


SHORT COMMUNICATION

The best use of technology in the health emergency operation centers during COVID-19 pandemic

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ABSTRACT

Since the outbreak of the coronavirus in the Kingdom of Saudi Arabia in 2020, National Health Emergency Center aligned itself to the Saudi Arabia's Vision 2030 and has played a key role to link the different health sectors in the country with Ministry of Health, through the use of state-of-the-art infrastructure, innovative digital technologies, location intelligence, data analysis, and real time data. Thereby, General Directorate of Emergency, Disasters and Medical Transportation - Deputyship of Curative Services, launched the National Health Emergency Operation Center, which integrates digital technologies to deliver substantial improvements to emergency healthcare management. Through real-time maps, apps, and dashboards, the innovative integration of different technologies has revolutionized the Center's operations by providing location intelligence and evidence-based analysis that shapes sound policy and saves lives. Disaster health management has become a key goal for every nation in order to reduce the impact of disasters on human health and wellbeing. It is an important aspect of any resilient healthcare system.

Keywords: NHEOC, COVID-19, Disaster management, Ministry of Health, Saudi Arabia.

Introduction

Complex and increasing threats to public health and safety have driven the need for effective disaster health management in the Kingdom of Saudi Arabia. These threats range from mass-casualty events at the peak of Hajj and Umrah seasons [1], to biological disease outbreaks such as middle east respiratory syndrome [2], and catastrophic natural disasters, from flash floods to dust storms [3]. While the magnitude and impact of the disasters are not at the same level as faced by many other countries, their occurrences have increased in the recent years [4].

Disaster health management has become a key goal for every nation in order to reduce the impact of disasters on human health and wellbeing. It is an important aspect of any resilient healthcare system [5-7]. During COVID-19 pandemic, many challenges have been faced in terms of compounded by fragile health systems, complex emergencies, a suboptimal level of public health preparedness, weak disease surveillance, and poor response capacity [8].

Therefore, in alignment with Saudi Arabia's vision 2030 (goal 3: reducing health risks) [9], General Directorate

of Emergency, Disasters and Medical Transportation, launched the National Health Emergency Operation Center (NHEOC) [10], that integrates digital technologies to deliver substantial improvements to emergency healthcare management. Blending an innovative mix of digital technologies and state-of-art infrastructure, the center uses real-time data and location intelligence to manage and monitor health incidents, automate manual processes and procedures, speed up response time, and perform data analysis so that lessons learnt are developed for future crises.

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Materials and Methods

Thorough research was conducted for the facility location, building functionality and efficiency, infrastructure connectivity, and utilities requirements to launch the NHEOC. The facility was aligned with the latest international engineering and functional standards, with state-of-the-art technologies including video walls, communication platforms, IT infrastructure and datacenter, hosting the NHEOC applications and sustaining its life-saving operations. The NHEOC is a highly functional space that allows a seamless integration between the human element, Architecture, Engineering and Construction and Information & Operational Technologies. By uniting multiple deployable and stationary locations in a shared workspace of video, imagery, applications, and devices, team operations with in room and distributed end points have significantly improved. Also, remote subject matter experts could connect and contribute to the workspace via their laptops or mobile devices as if they were on-site.

This content and information-centric means of remote collaboration has brought far more agility, responsiveness, and recovery as compared to traditional tele-presence. For effective communication, joint training on communication mechanisms and tools were organized between parties participating in event management, such as other centers in the regions, civil defense, and the Red Crescent. This has helped the Ministry in increasing the coordination level between the concerned departments, emergency response partners, stakeholders, and local communities.

Discussion

Technology overview

NHEOC is launched by the General Directorate of Emergency, Disasters and Medical Transportation - Deputyship of Curative Services. It integrates digital technologies to deliver substantial improvements to emergency healthcare management - this has proven hugely beneficial since the start of the coronavirus pandemic. Since the outbreak of coronavirus, it has played a key role as the command center and the official link between the Ministry of Health and other governmental and public/ private health sectors [11].

NHEOC functions as a command-and-control center. Through its efficient management of vast amount of user-generated, humanitarian and hospital data, the center is able to play a key role in the orchestration of nationwide disaster and crisis management [12].

The NHEOC consists of (1) A best-of-breed emergency management solution, namely, WebEoC- Tahob, which is combined with other technologies such as geospatial technology. (2) Enterprise Geographical Information System (GIS), decision and operations dashboards to use real-time technology and visualization to manage and monitor health incidents, automate manual processes and procedures, and speed up response times to save lives. This is consistent with previous research conducted on the remote sensing and GIS use during natural hazards

[13]. (3) Automation of workflows and notification systems is used to make data and location analytics to predict crises before they happen (preparedness or pre-response); analyze the incident cause and automate the required actions (response); reduce the effect of disasters by shortening the time of initial response and performing data analytics and insights, so that lessons are learnt, and insights are developed for future crises (Post-response). This was similar to the previous research which highlighted the importance of the preparedness and pre response in the disaster planning [14]. (4) An innovative mix of technology and engineering - design and infrastructure, systems, command structure, and plans and procedures, which are developed prior to each event.

Using Tahob system; the game changer

The business case for the technologies adopted was based on the need for an effective Disaster Health Management System, which acts as an incident command system leveraged to process large amounts of crisis-related data. Boasts advanced data collection and analyze technologies to achieve more effective and responsive disaster management. It plays a critical role in early warning, monitoring, and evaluation of emergent event, and linking it to common situational events. It also gathers situational information during disasters or emergency scenarios such as earthquakes, epidemic outbreaks, floods, hurricanes, using structured and unstructured data. It eases access of situational awareness to decision makers. The data gathering could promptly be characterized by the type of event, better address the response with respect to level of disaster, and closely track the dynamic evolution of emergencies over time. Furthermore, it facilitates immediate responses, early detection through real-time data, and provides information to reduce potential casualties and damage, leading to more effective resource allocation. It also builds a data-driven culture within the Ministry by helping decision makers, executives, in addition to the Minister to anchor decisions with data-driven, evidence-based actions. Moreover, it creates metrics and Key Performance Indicators (KPIs) that support the Ministry in making quantitative analysis of disaster and crisis impact on the public, in addition, it quantifies uncertainty by giving the Ministry a significant level of confidence to address such incidents through running exercises and continuous validation. Additionally, it also prepares the Kingdom to combat any disaster locally, regionally, and nationwide through its 20 regional branches, providing a centralized management during all disaster and emergency management phases [15].

A safer future

The NHEOC is linked to all hospitals, healthcare centers and other public and private health sectors. It monitors, oversees and follows up all health incidents that affect the health of individuals, and might cause collective losses. It monitors the performance of hospitals, in addition to the regional health directorates they report to. If a higher level of support is needed, the NHEOC could intervene

to manage, and orchestrate governmental communication in an effort to contain the consequences of that incident.

The Center takes on a proactive role to undergo multi-hazard and solution-driven research in disaster risk management to address gaps, obstacles, interdependencies; and social, economic, educational, and environmental challenges and disaster risks. It conducts a periodic survey of risks- both inside and outside health facilities-at a regional level, analyzes their causes, drafts periodic reports, and prepares action plans to prevent the recurrence of disasters and address the consequences beforehand. Likewise, another research study imposes upon the importance the disaster risk management [16].

The technology and the stakeholders' engagement

With its 20 regional branches throughout the Kingdom, the NHEOC offers the Ministry a unified operational environment and collaborative tools for improving operational coordination and decision-making [15].

The team and technology

The NHEOC enables real-time shared situational awareness across teams and locations. It integrates face-to-face communication with simultaneous content, application, and data sharing through a unified operational space.

Each regional NHEOC branch oversees public and private hospitals located in that region, and how they address potential incidents. The system processes the relevant, live-gathered information from the facilities on special platforms within the center's operation room, where it could be accessed anytime by the team. Through this information, a unified framework and on-the-spot awareness of the event's development are provided to make health crises and disaster management more accurate [12].

The WebEOC system (Tahob) plays its part in automating the events management operations based on the unified concept of operations in the Ministry, where it collects, processes, analyzes, and displays the event data and makes it accessible to decision-makers with precise instructions on how to respond. It is similar to the study conducted previously where WebEOC system was used for emergency management [17].

The added value for NHEOC Technology

The NHEOC helps to fulfill the third Sustainable Development Goal, for good health and wellbeing, a crucial component of the Kingdom of Saudi Arabia's sustainable development agenda. In addition, it supports the realization of the third pillar of Saudi Vision 2030 - "An Ambitious Nation - Enhance Government Effectiveness and Responsiveness" [9].

The innovative approach delivered by the NHEOC has played a key role in enabling a multi-sectorial and highly collaborative disaster risk management system that is in line with the World Health Organization (WHO) model [18].

It integrated adoption of WebEOC has digitally transformed traditional emergency management services and healthcare delivery in the Kingdom by bringing unprecedented dynamics at many levels.

Operational: digitalization of tasks using technologies

To this day, the NHEOC is linked at a regional level with 20 branches across the Kingdom. A team of more than 50 emergency personnel are operating around the clock to monitor incidents and reports, and ensure healthcare facilities are in a state of readiness by understanding their clinical capacity, the number of blood units available, the human resources available for specific specialties, the number of ambulances, and the available stock of essential medical supplies [15].

Organizational: change of processes and creation of new business models and inter-organizational relationships

The solution enables the NHEOC to analyze the data received from health facilities according to vital indicators/performance metrics (KPIs). Additionally, it could contribute to escalating the situation to a national level, when an emergency occurs, by calling the ministry leaders and specialists to manage the crisis and providing information which supports decision making.

The NHEOC hosts a set of applications that include: mapping and data collection apps to track cases, spread, vulnerable populations and places, and hospital capacity; dashboards for real-time situational awareness; and web apps for keeping the public informed. Health officials could overlay outbreak data with other location-based information such as schools, universities, markets, airports, and with the millions of peoples in Hajj and Umrah seasons.

The center carries out the official communication channel with the various ministries and state agencies as well as external organizations, especially with WHO in monitoring and analyzing the results of the coronavirus pandemic.

Social: effect on human/customer/beneficiary life, expectations, and experiences

The NHEOC allows emergency users in the Kingdom to efficiently respond to various types of events by initiating command, communicating effectively through technology, undertaking timely triage and decontamination, as well as delivering medical care in and out of the traditional healthcare delivery venues.

Conclusion

After its launch in 2019, the NHEOC received more than 4,500 health reports nationwide. Through real-time maps, apps, and dashboards, the innovative integration of different technologies has revolutionized the Center's operations by providing location intelligence and

evidence-based analysis that shapes sound policy and saves lives.

Conflict of interest

The author declares that there is no conflict of interest regarding the publication of this article.

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Consent for publication

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