



# Implementation of best practices for emergency response and recovery at a large hospital: A fire emergency case study



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## ABSTRACT

This paper illustrates a study conducted into the managerial practices implemented to mitigate the consequences of a major fire emergency and to promptly restore normal business operations at a large pediatric hospital. Stemming from prior research on crisis response and recovery in critical infrastructures, this investigation demonstrates that factors such as the complexity of the underlying stakeholder networks, the vulnerability of the involved actors, and several temporal and spatial constraints, all contribute in hampering the intervention of crisis managers. In these situations, relying on consolidated best practices may enable more rapid response and more adequate recovery.

This study adopts a qualitative approach to build a retrospective case study that highlights the crucial issues that healthcare crisis managers are requested to face when exposed to thorny work conditions: presence of numerous actors from the public and the private sector, involvement of organizations with contrasting interests, need for a balance among public health, cost containment and legitimacy, etc. The findings of the present investigation expand the theoretical knowledge on the dynamics that characterize crises occurring at critical infrastructures and provide practical recommendations for healthcare emergency managers to improve their response to, and recovery from, major fire emergencies.

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## 1. Introduction

Extensive academic literature has been dedicated to the evaluation of emergency response plans in a variety of industries and events, such as natural hazards (An et al., 2015; Bisri, 2013), nuclear (Ten Hoeve and Jacobson, 2012), industrial (Krausmann et al., 2011; Lindøe et al., 2011; Wei and Lu, 2015) and transport accidents (Carim et al., 2016; Fan et al., 2015). A burgeoning field of research, emergency management in the healthcare sector deserves further attention by researchers and practitioners, in order to diffuse best practices and reduce costs of accident prevention and response (Alves et al., 2015; Lakbala, 2016; Orlando et al., 2010). As critical infrastructures, modern hospitals are vital systems whose incapacitation ‘[...] would have a debilitating impact

on national security, national economic security, national public health or safety, or any combination of these.’ (Sullivant, 2007, p. 538). As a consequence, the amount of disaster planning and emergency preparation that modern hospitals are required to develop is significant (Bish et al., 2014).

The complexity that underlies healthcare operations in hospitals, coupled with the risks associated with an emergency, makes evacuations particularly delicate for emergency managers in the healthcare sector. During emergencies, complexity of operations in hospitals is exacerbated by a number of factors: presence of vulnerable patients (classified by severity and health conditions), presence of potentially dangerous substances (e.g., chemical and radiological) and the need for the evacuees to be constantly assisted. Furthermore, an acknowledged, natural proneness by the healthcare sector to be posed under strict scrutiny by the media (Wilmar et al., 2014) has the potential to exert further pressure on healthcare emergency managers. Natural hazards (earthquakes, floods, hurricanes, etc.) or human actions (deliberate or unintended) have in the past caused hospitals to implement their

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emergency plans in order to minimize risks for patients and staff members (Chavez and Binder, 1996; Schultz et al., 2007; Sternberg et al., 2004). Such emergency plans are based on a structured approach.

The American Society for Healthcare Risk Management (ASHRM) identifies four steps that are involved in emergency management in healthcare facilities: *prevention, planning and preparation, implementation and response and recovery* (Carroll, 2010). In the initial *prevention* phase, emphasis is placed on building robust internal reporting systems to detect early warnings of potential crises. In the *planning and preparation* stage, the emergency managers ensure that adequate emergency plans are effectively designed and maintained. In the *implementation and response* phase, the emergency plans are deployed and a first reaction to the events is provided. In the final *recovery* stage, financial, operational and psychological measures are taken in order to restore pre-crisis conditions.

The following Table 1 summarizes several significant studies that have explored the different stages of the healthcare emergency management process, and provides an overview of their main focus areas and findings.

Research demonstrates that American healthcare facilities are more covered against other types of hazards than fire events (e.g., radiological, chemical, and nuclear attacks, biological accidents, epidemics and pandemics) (Niska and Shimizu, 2011). An extensive body of academic studies in healthcare emergency management focuses on the aforementioned threats (see, among others, Cone and Koenig, 2005; Moore et al., 2015; Wetter et al., 2001). As illustrated in Table 1, academic research on healthcare emergency management seems to predominantly concentrate on other threats than fire events. Furthermore, the first two stages of the emergency management process, *prevention and planning and preparation*, attract most of the attention in the literature.

Based on this overview, the scholarly literature needs additional, comprehensive studies exploring the effectiveness of *implementation and response and recovery* plans executed by healthcare facilities, especially in situations of fire emergencies. Recent research (Lu et al., 2012) shows in fact that fire events in hospitals and healthcare facilities are usually associated with high fatality levels due to the relatively high vulnerability and low physical ability of their occupants. In the United States, the National Fire Protection Association has compiled an exhaustive report on the features of fire events in healthcare facilities (Ahrens, 2012). This report indicates that, on average, in the period 2006–2010, the US fire departments responded to 6240 fire events per year in healthcare facilities. These caused an annual average of around six deaths, 171 injuries among civilians, and more the 52 million USD in property damage. Despite this, surprisingly, in 2008 less than 80% of hospitals in the US had emergency plans for explosive or incendiary incidents (Niska and Shimizu, 2011).

Notwithstanding the scarce number of studies exploring the characteristics of fire emergencies in healthcare infrastructures, several exceptions exist. In their investigation on the recovery of fire-damaged medical equipment, Chien et al. (2011) illustrate the case of a fire event that occurred in a Taiwanese hospital and resulted in extensive damage to critical medical equipment. The researchers provide an overview of the disaster recovery process implemented after the event and emphasize the important support that appropriate web-based information systems can provide in maintaining adequate levels of care. Hertzberg et al. (2007) investigate an arson hospital fire which occurred in Sweden and identify a number of factors that contributed to the event. Among these, besides the perpetrator's deliberate act, the presence of easily ignitable materials in the mattresses and the flooring of the hospital's bedrooms facilitated the diffusion of fire, smoke and toxic substances. The investigation conducted by Lu et al. (2012) applied

the correspondence analysis technique to high-casualty fire data in China. This study highlights the associations between fatality levels and influence factors such as affected infrastructures, causes, time, month, year and location. The results demonstrate that fires in healthcare facilities tend to be strongly associated with high-fatality levels, especially when the origin of the fire event is task-related (e.g., negligence by operators), the fires occur in the daytime during the cold months, and the fires affect facilities located in highly-populated areas (e.g., Beijing).

This review of the academic literature emphasizes the need for researchers and practitioners to further analyze the nature and characteristics of fire events developing in healthcare and assistance facilities. As previously discussed, these events have the potential to yield a higher number of casualties, when compared to other accidents and infrastructures (Lu et al., 2012). In order to address this acknowledged gap in the literature, the present paper explores a major fire event that occurred at a large pediatric hospital in Rome. The main objective of this article is to share an experience of emergency response and recovery from a fire event that affected a hospital operating in thorny conditions. Focus of the present paper is on the *response* to, and *recovery* from, a fire event that occurred at the 'Bambino Gesù' hospital (OPBG) in November 2010 ('Bambino Gesù' Hospital, 2010b).

### 1.1. The hospital and the fire event

The 'Bambino Gesù' (OPBG) is a Catholic, pediatric hospital and research center owned by the Vatican City, established in 1869 ('Bambino Gesù' Hospital, 2015b). The hospital, which started as a room with four beds, is nowadays one of the largest pediatric hospitals and research centers in Europe. The OPBG is accredited under Joint Commission International, an independent organization that evaluates quality and patient safety in global health care (Joint Commission International, 2017). The hospital currently boasts occupancy of approximately 600 beds. Its occupancy rate was around 91% in 2015. It has almost 2600 staff members (in 2015, around 20% were contract workers) and each year provides over 1 million healthcare services to children and adolescents from all over the world ('Bambino Gesù' Hospital, 2015a).

Operations at the OPBG have been constantly expanding in the last years, as demonstrated in Table 2 below:

On November the 5th 2010, at 3.10 pm, the Intensive Care Unit (ICU) located in 'Pio XII' pavilion, first floor, was affected by a fire emergency. A nurse had noticed smoke coming from the head physician's room. At that moment, 'Pio XII' pavilion hosted 55 patients, 9 of which were in the ICU. A total of 82 staff members were employed in the affected building. The security and the first response team were alerted and immediately reached the ICU. The Vatican City Fire Brigade and the Italian Fire Brigade were also alerted (3.20 pm) and reached the hospital premises at 3.25 pm and 3.35 pm. In the meantime, the hospital's first response team, following the indications contained in the emergency plan, started assembling the fire hoses, which the Vatican City Fire Brigade then connected to their fire truck. The fire was extinguished before 3.35 pm, but the smoke kept spreading and reached the nearby Pediatric Pathology ward and the stairs of the building. It took 20–25 min to completely evacuate the two involved wards (ICU and Pediatric Pathology) and fully contain the emergency. No major injuries resulted from the event, but many pieces of equipment were damaged due to the high temperature, the smoke, the ashes and the electrical short circuits generated by the water from the sprinklers and the hoses. A report elaborated by the Vatican City Fire Brigade, and confirmed by the Italian Fire Brigade, indicated that the fire event was likely caused by an electrical short-circuit that affected a computer in the head physician's room (Vatican City Fire Brigade, 2010).

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