

# Improving Hospital Survivability: Tools to Inform Hospital Planning and Design

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## Purpose of Research

We need a more comprehensive understanding of hospital functionality and the risks they face in order to devise more effective ways of ensuring the continuity of health care operations. This project sought to develop and apply lessons from disaster science and hospital emergency management to medical facility planning and design for the purpose of improving the survivability of nonstructural systems to increase the likelihood that medical treatment facilities will remain operational following disasters. Tools were developed to improve the manner in which planners, designers, health care professionals, and emergency managers consider hospitals and their survivability during and after disaster events.

## Introduction

- Hospitals are critical infrastructure. Their importance in supporting the country is spelled out in the National Health Security Strategy and the Public Health and Health Care Capabilities documents prepared by DHHS and CDC.
- Hospitals are community disaster response assets. We expect them to be ready and available in times of crisis.
- Hospitals face a broad range of internal and external threats that can negatively affect their ability to provide health care.

## Methodology

I conducted two group and two one-on-one interviews with six respondents from the Military Health System (MHS). The individuals represented five health care specialties: health care administration, clinical practice, hospital operations / emergency management, hospital logistics, and hospital facility management. Collectively, the respondents represented an expert panel that refined two tools: an influence diagram and a Hazard Vulnerability Mitigation Framework (HVMF).

## Tools & Findings: Observations

### Influence Diagram.

- The functional relationships among the diverse hospital systems can be captured in an influence diagram that provides a graphical representation of the possible vulnerable elements and implications of failure. The rounded rectangles represent systems and components, while the arcs depict influences.
- The relationships can be shown at various scales.

Figure 1: System Diagram

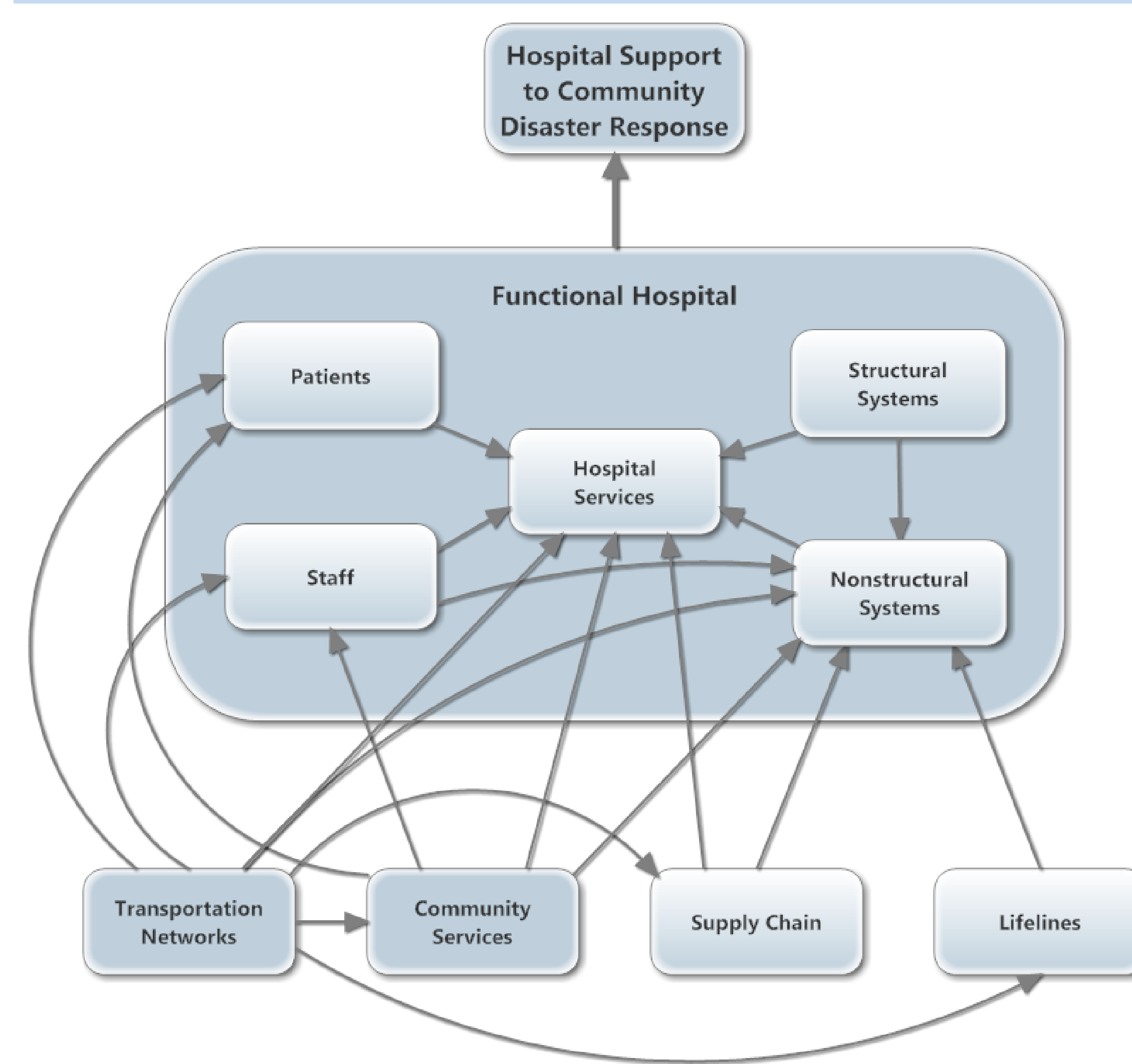
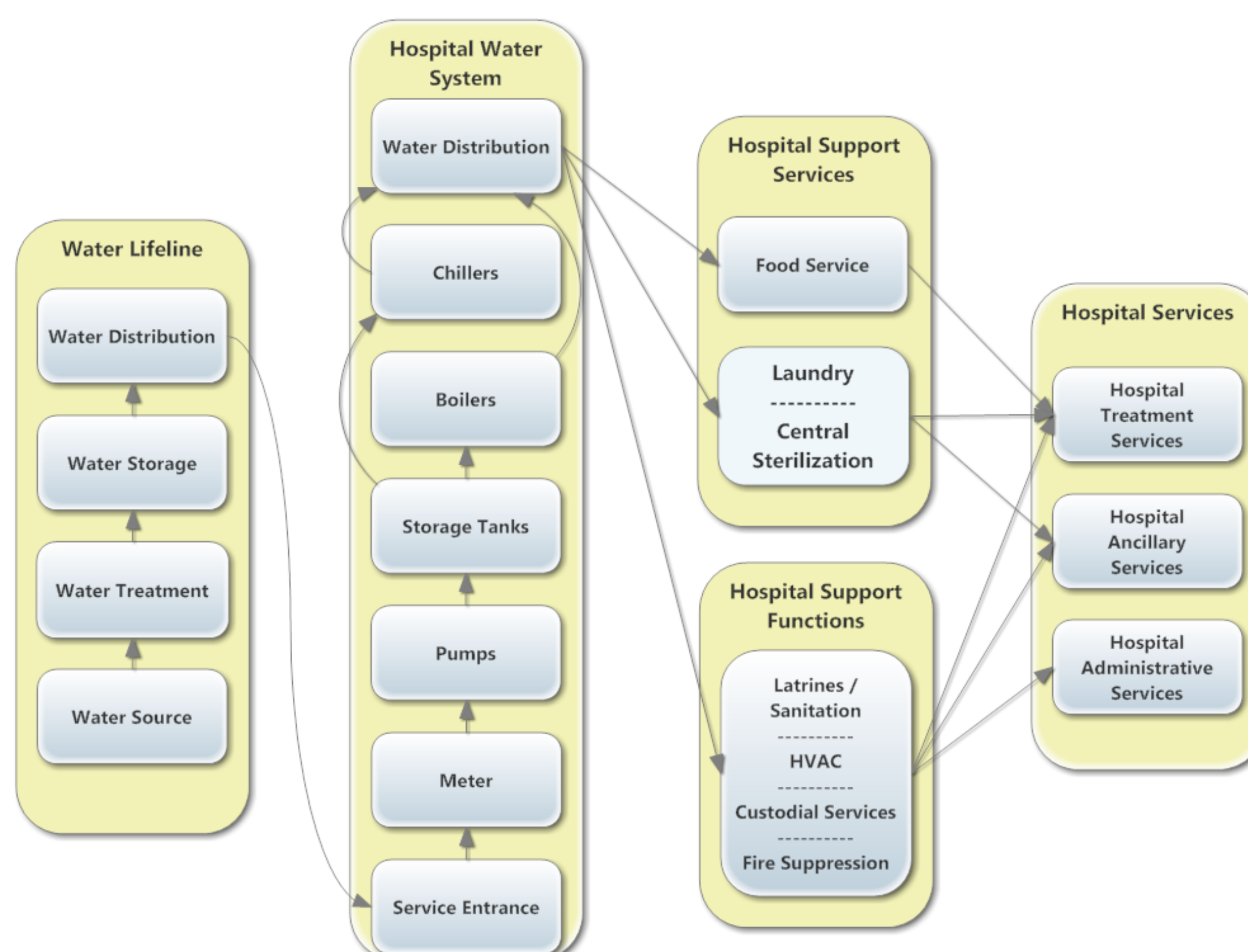


Figure 2: Service Diagram



### Hazard Vulnerability Mitigation Framework.

- The HVMF provides a more comprehensive, all-hazards approach to thinking about hazards, their agents and characteristics, exposure, vulnerabilities, consequences, and mitigation and preparedness. The framework supports the consideration of risks faced by hospitals and establishes the basis for identifying protective actions.

Figure 3: Hazard Vulnerability Mitigation Framework

HAZARDS	AGENTS & CHARACTERISTICS	EXPOSURE	VULNERABILITIES	CONSEQUENCES	MITIGATION & PREPAREDNESS
NATURAL EVENT	AGENTS	SYSTEMS	EXTERNAL	FATALITIES	ROBUSTNESS
TECHNOLOGICAL EVENT	SPEED OF ONSET	COMPONENTS / ELEMENTS	INTERNAL	INJURIES / ILLNESS	REUNDANCY
HUMAN EVENT	SCOPE OF IMPACT	INTERACTIONS		MENTAL DISTRESS	RAPIDITY
	DURATION OF IMPACT	DEPENDENCIES		SERVICE LOSS	RESOURCEFULNESS
	FREQUENCY OF IMPACT			FINANCIAL LOSS	ADAPTABILITY
	LENGTH OF WARNING / EXISTENCE OF ENVIRONMENTAL CUES			PROPERTY LOSS	AVOIDANCE
				LOSS OF REPUTATION	
				COST OF ADJUSTMENTS	

## Recommendations

### Planning for Community Support.

- Incorporate the role the hospital will have in community disaster response during planning and design.

### Planning and Designing for Flexibility

- Maximize support of operational flexibility in facility planning and design.
- Apply a holistic approach to understanding risk that entails a comprehensive analysis of threats, exposure, vulnerabilities, and consequences so that mitigation and preparedness actions are grounded in the specific circumstances of a facility or organization. Code compliance is the baseline, not the end state

## Limitations

- Having a comprehensive understanding of risks and identifying protective actions is different from prioritizing those actions and making capital investment decisions. These tools and findings support informed decisions, but they do not recommend courses of action or solutions.