

U.S. Trauma Center Preparedness for a Terrorist Attack in the Community

“The Study of the Impact of a Terrorist Attack on Individual Trauma Centers”



SEPTEMBER 2006

NATIONAL FOUNDATION FOR **TRAUMA CARE**

NATIONAL FOUNDATION FOR TRAUMA CARE

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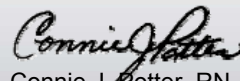
Since the 2001 terrorist attacks on the United States, Federal and state funding, primarily from the National Bioterrorism Hospital Preparedness Program (NBHPP), has resulted in a surge of hospital activity to prepare for future natural or human-caused catastrophes. Trauma centers were integrally involved in the response to the 2001 attacks as First Receivers of patients, communication hubs, and as convergence sites for families, the worried well, volunteers and donors. After the Madrid train station terrorist attack, Congress identified the need to study trauma center preparedness as an essential part of the nation's emergency management system.

In addition to caring for severely injured patients, trauma centers are pivotal resources for disasters of mass scale. In recent human-caused or natural disasters, trauma centers have been on the front line for clinical response and coordination of local, and often regional, resources. They remain uniquely positioned to respond to these events based on their constant state of readiness and the extra capacity required for daily operations.

This report summarizes responses to a U.S. Centers for Disease Control and Prevention (CDC/NCIPC) funded survey sent to all designated or verified Level I and II trauma centers in the US, to which 33% or 175 trauma centers replied. The study was guided and conducted by leading experts in trauma and disaster preparedness including surgeons, senior hospital administrators, and nurses. The NFTC respectfully thanks Senator Arlen Specter (R-PA), the Centers for Disease Control and Prevention, and the NFTC Board of Directors for their support of this project.



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EXECUTIVE SUMMARY



Trauma centers are uniquely positioned to respond to emergencies of mass scale when compared to general hospitals based on their resource availability, constant state of readiness, extra capacity, and strong connections with the local and regional emergency care community. The following report demonstrates that many of the characteristics of preparedness are in place in the reporting trauma centers, with some needed areas for improvement. Some of the identified preparedness gaps, such as communications, resupply, and sustainability, became evident after recent natural disasters and can be

reasonably applied to preparedness for terrorist attacks.

The data collected from a survey sent to all designated or verified Level I and II trauma centers in the US, to which 33% or 175 trauma centers replied, identified a small number of highly prepared trauma centers. The results also show a number that report below average preparedness scores five years after 9/11. Issues with funding are important because most trauma centers already have a heavy burden of direct costs and financial losses.¹

Most Reporting Trauma Centers are Not Optimally Prepared

Of the 175 responding trauma centers, the average overall preparedness score was 74%, while seven (7) trauma centers scored 89% or better. The lowest score was 31% on the self-reporting tool. There was disparity in the hospital's own rating of its preparedness and its data-derived overall preparedness score.

Keys to High Level Preparedness

Trauma centers scoring in the upper 20% had higher funding amounts from multiple sources whereas low preparedness scores were associated with lower funding.

- Better prepared trauma centers were close to multiple hazards and terrorist targets and/or near military installations.
 - All five (5) Highly Prepared Trauma Centers selected for Validation Visits were closely involved with local military bases to the point of conducting joint preparedness exercises and collaborating on evacuation plans.
- Use of funds for interoperable communication systems is in evidence, with over 93% reporting ability to communicate with all providers and other hospitals, and having non-land link lines.
- Nearly every trauma center has completed their Hazard Vulnerability Assessment (HVA), security, and lock down plans, but fewer have practiced them and are less able to lock down an individual department.

The Highly Prepared and Best Preparedness Practice Trauma Centers had strong leadership, both executive and front-line. Trauma Services that scored well and underwent Validation Visits had excellent intra-facility and interagency communication, strong relationships with the "Safety Officer" or Disaster Preparedness Manager, EMS and local Fire Officials, etc., as well as overall institutional support. They had also applied their preparedness plans in real events more often than the less prepared centers.

Recommendations for Improvement

Some preparedness components showed areas for improvement. These initiatives are recommended to fulfill each trauma center's preparedness potential:

- * *Provide adequate funding to trauma centers based on their proximity to hazards and threats.*
 - ◊ Remedy inequities noted by region to comparable levels needed for their vulnerabilities and threats.
- * *Establish Mutual Aid Agreements (MAA) or Memorandums of Understanding (MOU).*
 - ◊ While EMS agencies have had MOUs for decades, trauma centers are less likely to have MAA/MOUs other than transfer agreements. MAA and MOUs should encompass staff cross-credentialing and supervision, means of identifying emergency staff, financial responsibility, transfer of supplies, equipment and patients, access to information, and media relations.
 - ◊ Regional, statewide, interstate mutual aid plans should also be developed.

"Disaster planning is only as good as the assumptions on which it is based."

- Erik Auf der Heide

- * *Spread authority and information about planning and implementation.*
 - ◊ Commonly, individuals with a need to know in the lower scoring trauma centers did not have access to essential information about their preparedness plan. Those answers, including important policies and procedures, were often held by one individual who was at meetings or courses, or otherwise unavailable. This resulted in a higher than expected level of missing answers to key survey questions.
- * *Fund Statewide (and multi-state) resource monitoring systems.*
 - ◊ These systems can facilitate real-time capacity and resources assessment to improve patients being transported or transferred ultimately to the most appropriate health facility, including those outside of the region.
- * *Increase ability to communicate with Federal agencies and the military.*
 - ◊ Homeland Security and the National Guard were more often reported as being unable to communicate with than other agencies despite the need for interagency access.²
- * *Improve surge and decontamination capacity, particularly in regions with high vulnerability.*
 - ◊ With average surge capacity of 59 patients in one hour and decontamination capacity of 54 patients per hour, a terrorist attack involving biohazardous or radioactive materials could overwhelm trauma centers and general hospitals.
 - ◊ Having an average of 6 to 11 Class B sets of protective equipment per center by region, the predictable self-delivery of patients prior to prehospital decontamination would require the trauma center to perform decontamination normally done by HazMat teams^{3,4}
- * *Leave no trauma center behind.*
 - ◊ Level II trauma centers appear to need more assistance with preparedness. Those centers should receive help from more highly prepared Level I trauma centers as part of their outreach mission.
- * *Plan for family members of patients and staff, as well as convergers.*
 - ◊ Although most of the reporting trauma centers could feed and house children of patients and staff, their plans were incomplete and could cause staff distractions during disasters. Convergence is a common problem with disasters of all types, as the trauma center is the source of information, shelter, and emotional support.⁵ Planning for convergers is commonly missing, which poses a security threat to the trauma centers as well as diverting staff attention from casualties.
- * *Sustain operations for more than 3 days.*
 - ◊ Isolation and security issues relative to a mass casualty event, particularly one involving terrorism, requires that the trauma center sustain its operations, including water, fuel, food for more than 3 days. This was evident in recent natural disasters where evacuation and resupply was not possible.
 - ◊ Resupply reliance on vendors with no exclusive commitment to the facility needs improvement, including attention to regional and statewide suppliers.
- * *Provide after-care for chronically ill patients and displaced persons.*
 - ◊ A large number of elderly and chronically ill persons will become medically unstable after a terrorist attack or natural disaster. These people run out of essential but routine medications and/or oxygen, have no electricity for thermal control, and lack shelter, food or water. Nursing homes and other like facilities rarely have backup power supplies or stockpiles, requiring their patients to be transferred to a trauma center or general hospital.
 - ◊ Encourage the rest of the healthcare system, i.e., physician offices, clinics, nursing homes, etc., to prepare so they do not become disabled by the disaster, lessening the burden on hospitals and trauma centers.
- * *Fund disaster medical care at cost and develop sources of sustainable prospective funding.*
 - ◊ Funding from HRSA and FEMA is inadequate to the task of preparing trauma centers for the next inevitable event when they are already under economic duress. Not only does reimbursement for health care costs of injured and displaced persons need improvement, but also some broad source of sustainable prospective funding needs to be identified to help trauma centers before disasters occur.
- * *Provide caregivers and Mutual Aid Agreement Responders with Good Samaritan immunity from criminal prosecution or licensure suspension while working under extreme duress.*
 - ◊ This issue has been raised anecdotally and could be a barrier to caregivers responding to mass scale events, particularly in mutual aid.

The NFTC supports Congress' concern that our trauma centers need to be better prepared. However, to expect increased preparedness without supplemental funding is unrealistic at a time when emergency care is already in a state of crisis.² The NFTC supports increasing preparedness funds to trauma centers above those provided to general hospitals based on their higher direct costs, their linchpin role in disaster response, and their need to continuously improve their preparedness for a terrorist attack or natural disaster of mass scale.

PROJECT BACKGROUND AND DESCRIPTION

Evidence exists that blast-type explosive attacks are the most common terrorist threat world-wide, “with over 500 terrorist bombings between 2001 and 2003, resulting in 4,600 deaths.”⁶ With this in mind, Congress directed this first attempt to inventory regional (Level I or II) trauma centers’ preparedness for terrorist attacks in the community. In a recent publication, Ciraulo and co-authors note, “Although firearms remain popular, explosives are the most economical and readily available terrorist weapons, causing high numbers of casualties at a lower cost than any other weapons system.”⁷ Worldwide, explosive attacks have caused the majority of deaths, casualties and property damage, but they are only one of fifteen National Planning Scenarios, and 13th on the list of possibilities, introduced by the Department of Homeland Security.²

Although blast-type attacks, including those involving hazardous or radioactive materials, are the primary focus of this inventory and summary report, hospitals and trauma centers are commonly First Receivers of patients resulting from all disasters because of the phenomena of self-directed patient delivery.³ Trauma Centers have historically functioned as critical medical resources and communication hubs for both natural and human-caused catastrophes of mass scale. Injured patients in these centers are rapidly triaged, assessed, and treated within organizational structures and processes tested and refined since the 1993 and 2001 World Trade Center terrorist attacks, the bombing of the Oklahoma City Murrah Building, and natural disasters of all types nationwide, most recently being Hurricane Katrina.²



Trauma centers have also been borderless resources for aiding or receiving transfers and evacuees from other health care facilities that are overwhelmed or rendered inoperable during natural disasters. After hurricane Katrina flooded New Orleans in 2005, many medical facilities outside the city, and Tulane University Hospital and Clinic locally, received large numbers of patients evacuating from the city hospitals and the Superdome arena. Of the out-of-state facilities responding, at least five were Level I trauma centers: Tennessee’s Vanderbilt and Erlanger Medical Centers and Texas’ Ben Taub, Hermann and Parkland Medical Centers. This aid was elicited through contacts within the hospital and trauma care community, resulting in mobilization of out-of-state community resources. Without these networks, many evacuees would have not gotten proper care, and more deaths or avoidable complications might have occurred.

A variety of threats based on geography, weather patterns, natural and man-made structures which are possible sites or terrorist targets, have the potential for incidents of mass scale for which trauma centers need to be prepared. Examples of at-risk sites are landmarks or icons, transportation hubs, dams, stadiums or convention centers, governmental structures, military installations, munitions storage facilities, nuclear plants, among others.^{2,8} Many of these sites could produce a mass casualty incident that might contaminate patients, inadvertently making portions of the trauma center inoperable.² OSHA has determined that such First Receivers have Class B equipment as a minimum for patients with unknown exposures. Therefore, the admitting trauma center must promptly identify, segregate, and treat these types of patients. The capacity for a trauma center to decontaminate large numbers of patients, bystanders, and caregivers may need to be considerable based on their regional vulnerabilities. As important is a trauma center’s ability to lock down its facility to reduce the potential for inadvertent contamination or intentional terrorist attack as a secondary target.

Trauma center preparedness, whether for terrorist attacks and natural disasters, differs little in the basic components, as defined in “all-hazards preparedness.” According to Dr. Erik Auf der Heide:

“...empirical disaster research studies have identified a number of problems and tasks that appear to occur with predictable regularity, regardless of the disaster. ...For example, almost every major disaster requires collecting information about the disaster and sharing it with the multiple agencies and institutions that become involved in the response. Other tasks include warning and evacuation, resource sharing, widespread search and rescue, triage, patient transport that efficiently utilizes area hospital assets, dealing with the press, and overall coordination of the response.”⁹

“Explosions are by far the most common cause of casualties.”

- Jeffrey L. Arnold

The application of this model to trauma centers and systems uses public funds wisely. Trauma centers maintain a constant state of readiness, are staffed for all types of injuries, and have broad communications with regional hospitals, airmedical resources (including military) and emergency medical services. These preparedness components include emergency management planning, communications, resources plus surge capacity and decontamination, vulnerability and threat response, and clinical resources encompassing sustainability to recovery.²

PROJECT DESCRIPTION

News reports and professional or institutional assessments show that disaster response capability and capacity appear to vary where trauma systems are not developed or fully implemented, or where trauma centers are economically or resource threatened.^{10,11} Despite their role in disaster/terror response, the National Foundation for Trauma Care (NFTC) has identified only four (4) states that provide any direct fiscal support for trauma systems preparedness for terror attacks and the amounts allocated were less than optimal. Otherwise, anecdotal reports indicate that trauma centers are being treated no differently than general hospitals in the distribution of National Bioterrorism Hospital Preparedness Program (NBHPP) funds. This study is the first national evaluation of the preparedness for, and the effect upon, a trauma center from a terrorist blast attack in its community.

The National Foundation for Trauma Care believes that many trauma centers will benefit from useful clinical and hospital protocols or guidelines to help them prepare for mass casualty incidents. The NFTC Board of Directors determined that the first steps to developing optimal guidelines involved inventorying the existing practices at U.S. trauma centers and identifying and recording the experiences and methods of highly performing and best practice trauma centers. To that end, NFTC sought and received a one year grant funded by the Centers for Disease Control and Prevention (CDC/NCIPC) to survey the capability and capacity of trauma centers to respond successfully to mass casualty incidents, particularly those brought about by acts of terrorism. Included in the grant were funds to report the practices of five (5) highly prepared trauma centers as well as individual best preparedness practices from another five (5) selected centers.

The basic components of the model for “all-hazards preparedness” were used in this study to develop the inventory tool sent to 531 trauma centers and to organize a Validation Visit tool, Best Preparedness Practice selection process, and summary reports. These categories were expanded in keeping with the national trend to promote the expansion of bioterrorism preparedness planning towards all-hazards preparedness. This approach offers the best use of scarce resources and fully integrates trauma centers into emergency preparedness processes in their regions and states.

This project addresses the CDC/NCIPC “Healthy People 2010” focus area(s) of Injury and Violence Prevention and occurred in two phases. In phase I, the NFTC developed and conducted a survey of all known Level I and II trauma centers as verified by the American College of Surgeons’ Committee on Trauma (ACS COT) or designated by state or local authorities. The objective was to identify the degree to which they meet key characteristics of a well-prepared trauma center in the event of a blast-type terror attack, including one with the potential for biological, chemical, nuclear agents and other hazards. In phase II, trauma centers that scored high in the survey responses volunteered to undergo a validation visit or conference call from an expert in both trauma and emergency preparedness, provide requested and other appropriate documents, and participate in a summary review of their preparation for a blast-type terror attack or other hazards of mass scale as defined in the grant.

The project strives to benefit the public by trauma centers becoming better prepared for a blast-type terror attack as well as all other hazards. To achieve this goal, all recognized Level I, II, and III U.S. trauma centers will receive information from the highly performing trauma centers and those identified as having best preparedness practices in areas where fewer trauma centers scored highly. End products of this study include a summary report, a CD-ROM of complete Validation Visit reports with supplemental documents such as including Emergency Management Plans, policies and procedures, a PowerPoint™ overview, and educational/technical information that can be adapted to any trauma center’s unique circumstances. This report summarizes the findings of the preparedness survey of the responding national trauma centers, the practices across all components of five (5) trauma centers scoring highest in overall preparedness, and the individual practices from five (5) selected trauma centers based on their scores in specific preparedness components.

These end products are to be distributed by mail to more than 700 trauma centers and state agencies with responsibility for trauma or EMS systems. Summary reports will also be sent to state governors, appropriate Federal agencies, and professional organizations. Materials will be available on the publicly accessible portion of the NFTC website, www.traumafoundation.org.

Terror Preparedness Tools

NFTC will develop a dedicated page to Terror Preparedness. Links will include the complete reports from this study, including Emergency Management Plans and policies and procedures. There will also be a PowerPoint™ overview and other educational/technical information that can be adapted to any trauma center's unique circumstances.

For more information, visit the public portion of the National Foundation for Trauma Care website, www.traumafoundation.org.



METHODOLOGY

The self-reporting aspect of this study, and its two-stage approach, created a need for the design of multiple tools for the paper survey, the site visits, and the phone interviews. The study also required the development of a scoring system and selection processes for the five (5) most highly prepared trauma centers and five (5) trauma centers with notable practices in key preparedness areas.

Data Security

The Centers for Disease Control and Prevention (CDC/NCIPC) and the National Institutes of Health (NIH) approved the study. Both agencies agreed that due to the potentially sensitive nature of the data collected, i.e. terrorism preparedness planning, all NFTC employees, advisory and research partners and contractors should sign an NFTC approved Confidentiality Agreement. NFTC offices were secured by a monitored system with confidential data kept on an encrypted, removable hard drive that was secured each night. A unique, numeric identifier was used for each de-identified trauma center data record. No trauma center or regional information was or will be disclosed in any public manner that would create a security issue.

Preparedness Survey Tool and Data

In the first phase of this study, a group of trauma care experts, led by Principal Investigator (PI) Donald D. Trunkey, MD, FACS, developed a list of key characteristics of a well-prepared trauma center that can act as a First Receiver and communication hub in their community in the event of a blast-type terror attack or other mass casualty type incident. Dr. Trunkey, who brought world-wide experience in trauma, disaster planning, and battlefield medicine was joined by three Trauma Center Chief Executive Officers who served as Co-Investigators. These investigators have strong experience in disaster planning, including one whose trauma center served as the primary First Receiver of patients from the World Trade Center attacks in 1993 and 2001. Thereafter, the NFTC convened a diverse group of advisors with experience in trauma, emergency systems, and research.

Design

Seven (7) preparedness components were identified by the PI's and Advisors as crucial to the successful handling of any type of mass casualty incident. Questions were developed in the areas of Vulnerability, Planning, Communication, Resources, Security, Clinical Resources, and Sustainability. The questions were then subjected to a modified Delphi process in which the merits of any particular question were presented to the group and discussed. The survey tool was restricted to a maximum of four pages containing 154 "yes/no", numeric or text responses in total. The "yes/no" questions did not allow a response of "don't know" or "not available". Numeric responses were open-ended with no suggested ranges of response values.

Response Rate

The NFTC mailed surveys with cover letters in January of 2006 to the Trauma Medical Directors of 531 U.S. Level I and II trauma centers, either verified by the American College of Surgeons' Committee on Trauma (ACS COT) or designated by a state/local governmental agency. Trauma Medical Directors were selected based on their previous involvement in the Trauma Information Exchange Program (TIEP) funded by the CDC/NCIPC. Early response rates were improved when

The preparedness components studied were

- *Vulnerability*
- *Planning*
- *Communication*
- *Resources*
- *Security*
- *Clinical Resources*
- *Sustainability*

Trauma Program Managers became involved. By the cutoff date in May, the final response rate was 33% with 175 useable trauma center surveys.

Feedback from staff at responding trauma centers indicated that some questions were difficult to answer, contributing to the “missing values” rate of 16% of respondents that did not answer ten percent or more of the response items.

Survey Data

As surveys were received from the trauma centers, they were first checked for data completeness, illegible faxed data, missing pages, etc. When incomplete surveys were identified, the trauma center was asked to clarify answers or resubmit. Each survey’s data was dually entered, cross-checked, and reconciled to a single record. The electronic data entry tool and analysis program incorporated valid value checks and response consistency checks. Where trauma centers were unable to provide corrected information, the response was changed to, or left as, “missing.” Surveys lacking a majority of answers were not included in study results.

Characteristics of Responders v. Nonresponders

With the response rate for the survey being 33%, NFTC explored differences in trauma centers that responded to the survey and those that did not. Three publicly-available characteristics were compared: region of the country where the facility is located, trauma designation level, and membership in an organized state trauma system as defined by West, et al.^{11,12} No significant response difference existed among trauma center members in an organized trauma system.

Responders

For the responding group, more trauma centers (49%) were Level I trauma centers compared to nonresponders (40%). Regional differences in numbers of surveys returned from the responder versus nonresponder groups respectively is as follows: South (11% vs. 16%) and West (22% vs. 17%). The other regions did not differ in response by level in either the East (both ≈ 36%) or Midwest (both ≈ 31%). These trends, while statistically significant, are from a small sample.

NFTC Membership

With respect to response rates relative to membership to the NFTC, an NFTC member trauma center was no more likely to respond than were nonmembers. These results suggest minimal response bias among NFTC members.

Scoring and Analysis

The scoring system used to rank trauma center preparedness was based on the survey questions, favoring rankable scoring methods that were straightforward and simple. Different options were explored as to how a missing value should be scored, including if not knowing an answer should be penalized, i.e., a missing value assigned -.5 points, or whether it would count as “no.” Four different scoring methods were developed applying the options to combinations of “yes/no” and numeric responses.

After consideration, the method selected used “Yes” responses tallied as “1”, “No/Missing” answers tallied as “0”. Numeric answers were tallied as “1” if greater than zero, then as “0” if zero or if the answer was missing. The resultant summary score is the percentage the trauma center achieved of its potential maximum score. Other areas of interest were compared using averages, medians, and frequencies.

Highly Prepared Programs and Validation Visits

The NFTC selected the five (5) highest scoring designated or verified Level I or Level II trauma centers (state, local, or ACS COT) as having a Highly Prepared Program (HPP) in place for a mass casualty incident in their community. Qualified volunteers conducted a one-day, on-site Validation Visit to one each of the chosen trauma centers. Validation Visitors were given a standardized reporting tool based on the preparedness survey, received a conference call orientation to the process and report, and asked not to discuss their visit until all on-site visits were completed to assist in maintaining a standard process.

Reports were entered into a secure, encrypted laptop shipped to a named individual who signed the NFTC Confidentiality Statement. Validation Visitors signed a contract that defined the Validation Visitor and Trauma Center’s roles, responsibilities, and covered privacy issues. Draft reports were sent to both the Validation Visitor and the trauma center for review and changes were made if indicated. The reports and associated documents were blinded by NFTC staff to be scanned for the CD-ROM version prior to distribution. Reports, notebooks, notes, and other matters associated with the Visit were held confidential, including the location of the Trauma

Center, from persons who had not signed a Confidentiality Agreement. Trauma centers were identified en mass in the NFTC Newsletter and Summary Report but given an alphabetical title for all other reporting. Demographic and other information that could be used to identify the trauma center was removed from the distributed reports.

Best Preparedness Practice (BPP) Validation and Practice Descriptions

Five (5) trauma centers were selected by rank for having a practice in place to best respond to a mass casualty incident under the key preparedness components: Planning, Communication, Sustainability of Peak Operations, Sustainability Overall, and Education and Training (emphasis on hazardous materials and decontamination). Selection by sub-scores was calculated for each component using the previously described methodology. The Disaster Response or Safety Officer was the person commonly responsible to conduct a phone interview to validate the self-reported practice rather than conducting an on-site visit. The selected Best Preparedness Practice (BPP) trauma centers provided a detailed description of seven areas that prompted the development of their best practice. These areas included motivation for process development, leadership, resources, education and follow-up, evaluation and outcome – particularly as the BPP affects daily operations. The application of preparedness to daily operations is considered key to the staff internalizing the use of the practice.

As with the Highly Prepared trauma centers, the Best Preparedness Practice trauma centers identity was reported en mass and all distributed materials were blinded by name, geographic location, and other identifiers. The trauma center CEO signed a contract with the NFTC that described the protections afforded by the security measures.

**FIVE SELECTED
"HIGHLY PREPARED" HOSPITALS**

**Barnes-Jewish Hospital
St. Louis, MO**

**Children's Hospital and Health Center
San Diego, CA**

**Miami Valley Hospital
Dayton, OH**

**New Hanover Regional Medical Center
Wilmington, NC**

**Suburban Hospital Healthcare System
Bethesda, MD**

Highly Prepared Program Trauma Centers

The five (5) most highly prepared Trauma Centers were awarded \$7,000 for participating in the study. Each underwent a site visit to validate reported information. The validation visitor met with hospital staff and interagency representatives to discuss the plans for a collaborative response should a mass casualty situation occur, including but not limited to chemical, radiological, blast, or other such hazards. The on-site visit also included a tour of the facility to assess the hospital's decontamination capacity, clinical care and overflow areas, stockpiled resources, and overall plan for responding to a large scale catastrophic event. The validation visitor also interviewed staff and key managers, reviewed documents, and examined areas of the hospital to determine its overall preparedness to manage a large scale disaster.

Best Preparedness Practice Trauma Center

The five (5) Best Preparedness Practice Trauma Centers were awarded \$1,000 for participating in the study. The Best Preparedness Practice hospitals were chosen for their higher level of development on plans in areas of preparedness not commonly found in other participant responses to this study. Each hospital participated in a conference call to validate reported information. The Trauma Center submitted a summary and description of the practice, as well as supportive documents for their chosen component. The five (5) components of the Best Preparedness Practices are Communications, Education and Training (focusing on hazardous materials and decontamination), Peak Operational Sustainability, Overall Operational Sustainability, and Planning.

**FIVE SELECTED
"BEST PREPAREDNESS PRACTICE"
HOSPITALS**

**Henry Ford Hospital
Detroit, MI**

**Sacred Heart Medical Center
Spokane, WA**

**Trinity Mother Frances Health System
Tyler, TX**

**Wake Med Health & Hospitals
Raleigh, NC**

**William Beaumont Hospital
Royal Oak, MI**

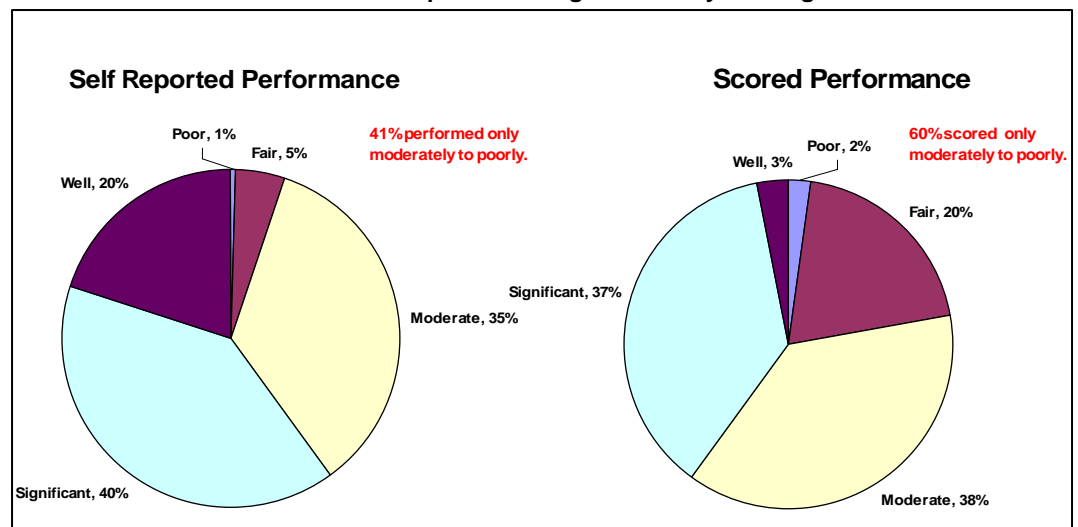
OVERALL FINDINGS

Preparedness Scoring

NFTC's scoring system, based on yes, no; or numeric answers to the survey questions, allowed the trauma centers to be ranked according to their level of preparedness. The average preparedness score of the 175 reporting trauma centers was 73.7% with a low score of 31% and a high of 96.5%. For all trauma centers combined, averages varied little across region or level. However, when preparedness scores were averaged by designation level for those scoring above and below 73.7% and then compared, differences in scores appeared. Level I centers (68%) were more likely to have a preparedness score above the average; Level II centers (56%) were more likely to score below. When the top and bottom 20th percentiles were compared, the Level II centers (67%) were more likely to be in the lowest 20th percentile. The distribution of Level I centers across lowest and highest 20th percentiles remained the same for above and below average.

Another variation in findings is the trauma centers' perception of their own preparedness from a single self-assessment question in the survey, as compared to the level of preparedness determined from the overall scores. When asked how well their trauma center performed in a drill, tabletop, or real event using five (5) categories ranging from poorly to well prepared, 41% of the responders rated themselves between "poor" and "moderate". However, 60% of hospitals scored "poor" to "moderate" when the range of scores was divided into five (5) comparable categories, with poor being 0-54%, fair 55-65%, moderately 66-77%, significant 78-90, and well >90%. While 20% rated their own performance as "well prepared", 3% scored in the equivalent "well prepared" category (i.e. score above 90%) overall (see Figure 1).

Figure 1: Percent of Hospitals In Preparedness Performance Categories From Self Reported Rating and Survey Scoring



The scoring system was also used to select five (5) most highly prepared trauma centers from ten (10) trauma centers that achieved overall preparedness scores of 88% or better. One (1) of these centers was eliminated from the selection process because it no longer had trauma center status and was therefore ineligible for an award. That hospital was notified of their high score and encouraged to continue their pursuit of renewed trauma center status.

Vulnerability, Threats and Funding

The strongest correlation to preparedness funding was in trauma centers that reported proximity to a large number of hazardous sites, particularly those which, if impacted by a terrorist attack or other event, could require mass decontamination of victims. The average capacity for decontamination is 54 patients per hour with a wide variation of capacity reported. Decontamination areas within the hospitals are commonly (85%) configured to separate patients by gender.

Planning

The emergency planning components where nearly all trauma centers report high levels of preparedness are those which have been a focus and funded by HRSA's National Bioterrorism Hospital Preparedness Program, communications and preparation for hazardous material contamination.² Virtually all (99%) are able to coordinate operations with their City/County Emergency Management. There are high levels of communications interoperability (92%), intra-

hospital communication (94%), communications with local and state Public Health (99%), and Non-Governmental Organization's (NGO) such as the American Red Cross (95%). Planning for a variety of hazards has been conducted in 97% of reporting trauma centers with the focus mostly on chemical, biological, and radiological events (98%). Guidelines for nuclear (dirty bomb) and explosive devices are in place in 90% of trauma centers.

Communication, Surge Capacity and Diversion

In their Emergency Management Plan (EMP), 94% of trauma centers reported their surge capacity, with an average capacity for 59 patients within one hour. Virtually all trauma centers (99%) have either a phone tree, pager, and/or radio system to rapidly notify staff. All trauma centers have an Emergency Operations Center (EOC) and 91% have an alternate site identified or planned should their initial EOC become inoperable or inaccessible.

These capabilities are important in that mass casualty situations could overwhelm regional resources rapidly, requiring state or even multistate resources to be mobilized. In that event, the trauma centers' communication systems are nearly all capable of notifying EMS that they are on diversion or bypass status (97%). To facilitate patient destination, 87% of trauma centers have regional real-time monitoring systems to assess capacities of ED, overall bed, ICU or OR resources, and 13% report having a statewide system that accomplishes the same level of resource monitoring. When both regional and state systems are combined, about 94% of centers have real-time capacity monitoring systems for ED, overall beds, and ICU and 81% of trauma centers can assess OR resources. To our knowledge, no one has a multistate system at this time, which is problematic given the borderless nature of mass scale events.

Sustainability

Sustainability was assessed by asking if the trauma center's EMP provides for operating more than 72 hours under emergency conditions. Although 82% said that their EMP includes this provision, only about half (42%) of the centers reported an actual ability to operate at peak capacity for more than three (3) days. Additionally, 64% reported exclusive arrangements for acquiring or maintaining stockpiles of pharmaceuticals and supplies. Overall, the trauma centers reported an average of 53 ventilators on site and the ability of obtain an additional 35 devices within two (2) hours. They reported a lower rate of contract exclusivity for ventilator replenishment (39%), which would be needed in an epidemic such as Avian Influenza or an attack from biohazardous materials or gases.

Most (\approx 94%) trauma centers are able to provide both patients and staff with adequate food and water to sustain operations for 3-4 days. Less often could they provide nutritional care to volunteers (83%) or patients' families (68%) and about half (51%) would extend nutrition to the media. With this in mind, education about emergency food supplies would be helpful for patients' families and non-injured persons, including staff, if a catastrophe might last longer than several days.

Sustainability and Caregivers

Family care issues are an important part of emergency staffing plans. A means to assure continued availability of caregivers is to relieve their concerns for family members or dependents. In this, trauma centers were less prepared, with 62% having a defined family care plan for children of injured patients or essential staff. The plans often did not include assisting staff to locate family members (36%) or gave authority to others to pick up children (25%). Family communication plans are present (43%) but only 23% had plans that give medical authority to care for dependents or minor children of essential staff. Slightly less than 1/3 report a written plan for staff's own family reunification. This lack of detailed planning, coupled with an average ability to cross-credential staff from other facilities of 65%, could impede the trauma center's ability to respond with adequate staff in a regional event of mass scale.

Special Populations

Plans to care for special populations were studied as well. Of the responders, 69% had plans for children, 57% address needs of pregnant women, and about 53% plan for elder care and immunocompromised patients. While 66% of trauma center plans address the special needs of psychiatric patients, fewer (58%) are prepared for the needs of the disabled, and 47% address the needs of obese patients. Nearly all (93%) of reporting trauma centers plan for the mental health needs of patients, staff and volunteers and 89% plan for mental health issues of visitors.

Finance

The public commonly responds to disasters of mass scale by offering donations for the affected.¹³ The study results are that trauma centers were mostly unprepared for these gifts, with 27% having an established mechanism for accepting donations. Most trauma centers (89%) are capable of tracking disaster expenditures, but experience from actual events described in the body of this report show that collecting on these expenses is problematic.

"Reimbursement for uncompensated care has yet to come and there is a 'huge debate regarding how best to have...dollars follow the patients'."

- Ruth Berggren

COMPONENT FINDINGS

VULNERABILITY AND HAZARDS

The trauma centers were asked about the number of threats, hazards and vulnerabilities within their catchment area. The catchment area was defined as the geographic region served by the hospital, even though other trauma centers and general hospitals may also be located within the region. Ninety-seven percent (97%) have performed a Hazard and Vulnerability Analysis (HVA) in the last 12 months. The most common hazard sites, i.e., those noted by more than 70% of responders, were public arenas, land transportation infrastructures, large universities, chemical factories, Federal buildings or state capitals, and prisons (see Table 1). However, many of the less common sites pose just as great of a risk for producing mass casualties. Nuclear power plants, dams, airports and mass transit facilities all potentially threaten large segments of the resident community if successfully attacked by terrorists. Incendiary tragedies could arise from either man-made or natural disasters at oil or natural gas refineries, at munitions plants or storage facilities, and even in certain port areas.¹⁴

| Hazard Type | % Reporting |
|--|-------------|
| Major interstate freeway, bridges, tunnels, etc. | 94% |
| Public arena, stadium, convention center, coliseum | 94% |
| Large University | 84% |
| Chemical factory | 72% |
| Prison | 72% |
| Federal building or State Capital | 72% |
| Railroad hub | 71% |
| Dam or water based hazard | 65% |
| International airport | 65% |
| Mass transit facility | 64% |
| Military Base | 57% |
| Hazardous waste dump or storage facility | 56% |
| Monument, landmark | 54% |
| Oil or natural gas refinery | 40% |
| Other | 39% |
| Port | 36% |
| Nuclear power plant | 34% |
| Munitions plant or storage facility | 34% |

Source: NFTC

“Up to 85% of victims arrive at the healthcare facility without prehospital treatment or decontamination.”

- Susan M. Briggs

A trauma center’s capacity to decontaminate patients becomes especially important in communities close to chemical factories, hazardous waste dumps or storage facilities, munitions plants or storage facilities, nuclear power plants, and oil or natural gas refineries. The study found that a greater number of toxic hazard sites in the community of a hospital is correlated to an increased preparedness score. By region of the country, decontamination capacity of trauma centers ranged from 67 patients per hour in the East to 38 in the South (see Table 2). However,

Table 2: Average Decontamination Capacity Per Hour by Region

| East | Midwest | South | West | All |
|------|---------|-------|------|-----|
| 67 | 47 | 38 | 53 | 54 |

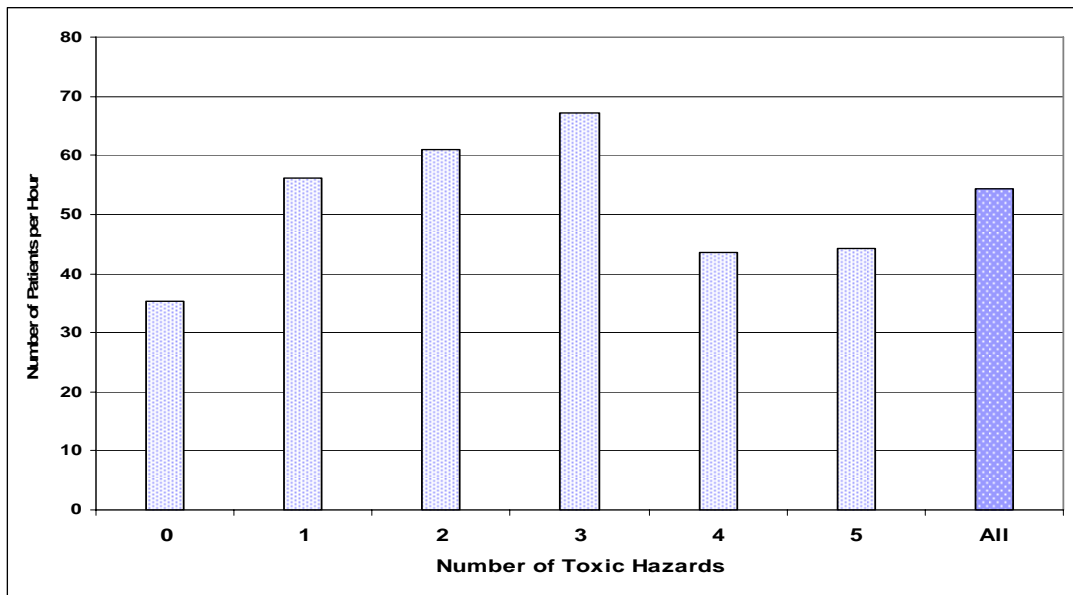
Source: NFTC

no correlation was detectable between a trauma center’s decontamination capacity and the number of their toxic hazard sites. Across regions, decontamination capacity by numbers of toxic hazards reported in a Trauma Center’s catchment area climbs steadily up to three (3) hazard sites, but then subsequently falls (see Figure 2).

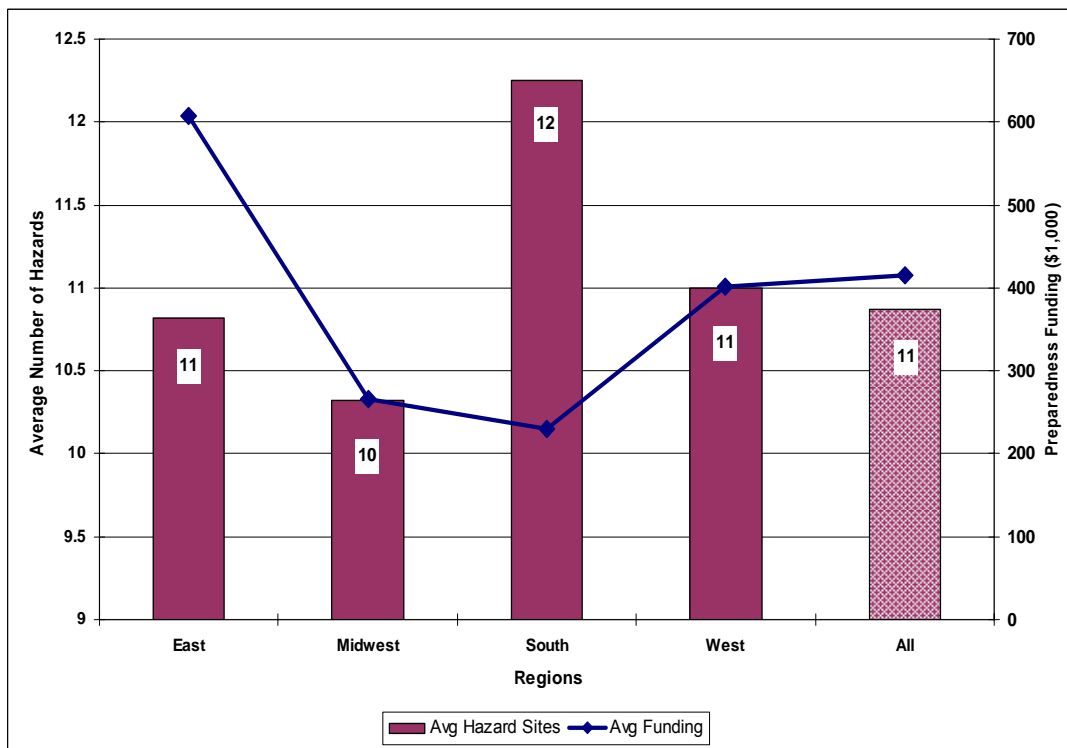
Seventy-nine, or 45%, of the responding trauma centers are at risk for three (3) or more toxic hazard sites in their regions. These centers have hazardous materials Personal Protective Equipment (OSHA) for the following number of personnel on average: Level A TECP suits for two (2) people; Level B positive pressure respirators and chemical-resistant garments for 11 people; Level C APRs and chemical-resistant garments for 50 people. OSHA has identified “B” equipment as the minimum recommended for unknown exposures.⁴ Given the propensity for patients to self-deliver to the nearest hospital, the availability of appropriate protective equipment and conducting regular training in its use is increasingly important.

Differences in preparedness funding were examined by region as well. Figure 3 superimposes this funding on the average number of hazard risk sites for each region. Trauma Centers in the East and West of the U.S. report greater funding for bioterrorism preparedness from all sources though the South reports more risks and hazards.

**Figure 2: Trauma Center Decontamination Capacity
(Average Patients per Hour By Number of Toxic Hazards)**



**Figure 3: Trauma Center Communities With Hazard Risk Sites
and Preparedness Funding By Region**



PLANNING

The trauma centers were asked specifically about their Emergency Management Plan (EMP), their integration into the city/county Emergency Operations Center (EOC), the status and redundancy of their Hospital Emergency Incident Command Center, and their post mass casualty incident recovery plans. Nearly all (>97%) were found to have either conducted tabletop drills or actual simulated drills, and 81% had applied their preparedness plan in a real event. These latter hospitals had higher scores (74.7%) for preparedness than hospitals who had never applied their EMP (69.9%) in a real situation. This trend was verified by the Highly Prepared trauma centers which all have activated their EMP in a real event.

Most trauma centers (>96%) have plans for patients injured in unconventional weapons attacks, i.e., illness due to chemical or radiological exposure, or caused by biological infectious materials (see Figure 4). In keeping with strong indications that terrorists have access to low-grade nuclear materials, i.e., dirty bombs, most trauma centers (90%) also have plans for radioactive

exposure.^{15,16} The same percentage (90%) of centers indicate preparedness for the simple incendiary and explosive devices that cost little, are in great supply to terrorists, and comprise the most common terrorist acts.⁷ Similar injuries also result from refinery fires, gas line explosions, rail car derailments and the like. All trauma centers EMP's allow for activation of the HEICS and 94% plan for medical surge, and 82% have an EMP that provides for operating longer than 72 hours (see Figure 5). All trauma centers report a specific location for their Incident Command Center and 91% identify an alternate location, should the initial site become inoperative. Most centers (94%) have a Hospital Liaison Officer (Communication Coordinator) assigned to the city/county EOC. Some trauma centers note that the alternate Incident Command Center site is not designated but will be relocated based on the hospital's circumstances, including to a possible off-site location.

Figure 4: Percent of Hospitals with Guidelines of Care for Different Hazards

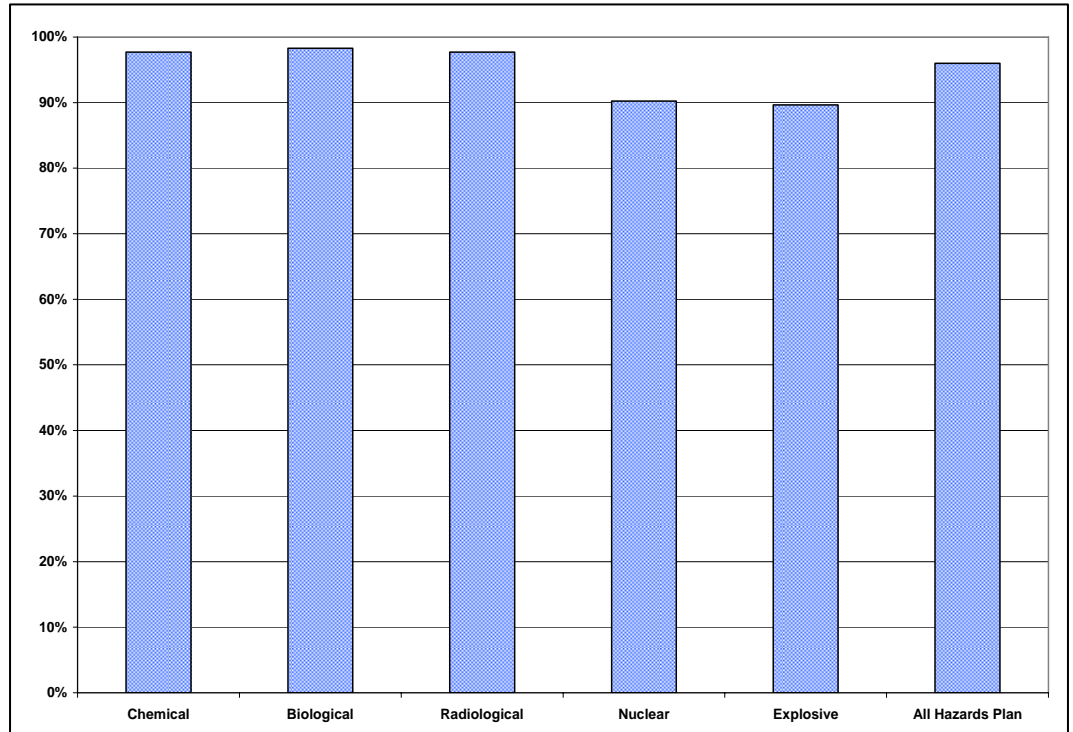
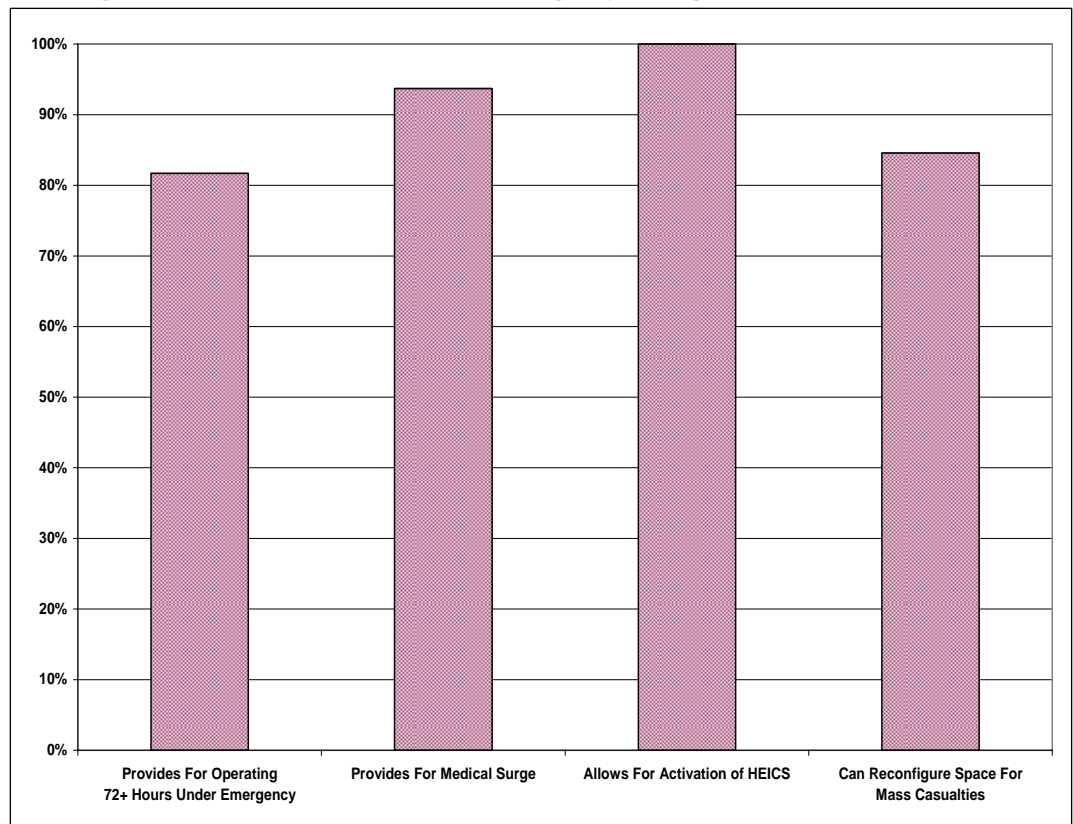


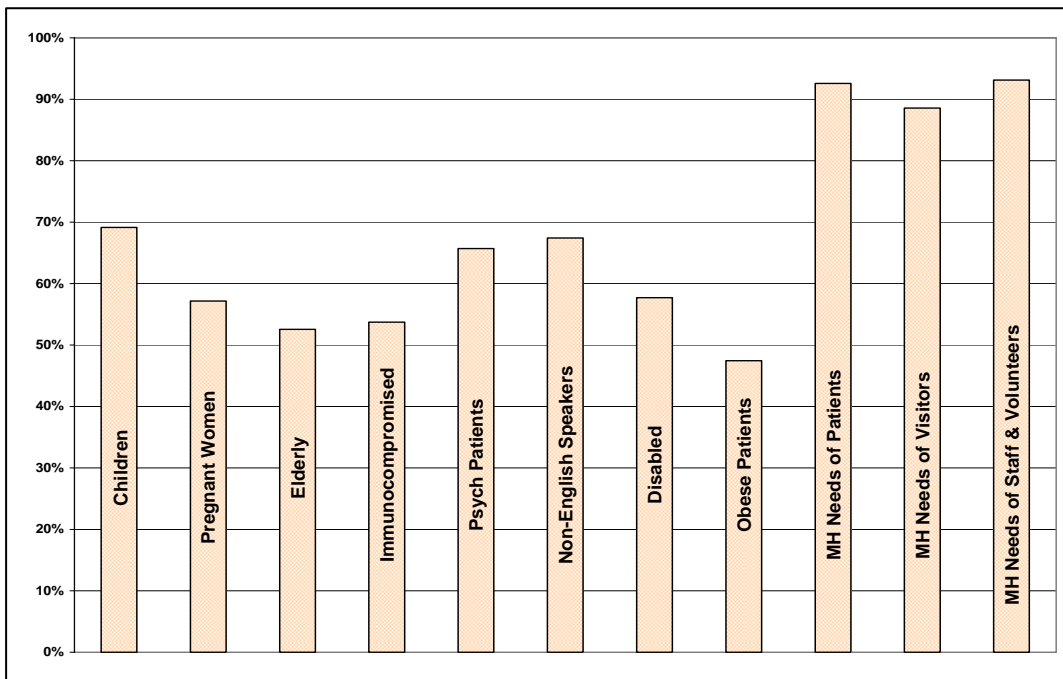
Figure 5: Percent of Hospitals with Emergency Management Plan for Operations



Most trauma center's (89-93%) plans for special needs encompass the immediate psychosocial needs of inpatients, staff, and visitors. Special needs of children (69%), psychiatric patients (66%), and pregnant women (57%) are not as commonly addressed (see Figure 6). Of other special needs patients, plans to care for immunocompromised, elderly, and obese patients are present about half of the time (54%, 53% and 48%, respectively).

Financial planning as part of the EMP activation is in place in most trauma centers (89%) but as noted previously only 27% have plans to accept donations of money, goods, or blood. In several previous events, blood donors caused congestion problems at hospitals and blood banks.¹³ For example, after the World Trade Center attack, donors, volunteers, and individuals searching for family members overwhelmed St. Vincent Hospital in Manhattan until they were redirected by city buses to other locations while staff were preparing for mass casualties.¹⁷

Figure 6: Percent of Hospitals with Mass Casualty Incident Plans for Special and Mental Health Needs



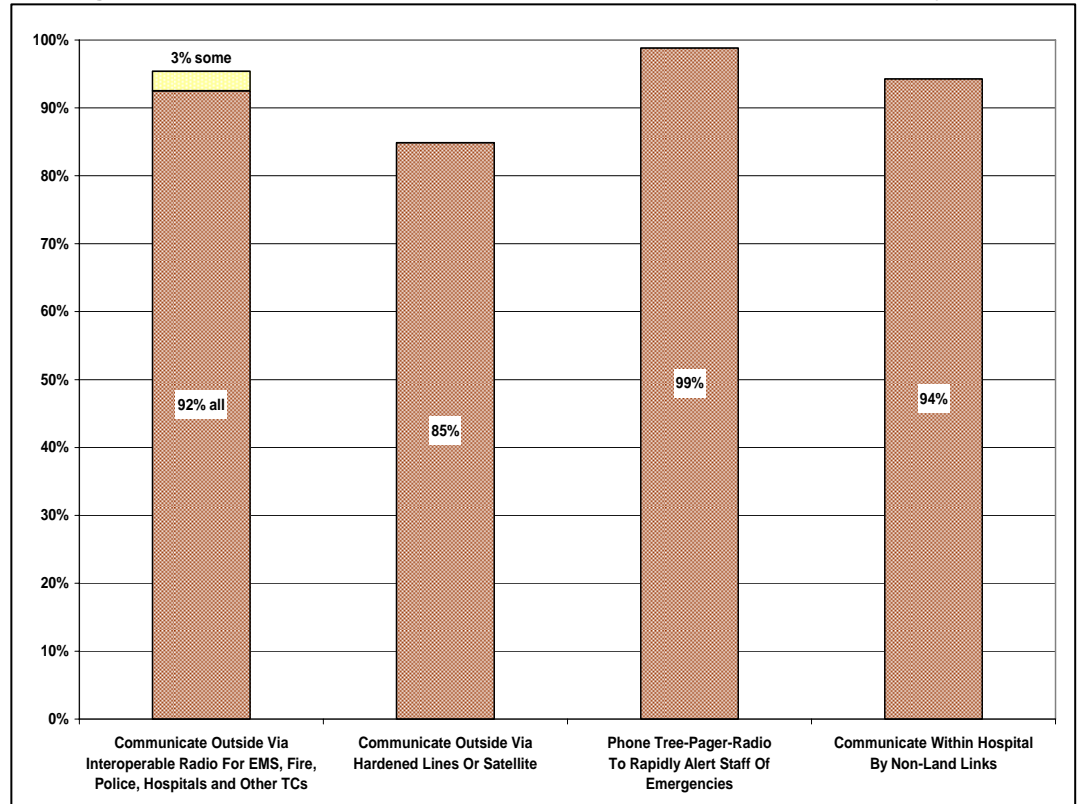
COMMUNICATIONS

Internal and external communications have proven to be vital, but often are the greatest barriers to successful operations of trauma centers in disasters of mass scale of all hazards.¹⁸ Key to successful communications is the ability to link disparate radio frequencies, satellite communications and landlines. Communications interoperability has plagued disaster response efforts in virtually every major event.² For example, problems with interoperability increased the loss of lives at the World Trade Center when it became known that the buildings would inevitably collapse.¹⁹ Interoperability problems also left the Gulf area incommunicado with only a few cell phones and Blackberry's™ being a means to call for outside aid during Hurricane Katrina.²⁰ With this primary aspect of preparedness in mind, trauma centers were asked whether they could communicate outside the hospital using interoperable technology with EMS, Fire, Police, and other hospitals and trauma centers (see Figure 7).

Ninety-two percent (92%) said they had fully interoperable communications capability, two-way radio or satellite phones, with all other providers and services, while three percent (3%) said they could communicate with some. Slightly fewer (85%) reported that their external communications could be connected through hardened (able to withstand nuclear or attacks by being placed deeply underground or shielded by copper and concrete) telecommunication lines, or satellite. Virtually all (99%) of reporting trauma centers have a telephone tree-pager-radio or other system to directly and rapidly alert key staff and others of an impending emergency. At least one (1) Highly Prepared trauma center does not use phone trees because of their lack of reliability.

Ninety-four percent (94%) of trauma centers report communications capabilities within their own facility that do not depend on land lines. These devices consist of "walkie-talkies" and other non-telephone means to communicate. Not asked was whether the trauma centers had a backup paper

Figure 7: Percent of Hospitals with External and Internal Communication Systems



method for ordering, communicating, and supporting operations during a true power blackout using runners or other communication chains. This aspect of intrahospital communications was observed during the onsite Validation Visits to the five (5) Highly Prepared Trauma Centers and those findings are detailed in their reports.

Table 3 shows the percentage of trauma centers able to communicate with a local military base, intelligence agencies including Homeland Security, local and state Public Health, Red Cross or other family reunification agency, and all prehospital services including commercial air medical and Military Assistance to Safety and Traffic (MAST) transport. While nearly all can communicate directly with local agencies and aid organizations, 81% percent can communicate with intelligence agencies and 65% percent with the military base present in the community. However, their dependence on functioning electrical power and telephone circuitry is not known.

| % | Community Entity |
|-----|---|
| 81% | Intelligence Agencies Including Homeland Security |
| 65% | Local Military Base (When Present) |
| 90% | All Prehospital Services, Airmedical and MAST |
| 95% | Family Reunification Organizations |
| 99% | Local and State Public Health |

Source: NFTC

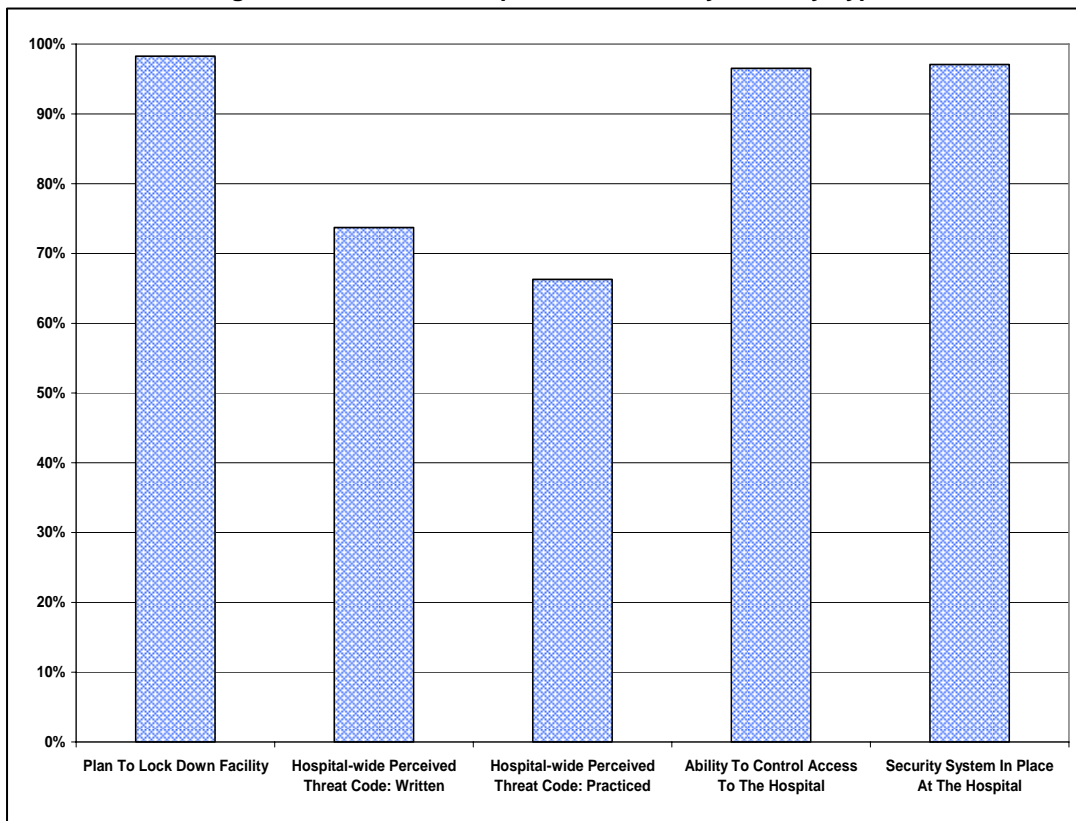
Approximately 94% of Level I and Level II reporting trauma centers are able to monitor resource availability, including staff for ED capacity, overall bed capacity, and ICU beds, and 81% can monitor OR suites. This capacity to monitor hospital resources mainly occurred at the regional level (87%). Statewide monitoring systems are present less often (13%). New Mexico, North Carolina and Maryland use a proprietary system configured to track both prehospital and hospital resources and capacity. The New Mexico system can also track the availability of air-medical services. These systems are commonly updated each morning, and when connected by pager or Blackberry™, key personnel can be alerted as to the status of current resources within 20-30 minutes 24/7. These systems also have been developed in Connecticut and the southern portion of New York State encompassing New York City.

SECURITY

The trauma centers were asked if they have established and practiced security plans. Over ninety-seven percent (>97%) of trauma centers indicated they had a plan to lock down their facility, had a security system in place, and were able to control access (see Figure 8). Fewer (74%) have a written “Perceived Threat” code for use throughout the hospital, and 66% had practiced the plan.

It is recommended that the lockdown plan be practiced with results recorded and evaluated to assure effectiveness and, if needed, improved. While nearly all hospitals had lockdown plans and 96% knew how much time it would take to lock down all entrances, 80% were able to, or were aware of the time needed, to lock down individual departments or units. Average lockdown times were 16.3 for hospitals and 15.2 minutes for individual departments. A few hospitals indicated that local Fire Marshall’s codes prevented them from locking down individual departments.

Figure 8: Percent of Hospitals with Security Plans by Type



“People with guns shut down an entire hospital evacuation for many hours.”

- Ruth Berggren

RESOURCES AND CLINICAL RESOURCES

Surge Capacity

In a mass casualty incident, one of the first resources needed is additional staffed bed capacity in all clinical areas. Figure 9 shows the average reported extra staffed bed capacities for three (3) of these critical resources. Trauma centers reported that 99 staffed beds could be added on average, constituting a 23% increase over their normal capacity. Their surge capacity within one (1) hour averaged 59 staffed beds, indicating the hospitals could be at 60% of their average maximum bed capacity within the first hour of a disaster.

| | Level A | Level B | Level C |
|---------|---------|---------|---------|
| East | 2 | 11 | 56 |
| Midwest | 1 | 6 | 31 |
| South | 5 | 30 | 102 |
| West | 2 | 8 | 36 |

Source: NFTC

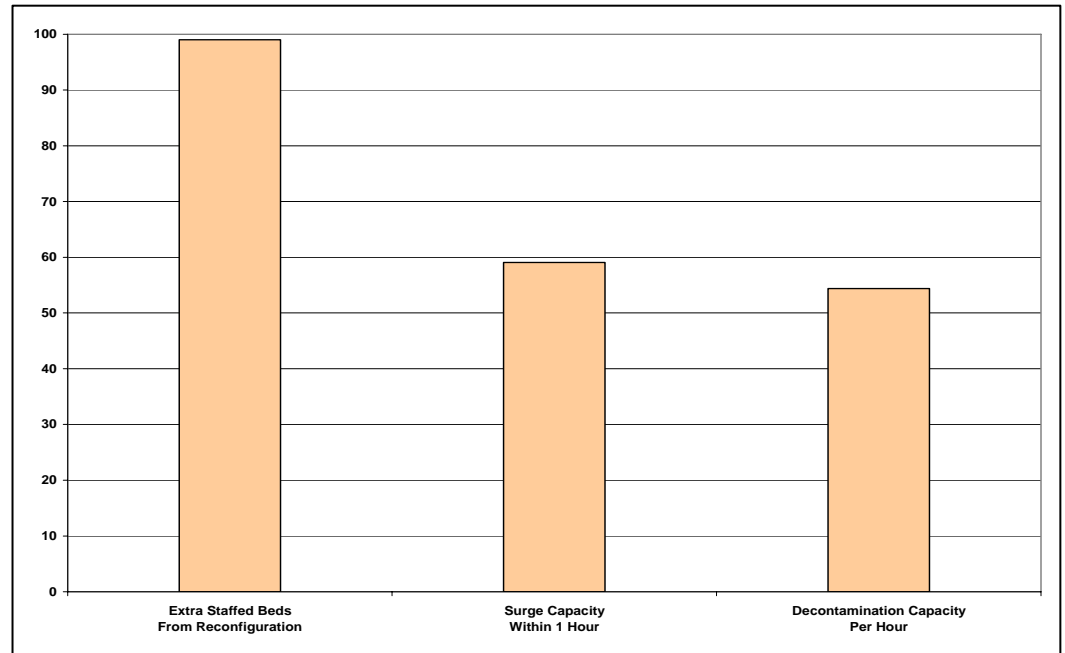
Decontamination Capacity

Decontamination capacity averaged 54 patients per hour (Figure 9) with a large capacity for waste water, but most of the highly prepared trauma centers that were visited stated that wastes would be disposed into the general sewer system or onto the ground in mass scale decontaminations. The resources needed for working with contaminated patients include different levels of staff protection. Level A protection, the most strict, is a self-contained breathing apparatus and a totally

encapsulating chemical-protective (TECP) suit normally available to field, i.e., HazMat, personnel. Level B protection involves the use of a positive-pressure respirator (self-contained breathing apparatus or supplied air respirator) and non-encapsulated chemical-resistant garments, gloves, and

boots. This level of protection is now recommended by OSHA as the minimum standard for unknown exposure. Level C consists of air purifying respirators and Level B clothing. Level D are the standard universal precautions found in all hospitals. On average across all regions, each trauma center possessed two (2) Level A suits, 11 Level B suits and 50 Level C suits. The median scores for protective equipment were zero (0) A suits, zero (0) B suits, and 30 Level C equipment when data was adjusted by frequency distribution. Equivalent measures for each region are shown in Table 4.

Figure 9: Average Extra Capacities of Hospitals for Emergency Conditions



Mutual Aid

Another resource issue that is often overlooked prior to a disaster is cross-credentialing of critical manpower resources.^{21,22} Sixty-five percent (65%) of the trauma centers have Memorandums of Understanding (MOUs) or other agreements for cross-credentialing staff from other general hospitals. For the critical staff that would be needed from other trauma centers during a mass casualty incident, 55% have established MOUs or agreements. Since injuries from a mass scale attack would ordinarily overwhelm an area, MAA/MOUs with trauma centers outside of the local area are advised.

Resupply

During a disaster that impacts a wide area, hospitals in the region without exclusive supplier contracts have found that the demand for resources and equipment rapidly exceeds supply. Among respondents in this study, 64% have exclusive contracts for pharmaceutical and medical supplies. Fewer (39%) have exclusive contracts with ventilator vendors. This lack of exclusivity was identified during one of the Highly Prepared Trauma Center Validation Visits where it was noted that the entire large metropolitan area is served by the same 10 durable medical supply vendors. In another visit, the State Trauma System is working on a problem with overlapping commitment for ventilators for the entire state.

Funding

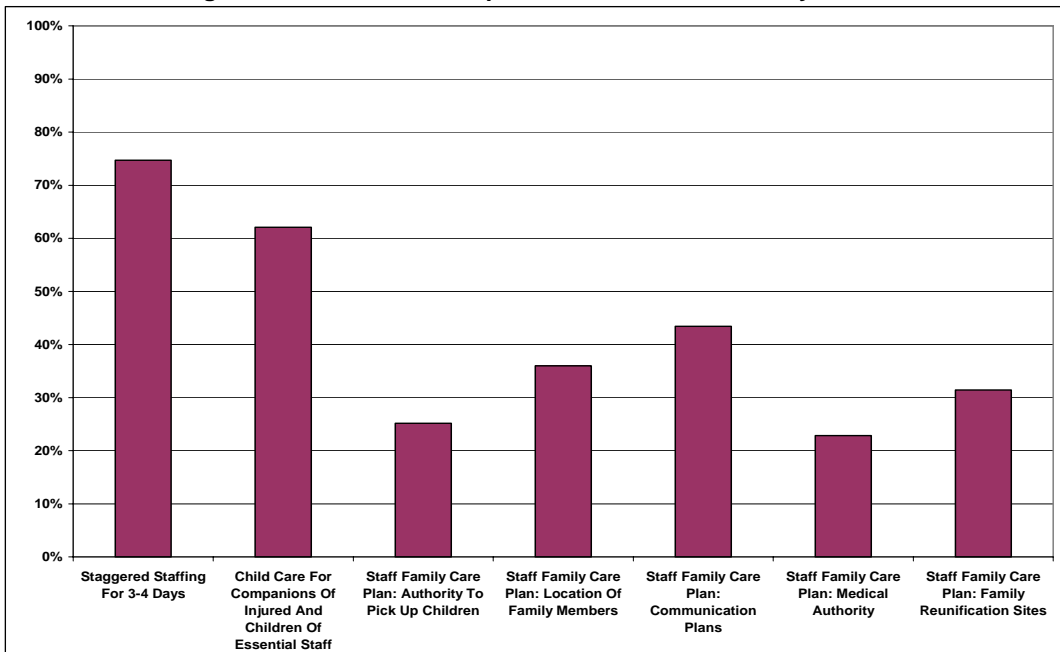
Preparedness funding is critical to successful hospital and trauma center response to disasters. A total of \$69.9 Million (median: \$182,500) was granted to trauma centers in 2004 from a variety of governmental funding sources. Although trauma centers that received more of this money had somewhat higher preparedness scores, this trend was from too small of a sample to determine statistical significance. The average scores for hospitals above and below \$182,500 are 76.0 and 72.8, respectively. By far, the largest amount of funding provided, \$45.6 Million or 65%, was from the Health Resources and Services Administration (HRSA) under the National Bioterrorism Hospital Preparedness Program (NBHPP). The survey results found that as the number of any type of hazard sites increased in the hospitals' catchment area, their preparedness funding went up. When funding was regressed on each type of hazard, it was determined that toxic hazards drove this statistically significant correlation.

SUSTAINABILITY

Along with coverage for added capacity, qualified credentialed personnel are needed to staff extra beds for prolonged periods, and to open and sustain external operations at supplemental care sites in an emergency situation. While willing staff are often quick to respond to a disaster, sustaining their involvement is more difficult unless provisions are made for care of dependent family members (elderly or disabled), children and pets, and for duty rotations. Three-fourths (75%) of responding trauma centers had plans to stagger staffing over 3 to 4 days (see Figure 10). These plans will be challenging if the natural disaster causes the employees' or physicians' own home to be endangered or even destroyed. In that case, their family could be at risk, injured, or scattered, making staff participation or mutual aid less likely for the long term.

Though 62% of reporting trauma centers plan for child care of staff and companions of the injured as part of the EMP, less contain details that would relieve their staff of child care concerns. For the responding hospitals, 25% have authorizations to pick up children of their staff, 23% can medically treat their minor children, and 43% and 31%, respectively have plans for staff family communication and reunification (see Figure 10).

Figure 10: Percent of Hospital with Staff Sustainability Plans



Best Preparedness Practices - Sustainability

Two of the Best Preparedness Practice Trauma Centers chosen have practices in place for maintaining operational sustainability.

Trauma Center H - Peak Operational Sustainability

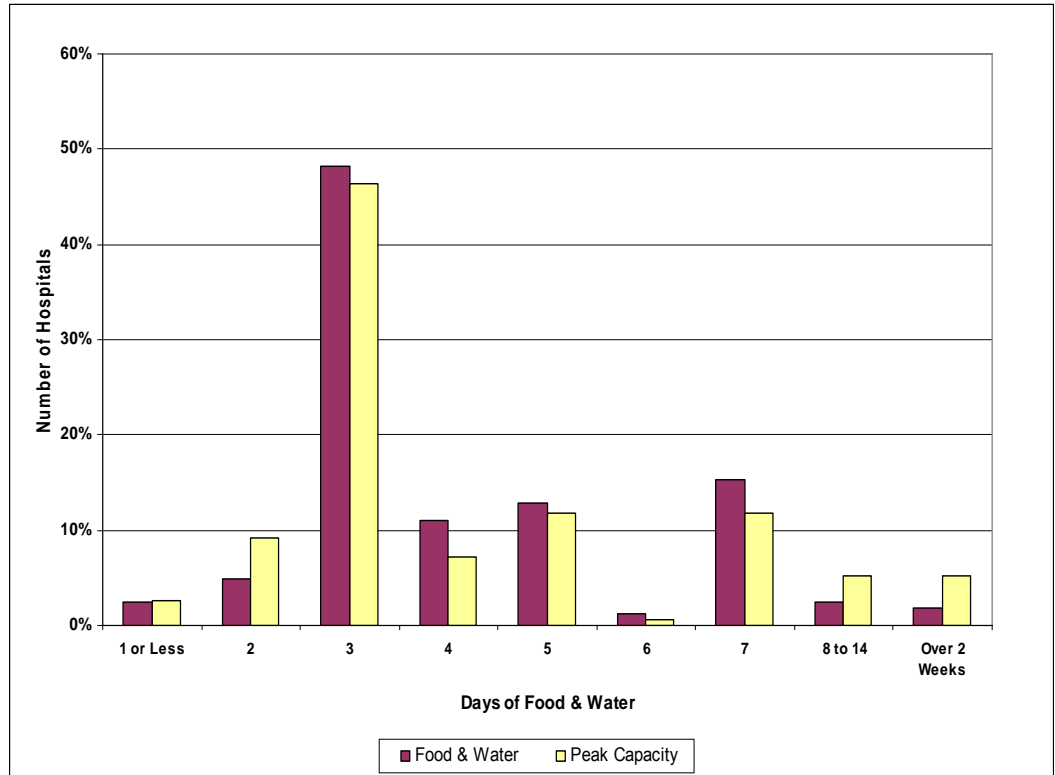
Trauma Center H has multiple management systems related to surge capacity that have been integrated into the hospital's normal daily operations. The efficiency of this daily practice has placed the hospital at a significant advantage in the event there is a sudden and/or a sustained influx of patients. Trauma Center H has a freestanding emergency department with plans to open a second one in 2007 and potential for a third is being evaluated.

Trauma Center I - Overall Operational Sustainability

Trauma Center I utilizes a two-tier employee call list for emergency situations and provisions can be made for employees to be housed on campus. Trauma Center I also stockpiles bulk amounts of food, water, gas, and other critical consumables. Employees are offered children, elderly dependent, and pet care on-site for the duration of a crisis.

Sustainability also includes the ability of the trauma center to provide nutrition, water, and sanitation for a large number of patients, staff, volunteers, and even media in the event of a prolonged disaster response. Nearly all ($\approx 94\%$) of trauma centers can provide both patients and staff with adequate food and water to sustain operations for 3-4 days. They are less able to offer nutritional care to volunteers (83%), patients' families (68%), and only half are prepared to feed the media (51%). While 82% say that their EMP provides for operating more than three (3) days under emergency conditions, half (42%) of the centers report ability to operate at peak capacity for more than three (3) days. The greater the number of days a hospital could operate at peak capacity was positively correlated to a higher preparedness score (see Figure 11).

Figure 11: Percent of Trauma Centers Able to Sustain Days of Self-contained Food/Water and Peak Capacity



“Integrated, collaborative networks with intrinsic local discipline, support, and assignment of responsibility represent the most effective planning and action model.”

- Kenneth L. Mattox

ABOVE VS. BELOW AVERAGE PREPAREDNESS SCORE CHARACTERISTICS

Trauma centers were scored (0 – 100) using their survey responses to measure their preparedness in case of a blast attack and/or disaster in the community. Initially, these results were analyzed by reviewing characteristics of trauma centers that fell above or below the average score of 73.7. Three (3) types of characteristics were compared by location by region, trauma designation level, and membership in a state trauma system. Additionally, if no significant differences appeared for that categorization, then characteristic differences between trauma centers in the top 20% and the bottom 20% were also analyzed.

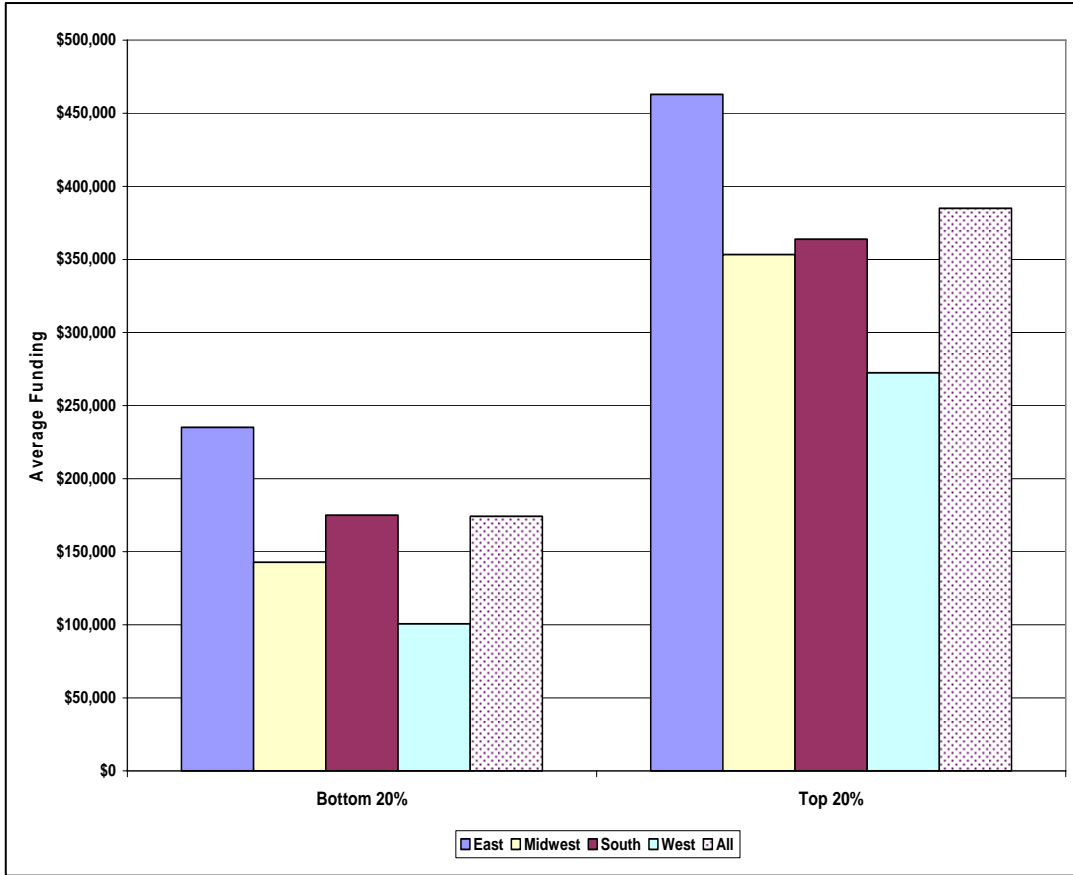
Membership in a state trauma system did not appear to influence whether the center scored above or below average in preparedness. Within systems, those states that linked bioterrorism preparedness to the trauma system (FL, NC, CT, NY) also showed no difference, however this finding was from too small of a sample to determine statistical significance. When only centers in the top and bottom 20th percentiles of scores were compared, 64% of centers in systems linking bioterrorism appeared in the top fifth, while 42% of centers in systems *not* linking bioterrorism appeared in the top 20%.

Trauma designation level exhibited a strong influence on a trauma center’s preparedness score. More Level I trauma centers (68%) scored above the average preparedness score than did Level II centers (44%), however the average scores for Level I and Level II centers were fairly close at 76.3 and 71.1, respectively, which is not statistically significant due to the small sample size.

As to regions, no regions differed by above or below the average preparedness score or in the top or bottom 20th percentiles. Though differences between the South and other regions appear large, the South’s small sample size makes statistical significance difficult to detect.

For the 168 trauma centers that provided funding information, significant regional differences in average reported preparedness funding exist for the East (\$606,520) compared to the Midwest (\$266,161) and to the South (\$229,893). For trauma centers having above average scores, significant regional differences in funding exist for the East (\$761,556) compared to the average of all other regions (\$361,651). In breakdown, the East's funding is different from the Midwest's (\$314,927) and from the South's (\$280,154) (see Figure 12).

Figure 12: Comparison of Average Preparedness Funding by Region for Hospitals Scoring in Bottom 20% vs. Top 20%



CHARACTERISTICS OF SELECTED HOSPITALS

HIGHLY PREPARED PROGRAM TRAUMA CENTERS

There are several key characteristics common to most, if not all, of the highly prepared hospitals that were visited. All of the hospitals are leading trauma centers that have prepared a wide array of resources to respond to large numbers of both adult and pediatric casualties from a host of hazards, whether natural or human-caused. In all instances, extraordinary leadership and commitment, both internal and regional, has fueled this planning and preparation. In every circumstance, excellent, collaborative relationships with local and regional partners led to the development of a well-planned, comprehensive *community or region-wide* strategy for responding to a large-scale catastrophe. Uniquely prevalent in each community visited was the hospital's partnership with the Military. Through this particular partnership, trauma centers are able to *significantly* expand their surge capacity for triage, decontamination, walking-wounded, emergency treatment space, medical and critical care beds, and surgical care.



Previous experience with an actual disaster or a mass casualty event was common to all of the highly prepared hospitals that were visited. The lessons learned from these experiences has kept the hospitals ever vigilant in planning for emergency operations and response to mass-casualty events. These experiences have led to the development of common areas of strength and excellence exhibited by each hospital's disaster preparedness program; attributes that can be readily adapted by other hospitals. These commonalities include:

- Exceptional leadership and commitment, both internal and regional, for emergency preparedness and disaster response planning exhibited by hospital Board, senior administrative staff, trauma services, physicians, staff, and community partners
- Hospital recognition of *its* role to serve as a leading institution for disaster preparedness planning in the region and as a significant community resource for disaster response
- Strong leadership and active participation in the state and regional trauma care system with lead functions for system and disaster planning
- Outstanding collaborative relationship with medical and command staff at major military installation, blending both civilian and military assets into a cohesive chain of expandable resources and capacity
- Excellent relationships and alliances with local, regional, and in some cases state, partners resulting in collaborative, region or statewide planning for disaster preparedness and response. Partners include but are not limited to EMS, Fire, law enforcement, military, police, emergency operations entities, Hospital Association, community hospitals, county government, and Public Health
- Previous experience with an actual disaster or large-scale casualty event including fire, severe storms, hurricanes, tornados, widespread electrical failure, and mass evacuation of patients from outlying facilities. The combination of these real events has kept each hospital vigilant in planning and improving its response to disasters and mass casualty events
- Extensive intra-hospital and local communication redundancies including landline telecommunication operable without community power, wireless telephone, alpha-numeric paging, wide-area UHF-VHF handheld and base radios, HAM amateur radio network with trained operators, overhead paging system, web-based communication and notification systems, and 'voice-over-internet-protocol' (VoIP)
- Web-based regional (and in some instance statewide) bed capacity and resource monitoring system that provides up-to-date information about the availability of trauma, sub-specialty, EMS, and disaster services
- Extensive sustainability with backup of all system requirements, inventories, power, human resources, and patient services to operate at peak performance for maximum patient volume. In some instances this could be extended up to 10 days
- Extensive and rapid ability to surge, both on and off campus, with *significant* capacity for triage, decontamination, ED beds, negative pressure treatment space, medical-surgical and critical care beds, and ambulatory and surgical care

"One of the best-prepared hospitals in the country to respond to a large-scale catastrophe resulting from any number of causes."

*- Validation Visitor of
Highly Prepared
Trauma Center*

- Excellent decontamination facilities and procedures for chemical, biological, radiological, nuclear, and explosive incidents including self-contained units with large run-off capacity, and measures for hypothermia prevention and protecting staff from inadvertent contamination
- Maintenance of a full schedule of “real-time” drills (including unannounced and off-hour); exercises and tabletop events done in collaboration with state and regional localities, Military, and local community; emergency preparedness exercises also designed to test specific aspects of the EMP, i.e., communications, security, media relations, etc.
- Sophisticated, well-designed security system with ability to lock down entire campus and shut off perimeter access within minutes. Some facilities included the use of an armed security force and cement barricades

BEST PREPAREDNESS PRACTICE TRAUMA CENTERS

There are several common traits in those trauma centers that scored highly in one or more essential characteristics defined by the Advisory Committee. One notable characteristic was a lead individual, empowered to convene others both within and external to the organization, to plan for and test emergency management planning assumptions. Another was the application of well-known principles of performance improvement, so that the plan became a living document that improved over time. Finally, most of the Best Preparedness Practices (BPP) had applications for daily operations which made them more likely to work seamlessly during a highly stressful, mass casualty event. Writing the BPP’s was mostly assigned to either the Safety Officer or Emergency Preparedness Director. They were well known in the facility and were often multi-tasking duties, often due to changes in the Joint Commission for Accreditation of Healthcare Organizations (JCAHO) requirements for patient safety and disaster planning. The BPP trauma centers nearly always planned for all-hazards, and focused resources on continuously training and updating staff on changes in the plan. Other distinctive aspects of these trauma centers are:



- Strong trauma service leadership with ties to the emergency care community and involvement in both hospital and regional disaster preparedness planning
- Development of technology to enhance the management and information flow related to patient tracking and placement
- Allocation of personnel and financial resources toward preparedness activities
- Involvement of executive management to spur development of practical approaches to emergency management planning
- Excellent interdepartmental communication and collaboration
- Flexible approaches that foster independent learning, self-teaching tools
- Willingness from the corporate and executive levels to redirect resources to planning and non-clinical tasks

OVERVIEW OF HIGHLY PREPARED TRAUMA CENTERS

TRAUMA CENTER A

Trauma Center A has used its experience of surviving three (3) severe natural disaster events to evaluate its overall state of preparedness and optimize plans for future response. The cornerstone of this hospital's success is its strong relationship with other regional hospitals and its participation and leadership in the state trauma care system, which in this state has integrated terror and all-hazards preparedness into its trauma plan. Trauma Center A has continuously improved its capacity and resources and has repeatedly met or exceeded expectations when faced with disaster situations. It has demonstrated that state and regional coordination, inter-agency cooperation, creativity, and thoughtful planning can result in an effective strategy for responding to mass-casualty. The areas of strength and excellence manifested by Trauma Center A are:

- History of effective response to multiple natural disasters that required interagency cooperation and coordination, staff recall, patient evacuation, and sheltering
- Extensive communication redundancies including a landline telecommunication system operates without community power, wireless telephone system, alpha-numeric paging, wide-area UHF-VHF handheld and base radios, HAM amateur radio network with trained operators, overhead paging system, and under beta testing, a "voice-over-internet-protocol" (VoIP)
- Development of disaster response "cost centers" for finance accountability provides precise cost accounting and the necessary documentation for reimbursement by Federal Emergency Management Administration (FEMA) if disaster is federalized; practice also facilitates future budget projection
- Establishment of excellent collaborative relationships with state and regional planners and care providers resulted in region-wide planning for disaster preparedness and response; partners include EMS, public health, veterinary/agriculture, military, emergency management (city and county), fire, law enforcement, mental health, and community health and education representatives
- Strong leadership and participation in state and regional trauma care system with lead functions on the advisory committee for trauma and disaster planning; Trauma Center A serves as the single point of contact for state offices in the event of a regional or statewide emergency
- A web-based state and regional bed capacity and resource monitoring system used to monitor and manage trauma, EMS, and disaster services and capabilities for the state; system provides up-to-date information on hospital specialty service capability
- Extensive sustainability with backup of all system requirements, inventories, power, human resources, and patient services to operate for 4 days at peak performance for maximum patient volume; emergency back-up power can be extended up to 10 days
- Well-defined security response plan that includes the police staff and ability to lock down entire campus in less than 5 minutes
- Extensive and rapid surge ability, both on and off campus (using sister community hospitals), with significant capacity for triage, decontamination, ED beds, medical-surgical and critical care beds, and ambulatory and surgical care
- Excellent decontamination resources for treating both ambulatory and non-ambulatory patients with additional immediate capacity available via a mobile truck; decontamination teams developed and trained and water used is heated

TRAUMA CENTER B

Trauma Center B is clearly one of the best-prepared facilities in the country. It has an extraordinary emergency management plan (EMP), an exemplary preparedness staff, a committed administration, and dedicated physicians and staff. The hospital has repeatedly tested and drilled each component of its EMP both through tabletop and actual mass casualty events. Through an actual disaster, it has demonstrated its capacity to effectively expand its resources for large numbers of patients and successfully operate for an extended period of time under blackout conditions.

A significant aspect of Trauma Center B's success is its strong relationship with emergency response agencies, other community hospitals, and its regional leadership as a trauma facility. Trauma Center B in collaboration with its multi-disciplinary, multi-jurisdictional partners has

“The plan lays out the procedures for decontamination and clearly is designed to protect ED or triage staff from inadvertent contamination. During the Validation Visit, members of the large decontamination team presented a decontamination drill that was outstanding. The drill was truly impressive (see photos). The surveyor was particularly impressed with the fact that more than 90% of the decontamination team was comprised of non-clinical personnel including painters, maintenance people, etc.”

- Trauma Center B Validation Visitor



developed a well-planned, comprehensive EMP that extends beyond the hospital campus to include the community at large. The strengths and areas of excellence exemplified by Trauma Center B include:

- Previous experience with an actual mass casualty event that required the hospital to rapidly accommodate hundreds of patients and operate without community power for an extended period of time
- Effective partnering with first response agencies (EMS, law enforcement, fire, emergency communications, etc.), medical community, other hospitals, public health, and government to develop an EMP for responding to large-scale critical incidents within the huge bi-state metropolis; includes an inter-agency affiliation agreement and regional organization (EOC) that is staffed during business hours, with on-call 24/7, to coordinate emergency operations and response between all area agencies, First Responders, and First Receivers
- Numerous redundant intra- and inter-hospital communication devices (pager, PDA, walkie-talkies, computer based notification, Ham radio, etc.) with ability to contact outside agencies including federal, state, and county government, other hospitals, and regional EOC via telephone, cell phone, satellite phone, email, and VHS radio; HEAR-RADIO system as well as a system-wide medical communications center (operates 24/7) used to communicate with EMS and other First Responders, and coordinate patient delivery and care with other community hospitals throughout the metropolitan area
- An administrative staff, trauma program manager, and trauma medical director have strong knowledge of disaster preparedness and dedicated to providing leadership for disaster management planning, drill exercises, and education
- Extensive and rapid ability to surge, both on and off campus, with significant capacity for triage, decontamination, medical-surgical beds, critical care beds, and ambulatory and surgical care
- Extensive sustainability with backup of all system requirements, inventories, power, human resources, and patient services to operate the campus for over 72 hours at maximum patient capacity; hospital has extended capacity up to 10 days
- Extraordinary state-of-the-art computer system provides a complete overview of patients, bed availability, OR suites, and staff; utilizes bar coding that starts in the field, as patient arrives at hospital, bar code on the ambulance call sheet is scanned and patient is entered into the hospital's computer system; patient can be followed throughout their entire hospitalization; a dashboard function allows user to see real-time census and numbers of patients waiting for beds showing the status of over 1,000 beds at one glance and tells user which bed is occupied, gender of patient, whether patient is waiting for tests, surgery, medications, etc., and other strategic information pertaining to hospital resources
- Excellent decontamination facilities and procedures for care of victims with chemical, biological, radiological, or nuclear exposure, from explosive incidents, or any other hazard; decontamination team comprised largely of non-clinical personnel including painters,

“The hospital has one of the best disaster preparedness plans this reviewer has seen.”

- Validation Visitor of Highly Prepared Trauma Center

maintenance people, etc.; security trained to guide vehicular and pedestrian traffic to the decontamination areas that include several alternate sites that are remote from clinical areas where mass decontamination can occur, using low-pressure fire hoses

- Financial tracking procedures well designed to meet Federal, state, and insurer guidelines for collecting reimbursement for disaster losses
- Multiple mutual aid agreements with other healthcare facilities to assure that there are ample credentialed nurses and physicians for any eventuality and an expedient emergency credentialing process that includes authorized ID cards
- One of the most sophisticated security systems in the country including a multi-million dollar security command center with redundant generator back-up, electronic monitoring of all entrances, digital video/camera monitoring throughout the campus, and an armed security force that can lock down and shut off the perimeter of the entire campus within a matter of minutes and have heavy barricades at all vehicular entrances within the hour

TRAUMA CENTER C

Trauma Center C has prepared a wide array of resources for large numbers of both adult and pediatric mass casualties from a host of hazards, whether natural or human caused. This preparation extends well beyond the hospital proper, into numerous buildings and external sites and has been thoughtfully coordinated with other community hospitals and entities responsible for disaster planning and response. The hospital has dedicated lead personnel and has actively participated in both the regional trauma care system and planning for emergency operations and response to mass-casualty events.



Trauma Center C has established a strong relationship with the local military installation, blending both civilian and military assets into a cohesive chain of expandable resources and capacity. The culture of sharing details about preparedness is well established in this facility, with trauma personnel taking the lead in providing regional education about surge capacity and resource expansion. This facility demonstrates how a trauma center's leadership and strong role in disaster response planning lends itself to optimal preparedness. Some of the strengths of the institution are summarized as follows:

- Previous disaster experience with widespread electrical failure and physical threat to hospital with near evacuation of patients; combination of these real events has kept the hospital vigilant in planning and improving its response to disasters and mass casualty events
- An administrative staff, trauma program manager and trauma medical director have strong knowledge of disaster preparedness and dedicated to providing leadership for disaster management planning, drill exercises, and education
- Excellent, collaborative relationship with medical and command staff at major military installation; ability to rapidly expand resources and capacity
- Integral to ability to respond to disaster situations is the County Medical Operations Center, a unit that is staffed and supported by hospitals, emergency medical responders, the County, and other community entities; partners within the community established this center to augment hospital response and resources within the region
- Extensive and rapid ability to surge, both on and off campus, with significant capacity for triage, decontamination, medical-surgical beds, critical care beds, and ambulatory and surgical care
- Numerous hospital communication redundancies, including a wireless telephone system, alpha-numeric paging, two-way radios, overhead paging system, runners, and a computer-based communication system
- Excellent relationships and alliances with emergency preparedness partners resulted in a comprehensive, well thought-out plan for disaster preparedness and response; partners include Emergency Operations Center (EOC), EMS, Police, Fire, Military, Medical Board, County government, Poison Control, Red Cross, and the Medical Examiner's Office
- Staff are very knowledgeable and engaged in disaster preparedness and response process
- An excellent operating room disaster preparedness plan developed using the AORN disaster preparedness guidelines and includes a staggered shift response
- Extensive sustainability with backup of all system requirements, inventories, power, human resources, and patient services to operate the campus for 5 days at maximum patient capacity; emergency back-up power includes 3 redundant systems and a number of diesel generators

"This hospital has one of the most sophisticated security systems in the country including the ability to completely lock down entire campus within five minutes."

*- Validation Visitor of
Highly Prepared
Trauma Center*

TRAUMA CENTER D

Trauma Center D exhibits all of the characteristics of a highly prepared trauma center predominantly by its exceptional leadership and commitment, both internal and regional. This high level of leadership and commitment has been translated to specific areas of strength and excellence exhibited by the hospital's disaster preparedness program; attributes that can be readily adapted by other trauma centers. These strengths include:



- Statement of commitment: *“The hospital recognizes its position as a leading institution in the region and as a community resource. The hospital will accept this role and support community operations and plans, provide resources for out-of-hospital emergency work, and fulfill its medical care responsibilities and duties outlined in the County Disaster Plan.”*
- High level of commitment and leadership for emergency preparedness program exhibited by Board, senior administrative staff, physicians, hospital personnel, and community partners
- State and countywide communication system links hospital and county Emergency Operations Center (EOC), Fire, Police, EMS, 9-1-1 dispatch, public health, a major military facility, and all hospitals throughout the state
- Extensive intra-hospital communication redundancies including a wireless telephone system, alpha-numeric paging, two-way radios, HAM amateur radio network with trained operators, overhead paging system, a web-based multilevel staff communication system, and designated emergency telephones located throughout the hospital and within the EOC
- Excellent collaborative relationship with medical and command staff at major military installation; relationship extends from the “everyday” rotation of surgical residents on the trauma service to participation in joint disaster exercises
- Outstanding Information Systems (IS) Disaster Plan developed for Hospital D and sister hospitals; plan includes a disaster recovery planner and three (3) IS specific drills conducted annually, incorporating functional and tabletop exercises; IS disaster plan has laudable goal to design and operate everyday systems architecture for quick emergency and disaster recovery
- Excellent relationships and alliances with community and regional partners resulted in collaborative region-wide planning for disaster preparedness and response; partners include fire, police, EMS, 9-1-1 dispatch, Hospital Association, community hospitals, Military, and county government, including Public Health
- Well-controlled key card security system with ability to lock down entire campus in less than 15 minutes
- Maintenance of a full schedule of “real-time” drills (including unannounced and off-hour); exercises and tabletop events done in collaboration with state and regional localities, Military, and local community; emergency preparedness exercises designed to test specific aspects of the EMP, i.e., communications, security, media relations, etc.
- Extensive and rapidly deployable surge capacity, both on and off campus, with significant capacity for triage, decontamination, negative pressure areas, ED treatment spaces, other ambulatory/urgent care treatment areas, operating rooms, medical-surgical and critical care beds; unique plan created to rapidly convert the ambulatory surgery prep and recovery unit to critical care beds, thereby increasing ICU capacity by 30 beds
- Excellent decontamination facilities with indoor self-contained, separate shower areas for men and women convert rapidly to negative pressure space, secure from both the ED and outside areas; decontamination facilities exterior to the building also gender separated, have heating units for use in winter conditions, and large capacity for spill and run-off containment
- Extensive sustainability with backup of all system requirements, inventories, power, human resources, and patient services to operate the campus for 3-4 days at peak performance for maximum patient volume operations; emergency back-up power extends to 8 days with existing fuel resources if power demands are decreased across the campus
- Well-designed program for identification of victims and reunification of victims and families

TRAUMA CENTER E

Trauma Center E exemplifies the benefits of partnership with regional and state public health, Military, other community hospitals, and emergency response agencies who share a vested interest in disaster preparedness and management planning. These partnerships have resulted in the ability for the hospital to rapidly expand its capacity, both on and off campus, with significant capability for triage, decontamination, and emergency treatment, medical-surgical and critical care beds, and ambulatory and surgical care.



As a regional resource within a long-standing, mature state trauma care system, Hospital E fills a niche between a larger, higher Level trauma center and other community hospitals, strengthening the capacity of the entire region. This facility demonstrates how a trauma center's leadership and partnered role in disaster management planning leads to optimal preparedness. The strengths of the institution include:

- Chief Operating Officer (CEO) is a strong leader who has experience with trauma systems and highly committed to providing the leadership and resources for disaster preparedness and response
- trauma program manager, medical director, and senior staff have strong knowledge of disaster preparedness and are dedicated to providing leadership for large-scale disaster management planning, drill exercises, and education
- excellent, collaborative relationship with a major Military installation and public health entity as well as with 5 community hospitals within its region; partnerships resulted in ability of the hospital to rapidly expand its surge capacity in terms of personnel, bed space, treatment facilities, and equipment
- extensive sustainability with backup of all hospital requirements, inventories, power, human resources, and patient care services to operate the campus for 3-5 days at maximum capacity
- sophisticated, well-designed security system with the ability to lock down entire campus and secure perimeter within minutes
- an impressive schedule of drills, actual and tabletop, conducted in collaboration with regional partners and the military; include the involvement of executive staff; drills videotaped, critiqued, and action plans for improvement routinely developed and implemented.
- an excellent color-coded system for identifying specific threats and hazards with protocols and guidelines established for the response and management of each type of threat; system developed in collaboration with the military and includes training from military teams
- an automated patient and resource tracking system including emergency department (ED) capacity, radiology, operating room (OR) availability, critical care bed space, staff, etc.; system ties into the state system for monitoring trauma hospital resources.
- excellent intra-hospital communication redundancies (web based, satellite phones, radios, etc.) that link with other community hospitals and the state, as well as the secure frequency military emergency communication system

OVERVIEW OF BEST PREPAREDNESS PRACTICE TRAUMA CENTERS

TRAUMA CENTER H: COMPONENT - PEAK OPERATIONAL SUSTAINABILITY

Trauma Center H has the ability to maximize and sustain its emergency department and inpatient capacity to meet sudden patient surges. Multiple management systems related to surge capacity have been integrated into the hospital's normal daily operations. The efficiency of this daily practice has placed the hospital at a significant advantage in the event there is a sudden and/or a sustained influx of patients.

Motivation

Trauma Center H's county has a rapidly expanding population, more than 700,000 people. This rapid growth in population has significantly strained both the education and healthcare systems. Trauma Center H recently applied and received a certificate of need to add 102 hospital beds to its system to meet the demands of the community. Trauma Center H has a Children's Emergency Department with approximately 40,000 visits per year and a Pediatric Intensive Care Unit.

Trauma Center H has a freestanding emergency department that opened in 2005 and plans to open a second one in 2007. The potential for a third one is likely and is currently being evaluated. The first site treats more than 70 patients per day and has a surge of greater than 85 patients in 24 hours at least once a month. In addition, in this first year alone, there have been approximately 2,000 inter-facility critical care or basic life support transports from this center.

Leadership

Since the year 2000, members of the senior executive staff have led numerous initiatives targeted to improving multiple processes related to surge capacity. The former Chief Operating Officer (COO) led a number of the task forces to address these issues. Another key individual served as the Vice President of Operations for a number of years and was recently promoted to the position of COO for the hospital system. The current COO's consistent leadership has led to the re-design of surge capacity initiatives.

Resources

Trauma Center H has a multitude of resources that has allowed it to maximize its surge capacity. Some of these resources include

- Performance improvement initiatives led by multiple task forces
- Optimal electronic information systems specializing in surge management
- Multi-disciplinary task forces
- Education and training in disaster response and hospital incident command for all departments and management staff
- Multiple drills/events related to surge/mass casualty incidents
- Upgrades and purchase of equipment and supplies for alternate emergency treatment sites
- Strong community partnerships with entities including hospitals throughout the state and region
- Plans for additional facility space for alternate treatment sites and observation units

Outcome and Evaluation

There are a number of changes that have been implemented as a result of regular and systematic evaluation of the system's ability to meet community demands. Initiatives will be continuously evaluated so systems can be improved to manage the growing daily operations as well as the periods of sudden influx of patients. Trauma Center H conducts continuous quality improvement monitoring to ensure that processes are evaluated and goals are accomplished and sustained.

TRAUMA CENTER I: COMPONENT - OVERALL OPERATIONAL SUSTAINABILITY

Trauma Center I's staffing issues for prolonged crisis are modeled after a number of facilities in Florida. Each unit's employee call list consists of two groups. When a disaster is expected to last longer than 24 hours, the first group is called immediately, then the second group is called in 11 hours. Provisions can be made for employees to be housed on campus from the onset of the disaster. Food, water, gas, and other critical consumables are stockpiled in bulk amounts. Trauma Center I has also established a plan for care of children, elderly dependents, and pets for the duration of the crisis.

Motivation

Trauma Center I increased efforts and funds in Disaster Preparedness after 9/11, including the addition of a full-time Emergency Preparedness Coordinator.

Leadership

The Director of Emergency Medicine and the Vice President of Operations were the key players who initiated the focus on Disaster Planning. Most efforts were produced in the Office of Safety.

CHILD, ELDER & PET DISASTER PLANS



Trauma Center I has developed Child, Elder and Pet Disaster Plan. See CD-ROM.

Resources

Trauma Center I conducts Operations and Awareness classes, as well as cross-training for staff to assist the ED should a crisis arise. Multiple drills are also performed with inclusion of all units.

Outcome and Evaluation

Hospital administration is proactive at Trauma Center I and encourages attendance from all administration and staff to HEICS, NIMS, and HazMat training. Disaster Planning has resulted in an increase in cooperation from inter and intra agencies and a decrease in friction and tension between units, hospitals and external agencies.

TRAUMA CENTER J: COMPONENT - PLANNING

Trauma Center J's Emergency Management Plan (EMP) was established to optimize patient care during all emergency situations. The plan addresses administrative issues such as program structure, reporting requirements for internal and external disasters, specific responsibilities, general safety, and staff education programs. This plan addresses four phases of emergency management planning: Preparedness, Response, Recovery, and Mitigation.

Motivation

Trauma Center J Health System's decision to enhance its ability to respond to emergency/disaster situations was based on the need to become more involved with local emergency response agencies and increase the level of preparedness to care for patients within the community.

Leadership

The Committee for reviewing and revising the Emergency Management Plan included the Environmental Care Director, Vice President for Integrated Services, Emergency Department Director, Director of Trauma Services, Chief Flight Nurse, Security Manager, and Vice President of Operations. Leadership for ongoing activities includes all of these individuals as well as a number of hospital department staff.

Resources

Resources were obtained through the hospital's corporate system, Disaster Preparedness/Response grants, and from the Regional Advisory Council (RAC).

Outcome and Evaluation

Information regarding disaster preparedness and response is distributed and discussed during new employee orientation and through tabletop discussions with the Emergency Incident Command cabinet regarding various scenarios. A "Safety Bite" (safety education tool) was also created for all system employees. The Health System's EMP was evaluated and revised through tabletop exercises and drill scenarios, both internally and externally in collaboration with local EMS, Fire, and various community leaders. Preparedness was tested after being successfully implemented during recent natural disasters.

TRAUMA CENTER K: COMPONENT - EDUCATION AND TRAINING

Trauma Center K has a dedicated Emergency Management Committee (EMC) that meets on a monthly basis to discuss and update emergency management plans. The Disaster Drill Committee (a sub-committee of the EMC), creates disaster drills for the hospital. The Disaster Drill Committee collaborates with local, state and Federal agencies to create courses in preparedness and develop realistic, large disaster drills.

Motivation

Trauma Center K's motivation to allocate more time and effort, as well as funds, for disaster preparedness and training was its sense of urgency to better prepare for an all-hazards approach to mass-casualty incident (MCI).

Leadership

The Emergency Management Committee utilizes the Department of Homeland Security – Federal Emergency Management Agency (FEMA) guidelines for leadership development and chain of command through the National Incident Management System (NIMS) training network and unified incident command.

Resources

Trauma Center K has subject matter experts to teach and coordinate *Hazmat Awareness and Donning and Doffing class (Hospital Decontamination For Chemical, Biological, Radiological, Nuclear, and high-yield Explosives (CBRNE)/Weapons of Mass Destruction (WMD) Incidents)* on a regular basis to all employees. Trauma Center K also offers and coordinates *CBRNE-MCI classes* on a regular basis to individuals from the emergency department, the Emergency

Management Committee, Facilities Maintenance, and Security Department. Courses on FEMS-NIMS training are also provided and taught to hospital personnel.

As part of partnership and preparedness with the community, members of the Emergency Management Committee assist the Regional Bioterrorism Network in teaching *Hazmat Operations Courses* and provide *WMD classes* for Emergency Medical Services (EMS) providers and hospital workers in a three (3) County area. Funds acquired are from the Center of Disease Control and Prevention (CDC/NCIPC) grants and regional grants from the local medical control authority (MCA). Funds have been allocated for redundant communication, personal protective equipment, decontamination equipment, NIMS, and trauma and Hazmat preparedness training.

Outcome and Evaluation

To evaluate the needs of the hospital, there have been multiple hazard assessments and vulnerability analyses performed with the appropriate follow-up actions developed. These have been created with tabletop exercises, paper drills, full-scale drills, and implemented for real events. Outcomes are measured using evaluation tools for all of these exercises. Post drill or real event reports are reviewed and disseminated by the Emergency Management Committee. Trauma Center K has assessed and improved the EMP on an ongoing basis with limited change. These assessments and improvements are multidisciplinary and have led to a better prepared Trauma Center for disaster response.

TRAUMA CENTER L: COMPONENT - COMMUNICATIONS

Trauma Center L has been working with other healthcare and emergency response and operations entities over the past several years to enhance the state and regional communications system. Several disciplines have purchased various types of communications systems and equipment using Federal funds. Trauma Center L benefits from the recent implementation of a statewide emergency radio system that includes the State Patrol (SP) and the Department of Health and its Emergency Medical Services (EMS) Division. The EMS emergency radio system is used to coordinate the activity of airborne or mobile medical personnel with hospital emergency departments throughout the state. Internally, Trauma Center L has a resource monitoring system that monitors the availability of resources in real time including the emergency, radiology, surgical, and pharmacy departments, and has the capability of communicating bed and staff levels.

Motivation

From a regional perspective, Trauma Center L regards redundant communication systems as an essential aspect of its Emergency Preparedness Plan (EMP) for planning, preparedness, response, and recovery prior to and during an incident.

Leadership

There are a number of individuals who have been instrumental in providing leadership for disaster related preparedness, with the hospital Safety Officer as the key person charged with this responsibility.

Resources

Trauma Center L's funding sources for this and other best practices were supported by the medical center, HRSA, Metropolitan Medical Response System, and Homeland Security grants, as well as Nunn-Lugar-Domenici, and the Office of Domestic Preparedness (ODP) programs.

Outcome and Evaluation

Many of the communication devices are used on a daily basis with back-up equipment tested regularly through the year. Information regarding all communication devices is disseminated over the hospital tele-health video conferencing system that communicates with 19 healthcare facilities within the bi-state region. Participants gather at the hospitals on a monthly basis to review and update the State/Regional Emergency Preparedness and Response Plan, with communications as a major focus point. A functional communications exercise with over 500 participants was recently conducted and involved a national border, multiple state/local agencies, an adjacent state, and multiple regions.

FINANCING EMERGENCY MANAGEMENT PREPAREDNESS AND RESPONSE

Trauma Centers have historically been First Receivers of severely injured patients, a communication hub for hospital response and patient redistribution, rescuers of regional facilities including nursing homes during natural and human-caused catastrophes, and integral to the preparedness and response to any type of terrorist attack or natural disaster. Despite this, there has been no supplemental funding to enhance trauma center preparedness for large scale events or those requiring special resources. Worse yet, they have been inadequately reimbursed for their “Good Samaritan” role in a number of instances as described in the following cases.

Totals for individual trauma center preparedness funding averages showed considerable differences by region. The Eastern region trauma centers report receiving 270% more funding than the Midwest and West and 925% more than hospitals in South as defined by NFTC standard criteria.

**Table 5: Trauma Center Regional Preparedness Funding Amounts and Sources
By Governmental Agency**

| | East | Midwest | South | West | All |
|--|---------------|----------------|--------------|---------------|---------------|
| Gov't Preparedness Funding Source | (n=62) | (n=52) | (n=19) | (n=35) | (n=168) |
| Local Public Health | \$ 527,000 | \$ 671,000 | \$ - | \$ - | \$ 1,198,000 |
| Regional Public Health | \$ 10,000 | \$ - | \$ - | \$ - | \$ 10,000 |
| State Public Health | \$ 2,832,647 | \$ 282,470 | \$ 40,000 | \$ 281,318 | \$ 3,436,435 |
| Regional EMS | \$ - | \$ 17,000 | \$ 51,129 | \$ - | \$ 68,129 |
| State EMS | \$ 25,000 | \$ - | \$ 100,000 | \$ 538,908 | \$ 663,908 |
| CDC | \$ 858,816 | \$ 168,070 | \$ 4,000 | \$ 101,179 | \$ 1,132,065 |
| HRSA | \$ 22,495,491 | \$ 9,415,368 | \$ 3,414,832 | \$ 10,244,039 | \$ 45,569,730 |
| Homeland Security | \$ 2,478,367 | \$ 1,471,817 | \$ 400,000 | \$ 1,774,249 | \$ 6,124,433 |
| Other Federal Agency | \$ 5,529,488 | \$ 1,764,669 | \$ 20,000 | \$ 24,000 | \$ 7,338,157 |
| Other | \$ 2,562,455 | \$ 50,000 | \$ 338,000 | \$ 1,088,200 | \$ 4,038,655 |
| Total* | \$ 37,604,264 | \$ 13,840,394 | \$ 4,367,961 | \$ 14,051,893 | \$ 69,864,512 |
| Average | \$ 606,520 | \$ 266,161 | \$ 229,893 | \$ 401,483 | \$ 415,860 |
| Hospital Spending On Preparedness | \$ 20,614,303 | \$ 17,977,445 | \$ 4,305,069 | \$ 11,288,850 | \$ 54,185,667 |
| Variance | \$ 16,989,961 | \$ (4,137,051) | \$ 62,892 | \$ 2,763,043 | \$ 15,678,845 |

* East region column does not sum to Total as one hospital did not break down total funding by source.

Trauma centers constitute only 10% of all healthcare facilities and have unique economic impediments.¹ They are less able to muster additional funds than other general or specialty hospitals with fewer economic burdens. Despite running a 14% loss for their trauma services nationally, trauma centers were at the forefront of the response to 9/11/2001 attacks in NYC and Washington and engineered the rescue of a majority of evacuees from the Gulf State hurricanes in 2005.¹

Case #1: St. Vincent Catholic Medical Centers

On the morning of September 11, 2001, St. Vincent Hospital in Manhattan had a clear view of the World Trade Centers (WTC) from the street and its top floors. Staff and patients watched in horror as the planes struck and the towers collapsed. Preparation for such a tragedy was well established since the initial attack on the WTC in 1993. St. Vincent's had established a well thought-out and executed plan to include family care, perimeter control and security, and staff response. As the 844 survivors eventually treated arrived, many on foot or by privately owned vehicle (POV), the hospital suspended normal operations, called in extensive staff to treat thousands of anticipated injured, and transferred stable medical patients to outlying facilities.

Although St. Vincent Catholic Hospital's response is a model for other hospitals, their financial compensation was not. Care and lost opportunity costs were determined to be \$25 Million, of which, after two years of lobbying, additional administrative work, and Congressional intervention, resulted in reimbursement of \$22 Million, leaving a \$3 Million deficit. This does not include the large amount of funds expended to upgrade its preparedness in anticipation for what is considered to be an inevitable next attack.

"Trauma Care Crisis Highlighted by New York Hospital Officials: 'We're Unprepared for Catastrophic Terrorist Attack'"

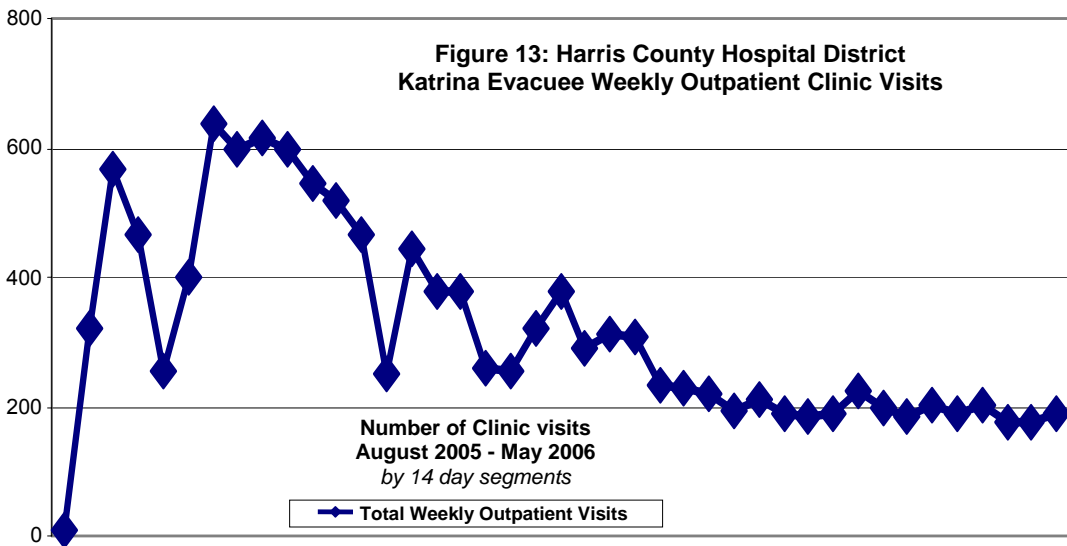
*- Anthony L. Kimmerly
HS Today*

Case #2: Harris County Hospital District

Harris County Hospital District engineered one of the most rapid and effective responses for displaced persons from Hurricane Katrina ever provided in this country. The Hospital District, manned by a multidisciplinary EOC with a single command structure, opened the Houston Astrodome to tens of thousands of chronically ill, injured, and displaced persons within 24 hours of notification. The County also mobilized all types of private and public buses to transport stranded victims from several states. The Astrodome and surrounding parking lots became a temporary healthcare facility to include shelter, clinics, mobile hospital and ancillary services, and a landing area for airmedical transport. This facility was intended to last only two weeks, a period shortened by the arrival of Hurricane Rita requiring the evacuation of Houston and the redistribution of these same evacuees.²³

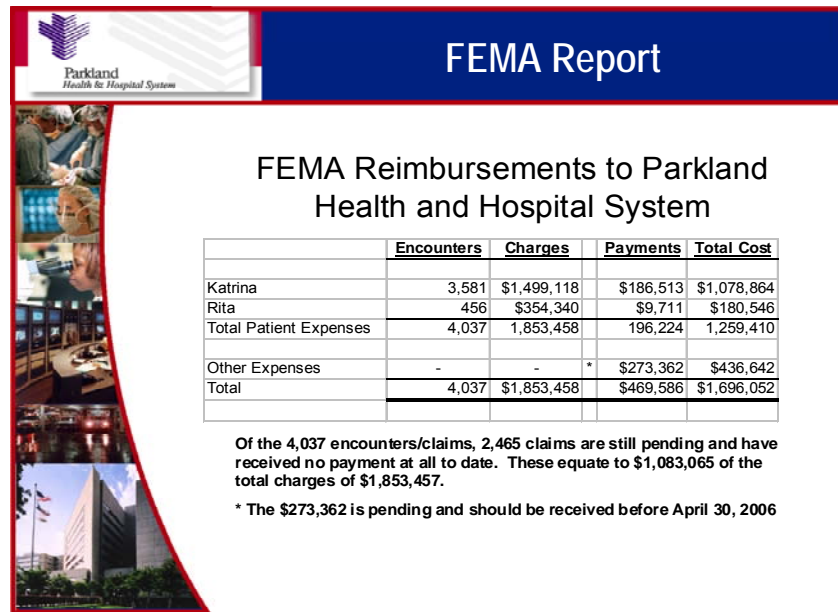
The overall costs of caring for Katrina-related ill and injured patients, those chronically ill including a large number of dialysis patients, and persons who became ill as a result of lack of nutrition, hydration, and shelter, was determined to be \$7 Million. Louisiana Medicaid waivers resulted in payments of \$2.3 Million. Some private insurances paid, but the amounts were insignificant. The Federal Emergency Management Administration (FEMA) paid only for opening and closing the Astrodome but not for patient care.

FEMA only pays for staff overtime, including that of local law enforcement, although the hospital provided a large number of staff. No overtime payments were recovered because the event occurred over Labor Day weekend which was the start of a new pay period. Thus, all salaries were paid by the hospital district. Ultimately, Harris County lost \$5.7 Million for its immediate response to the victims and displaced persons from Hurricane Katrina. Additional losses are not quantified for the continuing care for those persons who are unable to return to their homes in bordering states and are dependent on Harris County's charity care for the foreseeable future as their Medicaid waivers have expired.²⁵



Parkland has recovered \$219,900 with \$273K anticipated, for a loss of \$1 Million for its efforts to aid these unfortunate U.S. citizens. Parkland, following the example of St. Vincent's Hospital in NYC, will work diligently to pursue additional funds from any and all Federal and State sources.

**Figure 14: Parkland Health & Hospital System
Hurricane Charges and Reimbursement**



Financial issues in Emergency Preparedness and Response

The trauma center cases described show a pattern of poor financial returns on response to disasters that are of a scale that no one facility should bear financially. For FEMA to cover only the establishment of temporary medical facilities and tent hospitals without encompassing the costs of staffing and supplies is counterproductive. To cover staffing costs only for overtime simply burdens the trauma center in its period of recovery for the front-end costs engendered solely because of the disaster. The likely effect of this lack of equity in funding emergency response will be a general unwillingness for trauma centers to extend aid to other healthcare entities except for those under their corporate umbrella or with whom they have a Mutual Aid Agreement/Memorandum of Understanding (MAA/MOU) which guarantees reimbursement for costs. Since trauma center MAA/MOUs were found to be uncommon in our responding trauma centers (55%) and generally lack a fiscal component, failure to aid other centers could become a difficult but necessary executive decision.

Lessons Learned

FEMA should not be counted on to provide for or fund medical care. A State of Emergency must be declared for even Medicaid waivers to be offered to receiving hospitals. In addition, it was found in Katrina's displaced population, that FEMA prescriptions were not funded outside of the state in which the disaster occurred, requiring treating hospitals, clinics and aid agencies to pick up the drug bills for displaced patients.²⁴ Furthermore, for hospitals to be penalized for aiding evacuees, particularly those who cannot return to their homes, at their expense demonstrates a need to overhaul FEMA and other Federal aid prior to the next catastrophe. States need to have uniform standards as to what constitutes a State of Emergency to ensure that these are determined in a standard manner, rather than avoided as a means to conserve scarce Medicaid funds.

Another problematic area is the transferability and access to state Medicaid funds and other government sponsored payors. To better support ongoing disaster planning and subsequent care, CMS and private insurers need to be accountable for the costs of disaster response and ensuing health care, and make provisions for preparedness expenses such as stockpiles, added and unused capacity, new Disaster Preparedness staff positions, education, disaster drills and practices, and new technology and supplies to sustain operations. Other broad means to support sustainable preparedness functions are possible.

What is lacking in these and other cases is a means to recover the costs of preparing for and responding to a catastrophe of mass scale through the normal hospital billing processes. The only billing codes available for hospitals' initial response are those for outpatient, emergency care

and trauma response. These codes do not avail themselves well to disaster response because of the high response costs and low cost recovery. The trauma response codes rarely can be applied because the scale of the catastrophe does not allow a trauma team to assemble in the same timeframe and composition as required by policy.

There needs to be more efficient and less burdensome means for hospitals and healthcare consortiums to recover the extraordinary costs of responding to a disaster, lost revenues from cancelled surgeries and transferred patients, and sustaining care over time for those who cannot return to their homes or border counties/states. Given that many academic trauma centers are public hospitals, the taxpayers of their city/county should not be burdened by the care costs of those who do not reside there. An efficient means to bill for the initial response to victims of an MCI is a new Universal Billing 1992 (UB-92) code from the American Hospital Association (AHA) National Uniform Billing Committee (NUBC). Such a code would be more accurate, allow the Centers for Medicare & Medicaid Services (CMS) to appropriately address the costs of care for these individuals, and be a means for other agencies such as FEMA to better address the funding of medical care in disasters.

As important is to develop a reliable and efficient funding source for trauma center all-hazards preparedness in excess of that awarded general hospitals, given the poor economic status of the majority of U.S. trauma centers.¹ Funding is needed for a statewide, and eventually an interstate, readiness and capacity monitoring system for healthcare assets including prehospital, and planning for a network of validated and prepared trauma centers to aid one another well ahead of and in coordination with a Federal response. This network could expand over state borders, be linked electronically through hardened and redundant systems, and rapidly move resources and patients to their most appropriate treatment locale. Trauma centers have repeatedly proven their ability to clearly and concisely communicate resource needs and apply the ICS/HEICS principles. This assures that disaster victims and affected others are given appropriate treatment so that their conditions do not worsen due to lack of essential needs such as routine medications, nutrition, hydration, sanitation, and shelter from the elements. This preparedness should be uniform throughout the trauma care community and better funded as part of the hospital bioterrorism program.

“The amount (of Federal funding) going specifically to hospitals to improve preparedness efforts has been slim.”

- Institute of Medicine of the National Academies

OPPORTUNITIES FOR IMPROVEMENT

This survey identified areas of preparedness that would benefit from performance improvement (PI) measures. Improvements in some areas may require only for trauma centers to adopt the successful practices shared by the Highly Prepared and Best Preparedness Practice trauma centers selected from the 175 responders to this survey and others published in the References. Other improvements require an investment of time and monies. Many will not occur without regional, state, or Federal investment and directives. General hospitals and trauma centers are inevitably First Receivers of patients who self-deliver to the nearest hospital. Without planning and advanced communication technology, severely injured patients will not be directed to a trauma center although that is where they could have a better chance of survival.^{13,26} This section describes areas for improvement divided into the optimal preparedness components guiding this project.

Vulnerability

The trauma centers that reported a high number of terrorist targets and natural hazards within their catchment area have a more difficult path to optimal preparedness. Inequities in funding, as compared to the number of regional hazards, places a higher burden on centers located in less well funded regions such as the South. Decontamination capacity had wide variability noted, from a low of 38 patients per hour in the South, the area with the highest average number of hazards, to a high of 67 per hour in the East. Since many patients will bypass the prehospital systems and their HazMat teams,



decontamination may be done at a hospital poorly prepared for a large influx of contaminated patients. If the patient bypasses security and enters the facility, contamination could render it inoperable and place staff and other patients at risk. Scarcity of Class B suits, ranging regionally from 6 to 30 but averaging 11 overall, makes decontamination from highly hazardous materials less likely. This level of decontamination is considered a hospital function that will require training and equipment as indicated by OSHA. The propensity for patients to self-deliver to the hospital makes it more important that hospitals have a higher capacity to decontaminate patients and be better equipped.²⁷

Planning

The survey results reinforce informal evidence that clearly defined plans for the administrative aspects of emergency management are in place in the nation's trauma centers. However, details about daily operations, issues that became problematic during the isolation of staff and patients at Charity Hospital in New Orleans, were not requested in the survey due to the length of the questionnaire. Literature describing that event shows that these details were critical to the emotional and physical ability of caregivers to sustain operations under extreme duress.^{28,29}

Plans need to address issues such as adequate numbers and correct types of batteries to replenish flashlights, allowance for sanitary disposal of body wastes, requirement for staff and volunteers to bring extra clean clothing, and stockpiles of prophylactic medications for inevitable breaches in sanitation. Charity Hospital's lack of emergency generator fuel re-supply was especially problematic, with reserves available within blocks of the hospital but denied due to lack of interagency cooperation and prioritization. Another significant need evidenced by Charity's situation was its inability to secure the building and its perimeter from convergers and keep the facility from being a secondary target.²⁴

Information derived from lectures at the Annual Conference of the Eastern Association for Surgery of Trauma (EAST) showed that a prolonged siege can be more emotionally hazardous to rescuers and caregivers. In New Orleans, nearly 25% of one facility's staff suffered near or complete psychotic episodes during their almost week-long plight.²⁴ These conditions would also presumably increase the incidence of Post Traumatic Stress Disorder (PTSD). It is reported that some rescuers displayed insensitivity for the caregivers' emotional status during Charity's long-awaited evacuation.²⁸ Training rescuers, including military and law enforcement, to better deal with patients, families, and caregivers whose emotional reserves have been exhausted is appropriate, as well as the providing post-event Critical Incident Stress Debriefing (CISD).

Communications

Most trauma centers indicate that they are well prepared in the area of interagency and regional communications. However, very few states have comprehensive healthcare resource capacity monitoring, and there are no multi-state systems. These systems are needed to rapidly notify and direct staff to appropriate care sites, move patients from threatened facilities, track the number, identity, and location of victims for worried families, and inform the media in real time. Patient tracking was at times referred to as an American Red Cross issue in survey responses, whereas the trauma centers involved in major disasters have found their communications systems deluged with phone calls from the media, worried families, and volunteers.¹⁷ Tracking of displaced persons and patients who became separated from their families after Hurricane Katrina was problematic to the extent that some families are still missing information.

The ability to communicate with military (65%) and Federal assets (81%) was present a majority in survey responses. Even better integration of these resources will be needed for a seamless and unified response to mass scale disasters.²³

Resources

The ability to respond to disasters of mass scale is dependent on the adequacy of pharmacy and medical supply stockpiles and their accessibility, as well as essentials such as food, water, and sanitation. Most trauma centers are able to mobilize staff and maintain operations for three (3) days and increase capacity by 60% over time. This level of surge capacity relies on the trauma center being accessible to staff and on a continuous supply of water and power.

The study results show some lack of preparation for patients with special needs, such as obese, immunocompromised, and chronically ill patients that needs particular attention. There is also a low rate of contract exclusivity, particularly for ventilators (<40%), at a time when pandemic influenza and airborne forms of bioterrorism are predicted to be an imminent public health threat. Overall, one solution is for Mutual Aid Agreements (MAA) or Memorandums of Understanding (MOU) with other facilities both within and outside of the region to collaborate on distributing staff and supplies needed to rapidly react and move patients to the most appropriate destination. Local planning to store and distribute CDC Strategic National Stockpile supplies and coordinate all available healthcare resources is a priority. Ideally, general hospitals will participate by accepting patients who do not require specialty care as well as by providing alternative forms of transportation, so that those with the severest injuries are ultimately treated at a trauma center. This will not occur spontaneously due to the acknowledged problem of patient self-delivery to the closest hospital.

Basic supplies, including fuel and water, need to be available in adequate amounts to respond initially, then to maintain high care volumes for at least three (3) days. The problems of complete blackout at Charity Hospital and other facilities in New Orleans resulted in staff having to manually ventilate patients at a time for prolonged periods.²⁴ It is also rare for the emergency power supply to preserve air conditioning. Power failures that impact the Information Technology (IT) system can delay care, impede patient tracking, and slow resource availability. Testing of IT services under power outage conditions and reverting to paper systems should be familiar to both staff and physicians.



Security

The ability to lock down the entire trauma center is well planned but not as commonly practiced, less so at the departmental level. Convergence of medical voyeurs and other non-essential persons, including media, poses a specific problem that requires lockdown. Diversion of such persons, including the worried well, families, and those emotionally traumatized by the event, away from clinical areas will best occur when access to the facility is controlled.

The survey did not address perimeter control. However, the Validation Visitors did review that particular security measure on-site. They found that Highly Prepared trauma centers pay particular attention to managing their extensive properties, authorize staff to secure remote clinics and buildings immediately, and provide special identification for incoming staff, vendors and other essential personnel so that inappropriate persons are confined and redirected. These highly prepared facilities assigned non-clinical personnel such as painters and maintenance personnel to redirect convergers to non-clinical areas. Although most hospitals have security plans in place, about two-thirds have practiced them. Regular lockdown drills should be practiced and improvements made as needed.

Clinical Resources

Careful planning for locating stored supplies is critical to them being available in a catastrophe of mass scale. At times, ample supplies are inadequately stored in areas of the campus or building prone to flooding, damage or pilferage. Supplies stored in the basement of Granada Hills Medical Center in California were inaccessible, broken, or damaged during the magnitude 6.7 Northridge earthquake. The Central Supply basement area shelves tipped over despite being harnessed in accordance with seismic safety practices of that time. No supplies other than those in the ED could be accessed when over 600 patients arrived. Emergency care was provided on the hospital grounds using supplies and staff sent urgently from the adjacent county's Level I trauma center. Full evacuation of neonates, who had oxygen tanks but no heat in their infant warmers, was performed well before DMAT or other Federal resources were available.

Collaboration for this aid was a result of urgent physician-to-physician cell phone calls to University of California, Irvine Medical Center (UCI) shortly after the earthquake. UCI responded with two (2) teams recently returned from Bosnia, and vans loaded with simple suturing, pharmaceuticals, dressings, IV supplies, and additional cell phones. UCI, although approved for the task by Los Angeles EOC in the absence of other resources, had no transfer agreement or MOU with Granada Hills and relied on the goodwill of the hospital's administration to be paid for the supplies sent the morning of the earthquake. Ultimately, Granada Hills repaid UCI for all of the supplies sent.^{30,31}

The study results show mutual aid agreements with other hospitals at 65% on the average and less often with other trauma centers (55%). Trauma centers would benefit not only from MAA/MOUs with hospitals in their community, but others they establish through a mutual aid network with prepared and willing trauma centers outside their catchment area. Such a trauma network would have written agreements (MAA or MOUs) for cross-credentialing staff, assigning outside personnel to be supervised by trauma center staff, facilitating rapid acceptance of transfers and coordinating patient transports, accessing needed supplies, sharing patient information, and accepting fiscal responsibility for aid rendered.

Sustainability

The ability of the trauma center to provide nutrition, water and sanitation for a large number of patients, staff, volunteers and even media is essential in the event of a prolonged disaster response, but is not as prevalent as desirable. If the facility becomes isolated, it will have difficulty obtaining resupply of fuel and other essential resources for days. Emergency and Mutual Aid Agreement staff need to be prepared to bring their own supplies of special foods, extra clothing, sensible shoes, chargers and extra batteries for their personal cell phones, and medications. Family members, however helpful they may be in caring for their injured relative, may impose a further drain on resources if they do not bring supplies with them.

Most essential to the sustainability of operations is generation of power. Disasters which were already creating regional crises were worsened by poor engineering and planning errors. For example, flooding in Houston resulted in total darkness at Hermann Hospital when water reached the underground garage of the facility where the electrical switchgear was located. Even with the emergency generator above ground and having adequate fuel, a complete power outage occurred. The hospital was evacuated in total darkness, through stairwells and under dire conditions.³²



Staffing and supplying child and elder care allows responding clinicians and essential support staff to concentrate on the medical aspects of the disaster, rather than its personal consequences. Comprehensive family care plans can help the trauma center operate for extended periods of time and assure that essential personnel are available and not overly distracted by concerns for families.

Replenishment of material stores and personnel are not enough if the trauma center does not address fatigue and emotional issues. Hospitals need to rotate staff for rest periods, provide communication access to their families, and stockpile nutritional and sanitation supplies for the long term. The data from this study shows an average capability of three (3) days, whereas recent natural disasters have isolated some trauma centers and extended their recovery for nearly one week. Plans for rationing, replenishing fuel and water, and upholding morale are

less tangible and often not present in the EMPs. There is a common assumption that essential needs will be provided for, which was shown to be invalid during the Gulf Coast catastrophe.²⁸

Measures that helped Charity Hospital sustain semi-humane conditions included providing for adequate rest through shift assignments, disposal of human wastes in a planned and careful manner using commodes and plastic bags, rationing of food supplies (stored in the basement which was the first area to flood), and psychological support measures such as non-denominational religious services, singing and other forms of respite.²⁸

HIGHLY PREPARED TRAUMA CENTERS

Of the 175 hospitals that responded to the survey about their preparedness and ability to respond to a mass casualty event, five (5) were identified as among the Nation's most highly prepared facilities. Each hospital, all of which are either a Level I or II trauma center, underwent a review of its disaster preparedness program by a leading expert in disaster management planning. While the facilities visited are the best-prepared centers in the country, there were a few opportunities for improvement identified. These opportunities, however, were not uniformly prevalent in all of the hospitals visited and many were in the process of being addressed.

Rare Weaknesses

The following weaknesses were generally only noted in one or two institutions with the exception of funding discrepancies.

- Most prevalent and common shortfall noted was inconsistency of government funding, ranging from \$30,000 to \$702,000, with most funds coming from HRSA and predominantly received by hospitals in the Eastern regions
- Inadequate participation of staff from the Federal Emergency Management Agency (FEMA) and Department of Homeland Security in emergency management training
- Lack of defined space and procedures to accept community donations of materials, monies, services, and blood during emergency operations
- Absence of cross-credentialing and cross-training program to augment staff resources (physicians, mid-level practitioners, nursing, etc.) from outlying hospitals, including Military facilities
- No testing of decontamination capacity to determine whether projections are realistic
- Insufficient morgue capacity with lack of separation of those expected to die from those dead
- No operational, day-to-day programmatic relationship between hospital emergency planning personnel and hospital-operated EMS service outside of regional planning meetings
- No single all-hazard emergency management plan; there are eleven separate "plans" that are somewhat disparate in format and function
- Lack of separate and independent emergency management planning process outside of participation in the regional planning process
- No specific security or lock-down plan included in the Emergency Management Plan except for the Security Officer Job Action Sheet
- Lack of a family care plan for employees including shelter for families of employees
- Lack of an exclusive contract that guarantees set number of ventilators during a disaster event
- No defined "threat" or emergency response code system
- Inability of families to locate their loved ones in a disaster continues to be a major problem in both natural and man-made disasters most recently evidenced during the Bombay bombings, London subway bombings, Gulf Coast hurricanes, Madrid commuter train bombings, and 9/11
- Multiple 9-1-1 dispatch centers within the region area with no one single point of contact to collect, dispatch, and collate information on large scale casualty event to the critical services that need information to respond

Recommendations

Given the extremely high level of preparation for a mass casualty situation already in place at these leading trauma hospitals, further attention to the specific areas below will move these centers toward a status of optimal preparedness for all types of hazards. Many of these suggestions are already being addressed or are being planned.

- Develop disaster response "cost centers" for finance accountability that provide precise cost accounting and the necessary documentation for reimbursement by the Federal Emergency Management Administration (FEMA) if the disaster is federalized. This practice also facilitates future budget projections.

- Develop and test capability and assets to open an alternate treatment site remote from hospital in coordination with regional EMS providers, healthcare facilities, and governmental agencies.
- Provide training to Board of Trustees/Governing Body regarding their role during a full-scale disaster
- Review newly issued (7/1/06) JCAHO Emergency Management Standards
- Use disaster tags for all incoming patients including those self-presenting (could be used in conjunction with existing triage documentation)
- Expedite timing for the creation of post disaster drill action plans → consider conducting debriefings immediately after the exercise to ensure that the critique is quickly performed and the action plan promptly developed (within 5 days of the drill). Use email “approval votes” from the Disaster Committee on these action items if next Committee meeting is not within 30 days of the disaster drill
- Consider using HealthStream™ or other web-based training system for disaster role orientation for attending physicians and residents; ensure that personal disaster preparedness is incorporated into this training
- Review decontamination water containment system to determine whether there is a more environment conscious method to contain wastewater
- Review “new hire” orientation curriculum to ensure that personal disaster preparedness and family disaster planning are addressed as a training opportunity. Review Red Cross or other family disaster planning tools to provide handouts. Consider placing a Family Disaster Planning Home Page on hospital web site
- Lead efforts to develop a unified patient tracking system for both ambulance and ambulatory patients presenting to hospitals throughout the region
- Ensure an MCI or similar alert system is developed to link regional hospitals, public safety, EMS, and blood bank
- Develop a single All-Hazard Emergency Response Plan that establishes a uniform, comprehensive framework for the management of incidents. The hospital emergency management plan and hospital incident command system should be in compliance with National Response Plan (NRP) and the National Incident Management System (NIMS)
- Reconsider organizational chart and reporting structure of the Safety Officer to provide a direct operational and day-to-day programmatic relationship to the EMS Division
- Support development of a statewide process to assure that there is redundancy in the vendors for durable medical supplies and pharmaceuticals
- Establish space, assign manpower, and develop protocols for managing donated goods or items, including blood donations from walking volunteers, during a disaster event

CONCLUSION

Application of disaster preparedness principles comes readily to trauma centers. In their daily operations, trauma centers are expected to expand rapidly to an event's scale, based on the random nature of trauma, and many centers already have responded exceptionally well to both natural and human-caused catastrophes. The trauma profession has a long history of stringent review of its practices and outcomes, which afforded the researchers a rich reserve of publications and textbooks, as well as lectures given at professional conferences, as reference materials. The expert panel



worked as a team to develop the inventory based on accepted preparedness components, evaluate survey results, and recommend opportunities for improvement to assure that our nation's trauma centers continue to upgrade their preparedness for future inevitable catastrophes of mass scale.

It is notable that 175 reporting trauma centers out of 531 surveyed voluntarily critiqued their operations and candidly assessed their preparedness. Their diligence in finding answers to the detailed inventory questions demonstrates commitment to the internal review and research processes that characterizes trauma care. Each of the reporting facilities is commended and held in the highest regard for their participation. Their efforts will benefit all trauma centers. Those that conveyed a lack of knowledge about their preparedness plans are highly motivated to take advantage of the project products. Historically, trauma professionals have shown a keen interest in improving their center's readiness and response to terrorist attacks or natural disasters as seen in the high scores for regional disaster planning. Another indication of this interest is the strong attendance to trauma courses where disaster "lessons learned" have become an educational standard.

Since the NFTC was founded a decade ago, its success has been in its ability to identify high performing facilities, practices or clinical models, and disseminate them through a broad array of learning modalities. These modalities include a website, scheduled conferences, audioweb lectures, slide shows, and printed materials such as policies, protocols and procedures. This approach allows the trauma professional to select from a menu that suits their work schedule and learning style. The NFTC's approach is practical, affordable, and adaptable to the size and locale of the trauma center. NFTC staff offer support and guidance once materials are disseminated through scheduled conference calls, emails, and correspondence.

The NFTC relies on a broad team of advisors who are some of the most esteemed and experienced surgeons, physicians, administrators, and nurses in trauma care. These professionals commit to projects such as this survey, serve on NFTC's Board of Directors, Chair or serve on committees, lead national initiatives, and advise other trauma professionals on an ad hoc basis. These volunteers are the real drivers that have built the NFTC into a creative, collaborative force to lead real and lasting positive change in a difficult and unstable healthcare niche.

NEXT STEPS

This grant's objectives will be completed through the mass mailing of the summary report and accompanying CD-ROM to over 700 Level I-III trauma centers and state agencies assigned responsibility for trauma care systems. Reports will also be sent to key national organizations, and all 50 Governors. The CD-ROM contains specifics from the Validation Visits including entire Emergency Management Plans, policies and procedures, educational slide shows, and other materials of interest that aided the development of Highly Prepared Trauma Centers and Best Preparedness Practices. These materials, as well as the summary report, will be maintained in a downloadable format on the NFTC website, www.traumafoundation.org.

Future projects will build upon the study findings and recommendations:

- Publish findings in a broad array of both medical and general print media
- Develop presentations to disseminate important findings and recommendations
- Participate in press conferences and other public venues
- Provide briefings to legislators and Federal agencies
- Work collaboratively with other trauma professional organizations to improve trauma center and system preparedness funding
- Advocate for other financial initiatives so that trauma centers have the resources to maintain and upgrade their capabilities

PROPOSED INITIATIVES

- Reauthorize the National Bioterrorism Hospital Preparedness Program (NBHPP) to provide a greater focus for trauma centers and trauma care systems
- Apply for a hospital disaster response charge code
- Collaborate with key trauma organizations to develop a preparedness validation process
- Create a highly prepared trauma center network to react rapidly under mutual aid agreements, in coordination with existing responders, to mass scale catastrophic events
- Encourage the development of real-time regional, state, and interstate interoperable communication and resource capacity systems capable of tracking patients and healthcare resources
- Increase knowledge about trauma care, trauma centers, and systems as an essential part of terror preparedness both in the US and worldwide
- Develop a template for Good Samaritan immunity for caregivers providing clinical care under mass casualty emergency conditions
- Maintain a resource library of emergency preparedness problems and solutions accessible through the public website, www.traumafoundation.org



NFTC Advocacy Committee

On behalf of its Board of Directors, NFTC would also like to thank the Advocacy Committee for their efforts in obtaining this grant. These Government Affairs representatives from NFTC member hospitals worked with a national lobbyist to secure this CDC/NCIPC funded grant.

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NATIONAL FOUNDATION FOR TRAUMA CARE

The National Foundation for Trauma Care (NFTC) is America's premier Trauma Center Trade Association. NFTC, a non-profit 501(c)6, is dedicated to securing the economic viability of trauma centers and systems across the country.

The Foundation's mission is to foster the development of a national system of trauma care so that access to excellent care for the seriously injured is assured.

NFTC's members receive education on best practices, advice on trauma billing and system development, access to the most comprehensive trauma database, and linkages to other trauma centers and systems. Members include over 200 Trauma Centers in more than 40 states and 20 state and regional trauma agencies responsible for trauma system development and oversight.

The NFTC Board of Directors include the most qualified and influential professionals in the trauma care industry. These leaders direct the NFTC in all member initiatives and NFTC national advocacy efforts. The Foundation's seven established committees actively guide member services and activities. The committees consist of representatives from active NFTC members and include Advocacy, Development, Education, Reimbursement, System Management, and Terror Response.