

AN EXAMINATION OF COMMUNICATION, INFORMATION, AND RESOURCE
MANAGEMENT LINKAGES AMONG COMMUNITY HOSPITALS
AND EMERGENCY MANAGEMENT AGENCIES

By

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For my beloved family

Jeff, Emma and Erin

Infinitely supportive and partners in all my hopes and dreams

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CHAPTER I

INTRODUCTION

As a result of the horrific tragedies of September 11, 2001 and Hurricane Katrina, considerable resources have been devoted by Federal, state, and local agencies to improve the nation's capacity to respond to terrorist acts and naturally occurring epidemics/disasters. The focus has been on improving the capabilities of traditional "first responders", such as fire, law enforcement, and emergency medical service (EMS) personnel. Additionally, the focus of the majority of communication, information, and resource supply improvements has been on those organizations and personnel "in the field". Only recently have hospitals been recognized as first responders or "first receivers", and included in these initiatives. (OSHA, 2005)

Recent mass casualty events, such as 9/11 or Hurricane Katrina, have illustrated that the demand for health care can overwhelm the ability of hospitals to respond. Acute care hospitals are essential to the infrastructure of modern communities. Hospitals can be damaged by a disaster and still have to protect and support in-house patient populations as well as treat large influxes of new patients. During emergency events, it is critical that state and local emergency management agencies (EMAs) have effective communication with and information about area hospitals.

Communication, information, and resource management (CIR) linkages are the who, what, why, and how of emergency response: what information is crucial, how can it be transferred quickly and accurately, who needs it, and how does one make sense of overwhelming volumes of it during a crisis? This concept and the interrelated value of information management systems was eloquently explained in the U.S. House of Representatives special 2006 report entitled, A Failure of Initiative:

“The preparation for and response to Hurricane Katrina show we are still an analog government in a digital age. We must recognize that we are woefully incapable of storing, moving, and accessing information – especially in times of crisis.

Many of the problems we have identified can be categorized as ‘information gaps’ – or at least problems with information-related implications, or failures to act decisively because information was sketchy at best. Better information would have been the optimal weapon against Katrina. Information sent to the right people at the right place at the right time. Information moved within agencies, across departments, and between jurisdictions of government as well. Seamlessly. Securely. Efficiently.

The Federal government is the largest purchaser of information technology in the world, by far. One would think we could share information by now. But Katrina again proved we cannot.” (GPO, 2006)

The purpose of the research presented in this dissertation was three-fold: (1) to determine the current state, post 9/11/01, of communication, information, and resource (CIR) management linkages during mass casualty events among emergency management agencies (EMAs) and area hospitals in large US cities; (2) to identify and investigate a real-world model of strong CIR linkages; and (3) to determine how weaknesses in current CIR linkages could be strengthened, including the role of information technology in supporting these improvements.

The following three chapters are arranged into three separate manuscripts, formatted for refereed journal publication consideration. Chapter II reviews historical CIR linkages among EMAs and hospitals and describes lessons learned that can be used by any response agency to improve CIR linkages. This served as the foundation for the development and conduct of a survey, presented in Chapter III, to determine the state of the practice, post 9/11, of CIR linkages among hospitals and EMAs in several large cities across the country. Of particular interest was whether the post-9/11 influx of resources and attention to emergency preparedness had yielded any improvements in CIR linkages. Chapter IV presents a detailed investigation of relationship and linkage-

building efforts in Phoenix, Arizona which emerged as a best practice from the research study. Finally, Chapter V concludes by summarizing key research findings and recommendations, and discussing directions for future study.

Because Chapters II, III, and IV are intended to be independent, yet interrelated, certain information is repeated. Efforts were made to keep this redundancy to a minimum, overlapping only when necessary for clarity.

Reference

General Printing Office (GPO), (2006). "A Failure of Initiative – Final Report of the Select Bipartisan Committee to Investigate the Preparation for and Response to Hurricane Katrina", U.S. House of Representatives, February 15.
<http://www.gpoaccess.gov/congress/index.html> [accessed March 2, 2006].

CHAPTER II

A SYNTHESIS OF THE LEVEL OF COORDINATION AMONG HOSPITALS AND EMERGENCY MANAGEMENT AGENCIES

Introduction

As a result of the horrific tragedies of September 11, 2001 and Hurricane Katrina, considerable resources have been devoted by Federal, state, and local agencies to improve the nation's capacity to respond to terrorist acts and naturally occurring epidemics/disasters. Emphasis has been on improving the capabilities of traditional "first responders", such as fire, law enforcement, and emergency medical service (EMS) personnel. Additionally, the focus of the majority of communication, information, and resource supply improvements has been on those organizations and personnel "in the field". Only recently have hospitals been recognized as first responders or "first receivers", and included in these initiatives. (OSHA, 2005)

Actual mass casualty events, such as 9/11 or Hurricane Katrina, and disaster drills, such as the Top Officials (TOPOFF) exercises, have illustrated that the demand for health care can overwhelm the ability of hospitals to respond. Acute care hospitals are essential to the infrastructure of modern communities. Hospitals can also be damaged by a disaster, and still have to protect and support in-house patient populations as well as treat large influxes of new patients, as depicted in Figure 2.1. (Lai et. al., 2003; Montgomery, 2005; Davis, 2006; Arendt and Hess, 2006) During emergency events, it is critical that state and local emergency management agencies (EMAs) have effective communication with and information about area hospitals. This is crucial not only to properly direct the injured from the event (in order to optimize the local medical system), but also to ensure that hospitals continue to care for both the patients

created by a disaster as well as those already hospitalized. (Auf der Heide, 1989) A hospital cannot effectively provide patient care if it cannot remain operational nor can it easily evacuate as can other types of organizations.



Source: Photo by Bill Haber: GPO, 2006.

Figure 2.1. Memorial Medical Center in New Orleans, LA under Floodwaters.

One possible reason for the lack of focus on hospital preparedness and coordination with other local response agencies is that the U.S. has been very fortunate in historically experiencing low casualty rates during disasters. However, the recent mass casualty components of 9/11 and Hurricane Katrina have brought this lack of coordination with hospitals to the forefront. (Wachtendorf, 2002) The importance of linkages among EMAs and hospitals could not have been more fully, and more tragically, illustrated than in New Orleans in the days following Hurricane Katrina. It is imperative to learn from these mistakes and improve our nation's emergency preparedness. (Montgomery, 2005; Davis, 2006; Arendt and Hess, 2006; GPO, 2006)

Before proceeding further, it is useful to define certain terms used throughout this discussion. Emergency management is defined as the application of "science,

technology, planning, and management to deal with extreme events that can injure or kill large numbers of people, do extensive damage to property and disrupt community life". (Drabek and Hoetmer, 1991) Throughout this text, the terms "emergency", "disaster", and "mass casualty" are used interchangeably to mean a natural or man-made disaster, including terrorism events, resulting in injuries to at least 50 people. (Wright, 1976; JCAHO, 2001) Because this work addresses the relationship between hospitals and community emergency managers, it will focus specifically on the coordination of communication, resources and information between hospitals and corresponding community emergency management agencies. Accurate information, communicated efficiently, is essential to effective resource management. Therefore, communication, information, and resource linkages are considered to be so interdependent throughout this work that they will hereafter be referred to as "CIR linkages". Only when a discussion pertains specifically to one of these three processes and not the others, will it be identified as such.

CIR linkages are the who, what, why, and how of emergency response: what information is crucial; how can it be transferred quickly and accurately; who needs it; and how does one make sense of overwhelming volumes of it during a crisis. This concept and the interrelated value of information management systems was eloquently explained in the U.S. House of Representatives special 2006 report entitled, A Failure of Initiative:

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The Federal government is the largest purchaser of information technology in the world, by far. One would think we could share information by now. But Katrina again proved we cannot.” (GPO, 2006)

This paper reviews historical CIR linkages among EMAs and hospitals, for the purpose of synthesizing lessons learned that can be used by a response agency to improve CIR linkages.

Published Literature

Literature was reviewed in three distinct areas: 1) coordination of multi-organizational response to disasters, 2) information and communication technology use in emergency management, and 3) hospitals’ role within the community response during mass casualty events. This discussion concentrates specifically on the themes of CIR management throughout these three areas. The literature available concerning hospitals focused primarily on medical treatment during mass casualty events or the specific response of one hospital during a single event, but did not address coordination with other response agencies or other hospitals. Most literature concerning overall medical response during disasters concentrated on EMS response to the site of the disaster.

There are two fairly large spikes in the quantity of literature published on emergency management. The first occurs in 1996-1997, which appears to be a result of the 1993 bombing of the World Trade Center, the 1994 Northridge earthquake in California, and the 1995 Oklahoma City bombing. The second spike started in 2003, presumably as a result of the 9/11 tragedy, and continues today in the wake of the Hurricane Katrina.

Multi-organizational Response to Disasters

In 1984, James Ginger produced, for the first time, research that treated the response to international terrorism as an organization problem; it had been characterized as a political, psychological, sociological, ideological, and communications problem prior to his work. (Ginger, 1984) Ginger established the need for an inter-organizational approach to counter-terrorist response and concluded that no workable inter-organizational approach had been effective to date. He also concluded that there was a significant difference in the way “experienced” and “inexperienced” organizations planned for terrorism. Experienced organizations, or those who had actually responded to a terrorism event, tended to plan by identifying needed capabilities and then attaining these capabilities. Inexperienced organizations tended to plan by focusing on identification of probable events and developing responses to these events. Ginger suggested that an improvement in counter-terrorist response systems would be to eliminate contingency planning and replace it with strategic planning which would identify critical inter-organizational connections and ensure the creation, maintenance, and use of those connections to foster information transfer. (Ginger, 1984)

In the mid-1990s, Gerald Hinson applied established organizational theories to emergency responders by testing three organizations participating in simulated disaster responses as part of the Integrated Emergency Management Course designed by Federal Emergency Management Agency (FEMA). (Hinson, 1994) The simulated disasters were an earthquake, a flood, and a hurricane. His research tracked telephone contacts within an organization and within functional areas across organizations during the events. Hinson concluded that organizations tended to maintain their hierarchical structures throughout the disaster instead of restructuring into tactical teams as was planned. He also found that communication and response efficiencies improved as the disaster progressed and the organization learned accordingly.

The following year, Robert Duncan conducted a survey of 107 local emergency managers and other associated local officials. (Duncan, 1995) He attempted to measure coordination among local emergency response organizations, including volunteer organizations such as the Salvation Army and American Red Cross. He sought to study the question, "Why is it that local emergency management coordination is not more effective?".

Duncan found that the most common analytic approach in studying inter-organizational coordination was the use of *domain consensus*, or to concentrate on organizations working within a similar service delivery area or with common clients. Most organizations within the same domain are also in a constant struggle for resources, often competing with one another. A scarcity of resources forces inter-organizational linkages and exchanges during crises. Therefore, establishing these linkages before a mass casualty event occurs was deemed imperative.

Duncan also discussed the dichotomy between the daily life of local emergency managers and their role during a disaster. A local emergency manager might supervise a handful of people at most during routine daily activity. They might be responsible for a small budget with limited physical resources. However, they would be confronted with managing thousands of individuals, multitudes of organizations, tons of supplies, and hundreds of problems in the instance that a large-scale disaster occurs. One of the respondents in Duncan's research likened it to becoming the CEO of a multimillion dollar company overnight. This conundrum results in information overload and ineffective decision-making by the local emergency manager.

In 2002, David McEntire published a case study of the response in Fort Worth, TX to a tornado that struck on March 28, 2000. (McEntire, 2002) He characterized the multi-organizational response by emergency responders as coordinated and effective. Small problems with information management, communication between the Emergency

Operations Center (EOC) and field operations, and equipment issues were apparent. However, the response was coordinated due to the supportive political leadership of Fort Worth, past planning meetings and training activities, pre-existing relationships between emergency managers that led to networking and cooperation, experience with previous incidents, the effective implementation and use of technology, and a well-equipped and strategically located EOC. McEntire concluded that other municipalities could learn from Fort Worth on how to effectively prepare to respond to a disaster. McEntire's case study of the Fort Worth tornado of 2000 was the only example of relatively effective CIR management by a locality in a disaster that could be found in the literature.

In the 2003 volume of *Disaster Prevention and Management*, Ronald Perry discussed the evolution of Incident Management Systems (IMS), its integration into area emergency and disaster management, and common structures of IMS used at the municipal level. IMS is another name for Incident Command System (ICS), discussed later within the framework of the National Incident Management System (NIMS). IMS is a management system wherein one individual is designated as Incident Commander (IC) and individuals from varying departments or organizations assume functional roles as support to the IC. These individuals are typically housed during an event in an EOC. In 2003, IMS was used extensively by those that are first-responders, such as fire, police, and EMS, but not by EOCs. Perry asserted that IMS is a flexible approach for organizing emergency operations.

A study released in May 2004 by the Center for Studying Health System Change determined that larger communities exhibit stronger disaster response capabilities than smaller communities. The study, conducted in late 2002, evaluated twelve communities throughout the U.S. that varied in size from small (fewer than one million people) to large (more than 2.5 million people). The researchers conducted 132 semi-structured telephone and in-person interviews with a variety of key emergency response personnel

in each community. Respondents rated communication among key agencies/organizations and information technology (IT) to be among the weakest areas of emergency readiness. (McHugh et al, 2004)

Information and Communication Technology Use in Emergency Management

Information management systems serve a dual purpose in emergency management. These systems can assist with the organization of the vast quantities of information generated quickly during a disaster and with the communication of this information. Many new information management and communication technologies have been developed in the past decade, commensurate with increased use of the personal computer and the Internet.

Thomas Drabek published the first systematic research into microcomputer use in emergency management in 1991. (Drabek, 1991) Drabek put forth that: 1) the most significant innovation to emergency management was the microcomputer; and 2) no research had been initiated to date on the implementation of IT, uses during actual disasters, or organizational consequences of the adoption of IT within EMAs. He performed field studies with three state and six local EMAs to assess microcomputer adoption and implementation. He then returned to several of the previously studied agencies after a major disaster to assess the degree of fit between actual microcomputer use and planned usage. Drabek concluded that failure to use microcomputer capabilities constrained EMA effectiveness and efficiency; microcomputers were but one component within a complex communication system; use during disaster response was curtailed due to staff inadequacies or unavailability; and the absence of computer-based linkages between state and local EMAs was a serious constraint on response effectiveness.

In 1994, Paul Katzer compared and contrasted two Digital Spatial Database Systems for use by local government emergency management. (Katzer, 1994) He compared Emergency Information System (EIS) and ArcInfo GIS. EIS was a system developed specifically for emergency management applications while ArcInfo is a GIS that is used in a variety of fields. Both systems were evaluated in simulations of a flood and an industrial accident based on criteria for ease of set-up, ease of analysis, time to perform applications, steps to perform applications, and ability to perform data handling. Katzer concluded that ArcInfo offered a greater level of flexibility for the local emergency manager. ArcInfo could import and export more data formats than EIS and could capture spatial features in different projection systems. He cautioned, however, that more set-up effort was required specifically because of this flexibility. Overall, ArcInfo appeared to be the more robust system. (Katzer, 1994)

In 1996, Steven Jensen performed an extensive literature review focusing on the adoption and use of information systems in emergency management. (Jensen, 1996) He discussed the need for information systems in emergency management due to the influx of enormous quantities of information during a disaster and limitations on the amount of data that one individual is able to process. Jensen also discussed how two levels of information must be managed simultaneously: a macro-view of the event and a micro-view of the details of specific subparts of the event. It was suggested that emergency management is the most spatially oriented of all management sciences and that it is essentially a form of information management.

In 1997, Quarantelli presented ten possible negative consequences of the information revolution on disaster planning and research. (Quarantelli, 1997) He pondered the possibility that technology that is a “means” will be turned into an “end” in itself. Studies by the Disaster Research Center in the 1960’s-1980’s showed that emergency response organizations believed that more communication “means” such as

radios and walkie-talkies were the answer to their communication problems. However, his research showed that the problem was actually the flow of information content that was inaccurate, incomplete or misdirected. He argued that more field communication equipment could not solve this problem. His discussion also dealt with the inevitable information overload. At some point in a disaster, most of the information would have to be assessed and interpreted. Quarantelli argued that technology could not solve the problem of interpretation and meaning. He explained this concern by stating that “the existence of better communication facilities does not necessarily lead in itself to a better exchange of knowledge and intelligence, and/or a greater understanding of what is occurring.”

A companion article used a case study approach to evaluate the role of information in disaster planning. (Riley and Meadows, 1997) Riley and Meadows evaluated three different mass casualty events and found problems with communications due to overloading of the local communication systems as well as problems with information flow between emergency response organizations. Emergency plans in place before each of these disasters were concerned mainly with the assignment of responsibilities in the short-term, not on information flow. Plans were changed subsequently to ensure effective information flow.

Also in 1997, Michael Flanagan conducted research on the response to crisis through the integration of technology into a virtual consolidated operations center. (Flanagan, 1997) He concluded that: 1) communications and coordination of resources presented problems for governmental organizations in responding to disasters, 2) a cost-benefit analysis of the adoption of GIS technology showed potential improvement in communications, and 3) technology could affect a decrease in operational costs while previous service levels are maintained.

Ann Marie Willis probed the effects of information technology on State EMAs in 2000. (Willis, 2000) She reported that many state, county, and some city EOCs had developed integrated data communication capabilities at the time. Extensive differences existed, however, in implementation. One unexpected finding was that GIS was in little use in State EMAs as opposed to its prevalent usage at the county level. Her conclusion was that information management was still a critical and neglected issue in EMAs in 2000; therefore, not much had changed since the 1960's.

An evaluation by Dr. David Bradt of the site management of health issues during the World Trade Center disaster of 9/11//2001 addressed this topic. (Bradt, 2003) He espoused the successful use of GIS technologies during the disaster, calling them critical to disaster management. He envisioned GIS professionals as "information first responders", guiding disaster managers in their work in the future. He illuminated the telecommunications challenges during the disaster and explained how hand-held technology using wireless applications, such as Palm units, continued to work and allowed e-mail transmissions when landlines and cell phones failed.

The Department of Homeland Security released in January 2007 its "Tactical Interoperable Communications Scorecards" for 75 urban/metropolitan areas in the U.S. The scorecards evaluated the maturity of interoperable communications within governmental agencies, but not with other community organizations such as hospitals. (U.S. DHS, 2007) Also, the DHS study focused on physical communication processes, not on determining relationship or organizational issues. Overall findings show that while interoperable communications capabilities have made considerable progress in the recent past, solutions have not been readily adopted regionally and are far from seamless in most areas. Even in areas where interoperable technologies have been developed, organizational factors have hampered multi-organizational adoption.

A number of electronic information management systems, such as WebEOC, Eteam and Reddinet, have proliferated recently to organize hospital information and assist EMAs with protecting critical community infrastructure during a mass casualty event. While an important step, many of these systems are only being used by the EMA during an actual emergency and not for planning purposes. There is usually no real-time information exchange with medical facilities on their status or needs, nor can the hospitals gain access to the information contained in the system. (EmerGeo, 2006; Eteam, 2007; Welsh, 2003; HASC, 2004)

Hospital Response to Mass Casualty Events

In 1976, Joseph Wright performed research on inter-organizational systems and networks in mass casualty situations. (Wright, 1976) The focus of Wright's research was the flow of CIR among organizations. He collected data from ten mass casualty events and concluded that the "mass assault" of rescuers in these events leads to the uncontrolled allocation of casualties to hospitals. This uncontrolled allocation leads to an inefficient hospital response, with the hospitals located nearest the scene being inundated while those that could have absorbed casualties more efficiently were uninvolved. He asserted that communication with hospitals during mass casualty events is essential, but difficult.

Wright also found that vast resources in metropolitan areas were often neither mobilized nor organized, resulting in the effective management of fewer casualties than one would expect based on their normal load. Another conclusion was that the most effective disaster plans are those that use everyday ways of accomplishing tasks rather than trying to replace these prior organizational linkages during an event. This observation highlighted the need for establishing CIR-sharing linkages prior to an actual event. (Wright, 1976)

E.L. Quarantelli published a book on emergency medical services in disasters that was an extension of Wright's work. (Quarantelli, 1983) He reported that the need for improvement in both day-to-day and emergency communications with and among hospitals was recognized as far back as 1963 by the Committee on Shock in the Division of Medical Sciences of the National Academy of Sciences. To investigate this concern, Quarantelli studied 28 actual mass casualty events and five events with high mass-casualty potential.

Quarantelli found CIR management problems with hospitals in virtually all of the events studied. Either hospitals were never notified of the event or they received inaccurate information. Emergency managers generally had little information on the status of the area hospitals either before or after an event. Quarantelli's conclusion was that the overall effectiveness and efficiency in the handling of medical casualties in a disaster depended on how well the local medical care system, including hospitals, responded as a whole. He asserted that it was the hospital response as a "system" that was important. The relationship between information, communication, and emergency medical response was described by Quarantelli as, "Without full and correct information flow, there can be no valid communication. Without appropriate communications, coordination of efforts suffer. If there is weak coordination, there can be, at best, only a loosely integrated response. At both the EMS component or system level, this is frequently the character of the situation which prevails in the EMS response to disasters."

Quarantelli also noted a general trend of larger communities having more coordination problems in EMS response than smaller communities. He hypothesized that this could be a result of the higher number of hospitals and agencies that require coordination in a disaster in a larger community. He also suggested the domain consensus explanation discussed earlier by Duncan. (Duncan, 1995) He believed that

pre-existing linkages were vital as natural communication pathways during a mass casualty event. His research found these linkages were generally non-existent in larger communities prior to a disaster.

Quarantelli's research is considered a seminal work in the understanding of hospital and EMS response to mass casualty events and is referenced in almost every document found during this literature review. His effort was the first, and arguably the most comprehensive, systematic and comparative study of the delivery of emergency medical care during disasters.

Moving forward, Bridget O'Brien concluded in her research that, "whether a disaster causes 25 or 25,000 injuries, careful coordination is essential for delivering victims to facilities which can effectively manage the level of injury. Simply taking all the injured to the nearest facility is quite possibly the worst 'system' of resource utilization". (O'Brien, 1991) She asserted that the overwhelmed system would no longer be able to meet the minimum needs of the victims of a mass casualty event, much less concentrate on special cases. O'Brien also found that most patient tracking systems, including the National Disaster Medical System (NDMS), had hospitals report their bed availability based on acute or non-acute. However, casualties are triaged by injury type, such as orthopedic, burn, etc. (Auf der Heide, 1989) This mismatch in information could lead to an ineffective allocation of resources during an actual mass casualty event.

In 1996, a survey of 526 emergency nurses was conducted to determine their knowledge of disaster procedures and management. (Haney, 1996) Nurses are central to the management of any operation within a hospital, are commonly found in administrative roles, and far outnumber the physicians available at any time. Haney found that proper pre-hospital triage can prevent any one hospital from being overloaded with too many critical patients and could be the key to the management of mass

casualties. The need for communication, both internal and external to the hospital, was considered crucial for disaster operations.

In 2001, Kimberly Treat and her colleagues queried personnel at 30 hospitals on the level of preparedness, mass decontamination capabilities, training of hospital staff and security capabilities for WMD incidents. (Treat et. al., 2001) They reported that WMD preparedness had been incorporated into only 27% of hospital disaster plans and 73% were capable of setting up only a single-room decontamination process. Only 10% had the ability to handle more than 50 casualties. One-fifth stated that disaster drills for WMD events had been conducted. This study, when compared to the Braun et. al. 2006 work performed for JCAHO (discussed later), is illustrative of advances in hospital preparedness activities made in just the few years since 9/11.

In 2003, Rory Connell conducted focus group interviews with representatives from numerous hospitals in California, Tennessee, and New York. He found that hospitals have limited financial resources and are reluctant to invest them in disaster preparedness. Additionally, hospitals implemented only the measures required by regulation or by their accreditation agencies. (Connell, 2003)

The U.S. General Accounting Office (GAO) released a Report to Congressional Committees in August 2003, entitled "Hospital Preparedness: Most Urban Hospitals Have Emergency Plans but Lack Certain Capacities for Bioterrorism Response". The GAO conducted a survey of 1,489 urban hospitals in the 50 largest Metropolitan Statistical Areas (MSAs) across the country. The questionnaire addressed emergency room functionality and hospital preparedness for bioterrorism. In its report, the GAO explained how the demand for health care could quickly outstrip the ability of hospitals to respond during a mass casualty event. (GAO, 2003) Hospitals across the country have been operating at or near surge capacity and are reluctant to spend money to stockpile resources and create surge capacity that is not needed on a routine basis and might

never be used. The report asserted that “hospitals would need to be able to communicate easily with all organizations involved in the response as events unfold and critical information is acquired” in order to provide for the sharing of resources among hospitals and other organizations that may be in short supply on a local level during an emergency. The survey showed that larger hospitals had emergency plans that covered more functions and had more inter-agency agreements than smaller hospitals.

St. Vincent's Manhattan Hospital, the closest Level 1 trauma center to the World Trade Center, learned from the 9/11 experience that additional communication methods were needed for both system-wide communications within St. Vincent's hospital system and city-wide. They began developing data sharing systems that identify excess hospital capacity, needed resources and the location of patients in treatment. Resources were expended to enhance system-wide preparedness for future disasters, including the development of communication systems to assure efficient sharing of resources between hospitals within the St. Vincent system. (Ackerman, 2003)

Trust for America's Health (TFAH) is a non-profit, non-partisan organization that has published an annual report since 2003 which assesses state preparedness to protect the public from diseases, disasters, and bioterrorism. TFAH evaluates state preparedness activities against a set of indicators developed to ensure effective response to biological health threats. In the five years since 9/11, TFAH found that the nation is “only modestly better prepared to respond to health threats than prior to the 2001 tragedies.” Public health preparedness is still not considered by this group to be at an acceptable level. (TFAH, 2005; TFAH, 2006)

A number of studies have been published that investigate the impact on hospitals in New Orleans during Hurricane Katrina. Particularly illuminating are the “A Failure of Initiative” report and a qualitative study of all 15 hospitals in New Orleans Parish that investigated hospital decision-making with regards to evacuation or shelter-in-place.

(GPO, 2006; Arendt and Hess, 2006) Arendt and Hess interviewed hospital executives and staff members, who were asked to evaluate their hospitals' emergency plans and other planning documents to discern the organizational decisions that were made. A primary finding was that no hospital had a well-developed plan for full evacuation. Moreover, administrators at New Orleans' hospitals were so jaded with regards to hurricanes that they never thought "it could happen to them", and therefore did not plan for a two-stage scenario such as a hurricane/levee break or for a full hospital evacuation. The plans that were reviewed were based on event types, not capabilities, and quickly became useless in the ongoing stages of crisis that occurred. Lessons learned included the need for all-hazards, scalable plans, along with thorough training and drilling. Additionally, even though New Orleans is below sea level, most hospitals had their generators, supplies and food stocks stored on ground floors. One of the most important lessons learned by these hospitals was how invaluable their pre-established relationships and networks became during the event. These linkages with governmental agencies, other hospitals, and anyone else they could think of became a lifeline for evacuation methods, supplies, relief personnel, and information. (GPO, 2006; Arendt and Hess, 2006; Maher, 2005; Montgomery, 2005; Davis, 2006)

Review of Major National Policy Initiatives Involving Linkages Among Emergency Management Agencies and Hospitals

The Federal government has recognized the need for preparedness and planning for mass casualty events, both natural and man-made, for many decades. As a result, there have been five major national initiatives to coordinate medical response to mass casualty events in addition to the December 2006 signing of the "Pandemic and All-Hazards Preparedness Act" by President Bush. (Bush, 2006) Billions of dollars have been distributed through these initiatives with questionable results. Each of these

national initiatives is discussed in this section, with a focus on the themes of CIR linkages between EMAs and hospitals.

National Disaster Medical System (NDMS)

The National Disaster Medical System (NDMS) is a Federally coordinated system that supplements the nation's emergency medical response capability. Initiated by President Reagan in 1982, the NDMS was originally a partnership between the US Department of Health and Human Services (DHHS), Department of Veteran Affairs (VA), and Federal Emergency Management Agency (FEMA). (Natarajan, 2004) The NDMS was moved to the Department of Homeland Security and then back to the DHHS as of January 1, 2007. (Bush, 2006) The purpose of the NDMS is to establish a single, integrated national medical response capability for assisting state and local authorities in responding to disasters. It has the dual purpose of supporting the Department of Defense and Veterans Affairs medical systems in caring for casualties returning from overseas conflicts. (NDMS, 2003)

The National Disaster Medical System is comprised of 72 Federal Coordinating Centers (FCCs), as shown in Figure 2.2, located in major metropolitan areas with large concentrations of hospitals in close proximity to airports. These 72 FCCs are Army, Navy, Air Force, or VA hospitals that coordinate a network of 2,000 non-Federal hospitals. The FCCs enroll the non-Federal hospitals and then coordinate bed availability and patient reception during an incident. An additional component of the NDMS is the creation of Disaster Medical Assistance Teams (DMATs) and International Medical Surgical Response Teams (IMSURTs). These medical teams are volunteer groups of health and medical professionals that can mobilize to remote locations both within and outside the US. The NDMS provides medical response teams, supplies, and equipment to an affected area, assists with the movement of patients to unaffected

areas of the country, and ensures definitive medical care at participating hospitals in unaffected areas. (NDMS, 2003) The NDMS is only activated when state resources have been overwhelmed and a request has been made by the state for federal assistance.

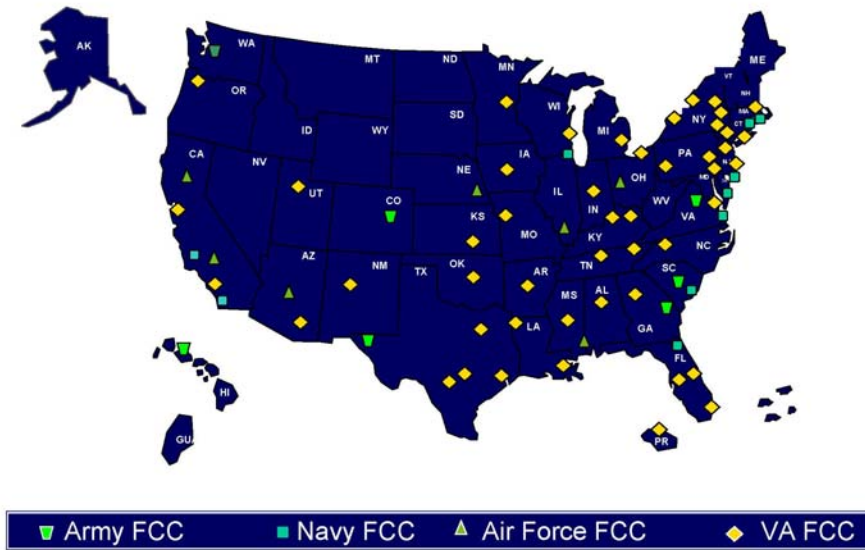
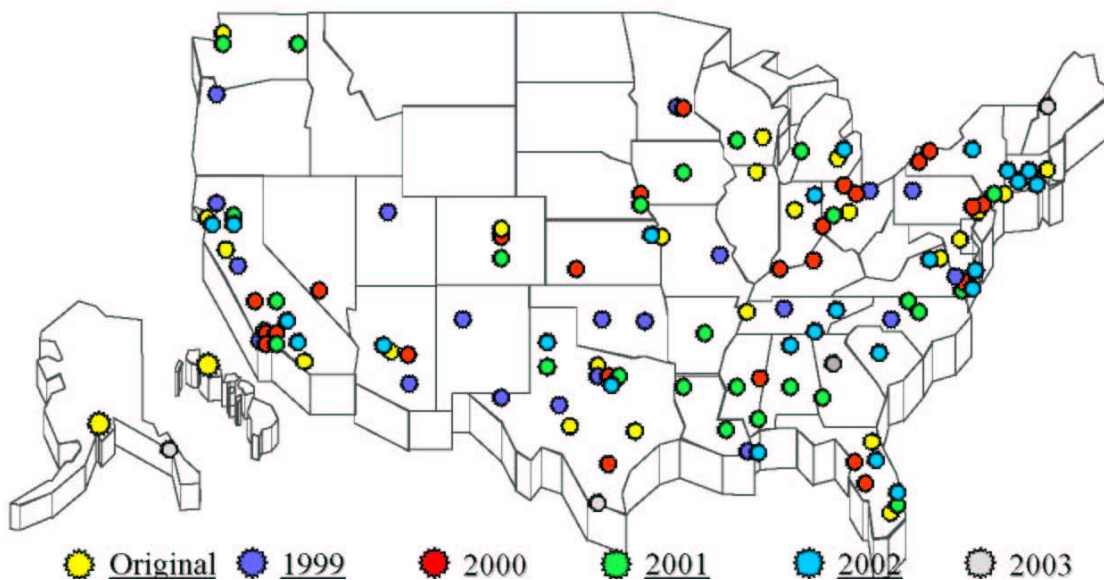


Figure 2.2. NDMS Federal Coordinating Centers.

The NDMS is equipped to manage patient data through the TRAC2ES computer system for patient reception or reverse patient flow. However, it requires 72 hours to activate the NDMS. Therefore, the NDMS computer system does not supplant the need for locally-devised systems to immediately manage patient and resource flow, and that are compatible with the NDMS computer system. (Thresher, 2003)

Metropolitan Medical Response System (MMRS)

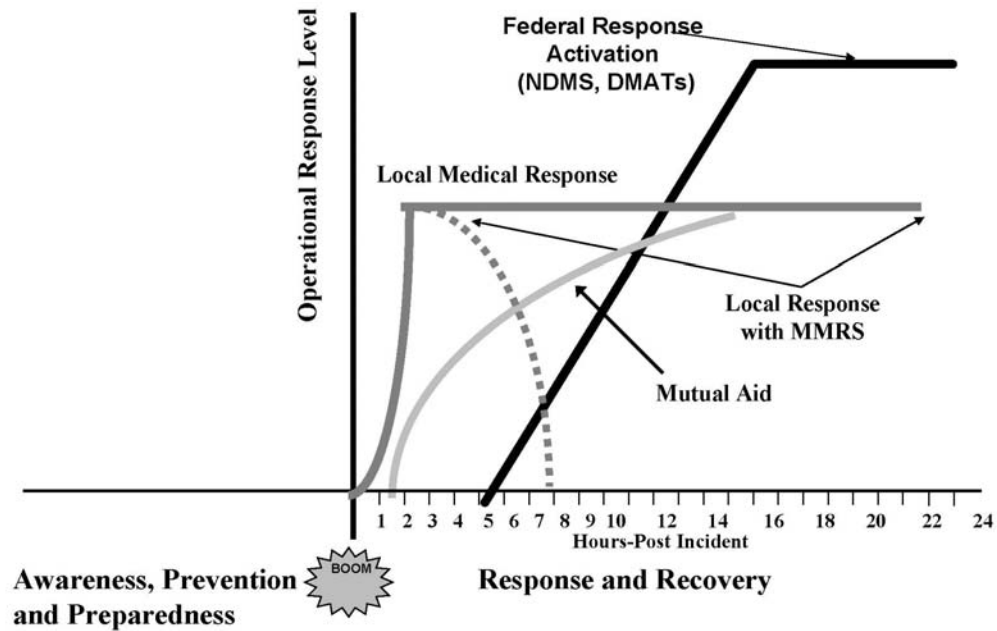
The Metropolitan Medical Response System (MMRS) was created by the National Defense Authorization Act of 1997. Its purpose is to assist localities with preparation for mass casualty events by awarding grants to local jurisdictions to improve their response capabilities, specifically to WMD events. The MMRS program was transferred from the Department of Health and Human Services (DHHS) to the Department of Homeland Security (DHS) in 2003. MMRS has been the only Federal program which directly supports the linkages among all the local elements essential in managing a Weapons of Mass Destruction (WMD) mass casualty event. As a byproduct of preparing for WMD events, these enhancements also increase capabilities to manage mass casualty events caused by hazardous materials incidents, disease outbreaks, or natural disasters. (MMRS, 2004) As of 2003, there were 124 designated MMRS regions (see Figure 2.3).



Source: MMRS, 2004.

Figure 2.3. MMRS Regions.

In any disastrous event, whether natural or manmade, the locality will have as its primary focus the management of the mass casualties; thus, local medical response capability is a critical component of a viable national disaster management system. Over time, response to a large incident will move from a local to a state response, then to a national response level once the state response capabilities are overwhelmed. Therefore, the government established the MMRS to provide equipment and money to enhance local response capabilities for the first 72 hours of an incident until the NDMS can be activated (see Figure 2.4).



Source: MMRS, 2004.

Figure 2.4. Effect of Policy Initiatives on Local Medical Response.

The primary focus of the MMRS is WMD and other incidents that would require decontamination of patients in addition to medical response. Decontamination complicates response to a nuclear, chemical, or biological material because the medical workers must be protected from contamination. Much of the money provided by MMRS has been designated for decontamination supplies and personal protective equipment, such as respirators and protective suits for first responders and hospital emergency department personnel. All organizations within the local MMRS, such as hospitals, fire departments, law enforcement, EMS, local metro and state emergency management agencies, must share the funding received. (MMRS, 2003a)

MMRS has been the only Federal program to directly support local linkages essential in managing a WMD mass casualty event. To be effective, however, it must be interoperable with Federal response programs such as NDMS and NIMS, as discussed below.

National Incident Management System (NIMS)

In March 2004, Director Tom Ridge of the Department of Homeland Security announced the creation of a National Incident Management System (NIMS). The intent of the system was to “provide a consistent nationwide approach for Federal, State, local and tribal governments to work effectively and efficiently together to prepare for, prevent, respond to, and recover from domestic incidents, regardless of cause, size, or complexity.” (Ridge, 2004)

NIMS was created in response to Presidential Directive, HSPD-5, “Management of Domestic Incidents” issued in February 2003. (Bush, 2003) This Presidential directive required all Federal departments and agencies to adopt NIMS immediately and required Federal agencies to make adoption of NIMS by state and local organizations a condition of Federal preparedness assistance beginning in FY 2005. The document

established the basic concepts and structure of NIMS, with the development and refinement of national standards, guidelines, protocols, systems, and technologies to occur in the near future.

NIMS standardizes philosophy, concepts, principles, terminology and organizational processes of emergency management and integrates Federal government domestic prevention, preparedness, response and recovery plans into a single, all-disciplines, all-hazards plan. The basic principle of NIMS is standardization; however, the creators acknowledged the need to strike a workable balance between standardization and flexibility.

The six major components of the NIMS plan are Command and Management, Preparedness, Resource Management, Communications and Information Management, Supporting Technologies, and Ongoing Management and Maintenance. (DHS, 2004)

The foundation of the NIMS command and management structure is the Incident Command System (ICS), multi-agency coordination systems using Unified Command, and the Joint Information System (JIS). The Incident Command System integrates facilities, equipment, personnel, procedures, and communications from all organizations participating in an emergency response within one common organizational structure. The system is familiar to many emergency response organizations and has been readily adopted throughout the country by typical emergency response agencies such as fire and police. It is similar to the Hospital Emergency Incident Command System (HEICS) system that has been used by hospitals for a number of years. HEICS has now been updated and integrated with HICS IV, which is a hybrid version of the original HEICS that is NIMS-compliant for hospitals.

The NIMS Integration Center issued a “NIMS Alert” in September 2006, launching the “NIMS Implementation Activities for Hospitals and Healthcare Systems” guidance. This new guidance document was developed as a collaboration between

DHHS and the National Bioterrorism Hospital Preparedness Program (NBHPP). The NBHPP required hospitals to meet the NIMS implementation requirements during the FY2006 funding cycle. (FEMA, 2006b; FEMA, 2006c) The implementation guidance document includes 17 elements that are to be addressed in a hospital's emergency management program documentation. These range from adopting and training on ICS, to linking the Hospital Command Center with local EOCs and 911 centers, to maintaining response supply and equipment inventories as well as establishing memoranda of understanding or vendor contracts to obtain additional supplies.

In addition to hospital standards, the NIMS Integration Center developed guidance documents for Communications and Information Management and for Resource Management that were issued in March 2006. These guidance "fact sheets" outline concepts and principles for effective resource management, interoperability standards, information technology (including wireless applications) and standardized status reporting. They do not yet provide specific requirements, but are useful for organizations to improve planning in these areas. (FEMA, 2006d; FEMA, 2006e)

The new NIMS requirements address many of the issues discussed in this research and should drive hospitals to improve CIR linkages with local EMAs, if adopted universally and without undue financial burden. Overall, it is clear that the Department of Homeland Security recognizes that CIR linkages among hospitals and EMAs are integral in community-wide response.

National Bioterrorism Hospital Preparedness Program (NBHPP)

The DHHS created the Hospital Bioterrorism Preparedness Program in FY 2002. The Health Resources and Services Administration (HRSA) provided significant funds to states and eligible municipalities to enhance the capacity of hospitals and associated

health care entities to respond to bioterrorism. (JCAHO, 2003) “The vision of the NBHPP is for U.S. hospitals and the supporting healthcare systems to provide immediate and effective healthcare through a well-trained and equipped workforce to minimize morbidity and mortality in the event of a terrorist attack or other public health emergency.” (DHHS, 2007)

To be eligible for funding, each entity is required to submit detailed implementation plans addressing critical benchmarks. These benchmarks include: 1) establishing a Hospital Bioterrorism Preparedness Planning Committee in each area which consists of State and local health departments, EMAs, and the hospital community as well as others, such as police and fire; 2) creating a timeline for a state-wide plan for response to a bioterrorism event, infectious disease outbreak, or other public health emergency; 3) creating regional plans for responding to a mass casualty event or epidemic including at least 500 patients; 4) developing a plan to distribute critical vaccines or antibiotics on a 24/7 basis; and 5) developing a plan for communication systems that provide 24/7 (and redundant) flow of critical health information between hospital emergency departments, state and local health departments, and law enforcement. (Agrabrite, 2003) Additionally, the DHHS required a plan for “electronic tracking of bed status across the State with a central device or system, and how this information will be updated continuously to maintain currency”.

Research on websites of local OEMs and State EMAs across the county as well as personal communication with representatives of these offices has indicates that most chose GIS to meet this requirement. (Nashville OEM, 2003) Hospitals call or fax in their information on a periodic basis and someone, usually in a local OEM, updates the system. Others use Access databases or other internal systems unique to their area.

(GNYHA, 2003; HASC, 2004) These systems focus on bed status or epidemiological information of hospitals, not capability, operational or resource issues.

In September 2003, DHHS increased the funding for this program “for states to develop surge capacity to deal with mass casualty events”. (DHHS, 2003a; DHHS, 2007) These additional resources were directed at the expansion of the number of hospital beds, development of isolation capacity, identifying additional health care personnel, establishing hospital-based pharmaceutical caches, providing trauma and burn care, enhanced communications, and personal protective equipment. Distribution of funding has been slow and generally considered by the public health community to be insignificant relative to the need. (McHugh et al, 2004; NFTC, 2004)

According to the DHHS Fact Sheet entitled, “Public Health Emergency Preparedness: Transforming America’s Capacity to Respond”, internal public health system communications have improved. (DHHS, 2003b) As of September 2003 when the publication was released, 42 states could send and receive public health information among hospitals, emergency departments, state and local officials and law enforcement through the Public Health Information Network (PHIN) and the EPI-X system. Additionally, all states had plans with their hospitals for dealing with epidemics of at least 500 patients. As of FY2005, 89% of jurisdictions had some sort of communication system in place with local emergency management agencies. 97% had portable or fixed decontamination systems, but only 87% had personal protective equipment for hospitals personnel to use the decontamination systems. (DHHS, 2007)

TOPOFF Exercises

In 1998, the U.S. Congress directed the Attorney General and FEMA to undertake a mass casualty exercise that involved all key Federal personnel. (Colvin, 2003) In 2000, the Department of Justice conducted a drill that tested the readiness of

top government officials to respond to terrorist attacks directed at multiple geographic locations. The exercise was called “TOPOFF” (top officials) and simulated a chemical weapon attack in Portsmouth, NH, a radiological attack in Washington, DC, and a bioweapons attack in Denver, CO. (Inglesby et. al., 2001)

The Denver attack simulated the release of plague aerosol (*Yersinia pestis*), which eventually led to more than 2,000 cases of pneumonic plague with hundreds of simulated deaths. The unannounced exercise took place over three days in May, 2000 and involved hundreds of personnel from the county health agency, state health agency, Centers for Disease Control (CDC), Office of Emergency Preparedness, Public Health Services as well as three Denver hospitals. (Hoffman and Norton, 2000)

Inglesby et. al. discussed lessons learned from the Denver portion of the drill. (Inglesby et.al., 2001) Communication failed in many instances. Officials using 800 MHz radios did not report communication problems while regular phone lines became highly dysfunctional. “Hospital officials in particular had great difficulty communicating by phone with the health department or others involved in consequence management”. Inglesby pointed out that hospitals needed to communicate with and receive support from a wide variety of organizations, including other hospitals, and that the capacity for efficient communication throughout the health care system during a crisis should have already been built.

Antibiotic distribution and resource management quickly became inoperable. Hospitals were competing for ventilators and antibiotics. The authors viewed it as critical that the local community have the capability to efficiently and rapidly distribute antibiotics and other resources, such as simple face masks, to where they were needed.

The flow of information was also reported as a major concern. Participants were unsure how decision-makers would know whether a hospital was overwhelmed. Decisions were made, then overturned within hours, only to be reinstated a few hours

later. Inglesby asserted that decision-making in such a crisis requires information sources and conduits that did not exist in 2000. The development of information systems that deliver real-time data and allow decision-makers to communicate efficiently with hospitals is vital to improving future response capabilities to bioweapon attacks.

In March 2003, responsibility for the TOPOFF exercises was transferred from the Department of Justice to the Department of Homeland Security. (Colvin, 2003)

Therefore, the DHS had responsibility for conducting TOPOFF 2. Whereas the original TOPOFF was designed as a single event, no-notice exercise, TOPOFF 2 was organized as a cycle of exercise activities that increased in complexity. A series of seminars explored various emergency response issues, culminating in a Top Officials seminar to prepare for the upcoming full-scale exercise. The objective of the “open” design was to strengthen relationships within the national response community using a building-block approach. (DHS, 2003)

TOPOFF 2 included a combination of natural disasters and terrorism events, “designed to overwhelm local, state, and federal agencies in Seattle, King County, Pierce County and the State of Washington, as well as in Chicago and its surrounding counties. British Columbia and Ottawa, Canada also participated”. (May, 2003)

On May 12, a Radiological Dispersal Device exploded in Seattle at the same time that Chicago hospitals were reporting an increase in unknown illnesses. On May 13, 2003, a bomb exploded on a transit bus south of Tacoma, WA on which terrorists were holding hostages. On May 14, the Washington State ferry had a hostile takeover. For 36 hours, participants struggled to respond to the cascade of events. The exercise concluded on May 16, 2003. (May, 2003)

In Chicago, 64 hospitals participated in the exercise, making it the largest mass casualty drill ever undertaken. The Department of Homeland Security, in its After Action Summary Report, concluded that there were significant challenges regarding

communication and the management of resource requirements during TOPOFF 2. DHS found that the “lack of a robust and efficient emergency communications infrastructure was apparent.” (DHS, 2003) The communication system in place relied on telephones and faxes, which were quickly overwhelmed. Additionally, there was little electronic data capture; information was copied manually to a form, faxed, and then manually tabulated on another form before being entered into an information system. (DHS, 2003)

During the radiological incident, incident command did not provide periodic information updates to hospital control. The hospitals were unaware of the need to conduct more detailed risk-benefit analysis before commencing treatment, nor were the hospitals aware of periodic work stoppages at the explosion site.

An additional challenge was hospital resource demands. Hospitals were competing for the same pool of supplemental resources since they had little on hand. Staff and isolation/negative pressure rooms presented special issues, with extra conference rooms, lobbies and other labs eventually being turned into negative pressure rooms and isolation wards. Cumbersome procedures and insufficient electronic means to track resource status taxed hospital staff in most cases. (DHS, 2003)

TOPOFF 3 was an announced exercise conducted from April 4-8, 2005, involving 27 federal, 30 state, and 44 local governmental departments and agencies, in addition to 156 private sector organizations from New Jersey, Connecticut, United Kingdom and Canada. By any measure, TOPOFF 3 was the most ambitious civilian terrorism response exercise ever conducted, taking a year to plan at a cost of \$21 million; it was also the first opportunity for DHS to manage an entire exercise of this magnitude. The exercise was unique in that it incorporated the National Response Plan, NIMS, pre-exercise intelligence play, private sector organizations, and the Department of Defense. (DHS, 2005)

TOPOFF 3 simulated releases of pneumonic plague in Union and Middlesex counties in New Jersey, and mustard gas and a high-yield explosive in New London, Connecticut. These exercises were linked to the “Atlantic Blue” exercises in United Kingdom and “Triple Play” exercises in Canada. (DHS, 2005)

While the overall objectives of the exercise were met, a number of opportunities for improvement were discovered. Confusion in incident command and response coordination was common, although DHS felt that future compliance with NIMS should reduce these conflicts. It was also found that information collection and dissemination needed standardization, and formidable challenges in the treatment and sharing of key information were present. “The secured messaging system and information collection and reporting structure in place for exercise participants were insufficient to process, prioritize, and track the volume of information flowing among participants.” DHS recommended the design of an information management system for use in future exercises to standardize format and methodology for collecting information, and to allow for more open and efficient tracking and sharing of information. DHS also recommended the development of best practices and lessons learned from private industry to facilitate information management and sharing. (DHS, 2005)

Pandemic and All-Hazards Preparedness Act

President Bush signed the Pandemic and All-Hazards Preparedness Act into law in December 2006. (Bush, 2006) This act is focused on improving public health and hospital emergency preparedness, and consolidates authority for the NDMS, the Medical Reserve Corps, the Strategic National Stockpile and other public health preparedness efforts under the new Assistant Secretary for Preparedness and Response within DHHS. Additionally, it requires the development of a National Health Security Strategy in 2009 for coordinated public health preparedness and response measured against evidence-

based benchmarks. Other notable requirements are the establishment of a nationwide, near real-time electronic system to share critical public health and medical information using an interoperable network of information management systems, and the requirement of the Secretary to award grants directly to hospital and healthcare facilities to improve surge capacity and to enhance community and hospital preparedness. This law could prove to be the most significant development to date in the advancement of overall hospital emergency preparedness, in addition to specific CIR linkages among hospitals, if all initiatives are fully implemented.

Joint Commission on Accreditation for Healthcare Organizations (JCAHO)

The Joint Commission on Accreditation for Healthcare Organizations (JCAHO) is an independent, not-for-profit organization which “is the nation's predominant standards-setting and accrediting body in health care.” (JCAHO, 2004a) The Joint Commission evaluates and accredits more than 16,000 health care organizations and programs in the United States. JCAHO accreditation is essentially a seal of approval recognized nationwide that indicates an organization has met performance standards set by a board of medical professionals.

Although JCAHO has had disaster preparedness requirements for its members for many years, they were focused mainly on operational issues that could befall an institution such as loss of water or power. These requirements were significantly upgraded in January 2001 to require a full-scale hazard vulnerability analysis encompassing all hazards, whether manmade or natural, intentional or unintentional. The Environment of Care standard EC 4.10 required emergency preparedness plans to address the four phases of emergency management activities of mitigation, preparedness, response and recovery. This standard required, among other things:

- 1) the definition and integration of each hospital's role with that of the community emergency response agencies,
- 2) cooperative agreements with health care organizations within a contiguous geographic area to establish a process to share information about the emergency control centers as well as resources and assets that could be pooled in a community emergency response, and
- 3) the establishment of backup internal and external communication systems.

Environment of Care standard EC 4.20 also required a hospital to execute its plan by conducting emergency management drills. The standard required drills to be performed twice annually, with one of these drills including an influx of volunteer or simulated patients (mass casualty), and participation in an annual community-wide drill which assesses communication, coordination, and the effectiveness of the organization's and community's command structures. (JCAHO, 2001)

In December 2006, JCAHO issued proposed revisions to the Emergency Management Standards Field Review that resulted from a variety of disasters impacting health care organizations between 2001 and 2006. The revisions included the expansion of planning to develop scalable capacities, core organizational capabilities, and long-term resource management plans to manage the "variety, intensity, and duration of disasters that may actually be encountered." (JCAHO, 2006)

JCAHO also acts as an education and advocacy entity for healthcare organizations. In March 2003, JCAHO released a white paper entitled, "Health Care at the Crossroads: Strategies for Creating and Sustaining Community-wide Emergency Preparedness Systems". This document was meant as a "call to action for those who influence, develop or carry out policies that will lead the way to resolution of the issue." (JCAHO, 2003) In this paper, JCAHO explained that the concept of community-wide preparedness is new to most health care organizations as they have typically operated in isolation, and their disaster plans reflect this mindset. JCAHO recognized that hospitals had been asked to step up their level of emergency preparedness involvement,

but countered that it was occurring at a time when severe resource constraints are prevalent and most hospitals cannot manage current day-to-day patient care demands. (JCAHO, 2003)

JCAHO's assertion was that 9/11 and the anthrax attacks highlighted new fundamental needs for emergency preparedness that required leadership and coordination at the community level which previously did not exist. "In most communities, there is no team, nor teamwork, among public health agencies, healthcare provider organizations, and other municipal and county leaders. And, there is no community emergency preparedness plan, nor program, nor system". (JCAHO, 2003)

Many hospitals and even more emergency departments closed over the past two decades as public policy reduced the installed capacity of the U.S. health care delivery system. The American Hospital Association (AHA) reported that there were 900 fewer hospitals in 2002 than in 1980. However, demand for services had not diminished; therefore, many hospitals are experiencing critical shortages of personnel, space, and resources. Most hospitals and emergency rooms are chronically overcrowded and are likely to be diverting patients on any given day, absent any external disaster. (The Lewin Group, 2002) The hospitals that remain open face ever shrinking operational profit margins, a loss of qualified medical personnel, and an increasing naivety by the public and political communities that hospitals are adequately preparing for terrorism events and catastrophic casualty loads. (Barbera et.al., 2002)

The Joint Commission white paper lampooned the "much ballyhooed" billions of federal dollars being poured into antiterrorism efforts. It maintained that very few of these funds are trickling down to the local community level, with most hospitals having yet to see "their first nickel" of federal terrorism preparedness money. (JCAHO, 2003)

The white paper outlined recommendations based on JCAHO's Public Policy Initiative, which included roundtable discussions and national symposia with those who

have had experience with recent, large disaster events.. The first key idea was to facilitate community-based emergency preparedness instead of organization-focused approaches of the past. The second set of recommendations identified the need for a definition of surge capacity at the federal or state level, so that there can be an effective communication of needs within and across communities. Supplies should be stockpiled to anticipate stand-alone capacity for 48-72 hours, and mutual aid agreements should be established among community hospitals and other health care organizations. This latter set of recommendations held information management as key. The creation of redundant, interoperable communication systems and centralized community-wide patient locator systems was considered critical.

The third set of recommendations involved the establishment of accountability and oversight of community preparedness systems. JCAHO called on the federal and state governments to provide adequate and sustainable funding for hospital emergency preparedness planning and to assure that these funds actually reach the local level. JCAHO clearly delineated the absence of, and need for, research on the development of standards to actually measure community readiness for emergencies, and for templates and models for what constitutes acceptable community emergency preparedness. Existing best practices and lessons learned should be distributed in a standardized form to community organizations, hospitals, and other affected organizations.

JCAHO asserted that hospitals usually still fulfill their mission to treat and protect patients in the face of dire circumstances, but this has been based on the tenacity and resourcefulness of the hospital staff rather than on prepared and planned responses to disaster. They outlined these recommendations and needs from the health care community perspective in issuing a “call to action” to the Federal government and state governments across the country. JCAHO clearly believed that while much has been touted, little has been actually done to increase the nation’s capacity for response to

disasters and that the country was again becoming complacent to the threat of terrorism. JCAHO closed its paper by stating that, "This country should not need another major disaster in order to understand the degree of its vulnerability. The time to begin to develop true emergency preparedness capabilities across America's communities is now". (JCAHO, 2003)

Subsequent to the white paper, JCAHO conducted a study to assess changes in bioterrorism preparedness linkages between hospitals and key community entities before and after 9/11. A self-administered questionnaire was sent to all hospitals due for accreditation in April-May 2001 and then those due in May-June 2002. Data was gathered on hospital-specific emergency management plans for bioterrorism, hospital perception of community-wide bioterrorism emergency management plans, hospital perception of community coordination, and hospital demographic information. 68 hospitals participated in 2001 and 97 in 2002. Planning-related indicators showed the greatest improvement, while items related to equipment, electronic information sharing, and training showed the least improvement. (Braun et. al., 2004)

In 2004, JCAHO and the George Washington University Institute for Crisis, Disaster, and Risk Management conducted a follow-up to the 2001/2002 study. Hospitals self-reported their prevalence and breadth of participation in community-wide planning based on the examination of 17 basic elements in a weighted analysis. The assessment found that hospitals self-reported substantial integration, but that relationships between hospitals and other critical response agencies were still not sufficiently robust. (Braun et. al, 2006) The limitations of both the JCAHO studies are that they focused only on hospitals and their perceptions of community linkages, with no cross-correlation to the linked community organizations.

Conclusions and Opportunities to Strengthen CIR Linkages among Hospitals and EMAs

From reviewing the literature, the following can be said about multi-organization response to disasters, information and communication technology usage by EMAs, and hospitals' roles in community emergency response:

- Large increases in funding and importance surrounding mass casualty response have occurred since 9/11/2001, but CIR linkages remain less than optimal.
- Federal policy initiatives aimed at improving mass casualty response have not been fully implemented or effective to date.
- CIR linkages among emergency management agencies and area hospitals have been shown to be critical to response, but ineffective during recent mass casualty events or drills.
- No entity has responsibility for assisting hospitals in obtaining resources or maintaining operations during a crisis.
- Hospitals across the country are operating at or near surge capacity and could be easily overwhelmed in a mass casualty event.
- Geographical information systems have been shown to improve information management and the ability to communicate information within and between organizations.
- Internet-based technologies can be useful during a mass casualty event and should not be assumed to become non-functional as landlines and cell phones typically do.
- The need for evidence-based research to produce useful emergency management models and templates is well-recognized.

Specific findings that could be used to strengthen CIR linkages among hospitals and EMAs towards improved mass casualty response include:

- Community-wide organizational response to disasters is best characterized and modeled as a complex organization.
- Larger communities tend to have more problems with organizational structure and linkages than small communities.
- Local communities should be the lead organization in disaster response and should plan to be on their own for a minimum of 72 hours.

- Experienced organizations plan for capabilities while inexperienced organizations plan for events.
- Emergency managers and decision-makers are quickly overwhelmed with information during emergencies, leading to information overload and ineffective decision making.
- Emergency management is the most-spatially oriented of all management sciences and can benefit greatly from computer tools that display maps and relational databases.
- Establishing relationships prior to a crisis improves response and coordination.
- Incorporating daily operations into planning efforts improves response and coordination.
- Organizations working within a similar service delivery area are in a constant competition for resources. Lack of resources during an event forces inter-organizational linkages, but this is much more efficient when developed and planned for pre-event.
- Hospital response as a system is more critical to effective medical care during a crisis than individual hospital response.
- Each hospital in a local area has capabilities and resources that are unique.
- Uncontrolled allocation of casualties to hospitals leads to inefficient hospital response and lives lost.
- Efforts are underway to improve patient tracking systems using GIS.
- Hospitals generally implement only measures required by law or JCAHO.
- Interoperable communication “means” are not the answer to the communication problem; improving the flow of information is the solution.
- Most common, currently used communication methods, such as phones and radios, are a one-to-one or one-to-many communication method which restricts communication and the distribution of information.

Strong CIR linkages can then be summarized to result from the following behaviors:

- ✓ An institutional commitment to emergency planning and preparedness;
- ✓ Planning with an all-hazards approach and for common response capabilities, such as communication, information sharing and management, and resource acquisition;

- ✓ Pre-event collaboration and coordination of responding agencies through:
 - coordination of written plans and hazard analyses,
 - establishment of interpersonal relationships prior to actual response,
 - use of common language/lingo/structure during response, and
 - development of interoperable and redundant communication methods.
- ✓ Use of web-based information management systems such as GIS which:
 - improve response providing many-to-many communication methods,
 - reduction of “information overload” on participants in the crisis, and
 - improved accuracy and timeliness of information transfers.

In order for these behaviors to be accepted as best practice by EMAs and hospitals, they must be institutionalized through inclusion in future policy initiatives, laws, and accreditation processes, as occurred recently in the “Pandemic and All-Hazards Preparedness Act” and recent changes to JCAHO standards. Further acceptance will also occur as evidence-based best management practices are developed and case studies are disseminated that encourage and support these behaviors. (Auf der Heide, 2006) It is important that the Federal government base future funding and policy initiatives on such evidence-based scientific research instead of anecdotal information. A significant national improvement would be a single, standard, web-based information management tool that could be used by all EMAs and hospitals across the country to improve CIR linkages and response. However, CIR linkages will only improve if all levels of government recognize hospitals as critical infrastructure with special needs and ensure they are a key partner for all community emergency planning efforts.

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CHAPTER III

ASSESSMENT OF CURRENT COMMUNICATION, INFORMATION, AND RESOURCE MANAGEMENT LINKAGES AMONG HOSPITALS AND EMERGENCY MANAGEMENT AGENCIES

Introduction

Considerable resources have been expended over the past few years to improve the nation's capacity to respond to terrorist acts, such as 9/11 or the anthrax attacks, and to natural disasters and epidemics, such as Hurricane Katrina, SARS, and Avian Influenza. Emphasis has been primarily on improving the response of traditional governmental "first responders", such as fire, law enforcement, and EMS personnel that respond directly to the scene of an incident. Only recently have hospitals been recognized as first responders or "first receivers", and included in these initiatives. (OSHA, 2005).

Recent mass casualty events have illustrated that the demand for health care can quickly overwhelm the ability of hospitals to respond. At the same time as attempting to handle large influxes of new patients, they must continue to protect and treat the patient population already in-house, since hospitals cannot readily be evacuated. Thus, it is crucial that community hospitals be supported by local emergency agencies in a disaster and receive special attention during emergency planning efforts. Pre-establishing communication, information, and resource management linkages with area hospitals benefits the emergency management agency by allowing for the proper assignment of the injured to a medical facility to optimize the local medical system and by ensuring that local hospitals continue to function. (Auf der Heide, 1989) "In considering the consequences of disasters for communities, hospitals merit special

attention thanks to their complexity and occupancy characteristics and thanks to their role during disaster situations.” (Arendt and Hess, 2006)

One possible reason for the historical lack of focus on hospital preparedness and coordination with other local response agencies is that the U.S. has been very fortunate in historically experiencing low casualty rates during disasters. However, the recent mass casualty components of 9/11 and then Hurricane Katrina have now brought this lack of coordination with hospitals to the forefront. (Wachtendorf, 2002) The importance of linkages among EMAs and hospitals could not have been more fully, and more tragically, illustrated than in New Orleans in the days following Hurricane Katrina. It is imperative to learn from these mistakes and affect improvements in our nation’s emergency preparedness. (Montgomery, 2005; Davis, 2006; Arendt and Hess, 2006; GPO, 2006)

Recently in much of the country, state and local EMAs have begun gathering information from hospitals, such as bed availability, diversion status, and isolation room availability, to determine surge capacity. However, most EMAs have not yet recognized the differing hospital capabilities that could be critical in effective response to a mass casualty event, particularly one involving weapons of mass destruction (WMD) or hazardous materials. Information about specialties (e.g., burn, infectious diseases) that match the way patients are triaged at a scene (e.g., vaccination status of personnel at a hospital, pharmaceutical stockpiles, decontamination capabilities, amount of personal protective equipment on hand, ability of staff on site to provide decontamination) could mean the difference between sending casualties to the right facility and sending them to a facility where they will not only be treated ineffectively, but the hospital staff themselves would be in peril.

A number of electronic information management systems, such as WebEOC, Eteam and Reddinet, have been developed to organize this information and assist EMAs

with protecting critical community infrastructure during a mass casualty event. While an important step, many of these systems are being used solely by the EMA or only during an actual emergency, but not for planning purposes. There is usually no real-time information exchange with medical facilities on their status or needs, nor can the hospitals gain access to the information contained in the system. (EmerGeo, 2006; Eteam, 2007; Welsh, 2003; HASC, 2004)

The many directives and initiatives underway at the federal, state, and local levels as well as the applicable body of academic research provide ample evidence of the need for improvement in coordination between EMAs and hospitals. Several studies were recently published that attempt to assess communication linkages or information management practices in cities across the country. (Braun et. al., 2006; DHS, 2007). For example in 2004, representatives from the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) and the George Washington University Institute for Crisis, Disaster, and Risk Management conducted a nationwide survey of hospital integration into community emergency preparedness planning. (Braun et.al, 2006) A questionnaire was sent to a random sample of 1,750 medical-surgical hospitals in the U.S. resulting in a 33% response rate. Hospitals self-reported their prevalence and breadth of participation in community-wide planning based on the examination of 17 basic elements in a weighted analysis. The assessment found that hospitals self-reported substantial integration, but that relationships between hospitals and other critical response agencies were not sufficiently robust. Additionally, the Department of Homeland Security released in January 2007 its "Tactical Interoperable Communications Scorecards" for 75 urban/metropolitan areas in the U.S.; however, it evaluates interoperable communications only within governmental agencies, but not with other community organizations such as hospitals. (DHS, 2007)

While previous studies are important in understanding the current state of CIR linkages in communities, they have been limited in that they gathered information from either hospitals or emergency response organizations, but not both. As Yin states, “Suppose you want to study a single organization. However, your research questions have to do with the organization’s relationship to other organizations. Such questions can only be answered if you collect information directly from other organizations and not merely the one you started with. If you complete your study by examining only one organization, you cannot draw accurate conclusions about inter-organizational partnerships”. (Yin, 2003)

The DHS study focused primarily on gathering information about what physical communication processes are in place, not on determining relationship or organizational issues. As evidenced during Hurricane Katrina, having the physical ability to communicate does not necessarily mean effective communication will occur; a hospital must know who to communicate with and what information to impart. For example, a local hospital in Metairie, Louisiana had cell phone capabilities but did not know initially how to call the local or state EMA or Federal Emergency Management Agency (FEMA) in order to alert officials that they had patients that could not be evacuated. Even when the hospital was finally able to contact FEMA, all levels of EMA insisted that the hospital was closed and everyone had been evacuated. By the time the problem was rectified and assistance was provided, hospital staff had been on duty for more than a week, working around the clock and giving what little food they had on hand to patients to keep them alive. A number of larger hospitals in New Orleans experienced similar circumstances. (Arendt and Hess, 2006; Maher, 2005; Montgomery, 2005).

Study Methodology

The research described in this paper attempted to gather information from multiple sides of the communication paradigm operating in the same city to compare responses on management methods as well as perceived strengths and weaknesses. The primary study objective was to determine whether improvements are still needed in CIR linkages among a community's EMAs and hospitals, even though massive amounts of funding and activity have recently been directed at the problem. An additional objective was to assess whether visual web-based technologies could be one potential way to realize these improvements. To achieve these objectives, a survey was developed and administered to EMA and hospital professionals in ten major metropolitan areas across the country.

Major metropolitan cities were chosen as the unit of analysis for a number of reasons. Most literature sources and major national policy initiatives, such as Metropolitan Medical Response System (MMRS) and the National Response Plan, agree that the first 72 hours of a disaster should be managed at the local level. (O'Leary, 2004; MMRS, 2004; DHS, 2004) The majority of medical response will also occur in these first few hours, with the possible exception of a bioterrorism or pandemic event. (JCAHO, 2003; Duncan, 1995; McHugh et al, 2004; DHS, 2004)

Major metropolitan cities were also chosen as the unit of analysis because of the complexity of organizational relationships present in these locations. These areas typically have both a local EMA as well as a branch of the State EMA, and may possibly have a county or regional EMA as well. The literature has shown that confusion is typical as to which agency has governance, or the actual decision-making authority, in an event. (Erich, 2003; GPO, 2001; Wright, 1976; DHS, 2007) Additionally, metropolitan areas generally have multiple hospitals of varying sizes and capabilities. Surveys have shown that the level of coordination with local and state EMAs is correlated with the size

of the responding hospital. (GAO, 2003; Braun et. al., 2006) Thus, it appears relevant to include information and opinions from both larger and smaller hospitals within each city (as defined by number of beds). Moreover, larger cities are the focus of this research because they: 1) are perceived to be more likely to be a terrorist target, 2) would have a larger number of casualties due to population concentration, 3) involve multiple hospitals and multiple EMAs so multi-organizational coordination becomes more important, and 4) have been the beneficiary of greater funding from the major national policy initiatives and grant programs to improve response and coordination. The Department of Homeland Security recognized the importance of “jurisdictions” or cities as the central and most important unit for emergency planning in the “Prevention Guidelines for Homeland Security”. (DHS, 2003)

Ten cities were included in this research by dividing the country into five geographical regions and randomly choosing two cities within each geographical region. Regional divisions are shown in Figure 3.1.

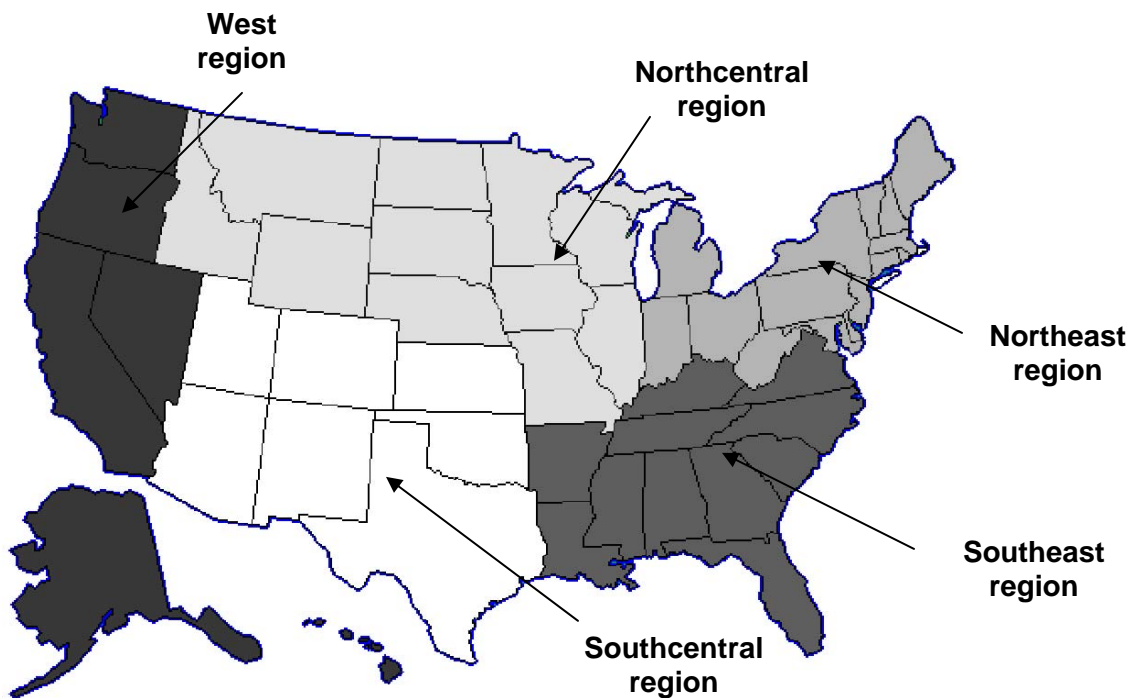


Figure 3.1. Regional Divisions for Research Study.

All hospitals within each city were included in the sample population. The local EMA office, any county or regional EMA that could be identified, and the appropriate State EMA were also included in the survey. For security purposes, the participating cities are presented in a non-identifying format.

A separate questionnaire was developed for hospitals and for EMAs, each containing mirrored questions to allow for comparison of responses. Established and accepted methodologies and references were used to develop the questionnaires to ensure scientific validity and minimize bias. (Punch, 2003; Thomas, 1999; Dillman, 2000) Both questionnaires were piloted by three different groups and revised accordingly. Online survey software was used to program web-based versions of each of the paper surveys, developed in accordance with accepted internet survey design approaches. (Dillman, 2000)

The survey instrument was designed to obtain opinions and information concerning the organizational behaviors associated with strong CIR linkage planning and response. Accordingly, planning and response indicators and questions were developed so the following areas could be assessed:

- Organizational commitment
- Communication capabilities and linkages
- Information management
- Resource acquisition and allocation strategies

Survey Results

Of the 25 surveys distributed to city, metro, county, regional and state-level EMAs affiliated with the selected cities, eight emergency management agencies responded, representing 7 of the 10 cities and 4 of the 5 regions. Since the research project was designed to assess CIR linkages among EMAs and hospitals by comparing

and contrasting responses from both sets of organizations, cities where no responses were obtained from EMAs were removed from further consideration. Thus, surveys were sent only to hospitals in seven cities. This resulted in the distribution of 233 surveys to hospitals, with 67 being returned, representing a 29% hospital response rate. (see Figure 3.2.) The results of the study were evaluated in a number of ways and are presented in the following discussion.

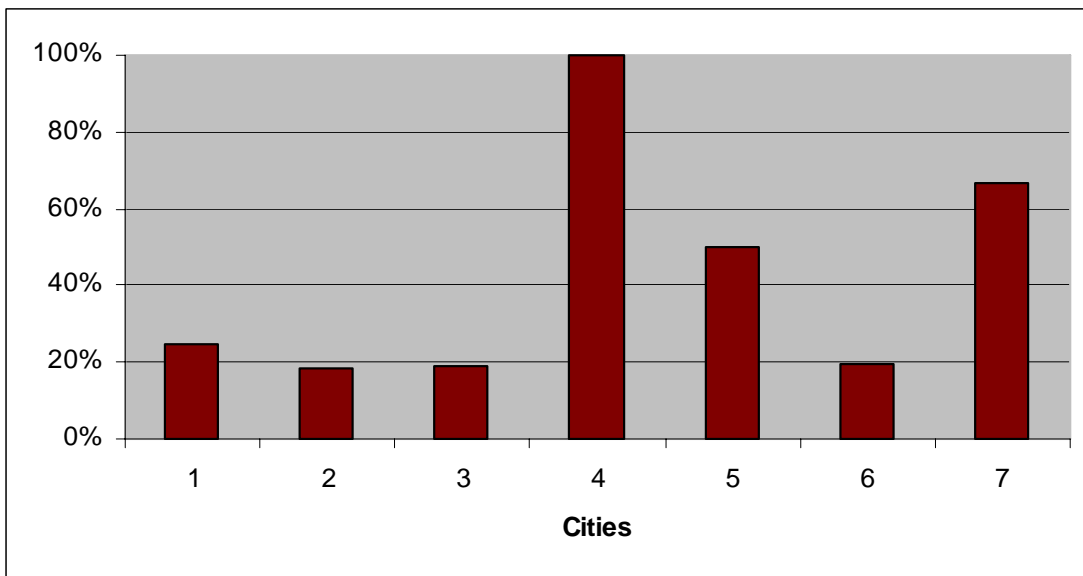


Figure 3.2. Hospital Response Rates by City.

EMA Organizational Representation

Although the EMA respondent population size is small (n=8), it is important to recognize that this study was not meant to be representative of all EMAs across the country, only of those with relationships to the cities of interest. It is interesting to note, however, that of those that responded, four were city or metro-level EMAs, three were county/regional-level EMAs and only one was from a state-level EMA. All but one knew there was a group other than their agency that coordinated hospital emergency planning

and response in their city. Also, a majority stated that there was a specific individual within their organization responsible for emergency planning or coordination with area hospitals, although most of these positions are only part-time.

Hospital Organizational Representation

The typical measure of the size of a hospital is the number of beds it contains. Hospitals in all seven cities had between 12 and 1,435 beds with a mean size of 354 beds, while the hospitals responding to the survey had bed sizes ranging between 25 and 1,225 beds and averaged 390 beds. A between-subjects t-test assuming equal variances was performed on hospital data from each city to test statistical difference between the means of the bed size data from the sample and the overall hospital population in each of the seven cities. (DeCoster, 2006; Moore and McCabe, 2003) It was found that the mean bed size for hospitals responding to the survey was not statistically different from the mean bed size of hospitals that were sent questionnaires in each city, based on a 95% confidence level and two-tailed test (with t-values ranging from 1.96 to 2.23 and p-values ranging from 0.27 to 1.0). Thus, the hospital responses can be considered representative of all hospitals, respectively, in each city.

Survey Results by City

Survey results for each city are summarized in Tables 3.1, 3.2, and 3.3. Table 3.1 describes the general characteristics of the respondents from each city. Tables 3.2 and 3.3 qualitatively assess emergency planning indicators as well as response to a mass casualty event or drill in relation to behaviors that result in strong CIR linkages among EMAs and hospitals. The seven participating cities are numbered to prevent identification. Specific findings of interest are discussed following presentation of the summary tables.

Table 3.1. General Response Characteristics by City.

Characteristic of Respondents	1	2	3	4	5	6	7
Hospital Response Rate	25%	18%	19%	100%	50%	19%	67%
% of available beds represented	32%	28%	15%	100%	42%	28%	78%
Average bed size range	501-750	251-500	251-500	251-500	101-250	251-500	251-500
% of respondents who are Trauma Centers	75%	75%	30%	27%	28%	46%	70%
% of respondents who are JCAHO-accredited	100%	100%	100%	100%	86%	100%	90%
Does EMA have a hospital coordinator?	Full-time	Full-time	No response	Part-time	Part-time	Part-time	None
Do hospitals have emergency planners?	50% PT 25% FT 25% None	75% PT 12.5% FT 12.5% None	66% PT 33% FT	45% PT 27% FT 27% None	57% PT 29% FT 14% None	55% PT 45% FT	90% PT 10% FT

FT = full-time; PT = part-time

Table 3.2. Emergency Planning Indicators by City.

Emergency Planning Indicators	1	2	3	4	5	6	7
Third-party organization coordinating hospital response other than EMA	Yes	Yes	No	Yes	Yes	Yes	Yes
Written plans organized by capabilities needed to respond to mass casualty events	Poor	Excellent	Good	Excellent	Good	Excellent	Good
Written plans address: - communications - information management - resource management	Excellent Excellent Excellent	Excellent Excellent Excellent	Excellent Excellent Excellent	Excellent Excellent Excellent	Excellent Excellent Excellent	Excellent Excellent Excellent	Excellent Excellent Excellent
Written plans/vendor agreements address competition for resources by hospitals	Poor	Fair	Fair	Fair	Fair	Fair	Fair
Written plans incorporate Incident Command System (ICS)	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent	Excellent
Level of plan coordination with - EMA - other area hospitals	Excellent Excellent	Excellent Fair	Excellent Good	Excellent Good	Excellent Fair	Good Fair	Excellent Good
Routine interactions with - EMA - other area hospitals	Excellent Excellent	Excellent Excellent	Excellent Good	Excellent Excellent	Excellent Good	Excellent Good	Excellent Excellent
Degree of hospital involvement in LEPC	Excellent	Good	Good	Fair	Good	Good	Excellent
Frequency of routine status update exchanges with - EMA - other area hospitals	Excellent Excellent	Excellent Fair	Good Fair	Excellent Good	Excellent Good	Excellent Good	Excellent Excellent
EMA and hospital agreement on community hazards and risks	Excellent	Poor	Good	Excellent	Excellent	Fair	Poor
Hospital use of geographical information systems (GIS)	Good	Poor	Poor	Poor	Poor	Poor	Poor

Excellent = 75% - 100% of hospitals responded positively to indicator
 Good = 50% - 75% of hospitals responded positively to indicator

Fair = 25% - 50% of hospitals responded positively to indicator
 Poor = 0% - 25% of hospitals responded positively to indicator

Table 3.3. Emergency Response Indicators by City.

Emergency Response Indicators	1	2	3	4	5	6	7
Timeliness and accuracy of information provided by EMA about event	Poor	Good	Fair	Excellent	Excellent	Good	Good
Frequency of status update exchanges with - EMA - other area hospitals	Poor Poor	Good Fair	Fair Fair	Good Good	Excellent Fair	Excellent Fair	Good Good
Use of hospital status updates to route casualties during event	Poor	Fair	Fair	Poor	Poor	Good	Good
Degree of inter-hospital communication and coordination during event	Fair	Fair	Fair	Good	Fair	Good	Good
Adequacy of resource acquisition and management during event	Excellent	Excellent	Poor	Excellent	Excellent	Good	Good
Adequacy of written plan and staff training	Excellent	Excellent	Fair	Excellent	Excellent	Good	Excellent
Adequacy of decontamination capabilities	Excellent	Excellent	Fair	Fair	Good	Good	Fair
Use of information management systems	Good	Good	Fair	Fair	Fair	Good	Fair
Interoperability of communication systems used during event	Fair	Fair	Fair	Fair	Fair	Good	Good
Breadth of information exchanged about hospital status during event	Fair	Good	Good	Fair	Fair	Excellent	Good
Highest priority for improvement in response coordination among EMA and hospitals	Info accuracy Casualty routing	Communication	Interoperable Information Management	Mass Decon Abilities	Hospital Interoperability	Communication	Communication

Excellent = 75% - 100% of hospitals responded positively to indicator
 Good = 50% - 75% of hospitals responded positively to indicator

Fair = 25% - 50% of hospitals responded positively to indicator
 Poor = 0% - 25% of hospitals responded positively to indicator

Overall institutional commitment indicators among hospitals were strong, with 89% of respondents stating that there was a specific individual within their organization responsible for emergency planning. Of hospitals with an identified emergency coordinator, 70% of these individuals were part-time, with the remainder being full-time emergency coordinators. All responding hospitals had a written mass casualty response plan that incorporated the Incident Command System. The majority of respondents stated that their plan addressed CIR linkages and had been coordinated with their local EMA.

Most hospitals reported participating in their Local Emergency Planning Committee (LEPC), and 90% participated in community emergency planning groups other than the LEPC. 98% periodically conduct drills to test preparedness for mass casualty events. Dedicating staff time to focus on emergency planning, write plans, and participate in community planning groups as well as resource expenditures to conduct drills are all indicators of an institutional commitment to mass casualty preparedness and effective response.

As shown in the tables, hospitals responded more negatively to indicators concerning actual community response to a mass casualty event or drill. Most hospitals felt they had adequate resources to respond to the event, their written plan was sufficient, and hospital staff were well-trained. However, a number of hospitals did not believe they received accurate, timely or sufficient information from the EMA during event response. The degree of inter-hospital communication and coordination was consistently rated only fair to good, and the majority of hospitals stated that any status updates they did provide were not used to improve casualty routing during the event. The majority of hospitals expressed that they had the same priority concern, which was to improve communications.

City 5 was recognized as an exemplary practice by displaying positive relationships and linkages among the various emergency management agencies in the city as well as by the high level of coordination evident in responses by the city's hospitals to indicators concerning actual emergency response. Of the seven cities included in the study, the City 5 hospital community was the only one that challenged the author's identity due to security concerns. This led to a lengthy personal correspondence with both the city and county EMA representatives as well as several of the hospital representatives. From this and the survey results, it was clear that the hospitals and both levels of EMAs have an active working relationship. Additionally, a close working relationship exists between these two local EMAs. The City 5 EMAs have long-recognized and acted upon a number of the strengths in emergency planning and have implemented two types of unique EMA linkage-building organizations that have been recognized throughout the country as a best practice. (DeYoung, 2006; NGA, 2005; FNS, 2006) City 5 was further developed into a case study that is discussed in a subsequent chapter.

A number of cities had conflicts between the EMA responses and the hospitals responses which were not captured in the summary tables presented. Even though the hospitals in several cities responded positively that they had received accurate and timely information from the EMA, the EMA disagreed that they had received accurate and timely status updates from the hospitals, although such information had been requested. Additionally, the EMAs and hospitals tended to have conflicts in identified hazard prevalence within the community, communication methods used during event response, and use of GIS.

Hazard Evaluation Results

The survey asked respondents to identify what natural and manmade hazards were perceived to imperil their community. While it has been shown that planning for response capabilities that could be used in any response to any hazard is the most effective for successful emergency response, this question was included to determine whether EMAs and hospitals had worked together in analyzing their community's hazard vulnerabilities. Additionally, a hazard vulnerability analysis is important to ensure that an organization's planning efforts will be sufficient to respond to any known natural or man-made hazards and corresponding issues. For example, a community could do an outstanding job of planning for response capabilities in all-hazard planning. However, because they would need specialized equipment, training, and knowledge to properly respond to a radioactive materials release from a nearby nuclear power plant, the community's response organizations would need to specifically plan for this response in addition to all-hazard planning efforts.

As reported in the city summaries, there were a number of communities wherein the indicated hazards were highly variable throughout EMA and hospital responses. This indicates both a lack of coordination in planning among organizations in a community, as well as insufficient planning if all organizations in a community have not planned to respond to similar sets of hazards. As an example of this variability, the results from surveys returned by the EMA and hospitals in City 7 are shown in Table 3.4. Areas of inconsistency are highlighted in red showing the disagreement prevalent in this community. The lack of consistency in recognizing potential hazardous materials events is of particular concern.

Table 3.4. Most Prevalent Natural Hazards, Manmade Hazards, Threats, or Terrorist Targets as Reported by City #7 Respondents.

Hazards Reported Consistently by City 7 Respondents	Hazards Reported Inconsistently By City 7 Respondents
Natural Hazards	Natural Hazards
Earthquakes	Winter Storms
	Other
	Floods
	Landslides
	Tsunamis
	Hurricanes
	Tornadoes
	Wildfires
	Extreme Heat
Manmade Hazard/Threat/Target	Manmade Hazard/Threat/Target
Seaports	Nuclear Power Plants
Ferries	Dams
Large Sporting Events/Venues	Power Plants
Large College or University	Potential for other terrorist activities
Bridges	Other
Waterways	Potential for radioactive releases
Water Treatment Plants	Chemical Manufacturing Plants
Military Installations	Chemical Storage Facilities
Commuter Trains/Train Stations	Potential for chemical releases
	Potential for biological releases
	National Defense Laboratory
	Subways

Communication Methods and Information Transfer during Mass Casualty Events or Drills

The questionnaire assessed the most prevalent methods used by EMAs and hospitals to communicate with each other during mass casualty events and drills as well as the types of information that were transmitted during these communications. To improve CIR linkages among EMAs and hospitals, it is important to understand “how” they are currently talking to each other and “what” they are telling each other during current event response. Interoperable communication methods are needed so that the

organizations can physically talk to each other, but that alone is not sufficient. Strong response will only occur if the information being transmitted is timely, accurate, and of sufficient quality.

All EMAs stated that they communicated with area hospitals during their last event or drill, while 84% of hospitals reported communicating with either their local EMA or other local hospitals. The most prevalent communication methods used are presented in Figure 3.3.

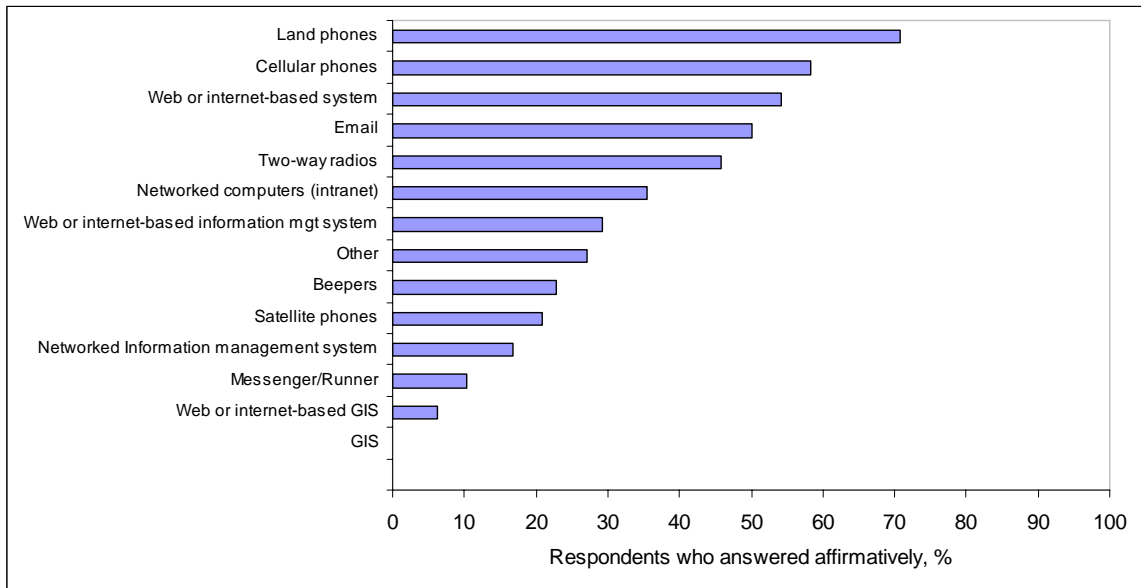


Figure 3.3. Inter-organizational Communication Methods.

Figure 3.4 illustrates the type of information currently being transmitted from the hospital to the EMA during a response to a mass casualty event or drill. Since the amount of information needing to be transmitted grows as an event evolves, the use of information systems (such as GIS) increases in importance, as to enable larger quantities of information to be transmitted quickly and accurately. It would be difficult during a mass casualty event to provide such information on a hospital’s status via

phone, which is the most popular means of communication currently being used. It would be even more difficult for an EMA to quickly and accurately manage the amount of information pouring in by phone from dozens of hospitals without being quickly overwhelmed. Thus, electronic information management systems become crucial to a strong community response.

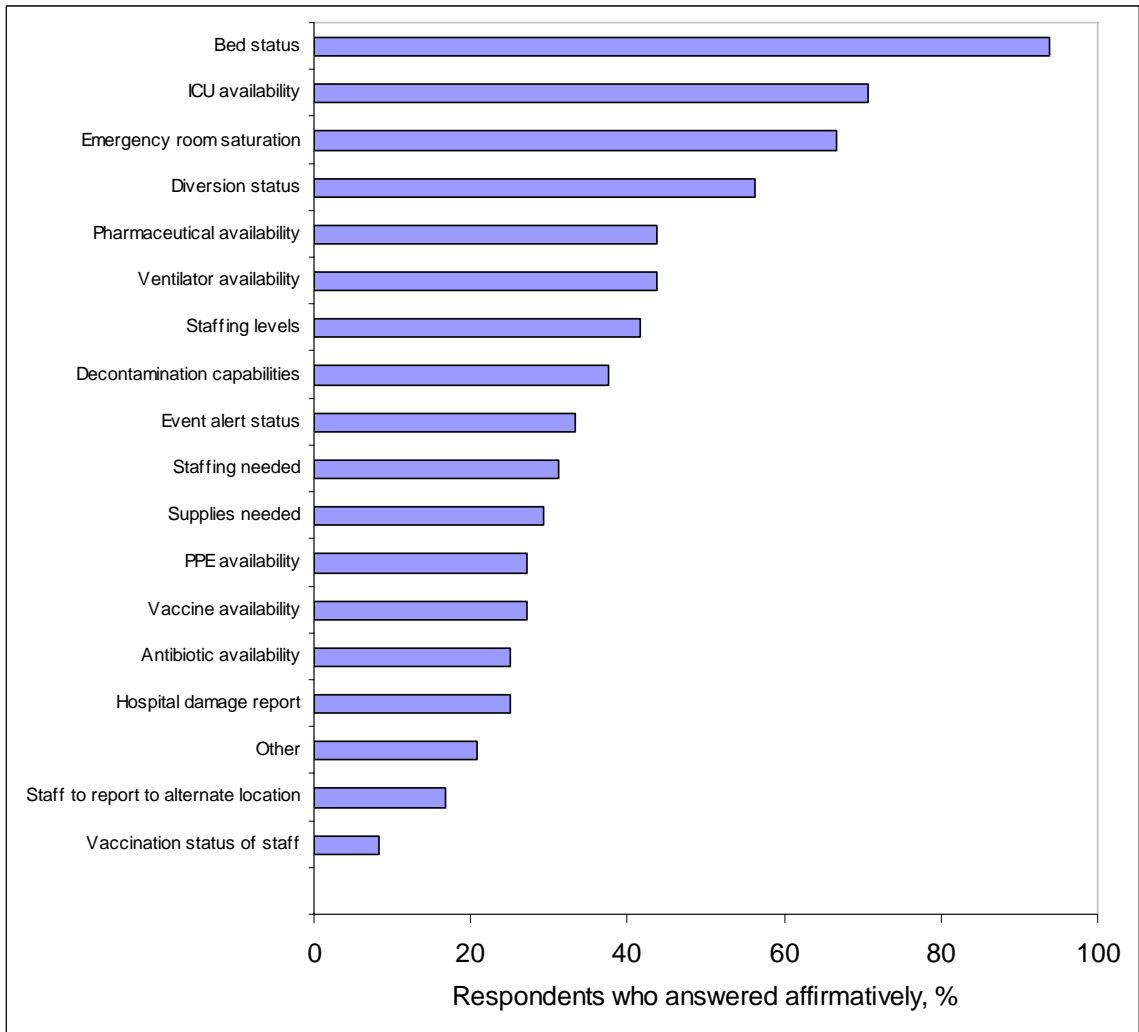


Figure 3.4. Types of Information Provided by Hospitals to the Local EMA or Other Area Hospitals.

Information Technology and GIS Usage

The survey also included questions to ascertain the current level of usage of electronic communication and information management systems, particularly GIS, in emergency planning and response by both EMAs and hospitals. All responding EMAs were already using GIS for at least one application, with GIS being used for hazardous materials release plume modeling, damage assessment, evacuation modeling, and flood mapping. Less than half of the EMAs reported using GIS with applications specific to hospitals, including hazard vulnerability analyses and capacity planning for hospital staff and equipment.

Unfortunately, the vast majority of hospitals were either not using GIS (70%) or did not know whether they were using GIS (20%). Thus, the majority of hospitals would need to purchase a GIS platform and then be trained in its use for this information technology to become a viable communication option and information management system for both EMAs and hospitals. On a positive note, a number of EMAs and hospitals reported using web-based information systems such as WebEOC, ETeam or ReddiNet from third-party vendors. A visual GIS component targeting hospitals and supporting suppliers would significantly enhance these systems, and overall CIR linkages, with minimal additional cost and training.

Study Conclusions

Survey findings support the conclusion that improvements are still needed in CIR linkages among a community's EMAs and hospitals, even though massive amounts of funding and activity have been directed at the problem, particularly since the events of September 11, 2001. While the need for improvement remains, it is noteworthy that significant progress has been made. The findings also support the conclusion that the most viable way to realize these improvements is through enhanced organizational

management strategies. The use of web-based information technologies, particularly applications that leverage GIS, represents a promising way to improve the tools needed to support decision-making by those managing mass casualty events.

A number of strengths and weaknesses in both mass casualty planning and actual response within these seven cities were also identified. Since these were common themes throughout all seven city responses, they likely represent the typical strengths and weaknesses present in planning and response in most metropolitan U.S. cities throughout the country.

SIGNIFICANT STRENGTHS:

- ✓ Planning indicators are generally much stronger and better developed than actual response indicators. Since most cities conduct more drills than actual responses to mass casualty events, this is expected.
- ✓ Hospitals are demonstrating institutional commitment to emergency response planning; nearly all had a specific individual responsible for emergency preparedness. However, most of these individuals have this as a part-time duty.
- ✓ EMAs now recognize the importance of hospitals as critical infrastructure in community emergency response and have committed to collaborative planning efforts, with most having a specific individual designated with this responsibility.
- ✓ Hospitals are having many formal and informal relationship and linkage-building opportunities with their local EMAs, resulting in high routine interaction levels.
- ✓ The Incident Command System is being used throughout EMAs and hospitals for emergency response. Thus, all responding agencies are using the same management system and terminology during response, which should reduce confusion and miscommunication.

- ✓ Most hospitals have organized their mass casualty response plans by response capabilities, which is a more effective strategy than planning by event type.
- ✓ The majority of hospitals and EMAs reported having agreements with vendors already in place to obtain additional supplies during a mass casualty event.
- ✓ Electronic communication systems are currently being used by both EMAs and hospitals during emergency response.
- ✓ All cities reported significant drill activity, averaging one per year since 9/11.
- ✓ The majority of hospitals reported communicating with the local EMA during their last event or drill.
- ✓ Nearly all hospitals reported that their personnel were sufficiently trained to be able to follow written emergency plans.

SIGNIFICANT WEAKNESSES:

- Hospitals and EMAs have not coordinated their hazard vulnerability analyses to focus planning efforts and to ensure that all known hazards and threats are accommodated.
- Mass decontamination abilities have not been fully developed in all hospitals.
- Hospitals and EMAs have not fully developed interoperable communication and/or information management systems. EMAs are using mostly one-to-one communication methods, such as phones and radios during an actual event. Hospitals reported using computer-based information technology during actual response much more frequently than EMAs.
- Resource acquisition and management is not being fully addressed and could potentially cause a critical failure of the entire response system. The competition between hospitals for resources during an actual event has been virtually ignored throughout all cities.

- When hospitals did provide status reports during response, this information was not used to route casualties to or away from their hospital. Casualty routing appears to be disconnected with information about a hospital's status.
- While hospital/EMA linkages have improved since 9/11, inter-hospital linkages are still weak and could improve so hospitals are not entirely dependent on their local EMA for information and assistance.
- Open-ended responses overwhelmingly indicated that “communication” should be the highest priority for improvement in response coordination between EMAs and community hospitals.
- Open-ended responses from every city indicated that city/state health departments or third-party hospital associations are the primary emergency planning linkage for hospitals. EMA/hospital planning linkages are possibly secondary to those established with health departments. Since the primary response agency to any mass casualty event will be the local EMA, it is uncertain whether these health planning linkages will result in strong community response to an event.

From the information gathered during the study, a diagram depicting the quality of current CIR linkages among EMAs and hospitals in a metropolitan city is provided in Figure 3.5. As shown, general CIR linkages between a community's EMA and its hospitals have strengthened since 9/11, with some specific areas of improvement still needed, such as interoperable communications and resource management. Each hospital appears to be coordinating more effectively with its area EMA and the third-party coordinating organization than it is with other area hospitals; thus, CIR linkages among the hospitals themselves appear to need significant improvement. Local EMAs reported weaker linkages with State EMAs than with area hospitals, and hospitals appeared to have very weak or non-existent linkages with State-level EMAs. Hospitals

reported strong linkages with third-party coordinating agencies, but the linkages among these agencies and EMAs were not assessed in this study.

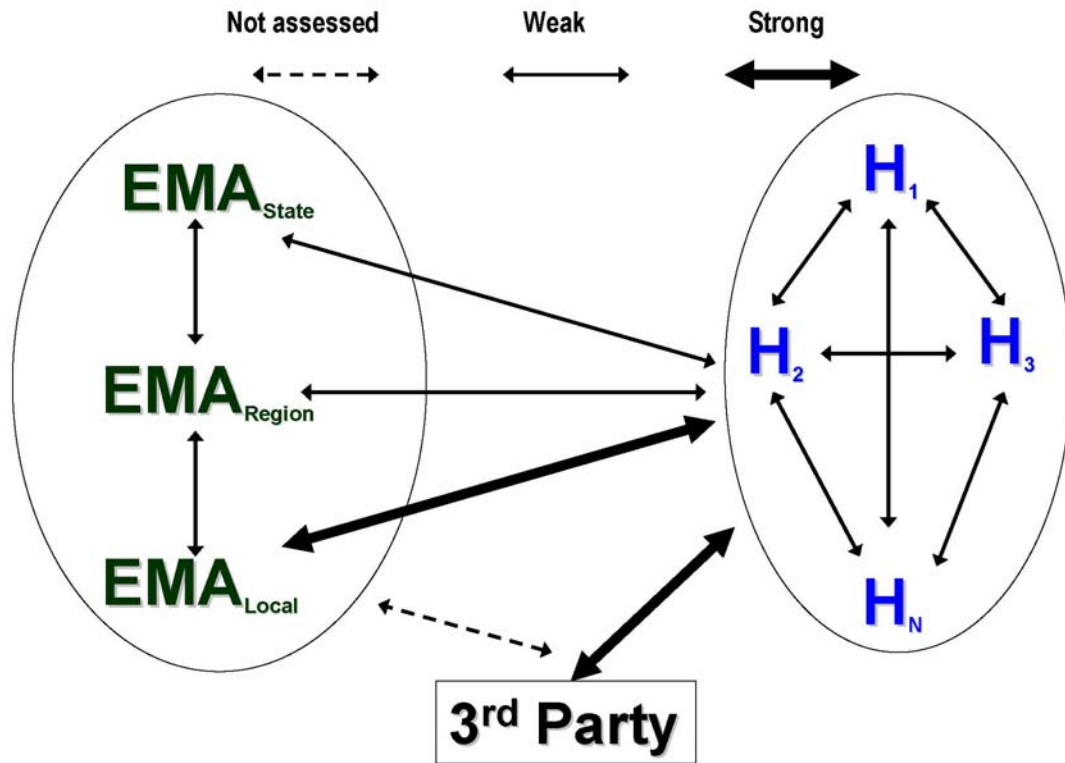


Figure 3.5. Current State of CIR Linkages among EMAs and Hospitals.

Directions for Future Improvements

The findings from this study provide a path forward for future improvements in CIR linkages. The primary recommendation that will strengthen inter-hospital and inter-EMA CIR linkages is to improve organizational management strategies that force routine pre-event interactions, relationship-building and planning coordination opportunities within the EMA and hospital communities, as well as other emergency response organizations. These strategies will encourage cooperation, trust, communication,

information sharing, coordination, and team-building both during pre-event planning and during event response. Specific improvement strategies that have been shown to be successful are planning committees, routine status update exchanges, plan coordination, and drill participation. The strategies that work may be unique to each community.

No tool will improve CIR linkages if core organizational management strategies are not sufficiently vigorous. However, the study also found that more robust and innovative systems for communication and information management should be created to support decision-making during a mass casualty event. These systems should allow all stakeholders to gather, disseminate, and view event information and status reports in real-time. While WebEOC, Eteam, and Reddinet are substantial improvements over what existed a few years ago, these systems need to become more robust, be able to handle more types of hospital status parameters, have additional visual and geographic components, and be adopted on a widespread basis by both the EMA and hospital sectors. The visual components are especially important in light of previous research findings that information systems with capabilities to visually project information allowed emergency managers to make quicker and better-informed decisions.

More robust information management systems would also improve resource management capabilities for the community as a whole, reduce the competition for resources by hospitals during events, allow for more fully developed casualty routing methods, and decrease the information overload suffered by all responders during a mass casualty event. By web-enabling these systems and allowing access by all stakeholders, communication and information quality would be substantially improved through increased accuracy and timeliness of information transfer. These systems can be supported during emergencies as most Emergency Operations Centers in EMAs and hospitals have back-up electricity generators to offset power outages. Thus, visual web-

based information technologies offer the most robust answer to the “interoperability” and “information overload” conundrums.

A successful emergency management information system should contain appropriate information attributes as well as provide interconnectivity between the various parties so that the right information is getting to the right place at the right time. One potential approach to achieve this objective is the system conceptualized in Figure 3.6, a GIS-based approach designed to improve these weak CIR linkages among EMAs and hospitals.

The system would allow for all levels of EMAs as well as all area hospitals to be connected and have access to the same information about an incident. Involved EMAs would provide routine site updates about the event, including estimated casualties, type of injuries to expect, potential involvement of hazardous materials, criminal status, and other information about the status of the surrounding community. The hospitals would provide routine information updates concerning the casualties they are receiving, any damage to the hospital, how many more casualties the hospital could handle, ongoing resource status, etc. Additionally, all entities would have access to pre-created and pre-planned data layers containing information that the EMAs or hospitals might need to obtain additional or specialized resources, vendors, or assistance.

Opportunities for further system development include optimizing and expanding this design and implementation of a pilot project in a city wherein EMAs and hospitals are already using GIS for other applications.

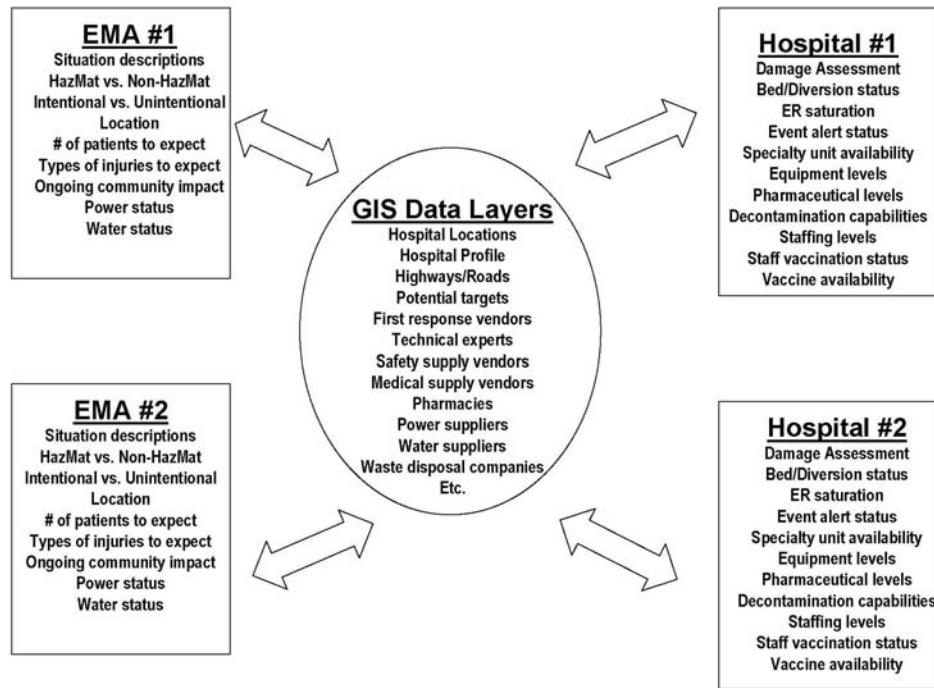


Figure 3.6. Conceptualization of GIS Design to Improve Weak CIR Linkages.

The features of best practice CIR linkages in a community have been transformed into a 10-point evaluation/audit tool, as shown in Table 3.5. This tool could be used to provide a qualitative assessment and gap analysis of the performance level of CIR linkages among EMAs and hospitals within a community. Each factor in this template is a measurable performance indicator of strong community CIR linkages that are likely to result in improved response to mass casualty events. Each performance measure should be scored as “Non-existent”, “Needs Improvement”, “Satisfactory” or “Exemplary”.

Table 3.5. Community CIR Linkage Scorecard.

	Performance Indicator
1.	Institutional commitment by key response organizations demonstrated by dedication of staff to focused emergency planning and coordination among EMA and hospital communities.
2.	Formalized committees or other interaction mechanisms between EMA staff and staff from all hospitals in community.
3.	Informal interaction opportunities: <ul style="list-style-type: none"> - within EMA community - between EMA and hospital community - within hospital community
4.	Pre-event status of interpersonal relationships among all key stakeholders in EMAs and hospitals.
5.	Development of community hazard vulnerability analysis and use by all key stakeholders in planning.
6.	Development of redundant, interoperable communication methods connecting all key EMA and hospital stakeholders.
7.	Development of large-scale information management and decision documentation mechanisms that are interconnected among all key EMA and hospital stakeholders.
8.	Community-wide planning effort for hospital resource support during mass casualty event, including pre-event planning for competition for resources by hospitals.
9.	Capability of all hospitals in community to decontaminate mass volumes of patients for hazardous materials contamination.
10.	Routine community-wide drills or practice mechanisms for multi-hospital response to mass casualty events.

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CHAPTER IV

PHOENIX, ARIZONA: THE GOLD STANDARD OF EMERGENCY MANAGEMENT LINKAGES

Introduction

In 2006, a research study was conducted that assessed communication, information, and resource management (CIR) linkages among emergency management agencies (EMA) and hospitals during mass casualty event response in seven major U.S. cities. This study evaluated whether any improvements had occurred in emergency management planning and response since the events of 9/11/01, particularly relating to hospital coordination and support during mass casualty events. An additional goal was to develop a best management practice case study focusing on a single city, recognizing that this approach considered accepted methodology in disaster research. (Valelly, 2004; Auf der Heide, 2006) Of the cities under consideration, Phoenix emerged as having exemplary communication, information, and resource management linkages, particularly among various levels of emergency management agencies. For this reason, it was selected for case study development.

Phoenix, as shown in Figure 4.1., is the country's fifth-largest city (with nearly four million residents in the metropolitan area), contains the world's sixth-busiest airport, is within fifty miles of the country's largest nuclear power plant, is one of the country's top tourist destinations, is a neighbor to the Luke Air Force Base, and is located within two hundred miles of the U.S./Mexico border. (AP, 2006b) These characteristics make it imperative that Phoenix have well-organized and fully-developed capabilities to respond to a potential mass casualty event. Additionally, Arizona has, unfortunately, had intimate connections to the two worst terrorist events on American soil, as both Timothy McVeigh

and several of the 9/11 terrorists lived in the state. While no area in Arizona was believed to be a target of these individuals, it showcases that terrorist activities are present. (Hensley, 2005; AP, 2006a) Recognizing these circumstances, Governor Janet Napolitano developed the first statewide homeland security strategy, one that: 1) identified priority projects which would protect first responders, 2) improved security of critical infrastructure such as hospitals, and 3) enhanced communications systems and overall detection/response capabilities. (Napolitano, 2003) One of these priority projects was the development of the Arizona Counter Terrorism Information Center (ACTIC) in 2004, which is discussed in detail later.



Figure 4.1. Phoenix, Arizona.

Phoenix emerged as a best practice by exhibiting positive relationships and linkages among the various emergency management agencies in the city, as well as a high level of coordination with and between the city's hospitals. From lengthy personal correspondence with both the Phoenix and Maricopa County EMA representatives as well as several of the hospital representatives, in addition to survey responses, it became clear that the hospitals and the EMAs have an active working relationship, as do the EMAs with one another. Moreover, the Phoenix, Maricopa County, and State of Arizona EMAs have long-recognized and acted upon a number of proactive emergency

planning methods, resulting in the implementation of two types of unique EMA linkage-building organizations that have been recognized throughout the country as a best practice. (DeYoung, 2006; NGA, 2005; FNS, 2006). The following discussion provides more details on these initiatives.

Phoenix Homeland Defense Bureau

The Phoenix Homeland Defense Bureau (HDB) was launched in late 2002 in order to improve and formalize operational relationships among Phoenix's Fire, Police, Public Health, and Emergency Management departments. The HDB was created to develop teams of public safety experts who could jointly assess vulnerabilities or situations so that incidents could be resolved more quickly and safely. (Kahn, 2006) While the name suggests a sophisticated center laden with the latest high-technology gadgets, the HDB is more about a concept than a physical location or equipment. HDB focuses on relationship and linkage building.

The HDB is a coalition of at least one high-ranking official from each of the aforementioned local emergency response agencies, who have physically co-located their offices into one open setting. Each representative remains a part of his/her home organization and acts as a liaison between the Bureau and their home organization. While the relationship between these agencies has historically been positive, they were confined to the street level – “interaction at emergency scenes and the occasional drop by visit for coffee”. (Khan, 2006) The HDB extends this interaction into the highest level of administration of these public agencies. Through the Bureau, assistant chiefs and police commanders are able to have daily interactions, quickly discuss situations and ideas to brainstorm solutions, and understand their partner organizations more thoroughly. This “culture shift” has occurred with a minimal economic outlay and has been seen as an extremely positive improvement by all organizations involved. (Villa,

2003; Khan, 2006) A financial investment was made to improve communications among these departments by creating interoperable systems that all could use. These interoperable systems were recently highlighted by the Department of Homeland Security in the “Tactical Interoperable Communications Scorecards” report. (DHS, 2007)

Positive relationships among these organizations were clearly evident during the site visit. In many cities, these organizations are antagonistic and turf wars prevail, primarily because the police, fire, and emergency management agencies compete for funding and primacy in their locality. However, this conflict was not apparent in Phoenix. Considerable informal, positive interaction was observed occurring among all levels of staff at the Bureau. For example, police representatives were very complimentary of their partners in the fire department and emergency management agency. Inter-agency staff eat lunch together while discussing various programs and incidents. These informal interactions and relationships have been shown to be a significant strength in emergency planning and response because communication is more frequent, information is disseminated more quickly, and decisions are made more rapidly with greater input.

While primary linkages are between the HDB and the city’s traditional emergency response organizations, secondary linkages also extend to other community programs and organizations with an important role in emergency planning and response. These linkages are shown in Figure 4.2.

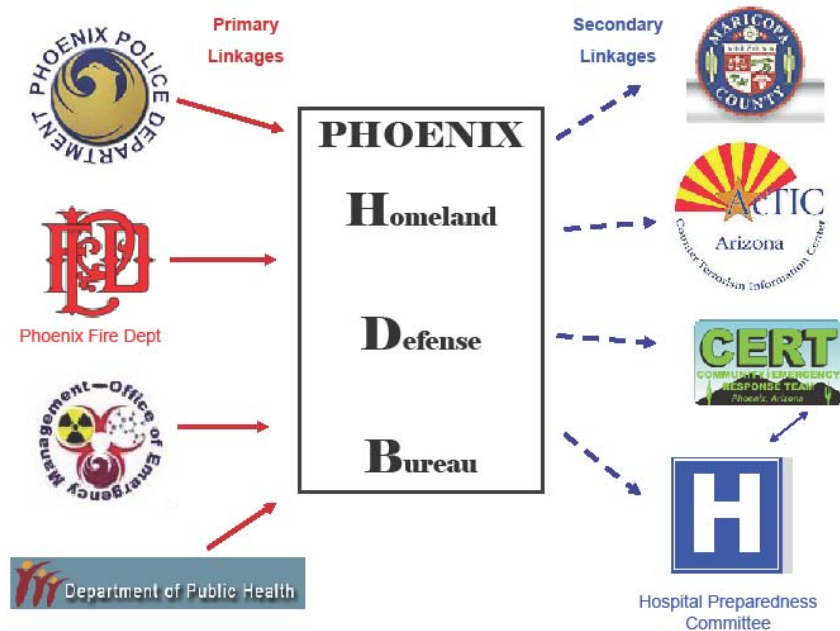


Figure 4.2. Phoenix Homeland Defense Bureau Linkages.

It should be noted that the city has developed an all-hazards response plan that is compliant with the new requirements of the National Incident Management System (NIMS). Additionally, the Bureau practices a true unified command, with the police and fire departments responding jointly to all incidents, yet agreeing on the designation of one on-scene incident commander directing both police and fire department activities. With the city's Emergency Operations Center located upstairs from the HDB, there is also a strong linkage between the Bureau and the EOC, enabling information to flow freely during an incident.

Hospital Coordination and Support

A review of aggregate survey responses for all cities indicated strong linkages between the local EMA and area hospitals, with weaker linkages evident within the hospital community itself. In Phoenix, efforts are being made to address this problem.

A hospital preparedness committee was formed by HDB several years ago so that a closer working relationship could be developed with area hospitals towards improving medical response to a mass casualty event. With the HDB representative being a registered nurse with over 20 years experience in various hospital settings, working closely with hospitals became a natural extension for the agency.

The productive work of this committee was evident both in survey responses and the site visit. Phoenix has two major healthcare systems, Banner and Abrazo. Representatives from the Abrazo indicated a very proactive approach to response planning. Banner is in the process of creating a unique, system-wide hospital Emergency Operations Center that would coordinate response among Banner hospitals and liaison with the city's EOC. If the Banner system-wide EOC proves useful in upcoming drills, the city is considering creating an all-hospital EOC that would coordinate and support all area hospitals during city-wide incidents.

Phoenix officials have also developed a strategic communication plan that includes broad representation from various public support disciplines, including thirty-six area hospitals. (DHS, 2007) This strategy supports the prioritization of communication goals so that funding can be planned accordingly.

Another innovative program implemented by HDB to support area hospitals is the development of medical Community Emergency Response Teams (CERTs). CERTs are comprised of community volunteers, often people who have some medical expertise such as EMTs, pharmacists, or retired physicians and nurses, and are an attempt to pre-organize and effectively use those volunteers in disaster situations. CERT volunteers commit to a significant amount of training, including Incident Command System and Chemical, Biological, Radiological, Nuclear and Explosives (CBRNE) response training, as well as participating in city-wide emergency drills. The CERTs are deployed to local hospitals to improve surge capacity during a mass casualty event. The Hospital

Preparedness Committee has designed the program with the teams being managed by the city's Public Health Manager and the volunteers being trained by area hospitals. Although credentialing is a problem, it is being addressed as the program evolves. The goal is to have each CERT deployed with a ham radio and trained operator, as well as their own supply cache designed to last at least 72 hours. The ultimate goal of the program is to recruit eight hundred CERT volunteers into various specialty teams.

The City of Phoenix has been innovative in improving its emergency response capabilities by embracing low-cost, non-traditional ideas such as the Homeland Defense Bureau and the development of the CERT program. These government initiatives, coupled with the innovation of the hospital community in creating the hospital preparedness committee, system-wide EOCs, and possibly all-hospital EOCs, have made Phoenix a study in best practices that any city could adopt. Primary and secondary linkages among the hospital community and EMAs in Phoenix are depicted in Figure 4.3.

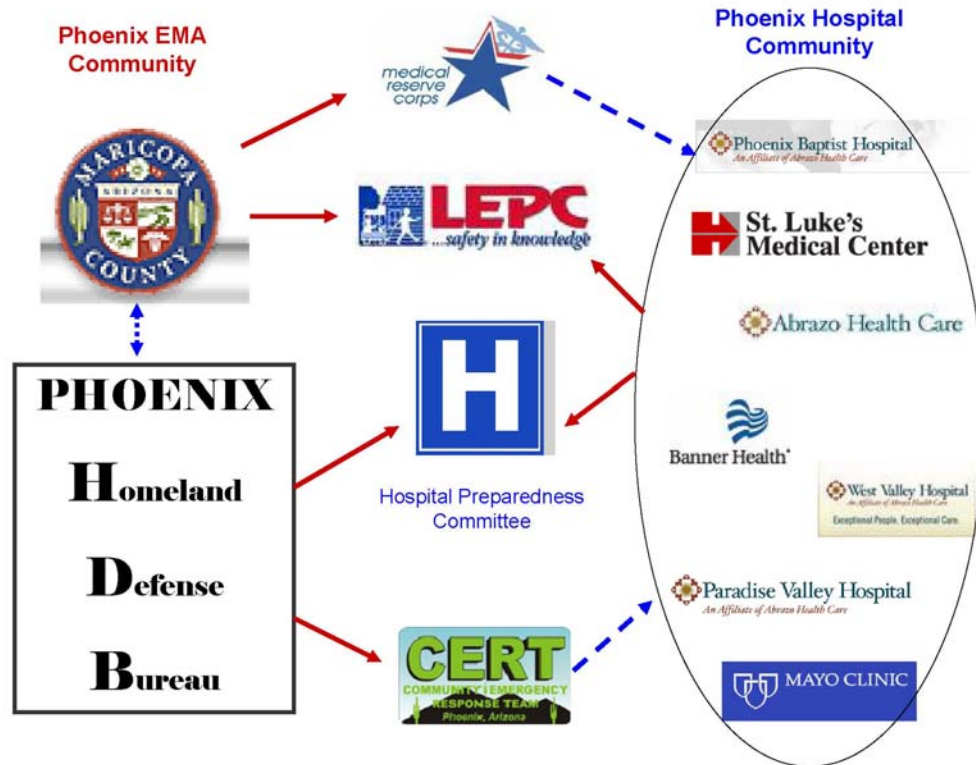


Figure 4.3. Phoenix Medical Community Emergency Planning Linkages.

Maricopa County Department of Emergency Management

The Maricopa County Department of Emergency Management (DEM) encompasses the City of Phoenix as well as a large area that has sparse populations outside the metropolitan region. It also includes an Indian reservation and the largest nuclear power plant in the country. Since Phoenix has such well-developed emergency management capabilities and its own EOC, Maricopa County DEM tends to focus on county incidents, such as flooding, and issues relating to the nuclear power plant.

It was observed that the Operations Manager of the Maricopa County DEM had a long-established and productive relationship with the Phoenix Homeland Defense Bureau. These two organizations were extremely knowledgeable and respectful of the

programs and actions of each other. Positive and productive linkages were well-developed and apparent.

The Maricopa County Emergency Operations Center (EOC) is technologically well-equipped, employing a web-based EOC management program and various geographical information system (GIS) applications. Maricopa County employs a full-time GIS specialist who has created mapping interfaces that are used by the EOC, such as a spatial database detailing the locations of all persons with special needs in the county. The County EOC uses the web software to manage information received from area hospitals and has the capabilities to receive daily, routine status reports. Clearly, access to this information is dependent on each hospital entering the daily updated information.

Maricopa County DEM spearheads the county Local Emergency Planning Committee (LEPC), which encompasses the City of Phoenix, and has many participating hospitals. Although Maricopa County DEC appears to be a more traditional organization than the City of Phoenix, it has been open to and engaged in the city's innovative programs.

The State of Arizona's Emergency Operations Center is located at the same military installation as the Maricopa County DEM office and EOC. The State's EOC appeared typical, with phones and computer stations for all of the various state agencies, as well as a "Mass Care representative" and a "Medical Branch representative".

The State EMA appeared disconnected from both the Maricopa County DEM and the Phoenix HDB. State emergency management representatives did not know the city or county level emergency managers, and refused to share any after-action reports or performance information from recent drills with the author. These actions seemed to indicate a disconnect of linkages between the State EMA and the local EMAs. This is

disturbing, given that Arizona state leaders clearly recognized the importance of these linkages when creating of the Arizona Counter Terrorism Information Center (ACTIC).

Arizona Counter Terrorism Information Center (ACTIC)

The Arizona Counter Terrorism Information Center (ACTIC) was opened in October 2004 as one of the cornerstones of Governor Napolitano's homeland security strategy. This intelligence "fusion center" houses more than 200 representatives from 34 local, state and federal agencies, acting as the state's central analysis hub for crime and terrorism-related intelligence. (DeFalco, 2004; Hensley, 2005; FNS, 2006) At the state level, intelligence fusion centers provide an opportunity to break down intelligence silos and transcend traditional bureaucratic turf wars. (NGA, 2005) At the time it was created, the ACTIC was considered state-of-the-art and unlike any other center in America. Now, there are 42 such fusion centers in operation with more being introduced. However, the Arizona center is still considered one of the best-operated and most effective. (DeYoung, 2006; NGA, 2005)

The ACTIC was the brainchild of the former assistant director of Arizona's Department of Public Safety and the former head of the FBI's Joint Terrorism Task Force, who designed the center together on a napkin one morning over breakfast in 2002. The pair approached Arizona's political leadership, who supported the idea and secured a federal Department of Homeland Security grant to pay for the \$5.3 million complex. (Hensley, 2005; DeFalco, 2004; DeYoung, 2006) In June 2003, the DHS Office of Domestic Preparedness issued the "Prevention Guidelines for Homeland Security", which encouraged the development of these fusion centers across the country. (DHS, 2003) Although the original purpose of ACTIC was counterterrorism work, it is now an all-hazards center.

Based on a site visit to the ACTIC, the entire structure and concept can be summed up in a word, “relationships”. ACTIC is all about building linkages and relationships among various levels and jurisdictions of emergency response agencies.

ACTIC is housed in a plain, unidentified facility. The center is completely self-supporting, with generators, food stores and water filtration systems to keep the staff safe. The center was originally designed to be kept completely secret, but the State later recognized that public input was needed for the center to be successful, and subsequently created a public outreach and education arm.

The ACTIC director and department heads’ salaries are funded by the Arizona Department of Public Safety (AZDPS), with the remaining 200-member staff being supported by their home agencies, such as city-level police and fire departments. All staff serve voluntarily, but at the request of AZDPS, and their home agencies have signed a Memorandum of Understanding to devote personnel full-time to the goals and activities of the ACTIC.

The core of ACTIC is one large office area filled with cubicles in the interior and hard-side offices around the edge. These represent the offices of representatives from police, fire, and emergency management agencies from across Arizona. Officers from agencies in the same geographical area are separated in the ACTIC office space (e.g., the police representative and fire department representative from Tucson are seated apart from each other). This seating structure is meant to encourage relationships among staff from various agencies and across geographical regions. Representatives work on cases from their home areas as well as on more general state-wide situations. These relationships are meant to foster communication and information management linkages among disparate agencies and personnel. The benefit of this approach is that people with differing technical expertise and regional experience may view evidence from the same case differently or might draw parallels to cases in their own areas,

particularly since criminals are not considerate enough to only break the law in one place. Thus, these emergency response and law enforcement agents are mixed and mingled purposely.

Across the hall from the Arizona contingent is the Federal agency area. The FBI is the primary federal stakeholder although dozens of other agencies are also represented, from the CIA to the U.S. Forestry Service. These federal agents have offices located in a separate area of the building because of the differences in security clearances. Even so, they are within close proximity and join the Arizona agents in the joint Emergency Operations Center during a major event, as well as during everyday interactions, such as for meetings and lunch. Primary and secondary relationships of the ACTIC with other emergency response organizations and programs are shown in Figure 4.4.

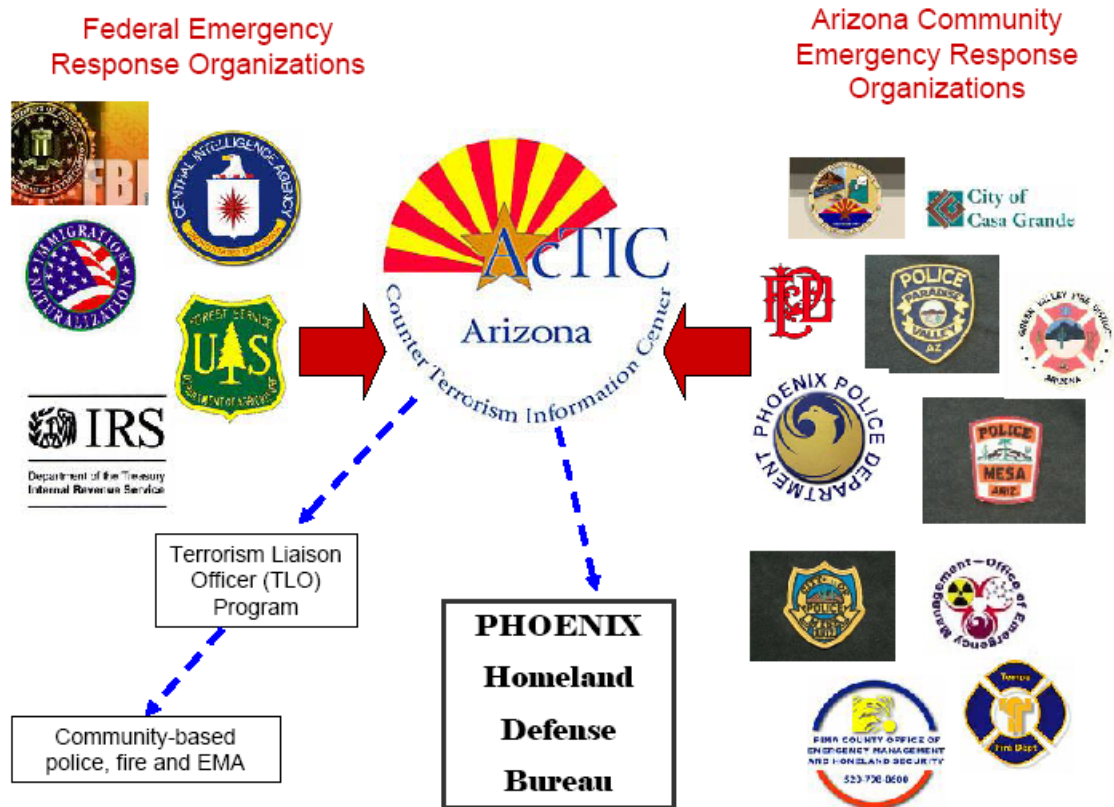


Figure 4.4. ACTIC Linkages.

The ACTIC is supported by state-of-the-art technology and clearly recognizes the importance of the use of geographic information systems. Not only does the ACTIC have access to the information in over ninety-one databases, it also has a large, dedicated GIS staff. These experts are capable of instantly creating GIS applications as different ACTIC needs arise.

The ACTIC EOC uses web-based software modified with in-house GIS programs as its overall information management system. The EOC has video projection wall capable of projecting numerous video streams of information at one time, such as a GIS map of infrastructure, news reports, etc. The ACTIC EOC also gathers critical

infrastructure information during events, such as hospital facility damage reports and hospital resource capabilities.

Terrorism Liaison Officer (TLO) Training Program

Since every emergency response agency in Arizona cannot dedicate a full-time staff member to ACTIC, an outreach training program was created by ACTIC to establish linkages with agencies outside its umbrella. Staff from any agency, even outside of Arizona, can attend TLO training to become familiar with hazard analysis, risk assessment, terrorism identification and response, counterterrorism measures, response to Chemical, Biological, Radiological, Nuclear and Explosive (CBRNE) events, and other subjects.

After training, the TLO returns to their home organization, but acts as an ongoing liaison with ACTIC. The TLO also conducts a threat vulnerability analysis for their geographical area and funnels that information back to ACTIC to more fully develop the centralized information system. The TLO program is considered a model for other states, and ACTIC routinely hosts delegations interested in learning more about its operation.

Conclusions

When considered together, the multi-layered human and technological linkages constructed by the Phoenix Homeland Defense Bureau, its CERT program, and close relationships between HDB and Phoenix hospitals, the Maricopa County Department of Emergency Management, and the ACTIC and TLO program are a model program and best management practice that can easily be implemented in other states with minimal outlay. From the low-cost Homeland Defense Bureau to the unique funding collaboration that created ACTIC, these various programs provide contrasting examples

of accomplishing the same end result in different ways. These programs represent unique and innovative ways to improve communication and information management linkages in mass casualty response, not just in Arizona, but nationwide.

These conclusions are also supported when evaluating Phoenix utilizing the 10-point CIR audit/evaluation tool developed in Chapter III (see Table 4.1). While there remain opportunities for improvement in a few areas, Phoenix represents the most comprehensive and multi-layered system of organizational management strategies, which have primacy in importance in improving CIR linkages, that was found during this research.

Acknowledgements

The information discussed in this chapter was gathered from independent research, telephone and email conversations, and a site visit to Phoenix on October 6, 2006. During the visit, David Leinenveber, RN, Public Health Manager of the Phoenix Homeland Defense Bureau, and Dennis Cvancara CEM, CPM, Operations Manager of the Maricopa County Department of Emergency Management, were kind enough to spend an entire day touring the author through the Phoenix Homeland Defense Bureau, Maricopa County Emergency Operations Center, State of Arizona Emergency Operations Center, and the Arizona Counter Terrorism Information Center (ACTIC).

Table 4.1. Phoenix Community CIR Linkage Scorecard.

	Performance Indicator	Phoenix Rating
1.	Institutional commitment by key response organizations demonstrated by dedication of staff to focused emergency planning and coordination among EMA and hospital communities.	Exemplary
2.	Formalized committees or other interaction mechanisms between EMA staff and staff from all hospitals in community.	Exemplary
3.	Informal interaction opportunities: <ul style="list-style-type: none"> - within EMA community - between EMA and hospital community - within hospital community 	Exemplary Exemplary Satisfactory
4.	Pre-event status of interpersonal relationships among all key stakeholders in EMAs and hospitals.	Exemplary
5.	Development of community hazard vulnerability analysis and use by all key stakeholders in planning.	Exemplary
6.	Development of redundant, interoperable communication methods connecting all key EMA and hospital stakeholders.	EMA – Exemplary Hospitals – Needs Improvement
7.	Development of large-scale information management and decision documentation mechanisms that are interconnected among all key EMA and hospital stakeholders.	Exemplary
8.	Community-wide planning effort for hospital resource support during mass casualty event, including pre-event planning for competition for resources by hospitals.	Satisfactory
9.	Capability of all hospitals in community to decontaminate mass volumes of patients for hazardous materials contamination.	Satisfactory
10.	Routine community-wide drills or practice mechanisms for multi-hospital response to mass casualty events.	Exemplary

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CHAPTER V

CONCLUDING REMARKS

Summary of Research Contributions

This dissertation presents a condensed assessment of the major research and national policy initiatives that impact CIR linkages among hospitals and EMAs, and makes recommendations grounded in evidence-based research that can be used by any organization involved in emergency response to strengthen CIR linkages. Through a review of previous literature and the conduct of a survey of EMAs and hospitals in several major U.S. cities, it was determined that CIR linkages have benefited from the resources directed at the problem since the events of September 11, 2001. However, significant opportunities for improvement remain. Strengths and weaknesses of current CIR linkages within the hospital community, within the EMA community, and between hospitals and EMAs are highlighted, and the potential for employing innovative organizational management strategies and decision-support tools to cost-effectively address the identified deficiencies are examined.

As the field of emergency preparedness has gained importance throughout the country since 9/11, affected organizations have been left void of actual research that explores what really works and what does not. Disaster planning is only as good as the assumptions on which it is based, and most have relied on anecdotal evidence, myth or government mandate to move forward with improvements of CIR linkages. As JCAHO discussed in 2003 and Auf der Heide reiterated in 2006, “there is a fundamental need for templates or scalable models of community-wide preparedness to guide planning. Several nascent templates are emerging; however, there are none yet that present evidence-based models which are likely to be adaptable to the varied urban, suburban,

and sparsely populated communities that make up the United States". (JCAHO, 2003; Auf der Heide, 2006).

This research has contributed a set of research-based recommendations for CIR linkage improvement, a combination of innovative organizational management strategy and enhanced decision-support capability. It has also contributed a documented best practice case study of CIR linkages in a major metropolitan area, that can be adapted to various community settings. Moreover, a product of the research is a CIR evaluation/audit tool that can be used by any community to assess the quality of its CIR linkages. Its use is also illustrated as part of the case study, serving as both a CIR baseline assessment and gap analysis.

Opportunities for Future Research

As in any comprehensive research effort, there is always room for improving or extending study methods and objectives. In this instance, opportunities for research in the disaster planning field are abundant and badly needed.

Based on the research conducted herein, one future research direction would be the expansion of the community study in terms of data and scope. Expansion to additional cities would yield an improved robustness to the findings, based on a larger sample of hospitals and (most particularly) EMAs that have been queried. Expansion would also allow for the potential identification and investigation of additional innovative strategies. CIR linkages within the hospital community were found to be weaker than those among EMAs and hospitals; thus, additional research could focus on developing evidence-based improvement strategies specifically for the hospital community.

Data gathered during this research could be used to design and implement the conceptualized decision-support system. This tool could be piloted in one of the cities

that reported that EMAs and hospitals were already using GIS for other applications to overcome hesitation by the hospital community in applying this technology.

A prime opportunity for future research would be to study the effectiveness of these improvement strategies in the same community prior to and after an actual mass casualty event, to determine whether these models actually improved response when compared against a control community that had not implemented any improvement strategies. This research would be extremely challenging to conduct. Alternatively, a retrospective study of a number of mass casualty events could yield extremely useful results and would be unique to this field of study.

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