

## Chapter IX

# A Hospital Emergency Support System for Real Time Surveillance Modeling and Effective Response

### INTRODUCTION

*Before 2001, public health departments, including hospitals, rarely played a role in disaster planning, though they functioned in critical roles for victim treatment and recovery. Their roles in disaster response usually initiated after a disaster event had occurred. But the potential for chemical or biological terrorism has pushed them to become frontline responders, as well as critical and central players in most state and local emergency planning teams. According to U.S. General Accounting Office [GAO] (2003), increasing expectations demand that public health agencies at all levels in the United States develop their capacities to respond to incidents of terrorism and other disasters (Bashir et al., 2003). For healthcare facilities, hospital emergency response plans rely on their emergency departments' response. That is, the emergency department must determine the magnitude of the event and initiate the appropriate institutional response, including decisions to declare an institutional disaster or institutional lock-down and determinations of whether victim decontamination is needed. From this point of view, the extent of the response depends on the capability of each emergency department. At present, however, even without a terrorism incident, emergency departments are crowded, and patients might wait up to a full day to receive treatment (Brownstein, 2007; U.S. National Center for Injury Prevention and Control [NCIPC], 2007). According to a Harvard Medical School survey, the number of ER visits rose from 93.4 million in 1994 to 110.2 million in 2004. A patient has a one in four chance of waiting for more than 50 minutes because of overcrowding in the emergency department, and wait times appear likely to keep increasing (Reuters, 2008). This widespread problem logically will negatively influence their ability to respond to high-consequence chemical, biological, radiological, or nuclear (CBRN) attacks or natural disasters. Should a huge influx of patients arrive due to an unexpected disaster event, the current crowding situation of most emergency departments implies that real emergencies may be lost in the shuffle without an organized response (Conte, 2005 Morse, 2002).*

*Because a variety of challenges, such as organizational, logistical, and patient-care related issues, arises when dealing with an unexpected disaster event, units other than the emergency department within a healthcare facility or hospital may also need to engage in response processes. One of the most important challenges is determining how to increase facilities' ability to generate and organize a response rapidly (NCIPC, 2007). Effective preparedness and response demand an established functional leadership structure with clear organizational responsibilities, which knows what actions need to be implemented and how to handle clinical management during a disaster. Should an incident occur, those exposed or injured rapidly seek care and may not do so at the facilities designed by existing response plans. Thus, every healthcare facility must be able to organize a response quickly; speed is critical to save lives. The best means to employ existing health care capacities and generate a "dual-use" response infrastructure therefore becomes an urgent issue, because many of the capabilities required for responding to a large-scale chemical or biological attack are also required for responses to naturally occurring disease outbreaks. Furthermore, in a fast-paced disaster such as an explosion, there is little time for meetings or discussion about the appropriate use of different support functions and personnel.*

*In this chapter, we present a framework for a hospital emergency support system that helps hospital managers generate a dual-use response infrastructure based on existing hospital facilities. Ideally, healthcare routine functions and hospital emergency response functions work together as an integrated system that exploits existing resources effectively and efficiently. We consider two situations. In the first, healthcare professionals detect an event, such as influenza pandemic, that triggers an emergent response. In the second, a passive reaction creates a sudden surge of calls for an immediate response. For example, if an incident such as a bombing occurs, hospitals near the scene may expect to receive a large influx (or surge) of victims. In the 2004 Madrid bombings, for instance, the hospital closest to the scene received 272 patients in less than three hours. For the former situation, we consider how hospital routine care functions might be integrated to provide health surveillance for early disease detection. For the latter, we explore how overcrowding might be reduced through effective organization. In either situation, the proposed framework offers step-by-step assistance to hospital administrators, which may help bring some order to the chaos, improve response times, and save lives.*

*To provide early detection of events such as influenza, real-time data collection is critical. For example, to monitor influenza-related activity in the United States, a health surveillance system requires each participant to submit the number of consultations with patients complaining of influenza-like illness (ILI) symptoms, categorized by age group and total number of consultations. These data then help determine if there exists any unusual pattern that might suggest a possible disease outbreak. As we discussed in Chapter VI, such patient data analysis usually starts one week after the data are received, which means that detections of unusual patterns refer to the previous week, and there is a seven-day delay period. Such a data collection and analysis approach creates no real concerns when time is not critical, but for a disease response, particularly for infectious diseases, time is crucial, because many people may become infected during the delay period. Therefore, public health officials require a real-time data analysis that uses concurrent rather than previous data. In our proposed framework, we introduce a Web-based module for data collection and real-time analysis.*

*This chapter is organized as follows: We first review some existing clinical support systems, then discuss how hospital routine care functions might be captured using a patient care system. Next, we discuss how a real-time data analysis could be conducted to suggest an early alert of a potential disease outbreak. A proposed hospital emergency support system shows how clinical management issues involved in emergency response can be handled. We conclude with a discussion and future implications.*

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