Review

Challenges and Obstacles in the Use of Search and Rescue Dogs During Disaster Operations: A Case Study of the Earthquake in Turkey

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Challenges and Obstacles in the Use of Search and Rescue Dogs During Disaster Operations: A Case Study of the Earthquake in Turkey

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Abstract: Deploying search and rescue (SAR) dogs in disaster situations is crucial for effective rescue missions. This study delves into the challenges and obstacles encountered during the use of SAR dogs, particularly focusing on the earthquake that hit Turkey in February 2023. By employing a case study approach, the research explores various factors that impact the efficiency and safety of SAR dog operations, such as environmental conditions, equipment needs, cultural perceptions, and logistical hurdles. Environmental conditions such as extreme weather, hazardous materials, and unstable structures present significant risks to both the dogs and their handlers. The adequacy of equipment, including protective gear and medical supplies, is critical for ensuring the safety and efficiency of rescue operations. Logistical challenges, including the transportation and care of dogs in disaster zones, further complicate their deployment. Cultural barriers also play a crucial role, as perceptions of dogs vary widely across different communities, potentially affecting the acceptance and integration of canine units in rescue efforts. The case study of the earthquake in Turkey highlights these issues, showcasing the successes and setbacks experienced by international rescue teams. The findings indicate that although SAR dogs are invaluable in locating survivors, they face significant dangers, including hazardous materials, extreme weather, and physical injuries. Additionally, cultural differences and logistical issues complicate their deployment. This paper highlights the necessity for improved training, protective measures, and international standards to ensure SAR dogs' well-being and effectiveness in disaster response efforts. The study's implications suggest that addressing these challenges can markedly enhance the preparedness and resilience of SAR teams, leading to more efficient and safer rescue operations in future disaster scenarios.

Keywords: search and rescue (SAR) dogs; disaster response; earthquake; environmental challenges; equipment needs; cultural perceptions; logistical hurdles; rescue operations; Turkey earthquake 2023; rescue dog safety

1. Introduction

The deployment of rescue dogs in disaster scenarios is a crucial aspect of search and rescue operations, yet it involves numerous challenges and requirements (Cvetković, 2024). Integrating rescue dogs into these missions brings substantial advantages but also presents a complex array of conditions and obstacles that must be addressed (Jones et al., 2004). Rescue dogs are trained to handle various situations, from natural disasters such as earthquakes and floods to missing person cases in both urban and rural environments. However, their effectiveness is contingent upon several factors, including environmental conditions, the adequacy of equipment, cultural barriers, logistical challenges related to transportation and care, and the time pressures inherent in rescue operations (Jones et al., 2004).

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In the field, rescue dogs and their handlers confront unpredictable and often extreme conditions, necessitating high adaptability and constant readiness for rapid response. Cultural differences can exacerbate these challenges, as community perceptions of dogs can vary, potentially influencing the acceptance of their assistance. The transportation of rescue dogs to and from disaster sites, along with their care in challenging conditions, requires meticulous logistical planning and ongoing attention to their well-being (Zeagler et al., 2016). Moreover, the urgency of rescue missions frequently imposes additional pressure on rescuers, necessitating swift and efficient actions to save lives. Despite these challenges, the use of rescue dogs remains a demanding yet invaluable component of contemporary search and rescue strategies (Otto et al., 2002).

The goal of this study is to explore and understand the primary challenges and obstacles encountered by search and rescue (SAR) dogs during their missions, with a particular emphasis on the earthquake scenario in Turkey. This examination delves into how different factors—such as environmental conditions, the adequacy of equipment, cultural perceptions, and logistical hurdles—affect the efficiency and safety of SAR dogs. By thoroughly analyzing these elements, the study offers recommendations aimed at enhancing training protocols, protective measures, and international standards to safeguard the well-being and effectiveness of SAR dogs during rescue operations.

Moreover, the research underscores the significance of cultural differences in how dogs are perceived and treated, providing insights into overcoming logistical issues related to the transportation, handling, and field management of SAR dogs. Ultimately, the objective is to foster a deeper understanding and better planning concerning the pressures of time and environmental conditions during rescue missions. This improved awareness is intended to boost the preparedness and resilience of SAR teams, thereby advancing the practices involved in employing SAR dogs for rescue tasks.

2. Optimal Environmental Conditions and Equipment Requirements for Rescue Dogs and Their Handlers

A primary factor for the successful deployment of rescue dogs is the environment in which operations occur (Cvetković & Synodinou, 2024; Tanasić & Cvetković, 2024). Different terrains, such as mountains, forests, rubble, or urban areas, present unique challenges. Dogs must adapt to varying conditions, from high temperatures and humidity to cold and snow. Additionally, these terrains can be physically demanding, with obstacles like rocks, trees, or debris hindering movement and navigation (Zelinotti et al., 2018). The equipment used by rescue dogs and their handlers plays a crucial role in the success of operations. Dogs are often equipped with protective vests, paw boots, GPS devices, and reflective vests to ensure visibility in all conditions. Handlers need appropriate gear for safe and efficient interaction with the dogs, including leashes, medical supplies, and communication tools. Without proper equipment, the effectiveness of rescue operations can be significantly compromised (Zeagler et al., 2016).

Environmental conditions are critical to the effectiveness of rescue dogs during search and rescue missions (Cvetković, 2023; Cvetković, Čvorović, & Beriša, 2023; Cvetković & Nikolić, 2023; Cvetković, Romanić, & Beriša, 2023; Nikolić, Cvetković, & Ivanov, 2023). These dogs face diverse and often extreme conditions, requiring high adaptability and readiness for various scenarios (Zelinotti et al., 2018). Search and rescue dogs are utilized to locate victims of catastrophic events or mass casualty incidents (e.g., earthquakes, landslides, building collapses, plane crashes) and can also be deployed in urban environments such as hospitals, factories, and airports. Besides rescue and recovery, search and rescue dogs can perform wilderness searches, disaster searches, cadaver searches, and avalanche searches (Zelinotti et al., 2018).

In wilderness search and rescue operations, air-scenting dogs may be deployed in areas with high probability zones. These are places where the person or target might be or where the person's scent could accumulate, such as drainage channels in the early morning (Zeagler et al., 2016). Tracking dogs might be deployed to the last known points or areas where a trail has been found. Handlers must be able to navigate through forests, possess wilderness survival skills, and be self-sufficient. Dogs need to be capable of working for 4-8 hours without being distracted (e.g., by

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wildlife). Disaster search and rescue dogs primarily rely on air scent and can be limited in mass casualty events due to their inability to distinguish survivors from recently deceased victims (Zeagler et al., 2016).

Natural disasters such as earthquakes and floods create challenging and unpredictable conditions (Cvetković, Bošković, & Ocal, 2021; Cvetković et al., 2022; Cvetković & Grbić, 2021; Cvetković, Pavlović, & Janković, 2021; Cvetković & Planić, 2022; Cvetković & Svrdlin, 2020; Cvetković & Todorović, 2021; Cvetković, Radovanović, & Milašinović, 2021; Cvetković, Tanasić, et al., 2021; Kachanov, 2021; Öcal, 2021). Dogs must navigate through building rubble, debris, and unstable structures, where there is a risk of further collapses (Zelinotti et al., 2018). For example, during earthquakes like the one in Turkey, dogs had to search through debris for survivors, facing hazards such as asbestos and other dangerous materials released by collapsing buildings (Zelinotti et al., 2018). Floods further complicate the situation, as floodwaters can contain silt and contaminants that accumulate in depressions and basements. These waters often carry chemical and biological substances and organic matter from sewage and corpses, posing additional risks to the dogs (Zelinotti et al., 2018). Dogs must be carefully guided through such areas to minimize health hazards.

Industrial accidents and terrorist attacks add further complexities to the working environment for rescue dogs. In urban areas, these dogs might encounter various chemical contaminants from small and medium-sized industries, as well as high-risk chemicals from heavy industries located in the suburbs. Terrorist attacks frequently involve explosions that release hazardous substances, necessitating that rescue dogs operate in conditions with the risk of additional explosions or "secondary devices" (Zelinotti et al., 2018). Radiological threats are another serious concern in certain scenarios. The collapse of hospitals and laboratories containing radioisotopes can create radiological risks for rescue teams and their dogs. "Dirty bombs" also present a radiological hazard, requiring specialized equipment and additional precautions (Zelinotti et al., 2018). In such cases, appropriate protective measures, such as specialized boots and masks for dogs, can significantly reduce the risk of contamination. Due to their proximity to the ground and potentially contaminated objects, dogs are particularly at risk of inhaling or coming into contact with hazardous materials through their paws, muzzles, and eyes. Dogs' eyes are sensitive to dust and fumes, while their paws and muzzles are directly exposed to contaminated surfaces (Zelinotti et al., 2018). Additionally, dogs use their noses to explore their environment, increasing the likelihood of inhaling harmful particles.

Given these specific risks, rescue teams need to provide adequate protection and training for the dogs to minimize exposure to hazardous materials. Preventive measures include regular health check-ups for the dogs and training to recognize dangerous substances. Furthermore, dogs should be equipped with protective gear tailored to the specific risks present in the field. Given all these factors, working dogs must be well-protected and constantly monitored during rescue operations. Protective equipment can help reduce risks. Additionally, dog handlers must be extremely cautious and aware of potential dangers to ensure the safety of their dogs and enhance their effectiveness in rescue missions.

In search and rescue operations, the equipment used by rescue dogs and their handlers plays a crucial role in the mission's efficiency and safety. Proper equipment allows dogs to perform their tasks in diverse and often hazardous conditions while providing necessary protection and support to the handlers. Rescue dogs face numerous physical threats during their missions, including sharp objects, toxic materials, extreme temperatures, and other hazards. To mitigate the risk of injury and illness, various forms of protective equipment are used (Zeagler et al., 2016):

a) Protective vests: these vests shield the dog's body from sharp objects, chemicals, and other physical injuries. Vests are typically made from durable yet lightweight materials that allow dogs to move freely while providing protection;
b) Paw boots: boots protect the dogs' paws from sharp rocks, glass, hot surfaces, and chemical contaminants. They are particularly important in urban disaster areas where dogs navigate through rubble and debris;

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c) Respiratory masks: in environments with high levels of dust, smoke, or toxic gases, respiratory masks protect the dogs' respiratory system. These masks are designed to fit snugly over the dog's muzzle, allowing normal breathing while filtering harmful particles;
d) Protective goggles: dogs are often exposed to dust, fumes, and other materials that can irritate or damage their eyes. Protective goggles shield the dogs' eyes from these hazards, enabling them to perform their tasks effectively.

Dog handlers must also be adequately equipped to deal with the challenges of search and rescue operations. Their equipment includes (Zeagler et al., 2016):

a) Communication devices: radios, mobile phones, and other communication tools enable handlers to stay in contact with team members, coordinate actions, and inform about changes in the field situation;
b) Navigation equipment: GPS devices, compasses, and maps are essential for navigating through unfamiliar or difficult-to-access areas. This equipment helps handlers accurately locate themselves and their dogs and the search targets.
c) First aid kits: first aid kits for both dogs and humans are a necessary part of the equipment. These kits contain materials for treating injuries, such as bandages, antiseptics, and medical instruments for emergency interventions.
d) Protective clothing: handlers wear protective clothing that shields them from weather conditions, physical injuries, and contamination. This includes waterproof jackets, pants, boots, gloves, and helmets.
e) Food and hydration: rescue dogs and their handlers must be adequately hydrated and nourished during missions. Special water reservoirs, portable bowls, and energy bars are crucial for maintaining energy and strength during operations.

In specific scenarios, such as avalanche or rubble searches, specialized tools are also used (Zeagler et al., 2016): a) search sonars and cameras: these devices help locate victims beneath snow or rubble. Dogs and handlers can use these tools to identify the exact locations of trapped individuals; b) demolition and rescue tools: in situations where obstacles need to be removed to reach victims, equipment such as shovels, pickaxes, and hydraulic tools is used.

Proper use of this equipment requires thorough training and continuous preparation to ensure the maximum efficiency of rescue teams. Equipment must be regularly maintained and checked to ensure its functionality in critical moments. Through a combination of adequate equipment and training, rescue dogs and their handlers can effectively and safely perform their tasks in the most challenging conditions.

2. Exploring Cultural Variations in the Perception and Treatment of Dogs

The status and treatment of dogs vary widely across different cultures, significantly influencing their roles and effectiveness in disaster rescue operations. These cultural distinctions are often deeply embedded in religious beliefs, societal norms, and historical contexts, leading to diverse perceptions and uses of dogs. In these contexts, handlers must be cognizant of local customs and potential obstacles to accepting dogs as essential participants in rescue efforts (Marjanić & Kiš, 2007).

Religious traditions and teachings significantly shape how dogs are viewed across different regions. Buddhism teaches respect for all forms of life, including dogs. In contrast, Hinduism presents a dual view of dogs: they are seen both as guardians of homes and temples and as associated with Yama, the god of death. In rural India, dogs are often valued as protectors and hunters, but regional and specific religious beliefs can cause variations in their perception (Marjanić & Kiš, 2007).

Christian traditions often portray dogs as loyal companions and symbols of fidelity, leading to generally positive attitudes toward dogs in Christian communities worldwide. This positive perception facilitates the use of dogs in rescue missions. Conversely, in many Islamic countries, dogs are often viewed as unclean animals. Islamic traditions present a complex view of dogs, with perceptions varying significantly based on interpretations of religious texts and cultural norms within different Muslim communities. Islamic law, or Sharia, offers guidelines on interacting with dogs, although these guidelines are sometimes interpreted in various ways (Sarwar et al., 2023).

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Islamic views on dogs are primarily derived from Hadiths (sayings and actions of Prophet Muhammad) and the Quran. Hadiths contain several references to dogs, some suggesting that dogs are considered impure animals. For instance, one Hadith indicates that angels do not enter a house with a dog and that ritual purification (known as Tahara) is necessary after contact with a dog (Sarwar et al., 2023). However, the Quran does not explicitly state that dogs are impure. In one passage, a dog accompanies a group of believers and serves as their protector, which might suggest a positive view of dogs as guardians (Sarwar et al., 2023).

In practice, many Muslim communities have an ambivalent relationship with dogs. A clear distinction is made between dogs used for practical purposes—such as guarding, herding, and hunting—and those kept as pets. Working dogs are often tolerated and even valued for their practical roles while keeping dogs as pets may be seen as undesirable. When it comes to rescue dogs, attitudes are often more positive, especially when their role is humanitarian. In Muslim communities affected by disasters, rescue dogs may be accepted due to their life-saving capabilities. However, this acceptance may require additional efforts to educate local populations about the importance and role of these dogs. Rescue teams operating in predominantly Muslim areas often need to adapt their procedures to respect local religious and cultural norms. One practical challenge in working with dogs in Islamic communities is the issue of ritual purification. Contact with dogs is often associated with the need for purification, complicating interactions with rescue dogs. In such situations, rescue teams must be aware of and respect religious practices, offering solutions that allow cooperation without violating religious norms (Sarwar et al., 2023).

Social norms play a crucial role in determining the status of dogs. In many Western countries, dogs are highly valued as pets and family members. These countries have well-developed systems for training and using rescue dogs, and their deployment in rescue operations is widely accepted. In some Asian countries, perceptions of dogs can vary. For example, in Japan, dogs are highly valued and often have a special status, while in some parts of China, dogs may be viewed less favourably. These differences can affect the speed and effectiveness of deploying rescue dogs during disasters (Marjanić & Kiš, 2007).

Cultural differences in the perception of dogs can significantly impact rescue operations during disasters. In communities where dogs are viewed negatively, introducing rescue teams with dogs can be challenging. Additional education and communication with the local population are needed to explain the role and importance of dogs in saving lives. In communities where dogs are highly valued, rescue teams can operate more quickly and effectively, encountering fewer cultural barriers and greater cooperation. Rescue teams must be aware of cultural norms and adapt their methods of operation accordingly.

Understanding and respecting local cultures is crucial for effectively and humanely conducting rescue missions, thereby increasing the chances of successful life-saving efforts in disasters. Cultural differences in the treatment of dogs present both challenges and opportunities for improving standards in rescue operations. By acknowledging and adapting to these cultural nuances, rescue teams can enhance their effectiveness and humanitarian impact.

3. Overcoming Challenges in the Transportation, Handling, and Field Management of Rescue Dogs

The transportation and field management of rescue dogs present a range of significant challenges that require careful consideration and meticulous planning. Handlers and their dogs are often required to travel to distant and inaccessible locations, making logistics particularly demanding. Ensuring that dogs receive adequate shelter, nutrition, hydration, and veterinary care throughout the mission is crucial. A shortage of these vital resources can jeopardize the health and efficiency of the dogs, ultimately affecting the success of rescue operations.

Search and rescue dogs are transported using various modes of transport, including vehicles, snowmobiles, boats, helicopters, and aeroplanes. Each transportation method comes with its own set of specific challenges (Godfrey-Smith, 2004). For example, airlifting a dog via helicopter necessitates specialized training for both the dog and the handler to ensure safe hoisting or descent. Moreover,

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handlers typically prefer not to transport their dogs separately, adding another layer of complexity to logistical planning.

During periods when the dogs are not actively working, it is essential to provide them with safe and secure accommodations overnight. Handlers often stay close to their dogs, regardless of whether they are in the field or lodged in a hotel or boarding facility (Godfrey-Smith, 2004). This practice can become problematic if commercial accommodations do not permit dogs, necessitating alternative arrangements. Every search and rescue mission requires adaptability to field conditions. Handlers must be prepared to improvise and modify their strategies for transporting and housing dogs based on the specific circumstances encountered. This may involve using unconventional transportation methods or identifying safe overnight locations in unpredictable environments (Godfrey-Smith, 2004).

Effective transportation and field management of rescue dogs are vital components of successful search and rescue missions. These operations demand thorough planning, flexibility, and a strong emphasis on the safety and well-being of the dogs. Handlers must be highly trained and ready to confront a variety of challenges to ensure that rescue missions are carried out successfully (Godfrey-Smith, 2004). Ensuring the mental well-being of rescue dogs during prolonged missions is just as critical as maintaining their physical health. Extended periods of high-stress activity can lead to burnout, making it essential for these dogs to receive regular rest and mental stimulation. Careful planning for potential obstacles such as adverse weather or challenging terrain can greatly enhance the efficiency of rescue missions. Handlers must be ready with contingency plans to address unexpected difficulties that might impede transport or field operations (Cvetković & Miljković, 2024a, 2024b).

The integration of advanced technology like GPS tracking and drone support significantly improves the coordination and safety of rescue dogs in the field. These tools allow handlers to monitor the dogs' movements, ensuring they remain within safe zones during complex rescue operations. Training programs for rescue dogs should include simulations of various transportation methods and field conditions to better prepare them for real-world scenarios. Comprehensive training ensures these dogs can swiftly adapt and perform reliably under diverse circumstances. Collaboration with local authorities and communities can facilitate smoother operations by providing additional resources and support. Engaging with local experts offers valuable insights into the best practices for navigating specific regions and conditions (Cvetković & Miljković, 2024a, 2024b). Developing a network of veterinary professionals who can be quickly mobilized in emergencies is crucial. Immediate access to medical care prevents minor injuries from becoming serious issues, ensuring the dogs remain in optimal condition throughout the mission.

4. Overcoming Time Constraints and Environmental Pressures in Rescue Operations

The scarcity of time and the additional pressures from the environment often pose the most significant challenges in rescue operations. Disasters require immediate action, allowing little room for mistakes (Cvetković, Nikolić, & Lukić, 2024; Cvetković & Šišović, 2024; Cvetković, 2024a, 2024b; Grozdanić, Cvetković, Lukić, & Ivanov, 2024). The urgency can impact decision-making and heighten stress for both handlers and dogs. Effective time and resource management, along with thorough mental and physical preparation, are essential to overcome these hurdles and achieve successful rescue outcomes (Baruh, Dey, & Dutta, 2023; Chakma, 2023; El-Mougher, Abu Sharekh, Abu Ali, & Zuhud, 2023; Hasan & Sultana, 2024; Hossen, Nawaz, & Kabir, 2022; Iftikhar & Iqbal, 2023; Islam, 2023; Kabir, Hossain, & Haque, 2022; Mohammed & Maysaa, 2022; Molnár, 2024; Podder, Hasan, & Islam, 2022; Rajani, Tuhin, & Rina, 2023; Sergey & Gennadiy, 2022; Starosta, 2023; Sudar, Cvetković, & Ivanov, 2024).

Search and rescue missions often demand rapid responses and urgent measures. Limited time can severely curtail the period available for adequate preparation and planning, thereby intensifying the pressure on handlers and their dogs to act swiftly and make on-the-spot decisions (Cvetković & Miljković, 2024a, 2024b).

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Environmental pressures can create highly stressful scenarios for both handlers and dogs. Unpredictable elements like severe weather conditions, dangerous terrains, the presence of the victims' families, friends, or neighbours, or life-threatening situations can exacerbate stress and anxiety. These factors can negatively affect the team's performance and require additional mental and emotional fortitude (Otto et al., 2002). Environmental pressures and stress can impact search and rescue dog handlers and their dogs in several ways. Firstly, constant exposure to stressful conditions can increase anxiety levels in both handlers and dogs. This elevated anxiety can compromise the team's mental health and overall effectiveness, as high-stress levels can impede clear thinking and prompt decision-making.

Secondly, environmental pressures can lead to both emotional and physical fatigue in handlers and dogs. Operating in extreme conditions, such as unpredictable weather or hazardous terrains, demands intense physical effort and mental concentration, resulting in exhaustion and decreased effectiveness. Consequently, search operations are time-limited, and breaks are necessary. Furthermore, environmental pressures can lead to heightened tension within the team and disrupt interpersonal relationships. In high-stress situations, communication can become challenging, and conflicts or disagreements may arise. This can further complicate search and rescue efforts, necessitating additional efforts to manage team dynamics (Otto et al., 2002).

Handlers often face situations requiring quick decision-making under pressure. This includes assessing risks, choosing the best search strategy, or responding to unexpected challenges in the field. In dynamic environments like natural disasters or accidents, conditions can change rapidly. Limited time can hinder adaptation to these changes, requiring flexibility and quick reactions from the search and rescue team. Handlers and their dogs must be prepared to adapt to new circumstances and changing field conditions (Otto et al., 2002).

Time constraints and additional environmental pressures are common challenges in search and rescue operations. Handlers and their dogs must undergo extensive training; dogs must be stable, well-trained, and have a strong bond with their handlers, with whom they must have complete trust. Handlers must be mentally resilient and ready to face rapid changes and stressful situations. Effective management of time and environmental pressures is crucial for successful search and rescue missions.

The interplay of these factors makes the deployment of rescue dogs in the field a complex process that requires meticulous planning, thorough training, and continuous adaptation to the specific conditions and challenges of each situation. Despite these challenges, rescue dogs remain invaluable partners in search and rescue missions, providing essential support and significantly enhancing the likelihood of locating and rescuing missing persons.

5. In-Depth Case Study: Utilizing Rescue Dogs in the Aftermath of the Turkey Earthquake

In the early morning hours of February 6, 2023, a devastating earthquake with a magnitude of 7.8 struck near the Turkish city of Gaziantep in Hatay province, home to approximately 2 million people near the Syrian border. As most people slept, the quake was followed by dozens of aftershocks, including one measuring 7.5 in magnitude. Following these powerful tremors and hundreds of subsequent aftershocks that impacted southeastern Turkey and northwestern Syria, rescue teams from around the world began to converge on Turkey (IRFC, 2023).

Teams with search and rescue dogs rapidly arrived from various countries to assist Turkey's civil protection units and GEA, Turkey's volunteer rescue team (IRFC, 2023). Dogs from countries like Croatia, Slovenia, and Serbia were among those deployed. Slovenia dispatched a team with seven rescue dogs, their handlers, and four assistants. Croatia sent 41 rescuers and seven rescue dogs with their handlers, while Serbia sent a team of 45 firefighter-rescuers and one rescue dog, Ziggy. The Slovenian team, along with their dogs, managed to locate and save five people (STA, 2023). The Serbian team with Ziggy found and rescued three individuals from the rubble, including a seventeen-year-old girl who had been buried for 108 hours (Government of the Republic of Serbia, 2023). Unfortunately, the Serbian dog also located 23 deceased individuals. The Croatian team, despite

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finding only deceased persons, played a significant and valuable role in the overall international rescue mission in Turkey.

In this disaster, rescue dogs played a crucial role in search and rescue efforts. Specially trained dogs, known as Search and Rescue (SAR) dogs, were deployed to locate people trapped under debris. These dogs are trained to use their sense of smell to detect human scent even in the most challenging conditions, such as collapsed buildings. In these extremely dangerous situations, dogs can enter small spaces inaccessible to humans, proving invaluable in locating both survivors and victims beneath the rubble (IRO, 2023).

These SAR dogs are trained to sniff out human scent, stop, and bark loudly to alert their handlers to the location of the scent. Another dog is then sent to confirm the location. If both dogs indicate the same spot, rescuers focus their efforts on digging at that location until the person is found. Dogs work in shifts, with each shift lasting 20 minutes followed by a 40-minute break. In one instance, after dogs signalled where people were buried, rescuers began digging and soon heard knocking from trapped victims, confirming the dogs' precise detection. If the survivor is not deeply buried, dogs can quickly pick up the scent. However, some collapsed buildings were multi-story structures with 2-3 meters of concrete between each level, making it difficult to find deeply buried individuals (Gadzo, 2023).

Dogs of various breeds involved in the rescue efforts in Turkey were selected and trained from an early age by their handlers, who treat them as colleagues and vital partners in the perilous task of rescuing people trapped in confined spaces deep under the rubble of collapsed buildings. These dogs' ability to sniff, identify, and indicate survivors amid the chaos of collapsed structures, regardless of the difficulties and dangers they face, makes them irreplaceable in such rescue missions. Trained dogs are uniquely equipped by nature to locate survivors, no matter how faint the scent might be.

The working conditions for these brave animals are always extremely challenging. They must walk and crawl over broken concrete, steel, glass, pipes, and navigate through toxic fumes and liquids of all kinds. They search through hazardous vapors and endless clouds of dust in impossibly tight spaces, seeking signs of life that only they can detect. Ideally, rescue dogs should work in search shifts of less than half an hour, followed by rest periods of an hour before the next shift. Handlers should monitor environmental conditions and contamination from toxic substances that the dogs might inhale or come into contact with through their paws and fur, as well as any potential injuries to their dogs.

During the rescue operations in Turkey, the International Federation of Red Cross and Red Crescent Societies warned about the presence of asbestos in many buildings, despite its use being banned since 2010 in the country (Turkish Minute, 2023). This meant that all rescue dogs brought to Turkey spent days and weeks inhaling asbestos, which can cause lung cancer and various symptoms of intoxication. The warning came later, and the dogs worked without any protocols or protection against this serious health risk. Symptoms may manifest even a year or more after exposure, so some consequences may only become apparent later in some of the participating dogs. Aside from this risky situation, Proteo, a German Shepherd working with the Mexican rescue team in Kahramanmaraş, died in an accident when the remains of a building he was searching for survivors in collapsed on him. He was declared a hero by the Mexican Ministry of Defense.

These examples highlight the need for stronger safety and health protocols for rescue dogs. Given that these dogs can be the only hope for a trapped victim to be found and saved, they must be in excellent health, receive the best immunization protocols, working conditions, nutrition, exercise, and training, and have reduced working hours with clear decontamination protocols during field operations. Well-equipped professional search and rescue teams must have handlers trained and equipped for veterinary first aid, and field veterinarians trained to provide emergency veterinary care and treat traumas should be present. Rescue dogs should travel in the main cabin of the plane; ground transport should be in safe transport carriers. They should sleep and eat with their handlers, work in short periods, and rest extensively, with handlers keeping a constant watch over the dogs' paws, eyes, and bodies. Ultimately, enhancing international standards for the welfare and well-being of rescue dogs and ensuring the best training and conditions for these licensed dogs and their handlers is of great importance.

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7. Recommendations

Based on the analysis of the challenges and obstacles encountered by search and rescue teams with dogs during rescue operations, particularly in the context of the earthquake in Turkey, the following recommendations are identified as crucial for improving the efficiency and safety of these operations:

a) Procure and use high-quality protective equipment for dogs, including protective vests, paw boots, respiratory masks, and protective goggles;
b) Ensure adequate equipment for dog handlers, such as communication devices, navigation equipment, and first aid kits for both dogs and humans;
c) Implement regular checks and maintenance of equipment to ensure its functionality in critical moments;
d) Develop comprehensive training programs that include simulations of various transportation methods and field conditions;
e) Train dog handlers to provide veterinary first aid and ensure the presence of field veterinarians during operations;
f) Conduct regular exercises and simulations that include real disaster scenarios to increase teams' readiness for quick and efficient responses;
g) Develop and implement international standards for the use of search and rescue dogs, including protocols for decontamination and protection from hazardous materials;
h) Standardize procedures for the transport and accommodation of dogs, as well as fieldwork conditions, to ensure their safety and efficiency;
i) Educate local populations about the role and importance of search and rescue dogs to overcome cultural barriers and ensure greater community support;
j) Adapt operations to local religious and cultural norms to ensure acceptance and cooperation;
k) Plan and organize adequate transportation and accommodation for dogs and handlers, including air and ground transport, with special attention to the safety and comfort of the dogs;
l) Ensure sufficient resources, such as food, water, and medical supplies, to provide continuous care for the dogs during operations;
m) Establish a network of veterinary professionals who can be quickly mobilized in disasters;
n) Conduct regular health check-ups for dogs before, during, and after operations to identify and treat potential health issues promptly;
o) Implement preventive measures, including vaccination and control of exposure to hazardous materials, to reduce health risks for the dogs.

7. Conclusions

The role of search and rescue (SAR) dogs during natural and man made disasters has proven indispensable in locating survivors. Research from the earthquake in Turkey in February 2023 reveals many challenges faced by rescue teams using these dogs. Harsh weather, hazardous materials, unstable structures, and various logistical and cultural issues all affect the efficiency and safety of operations. Despite these hurdles, SAR dogs remain essential due to their unique ability to find survivors when other methods fail. To ensure their effectiveness and safety, it's crucial to enhance training, protective measures, and international standards for both dogs and their handlers. Providing necessary equipment like protective gear and medical supplies is vital for successful missions.

Logistical issues, including transporting and caring for dogs in disaster areas, complicate their use. Detailed logistical planning is essential to maintain their well-being. Cultural barriers, affecting how dogs are perceived in different communities, also play a significant role. Educating locals about the importance of SAR dogs can improve their acceptance and integration into rescue efforts. The study concludes that better training, protective measures, and international standards are needed to ensure SAR dogs' well-being and effectiveness. Tackling these challenges can greatly enhance SAR teams' preparedness and resilience, leading to more efficient and safer rescue operations in future disasters.

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Additionally, the research underscores the importance of international cooperation among rescue teams. Sharing experiences and knowledge can lead to better methods and strategies for using SAR dogs. Such cooperation can also help standardize procedures and training, boosting the efficiency and safety of rescue missions. Attention to the psychological state of SAR dogs and their handlers is also critical. Prolonged stress and extreme conditions can harm their mental health. Regular breaks, mental stimulation, and adequate support can maintain high operational readiness. Psychological support for handlers and dogs should be part of training and operational procedures.

Lastly, technology increasingly supports SAR operations. Integrating advanced tech like drones and tracking systems can significantly improve coordination and efficiency. These tools help pinpoint survivors more accurately and enhance team safety. Ongoing research and new technologies will further boost SAR operations' efficiency. In summary, the study highlights the need for ongoing research and strategy development to improve SAR dogs' working conditions and protection, directly enhancing rescue operations' overall efficiency and lifesaving potential.

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