
The Evolution of Emergency Response Protocols in Saudi Arabia Over the Decades

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Abstract:

Emergency response protocols in Saudi Arabia have significantly evolved over the decades, shaped by the country's rapid growth and development, as well as the increasing complexity of emergencies from natural disasters to security threats. In the 1970s and 1980s, the establishment of the Civil Defense Directorate marked the beginning of a more organized approach to emergency management, focusing primarily on fire safety and disaster preparedness. As the nation faced urbanization and infrastructural expansion, the protocols began to incorporate more comprehensive training for first responders and the establishment of communication systems to enhance coordination among various agencies. The Gulf War in the early 1990s further highlighted the importance of strategic emergency planning and led to improvements in civil defense strategies and national readiness. By the 2000s, as Saudi Arabia modernized and implemented broader economic and social reforms, the emergency response framework further integrated advanced technologies and international best practices. The establishment of the Saudi Red Crescent Authority and collaboration with global organizations underscored a commitment to humanitarian principles and efficient crisis management. Recent decades have seen a focus on enhancing public health emergency responses, particularly in light of the COVID-19 pandemic, which necessitated rapid adaptations to protocols and increased public awareness campaigns. Today, Saudi Arabia continues to invest in training, infrastructure, and community engagement to ensure a resilient emergency response system capable of addressing the evolving challenges of the future.

Keywords: Emergency Response Protocols, Saudi Arabia, Civil Defense, Disaster Preparedness, Gulf War, Saudi Red Crescent Authority, Public Health Emergency, Crisis Management, Technological Integration, Community Engagement.

Introduction:

The Kingdom of Saudi Arabia, characterized by its strategic geopolitical location, vast desert landscapes, and rapid modernization, has faced a myriad of emergencies over the decades, ranging from natural disasters to large-scale industrial accidents and health crises. The necessity for effective emergency response protocols has, therefore, emerged as a salient issue in the nation's overarching public safety discourse. As Saudi Arabia has evolved economically and socially, so have its strategies for managing emergencies [1].

Historically, the roots of emergency response in Saudi Arabia can be traced back to the early 20th century, during a period marked by limited infrastructure and resources. The nascent state relied heavily on local community efforts and traditional methods to address emergencies, such as tribal coalitions stepping in to manage crises. However, the significant socio-economic transformations spurred by the discovery of oil in the 1930s marked the beginning of a new era that necessitated formalized emergency response mechanisms. This seismic shift not only catalyzed the introduction of modern governance structures but also highlighted the urgent need for robust emergency management strategies, particularly in urban centers such as Riyadh, Jeddah, and Dhahran, where population densities were beginning to rise [2].

The 1970s and 1980s represented a critical period in the evolution of emergency response protocols, as Saudi Arabia began to implement more systematic approaches to disaster management. This phase was characterized by the establishment of governmental institutions such as the Civil Defense Department, which was tasked with disaster preparedness, response, and recovery. The introduction of formal training programs for emergency personnel became essential, fostering a culture of readiness in the face of potential hazards. Traditional approaches, which may have emphasized communal responsibility, began to intertwine with modern practices rooted in state governance. Such collaborations reflected a burgeoning recognition of the importance of emergency management as an institutional function, rather than a mere community effort [3].

With the advent of the 1990s, globalization and technological advancements further propelled the evolution of emergency response protocols in Saudi

Arabia. The Gulf War (1990-1991) presented unprecedented challenges, including the threat of chemical attacks and the need to manage vast populations displaced by conflict. In response, Saudi Arabia adopted international standards for disaster response and became increasingly involved in collaborative efforts with organizations such as the United Nations and the Red Crescent Society. The lessons learned from this tumultuous period catalyzed revisions to existing emergency protocols, fostering greater integration of modern technologies such as telecommunications and information systems into the emergency management framework [4].

In the 21st century, the emergence of new threats, including terrorism, health pandemics, and climate-related disasters, has further underscored the need for continuous improvement in emergency response protocols. The tragic events of September 11, 2001, and subsequent acts of terrorism reshaped the national security landscape, precipitating the establishment of the National Security Council. This body emphasized a comprehensive approach to emergency management that encompasses prevention, preparedness, response, and recovery phases, paving the way for more inclusive and holistic strategies. The explosion of information technology has further revolutionized protocols by enabling real-time communication and data sharing among emergency responders, thus enhancing operational efficiency and accuracy during crises [5].

Recent years have also witnessed a significant focus on the integration of public health responses into broader emergency management frameworks, particularly in light of the COVID-19 pandemic. The Saudi government adopted rigorous health protocols and mobilized resources to manage public health emergencies more effectively. The establishment of the Ministry of Health's Emergency Health Management Center exemplifies a proactive approach, prioritizing the development of plans that address both the immediate needs during crises and the long-term health outcomes of affected populations [6].

A critical component of this evolution has been the recognition of the importance of community engagement and stakeholder involvement in emergency management. Initiatives such as the

establishment of volunteer groups and public awareness campaigns seek to foster a collective sense of responsibility among citizens. This shift towards participatory emergency management signifies a move away from a solely top-down approach, promoting resilience and a culture of preparedness at the community level [7].

Establishment of the Civil Defense Directorate (1970s-1980s):

The evolution of urban society has always been punctuated by the need for safety and security, especially in the face of natural disasters, conflicts, and other unforeseen emergencies. The establishment of organizations dedicated to civil defense has been paramount in ensuring that governments can effectively respond to crises and safeguard their citizens. The 1970s and 1980s marked a significant shift in civil defense paradigms across many nations, leading to the establishment of various Civil Defense Directorates worldwide [7].

The post-World War II era was dominated by geopolitics heavily influenced by the bipolar tensions between the United States and the Soviet Union. The Cold War ushered in a pervasive fear of nuclear warfare as both superpowers built formidable arsenals and advanced military technologies. Governments around the world recognized the urgent need to prepare their populations for the potential fallout from these distinct threats. This urgency was not only due to the possibility of nuclear war but also stemmed from rising incidences of natural disasters, such as hurricanes, earthquakes, and floods, which were becoming more pronounced due to climate change [7].

Against this backdrop, civil defense emerged as a critical component of national security strategy. The objective was twofold: to mitigate the loss of life and property during crises and to bolster public confidence in government capabilities. Consequently, countries initiated various civil defense initiatives, leading to the establishment of dedicated Civil Defense Directorates [7].

In numerous countries, civil defense frameworks were established in response to this escalating threat environment. For instance, in the United States, the Federal Civil Defense Act of 1950 laid the groundwork for a structured national civil defense

system. This legislative initiative provided funding for local and state civil defense programs aimed at preparing communities for potential nuclear attacks, including developing public alert systems, first-aid training, and the establishment of emergency shelters [8].

Similarly, in Western Europe, European nations began to formalize their civil defense strategies. For instance, in 1975, the Federal Republic of Germany implemented its own Civil Defense Law, leading to the establishment of the German Federal Office for Civil Protection and Disaster Assistance (BBK) in 2000. This institution stemmed from earlier civil defense efforts aimed at the protection of citizens against both military and civilian dangers [8].

Well beyond Europe, many other nations initiated their civil defense programs during this period. The Soviet Union, under Leonid Brezhnev, crafted an extensive civil defense strategy that emphasized preparedness for nuclear attacks, domestic stability, and control over populace mobilization. In various Asian countries like Japan and India, civil defense programs were rooted in historical experiences with natural disasters and military conflicts, driving nations to prioritize disaster management and public safety [8].

Organizational Structure and Functionality

The Civil Defense Directorates, established during this period, were designed to function at multiple levels—national, regional, and local. These agencies were tasked with several critical roles, which remain foundational to civil defense operations today:

1. **Preparedness Planning:** The primary responsibility of these directorates was to develop and implement emergency response plans. This included conducting risk assessments, identifying vulnerable populations, and recommending appropriate responses to potential disasters ranging from natural calamities to terrorist attacks [9].
2. **Training and Education:** Training was pivotal. Civil Defense Directorates focused on educating citizens about emergency preparedness, conducting drills, and ensuring that communities could access vital information quickly during a crisis.

This included first-aid training, evacuation procedures, and the distribution of materials outlining suitable actions in various emergencies [9].

3. **Coordination with Local Entities:** Effective crisis management required coordinated responses among multiple agencies, including fire departments, police, medical services, and the military. Civil Defense Directorates acted as central coordinators, fostering collaboration among these entities to ensure efficient resource sharing and communication during emergencies [9].
4. **Public Awareness Campaigns:** Public awareness was crucial for the success of any civil defense initiative. Directorates conducted campaigns aimed at heightening consciousness regarding emergency preparedness, thus empowering citizens to take proactive stances in their safety [9].
5. **Research and Development:** As threats evolved, so too did the strategies to combat them. Civil Defense Directorates were often at the forefront of research, exploring new technologies for disaster response and recovery, coordinating with scientific communities to develop innovations that could help mitigate disaster risks [10].

Impact and Legacy

The establishment of Civil Defense Directorates in the 1970s and 1980s bore a significant impact on governmental preparedness and civic engagement. These organizations effectively institutionalized the concept of civil defense, fostering a culture of readiness that permeated various societal strata [11].

The legacy of these initiatives is observable in contemporary emergency management systems. The improved structures resulting from these early efforts laid the foundation for the sophisticated emergency management frameworks that prevail today. The approach adopted during this time paved the way for internationally recognized protocols, such as the establishment of the International Civil Defense Organization (ICDO) in 1966 and the development of comprehensive emergency

management systems that now incorporate disaster risk reduction initiatives [11].

Furthermore, the challenges faced and lessons learned during the second half of the twentieth century catalyzed contemporary discussions around climate change, preparedness for pandemics, and resilience to biosecurity threats. The frameworks established for civil defense, aided by technological advancements such as the internet and mobile communication, have transformed into dynamic emergency management practices applicable across various disciplines [12].

Impact of Urbanization and Infrastructure Development on Emergency Protocols:

Urbanization and infrastructure development are integral components of modern societal progress. As communities expand and evolve, their social fabric, economic viability, and overall functionality are profoundly influenced by these two phenomena. However, the rapid pace of urbanization accompanied by extensive infrastructure development presents unique challenges and opportunities in the realm of emergency protocols [12].

Urbanization refers to the increasing population shift from rural to urban areas and the resulting growth of cities. According to the United Nations, more than half of the world's population now resides in urban areas, a trend that continues to accelerate. This influx contributes to the expansion of cities both in terms of population density and geographic area. Infrastructure development encompasses the construction and enhancement of essential systems and services, including transportation networks, utilities, public health facilities, and communication systems, all of which are necessary to support urban populations [12].

The proliferation of urbanization and infrastructure development significantly affects the way emergency services plan for, respond to, and recover from disasters and crises. Several dimensions must be examined to understand this interplay fully [13].

One immediate consequence of urbanization is increased population density within urban ecosystems. With more people living in confined areas, the potential for human casualties in emergency situations rises. This heightened risk

necessitates comprehensive emergency protocols that account for the dense concentration of individuals, especially during natural disasters, terrorist attacks, or public health emergencies. Emergency services must adapt their strategies to effectively reach and evacuate large populations, which may require sufficient planning for transportation routes, crowd control, and communication systems [14].

Infrastructure is vital not only for day-to-day functioning but also for effective emergency responses. Urban areas often possess critical infrastructure such as bridges, roads, hospitals, and power grids that, when compromised, adversely affect emergency response capabilities. Urbanization presents challenges in maintaining and safeguarding these infrastructures against various hazards, including climate change, natural disasters, and aging systems [14].

Assessing resilience becomes essential. There must be protocols in place to evaluate the structural integrity of buildings and infrastructure systems, and to implement upgrades where necessary. This includes designing infrastructure with the capability to withstand extreme weather conditions or seismic activities, and ensuring redundancy in critical services such as healthcare and emergency communication systems [14].

The advent of smart technology and data analytics is reshaping emergency protocols in urban centers. As infrastructure develops, cities increasingly harness technologies such as Geographic Information Systems (GIS), artificial intelligence, and real-time data analytics to enhance emergency response efforts. Urban planners and emergency responders utilize these technologies to map population density, identify high-risk zones, and facilitate faster evacuation routes [15].

For instance, smart transportation systems can guide emergency vehicles efficiently through congested urban areas, while mobile apps enable real-time communication with residents concerning safety measures during an emergency. As such, the integration of technology into urban infrastructure not only bolsters emergency preparedness and response efforts but also transforms protocols to align with rapidly evolving urban landscapes [16].

Urbanization necessitates coherent policy frameworks that bring together various stakeholders, including government agencies, non-governmental organizations, and community groups, to develop robust emergency protocols. The complexity of urban environments often requires inter-agency collaboration and resource sharing, enabling collective responses to crises [16].

In many cities, emergency management agencies are increasingly adopting a whole-community approach to empower residents in disaster preparedness. Initiatives may include community drills, educational programs, and neighborhood watch schemes that rely on local engagement. As urban areas grow, it becomes critical to develop policies that not only prioritize infrastructure development but also address the social dynamics of urban communities, ensuring that no population segment is left vulnerable during emergencies [17].

The relationship between urbanization and climate change introduces further challenges for emergency protocols. Rapid urban growth often results in environmental degradation, which can exacerbate the effects of climate-related disasters. Consequently, developing sustainable urban infrastructures becomes a pivotal aspect of emergency preparedness [17].

Cities must incorporate sustainability into their emergency plans by considering the long-term impacts of climate change. Building green spaces, enhancing drainage systems, and utilizing resilient building materials are instances of infrastructure development strategies that can reduce vulnerability to disasters. Emergency protocols focused on sustainability not only aim to mitigate damage during disasters but also emphasize recovery and rebuilding efforts that align with eco-friendly principles [17].

Lessons from the Gulf War: Strategic Enhancements in Response Planning:

The Gulf War, which took place from August 1990 to February 1991, stands as a defining conflict in modern military history, illuminating numerous lessons that have reshaped strategic thinking in military response planning. Initiated in response to Iraq's invasion of Kuwait, the Gulf War showcased the importance of rapid force mobilization, technological advances, international coalitions, and

the intricate interplay between military action and political strategy [18].

1. The Importance of Coalition Building

One of the most profound lessons of the Gulf War was the effectiveness of coalition warfare. The United States, alongside a coalition of 34 other nations, successfully united a diverse array of military forces against Iraq. This massive coalition demonstrated that multilateral engagement not only broadens the legitimacy of military actions but also enhances operational capabilities through shared resources and expertise. As a response to this observation, modern military planning increasingly emphasizes establishing coalitions well ahead of potential conflicts. Formal alliances, as witnessed in the North Atlantic Treaty Organization (NATO), and informal coalitions formed through diplomatic channels have become crucial elements in contemporary military strategy, facilitating an expanded operational footprint and mitigating the burdens of unilateral action [18].

2. Emphasis on Joint Operations and Interoperability

The Gulf War underscored the necessity of joint operations, where military branches work cohesively to achieve common objectives. The integration of air, land, and naval forces showcased the value of synchronized operations. The successful execution of Operation Desert Storm demonstrated how air superiority—achieved through precise and sustained air campaigns—was indispensable to ground forces' effectiveness. As a direct result of this lesson, militaries around the world have invested heavily in joint training programs and exercises to enhance interoperability. Forward-thinking militaries have implemented systems that facilitate real-time communication and intelligence sharing, which are pivotal for effective cooperation between joint and coalition forces in future conflicts [18].

3. Technological Superiority and Innovation

The Gulf War was notable for the extensive use of advanced technology, including precision-guided munitions (PGMs), stealth capabilities, and sophisticated reconnaissance and intelligence systems. These technological advancements shifted the paradigms of warfare, emphasizing the power of information and speed. As military planners learned from the Gulf War, the necessity of technological

superiority became paramount. The integration of cutting-edge technology in warfighting capabilities has now become intrinsic in strategic planning, underscoring the relentless pursuit of innovation. Today's militaries prioritize research and development in emerging technologies such as artificial intelligence, cyber warfare capabilities, and unmanned aerial systems (UAS). The lessons from the Gulf War remind modern planners that maintaining a technological edge can dramatically alter the course of military engagements [19].

4. The Role of Media and Information Warfare

The Gulf War also marked a significant transformation in the role of media and information warfare. The unprecedented coverage of the conflict through television and other media outlets brought the horrors and realities of war into the living rooms of millions around the world. This 24-hour news cycle influenced public opinion and political decision-making, highlighting the importance of information dominance not only in a military context but also in shaping the narrative surrounding military action. Planners have since recognized the necessity of controlling information dissemination as part of response planning. Modern military strategies incorporate robust public affairs and information operations to manage perceptions and counter adversarial narratives effectively [19].

5. Understanding the Political Context

The political ramifications of military action were vividly demonstrated in the Gulf War. While the seamless execution of military strategies was evident, the post-war dynamics revealed the complexities of political engagement, particularly in securing diplomatic stability in the region. The lessons learned from failing to address the political aftermath of military success post-Gulf War underscore the importance of integrating political considerations into military planning. Contemporary military planners are now increasingly expected to engage not only with military objectives but also with the broader geopolitical landscape, promoting stability through diplomatic channels once hostilities cease. This holistic approach emphasizes the delicate balance between military objectives and political realities in achieving long-term peace and stability [19].

6. Flexibility and Adaptability in Military Doctrine

The Gulf War highlighted the necessity of flexibility in military doctrine and planning. The rapid evolution of battlefield scenarios necessitated an ability to adapt on the fly rather than relying strictly on pre-determined strategies. This adaptability was evident in the U.S. military's ability to respond to the evolving threat landscape and battlefield conditions, employing tactics that shifted based on real-time intelligence and operational feedback. Modern militaries now prioritize flexibility within their doctrine, encouraging creative thinking and rapid response capabilities. This approach allows forces to pivot quickly in unpredictable environments, maximizing effectiveness in dynamic circumstances [20].

Advancements in Technology and Their Role in Modern Emergency Response:

In a world marked by unpredictability and an increasing frequency of natural disasters, technological advancements play a crucial role in enhancing emergency response efforts. From disasters such as floods, earthquakes, and wildfires to man-made crises including terrorist attacks and pandemics, the necessity for effective and efficient emergency response is more vital than ever. The confluence of technology, data analytics, and communication systems has transformed traditional emergency response frameworks, leading to more robust and coordinated efforts in safeguarding lives and properties [21].

Historically, emergency response relied heavily on manual processes and human intuition, which often resulted in delays and inefficiencies. However, with emerging technologies such as geographic information systems (GIS), data analytics, and artificial intelligence (AI), emergency management has undergone a paradigm shift. These advancements have provided responders with the tools to orchestrate more responsive and data-driven approaches to crisis management [22].

One of the most significant developments has been the integration of satellite technology and GIS. These tools facilitate real-time mapping and monitoring of natural disasters, offering emergency responders a comprehensive view of affected areas. For example, during hurricanes, satellites can provide up-to-date information on storm paths and

wind speeds, enabling swift decision-making regarding evacuations and resource deployments. GIS allows for the visualization of hazards overlaying demographic and infrastructure data, which is critical for determining which communities are most vulnerable and require immediate assistance [22].

Mobile technology has introduced another layer of efficacy in emergency response. Numerous applications have been developed to assist both emergency responders and the general public in times of crises. For instance, platforms such as the FEMA App and Red Cross Apps provide users with real-time information about disasters in their area, emergency preparedness tips, and checklists. Local government agencies can communicate alerts and instructions directly to citizens through mobile notifications, thereby reducing misinformation and confusion [23].

Moreover, mobile applications allow individuals to report incidents, request assistance, and even donate to relief efforts from their smartphones. Social networking platforms have also emerged as critical communication channels, enabling people to share real-time updates about emergencies. The hashtag campaigns that trend on platforms such as Twitter during emergencies serve to galvanize public engagement and mobilize support, demonstrating the power of technology in fostering community solidarity [23].

Drones have positioned themselves as transformative tools in emergency management, offering capabilities that were previously unattainable. In disaster scenarios, drones can be deployed to assess damage, locate victims, and deliver essential supplies, dramatically reducing the time needed for ground assessment and response. For instance, in the aftermath of a natural disaster like an earthquake, drones equipped with infrared cameras can identify heat signatures, helping search and rescue teams locate individuals trapped under rubble [23].

Additionally, drones are instrumental in surveillance during wildfires, allowing responders to monitor fire progression and behavior in real-time. This information is vital for strategic planning, ensuring that firefighting resources are allocated efficiently and effectively to mitigate damage and protect lives. The cost-efficiency and speed of drone technology

also enhance operational efficacy, significantly reducing the risks facing human responders [24].

Artificial intelligence (AI) and machine learning are increasingly finding applications in the realm of emergency management. Predictive analytics use vast amounts of data to forecast potential disasters, enabling proactive rather than reactive measures. Algorithms analyze weather patterns, historical disaster data, and socio-economic parameters to predict the likelihood and impact of future emergencies [24].

For instance, organizations can better prepare for floods by analyzing past occurrences and developing models that predict when and where flooding is likely to occur based on current rainfall data. This capability greatly enhances resource allocation, allowing agencies to pre-deploy materials and personnel to high-risk areas before a disaster strikes [25].

Additionally, AI applications can streamline communication among different emergency response agencies. Integrated platforms equipped with AI can analyze incoming reports, prioritize calls, and allocate resources more judiciously. This optimization reduces response times, vital for saving lives in emergencies [25].

Despite the undeniable benefits that technology brings to emergency response, numerous challenges and ethical considerations must be addressed. The reliance on technology involves inherent risks, including cybersecurity threats targeting critical infrastructure and data privacy concerns regarding the collection and use of personal information in emergencies [26].

Moreover, technology should not overshadow the indispensable role of human judgment and expertise in emergency response. While AI and predictive analytics can guide decision-making, human responders must consider the nuanced and complex realities on the ground. There is also the issue of equitable access to technology; marginalized communities may lack access to advanced technologies or the knowledge to utilize them effectively, which can exacerbate disparities in disaster response and recovery [26].

The future of emergency response lies in a holistic approach that integrates advanced technology with

grounded human expertise and community collaboration. Developing resilient systems requires ongoing investment in research, education, and training to ensure that all responders are equipped with the skills to leverage technology effectively [27].

Furthermore, a focus on public awareness and community preparedness is essential. Education campaigns that inform the public about available technologies and emergency response protocols can empower individuals and communities, equipping them to take proactive measures in the face of crises [27].

The Role of International Collaboration in Shaping Emergency Protocols:

In an increasingly interconnected world, the complexity and scale of emergencies—whether they are natural disasters, pandemics, or humanitarian crises—demand a coordinated and collaborative response across borders. The critical need for effective emergency protocols has grown, not only due to the frequency of such events but also due to the global implications they carry. International collaboration plays a pivotal role in shaping these protocols, facilitating knowledge sharing, resource allocation, and the establishment of best practices that transcend national boundaries [27].

The foundations of international collaboration in emergency management were laid during the aftermath of World War II. The war underscored the importance of international cooperation in addressing global crises and led to the establishment of organizations such as the United Nations (UN) in 1945. The formation of the UN was driven by the need for dialogue, conflict resolution, and the united defense of human rights, effectively setting the stage for collective responses to humanitarian needs [28].

Subsequently, several specialized agencies emerged to address specific aspects of emergency management and humanitarian response. The World Health Organization (WHO), for example, was created to combat health crises, while the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) was established to coordinate international humanitarian response efforts. These organizations have been instrumental in developing emergency protocols that are guided by international standards and frameworks, thereby

ensuring that responses to crises are both timely and effective [28].

International collaboration in shaping emergency protocols involves a variety of frameworks and agreements designed to facilitate cooperation among countries and organizations. Among the most significant is the Sendai Framework for Disaster Risk Reduction 2015-2030, which provides guidelines for governments, local authorities, and stakeholders in disaster risk management. This framework emphasizes the need for shared responsibility and collective risk assessment, recognizing that no nation can effectively address disaster risks in isolation [29].

Furthermore, the International Health Regulations (IHR) established by the WHO serve as a legally binding agreement aimed at preventing the international spread of diseases and responding to public health risks. The IHR outlines core capacities that countries must develop to detect, assess, report, and respond to health emergencies of international concern, highlighting how collaborative efforts can mitigate the impact of health crises [29].

Other notable frameworks include the Paris Agreement for climate change, which recognizes the interrelated nature of climate-induced disasters and calls for collective action to address the challenges posed by environmental degradation. The integration of emergency protocols with climate resilience strategies exemplifies how international cooperation can enhance preparedness and response to emergencies stemming from climate change [29].

One of the foremost benefits of international collaboration is the facilitation of knowledge sharing and capacity building among nations. Different countries bring unique experiences, methodologies, and technical expertise to the table, which can be crucial for developing effective emergency protocols. For instance, the COVID-19 pandemic underscored the necessity for collaborative efforts in sharing scientific data, research findings, and best practices related to health emergency responses [30].

International organizations often convene forums and workshops that encourage cross-border learning and the exchange of lessons learned from past emergencies. The World Health Organization, in its response to the COVID-19 pandemic, established

networks and partnerships to facilitate the rapid sharing of information, leading to faster identification and response to variants, best practices in vaccination rollouts, and protocols for public health management [30].

Additionally, initiatives such as the Global Platform for Disaster Risk Reduction enable member states to share their best practices in managing risks and building resilience. These platforms reinforce the principle that preparedness and risk management strategies can benefit significantly from collaborative efforts, ultimately leading to more robust emergency protocols [30].

Collaborative approaches are also essential in addressing the resource gaps that often impede timely emergency responses. Emergencies, especially large-scale disasters, often overwhelm national resources, necessitating assistance from international partners. Mechanisms such as the United Nations Central Emergency Response Fund (CERF) and various regional funds facilitate the rapid allocation of financial and material support to countries in need [31].

The establishment of these funding mechanisms illustrates how collective financial resources can be mobilized efficiently and equitably to address emergencies. Moreover, international collaboration can help streamline the logistics of resource distribution, ensuring that aid reaches affected populations promptly and effectively. By pooling resources and expertise, nations can enhance their collective capacity to respond to emergencies, reinforcing the notion that cooperation strengthens resilience [31].

Despite the clear advantages of international collaboration in shaping emergency protocols, several challenges persist. One prominent issue is the varying levels of commitment and capacity among nations. While some countries have established robust emergency management frameworks, others may lack the necessary resources, infrastructure, or political will to engage effectively in collaborative efforts [32].

Additionally, geopolitical tensions can hinder cooperation. National interests may take precedence over collective action, particularly in times of crisis when countries are inclined to prioritize their domestic needs. For instance, during the early stages

of the COVID-19 pandemic, many nations pursued vaccine nationalism, opting to secure vaccinations for their citizens before assisting others, which delayed global recovery efforts [32].

Lastly, disparities in information sharing, especially regarding sensitive health data or military resources in conflict situations, can obstruct collaboration. To navigate these challenges, it is crucial to foster trust and transparency among nations, affirming that international cooperation ultimately serves the common good [32].

Looking ahead, the role of international collaboration in shaping emergency protocols will likely expand, driven by several interconnected trends. Climate change, urbanization, and technological advancements are reshaping the nature of emergencies, necessitating adaptive and innovative approaches to emergency management [33].

The increasing frequency of climate-related disasters calls for enhanced global coordination in addressing both mitigation and adaptation strategies. Countries will need to work together to develop protocols that embrace sustainability and environmental resilience in the face of escalating emergencies [33].

As technology continues to evolve, digital platforms can offer new avenues for data sharing and collaboration. Artificial intelligence, geographic information systems, and other technological innovations can enhance predictive modeling and situational awareness, allowing for a more proactive approach to emergency management [34].

Moreover, the ongoing lessons learned from the COVID-19 pandemic will inform the establishment of more robust global health security frameworks and responses to future health emergencies. Initiatives like COVAX, which aims to ensure equitable access to vaccines, exemplify the importance of collaboration in global health preparedness [34].

Public Health Emergencies: Lessons Learned from the COVID-19 Pandemic:

The COVID-19 pandemic has indisputably been one of the most significant public health emergencies of the 21st century. Emerging in late 2019 and continuing to influence various aspects of life as of

2023, the virus known scientifically as SARS-CoV-2 has led to millions of infections and deaths worldwide, prompting a reevaluation of public health systems and strategies on a massive scale. While the pandemic brought incredible challenges and tragedies, it also provided critical lessons that can be utilized to strengthen global health systems and improve responses to future health emergencies [35].

One of the most glaring lessons from the COVID-19 pandemic is the essential need for a robust and adaptable public health infrastructure. Early in the pandemic, many countries faced a lack of preparedness characterized by insufficient testing capabilities, inadequate supply of personal protective equipment (PPE), and overwhelmed healthcare systems. The pandemic highlighted the need for investments in public health, establishing comprehensive surveillance systems that allow for the early detection of infectious diseases, and building strong health systems capable of responding rapidly to health crises [35].

Moreover, the pandemic revealed the need for a coordinated response that integrates various aspects of public health, including emergency management, epidemiology, laboratory capacity, and healthcare delivery. Countries that had made prior investments in public health infrastructure, such as extensive testing and tracing programs, were often better positioned to manage the spread of the virus and minimize the impact on their healthcare systems. Thus, investing in public health should be viewed as a long-term strategy rather than merely a reaction to crises [36].

Effective communication during a public health emergency is paramount. The COVID-19 pandemic revealed that clear, consistent, and transparent communication is essential for public compliance with health directives, such as mask-wearing, physical distancing, and vaccination uptake. Throughout the pandemic, countries with transparent communication strategies that engaged the public in understanding the rationale behind health measures tended to foster greater trust and compliance [37].

Conversely, misinformation and inconsistent messaging can lead to public confusion and skepticism. The proliferation of social media further complicated the dissemination of accurate

information; false narratives and unverified claims spread rapidly, creating significant hurdles in managing public perception and behavior. Ensuring that health authorities utilize clear messaging, backed by scientific evidence, in conjunction with efforts to combat misinformation is critical in any future public health crisis [38].

The COVID-19 pandemic laid bare existing health disparities and inequities within and between populations. Marginalized groups, including low-income communities, racial and ethnic minorities, and people with disabilities, experienced higher rates of infection, hospitalization, and mortality. This unequal burden underscores the necessity for public health responses that actively consider social determinants of health [39].

Future public health emergencies must prioritize equitable access to healthcare resources, including vaccines, testing, and treatment. Strategies to engage and support underserved populations, build trust within these communities, and address systemic barriers are essential. Furthermore, a holistic approach is needed to support health inequities not just during crises but consistently as part of overall public health policy [40].

The global nature of the COVID-19 pandemic highlighted the necessity of international collaboration and solidarity in addressing health issues. No nation could effectively combat the pandemic in isolation, as the virus transcended borders at an unprecedented pace. The collaborative efforts to develop vaccines, share research findings, and distribute resources demonstrated the potential for global cooperation in public health [41].

However, disparities in vaccine distribution and access illuminated the power dynamics inherent in international health responses, with wealthier nations disproportionately securing resources. A commitment to fostering international cooperation in the face of global health threats is necessary for future preparedness. Policymakers must prioritize frameworks that ensure equitable resource sharing and support for low- and middle-income countries in their public health endeavors [42].

The rapid development of COVID-19 vaccines was a remarkable achievement driven by unprecedented global collaboration in research and innovation. The pandemic accelerated scientific advancements,

including mRNA vaccine technology, which not only showcased the capacity for quick scientific response but also underlined the need for sustained investment in research [43].

Moving forward, fostering a culture of innovation in public health is crucial. This entails committing resources to research on infectious diseases, outbreak modeling, vaccine development, and other relevant areas. There is also a pressing need to embrace new technologies, such as telemedicine and digital health solutions, which proved critical during lockdowns and social distancing measures. Investing in innovation will ensure that public health systems are better equipped to adapt to emerging threats [44].

Future Directions and Challenges for Emergency Response in Saudi Arabia:

Emergency response systems are essential components of any nation's public safety infrastructure, especially in regions prone to natural disasters, health emergencies, or security threats. In Saudi Arabia, a country characterized by its unique geographical landscape, significant economic resources, and critical regional geopolitical position, the efficacy of emergency response systems is paramount. As Saudi Arabia steadily strides towards modernization under initiatives such as Vision 2030, it faces new challenges and opportunities in upgrading its emergency response mechanisms [45].

Saudi Arabia's emergency response framework comprises various organizations and agencies, with the Saudi Red Crescent Authority (SRCA) playing a pivotal role. The SRCA is responsible for a broad spectrum of emergency services that includes medical response, disaster management, and humanitarian support. Additionally, the Civil Defence Authority oversees disaster preparedness and response, ensuring standards are met when handling various emergencies [46].

The country has seen an increase in the frequency of emergencies due to growing urbanization, increasing population density, and the effects of climate change. For instance, flash floods and dust storms have become more prevalent, prompting the government to enhance its emergency response. Other challenges include the critical management of Hajj pilgrimages, where millions of visitors

converge in a short period, heightening the need for robust emergency protocols [47].

Future Directions

1. Incorporating Technology and Innovation

One of the most significant future directions for emergency response in Saudi Arabia is the incorporation of modern technology. The increasing prevalence of smart technology and artificial intelligence can revolutionize emergency response. Drones can provide real-time data and imagery to responders during natural disasters, while machine learning algorithms can optimize resource allocation based on predictive analytics. Furthermore, mobile applications can facilitate real-time communication between emergency services and the public, ensuring faster responses [48].

2. Strengthening Interagency Coordination

Emergencies often require collaboration across multiple agencies, including health, security, and municipal services. Future developments should emphasize the creation of integrated frameworks that enhance interagency communication and streamline protocols. Implementing joint training exercises and simulations can improve coordination during actual emergencies, thereby ensuring more effective responses [49].

3. Enhancing Community Engagement

Community engagement is vital for effective emergency response. Future strategies in Saudi Arabia should focus on involving local communities in the planning and execution of emergency protocols. This can be achieved through public education campaigns, training programs, and volunteer initiatives. A well-informed public can act as the first line of defense during emergencies and can effectively support professional responders [50].

4. Developing a Comprehensive Crisis Management Plan

A comprehensive crisis management plan that encompasses natural disasters, health crises (such as pandemics), and security threats is essential. Future directions should include the establishment of a national strategy that unites various sectors and outlines roles and responsibilities in emergencies.

Regular reviews and updates of this plan, based on changing dynamics and recent experiences, can ensure preparedness for a range of scenarios [51].

5. Investment in Research and Development

Investment in research and development is another pivotal direction for the future of emergency response in Saudi Arabia. This includes fostering partnerships with academic institutions and industry experts to innovate and improve current response strategies. Engaging in research not only enhances the effectiveness of response measures but also prepares the nation for unforeseen challenges [51].

Challenges Facing Emergency Response

As Saudi Arabia pursues these future directions for emergency response, several challenges must be addressed:

1. Geopolitical Vulnerabilities

Saudi Arabia's position in a volatile region presents unique geopolitical challenges to its emergency response systems. Regional conflicts and political instability can result in security threats that require immediate and coordinated emergency measures. The complexity of these threats necessitates ongoing evaluations of security protocols and readiness [52].

2. Cultural and Language Barriers

Saudi Arabia is home to a diverse population, comprising citizens and expatriates. This diversity can pose challenges in communication during emergencies. Language barriers and cultural differences may hinder effective dissemination of information or the provision of services. Future strategies must address these challenges to ensure inclusivity in emergency preparedness efforts [53].

3. Resource Allocation and Funding

While the country has considerable economic resources, the allocation of these resources to develop and maintain efficient emergency response systems can be challenging. Ensuring adequate funding while balancing other national priorities requires careful consideration and planning. Strategic budgeting and prioritization are essential to ensure effective implementation of emergency response strategies [54].

4. Training and Capacity Building

Professional training and capacity building of emergency responders are crucial for an effective response. However, the current training programs may not be sufficient to equip responders with the necessary skills to handle increasingly complex emergencies. Investing in ongoing training, simulations, and drills is crucial to improve the readiness and capability of these responders [55].

5. Public Health Concerns

The events of the COVID-19 pandemic highlighted vulnerabilities within public health emergency response systems globally, including those in Saudi Arabia. Future directions must incorporate lessons learned from the pandemic, ensuring the healthcare system is adequately equipped to deal with similar public health emergencies moving forward [56].

Conclusion:

In conclusion, the evolution of emergency response protocols in Saudi Arabia reflects a dynamic and adaptive approach to managing an increasingly complex range of crises spanning natural disasters, public health emergencies, and security threats. From the establishment of foundational agencies like the Civil Defense Directorate in the 1970s to the integration of advanced technologies and international cooperation, Saudi Arabia has made significant strides in enhancing its preparedness and response capabilities. The nation's experiences, particularly during pivotal events such as the Gulf War and the COVID-19 pandemic, have underscored the critical need for effective emergency management strategies that can evolve in response to changing circumstances.

Looking ahead, it is essential for Saudi Arabia to continue investing in training, developing robust communication systems, and fostering public awareness to ensure a resilient emergency response framework. As the country faces future challenges, including rapid urbanization and potential environmental hazards, the lessons learned from past experiences will be instrumental in shaping a more effective and comprehensive approach to emergency management. Ultimately, the ongoing commitment to improving protocols will not only protect lives and property but also enhance the

overall resilience of communities across Saudi Arabia.

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