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# Hospital as a critical infrastructure in the community disaster response system

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Thesis

Hospital as a Critical Infrastructure in the Community Disaster Response System

Yixuan Li

May 20, 2012

Department of Civil Engineering Technology

Environmental Management & Safety

Rochester Institute of Technology

Rochester, NY

Thesis submitted in partial fulfillment of the requirements of the degree of Masters of Science in  
Environmental, Health & Safety Management.

Approved by:

\_\_\_\_\_

John Morelli, Ph.D., P.E. Department Chair

\_\_\_\_\_

Date

\_\_\_\_\_

Jennifer Schneider, Sc.D., CIH Professor & Advisor

\_\_\_\_\_

Date

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## **LIST OF ACRONYMS**

**ANA** – American Nurses Association

**APHA** – American Public Health Association

**CEMSA** – California Emergency Medical Services Authority

**CERS** – Community Emergency Response System

**CHA** – California Hospital Associations

**CIKR** – Critical Infrastructure and Key Resources

**CM** – Critical Manufacturing

**CT** – Computerized Tomography

**DHS** – Department of Homeland Security

**DHHS** – Department of Health and Human Services

**DIB** – Defense Industrial Base

**DOC** – Department Operations Center

**DPH** – Department of Public Health

**EMS** – Emergency Medical Services

**EOC** – Emergency Operations Center

**EPA** – Environmental Protection Agency

**ESF** – Emergency Support Function

**ESS** – Emergency Services Sector

**FEMA** – Federal Emergency Management Agency

**GCC** – Government Coordinating Council

**HICS** – Hospital Incident Command System

**HPH** – Healthcare and Public Health

**HSPD-7** – Homeland Security Presidential Directive 7

**ICS** – Incident Command System

**JCAHO** – Joint Commission on Accreditation of Healthcare Organizations

**MACS** – Multi-Agency Coordination System

**MCI** – Mass Casualty Incidents

**NASDA** – National Association of State Departments of Agriculture

**NFPA** – National Fire Protection Association

**NIMS** – National Incident Command System

**NMI** – National Monuments and Icons

**OEM** – Office of Emergency Management

**OSHA** – Occupational Safety and Health Administration

**SCC** – Sector Coordinating Councils

**SSA** – Sector-Specific Agency

**UNDP** – United Nations Development Programme

## **ABSTRACT**

The Department of Homeland Security lists 19 groups of sectors as Critical Infrastructure Key Resources (CIKR) such as Water, Emergency Services, and Healthcare and Public Health (HPH). Protection of those interdependent sectors is of vital interest for the country in the event of disaster.

Hospital infrastructure systems are basic HPH elements of the CIKR. Local hospitals deliver essential routine healthcare services as well as serving as frontline responders during non-routine disaster events. Currently, hospitals generally extend their routine healthcare activities for external community disaster preparedness and response services. This extension takes the form of coordination with other responders within the community. Under this condition, determining the hospital's role in the community disaster response is critical. This thesis evaluates the current external performance of a hospital in response to a community disaster and the degree of integration of hospitals with the community system during and after a disaster. Case studies of two hospitals in Western New York State, one a rural institution sample and the other an urban institution sample, are conducted with data collected through program review and structured interviews of the hospitals' staff and the Emergency Management Officers of each community and analyzed using context analysis. The analysis shows that rural hospitals are more critical to community recovery than urban centers; communication both internal and external to the hospital is key to effectiveness; and emergency planning is actually only a small part of response.

# **CHAPTER 1**

## **INTRODUCTION**

In a sense, the terrorism events of 9/11 delivered a permanent change to the US national security system and endowed an unprecedented significance on “critical infrastructure” recognition and protection. After only 45 days after the attack, the USA PATRIOT Act (Uniting and Strengthening America by Providing Appropriate Tools Required to Intercept and Obstruct Terrorism) was approved and made into law, which renewed the federal government’s definition of “critical infrastructure.” In the months after 9/11, the Homeland Security Act was passed. This Act of 2002 consolidated more than 20 federal agencies into the Department of Homeland Security (DHS) and designated it as the primary authority for the overall homeland security mission. The Department of Homeland Security assumed the primary responsibility of developing national plans to secure Critical Infrastructure and Key Resources (CIKR) (US DHS, 2012d).

Under the Homeland Security Presidential Directive 7 (HSPD-7), the newest list was updated by DHS in 2008, covering 18 groups of key sectors as follows: Agriculture and Food; Banking and Finance; Chemical; Commercial Facilities; Communications; Critical Manufacturing; Dams; Defense Industrial Base; Emergency Services; Energy; Government Facilities; Healthcare and Public Health; Information Technology; National Monuments and Icons; Nuclear Reactors, Materials and Waste; Postal and Shipping; Transportation Systems; and Water (US DHS, 2012d). Those interdependent sectors are of vital interest to the continuity of the critical infrastructure of the country. For each key sector’s safety protection, a federal Sector-Specific Agency (SSA) has been assigned, together with governmental and non-governmental programs and platforms.

Accompanied by the formulation of national policies about CIKR, the community of preparedness and response to emergency is also established. In August 2011 DHS invested over \$2.1 billion to develop a “nimble” or effective emergency response system and foster a culture of preparedness at the national level (US DHS, 2011a). Public and private emergency responders gradually bridge the gaps between them and coordinate within one framework.



Among the Critical Infrastructures, the Healthcare and Public Health (HPH) Sector can be viewed as an emergency responder. This sector is composed of private organizations such as hospitals and public health agencies and institutions; the Department of Health and Human Services is designated as its SSA. Within the relationships of emergency support to key sectors, HPH together with the Emergency Sector is mapped to mass care, emergency assistance, housing, and human services (Emergency Support Function [ESF] #6) and to public health and medical services (ESF #8) (FEMA, 2008). The importance of HPH to the nation not only lies in its interdependencies with other sectors and resources but also in its function of emergency response and recovery. As DHS emphasized, HPH “plays a significant role in response and recovery across all other sectors in the event of a natural or manmade disaster” (US DHS, 2012l).

The HPH Sector is distributed from the federal, state, and regional level to the local level. As an element of HPH, a hospital delivers healthcare services and other functions in the frontline of local emergencies. When disaster strikes, federal, state, and local governments should try to keep a hospital functioning; other key sectors such as energy, communication systems, and organizations such as the fire department and Department of Health should support a hospital’s operations as “protecting and preventing damage to any one asset is less vital than the ability to continue to deliver care” (US DHS, 2011b).

Meanwhile, it is commonly realized that hospitals should be more involved with community planning to establish a systematic response. When the disaster’s spatial scale and/or quantity scale overwhelm the capacity of a single entity, manipulation of the resources at the regional level seems rational and certain as are the coordination, collaboration, and communication between hospital systems and emergency responders (Maldin et al., 2007). Since Hurricane Katrina, integration of hospitals with the community has been identified as a key factor of a successful regional response and recovery of the affected area (US Congress, 2006). Most hospitals in the US have extended their routine healthcare activities for external community disaster preparedness and response services. This extension generally takes the form of hierarchical communication networks among the community’s hospitals, response authorities, regulatory agencies, and emergency management providers within a geographical region (CEMSA, 2006).

Meanwhile, according to Comfort, Ko, and Zagorecki (2004), in different contexts, different demands and response patterns will be generated based on different systems' capacities to contain or control the crisis. In the actual disaster events, the challenges are highly dynamic; the capacity of a facility and the demand for external assistance varies over time. Those variables increase the complexity of the community-scaled response system, which is generally supposed to address all kinds of crises. To control potential chaos, the role identification of key responders and plans for interactions between them are vital, as disaster response and recovery require effective decision making and activities in a limited time and in unpredictable environments. When evaluating the response activities in Hurricane Katrina, the disintegration between the hospitals as private entities and public emergency agencies and the murky role identification have been cited as two main reasons for the defeat in response (US Congress, 2006). In this circumstance, determination of hospitals' behaviors in the regional emergency response system and recognition of their significance to the locality's resiliency are compulsory for the related research community.

In this study, the following questions will be answered with qualitative data:

- 1) How does the hospital interact with emergency responders and CIKR during the disaster and aftermath in an actual situation?
- 2) How does the hospital play a role in the community's (rural and urban) disaster response system?

Although the value of a hospital system to the resiliency level of the community is critical, few studies identify the hospital as a CIKR. In attempting to discern the role of the hospital in the community disaster preparedness, response, and recovery systems, this paper also will tentatively demonstrate the hospital as a critical infrastructure.

Hospitals' roles in community emergency response systems, their interactions with external partners, and contributions to community recovery are aligned to discern the hospitals' value and status in the locality and to demonstrate the hospital as a CIKR.

Because first-hand emergency responses and healthcare activities most often occur locally, this study is conducted at the local level. Case studies on a rural and an urban hospital in Western

New York are contrived to answer those questions. To evaluate a hospital's criticality in different external context, the rural and the urban are set as the variables in this study. Also, this research conducts a comparison between the two hospitals in respect to each hospital's roles, interactions, and status in its community.

# **CHAPTER 2**

## **LITERATURE REVIEW**

The literature review for the thesis includes two parts. First, it will examine the Critical Infrastructure including its definition, key sectors, and the protection of CIKR, to show the interdependencies of CIKR and its criticality to the whole society. Then it will examine the standards for hospitals' activities in and after a disaster and collect current studies on the hospitals' performances in Hurricane Katrina of 2005. This review will provide the background in understanding the roles of hospitals facing disaster to their status in the community.

### **2.1 Critical Infrastructures**

The federal government's most recent definition of "critical infrastructure" is determined by the USA PATRIOT Act of 2001 (P.L. 107-56) and adopted in the Homeland Security Act of 2002, which established the DHS. The definition of critical infrastructure is as follows:

...Systems and assets, whether physical or virtual, so vital to the United States that the incapacity or destruction of such systems and assets would have a debilitating impact on security, national economic security, national public health or safety, or any combination of those matters (USA PATRIOT Act, 2001).

The classes of the Critical Infrastructure Sector are open to update, and the list renewed most recently includes 18 different sectors: Agriculture and Food, Banking and Finance, Chemical, Commercial Facilities, Communications, Critical Manufacturing, Dams, Defense Industrial Base, Emergency Services, Energy, Government Facilities, Healthcare and Public Health, Information Technology, National Monuments and Icons, Nuclear Reactors, Materials and Waste, Postal and Shipping, Transportation Systems, and Water (US DHS, 2012d). The vulnerabilities of the country, from federal to local levels, are highly related to the interdependencies of those sectors whose protection and preparedness thus embrace vitality to the whole nation.

### **2.2 CIKR's Protection and Preparedness**

In the US, the CIKR's protection and preparedness is under the supervision of federal governmental agencies and related parties. The Homeland Security Act of 2002, Homeland Security Presidential Directive (HSPD) 7 - Critical Infrastructure Identification, Prioritization, and Protection, the National Strategy for the Physical Protection of Critical Infrastructure and Key Assets, and the National Strategy for Securing Cyberspace are the main authorities for the policies of CIKR protection and preparedness. Under those authorities, the DHS is designated the responsibilities of coordinating SSAs and public and private incident managers from the federal to local levels (FEMA, 2008). DHS strives also to create CIKR situational awareness in support of incident operations.

The National Infrastructure Protection Plan (NIPP) and its associated CIKR Sector-Specific Plans (SSPs) are the general authorities that guide CIKR-related activities. They "provide a foundation for CIKR preparedness, protection, response, and recovery efforts in all-hazardous context" (FEMA, 2008, p. 3). Within those plans, authorities, roles, and responsibilities of different parties are recognized for risk management. Under the NIPP, national organizational structures provide mechanisms for government and private sector coordination, situational awareness, impact assessments, and information sharing beyond the border of sectors. National Operations Center, National Response Coordination Center, National Infrastructure Coordinating Center, Department of Justice/Federal Bureau of Investigation Strategic Information and Operations Center, and National Coordinating Center for Telecommunications are the national-level clearinghouse for CIKR-activities involving "the exchange of liaisons, implementation of reporting and information-sharing protocols, and/or physical representation" (FEMA, 2008, p. 9).

Also, the full coordination between government and industry/private owners within each key sector beyond the chasm in public and private organizations is under establishment. The HSPD 7 identifies the Secretary of Homeland Security as coordinating the overall national effort for CIKR protection and preparedness and charges a federal government SSA with responsibility for protection coordination within each CIKR sector. The "Industrial" Sector Coordinating Council (SCC) and the "Governmental" Coordinating Council (GCC) have been organized under each SSA (except SSA for Government Facilities and National Monuments and Icons sectors, because those sectors are uniquely governmental). SCC and GCC will coordinate to plan and implement homeland security policies and programs for each sector (NASDA, 2007).

## 2.3 Key Sectors

It is commonly accepted that the interdependencies between critical infrastructure key sectors are of significance to the protection of the country. As the US Environmental Protection Agency (US EPA 2010, p. 1) claimed, recognition of those interdependencies will “help to strengthen the overall resiliency of a community in the face of all-hazards threats.” Hospitals’ interactions with other key sectors will be better understood with a brief review of each key sector.

### 1) Agriculture and Food

With the mission of feeding and clothing people well beyond the boundaries of the nation, the Agriculture and Food Sector is overseen by the Department of Agriculture at the federal level. It has critical dependencies mainly with: Water, Transportation Systems, Energy, Banking and Finance, Chemical, and Dams (US DHS, 2012j).

### 2) Banking and Finance

The Banking and Finance Sector is composed of over 29,000 financial firms in US. The Treasury Department as its SSA organizes the Financial and Banking Information Infrastructure Committee (FBIIC) and Financial Services-Information Sharing and Analysis Center (FS-ISAC) to help protect the nation’s financial infrastructure over the global market. This sector is highly dependent on these sectors: Energy, Information Technology, Transportation Systems, and Communications (US DHS, 2012a).

### 3) Chemical

The Chemical Sector includes five main segments: (1) basic chemicals, (2) specialty chemicals, (3) agricultural chemicals, (4) pharmaceuticals, and (5) consumer products. DHS is designated as its SSA to reduce the potential risk of chemicals and the related economic impact. The Chemical Sector is highly dependent on these sectors: Transportation Systems for the movement of raw materials and finished products, Energy, Water, Agriculture and Food, Information Technology, and Communications (US DHS, 2012b).

### 4) Commercial Facilities

Commercial Facilities are the facilities operating on the principle of open public access. DHS

acts as the sector's SSA to foster coordination on homeland security issues and provide national coordination of commercial facility strategies and activities (US DHS, 2012c).

#### 5) Communications

The Communications Sector underlies the operations of all businesses, public safety organizations, and government. The assignment of this sector is focused on reducing risk through “striving to ensure that the Nation’s communications networks and systems are secure, resilient, and rapidly restored after a natural or manmade disaster; and assessing other sectors’ communications dependencies for high-risk assets, networks, systems, and functions” (US DHS, 2011c). It is closely connected to the Energy Sector, Information Technology Sector, Banking and Finance Sector, Emergency Services, and Postal and Shipping Sector.

#### 6) Critical Manufacturing (CM)

CM is the newest key sector identified by DHS. Based on the guidance provided by HSPD-7, the following industries are identified inside the CM Sector: Primary Metal Manufacturing, Machinery Manufacturing, and Transportation Equipment Manufacturing. DHS’ Office of Infrastructure Protection is designated as the SSA for this sector (US DHS, 2012e).

#### 7) Dams

The Dams Sector covers hydroelectric power, river navigation, water supply, wildlife habitat, waste management, flood control, and recreation. The Office of Infrastructure Protection (IP) within DHS acts as its SSA. This sector has dependencies and interdependencies mainly with these sectors: Agriculture and Food, Transportation Systems, Water, Energy, and Emergency Services (US DHS, 2012f).

#### 8) Defense Industrial Base (DIB)

The critical assets of the DIB Sector exist mainly in an open and global environment, which makes it potentially vulnerable to exploitation and attack. This sector includes the Department of Defense (which is also the SSA of this sector), government, and the private sector worldwide industrial complex with a mission to ensure adequate industrial capacity to support national security. The DIB Sector is mainly dependent upon the Energy Sector, Communications Sector,

and Transportation Systems Sector (US DHS, 2012g).

#### 9) Emergency Services

The DHS defines the Emergency Services Sector (ESS) as “a system of response and recovery elements that forms the nation's first line of defense and prevention and reduction of consequences from any terrorist attack” (US DHS, 2012h). ESS covers the following disciplines: Law Enforcement, Fire and Emergency Services, Emergency Management, Emergency Medical Services, and Public Works. ESS is the primary protector for all other CIKR. DHS serves as its SSA.

#### 10) Energy

The Energy infrastructure, which mainly is owned privately, functions as the blood vessel for the economy of the US and supplies health and welfare. The Energy infrastructure can be divided into three interrelated segments: electricity, petroleum, and natural gas. The Department of Energy acts as the SSA of this sector. This sector's reliance on pipelines highlights its interdependency with the sector of Transportation, while all other sectors depend on Energy (US DHS, 2012i).

#### 11) Government Facilities

The Government Facilities Sector consists of “a wide variety of buildings, owned or leased by Federal, State, territorial, local, or tribal governments, located domestically and overseas” (US DHS, 2012k). Many government facilities are open to the public, and the ones that are not open generally contain highly sensitive issues. Cyber- related elements are viewed as a part of this sector. The DHS Federal Protective Service, as part of Immigration and Customs Enforcement, serves as the SSA.

#### 12) Information Technology (IT)

The assets of the IT Sector include hardware, software, IT systems and services, and the Internet. Promising the availability of IT networks and services is the collective responsibility of both the IT and Communications sectors. DHS plays the role of this sector's SSA. The dependences of the IT sector include Banking, Government Facilities, Emergency Services, and



Transportation. Also, the IT Sector is highly relied upon by Communications and Transportation sectors (US DHS, 2012m).

### 13) National Monuments and Icons (NMI)

The NMI Sector, which is mainly owned by the federal government, includes many assets, systems, networks, and functions located throughout the US. The NMI Sector is committed to ensuring that the symbols of our nation remain protected and intact for future generations and that staff and visitors are protected from harm. Generally, this sector depends on IT Information Systems, Communications, Transportation, and Energy (US DHS, 2012n).

### 14) Nuclear Reactors, Materials, and Waste (Nuclear)

The Nuclear Sector covers “nuclear power plants; non-power nuclear reactors used for research, testing, and training; nuclear materials used in medical, industrial, and academic settings; nuclear fuel fabrication facilities; decommissioning reactors; and the transportation, storage, and disposal of nuclear material and waste” (US DHS, 2012o). Sector-Specific Agency Executive Management Office (SSA EMO) of DHS and the Nuclear Sector-Specific Agency maintain responsibility for CIKR protection of this sector. The Nuclear Sector can affect every other sector and mainly depends on IT Information Systems, Communications, Transportation, Military, Emergency Services, and Energy.

### 15) Postal and Shipping

The Postal and Shipping Sector includes letters, flat mail, publications, and small and medium-size packages. Assets of this sector include automated processing facilities; local delivery units; collection, acceptance, and retail operations; and transport vehicles. DHS is the SAA of this sector. Major interdependencies include Information Technology, Communications, Energy, and Transportation Systems sectors (US DHS, 2012p).

### 16) Transportation Systems

The Transportation Systems Sector consists of six key subsectors: Aviation, Highways, Maritime Transportation System, Mass Transit and Passenger Rail, Pipeline Systems, and Freight Rail. The Transportation Security Administration is designated as the SSA for the

Aviation, Highways, Passenger Rail, Mass Transit, Freight Rail and Pipeline modes. The United States Coast Guard is the SSA for the Maritime System. The Transportation Sector can impose profound impacts on Energy, Agriculture and Food, Chemicals, Emergency Services, and Commercial, while it depends highly on IT, Communications, and Energy (US DHS, 2012q).

#### 17) Water

The Water Sector is vulnerable to a variety of attacks including contamination with deadly agents, physical attacks, and cyber attacks that can impact public health and economic vitality. The Environmental Protection Agency (EPA) is the SSA for protecting the Water Sector. The dependent and interdependent sectors of the Water Sector include Energy, Transportation, and Food and Agriculture (US DHS, 2012r). Chemical industrial also is in close relationship to the Water Sector (Copeland, 2010).

#### 18) Healthcare and Public Health (HPH)

The HPH Sector, approximately 15 percent of which is publicly owned, plays a significant role in response and recovery across all other sectors in the event of disaster with the vision to achieve overall resiliency against all threats. This sector consists of hospitals, ambulatory care facilities, nursing and residential care facilities, pharmacies, blood and organ banks, pharmaceutical manufacturing sites, and public health laboratories. It is vital to all-hazards threat preparedness and response and the overall critical infrastructure recovery. The protection responsibilities for this sector include preventing damage to the nation's healthcare and public health infrastructure and preserving the sector's function in responding to routine and emergency situations (US DHS, 2012l).

The HPH Sector is highly dependent on these sectors: the Energy, Water, Transportation, Emergency Services, Food and Agriculture, Information Technology, and Communications. Detailed information for interdependency with HPH and corresponding sectors is shown in Table 1. Specially, the interdependence with Water, Transportation, Power (electrical power grid), and Food are critical and could raise health and safety issues within the HPH Sector (DHHS, 2007).

Here is an example of the interdependence between Water and the HPH Sector. HPH relies on the Water Sector to ensure continuous and reliable drinking water and wastewater for various

services and functions including “infection control, renal dialysis, heating and air conditioning, manufacturing and storage of pharmaceuticals, sterilization, maintenance of blood and organ banks, drinking water for patients and staff, and transportation of supplies and equipment” (EPA, 2010, p. 1). Interruptions of water service can greatly affect the hospital system and its healthcare services. During the 2005 Hurricane Katrina, the patients in New Orleans were overloaded in area hospitals and congested the roadways. That condition resulted in the wastewater backup at the local area hospitals and exacerbated the bad healthcare environment for patients (EPA, 2010, p. 2).

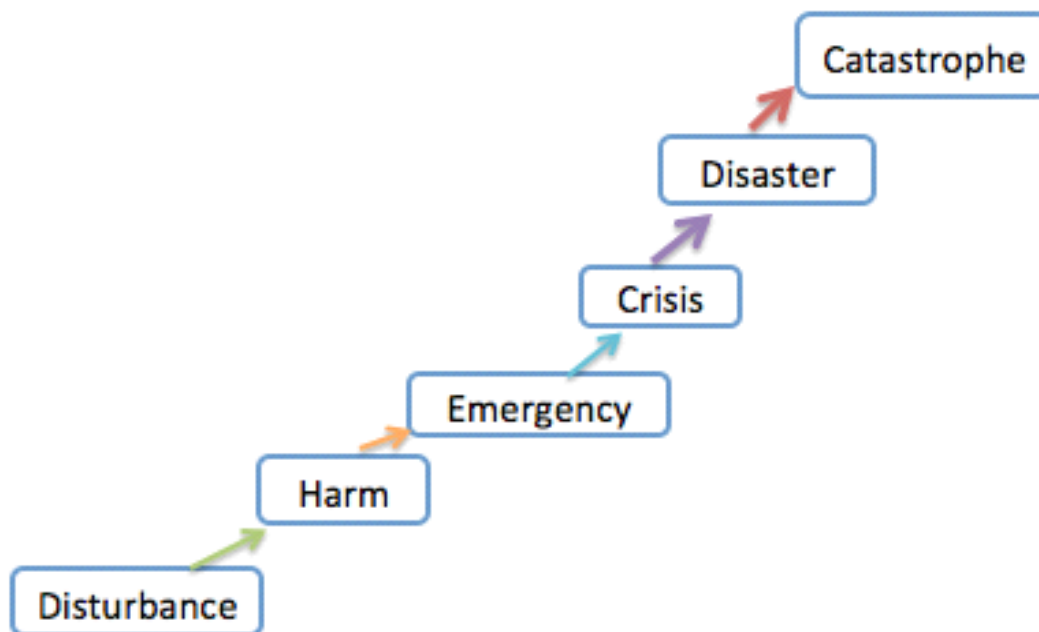
**Table 1: Interdependency and Interdependent Sectors (DHHS, 2007)**

<b>Interdependent Sector</b>	<b>Interdependencies with HPH Sector</b>
Transportation Systems	Movement of supplies, raw materials, pharmaceuticals, personnel, emergency response units, patients, and fatalities
Communications	Third-party reimbursements and other business processes
Energy	Electric, natural gas, propane, and diesel fuel to power and run facility functions of all kinds including facility protection programs
Water	Healthcare, pharmaceutical operations, and sanitization services
Emergency Services	Coordination with first responders and Emergency Medical Services and includes local law enforcement for security for various emergencies (e.g., quarantine and imposed isolation)
Information Technology	Business, clinical, and security information systems
Postal and Shipping	Movement of equipment and supplies
Chemicals	Support to the pharmaceutical industry
Food and Agriculture	Food production and distribution for healthcare and public health personnel and patients

Except the interdependencies mentioned above, the main criticality of the HPH Sector for all other sectors lies in its protecting and recovering individuals, especially when a manmade or natural disaster strikes. For instance, the Banking and Finance Sector will be disrupted once the financial officers or the customers cannot be efficiently recovered by the healthcare facilities. A dam can hardly be operated if the related managers and operators are all absent because of their health issues. The Government Facilities will lose its functions under a bio-terrorism attack if the public health laboratories cannot countermeasure against it in time. Likewise, Critical Manufacturing, Commercial Facilities, Nuclear Reactors, Materials and Waste, National Monuments and Icons all rely on the HPH Sector to protect and restore the health and safety of the “people,” which is the most elementary foundation for CIKR and the basis for the economics, security, and safety of the nation. The critical significance of the HPH Sector to the community is self-evident.

## 2.4 Disaster

Disaster is a condition wherein crisis creates an unmanageable situation and the injury caused by the disturbance cannot be contained. Simultaneously, a given system's ability to prevent widespread injury has been breached. The creation of disaster may be influenced by a variety of factors including the amount of advance notice (time scale), extent of impact (spatial scale or quantity scale), and certain characteristics of the harm, for example, toxicity (functional scale). Disasters could evolve along a continuum culminating in catastrophe or even annihilation. **Fig 1** shows the terminologies applied to “disasters” of different degrees. This thesis does not specifically discriminate between the two words “emergency” and “disaster.”



**Fig 1. Terminology of Emergency (Source: Baker & Refsgaard, 2007)**

Institutional systems charged with the responsibility to manage in disaster situations face multiple challenges including the need for quick action and accurate targeting of aid in an environment where information quality and quantity is highly unpredictable. Furthermore, disasters' consequences may give rise to further harm such as water and food shortages and pestilence.

In particular, if the disaster is a mass casualty event or regional scale such as a major earthquake, a single healthcare institution can hardly take care of all the victims as the patient load will overwhelm it. The management of such an emergency situation usually requires several autonomous public agencies to collaboratively mitigate, prepare, respond, and recover from heterogeneous and dynamic sets of hazards to society. With the support from other key sectors (such as Energy and Communication), healthcare facilities and related private entities will contribute to the coordinated effort for community recovery.

## **2.5 Hospitals and Disaster Response**

Considering the broad spatial dimension that a disaster may spread over, many relevant studies apply “region” or “community” to refer to the local populations and areas affected by the disaster. This thesis will not specifically discriminate the applications of the two words.

A regional/community response to disaster is a systematic reaction of the human society against it, a series of answers consisting of many functions such as logistics, command and control, operations, volunteers, employment, and healthcare. Hospitals, as the main healthcare provider for the locality, shall contribute to and/or maintain those functions and integrate with the regional response system. The following review is focused on the behaviors, activities, and roles of hospitals concerning a regional disaster.

Hospitals play a critical role among healthcare infrastructures and assume primary responsibility for saving lives. When disaster strikes, the affected community relies on hospitals to provide prompt and effective medical care to the maximum number of patients possible and act as a vital resource for diagnosis, treatment, and follow-up for both physical and psychological care with the mission to minimize morbidity and mortality (UNDP, 2008).

Faced with severe pressure from a disaster, hospitals should strive to function through effective internal and external management over resources and assets, staff, utilities, patients, and volunteer practitioners. California Hospital Associations (CHA) (2009) creates the hospital Emergency Management Program Checklist that identifies the following issues concerning what should/might be done by hospitals:

- (1) Initiate (and terminate) an Emergency Operations Plan
- (2) Activate the Hospital Command Center
- (3) Initiate/maintain communication and coordination with community resources (such as EOC/DOC, other healthcare facilities, and media) that cover the issues of hospital status/capacity, event management, patient management, resource sharing, and patient/victim tracking
- (4) Offer Hospital Incident Command System (HICS) reference materials including Job Action Sheets, Incident Planning Guides, Incident Response Guides, and HICS forms
- (5) Track and document financial issues
- (6) Identify and implement Hospital Emergency Codes

(7) Implement Specific Response Plans including the top 3-5 top HVA vulnerabilities (such as earthquake, evacuation, pandemic)

(8) Implement Hospital Surge/Expansion plans

(9) Describe plans/agreements, if any, the hospital has to deploy clinical resources outside the hospital (such as field triage/treatment teams)

(10) Identify hospital capabilities and establish response procedures when the hospital cannot be supported by the local community for at least 96 hours. Document response procedures (such as maintaining/expanding services, conserving resources, curtailing services, supplementing resources from outside the disaster zone, and partial/staged or full evacuation, as necessary)

(11) Implement Communications Systems such as Health Alert Network, HAM radio, and so on

(12) Apply Emergency Communications Strategies

(13) Manage resources and assets such as inventory/acquisition/monitoring/replenishment of assets and resources, staff support, sharing resources and assets with other healthcare organizations, and transportation.

(14) Manage Safety and Security including establishing internal safety and security, controlling access and movement, coordinating with community agencies for security activities, managing hazardous materials and waste, and isolating and decontaminating radioactive/ biological/ chemical contaminants.

(15) Manage workforce roles and responsibilities including defining staff/medical staff roles and responsibilities, applying reporting instructions, training, accepting and using staff from other healthcare organizations, accepting and using volunteers (clinical and non-clinical), identifying the workforce (such as ID badges, vests, and wristbands)

(16) Manage utilities (such as electricity, water, fuel, medical gasses and other essential utilities)

(17) Manage clinical and support activities such as managing patient clinical activities, supporting evacuation, managing surge activities such as creating surge beds, canceling elective procedures, managing clinical services for vulnerable populations, supporting patient hygiene and sanitation needs, supporting patient mental health needs, supporting decedent management/mass fatality procedures, documenting and tracking patient clinical information,



identifying specific responsibilities by department or need (such as labor pool, volunteers, and Emergency Department).

Mainly focused on the hospital's inner activities in a regional disaster, this checklist mentioned also that the hospital's external coordination with the community is warranted, especially in the areas of hospital status/capacity, event management, patient management, resource sharing, and patient/victim tracking (3). During the disaster, the hospital may provide clinical services outside if necessary (9); share resources and assets with other healthcare providers (13); require external help following the procedures (10); coordinate with community agencies such as law enforcement for security activities (14); and other contributions to the community recovery.

Historically, disaster response for the hospital was not competitive compared with other more visible needs within the hospital (Farmer & Carlton, 2006). Also, because of gaps between the governmental first responders like the fire department and private entities like the hospital, the hospital's part has been absent from the community disaster response planning in the US until recently. Hurricane Katrina brought insufficient coordination and even the barriers between hospitals and public agencies into light; the roles of the hospital in a community disaster response must be perceived as having more planning precision (Farmer & Carlton, 2006). The hospital's involvement is indispensable for a coordinated response that will help optimize the services and resources available in an emergency and "strengthen community relationships, form mutually beneficial partnerships, and build community trust and support for the hospital" (The Walker Company, 2010).

The extension of the interaction, communication, and coordination shall be assistance for the hospital itself. In and after Hurricane Katrina, many hospitals faced massive challenges such as electricity deficiency, unavailable communication equipment, and the inability to contact local authorities. Those problems were raised more or less by the absence of governmental agencies' support in the hospitals' operations during the disaster (Franco et al., 2006). With a defined role in a broader response framework, hospitals can receive more organized and substantive support from local, regional, or even state and federal agencies and other key sectors.

The Occupational Safety and Health Administration (OSHA) (1997) summarizes the hospital's behaviors during external management for a coordinated emergency response that include:

(1) Defining its role in community emergency response by pre-planning and coordinating with other local emergency response organizations,

(2) Installing an Incident Command System (ICS) with other local emergency response organizations,

(3) Establishing lines of authority and communication between the incident site and hospital personnel,

(4) Supplying information and support access to a database to help the emergency response system make in-time decisions.

Hospitals' contributions for the regional response often take the form of consistent and effective practiced interactions with other members of the response community, as highly emphasized by the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) (2003). Hospitals should establish linkages with local healthcare facilities and governmental institutions and "exchange critical information and seek additional resources as required" (Rubin, 2001). According to the California Emergency Medical Services Authority (CEMSA) (2006), Table 2 shows the local entities with which a hospital will coordinate and the behaviors a hospital may take in the coordination before and during disasters.

Networking among local entities is essential for augmentation or optimization of available resources, and this network should be open to district authorities to better manipulate available health resources (UNDP, 2008). Table 3 lists local, state, and federal governmental partners that hospitals can reach for resources in an emergency.

In the medical response by Houston/Harris to help Katrina evacuees, hospitals were required to assign representatives who would maintain a regional advisory council with the representatives from EMS agencies in each trauma area. Cooperating with the Unified Area Command Astrodome/Reliant Center Complex Medical Branch, this council played an important role in maintaining the medical infrastructure and coordination of care. During this response, hospitals also were responsible to collect and offer information about their bed availability,

healthcare capacity, assets, and resources to the Medical Operations Center for patient allocation. They were also involved in the patient tracking mechanism establishment (Hamilton et al., 2009).

Basically, hospitals will offer shelter, healthcare, and other necessities such as water and food to the population in need. Immediately after Hurricane Katrina, 7 of the 22 area hospitals of metropolitan New Orleans closed; the remaining hospitals had to deliver greater amounts of healthcare to victims and kept providing medicine for patients with chronic diseases. It was reported that 11 hospitals trapped by the flood housed more than 7,600 people in addition to the patients. One of them, Charity Hospital, strived to sustain the supplies, including potable water, food, power, and healthcare for almost three days in an isolated environment before they restored communication with externals. Those facilities also assumed the responsibility to discharge ambulatory and stable patients with the help of helicopters (Gray & Hebert, 2006). On a temporary basis, a hospital shall sustain its services and operations for at least 96 hours self-reliantly.

**Table 2: Hospitals’ Interactions (Source: CEMSA, 2006)**

<b>Local entities for Interactions</b>	<b>Hospital’s role/responsibilities in the coordination before disaster</b>	<b>Hospital’s activities in the coordination during disaster</b>
Other Hospitals and Healthcare Facilities, Primary Care Clinics	Meet with each other regularly, clarify perceived roles and responsibilities, resource assets and limitations, and response capabilities; discuss planning and training issues; conduct joint drills and exercises	Require or provide assistance and share resources; credentialing; initiate patient transfers
First Responders: Fire Departments, private ambulance providers, air medical services, and the governing Emergency Medical Services (EMS)	Be familiar with the community multiple/mass casualty plan, especially concerning the roles, perception, patient transport, information sharing, and personnel supplementation	Require or provide assistance with personnel, patient, and equipment/supply; follow the information sharing procedures
Law Enforcement (LE)	Have a daily working relationship with LE; develop a memorandum of understanding between the two parties	Require security supplementation from LE, integrate their personnel into hospital operations and incident command; require rule

		implementation for crowd control
Public Health Department	Regularly meet to define roles and responsibilities, discuss response needs, and develop plans and procedures directed at keeping the healthcare system operational	Require assistances in healthcare such as equipment, medications, and supplies when necessary
Medical Examiner's Office/Coroners	Align with the local or state mass fatality plan involving the medical examiner/coroner	Ensure that the hospital's procedures for managing the deceased are consistent with expected practices
Behavioral/Mental Health Specialists	Develop a response plan addressing the psychological effects on community using qualified staff members and outside behavioral/mental health specialists	Coordinate the mental recovery of the affected population
Local Emergency Management Agency (EMA)	Coordinate the community's all-hazard preparedness efforts; be familiar with the personnel in the EMA and its operations	Request response assistance beyond existing resources and mutual aid agreements through EMA
State Response Teams, Federal Response Teams	Hospital planning should address the need to effectively integrate those teams	Request staff supplementation and other logistical support from those teams
American Red Cross (ARC)	Be familiar with the ARC's disaster response capabilities and leaders of the local and state ARC chapter; have plan for utilizing external help from ARC	Coordinate setting up and operating community shelters and helping victims in need of food, water, clothing, and other household goods
Media	Establish good working relationships with members of the media	Gather, prepare, and disseminate information, and coordinate with media to provide information to the public

**Table 3: Hospitals’ involvement with governmental emergency (Source: CEMSA, 2006)**

<b>Governmental Partners: Local/Tribal, State, and Federal</b>	<b>Partners’ function and operation related to hospitals</b>
Emergency Management Assistance Compact (EMAC)	EMAC can be implemented as a means of expediting the delivery of personnel and other resources required by hospitals, usually from states closest to the affected area
Regional Hospital Coordination Centers (RHCC)	RHCC helps coordinate hospitals in information-sharing and medically related resource management during a crisis
Local Emergency Operations Center (EOC)	Hospitals shall have access to local EOC for requesting resources from the various ESFs in an emergency and shall submit periodic situation reports and Incident Action Plans to EOC
State Emergency Operations Center	The state EOC serves as a liaison with the federal government to ensure that local needs are being conveyed to and addressed by federal officials during and after the incident

## 2.6 Hospitals and Post-Disaster

As the American Nurses Association (ANA) (2008) declared, “no response to an extreme circumstance is complete until the participants have moved to the recovery phase, including reestablishing the medical and public health infrastructure, both physically and in human resources, disrupted by the disaster.” Basically, it is difficult to separate the recovery phase from the response phase, both of which start immediately when the disaster strikes. Disaster recovery management refers to a series of activities including mitigation, preparedness, response, and recovery, with the aim to rapidly restore the disturbed conditions to back to normal. Recovery will bring “the post disaster situation to some level of acceptability, which may or may not be the same as the pre-impact level” (Quarantelli, 1999). Also, the recovery process must be facilitated to reduce secondary damage and loss (Chien, 2011).

Hospitals’ immediate response to disasters will extend to a continuity of healthcare and public advisories. Identified as the Health Sector’s role, surveillance of disease and data collection are critically important for all phases of recovery and learning how to mitigate future disasters (Bidwell, 2011). Hospitals collaborating with public health departments after disasters are indispensable to the community and includes (APHA, 2006):

- 1) Monitoring environmental infrastructure including water, sanitation, food, and vector control;
- 2) Assessing the needs of special populations and emphasizing the need to identify where such vulnerable groups are and actively involve them in recovery;
- 3) Ensuring the continuity of healthcare;
- 4) Initiating injury prevention and surveillance, including rates of injury, infectious disease, drinking water, sewage, and solid waste collections;
- 5) Issuing health advisories that are in appropriate languages and media;
- 6) Determining needed immunizations and allocating appropriate resources;
- 7) Involving planning for disaster preparedness and mitigation.

During the after-disaster phase of Hurricane Katrina, local hospitals and public health agencies set up immunization sites to administer childhood vaccinations while providing “tetanus vaccinations for workers about to deploy to affected Gulf Coast areas” (Hamilton et al., 2009).

To help prevent infections from spreading during and after a disaster, hospitals should provide hand-washing stations with running water, cleaning services to keep supplies dry and clean, screening of openings into the ambulatory care area to decrease dust and insects, and detailed procedures for medical waste disposal (Sullivan & McDonald, 2006). The recruitment and training of volunteers as cleaning crews and waste management personnel, together with the hospitals’ inner recovery plan (staff, logistics, operation, etc.) are also critical.

## 2.7 Hospitals and CIKR

Among Critical Infrastructures, the Healthcare and Public Health (HPH) Sector is fragmented, characterized by numerous infrastructure facilities as well as physical and non-physical (organizational) networks. To perform the healthcare task, a complex structure of very different services must operate at the highest level of reliability, which includes health authorities, laboratories, transport services, pharmacies, health insurances, the pharmaceutical industry, rescue services, nursing homes, homecare, hospitals, medical practices, and healthcare centers. Meanwhile, the HPH Sector is heavily dependent on these sectors: Energy, Water, Transportation, Emergency Services, Food and Agriculture, Information Technology, and Communications. Those sectors also are vital to the hospital.

Tagged with the socio-economic function, hospitals are of great significance to the health and safety of populations and the economics in the community. Failure of hospitals' operations will "impact those especially societal groups, whose capacities to anticipate, cope with, resist and recover from the impact of a natural or man-made hazard is exceedingly low," and, thus, "reducing the vulnerability of these socioeconomic infrastructure facilities will reduce the overall vulnerability of a community" (Riegel, 2006).

The interdependencies between the key sectors of the Critical Infrastructure are highly significant to the vulnerabilities of the community (Baiardi, Sgandurra, & Telmon, 2009). Whether a hospital shall be viewed as CIKR has not yet been demonstrated, but its interactions with other key sectors are definitely critical. Those interactions were identified as follows by the US Public Health Service (2002):

- Healthcare facilities contain contaminated medical wastes, hazardous laboratory wastes, and regular solid wastes. Dealing with this waste is a formidable challenge.

- Hospitals contain specialized equipment and chemicals such as radiology equipment, medical diagnostic and treatment equipment, medical gases and piping (NFPA 99, Standard for Healthcare Facilities), and pharmaceuticals, all of which have critical storage requirements and are important (financial) assets.

- The Electrical system (NFPA 70, National Electric Code), especially related to patient care activities (NFPA 99), requires greater reliability (NFPA 110, Standard on Emergency and



Standby Power Systems) and added redundancy within its power distribution system.

- Traffic patterns and indoor air pathways must be preserved as designed to protect all the occupants due to the risk of exposure to contagious patients.

- Most medical treatment and support spaces have specific adjacency criteria for optimal functionality and fire code safety requirements.

In addition, Symantec Corporation (2007) asserted that the distributed business environments, stringent data privacy requirements, and constantly evolving threat landscapes enhance the vulnerabilities of information and communication security in the healthcare sector (hospital). The security of the hospital as an asset is a major concern of the social fabric in a regional disaster.

Finally, the hospital may act as a facility that contains multiple functions of other key sectors during a disaster. In the areas affected by Hurricane Katrina, more than one hospital sheltered the patients and victims and the hospital staff, taking pains to sustain the provision of food, water, energy, communication, and other necessities for the people trapped by the flood (Gray & Hebert, 2006). To some degree, these hospitals can be recognized as small centers of multiple Key Sectors.

## **CHAPTER 3**

### **METHODOLOGY**

This thesis is targeted at analyzing the hospitals' activities in the real-life community emergency response system (CERS). The methodology applied here will provide an actual description of the characteristic mode of hospitals' behaviors and develop an insight on the hospitals' significance in the community. The case study method is applied to address this task. In this study, two hospitals that represent the rural and the urban sample are investigated separately. Comparisons will be made between the two hospitals with the goal of demonstrating the differences in terms of capabilities, available resources, and the effect of the community infrastructures on their preparedness. Through the investigation on the two hospitals in Western New York State, this study will lay the first step to present a whole picture of the involvement of private healthcare facilities in emergency response and recovery in the US after the disaster of Hurricane Katrina.

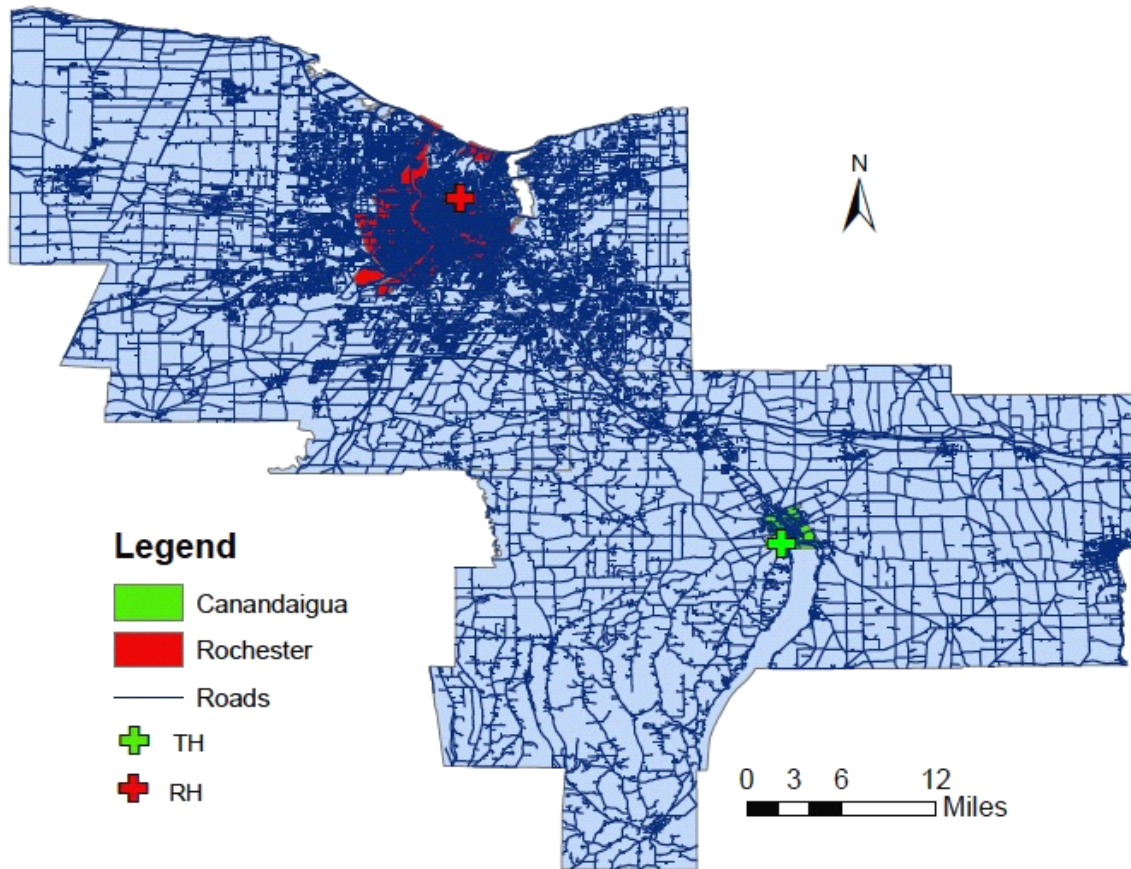
#### **3.1 Subjects of the Study**

An urban and a rural hospital in Western New York State (WNY) are chosen as the subjects for this research. As mentioned in the previous chapter, a hospital is an important asset of the nation, which impacts the health and safety of the locality as well as its economics. Nowadays, a hospital is expected to extend its routine healthcare activities for external community disaster preparedness and response services. T Hospital as the rural subject and R Hospital as the urban subject are investigated.

T Hospital (TH) is a general medical and surgical community hospital. It is located in the rural area of Ontario County, NY. This hospital is a part of a healthcare system that has delivered healthcare services to the residents and their families in the greater Finger Lakes region for many years. Accredited by the Joint Commission, TH owns more than 260 beds (113 of which are acute care beds), 15 full-time physicians and dentists, and 115 full-time registered nurses.

Located in the central urban area of Monroe County, R Hospital (RH) is the flagship of healthcare providers in Rochester (US News, 2012). As a general medical and surgical hospital, it provides a broad range of high-quality healthcare service to the community, with over 500 acute beds. Accredited by the Joint Commission (JC), the hospital is nationally recognized for its adult specialties (such as cardiology and heart surgery, diabetes and endocrinology), which are usually not available in rural hospitals.

**Fig 2** illustrates how the service areas of TH and RH geographically relate to one another within the WNY region. They will be presented as the subjects of the research and will offer a baseline model for the performance of the whole state/country's hospitals in terms of emergency preparedness and response.



**Fig 2. Map of TH and RH and their Community**

## **3.2 Case Study Methodology Overview**

Targeted at discerning the hospital's role in the community disaster response system, this research relies on case studies to deliver the actual situations and the following analyses. According to Yin (2003), a case study is "an empirical inquiry that investigates a contemporary phenomenon within its real-life context." As a detailed and in-depth study on a limited number of events, the case study is widely used in the qualitative research of the social science area. Many professionals applied case study methodology to "examine contemporary real-life situations and provide the basis for the application of ideas and extension of methods" and helped extend experience or add strength to the literature review (Soy, 1997). Considering the topic and the potential challenges of the research, case study methodology is applicable and appropriate. Case study on a specific hospital can display the actual context, activities, and interactions in terms of emergency response and preparedness, which can be further applied as baseline knowledge for future investigation. Through the case study, the examination of a hospital's involvement with CERS can be combined with the background information of the hospital such as its available resources, detailed medical functions, and the locality; from them the inferences abstracted can present the problems and other interesting issues for the research community concerned and can make a contribution to the areas of emergency planning and response, risk management, disaster recovery, and business continuity.

The case study is focused on developing an understanding of hospitals' roles in the actual urban and rural disaster response system through the qualitative analysis of the hospitals' capacities and activities, related partners' activities, and interactions between disaster responders and the CERS. The application of two case studies helps to discern the differences of the hospitals' roles in urban and rural community response systems and to identify the impacts from the community (such as the local CIKR, governmental agencies, and available resources) on the hospital's preparedness and response.

### 3.3 Case Study Reference

In order to fabricate the two case studies, data are collected concerning the two hospitals' preparedness and response activities through interview and document review, and the interview data shall be the main references in this research.

The document review aims to procure qualitative data from the two hospitals' emergency planning and related standards and regulations. TH provided their newest *Code Triage Disaster Plan*, which was completed by their Director of Infection Control in September 2011. The planning profiles of RH includes *Hospital Comprehensive Emergency Management Plan* (July 2011), *Rochester Regional Healthcare Association—Hospital Mutual Aid, Evacuation and Supply Plan* (July 2011), *Hospital Mass Fatality Plan Annex* (July 2009), *Hospital Point of Dispensing (HPOD) Plan Annex* (November 2009), *Hospital Evacuation Annex* (July 2010), *Hospital Explosive Plan Annex* (December 2009), *Hospital Emergency Management Response Flow Chart* (July 2011), *Hospital Contingency Resources Listing* (February 2010), *Hospital Biological Incident Annex* (July 2009), and *Hospital Alternate Triage Site Plan Annex* (January 2010). Meanwhile, standards and guidelines in crisis management such as *Hospital Incident Command System Guidebook* sponsored by CEMSA (2006), *NIMS Implementation Activities For Hospitals and Healthcare Systems* (FEMA, 2006), and *Best Practices for Hospital-Based First Receivers of Victims from Mass Casualty Incidents Involving the Release of Hazardous Substances* (OSHA, 2005) have been reviewed as the expectations for the hospital's actual external behaviors and have been compared with the findings from interview data.

Information was gathered through interviews of relevant people and is one of the most important sources of case study information. In this thesis, interviews were conducted through face-to-face meetings from October to November 2011. Participants from the two hospitals (5 from TH and 9 from RH) are mainly management personnel such as Emergency Preparedness Director and Team Leader, Director of Safety and Security, Director of Infection Prevention, and Liaison Officer. As representative of the external groups, Emergency Management Officers (1 from Monroe County and 1 from Ontario County) also have been interviewed using the same questionnaire as shown below. Tapes collected the audio text, which then was turned into a transcript in December 2011 by a professional officer at RIT.

## Questionnaires

### Section 1: Hospital's role and readiness for community emergency response

1. What are your thoughts about the hospital's role within a regional disaster response?
2. What are your thoughts about how related emergency responders and the local community view the hospitals' role within a regional disaster response?
3. What are your thoughts about the hospital's readiness to assist with the community's response to a regional disaster?
4. Who is your liaison within the local Incident Command System?
5. What are your thoughts about the capabilities of the hospital to interact with other hospitals, healthcare institutions, and disaster response organizations during a regional disaster response?

### Section 2: Interactions with externals and contribution to recovery

6. What do you think are the top priorities that enable the hospital to improve these interactions during a regional disaster response?
7. What do you think is the hospital's role in contributing to the community's recovery after a regional disaster?
8. Do you have any suggestion for improving the internal/external interactions during a regional disaster response?
9. Do you have any suggestion for improving the hospital's capabilities for responding to the region's recovery/resiliency after a regional disaster?

### Section 3: Critical Infrastructure

10. Do you think that the hospital is an essential component of the regional Critical Infrastructure Systems?

### Section 4: Urban vs. Rural

11. Do you think that there is a difference in the regional disaster response roles for the rural hospital vs. the urban hospital?

Regarding Section 1 of the questionnaire, the first five questions aim to probe into the real picture of the hospital's willingness, readiness, and role in assisting and integrating with the CERS. Specifically, Q1 and Q2 aim to investigate the roles of the hospital as perceived by the hospital staff, determining their self-perception of the hospital's responsibilities in the community EPRS. Q3 is to discern the hospital's readiness for the community's response, while

Q4 is specifically targeted at the preparedness of internal interaction of the incident command system, and Q5 is targeted at the self-evaluation of the hospital's external interactions.

In Section 2, Q6 and Q7 aim to investigate the potential improvement of the hospital's contribution and interaction with the community; Q8 and Q9 are to collect suggestions on the hospital's interactions during a disaster and capabilities for regional recovery while identifying the possible flaws of the current emergency management system.

Section 3 (Q10) is created for the identification of a hospital as a critical infrastructure. Identification of the hospital as CIKR is to admit the significance of the hospital's functions and interactions across the whole community.

Section 4 (Q11) is to probe into the differences of rural and urban hospitals in the community response system and to disclose the community's impact on the hospital's roles.

Following the data collection, context analysis was taken to analyze the interview data and procure useful inferences. Context analysis is commonly applied when researchers "quantify and analyze the presence, meanings and relationships" of some special words and concepts and "then make inferences about the messages within the texts, the writer(s), the audience, and even the culture and time of which these are a part" (Colorado State University, 2012). In this thesis, two concepts, "Preparedness" and "Response," are identified as the key words for coding and discriminating each single reply. Coding with "Preparedness" means this reply is more concerned with the hospital's internal management during disaster such as Incident Command System and energy supplies; coding with "Response" implies the reply is more concerned with the "external" part of hospital management during the disaster. Inferences are formed through the qualitative and quantitative analysis based on coding tables, transcripts, and pertinent documents.

## CHAPTER 4

### CASE STUDY OF T HOSPITAL

#### 4.1 Basic Information on the Rural Hospital

T Hospital (TH) is a community hospital located in the Ontario County, NY. Within this county, TH and the other two hospitals are scattered in different locations with the distances between each other approximately 11 miles. Being the only hospital at this region, TH serves the healthcare needs of the locality and operates as the center of a healthcare network to improve community health. Detailed healthcare services provided are shown in **Table 5**. Admissions and other operation records of TH in 2011 are shown in **Table 4**.

For terminology, the discrimination between an urban hospital and a rural one basically depends on its location. Considering the low population density and the few urbanized/industrial features of land use in the surrounding area, the community served by TH can be viewed as “rural.” Also, due to its location, TH will be viewed as an example of a rural hospital.

In review, the *Code Triage Disaster Plan* claims that TH will play a key role to mitigate, prepare for, respond to, and recover from internal or external emergencies and/or Mass Casualty Incidents (MCI) that occur within its area and immediate vicinity. The following sections will examine the hospital’s roles, contributions, and status in the community when a disaster strikes.

**Table 4: Statistics of TH in 2012 (Source: US News, 2012)**

Admissions:	<5000	Inpatient surgeries:	Almost 980
Outpatient visits:	1.10 million	Emergency room visits:	Almost 25,700
Births:	<650	Number of beds:	<270



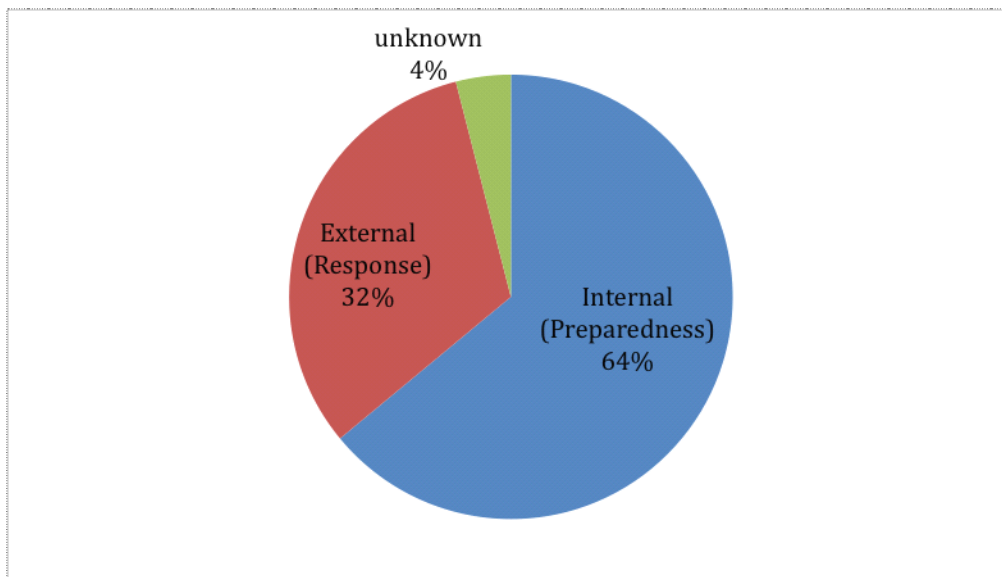
**Table 5: Service Provided in TH (Source: US News, 2012)**

Inpatient:	<ul style="list-style-type: none"> <li>• Birthing room</li> <li>• Hospitalists</li> <li>• Cancer services</li> </ul>	<ul style="list-style-type: none"> <li>• Elderly/disabled (Skilled nursing care)</li> <li>• Infection isolation room</li> </ul>
Outpatient:	<ul style="list-style-type: none"> <li>• Alzheimer center</li> <li>• Chemotherapy</li> <li>• Geriatric services</li> <li>• Sports medicine</li> <li>• Sleep center</li> <li>• Urgent-care center</li> <li>• Women's health center</li> </ul>	<ul style="list-style-type: none"> <li>• Breast cancer screening/mammograms</li> <li>• Extracorporeal shock lithotripter</li> <li>• Chemotherapy</li> <li>• Physical rehabilitation</li> <li>• Stop-smoking program</li> <li>• Wound management services</li> </ul>
Patient/Family Support Services:	<ul style="list-style-type: none"> <li>• Alzheimer center</li> <li>• Cancer services</li> <li>• Translation services</li> </ul>	<ul style="list-style-type: none"> <li>• Help with government services</li> <li>• Patient support groups</li> </ul>
Community Outreach:	<ul style="list-style-type: none"> <li>• Health fairs</li> </ul>	<ul style="list-style-type: none"> <li>• Health screenings</li> </ul>
Imaging Services (Diagnostic and Therapeutic):	<ul style="list-style-type: none"> <li>• CT scanner</li> <li>• Ultrasound</li> <li>• Single photon emission CT</li> </ul>	<ul style="list-style-type: none"> <li>• Diagnostic radioisotope facility</li> <li>• Magnetic resonance imaging</li> </ul>

## 4.2 Hospital's Role and Readiness for Community Emergency Response

### Section 1: Hospital's role and readiness for community emergency response

1. What are your thoughts about the hospital's role within a regional disaster response?
2. What are your thoughts about how related emergency responders and the local community view the hospital's role within a regional disaster response?
3. What are your thoughts about the hospital's readiness to assist with the community's response to a regional disaster?
4. Who is your liaison within the local Incident Command System?
5. What are your thoughts about the capabilities of the hospital to interact with other hospitals, healthcare institutions, and disaster response organizations during a regional disaster response?



**Fig 3. Coding the TH's Replies to Section 1**

In the current CERS, most policies and procedures for a hospital's external (response) activities are informal; therefore, the hospital's willingness can be taken as an indicator to size up its performance within the CERS. In the two case studies, hospitals' inclination for inner preparedness or external response has been discerned. In favor of external response, a hospital

can foster and strengthen the interdependencies with other responder agencies and the Critical Infrastructures nearby, which will also enhance the hospital's status in the community.

Through contextual analysis, it is found that the participants from TH highlight their internal preparedness rather than external response. As **Fig 3** shows, 64% of answers put more emphasis on preparedness, while 32% concern external contribution to the community response. Not all participant replies were categorized, as the "unknown" designation shows. This ambiguity may be a result of the participant not understanding the question prose and/or inexperience with EPRS.

In terms of preparedness, TH participants assume that a rural hospital will have activities as follows: (1) participate in all-hazard exercise programs, prepare the personnel with training and practices for incident situations, and establish the mechanism for feedback collection, incident management evaluation, and organizational learning; (2) (for all emergency responders) construct the communication systems and enhance the networks (such as the radio system) for internal and external interfacing; (3) be align with the community emergency planning, establish good relationships with the first response agencies and government, and request assistance if necessary from volunteer agencies, the National Guard, or other organizations related to needs such as manpower, supplies, and maintaining law and order. TH groups also are concerned about a hospital's logistics issues such as the supply of water, electricity, and gas, and the acquisition for funding support from the federal government to enhance its preparedness level. In the meantime, as the representative of the external group, the Office of Emergency Management (OEM) of Ontario County suggests that the comprehension of ICS structure is significant to enhance the preparedness level of a hospital, and the relative training and practices based on the National Incident Command System (NIMS) will be incorporated.

In regard to the response activities in CERS, TH participants mentioned these as follows: (1) provide the medical care, pharmaceuticals, water, food, shelter, and other necessities for the victims and sustain the clinical activities to recover patients; (2) be actively engaged in meeting with the emergency management colleagues from public and private agencies, coordinate the efforts at resources provision and acquisition, data and information sharing, manpower allocation, and so on, and join the decision making of the CERS; (3) participate in interagency mutual-aid agreements, establish cooperation between hospitals in terms of patient evacuation and reception, equipment sharing, information provision, and other issues. The OEM of Ontario County

emphasizes a hospital's responsibility at setting up the decontamination area and the relevant services in sanitation and public health.

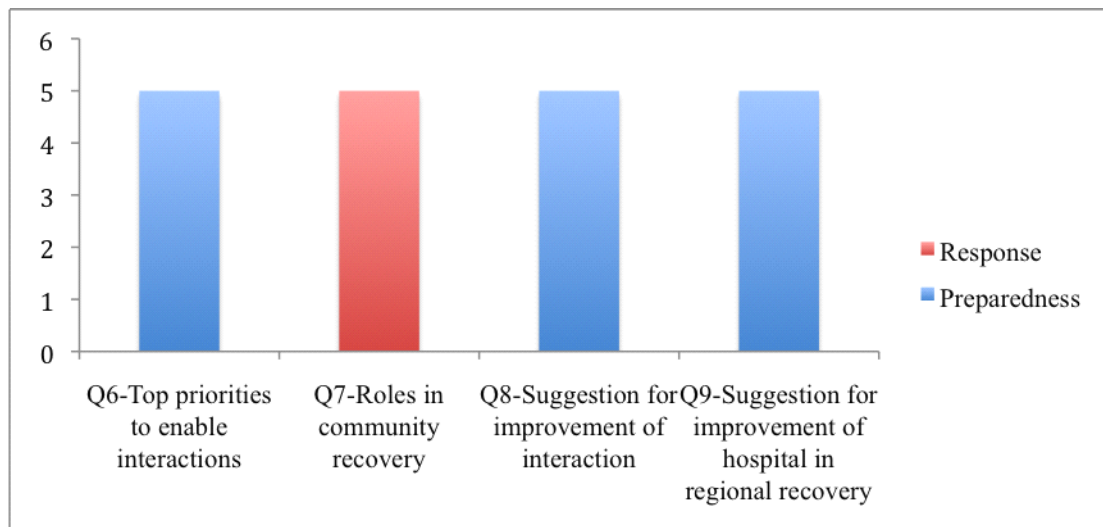
Although most guidelines and standards for the hospital's emergency management such as the NIMS shall be followed regardless of the size of the hospital, size and type of incident, and/or limitations of resources, personnel, and equipment, the capabilities and functions of a hospital will nevertheless impact the hospital's contribution to the community's recovery. Both TH and the OEM identify that the TH is not a trauma center and has no experts or equipment for neurosurgery, cardiothoracic surgery, and other adult specialty areas (as **Table 5** shows), the hospital will not receive all kinds of victims but rather will act as a triage center and take care of the patients with injuries of lower acuity. In response to the community emergency, TH shall help stabilize patients and coordinate with the ambulance system to deliver the critical patients to a tertiary hospital at an urban area. It is also noteworthy that in this study the focus of the TH group on its limited capabilities and resources may lessen its concerns about outreach activities. More than one director from the TH mentioned the necessity of external help in an emergency to sustain their clinical operation.

TH is the main healthcare provider in the geographic area of the Finger Lakes and keeps consistent practiced integration with other members of the local response community. As a member of Rochester Regional Hospital Association and the Eastern Sub-region Regional Response Center, TH and other members meet regularly, sharing insights on roles and responsibilities, crafting regional response plans, and developing a sense of partnership. This group also plays an integral part in the decisions made by the county OEM as well as requests forwarded by NY State and FEMA. To enhance the overall preparedness in the region, TH incorporates awareness education for their associates in non-clinical areas as well as in their off-site locations. Combined with the inferences shown above, the study recognizes the rural hospital's interface to the critical areas of public health, water, law enforcement, information sharing and (cyber) security, and financial asset protection, which implies the hospital's connection with the CIKR in the community.

## 4.3 Hospital's Interactions with Externals and Contribution to Community Recovery

### Section 2: Interactions with externals and contribution to recovery

6. What do you think are the top priorities that enable the hospital to improve these interactions during a regional disaster response?
7. What do you think is the hospital's role in contributing to the community's recovery after a regional disaster?
8. Do you have any suggestion for improving the internal/external interactions during a regional disaster response?
9. Do you have any suggestion for improving the hospital's capabilities for responding to the region's recovery/resiliency after a regional disaster?



**Fig 4. Statistics about the Coding of TH's Replies to Section 2**

To delve into the hospital's activities in CERS, this research focuses on the two issues of interactions and the contributions to community recovery. The data collected in this section can mainly be divided into three categories: (1) the hospital's interactions, (2) the hospital's contributions to the community aftermath, and (3) suggestions to improve the first two issues.

This section predicts and assumes the hospital's performance rather than evaluates it and also concerns the hospital's criticality in its locality.

In regard to the hospital's interaction (Q6), all TH interviewees gave preparedness-related answers. These answers emphasize the following issues: (1) construct the communication infrastructures through which the hospitals and the first responders can exchange the information efficiently; (2) conduct more regional drills cross-training programs for emergency response that helps identify the roles of different entities in an multi-agencies environment and recognize the gaps between the espoused role and perceived one; (3) have personal relationship with the members of other agencies, either private or public, in the response community, which is supposed to strengthen the hospital's interactions when an incident occurs. The external group, OEM of Ontario County, agrees on the significance of the communication infrastructure system for interactions.

In the current world, the supposed functions a hospital assumes can no longer be limited to the healthcare but embraces more elements of communication, security, and other valuable issues. Contribution to community recovery can illustrate the hospital's value of the locality. In terms of the contributions to the community recovery aftermath, TH staff recognize the activities as "external" and highlight the following points: (1) keep providing information, especially about the patients for Ontario County OEM, the public media, NY state and related federal agencies such as FEMA, aiming to restore the families in the region; (2) continue the clinical activities in and off-site and promise the business continuity to provide healthcare and other necessities for the community; (3) set up a decontamination area and provide other sanitation services for the locality; and (4) meet with other responders to review the activities during emergency and give/receive feedback (response evaluation and organizational learning). According to the present guidelines such as *Hospital Incident Command System Guidebook* (CEMSA, 2006), the hospital's activities after the disaster will include the internal recovery and response evaluation and organizational learning. Those topics have been demonstrated in the audit text collected in this study as shown above. The OEM of Ontario County mentions that the hospital may act as the Department of Public Health and restore the families.

Q8, suggestions for improving the hospital's interactions, and Q9, suggestions for improving capabilities for regional recovery, are both targeted at finding the shortcomings of the

performance based on the current mechanism and environment. All collected data are about “internal preparedness” and cover the issues as follows: (1) conduct more training and cross-training to elevate the hospital (and the community)’s resiliency level and emergency response; (2) promote the communication infrastructures such as the radio system and visual and auditory equipment; (3) promote the supply management and logistics to promise the hospital’s business continuity; (4) promote the communications protocols and involve more debriefing; and (5) acknowledge that funding is necessary to help a rural hospital continue developing its preparedness. The OEM of Ontario County emphasizes the incorporation of the NIMS/ICS into internal and external emergency management training and exercises.

Either in terms of the interactions or the activities after the disaster, or the suggestions given, emphasis on communication is an issue that has been referred to over and over by hospital staffs and the Officer of Emergency Management. As summarized by the Response System (n.d.), internal and external communication is one of the six critical areas to demonstrate the hospital’s proper emergency planning. In the case study of the rural hospital, the personnel claim that, when constructing an integrated systematic emergency response, conformity of the communication infrastructures such as a reliable radio system with the same frequency for all responders is necessary but still under construction. This point is a gap between the supposed situation and the actual facts concerning the regional level of resiliency.

## 4.4 Identification of Hospitals as Critical Infrastructure

### Section 3: Critical Infrastructure

10. Do you think that the hospital is an essential component of the regional Critical Infrastructure Systems?

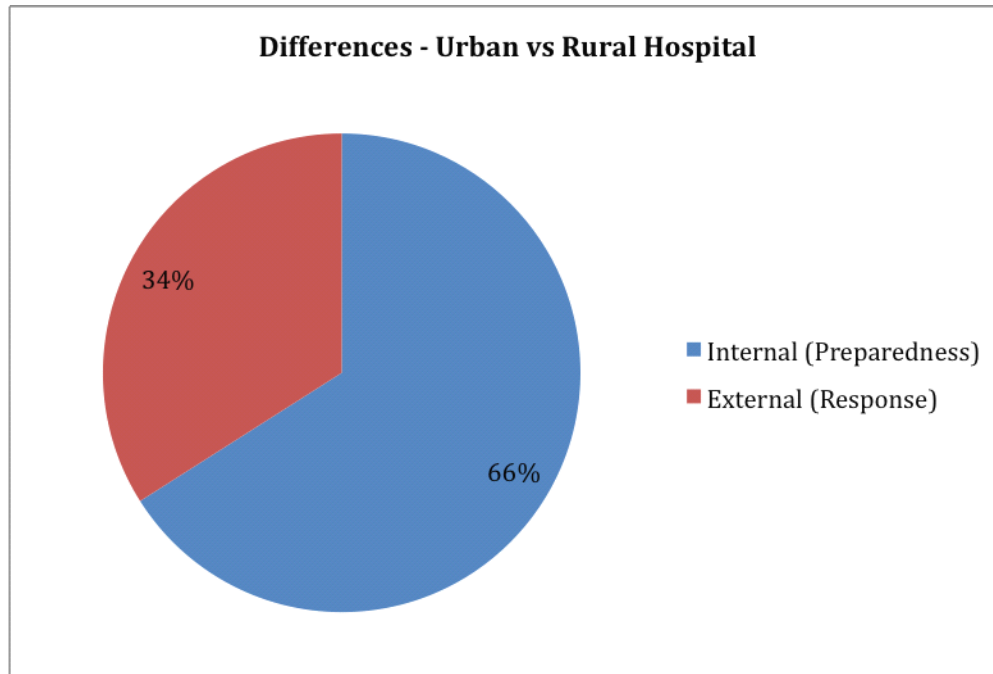
A hospital's contribution to the community in and after a disaster implies its significance to the health, safety, security, and economics of the locality. As a continuation of the last two sections, the Q10 is directly targeted at the identification of a hospital as a critical infrastructure/key resource component. All participants from TH confirmed that a hospital should be viewed as a CIKR, and more than half ascribed its criticality to the hospital's medical care services for the community. The OEM of Ontario County shares a similar idea. The data collected here shows a common perception that the rural hospital's interdependencies across all key sectors are vital to the vulnerabilities of the whole area.



## 4.5 Comparison of Urban and Rural

### Section 4: Urban vs. Rural

11. Do you think that there is a difference in the regional disaster response roles for the rural hospital vs. the urban hospital?



**Fig 5. Coding the TH Replies to Section 4**

In regard to the role differences between an urban and a rural hospital in CERS, 66% of the answers from TH believe that it mainly concerns the internal preparedness, and 34% believe it is more involved with outreach activities (**Fig 5**).

Basically, embracing fewer resources and smaller space, a rural hospital may be vulnerable to a small-scale emergency situation that does not affect an urban one. Due to the absence of related specialists, equipment, and personnel, a rural hospital cannot deal with trauma cases, which differentiates their medical care services from those of urban hospitals. The OEM pointed out that the limited call volume in a rural community cannot support a trauma center; nevertheless, the preparedness level should be the same for an urban and a rural hospital.

More than one participant shares the idea that the value of a hospital for the rural community is more critical than for an urban one. There is only one hospital in a rural area in a ten mile radius, and the one have to handle all the problems and situations happened in this community. In contrast, an urban hospital can share the responsibilities and co-work with other hospitals in the same region. This finding is fortified in the next case study.

# CHAPTER 5

## CASE STUDY OF R HOSPITAL

### 5.1 Basic Information of RH

Residents in Monroe County, NY, have six hospitals to choose from within driving distance. R Hospital (RH) is one of the six community hospitals with self-recognition as “a regional leader in healthcare” serving the Greater Rochester region and beyond. Admissions and other records in 2011 are shown in **Table 6**; detailed healthcare services provided are shown in the **Table 7**.

Considering the high population density and the highly urbanized feature of the land use in the Greater Rochester area, the community served by RH shall be “urban,” and RH can be recognized as an urban subject.

In the RH Emergency Management Plan, RH claims that it will facilitate community emergency management, integrating the hospital’s activities with emergency management programs across the region, thereby fostering the coordination of medical planning, preparedness, response, information sharing, and recovery throughout the region.

**Table 6: Statistics of RH in 2012 (Source: US News, 2012)**

Admissions:	<29,000	Inpatient surgeries:	Almost 10,500
Outpatient visits:	1.44 million	Emergency room visits:	Almost 99,700
Births:	Almost 2500	Number of Beds:	520

**Table 7: Service Provided in RH (Source: US News, 2012)**

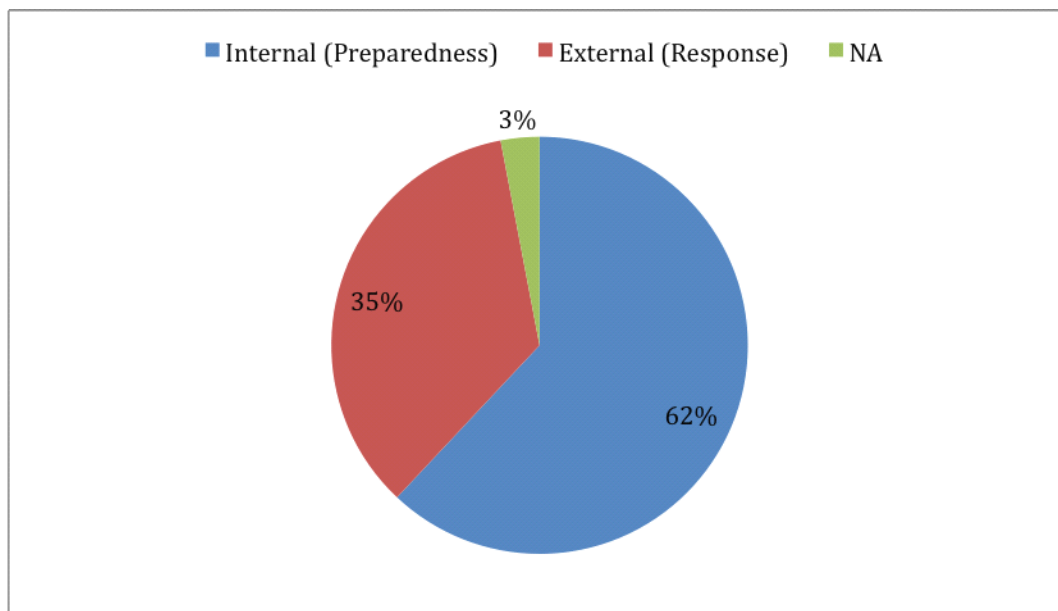
Inpatient:	<ul style="list-style-type: none"> <li>• Birthing room</li> <li>• Heart catheterization—diagnostic (adult)</li> <li>• Elderly/disabled (Skilled nursing care*)</li> <li>• End-of-life services (Pain management)</li> <li>• Heart surgery (adult)</li> <li>• Hospitalists</li> </ul>	<ul style="list-style-type: none"> <li>• Infection isolation room</li> <li>• Heart catheterization—treatment (adult)</li> <li>• Neonatal intermediate care</li> <li>• Cancer services</li> <li>• Psychiatric care (Partial hospitalization and Psychiatric emergency services)</li> </ul>
Outpatient:	<ul style="list-style-type: none"> <li>• Bariatric/weight control services</li> <li>• Breast cancer screening/mammograms</li> <li>• Certified trauma center</li> <li>• Chemotherapy</li> <li>• Complementary/alternative medicine</li> <li>• Dental services</li> <li>• Heart catheterization—diagnostic (adult)</li> <li>• Extracorporeal shock lithotripter</li> <li>• Geriatric services</li> <li>• HIV-AIDS services</li> </ul>	<ul style="list-style-type: none"> <li>• Home health services</li> <li>• Heart catheterization—treatment (adult)</li> <li>• Kidney dialysis</li> <li>• Physical rehabilitation</li> <li>• Psychiatric services (Child/adolescent services, Consultation, Geriatric services and Outpatient care)</li> <li>• Stop-smoking program</li> <li>• Sports medicine</li> <li>• Substance-abuse programs</li> <li>• Women's health center</li> <li>• Wound management services</li> </ul>
Patient/Family Support Services:	<ul style="list-style-type: none"> <li>• Help with government services</li> <li>• Chaplaincy/pastoral care services</li> <li>• Cancer services</li> </ul>	<ul style="list-style-type: none"> <li>• Patient support groups</li> <li>• Patient representative/ombudsman</li> <li>• Transportation for elderly/handicapped*</li> <li>• Translation services</li> </ul>
Community Outreach:	<ul style="list-style-type: none"> <li>• Health fairs</li> <li>• Meals on Wheels</li> </ul>	<ul style="list-style-type: none"> <li>• Health screenings</li> </ul>
Imaging Services (Diagnostic and Therapeutic):	<ul style="list-style-type: none"> <li>• CT scanner</li> <li>• Diagnostic radioisotope facility</li> <li>• Magnetic resonance imaging</li> </ul>	<ul style="list-style-type: none"> <li>• Multislice spiral CT</li> <li>• Single photon emission CT</li> <li>• Ultrasound</li> </ul>

## 5.2 Hospital's Role and Readiness for Community

### Emergency Response

### Section 1: Hospital's role and readiness for community emergency response

1. What are your thoughts about the hospital's role within a regional disaster response?
2. What are your thoughts about how related emergency responders and the local community view the hospital's role within a regional disaster response?
3. What are your thoughts about the hospital's readiness to assist with the community's response to a regional disaster?
4. Who is your liaison within the local Incident Command System?
5. What are your thoughts about the capabilities of the hospital to interact with other hospitals, healthcare institutions, and disaster response organizations during a regional disaster response?



**Fig 6. Coding the RH's Replies to Section 1**

After analyzing the hospital's inclination for internal or external behaviors against a regional incident, this study identifies that the RH participants have preference for preparedness within the facility. **Fig 6** shows that 62% of the answers consider that the hospital's behavior during the emergency will orient to "internal," and 35% deem it as "external." Three percent (3%) of the replies are difficult to code, which may be a result of participants not understanding the question and/or inexperience with EPRS. From the statistical aspect, it seems that the hospital's devotion for the CERS will be elevated.

In terms of “preparedness,” RH group identified the following issues: (1) establish a relationship with first responders, governmental agencies, and other local health-commissioned organizations through regular committee meetings, share information, and other relevant resources to advance the facility’s level of preparedness; (2) update the communication infrastructures, and, more importantly, promote the communication network to absorb or disseminate information within the ICS structure; (3) prepare personnel with training and practices and conduct more drills with the partners in community; (4) guarantee supplies and stockpiled equipment to promise the hospital’s operation. When discussing those issues, RH participants exhibit also the confidence about their preparedness level in the urban environment. As the representative of the externals, the OEM of Monroe County has a special concern about the hospital’s preparedness in internal security and financial asset management.

In regard to “response,” the RH group identifies the following activities a hospital shall undertake: (1) provide the medical care, pharmaceuticals, water, food, shelter, and other necessities for the community and maintain relative clinical activities; (2) collaborate with the Department of Health, ambulance system, volunteer agencies, and especially the first responders within a integrated response system in the areas of resources, equipment, and information, offer support for the first responders and involve the decision making in the CERS; (3) participate in interagency mutual-aid agreements, establish cooperation with other healthcare facilities nearby in terms of patient evacuation and reception, equipment sharing, information provision, and other issues; (4) monitor the health and sanitation condition of the community (especially during pandemic disaster), such as providing knowledge and guidelines for people in the affected region and setting up a decontamination area.

RH’s contribution to the community mainly takes the form of coordination with external entities. According to its emergency plan, RH is one of the main creators in setting up the Multi-Agency Coordination System (MACS) among the response agencies in Monroe County, communicating its ability to share resources and assets (e.g., personnel, beds, transportation, fuel, personal protective equipment, medical equipment and supplies) with healthcare organizations in the area in the event of a regional or prolonged incident. Also, the other hospitals in the urban zone develop the network covering RH to assume the responsibilities together.

## 5.3 Hospital’s Interactions with Externals and Contribution to Community Recovery

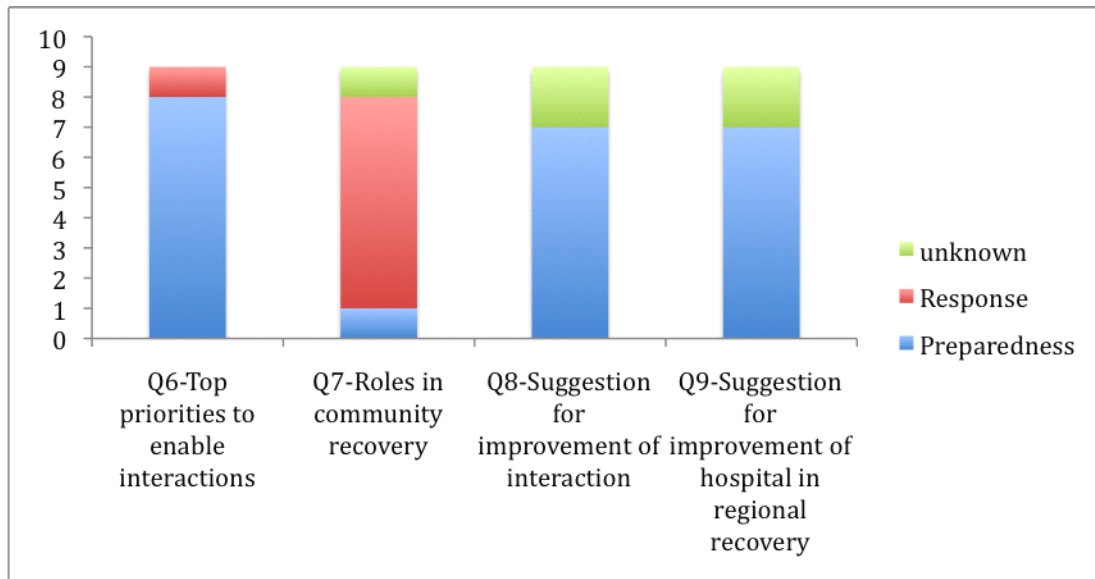
### Section 2: Interactions with externals and contribution to recovery

6. What do you think are the top priorities that enable the hospital to improve these interactions during a regional disaster response?

7. What do you think is the hospital’s role in contributing to the community’s recovery after a regional disaster?

8. Do you have any suggestion for improving the internal/external interactions during a regional disaster response?

9. Do you have any suggestion for improving the hospital’s capabilities for responding to the region’s recovery/resiliency after a regional disaster?



**Fig 7. Statistics about the Coding of RH’s Replies to Section 2**

As the *Hospital Incident Command System Guidebook* (CEMSA, 2006) claims, effective emergency response (and preparedness) cannot be achieved by a hospital in the absence of consistent and effective interactions with external groups, and these guidelines have gradually

improved since Hurricane Katrina. In the first part of the section, the study will describe the current level of interactions at the RH as a rural sample.

In regard to the priorities to improve the hospital's interaction (Q6), 8 of 9 interviewees from RH give preparedness-related answers that cover the following issues: (1) update communication infrastructures such as telecommunication and promise a well-established communication network for a more efficient, in-time information provision and delivery; (2) participate in more practices and more regional-scaled drills that help all the entities involved discern the roles of each other and their own responsibilities; (3) set up more debriefing meetings under the ICS structure as an information exchange method, which is significant for the response evaluation stage of an incident life cycle as identified by the *Hospital Incident Command System Guidebook*. The external group, the OEM of the Monroe County, holds similar ideas as the hospital.

Another topic analyzed here is the hospital's contribution to the community aftermath (community recovery), which is rarely referred to in the emergency response plan and has a relation with the hospital's criticality to the locality. In terms of this topic, RH personnel recognize the contribution activities as "external" with emphasis on the following issues: (1) continue to provide healthcare, safe harbor, and other needs of the community; (2) provide assistance for victims' mental health recovery through providing experts and helping restore affected families in the aftermath; and (3) collaborate with other responders to review the activities during the emergency and give/receive feedback. The OEM of Monroe County highlights that the hospital shall provide mental health support for community recovery.

Identical with the JCAHO guidance, RH participants highlight the status of communication with a focus on efficient information sharing under an organized structure (ICS). Terminology shall be standardized, and information-sharing procedures must be well known by all related parties. Integration of prudent and detailed planning among the responders can address the coordination in the area of information delivery.

RH's suggestions for improving the hospital's interactions (Q8) and for improving the capabilities for contributions in the aftermath (Q9) are all related to "internal" including the following items: (1) promote the communication network for a better information collection and



dissemination; (2) conduct more training and cross training to prepare the hospital and community; and (3) enhance the supply management and approach external resources when necessary to recover internal functions efficiently and promise continuity of the hospital's healthcare operation. Those replies coded with "unknown" may be a result of the participants' inexperience with CERS and/or not understanding the questions.

## 5. 4 Identification of Hospital as a Critical Infrastructure

### Section 3: Critical Infrastructure

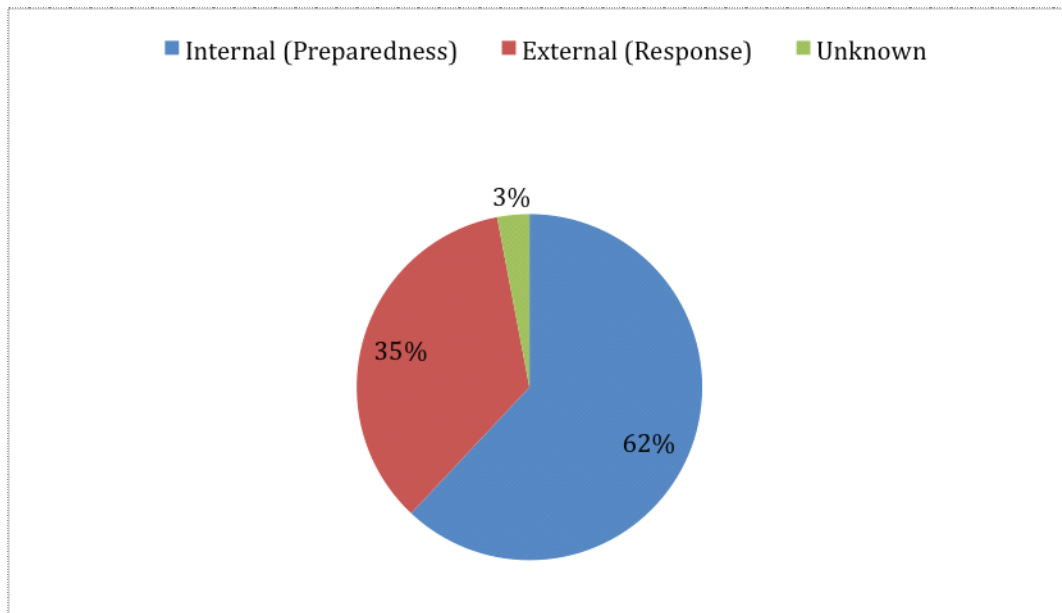
10. Do you think that the hospital is an essential component of the regional Critical Infrastructure Systems?

Following the last two sections, this section will go on to discuss the hospital's criticality. Basically, identification of the hospital as a CIKR is a recognition of the hospital's significance for the health, communication, security, and economics in the region. All participants from TH and the OEM of Monroe County agree the claims that a hospital is a CIKR.

## 5.5 Comparison of Urban vs. Rural

### Section 4: Urban vs. Rural

11. Do you think that there is a difference in the regional disaster response roles for the rural hospital vs. the urban hospital?



**Fig 8. Coding the RH Replies to Section 4**

Regarding the differences between the role of a hospital in a rural and an urban area, 62% of the answers from RH maintain it concerns internal preparedness, and 35% believe it is related to the external activities during an emergency, as **Fig 8** shows. The replies coded with “unknown” may be the result of the participants not understanding the CIKR.

The RH group claimed that the inner preparedness level for all hospitals should be the same due to the identical guidelines, regulations, and standards adopted in each hospital. However, with smaller capacities, limited medical services, and fewer resources, a rural hospital facing a community disaster may require assistance from an urban hospital. Oppositely, a large urban hospital such as RH will undertake outreach work, absorbing patients from outer regions when necessary.

Another issue identified by the OEM of Monroe County is that the emergency situation in an urban area is more diverse than in a rural area, and an urban hospital need to have plans addressing the different emergencies from an explosion to traffic accidents to bio-terrorism.

RH participants hold the same idea as the TH group concerning the hospital's status in a rural/urban area. An urban hospital often has a close proximity with other healthcare facilities and can share the patient flow or resources more readily. In the rural environment, the hospital's status is more important as there is only one hospital.

## **CHAPTER 6**

### **COMPARISON OF THE TWO CASE STUDIES**

#### **6.1 Comparison Overview**

In the last two chapters (4 and 5), case studies about a rural hospital and an urban one in Western New York state have been presented with the focus on the hospital's role (activities, inclinations, and responsibilities) in the CERS and on the hospitals' interactions with external agencies. Also, the two studies have discussed each hospital's criticality in the community based on the interview data and document review.

In the US, a rural and an urban hospital display marked differences in the aspect of capabilities, resources, the agencies for cooperation, and the locality for which they deliver the service. Those factors will affect the hospital's behaviors during and after the emergency event. In this condition, two separate case studies are necessary when taking an overview of the US hospitals and their integration with CERS. At the same time, the comparison of the two case studies is indispensable when delving into the hospitals' performances in different contexts of the CERS. Comparison between the rural and the urban hospital will further discern the hospitals' outreach activities and external interactions and the influences from the hospitals' capabilities, resources, and outside environment. Such comparison also would provide the baseline information for future studies on hospitals' external activities of emergency response and community recovery.

In the following sections main findings about the two hospitals will be summarized and compared with each other. As a final part of the conclusion, a preliminary step will be taken to settle the hospitals' status (as a CIKR) in the community.

## 6.2 Comparison of the Rural and the Urban Hospital

### 6.2.1 Hospitals' Emergency Planning

In review, the ICS have been fully adopted in the disaster management plans of the rural and the urban hospital. Both hospitals claim that a target of their emergency management planning is to integrate their emergency management system with the community disaster response. Basically, both hospitals hold the compliance with NIMS in paperwork terms.

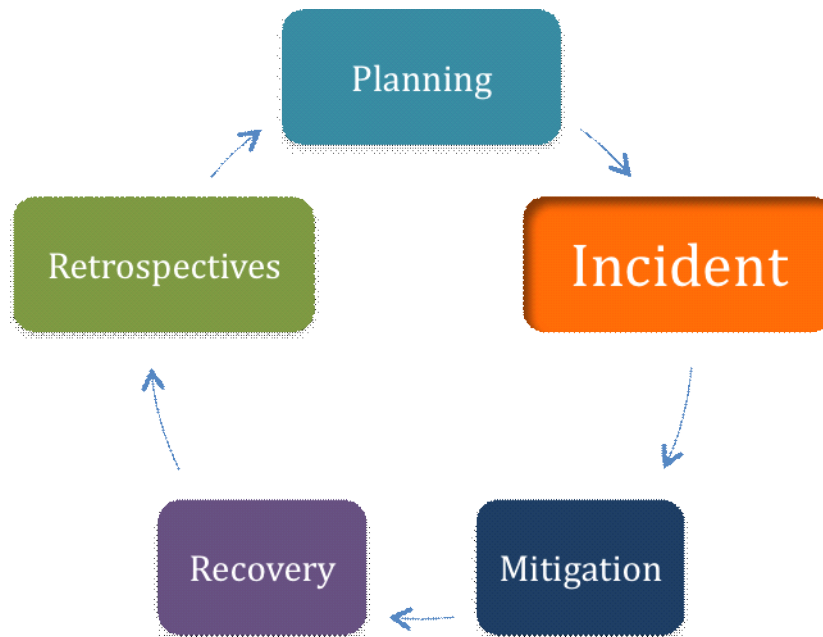
The only document provided to this research by the rural hospital is the *Emergency Management Plan* and an elaboration of its interior unit operations during a disaster. However, the hospital rarely mentions the external environment.

Disasters such as explosion, biological incident, pandemic flu, and mass fatality virtually are more likely to happen in an urban area rather than a rural area. The planning profiles of the urban hospital document its supposed behaviors specifically in these emergency conditions. Also, the urban hospital has prepared the documents for its large-scale organizational behaviors including the hospital's mutual aid, evacuation, and supply, hospital point of dispensing, and contingency resource supplies. Both hospitals' emergency planning are fabricated to prepare and respond to the assumed scale and kind of disasters, while the two hospitals have written protocols to absorb external resources and to dispense the patients when their own capabilities cannot contain the crisis.

In review, the profiles of the two hospitals show that (1) in terms of preparedness level, there is little diversity for the rural and the urban hospital; (2) an urban hospital needs to address an environment with more variables of potential risks; and (3) nevertheless, it also has more resources to manipulate.

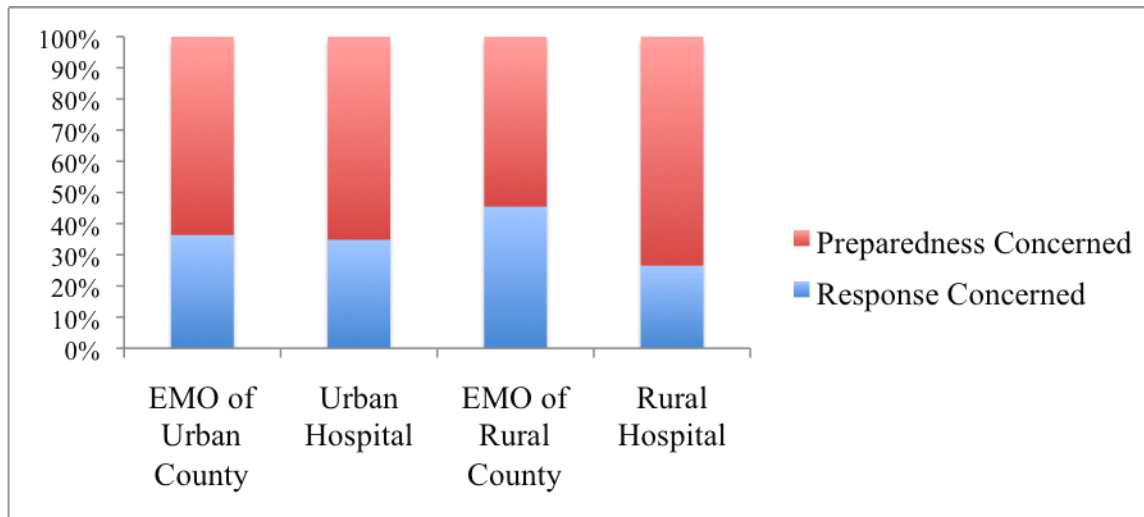
It should be noted that in the life cycle of an incident emergency planning and its implementation is only a part of the response (**Fig 9**). Once the emergency occurs, measures will be taken to mitigate its consequences immediately with the manipulation of resources available and coordination between the public and private entities within an organizational system. After the disaster, the system and each single response agency must conduct retrospectives and

evaluations of response. The incident and its consequences, the mitigation measures, and the final retrospectives will be examined in detail and show wisdom and ways to enhance the initial stage of emergency planning. Likewise, the hospital's emergency planning is only a part of its emergency response. Its capabilities, resources, external interactions in community, and activities in the aftermath also shall be counted as a part of the response. This inference also is revealed in the interviews with the hospitals' management.



**Fig 9. Cycle of Incident Response**

## 6.2.2 The Inclination for the Response or Preparedness



**Fig 10.** Comparison of the Two Hospitals’ Replies and the Two County OEMs’ Replies

In this research, the inclination for internal preparedness or external response is applied as an indicator to measure a hospital’s devotion to the CERS. As **Fig 10** shows, in term of the inclination, the difference is negligible between the rural and the urban hospital. Considering that there is only one participant from each county’s OEM, the value of the statistical diversities involved in OEMs is not counted.

Both hospitals’ inclination shown in the interview implies that the two hospitals will promote their consciousness of the external management during a disaster and take steps to integrate it with the CERS.

In a close review of the response activity, both hospitals are found to rank “care provision” as a top responsibility in a disaster. First, their medical care services are not identical. A rural hospital virtually has few capabilities in adult specialties; it may “export” the patients to an urban hospital when addressing severe cases. Conversely, an urban hospital tends to have more of the necessary experts, equipment, and resources and more partner hospitals nearby and will “absorb” patients from other regions/counties if necessary. Meanwhile, when a disaster occurs, a hospital will provide more than the clinical services and shall offer food, water, energy, electricity, and other necessities to the community. Those services are all recognized as parts of the “care provisions.”



### **6.2.3 Interactions and Contributions Aftermath**

It is commonly recognized that a hospital's external interactions with governmental agencies and CERS members help it better prepare for an incident. Also, the interdependencies between a hospital and other critical sectors of the community can demonstrate its criticality to society.

In this study, both hospitals, TH and RH, are the members of the Rochester Regional Hospital Association, which organizes meetings 4-5 times per year. Meanwhile, as members of the Eastern sub-region Regional Response Center, managers from the two hospitals meet regularly with the representatives from other facilities and have developed a sense of partnership.

Also, as the contextual analysis shows, participants from rural and urban hospitals both highlight the communication issue but from different perspectives. The highlight of communication is in alignment with many relevant studies (Franco et al., 2006; Braun et al., 2006; US Congress, 2006). Specifically, the rural hospital gives more attention to communication infrastructures such as radio and other similar backup systems whose alignment with the locality is still under construction. The urban hospital has more concern for the efficiency and accuracy in communication such as the standardization of terminology, real-time information sharing through the ICS structure, and so on. Generally, compared to a rural facility, the urban hospital has a more complete preparedness in the aspect of technology.

The hospital's contribution to community recovery has been discussed in the two case studies. It can be viewed as a parameter in the evaluation of a hospital's significance to the local community. Basically the hospital's contribution to the community after the disaster, either urban or rural, mainly will take the forms of healthcare, mental care, and other related services. Currently there are no standards or regulations that require the hospital to contribute to the external environment; in the aftermath a hospital will (1) keep the alignment with CERS because the stages between disaster response and community recovery are hard to separate; (2) coordinate with the Department of Public Health (DPH) because a hospital needs to provide related data continually to the local DPH and sometimes even act as a DPH to help restore families and society.

## **6.2.4 Hospitals' Status in Community and Hospital as a CIKR**

Through a consecutive view of hospitals' response activities, interactions, and contributions in the aftermath, it is identified that a rural or an urban hospital's "blend" with the critical areas of health, security, financial assets, and communications does exist and has an important influence on the resiliency of the locality. The significance of the hospital's interdependencies with other critical infrastructures such as Water, Energy, and Public Health, has been perceived in the rural and the urban communities. During the interviews, almost all participants agreed on the hospital as a CIKR. There are still some gaps between the actual situations and a full integration of hospitals with CERS; nevertheless, a hospital can be viewed as a CIKR in the main.

Finally, the research identifies that a rural hospital is more likely to be the determinant of the community's vulnerability and resiliency than an urban hospital. In the rural area, there are fewer critical infrastructure key sectors and fewer healthcare facilities; a rural hospital will shoulder all the healthcare responsibilities in its surrounding region. Moreover, when a disaster occurs, a rural hospital possibly will be required to provide the functions of other critical infrastructures such as water, food, and communication; it will perform more than a healthcare facility, as shown by the functions of hospitals trapped by the flooding of Hurricane Katrina. Conversely, for the urban area the challenges for a single hospital can be partly diluted by other hospitals and various critical infrastructures within the zone. Therefore, the status of a rural hospital is more critical for its surrounding community than that of an urban hospital.

## **6.3 Limitations and Future Work**

All studies have limitations and this one is no exception. The conclusions shown above are mainly deduced from the interview data whose collection and subsequent contextual analysis cannot eliminate the subjectivity given by the researchers. Moreover, the background of the interviewees including their education, position within entities, and personal experiences is an issue that may make the interview data stray from our topic. The data collection could have been more comprehensive with a further stratification of the respondents in hospitals.

Another limitation resulted from the deviation of the number of people interviewed in different groups. The interviewee numbers are seven, nine, one, and one, respectively from TH, RH, and the two OEMs. The conclusions could have been more convincing with input from more agents/officers of external groups.

Following the path of this study, an expansion can be made with the vision of more hospitals in New York State. That study could provide a broadened picture of the hospitals' performances, roles, and other related issues concerning the emergency response system and offer a basis for the hospitals' integration with its community response and recovery in US, which will finally contribute to the disaster preparedness and the protection of the entire nation.

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