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.