

SPECIAL COMMUNICATION

The EMIRATES Framework: Emergency Management Integrated Roadmap Aimed Towards Every Healthcare System. A conceptual framework

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ABSTRACT

Healthcare systems play a key role in the response to everything from day-to-day events to overwhelming disasters. There are common challenges worldwide which include the presence of multiple players, a lack of clarity with regard to the chain of command, the absence of important components to make the system work, and a lack of specialized training and education. Given these challenges, the ability to respond adequately requires an integrated emergency management system. Several countries may have different components of the emergency services but occasionally not well integrated. The Emergency Management Integrated Roadmap Aimed Toward Every healthcare System framework is a simplified conceptual framework to help the healthcare decision-makers in different systems to plan the approach to any day-to-day emergencies or disasters with a structured system that can be customized further according to their needs.

Keywords: Emergency, emergency management, disaster, mass casualty incident, disaster management, integrated, health care, roadmap, conceptual framework.

Introduction

The increasing number of disasters and mass casualty incidents (MCIs) over the past few decades, including the most recent coronavirus disease-2019 (COVID-19), has reinforced the importance of having a medical focus on emergency and disaster preparedness [1–5]. Those events continue to expose numerous gaps in current systems and reflect the need for having an integrated and comprehensive emergency management system for the healthcare sector. The “integrated system” must be set up at all levels within the healthcare sector, locally and nationally.

Furthermore, any vision to develop the healthcare sector cannot be achieved unless we address this important topic comprehensively, with a focus on all phases of the emergency management cycle continuum. Numerous models have been described in the literature looking at different spectrums of emergency care [6–13].

In this article, the author presented a brief overview of the common challenges faced by the emergency medical sector in many countries, and then, the author proposed the Emergency Management Integrated Roadmap Aimed Toward Every healthcare System

(EMIRATES) framework, which is a comprehensive conceptual framework that can be adopted when an

Highlights

- Integrating Emergency Management in Healthcare systems is complex and needs a structured approach.
- Several models exist world-wide and many share common challenges among their healthcare systems.
- The EMIRATES Framework proposes a simplified conceptual framework to approach the system-wide integration of emergency services in healthcare.

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existing system needs to be reformed. The author has placed a particular focus on the coordination of the different medical emergency services. This framework was envisioned based on the practice in emergency medicine, prehospital care, disaster medicine, and public health in North America, Europe, and the Middle East. It is a collective framework of different practices worldwide.

Common Challenges in the Current Systems

To deal with any daily emergency, an MCI, or a large-scale disaster, the healthcare system requires a robust emergency management system that fully incorporates federal, regional, and local response; includes both governmental and private capacities and capabilities; and is executed in a well-orchestrated fashion. However, the author has identified several challenges present in various parts of the world summarized as follows:

Multiple players

In general, the emergency care delivery (medical or non-medical) usually involves multiple stakeholders including police, emergency medical services (EMS) or ambulance services/helicopter EMS, fire/civil defense, military, search and rescue (SAR) teams, anti-terrorism units, emergency management officials, and private organizations. Similarly, when it comes to “medical” emergencies, the response must occasionally necessitate participation from multiple providers and entities including EMS, hospitals (public and private), nongovernmental organizations, and other local governments’ health providers [5]. Unfortunately, those entities frequently prepare individually, which create miscommunication, duplication of effort, and unnecessary confusion among providers during real-time responses.

Unclear chain of command

Like any other type of emergency, medical emergencies require a rapid and well-coordinated response. A frequent and significant problem is the lack of a structured incident command structure that can manage threats and mobilize appropriate resources across all levels in the healthcare sector. Command/operation centers can fill part of the communication gaps if incorporated within a larger command system. However, many countries experienced serious limitations and challenges to these centers.

Lack of important components

Given the complexity of delivering emergency care, several key components are commonly overlooked or missing. In particular, many countries lack key elements of a “real EMS” including medical oversight, a medical priority dispatch system, quality assurance, and continuous education, to mention a few. A very common belief in many parts of the world is that prehospital care is only related to EMS, whereas, in reality, it goes far beyond. The SAR teams, the disaster

medical assistance teams (DMATs) (often called field hospitals), mass fatality management teams, air-based medical evacuations, as well as hazardous materials (HazMat)/chemical, biological, radiological, nuclear, and explosive (CBRNE) teams all have crucial roles in the prehospital “medical” response, and their operations must be well coordinated. Overlooking such important players will certainly affect the adequacy of the response.

Similarly, many hospitals task emergency departments (EDs) to deal with both small and large emergencies. Although this might be suitable for smaller emergencies, it cannot be applied to large-scale events which need the involvement of the hospital as a whole or even a group of hospitals; hence, there was the need for hospitals’ coalitions and funded hospital preparedness projects. Another important gap in many healthcare systems is the lack of public health preparedness. This does not refer to the preventive measures only; rather, it refers here to the system-wide projects that need to be established or supported. These projects are crucial in facilitating the prehospital and hospital responses alike, but none of those levels are tasked with or able to control those types of projects. It is of utmost importance for decision-makers to understand that investing in building a robust day-to-day emergency care system will definitely create the strong backbone necessary to handle any overwhelming disasters.

Lack of specialized training and education

Despite the increasing demand for robust emergency services, there has been limited availability in providing specialized training and education to emergency medical providers. With the wide spectrum of emergency medical response levels, special knowledge and competencies are needed at different levels. This can be in the form of courses, exercises, or degrees offered through the involvement of academic institutions.

The EMIRATES Framework

The EMIRATES framework is a simple, logical and comprehensively shows the bigger picture of the emergency management system within any healthcare system (Figure 1). It presents the emergency medical management system in four key segments, described below. It covers the full spectrum starting from governance (including system operations) to prehospital care with the other related field teams, all the way to the hospital level; and finally, to the public health level. It gathers practices from different parts of the world and puts it in a simplified way to help ease the integration process. It is important to emphasize that the execution of the framework can take years, and the approach will vary from one country to another. To execute the framework, an effort should be taken to evaluate any existing services or initiatives in their community to build on them. After identifying the levels of service available, a plan needs to be set to build bridges and connect the dots among those services. In numerous situations, this can easily happen by establishing a

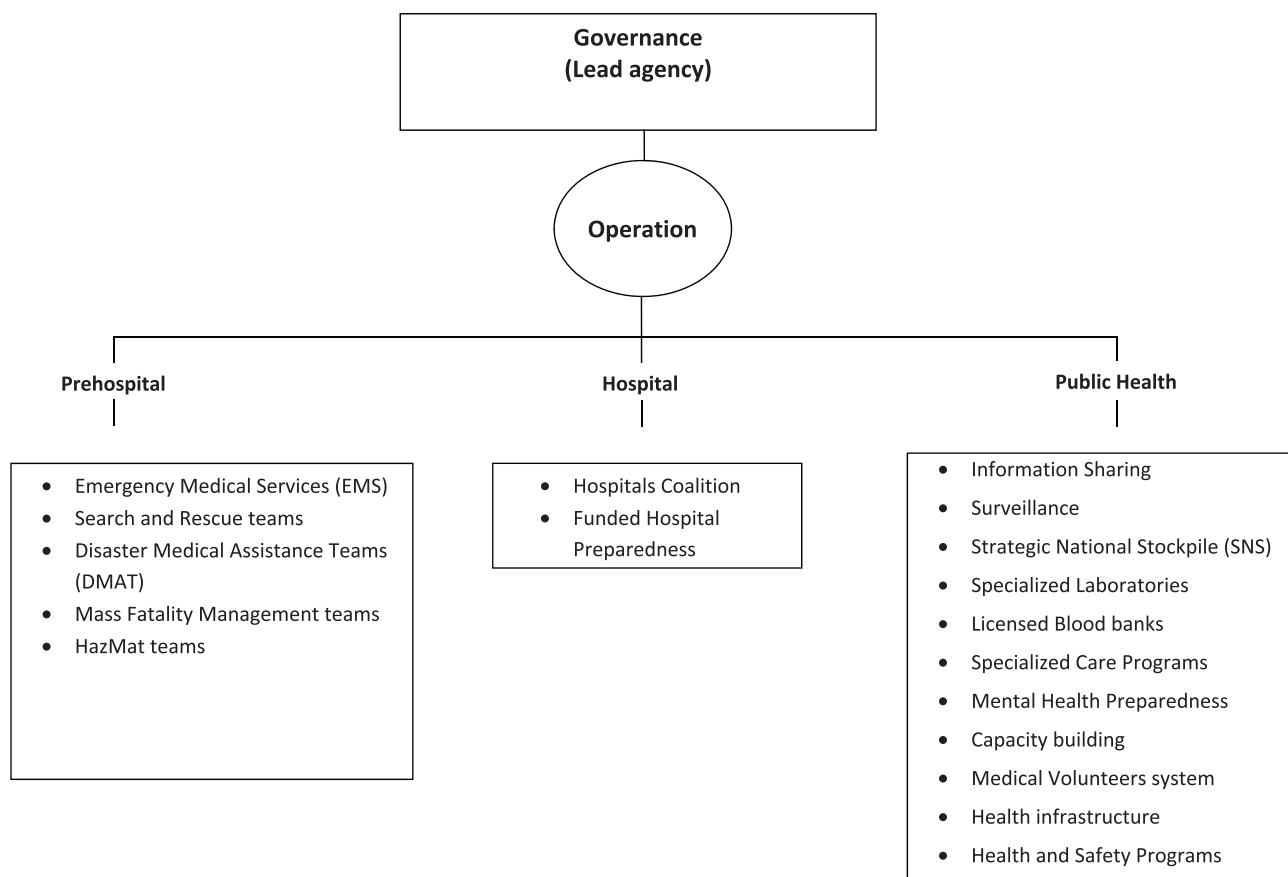


Figure 1. The EMIRATES Framework.

good communication channel, merging certain services together; or defining roles and responsibilities among the different stakeholders. This framework adopts a “system of services” or network-centric approach to emergency management, where it “puts everything together.” The components of each level will be covered as follows:

Governance

To be able to have an efficient emergency medical management system, a clear command and control structure need to be established to supervise, guide, and coordinate efforts and resources within the health system, covering public and private-as well as local and federal-institutions. Such a structure can be initiated by defining a lead agency first. The importance of the lead agency in the emergency system was emphasized by the recent World Health Organization resolution on emergency care systems for universal health coverage [14]. In the EMIRATES conceptual framework, the lead agency should develop “ownership of the emergency medical system” by having key roles including legislating, monitoring, funding the system, and coordinating the resources within the system. This agency should act as the “brain” of the emergency medical system, meaning that it puts everything together in the day-to-day responses and escalates during disasters. This hierarchy should facilitate a smoother response during a real emergency

and help to implement a “common language” among responders. There are several command and control systems in use, for example, the incident command/management system which is commonly in use in North America or the gold-silver-bronze command structure which is used by the emergency services in the United Kingdom.

A core part of any lead agency is to ensure that the system is running efficiently. This can be done by establishing an operation center (also commonly called a command center or an emergency operation center, etc.) either under direct supervision of the government or delegated to another capable entity within the system. Another core role of the lead agency is to ensure that a clear public information is been delivered, which can be crucial in strengthening the ability of the system and the community to respond to any emergency. This was clearly evident during COVID-19 pandemic. Commonly, the “Public Information Officer” is a key role in most of the command systems in use.

Prehospital

Although EMS (also commonly called “ambulance service”) is considered a main player in the prehospital care in general, many planners and officials overlook the other important services involved in prehospital care. For example, EMS providers will not be able to provide care if patients are in dangerous zones such

as a collapsed building, a contaminated location, or a situation, where there are a large number of fatalities that need to be handled. Therefore, having a better understanding of the important services involved in this part of the spectrum is crucial to ensure orchestrated operations in the field. The following is a brief overview of these services.

Emergency Medical Services (EMS)

EMS is certainly a cornerstone of medical response and can be a friend or a foe if not well prepared. As stated earlier, many EMS providers are missing important elements that can improve the quality of the service. This includes qualified medical oversight, standardized clinical practice guidelines, and medical priority dispatch to mention few. Many countries have several EMS providers but lack adequate coordination between them. This creates confusion and most likely duplication of effort that negatively impacts emergency care.

Search and Rescue

Proper SAR teams are among the important links in the emergency management process. Although they can be purely operational and nonmedical at times, those teams should have a *medical* arm as part of their standard operations. This is due to the unique conditions that emergency and disaster victims could be under which need treatment by trained and experienced medical providers. Regular EMS providers are not trained to operate under austere environment such as a collapsed building. Those teams can be incorporated within the emergency medical management system or just in coordination with civil defense or other specialized entities. The SAR teams must be involved throughout the emergency management cycle to ensure alignment during the response.

Disaster Medical Assistance Teams (DMATs)

Disaster medical assistance teams (DMATs) (also called field hospitals) are well-established teams in the United States and other developed countries [15]. Such teams are usually deployable to disaster sites with a defined inventory that includes adequate supplies and equipment to initially support themselves for 72 hours while providing medical care at fixed or temporary medical locations. Teams may provide primary health care and/or augment overloaded local healthcare staff.

Disaster medical assistance teams (DMATs) are designed to be a rapid-response element to supplement local medical care until other external resources can be mobilized, or the situation is resolved. This team can be drawn from the workforce in the healthcare system (public and private), and the service can be incentivized to encourage participation. Linking such teams to the prehospital providers will facilitate and smooth out the

field operations. DMATs can be empowered by joint planning, training, exercising, and response.

Mass fatality management teams

With a similar concept to the DMAT team, mass fatality teams are usually deployable teams sent to disaster sites to provide victim identification and mortuary services. These responsibilities include establishing temporary morgue facilities; performing victim identification, including using forensic dental pathology, forensic anthropology methods, processing, and preparation; and the disposition of remains [16].

The mass fatality teams are composed of experienced providers (public and private), each with a particular field of expertise, who are activated in the event of a disaster. Members are required to maintain appropriate certifications and licensure within their discipline. The International Criminal Police Organization (INTERPOL) developed similar methods to identify victims in such events, which they named as Disaster Victim Identification (DVI). Member countries can have access to the DVI guide and forms, as well as assistance with command and coordination, and have an INTERPOL deployable incident response team to support onsite [17]. Developing local capabilities and capacities in dealing with this challenge will facilitate field operations.

Hazardous materials (HazMat) [for chemical, biological, radiological, nuclear, and explosive (CBRNE)] teams

One of the most challenging aspects of providing emergency medical care is attending to patients who have been contaminated with HazMat. These events are occasionally called CBRNE events [18]. In several countries, the military or civil defense is tasked with handling these events and is ultimately responsible for protecting the health of the community. HazMat events will interact in patient care in the field and must be incorporated into this framework. Similar teams can be established within major hospitals to deal with such patients.

Hospital level

Hospitals are backbone of any emergency management system. Fortunately, significant amounts of time and money are invested in the development of hospitals (governmental or private), and these institutions can receive and treat a large number of patients but only if activated and prepared appropriately. The hospitals' emergency management performance can be augmented by the implementation of international standards (for example the Joint Commission standards) [19] into emergency management programs within those facilities, which has to be standardized across the system. Having full-time emergency managers within hospitals can be of huge significance in uplifting

the level of response by closely coordinating the emergency management activities throughout the emergency management cycle, compared to the part-time staff or committees. Furthermore, it is beneficial to form hospitals' coalitions/networks within the system. Member hospitals will be able to share key information that is relevant for emergency management with other hospitals nearby.

Another advantage of such a coalition is that the lead agency or the government will have to contact and deal with the interface of this coalition rather than dealing with each individual facility. This will create efficiency and prevent duplication of effort and miscommunication.

It is highly recommended that lead agencies create a government-based fund for incentives which can be put toward building medical surge capacity and capability at the hospitals' level. This will result in increasing their ability to manage emergencies with a clear return of investment [20].

Public Health level

Public health projects (meaning projects with a system-wide scope) are among the most important components in emergency management for any healthcare system, but, unfortunately, they are often overlooked in many countries. Typically, these projects cannot be established at the prehospital or the hospital levels alone, and they need the lead agency (usually the government) to fund and manage them. Many projects can be introduced under this component and integrated into the emergency management framework to serve the system as a whole. The following are some of the key projects:

Information sharing

Lack of information or miscommunication is considered one of the most common challenges in the emergency care. Endless examples highlight the information gap and how different messages are delivered at the same time, which creates panic and inefficiency [21–25]. Having a platform to share information on a real-time basis can bridge this huge gap and build transparency within the system. With the rapidly growing telecommunication technologies, linking the field to the hospitals and the system can be done fairly easily. This is certainly a cost-effective solution. Furthermore, this type of robust information capturing methodology with help to establish several crucial registries including trauma, stroke, acute myocardial infarction, out-of-hospital cardiac arrest, and sepsis, just to mention a few. Similarly, it is crucial to establish a registry for disaster-related medical responses, where decisions are tracked [26]. The registries will be the best source of data for ongoing quality assurance processes for the specialized care systems highlighted below.

Surveillance system

Surveillance is the process of active data gathering from all over a region with appropriate analysis and

interpretation of any data that might relate to disease activity and threats to human health, whether infectious, toxic, metabolic, or otherwise, and regardless of man-made or natural origin, to achieve early warnings of health threats, early detection of health events, and overall situational awareness of disease activity [27]. The lack of this system will result in a harmful delay in detecting threats. In well-established systems, data are presented on real-time dashboards at operation centers and to decision-makers who can act promptly when needed [27]. This was evident during COVID-19 pandemic by easily tracking cases.

Strategic National Stockpile (SNS)

In the context of disasters, the rapid distribution of medical supplies (personal protective equipment, vaccines, drugs, therapeutics, or even essential food) to a large population requires significant resources and infrastructure. Systems should be able to meet the objective of dispensing these countermeasures to their entire population within a short time frame (e.g., 48 hours) after the decision has been made to do so. Recognizing that the government has the primary responsibility to protect citizens, it should create the appropriate framework and policies for sharing information on best practices and mechanisms to address the logistical challenges associated with this requirement. This can be arranged with other emergency management agencies and other key stakeholders to create effective templates for countermeasure distribution [27,28].

Specialized laboratories

Laboratories play an important role in all phases of emergency management. A network of specialized laboratories can be established as a stand-alone or at designated institutions to provide specialized services [29]. The timely identification of chemicals and organisms depends on a well-established process to deal with anything, anytime, and anywhere. This key element in the response cascade may result in devastating outcomes if overlooked.

Licensed blood banks

Licensed blood banks are critical for the management of trauma cases, day-to-day emergencies, or mass casualty events. Those banks should be networked to handle surge needs during emergencies. They ensure the availability and the provision of safe blood to respond to immediate demand in coordination with all other emergency spectrum partners (EMS, DMAT/field hospitals, hospitals, etc.).

Specialized care programs

With the increase of various conditions and noncommunicable diseases, the role of emergency medical care changes accordingly. Numerous studies have highlighted the role of emergency medical care in decreasing mortality and morbidity [30–32]. This

includes trauma systems, burn systems, stroke programs, chest pain programs (commonly known as ST-segment elevation myocardial infarction regionalization program or network), sepsis pathways, poison control, pediatric, and obstetric emergency care systems. This cannot succeed without structured and coordinated system-wide programs managed or at least funded by the lead agency since it serves the community as a whole. Such programs can be managed by multidisciplinary teams capturing clinicians, policymakers, administrators, and payers and are usually led by experts in that specific field [33–39].

Mental health preparedness

Several recent disasters have demonstrated the pressing need for a well-established mental health preparedness program that encompasses all key aspects of victim care, in addition to the provision of any mental health care that the responders may need, given the impact of what they experience [40]. Any proposed program should accommodate the local culture, religion, and all ethnicities of each community. It should encourage research to develop the methods to assess mental health preparedness training needs and identify all relevant candidates, including public health and allied health professionals, as well as the “second victims,” the families [41].

Capacity building

With the dramatically increased attention being paid to medical preparedness over the past few decades, there is also a pressing need to increase healthcare capacity to respond to new threats in the future, based on changing threat assessments and developing technology. This capacity building should take a comprehensive approach with a focus on the key elements of emergency management, including teaching basic and advanced life support courses to key providers and giving HazMat/CBRNE training to healthcare providers. Many communities have succeeded in building their capacity by integrating community-based emergency response programs into their systems. This can be further enforced by the introduction of public access defibrillator programs into communities; the introduction of disaster medicine into medical and non-medical curriculums; the introduction of a “Good Samaritan Law” or equivalent if one does not exist; and the introduction of residency programs for Emergency Medicine, Emergency Nursing, paramedics and emergency managers. Finally, it should include conducting mock exercises on a regular basis, featuring various types of disasters with various stakeholder groups, for an efficient and effective response.

Emergency medical volunteers system

Many countries across the world have started focusing on utilizing both healthcare and non-healthcare personnel and expertise, both public and private, in cases of emergencies. Such initiatives have encouraged

those countries to form a government-based volunteer organization [42]. Establishing local emergency medical volunteer systems within each healthcare community will create a bank of experienced healthcare providers in times of need.

Maintaining health infrastructure

The devastating disruption of the normal lives of any population following a disaster forces those in charge to plan for maintaining the health infrastructure and plan for surge capacity and capability within their community. This is an important proactive step that is needed and usually requires intensive efforts in terms of collaboration and planning, as well as testing. This involves defining alternate care sites, conducting scientific needs assessment before and after all disasters, assuring important services are available for isolated communities, providing specialized beds per surge capacity plans, and organizing continuity of operations when everything is disrupted. The resilience of any system is directly related to its ability to function during worst-case scenarios.

Health and safety programs

During disasters, the lead agency is expected to provide health and safety recommendations regarding food and water safety, vector control, sanitation programs, and many more activities. Specifically, in shelters, health and safety aspects are crucial and can end up being another “disaster” if ignored. Communities evacuated suddenly often leave valuable personal belongings behind (medications, medical devices, glasses, etc.) which can have a negative impact over time. A robust and structured health assessment must be conducted to ensure the provision of necessary items for community members sooner rather than later to **prevent** rather than **react** to problems. Similar to the effect on humans, animals can become injured or diseased after emergencies or disasters. Veterinary emergency management should be included in the healthcare system or any specialized entity overseeing disaster response to ensure the safety of all animals [43–45].

Limitations

Despite the efforts made to conceptualize this framework and the different systems reviewed, several limitations exist, which may affect its implementation in some countries. The most important limitation is the variation in geopolitical situations between countries. What is easily achievable in smaller countries can be very challenging in bigger ones; this applies to everything from terminology to organizational structures which usually vary between one region and another. Furthermore, the framework may have overlooked smaller components that can arguably be included. It is important to understand that this framework is meant to capture the key components of an emergency management system in health care while operationalizing it might need a more detailed and tailored approach that will vary from one country to

another. Although the military system was not covered by the framework, it can be modified to cover military medical needs. It is important to note that the title was not meant to reflect that the framework is fully implemented in the United Arab Emirates. Rather, it is an acronym chosen to ease memorization.

Conclusion

The EMIRATES framework proposes a comprehensive approach to integrate the different components of emergency management services in any healthcare system, to simplify the complexity of the emergency medical systems, and to overcome the common challenges faced in many countries during day-to-day emergencies, MCIs, or disasters. It covers four key components, starting with governance, prehospital care, hospital-level care, and finally public health. This framework can serve as a roadmap for healthcare leaders to improve their system preparedness and efficiency when dealing with medical emergencies.

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List of Abbreviations

CBRNE	Chemical, biological, radiological, nuclear, and explosive
COVID-19	Coronavirus disease 2019
DMAT	Disaster medical assistance team
DVI	Disaster victim identification
ED	Emergency department
EMIRATES	Emergency Management Integrated Roadmap Aimed Towards Every healthcare System
EMS	Emergency medical services
HazMat	Hazardous materials
INTERPOL	International Criminal Police Organization
MCI	Mass casualty incidents
SAR	Search and rescue

Availability of data and materials

Further information is available from the author upon reasonable request.

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