The Joint Commission

# Surge Hospitals:

## Providing Safe Care in Emergencies

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# Executive Summary

After Hurricane Katrina slammed into the Gulf Coast in late August 2005 followed closely by Hurricane Rita, the health care community quickly mobilized to provide care to thousands of people who were caught in the storms' paths. Because the hurricanes and subsequent flooding caused the same sort of devastation to many local health care facilities as it did to other types of buildings in the region, the disaster forced many health care organizations to set up temporary facilities called "surge hospitals" in places such as shuttered retail stores, athletic arenas, and veterinary hospitals. The surge hospitals, so-called because they are designed to treat a surge in the number of patients needing care, contained triage, treatment, and sometimes even surgical capabilities. These temporary facilities were established to serve as a stopgap measure to provide medical care until the area's health care organizations could reopen. The severity of the damage that was done to the region's health care facilities has brought the health care community's responsibility for planning, building, and operating effective surge hospitals into focus. As this disaster has shown, health care organizations may be forced to provide care at surge hospitals for an extended period of time due to the damage sustained to their permanent facilities during catastrophic events. This reality challenges the Joint Commission to consider implementing a minimum set of standards to ensure that care provided at surge hospitals is safe and of high quality. Should the development of these standards move forward, the Joint Commission would seek input from groups that have extensive knowledge of surge hospitals, such as the Texas A&M University System Health Science Center. (Representatives of this organization were involved in establishing and operating the surge hospital described in Case Study 5, which begins on p. 21.)

It is crucial that health care organizations understand what surge hospitals are and how they can plan for and establish them, including whom they should work with to do so. Hurricanes Katrina and Rita have shown us that having plans to "surge in place," meaning expanding a functional facility to treat a large number of patients after a mass casualty incident, is not always sufficient in disasters because the health care organization itself may be too damaged to operate. Where outside of its own walls does a health care organization go to expand its surge capacity? Who should be involved in planning, establishing, and operating surge hospitals? This paper provides the answers to these questions and offers real-life examples of how surge hospitals were established on the Gulf Coast.

# Introduction

"Few, if any, hospitals in America today could handle 100 patients suddenly demanding care. There is no metropolitan area, no geographically contiguous area, that could handle 1,000 people suddenly needing advanced medical care in this country right now."

Source: U.S. Congress. Senate. Committee on Government Affairs. *FEMA's Role in Managing Bioterrorist Attacks and the Impact of Public Health Concerns on Bioterrorism Preparedness.* 107th Cong., 1st sess., July 23, 2001. Testimony of Tara J. O'Toole, M.D., M.P.H., Johns Hopkins Center for Civilian Biodefense Studies.

A familiar concept to health care organizations, *surge capacity* is a health care system's ability to expand quickly beyond normal services to meet an increased demand for medical care.[1] *Surge hospitals* have been defined as facilities designed to supplement existing hospitals in the case of an emergency.[2]

Because many health care organizations' ability to *surge in place,* meaning the capability to expand the surge capacity of a functioning health care facility, is limited, health care organizations need to have plans for increasing surge capacity which include the establishment of temporary surge hospitals. It is critical that health care organizations (in concert with community leadership) initiate pacts with other organizations such as medical centers, schools, hotels, veterinary hospitals, and/or convention centers to establish locations for the off-site triage of patients as well as for acute care during an emergency. Hospitals and other health care organizations must develop communitywide response plans that integrate their capacities into a single, organized response. Communications and data sharing that link health care organizations to local and state public health agencies are critical to this process.

In truth, no single model exists for the surge hospital. Today's health care leaders must examine the various types of surge hospital facilities that have been used to respond to emergencies and build their plans based on the needs of the community as well as the resources available to the organization.

## Goal of this Publication

This publication provides information to health care planners at the community, state, and federal level about what surge hospitals are, the kind of planning they require, how they can be set up, and who should be responsible for their establishment and operation. The case studies at the end of this paper describe how surge hospitals along the Gulf Coast were established and operated, providing a real-life perspective on the importance of creating safe surge hospitals after disasters strike as well as on the challenges that go along with providing care under these makeshift conditions.

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# Using surge hospitals to respond to emergencies

Positioning a hospital emergency room near the site of every potential disaster is impossible, yet a patient with serious injury needs to be transported to surgery within the "golden hour" after the injury occurs for the best chances of survival. Health care planners have developed a number of innovative ways that a surge hospital can respond to this need. These solutions include opening shuttered hospitals or closed wards in an existing facility, temporarily using buildings in the community to obtain greater surge capacity, transporting mobile medical facilities to the site, installing portable medical or surgical units near the emergency, and using these types of portable facilities to augment hospital capacity. Agreements for use of these facilities should, if possible, be made in advance to expedite the delivery of care in a worst-case scenario. A description of the different kinds of surge hospitals follows.

## Types of surge hospitals

### Shuttered hospitals or closed wards

The Agency for Healthcare Research and Quality (AHRQ), a branch of the U.S. Department of Health and Human Services (DHHS), offers guidance on using closed hospitals to expand surge capacity in an emergency. The agency recommends two occasions when the use of a shuttered facility is warranted: mass casualty events and cases where quarantines must be instituted to guard against transmission of an infectious agent or communicable disease. Any institution contemplating the use of a closed hospital to expand surge capacity should ideally engage in advance planning to thoroughly assess the facility, although it must be acknowledged that in many cases the urgency of a situation often calls for swifter action. The best approach might be for an existing hospital or other health care organization to acquire the shuttered hospital as a satellite of the medical center so that patient services such as pharmacy and laboratory can be extended to the satellite. Whether the site is a shuttered hospital, or, as is described in Sidebar 1 below, a closed hospital ward, the first staff to enter the facility should be an environmental crew that would clean the facility to ensure that the water, air, and general environment are sanitary and adequate for their intended use.

**SIDEBAR 1. AN EXAMPLE OF "SURGING IN PLACE"—OPENING A CLOSED HOSPITAL WARD**

Baton Rouge's largest public health hospital, the 200-bed Earl K. Long Medical Center, is a facility that provides care to the indigent: the poor, the uninsured, the frail elderly, and prisoners from the city's four jails. This hospital's method of increasing surge capacity to treat victims of Hurricane Katrina was to open several closed wards within the hospital. This step expanded its capacity by 200 beds, effectively doubling the hospital in size. Jimmy Guidry, M.D., state health officer of Louisiana and medical director for Louisiana's Department of Health & Hospitals (DHH), made the decision to open the wards, using the strategy of "surging in place" to increase the hospital's surge capacity.

### Facilities of opportunity

"Facilities of opportunity" are nonmedical buildings that, because of their size or proximity to a medical center, can be adapted into surge hospitals. These facilities may include sites such as veterinary hospitals, convention centers, exhibition halls, empty warehouses, airport hangars, schools, sports arenas, or hotels. Health care organizations can designate such nearby buildings and equip them to handle an overflow of patients. Sometimes a medical facility designed for another purpose, such as a day surgery center, can quickly adapt into a surge hospital with minimal cost and effort.

## Mobile medical facilities

Another type of surge hospital is the mobile surge hospital, such as an 18-wheeler truck fitted with state-of-the-art surgical and intensive care units that can rapidly deploy to the scene of an emergency. These mobile intensive care units typically have six beds and their surgical units contain pre-op and post-op recovery areas, a centralized nursing station, and clean and soiled utility rooms. An additional advantage is that these facilities can be used not only for disaster management but also as portable clinics offering preventive services to rural or otherwise underserved areas. These dual-use facilities have been referred to as *Thursday hospitals* because they can be used for patient care in one given location on a certain day of the week (such as on a Thursday) and can be used in other locations the rest of the week, while remaining available for other purposes of disaster response at all times.

## Portable facilities

An additional answer to the surge capacity problem is the portable, mobile medical facility that can be set up quickly and be ready to be used to provide care in a few hours. Such units, commonly known as *hospitals in a box,* are fully equipped, self-contained, turnkey systems designed to be set up near mass casualty events to treat the most severely wounded as soon as possible. One soon-to-be-available protoype, the Advanced Surgical Suite for Trauma Casualties (ASSTC), is a highly mobile, lightweight, self-contained surgical facility that has both military and civilian uses. It can be set up in less than 30 minutes and is stored in a 5ft. x 5ft. x 10ft. box. Supply cabinets in the unit can be stockpiled with medications and equipment tailored to the specific situation.

## Project ER One

Project ER One is a prototypical emergency care facility developed by Washington Hospital Center in Washington, D.C., and conceived as a chemical- and bioterrorism-ready mass casualty facility. Intended as a model for all new emergency departments constructed in the nation, ER One features the following emergency-ready elements to enable a rapid response in disaster-stricken communities:

- Treatment areas designed to thwart cross-contamination and cross-infection
- Modular scalability to serve many patients on a daily basis and then expand for larger numbers in minutes
- An educational training center that can also serve as a planning hub for neighboring health care organizations and for handling non-conventional threats
- State-of-the-art computer information system that can track patients and patient records in real time
- The ability to share encrypted data with sanctioned medical, public safety, military, and governmental agencies
- A laboratory for research and development in bioterrorism and similar events

ER One embodies the hallmark principles of the surge facility, which include dual use, scalability, and modularity. During phase one of the project, design specifications were developed for the emergency facility at Washington Hospital Center. The Phase II design study will put the phase one findings into operation at the hospital center.

# Planning for, establishing, and operating surge hospitals

When planning for the potential use of a surge hospital, health care institutions need to consider their definition of *surge capacity* as more than just the number of available hospital beds. Instead, they need to think about their ability to handle a public health emergency by examining two additional types of resources inside their institutions: staffing and equipment. Organizations also need to investigate pharmaceutical reserves in local pharmacies so they can have a ready supply of needed medications that last until additional supplies arrive from the Strategic National Stockpile (see p. 7 for a detailed description of the Strategic National Stockpile). In addition, communications systems and information technology should be in place so that the organization can communicate with both internal staff and outside agencies. Another fundamental part of the planning process is the connectivity with community leaders and planning organizations to ensure compatibility with community thinking and functional initiatives.

## Evaluating the options for surge capability

When considering the surge facility options available to a health care organization, it is important to start at the neighborhood level and work outward. Can any closed wards be opened? Does the organization have a satellite outpatient facility that can be converted to inpatient use to increase hospital capacity? What are the closest available large-capacity venues, such as veterinary hospitals, exhibition halls, or schools that could be used to expand capacity?

Mobile medical facilities and portable surgical units can also be attractive candidates to serve as surge facilities; however, a disadvantage of using these facilities is their considerable cost. Cash-strapped hospitals and other health care organizations may find it difficult to dedicate huge sums of money for infrastructure changes that may rarely, if ever, be used. For this reason, many organizations are looking at ways to retrofit their existing buildings to add surge capacity while controlling costs.

## Design considerations for dual use in existing buildings

Health care facilities that have one purpose, such as a surgery suite in nonemergency circumstances, but which can be converted to increase surge capacity in an emergency, are called dual-use facilities. Hospitals themselves can be equipped for dual use during a crisis, but the cost of retrofitting a hospital for dual use is prohibitive for many organizations. The Joint Commission encourages health care organizations undertaking new construction to build for dual use. (See Sidebar 2 on page 5 for information about building considerations for dual use facilities.) Health care leaders should also consider becoming involved in the construction and planning of new structures, such as libraries, civic centers, or community centers so that these buildings can incorporate dual-use concepts into their construction plans.

## Coordinating efforts with local, state, and federal emergency management planners

Hurricanes Katrina and Rita illustrated that state and local preparedness is a key factor in a successful response during the first 24–28 hours after a disaster. The relationships and agreements established before a disaster occurs are critical to an effective emergency response.

Health care organization leaders should evaluate their surge capacity outside of their own institution in the context of their local communities as well as at the regional level. (See Sidebar 3 on page 5 for a list of issues that leaders should consider regarding collaborating with other health care organizations during emergencies.)

### Sidebar 2. Building code variances

Disaster planning highlights the need for changes in building code requirements to meet the demand for high-volume patient care. Most of these recommendations could also apply to the new construction of schools, libraries, hotels, and other buildings in a community. Some of the variances that health care organizations need to consider include the following:

- Wide hallways and stairwells to allow stretchers to pass each other
- Redundant power, such as a second generator or a duplicate electrical system that serves as a backup for the primary system
- "Clean" rooms that contain self-decontaminating surfaces, negative pressure air–handling systems, and controlled pressure, temperature, and humidity
- Horizontal construction with larger and faster elevators to avoid bottlenecks when moving patients to different floors
- Multiple patient drop-off entrances to prevent traffic jams
- HEPA filter systems that trap biological agents in incoming air and expose them to ultraviolet light to render them harmless
- Storage for medical equipment which protects supplies from biological and radiological threats
- Docking stations to accomodate 18-wheeler response vans that meet all standards of care

### Sidebar 3. Leadership issues for collaborating with proximate health care organizations

- What health care organizations are geographically proximate (all types, whether offering similar services or not)?
- What proximate health care organizations offer similar services?
- What resources (such as supplies, beds, and staff) might be shared or pooled in an emergency response?
- What might our organization be able to provide for proximate health care organizations? What provisions can we make to offer such services/supplies in the event of a disaster or emergency?
- What in-kind or reciprocal agreements might we make with each organization?
- How will we communicate with proximate health care organizations? Who should be contacted at each organization?
- If care recipients must be evacuated from our organization, which neighboring organization could receive transferred individuals?
- What suppliers/vendors does each proximate organization rely on for materials that might be needed in an emergency? What are their back-up plans for supplies in case of an emergency? Are all of the region's health care organizations relying on the same vendors?

Source: Joint Commission on Accreditation of Healthcare Organizations: *Guide to Emergency Management Planning in Health Care.* Oakbrook Terrace, IL: Joint Commission Resources, 2002.

The catastrophe in New Orleans showed the nation nothing if not the reality that disasters can cripple entire regions. Institutions must put cooperative agreements in place with state and regional partners and also work with federal representatives who can ensure that sufficient resources are available to handle a widespread emergency.

Certain locations in the country are already doing this. For example, New York City understands, because of its recent history and proximity to other states, that a disaster that occurs inside the city could also impact New York State, New Jersey, and Pennsylvania if the city's ability to respond to the emergency is overwhelmed by the severity of the disaster. As a consequence, a significant amount of regional planning occurs in that city.

## Obtaining needed personnel and supplies

One of the key components of an effective health and medical care response is ensuring an adequate number of qualified health care providers who are available and willing to serve in a mass casualty event. Having sufficient supplies, pharmaceuticals, and equipment is also critical.

### Obtaining a sufficient number of staff members

A model for determining the number of staff needed for a surge facility is the Modular Emergency Medical Stem (MEMS) designed by the U.S. Department of Defense. The system is based on the incident command system, which is commonly used by the emergency medical services community. The system sets up a network used to access patient care personnel through neighborhood emergency help centers and acute care centers. Activities that can help in the search for additional qualified personnel in a time of need include the following:

- Recruiting from retired or currently unemployed but qualified volunteer providers within the community and state
- Making use of reserve military medical and nursing providers and other responders, as well as an expanded group of providers, such as veterinarians, dentists and dental auxiliary providers, pharmacists, and health professional students
- Reallocating providers from nonemergency care and nonemergency sites to emergency response assignments and from unaffected regions to affected regions (this will involve identifying skill sets of each practitioner group [such as paramedics and nurse midwives], so as to optimize reassignment potential)
- Creating and training a pool of nonmedical responders to support health and medical care operations
- Making adequate provisions to protect providers (and their families) who serve in mass casualty event situations to ensure their willingness to respond

Perhaps the best known source of supplementary medical personnel is the Medical Reserve Corps (MRC) Program, which organizes the services of more than 27,000 practicing and retired physicians, nurses, and other health professionals as well as ordinary citizens who wish to volunteer in community public health efforts and help during large-scale emergencies. Founded by President George W. Bush in 2002 in cooperation with the USA Freedom Corps, the MRC specializes in identifying, training, and organizing volunteer medical and public health professionals.

Two additional resources exist for the recruitment of medical staff in a worst-case scenario. The first is the National Disaster Medical System (NDMS), established in the 1980s by the U.S. Departments of Health and Human Services and Veterans Affairs and the Federal Emergency Management Agency. NDMS organizes 7,000 health care volunteers in locally sponsored specialty teams that become federalized upon activation. The second resource is the Public Health Service Commissioned Corps headed by the surgeon general. The corps consists of roughly 6,000 physicians, nurses, pharmacists, allied health care workers, dentists, scientists, computer specialists, and other officers available to offer health care–related expertise in times of war or national emergencies.

Local medical, nursing, and allied health care students can also help provide care in times of need. In addition, the American Red Cross, temporary medical staffing agencies, and volunteer programs, such as AmeriCorps and SeniorCorps, provide medical personnel and volunteers to health care organizations during emergencies.

Education of the existing hospital staff is also important and involves the following areas: better disaster-response awareness, improved skills,

an understanding of roles and responsibilities, more effective communication, and experience in cooperating with other staff members as well as personnel from outside agencies and organizations during emergencies. Strengthening emergency training programs fortifies preparedness, but the skills most valuable during a disaster are those practiced by staff every day.

### Medical supplies and equipment

A number of options exist to acquire the needed beds, medical supplies, and equipment in a time of crisis. The Strategic National Stockpile, a program of the Centers for Disease Control and Prevention (CDC), maintains large quantities of medications and medical supplies, such as airway maintenance, IV maintenance, and medical surgical items to be used in public health emergencies including infectious disease outbreaks, natural disasters, and man-made disasters. Needed medicines and supplies can be delivered free of charge to any state as part of this program. Each state is then responsible for distributing supplies to local communities. To respond to this additional need, the medical center may need to consider equipment rental or leasing options.

The experience of the medical teams that set up the surge hospitals in Louisiana and Texas following the hurricanes was that the Strategic National Stockpile may not be able to deliver needed medical goods for several days during emergencies of extreme magnitude. In such emergencies, hospitals and medical centers may have to order equipment from local suppliers or request donated items from physician offices, medical schools, local armories, medical supply houses, and other sources. This fact underscores the value of establishing partnerships with such organizations in advance to accelerate the procurement of supplies in an emergency.

Surge facility pharmaceutical procurement can be more problematic than that of disposable equipment and supplies because of the legal requirements surrounding the prescription, storage, and preparation of medications. Ordering drugs could pose a problem if the surge facility does not have preexisting contracts with pharmaceutical suppliers. One way of handling this problem is to have a sponsoring hospital or other health care organization order medications for the surge hospital. Another option is for a hospital to establish an advance contract with a pharmaceutical distributor that would be implemented only in an emergency. If possible, the number of supplies held in inventory at the surge hospital should be sufficient to last at least three days per patient.

## Leaders in charge of establishing and operating surge hospitals

It is vital that the leaders who have integral roles in establishing and maintaining surge hospitals are visible within the community and ensure consistency in the way surge hospitals operate. The intent of setting up the surge hospital is to demonstrate to stricken communities that the medical community will continue to take care of the ill and injured. In this role, the leaders of the state are key. Advance planning for emergency events is crucial in enabling them to project consistency and to protect and enhance the public trust. To promote visibility, officials must maintain communications with the public through personal visits to the hospital site as well as through media interviews and appearances.

Disasters happen locally, requiring a local response. As such, the states within the U.S. have various designated government officials who possess the authority to call for the establishment of surge hospitals. In Texas, for example, the county judge has the power to order the creation of a surge

hospital. However, if it becomes clear that the emergency will have a statewide effect, the governor takes charge of the effort and delegates the establishment of surge hospitals to the senior medical officer in the state, usually the commissioner of health or director of the public health department. This is what occurred as Texas prepared for Hurricane Rita.

### The state's senior medical officer's role in surge hospitals

The senior medical officer in the state appoints a medical director of the surge hospital, who then assembles a set-up team. Sometimes the person recommended to oversee the creation of a surge hospital is a physician who has developed a relationship with state officials and has become a trusted advisor. This is the way Raymond Swienton, M.D., FACEP, was given the authority to recommend the sites for and supervise the opening of the surge hospitals at Louisiana State University (see p. 16) and at an empty former retail store a few blocks from the Earl K. Long Medical Center in Baton Rouge (see p. 19). Swienton is the co-director of Emergency Management Services of the Disaster Medicine and Homeland Security Section, and associate professor, Division of Emergency Medicine in the Department of Surgery at the University of Texas Southwestern Medical Center at Dallas. In addition, Swienton served as a senior advisor to the State of Louisiana's Secretary of Health as well as the State Health Officer and staff. Over the previous two years, he has become well known to the senior state health care leadership by providing disaster preparedness education and training programs and helping establish these programs statewide.

## Effective communication in and with surge hospitals

Communication is often the weakest link in mass casualty incident responses.[3] This fact is borne out by the experience of those who worked in the post-Katrina surge hospitals in Louisiana and Texas. The surge hospital at the empty former retail store site was no exception to this rule. Cellular access was sporadic at best and often not available for an hour or more. Radio communication with arriving buses or emergency services vehicles was essentially nonexistent. Inside the facility itself, communication posed a separate challenge because of the size and acoustic environment of the facility.

A redundant communications system that includes two telephone systems, two-way radios, more reliable paging systems, and better satellite communications needs to be explored to mitigate the negative effects of poor communication on patient care.

# Other issues to consider

## Sufficiency of care

Ideally, the goal of the surge facility is to maintain high standards of care. In practice, however, medical treatment in a surge hospital may reach only the level of sufficiency of care because of the challenging circumstances under which the facility must operate. (See figure below for an illustration of the difference between the standard of care and sufficiency of care.)

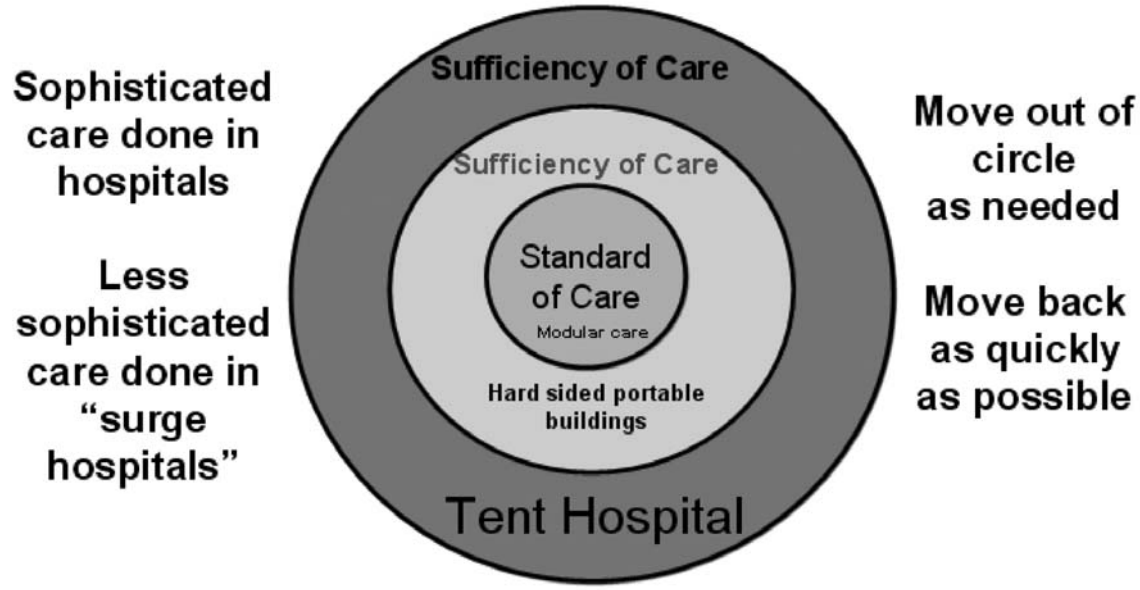
In a sufficiency-of-care facility, the medical staff faces challenges such as limited privacy for patient assessments, crowded conditions, limited access to medical records, and inadequate access to testing capabilities. For example, of all the surge hospitals set up after Hurricane Katrina, the empty former retail store (see p. 19) veered the furthest from the accepted standard of care—but it still delivered sufficient care. The goal of any sufficiency-of-care-facility is to treat each patient and then transfer him or her to a facility with full capability to treat patients at an ideal level of care. Again, this is what occurred at the empty former retail store site, which remained open for only five days.

The veterinary hospital in College Station, Texas, (see p. 21) was able to deliver a higher quality of care because, although it was intended for use as an animal hospital, it contained most of the equipment and supplies necessary to treat human patients. In addition, electrical power, the water supply, and the telephone system were all in working order and it had backup power systems, access to medical gases, and a high standard of cleanliness.

Any plan for a surge hospital that is envisioned as a sufficiency-of-care site should be part of a

**Standard of care vs. sufficiency of care**

The concept of sufficiency of care—medical care that may not be of the same quality as that delivered under nonemergency conditions, but is sufficient for need—is often the reality of surge hospitals because of the difficult circumstances in which care is provided.



community response network. This way, all invasive procedures, deliveries, or surgical needs can be transferred to a standard-of-care-based hospital unless emergent intervention is needed to save a life. To handle such emergent cases, advanced airway equipment, ventilator support, portable dialysis units, and monitoring capabilities should be available on site.

## Legal and reimbursement issues

Anytime health care workers perform volunteer services, they expose themselves to the risk of having claims filed against them by patients who believe they have been harmed during the delivery of care. The state and federal governments have methods by which the law can be changed to provide some liability protection. During the crisis in the Gulf Coast, for example, the governor of Louisiana waived the state of Louisiana licensing restrictions to allow access to all licensed providers throughout the U.S. The federal government also set aside certain national laws so that health care workers responding in an emergency could act as their professional judgment dictated while delivering care without fear of medical liability. For example, the U.S. Department of Health & Human Services afforded liability protection to health care workers who volunteered to treat hurricane victims.

The Emergency Medical Treatment and Active Labor Act (EMTALA), which states that emergency rooms must diagnose, treat, and stabilize a patient before being able to transfer him or her, was also waived because, during an emergency, transfer may be the most expedient action. By prearranged cooperative agreement, particular medical centers in a community may be designated to accept certain types of patients, such as burn or trauma victims. Therefore, if a burn victim arrived at a surge facility during an emergency, the patient would immediately be transferred to the preselected hospital.

A number of recent laws and agreements have made it easier for medical personnel from other regions to provide health care assistance to affected areas. The need to make the best possible use of volunteer health workers in an emergency led to the development of the Emergency System for Advance Registration of Health Professions Volunteers (ESARHPV)[4]. This act, still in its developmental stages, will enable each state and U.S. territory to set up a standardized, volunteer registration system for medical workers. Each state's system is designed to contain up-to-date information about a volunteer's identity, licensing, credentialing, accreditation, and privileging in hospitals or other medical organizations. Such a system will allow each state to rapidly identify professional health care volunteers during mass casualty events and will enable states to share these preregistered and already credentialed health care workers nationwide.

The Emergency Management Assistance Compact (EMAC), enacted by Congress in 1996, also facilitates mutual aid between 49 U.S. states, the District of Columbia, Puerto Rico, and the Virgin Islands in times of crisis. EMAC, which is administered by the National Emergency Management Association, is not an agency of the federal government, but is instead an agreement among the states to provide aid across state lines when any type of disaster occurs. The governor of the affected state must first declare a state of emergency, and then the state can request the assistance it needs. This appeal then activates the response from other EMAC-member states, putting the EMAC system of coordination and deployment in motion. EMAC garnered national attention in 2004 when four major hurricanes hit the U.S. in a six-week period, triggering what was then the largest use to date of state-to-state mutual aid in U.S. history.

Under the compact, licensed physicians or other health care workers who travel to any of the EMAC member states or territories (once the conditions for providing assistance have been met) will have their credentials honored across states lines. EMAC provisions addressing liability and workers compensation issues for these personnel alleviate the financial and legal burdens of the responding states.

EMAC enabled a massive deployment of medical personnel and resources in response to Hurricanes Katrina and Rita. More than 31,000 workers, including medical personnel, search and rescue staff, law enforcement officers, waste management experts, and fire fighters were dispatched from dozens of states to Louisiana and Mississippi.

Reimbursement is another issue that the federal government would need to examine so that certain provisions of reimbursement for Medicare and Medicaid might be relieved in a disaster situation. Some of these federal requirements involve certifying the quality of the facility, the privileging of its staff, and the upkeep of medical records to secure reimbursement from the federal government. Many of these requirements would have to be set aside so that the health care system does not end up with two disasters—one caused by the event itself, and the other caused by the loss of revenue to the health care organizations involved in providing care.

# Ensuring that long-term surge hospitals offer safe care

All surge facilities must ensure that the care they provide is safe. In addition, certain quality assurance processes must be followed in surge hospitals so that, for example, patients are identified and drug errors do not occur. The longer a facility remains operational, the more demands must be made on both its environment of care and the process of care delivery to make sure they are in line with high standards of care. These demands can ensure that, while expedient care may be given, substandard care is never allowed.

The possibility of surge hospitals operating on a long-term basis adds a third dimension to the concept of the emergency event itself. Health care organizations are used to thinking about emergency events on two levels of magnitude, each with its own response. The first level of emergency can be called the major incident. Examples include a school bus accident with multiple casualties, or an industrial explosion producing numerous burn victims. The local hospital needs to respond by activating its emergency management plan in order to have enough staff available to manage the situation; however, this type of event is usually short-lived—lasting perhaps 24 hours—and the community and its hospital both remain intact.

The second type of emergency event can be characterized as the disaster. For example, Hurricane Katrina was a disaster in Gulf Port and Biloxi, Mississippi, because the health care infrastructure was damaged as was the infrastructure of the community. The disaster presents as a community-wide problem that can extend for many weeks or months and may need extensive state and federal resources to ameliorate the situation.

The third level of emergency, virtually unvisited by health care planners until recent events thrust it into view, can be described as the catastrophe: a series of disasters occurring to the same community in a short period of time. What happened in New Orleans after the levees broke was a catastrophe. First, the hurricane hit, causing serious but manageable damage. Then the levees broke, flooding the city. As a consequence, the community's entire infrastructure broke down: sewer, water, and electrical power were all disabled. The ability of health care and emergency medical services to respond was totally disrupted. Finally, civil disturbance occurred as desperate people fought to survive. This event was unprecedented in recent U.S. history and can only be compared to the San Francisco earthquake and fire of 1906, which ranks as one of the most serious natural disasters of all time.

What happened in New Orleans has forced health care organizations to think about how surge hospitals can be used on a long-term basis to supply needed medical care. Most pointedly, Charity Hospital, which was significantly damaged in the disasters, has prompted the need for patients who would normally be treated at the hospital to instead seek care at surge hospitals in the area. The surge hospital that was initially established in this area (and which will be developed further in two additional phases) could be used by the Federal Emergency Management Agency (FEMA) as a model for the nation.

The initial stage of the surge hospital that was set up after Charity Hospital was severely damaged was the tent hospital established on October 8, 2005, in the parking lot of the old Charity Hospital. This surge hospital remained in place when this publication went to press. The next phase being considered is a hard-sided shelter system with individual rooms, each with its own bathroom.

Louisiana State University (LSU), which operated Charity Hospital, expects to set up a modular component structure over the next six months that has been used nationwide and meets all Joint Commission standards. Such a structure may represent a permanent solution to the problem of a replacement for hospitals that must be rebuilt due to extensive damage from a disaster. This type of premanufactured component construction is assembled on site and is built to last for years. Alternatively, the permanent facility might evolve into a site that has a main hospital downtown with eight satellite offices that could accommodate outpatient surgery suites or clinics. These satellites could be converted into surge hospital space within hours. Other options were being considered as this paper went to press.

## Possible development of Joint Commission standards for surge hospitals

In the aftermath of the hurricanes that caused significant damage to health care organizations on the Gulf Coast, the Joint Commission is considering the development of a set of standards with which surge hospitals would need to comply. These standards would assure the public that the care received in a given surge hospital—or in the health care system as a whole—is safe. If the development of these standards moves forward, the Joint Commission will work with health care organizations that are developing plans for surge facilities so that these standards can be implemented quickly and with minimal cost.

# Case studies

This section examines several surge hospitals that were set up after Hurricanes Katrina and Rita devastated the Gulf Coast. They illustrate the variety of forms the concept can take as well as the variety of responses medical personnel were able to coordinate in response to the recent disasters.

## Case Study 1: "Katrina Clinic," Houston, Texas

The Houston Astrodome served as a shelter for more than 25,000 of the people who fled the levee breaches that followed Hurricane Katrina's destruction in New Orleans. In response to this onslaught of evacuees in crisis, many of whom had lived in appalling conditions for days, Harris County Hospital District (HCHD) in Houston set up "Katrina Clinic" in Reliant Arena, a building adjacent to the Houston Astrodome. In partnership with HCHD, physicians and faculty from Baylor College of Medicine (BCM) staffed the clinic with other medical volunteers from throughout the region.

Three days after the storm hit, Harris County, Texas Judge Robert Eckels and Houston Mayor Bill White asked George Masi, chief operating officer of the Harris County Hospital District, to coordinate a facility that could manage the health needs of the arriving multitudes. The Houston Astrodome in Reliant Park, in ordinary times used as a livestock exhibition hall, had been long designated a shelter by local officials involved in disaster planning. The team from HCHD and its physician staff from BCM had roughly 15 hours to prepare before the first busload of patients arrived.

The set-up team employed stored rods and curtains used for exhibitions to separate rooms into spaces that could be used for patient registration, triage, exam rooms, and a pharmacy. Tables, computers, photocopiers, telephones, and full sets of medical equipment and supplies were deployed from HCHD and brought to the clinic, which had the benefit of full electrical power, working toilets, and potable running water. The team acquired a number of donated X-ray machines from a national medical supply corporation and a major pharmaceutical company sent a mobile laboratory on an 18-wheeler truck. Two national drug store chains set up pharmacies at the site, one housed in two mobile homes. Many local businesses donated medical supplies and the Red Cross provided cots. For the most part, the 100,000-square-foot clinic was prepared to provide care to patients by midnight.

Supervised by medical director Thomas Gavagan, M.D., MPH, vice chair for community health in the Department of Family and Community Medicine at BCM, the clinic processed 150 patients per hour over 15 days—or a total of more than 10,000 people.

Originally equipped with 20 examination rooms, the clinic quickly ballooned to 65 exam rooms. The medical staff members worked 36 hours straight after the clinic opened, and were finally relieved after a call for medical volunteers produced about 2,700 responders. For the rest of the time, 25 physicians were assigned to work per each 12-hour shift. The staff administered thousands of immunizations—10,000 tetanus shots alone—and filled a similar number of prescriptions. The site remained an outpatient facility; acutely ill patients were sent to local hospitals for treatment.

Paul Sirbaugh, M.D., Director of Prehospital Medicine at Texas Children's Hospital, oversaw a special pediatric clinic at the Astrodome so that children could be seen by a physician without having to be separated from their parents. Mental health needs were seen as crucial to the care of hurricane survivors, so psychiatric staff from BCM stepped in to provide mental health counseling.

The clinic's medical staff treated patients with broken bones, chest pain, and withdrawal from drug addiction, but most of the patients had

chronic conditions, such as asthma, diabetes, and high blood pressure. One patient presented with a gunshot wound to the arm. On the fourth day of operation, physicians began to see quite a few pediatric patients with some type of gastrointestinal infection that caused diarrhea and vomiting, presumably from exposure to the contaminated water in New Orleans. The infection was transmitted to several hundred people before physicians identified the cause as the Norwalk virus and promptly provided treatment. As the number of acute care cases decreased, evacuees at the Astrodome began requesting assistance for more mundane medical needs, such as prescription eyeglasses or other minor complaints for which they could not seek care in New Orleans because of a lack of health insurance.

As patients continued to pour into Katrina Clinic, Houston's mayor requested that a second clinic be opened at the George R. Brown Convention Center. Physicians from the University of Texas Health Science Center in Houston staffed this site. It processed 500 to 700 evacuees each day, for a total of more than 9,000 patients.

Katrina Clinic remained open for 2½ weeks at a cost of $4.1 million. After it closed down, the Red Cross established an outpost at the site to deliver first aid to evacuees.

Thomas Gavagan, M.D., MPH served as the primary source of information for this case study.

## Case Study 2: Dallas Convention Center

Physicians, employees, and students from the University of Texas (UT) Southwestern Medical Center at Dallas began gearing up their relief efforts even before Hurricane Katrina evacuees started pouring into Dallas. They established a medical command center at the Dallas Convention Center, where they set up a surge facility. The site for the facility was chosen by officials from the City of Dallas Office of Emergency Management and the city fire marshal's office, Dallas Fire-Rescue.

In Dallas, faculty and employees from UT Southwestern volunteered in large numbers, working at Reunion Arena and the Dallas Convention Center to help with the relief effort. Volunteers included physicians as well as nurses, pharmacists, respiratory therapists, and allied health care workers.

Kathy J. Rinnert, M.D., MPH, assistant professor of emergency medicine at UT Southwestern Medical Center in Dallas and attending physician at Parkland Health and Hospital Systems and Raymond Fowler, M.D., associate professor of emergency medicine at UT Southwestern Medical Center and deputy medical director for operations and quality assurance for the Dallas Area BioTel (EMS) System, both served as medical directors of the site. More than one hundred physicians from UT Southwestern as well as medical staff from Parkland Health and Hospital Systems, Children's Medical Center of Dallas, Methodist Hospital of Dallas, Medical City Hospital, and Baylor Medical Center worked up to 20-hour days to care for the sick and injured. The site was staffed locally with no support from out-of-state medical volunteers. Facilities included an 11-bed urgent care center and a 20-bed chronic care center.

The 8,200-square-foot surge facility was open from September 1 through September 16. Faculty, staff, residents, and medical students treated more than 4,000 evacuees during the first week alone, and a total of roughly 8,600 patients over the 16 days of operation. The medical staff treated not only patients from the shelter set up at the site, but also those from other shelters and hotels in Dallas. Wounds were the principle injuries seen

during the first three days, followed by gastrointestinal disorders, and then acute exacerbations of chronic medical conditions such as asthma, diabetes, and cardiovascular problems.

Located one sub-basement level down from the main floor, the facility shared space with an evacuee shelter ringed by a variety of social service agencies, such as the Red Cross, the Salvation Army, and the Texas State Child Protective Services Agency. Medical equipment, supplies, and pharmaceuticals came from the local medical community, primarily Children's Medical Center and Parkland Health and Hospital Systems, the largest contributor. Telephones, copiers, fax machines, and other office equipment were provided by the City of Dallas.

According to Rinnert, the main advantages of a surge facility site such as a convention center include the flexibility of the space, which can be cordoned off as circumstances dictate, and the availability of air conditioning in a climate that normally averages more than 100° Fahrenheit in September. Several disadvantages were the austere appearance of the site, which had bare concrete floors and harsh fluorescent lighting, and the absence of showering facilities. Overall, however, the convention center proved to be a satisfactory environment for a surge facility.

Kathy J. Rinnert, M.D., MPH, served as the primary source of information for this case study.

## Case Study 3: Basketball arena and field house at Louisiana State University, Baton Rouge

### Planning for the surge hospital

When Jimmy Guidry, M.D., the state health officer of Louisiana and medical director for the Louisiana Department of Health & Hospitals (DHH), heard that large numbers of patients had not been evacuated from New Orleans hospitals and nursing homes before Hurricane Katrina hit, he decided that the state needed to have an additional acute care facility in place in Baton Rouge, knowing that existing hospitals would be inundated with patients. Raymond Swienton, M.D., served as an advisor to Guidry to aid in the selection of the site for this surge hospital. Because of a longstanding relationship between the DHH and Louisiana State University (LSU), Guidry selected Chris Trevino, M.D., director of emergency medicine at St. Elizabeth's Hospital in Gonzales, Louisiana, and medical director of emergency medical services for the state of Louisiana, to oversee the establishment of a surge hospital at the university. Guidry then chose the LSU Pete Maravich Assembly Center (PMAC), a basketball arena, as the site of the surge hospital and LSU's Carl Maddox Field House, located next door, as a special needs shelter. The two sites were chosen because of their size and the availability of medical staff from LSU.

Guidry selected Walter Cain, M.D., medical director of LSU's Fire and Emergency Training Institute and attending physician at Earl K. Long Hospital, a part of LSU's Health Care Services Division, to set up the special needs shelter. Cain then asked Stephen Barr, assistant technical director of the LSU Theater, to help convert the field house into a special-needs hospital, primarily for nursing home patients.

### Setting up the surge hospital

The PMAC began as a medical triage facility, but was soon transformed into a surge hospital. The 800-bed facility at the PMAC became the largest acute care field hospital to be established in the U.S. since the Civil War.

The LSU administration drew on its student government to take charge of the volunteer efforts of

the students, faculty, and staff. The student leaders set up a volunteer hotline and Web site for volunteer registration. They handled more than 1,000 calls per day from people at LSU who wanted to volunteer or provide lodging to displaced persons or emergency personnel. Student volunteers staffed 80 to 90 people per shift to work in both hospitals. After the schedules were finalized, the students called volunteers back to give them their shift assignments. The student leaders managed nonmedical volunteers both at the field house and at the PMAC. Eighty-five nonmedical volunteers worked 12-hour shifts daily. Student volunteers also helped set up the surge facilities by moving boxes, setting up shelves and tables, and performing other nonmedical tasks. LSU Chancellor Sean O'Keefe met with medical staff daily to assess their most pressing needs.

A significant number of health care providers arrived from out of state. For example, the Illinois Medical Emergency Response Team assisted teams from medical centers in Texas as well as local medical volunteers from Baton Rouge, especially those from St Elizabeth's Hospital.

The special-needs hospital at the field house took only approximately two days to establish because the state had experience in creating back-up special-needs facilities for nursing home patients who have to be evacuated because of power outages and other similar problems. Setting up the PMAC had to proceed rapidly because patient arrival was imminent, so the emergency room at the PMAC was up and running in eight or nine hours. Electricity was in good working order and generator backup was available.

The DHH, through one of its components, the Bureau of Emergency Medical Services, was intimately involved in the emergency room's set up, providing both paramedics and supplies. Two years before, Guidry and the rest of the medical leadership in the state had evaluated what it would take to set up a field hospital and had purchased supplies and equipment through a grant from the U.S. Department of Homeland Security. As a result, the state already had a 200-bed hospital and all the supplies associated with it in storage. Training had also been in place. In fact, just a week before, the state held a disaster exercise to prepare for a fictional storm named "Hurricane Pam."

Private emergency medical service companies lent volunteers and equipment. Trevino also obtained assistance from the nursing, respiratory therapy, and other professional staff at St. Elizabeth's Hospital to set up and staff the PMAC emergency room. During the first 48 hours of operation, the medical and professional staff worked straight through, without leaving the facility, perhaps sleeping for an hour or two at a time. After the third day, hundreds more volunteers from other local hospitals arrived to lend a hand, but the huge volume of patients continued to demand 12-hour shifts or more.

Large sports arenas typically have sizeable entry ports where trucks can easily bring equipment into the site. The medical team chose one of the larger of these ports as a triage center. They set up tables in the port, where physicians and nurses could examine the patients coming in by ambulance or bus and then send them into the arena on foot or by wheelchair or stretcher. At times, convoys of up to 15 ambulances, each carrying four patients, would arrive at once. Busloads of 50 patients would also arrive; sometimes, only a few on each bus were ill. Healthy passengers who had traveled 60 miles from New Orleans wanted to exit the bus, use the bathroom, and have something to eat or drink before getting back on the bus to be transferred

elsewhere. Patients coming in by helicopter entered at a different port and then were triaged. In total, both hospitals treated or housed roughly 6,000 patients in addition to the people who simply used the facility as a stopover before being bused to a shelter. Counting those people, both facilities served 15,000 to 20,000 people.

Areas of the PMAC were reserved for laboratory, X-ray, electrocardiogram, and ultrasound services. The staff also arranged for dialysis patients to be transported to a local dialysis center for treatment. The hospital even had 80 beds equipped with a cardiac monitoring system. As for meals, one of the larger local church groups called Trevino and announced they could provide up to 16,000 cooked meals a day for both the PMAC basketball arena and the special-needs field house next door. LSU volunteers also donated food. Meals were provided four times per day so that staff and volunteers could eat during night shifts.

Security was initially provided by the LSU security force and was later supplemented by SWAT teams and the National Guard. Neither site had a major security incident, although a potential security threat occurred when healthy individuals arriving in buses were originally told they could not leave the bus unless they were sick. This problem was resolved by allowing everyone off the bus to freshen up and have some food and drink. After the riders understood that the facility was a hospital and not a shelter, they returned to their seats on the bus.

## Treating patients

As patients poured into the facilities at LSU, they quickly filled the basketball arena's emergency room to capacity and spilled over into the field house for four to five days. The initial surge of patients was from hospitals and nursing homes, but buses full of evacuees soon transported a population of all ages to the facilities. The principal condition treated was the exacerbation of chronic medical conditions such as diabetes or asthma because of dehydration and because patients had not been able to take their prescribed medications for several days. Another issue was the fact that some patients could not recall the names of the medications they had been taking. The staff also saw some cases of trauma and delivered several babies who needed resuscitation. At one point, the hospital had 14 ventilatory patients. Because the patients arrived so early after the disaster, only a few cases of infectious disease, such as abscesses and cellulitis, were seen.

When the patients came in such waves, the primary goal of the medical team was to treat them as quickly as possible. After the first day, the documentation process began to take shape and by the third day, the site had a full medical records system in place.

As soon as it became apparent that large numbers of new patients were no longer arriving from New Orleans, Trevino began to close the PMAC facility down, recognizing that, as functional as the facility was, it was not optimal for patient care; however, as of this writing, the LSU field house remains open as a special-needs shelter for nursing home patients.

## Some disadvantages

As a university with more than 30,000 students, LSU presents some disadvantages as a surge hospital site. For example, housing a medical facility at a university can be disruptive to student life. Imagine seeing Blackhawk helicopters full of evacuated patients landing on the quad. Secondly, sheltering sick patients and medical personnel on a university campus holds the potential for transmission of disease. Operationally, it is problematic

to expect a university to essentially shut down its educational function and take over disaster relief in an emergency. Other venues, such as an exposition center similar to the Houston Astrodome or other multiuse facilities, can more easily cancel events to gear up for an emergency situation while maintaining logistical and infrastructure support.

Chris Trevino, M.D., served as the primary source of information for this case study.

## Case Study 4: Empty former retail store in Baton Rouge, Louisiana

### Establishing the surge hospital

Physicians from the University of Texas (UT) Southwestern University Hospitals took leadership positions in providing emergency care and mental health services in the state of Louisiana after Hurricane Katrina struck the Gulf Coast. UT Southwestern's Raymond Swienton, M.D., and William M. Cassidy, M.D., associate professor of medicine at Louisiana State University Medical Center (LSU), chose to locate one of the temporary field hospitals in a building that had formerly housed a large retail store in Baton Rouge, Louisiana. They chose the site because it was located just one half block from LSU's Earl K. Long Medical Center and because LSU had been in the process of purchasing the property, which was to be torn down to make space for the construction of new clinics. The location proved to be desirable in terms of management of emergencies, medical staffing, and supplies.

Cassidy served as medical director of the facility, but he gave responsibility for the actual set up to Steven Winkler, MHA, former senior director of risk management at Baton Rouge General Medical Center, and Monica Nijoka, MHA, BSN, R.N., former vice president of patient care services at the same medical center. The team first arrived at the site at 4:30 P.M. on Thursday, September 2, 2005. By 7:00 P.M. the next day, they were ready to provide care to patients.

The neglected site was daunting. The floor was greasy and layers of dust covered everything. There was virtually no lighting, the telephones were out of order, and only one toilet functioned. The inside temperature reached 100° Fahrenheit. Over 400 volunteers worked to clean the site, remove trash, fix the plumbing, and install electrical outlets and emergency power. Winkler and Nijoka designed the layout of the surge facility and developed a staffing plan for the professional staff. They supervised information systems personnel who installed a computer system that would allow medical staff to document information in computerized patient records.

At the Louisiana Department of Health and Hospitals, urgent contracting deals were made with national vendors to acquire medical supplies, medications, beds, and other equipment. These expensive acquisitions were needed because the state stockpiles had already been deployed at the LSU campus sites. The team obtained the rest of its materials by way of donations from local supply houses, physicians' offices, and hospitals. Intravenous (IV) poles never appeared, so the staff made do by stringing rope along the ceiling and then using metal chips to hang the intravenous bags from the rope. They set up the pharmacy in the area where the store's pharmacy had originally been.

### Treating patients

Most patients were assessed at the centralized triage station at the PMAC Center on the LSU campus and then transported to the surge hospital by emergency medical services or bus.

Staffing at the site consisted of physicians, nurses, technicians, social service workers, and other health care workers from local hospitals, home health care agencies, and physicians' offices. Disaster medical assistance teams (DMATs) from all parts of the U.S. also descended on the site, with particular assistance from the DMAT in Iowa. Most of the professional staff worked in 12-hour shifts, while nonmedical volunteers put in shifts that lasted from one to 36 hours.

Volunteer medical workers fulfilled a number of vital roles, including nursing, pharmacy, registration, central supply, social service, mental health, discharge planning, waste handling, respiratory therapy, and food service. In addition, a number of local restaurants, caterers, and church groups sent cooked meals to the site. Several volunteers were dedicated to the scheduling of professional and nonprofessional staff and also assisted in the credentialing of the professional staff. Many local volunteers also sorted and distributed the donated clothing and toys brought to the site.

The team decided to locate the triage area in what had been the oil-change department inside the store's automotive service center because it afforded a wide space that could accommodate incoming buses and ambulances. Triage was divided into two areas: decontamination/security and registration/medical triage. The local fire department set up portable showers outside of the building where patients showered and were given clean clothing before entering the building. Most of the clothing worn by patients had to be destroyed because of contamination from the polluted water that had flowed into New Orleans. After being scanned for weapons by hand-held security wands, patients proceeded through registration and into medical triage, where physicians, nurses, and paramedics assessed their vital signs and general condition. The state police, National Guard, and a private security guard firm maintained security at the site.

The surge hospital served about 250 patients over the course of three days. Like the other post-hurricane surge hospitals, this facility mainly saw patients whose chronic conditions were made worse by the loss of their prescribed drugs. Although the medical staff saw some rashes and infections from exposure to contaminated water, their main task was to stabilize the patients and get them back on their prescribed medications. The staff maintained paper records and computer files on all patients that included information about where they were transferred or discharged.

## Lessons learned

In the confusion that occurred after Hurricane Katrina hit, communications seemed to be the weakest link at the site. The telephone system took a long time to be installed and cellular phones were inoperable most of the time. When communications did get through, the information was often incorrect. For example, the hospital team was told that the location would be used heavily to free up space at the two surge facilities set up at LSU. However, the site was closed after three days while the field house at the university remained operational for weeks after the event. Twice word came that many more patients would soon be arriving, but additional patients never arrived. In fact, the hospital could have handled many more patients. As a result, the staff viewed the facility as sound but underutilized.

Overall, the strongest factor was the spirit of volunteerism among the workers. When asked to perform, volunteers and local suppliers could not do enough, according to Winkler and Nijoka. Only two suppliers refused to send

needed provisions, because the hospital could not issue purchase order numbers, and had no means to ensure payment.

Steven Winkler, MHA, and Monica Nijoka, MHA, BSN, R.N., served as the primary sources of information for this case study.

## Case Study 5: A veterinary hospital in College Station, Texas

Hurricane Rita also produced an unlikely site for a surge facility: the Large-Animal Hospital at the College of Veterinary Medicine and Biomedical Sciences at Texas A & M University. The university transformed the veterinary hospital into a special needs shelter that cared for 320 patients—primarily geriatric nursing home patients, pediatric burn victims, physically handicapped children, and home health care patients—from Houston and Galveston. University staff emptied the hospital of all of its animals (including 20 horses), then cleaned and sterilized the building and made it ready for use in less than a day under the direction of William Moyer, D.V.M., head of the Department of Large Animal Clinical Sciences. At its peak on the night before the hurricane hit, the facility housed about 650 people, including patients, families, and caregivers. The transfers of high acuity patients from less sophisticated shelters into this facility and free transfers back and forth between the surge hospital and St. Joseph Hospital, the largest hospital in the area, allowed St. Joseph Hospital to never exceed 80% occupancy. This enabled the standard of care to be met despite transfers of large numbers of patients with critical medical needs.

Paul Carlton, M.D., of the Texas A&M University System Health Science Center (HSC), served as the medical director of this surge hospital. Carlton, a former surgeon general of the U.S. Air Force, worked with HSC staff as well as representatives of the CDC, Public Health Service, and FEMA to establish the facility. The volunteers set up the first 600 bed component before the arrival of any outside help, and an additional 500 beds from the CDC were added before the storm hit. Thus, the 1,100 bed surge facility was prepared to provide care prior to Hurricane Rita's assault. The staff included physicians, nurses, medical and veterinary students, and many volunteers. Only one medical procedure had to be done, which was to treat an abscess. At one point, Evelyn Castiglioni, Ph.D., head of the university's Department of Veterinary Anatomy and Public Health and an accomplished harpist, calmed patients with an impromptu concert. The hospital remained open for six days.

### Lessons learned

The main advantage of converting veterinary hospitals into surge hospitals is their state of readiness. The state-of-the-art facility was a fully equipped hospital, so no building issues had to be dealt with. The power system had an emergency generator for continuous power if commercial power was lost and the building was plumbed with medical gases and suction so that portable equipment did not have to be used. Use of this site shows that a veterinary hospital can be an ideal model for the surge hospital in a catastrophic situation.

# Closing Comment

Advance planning, coordination of resources, effective communication, and visible leadership are critical to ensuring that surge hospitals can be set up quickly and can provide care to patients during emergencies. Health care organizations must prepare for the possibility that their buildings could be too damaged to function during as well as after a disaster, necessitating the use of surge hospitals—some of which may need to operate for months or years until permanent health care organization facilities can be rebuilt. As the Joint Commission considers the need for standards to ensure the quality of care being provided at surge hospitals, health care planners at all levels must familiarize themselves with the challenges associated with surge hospitals and must develop thorough plans for their use in emergencies.

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