Building Resilience in Community Health: A Template for Memphis
BUILDING RESILIENCE IN COMMUNITY HEALTH:
A TEMPLATE FOR MEMPHIS

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<tr>
<td>AAR</td>
<td>After Action Report</td>
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<tr>
<td>ACS</td>
<td>Alternate Care Sites</td>
</tr>
<tr>
<td>AP</td>
<td>Associated Press</td>
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<tr>
<td>ARC</td>
<td>American Red Cross</td>
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<tr>
<td>CARRI</td>
<td>Community and Regional Resilience Institute</td>
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<tr>
<td>CART</td>
<td>Community Assessment of Resiliency Tool</td>
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<tr>
<td>CDC</td>
<td>Centers for Disease Control and Prevention</td>
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<tr>
<td>CEO</td>
<td>Chief Executive Officer</td>
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<tr>
<td>CERT</td>
<td>Community Emergency Response Team</td>
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<tr>
<td>CMO</td>
<td>Chief Medical Officer</td>
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<tr>
<td>CUSEC</td>
<td>Central United States Earthquake Consortium</td>
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<tr>
<td>DATs</td>
<td>Disaster Assistance Teams</td>
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<tr>
<td>DHS</td>
<td>Department of Homeland Security</td>
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<tr>
<td>EMA</td>
<td>Emergency Management Agency</td>
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<td>EMP</td>
<td>Emergency Management Plan</td>
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<tr>
<td>EMR</td>
<td>Electronic medical records</td>
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<td>EMS</td>
<td>Emergency Medical Services</td>
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<tr>
<td>EMT</td>
<td>Emergency medical technician</td>
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<tr>
<td>EOC</td>
<td>Emergency Operations Center</td>
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<tr>
<td>EPCRA</td>
<td>Emergency Planning and Community Right-to-Know Act</td>
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<tr>
<td>EPIC</td>
<td>Emergency Preparedness and Incident Conference</td>
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<tr>
<td>ERC</td>
<td>Emergency Response Coordinator</td>
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<tr>
<td>ESAR-VHP</td>
<td>Emergency System for Advance Registration of Volunteer Health Professionals</td>
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<tr>
<td>ESF</td>
<td>Emergency Support Function</td>
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<tr>
<td>FEMA</td>
<td>Federal Emergency Management Agency</td>
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<tr>
<td>GETS</td>
<td>Government Emergency Telecommunications System</td>
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<tr>
<td>HD</td>
<td>Health Department</td>
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<tr>
<td>HHS</td>
<td>Department of Health and Human Services</td>
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<tr>
<td>HRC</td>
<td>Hospital Resource Coordinator</td>
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<tr>
<td>HRSA</td>
<td>Health Resources and Services Administration</td>
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<tr>
<td>HRTS</td>
<td>Hospital Resource Tracking System</td>
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<tr>
<td>LEPC</td>
<td>Local Emergency Planning Committee</td>
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<tr>
<td>LRN</td>
<td>Laboratory Response Network</td>
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<tr>
<td>MASH</td>
<td>Mobile Army Surgical Hospital</td>
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<tr>
<td>MEDCOM</td>
<td>Medical Communications Center (at The Med)</td>
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<td>MIFA</td>
<td>Memphis Inter-Faith Association</td>
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<tr>
<td>MMRS</td>
<td>Metropolitan Medical Response System</td>
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<tr>
<td>MRC</td>
<td>Medical Reserve Corps</td>
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<tr>
<td>MSACP</td>
<td>Mid-South Association of Contingency Planners</td>
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<tr>
<td>MSC</td>
<td>Memphis and Shelby County</td>
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<tr>
<td>MSCCSA</td>
<td>Memphis and Shelby County Community Services Agency</td>
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<tr>
<td>MSCEMA</td>
<td>Memphis and Shelby County Emergency Management Agency</td>
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<tr>
<td>MSCHD</td>
<td>Memphis and Shelby County Health Department</td>
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<tr>
<td>MUA</td>
<td>Memphis Urban Area</td>
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<tr>
<td>Acronym</td>
<td>Description</td>
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<tr>
<td>NAACP</td>
<td>National Association for the Advancement of Colored People</td>
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<tr>
<td>NDMS</td>
<td>National Disaster Medical System</td>
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<tr>
<td>NGO</td>
<td>Nongovernmental organization</td>
</tr>
<tr>
<td>NREVSS</td>
<td>National Respiratory and Enteric Virus Surveillance System</td>
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<tr>
<td>OHA</td>
<td>Office of Health Affairs, Department of Homeland Security</td>
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<tr>
<td>OMS</td>
<td>Outbreak Management System</td>
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<tr>
<td>PODs</td>
<td>Points of Distribution</td>
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<tr>
<td>RHC</td>
<td>Regional Hospital Coordinator</td>
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<tr>
<td>SARS</td>
<td>Severe Acute Respiratory Syndrome</td>
</tr>
<tr>
<td>SNS</td>
<td>Strategic National Stockpile</td>
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<tr>
<td>TDOT</td>
<td>Tennessee Department of Transportation</td>
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<tr>
<td>TEMA</td>
<td>Tennessee Emergency Management Agency</td>
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<tr>
<td>TN</td>
<td>Tennessee</td>
</tr>
<tr>
<td>UASI</td>
<td>Urban Area Security Initiative</td>
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<tr>
<td>UT</td>
<td>University of Tennessee</td>
</tr>
<tr>
<td>VA</td>
<td>Veterans Administration</td>
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<tr>
<td>VOAD</td>
<td>Voluntary Organizations Active in Disaster</td>
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<tr>
<td>WHO</td>
<td>World Health Organization</td>
</tr>
<tr>
<td>WMD</td>
<td>Weapons of mass destruction</td>
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ACKNOWLEDGEMENTS

The author thanks the many Memphis and Shelby County officials, healthcare and emergency management professionals, and community leaders for their willingness to participate in this review of community health and its role in promoting community resiliency. The introduction into the community provided by the CARRI Memphis Urban Area study proved invaluable in affording a “running start” for this study. Many thanks to Ann Farrar, Dave Lannom, Dave Landguth, Sarah Walen, and others from that program. And of course, the guidance and access provided by Kathie McCracken of the Department of Homeland Security proved invaluable in this undertaking.
EXECUTIVE SUMMARY

In conjunction with Oak Ridge National Laboratory’s Community and Regional Resilience Institute (CARRI) program in Memphis, a focused review was undertaken of community health security\(^1\) in the Memphis region in terms of its contribution to community resilience. CARRI defines resilience as “the capability to anticipate risk, limit impact, and bounce back rapidly through survival, adaptability, evolution, and growth in the face of turbulent change.” Improving a community’s resilience is to not only prepare it to help prevent or minimize the loss or damage to life, property, and the environment but also to enable it to quickly return citizens to work, reopen businesses, and restore other essential services needed for a full and swift economic recovery (CARRI, 2009).

The objective was to define actionable steps, in collaboration with local public health, medical, and community stakeholders, that can be taken to facilitate effective integration of local and regional health capabilities and assets to support and enhance community resilience in the face of major disruptions, whether natural or man-made. This review was designed to complement, not duplicate, the comprehensive onsite research and interaction previously accomplished in CARRI’s Memphis Urban Area (MUA) community engagement project during 2007–2009. It enables a deeper focus on how the healthcare component influences overall community effectiveness in this regard. In terms of geographical scope, this study focused on Memphis and its immediate region—a scope similar to that of the CARRI MUA study.\(^2\)

This review was conducted from September 2008 through June 2009 and was built on ongoing CARRI activities in Memphis such as the focus group for Medical Professionals and Community Resilience. Research was conducted on relevant lessons learned from regional disasters such as Hurricanes Katrina and Gustav, as well as more local events such as the “Hurricane Elvis” windstorm. Through interviews with Memphis healthcare stakeholders, the project has sought active community participation for addressing how public health and medical considerations can serve and contribute to effective emergency response and recovery. It also included presentations to and discussions with federal government sponsoring agencies of some of the specific Memphis-based programs that were reviewed.

The review found that the Memphis community enjoys a considerable healthcare infrastructure that provides it with inherent resources and networks that would enable a robust disaster response and recovery. As pointed out in the CARRI case study for the MUA (CARRI, 2008),

\(^1\) Health Security exists when the public is prepared for, protected from, and resilient in the face of health threats having potential large-scale economic or national security implications. National health security is achieved when public health agencies, other government agencies, the medical care system, and tribal, private sector, and non-profit entities successfully coordinate their efforts domestically and globally to support individuals, families, and communities to prevent, protect against, quickly respond to, and recover from health emergencies (HHS, 2009).

\(^2\) In that review, the study community was defined to be consistent with the U.S. Department of Homeland Security’s Urban Area Security Initiative (UASI) program and therefore included the six counties immediately adjacent and socially and economically linked to the city of Memphis. While the Memphis UASI was expanded to include an additional four Mississippi counties in late 2008, the CARRI team and this review focused its efforts on the original UASI counties, Shelby, Lauderdale, Tipton, and Fayette in Tennessee, Crittenden County, Arkansas, and DeSoto County, Mississippi, with a primary focus on Memphis and Shelby County.
however, Memphis also has the highest concentration of chronic poverty in the nation, which makes it doubly important that this healthcare resource base becomes a strong adjunct to community resiliency. This already vulnerable population, like that in New Orleans during the Hurricane Katrina disaster, also includes those with special healthcare needs, such as medical impairments and medication and equipment requirements. While there are clear challenges associated with addressing these and other vulnerabilities, the evident engagement of the various critical sectors of the community—government, first responders, healthcare, business, community groups, and citizens themselves—is, itself, a strong contributor to resiliency that enables the Memphis community to recognize such needs and take action.

For community health, resiliency in Memphis is enhanced by the various civic partnerships that have been established, particularly those that bridge between public health and private healthcare, between the community and its citizens, and between business and the rest of the community. Successes have gone well beyond organizational coordination itself to functioning collaborations, including the Community Emergency Response Teams (CERT) sponsored by the Memphis Shelby County Emergency Management Agency (MSCEMA); Memphis FIRST, a regional business network for preparedness; the Medical Reserve Corps (MRC) volunteers sponsored by the Memphis Shelby County Health Department (MSCHD); and the re-inaugurated VOAD (Volunteer Organizations Active in Disaster), initiated by the local American Red Cross (ARC) chapter. Recognizing the importance of strengthening organizational coordination across the community, the Shelby County Office of Preparedness and MSCEMA, together with the Assisi Foundation and Memphis First, have taken the initiative to work within the Memphis community to improve these relationships. Of particular note is a new initiative—the Shelby County Mayor's Collaborative Community-Wide Preparedness Initiative or "I'm Ready" Campaign—which is an unprecedented partnership of the various mayors of Shelby County to develop and sustain disaster readiness across their region.

However, it is also clear that much more can be accomplished by the expanded use of these community-based resources. For example, notwithstanding a proposal by the Health Department (HD) to include community public health preparedness training in the CERT program, there has been local resistance to doing so. Discussions during this project with the Federal Emergency Management Agency (FEMA) indicate that there is no agency constraint and actual support for such expanded scopes. The MRC, while having thousands of volunteers on its roster, has relatively few physicians among its membership, in part because of concerns surrounding liability, training, and credentialing. Like discussions with the Office of Public Health Preparedness in the Department of Health and Human Services (HHS) indicate that federally mandated credentialing through the Emergency System for Advance Registration of Volunteer Health Professionals (ESAR-VHP) should be the basis for resolving such issues in every locality, albeit there are apparently delays in state implementation for Memphis. While federal and state homeland security and public health preparedness grants have lent significant support in the past, 

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3 The Assisi Foundation of Memphis, Inc., is a key philanthropic organization based in Memphis that since its formation in 1994 has awarded over $100 million to not-for-profit organizations serving people located primarily in Memphis, Tennessee, and in the Mid-South region surrounding Memphis. The foundation's areas of interests include health and human services, education and literacy, social justice/ethics, cultural enrichment, and the arts.
they have also tended to stovepipe aid and drive community priorities in ways that are not always coherent and regional in perspective [e.g., in Memphis, Metropolitan Medical Response System (MMRS) funding is being used to stand up electronic medical records (EMRs) in one medical center, but others do not have the same priority nor outside funding support]. In all of these cases, government mechanisms exist to meet critical needs at the community level but are not applied in ways that necessarily meet those needs. It is clear that steps can be taken by federal and state governments to provide for better collaboration with “on-the-ground” agencies, and clearer and more enabling direction and guidance that would better leverage these existing program tools.

For the Memphis healthcare community, the flip side of the coin is the challenge that exists in overcoming the traditional insularity between the hospital systems, public health, and the private medical professional community. Each has its own requirements, economic niche, knowledge base, and roles and responsibilities within the community—ones that are difficult to transcend under normal conditions but need to be, in order to optimize response during a major disruption. A positive factor in the community’s favor is the close relationships and interconnectedness of the key leaders in these sectors who interact with each other in numerous community health venues and who would fill the same roles in an emergency. Resiliency finds its real strength from community relationships, and the person-to-person linkages are strong in Memphis. One vulnerability that surfaced is the lack of an obvious “back-bench” of community health “players” from which future leadership can be developed and substitutes can be found. Many of the principals in the various key sectors are “one deep” and difficult to replace during an emergency if they were unavailable.

Notwithstanding the strength and scope of the Memphis regional healthcare system and industry, some vulnerabilities exist that may reduce the resilience and health security of the community. The vulnerability of the Regional Medical Center for Memphis (“The Med”) to a major earthquake would likely incapacitate the region’s only level one trauma and burn center, and remove the principal care center for the disadvantaged population of the inner city. Likewise, hundreds of patients would be put at risk and evacuation would prove difficult, if not impossible, for many. In its fragile financial condition, it would not likely recover as a viable healthcare provider. The parallels with New Orleans’ Charity Hospital (inner city hospital that was flooded and yet to reopen) are clear. The loss of such a community healthcare asset, even if backed up by other medical facilities, would hamper the overall recovery by Memphis from a disaster and would diminish the quality of life in the inner city. While a financially daunting issue, it is important to consider whether it and other critical Memphis facilities should be seismically hardened to withstand a major earthquake, as was done by the federal government with the adjacent Veterans Administration hospital a few years ago.

Most hospital systems today operate within narrow financial margins that preclude much personnel surge capacity for major disasters. This is equally true in Memphis, where reliance is placed more on the ability of the larger medical systems to cover for their member hospitals than on external contingent medical staff. While the Memphis region enjoys a considerable physician and nursing population, the deployment of this vital resource on a volunteer basis during a catastrophic disaster remains nascent. An opportunity exists to overcome some of the identified impediments (credentialing, training, organization) to tap this professional resource as a means to
relieve emergency departments, staff alternate care sites (ACSs), and support evacuees at shelters—all vulnerabilities that have been identified in the Memphis region. Doing so will enhance critical redundancies and enable the community to take care of itself before outside relief is available (or in the event of pandemic influenza, because outside relief would not be forthcoming).

Even without a national or state credentialing system, however, more can be done within the current purview of the Memphis region healthcare community. Each hospital system can begin developing rosters of physicians, nurses, behavioral professionals, and other staff who would have recognized privileges in their emergency departments and ACSs. These rosters could be cross-indexed with other medical systems in the region to provide staffing when and where a major emergency outstrips the surge capacity in one or multiple locations. As is currently done in the adjoining state of Mississippi, these professionals can be provided picture IDs that have their credentials encoded to permit ready entry into emergency treatment facilities and hospitals.

Another opportunity is the application of EMRs for regional emergency response and recovery. Individual hospitals are standing up EMR systems in response to existing governmental mandates (e.g., Pandemic and All Hazard Preparedness Act) but are not designing them to crosslink with each other in the event of a regional emergency. Privacy concerns, notwithstanding, other municipalities, such as Washington, D.C., have developed the means to share electronic patient information in the event of an emergency.4 As noted earlier, at least one such Memphis-based system is being funded with a federal MMRS grant, which also opens up the issue of how the federal emergency preparedness grant programs may play a role in enhancing community resiliency in this regard.

Another federal mandate derived from a Katrina lesson learned is attention to special needs populations. The socioeconomic and community health circumstances of Memphis bear a striking similarity to those of New Orleans before Hurricane Katrina struck in 2005. Given the healthcare needs of Memphis’ special needs population and their reliance on a few key healthcare delivery points in the inner city (primarily The Med and two healthcare clinics), the ability of the city to recover from a major disruption with health consequences is fragile and would benefit from attention. Actions that would make healthcare more resilient for this population include characterization of the numbers and scope of those affected, their routine healthcare needs, limitations on mobility, and available contingent care and interventions to sustain those who cannot be evacuated.

One option would be to emulate initiatives taken in other communities confronted with this issue. One such initiative, Collaborating Agencies Responding to Disasters (CARD), was developed in Alameda County, California, following the Loma Prieta earthquake. It is designed to train and integrate key service providers in the community to act as a “safety net” for the special needs population that would have limited means to address their own needs following a disaster (Schoch-Spana, 2007).

4 An innovative program has been implemented that “breaks the glass” during a recognized emergency condition and enables Washington, D.C., hospital emergency departments to readily share electronic patient registration information (Smith, 2008).
Beyond physical and healthcare infrastructure issues, the resiliency of community health in Memphis is a tale of two socioeconomic cities: those with financial security, health insurance, and access to healthcare and those in poverty, with no insurance and limited access to a fragile system of healthcare facilities. The former, located in the middle-class sections of the city and in its suburbs, will have advantages and access to aid within their communities, whereas the latter, largely minority and poor in the inner city, will likely have to await aid from outside their neighborhoods, for which access will be made more difficult by lack of transportation, mobility, and resources. Katrina demonstrated that the earliest medical relief “on the ground” following the flooding were the non-profit volunteer clinics that sprung up throughout the affected parts of the city when New Orleans residents found themselves without hospitals and without any means to leave. For recovery following a major disruption in Memphis, the equalizer may well be the role played by institutions within the community: churches and faith-based organizations, non-profit clinics and organizations, and neighborhood groups. All have long histories of engagement on health issues within the poorer sections of the city but have only recently been seen as a key adjunct to traditional disaster relief organizations (e.g., the Red Cross). An opportunity exists for the Memphis community to engage these important assets as a means to make the community more self-sufficient in providing rudimentary healthcare during a protracted emergency, as well as relieving the burden on key emergency facilities such as The Med.

Finally, it is clear from a review of available health security metrics that what can and needs to be measured will be a combination of statistically based (quantitative) and subjective (qualitative) metrics. Selected quantitative metrics are particularly useful where statistics are uniform and understood (e.g., surge capacity, training, pharmaceutical supplies) and can be benchmarked by the community once recognized criteria are agreed upon. Subjective performance measures will, of necessity, be part of a self-assessment framework that includes critical evaluations of healthcare assets, resources, and management (leadership, planning, communication). A hybrid of both kinds of indicators offers the most flexible approach for communities while enabling them to achieve results that are benchmarked against established norms or expectations.
1. INTRODUCTION

Concerns over community resiliency in response and recovery predated the Hurricane Katrina disaster but achieved a new level of national recognition in its aftermath. New Orleans has often been described as a disaster waiting to happen. Its below-sea-level location, its history of major hurricanes, its recognized vulnerability to catastrophic flooding, and its spotty preparedness are all now familiar warnings that went unheeded. However, what was new about Katrina that held the most implications for communities nationwide was the existential nature of the disaster—one that not only devastated the city and the region, but one that may have irrevocably altered the community in almost all fundamental ways: physical, social, economic, and political.

For community health, the security and operability of the healthcare system, and its ability to sustain patient care during and following the emergency, were critical to response and recovery but fell considerably short of meeting the needs of the community during its darkest hours.

During the initial flooding, the local healthcare system was rendered helpless quickly (Colten, 2008):

> Despite extensive emergency apparatus in the city’s hospitals, the floodwaters disabled several low-floor generators or their electronic controls and left patients and staff in sweltering conditions. Medical personnel soon discovered that emergency medical supplies were inadequate for the extended emergency period. Further, evacuation plans for hospitals offered little hope for immediately alleviating conditions. Congress concluded that evacuation plans for those with special needs were inadequate (U.S. Congress, 2006). When flooding occurred, medical staff remained on hand without outside assistance until hastily arranged evacuations could move the patients to triage centers at the airport and beyond the city (U.S. Congress, 2006; Batcher, 2005). Nursing homes proved to be even more inadequate than the hospitals in terms of providing care for their charges.

In terms of post-disaster recovery, the resiliency of the healthcare system in New Orleans proved equally wanting (Colten, 2008):

> Higher education and medicine, mainstays of the economy, suffered long-term blows from the storm...Displaced medical schools have largely returned, but with reduced capacity...Hospital closures have left a major gap in health care, especially for mental illness. The city has only about three-quarters the pre-storm hospital capacity (Brookings, 2008) and still faces a major loss in skilled medical jobs, and consequently physicians continue to leave the area (N.Y. Times, 2007)...Two principal hospitals, including the major public facility relied on by lower-income residents, have failed to reopen. [Fig. 1.1]
While it is tempting to view the Katrina experience as unique to the historic circumstances of New Orleans, it would be wrong to consider a catastrophic disaster of such magnitude as too remote for serious consideration. Memphis has its own version of a potential low-probability, high-consequence natural disaster of this magnitude and scope—one that, like New Orleans, had its antecedent of earlier occurrences that make a reoccurrence at some point in time almost a certainty.

In 1811–1812, the mid-South region was rocked by the most significant earthquake east of the Rocky Mountains since European settlement took place on the continent. While the population was limited at the time, the impact was dramatic:

*At the onset of the earthquake the ground rose and fell—bending the trees until their branches intertwined and opening deep cracks in the ground. Landslides swept down the steeper bluffs and hillsides; large areas of land were uplifted; and still larger areas sank and were covered with water that emerged through fissures or craterlets. Huge waves on the Mississippi River overwhelmed many boats and washed others high on the shore. High banks caved and collapsed into the river; sand bars and points of islands gave way; whole islands disappeared. Surface rupturing did not occur, however. The region most seriously affected was characterized by raised or sunken lands, fissures, sinks, sand blows, and large landslides that covered an area of 78,000–129,000 square kilometers, extending from Cairo, Illinois, to Memphis, Tennessee, and from Crowleys Ridge to Chickasaw Bluffs, Tennessee. (USGS, 2009a)*

At a magnitude of 7.2–8.1 over 600,000 square miles (Fig. 1.2), the New Madrid earthquake (named for a Missouri town near its epicenter) was two to three times larger than the 1964 Alaska earthquake and ten times larger than the 1906 San Francisco earthquake. For the primitive river settlement of Memphis, Tennessee, the impact was negligible at the time. Today, a similar earthquake would devastate cities such as Memphis, which have only recently tightened

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**Fig. 1.1. Charity Hospital in New Orleans—closed due to flood damage from Hurricane Katrina since October 2005 (LSU, 2009).**
building codes to include earthquake resistance as a criterion. A substantial portion of the impact would involve the healthcare infrastructure, its hospitals, clinics, and human resources, at a time when its support to the community would be in most dire need. The same dilemma would confront the medical system in the event of a natural pandemic influenza or, more insidiously, a bioterrorist attack, where shortages of medical personnel would strike at the same time as a surge of victims needing emergency care.

The scope and consequences of such existential threats to the community necessitate attention not only to steps that should be taken to prepare and respond to them but also to forward thinking about what steps can be taken by a community in advance to give it the ability to recover from such an event, and maintain its political, social, economic, and physical fabric. The healthcare system and public health programs of the community are essential enablers of an effective emergency response and of the subsequent recovery.

In support of the Department of Homeland Security (DHS) Office of Health Affairs, this review was carried out in conjunction with Oak Ridge National Laboratory’s CARRI program with the Memphis urban area (MUA) community. The objective was to define actionable steps, in collaboration with local public health, medical, and community stakeholders, that can be taken to facilitate effective integration of local and regional health capabilities and assets to support and enhance community resilience in the face of major emergencies or disasters, whether natural or man-made.

This review was designed to build on and complement ongoing CARRI activities in Memphis (in particular, by engaging participants in a Memphis CARRI focus group for Medical Professionals and Community Resilience). Research was conducted on relevant lessons learned from regional disasters such as Katrina, as well as more local events such as the “Hurricane Elvis” windstorm, recent destructive tornadoes, and regional evacuations to Memphis from the Gulf states as a result of Hurricane Gustav. Through interviews with Memphis healthcare stakeholders, the project has sought active community participation in addressing the following issues and questions in the context of how public health and medical considerations can serve to contribute to effective emergency response and recovery:

![Fig. 1.2. New Madrid Seismic Zone Earthquake epicenters, 1974–1998 (USGS, 2009b).](image)
• How both formal and informal community relationships can be leveraged to build more effective cooperation in the event of a major emergency.

• What capabilities or capacities need to exist, and what dependencies or interdependencies need to be satisfied, to make for effective response and recovery? How can this be achieved and how can progress be measured?

• What resources are available to the community to enhance resilience; what role should regional, state, and federal assets play?

• How both regional disasters and widespread catastrophic events (with implications for infrastructure) can be addressed.

• How local communities and individuals within that community can be empowered to assume more responsibility for their own health and safety.

• How non-traditional stakeholders such as private business, regional supply chains, and community members can contribute.

• How the “social fabric” of communities can be sustained and made more resilient to promote recovery.

• How a stronger “business” or economic case can be made for investing in building community resilience in the context of health preparedness and recovery.

These sources of information served to reinforce certain health system concerns as being relevant to Memphis disaster response and recovery, and provided lines of inquiry for gauging the robustness of regional health security and indicators for how resilient community health is.
2. ORGANIZATIONAL TAXONOMY FOR MEMPHIS COMMUNITY HEALTH CARE

Memphis is the largest city within a six-country, three-state region, as shown in Fig. 2.1, and is the premiere healthcare center for the mid-South. Three of the top ten private companies in Memphis are healthcare related and employ tens of thousands of workers in the immediate regional area in their hospitals or healthcare operations (Dries, 2008). The two largest regional hospital systems, Baptist Memorial Healthcare employs 8,700 and Methodist Healthcare employs about 10,250. St. Jude Children’s Research Hospital and the Regional Medical Center of Memphis (“The MED”) employ about 3,000 each. The three major biotechnology firms in the area add thousands more. In any given year, millions come to Memphis either as patients, consumers, or business transactors.
As a city and regional metropolis, the history of community health in Memphis was defined by its early public health challenges, emerging medical care focus, and growing urbanization that has led to inner city socioeconomic problems. Yellow fever epidemics were common in the United States during the period 1793–1806, with a particularly severe series crippling Memphis in 1873–1879, with depopulation leading to loss of its city charter. As public health practice improved to control the most virulent infectious diseases, attention turned to opening hospitals and improving routine medical care.

The predecessor to The MED, the Memphis Hospital, was chartered in 1829, and was, successively, a children’s hospital, tuberculosis hospital, military hospital, and maternity hospital, before becoming a regional medical center. With its affiliation with the University of Tennessee Health Sciences Center, over half of all physicians in Tennessee are trained there. A burn center was opened in 1985, a wound center in 1992, and an outpatient center (“MedPlex”) in 1994. It has been designated a regional trauma center by the state and, as such, provides the highest level of surgical care to trauma patients with a full range of specialists and equipment available 24 hours a day. In 1999, The MED and the Memphis Shelby County Health Department entered into a formal agreement whereby The MED agreed to manage six health department primary care clinics throughout the city, along with the four clinics that The MED already managed.

As the population of Memphis swelled after the Civil War, the city of 135,000 found itself in 1906 with only 500 hospital beds (Baptist, 2009). An historic bedrock of the Memphis community, the religious faith community responded by advancing the need for an expanded hospital system. A group of Southern Baptists broke ground for their new hospital at the eastern edge of Memphis, Baptist Memorial Hospital, in 1912. Similarly, a United Methodist layperson laid the groundwork for the chartering of their new church-affiliated hospital in 1918. Both of these early hospitals were the respective origins of today’s two largest Memphis-based medical care systems, Baptist Memorial Healthcare and Methodist Le Bonheur Healthcare. The former consists of 15 individual hospitals in a three-state region (nine in Tennessee, five in Mississippi, and one in Arkansas), and the latter is made up of six hospitals in the immediate Memphis region. Both have numerous health care clinics and specialty (medical, diagnostic) centers throughout the region.

In terms of community cooperation on public health, the antecedents go back to the yellow fever epidemics of the late 1800s. Various Memphis community organizations, including the Baptist and Methodist churches, the Hebrew Hospital Relief Association, the German Benevolent Association, the Knights of Phythias, Odd Fellows, Masons, and others, provided support and financial assistance to relief organizations and victims of the epidemics (Kraut, 2007). Various churches, businesses, and private homes took in disease victims at considerable risk to themselves. Rooted in this tradition, community service and cooperation continues to this day with a spectrum of nonprofit and government agencies that contribute to day-to-day emergency response and disaster relief both in Memphis and on a regional basis. During the more recent evacuation of thousands of Gulf state residents to Memphis in the aftermath of hurricanes Katrina and Gustav, Memphis emergency response agencies, nonprofit community organizations, and the medical community all responded to provide temporary shelter and care on short notice.
2.1 COMMUNITY HEALTH FOCUS AREAS
In reviewing resiliency in terms of how health security contributes to a region’s response and recovery from major disasters and emergencies, it is useful to examine the full scope of a community’s social, economic, cultural, and physical environment. The assets that come to bear during a severe emergency go well beyond its physical or even institutional infrastructure, to encompass individual, family, and community relationships and experience. All sectors must be factored in and engaged to enable a community to not only persevere during a prolonged emergency but to ultimately recover to a state that sustains it into the future, as noted in a recent CARRI website blog, excerpted below (Edwards, 2009).

Achieving resilience implies the systematic inclusion of the full fabric of society in the continuum of preparedness in order to secure a full recovery. While the efforts of governments (federal, state, local, tribal) are critical, they are not sufficient. The private business sector provides most of the Nation’s critical infrastructure and must be integrated either voluntarily or through regulation. Each method will have a place. The business sector will have an incentive to participate in resilience activities where they can be shown to prevent loss and ensure a degree of protection from business disruptions. Large businesses already operate across the continuum—preventing those things that seem preventable, protecting critical assets and information, responding to disruptions as required and getting their business back on line as quickly as possible....

In a wider sense, the private sector is not limited to the private business sector but also includes the non-governmental, volunteer, faith-based, academic and associational organizations that make up our social fabric. All of these organizations are important to the resilience continuum—some are critical. Very few of these entities view themselves as agents of “protection” and yet they bring tremendous resources to the response and recovery effort when prevention and protection fail. This part of the private sector is best engaged under the rubric of resilience. Their involvement in the preparation phase can magnify the potential for faster and more complete community-level response and recovery. In addition, they can play a critical role in building a culture of individual and family resilience. This is an often invisible element of critical infrastructure protection and recovery because without staff and employees capable of returning to work, no facility or sector can sustain itself during an incident or recover and return to full functionality....

One of the first steps taken in the CARRI MUA study was to bring representatives from diverse sectors of the community and have them define the broad scope of community stakeholders important to response and recovery from major events. Figure 2.2 was the product of this discussion.
In examining the community health-related organizations within this scope, specific focus areas became evident during initial research and discussions with Memphis healthcare stakeholders. As illustrated in Fig. 2.3, these consisted of government agencies with public health responsibilities (e.g., health department, emergency management, community services), the health care community (hospitals, clinics), first responders [emergency medical services (EMS), police], nonprofit community service organizations (e.g., Red Cross, Salvation Army), and the business community. It became evident that for Memphis, these “communities” within the community represented key components of an integrated network of health-related capabilities and capacities to respond and recover from a disaster. They are distinguished and defined by their respective relationships and interdependencies and provide a starting point for examining how effective their collective contributions would be brought to bear in the event of an existential health threat to Memphis and the mid-South region. These communities are not separate from nor do they exclude the organizations in the broader community model defined above; this organizational taxonomy simply highlights those community elements that most directly support a public health and medical system response and recovery. [The sector and organizational interdependencies noted in the diagram involve the flow of communications, coordination, and resources, while the dependencies are noted for specific sectors and organizations. These are discussed in more detail in Sect. 3.]

Fig. 2.2. Memphis community model (CARRI, 2008).
Fig. 2.3. Taxonomy for health security: Memphis.
Figure 5 illustrates the organizational relationships important to health security in the MUA. The experience and trust embodied in community connections, such as these, enhance the resilience of response and recovery to major disasters and emergencies. The organizations important to health security (or community health) are denoted by ovals and grouped by sectors: local government-related authorities, medical care, first responders, grassroots/NGO and business. Key functions or activities of organizations are provided in squares. Relationships between organizations are both formal (solid line, for organizational reporting, formal coordination, supervisory) or informal (dotted line, for communications, informal coordination, information sharing), and are reflective of interdependencies that exist. Sector dependencies are identified, based on community feedback, for public health, first responders, healthcare facilities, and selected others (e.g., emergency evacuation, red cross sheltering and fatality management), with current robustness of critical elements indicated by red, yellow or green circles (green = fully addressed; yellow = addressed, but some vulnerabilities; and red = not addressed). Plans or planning are indicated by an arrow, with the same status coloration. [It should be noted that status of current capability or capacity is subjective, drawn from interviews with MUA community health principals and stakeholders].

This information is illustrated in the legend below:

<table>
<thead>
<tr>
<th>Organizations</th>
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<tr>
<td>Key functions or activities</td>
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<td>Organizational relationships: formal/informal</td>
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<td>Dependencies: status of elements and plans</td>
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<td>• green: fully addressed</td>
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<td>• yellow: addressed, but some vulnerabilities</td>
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<td>• red: not addressed</td>
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2.1.1 Government Organizations

The core government organizational functions with community health responsibilities are those implemented jointly by the respective Memphis City and Shelby County governments. These consist of the Emergency Management Agency, the Health Department (HD), and the Community Services Agency.

The Memphis Shelby County Emergency Management Agency (MSCEMA) assists local, state, and federal agencies with response for “major fires, hazardous material incidents, evacuations and any other emergency or disaster operation that requires a multi-agency/multi-jurisdictional response” (MSCEMA, 2009). Staffing consists of a director, manager of operations, several planning and training officers, full- and part-time emergency technicians, a volunteer amateur radio program, and a volunteer reserve program (MSCEMA, 2004). The MSCEMA is responsible for the Memphis/Shelby County Emergency Management Plan (EMP) and for operation of the Emergency Operations Center (EOC). While each individual local government agency (e.g., the HD) is responsible for performing its specific function during routine emergencies, the Emergency Management Agency (EMA) assumes the necessary coordination role during major emergencies/disasters, which takes place in the EOC. The EMP sets forth the standard operating procedures for each Emergency Support Function (ESF), as defined in the National Response Framework, and provides a concept of operations that details how communications will flow to and between the various ESF groups, and provides for pre-emergency planning and training.

For community health security, the relevant ESFs are ESF 6 (Mass Care) and 8 (Public Health and Medicine). Under ESF 6, the EMP specifies roles and responsibilities for public sheltering, including those for special needs populations. The Shelby County Community Services Agency serves a leading role in this capacity and would oversee the selection, staffing, and operation of emergency mass care shelters, as well as individualized crisis counseling for those affected by the emergency.

Under ESF 8, the EMP assigns organizational roles for emergency medical services, public health, and crisis intervention support. For EMS, the Memphis and Shelby County Health Department (MSCHD) is the lead agency for “guidance, prioritization and coordination of resources involved in the triage, treatment and medical evacuation” of disaster victims (MSCEMA, 2004). For public health, the HD is the lead agency for providing public health support in the post-emergency or disaster environment. The EMA has the lead agency responsibility for ensuring that psychological support and counseling is provided for local emergency responders coping with the stress of handling major emergencies.

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5 The National Response Framework (NRF), which focuses on response and short-term recovery, articulates the doctrine, principles, and architecture by which our nation prepares for and responds to all hazard disasters across all levels of government and all sectors of communities. The NRF is responsive to repeated federal, state, local, and private sector requests for a streamlined document that is less bureaucratic and more user friendly. The NRF also focuses on preparedness and encourages a higher level of readiness across all jurisdictions (DHS, 2008).
The EOC serves as the centralized management center for emergency operations. When warranted by the size and scope of an emergency, the EMA can activate its EOC to coordinate interagency and organizational response to and resources for an emergency. Participants in the EOC consist of core representatives from the EMA, the HD, law enforcement, fire department, and EMS, and often include volunteer organizations such as the American Red Cross (ARC) and other key participants and stakeholders.

The Memphis and Shelby County Health Department (MSCHD), as prescribed by EMP, coordinates the community’s emergency public health response under ESF 8. It also serves as the lead agency for risk communications messaging and public education, provides public health surveillance during a health-related emergency, and communicates with and coordinates the healthcare community medical response. This last function is fulfilled through its Regional Hospital Coordinator (RHC) and the Shelby County Regional Hospital Disaster Planning Council, designed to coordinate resources, supplies, and information among the various medical centers, clinics, and operations. The Director of the Health Department (Health Services) communicates and coordinates with government leaders in Memphis and Shelby County, conveys public health directives and guidelines to various affected stakeholder organizations in the city and county, and ensures adequate staffing and continuity of resources for the department during a health emergency. The MSCHD’s All Hazards Emergency Response Manual (MSCHD, 2007a) requires that the health department maintain critical operations during an emergency including immunizations, select programs and clinical services, assessments and recommendations regarding environmental health issues, and overall emergency response.

The MSCHD Health Officer has the legal authority during health emergencies to authorize and communicate public health directives to the community and supporting agencies, including social distancing strategies and quarantine actions. The Health Officer communicates and coordinates directly with the healthcare community and makes recommendations regarding strategies, thresholds, and methods for reallocating resources.

An Emergency Service Coordinator leads the department’s emergency preparedness and response planning, conducts public health preparedness training, drills, and exercises, and is the key interface with the EMA and on the EOC. This role is particularly critical for widespread infectious disease outbreaks such as those associated with a bioterrorist attack or pandemic influenza. For pandemic influenza response, a formal plan was prepared with broad community input that is designed to support the local response to pandemic influenza and coordinate local, state, and federal response planning (MSCHD, 2007b). This plan is activated once a pandemic influenza emergency is declared by the state and after the Tennessee EMP is activated. It identifies roles and responsibilities for a number of other local and regional government agencies, healthcare organizations, media representatives, community organizations, educational institutions, and private businesses that will need to work with the MSCHD during a pandemic influenza emergency. Key elements of the plan consist of continuity of HD operations, disease surveillance, laboratory diagnostics, healthcare planning, vaccine distribution and use, antiviral
drug distribution and use, community interventions, public health communications, and workforce and social support.

A SARS (Severe Acute Respiratory Syndrome) preparedness plan was prepared by the state, with local efforts devoted to development of plans for smallpox vaccination, mass prophylaxis, pandemic influenza, and Strategic National Stockpile distribution plans. An MSCHD Bioterrorism and Emerging Infectious Disease Manual (the “Black” book) has been prepared highlighting standard references and benchmark information for public health personnel and providing an “all hazards” basis for operations (Fitzgerald, 2005).

A syndromic surveillance system has been established, with surveillance conducted for key indicators including febrile rash symptoms, gastrointestinal and respiratory illnesses, and sepsis, with three of 11 hospital emergency departments reporting influenza/pneumonia–related deaths, sentinel influenza through individual providers, and pharmacy sales (over the counter and selected prescriptions). In the event of an emergency, surveillance would be expanded to cover the 911 system, the medical examiner, and large physician groups. Communication with the Centers for Disease Control and Prevention (CDC), the state, and other regional health departments is afforded through the Health Alert Network and Epi-X. For communication between the health department and healthcare providers (hospitals, physicians), a broadcast fax system is used (there is no web-based real-time reporting or communication system). MSCHD has established a medical treatment response capability in terms of pharmaceuticals, which had its initial funding in 1996 through the Metropolitan Medical Response System (MMRS). The target of this program is to ensure that at least 20% of the public could receive treatment, including the five lines of antibiotics in inventory. The HD’s Select Agent Laboratory (Biosafety level 3) has been in full operation following a major renovation in 2001 and is currently capable of conducting mandated, under the Laboratory Response Network (LRN), confirmatory testing for the key major select agents (Fitzgerald, 2005).

The Memphis and Shelby County Community Services Agency (MSCCSA) was established in 1993 as a quasi-governmental institution of the state of Tennessee under the direction of the state Department of Finance and Administration. It is located in the Memphis and Shelby County (MSC) Division of Community Services reporting to the County’s Chief Administrative Officer and has a Board of Directors made up of community leaders who are appointed by the governor. MSCCSA is focused on strengthening the community by providing services that enhance individual and family strengths, and community involvement. It has 50 paid staff (some of whom are contractors) who operated from funding provided by MSC government from federal and state grants. Because of this governmental support, MSCCSA can provide community support where others cannot.

Its programs provide local funds management, case management, and care coordination. Examples of community services rendered in the past include emergency shelters for Hurricane Katrina evacuees (shelter management and staffing), case management tracking and support for displaced Katrina evacuees in the Memphis area, case support for individuals with mental cognitive disabilities, and medical transportation services. For Katrina and, later, Hurricane
Gustav, MSCCSA placed senior managers and administrators to serve in most shelters that received the evacuees arriving by bus and train. In Katrina, only one shelter was a Red Cross shelter, and CSA worked with them and other Memphis-based organizations to open it. After Gustav, it was decided by the EMA that the MSCCSA would no longer manage shelters in the future (deferring to the Red Cross); MSCCSA staff have taken the Red Cross sheltering training in order to provide backup resources for the community (Lawler, 2008).

### 2.1.2 Healthcare Community

Memphis is the eighth largest medical care center in the country. Key organizational elements of Memphis and Shelby County healthcare important to sustaining community resilience consist of the major regional hospital systems, mental health services facilities, community health services clinics, the regional blood center, regional health insurance companies, and the private physician community.

The Regional Medical Center for Memphis, commonly known as “The MED,” was chartered in 1829 and is the oldest hospital in Tennessee. It is an acute-care medical center located in downtown Memphis that serves a six-state region in the mid-South. It is a Level One trauma center (the second busiest in the country) and a major burn care center. In addition to these specialty areas, The MED supports centers of excellence in the care of wounds, high-risk obstetrics, neonatal medicine, sickle cell, and HIV/AIDs. The medical center is managed by the non-profit Shelby County Healthcare Corporation, with a $331 million annual budget, of which 25% comes from local and state grants. (In 2008, $255 million in individual charitable support was provided to its patients.)

In 1999, The MED and the Memphis Shelby County Health Department entered into an understanding whereby the former managed the six health department neighborhood clinics along with its four local clinics as part of the “Health Loop” primary care network, which supports more than 60,000 patient visits per year.

The Methodist Healthcare System began as the Methodist Hospital of Memphis, which was chartered in 1918; it became Methodist Health Systems in 1982 and Methodist Healthcare in 1998. The seven-hospital system includes the flagship Methodist University Hospital in downtown Memphis, as well as hospital centers in outer Memphis (Methodist North and South, respectively), Germantown, and Somerville. The University Hospital is the largest hospital in the system with 693 beds in a downtown complex. It has been affiliated, since 2002, with the University of Tennessee Health Science Center as the principal private teaching hospital. The healthcare system also manages Le Bonheur Children’s Medical Center and an extended care hospital, as well as home health agencies and outpatient clinics. Serving the entire Mid-South region, the Methodist Healthcare System is one of the largest in the country and has leading specialty services in neuroscience, oncology, transplant, and pediatric care. The overall system has about 1,600 total beds with 10,000 employees and 2,000 physicians.
Baptist Memorial Healthcare began in 1912 as a 150-bed hospital located in downtown Memphis and now consists of 15 affiliated hospitals (with 1,300 of 2,600 beds in the Memphis metropolitan area), 7 homecare facilities, 8 hospices, and 20 minor medical centers and clinics, in the mid-South region. Beginning in 1979, the Baptist began a prolonged expansion into a regional healthcare system, purchasing or building hospitals in the Memphis suburbs and across a three-state region (Tennessee, Mississippi, and Arkansas). In 2008, ground was broken at downtown Baptist Memphis for a major renovation and expansion of the emergency facilities, with advanced diagnostic technology being installed and an increased capacity of 54 treatment facilities. The overall hospital system has 12,000 employees with approximately 8,700 employees in the Memphis area and 3,100 affiliated physicians.

Other major medical centers include the Memphis Veterans Administration Medical Center located downtown (adjacent to The MED) since 1922 with 244 beds, supported by two VA-staffed offsite primary care clinics located in suburban Covington and in South Memphis. The St. Jude Children’s Research Hospital is one of the world’s premiere pediatric cancer research centers and sees about 5,400 active patients annually, most on an outpatient basis; it has 78 beds for those needing hospitalization. The research hospital has 3,300 employees and is primarily supported by public charitable contributions. St. Francis Hospital opened in 1974 with 519 beds in the suburban East Memphis area, with a 197-bed nursing home, pharmacy, and a University of Tennessee-affiliated residency facility in family practice. The UT Medical Group is a non-profit multispecialty physician practice founded originally in 1974 with over 350 physician providers affiliated with the UT Health Science Center College of Medicine, with clinics located at the Memphis Medical Center and several locations in suburban Germantown. The Delta Medical Center is a short-term 240-bed hospital in Memphis with an affiliated 90-bed psychiatric unit, and over 200 employees. Besides Delta and St. Francis, Lakeside Behavioral Hospital (295 beds) in northeast Shelby County and Parkwood Behavioral Health System (128 beds) across the state border in Mississippi (7 miles south of Memphis) have psychiatric and substance abuse treatment facilities.

The Shelby Regional Hospital Disaster Planning Council serves in an advisory capacity to the Shelby County hospitals, the EMA, the EMS community, and the MSCHD and provides a means to facilitate communication, collaboration, and resources for emergency planning and preparedness. The MSCHD, through its Regional Hospital Coordinator, acts as the technical advisor to the Council.

The Regional Medical Communication Center Council is comprised of EMS and hospital representatives in the Memphis area who meet regularly to discuss emergency communications effectiveness throughout the Memphis medical community. A key focus of the council is to ensure that MEDCOM, the medical communications center located at The MED, is functioning effectively and that there are contingency communications available during emergencies. MEDCOM provides ground and air ambulance-to-hospital medical communications.

In addition to the outpatient clinics affiliated with major medical centers, two community health centers are located in the city of Memphis: the Church Health Center and Christ Community Health Center. Both are faith-based community-based clinics aimed at providing a range of
outpatient medical services to thousands of poor, uninsured, and homeless individuals in designated areas of urban Memphis.

The **Memphis Medical Society** is the professional organization for the medical community with about 75% of local physicians represented as members. During emergencies, as well as most recently, in the Hurricane Gustav evacuations from the Gulf states to Memphis, the society has coordinated with the EMA to provide supplementary staffing for the Church and Christ Community Health Centers. The society has also arranged for private physicians to open their private offices for evacuees who need to be seen by physicians (Cates, 2008).

The **Lifeblood Mid-South Regional Blood Center** was established as a predecessor blood donor center located in Memphis in 1974. It has grown to be the principal blood supply entity for the Memphis healthcare system with 60,000 units of blood collected and processed annually at nine urban and suburban centers.

### 2.1.3 First Responders

**Emergency Management Services** in Memphis/Shelby County is comprised of 34 advance life support companies. Each basic life support company is equivalent to a typical fire department company of four personnel. Memphis/Shelby county has 33 ambulances (one per company), plus one company stationed permanently at President’s Island for high hazard emergency response. Current EMS capacity is based on the projected demand over time, that is, call volume, and assumes 12 hour rotating shifts. The **Mid-South EMS Council** provides a forum for EMS management and personnel in the Memphis region to contribute their experience to addressing community EMS issues in a coordinated fashion. The council meets regularly, invites community leaders to discuss EMS-related issues, and provides input to local policymaking for EMS operations (Holley and Rike, 2008).

### 2.1.4 Non-Profit/Volunteer-Based Service Organizations

Memphis has a long history of charitable organizations being active in emergency relief, beginning with the yellow fever epidemics at the very inception of the city. In the latter 1800s into the 1900s, the faith-based organizations of the city were most active in providing sheltering, nursing care, and community support. Thereafter, national service organizations such as the ARC and Salvation Army became active in community relief. More recently, governmental-sponsored and local volunteer organizations involving a broader constituency of the Memphis public and business community have become part of the social fabric of the Memphis community. The **American Red Cross** mission statement of the Memphis chapter is that the “Mid-South Chapter of the American Red Cross will be the premier provider of services that will enable the local chapter to achieve its mission of empowering Mid-Southerners to prevent, prepare for and respond to emergencies” (ARC, 2009). The Mid-South chapter serves a four-county area in western Tennessee, Tunica County in northern Mississippi, and Crittenden
County across the Mississippi River in Arkansas. During 2008, the Mid-South chapter assisted 3,555 individuals in that region who needed support for food, clothing, bedding, household items, medicine, and other necessities. Besides traditional first-aid training, the local chapter has actively provided instruction in disaster safety techniques, teaching over 3,631 members of the public the means to respond to events relatively common to the community such as house fires and tornadoes (ARC, 2009). The local chapter requested volunteers for Hurricane Gustav evacuee sheltering and got 350 individuals who were trained quickly and used in the shelters. The national Red Cross responds to all requests for emergency relief and makes appropriate priorities in the number of staff and volunteers it can reassign from its various field operations. For past hurricane seasons, there were several hurricanes almost simultaneously (Gustav, Hanna, Ike), and therefore many volunteers were needed in those respective areas. The fact that the largest evacuation in U.S. history took place in the affected Gulf states resulted in many people needing shelter in Memphis at the same time that the ARC national headquarters had to staff for the impacted areas. In this instance, the national office could not provide support to Memphis given the demands on resources elsewhere. In Memphis, the local chapter sheltered over 3000 evacuees, with eight shelters being run by ARC for the Federal Emergency Management Agency (FEMA)–managed evacuees, with another 15 shelters being run or supported for the self-evacuees (Hoguet, 2008).

The Metropolitan Inter-Faith Association (MIFA) of Memphis receives funding support from both the city as well as charitable support from the faith-based community of the Memphis area (such contributions total about $4 million per year). As a non-profit that depends on these two avenues of support, it must make up in donations what it does not receive from the city or state for its key missions of supporting the poor and disadvantage in the community. Key activities include the MIFA store, which sells donated clothing at discount prices, “meals on wheels” and other food services, the Community Legal Center, youth services, temporary housing, and seniors programs. Approximately 4,000 volunteers support these programs.

For emergencies, MIFA “sits” at the table in the EOC and takes direction from MSCEMA regarding how it will contribute during an emergency. In a past campaign to make its inventory of clothing available to evacuees and for Katrina, a plea to the Memphis community swamped them with donations due to the size of the community response. Because of its ability to provide food services, it has also supplemented Red Cross efforts by providing food to emergency personnel and displaced individuals. For Gustav, MIFA provided donated personal hygiene kits to the evacuees. For Hurricane Elvis, MIFA provided extensive support to individuals who were unemployed and displaced because of destroyed businesses and homes (Phillips, 2008).

For the Salvation Army, feeding individuals is the primary community relief role for the local Memphis chapter. While no emergency sheltering is provided, the Salvation Army does provide limited temporary sheltering in Memphis. With respect to community relief, there are four levels of response: national, territorial, regional, and local, as a function of the scope and significance of an emergency. Each level has differing levels of resources allocated by the Salvation
Army, as well as attention by their hierarchy. For example, for Memphis, their food wagon is supported by the Army’s territorial office (Memphis is part of the Atlanta territory). Regional resources come into play for regional emergencies such as the recent tornadoes in Jackson, Tennessee. The Memphis local company relies upon local contributions for routine operations, with the exception of emergencies that require broader support from the Army region or territory, in which case the local company would make a request for that support (Woodcock, 2008).

The Medical Reserve Corps (MRC) was created following President Bush’s 2002 State of the Union Address and is to be comprised of organized medical and public health professionals who volunteer their time. The intended purpose of the MRC is to provide the necessary organization and structure to provide ready medical and public health personnel in response to an emergency requiring their volunteer capabilities (albeit, there are no specific requirements for medical or public health expertise). The Shelby County MRC is under the direction of the MSCHD’s Public Health Preparedness Program, which has assigned an in-house coordinator. The MSCHD has registered 2,700 volunteers who have received basic orientation and preparedness training. To date, they have been deployed to support the MSCHD’s Katrina and Gustav response, to support mass influenza immunization drives, and to serve in non-emergency roles in support of health department programs such as health fairs. Only a small number of the MRC units in Shelby County are physicians and public health professionals (Moore, 2008).

The origin of the Community Emergency Response Team (CERT) was founded in recognition that during a major prolonged emergency, members of the community may be without basic services such as the fire department, police, EMS, electricity, water, and telephones. CERT personnel are trained about emergency preparedness regarding hazards that exist in their area, including fire safety, first aid, light search and rescue, gas line shutoff, team organization, and disaster medical operations. A number of CERT participants have ham radio experience. From a program template established by the FEMA, the MSCEMA has established CERT teams throughout the Memphis region. CERT members are also encouraged to actively participate in emergency preparedness programs in the community.

A related Teen CERT program has been established by MSCEMA which entails disaster preparedness training in the classroom at the high school level. With a course content similar to the adult courses, the objectives of the programs are three-fold: (1) to provide students with a knowledge base of the effects of natural and man-made disasters and their emotional, social, and economic impacts; (2) to build decision-making and problem-solving skills and strategies to help students make informed decisions regarding readiness, response, and recovery; and (3) to provide students with hands-on disaster preparedness and emergency response training with periodic reality-driven drills and exercises (Shelby County, 2009). A priority has been to “train-the-trainers” to accelerated implementation of the program in the schools.
Another non-profit/volunteer organization that is actively engaged in relevant community relief activities is Volunteer Mid-South, which formerly was named Volunteer Memphis and Hands On Memphis (which merged in 2006), respectively. Its mission statement is to “help meet the challenges of building and supporting a stronger community” (Volunteer Mid-South, 2009). Volunteer Mid-South recruits and refers volunteers and supports non-profit organizations by facilitating their use of volunteers and linking organizations to needed information, guidance, and resources to best deliver services to the community. One program recruits and matches volunteers to disaster relief volunteer opportunities in the Memphis regional community.

Other organizations that have or could have a role in health emergency relief include the Catholic Diocese Memphis, the Memphis Food Bank, Memphis Family Shelter, and Family Services of the Mid-South.

2.1.5 Business/Private Sector

There are a number of organizations that link the greater Memphis business community with others in the community, including the various chambers of commerce, business associations, and professional organizations. However, the following three groups provide the most direct links on the subject of emergency preparedness and business continuity in the face of disasters.

The Memphis/Shelby County Local Emergency Planning Committee (LEPC), authorized under the Emergency Planning and Community Right-to-Know Act, or EPCRA, brings together emergency planners from government, law enforcement, emergency management, fire departments, transportation, hospitals, the health department, representatives of the community, business, and the print and broadcast media. LEPC notes that it has the following capabilities in support of the Memphis community (MSC/LEPC, 2009):

- LEPC has been an emergency response educator, has worked hand in hand with our response agencies in drills and evaluations of our emergency response plans and developers, and most of all has been a focal point for building stronger working relationships among agencies, industry, and the community.
- LEPC serves as a focal point in the community for information and discussions about hazardous substances, emergency planning, and health and environmental risks. The community can expect the LEPC to reply to questions about chemical hazards and risk management.
- Besides working with local emergency management agencies in developing emergency response plans, the LEPC receives chemical release and hazardous chemical inventory information submitted by local facilities and makes this information available to the public at the Memphis and Shelby County Emergency Management Agency.
- LEPC has the authority to request additional information from facilities for their own planning purposes or on behalf of others. The LEPC can also visit facilities in the community to find out what they are doing to reduce hazards, prepare for accidents, and reduce hazardous inventories and releases.
LEPC members include federal government agencies such as the Coast Guard, EPA, and FBI; local agencies such as the MSCHD, Fire Department, and the EMA; non-profit service organizations such as the ARC and Salvation Army; healthcare organizations such as Baptist, Methodist-LeBonheur, and The MED; and businesses such as Federal Express, E.I. DuPont, CN Railway, and Schering-Plough.

Memphis FIRST is a 2007 initiative in which a group of Memphis businesses have banded together to help themselves and other private sector organizations to prepare and protect Memphis and the surrounding area in the event of a crisis or emergency management situation. Memphis First is sharing lessons learned and best practices, helping businesses and organizations establish continuity plans, and assisting the county EMA as well. During their first year of operation, Memphis FIRST was an independent organization that focused on membership matters and identifying priorities for attention. In its second year (2008–2009), the organization came under the auspices of the Memphis Chamber of Congress, which has provided its resources and structural support to the membership. The organization has since established four working groups: Incident Response, Marketing, Educational Awareness, and Technology. The respective working groups have developed action plans for the next 5 years. The Incident Response working group will be focusing on the development of a local credentialing protocol for volunteers during an emergency. It is also inventorying incident response assets among its business members, although it is not clear yet how that information will be used. The Educational Awareness working group is looking at what training is needed for individuals to represent their respective organizations at the EMA, and during emergencies at the EOC. From the Technology working group, members are reviewing available communication mechanisms for different hazard levels and what dependencies need to be addressed (Mueller, 2009).

Member businesses include FedEx, International Paper, AutoZone, Medtronic, Smith & Nephew, First Tennessee Bank, 5R Processors, Schering-Plough, and representatives from small businesses and the healthcare community. The Chamber of Commerce notes that there is interest within Memphis First to bring into the organization more participation by the Memphis healthcare community, including the major hospital systems and local medical industry, as well.

According to its charter, the purpose of the Mid-South Association of Contingency Planners (MSACP) is “to provide an environment for members to share information about the business continuity and disaster recovery fields, and improve their job performance through peer-to-peer education” (MSACP, 2009). Its membership represents a wide variety of industries and organizations throughout Memphis, Shelby County, and the greater Mid-South region. Sectors included are entertainment and media, banking and financial, transportation and shipping, health care, information technology and telecommunications, chemical and utilities industries, as well as governmental agencies, private organizations, and educational and research institutions. MSACP typically meets monthly with a different business continuity, emergency preparedness, personal or business security, or homeland security topic presented. It also sponsors periodic conferences such as the annual Emergency Preparedness and Incident Conference (EPIC) that addresses a broad range of business continuity and emergency preparedness issues pertinent to the Mid-South region (e.g., earthquakes and tornadoes).
3. HEALTH SECURITY DEPENDENCIES AND INTERDEPENDENCIES

Interdependencies are needed support and cooperation between institutions or community groups during and following an emergency that are important to the effectiveness of emergency preparedness, response, and recovery. In Organization in Action (Thompson, 1967), James D. Thompson outlines three forms of interdependence in social systems:

1. Pooled interdependence, where separate organizations or functions, which perform adequately on their own, fail if one or more of the others fail. Failure threatens all. For health security, an example would be the relationship of hospitals to each other, and to EMS units. The regional emergency room functionality is dependent on the capacity of individual hospitals to receive emergency patients, and the ability of EMS units to deliver them. If EMS is unable to deliver victims to hospital emergency rooms because the latter have exceeded their surge capacity, regional routing of patients breaks down, or transportation routes are impassible, the overall system breaks down. All organizations/functions (EMS, hospital EDs, regional patient transfers) fail if one of the others fail.

2. Sequential interdependence, which is linear like a supply chain or assembly line. One unit in the chain produces something necessary for the next unit, and so forth. Using the same example above, the emergency room capacity is dependent upon available medical staffing which is, itself, dependent upon a combination of backup contingent personnel and programs to facilitate staff being able to get to work during a major emergency.6 If staffing fails to sustain emergency room operations, the latter fails, which would then preclude receipt of EMS patients, setting up EMS for failure (“cascading failure”).

3. Reciprocal interdependence, where the output of one organization becomes the input for others and vice versa. As above, emergency care can only succeed if EMS can deliver its critical care patients (output) to the healthcare system for treatment (input), whether it be a hospital emergency facility or an alternate care site (ACS).

The implication is that individual organizations or components of a community become less distinguishable from each other in acute circumstances such as disaster relief where a more “organic” response is required of the whole rather than its parts. The above forms of interdependence apply to physical systems as well, such as physical infrastructure where community “lifeline” systems such as electric power networks, telecommunications, postal and shipping systems, transportation systems, water supplies, and public health systems are cross-linked in ways that are not always apparent during routine, non-stressed circumstances.

In contrast, dependencies are personnel, supplies, functions, and other prerequisite support needed to enable an institution or group to mount and sustain an effective response and recovery to an emergency. When not adequately satisfied, dependencies have the potential for impairing or preventing an organization from fulfilling its mission or function during an emergency, which may then impact its interdependence with other community organizations, leading to a cascading effect which would undercut the overall response and resilience of a community. Classic examples are the dependency of organizations on critical staffing, transportation on the availability of fuel and passable roadways, and medical treatment on electricity, water, and equipment.

6 In this report, this is also defined as a sequence of “dependencies.”
3.1 EXPERIENCE FROM REGIONAL DISASTERS

Every disaster provides a unique set of lessons learned. For the Memphis region, an added dimension has been the management of thousands of evacuees who were transported to Memphis following Katrina and Gustav. Similarly, as with most regions, Memphis has had its share of local emergencies that involved widespread damage including seasonal tornadoes, ice storms, and windstorms. All of these provide both essential information on the performance of community disaster response and recovery systems, particularly the interdependencies of organizational roles and responsibilities, and the dependencies of those functions.

Katrina, which struck the Gulf Coast near New Orleans as a Category 4 hurricane on August 29, 2005, began as a classic hurricane with wind and flooding but, due to the collapse of a number of critical levees, resulted in widespread infrastructure damage, flood damage, civil disorder, healthcare collapse, and the stranding of thousands of residents without adequate food, water, and medicine for days. From a health security standpoint, a medical crisis ensued immediately with the inability to evacuate thousands of inner city residents isolated by the flooding. Emergency planning for hospitals and the Superdome assumed only 3 days rather than the approximate week required for full evacuation. With no power, including emergency generator power, to run respirators and other critical care equipment, critically ill patients expired in several flooded hospitals before they could be evacuated. In one infamous case, a nursing home manager evacuated without making like arrangements for his nursing home residents; many likewise died.

The collapse of the healthcare infrastructure of the New Orleans soon devolved to how and when that capacity could be recovered. Two years after the storm, only one of the city’s seven general hospitals was operating at its pre-Katrina capacity, with two more partially open; the number of hospital beds reduced by two-thirds. Notably, the largest one serving the inner city poor residents, Charity Hospital, may never reopen without a major financial infusion given its age and financial circumstances. With the slow recovery of medical facilities, medical professionals have been similarly slow to return, which has had the collateral impact of slowing economic recovery because the healthcare industry had been the third largest employer in New Orleans (behind tourism and retailing). Into this breech, local volunteers and nonprofit organizations have stepped in to open and operate low-cost clinics, which while successful, have not been able to substitute for the lost hospital capacity (NY Times, 2007).

Some clear lessons from Katrina that have a bearing on weighing Memphis interdependencies and dependencies include the following:

- Hospital emergency planning did not adequately consider the implications of catastrophic flooding and its impact on operability, for example, with respect to evacuation, emergency power, contingency treatment of critical care patients, and medical staffing. Similar dependency issues would apply in Memphis in the event of a major earthquake or commensurate disruption.

- Medical facilities in New Orleans were not designed in a resilient manner for external disasters; they were not prepared for flooding (e.g., some had basements where emergency
generators, computers, and other key utilities were located). In Memphis, attention to backup or hardened critical systems will be important.

- Hospital emergency generators either were flooded because they were located at a lower level (and did not have a flood wall or sump pump) or did not have a fuel supply beyond a few days. Attention to single-mode dependencies is important.

- Healthcare facilities did not plan or prepare for self-sufficiency, that is, with at least 5 days of food, water, electrical generator capacity, sewage, and supplies. For Memphis, water may be the limiting supply chain factor that needs attention.

- There was little expectation that all of the major city hospital systems would go down simultaneously; in particular, there was little backup for the loss of Charity Hospital, the Level One regional trauma center and key healthcare center serving inner city residents. The MED can be considered the Memphis corollary to Charity Hospital.

- Unavailability of transportation routes for emergency egress and the movement of patients and victims were not adequately considered in planning. Like Katrina, an earthquake would similarly disrupt evacuation routes; it is not clear that this scenario has been adequately addressed.

- The special needs population of the city, including the medically disabled, infirmed, or equipment reliant (e.g., dialysis patients), were not adequately addressed. This need would be particularly important for Memphis, which has a sizable disadvantaged population.

- First responders and recovery organizations had not worked together before and experienced widespread communications problems. Experience by Memphis responder and emergency response organizations during Katrina and Gustav evacuations provided firsthand experience in this regard; issues are addressed in after action reviews within the community.

- Inner city healthcare facilities serving poorer residents are financially frail, and least resilient to disaster and least likely to recover.

- Community volunteer organizations are most likely to be active during recovery in terms of providing interim healthcare relief but cannot replace loss of hospital capacity. While Memphis has some non-profit healthcare clinics, it is not clear how they and others would function in the aftermath of a major disaster with the incapacitation of some of the major hospitals.

- Emergency electronic communications was a problem for everyone, including the healthcare community; digital-based telephones and the internet were down, and cell phone networks were either not functional or overloaded. Attention has been paid by Memphis healthcare facilities to alternative communications such as ham radio operators and satellite phones, but questions remain regarding how best to “harden” existing communication systems and to ensure effective interoperability.
• For recovery, planning needs to include retention of valuable medical staff, including incentives to get them back to work and support for their families.

Hurricane Gustav was a more recent hurricane (August 2008) and the first major one for which changes in post-Katrina emergency response could be tested. Whereas Katrina demonstrated the dangers of not properly evacuating residents most at risk, Gustav illustrated the risks of moving thousands of residents, most poor and without private transportation, at considerable distance. Some 9,000 Gulf coast residents were medically evacuated in advance of Gustav, with about 8,000 of them from nursing homes (Jervis et al., 2008). Some were inpatients at hospitals; others were infirm or chronically ill; some had mental disorders or physical disabilities; and many became exhausted by the evacuation process. Trains that arrived in Memphis with thousands of New Orleans evacuees had to discharge their passengers through an initial check-in, a subsequent bus ride to a National Guard facility at the airport, and a final public health survey and sheltering registration (Lawler, 2008). Of the 18 deaths that were attributed to Gustav, six were linked to the medical evacuation itself, and while these critically ill patients may have died anyway, the decision to evacuate seriously ill patients is clearly a difficult one and a policy issue itself (Fink, 2008).

Some of these issues and lessons are addressed in the after action report (AAR) that was developed following the evacuation of residents to Memphis in the face of Gustav. Others have been documented for medical care facilities directly affected by Gustav along the Gulf Coast:

• Large hospital inpatient populations during Katrina had complicated patient care during loss of power and flooding, and made later evacuation difficult. In the run-up to Gustav, preparedness included reducing that population to a bare minimum by elective procedures and advance evacuation of moveable patients.

• During Katrina, the inability of hospitals to function without regular electrical power was a major problem; at some hospitals, auxiliary power (generators) failed, endangering critically ill patients on life support equipment. Given the summer heat, some of these hospitals were barely habitable because of the lack of air-conditioning and inability to open sealed windows (Fink, 2008). For Gustav, most New Orleans area hospitals had sufficient auxiliary power to support all routine needs (including air-conditioning) for at least a week (Osterweil, 2008). As noted before, these dependency issues (particularly with water supplies) are equally critical to Memphis area hospitals whose ability to function on emergency power has not yet been tested at length.

• Given communication problems experienced during Katrina, area hospitals during Gustav relied upon hurricane-proof satellite dishes, ham radios, and cell phones using outside area codes (local cell phones jammed due to communications volume during Katrina).

• To protect diesel power generators after Katrina, additional generators were installed on hospital garage rooftops; basement generators were protected by flood walls and sump pumps, and some hospitals had installed additional fuel tank capacity.

• For the evacuations, themselves, the process of registering the evacuees, taking medical histories, and transporting large numbers of individuals to locations such as Memphis proved
challenging to host communities who lacked the logistical preparation and experience. Post-Gustav, Memphis has established the need to streamline the receiving process and coordinate better among the various responsible local and state agencies.

When boiled down to the overarching lessons from Katrina and Gustav that have implications for community health, it comes down to reducing overall vulnerability in terms of the potential for physical and socioeconomic harm from natural and man-made disruptions by (1) instilling redundancies and backups to key safety processes and systems, and increasing the resourcefulness of the community when unexpected challenges occur, and (2) increasing the self-sufficiency of the community to sustain itself during and immediately following a disaster by protecting the well-being of its members (both to increase their physical endurance as well as to lessen demand on already stretched healthcare resources). For community health, the former addresses the inherent strength and interconnectedness of the healthcare infrastructure—physical, socioeconomic, human resources. For the latter, resiliency is influenced by effective engagement between the traditional pillars of the healthcare system, the hospitals and clinics, with the broader community, including private physicians, volunteer organizations, the faith-based community, and emergency response organizations.

3.2 MEMPHIS COMMUNITY PROFILES

The profiles provided below address the interdependencies and dependencies of selected Memphis organizations that are representative of those in the critical community sectors important to health security and its resilience. They provide a more specific case review of what organizational interdependencies and dependencies exist, and their implications for responding to and recovering from a major health emergency. These profiles are a “snapshot” in time based on interviews with knowledgeable representatives of the organizations in question, as well as lessons learned from recent disasters such as Hurricane Katrina.

“Interdependencies” are defined here as needed support and cooperation between institutions or community groups during and following an emergency that are important to the effectiveness of emergency preparedness, response, and recovery. “Dependencies” are needed personnel, supplies, functions, and other prerequisite support needed to enable an institution or group to mount and sustain an effective response and recovery to an emergency.

3.2.1 Memphis Urban Hospital: The Regional Medical Center for Memphis (“The MED”)

The Regional Medical Center for Memphis, commonly known as The MED, is an acute-care medical center located in downtown Memphis that serves a six-state region in the mid-South. It is a Level One trauma center (the only one for 150 miles around) and a major burn care center. In terms of financial stability, The MED is confronted with challenges similar to many inner city hospitals. About 30% of its patients do not have health insurance and cannot pay for their treatment; this accounts for about 60,000 uninsured patients per year (Heiberg, 2007). About 80% of its admissions come directly from the emergency department. It loses money in its burn center because state payments to support burn patients being treated do not cover all costs. A

7 Except where noted, this profile is based on an October 7, 2008, interview with Steve Chunn, Safety Director, The Regional Medical Center for Memphis (Chum, 2008).
management consultant, FTI Cambio, was hired to review current processes, revenue cycles, operations, building functions, productivity, and quality and recommend any efficiencies that can be taken by hospital management; it has recommended changes, since accepted by The MED’s board, such as the divestiture of medical units and layoff of staff, that may save $25 million a year (Memphis Business Journal, 2009). Already highly unstable, the resilience or survivability of The MED from a financial standpoint would be questionable in the aftermath of a major earthquake or similar disaster damaging its physical structure.

**Interdependencies**

In the event of a large-scale disruption, The MED would be highly dependent upon outside healthcare organizations for support and relief. While mutual aid agreements do exist between the hospital and other regional health centers, it is seen as more likely that the CEOs of the medical systems would need to be in contact with each other and the municipal government (i.e., the EMA and the Regional Hospital Coordinator) in order to arrange assistance between systems. This circumstance, in part, reflects the natural competitive nature of private and public health care systems, where routine resource sharing is rare.

Reliance on the nearby Veterans Administration hospital would be particularly important with it being the ACS if The MED’s critical care facilities were not useable during an emergency (albeit, according to a MED hospital representative, it is not likely that many of those in critical care could be moved without risk to other facilities).

Reliance on local mental health care facilities (e.g., Parkwood and Lakeside clinics, and St. Francis and Delta psychiatric center) would be a major interdependency due to the numbers of victims and evacuees who would likely require such care. This would constitute a true gap during a major regional disaster because under “normal” conditions, it currently takes 2–3 days for get a referral accepted for a local psychiatric ward. Lakeside clinic has a mobile counseling van that can be deployed for emergencies, and the UT psychology department is a source of support, if needed; however, none of these support options is “hardwire” or prearranged in advance.

With respect to the EMA, coordination of hospital receipt of disaster or (in the case of pandemic flu) infectious disease victims would be handled through the EOC, primarily through the Regional Hospital Coordinator. One representative of The MED sees the EOC as the “glue” that would hold everything together during an emergency and views The MED, in particular, being reliant on directions and coordination being provided via the EOC.

The Memphis Shelby County Health Department would be a key interdependency for The MED, given key roles played including Chief Medical Officer (CMO) and Hospital Resource Coordinator (HRC). The MED would need the CMO and HRC to intervene if The MED’s ability to receive patients in an emergency is overwhelmed and outside support is required. In turn, The MED, as the regional trauma and burn center, would be one of the key medical response components for a major disaster, such as an earthquake, explosion, or fire.

EMS ambulance units would be responsible for transporting victims to the Emergency Department for emergency care, making use of the Hospital Resource Tracking System (HRTS)
to determine available capacity. The MED would be reliant on the EMS and its tracking system to ensure that an unmanageable surge would not be experienced in the emergency department.

The MED would need support from the local and regional police to provide security if the medical center became inundated with emergency patients or became threatened by civil unrest. In turn, assuming it survives intact, The MED would likely be a key medical care base for first responders involved with disaster response and recovery.

**Key Dependencies**

The following are key dependencies identified for The MED that are relevant to ensuring effective response and recovery to major emergencies and regional disasters, and need to be addressed to make community recovery effective and efficient.

**Backup power.** All hospitals are reliant on electrical power from the local and regional grid to support operations and have backup fueled electrical generators to supply emergency power when needed. The MED has backup diesel generators located in the various buildings at its downtown location, each having its own fuel tank capacity. This capacity ranges from 3–8 days, with provision for resupply from an outside vendor. An option exists to transfer fuel by hand pump from one facility tank to another to permit operation of particularly critical facilities; however, it is not clear how effective this would be in practice.

**Water supplies.** Water is a key dependency for hospitals in the mid and deep South because of the necessity of facility air-conditioning, which relies on water chillers for heat transfer, as well as routine supplies for sterilization needs and sanitation. The MED would only have a 1–2 day backup supply of water for the latter and an inadequate supply for the chillers. During Hurricane Elvis, the local water pumping station went out and water had to be hauled up to the upper floors of the hospital. They have looked into the possibility of drilling wells, but that option is cost prohibitive. Plans are to arrange resupply with an outside vendor (using tankers) that would permit in-house sterilization and other critical activities to continue, but would not enable air-conditioning to resume. If a disaster occurred in the summer months, the lack of air-conditioning under these circumstances would likely render larger parts of the hospital complex unusable.

**Adequate staffing.** During a major disaster, and in particular, a pandemic flu outbreak, a critical dependency is ensuring an adequate workforce to man the critical care functions of the hospital. This involves not only the development of a surge plan to provide for additional staff during the emergency but also advance planning to both mitigate against staff shortages that may arise due to increased personnel absenteeism. This would include cross-training of medical and nursing staff, identifying backup personnel options beyond the immediate onboard staff, and making provisions for family support to enable key personnel to report to work. Provision has been made to make available 3,000 influenza vaccine doses for MED employees and their families as a means to maintain staffing levels during a major outbreak. If staff members were severely impacted, they have the option of contacting the HD’s CMO to request backup physician and nursing coverage, as well as tapping physicians available from the University of Tennessee Medical School (with whom they have a teaching hospital relationship). At The MED, the issue of adequate medical staffing is a routine challenge and would be exacerbated in an emergency.
Preliminary planning is in progress, and the objective is to develop guidelines on how supplemental staffing resources will be provided.

**Backup communications.** Normal communications means such as telephones, faxes, the internet, and cell phones may be lost during and in the aftermath of a major disaster. Katrina demonstrated the difficulty the community and relief teams confronted in being able to communicate with each other and the outside world. At The MED, a key backup means of communication will be through volunteer ham radio operators, who will man preexisting radio units at the hospital. If communication towers survive the immediate emergency, cell and handheld digital internet communications may also be available.

**Medical supplies.** The MED maintains a pharmaceutical cache and an equipment reserve [regarding the latter, a Health Resources and Services Administration (HRSA) grant was used to purchase additional ventilators, wheelchairs, and N95 masks]. The in-house pharmacy can operate for up to 48 hours with existing supplies. The critical supply chain for the hospital is under review at this time.

**Medical records.** Digitized medical records are important not only to facilitate patient treatment, particularly during an emergency, but also to enable more effective care of victims and evacuees when hospitals are disabled and residents may be scattered across the region and in other states. Katrina demonstrated the value of an interconnected records system that can be accessed using patient identification information. In the case of The MED, it maintains electronic patient records, but they cannot be shared electronically outside of their in-house system.

**Safety/security.** Supporting the safety of hospital personnel is critical to maintaining their well-being during periods of elevated stress and exposure to potential pathogens. The experience with the SARS outbreak in Canada was instructive as to the importance of wearing protective clothing and taking precautions in patient care. At The MED, N95 masks have been provided to all medical care personnel, and they have been fit-tested and trained in proper use. Broader training in the use of protective clothing and ID techniques was included in a recent pandemic flu exercise involving 200 fictitious patients presenting at The MED.

With respect to security, Katrina clearly demonstrated the importance of maintaining civil order during disaster response and recovery. While outside security may be forthcoming at some point from the National Guard and state police, the ability of a medical center to continue its operations in the aftermath of a major disaster relies upon the local police and their ability to provide security. With its location in midtown Memphis, the Memphis Police Department would have to provide backup security in the event of an emergency where civil order was breaking down.

**Physical infrastructure.** With its siting in a recognized subsidence zone, The MED center would likely suffer considerable physical damage from even a moderate earthquake. A catastrophic earthquake (on the historic scale of the 1811 event) would likely see all of the buildings collapse with the possible exception of two newer facilities (Medplex and the burn center). Beyond the deaths of patients, the collapse of The MED would remove the primary medical care center available to downtown residents (ones most likely to be injured in an
earthquake). Given the precarious financial state of the hospital, little can be done to mitigate this vulnerability without massive state or federal resources. It is not evident that actions have been taken by or for The MED to mitigate the impact of even moderate earthquakes on the physical plant of the hospital, improve the survivability of patients, and facilitate the continuity of operations.

Physical capacity. The surge plan provides for several hundred additional beds during an emergency by doubling up in existing patient rooms and by expanding into available space (e.g., the burn center and Medplex). Limiting factors for effective use of some of the expandable space is lack of electrical outlets (to power equipment) and medical devices themselves. These limitations are being reviewed to determine how additional power can be provided for these spaces, as a contingency.

3.2.2 Memphis Suburban Hospital: Methodist Healthcare System

The Methodist Hospital of Memphis was chartered in 1918; it became Methodist Health Systems in 1982 and Methodist Healthcare in 1998. The seven-hospital system includes the flagship Methodist University Hospital in downtown Memphis, as well as hospital centers in outer Memphis (Methodist North and South, respectively), Germantown, and Somerville. The University Hospital is the largest hospital in the system with 693 beds in a downtown complex. It has been affiliated, since 2002, with the University of Tennessee Health Science Center as the principal private teaching hospital. The healthcare system also manages Le Bonheur Children’s Medical Center and an extended care hospital, as well as home health agencies and outpatient clinics. Serving the entire Mid-South region, the Methodist healthcare system is one of the largest in the country and has leading specialty services in neuroscience, oncology, transplant, and pediatric care. The overall system has about 1,600 total beds with 10,000 employees and 2,000 physician partners (Methodist Healthcare, 2009).

Interdependencies

In a major regional emergency, the seven major hospitals in the Methodist Healthcare system can rely on each other for support. This is particularly important given the downtown location of two key hospitals—University Hospital and Le Bonheur Children’s, plus administration buildings—that would make them vulnerable to an earthquake. There is a local cooperative relationship between the downtown Methodist hospitals and the nearby Medical Center of Memphis (The MED) and the Veterans Hospital, but the mutual aid agreements have not been tested in any significant way (there is what is described as an informal “consortium” of hospitals, including the University of Tennessee medical center, that provides ongoing support to The MED). However, it is clear that for hospitals within the system and for hospitals in the region to be able to work together effectively during a regional emergency (e.g., pandemic flu), there is a need for sharing of patient medical records. The Shelby Regional Hospital Disaster Planning Council was established by the regional hospitals as a mechanism to conduct disaster planning and interact with the Memphis Shelby County Emergency Management Agency and other emergency preparedness organizations.

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8 Except where noted, this profile is based on an October 8, 2008, interview with Andrea Merriweather, Safety Director, Methodist Healthcare System.
Within the medical care community, Methodist interacts in a number of forums with other critical community players, including EMS, other hospital systems, private physicians, non-profits, and the business community. These integrative activities include the Memphis Delta Regional Medical Communications Center Council (addressing regional medical communications), Mid-South Emergency Medical Services Council, the aforementioned hospital disaster planning council, and participation on UASI and MMRS panels. Each of these groups has overlapping functions and representation, providing for an effective means of interacting within the medical care community. However, this level of integration is not as apparent between the hospital community and the public health and business communities, where more formal interfaces exist through the EMA and through work on public health response policies.

A key point of coordinating Methodist’s medical support during a health emergency would be through the EOC and the RHC. The RHC has proven to be an effective function that was originated during bioterrorism planning. It is seen as an “honest broker” that is familiar with and can influence the allocation of regional hospital resources. However, the effectiveness of the RHC function derives from the effectiveness of and trust in the individual assigned; otherwise, the various hospital representatives would be less open about resource issues with their peer competitors.

The Memphis Shelby County Health Department and the Health Officer for the Department would be interdependencies of the Methodist hospital system. The Health Officer is responsible for communicating and coordinating directly with the healthcare community and making recommendations that pertain to allocation of resources and actions during a health emergency. The HD develops many of the directives and guidelines that would be implemented and would provide resources to administer shelters, conduct mass vaccination, and direct a public health response.

One issue which has surfaced is between the HD, which is responsible for these roles, and the hospitals and EMS units responsible for carrying out healthcare functions is the operational experience of the public health personnel involved. According to some on the operational side of emergency medical response, this has its roots in the historical “preventative” role of public health and its disease surveillance role, with staffing that is designed to match this more traditional function. There is some apparent concern that there is not likely sufficient HD staffing on a 24/7 basis to support its designated operational emergency role. Recent experience with sheltering of Gustav evacuees indicates that these two organizational components of emergency response (medical and public health) are at somewhat of a divide on how to operationalize health care in an emergency.

A related organizational integration issue that is related to this issue is the extent to which the HD, specifically the CMO, is able to delegate implementation responsibilities among the various Memphis organizational components with health-related functions.

EMS ambulance units would be responsible for transporting victims to the emergency department for emergency care, making use of the HRTS to determine available capacity. The Methodist healthcare system would be reliant on the EMS and its tracking system to ensure that an unmanageable surge would not be experienced in the emergency department.
The downtown hospitals of the Methodist system would need support from the local and regional police to provide security if they became inundated with emergency patients or became threatened by civil unrest. In turn, The MED, in its Level 1 regional trauma care and burn center role, would likely be a key medical care base for first responders involved with disaster response and recovery (albeit, that role would be shared in a major emergency with nearby medical centers such as Methodist (North and South), Baptist, and UT.

Beyond these obvious interdependencies, the Methodist system prides itself on its self-sufficiency and has taken steps to reduce reliance on external support during an emergency. The sense is that if “we take care of Methodist, we will take care of the community.”

Key Dependencies

The following are key dependencies identified for the Methodist Healthcare system that are relevant to ensuring effective response and recovery to major emergencies and regional disasters.

Backup power. The Methodist healthcare hospitals have backup diesel generators as well as a portable air-conditioning system that can be used, if necessary. These generators have enough fuel to sustain operation for 2–3 days, with provision for resupply from an outside vendor (however, upon actual review, these long-standing arrangements turned out to be ad hoc, and not contractually binding—this issue is being revisited at present).

Water supplies. Water is a key dependency for hospitals in the mid and deep South because of the necessity of facility air-conditioning, which relies on water “chillers” for heat transfer, as well as routine supplies for sterilization needs, laboratory use, and sanitation. Most hospitals in the Methodist system would only have a 2-day backup supply of water for the latter and an inadequate supply for the chillers. If a disaster occurred in the summer months, the lack of air-conditioning could be mitigated somewhat by the use of fans and portable air-conditioners. (Regulations do not permit patients to remain in indoor environments above 78º F for extended periods of time; during Hurricane Elvis, the use of fans helped avoid a mandated patient evacuation.) It was noted that while some hospitals have better contingencies (e.g., St. Francis has an adjacent nature center with a pond from which water can be pumped for their chillers), this tends to be a limiting barrier for extended operation without power and resupply.

Adequate staffing. During a major disaster, and in particular, a pandemic flu outbreak, a critical dependency is ensuring an adequate workforce to man the critical care functions of the hospital. This involves not only the development of a surge plan to provide for additional staff during the emergency but also advance planning to mitigate against staff shortages that may arise due to increased personnel absenteeism. This would include cross-training of medical and nursing staff, identifying backup personnel options beyond the immediate onboard staff, and making provisions for family support to enable key personnel to report to work. The Methodist healthcare system has developed surge plans but has not yet addressed comprehensive cross-training or external contingency staffing.

Backup communications. Normal communications means such as telephones, faxes, the internet, and cell phones may be lost during and in the aftermath of a major disaster. Katrina demonstrated the difficulty the community and relief teams confronted in being able to
communicate with each other and the outside world. At Methodist, a key backup means of communication will be through volunteer ham radio operators, who will man preexisting radio units at the hospital (selected physicians and other staff members have also been trained in their use). In addition, Methodist staff has access to satellite phones and a government emergency telecommunications system (GETS) to enable priority communications that bypass the telephone system.

**Medical supplies.** The Methodist medical system, like other hospital systems, maintains pharmaceutical caches, with backup to be provided by the Strategic National Stockpile (SNS).

**Medical records.** Digitized medical records are important not only to facilitate patient treatment, particularly during an emergency, but also to enable more effective care of victims and evacuees when hospitals are disabled and residents may be scattered across the region and in other states. Katrina demonstrated the value of an interconnected records system that can be accessed using patient identification information. For the Methodist system, electronic medical records (EMRs) development is under way throughout the system with a projected completion date of 2010 (funded, in part, by a MMRS grant that served to purchase commercially available software). As a particular hospital in the system has its EMR system stood up, testing and training is required, with an approximate 3–6 month cycle time for each hospital. However, in the end, the hospital-specific EMRs will be maintained on a hospital-by-hospital basis and are designed to be accessed on system-wide (Methodist, in this case) basis; however, they are not now accessible outside of the system. Therefore, sharing of medical information in a regional emergency would not be possible without some effort to make the systems compatible and to overcome privacy and business proprietary information concerns. The potential value of applying the EMR capability in this way was underscored by the successful use of the new software for the first time during the Gustav evacuation as an individual patient tracking tool at the Memphis shelters.

**Physical infrastructure.** As with other inner city hospitals located in the New Madrid subsidence zone, the University hospital and Le Bonheur Children’s Hospital would suffer considerable damage from a moderate to severe earthquake. Other components of the Methodist healthcare network located in the region would be less affected by earthquake damage and would provide intra-system support for these two hospitals.

**Physical capacity.** Existing surge capacity plans are targeted at self-sufficiency for a 72 hour period following a regional emergency event.

### 3.2.3 Memphis Area Emergency Medical Services

The span of EMS services in Memphis/Shelby County comprises 34 advance life support companies. Each basic life support company equates to a typical fire department company of four personnel. Memphis/Shelby county has 33 ambulances (1 per company) plus one company stationed permanently at President’s Island for high hazard emergency response. Current capacity is based on projected demand over time, that is, call volume, and assumes 12 hour rotating shifts.

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9 Except where noted, this profile is based on an October 6, 2008, interview with Joseph Holley, Medical Director, Memphis Fire Department, and Joseph Rike, EMS Division Chief, Memphis Fire Department.
EMS relies upon an automated system to coordinate individual emergency department capacity to receive EMS patients. There is no contingency plan for ER backups during high-surge demand; that would need to be improvised during an emergency. In an extreme emergency, paramedics would make triage judgments as to who would be transported. Incident commanders would handle routine emergencies; if an EOC is stood up, the EOC would coordinate resources across the city and region for ESF 6 that EMS is part of. For mass evacuations, EMS would take direction and coordination from EOC.

**Interdependencies**

Probably the most fundamental interdependency for EMS is having operable hospitals with functional ERs staffed with sufficient doctors and nurses. Adequate medical response during a major emergency will be a function of how many seriously injured or ill patients can be provided timely care, which, in turn, will be function of emergency transport and medical intervention. However, even if EMS and other transport capabilities can keep pace, the surge capacities of hospital emergency departments may be exceeded. Unless ACSs are stood up promptly or airborne evacuation of victims can be relied upon, the effectiveness of EMS (turnaround availability of units) may become hampered as delivery of patients is delayed.

The EMS looks to the HD and the EMA to determine how what role EMS plays in a large emergency. There is some concern over whether the HD is sufficiently operational in its evolving organizational role in Memphis. One recent lesson from handling the Hurricane Gustav evacuees was that medical screening was not handled adequately by HD personnel—that there was too much initial reliance on 911 calls at the shelters for emergencies that did not turn out to be emergencies.

Key interdependency issues from EMS standpoint:

- Hospitals have little surge capacity; it is not likely that staffing will be adequate in event of regional emergency.
- ER physicians, in particular, are in short supply, a situation that would be exacerbated with escalating demand for emergency services.
- National Guard units (Citizen Emergency Response Units) have not integrated well in the past with local community response organizations.
- Mobile units, that is, Mobile Army Surgical Hospital (MASH) units, would be helpful and have been discussed by local hospitals, but nothing has ever materialized.

The bottomline is whether the component organizations supporting Memphis response and recovery have “operational experience” coupled with “tested systems” that have been shown to work under emergency circumstances. It is apparent from feedback from some members of the Memphis regional emergency response community that a number of such components (e.g., mass sheltering and medical transport) have not worked as expected during recent experience with Gustav evacuees and before that, Katrina (Holley, 2008; Merriweather, 2008; Lawler, 2008).
Key Dependencies

Availability of personnel. Adequate emergency medical technicians (EMTs) and other personnel required to man mobile units is likely the critical dependency for maintaining EMS during a major emergency. Normally, a complement of skilled personnel are assigned rotating shifts and are backed up by cross-trained fire department staff. However, during a disaster, there may be some disruption as it is understood that drivers and paramedics would take care of their families first and then report to work. While this disruption may decrease the number of units available in the immediate aftermath of an event, EMS would be expected to continue and strengthen as personnel reported to work. A pandemic flu outbreak, however, would likely have a longer lasting impact, albeit one that can be mitigated with timely vaccinations and antivirals.

Communications. It is acknowledged that communications with and between mobile units would be challenged if radio “repeaters” are taken out (communication gets increasingly difficult if infrastructure is lost). This disruption was experienced firsthand in the aftermath of wind damage experienced during “Hurricane Elvis.” While the Memphis police have satellite phones (through an UASI grant), the fire department and EMS do not. Without adequate backup radio communications, EMS units will have difficulty responding to calls and coordinating transport of victims to area hospitals.

Backup fuel. The EMS system has plenty of vehicle fuel (500–1000 gallon tanks at each EMS station), but would lack electricity for pumps if power was cut off, necessitating the use of hand pumps. Not all of the EMS stations have backup diesel generators or such hand pumps to enable refueling of mobile units in a protracted emergency.

3.2.4 Mid-South American Red Cross

The Mid-South chapter serves a four-county area in western Tennessee, Tunica County in northern Mississippi, and Crittenden County across the Mississippi River in Arkansas. During 2008, the Mid-South chapter assisted 3,555 individuals in that region who needed support for food, clothing, bedding, household items, medicine, and other necessities. The local chapter requested volunteers for Hurricane Gustav evacuee sheltering and got 350 individuals who were trained quickly and used in the shelters. Previously, the local chapter sheltered over 3,000 Katrina evacuees in the Memphis region, with eight shelters being run by ARC for the FEMA evacuees, with another 15 shelters being run or supported for the self-evacuees.

Interdependencies

A critical relationship during an emergency situation is between the ARC and the local medical community. The ARC always calls on the medical community for support and the police for security during a disaster. This is done through the EMA, which has the overall responsibility for the welfare and safety of the citizens. During Gustav, the number of evacuees in the city stretched the overall capacity of the city medical and security. The ARC is reinvigorating the VOAD—Volunteer Organizations Active in Disaster—to facilitate better integration of ARC

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10 Based on October 15, 2008, interviews with Robert Hoguet, Executive Director, and Terry Donald, Director of Emergency Services, American Red Cross, Mid-South Chapter.
activities with those of hospitals and other health care providers in the area. The VOAD will be jump started through Assisi Foundation–facilitated focus group sessions with the medical care and “safety net” organizations in the region.

Another important relationship is with the mental healthcare community. ARC has mental health nurses as part of shelter staffing, but their numbers are limited. They also have certified mental health counselors embedded in ARC chapters who can provide support during emergencies. They observed that during the “hot wash” after action meeting for the Gustav evacuation at the EOC, some of the medical personnel raised concerns regarding the local capacity to screen or handle a large number of mental health clients (e.g., during an evacuation).

One Katrina lesson learned that was acknowledged in the national ARC’s assessment following that disaster was that the ARC lacked adequate “cultural competence” in some cases (ARC, 2006). The national ARC has met with the NAACP to explore how its response could be improved. The local Mid-South chapter itself has reviewed its Disaster Assistance Teams (DATs) to promote diverse membership, including Hispanic, African-American, and other ethnic representation. It has also increased its shelter agreements with numerous minority churches. Overall, the ARC has taken a number of steps to improve collaborations with all cultures.

**Key Dependencies**

Probably the most limiting issue for the local ARC chapter is available resources. It sets its own budget based on anticipated demands and incoming charitable donations and cannot increase support in the event of a major disaster unless additional resources are provided by the national ARC office (which provides for such support in many cases, but not all, as a function of other national and regional demands). This was experienced firsthand when western Tennessee experienced a series of tornadoes last year and no additional funding was provided by the national office even though local chapter support was provided to those affected by the storm’s damage. Expectations for ARC support has grown, particularly for emergency sheltering, where that role in Memphis had been centralized under ARC management (it had been split with the CSA), but it is not clear whether resources will keep pace in the future. Initiatives have been taken by the local ARC chapter to boost contributions and train volunteers to man shelters and perform other functions to augment existing ARC personnel.

Another dependency is the availability of sufficient sheltering. The ARC chapter and the EMA have jointly identified suitable sheltering sites and have explored contingent sites.
4. COMMUNITY RESILIENCE VULNERABILITIES: HEALTH SECURITY

4.1 RESPONSE TO AND RECOVERY FROM MAJOR EARTHQUAKE PROBLEMATIC FOR MEMPHIS COMMUNITY

The resilience of a community is founded not only on the ability of its inhabitants to marshal native resources and capabilities to persevere and recover but also to take the necessary steps to gauge what major threats require advance planning and preparation. The salient lesson from Hurricane Katrina is that the confluence of circumstances—New Orleans being below sea level, the levees being built to withstand up to Level 3 hurricanes, and the clear probability of a strong hurricane breaching the walls—made a disaster of that magnitude a certainty at some point in time. While the probabilities are different, it is plausible to view a major earthquake centered in the New Madrid fault area as having similar implications.

In the winter of 1811–12, the central Mississippi Valley, including Memphis, experienced three of the most powerful earthquakes in U.S. history. Since then, the region has experienced more earthquakes than any other part of the country east of the Rocky Mountains (USGS, 2009a). The city of Memphis and the surrounding eastern Tennessee region lie within the New Madrid seismic zone, within which there is a 90% chance of a magnitude 6.0 earthquake (approaching the 1994 Northridge, California, earthquake) every 80–100 years and a magnitude 8.0 earthquake (equal to the original 1811 earthquake) every 500 years. Most of the modern city has been built on high-liquefaction loess soil, which has very low load-bearing capacity during an earthquake. With a few exceptions, most of the existing downtown buildings are not earthquake resistant.

4.1.1 Mitigating Actions Being Taken

Since 1967 the building codes in Memphis and Shelby County have been gradually modified to include earthquake-resistant measures for new construction, culminating in the first specific seismic-related provisions in 1992. However, no modifications (such as bracing) have been required for existing structures, except for some key transportation bridges and pipelines. This has obvious implications given that most of the building stock in the city is not reinforced to be earthquake resistant, including all but the most recent hospital construction (only the VA hospital has been rebuilt to the new code adopted by FEMA at a retrofit cost by the federal government of $100 million) (Charlier, 2003). Adoption of a new building code based on an upgraded seismic vulnerability rating for the area would necessitate the same retrofitting considerations that drove the rebuilding of the VA hospital. This would pose a significant financial impact that neither the city, region, or state would likely find palatable during this time of economic crisis, and for which questions have been raised regarding the risk-benefit justification given the lower frequency and risks of earthquakes as compared to the West Coast (Stein et al., 2004).

A number of community-based and regional-based organizations have been actively engaged on the issues and needs associated with emergency preparedness and response to earthquakes, including the Central United States Earthquake Consortium (CUSEC), the University of Memphis’ Center for Earthquake Research and Information (CERI), the West Tennessee Seismic Safety Commission, the Mid-South Association of Contingency Planners (MSACP), and the New Madrid Seismic Zone Catastrophic Disaster Planning Project (FEMA). It is clear that while...
a serious community dialogue has been ongoing, no clear path yet exists for what mitigative steps make sense in the Memphis region.

4.1.2 Implications for Community Health Security

Recovery from an earthquake will be highly dependent on its severity in the immediate MUA. Small or moderate earthquakes may involve damage but not on a community-wide level, and not to a degree where the existing healthcare infrastructure is seriously impaired as with a major earthquake (e.g., comparable to the Loma Prieta earthquake in the San Francisco area in 1989, at a magnitude 6.9).

A number of urban healthcare facilities are particularly vulnerable to earthquake damage due to their construction, location, and vulnerable utility lifelines. The Regional Medical Center in Memphis (The MED) is not likely to survive intact in a major earthquake, potentially depriving the region of its Level 1 trauma and burn center, and centralized medical communications center, MEDCOM (Chunn, 2008). Other key emergency and medical facilities, such as the Emergency Management Agency’s EOC, the Methodist LeBonheur hospital, and some downtown clinics would have varying degrees of damage and impairment of services. All utilities, such as electricity, water, and sanitation would be interrupted in a major earthquake.

Debris from building collapse, highway bridge failures (including those on the Mississippi), and fires from ruptured gas lines would contribute to the impassability of many transportation routes, making both evacuation of the urban population (and downtown hospital patients and other special needs populations), and emergency ingress by urban search and rescue teams and EMS personnel, difficult and prolonged. It would also be a significant barrier for healthcare personnel to report to their respective hospitals to bolster emergency care. The community would be largely on its own for an extended period until outside help was forthcoming from the adjoining states and federal government.

4.1.3 Enhancing Community Resiliency

The Memphis community has accelerated its focus on addressing the catastrophic potential of a major earthquake, particularly in the wake of the Katrina disaster in New Orleans, which has been equated as being similar to this threat (low-probability, high-consequence natural disaster). With a number of federal, regional, and community groups studying the risk of such an event and advancing means of preparedness, the state formed the West Tennessee Seismic Safety Commission in 2006 to review this and other work, and formulate recommendations for what actions need to be taken to decrease vulnerabilities and increase preparedness. The commission consists of a 12-member board appointed by the governor and legislature, who represent relevant professional areas such as architecture, fire protection, public utilities, engineering, geology or seismology, local government, insurance, business, emergency health services, nonprofit emergency assistance, local education, and emergency management (CERI, 2009). To date, the commission has discussed planning and needed actions and is developing recommendations.
4.2 ENHANCED RESILIENCE BY EXPERIENCED KEY HEALTHCARE PLAYERS AND LONG-STANDING RELATIONSHIPS AND THE CHALLENGESPOSED BY A LACK OF EXPERIENCED BACKUPS

The resilience of the Memphis community is enhanced by the expertise and experience of many of its key emergency preparedness and response principals, and the close relationships and trust that have been built up between them over the years. These include the various safety directors at the major hospital centers, the respective emergency response coordinators (ERCs) and regional hospital coordinators at the HD, the lead EMS representatives, and heads of Memphis’ major community service organizations, such as the ARC, Salvation Army, and Community Services Agency. This network of senior personnel form the core of healthcare management during a major emergency, evident by the fact that many of them sit on the same community health-related committees, boards, and groups dealing with health-related emergencies. These cross-organizational relationships would become the essential bond that would enable trust, cooperation, and coherent action during a community-wide disaster where routine organizational functions would not exist.

However, from discussions with all of these principals, it is clear that most do not have backups who now have, or in the future would likely have, a similar level of visibility, expertise, and experience to fulfill the same role for their respective organizations. Having a so-called “backbench” or succession plan in place is common in private business (where business continuity is critical to success) but is less likely to exist in governmental, healthcare, or community organizations where specialists with the right leadership and professional skills mix are relatively rare and tenures are long. The danger is that key players may leave or be away from the area at the time of an emergency, which may hamper emergency management and response. This situation was actually experienced in Memphis during the Katrina disaster when key EMA officials were out of town on business (Lawler, 2008).

4.2.1 Mitigating Steps Being Taken

No mitigating steps have been taken to date. Resources are growing tighter, and one-of-a-kind positions in emergency preparedness will likely continue to be the case. The EMA organization has suffered some personnel losses in the past 2 years and has yet to backfill those gaps. A number of health department positions are supported by federal grants and would be at risk if those grants were reduced or eliminated in the future. At least one of the hospital safety director positions is being considered for elimination due to budget shortages. Cross-training between positions is performed on a limited basis but not to the degree it would mitigate this concern to a notable extent.

4.2.2 Implications for Community Health Security

If the strength of community resiliency for healthcare is the strong and effective relationships of its principal players, that “layer” of expertise is about one deep for most key organizations. This has been acknowledged by a number of these principals, but a ready solution is not apparent. With additional personnel resources not available (and actually being reduced for some), there is a risk that the effectiveness of their organization will be weakened as this core group retires or leaves (or, as noted, is merely away when a disaster strikes). There are parallels with the issue
surrounding limited hospital surge capacity for medical personnel; “just-in-time” budgeting leaves little room for contingencies and backup.

4.2.3 Enhancing Community Resiliency

Giving more consideration to cross-training is one avenue of mitigation. However, the community (perhaps the EMA) needs to identify each principal critical to overall emergency response and recovery and advocate both mentoring of substitutes or backups from their respective organizations. As the central emergency management agency for the Memphis region, the EMA needs to maintain staffing expertise and continuity of operations to provide for a coordinated and coherent response to an emergency.

4.3 RESERVE MEDICAL STAFFING (PHYSICIANS AND NURSES) REMAINS A CHALLENGE ACROSS THE BOARD IN MEMPHIS

Resilience during a major emergency, such as a pandemic influenza outbreak or a natural event with thousands of medical emergencies, necessitates some means of complementing existing medical personnel in hospitals, neighborhood clinics, ACSs, EMS, and shelters. It is also critical to community recovery in the aftermath of such events, when, as the experience of Hurricane Katrina illustrated in New Orleans, existing medical establishments can be hollowed out by the incapacity or departure or evacuation of core staff during a disaster. While private physicians may volunteer their services, the lack of recognized credentialing and training for local Memphis physicians and nurses often hampers their utilization (Merriweather, 2008).

4.3.1 Mitigating Steps Being Taken

Some Memphis institutions have contingency planning for continuing essential services. For the HD, this includes cross-training, “mobilization,” or reassignment of staff from non-essential services, and use of professional and lay volunteers from sources such as the MRC (MSCHD, 2007a). For EMS, contingency plans exist that would move cross-trained fire department personnel into EMS crews if the latter were shorthanded, and put in place medical triage criteria for patient pickup (Holley, 2008).

For the various hospital systems, however, contingency planning for augmenting personnel is not clearly defined. For one major hospital system, no cross-training is done, although a “crib sheet” is being developed to outline the key functions of various hospital jobs (Merriweather, 2008). In another major medical center, very little surge capacity exists and reliance would be placed on outside volunteers, possibly the local Medical Society or the University of Tennessee Medical School; however, none of this has been pre-arranged (Chunn, 2008).

Training and credentialing of private physicians was a key lesson learned from the Katrina experience in New Orleans. During that emergency, numerous private physicians came forward to volunteer their services but were often unable to function in a medical role due to a lack of transferable credentials and liability concerns. The need for an institutional means of credentialing medical personnel (including nurses) was reflected in the Pandemic and All-Hazards Preparedness Act, which mandated a national system for credentialing and badging medical and nonmedical volunteers. Such a system, the Emergency System for Advance Registration of Volunteer Health Professionals (ESAR-VHP), was established by the Department
of Health and Human Services (HHS) in 2004 for the credentialing and deployment of medical professionals in the event of a large-scale emergency and rolled out in 10-state increments on an annual basis (Handrigan, 2009). The state of Tennessee has reviewed the ESAR-VHP program template and has moved to develop a corresponding state credentialing program based on existing MRC volunteer rosters (this has not been enacted in the Memphis area to date) (Foust, 2009).

The ARC chapter approached the various hospital systems in Memphis through the facilitation of the Assisi Foundation to explore how the latter can better support emergency response by the Red Cross for evacuation shelters and other relief activities requiring medical support. This was, in part, a response to the lack of adequate medical resources experienced during the Hurricane Gustav evacuations to Memphis.

### 4.3.2 Implications for Community Health Security

The Memphis medical establishment is vulnerable to shortages of critical medical and nursing personnel at times of significant need during major emergencies. All of the hospital systems operate under thin margins of medical staffing and apparently have few pre-established avenues of contingent staffing in the various clinical specialties. From discussions with various representatives of major, multi-hospital systems, it is clear that the expectation is that if one hospital suffered such personnel shortages, the others in that system would provide whatever support is necessary. However, for a major regional emergency (e.g., pandemic influenza or major earthquake), such internal sharing of resources would be a problem because the entire medical establishment would be likely decimated for a prolonged period of time. Similarly, one of the key concerns for the functionality of EMS during a protracted medical emergency would be the lack of emergency room capacity (i.e., ED medical personnel) to handle an abrupt patient surge (Holley, 2008).

This is not an issue exclusive to Memphis, as noted in an Institute of Medicine report in 2006 regarding the future of emergency care (Institute of Medicine, 2006).

> In many cities, the hospitals and trauma centers have problems dealing with a multiple car highway crash, much less a major mass casualty event. With many hospitals operating at or near capacity, most hospitals do not have the capacity to handle the volume of patients likely to result from a large-scale disaster. In emergencies, there are a number of things that hospitals can do to free up capacity and extend their resources. But there are serious physical limits to such expansions.

Another example of this vulnerability can be found with ACSs. ACSs are planned to provide alternatives to hospitals and clinics that may have been destroyed or overcrowded due to a major disaster or medical emergency. In Memphis, these have been pre-planned in terms of location, equipment, and procedures for use. However, it has been reported that from what sources the requisite physicians, nurses, and other support personnel will come is not clearly defined, given that existing community reserves—for example, the MRC—do not possess medical personnel in appreciable numbers (Holley, 2008).
4.3.3 **Enhancing Community Resiliency**

With slim staffing margins, the resilience of existing medical establishments will not only need to come from available “force-multipliers” such as cross-training and reassignments but also from concerted use of the vast reservoir of volunteer private medical professionals in the Memphis region. Although actively advocated by the Memphis Medical Society (Cates, 2008) and despite regional hospital systems being receptive, lack of credentialing has hampered planning and implementation. With state-wide credentialing, further steps to provide emergency response training (e.g., via the MRC) and address liability concerns would enable inclusion of private physicians and nurses on a meaningful basis. Apart from credentialing, steps can be taken by the community now to identify a roster of available medical professionals and their applicable experience as a first step to begin compiling reference rosters.

4.4 **HEALTH SECURITY AND ORGANIZATIONAL RESILIENCE IS HAMPERED BY PROGRAM STOVEPIPES BETWEEN VARIOUS KEY EMERGENCY RESPONSE AND RECOVERY PROGRAMS**

While relationships among the Memphis healthcare community are strong and long-standing, some organizational “fault lines” exist that have served to limit fuller integration of emergency preparedness and response capability. Examples that were cited in various interviews with key healthcare managers included the following.

- Concerns were expressed regarding the relationship between the health department and medical community (hospitals and EMS) during an emergency. The former has the traditional (and legal) CMO authority to make decisions and define community health policy, while the latter sees itself having the requisite day-to-day operational expertise and experience to best manage medical emergencies. This issue arose in the health management of Gustav evacuees in 2008 when EMS medical staff supplanted those of the assigned health department personnel, given their operational experience.

- Concerns were expressed regarding the inability of the HD to employ existing CERT capability (administered by the EMA) to train the local community in public health preparedness and response. Apparently, the EMA views such training as being out of scope.

- Concerns are being addressed by the ARC chapter regarding their relationship with local hospital systems during emergencies—an issue that is being pursued through Assisi Foundation–facilitated working sessions. In the past, major hospitals have not been effectively integrated to support the ARC and other relief organizations during major emergency response and recovery.

4.4.1 **Mitigating Steps Being Taken**

While issues exist, a number of effective means of organizational coordination have been established by the Memphis healthcare community.

In terms of hospital response, the RHC function has proven to be an effective link with the hospital safety directors and EMS departments in the area, although efforts are still under way to ensure the RHC is part of key planning meetings (Zerwith, 2008). The safety directors have confirmed the utility of this role, although it is apparent that its effectiveness is as much a
function of the expertise and interpersonal skills of the individual filling the role (which have been strong in the past).

The Mid-South Emergency Medical Services Council meets regularly to enable the EMS community to discuss policy issues and service delivery experience, and to coordinate regional practices. The EMS Council draws membership from area EMS departments, hospital safety directors, area fire departments, and the Memphis Medical Society.

The Memphis Delta Regional Medical Communications Center Council provides a forum for hospital and EMS personnel to discuss policy issues and operating experience involving emergency medical communications in the region, particularly those handled by the MEDCOM communications center located at the Regional Medical Center of Memphis (The MED).

The Memphis Shelby County Local Emergency Planning Committee (LEPC) consists of elected officials, law enforcement, emergency management, fire departments, transportation, hospitals, the health department, community representatives, industry, and members of the media. Its formation was mandated by the EPCRA, and it is responsible for community emergency planning and what should be done in the event of a hazardous incident, such as a chemical spill. In addition to monthly meetings in the community, the LEPC receives regular chemical inventory and spill reports and provides these to the MSCEMA.

Other community-based integration activities active in emergency preparedness and response include those of the MSACP and Memphis First. The Emergency Management Agency, in its meetings, drills, and exercises, provides a continuing means of bringing together the healthcare elements of Memphis and Shelby County, and breaking down potential stovepipes during emergencies.

### 4.4.2 Implications for Community Health Security

While effective integration of community healthcare institutions, capabilities, and functions during a major emergency is the ideal, every city or region and its institutions have their unique interrelationships and histories. Memphis and Shelby County have a long history of the community pulling together to respond to health-related emergencies ranging from the yellow fever epidemics of the 1800s to the medical needs of hurricane evacuees from the Gulf Coast. As government and private healthcare institutions have evolved, circumstances and interrelationships have evolved as well, in ways that influence emergency management.

The issue raised in Memphis regarding the role of the HD in emergency medicine is instructive. Whereas the HD was once on the frontlines responding to frequent epidemics and constant public health challenges, these demands have receded significantly since the 1950s with the advent of modern disease control and improved sanitation. Nationwide, public health turned to social-based public health concerns such as obesity, tobacco use, and AIDS. Coupled with reduced staffing resources during that time frame, local health departments had fewer personnel involved firsthand with managing health emergencies. In contrast, EMS units have daily involvement in triaging, transporting, and managing emergency medical care. The organizational tension apparently stems from a viewpoint by some principals in the Memphis healthcare community that while the traditional historic authority for managing the medical and public
health aspects of a major emergency resides in the HD, the true operational experience resides within the hospitals and EMS. This dichotomy manifested itself most recently with the sheltering of the Gustav evacuees, and led to confused or contradictory decision making in some cases (Holley, 2008; Merriweather, 2008). More importantly, it is a source of tension between the HD and other components of the healthcare community that stands as one of the few organizational impediments to achieving coherent health security during emergency conditions.

Another organizational interface in Memphis that bears attention is between the public health and healthcare sectors and the emergency management sector. As noted, the HD wanted an avenue to orient the broader community to public health preparedness (e.g., pandemic influenza preparedness) and approached MSCEMA with an offer to provide HD trainers for this purpose. However, while MSCEMA has fielded a number of CERT teams whose members are trained on basic first aid, fire safety, light search and rescue, and disaster medical operations, they apparently did not believe their mandate and program scope from FEMA permitted the scope of CERT training to be expanded this way (Moore, 2008). Discussions with FEMA headquarters program personnel for CERT indicated that there are no restrictions of this kind and that this is a local interpretation. The implication for health security is that with increasing resource limitations, there will be little choice but to make use of the efficiencies available from using existing community programs and assets to further health security, homeland security, and overall community resilience.

The contribution of the major private hospitals systems to regional health security in the Memphis region is critical given the considerable healthcare capabilities and capacities that they possess. However, while working effectively within prescribed emergency coordination procedures (e.g., the EOC, regional hospital coordination), their collective contributions to community emergency relief activities, such as the recent Gustav evacuations, have been less supported. Both they and the ARC chapter have recognized the need to change this and have enlisted the Assisi Foundation to facilitate discussions regarding a more collaborative approach to engaging hospital resources (Hoguet and Donald, 2008).

4.4.3 Enhancing Community Resilience

Community resilience is enhanced by a cooperative and integrated approach to managing major emergencies. Strong interrelationships and trust between and within local government, hospital systems, EMS, and community and business organizations will carry over to response and recovery for a community emergency. Attention has been paid to these organizational issues in the AAR for the Hurricane Gustav evacuation of some 3,000 New Orleans area residents to Memphis. Likewise, various healthcare agencies and groups have been meeting to resolve how they should and will cooperate in preparedness, response, and recovery operations. One advantage for the Memphis community is the availability of and the willingness of the Assisi Foundation to facilitate this process. In some cases, federal and state government sponsors, such as FEMA, can help to promote community collaboration with guidance that opens up such programs as CERT, MMRS, and MRC to broader applications.
4.5 HEALTHCARE MANAGEMENT FOR SPECIAL NEEDS POPULATIONS
REPRESENTS A VULNERABILITY DURING A MAJOR EMERGENCY IN MEMPHIS

Special needs populations can be defined as individuals in the community who have unique needs that make it difficult for them to take protective actions on their own and who may require special or individual interventions during a major disruption such as a natural or man-made disaster. Managing the care and, if necessary, the evacuation of, special needs populations during a protracted major emergency such as Hurricane Katrina requires attention by emergency management and healthcare authorities. During Katrina, as in other major disasters, vulnerable populations, for example, the elderly, children, the disabled, homeless, the homebound, non-English speakers, low income, medically disabled, mentally ill, oxygen dependent, and electricity dependent, are often disproportionately impacted by the effects of the emergency (UC Berkeley, 2006). In Katrina, many medically disabled individuals went without kidney dialysis, oxygen, and medications until rescue teams reached them. Others were in distress at the Superdome emergency shelter, and in hospitals and nursing homes that were isolated by the flooding. The number of deaths was disproportionately higher in this population group in the aftermath of Katrina.

From a health security standpoint, it is important to know who makes up this population, what their emergency healthcare needs would be, and where they are located in order to properly plan relief and recovery. In the event of an emergency that disrupts sheltering and lifelines, such as food, water, medicine, and essential utilities, it may be necessary to deliver supplies and arrange evacuation. Many in this group may not be able to self-evacuate due to lack of personal transportation. Others may not be able to follow government instructions due to language barriers. Still others may not be physically or mentally able to leave their homes. In the absence of medications, treatments, and basic utilities, their medical conditions will deteriorate over the initial days of the emergency unless relief is provided.

From discussions with the MSCHD (Moore, 2008), the special needs population of Memphis and the surrounding county has not yet been characterized. This was acknowledged as a significant, resource-intensive undertaking. Currently, the EMS units track those special needs individuals in their districts for planning and response purposes; however, that data is not shared across the various districts to provide a city or county-wide census. It also would not include the full scope of what would be considered “special needs” individuals in the event of a major emergency (as listed above).

4.5.1 Mitigating Steps Being Taken

EMS units maintain computerized listings of medically disabled individuals residing in their respective districts for use during calls.

4.5.2 Implications for Community Heath Security

This is a key Katrina lesson learned. First, the definition and scope of the special needs population was not agreed on before the hurricane struck and there was considerable confusion over what “special needs,” in fact, needed to be addressed by emergency management and public health authorities in New Orleans. Stovepipes in applying the National Response Plan (by
exclusive ESF category) were experienced at the time; for example, dialysis stations were established outside of the flood area, but those in need of it did not have the means of transportation to receive it (UC Berkeley, 2006). Likewise, the homeless, deaf, and blind populations were not seen as “special needs” because they did not require special medical attention. Similarly, unforeseen circumstances arose when hospital emergency generators failed and incapacitated patients on electrical medical equipment had to be evacuated to hospitals having the beds, equipment, and power to receive them. Nursing homes and hospices were often off the “radar screen” for special attention and evacuation, which led to tragic consequences in a few cases.

It is clear that the role that local government can play is to not only support local special needs shelters (or ACSs) but also to equip these shelters with the equipment and medications to provide for the needs of the those being evacuated to them. Or, if sheltering in place is mandated, to provide medical supplies and services to those at need in their residences or in local clinics for which transportation is available. If the HD does not know the number of diabetics or number requiring dialysis in the community, and where they reside, it will be more difficult to ensure them the proper level of support during a major emergency.

4.5.3 Enhancing Community Resilience

Community resilience is enhanced when the community embraces all of its inhabitants, particularly those most vulnerable during an emergency and recovery. The Public Health Preparedness Act of 2007 mandates attention to special needs populations as part of an overall strategy of emergency preparedness and response. While various databases maintained by EMS and hospitals identify segments of these populations, there is no master database for the region that addresses the most significant categories of concern (e.g., dialysis patients, diabetics, medical equipment dependent, etc.). These can be a starting point for developing a census that can be used for planning purposes and one that also can inform policies on how best to manage their support and evacuation during major emergencies. This will also mitigate against the unexpected arrival at public shelters and in hospital emergency rooms of those in need of urgent medical or mental healthcare. Another option would be emulate initiatives taken in other communities confronted with this issue; one such initiative, CARD—Collaborating Agencies Responding to Disasters—was developed in Alameda County, California, following the Loma Prieta earthquake, to train and integrate key service providers in the community to act as a “safety net” for the special needs population that had limited means to address their own needs following the disaster (Schoch-Spana, 2007).
5. PANDEMIC INFLUENZA AND COMMUNITY RESILIENCE

Pandemic influenza (flu) is a virulent human flu, often involving a new, dramatically different strain of virus for which the majority of people do not have immunity. A pandemic influenza has the potential to spread rapidly from person to person and can cause high levels of morbidity and mortality. The increasing presence of novel infectious disease (variously attributed to the use of “factory” animal husbandry for swine, chickens, and other foodstock animals, as well as the encroachment of humans on once remote ecologies), coupled with the global movement of people and their infections, makes for the likelihood of more frequent pandemic disease outbreaks.

On June 11, 2009, the World Health Organization (WHO) officially announced that “the world is now at the start of the 2009 influenza pandemic” (WHO, 2009). The first Level 6 declaration in 41 years, WHO confirmed that the novel H1N1 influenza had now caused 30,000 confirmed cases in 74 countries. One characteristic of an emerging pandemic flu virus is how it tends to crowd out the existing seasonal varieties of flu viruses. As shown in Fig. 5.1, this is already occurring in the United States as of May 2009 (CDC, 2009).

An especially severe pandemic, in addition to causing serious illness and deaths throughout the population, can lead to significant social disruption and economic loss. The CDC estimates that an influenza pandemic could infect 30% of the overall U.S. population, which translates to about 300,000 residents of Memphis and Shelby County who could become ill. The HD estimates that this likely would cause a 25% increase in hospital admissions and a 40% absentee rate in schools and throughout the regional workforce (MSCHD, 2007b).
Unlike other potential major emergencies, a severe regional or pandemic flu is a public health emergency that would decimate the “human” resource infrastructure, rather than the physical infrastructure, and cripple all community organizational capacities and capabilities, including the healthcare system that would be relied upon for emergency support. This is a particularly challenging scenario because the backup personnel and organizational redundancy that contributes to community resiliency would be, itself, impaired significantly. Pandemic disease has been found to pass through a community in “waves,” with a second or third wave more serious than the initial one (a pattern first seen in the 1918 flu outbreak). The community would largely be “on its own” for several weeks to months in such an event given the national and global reach of the outbreak.

Individuals within the community would clearly become the key to the community’s social and civic sustainability during the crisis. For the good of all, individuals would need to adhere to public health directives regarding “social isolation” and quarantine; all would need to manage their own self-sufficiency with respect to food, medicine, and other critical supplies during the health emergency. From a resiliency standpoint, the community risk being managed here is not so much the physical assets of the community but rather the collective human perceptions, feelings, and behavior of its members. To enable effective response and recovery, community members must learn to cope with the inherent fear, uncertainty, and surprise associated with such infectious disease outbreaks, whatever their origin, and make decisions with the larger community in mind (Pommerening, 2007).

The goal of limiting the impact of a pandemic by reducing opportunities for transmission of the virus must begin within the community. As illustrated by recent events with H1N1 influenza, there is a likelihood of confusion, anxiety, and panic on the part of the public as the infection spreads, and reports of illness and death become prevalent. Advance preparation coupled with active communication can engage the community as an active participant in its own defense, as opposed to being more passive victims awaiting relief that will be slow, if ever, in coming. Beyond pre-planning to reduce and mitigate the loss of individuals in key infrastructure sectors (e.g., healthcare, emergency responders, schools, government, food and medical supplies, etc.), attention needs to be focused on how best to influence the behavior and perseverance of the public during the emergency. This will entail leaders within the community focusing on factors such as advance education of the public, timely public information during the emergency, and necessary trust and equity behind unprecedented civic actions such as quarantine and social distancing.

The initial outbreak of H1N1 influenza (“swine flu”) in the spring of 2009 has once again put the potential significance of this threat into high profile. In Memphis and Shelby County, the first case of H1N1 flu was locally confirmed for a young individual on April 30, 2009 (MSCHD, 2009a), the second such case identified in the state of Tennessee. (By mid-May, 54 cases had been confirmed in Tennessee and two more in Memphis and Shelby County, a much milder outbreak than once feared.) Consistent with its Pandemic Influenza Response Plan, the MSCHD provided antiviral medication to the patient’s family and close contacts and closed the patient’s school for at least 7 days (school closings in Memphis, based on CDC’s initial guidelines, ceased.
on May 5th following revised CDC guidelines). The HD also expanded its testing and increased surveillance in order to better detect new flu cases in the county.

5.1 COMMUNITY RESPONSE STRATEGIES/MEMPHIS ACTIONS

A review by Reissman et. al. (2006) categorized the findings of several WHO expert panels with respect to three strategic approaches that are important to responding and recovering from to a pandemic disease outbreak:

1. Measures to shape the public’s behaviors so they are as adaptive and risk reducing as possible
2. Measures to reduce social and emotional deterioration and improve functioning
3. Measures to support key personnel in critical infrastructure functions

With respect to individual or community level factors that will influence behavioral responses, Reissman et. al. listed the following factors in Table 5.1 as being most relevant.

Table 5.1. Community factors influencing behavioral responses for pandemic influenza

<table>
<thead>
<tr>
<th>Preexisting knowledge</th>
<th>Knowledge about:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• What differentiates seasonal and pandemic strains</td>
</tr>
<tr>
<td></td>
<td>• What constitutes an effective public health response and what each person can do</td>
</tr>
<tr>
<td></td>
<td>to prepare (physically and emotionally) and protect loved ones</td>
</tr>
<tr>
<td></td>
<td>• Where to receive accurate health information and guidance as the pandemic evolves</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Information availability and accessibility</th>
<th>Existence of appropriate public information exchange about the emerging situation and the following:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>• Ensuring that all critical information is available in an understandable language (or translated)</td>
</tr>
<tr>
<td></td>
<td>• Ensuring that all critical information is available in forms that are accessible by all community members</td>
</tr>
<tr>
<td></td>
<td>• Whether outside help is needed (e.g., likelihood of becoming seriously ill)</td>
</tr>
<tr>
<td></td>
<td>• How to access appropriate assistance and information</td>
</tr>
<tr>
<td></td>
<td>• What personal protective actions to take</td>
</tr>
<tr>
<td></td>
<td>• What is being done to stop the spread of the disease</td>
</tr>
<tr>
<td></td>
<td>• Measures that will ensure adequate and equitable resource distribution</td>
</tr>
</tbody>
</table>

| Perceptions of equity | Whether individuals anticipate and assess the impact of public health measures may have a differential impact on individuals or groups (e.g., restricted movement is a shift in civil liberties and may exacerbate underlying socioeconomic or cultural conflict). |

| Perceived trust and faith in institutions | Establishing a track record with one’s constituency that builds trust and faith in their social institutions and reinforces beliefs about leaders being appropriately prepared and willing to help. |

| Perceived and/or actual economic impact | Providing avenues for assistance as the pandemic spreads to mitigate against uneven economic impact, as well as the impact of public health response measures (e.g., the extent to which disease containment measures call for the closing of schools or businesses, thus depriving individuals of income). |
With respect to the first WHO strategic goal, Memphis and Shelby County determined that “risk communications and public outreach activities will be conducted in order to build trust, confidence and cooperation among Shelby County residents. . .” with the goal being “to prevent fear-driven and potentially damaging public responses to a pandemic influenza crisis” (MSCHD, 2007b). While the MSCHD Pandemic Influenza Response Plan outlines specific communication strategies for various audiences (e.g., community, government, media, physicians, etc.), the HD’s approach to communications during the recent H1N1 outbreak is particularly instructive.

The MSCHD adopted a communication plan that included advance briefing material, including “pandemic flu planning checklists” for different sectors of the Memphis/Shelby County community (homes, businesses, schools, faith-based organizations, medical offices, and media); active dialogue with state and federal public health authorities; a swine flu telephone information line; and frequent public information releases. In public press releases to the media, Shelby County Major A. C. Wharton and MSCHD Director Yvonne Madlock were the principal spokespersons for information regarding flu cases in the region and the status of school closings. These releases included a statement from the MSCHD that provided information regarding what the HD was doing to address the outbreak, how initial patients were being treated, symptoms of the flu, tips for preventing and managing the flu, and reassurance that the outbreak was being managed effectively and a caution not to panic.

In terms of mitigative steps, the HD reached out to suburban physicians to provide added local surveillance of confirmed or suspect flu cases (the existing volunteer physician surveillance network consisted of only physicians in Memphis—a new lesson regarding the need for region-wide planning). It worked with school administrators to close schools that had suspected cases of H1N1 influenza. It also worked with school and airport authorities to develop a response to cases involving flu-like symptoms for school personnel and airline passengers. At the time (April 28, 2009), recommendations for dealing with sick airline passengers were still being developed by the HD (MSCHD, 2009b). It also had a cache of antiviral medications to be administered to patients. While several suspected and confirmed H1N1 cases were identified, the relatively small numbers proved to be manageable, and none led to serious illness or death.

The second strategic approach recommended by WHO for responding and recovering from a pandemic disease outbreak is to take measures to reduce social and emotional deterioration and improve community functioning. These include providing information to facilitate emotional and social recovery, with special attention to building community resilience. The latter would include tips for increasing social support, maintaining optimism, setting manageable goals, achieving emotional and social balance, and providing proven coping mechanisms (Reissman et al., 2006). Existing community relationships, for example, through churches, faith-based organizations, community service organizations, and volunteer organizations, need to be part of planning and preparations for a major pandemic disease outbreak such that they can be employed to provide social and emotional support for their members and the community at large. Memphis and its suburban community have an existing network of such supportive networks that will be a strong foundation for such support, if needed. However, the extent of their inclusion in actual preparations for a pandemic outbreak was not apparent from interviews conducted with a cross-section of Memphis community organizations.
The third WHO strategic approach is to support key personnel in critical infrastructure functions. The goal is to plan for and provide the necessary and enabling policies, skills, resources, and capabilities to sustain critical community functions for the duration of the public health emergency. This translates into advance preparations—policies, training, exercises, and information—that can prepare the community for a pandemic disease outbreak and a systematic examination of critical community functions that will be impacted and how these functions can be sustained during the emergency. For healthcare providers, an added dimension to resiliency is the need to cope, themselves, with the stresses of a prolonged emergency that would not only involve staff shortages but long hours and death and disease among their own ranks, their families, and their neighbors.

In Memphis, actions commenced in mid-2006 with a planning process for pandemic flu response that involved a series of community stakeholder meetings that included community leaders, emergency responders, educators, business people, and those who provide services to vulnerable populations. The resulting plan is responsive to the HHS 2007 grant guidance for pandemic influenza that included specific requirements for state and local health departments. However, in testimony provided by Yvonne Madlock, Director of MSCHD, it was noted that the 2007 DHS guidance (in contrast to the HHS guidance) for state and local emergency management offices did not address pandemic flu preparedness (Madlock, 2007). This disparity in federal guidance was a concern for local agencies who were aiming for more integrated and coherent community emergency response strategies. This same concern (rooted in the lack of information on non-medical emergency management aspects of pandemic preparedness that should be forthcoming from DHS) was also raised in other cities, such as Seattle, where the 2007 BlueCascades IV exercise found it a source of uncertainty and confusion for that community’s regional leadership (Pacific Northwest Center, 2007).

Tabletop exercises for pandemic influenza have been conducted for the Memphis region representing the full range of community entities including elected officials, public safety responders, hospitals, the airport authority, schools and colleges, media, community service organizations, and business representatives. Given the lack of federal guidance for local emergency management organizations, it was particularly valuable to test how various sectors would coordinate their roles and actions through the Emergency Management Agency. It was also an opportunity for the HD to reemphasize how it would operate under the “shared command and management framework” provided by the National Response Framework.

With respect to critical community functions important to resiliency and potential impacts from personnel shortages, a number of notable dependencies and interdependencies need to be addressed to sustain these functions during a prolonged pandemic outbreak, as follows.

5.1.1 Logistics and Supply Chains (e.g., Food, Medicine, Transportation, Fuel)

In a prolonged infrastructure disruption due to a severe pandemic influenza, maintaining minimal supplies of food, medicines, fuel, and other essential products and materials will be a critical challenge. Populations of urban areas such as Memphis depend on a continuous supply of these services and goods, with typical inventories of only a few days existing at any given time (which may be gone in minutes or hours if panic-buying ensues). The integrity of critical infrastructure such as power, water, waste treatment, and transportation can be affected precipitously if severe
personnel shortages are experienced for those utilities. Disruptions in the pharmaceutical supply chain will likewise have an impact on vulnerable populations dependent on routine medications such as for blood pressure, diabetes, and other chronic ailments. While the MSCHD provides for continuity of operations planning for its own department, it is clear from interviews with a broad range of community healthcare representatives that lack of surge capacity, backup personnel, and cross-training will hamper many of their organizations in the event of a severe pandemic disruption.

Some inconsistencies are also apparent. While emergency responders have dedicated fuel supplies, similar fuel caches for transportation of key supplies such as food and medicine are not as clearly planned. It is apparent that planning for the low-probability, high-consequence aspect of a pandemic outbreak (i.e., a prolonged and severe outbreak with successive waves of victims similar to that in 1918 and feared in the Avian influenza outbreaks) is not as developed and addressed as the more moderate and typical cyclical pandemic outbreak (e.g., 1959, 1968, 1976, etc.). The former can be considered closer to an existential threat outside of the experience of the community, while the latter is clearly within the experience of today’s public health community. Existing community planning may not be sufficient to sustain all critical community sectors necessary for self-sufficient response and recovery unless contingencies are realistically examined and addressed for what is essentially a “just-in-time” economy and healthcare system. A community-wide pandemic preparedness effort that transcends public health or medical management is not in evidence in Memphis; most planning for continuity of personnel and services has been accomplished within organizations as opposed to a community-wide, cross-sector manner. This makes it difficult to gauge how interdependencies will influence community response and recovery from a severe pandemic outbreak.

5.1.2 Healthcare System

As noted in other parts of this report, limited hospital surge capacity and contingency personnel are some of the challenges confronting the healthcare system in the event of either a catastrophic disaster or a severe and prolonged pandemic disease outbreak. Of the major Memphis area hospitals from which representatives were interviewed, all conceded that only limited backup staffing was available, and reliance would be placed on other hospitals within their respective systems or mutual aid agreements between systems. Emergency rooms, in particular, have little surge capacity, a key concern among critical care physicians in the Memphis region. Another would be the availability of mechanical ventilators, and the critical care physicians and respiratory therapists to oversee their use. Undoubtedly, however, hospitals will likely fill up to and exceed capacity with flu patients, and mutual aid agreements between hospitals in the region will prove ineffective due to the flu’s widespread regional impact. First responders, including EMS, are probably best equipped in the event of personnel shortages given well-thought-out backup staffing and cross-training. One key will be the advance credentialing and deployment of volunteer private physicians and nurses within the community during the public health emergency. One of Memphis’ strengths will be its cadre of volunteers who are available to staff vaccination clinics and support health services. Given the unprecedented need by the community for health services in a variety of modes during such an emergency, the sustainability of the healthcare system will be one of the critical pillars of community resiliency during such a crisis (the others being food supplies, transportation, and essential utilities).
5.1.3 **Governance, Law Enforcement, and Security Issues**

With the closure of businesses, schools, and other community activities, and the likely social unrest that would attend a severe and prolonged pandemic outbreak, the law enforcement sector will face a particularly difficult challenge with a sharply reduced complement of officers. With National Guard and state police resources stretched thin by the outbreak and other demands, outside relief will be less likely. (A security crisis was averted in New Orleans after Katrina by the infusion of federal and state resources; this will be more difficult in a pandemic.) A breakdown in the social order may occur at the same time that distribution of antivirals and vaccines becomes critical, necessitating further demands for security. An added dimension would be the inability of key government officials to perform their functions due to illness. As with the healthcare community, steps would need to be taken to care for the families of law enforcement officials to enable their availability for duty throughout the emergency. The degree to which these circumstances are heightened during such a prolonged crisis will be as much a function of preexisting socioeconomic issues within the community (and the strength of family units within it) as would the ability of local government to use its own resources, as well as those of community organizations, to maintain order.

5.2 **RESILIENCY IMPLICATIONS**

5.2.1 **Community “Containment” for Pandemic Influenza Will Entail Community Preparation and Commitment**

When the first wave of a pandemic influenza strikes a community such as Memphis, it is unclear whether the supply of antivirals and vaccines will be both available and sufficient for the population, nor will it be known how effective they will be against novel strains of the disease. Therefore, non-pharmaceutical measures, such as isolation and home treatment, voluntary quarantine of ill individuals, school closures, and social distancing measures (e.g., cancelation of social gatherings, telecommuting), and other community-based strategies will form the bulwark of initial public health response and recovery during a pandemic emergency, coupled with pharmaceutical interventions. The MSCHD Pandemic Influenza Response Plan specifies how both pharmaceutical and non-pharmaceutical responses will be managed, including disease severity criteria and community priorities for treatment. The recent Memphis area public health response to the H1N1 influenza outbreak, while not dealing with a severe pandemic, is indicative of community-wide preparation and awareness of these containment strategies, including clear mitigative responses (school closings, patient isolation) and timely risk communication from the MSCHD health department. The lessons learned from this ongoing real-time “exercise” have already served to identify gaps in information flow or community responsiveness. These containment measures, as illustrated in Fig. 5.2, are paramount to mitigating the impact on a community from a severe pandemic influenza and lessening the burdens on its health infrastructure.
Fig. 5.2. Goals of community mitigation (CDC, 2007).

Ultimately, however, the ability of the Memphis community to sustain these measures over an extended period of time will be a function of the trust of the public in their political and healthcare leadership, the continued openness and timeliness of communications, and the preexisting relationships and support mechanisms within the community. It will also require a cultural “step back” to past U.S. history, when a greater sense of “shared” community responsibility and active public preparedness prevailed, as in the 1950s with community civil defense activities and drills during the height of the Cold War, or even earlier with community interventions in response to epidemics. Active community engagement by local government will be critical to catalyzing effective involvement by the public in preparedness, response, and recovery from a pandemic, or for any disaster. As pointed out by the Working Group on Community Engagement in Health Emergency Planning (Schoch-Spana, 2007), the benefits to pandemic influenza planning are important and include the following.

- Containing the spread of contagious disease in a community—Advance community input for “nonpharmaceutical disease containment strategies” (e.g., voluntary social isolation, home quarantine, school closures) would help with equity and logistics issues.
- Weighing risks and benefits—In addition to issues of science, practical ones of social, economic, and political realities can best be served by community involvement.
- Identifying and fairly distributing adverse effects—Well-intended containment strategies for infectious disease control may have unintended social impacts on the community that can best be identified and resolved with community engagement.

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11 Empanelled in 2006 by the University of Pittsburgh Center for Biosecurity as concerns arose over the possibility of an avian influenza pandemic.
Extending government’s abilities to implement—As the SARS experience in Canada suggests, the ability of government to implement a regional disease containment strategy requires support within the community to help care for the ill by providing meals, medicine, and care to homebound individuals, and enabling essential workers to return to work.

5.2.2 How Interdependencies in a Prolonged, Multiphase Response Will Affect Regional Capabilities to Maintain and Sustain Critical Services Is Unclear

Government pandemic flu response procedures, such as social distancing, school closures, curtailment of air flights and shipping, passenger screening, and quarantines, could complicate and exacerbate interdependencies-related disruptions. The 5-day curtailment of restaurants, theaters, and other establishments in Mexico City in April/May 2009 had immediate economic impacts to the local and national economy that would have been difficult to sustain and recover from if it were to have been longer in duration. One estimate of the economic loss was $57 million per day for Mexico City (Associated Press, 2009). School closings would keep many healthcare workers home for childcare purposes, exacerbating an already decimated workforce due to the flu itself. Lack of drivers or fuel could curtail delivery of critical medical gases or supplies to hospitals, as well as pharmaceutical inventory to restock local pharmacies. Lack of mortuary capacity and staff would require backup personnel from regional sources (e.g., UT Medical School) and additional equipment (e.g., refrigerator trucks), although it is not clear how this would function during a severe pandemic event. Ineffective or only partially effective antivirals or vaccines would place a greater premium on more traditional isolation and quarantine strategies. A sharply increased need for mechanical ventilators across the region to treat patients with flu-related pneumonia would not likely be supportable given the current inventory and the widespread geographic nature of an outbreak. Current pandemic planning tends to focus on sector-specific needs and contingencies (public health preparedness, business continuity, hospital surge capacity) but does not investigate and provide guidance regarding vulnerabilities associated with and actions needed to address community-wide interdependencies.

5.2.3 Community Leadership and Communication Will Become Paramount as Social Isolation and Fear Increases

During a prolonged pandemic, containment measures such as social isolation (i.e., school closures, church services curtailments, cancelation of social events, work at home measures, etc.) will significantly reduce a community’s normal activities and interactions, and severely test its collective resolve and resilience. As the H1N1 outbreak has already shown in microcosm (as did the avian flu and SARS outbreaks before it), the consequences of an unexpected and novel pandemic infectious disease would include social and economic disruption, and public fear (but not panic). With a severe pandemic, outside relief will not be readily available and media coverage of illness and death will compound a public sense of dread and the need for individuals to isolate themselves further from contact with anyone outside of the home. It will take effective community leadership—whether civic, religious, or community based—to keep communications open within the community and render support during what would be its darkest time. Much of this will need to already be a part of the social and neighborhood fabric, although it can be improvised as events unfold. Neighbors helping neighbors, community volunteers willing to...
reach out to special needs patients, and impromptu ACSs will be as important to community resiliency as the standing EMS and medical establishment.

However, the level of trust and engagement necessary for community leaders to catalyze such active involvement of community members in their own preparedness, response, and recovery entails advance communication, joint problem solving, and effective collaboration between government, non-profit organizations, local citizens, and advocates. Again, as observed by the Working Group on Community Engagement in Health Emergency Planning (Schoch-Spana, 2007),

> decision makers who proactively solicit community partners prior to a crisis may be better equipped to govern effectively during an actual event: first, by commanding greater public confidence in their decisions, and second, by exercising better judgments in the context of uncertainty and evolving circumstances.

While greater participation of the community in its own response and recovery from disasters can ease the burdens on municipal and non-profit agencies, the Working Group also emphasized the dangers of over-reliance by government on community-based partnerships to fulfill functions that may exceed their capabilities and capacities, and rightfully belong to government. The example they used to illustrate this concern was the proposed use of a community “meals-on-wheels” program to deliver food to the homebound during a voluntary quarantine for pandemic influenza. They observed that assigning such responsibilities may exceed the ability of the non-profit involved to fulfill that obligation during the height of a disaster or health event such as widespread influenza.

A precedent for the Memphis community can be found in its early years when epidemics such as yellow fever were prevalent and the community itself responded, both on an individual basis and through its faith-based organizations, to administer to the sick and dying. The MSCHD pandemic influenza plan and most such plans satisfy the preparedness and response tenets defined by the federal and state governments but do not similarly address how the community itself will manage the challenge of sustaining itself over the months of a severe pandemic disease outbreak, and how government will strive to empower the community in this regard. While such an existential threat has no precedent in the recent past, the resilience of the community and its recovery will likely depend as much on the community’s self-reliance and its collective ability and willingness to support its members.
6. HEALTH SECURITY: CONTRIBUTING TO COMMUNITY AND REGIONAL RESILIENCE

6.1 INTEGRATING EMERGENCY MANAGEMENT AND MEDICAL RESPONSE CAPABILITIES

Community resilience, as noted previously, is enhanced when the public is engaged in a robust and integrated local healthcare system that has the policies, procedures, resources, training, and relationships to prepare, respond, and recover from major emergencies for which emergency medical response is a key component. However, it can be viewed more broadly as stemming from a “strong, diversified economy with widely distributed opportunity, lively social networks for exchange of information as well as emotional and material support, and a collective sense of self-efficacy” (Schoch-Spana, 2008). As concluded from discussions on this topic at a community resilience roundtable held at the Center for Biosecurity of the University of Pittsburgh Medical Center, two kinds of investments are needed to bolster community resilience in the face of potential health catastrophes: First, efforts to better integrate the public and community-based groups into the more formal medical and public health emergency systems, and second, efforts that promote and further the extent to which individuals work together to solve community problems, and acquire the communications and problem-solving skills that will not only further response to health emergencies but enhance the resilience of the community to the broad spectrum of challenges it may face in the future (Schoch-Spana, 2008).

While the second investment is clearly a goal of CARRI and its ongoing engagement in the three regional communities, the first—linkage of the public with its healthcare emergency response—is clearly one key aspect of integrating emergency management with medical and public health response. A second would be the linkage between the various components of that system; that is, how able and willing are the hospitals, EMS, Red Cross, health department, and local government to work together, combine resources, and draw upon their respective strengths for the collective good?

On the first need—to increase the engagement and participation of the community in its own emergency healthcare system—several initiatives have been taken in the Memphis area. From the federal government standpoint, the Medical Reserve Corps and CERT teams stand out as prime examples. The Memphis Medical Society is an advocate of making use of private physicians as backups in hospitals, shelters, and in other emergency capacities, and initiatives were taken in the past to support the medical needs of hurricane evacuees to Memphis. However, more can be done and is being considered. As indicated earlier, the local chapter of the ARC has opened facilitated discussions with the major hospital systems in the Memphis region to explore how they be better integrated with emergency management. The health department has approached the MSCEMA with an initiative to open up CERT training to include more robust public health preparedness training. Through recent pandemic influenza preparedness planning and exercises, members of the public were made more aware of their role in containing an infectious disease and how the healthcare system would function in such an emergency. The volunteer rolls were expanded to enable staffing of multiple community vaccination clinics and to address staff continuity issues in various agencies. However, the effective integration of the numerous private physicians and other medical staff in the Memphis area has not occurred, being
hampered by lack of local credentialing, resolution of liability issues, and a focus on resolving the very limited surge capacity that exists at most hospitals and clinics. Driven by the economics of the prevailing healthcare system, the contribution of the Memphis hospital system to community resilience will continue to be hampered unless these issues are resolved.

The second imperative, the integration and relationships between the various healthcare components, shows both success and some challenges for the future. The HD has stood up an effective RHC position that is respected and used by the various regional hospital systems to harmonize emergency planning and resource allocation. While effective in routine emergencies, it is not clear whether this coordination would be effective in a major disaster where needed resources would be substantial. In those cases, mutual aid agreements between the hospitals may figure, but at least one key manager remarked that even those agreements would not be sufficient and that “CEO” negotiations between the various hospitals would probably occur (Merriweather, 2008).

Another challenge that has been previously discussed is the apparent conflict between the traditional authoritative role in emergency medical response that the HD assumes in a major emergency and the operational role that EMS and hospitals carry out routinely. In Memphis, this challenge has been recognized and is being addressed through extensive interactions between all parties via working sessions on policies and procedures, attention to AARs (e.g., the recent Hurricane Gustav evacuation), and through the RHC. As noted before, it will be important for the community to reconcile on this matter as it can hamper effective emergency management.

6.2 RESOURCES AVAILABLE TO LOCAL AND REGIONAL COMMUNITY HEALTH THAT CAN ENHANCE HEALTH SECURITY AND COMMUNITY RESILIENCE

Health security can be enhanced by the effectiveness by which the emergency management community (including healthcare) applies the resources and tools available both within the community, and from external sources to build capability and contingent resources. One tendency that has been observed in other communities is that emergency management agencies tend to focus on “hazards” as opposed to system “vulnerabilities.” From a Memphis standpoint, for example, vulnerabilities such as hospital surge capacity, reserve physician availability (e.g., for staffing ACSs and backing up hospitals), EMRs, and addressing special needs populations do not garner as much attention as does emergency planning for the chemical hazards on President’s Island, tornadoes, or terrorist attacks. This is not to say that the latter are not critical, it is just that long-standing systemic gaps require institutional change and resources, which typically requiring a compelling force behind them (whether governmental mandate or major crisis, or both).

From a community standpoint, the Memphis community has made substantial investments. Robust volunteer-based programs have been established and promoted, such as the Medical Reserve Corps and CERT. It has developed methods for pharmaceutical, equipment, and human resource sharing. Agreements have been reached between organizations for sharing resources, although actual implementation remains to be tested. Communications among the healthcare system, including public health, the hospitals, and EMS, have been scrutinized and coordinated. Education, training, and exercising have been supported by all components, although the level of such activities appears to be most sensitive to budget resources.
In terms of applying outside resources, the Memphis healthcare community relies on federal and state funding grants to support emergency preparedness positions in the HD (CDC public health preparedness grants), to fund purchases of emergency pharmaceutical caches and stand-up hospital EMRs (both MMRS), and to support local emergency planning (HRSA). In the past, federal and state homeland security grants have funded the HD’s pandemic influenza preparedness program, the bioterrorism response program (including coordinator position), and hospital preparedness (through HRSA grants). It relies on state resources (e.g., Tennessee National Guard) in the event of a regional emergency, the most recent being the evacuation of 3,300 residents of the New Orleans area to Memphis in advance of the landfall of Hurricane Gustav in 2008.

The most serious challenge confronting the community is the decline of these outside resources. Reductions over the past two budget cycles in the federal hospital preparedness and public health emergency preparedness grants have been experienced. State and local funding of the MSCHD has been in jeopardy as the state has experienced a severe budget deficit, and as Memphis and Shelby County have debated their respective fair share of funding (the Memphis City Council zeroed out the city’s $14 million share of HD funding in January 2009, although it was restored on a 1-year basis in May 2009). While these resources were intended to strengthen and empower local emergency preparedness and response, local agencies and groups have relied on them to support personnel staffing, purchase equipment, and upgrade response critical systems. The challenge for the Memphis and Shelby County community, as well as for the country, as a whole, is to combine these declining resources with resourceful use of capabilities within the community itself. It is possible that declining external monies may actually promote increased community resilience by encouraging the community to look within for its own resources to respond and recover from emergencies.

6.3 INTERDEPENDENCIES AND DEPENDENCIES OF FIRST RESPONDERS

In Memphis and Shelby County, the concentration of healthcare systems provides for a strong network of emergency capacity. However, the strongest interdependency and dependency challenges lie in the degree of personnel surge capability for the hospitals and ACSs during a major or protracted medical emergency. As noted earlier, the medical systems operate with a thin margin of physician and nursing coverage, which is not backed up with any systemic means of contingency staffing. During a protracted medical emergency, such as pandemic influenza, the influx of emergency patients would likely coincide with a medical staff shortage (i.e., the staff would be equally affected by the emergency itself). Volunteer private physicians are plentiful in the region but are not yet credentialed and trained to serve in that role. The Medical Reserve Corps has thousands of volunteers on its roster, but few are credentialed physicians and nurses that would be able to fulfill those roles. One of most serious concerns of EMS managers interviewed is the likelihood that hospital emergency departments will close to EMS units due to not having enough emergency department physicians to handle a surge of disaster victims.

Some actions are under way. The state of Tennessee, in response to federal initiatives for medical professional credentialing, has initiated its own program to do so through the state’s medical reserve corps. The Medical Society of Memphis has applied its membership roster in the past to supplement local response to emergency evacuations and is prepared to do so in the
future. The local ARC chapter has begun engaging the various medical systems with an aim toward increasing their involvement during evacuation sheltering to bolster emergency medical care. In its pandemic influenza planning, the MSCHD has developed continuity of operations plans for the department with provisions for cross-training of personnel. Some hospital systems are addressing cross-training of staff and establishing programs to enable personnel to make it to work during regional emergencies. However, these efforts have not yet collectively changed the status quo in the Memphis and Shelby County region, and medical staffing shortages during major emergencies may be a dependency that hampers the local healthcare system’s resiliency despite (ironically) the wealth of native resources in the region.

Other interdependency and dependency issues, while important, are secondary to the issue of contingent personnel. For example, the regional hospital systems are dependent on a single major supplier of medical gases. Water supplies tend to be a limiting resource for hospitals during a protracted emergency, particularly during warmer months when air-conditioning is required to keep inside temperatures below 80ºF (above which the state requires patient evacuation). Patient tracking is hampered by the lack of electronic records available on a regional basis.

Added to this list of issues would be a broader range of serious breakdowns associated with a major earthquake in the Memphis area. Such an earthquake would sever critical regional communications, transportation, utilities, and supply networks and serve to isolate whole parts of the community, particularly those in downtown subsidence zones where the destruction would be greatest. Key downtown hospitals, such as The MED, would be either destroyed or seriously damaged. Roadways would be blocked and bridges damaged, hampering public evacuation and EMS unit access. Reaching special needs populations within the city who have medical devices or pharmaceutical needs would be difficult. In general, the circumstances would possibly resemble those experienced with Katrina, where large groups of residents, many having medical needs, are isolated within the city and evacuation is delayed by disabled infrastructure. The local emergency response infrastructure that would be in place and functioning in all other emergencies (except for a major WMD attack) would be strained if not dysfunctional in the immediate aftermath of a catastrophic earthquake.

6.4 ROLE OF CONTINGENCY PLANNING

Contingency plans are alternate plans that can be put into effect if certain key events do not occur as expected (David, 1998). Addressing the unexpected is the basis for all contingency planning, which for disasters is directed at unexpected or unpredictable natural and man-made emergency events. Contingency planning should mitigate against the typical uncertainty, indecision, and delays that are associated with reacting to situations that are unusual or unplanned. Community resiliency is founded in the ability of a community to have the inherent resourcefulness, knowledge, capabilities, and experience to respond to, and recover from, whatever contingencies present themselves. However, to be in that position, planning must “think outside the box” in terms of the unexpected.

The lessons from the 9/11 terrorist attack and recent natural disasters are instructive. Contingency planning for emergencies in New York City did not anticipate another attack at the World Trade Center (the central EOC was located there despite a bombing there in 1993), nor a skyscraper fire with structural collapse. During Katrina, the importance of contingency planning
was evident in the stranding of evacuees in New Orleans (due to flooding and lack of transportation), the deaths of vulnerable populations (critically ill, nursing homes), and difficulties in reestablishing the community’s inner city medical infrastructure. More recent experience with Hurricane Gustav in 2008 found that, unexpectedly, thousands of evacuees transported to Memphis from the New Orleans area did not have available medical histories and needed medications, and arrived after a long trip to find a lengthy shelter registration process at the airport. In the last case, local officials were able to adapt to the circumstances and change the response to mitigate the problems experienced. However, the existing planning did not anticipate such problems.

Contingency planning is a discipline for a community that enables it to examine both its preparation for what could be considered the “expected” gaps and challenges from various plausible emergency scenarios, as well as gauge its capabilities and capacities to withstand and recover from the “unexpected.” The former is rooted in the familiar “what if” of fault tree or decision analysis wherein planners probe the underlying assumptions, interdependencies, and dependencies upon which planned community emergency response is based. Given the preceding outline of Memphis interdependencies and dependencies, for example, the following questions would need to be considered.

- What if emergency rooms become inundated with both victims and the “worried well” during a major disaster (e.g., pandemic influenza)? Where and how will emergency patients be routed and who will tend to them?
- What if special medical needs patients, for example, equipment dependent, disabled, or mentally disabled individuals, become isolated or trapped due to a major catastrophe such as an earthquake? How will special medical needs patients be tracked, evacuated, and treated?
- What if utilities (i.e., electric power and water) are cut off for an extended time during a high heat period? How will hospitals and clinics handle patients?
- What if the emergency event (e.g., pandemic influenza) itself leads to severe physician and nursing shortages across all healthcare institutions? How will contingent staffing be provided during the recovery phase?
- What if displaced individuals from an inner city disaster who need to be evacuated exceed the existing capacity of the Red Cross and CSA? Where would they be sheltered? What additional personnel would manage these shelters and provide medical care?
- What if the duration of an emergency leads to widespread psychological–social stress and unrest? How would the community both provide intervention, security, and mental healthcare?

The best example of contingency planning for Memphis along these lines is the Pandemic Influenza Response Plan of the Memphis and Shelby County Health Department (MSCHD, 2007b). The plan addresses a number of prerequisites for a sound community emergency contingency plan. First, it incorporates broad community input from key stakeholders, both within the Memphians and Shelby County community, and at the state and regional level. It includes a continuity of operations plan for the HD to maintain essential public health services. It both addresses public education and training in advance, as well as contingencies for staff
shortages, vaccine shortages, social and economic disruptions, and unprecedented stresses on the healthcare establishment. It provides for a spectrum of community interventions, including social distancing, mass casualty care, and disease surveillance and case management.

However, while it addresses the essentials of such planning, that is, community authorities, roles, process, education, and assets, it does not (and perhaps cannot given its purpose) probe whether the capabilities exist and effective execution is likely.

A case in point is the lack of healthcare surge capacity and contingent medical staffing. While the Medical Reserve Corps and other sources of local volunteers are cited in the plan as institutional sources of contingent personnel, they are intended as a means to staff (for example) vaccination centers and pharmaceutical points of distribution (PODs), and not as a broad source of the type of backup medical staffing that would be necessary to backstop Memphis healthcare in the event of an outbreak of pandemic influenza. In this case, the plan focuses more on the functioning of the HD than on the broader functioning of the healthcare systems in the Memphis community. From a resiliency standpoint, a broader perspective of “what if’s” would serve to expose some clearly predictable vulnerabilities in response and recovery.

Planning for the “unexpected” would seemingly pose the classic conundrum of not “knowing what one does not know.” However, the essence of contingency planning and enhancing community resiliency, itself, is to build the capability and capacity (and flexibility) of the community to respond to and recover from existential threats that cannot not necessarily be predicted in terms of hazard level and specific consequences. In such cases, steps can be taken to strengthen resiliency by building interrelationships within the community, by adding redundancies and backup capabilities both from within and without, and by nurturing strong and flexible leadership at all levels. All of these build on the foundations of emergency planning, training, and assets, by ensuring that the capabilities and leadership exist to execute a response and recovery that is flexible and adaptable to the event as it unfolds.

6.5 ENHANCING RESILIENCE OF COMMUNITY HEALTH: CONTRIBUTING TO ESF 6 AND ESF 8

The National Response Framework includes two key Emergency Support Functions (ESFs) that need to be addressed for promoting health security: Mass Care, Housing, and Human Services (ESF 6) and Health and Medical Services (ESF 8).

Mass care involves the coordination of nonmedical mass care services including sheltering of victims, provision of food, emergency first aid, provision of information on victims to their families, and provision of bulk relief supplies. Housing encompasses assistance for both short-term and longer-term housing for displace persons. Human services include victim-related recovery efforts such as social support, counseling, expediting of emergency claims, and victims compensation.

Enhancing the resilience of community health could serve ESF 6 in a number of ways. By improving the relationship between the various healthcare institutions critical to emergency sheltering (Red Cross, HD, hospitals), better coordinated and executed sheltering can be provided. As noted earlier, steps are being taken in the Memphis community to improve this
engagement through facilitated meetings (Red Cross and hospitals via the Assisi Foundation), through reviews of AARs (e.g., following the Gustav evacuations in terms of EMS and the HD), and through interactions between the Red Cross and the MSCCSA (in terms of shelter management). Likewise, the local authorities have opened up a dialogue with the faith-based community in Memphis to explore how their large facilities could be used on a contingent basis for sheltering and feeding disaster victims. The MSCCSA, the Memphis Inter-Faith Association (MIFA), the Salvation Army, and local churches are all actively engaged in providing routine community support and relief, and using their volunteer base can expand services if circumstances dictate (all can or have been represented on the EOC during past emergencies).

Health and medical services encompass a broad range of support in identifying and meeting the health and medical needs of victims following a major disaster, emergency, or terrorist attack. Included would be an assessment of community health and medical needs, health surveillance, medical personnel, medical-related equipment, patient evacuation, hospital care, public health, mental healthcare, and worker health and safety.

Efforts in the MUA to enhance community health have focused on integrating its various institutional facets through coordination and collaboration. The EMA is the essential “glue” for managing these resources during an emergency event through its EOC function. However, for health and medical services, there are number of other venues for such integration. The HD provides community leadership through its RHC role in coordinating regional hospital functions and services during both routine and nonroutine circumstances. The EMS departments have active engagement through a number of working committees that include representatives from the major hospital systems and the Medical Society of Memphis. The hospital systems themselves have mutual aid agreements. Enhancing these activities with more robust treatment of issues such as hospital surge capacity and contingency medical staffing, special needs emergency medical care, electronic medical patient tracking, and mental health coverage would serve to enhance community resilience and more completely satisfy ESF 8.
7. METRICS FOR HEALTH SECURITY

The concept of performance indicators for measuring community resilience has emerged as a challenge in the wake of the catastrophe of Hurricane Katrina in New Orleans. Many of the goals and objectives of the National Response Plan were either found to be inadequate for the scale and scope of the disaster or simply did not focus on the inherent or adaptive capability of communities and organizations to respond and recover from disasters. A key goal of the CARRI Institute is to develop “Community Resilience Certification” which entails developing consensus on what constitutes critical indicators of community resilience. For the health security aspect of disaster response and recovery, this project focused on leading indicators of what the Memphis community viewed as important to public health and medical care.

As outlined by Tierney (2009), several conceptual frameworks have been developed by researchers. In one, the MCEER “4-R” model, resilience is characterized by four attributes: robustness, redundancy, resourcefulness, and rapidity. In the context of health security, robustness would apply to the ability of healthcare systems to resist disruption and failure, and continue functioning during and following a disaster. Redundancy would be the availability of alternate systems and capabilities (e.g., organizations and personnel) to respond when primary ones are impaired or disabled. Resourcefulness would refer to the ability of the healthcare community to mobilize available resources to sustain emergency response and recovery. Finally, the rapidity of the healthcare community’s response to challenges posed by a disaster is linked to preparedness (including the other three attributes, plus training and testing), preexisting community relationships, and adaptability to circumstances.

Such attributes can be applied to four resilience “domains:” technical (or physical), organizational, social, and economic systems. As further outlined by the MCEER model, the technical or physical domain is location based and tied to physical infrastructure issues such as facilities, siting, and transportation for healthcare delivery. Organizational issues would encompass the capabilities, capacity, and coordination of healthcare and public health agencies and institutions. Social systems would include the characteristics and dynamics of the community and its population. The underlying economic system would cover the robustness and attributes of the prevailing economics of the local community.

Table 7.1 provides illustrative examples of how these resilience properties can be applied to some of the attributes and issues of health security in the Memphis urban region. Some of these attributes will be inherent to the community resiliency dimension at hand, as with the robustness characteristic in MCEER framework. Others will be adaptive, that is, characteristics that come into play once a disaster occurs and are linked to the resourcefulness and redundancy of a community. For overall community resiliency, as well as for the health security aspect, a balance of both inherent and adaptive resiliency is necessary to be able to recover from a disaster in an effective manner.
### Table 7.1. Resilience attributes with Memphis healthcare examples\(^{13}\)

<table>
<thead>
<tr>
<th>Dimension/Domain</th>
<th>Technical/Physical</th>
<th>Organizational</th>
<th>Social</th>
<th>Economic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Robustness</strong></td>
<td>Newer structures built to earthquake codes; older structures retrofitted including hospitals</td>
<td>Extensiveness of emergency operations planning</td>
<td>Vulnerability of special needs population; medical needs of evacuees</td>
<td>Implications of poverty in inner city; business infrastructure</td>
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<td></td>
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<tr>
<td><strong>Redundancy</strong></td>
<td>Alternative Care Sites w/ staffing; backup ED capacity</td>
<td>Backup EOCs, organization continuity of ops planning; personnel surge capacities</td>
<td>Availability of options for evacuees (e.g., shelters, temp housing); contribution by community volunteers</td>
<td>Alternative sources of business activity; ability to substitute economic goods</td>
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<td></td>
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<tr>
<td><strong>Resourcefulness</strong></td>
<td>Availability of facilities, equipment, and supplies from community sources</td>
<td>Capacity to use information, improvise, innovate, expand</td>
<td>Capacity to address community healthcare needs during disaster and recovery</td>
<td>Capacity of economic players to improvise and innovate solutions</td>
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</tr>
<tr>
<td><strong>Rapidity</strong></td>
<td>Healthcare system downtime, restoration time</td>
<td>Time between impact and early recovery</td>
<td>Time to restore basic healthcare, housing, jobs</td>
<td>Time to regain business capacity, jobs, and revenue</td>
</tr>
</tbody>
</table>

Other frameworks, such as that formulated by Norris et. al. (2008), have defined resilience from the standpoint of “physical, ecological, and social sciences,” as they pertain to both communities and individuals within the community. In this framework, community resilience is associated with “adaptive capacities” in four domains: information and communication, community competence (i.e., capacity for collective action and decision making, and community empowerment), social capital (e.g., supportive social networks and citizen participation), and economic development.

The Community Assessment of Resiliency Tool (CART)© was developed by the Terrorism and Disaster Center of the University of Oklahoma Health Sciences Center (Pfefferbaum, 2009). It employs a self-survey consisting of eight interrelated community resilience attributes. These are highly subjective (making them less useful as performance indicators) and more designed as a means for communities to be introspective about resiliency subjects. The eight resilience attributes are listed as follows with corresponding health security examples for the MUA:\(^{14}\)

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\(^{13}\) After K. Tierney (2008).

\(^{14}\) After Pfefferbaum (2009).
**Connectedness, commitment and shared values:** For community health resiliency, the closeness of the community and its shared history in terms of mutual concern, diversity, and mutual aid are important attributes.

**Participation:** The sense of belonging and willingness to contribute through volunteering and supporting charitable groups are indicators. Communities that foster citizen engagement in various forums and civic organizations enhance their resilience. Memphis has numerous venues that have fostered volunteerism and have served to make local organizations a part of the emergency response network. A particular challenge for the Memphis community is to engage and credential medical professionals to enhance their involvement in response and recovery.

**Structure, role and responsibilities:** Resilient communities have organizations, both formal and informal, that overlap in terms of membership and whose interrelationships promote good communication, cooperation, and overall social interaction. Their structures, roles, and responsibilities lend themselves to timely and adaptive decision making founded on a high degree of mutual trust and community experience. In Memphis, such overlapping participation in various governmental, civic, and healthcare-related organizations has contributed to a network of associations between key players in most of the important healthcare agencies and organizations.

**Resources:** Including physical and human resources, a resilient community makes effective use of its available resources and looks for ways to meet the needs of its citizens in an equitable fashion. Attention to the physical plant and essential equipment, personnel, and training needs are all indicators. For Memphis, downtown physical infrastructure is a concern due to the potential consequences of a major earthquake. Investments are needed to bolster contingent medical staffing at hospitals, alternate care centers, and in evacuation centers.

**Support and nurturance:** Resilient communities support all of their members regardless of socioeconomic class and background and strive to address their needs in an equitable manner. Indicators would include the ability of the community to identify and effectively act on needs that arise during an emergency. One particular challenge that figured in the Katrina disaster is the need to address the special needs population in the Memphis community.

**Critical reflection and skill building:** It is a clear attribute for a community to be able to squarely weigh its preparedness and response capabilities and capacities, and critically evaluate performance results including AARs, exercise results, and independent reviews. Memphis has actively participated in various UASI, Safe Cities, FEMA, and CARRI assessments and has drawn performance feedback and results from all of these reviews. It has also conducted AARs on major exercises and actual evacuations from the Gulf Coast that have required emergency sheltering in Memphis.

**Communication:** Clear, timely, accurate, and effective communications in an honest and open manner are key attributes for building resiliency. Attention to reliable communication backed by redundant alternatives is critical. The hospitals and emergency response units in the Memphis region have followed the lessons of Katrina and have improved the reliability, redundancy, and interoperability of the existing medical communications system.
**Disaster preparedness and response:** The adoption and deployment of community disaster preparedness and response requires commitment, collaboration, and an inquisitive approach that views contingency planning in terms of expecting the unexpected and planning accordingly.

The CART process involves a self-assessment by community stakeholders of these resilience indicators employing information on demographics, interviews, focus groups, and a CART questionnaire. These are used by community members as a basis for identifying strengths, opportunities for improvement, and areas of disagreement. This is then coupled with a “problem-solving phase” where community focus groups can explore and address issues raised from the assessment phase. Much of this same dynamic has been captured in the community engagement activities of CARRI’s work in the MUA, as well as in Charleston, South Carolina, and Gulfport, Mississippi. However, this process does not lend itself very well to the development of actual performance metrics, as it does to further community engagement on relative priorities, planning needs, and organizational vulnerabilities.

### 7.1 MEMPHIS PERFORMANCE METRICS FOR COMMUNITY HEALTH

In conceiving performance indicators for community health, two approaches were taken: First, to develop community resilience measures borrowing from the preceding conceptual frameworks and, second, to develop “stretch” measures based on health security vulnerabilities identified by Memphis healthcare representatives. For community health, the following attributes and indicators are seen as most relevant based on a review of these conceptual frameworks and discussions with Memphis stakeholders.

#### 7.1.1 Community Health Resiliency Attributes

**Community Health Resources**

The capabilities and capacities of the healthcare and public health community in the Memphis region, including local government, hospitals, clinics, mental health, service organizations (e.g., ARC), the business sector, and private professionals (including personnel surge capacity and contingency backup personnel), are essential for the resiliency of community health. Considerations would include the robustness of the health infrastructure, both physically and financially, to withstand major disasters and sustain community services (including redundant facilities such as ACSs); the investments being made in human resources in terms of training, and for facilities and equipment in terms of necessary improvements; the sharing of community health resources and ability to improvise support where needed; and the experience and proven leadership of those managing key aspects of community health.
Available indicators:

- Capabilities and capacities of community health: people, facilities, experience

  Are the collective human resources sufficient in numbers and expertise, including contingent backup personnel; is the community likely to be adaptive to disaster circumstances? For Memphis, indicators would be a surge plan in place with contingencies built-in for extreme circumstances such as a pandemic flu outbreak (i.e., provisions for additional staffing support benchmarked on degree of need). This would include provisions for backup volunteer staffing from the private medical field and sharing of community healthcare resources. A series of quantitative benchmarks that can be considered for this purpose are the HRSA criteria for hospital personnel surge capacity\(^\text{15}\) (HRSA, 2004).

- Robustness and redundancy of healthcare infrastructure

  Are facilities sufficiently robust and equipped, and is there a redundancy built into the system? For Memphis, indicators would be whether critical healthcare facilities are earthquake resistant, have backup utilities for self-sufficiency for a week or more, and have planned alternate care sites with pre-planning for staffing and supplies.

Community Support (Commitment and Participation)

The support of the community for community health activities, particularly emergency preparedness and response planning, as manifest in ready volunteers to support programs and exercises, resources to support local service organizations and charities, and local government support (public support and resources) to agencies and private organizations engaged in community health and emergency preparedness and response.

Available indicators:

- Engagement of public in community health emergency preparedness

  Level of volunteer response for health-related emergency preparedness programs, for example, CERT, MRC, American Red Cross, and other civic groups. For Memphis, this would translate into not only collective numbers of volunteers but also degree (proportion) of participation by medical professionals important for response and recovery to health emergencies. Also, on an organizational level, capacity of relief organizations in terms of local and regional resources, equipment, and levels of permanent staffing.

\(^{15}\) For example, HRSA has set a critical benchmark for all states to establish a system that allows for the triage, treatment, and disposition of 500 adult and pediatric patients per 1 million population who suffer from acute illness or trauma requiring hospitalization from a biological, chemical, radiological, or explosive terrorist incident. HRSA also requires that states establish a response system that allows for the immediate deployment of 250 or more additional patient care personnel per million population in urban areas, and 125 or more additional personnel per million in rural areas.
• Support demonstrated by public officials, local government, and civic organizations to community health

    Enabling support provided by the local community to ensure adequate community health services. For Memphis, existing resources provided by local government, community groups, and the private sector (e.g., the medical community) to support medical and public health-related needs in the community (this may require a new benchmarking index of the combined resources and services available through these various sources—this basic community healthcare infrastructure would be important in a disaster, more so for the poorer segments of the community).

Disaster Preparedness, Response, and Recovery

The priority of and attention devoted to disaster preparedness, response, and recovery in the context of healthcare and medical services as manifest in an ongoing process that identifies the vulnerabilities, addresses needed capabilities and capacities, establishes planning and policies, and supports training, exercising, and performance feedback.

Available indicators:

• Extent to which community organizations devote attention and resources to emergency preparedness, response and recovery.

    Degree to which all relevant community organizations who would be key players or stakeholders during an emergency have developed appropriate planning, have ensured sustainable resources, and have experience with or tested their response capabilities. Whether organizations have reviewed potential disaster scenarios that would exceed current capabilities, capacities, or planning, and have developed corresponding contingency plans or alternative means to achieving response objectives. Being a qualitative indicator, this would require that a community such as Memphis continues to conduct self-assessments including a wide-range of experienced planners, and seek outside perspectives regarding preparedness and enhancing resilience.

• Extent to which the community addresses vulnerabilities for recovery following a major disaster or event.

    Degree to which key healthcare facilities are financially stable and have contingency plans in place to address needed resources (e.g., reserve funds, insurance, bonds, loans, etc.) to recover in an expedited manner in the event of a catastrophic event that damages or destroys the facility and its capability to serve the community. This is obviously a fiscal judgment that would need to be made by financial professionals familiar with loss control. For Memphis, this is an important issue given the condition of The MED, its importance to the community, and its location in a known seismic zone.
7.1.2 Health Security Metrics

In addition to addressing indicators for community health resiliency, consideration was given to what performance metrics would address specific health security needs in the community. These needs derive from many of the resiliency indicators cited above, including depth of resources, robustness of physical infrastructure, functional redundancy, and attention to the connectedness of the community with respect to community health. They reflect specific needs identified from interviews with various key community health stakeholders, including the MSCHD, major hospital systems, EMS, local chapter of the ARC, and the Medical Society of Memphis. They represent what could be called “stretch” performance metrics because they identify the current state of a critical attribute, the desired or envisioned future state, and a metric or goal that would enable the envisioned state to be achieved. These metrics are not uniformly measureable; some establish qualitative objectives (plans in place, improved organizational support, assessment completed) that can only be subjectively validated. However, for a number of issues confronting health security in Memphis, the first steps would be to acknowledge a gap or vulnerability and to engage the community to decide how to resolve or mitigate it through an inclusive planning process. Such metrics would serve to compel attention to some of the “too tough” issues that tend to be sidestepped because solutions are not easy, nor straightforward (nor are results discrete and readily visible).

Table 7.2 provides an outline of possible health security performance measures for Memphis that reflect input by community health stakeholders.

With respect to performance metrics, it is often said that “what gets measured, gets done.” For health security, it is clear from the above review and a “sampling” of available metrics that what needs to be measured will be a combination of statistical based (quantitative) and subjective (qualitative) measures. The former (e.g., percentage of regional patient EMRs integrated and accessible or ratio of credentialed backup physicians to current staff) can be benchmarked by the community once uniform criteria are agreed upon. The latter (e.g., integration of healthcare community in support of planning) will, of necessity, be part of a self-assessment framework that includes critical evaluations of healthcare assets, resources, and management (leadership, planning, communication). A hybrid of such indicators offers the most flexible approach for communities while enabling them to achieve results that can be benchmarked against established norms or expectations.
Table 7.2. Possible health security performance measures: Memphis/OHA

<table>
<thead>
<tr>
<th>Current State</th>
<th>Envisioned Future State</th>
<th>Proposed Metric</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most Memphis health care agencies and organizations have emergency contingency plans in place but lack backup staffing and credentialed volunteers to implement them adequately in the face of a prolonged or catastrophic major disaster.</td>
<td>Memphis health care agencies and organizations have sufficient operational capabilities and capacity, with suitable redundancies and backup, to manage an extreme disaster that has prolonged outages of essential services.</td>
<td>Continuity of operations plans in place for extreme disasters, with suitable reserve personnel and volunteer staffing identified and validated, for critical healthcare components (hospitals, EMS, HD, EMA, ACSs), as well as provisions for caring for family members of employees. HRSA surge capacity benchmarks can be applied.</td>
</tr>
<tr>
<td>Some fragmentation of responsibilities and inadequate coordination of resources exists between key components of Memphis healthcare community.</td>
<td>Memphis healthcare agencies and organizations are integrated such that roles and responsibilities during emergencies are clear and actionable, mutual trust exists regarding responsiveness, and resources are provided on timely basis.</td>
<td>Increase communication and coordination between Memphis healthcare components (e.g., through new VOAD); validate via exercises and other opportunities (e.g., using AARs following events as benchmarks of progress). Self-assessment criteria can be used.</td>
</tr>
<tr>
<td>Memphis healthcare infrastructure is vulnerable to single-mode failure of physical infrastructure that would undercut community resilience in the face of major disaster (e.g., collapse of key inner city facilities and roadways in earthquake).</td>
<td>Elimination or mitigation of single-mode failures of critical physical or organizational infrastructures; ability of organizations to work around and compensate for loss of key assets—redundancies and backups.</td>
<td>Interim earthquake vulnerability assessment completed for critical emergency response physical infrastructure (e.g., The MED, VA, Methodist, and other downtown facilities in subsidence zone) and contingency plans developed and implemented. All critical facilities meet 1995 seismic building code.</td>
</tr>
<tr>
<td>Public health preparedness of residents not as supported in local emergency preparedness training and information programs.</td>
<td>High level of public awareness, understanding, and expectations about public health preparedness and management; degree of public empowerment in promoting public health self-sufficiency during initial stages of disaster.</td>
<td>Integration of public health preparedness in public awareness programs, including CERT teams, train-the-trainer sessions, and public media. Proportion (%) of regional population being (1) reached and (2) trained.</td>
</tr>
<tr>
<td>Large special needs population exists in Memphis for which critical meds and services need to be more fully defined and addressed in emergency planning.</td>
<td>Special needs population identified, mapped, and integrated into emergency planning and response.</td>
<td>Special needs population defined, and % identified and mapped. Action taken to (1) define scope of medical supplies and treatment required and (2) promote self-sufficiency in first days of emergency.</td>
</tr>
<tr>
<td>Electronic Medical Records (EMRs) exist in individual institutions but are not integrated for access during emergencies.</td>
<td>EMRs regionally integrated and accessible for use during disasters.</td>
<td>Proportion (%) of regional patient EMRs integrated and accessible.</td>
</tr>
</tbody>
</table>

Referral to and discussion w/ HHS16

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16 These are issues addressed by the Pandemic and All Hazards Preparedness Act for which HHS has jurisdiction and program responsibility.
8. ACTIONABLE STEPS TO ENHANCE COMMUNITY HEALTH RESILIENCY

8.1 KEY HEALTHCARE INFRASTRUCTURE VULNERABILITIES CAN BE MITIGATED TO ENHANCE RESILIENCY

Notwithstanding the strength and scope of the Memphis regional healthcare system and industry, some notable preparedness gaps exist that reduce the resilience and health security of the community. The vulnerability of the Regional Medical Center for Memphis (The MED) to a major earthquake would likely incapacitate the region’s only Level One trauma and burn center, and remove the principal care center for the disadvantaged population of the inner city. The parallels with New Orleans are clear: Given the fragile financial condition of such medical centers, they would not likely be able to recover at a tremendous loss to the community. Likewise, hundreds of patients would be put at risk and evacuation would prove difficult, if not impossible, for many. More needs to be done by the community to address the major socioeconomic-based healthcare issues that fundamentally reduce the resilience of the Memphis community now and particularly during a regional emergency, such an earthquake or severe pandemic influenza outbreak.

8.2 LIKELY SHORTAGES OF HEALTHCARE PERSONNEL DURING PATIENT SURGE CAN BE BACKED UP WITH CONTINGENT STAFF

Most hospital systems today operate within narrow financial margins that preclude much personnel surge capacity for major disasters. This is equally true in Memphis, where reliance is placed more on the ability of the larger medical systems to cover for their member hospitals than on external contingent medical staff. While the Memphis region enjoys a considerable physician and nursing population, the deployment of this vital resource on a volunteer basis during a catastrophic disaster remains nascent. An opportunity exists to overcome some of the identified impediments (credentialing, training, organization) to tap this professional resource as a means to relieve emergency departments, staff ACSs, and support evacuees at shelters—all vulnerabilities that have been identified in the Memphis region. Doing so will enhance critical redundancies and enable the community to take care of itself before outside relief is available (or in the event of pandemic influenza, because outside relief would not be forthcoming).

Even without a national or state credentialing system, however, more can be done within the current purview of the Memphis region healthcare community. Each hospital system can begin developing rosters of physicians, nurses, behavioral professionals, and other staff who would have recognized privileges in their emergency departments and ACSs. These could be cross-indexed with other medical systems in the region to provide staffing when and where a major emergency outstrips the surge capacity in one or multiple locations. As is currently done in the adjoining state of Mississippi, these professionals can be provided picture IDs that have their credentials encoded to permit ready entry into emergency treatment facilities and hospitals.
8.3 CONTINUED COMMUNITY ATTENTION TO ENGAGING AND INTEGRATING ALL SECTORS IN IMPROVING DISASTER RESILIENCY HAS APPLICATION TO HEALTHCARE AND PUBLIC HEALTH

The need to enhance coordination within the Memphis community while working to minimize fragmentation and lack of cooperation during a disaster is recognized, and actions are under way. The scope includes improved integration of external with internal organizations, local with regional ones, traditional with non-traditional, and professional with volunteer (CARRI, 2008). For community health, a similar focus is being given by the ARC and the regional hospital systems who are meeting under the auspices of the Assisi Foundation to discuss how communications, coordination, and support can be improved during emergencies, and reconstituting the VOAD. An opportunity also exists in the same vein between the hospitals, EMS, and public health, where the authority for overseeing community health during health emergencies falls to the HD with much of the responsibility for patient care falling to the medical care system. Ensuring that these respective roles function effectively together during a disaster is critical to functionality during an event and in the aftermath. An expanding outreach to the business, faith-based, and private organizations in the region is evident and needs to be pursued further to broaden the scope of involvement and resources available to the Memphis community.

8.4 PUBLIC OUTREACH TO ENHANCE COMMUNITY ENGAGEMENT AND RESILIENCE FOR PUBLIC HEALTH PREPAREDNESS CAN BE AUGMENTED BY MAKING BETTER USE OF EXISTING GOVERNMENT COMMUNITY-BASED PROGRAMS SUCH AS CERT, MRC, AND MMRS

Opportunities exist to augment the considerable success achieved in Memphis with the CERT, MRC, and MMRS programs by using them as a vehicle for expanding community engagement and capacities for public health preparedness.

The CERT program is often cited for its effectiveness in educating the public regarding the hazards that may confront them during emergencies and training them in basic response skills such as first aid, light search and rescue, and disaster medical operations. However, given its established reach into the community, it would be advantageous to include public health preparedness training as well, for events such as a pandemic influenza event (in fact, such a request was made by the Health Department but is still awaiting positive response by MSCEMA) (Moore, 2008). From discussions with the FEMA, the sponsoring agency for the CERT program, no apparent exclusion exists for doing so (McCacken, 2009). However, without explicit federal and state support for doing so, it is unlikely that such an initiative will be possible given the competition for resources and the continuing divide between emergency management and public health with respect to public health emergencies. Such federal and state enabling guidance would make a clear difference.

For the MRC and the overall deployment of private medical personnel during an emergency, the challenge again lies upstream with the responsible government agencies at the federal and state level. Memphis is unable to train, credential, and deploy private physicians via the MRC or other means for a number of reasons: concerns by hospitals over liability; lack of a regional roster system for volunteers that matches professional experience with emergency needs; and lack of a recognized credentialing system that can be relied upon during an emergency. However, the last imperative, credentialing, has been addressed by the federal Department of Health and Human
8.5 PLANNING FOR COMMUNITY HEALTH EMERGENCY PREPAREDNESS, RESPONSE, AND RECOVERY CAN BE CONDUCTED IN A MORE INTEGRATED, REALISTIC MANNER

As discussed by Memphis organizational participants in several CARRI/MUA forums, emergency planning is not always performed, performed only within the scope of normal operations, or performed to the letter of an existing obligation without sufficient realism, coordination, and testing. From a limited review of community health organizations, this observation seems to apply as well (with the possible exception of pandemic influenza planning, as discussed earlier). One key member of this community commented that at least one Memphis-wide operational plan required component organizations “to plan to plan.” Without specific implementable planning, a number of Memphis responders indicate that they would have to improvise “in the heat of the moment” (Merriweather, 2008).

As another illustrative example, one contingency plan calls for the stand-up of “alternate care centers” when normal healthcare capacity becomes overloaded but does not address how these centers will be staffed given anticipated shortages of medical personnel. The need for comprehensive evacuation planning (including the special needs population) for a major inner city catastrophe, such as an earthquake, which would likely disrupt transportation routes and create hazards, was apparent. Beyond the obvious utility of realistic planning that has community support and awareness, the process of addressing anticipated hazards, needs, and roles and responsibilities serves to unify the community and enhance confidence that it will be resilient in the face of both expected and unexpected challenges. While “conceptual” planning and tabletop exercises can highlight who the institutional players need to be and how they would interact, more needs to be done to take such preparations to the next level to ensure that actionable planning is in place and has community buy-in and credibility.
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