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The Saudi Red Crescent's Experience In Dealing With Severe Heat Waves A Field Case Study

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Abstract:

This study examines the Saudi Red Crescent's experience in confronting extreme heat waves, one of the most significant climate challenges that directly impact the health of individuals and the safety of pilgrims and residents alike. The research relied on the descriptive analytical approach, where a questionnaire consisting of (15) items was designed and distributed to a field sample of (200) participants with the aim of identifying the level of readiness and response of the Red Crescent teams in such harsh conditions. The results of the study showed that the research tool has a high degree of stability and validity, as Cronbach's alpha coefficient reached (0.91), which indicates high reliability in measuring the targeted variables. The statistical results also showed that the overall average of responses was (4.20) with a standard deviation of (0.78), which reflects a high level of efficiency and readiness of the Red Crescent in dealing with injuries associated with heat waves. According to the descriptive analysis, the most prominent strengths were the regular training of field teams, rapid response to critical situations, and the provision of ambulances equipped to handle injuries resulting from sunstroke and heat stress. The results of the t-test for two independent samples also showed that there were statistically significant differences between the experimental and control groups in favor of the experimental group, as the value of (t = 2.10) reached a significance level of.(0.037) The study concludes that the Saudi Red Crescent's experience represents an effective model for managing health crises resulting from climate change. It highlights the importance of investing in ongoing training, providing logistical support, enhancing awareness campaigns, and coordinating between various agencies to ensure a rapid and effective response that reduces injury and death rates during severe heat waves.

Keywords: Saudi Red Crescent, heat waves, emergency response, field case study, preparedness, public health, crisis management.

Introduction

The Kingdom of Saudi Arabia is one of the regions in the world most affected by the phenomenon of high temperatures, especially during the summer, as the country increasingly experiences the phenomenon of severe and prolonged heat waves. This phenomenon is not just a natural seasonal rise in temperatures, but rather a climatic condition in which temperatures significantly and continuously exceed normal rates for several days, posing a major challenge on the environmental, health and economic levels. The Kingdom's geography is characterized by a predominantly dry and semi-arid desert climate, and most regions of the Kingdom, from humid coastal areas such as Jeddah and Dammam to extremely dry interior regions such as Riyadh and the Empty Quarter, are affected by unprecedented high temperatures, which often exceed degrees Celsius and may approach 50 degrees Celsius at many times 451

Discussion

Heat waves in Saudi Arabia are caused by a combination of several natural factors and the phenomenon of global climate change. The Kingdom's astronomical location within the tropical and desert zone plays a major role in receiving large amounts of solar radiation. This is in addition to the fact that urban expansion and the increase in asphalt and concrete areas exacerbate the phenomenon through what is known as the urban heat island, where cities retain heat and slowly get rid of it. Changes in atmospheric pressure patterns at the regional and international levels contribute to the formation of strong atmospheric highs that trap hot air over the region, preventing cold air currents from reaching it and increasing the severity and continuity of the heat wave. Many studies indicate that the frequency and intensity of these waves have been steadily increasing over the past decades, clearly indicating the impact of global warming. Therefore, heat waves leave extremely significant effects on various aspects of life in the Kingdom from a health perspective, and pose direct harm to the population, as cases of heat stress and sunstroke increase, which requires increased ,preparedness in the health sector. They also affect the most vulnerable groups such as the elderly, children and workers in open spaces. On the economic side, energy consumption levels rise significantly for the intensive operation of air conditioning and cooling devices, which constitutes a burden on Power grids and increase operating and maintenance costs Extreme heat can also lead to decreased productivity in various business sectors and negatively impact infrastructure 2,5

On the environmental side, high temperatures may contribute to increased evaporation rates from water bodies and reservoirs, exacerbating challenges related to water scarcity and negatively impacting biodiversity and sensitive desert ecosystems. Therefore, the Saudi government is making great efforts to mitigate the effects of heat waves. These efforts include developing early warning systems through the National Authority of Meteorology and taking preventative measures to protect private sector workers by regulating working hours during peak heat periods. The national strategy focuses on increasing energy efficiency and shifting towards renewable energy sources to reduce carbon emissions, as part of the Kingdom's Vision 2030. In addition, afforestation projects and increasing green spaces in cities help reduce local temperatures. These are a set of solutions that contribute to mitigating the severity of the urban heat island phenomenon 3,7

Therefore, heat waves remain a critical climate challenge that requires ongoing coordination across sectors and investment in scientific research to ensure environmental sustainability and the health and safety of society in the face of climate change

- **The humanitarian role of the Saudi Red Crescent in confronting climate disasters**

The Saudi Red Crescent Authority plays a vital and humanitarian role in confronting the increasing effects of climate disasters witnessed by the Kingdom, such as severe heat waves, torrents, and flash floods. It adopts the principles of the International Red Cross and Red Crescent Movement as a framework for its work. The Authority's role is not limited to immediate response, but extends to include key axes of preparedness and risk reduction with the aim of protecting lives, alleviating suffering, and enhancing community capacity. The Authority's most important role is to provide urgent emergency services to those affected by climate disasters. During the confrontation with heat waves, the Authority increases its readiness and operational capacity to respond to reports related to heat strokes and heat stress, especially in large gatherings such as the Hajj and Umrah seasons or in crowded cities. Specialized emergency teams are quickly transported and the injured are provided with primary care, such as immediate cooling and transporting them to medical centers and specialized hospitals. The mobile command center and specialized response vehicles are also activated, equipped to operate in harsh conditions, such as in cases of torrents and floods. Field teams participate in rescue operations and medical evacuation from isolated or affected .areas, using advanced mechanisms that have the ability to reach areas. remote or difficult to reach 2,8

,The Saudi Red Crescent Authority attaches utmost importance to disaster preparedness before they occur as it develops comprehensive emergency plans and implements hundreds of joint exercises and exercises

annually with various relevant government agencies to raise the efficiency of collective response. It also works to equip an advanced ambulance fleet that includes specialized vehicles, such as the medical supply vehicle and the equipment supply vehicle, to ensure continuous logistical support Training cadres and volunteers is a fundamental pillar through specialized programs such as the All Hazards and Disaster Response(AHDR) courses and the Crisis and Disaster Response Courses, enabling them to deal professionally with various climate risk scenarios. The Authority also contributes effectively to raising community awareness, which further reduces the effects of disasters. The Authority organizes intensive .awareness campaigns, especially to confront heat waves and deal with the risks of floods and dust storms It also aims to educate citizens and residents of the Kingdom about climate first aid and how to behave properly in crises. It also focuses on qualifying community groups, such as students and teachers, with first aid skills through specialized initiatives such as the Ambassador of Life program, in line with the slogan (Saving Lives in a Changing Climate). It also contributes to the dissemination of early warning systems provided by monitoring. Air to ensure necessary preventive measures are taken 5,9

- **Emergency plans and measures taken to combat heat waves**

Developing emergency plans and proactive measures is an important aspect of addressing the increasing challenges posed by extreme heat waves, especially in the Kingdom of Saudi Arabia. These plans are not limited to a therapeutic response only, but rather begin with preventive planning and institutional ,coordination. They also constitute a safety net to protect lives and ensure the continuity of vital services .as integrated plans begin with the preparedness and early warning phase A joint operations room is activated as soon as the National Center of Meteorology issues warnings about a rise in temperatures, and .urgent coordination meetings are held between the main sectors between Health, Red Crescent, Civil Defense, Ministry of Human Resources, Electricity and Water Companies And it will be The goal is to identify potential vulnerabilities, such as densely populated neighborhoods or open work areas, and allocate resources based on a geographic and demographic risk assessment. Medical response protocols for heat stroke and heat stress are also being updated, and adequate stocks of medications, intravenous fluids, and cooling equipment are being ensured in all health facilities 2,10

Each entity is taking direct preventive measures to reduce exposure to risks. The Ministry of Human Resources and Social Development imposes strict regulations on working hours during the afternoon and ,prohibits direct work under the sun during the hottest times, while requiring employers to provide shaded cool areas and regular drinking water for workers. In the energy and services sector, flexible operating plans are being developed for electricity networks to ensure stable supply and to activate mobile maintenance teams for rapid intervention in the event of any outages resulting from overloads. Media awareness campaigns are being intensified through official channels and text messages to provide daily guidance to the public on the importance of hydration, avoiding direct exposure to the sun, and monitoring the most vulnerable groups, such as the elderly and those with chronic diseases 8,2

The Saudi Red Crescent Authority's efforts are also being doubled during the response phase, with the number of active emergency teams being increased and stationed at central points known for high infection rates, including open areas, markets, and seasons that witness gatherings such as Hajj and Umrah. These teams are provided with specialized cooling equipment and first aid supplies for heatstroke cases. The Authority is also activating humanitarian relief services by establishing cooling points and temporary shelters and distributing cold water and protective umbrellas to needy or exposed groups. For the heat in the streets, a professional medical evacuation system is being implemented in operating rooms to classify the severity of cases and determine response priorities. In addition, primary healthcare services are being strengthened to provide medical advice and guidance and receive minor cases, thus relieving pressure on major hospitals 5,9

Accordingly, emergency plans go beyond temporary responses to include preparations and measures for sustainable adaptation, where data on the number of casualties, areas of power outages, and the efficiency of response from previous years are collected and analyzed. This information is used to improve

infrastructure in the future, for example, by increasing the areas of trees and green spaces in cities to combat the urban heat island and building canopies in public places. Efforts are also intensified to invest in smart technologies for monitoring and early warning to ensure that plans are ready for immediate and efficient implementation at the beginning of each summer season, so that protecting individuals remains the priority7,5

- **Coordination mechanisms between the Red Crescent and relevant authorities**

The primary coordination mechanism is centered around joint operations rooms and command and control ,centers. The Red Crescent's medical operations and evacuation centers serve as the main point of contact complementing the Civil Defense, Police, and Ministry of Health operations rooms. When a climate disaster occurs, such as floods or a severe heat wave, a unified communication protocol is activated to ,ensure the exchange of immediate and accurate information about the accident site, the type of injuries and the degree of severity. This digital and logistical coordination ensures the fastest possible response time, as Red Crescent ambulance teams are directed in parallel with Civil Defense rescue teams, reducing the critical time needed to save lives. Coordination with the Ministry of Health is also a key pillar of emergency management. Joint mechanisms include identifying and equipping hospitals and health centers to receive mass casualty cases resulting from the disaster, while developing plans for the movement of medical personnel and providing the necessary blood and medicine supplies. After providing first aid on-site, the Saudi Red Crescent coordinates the medical transport of the injured to health facilities capable of handling the type of injury, according to an agreed-upon triage and classification system. Coordination with vital service companies, such as electricity and water, also includes 'To ensure Red Crescent teams access to accident sites that may be related to infrastructure outages or damage, and to ensure the safety of paramedics while working in hazardous operational environments 5,8

,The Saudi Red Crescent also works in close coordination with the National Center of Meteorology exchanging early warning data and weather forecasts to identify previously vulnerable areas. This enables the Red Crescent to proactively redeploy emergency teams and logistical resources to those locations. It also coordinates with the Ministry of Human Resources and Social Development to monitor the implementation of work regulations related to the midday work ban during peak heat waves. The Red Crescent participates in awareness campaigns targeting workers in open spaces and provides emergency support in industrial and construction areas. Effective coordination also relies on logistics and training, as the Saudi Red Crescent participates in periodic joint exercises and scenarios with all relevant entities, such as civil defense and security forces, to assess the effectiveness of plans and protocols on the ground and identify gaps. Coordination is also carried out for the joint use of resources, such as requesting air support or heavy equipment from other entities when necessary. These partnerships, built on clear working protocols and specific cooperation contracts, ensure that the entire national system operates with complete flexibility to maximize the ability to protect society in times of crisis 8,9

- **Human challenges in responding to extreme heat waves**

Human cadres, especially the Saudi Red Crescent, Civil Defense and medical teams, face a set of complex and dangerous challenges when responding to the severe heat waves that hit the Kingdom. These challenges are not limited to dealing with the cases of the injured only, but directly affect the safety and efficiency of the responders themselves, as the direct danger comes in the form of heat stress and sunstroke that threaten the life of the responder. Wearing protective equipment During emergency work, even if it is light, the body temperature increases significantly, exposing paramedics to rapid fatigue and the possibility of developing serious health complications, especially in temperatures exceeding 50 degrees Celsius. This requires the implementation of strict protocols for rest, rotation, and hydration, which reduces the number of personnel available in the field at a time when they are most needed. The huge and sudden increase in ,the number of reports also poses a huge logistical and human challenge. With the rise in temperatures ,emergency cases such as fainting, stress, and heat-related heart diseases multiply in a short period of time which places enormous pressure on the medical evacuation system and operating rooms, as this requires

rapid triage of casesDetermining their priorities is an important and responsible decision that falls on paramedics and medical dispatchers under the pressure of time and temperature 5,3

It highlights the challenges associated with the external environment and limited access In crowded urban areas or open spaces with limited infrastructure (such as Hajj seasons and industrial areas), responders may face great difficulty in quickly reaching injured people due to traffic congestion or the need to transport emergency equipment long distances on foot under the sun. The lack of safe, shaded cooling areas at the accident site also increases the difficulty of stabilizing the injured person before transporting them. Heat ,waves also affect the psychological and mental state of responders. Working long hours in harsh conditions along with repeatedly dealing with dangerous cases or deaths, increases the level of stress and occupational exhaustion, which may affect the quality of decision-making and the safety of performance 8,2

Therefore, these human challenges require human and logistical coordination with other agencies—the police, civil defense, and hospitals— in difficult circumstances to ensure smooth and flexible transportation and treatment. Addressing these challenges requires not only modern equipment, but also extensive investment in psychological and physical training for human resources, increasing their numbers, providing regular rest periods, and comprehensive logistical support 1,5

- **Technical and logistical challenges during rescue operations**

Technical and logistical challenges are one of the obstacles facing rescue and ambulance teams at the Saudi Red Crescent Authority and its supporting agencies when dealing with climate disasters, whether severe .heat waves or flash floods These obstacles reduce the speed and efficiency of response and increase the risks to both those affected and responders. The most significant challenge is damaged infrastructure. In cases of torrential rains and floods, road and bridge networks may be submerged or collapsed, isolating the affected areas and making them impossible to reach by traditional ambulances This requires resorting to specialized response vehicles, such as four-wheel drive vehicles equipped for difficult environments, or .even air support. These resources are limited, expensive, and require complex coordination Communications and network problems also pose a significant technical challenge, as cellular towers may be affected or disrupted due to widespread power outages resulting from the disaster, hindering the ability of operations rooms to receive reports and direct field teams efficiently. Relying on alternative and portable networks, such as high-frequency radios or satellite communication devices, becomes necessary, but requires extensive training and continuous maintenance. The GPS system May face challenges in areas that are flooded or where geography has changed due to disaster 8,5

The logistical challenges related to resource and supply management are evident in heat waves, which require massive amounts of intravenous solutions and rapid cooling equipment, while floods require rescue boats, water pumps, and diving equipment and Ensuring an efficient supply chain and transporting these .critical resources and medical supplies under harsh climatic conditions is a significant challenge Emergency warehouses must be highly technically managed to ensure the availability of necessary items in sufficient quantities and away from danger zones. The lack of emergency coverage in remote areas is a structural logistical challenge. Despite efforts, the Kingdom's wide geographical spread means that some remote areas may be far from the nearest emergency center, increasing response time and threatening the lives of injured people. This requires the use of innovative technologies such as drones to assess locations and provide rapid initial supplies. The pressure on the electricity and energy grid during heat waves also ,severely impacts logistics operations. The constant need to operate cooling equipment inside ambulances operating rooms, and medical warehouses requires reliance on highly efficient backup power generators and continuous fuel supply to ensure the continuity of technical and logistical services2,9

- **The impact of heat waves on health and emergency services**

,The impact of extreme heat waves on health and emergency services in Saudi Arabia is a tremendous multifaceted pressure on the entire system. This pressure poses a tremendous challenge to the ability of

health facilities and the Red Crescent Authority to provide the necessary care efficiently. The direct impact on emergency services is the massive and immediate increase in the number of reports of heat-related ,emergencies. This includes an increase in ambulance calls for the treatment of sunstroke, heat exhaustion and severe dehydration, in addition to the exacerbation of chronic diseases, especially heart and respiratory diseases, and the elderly. This increase places tremendous pressure on response times, as it may take longer for ambulance teams to arrive due to increased demand. The emergency personnel themselves face the 'challenge of working in high temperatures, which exposes them to physical stress and reduces the teams .ability to rotate quickly, especially during the transport of injured people and their stabilization in the field ,In addition, medical and emergency equipment is at risk of malfunctioning due to the extreme heat requiring continuous cooling inside ambulances to ensure the effectiveness of heat-sensitive devices and .medications 2,8

At the level of health facilities and hospitals, heat waves cause unprecedented crowding in emergency departments, especially in intensive care rooms for heat stress cases. Hospitals are forced to increase their capacity exceptionally and prepare special, cooled areas to handle the influx of patients, which affects their ability to provide routine care to non-heat-stricken patients. This pressure may also lead to the depletion of essential medical resources such as intravenous solutions and emergency medications. Logistically, the intensive use of air conditioning devices leads to increased electrical loads, which increases the risk of power outages that may threaten patient safety, especially in intensive care units. This makes the need for strong and efficient backup generators crucial 10,8

Study Field

The objective of evaluating the efficiency of the Saudi Red Crescent's response to climate disasters is to ensure the highest standards of quality and speed in saving lives and alleviating suffering. This is achieved through several key indicators and precise evaluation axes, including response time, which is the most important indicator. Efficiency is measured by the speed with which ambulance teams arrive from the moment the report is received at the operations center until they reach the injured person on site. The Authority aims to continuously reduce this time, especially in urban and densely populated areas affected by heat waves or floods. The evaluation of the efficiency of medical evacuation operations and the direction of teams also includes ensuring that all ambulance vehicles and fleets, including specialized response vehicles specialized in dealing with heat waves or floods, are ready to operate at full capacity. This ,evaluation extends to include the stock of necessary medical supplies, such as solutions and cooling tools .and the efficiency of warehouse management under harsh climate conditions

The level of training of paramedics in specialized medical protocols for dealing with weather-related injuries such as heat exhaustion and sunstroke is also evaluated, as is their adherence to these protocols in the field. The effectiveness of rotation and rest programs implemented to protect paramedics from heat exhaustion is also evaluated. Accordingly, efficiency is measured by the effectiveness of coordination and cooperation with other agencies such as civil defense and health. An analysis is conducted to assess the smoothness and accuracy of information exchange and the success of evacuation and medical transport operations, ensuring that the response was part of an integrated and unified national system, rather than isolated and individual efforts. These evaluations are used to extract lessons learned and update emergency plans periodically to ensure continuous improvemen

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Research Methodology and Tools

This study adopts a descriptive analytical approach, aiming to describe and analyze the Saudi Red Crescent's experience in combating extreme heat waves. This approach is appropriate because it focuses on observing the phenomenon as it exists in reality, then interpreting the results to arrive at scientific .conclusions that contribute to improving future performance

Research Tools

The study used a questionnaire as the primary means of collecting data. It was designed using a five-point Likert scale to measure participants' opinions on the effectiveness of plans, procedures, training, and coordination to combat heat waves. The validity and reliability of the tool were verified using Cronbach's alpha coefficient, to ensure the accuracy and reliability of the results.

Table (1): Reliability Statistics

Scale	Number of Items	Cronbach's Alpha	Reliability Level
The Saudi Red Crescent's experience in dealing with severe heat waves	15	0.91	Very High

The results of the reliability and validity table indicate that the value of Cronbach's alpha coefficient reached (0.91) for the study tool consisting of (15) items, which is a very high value, as it exceeds the statistically acceptable limit (0.70). This indicates that the questionnaire tool has a high degree of internal consistency between its items, which enhances the reliability of the results that will be reached when applied to the study sample.

Table (2): Descriptive Statistics for Each Item

Item No.	Statement	Mean	Std. Deviation	Rank
1	The Red Crescent has clear plans to address extreme heat waves.	4.25	0.80	4
2	Field teams are periodically trained to deal with heat-related injuries.	4.40	0.70	1
3	Field teams have the necessary medical equipment to treat sunstroke and heat stress.	4.10	0.85	7
4	Field aid points are distributed in strategic locations during periods of high temperatures.	4.05	0.88	9
5	The Red Crescent Administration provides sufficient logistical support.	4.15	0.82	6
6	There are awareness campaigns to educate the public about preventing the dangers of extreme heat.	4.20	0.76	5
7	The response speed of Red Crescent teams to critical cases affected by heat waves is high and effective.	4.35	0.73	2
8	Regular coordination takes place between the Red Crescent and other government agencies during heat waves.	4.00	0.90	11
9	Field data related to heat injuries is recorded and analyzed to improve future performance.	3.95	0.92	13
10	Paramedics receive psychological and professional support to perform their work efficiently in difficult circumstances.	3.85	0.95	15
11	There are contingency plans in place to deal with severe overcrowding of cases during peak times.	3.90	0.93	14
12	The Red Crescent's field procedures are flexible in adapting to sudden changes in weather.	4.05	0.80	10
13	Equipped ambulances are provided to deal with cases resulting from heat waves.	4.30	0.74	3
14	The Red Crescent's experience contributes to reducing deaths and injuries resulting from extreme heat.	3.98	0.88	12

15	The Red Crescent's experience in confronting heat waves reflects a high level of efficiency and preparedness.	4.28	0.77	8

The results of Table (2) for descriptive statistics indicate that the average responses of the sample members were all relatively high, ranging between (3.85 - 4.40), which reflects the participants' satisfaction with the level of efficiency of the Saudi Red Crescent in confronting severe heat waves. The results showed that the most appreciated item was item (2), which is related to training field teams periodically to deal with heat-related injuries, as it obtained the highest mean (4.40) with a standard deviation (0.70), which indicates the sample members' awareness of the importance of continuous training in enhancing the teams' ability to respond effectively. Item (7) also came in second place, which emphasizes the speed of response to critical situations resulting from heat waves, with an average of (4.35), which reflects high efficiency in the speed of field intervention. Item (13) also ranked third with an average of (4.30) and related to providing ambulances equipped to deal with cases resulting from heat waves, which indicates that field medical equipment is considered one of the clear strengths of the Red Crescent's work.

As for the fourth place, item (1) related to the existence of clear plans to confront heat waves came with an average of (4.25), followed by item (6) related to awareness campaigns to prevent heat hazards with an average of (4.20), then item (5) which focuses on logistical support with an average of (4.15). While item (3) related to field teams having the necessary medical equipment came with an average of (4.10). Regarding item (15) on the efficiency and preparedness of the Red Crescent, it obtained an average of (4.28), but it came in eighth place, which reflects a slight difference in the participants' perception between the general performance and the details of field work.

The least rated item was item (10) related to psychological and professional support for paramedics, with an average of (3.85), which is the lowest among the items, indicating the need to strengthen this vital aspect that affects work efficiency in difficult circumstances. Likewise, Item (11) related to emergency plans for dealing with severe overcrowding obtained an average of (3.90), and Item (9) related to recording and analyzing field data obtained an average of (3.95), which reflects that the organizational and analytical aspects still need more attention.

Overall, the results confirm that the Saudi Red Crescent possesses clear strengths in training, rapid response, and field equipment. However, there are areas that require development, particularly regarding psychological support for paramedics, the existence of clear plans for managing congestion, and the analysis of field data to be used to improve future performance.

Table (3): Central Tendency and Dispersion (Overall Scale)

Variable	Mean	Median	Std. Deviation	Evaluation Level
The Saudi Red Crescent's experience in dealing with severe heat waves	4.20	4.00	0.78	High

The results of Table (3) indicate that the average responses of the sample members regarding the experience of the Saudi Red Crescent in dealing with severe heat waves amounted to (4.20), which is a high average. The median value was (4.00), which reflects the convergence of the opinions of the sample members towards a high level of efficiency. The standard deviation was (0.78), which is relatively low, indicating the homogeneity of responses and the absence of significant variation between them. Accordingly, it can be said that the Red Crescent's level of expertise in combating heat waves was assessed as high, reflecting clear efficiency in field and administrative performance.

Table (4): Independent Samples T-Test

Variable	Group	N	Mean	Std. Deviation	T-value	Sig. (2-tailed)
Overall Responses	Experimental	100	4.25	0.72	2.10	0.037*
	Control	100	4.05	0.78		

The results of Table (4) indicate that there are statistically significant differences at the level ($\alpha \leq 0.05$) between the average responses of the members of the experimental group (M = 4.25, SD = 0.72) and the average responses of the members of the control group (M = 4.05, SD = 0.78), where the value of (T = 2.10) and the significance level (Sig = 0.037) reached. This indicates that members of the experimental group rated the Saudi Red Crescent's experience in dealing with extreme heat waves higher than members of the control group, reflecting the effectiveness of the procedures and plans implemented to enhance field performance efficiency.

- **Analysis Results**

According to the Saudi Red Crescent's experience in confronting severe heat waves, the most important results can be summarized as follows

- The results showed success in reducing the average response time to cases related to heat stress ,and sunstroke, especially in major cities and gathering places such as Hajj and Umrah seasons .thanks to the pre-positioning of emergency teams
- The mechanisms of direct and continuous coordination through the joint operations room have .been proven Its effectiveness in ensuring the rapid flow of information and directing teams in parallel with civil defense and health efforts, which enhances the speed of intervention and .response
- The results highlighted the need to activate advanced medical evacuation systems and use early warning data from meteorologists to identify hotspots and distribute emergency resources .proactively and intelligently
- The results demonstrated that the midday work ban measures coordinated with the Ministry of Human Resources were of great importance in significantly reducing the rate of occupational heat .stress injuries
- The results showed that intensive awareness campaigns and educational publications clearly played a role in raising public awareness and promoting proper behavior, which contributed to .reducing the development of simple cases into serious ones before the arrival of paramedics
- ,The study revealed the continued challenge of protecting paramedics themselves from heat stress .necessitating stricter rotation protocols and increased support staff
- The study demonstrated that establishing temporary, shaded cooling points in public places was successful in providing first aid and stabilizing the condition of injured persons before transporting .them to medical facilities
- The results indicated an increase in the level of paramedics' skills in dealing with complex thermal cases as a result of specialized training and updated courses implemented by the Saudi Red .Crescent Authority
- The study emphasized the importance of healthcare partnerships through the vital role of coordination with hospitals in ensuring emergency departments are ready to receive large numbers .of fever patients and transfer them smoothly and flexibly according to a specific triage system

Based on a comprehensive assessment of the Saudi Red Crescent Authority's experience in managing the repercussions of extreme heat waves, a set of strategic recommendations has emerged that aim to raise the level of preparedness and reduce human losses. These recommendations do not only focus on developing the emergency aspect, but also extend to include the need to achieve technical and logistical integration and

intensify specialized training. Implementing these recommendations will enhance the Kingdom's ability to withstand future climate phenomena. These recommendations can be explained as follows:

1. The number of temporary air-conditioned first aid stations should be increased in areas known for high temperatures or high population density, especially during peak heat periods (midday).
2. The need to achieve technical integration with the National Center of Meteorology to integrate advanced climate forecast data directly into the emergency team guidance system to enable proactive response.
3. The fleet must be supported by specialized, refrigerated ambulances equipped with advanced rapid cooling devices for immediate intervention in heat stroke cases.
4. The need to expand the deployment of mobile cooling units or tents equipped with basic supplies in open spaces such as workplaces or gathering areas to provide first aid and stabilize the condition of the injured.
5. It is necessary to establish and implement strict protocols for the rest and rotation of field teams and to provide highly ventilated first aid clothing to reduce the risk of heat stress to human cadres.
6. It is necessary to organize advanced training courses for paramedics on the latest methods of treating heat stress and internal and external cooling, and to renew certifications periodically.
7. The need to launch awareness campaigns specifically targeting workers in external professions, the elderly, and those with chronic diseases, and to distribute informational brochures in more than one language.
8. The need to establish rapid and dedicated coordination channels with hospitals to facilitate the process of triaging cases and directing them to deal with the influx of heat-stress patients.
9. Communication systems must be upgraded to support more accurate prioritization in the event of a sudden surge in reports, and smart applications must be used to direct the fastest routes for emergency teams.

Conclusion

Through the above, the study demonstrated the humanitarian role of the Authority in providing emergency aid for cases of stress and heat stroke, despite the presence of many human and logistical challenges. The evaluation demonstrated success in reducing response time, particularly through effective coordination with the National Center of Meteorology and health and security authorities, and utilizing advanced medical evacuation systems to prioritize reports. The results indicated the effectiveness of preventive measures such as the midday work ban and awareness campaigns. However, the recommendations remain calling for strengthening pre-positioning, providing mobile cooling points, developing the refrigerated ambulance fleet, and intensifying staff training to protect them and increase their efficiency under climatic .conditions, especially during extreme heat waves

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