

Technical And Human Challenges Facing Saudi Red Crescent Teams In Dealing With Traffic Accidents

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Abstract:

This study examines the technical and human challenges facing Saudi Red Crescent teams in dealing with traffic accidents, as they are among the most demanding field situations, requiring rapid response and high efficiency. The importance of the study stems from the vital role these teams play in saving lives and mitigating the effects of injuries, given the increasing reliance on modern technology in emergency and first aid care. The study relied on the descriptive analytical approach as it is the most appropriate for monitoring and analyzing field phenomena. A questionnaire was designed consisting of a set of items that measure the technical and human aspects of the challenges. The questionnaire was distributed to a sample of (200) individuals from the Saudi Red Crescent teams working in the field, with the aim of collecting comprehensive and reliable data that reflects the practical reality. The results revealed that the technical challenges were represented by the difficulty of dealing with digital systems and smart applications, the weakness of the technical infrastructure in some locations, and the ongoing need for training on modern devices. Human challenges included the psychological and physical stresses team members face during incident response, some employees' resistance to change when new technologies are introduced, and lack of experience using electronic systems. The study concluded that these challenges directly impact the efficiency of emergency response and the speed of field intervention. This highlights the need to develop sustainable training plans, provide ongoing technical support, and enhance human readiness through advanced training programs, in addition to investing in digital infrastructure to ensure improved quality of services provided in traffic accident cases.

Keywords: Saudi Red Crescent – Traffic Accidents – Technical Challenges – Human Challenges – Ambulance Teams – Emergency – Quality of Health Services.

Introduction

Traffic accidents are among the most significant and prominent challenges facing modern societies. They are not only a major cause of human and material losses, but they also represent a significant burden on health systems and emergency services. In the Kingdom of Saudi Arabia, Saudi Red Crescent teams bear a significant responsibility in providing immediate and life-saving responses to those injured in these accidents. However, these humanitarian missions are not without challenges, but require continuous confrontation with a variety of difficulties, which can be classified into two types: technical challenges and human challenges¹³

Technical challenges lie in the need to keep pace with rapid technological developments and employ them effectively to serve ambulance operations. One of the most important of these challenges is the need for accurate tracking and guidance systems that help and enable ambulance teams to reach the accident site as quickly as possible, especially in remote areas or areas that lack good communications network coverage. Digital connectivity between Red Crescent teams and other relevant entities, such as traffic and civil defense, remains an important challenge to ensure effective coordination and real-time information exchange. Equipping vehicles with the latest medical devices and equipment necessary to deal with various types of injuries poses a financial and logistical challenge, as it requires continuous updating and periodic maintenance. Human challenges, which are no less important and complex, are directly related to the human cadre, which represents the foundation of field work. Continuous training and qualification of ambulance personnel is essential to keep pace with the latest medical protocols and deal with complex injuries. However, providing this training regularly to thousands of paramedics constitutes a significant organizational burden. Furthermore, paramedics face enormous psychological pressure as a result of their repeated witnessing of tragic accidents, which necessitates providing them with psychological and social support to ensure their continued efficient work. This is also a human challenge. Dealing with the public at the scene of an accident, as they may encounter behaviors such as lack of cooperation or crowds that hinder the rescue operation^{1,12}

Therefore, these challenges are not merely theoretical steps, but rather the foundation for ensuring that Saudi Red Crescent teams can continue to perform their humanitarian mission efficiently and effectively, saving lives and alleviating suffering—the ultimate goal these teams strive to achieve every time their ambulances sound their sirens to make their way to the accident site^{8,9}

Importance of the study

The importance of the study is evident in understanding the technical and human challenges facing Saudi Red Crescent teams in dealing with traffic accidents. These challenges are fundamental and directly impact the effectiveness and speed of response, thus saving lives and reducing the number of human losses. Therefore, technical challenges are a pressing force that may hinder the timely arrival of assistance. Accurate positioning and guidance systems are not just a luxury, but an absolute necessity. Without them, time may be wasted trying to locate the accident site, especially in desert areas or highways that lack clear landmarks. Effective communication systems that link operating rooms and ambulance teams with other agencies, such as traffic and civil defense, ensure flexible coordination and immediate exchange of information, which reduces duplication and increases the speed of the rescue process. In addition, equipping ambulances with the latest medical equipment, such as cardiopulmonary resuscitation devices and advanced vital monitoring devices, can save the lives of injured people at the accident scene before they are transported to the hospital. The presence of these technologies enables paramedics to provide advanced and effective care and prevents the aggravation of injuries^{10,1}

Human challenges are no less important than technical challenges, as continuous training and advanced qualification of paramedics is essential to ensuring their competence. Paramedics must be familiar with the latest medical protocols and methods for dealing with complex injuries, such as multiple injuries or burns. Lack of such training can lead to errors in diagnosis or treatment, which can have dire consequences. Therefore, the ability to deal with field pressures, such as dealing with crowds of people or obstacles that may be placed by some curious individuals at the accident site, requires high-level communication and crisis management skills. These skills enable the paramedic to focus on their primary task without distraction, ensuring the rescue operation proceeds effectively and efficiently^{5,9}

- An overview of the Saudi Red Crescent's efforts in traffic accidents

The Saudi Red Crescent Authority's efforts to respond to traffic accidents are evident as a fundamental pillar of the Kingdom's emergency response system. Its mission extends beyond providing first aid to encompass an integrated system of preventative, technological, and human resources. Traffic accidents are

among the most significant challenges facing Red Crescent teams, and the Authority has therefore intensified its efforts to ensure a rapid and effective response^{3,9}

The Red Crescent Authority's efforts are not limited to the field aspect only, but extend to developing systems and programs to ensure the provision of the best possible care for the injured. Among the most important of these efforts is the Authority's reliance on the latest technologies to reduce response time^{1,9}

Through the (Asafni) application This allows callers to accurately locate themselves and send a report immediately, saving a lot of time that was wasted describing the location. The Authority has also invested in employing air ambulances to deal with critical cases in remote areas or areas that are difficult to access quickly by conventional ambulances. This procedure ensures the transfer of injured people to specialized hospitals during the so-called "golden hour" to save lives. The Authority also pays great attention to continuously qualifying and training its staff on the latest international medical protocols for dealing with multiple injuries, which are a distinctive feature of traffic accidents. These training courses include vehicle rescue techniques, dealing with injuries resulting from severe shocks, and controlling severe bleeding. In addition, the Authority has launched intensive awareness programs targeting the public to raise awareness of the importance of giving way to ambulances and not crowding at accident sites, which hinders the work of paramedics and increases pressure on them^{3,8}

In a proactive step, the Authority is analyzing traffic accident data to identify road black spots. This contributes to the development of proactive plans and the strategic deployment of emergency teams in these areas to ensure rapid response. These diverse efforts, both technical and human, reflect the Saudi Red Crescent's commitment to providing the best care for those injured in traffic accidents, placing it at the forefront of humanitarian organizations in the region^{7,9}

- **Technical challenges (hardware, communication systems, infrastructure)**

Saudi Red Crescent teams face a range of complex technical challenges in their humanitarian missions to respond to traffic accidents. Among these challenges are equipment and devices, as ambulances are mobile emergency rooms. Equipping them with the latest medical equipment is a fundamental challenge. The rapid development of medical technology means the need to continually update equipment such as cardiopulmonary resuscitation devices, advanced vital signs monitors, and blood oxygen meters, which can be expensive. Maintaining these devices and providing the necessary spare parts in a timely manner is a major logistical challenge. Furthermore, equipping ambulances with wreck rescue tools, such as hydraulic shears, is essential for reaching injured people trapped inside vehicles. Providing these tools requires specialized training and regular maintenance^{2,8}.

Communication systems are also a vital and essential element for ambulance operations. One of the most prominent challenges here is ensuring continuous and reliable communications coverage throughout the Kingdom, especially in remote and desert areas and highways far from cities. A weak network may prevent ambulance teams from communicating with the operating room or with hospitals to provide them with initial information about the condition of the injured, delaying the decision-making process. Effective digital connectivity between the Red Crescent and other relevant agencies, such as the General Traffic Department and Civil Defense, remains a very important technical challenge. Immediate coordination between these agencies ensures the rapid and comprehensive delivery of assistance without conflicting roles. The technical infrastructure is also the foundation upon which all operations are built. One of the most important of these challenges is the need for a geographic information system. Advanced for accurate and rapid location tracking, especially in areas lacking clear addresses. Without an accurate system, time can be wasted trying to locate an incident. Report management systems also need to be able to handle large numbers of reports simultaneously, prioritize them, and automatically distribute them to field teams^{3,7}

Therefore, securing digital security systems against breaches or malfunctions is essential to ensure uninterrupted service continuity, especially since these systems contain sensitive data about infected individuals^{10,5}.

- **Human challenges (human resources, training, work pressures)**

Human resources are the backbone of emergency operations. They are not just responders, but the first line of defense, making important and decisive decisions in the most difficult circumstances. However, they face a set of complex human challenges that directly impact their efficiency and psychological and professional safety. These challenges can be explained as follows:

Continuous training and qualification of emergency personnel is one of the most important challenges, as traffic accidents require specialized skills in dealing with multiple injuries. Such as head and chest injuries and complex fractures, the paramedic must be fully aware of the latest international medical protocols to ensure the provision of appropriate care in a timely manner. The shortage of specialized personnel may sometimes increase the pressure on the existing paramedics, which may affect the quality of services provided. In addition, the skills of communicating with the injured and their families^{5,6}

- **The impact of these challenges on the speed and efficiency of response**

Without an effective location recognition system, teams may have to spend time searching, which significantly reduces the chances of rescuing the injured. The quality of field care also declines, as the lack of advanced medical equipment in ambulances affects the quality of care that can be provided at the accident site. Without resuscitation devices or vital monitoring, paramedics may not be able to effectively deal with critical cases such as internal bleeding or shocks, which increases the possibility of death before reaching the hospital. The lack of effective digital connectivity between the Red Crescent and other agencies such as traffic and civil defense also leads to poor coordination between these agencies. Several teams may arrive at the same location without coordination, or rescue teams may be delayed by traffic, leading to a waste of time and effort^{4,9}

One of the impacts of human challenges is the deterioration in the quality of performance. where Lack of ongoing training impacts paramedics' skills, potentially leading to poor decision-making in emergency situations. Dealing with multiple injuries requires high-level assessment and individualized handling skills. Lack of these skills can exacerbate the patient's condition, as well as lead to psychological exhaustion and its impact on decision-making. Constant psychological pressure places a heavy burden on paramedics, which can impact their ability to concentrate and make quick and accurate decisions during an incident. Emotional exhaustion can lead to a loss of passion for work, negatively impacting their performance in the field. Lack of community awareness and crowding directly impact the speed and efficiency of response. The presence of the public at the scene of an accident hinders the movement of ambulance crews, increases chaos, and places more pressure on paramedics, potentially delaying the provision of necessary care to the injured^{5,9}

- **Proposed strategies to overcome challenges**

Addressing the challenges facing Saudi Red Crescent teams in dealing with traffic accidents requires adopting integrated strategies that include both the technical and human aspects with the aim of improving the speed and efficiency of response and ensuring the highest level of care for the injured. These strategies do not focus on individual solutions, but rather on an interconnected work system. Among the strategies for overcoming technical challenges to improve the technical aspect, the Red Crescent can focus on several main axes, starting with developing a geographic information system. Advanced connectivity between operating rooms and ambulances with continuous road map updates and GPS In all vehicles, this system must have the ability to pinpoint the location of an accident with extreme accuracy, even in remote areas. The ambulance fleet must then be updated and equipped with the latest medical and rescue equipment, such as advanced vital signs monitoring devices and portable cardiopulmonary resuscitation devices, in addition

to hydraulic tools for cutting vehicle bodies. A unified electronic link system must also be activated between the Red Crescent and other relevant government agencies, such as traffic and civil defense, to ensure immediate exchange of information and prevent duplication of reports. A data and traffic accident analysis center must also be established and activated to identify road black spots and proactively distribute ambulance teams to these areas, thus reducing response time^{2,4}

Among the strategies to overcome human challenges and enhance the capabilities of human cadres, the Red Crescent can implement multiple strategies, including developing continuous training and rehabilitation programs that focus on the latest medical protocols for dealing with traffic accident injuries, with an emphasis on practical training and simulation of realistic scenarios, as well as providing psychological and moral support to paramedics by establishing specialized psychological clinics or guidance programs to help them deal with the psychological pressures resulting from the nature of their work, and organizing intensive community awareness campaigns aimed at educating the public about the importance of not gathering and congregating at accident sites and making way for ambulances, while clarifying that obstructing their work may lead to the death of the injured^{4,8}

Accordingly, to develop the Saudi Red Crescent's work in traffic accidents, an integrated strategy can be followed at the technical level. The ambulance fleet must be updated with advanced medical equipment, an accurate geographic information system must be activated to quickly determine locations, and a unified electronic link must be established with other entities to ensure immediate coordination. At the human level, the matter requires continuous training of personnel on the latest medical protocols and providing psychological and moral support to paramedics to cope with work pressures. Intensive awareness campaigns must also be launched in the community to teach them how to make way for ambulances and not to crowd at accident sites. These steps will ensure the provision of better care and save more lives^{10,11}

Field of Study

This study falls within the field of emergency health services and traffic disaster management.

Research Methodology and Tools

His study relied on the descriptive and analytical approach, as it is the most appropriate for studying field phenomena and monitoring the challenges and difficulties facing Saudi Red Crescent teams in the field. This approach relies on describing the current reality and analyzing field data, providing an accurate and comprehensive picture of the nature of technical and human challenges and their impact on the effectiveness of emergency response.

Research Tools

tool was a questionnaire. It was carefully designed to include a set of items measuring technical aspects (such as difficulties using digital systems, weak technical infrastructure, and lack of training on modern devices) and human aspects (such as psychological and physical stress, resistance to change, and lack of experience with modern systems). The questionnaire was distributed to a sample of (200) individuals from the Saudi Red Crescent teams to ensure the comprehensiveness and reliability of the results.

Analysis

Table (1): Cronbach's Alpha (Reliability Analysis)

Scale	Number of Items	Cronbach's Alpha
Technical & Human Challenges	15	0.91

In light of the results of Table (1), which displays the analysis of the reliability coefficient (Cronbach's Alpha), we note that the ****Technical and Human Challenges**** scale, consisting of (15) items, achieved a

reliability coefficient value of ****0.91****, which is a very high value. This result indicates that the instrument used in the study has a high degree of internal consistency, reflecting the homogeneity of the items and their ability to reliably measure the same dimension or domain. According to scientific standards, values that exceed (0.70) are considered acceptable in social and educational studies, while values that approach (0.90) or exceed it indicate excellent stability. Therefore, it can be said that the scale used in this study is valid for relying on in extracting and analyzing results, as the high value of the reliability coefficient enhances the accuracy of the data and reduces the possibility of errors resulting from variance or inconsistency in responses.

Table (2): Descriptive Statistics (Means & Standard Deviations)

Item No.	Statement (Shortened)	Mean	Std. Deviation	Rank
1	Teams face technical difficulties with new digital systems	2.40	0.70	10
2	Additional training required to handle modern equipment	2.65	0.60	3
3	Weak technical infrastructure affects speed of response	2.58	0.65	5
4	Some paramedics struggle with smart reporting apps	2.35	0.75	12
5	Technical challenges reduce performance efficiency	2.50	0.68	8
6	Lack of immediate technical support complicates issues	2.48	0.70	9
7	Poor network connectivity hinders team work	2.55	0.66	6
8	Rapid tech development is difficult to keep up with	2.45	0.72	11
9	Lack of financial resources limits equipment provision	2.63	0.62	4
10	Some employees resist change with new technologies	2.30	0.77	13
11	Psychological/physical stress affects system adaptation	2.43	0.73	11
12	Lack of ongoing training reduces effectiveness	2.50	0.69	7
13	Backup plans are needed when electronic systems fail	2.72	0.55	2
14	Human difficulties (fatigue/experience) affect tech use	2.49	0.70	8
15	Overcoming challenges requires human & technical support	2.80	0.50	1
Overall Scale	—	2.52	0.68	—

From Table (2), which displays the descriptive statistics (arithmetic means and standard deviations), it is clear that the overall average of responses regarding technical and human challenges amounted to ****2.52**** with a standard deviation of ****0.68****, which indicates the presence of an average level of challenges facing the teams under study. The ranking also shows that the highest averages were for items related to the need for ****joint human and technical support to overcome challenges**** (average 2.80), followed by the need for ****alternative plans when electronic systems fail**** (average 2.72), followed by the need for ****additional training to deal with modern equipment**** (average 2.65). This reflects participants' awareness of the importance of developing proactive plans and providing ongoing training to ensure adaptation to technological developments.

In contrast, the lowest averages were associated with ****some employees' resistance to change when introducing new technologies**** (average 2.30), as well as ****difficulty dealing with smart reporting applications**** (average 2.35), indicating a gap in technology acceptance among some individuals, and the need to enhance their technical skills and mitigate fears associated with change.

As for the standard deviations, they ranged between (0.50 - 0.77), which are relatively low percentages, indicating the closeness of the sample's responses and the absence of significant variation between them in assessing the challenges. Accordingly, the results confirm that technical and human challenges are significantly present, but at a moderate level, with particular attention focused on ongoing training, technical support, and the provision of alternative plans as essential factors for overcoming them.

Table (3): Final Ranking of Items by Mean Score

Rank	Item No.	Statement (Shortened)	Mean
1	15	Overcoming challenges requires human & technical support	2.80
2	13	Backup plans are needed when electronic systems fail	2.72
3	2	Additional training required to handle modern equipment	2.65
4	9	Lack of financial resources limits equipment provision	2.63
5	3	Weak technical infrastructure affects speed of response	2.58
6	7	Poor network connectivity hinders team work	2.55
7	12	Lack of ongoing training reduces effectiveness	2.50
8	5	Technical challenges reduce performance efficiency	2.50
9	14	Human difficulties (fatigue/experience) affect tech use	2.49
10	6	Lack of immediate technical support complicates issues	2.48
11	8	Rapid tech development is difficult to keep up with	2.45
12	11	Psychological/physical stress affects system adaptation	2.43
13	1	Teams face technical difficulties with new digital systems	2.40
14	4	Some paramedics struggle with smart reporting apps	2.35
15	10	Some employees resist change with new technologies	2.30

Table (3) shows the final ranking of the items according to the arithmetic mean, where it is clear that the highest challenge indicated by the participants is that overcoming difficulties requires integrated human and technical support (with an average of 2.80), followed by the need for alternative plans when electronic systems fail (with an average of 2.72), then the importance of additional training to deal with modern equipment (with an average of 2.65). These results confirm the respondents' awareness of the need to integrate technical solutions with human resources, in addition to providing ongoing training and emergency plans.

In contrast, at the bottom of the list, some employees resist change when new technologies are introduced (average 2.30), and some paramedics struggle with the use of smart reporting applications (average 2.35). This highlights challenges related to the human factor more than the technical aspect, as they relate to flexibility in accepting change and the level of digital proficiency.

Overall, this ranking indicates that challenges with strategic dimensions (such as planning, training, and technical support) received greater importance, while individual difficulties related to employees ranked lower. This reflects the Saudi Red Crescent's need to invest in psychological and technical training and rehabilitation to ensure better adaptation to the demands of field work.

Table (4): Validity & Reliability (Construct Validity and Reliability)

Type	Indicator	Value	Interpretation
Reliability	Cronbach's Alpha	0.91	High reliability

Validity	Internal consistency (item-total correlation)	0.45 – 0.72	Acceptable
Validity	Content validity (expert judgment)	Approved	Tool measures intended construct

Table (4) shows the results of the validity and reliability of the tool used in the study, where the value of Cronbach's alpha coefficient (0.91) showed a very high level of reliability, indicating that the items are homogeneous and able to measure the targeted field reliably. The correlation values between the item and the total score (0.45 - 0.72) reflect an acceptable level of internal consistency, confirming that all items are related to the primary variable and there are no abnormal or weak items. In addition, the content validity of the instrument was verified by presenting it to a group of experts, who agreed that it accurately measures the construct to be studied. These combined results provide high confidence in the validity of the tool for research use and the reliability of its results in drawing scientific conclusions.

Analysis results and recommendations

Results of the technical challenges facing Saudi Red Crescent teams in dealing with traffic accidents:

- The study showed that poor telecommunications network coverage in some remote areas and on highways poses a major challenge, making it difficult for field teams to communicate with operations rooms, thus delaying response times.
- The results revealed the need to update medical equipment in ambulances to keep pace with modern developments, as well as the need to provide specialized rescue equipment such as hydraulic shears to deal with entrapment incidents.
- The study demonstrated that the lack of a unified electronic system linking the Red Crescent with other relevant agencies, such as traffic and civil defense, makes coordination and information exchange difficult and impedes the process, potentially leading to wasted time and effort at the scene.
- indicated that current reporting systems need to be developed to ensure that incidents are handled more efficiently, prioritized, and appropriate teams are directed as quickly as possible.
- The results indicated that updating patient databases and medical records can be slow, affecting paramedics' ability to provide appropriate treatment as quickly as possible.

Results of the human challenges faced by Saudi Red Crescent teams in dealing with traffic accidents:

- The study concluded that there is an urgent need to provide ongoing, specialized training programs for emergency personnel to deal with multiple and complex injuries resulting from traffic accidents in order to ensure the provision of high-quality medical care in the field.
- The results also confirmed that paramedics are exposed to significant psychological and physical stress as a result of witnessing horrific accidents, which can lead to occupational burnout and post-traumatic stress disorder, negatively impacting their performance and ability to make sound decisions.
- The study showed that crowds of people gathering at accident sites and not making way for ambulances pose a major challenge, impeding and increasing the difficulty of emergency teams' work, which could result in delays in the arrival of assistance to the injured.
- The results revealed the need for paramedics to develop communication and crisis management skills to deal with injured people, their families, and the public during times of crisis, ensuring a more flexible and effective rescue operation.

- The results showed that limited budgets may hinder the provision of adequate specialized training courses for all personnel, thus affecting their level of preparedness.
- The study confirmed that psychological support programs for paramedics are insufficient and do not cover their actual needs to cope with emotional exhaustion and psychological stress.

- **Future recommendations**

The recommendations can be divided into two sections: recommendations specific to enhancing the technical aspect and recommendations specific to the human aspect, as follows:

-Special recommendations to enhance the technical aspect:

- It is recommended to establish an integrated GIS system linking all ambulances and operating rooms, with continuous updating of road maps and the provision of an accurate GPS system to ensure the fastest possible location, even in remote areas.
- Efforts must be made to provide reliable communications coverage across all regions of the Kingdom, and to activate a unified electronic linkage system between the Red Crescent and other relevant government agencies, such as the Traffic and Civil Defense Departments, to facilitate the exchange of information and immediate coordination.
- It also recommends upgrading the ambulance fleet and equipping it with the latest advanced medical equipment, such as portable vital signs monitors, automated cardiopulmonary resuscitation (CPR) machines, and hydraulic rescue tools to handle trapped situations.
- A specialized center must be activated to collect and analyze traffic accident data with the aim of identifying road hotspots, developing preventative strategies, and proactively deploying ambulance teams to ensure rapid response.

-**Recommendations to enhance the human aspect:**

- You must develop periodic training and qualification programs for your staff, focusing on the latest medical emergencies for dealing with patients, and capable of realistic simulations.
- Allocating comprehensive psychological support programs for paramedics, increasing the number of specialized psychological clinics dedicated to dealing with psychological exhaustion and work stress, including their partial exclusion.
- A wide range of public awareness campaigns across various media outlets to raise awareness of the importance of giving way to cars and not separating on websites, emphasizing that stopping them can directly impact someone's life.
- Commitment to improving the safe working environment for field paramedics by providing advanced safety equipment, in addition to providing moral support and continuous motivation to health teams by reminding them of their dedication to performing their humanitarian duties.

Conclusion

From the above, these signals indicate that they represent a practical roadmap and are effective in improving the Saudi Red Crescent's performance in dealing with traffic accidents. Therefore, they are capable of transforming challenges into opportunities for the development of others. Implementing these recommendations will directly reduce the time needed to deliver medical care, save lives, and improve the quality of field-based medical care. Furthermore, these recommendations were used to boost the morale and professionalism of emergency teams, and to facilitate various agreements, thus improving community confidence in the capabilities of the Saudi Red Crescent, affirming its role in serving humanity.

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