive results, the study identified several areas for improvement, particularly in resource management and optimization of medical equipment for future missions. Post-hoc analysis of the "Environment and equipment" category highlighted significant differences between nurses and firefighters (Mann-Whitney U test: $U=6.0$, $p=0.033$). Nurses showed greater awareness of challenges related to the operational environment and material resources. For example, one nurse stated: "We would have needed lighter and more portable medical devices, as well as tools more resistant to weather conditions." In contrast, firefighters tended to focus less on these aspects, concentrating more on search and rescue techniques. One firefighter reported: "The necessary

equipment was more or less the usual, but we had to 'improvise' different ways of using it because the working conditions were extremely difficult." This discrepancy suggests the need for more integrated training that raises awareness in both groups of the specific challenges faced by their colleagues, thereby improving collaboration and the overall effectiveness of rescue operations.

In summary, the study results provide a solid foundation for understanding the importance of health care integration within USAR teams. The reliability and consistency of the collected data strengthen the validity of the conclusions, highlighting the added value of health care personnel in rescue operations and suggesting future directions to further improve the effectiveness of disaster response.

Discussion

The discussion of the results obtained from the study on the Tuscan USAR team during the earthquake in Turkey is structured into several categories and subcategories, each offering meaningful insights into understanding the effectiveness and challenges of health care integration within rescue teams.

Technical–health care integration

The integration between the technical and health care components of the USAR team emerged as a crucial factor for the success of rescue operations. The presence of health care personnel, particularly nurses, significantly improved the quality of care provided to victims. One firefighter emphasized: "The presence of USAR-trained health care personnel provides a complete and integrated operational response in these scenarios." Another stated: "I would say it is essential, also for providing support to the USAR fire brigade teams themselves," while a third declared: "During the extrication of the victim in Turkey, having a health care professional as an interface with whom we could exchange opinions on how to proceed with the operations was fundamental. Having a health care professional who is able to obtain venous access and administer medications and analgesics, allowing us the time needed to do our job, is essential."

Collaboration and teamwork

Collaboration between firefighters and health care personnel was perceived as a fundamental added value. All participants (100%) recognized the importance of teamwork, as highlighted by the following testimony: "The patient we extracted on the second day had been trapped under three concrete slabs for about 60 hours. The joint work between technical and health care personnel ensured the safe extrication of the patient in nine and a half hours, with stable vital parameters and no pain". This integrated approach made it possible to optimize resources and improve the overall emergency response. Moreover, the integration of different professional profiles confirmed the delivery of high-level, safe, and patient-centered care, as reported in a recent systematic review on the topic.⁹ This first positive experience of the Tuscan USAR team lays the groundwork for an interdisciplinary and integrated approach to emergencies between two distinct administrative structures (the Ministry of the Interior and the Tuscany Regional Authority). Such an approach is necessary to improve collaboration and disaster response, in contexts where difficulties in cooperation among multiple agencies are well recognized and often lead to increased response times and confusion.^{10,11}

Psychological support and well-being

The experience in Turkey had a significant psychological

impact on participants, many of whom expressed a sense of helplessness in the face of the devastation. However, the psychological support provided by nurses was recognized as essential for maintaining the well-being of the entire team. One firefighter stated: "I believe that the presence of a health care professional is essential within the USAR team, both for their practical professional expertise and as psychological support for other rescuers, who see them as a reference figure to turn to in extreme situations." Nurses play a crucial role in providing Psychological First Aid (PFA) to both disaster victims and rescuers, helping to prevent the development of long-term psychological disorders such as Post-Traumatic Stress Disorder (PTSD).¹²

Stress management

Stress management emerged as a key competency for health care personnel, who demonstrated the ability to remain calm and operationally efficient under extreme conditions. The capacity to provide emotional support not only to victims but also to rescuers was widely recognized, as reflected in statements such as: "Working closely with health care personnel allows us to focus mainly on extrication operations, relieving us of the pressure of medical care. Moreover, having a health care professional is a major guarantee for us as rescuers." This testimony highlights the dual benefit of the presence of health care personnel: reducing the psychological burden on rescuers and providing an additional level of safety during operations.

Preparation and training

Preparation and training of USAR personnel were identified as strengths, but also as areas with potential for further improvement. A total of 82.4% of participants agreed on the need for continuous training, particularly regarding logistical management in international scenarios. One firefighter noted: "Current training is effective, but there is always room for improvement, especially in preparation for extreme scenarios." Technical training for both the technical and health care components included theoretical sessions and practical activities aimed at learning and simulating, as realistically as possible, scenarios similar to those faced in Turkey. Continuous training is recognized in the literature as essential for improving interprofessional collaboration between health care personnel and other professionals involved in disaster response, such as firefighters.¹³ A recent systematic review of the literature highlighted that first responder training is among the main preparedness strategies of EMS agencies in the event of disasters, together with infrastructure improvement, enhancement of prehospital care systems, public awareness and notification, effective evaluation systems (assessing responder performance during disasters and the status of prehospital medical care), and the development and implementation of disaster preparedness plans.^{14,15}

Equipment optimization

The optimization of medical equipment was identified as a priority for future missions. The need for lighter equipment and devices more resistant to environmental conditions was highlighted, with comments such as: "Yes, the equipment was adequate, but it still required operational optimization for an international mission." As this was the first real mission following training, a review of the equipment is considered appropriate in light of the specific challenges encountered in the real operational scenario. In particular, essential characteristics were identified, such as robustness and resistance to climatic conditions, in synergy with international guidelines and the actual environmental conditions encountered.^{5,16}

Role of the USAR Nurse

The USAR nurse emerged as a key figure in the overall effectiveness of rescue operations. Their ability to rapidly adapt to extreme conditions and to act as a bridge between the technical and health care components was widely acknowledged. One nurse stated: "I consider it a unique professional experience that allowed me to grow professionally and to strengthen the idea of the team as the winning factor in critical situations" while a firefighter emphasized: "I consider this experience decisive. I believe it should also be extended to routine emergency response."

Non-technical skills

Nurses' non-technical skills, such as effective communication and situational leadership, were identified as highly valuable distinguishing elements. Their ability to coordinate rescue efforts and remain calm under pressure was emphasized, as reflected in statements such as: "The professional nature of the nurse is able to adapt to the most challenging situations where, beyond technical skills, non-technical skills make the difference."

In conclusion, the discussion of the results highlights the importance of health care integration within USAR teams and the crucial role of nurses in enhancing the effectiveness of rescue operations. The collected testimonies reinforce the need for continuous training and a holistic approach to emergency management, suggesting future directions to further optimize disaster response.

Conclusions

The study highlighted the crucial importance of integrating the health care component within USAR teams, emphasizing the fundamental role of nurses and physicians in improving rescue operation outcomes. The experience of the earthquake in Turkey demonstrated that a multidisciplinary and integrated approach not only enhances the quality of care provided to victims through a dedicated medical component, but also increases the safety and efficiency of the entire team. The technical and non-technical skills of health care personnel – particularly their ability to manage stress and provide psychological support – were recognized as key elements for operational success. These findings suggest that further development and recognition of medical personnel roles are essential to strengthen disaster response capabilities.

Limitations

The study presents several limitations, including the small sample size, which may not fully represent the diversity of experiences within USAR teams. In addition, the qualitative nature of the study may introduce interpretative bias, despite efforts to ensure objectivity through independent evaluators and blinded text analysis. Finally, the lack of direct comparison with other national and international teams limits the generalizability of the findings. Future studies could address these limitations by adopting different methodological strategies.

Relevance for clinical practice

The results of this study are highly relevant to clinical practice, as they highlight the need to integrate advanced health care competencies into emergency response teams. The inclusion of health care personnel in USAR teams can significantly improve patient outcomes and operational safety. In addition, the emphasis on continuous training and the development of non-technical skills provides valuable insights for the education and preparedness of health care professionals in emergency settings.

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Online supplementary material:

Attachment 1. Questionnaire.

Contributions: all authors contributed significantly to this study. Vittorio Bocciero and Barbara Bruno led the study design. Vittorio Bocciero conducted the data analysis in collaboration with Nadia Mattaliano. Niccolò Salvadori coordinated data collection and contributed to the manuscript revision. Nadia Mattaliano provided support in drafting and revising the final document. All authors read and approved the final version of the manuscript.

Conflict of interest: the authors declare no potential conflicts of interest, and all authors confirm the accuracy of the content.

Ethical approval and informed consent: this type of study does not require approval from the ethics committee as there is no sensitive data and each questionnaire was compiled anonymously. The study complies with the 1964 Declaration of Helsinki, revised in 2013, concerning human and animal rights. All patients who participated in this study signed a written informed consent form for participation in the study.

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