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A SUPPLEMENT TO PEDIATRICS

Hurricane Katrina, Children, and Pediatric Heroes

HANDS-ON STORIES BY AND OF OUR COLLEAGUES HELPING FAMILIES DURING THE
MOST COSTLY NATURAL DISASTER IN US HISTORY

This supplement was made possible by grants from Baton Rouge Neonatal Associates, Children's Health Corporation, Children's Hospital of Alabama, Texas Children's Hospital, the Children's Health Fund, National Association of Children's Hospitals and Related Institutions, and the Michael and Helen Metrock Charitable Foundation

American Academy of Pediatrics

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Carden Johnston, MD, FAAP, FRCP, Supplement Editor; Irwin Redlener, MD, FAAP, Supplement Co-editor

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The content of the journal is intended to encompass the needs of the whole child in his physiologic, mental, emotional, and social structure.

The single word, PEDIATRICS, has been chosen to indicate this catholic intent.

Hugh McCulloch
PEDIATRICS, January 1948

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Pediatricians Providing Sophisticated Care Under Extreme Conditions

Carden Johnston, MD, FAAP, FRCP^a, Irwin Redlener, MD, FAAP^{b,c}

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KATRINA. THE WORD now brings up images of news reports of the disaster caused by the flooding after the hurricane. The news was bad, with people stranded in their homes or hospitals, not being able to eat, bathe, or drink water, and a slower-than-desirable rescue. There is a lot of good news as well and a lot of heroes, who have stories to tell about what they did and how they did it during the disaster. Many were recounted at the 75th anniversary meeting of the American Academy of Pediatrics (AAP) in Washington, DC, just over 1 month after the storm. These were experiences that needed recognition, that needed telling publicly, and needed to be in print and in the archives. The editors of *Pediatrics* are providing an opportunity with this supplement, and donors (thank you very much) are making it happen.

This supplement will report some of the experiences of pediatricians and others who cared for children in New Orleans, Louisiana, who were impacted by Katrina. Yes, there are other disasters, natural or man made, affecting children, and yes, there are other hurricanes, and yes, there were other parts of our country impacted by weather in 2005. However, the devastating flooding of New Orleans and an extraordinary 90 000 square miles of disaster impact on the Gulf Coast made Hurricane Katrina the most costly natural disaster in the history of our country. Because of the huge impact of this particular disaster and because of the thousands of contributions of pediatricians and others who care for children in the affected communities (and because of limited space in this supplement), we are focusing on just one small aspect of just one disaster.

The criticism of this supplement we expect to hear is that too many contributions are omitted. This is true. Although there may be a disproportionate focus on ne-

onates, their stories too have huge omissions. So, the reader will want to know, where are the other stories? What about the transport teams relating what happened in their vehicles? What about the hematologists who called patients and communicated what phase of what protocol they were on so their chemotherapy could be continued at a remote center? What about the pulmonologists who provided continuing care to their children on ventilators as well as children with chronic lung disease? What about the cardiologists who were preparing children for cardiac surgery in the next few days? What about the pediatric surgeons who were set to provide life-saving and -enhancing surgery to children in need? What about the hospital staffs (housekeeping, social service, food service, maintenance, security, etc) who kept care going even while their own families were in harm's way? The list goes on and on and on. All were omitted from this supplement, but those stories, too, need to be recorded.

Almost every pediatrician in the South has a story to tell, and with evacuees going to at least 48 states, there are stories of importance from all of those states. We cannot include all experiences. We have chosen to highlight just a few of our compadres' compassionate, concerned care of children under extreme circumstances,

Key Words: Hurricane Katrina, transport medicine, emergency medicine, hurricane, disaster, flood

Abbreviations: AAP, American Academy of Pediatrics

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and these are incomplete as well. However, the AAP is encouraging all pediatricians to document how Katrina impacted them and send the information to:

John O'Brien
AAP, PO Box 927
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These stories will be read, some will be put on a Web site, and all will be archived for disaster-management planners and historians to access.

Even the longest article in this supplement is woefully incomplete. There are chapters buried in just a sentence. For example: "the pediatrician could not find transport, so they drove the neonates in their cars"; "elevators in the hospital are not working, thus requiring hand transport of a patient and 500-lb VAD [ventricular assist device]"; and "the pilot said there was no room for the Isolette."

Fortunately, we were able to get some wonderful reports into this supplement and into pediatricians' libraries. Most of us will vicariously relive the experiences of our peers. This supplement is just a blink of time in a drama that continues to unfold. We worry about the omissions that should be, but are not, contained in this supplement.

The underlying purpose of a document such as this is, of course, to learn. Already the AAP, federal, state, and local governments, foundations, research people, and disaster planners are going over the lessons that Katrina taught us. Most will be applicable to other disasters that affect children regardless of whether they are man made or caused by nature.

Now a challenge lies before us: how do we assimilate all of those experiences into our lives to an advantage for children who will be impacted by disasters later? The AAP is having conferences, workshops, and committees work on disaster planning. There will be a focused presentation at the 2006 National Conference and Exhibition as part of the "Pediatrics in the 21st Century" series.

As we read about Katrina and the care that the children received, we have to be extremely proud of our colleagues. Incredibly, there is no documentation that we know of thus far of hospitalized or transported children who died in association with the effects of the

hurricane, the flood, or the rescue. In situations without lights, without power, and without water, mistakes in dosing of medications should increase exponentially. Equipment is put down in unfamiliar locations and then cannot be found when critically needed. Injuries occur with the staff getting hurt by running into objects, stepping on dropped equipment, falling over unseen material, etc. The heat and humidity cause germs to grow more easily, especially with the lack of clean water and cleansing materials. Staff morale becomes low with the stress of working without food, water, or an end in sight. Yet with all of those stressors, the pediatricians, the staff, the hospital employees did what was needed when needed.

Although we know of 3 unfortunate children who did not survive until out-of-state hospital discharge, there have been no reports of a hospitalized child dying during the storm or transport. This is an incredible testimony to the skills, commitment, education, and dedication to those who work with and love children. They put themselves at risk. More importantly, their patients were put at risk, not only by the disaster but also by the process of evacuation. Our peers were forced to make decisions to violate standard protocols for the right reasons, constantly having to decide which action or situation is less risky for the child. These decisions were made under dire—literally life-or-death—circumstances. The consistency of correct decisions made is more than remarkable: it is close to miraculous.

We stand in awe of the pediatricians and other colleagues who met the challenge of maintaining care of ill children during a major disaster even while their hospital was being evacuated and while improvising and facilitating mass transport. The challenge in front of us is how to be sure that the children whose families have been impacted economically, medically, and emotionally by Hurricane Katrina and the aftermath of the disaster will attain their optimal mental, physical, and emotional health. That is our goal and the mission of the AAP. Pediatricians who rose to the acute need of children during Hurricane Katrina will be rising to the chronic needs of children over the next decade, helping those children become the best adults they can be.

That is what pediatrics is all about.

Children's Hospitals Meeting the Challenge Together

Lawrence A. McAndrews, FACHE

President and CEO, National Association of Children's Hospitals and Related Institutions, Alexandria, Virginia

The author has indicated he has no financial relationships relevant to this article to disclose.

WHEN Hurricane Katrina turned toward Louisiana, children's hospitals and pediatricians from around the nation mobilized to assist Children's Hospital of New Orleans (CHNO) and other area hospitals with patient evacuation, supplies, volunteers, and equipment. The successful evacuation of 72 seriously ill children from CHNO, completed within 24 hours after the decision to evacuate was made, transpired with the help of multiple children's hospitals and many Louisiana hospitals. This experience bears out the fact that no hospital, and indeed, no locality, can rely solely on itself when a disaster occurs.

Overall, I believe it is fair to say that the nation's pediatric community responded to Katrina well. However, I do not believe that there is a question in anyone's mind that we could have done better, that in some cases a child's care slipped through the cracks, or that the next hurricane might be bigger. As surely as Hurricane Katrina left destroyed buildings and flooding in its wake, she left behind an opportunity that pediatric providers cannot ignore: the opportunity to strengthen health care for all children. By examining what worked and what did not work, this supplement takes an important step in that direction.

As the association that represents children's hospitals nationwide, the National Association of Children's Hospitals and Related Institutions had a bird's eye view of the pediatric community's response to Katrina. What worked was the high level of cooperation among pediatric health care providers, including the 4 children's hospitals that aided directly in the CHNO evacuation with helicopters and planes. Many hospitals accepted displaced patients, dozens of children's hospitals provided volunteers that worked alongside hundreds of individual pediatricians in the aftermath, and several children's hospitals held fundraisers for CHNO.

The strong response of children's hospitals to Katrina

victims was the result of years of networking that solidified the relationships of decision-makers and, most importantly, built trust. The strong bonds that most children's hospitals have with specialty and community pediatricians helped communities provide immediate care for injured children and ensured that healthy children stayed that way even as they took refuge in cities across the United States.

Working side by side with community pediatricians, child-focused organizations in the region, and other community hospitals, children's hospitals were reminded that knowing who to call and how to get hold of them is not a luxury but a necessity.

The lack of communication and mutual support between disaster-planning agencies and CHNO was clear. At more than one point during the storm and subsequent flooding, CHNO leaders were unsuccessful in obtaining help from federal, state, and local agencies. This lack of communication forced children's hospitals and pediatricians to create solutions to problems that had not been experienced in the past, and certainly not on the scale of this disaster. In one instance, 2 ventilator-dependent infants were transferred to CHNO from another hospital via a small boat paddled by residents in the early hours of the storm. In another, a make-shift helipad was set up on a grassy field near the hospital with event

Key Words: Hurricane Katrina, children's hospital, disaster planning, disaster relief, Medicaid

Abbreviation: CHNO, Children's Hospital of New Orleans

Opinions expressed in this commentary are those of the author and not necessarily those of the American Academy of Pediatrics or its Committees.

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lights and portable generators helping direct helicopter landings. Children survived because of committed staff who created and implemented these solutions. Administrators, physicians, nurses, laboratory technicians, and respiratory therapists, as well as cooks, housekeeping, maintenance, security, and many others, gave their time despite the needs of their own families. However, there is no question that partnership-building is sorely needed so that children's needs will be a higher priority in the next disaster.

Significantly, one of the reasons that children's hospitals in the region were able to offer much-needed assistance to CHNO, other hospitals in New Orleans, and federal and local governments, was because they had the skills, materials, knowledge, committed staff, and, importantly, access to financial resources. Volunteers contributed countless hours of time, and many businesses and organizations contributed materials, but there are still significant costs in responding to a disaster.

Hurricane Katrina made it clear that our pediatric health system must be financially sound so that it has enough resources to respond immediately in a disaster and to maintain full function in the weeks and months after. The issue of adequate funding of children's health care is particularly pertinent now as significant cuts to the Medicaid program, as well as increases in cost sharing and restrictions on care that children can receive, threaten the remaining resources that children's hospitals have and their ability to rebuild them, not to men-

tion the benefits children need. Medicaid is the single largest health insurer for children and the single largest payer of care delivered by children's hospitals, yet the impact of Medicaid cuts on children and the nation's pediatric infrastructure is a point lost on some policy makers. Now more than ever the pediatric community must stand firm together in demanding that pediatric health care resources be protected and expanded.

Cuts to Medicaid and children's services and benefits could well mean that children's health care providers may not be able to respond as comprehensively to the next big disaster as they did to Katrina, and this disaster has shown what the inability to act quickly could mean to potentially affected children.

Although we, the pediatric community, understand that children (especially those with chronic and acute disease, newborns, and the injured) do not easily fit into disaster-planning scenarios for adults, others do not. We must work together to ensure that the unique needs of children are recognized by community, state, and national disaster-planning agencies and experts. Pediatricians, children's hospitals, and other pediatric health care providers need to be integrally involved when these agencies are creating plans to prepare for and cope with disasters. Likewise, children's providers must work together in our states and at the federal level to strengthen and protect children's health care now so that we will be better prepared to take care of all children then.

Perspectives From a Private Pediatric Practice

Mitchell Gruich, Jr, MD, FAAP

Biloxi Pediatrics Clinic, Biloxi, Mississippi

The author has indicated he has no financial relationships relevant to this article to disclose.

ON AUGUST 29TH, 2005, Hurricane Katrina struck the Gulf Coast region of the United States with an unmerciful force of destruction that resulted in the worst natural disaster ever to occur in the United States. Thousands of people were left homeless, stranded, unemployed, grieving, traumatized, and in emotional shock. Every individual living on the Mississippi Gulf Coast was affected in one way or another by this disaster. Every single person. As a pediatrician in a solo practice in Biloxi, Mississippi, I was thrust into the center of this disaster. Hopefully, my experiences will help others to better prepare for the next disaster.

AUGUST 26: 3 DAYS BEFORE LANDFALL

My nurse, Teresa Oliver, LPN, and I went into hurricane-preparations mode. We carefully packed our vaccines into 2 different containers labeled “private” and “Vaccines for Children” in the event that I would have to transport them to another location. The vaccines are one of the first items to be addressed because of the large amount of money that can be lost to the Vaccines for Children program as well as the physician. In 1998, when Hurricane George struck the coast, I lost my vaccines because of power outage. Since learning that valuable lesson, vaccine preservation is a top priority for me.

I double-checked my generator and backup refrigerator. I gathered up medicines that would be in high demand: antibiotic samples, asthma medicines, spacers, nebulizers, and infant formulas.

AUGUST 27: 2 DAYS BEFORE LANDFALL

When the mandatory evacuation was issued, the telephone calls began, not only from parents of my patients but also from parents whom I had never seen. The requests for asthma and seizure medications were appreciated, but the parents were reminded that without electricity, the children would have to use their me-

tered-dose inhalers and not their nebulization units. The not-so-well-appreciated requests were for antibiotics because the child had a runny nose, cough, just developed a fever, did not eat their last meal, or just looked at their parent wrong. As parental anxiety increases, the desire for antibiotics increases exponentially. An enormous amount of time was spent convincing parents that a hurricane is not an indication for antibiotics.

After I boarded up the windows and doors of the clinic, I transported medical supplies and infant formula to my home. The vaccines would be moved 24 hours before landfall.

Being born and raised on the coast, my wife and I thought we were prepared for the hurricane. She rechecked the “hurricane boxes,” which she resupplies every June with food, water, and supplies to last a couple of weeks (including old-fashioned landline telephones). We topped off our automobiles’ fuel tanks along with the generator and several extra gasoline containers.

During rounds, I counseled, educated, and discharged all possible patients and newborns from the hospital. All were discharged except for a newborn on intravenous antibiotics. Parents were given written pertinent information for care including requests for follow-up bilirubin levels to give to out-of-town physicians.

I started receiving telephone calls from people wanting my opinion about the governor’s order to evacuate. Two days before the storm, the mother of a patient of

Key Words: Hurricane Katrina, private practice, pediatricians

Abbreviation: FEMA, Federal Emergency Management Agency

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another pediatrician wanted advice about where to go. Her newborn was post-esophageal atresia repair and on continuous oxygen, a feeding pump, hourly suctioning, and nebulization treatments every 2 hours. The mother had a portable nebulizer, suction unit, and oxygen. I advised immediate evacuation with family members to Houston, Texas, before the highways became gridlocked. It amazed me that people would think that their pediatrician would override what the weather forecasters, emergency management, and the governor were telling them to do. After 20 to 30 more telephone calls, I shortened my telephone time by politely interrupting and advising evacuation.

Then there were the requests from parents wanting their child to be admitted to the hospital. The parents were anxious; they did not want to go to a public shelter but wanted their child to be admitted to the hospital (one because of a "severe" diaper rash and another because she felt more secure there, although the hospital is 2 blocks from the coast).

AUGUST 28: 1 DAY BEFORE LANDFALL

I transported the vaccines to the hospital for the safest storage I could find. Katrina was not a routine hurricane, and Biloxi was on the strong side of the eye. I felt that we were going to be without power for at least a week.

The telephone calls and pages came to abrupt, ironic silence. But as the storm was strengthening, a patient with sickle cell anemia presented to the emergency department with fever and pain crisis. I instructed the emergency room physician to start intravenous fluids and antibiotics, get laboratory work, and transfer her to University of South Alabama Children's Hospital, which is ~50 minutes east. Although I emphasized immediate transport, I was notified later that the ambulance service could not transport the child. This resulted in 2 patients being in the hospital requiring intravenous antibiotics. Fortunately, Dr Dan Arnold, a pediatrician, would be in-house because his wife, 38 weeks pregnant, was expecting to deliver.

AUGUST 29: LANDFALL

I had told my 3 children that because the barometric pressure was the lowest since Hurricane Camille, I thought Katrina would change their lives forever. The day of the storm, I knew our lives would be changed forever.

The wind blew continuously for approximately 8 hours. The sustained winds were well above 100 miles per hour. The sound of the wind was like a railroad train running around the house endlessly. The sound of oak-tree limbs crashing into my roof reminded me of the cruise missiles we witnessed during Desert Storm on television. Rain water entered our living quarters. All of this was minimal to what came next.

The water from the Bay of Biloxi engulfed my neigh-

borhood, at first slow and steady, and then it rapidly rose approximately a foot every 10 to 15 minutes. As I watched my neighborhood go under water, I could now fully appreciate the words "surreal," "the power of nature," and "helplessness." There was nothing I could do to save my neighbors' homes and belongings. As I observed the crest, all I could see was overcome by water. My property, on a hill, had now become a small island. The Bay of Biloxi had now become my front yard with whitecaps and swells. I watched my neighbors' automobiles float around like toys in a child's bathtub and sink below the dark water. I observed a 6- to 8-foot alligator trying to find refuge on my island.

It was now obvious that my fellow citizens who did not evacuate from the eastern third of the city were either fighting for their lives or had already drowned. I prayed to God for their souls and safety, as well as for my brother and his son, who were in their house 2 streets away. He was standing on his second-story floor with water at his feet when the cellular telephone service failed. My sister had already reported that the roof blew off of her house. The water continued to rise to the point that I could see only dark swirling water and whitecaps breaking on my neighbors' shingled roofs.

As soon as the wind died down, I checked on my family. Our street was blocked with massive amounts of debris, and my brother's street was blocked with water. We hollered out and, to my joy, heard their voices. We proceeded back to the house to get a skiff and found one buried in the mud. On the way, my sister and her 4 grown children met us, and soon my brother and nephew walked up. The water had receded, but the mud hadn't. We hugged and kissed to celebrate surviving the worst hurricane to ever hit Biloxi. Dry, clean clothes were appreciated by all.

With darkness approaching, we set up sleeping arrangements, water supply, toilet access, and garbage disposal. The population at my home increased from 5 to 13 people, but the useable house had decreased to 2 rooms: a kitchen and a living room. We made the best of the situation in such cramped quarters and were thankful we were all there.

AUGUST 30: 1 DAY AFTER LANDFALL

Before sunrise, we drank coffee and made breakfast on an outside grill. With daylight, we began clearing debris from the driveway to gain a pathway for an automobile. It took 6 hours.

In awe of the total destruction around me, I set off to the hospital. Once there, I found my patient with sickle cell disease and the infant in the nursery doing well. The hospital generators provided lights but no air conditioning. With an ambient temperature of 95 to 96 degrees, we decided any infants delivered would not need radiant warmers.

The Federal Emergency Management Agency (FEMA)

Disaster Medical Assistance Team (DMAT) was busy setting up triage tents out in the parking lot (see “The National Disaster Medical System Response: A Pediatric Perspective,” pp S405–S411). I advised the Biloxi Regional Medical Center emergency room physicians to transfer any children who needed admission. The 3 pediatricians who could make it to the hospital decided to check on all pediatric patients regardless of whose service they were on. With Dr Arnold staying in-house, a lot of worry was alleviated.

I decided to split the limited supplies of formula into 2 parts: 1 for the nursery and 1 for the anticipated needs of outpatients and the community. Because safe drinking water to mix with the formula would be a long time coming, it was truly an optimum time to discharge all infants on breast milk. Even after lengthy discussions of the benefits of breastfeeding, especially now, mothers of the first 3 newborns chose to use formula. Even in a natural disaster with no running water, some moms still will not be motivated to breastfeed. So, we discharged these infants with formula and disposable nipples.

Jeff Thompson, RN, who was in charge of the nursery, checked the supply daily. He had to approve dispensing all formula for inpatients as well as outpatients. In this time of disaster with no idea of the outside response, cut off from the outside world with no communication, rationing of supplies can be critical. It is bad enough when adults are crying out for water, but when infants are in need of formula, the situation is emotionally explosive.

AUGUST 31: 2 DAYS AFTER LANDFALL

The temperature in the hospital was approaching 100 degrees, and outside it was in the high 90s. The smell in the hospital reached a point where I would vomit in the restroom before rounding. One day, all 4 infants in the nursery had temperatures of 99°F axillary and were never placed under a warmer.

I was amazed, but shouldn't have been, when the patient with the tracheostomy requiring oxygen presented to the hospital, never having gone to Houston. This time, however, mother and infant were evacuated. They were transported to a medical center upstate.

There were very few pediatric patients presenting to the hospital right after the storm, possibly because of the lack of transportation. However, there was no shortage of patients I saw as I was going to the hospital. They would stop me on the street, at intersections, parking lots, and even my driveway.

The first patients that I saw all had fever and otitis media or perforated ear drums with purulent discharge. I personally developed a throbbing, painful right ear approximately 6 hours before the peak of the storm. I think that with the drop in barometric pressure, fluid accumulates in the middle ear in those who previously had mild nasal congestion. I observed a definite associ-

ation with Hurricane Katrina and the incidence of otitis media.

The Federal Emergency Management Agency arrived and set up their pharmacy in the same place that the hospital had arranged, which was the radiograph department. We used what samples we could, and then we wrote prescriptions based on the formulary. From a pediatric standpoint we had what we needed, but we ran out of some antibiotics sooner than expected. When pharmacies eventually opened, patients who could pay or present their Medicaid, Children's Health Insurance Program, or private insurance card could get medications; some of those without insurance cards or resources, unfortunately, were turned away. I eventually found the samples needed and no one went without their needed medicines.

SEPTEMBER 1 THROUGH 5: 1 WEEK AFTER LANDFALL

Our supply of tetanus vaccine, although ample, was taxed. I spent an enormous amount of time telling people to put shoes on their children, but realized this was fruitless because the children did not have shoes to wear; the shoes were lost in the storm. So, the warning changed from “please wear shoes” to “please be careful when walking.” I actually treated one 11-year-old boy with 3 puncture wounds in his right foot. His grandmother told me that he had stepped on a nail and, en route to get his tetanus vaccine, stepped on 2 other nails.

The fact that no one had antipyretics terrified the parents. I treated a 2-year-old female who had an upper respiratory infection, otitis media, and fever. After her dad waited in line for hours to get in to a store, he found that they were out of antipyretics. I told him his child's diagnosis, gave him samples of antibiotics, bottled water, and instructions for how to reconstitute the antibiotic. Although I was explaining to him how to mix the medicine, he focused on the bottle of Motrin in my hand and kept asking me if I was going to give it to him. After he verbalized the instructions, I gave him the antipyretic. The man put his child down, wrapped his arms around me, hugged me tight, and started crying, thanking me for the samples. This scenario happened to me several times over the following days.

As a pediatrician examining children in the middle of a disaster, there was one blatantly obvious observation that just slapped me in the face after the storm. The fact that the children would not struggle, cry, smile, or laugh during an examination just tore at my heartstrings. I do not know the actual reasons for this, but I suspect that the children's observation of their parents' crying and lack of smiling and laughter resulting from stress was the cause. I think all pediatricians have weeks in which they wish they did not have to listen to crying, but when you have not one child crying or struggling, you realize that a disaster allows no one to escape unaffected.

At an apartment complex with people holding signs

asking for water, I asked if there were infants needing formula. I found that the best answers came from young females between the ages of 9 and 12. They knew names, ages, mothers, and apartment numbers, and they could relate. They were living, talking directories and provided entry to apartments with infants inside them. All too often we would find adults sitting in chairs, just holding their infants. They were psychologically traumatized and still in shock. I found a mother feeding her 6-week-old infant bottled water because that was all that she had. I went back to the truck, got some Gatorade, and poured it into the bottle. It is not the best electrolyte mixture for newborns, but it is better than pure water. I found several dozen infants less than 6 months of age drinking only water, but none of them experienced a seizure secondary to hyponatremia.

Organizing and distributing infant formula rose to the top of my priorities. I went to the hospital, got what ready-to-feed formula I could take, arranged for more to be coming, and then started distribution. My daily routine was relegated to making rounds in the nursery, then the pediatric floor, the emergency department, the tents outside, and finally with the help of my sons and nephews, loading and delivering the formula to those in need.

When I could get to the tents to see children, I would pull them from the long registration lines. I could get a chief complaint, history, any allergies, current medications, and pertinent information from the parents in minutes and then examine and treat them. I could see 4 children for every 1 they checked in. I got in trouble several times with nurses, but after a couple of days, they stopped saying anything to me. In times of a disaster, rules get bent, some policies take a back seat, and good old common sense must prevail.

I treated more children in apartments, parking lots, and the roadside than I would ever treat in the tents. Parents would stop me at intersections, on the road, and outside shelters and distribution centers all day long. While delivering formula I seldom left apartment parking lots without treating 6 or 7 children. Because 2 of the 3 major bridges were impassable, the patients on the north side of the bay were at a disadvantage coming into the city, so I started telling patients to meet me in the parking lot of Lowe's Home Center, located on the north side of the Bay of Biloxi. Some days I would see up to a dozen kids in the parking lot. After seeing patients we would start delivering formula first to those in need and then assessing the need for the next day.

SEPTEMBER 5 (LABOR DAY) THROUGH 12: 2 WEEKS AFTER LANDFALL

There was no more otitis media. The diagnoses changed to cellulitis and gastroenteritis. The media reported 1 of 2 adult patients with vibrio cellulitis dying. Then, one of the shelters had an endemic of Norwalk viral gastroen-

teritis, which was reported as dysentery. These news reports escalated anxiety and, consequently, the number of patients.

Asthma exacerbations increased to the point at which all spacers had been dispensed. I had to improvise with the use of toilet-paper rolls as spacers.

Slowly, the situation began improving. Private individuals, church groups, the Red Cross, and aid and supplies started reaching the people. But, there were less people because a mass exodus began. At one apartment complex with a large Hispanic population, I watched 20 to 30 adults, children, and infants load up into a large truck. My young female apartment directories became my interpreters, relating that someone in San Antonio, Texas, had provided transportation and promises of shelter and jobs. My usual reminders to wear seatbelts and stay in car seats were futile. In a disaster, the best I could come up with was to ride facing backward while holding children carefully.

The number of people leaving the coast was unbelievable. One of every 3 to 4 children I treated told me they were leaving. When the kids returned to school 5 weeks after the storm, there were only 3100 students, down from 6900 enrolled. As many as 50% to 60% of preschool children also left the community. This mass exodus brought me mixed emotions of joyfulness and sadness. I was joyful for them to leave this area of total destruction but saddened that our greatest resource, the future of generations to be in our community, were driven away by the winds of Katrina. Months later, requests for immunization medical charts keep coming.

SEPTEMBER 12 THROUGH 29: 3 WEEKS AFTER LANDFALL

I opened my clinic and was able to see patients in 2 examination rooms. We brought the safely stored vaccines back from the hospital. I began receiving multitudes of requests to diagnose and treat over the telephone because the parents could not pay. It was amazing to me that people who had lost everything still had their pride and were embarrassed that they were not able to pay.

My brother Charles Gruich, MD (a family practitioner), and I had already decided that for the month of September we would not charge anyone if they could not pay. So, he placed a sign in the front of the building: "No Charge/No Co-Pay." This reduced the number of telephone calls dramatically, and patients readily came to the clinic to be seen on a walk-in basis.

Finally, the emotional states of the children changed toward more normal. It was back to crying and smiling. The first time a child struggled and cried during an examination, I broke out in laughter of joy.

MENTAL HEALTH OBSERVATIONS

From what I have encountered with my patients, once the initial shock of the event is over (approximately 2

weeks), the mental and emotional state of the child is a reflection of their parents. I am not a child psychologist or child psychiatrist, and behavioral pediatrics is probably a weak area of mine, but what I have found is whatever way the parents or grandparents handle their emotional and mental state is mimicked by the young child.

I have seen parents who have lost everything including their job, home, car, and all their possessions, and they do not have the resources readily available to restore them. Some of my patients lost grandmothers and mothers, sat stranded on rooftops and trees, waded in chin-deep water, or were placed in Igloo coolers or garbage cans to be floated to higher ground. These kids are playing and joking around with me like nothing ever happened. The younger ones will ask me if my house got broken like their house. The older ones want to know how many people are staying in my house, and did I have to get in the attic, hang on a tree, or go swimming as they did. They even relay the events that occurred to them during the storm while continuing to joke and play around. A lot of these kids are residing in FEMA trailers, accepting it as an exciting adventure. Their parents have lost everything material but have not lost their common sense, humor, love, or sense of their role as a parent (Fig 1).

I do know one little girl approximately 4 years of age who lost her aunt and was one of the kids placed in an Igloo cooler and floated to higher ground. She would not let another aunt bathe her in a tub of water. Her aunt slowly kept working with her. Three months after the storm, she would finally get into a bathtub and be bathed.

On the other hand, 3 weeks after the storm, I got a



FIGURE 1
From left to right are Calvin Pritchett, 7 years old (son), Shaela Reid, 11 years old (daughter), Monica Starks, 4 years old (niece; the child referred to in the article about taking a bath), and Dwunshae Reid, 13 years old (daughter). These children were stranded by flood waters in the top of a tree for 6 hours during the storm with 3 cousins. They witnessed the death of their aunt while climbing to safety. This picture was taken 3 weeks after landfall; it shows considerable resiliency.

few telephone calls from people inquiring about psychologists because their children were crying or having nightmares, and the parents were experiencing the same thing. These telephone calls were from some of my middle-class parents who had lost basically nothing. They lost few material goods and no loved ones and never had to venture out into the storm.

Some children who evacuated and returned now do not want to go back to the place to which they were evacuated, because they fear another hurricane will strike. It just confirms that we are truly concrete thinkers until about the age of 7.

COMMENTS

The genuine appreciation displayed by adults for the formula they received and the treatment given to their children cannot be described in words. As pediatricians we have all experienced those moments of appreciation by a parent or grandparent for the treatment delivered to their young loved one. It is in these moments that you remember why you went to medical school. In a disaster, you are just providing the basic necessities of life: food, water, shelter, clothing, and medical treatment. In almost every encounter, you are thanked several times over. You can see the appreciation in their faces before any verbalization or action on their part. Some of them are so overjoyed for what you gave them that they can't speak. They just cry and hug you, and as they are walking away you hear a soft "thank you." All you can do is give thanks to God for allowing you to be a physician.

Providing pediatric care in a time of disaster reminded me of my days as a resident. There were times when we would curse the days and long for the time when we would get out into private practice. But, as most of us realize, once we are in private practice, the days of practicing pure pediatrics as a resident are tainted by obligations. As bad as everything was during Hurricane Katrina, the tremendous heat, the awful smells, the scene of total destruction and death, the unmerciful biting flies, the sleepless nights, and the 20-hour days that occurred after the storm were the best 4 weeks of practicing medicine in my entire career. To be able to provide quality pediatric care and not worry about the paperwork, billing, coding, defensive medicine, and documentation was a most enjoyable and rewarding experience. Although I had to meet the challenge of limited resources, I don't believe the quality of care I provided was lowered a single bit during this disaster.

In life, we all experience something that comes along and completely knocks us down, whether it is some terrible diagnosis, tragic loss of a loved one, devastating financial loss, or physical injury. After digesting the initial shock, we realize that life goes on. We cannot depend on others, quit, wait on government intervention, or expect that we are entitled to something. We have to get back into the game of life, doing something positive

each day. That is what pediatricians must do when we experience a disaster. We must continue to provide the highest quality of care we can to our patients. We must take an active role in times of disaster; we must go to the patients and not assume they will come to our clinic or hospital. Pediatricians, for the most part, know where the underprivileged kids reside. It is our responsibility to seek them out and do what we can to provide pediatric care and the basic necessities of life.

ACKNOWLEDGMENTS

I cannot write an article about the Hurricane Katrina disaster without giving a huge thank you on behalf of the children of the Mississippi Gulf Coast. To all who contributed their time, themselves, supplies, and money, from the bottom of my heart, I thank you. Your assistance and support in our greatest time of need was an affirmation of the good will of mankind. We truly live in the greatest country in the world.

Caring for and Transporting Very Low Birth Weight Infants During a Disaster

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The author has indicated he has no financial relationships relevant to this article to disclose.

AUGUST 29: HURRICANE KATRINA LANDFALL: I Am a neonatologist in private practice and had been at the hospital for >24 hours along with 40 other physicians. I had volunteered to take care of the patients at Memorial Medical Center (MMC) during Hurricane Katrina. There were 16 infants in the NICU, ~260 patients in total at the hospital, 500 essential employees, and >1200 family members of the patients and employees with their pets taking refuge from the storm. An additional 50 patients were in an acute care ward for adults with chronic conditions run by LifeCare within the hospital premises.

Like most people, I thought Katrina would be just like other hurricanes that had threatened the city in the last few years. We would be at the hospital for a few days, and then we would return home. I had no idea what we were about to encounter.

As Katrina approached New Orleans, Louisiana, the NICU staff moved the infants to an inside room because of the many windows that could endanger their safety. When Katrina made landfall in the early morning, the strong 125-mph winds did blow in several of the hospital's windows, including some in the NICU. As soon as the electrical power was lost, the backup generators started and restored the emergency electrical services.

After enduring several hours of severe winds and rain, there was a general feeling of relief because the storm was over. Many windows were shattered, there was glass and water in many places, but apparently there was little structural damage to the main hospital building.

In the ensuing hours we heard that the storm surge had breached the levee system, and the waters from Lake Pontchartrain were flooding the city. Still, we had no awareness of the impending severity of the situation.

It soon became ominous as the floodwater reached the hospital and started rising all too rapidly.

AUGUST 30: 1 DAY AFTER LANDFALL

It was midmorning when the evacuation order was given by the CEO of MMC. Now we needed to figure out where and how to evacuate the infants. One of our neonatologists was able to secure placement for the 16 infants at the Woman's Hospital NICU in Baton Rouge, Louisiana, ~80 miles northwest of New Orleans (see "Caring for Displaced Neonates: Intrastate," pp S389–S395). It was decided that the best option was to evacuate by helicopter. Workers at MMC cleared an abandoned landing pad located on the roof of the hospital's 8-floor garage building and made it functional.

Then, the really hard times began.

Multiple calls were made to emergency transport services, but they failed to respond promptly or gave conflicting reports. Everything seemed to be chaotic, telephone communications were poor, telephones were dying, and trying to identify who was in charge of the airlift was difficult. Eventually, the helicopter transport appeared to be underway.

The next task was to bring the incubators with the infants to the heliport, which proved to be quite an ordeal. Because the basement of the hospital was

Key Words: Hurricane Katrina, very low birth weight infants, neonatology, neonatal transport

Abbreviation: MMC, Memorial Medical Center

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flooded, the only way to access the parking garage was through a 35 by 45-inch hatch. The first transport incubator had to be carried by hand 8 floors to the top of the garage, because a truck flatbed was too high to negotiate the ceilings of the parking lot. Later, a different truck was successful in delivering the other incubators. Because the elevator to the heliport was not working, they had to be carried by hand up 3 flights of stairs to the landing pad (Fig 1).

Once at the holding area of the heliport, hours passed, with many choppers flying overhead. The few that landed had contracted with LifeCare for their patients. Incredibly, at least 2 helicopters tried to land on our parking garage to drop off evacuees with medical needs! The sun was now setting, and neither the Coast Guard nor National Guard helicopters that were supposed to carry the infants had shown up. Furthermore, there was no lighting in place for the helicopters to land after dark.

The transport incubators were still functioning because the backup generators were providing power to the holding area; however, there was concern that the rising water would flood the location of the back up generators, which would shut the power off.

Somebody was able to attract the attention of the pilot of one of the passing helicopters who took the first group of infants. A bit later, we were able to convince the pilot of a small, nonmedical, 3-seat chopper that was dropping supplies to carry 2 critical tiny infants with one of the nurses and me. Both were very low birth weight infants who required mechanical ventilation. One of them was infant boy S, a 6-week-old infant born at 24 weeks' gestation with severe bronchopulmonary dysplasia. He still weighed less than 1 kilogram and needed high respiratory support. The other infant had respiratory distress but was on low ventilator settings. The pilot told us that there was not enough space in the chopper for the transport incubator, so we wrapped the 2 infants

in blankets, placed them close to our bodies, and proceeded to ventilate them with hand-compression bags (Fig 2). We were able to bring intravenous pumps and several oxygen cylinders on the helicopter with us.

Although the trip was supposed to last about 30 to 45 minutes, it took much longer because after only a few minutes into the flight, the pilot had to land and wait for quite a while (what seemed like an eternity to me) to refuel. The night was very dark, and there were no lights at the heliport, but we did see 2 Army helicopters. Given the critical stage of the infants, I expressed my concern to the pilot about the delay. He looked at me and remarked that the Army helicopters were ahead of us refueling (first come, first served) and what they were doing was also extremely important because they were picking up people from their rooftops who could die if they were not rescued promptly.

I felt bad for my shortsightedness and apologized.

As we finished refueling, I checked my infant's oxygen tank and found that it was almost empty; with some difficulty, I switched to a new oxygen tank. If that prob-



FIGURE 1
Taking an Isolette up to the landing pad.



FIGURE 2
Dr Gershanik bagging a very low birth weight infant on a helicopter.

lem had occurred while in the air, it would have been almost impossible to switch tanks because of the lack of light and space. The refueling delay may have been instrumental in saving the infant's life.

To say that the transport was suboptimal is an understatement. Cold air was gushing through the windows, and there was no way to improve the situation. I tried to shield the infant with my body and kept him as close to me as possible, "pseudo-kangaroo," while bagging with high (undetermined) peak pressures and a fast rate to comply with his high ventilator-support requirements. There were no monitors to check the infant's heart rate, respiration, or oxygen saturation; the loud noises inside of the chopper and the lack of light (only a useless penlight was available) made it practically impossible to ascertain the condition of the infant while in flight, and only the movement of the infant's leg after pinching his extremity convinced me that he was still alive.

Finally, the lights of Baton Rouge appeared, and we landed at Woman's Hospital (see "Caring for Displaced Neonates: Intrastate," pp S389–S395), where a receiving team was waiting to take care of the infants. Both infants were placed in transport incubators, hooked to the ventilators, and brought to the NICU. Fortunately (and unexpectedly), the temperature and blood gases of infant boy S after the transport were similar to the ones before we left the NICU at MMC!

Military helicopters completed the evacuation of the remaining infants after workers at MMC strung together extension cords from the generator to the landing pad and shined lights to guide the pilots after dark.

After several attempts to follow-up on the status of the infants, we found that all 16 infants survived! In fact, they did as well during the transport as they were doing in the NICU. Some of them required a second transport to another NICU for different reasons (overcrowding, moving closer to where their families evacuated, etc).

Some parents left New Orleans before the storm; others stayed at MMC during Katrina, requiring evacuation mostly by boat, and eventually were reunited with their infants. No parents were transported with the infants. It took several days before infant boy S and his mother saw each other. He was eventually moved from Baton Rouge to Galveston, Texas, to where his mother had been evacuated. The infant was discharged at about 4 months of age in good condition with a home monitor and supplemental oxygen with feedings, which was discontinued shortly after discharge.

There is no way to accurately describe the dedication of the professional staff of the NICU at MMC and the incredible cooperation of their family members, who along with some of the patients' relatives did so much to achieve the best outcome for our tiny infants. We are so grateful for the help of employees at MMC and the kindness and professionalism shown by the doctors and



FIGURE 3
Infant boy S at 5 months.

nurses at Women's Hospital, which contributed to the success of our endeavor.

LESSONS LEARNED

There has to be a system in which the referring neonatologist and staff will be able to receive temporary hospital privileges and continue to take care of his or her patients in the receiving NICU. Many neonatologists were displaced to the same communities in which his or her patients were transported. The extra number of patients in at least one of the receiving NICUs generated a request from its responsible professional corporation to seek volunteers among their contract neonatologists nationwide to cover the additional medical help needed.

Systems that are activated at the local or regional level may prove more efficient than dependence on national or otherwise highly bureaucratic entities.

During the hurricane season (and other disasters), preparations for the worst scenario are a must. Emergency plans must include the possibility of catastrophic flooding in any potential trouble spot.

There is need for a local or regional central commander unit that can be activated during appropriate

times and match referring and receiving units. It would require an improved system of communications and the ability to follow the course and location of all the transfers.

Having the architectural design of critical care units and hospitals to prevent failure of the electrical and other vital systems is obvious, including locating backup emergency services where they cannot be affected by floods or other threats.

Another aspect of these disasters is the disruption/interruption of the clinical practice of the affected physicians. There is a heavy personal and financial toll that

develops, because physicians are unable to continue to practice and face a sudden interruption of income, sometimes for prolonged periods of time.

We need ways for families to find out promptly (such as via a telephone hotline) where their infants have been transported to and set up programs that could address the special needs of particular populations because of language limitations (eg, the Latino, Vietnamese, etc) or other barriers.

By the way, infant boy S (Fig 3) and his family will be back home soon. And, New Orleans will be back, better and stronger than ever!

The University Hospital NICU in the Midst of Hurricane Katrina: Caring for Children Without Power or Water

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The author has indicated he has no financial relationships relevant to this article to disclose.

AUGUST 26: 3 DAYS BEFORE LANDFALL: Like most Friday afternoons, our 12-person neonatology group went through the weekend sign-out process of patients divided among the 9 area hospitals for which we provide NICU coverage. I was assigned to University Hospital for the weekend. University Hospital is a state-run public hospital in downtown New Orleans, Louisiana, that serves primarily indigent patients as part of the campus of the old Charity Hospital. It has a level 3 NICU and is a full-service teaching hospital for the medical schools at Louisiana State University and Tulane University. I was aware of Hurricane Katrina, then a category 1 storm in south Florida, and all indications were that the storm was targeting the coast of the Florida panhandle.

By evening, as the storm's predicted path had dramatically changed westward, I began to review our available on-call neonatologists and plan for hospital coverage in the event that this new prediction held true. I also began to make plans for the evacuation of my wife and 5 children but hoped, as had been the case in recent years with other hurricanes, that Katrina would steer clear of New Orleans.

AUGUST 27: 2 DAYS BEFORE LANDFALL

As the predictions for the storm passing over or near New Orleans remained consistent, plans for covering each of our hospitals with an in-house neonatologist for the duration of the hurricane threat were finalized. Dating back to at least Hurricane Andrew in 1992, our division had gone through this process multiple times. Although several hurricanes during this time threatened to hit New Orleans, our city had managed to avoid any direct hit. Despite many doomsday scenarios, New Orleans had not experienced a direct hit since Hurricane

Betsy in September 1965. In recent years, there were increasing efforts to evacuate the city with such threats. Hospital evacuation had been discussed, but a plan to carry out an evacuation of such magnitude had never been fully developed. The risks and costs of such an evacuation would be significant. Instead, each hospital and the local civil authorities developed plans to allow for the hospitals and patients to weather the storm by using stockpiles of food and supplies, generator-supplied electricity, and staffing patterns for key personnel. This plan had worked well in recent years with several hurricanes striking glancing blows to our city. Hurricanes' effects on the hospitals, patients, and personnel had been more of an inconvenience than a problem.

The University Hospital NICU had a census of more than 20 infants, including 2 infants on conventional ventilators and 2 infants on high-frequency ventilators. Hospital administrators finalized details for implementing the "code gray" hurricane plan.

By nightfall, thousands of people had left the New Orleans area, including my own family. Evacuation continued through the night and into the next day as Katrina slowly moved closer to our region.

Key Words: Hurricane Katrina, neonatal intensive care unit, NICU

Abbreviations: CHNO, Children's Hospital of New Orleans; IV, intravenous

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AUGUST 28: 1 DAY BEFORE LANDFALL

With Katrina increasing in intensity and still targeting New Orleans, several hospitals closest to the projected path evacuated their small number of neonates from their level 2 NICUs. This began a flurry of activity with available local neonatal transport resources. Because of the concern for street flooding around University Hospital with heavy rains and its potential impact on electric power, a decision was made to transfer the 2 stable premature infants on conventional ventilators to other local hospitals that were less prone to such problems. The 2 unstable infants on high-frequency ventilators remained at University Hospital, because the risks to transfer these sicker infants at this time were thought to be greater than the risks of staying in place.

By early afternoon, light rains began and I assumed my role in-house at University Hospital along with my neonatologist colleague from Tulane University School of Medicine, Dr Betty Martinez. Together with a team of residents from both medical schools, we would be providing medical coverage for the NICU patients and any infants born during or after the storm. Although we hoped for the best, we each brought food, clothes, flashlights, extra batteries, portable radios, and other supplies to last several days. Along with many other in-house physicians, we jockeyed for a convenient place to lay our air mattresses down and call our own.

Throughout the evening, as the winds gradually increased and the rain fell in intermittent heavy bands, we monitored the hurricane on local television and the Internet. Shortly before midnight, I decided to go to sleep while I could, knowing that the worst was still to come.

AUGUST 29: LANDFALL

After a few hours of intermittent sleep, Katrina's fury woke me for good around 4 AM. Heavy rains and howling winds made sleep difficult. Outside electric power was lost, and the hospital's generator power came to the rescue. All of the infants were tightly cramped into an interior portion of our third-floor NICU away from windows, which rattled in their frames (Fig 1). As the sun tried to rise somewhere behind the darkened sky, the residents began their daily work. By midmorning, patient rounds took us away from concerns about the storm for a short while. Parts of the hospital roof, signage, and awnings were torn apart by the wind.

By early afternoon, the rain and wind began to subside. There was residual street flooding, but there was a sense of relief in everyone. The worst of the hurricane had passed, our hospital had survived, our infants had survived, and we had survived. We began to wonder out loud how soon we would be able to leave the hospital.

As the local television news came on later in the afternoon, we got our first glimpses of the extensive flooding in other parts of the city. Although we initially



FIGURE 1
The NICU's location away from windows when it still had power.

thought that we had weathered the storm reasonably well, the pictures we saw revealed that many parts of our city had not. We were surprised to see entire neighborhoods underwater. Flood victims were being rescued from the rooftops of their houses. As images of various parts of the city were shown on the screen, we tried to determine if our own houses were affected by the floodwaters. Outside, the skies were clearing, but water in the streets around the hospital continued to rise, reaching around 4 feet deep by sunset (Fig 2). Although several levees had been breached by this time and were responsible for the flooding, this information had not yet made it into news reports and certainly not to our unit.

AUGUST 30: 1 DAY AFTER LANDFALL

In the early-morning hours, generator power became erratic—the progressive street flooding had spilled over into the hospital basement and damaged the switching mechanisms. Without reliable power, the high-frequency ventilators supporting our 2 sickest patients would not function and the mechanisms usually used to monitor and care for these infants would be lost. Several portable generators were put into place on an adjacent



FIGURE 2
The view from the emergency department in the afternoon after landfall earlier in the day.

patio with extension cords running to the few pieces of equipment they could support. We quickly had to triage what equipment was absolutely needed and what equipment was not needed. As the sun rose, we could see that the water had risen further overnight, with 6 to 7 feet of water in the streets around University Hospital. In the air, the sounds of rescue helicopters blended with the hum of the high-frequency ventilators. On the radio, we heard that various levees around town had been breached and that additional flooding around the city was expected.

Realizing that the 2 extremely low birth weight infants on high-frequency ventilation could not be maintained for long under these circumstances, I began to make arrangements for transfer of these infants to Children's Hospital of New Orleans (CHNO), which had not flooded and had adequate generator power. Telephone contact was difficult at this time, with most landlines completely inoperable and cell phone service becoming progressively more erratic. A fire truck was available at CHNO with enough ground clearance to pass through flooded streets en route. The final 3 blocks of the journey, however, could not be negotiated by any available land vehicle, so arrangements for transport by boat or helicopter were necessary.

Attempts to reach outside rescue personnel by telephone and 2-way radio were unsuccessful. A ham radio operator volunteering at the hospital was able to relay a message to the state Department of Wildlife and Fisheries to request that a boat be made available to help transport these infants to the waiting fire truck and NICU transport team. After waiting almost 2 hours without any signs of such a boat, 3 orthopedic residents were seen canoeing in the streets across the hospital campus and up to our emergency department entrance, the level to which the water had risen. After they reported seeing the waiting fire truck, I explained the need for transport of the 2 infants and they agreed to help. Because they declined my offers to travel with the infants, I gave the nonpaddling chief resident brief but pertinent instruction: keep the endotracheal tube in place, squeeze the bag enough to make the chest rise, and keep the infant pink. The infants were transported 1 at a time wrapped in blankets, ventilated with 100% oxygen via bag to endotracheal tube, and placed into open acrylic infant cribs (Fig 3). At the end of the canoe trip, as the orthopedic resident handed the infant to my partner waiting with the transport team, he gave her the same instructions, word for word, that I had passed on to him minutes earlier. Both infants arrived at CHNO in good condition.

None of the remaining infants required mechanical ventilation, several were on supplemental oxygen, and several were on intravenous (IV) fluids. By typical standards, none were critical. Patient care issues were fairly simple at this time, and the thoughts of most everyone



FIGURE 3

The view from the emergency department 1 day after landfall. The canoe has an intubated neonate being bagged en route to a waiting fire truck.

centered on what was happening to our city and when we would be able to be evacuated.

As their batteries lost power, the hospital's strobe fire alarm lights dimmed after a day and a half of annoying pulses of light. By the end of the day, the water had neither risen nor fallen from where it was at sunrise.

AUGUST 31: 2 DAYS AFTER LANDFALL

Without communication outside the hospital, we could not get word on when we might be rescued, and we could not get in touch with our families. Rumors and wishful thinking for an imminent rescue provided some hope at a time when the uncomfortable conditions were continuing to take their toll on patients, families, and hospital personnel. Food and water were available but not plentiful. The air was hot, still, and muggy as nurses and doctors sought shady areas adjacent to the open windows. Because running water and sewerage were not available, personal hygiene was limited. Alcohol-based hand sanitizers were used in abundance. The various smells—floodwaters, generator exhaust, body odors, and wastes—were persistent. Thankfully, the NICU area smelled considerably better than the parts of the hospital in which adult patients were cared for.

Patient rounds went quickly; nursing shifts began to blend together as sleeping space and clinical care areas were often separated by a few feet because everyone sought the coolest areas. Available portable-generator power was used to power a single incubator that was used to warm 2 very low birth weight infants who required thermal support despite the high ambient temperatures. With the absence of reliable pumps, they were weaned off of IV fluids and feedings advanced at a faster-than-normal pace.

The tattered roof of the Louisiana Superdome was visible a quarter mile away, with the adjacent raised interstate filled with increasing numbers of survivors who made their way out of the water and to higher

ground. Each day brought the sound of more and more helicopters, taking off and landing continuously from the Superdome heliport. Convoys of trucks pulling boats to launch sites along interstate down ramps became a common site.

Coping mechanisms varied among the NICU personnel. A group prayer service provided comfort to most for a while. People worried about their families, their homes, their cars, and, most obviously, about when help would arrive. In the absence of any really sick infants, patient care efforts shifted to helping to manage 2 non-medical NICU workers who experienced panic attacks.

SEPTEMBER 1: 3 DAYS AFTER LANDFALL

We were called to attend the possible cesarean-section delivery of an infant whose mother had been in labor for more than 24 hours. Under normal circumstances, this delivery would likely have happened much earlier in the course, but these were not normal circumstances. The extension cord from our NICU's portable generator was transferred to the windowless delivery room to provide power for 2 spotlights. Those not directly caring for the patient fanned those who were, providing some air circulation in a surreal setting. A healthy boy was born with forceps assistance more than 1 hour after our being called to attend the delivery (Fig 4).

Later that afternoon, this mom and infant were carried down from the third to the first floor along with the rest of our NICU patients. We were led to believe that our patients and a few necessary caretakers would be evacuated by boat to another nearby hospital where helicopter transport was available. Several critically ill adult patients were evacuated in this manner. Deciding which nurses and respiratory therapists would leave with which infants required some diplomacy given the progressive anxiety.

As the first 6 infants, along with 6 nurses and a respiratory therapist, left on a flatboat accompanied by the driver and a rifle-bearing policeman, a sense of relief was felt. This feeling was short-lived, though, because before a second boat could arrive, the first boat returned carrying everyone who had left. After traveling the half mile to the nearby hospital, they were turned away because there was miscommunication over who was actually being evacuated at that time. Without a doubt, morale reached its low point at this time.

Violence in our city, both real and perceived, along with poor communications were affecting rescue efforts. Later that evening, a rare telephone call came through on one of our cell phones. I was able to speak to Dr Steve Spedale of Woman's Hospital in Baton Rouge, Louisiana, who was coordinating the care of evacuated neonates. It was unbelievable to us, but there was uncertainty in the outside world as to whether NICU patients were still present at University Hospital! I assured him that we still had more than 20 neonates who needed evacuation, and



FIGURE 4
A high-risk delivery with lights powered by a portable generator.

as sunset approached, he assured me that he was working on getting this done (see "Caring for Displaced Neonates: Intrastate," pp S389–S395).

Around this time, we received word that a mother who had been hospitalized for preterm labor since before the storm was in more advanced labor and unlikely to be stopped. At this time, she was at 25 weeks' gestation. I spoke to her about the risks involved in such a severely preterm delivery. Beyond the typical risks, I told her of the primitive circumstances in which we were working and the need for evacuation of her infant whenever it could be accomplished. She asked that we do all we could to help her infant survive.

SEPTEMBER 2: 4 DAYS AFTER LANDFALL

Shortly after midnight, we were called to the delivery of this 25-week-gestation infant. In preparation, we rearranged extension cords to provide power for a ventilator, warmer, monitor, and IV pump. We decided to take the infant back to the NICU for resuscitation, given the lack of equipment and support in the delivery-room setting at this time. The sight of young intern Dr Brandy Beauchamp running through darkened halls while cra-

dling this tiny infant girl as her upper-level resident Dr Regina Robbins provided flashlight guidance will be etched in my mind forever.

The infant was intubated, given artificial surfactant, and provided with umbilical catheters in short order. Orders, an admit history, and physical were written. The entire process was done in less than an hour—there were no radiographs or laboratory results to wait for, because none were available. The infant did very well, with oxygen being weaned by pulse oximetry and IV fluids and antibiotics provided based on an estimated weight.

With daylight, the water level remained at the same level it had been for over 3 days. Although everyone was hopeful that this would be the day for evacuation, we also were cautious in our expectations given what had happened previously.

Then, at midmorning, helicopters suddenly hovered unannounced over University Hospital. The sound of clanging metal and splashing water caused some alarm until we realized that roof debris was being cleared for the helicopters to land. In short order, we were called to carry the infants and their supplies up 6 flights of stairs to the roof, which had become a makeshift heliport.

Similar to what had been done 1 day earlier, the infants were carried in open cribs that also housed their medical chart and short-term supplies. The youngest infant, now less than 12 hours old and weighing about 700 g, was layered in plastic wrap and blankets, and brought to the roof being hand-bagged by Dr Robbins. The infant's mom gingerly walked behind. Several other postpartum moms made the same journey along with one dad and a new big brother.

Military helicopters hovered in proximity to the hospital like a car-pool line, waiting their turn to be filled with patients, families, and caretakers. Within minutes, 28 infants were airborne and headed for higher, drier, and safer ground. Pediatric and adult patients were likewise evacuated by air over the next few hours. The patient evacuation we had waited 4 days for was completed in less than 4 hours.

For any mother who had been discharged before the hurricane, we had no way of providing updates on her infant's condition, no way to ask for consent for transport, no way to let her know where her child was going. Many of these mothers were in the midst of their own rescue and evacuation. In the days and weeks after the evacuation, it would take the combined efforts of health care workers, the news media, and volunteer organizations to reunite these infants with their mothers (see "Reuniting Fractured Families After a Disaster: The Role of the National Center for Missing & Exploited Children," pp S442–S445).

Along with several hundred remaining physicians, nurses, and other health care workers, I left the hospital by airboat. Leaving behind most of our belongings, we

floated along high above the streets on which we usually drove. Turning a street corner by old Charity Hospital, I was startled by the sound of the airboat scraping the roof of a parked car below us. The excitement of leaving was tempered by the devastation and desperation seen along the journey to dry land, where ground transportation was available for the ride out. There was a sense of accomplishment in that all of our infants and all of us had made it out alive but also a sense of sadness for what we had been through, for what all of our city had been through.

NOVEMBER

Two months have passed since I left University Hospital to be reunited with my own family. Our house was flooded with up to 5 feet of water, which took almost 3 weeks to drain. All of the infants who left University Hospital after the flood have done well. The 2 "canoe" infants remain hospitalized, one reunited with her evacuated family in Fort Worth, Texas, and the other in Baton Rouge. Each has been to 4 hospitals with the hope that their next move will be to home. Although much media attention has focused on things that were done wrong in the days surrounding hurricane Katrina, 28 infants survived, in the midst of the worst natural disaster our country has ever faced, thanks to the efforts of many dedicated nurses, therapists, and physicians at a time when most faced great personal losses. Similar heroic efforts can be told about several other local hospitals.

University Hospital remains closed, having been extensively damaged by the hurricane and resulting floodwaters. Its future, like that of many other area businesses and families, remains uncertain, to be determined by a willingness and need to rebuild and the financial resources available to do so.

LESSONS LEARNED

There are many lessons to be learned from these events in the midst of Hurricane Katrina, some large and some small. Health care workers who may be involved in these situations need to be aware of what they may endure. Each person should bring necessary food and supplies for several days in addition to what may be available from the hospital. Having one's personal needs taken care of allows the health care worker to devote more effort to patient care. Hospital personnel have varying degrees of coping mechanisms in difficult circumstances. All need support both physically and emotionally. Team leaders should be prepared to provide such support.

Medical decision-making in such extreme circumstances is quite different from what is done in more normal times. Diagnostic modalities such as radiograph and laboratory testing may not be available. Standard therapies may be unavailable or difficult to implement. With limitations on resources, atypical triage decisions on

patient care may become necessary. Calmness, open-mindedness, tolerance, and improvisation are useful traits.

Large-scale patient evacuations were delayed and difficult after the flooding. The relative risks and benefits of large-scale patient evacuations in advance of such a storm threat need additional evaluation. Hospital evacuation of a large metropolitan area is difficult and risky without time constraints; such an evacuation in the short period before an impending hurricane is more difficult and more risky. Any such evacuation is beyond the capability of local and regional resources.

COMMENTS

Despite extensive media coverage, the devastation of Hurricane Katrina is difficult to comprehend unless you have been in the midst of it. For 4 days after this storm, interruption in everyday services such as electricity, water, sewerage, communication, and transportation presented great challenges in patient care. As we were evacuated from University Hospital that morning, most of us did not fully realize the more enduring challenges that were ahead of us as we started to rebuild our lives in the post-Katrina world.

Disaster Preparation and Lessons Learned at the Ochsner Foundation Hospital

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The author has indicated he has no financial relationships relevant to this article to disclose.

PREPARATIONS: In New Orleans, Louisiana, we had been through the drill many times before. Annually, disaster preparation is undertaken in conjunction with our Office of Emergency Preparedness when an imaginary hurricane strikes our city and causes catastrophic damage. Sometimes life imitates art. When Hurricane Katrina crossed the state of Florida and entered the Gulf of Mexico, New Orleans had a metropolitan population of 1.3 million, with 484 000 inside the city limits. Much of the city lies slightly below sea level, whereas the level of Lake Pontchartrain typically is 1 foot above sea level.

The Alton Ochsner Foundation Hospital is a 531-bed teaching hospital that is situated on the east bank of the Mississippi River, just west of New Orleans in the Parish of Jefferson. Providing incalculable benefit, the first floor of our hospital stands approximately 6 feet above sea level—12 feet above some of the lowest parts of the city of New Orleans. The NICU, located on the 10th floor of this 11-story hospital, was supporting 25 neonates, many of whom were on mechanical ventilation as Katrina approached the Gulf Coast of the United States. One infant was requiring extracorporeal membrane oxygenation (ECMO). The institution had established an emergency-management manual that, although remaining a perpetual work in progress, is currently 122 pages in length and addresses many topics including responses to loss of utilities, external and internal disasters, and severe weather conditions.

The Ochsner model of medical care includes many satellite clinics and a closed medical staff for the hospital. Preparing for a natural disaster involves having a facility that would withstand the storm (externally and internally) and having a staff that can care for patients, their families, and all personnel on campus. According to our procedures, after deciding the “essential staff,” “A” and

“B” teams are created. The A-team members are staff remaining during the storm, and the B-team members evacuate, report their final destination to their unit directors, and then return to relieve the A-team members once it is deemed safe to travel.

CHRONOLOGY OF EVENTS

August 27: 2 Days Before Landfall

Katrina became a category 3 hurricane, and its projected path has shifted westward. New Orleansians, along with others on the Gulf Coast, are beginning to realize that there is likely to be a sizable impact from the storm. The administrators at Ochsner decide to implement the severe-weather policy and assemble department chairmen (or their designee) to assign essential staff physicians. The pediatricians include a generalist/hospitalist, an intensivist, a cardiologist, a hematologist, a neonatologist (myself), and 4 neonatal nurse practitioners. In addition, general and specialist medical and surgical physicians and staff were appointed.

Our Section of General Academic Pediatrics had rehearsed and implemented the hurricane drill numerous times in the past. The pediatric hospitalist would assume care of the in-house general pediatric patients and the nursery infants, and the pediatrician on-call would be

Key Words: Hurricane Katrina, emergency preparedness, disaster planning

Abbreviations: ECMO, extracorporeal membrane oxygenation; FEMA, Federal Emergency Management Agency

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responsible for telephone calls. Because the evacuation was mandatory, all others would leave the designated hazardous area. It was a weekend, so we hoped all would be back in clinic by Tuesday morning doing business as usual.

Institutional plans were placed into effect regarding security, housing, communications, food services, and utilities. Team A members were reminded to bring their personal supplies (nonperishable food, water [1 gallon per person per day], blankets, pillows, sheets, mattress, flashlight with batteries, medications, toiletries, extra clothes [shorts/sandals/sneakers], radio or small battery-powered television, and pocket change). Bringing family and pets into the facility was discouraged; however, single A-team parents and others with no alternatives were given this opportunity. If a family arrived with small children, it was expected that age-appropriate supplies would accompany them.

August 28: 1 Day Before Landfall

Katrina was upgraded at 1 AM to a category 4 storm, and 6 hours later her sustained winds reached 175 mph, exceeding category 5 classification. Beginning at 7 AM, Ochsner Security posted guards at the entrance of the parking garages to ensure that all those entering were members of the essential personnel team. We had learned from previous hurricanes that many non-Ochsner personnel would attempt to use the safety of an elevated garage for parking such items as recreational vehicles and even boats. This created a situation that prevented Ochsner health care workers from finding a place for their own vehicle. A-team members arrived, and housing arrangements were made by using unoccupied interior patient rooms as well as rooms in our adjoining hotel. By using inflatable or foam mattresses, some physicians elected to set up sleeping quarters in their offices. SpectraLink wireless phones (which can be programmed to be similar to an office extension) were distributed to essential personnel.

That afternoon, the NICU hurricane shutters were closed, and although they were made to withstand winds in excess of 100 mph, the decision was made to transfer the 25 NICU patients to the postanesthesia care unit (recovery room), which was located on the second floor in the central portion of the hospital (where there are no windows). The move went smoothly, including the hand cranking of the pump for the infant on ECMO. After settling all the infants in their new "home," our staff prepared for the inevitable by charging up their cell phones and making sure all vital telephone numbers were posted in multiple locations.

Ochsner's food and nutrition department normally keeps a food inventory on campus that should support the patients, their families, and routine support personnel for more than 2 months. Additional cold-food-storage capacity was increased by using 2 refrigerated trail-

ers. All dietary production and refrigeration equipment was supported by emergency generator power. It was anticipated that the food and nutrition staff would be feeding approximately 500 persons per meal. Unbeknownst to our dietary staff, they were about to prepare more meals than ever anticipated and for a much longer time period than ever planned.

For security purposes, everyone was reminded to make sure that their picture identification card was in plain view wherever they went. Nonmedical personnel were tagged with specifically color-coded identification bracelets that afforded them the safety and amenities of the institution. Clinic administration held an evening meeting for all medical and unit directors to ensure that we were all well versed on the latest hurricane and facility information. We planned to meet at least 3 times daily into the foreseeable future so that a consistent message could be brought back to the personnel on the front line. This allowed leadership to remain visible and address concerns—both real and imagined.

August 29: Landfall

Katrina's eye crossed the Louisiana coast at 5 AM as a category 3 storm with winds that had "weakened" to 125 mph. Naturally, the outer bands of the hurricane arrived many hours before. With no tall buildings near us, there was little buffering of the winds taking place on the 10th floor. The ferocious winds were heard howling in the stairwells and near any windows. Electricity from our utility company failed at 7:45 AM, and our 3 diesel-powered generators (which are situated 12 feet above ground level and consume 100 gallons of diesel per hour) began functioning immediately. An underground supply of 60 000 gallons of diesel fuel was kept by the hospital for just such an occasion. The generators provided power for limited air conditioning, emergency electrical outlets and lighting, air and vacuum pressure, and oxygen. Although emergency lighting allowed for work to continue, having a flashlight was a necessity for performing certain tasks.

It was not long, however, before we began to feel the temperature and humidity rising. As fate would have it, after settling all the infants in the new NICU, the ceiling over the patient on ECMO began to leak. The nurses and respiratory therapists obtained large plastic sheets and created a makeshift tent, which kept the patient and all the equipment dry, relatively speaking.

Water pressure dropped midmorning when power failed at city-run water-pumping stations, and the flow from faucets dwindled to a trickle. Without water pressure, toilets could not refill, and because most new toilets in institutions do not have tanks, there was a major problem developing. A few hours later, there was discolored water flowing from the taps, and toilets once again could be flushed. Thankfully, some years ago as part of disaster planning, a well was dug, and although

“well water” was not potable or suitable for bathing infants, it certainly was adequate for showering and flushing toilets.

Methods and sources of communication varied. Local telephone service, especially for incoming calls, became very sporadic, and communication with the outside world became more difficult. We found that calling long distance had a higher likelihood of success than a call within the same area code. The cable company supplying the television signal failed, and we were restricted to our CBS affiliate, which began to give us a skewed vision of the local outside world. There were very few radio stations broadcasting originally, and ultimately this dwindled to the CBS affiliate as well. Most of the information provided was anecdotal and originated from callers to the show. There were reports and then pictures of a section of Interstate 10 between New Orleans and Slidell that had been washed away, which meant that rescue personnel could not enter from the east and evacuation in that direction would be impossible.

Our Ochsner Security force amounted to 36 in-house armed officers. These friendly faces worked rotating 12-hour shifts and provided the staff with as much of a sense of comfort as was feasible under the circumstances. Most of us got little sleep that first night post-Katrina, and the temperature in the NICU continued to rise.

August 30: 1 Day After Landfall

Reports of the broken levees with subsequent massive flooding throughout the area had a major dampening effect on the optimism that many were feeling from having just survived the storm. We could see the rising water level in the street outside, but it had not reached our front door. We were told by administration (correctly) that because of the elevation of the campus, flooding was not expected to reach the hospital. Nonetheless, there were sandbags available.

We reopened and returned to the 10th-floor NICU and began to open the storm shutters. We could still hear the wind outside, but the rain was limited to a passing sprinkle. Although we found no broken windows, water had seeped through the windows and even in between some bricks in the wall. We were even more astounded to find blades of grass and leaves stuck to the outside of our windows 10 floors up!

Our census grew late in the morning when there was a delivery of a near-term infant. The infant had the audacity to develop respiratory distress and subsequently required endotracheal intubation. Gowning for the placement of central lines was not much fun, because the environment of our NICU was starting to feel like a typical New Orleans summertime 90–90 day (90 degrees, 90% humidity). Acceptable attire in the NICU was now sandals, shorts, and T-shirts.

The utility status remained unchanged; we were still

using generator power, well water, and telephones (when you could connect). Because of the heat, a cold well-water shower was a luxury item (but you needed your flashlight close by, because most bathrooms were not on the generator circuit). The Internet miraculously continued to function with only very brief interruptions. Streaming video provided a connection to the outside world but only served to depress the morale of the team. We were beginning to see the devastation imparted by Katrina, and then we learned that there had been serious breaches of some of our levees.

The National Guard arrived with 8 soldiers to bolster our security force. Unfortunately, this group of 8 soldiers was young, inexperienced, and lacked the training needed for the magnitude of this situation. The National Guard soldiers were soon dispatched to the city. Because of social unrest in the downtown section of New Orleans and reports of looting in hospitals, Ochsner went into a “lock-down” mode after dark and maintained security guards at all entrances. With minimal fire protection available, everyone was cautioned repeatedly about the use of anything flammable.

By early evening, the temperature in the NICU was above 95 degrees. Because of the humidity, any item that was stuck to the wall with tape soon found its way to the floor. Although other areas of the hospital were slightly air conditioned, the general activity of all the health care workers and equipment kept our area from ever feeling any flow of air; not even warm humid outside air. The building was designed, like many others, for air conditioning, so windows do not open. Floor fans helped but could not improve the environment sufficiently for our patients. Soon the infants began telling us that the situation was becoming intolerable. Sponge baths were not feasible because of the unknown elements in the well water. The baseline body temperatures of the infants began to rise despite being clothed only in diapers. Many of the infants became increasingly irritable and then feeding-intolerant. Shortly thereafter, we were informed that because of the heat and lack of fresh water, the analyzers in the laboratory were shutting down. We then were limited to bedside point-of-care testing only.

I met with our NICU staff and made the difficult decision to begin evacuation proceedings. We were tasked with moving 26 infants to safer situations, which meant placing our infants and others at risk (but less risk than not moving). After more than 3 decades of being known as an NICU that accepted all ill newborns, we were faced with a large-scale evacuation. As the message circulated that we were looking for help, the telephone began to ring, and many of the friends whom we had helped over the years were anxious to return the favor. Teams from as far west as Houston, Texas, and as far east as Birmingham, Alabama, and many places in between, were making plans to send physicians, nurses, and neo-

natal nurse practitioners to rescue our little patients (see “Interstate Transfer of Pediatric Patients During Hurricane Katrina,” pp S416–S420; “Preparing, Improvising, and Caring for Children During Mass Transport After a Disaster,” pp S421–S427; and “Caring for Displaced Neonates: Intrastate,” pp S389–S395). Because of limited ability to communicate with our patients’ parents, when we were unable to contact them, we used the face sheet in each patient’s chart and determined whether to send the patient to a level 3 NICU east or west from New Orleans. Teams from Birmingham, Baton Rouge, Louisiana, and Houston arrived by fixed-wing plane, helicopter, or ambulance that night, and none of the crews left empty-handed (Fig 1). After experiencing the conditions that we had been working through, each of the transport teams vowed to return. The majority of our infants were transported to safety on this first day after landfall. With the skies over New Orleans having been commandeered by the Federal Emergency Management Agency (FEMA), this took much more coordination than any transports we had ever arranged.

August 31: 2 Days After Landfall

True to their words, every transport team returned on the second day. On their return, our staff was treated to

ice chests full of cold drinks and chocolates, and one team even brought us T-shirts (with their group’s logo). Their generosity struck us all deeply and brought many to tears. By midday, the only remaining patient was the infant who required ECMO (Fig 2). Many of our nurses were requested to assist in other areas of the hospital while discussions began regarding the downsizing of our staff.

One of the generators had an electrical failure, so we were down to 2 functioning sources of power. The temperature in the NICU remained above 90 degrees but was a bit more tolerable because of the lack of activity. Because of the restrictions from lack of laboratory support, other areas of the hospital also found it impossible to care for their sickest patients, and a limited evacuation of these patients took place during the day. With the help of our biomedical department, we evaluated the NICU from an electrical standpoint and found that the heat and humidity kept the monitors from functioning properly, which made returning to the 10th floor impractical.

Voice communication continued to be difficult. Landlines had collapsed, and cell phones became largely inoperable because of tower failures. We learned that the success rate of communicating with the outside world was much higher using text messaging than with a telephone call. Surprisingly, the Internet stayed functional throughout the storm and aftermath. Not only could we get messages out, but streaming video also gave us a glimpse of how post-Katrina New Orleans and the Gulf Coast appeared. The levee breaches were extensive, and flooding of homes was horrific. Most of us were speechless while watching the unimaginable and seeing the despair. Some of the staff had not heard from loved ones for days. Between what we saw and had heard (or in some cases did not hear), the staff began to need each other more than ever. Most of us found it close to impossible to sleep that night because of accommoda-



FIGURE 1
Members of the University of Alabama at Birmingham transport team, Ochsner transport team, and nursing staff escorting 4 infants on a stretcher.



FIGURE 2
An infant on ECMO even while in a disaster is cared for by one of the NICU nurses.

tions as well as the psychological effect the storm and its aftermath were having on us.

September 1: 3 Days After Landfall

With the population in the NICU reduced to our lone ECMO patient, we were able to allow for the departure of more than 50% of our staff. Enough personnel were kept on campus because we were unsure of when utilities would return (thereby making the keeping of patients possible once again). With the very limited and sometimes terribly inaccurate information provided by the news media, most did not wish to leave alone. Caravans of cars and buses were scheduled and departed at specific times. As we learned that travel to the east was impossible, only leaving to the west and north was feasible. Caravans headed toward Baton Rouge had little difficulty reaching their destination, although reports of scattered debris never did justice to seeing the destruction firsthand.

Emotions were overflowing as many felt like they were leaving one family in search of another. By now, the satellite photographs were becoming available on the Internet. With enough perseverance, neighborhoods and individual homes could be identified. For those of us remaining, the next wave of emotions hit. Some of us found our homes seemingly unscathed, while others discovered severe damage and flooding.

From an institutional standpoint, the generator that failed was brought back online when the part and technician were helicoptered in from Alabama. It did not make a noticeable difference in the section of the hospital where our patients had resided. The well water continued to serve its purpose, and as long as the Internet functioned, communication was still readily available. Instant messaging was a valuable tool to have at one's disposal. Some telephone service was returning, but it still worked best when calling areas outside of the local area code. Our security team was supplemented by 23 out-of-state contract officers.

Food and nutrition services reestablished their supply chain as shipments of food and dairy products arrived from Dallas, Texas, and Baton Rouge, respectively. We discovered how talented one member of our housestaff really was when he volunteered to operate a forklift to unload a food shipment. Other staff physicians became food servers to give the dietary staff a well-deserved break. By now the dietary staff had truly risen to the top of the food chain (pun intended); during peak times they demonstrated the ability to feed up to 1500 people within 30 minutes.

Our B team assembled in the Ochsner Clinic in Baton Rouge. This center became the peripheral command site that coordinated physician staffing, housing, and transportation to the New Orleans hospital and clinic. The B team traveled in caravans using buses and private cars from Baton Rouge to New Orleans during daylight hours

with National Guard escort. Their arrival was just what the members of the A team needed.

September 2: 4 Days After Landfall

At 10:30 AM, we had normal power restored to the campus when the first feeder line from Entergy was connected. By late in the afternoon, we could feel the heat and humidity dropping. As the day went on, there were more fresh faces appearing by the hour, and few members of the A team remained. For dinner that night, the clinic and hospital administration held a barbecue, which provided welcome relief from cafeteria-style and canned food that had sustained us for the previous 5 days. Just the smell of burning charcoal was worth the trip to the parking lot where the small crowd of 2500 was being fed. No one complained about the wait.

September 3: 5 Days After Landfall

Our first post-Katrina infant was delivered weighing 683 g (1 lb, 8 oz) and brought a new sense of life to our NICU. With the air conditioning returning to the facility, we were able to care for her. The patient did well and was discharged from the hospital in early December.

September 4: 6 Days After Landfall

We began calling the staffs of all hospitals that referred infants to us pre-Katrina to inform them that we were fully staffed and operational. We had also recovered the use of our helicopter and air space, because FEMA was allowing us to fly in the area again. We made a decision not to back-transfer patients to our institution, because few of our families had yet been able to return.

September 9: 11 Days After Landfall

City water returned, and it was refreshing to see something colorless flowing from the faucets. Everyone was cautioned about drinking the water for the first 24 hours, because there may have been breaks in the continuity of the underground pipes. The city wanted to be sure that the system had been cleared of any potentially contaminated water, which may have been sitting in the system for the last week and a half.

Feeding and watering of the troops had been flawless. Not only did our food and nutrition staff care for the patients, families, and staff, but they also fed the National Guard, security staff, and FEMA workers who had set up a mobile clinic in front of Ochsner. As part of the meals served, the staff and visitors had consumed 36 000 tomatoes, 7000 melons, and 10 000 apples. Bottled water and sports drinks totaled 45 000 served.

September 22: 24 Days After Landfall

After hearing about Hurricane Rita's possible landfall in northeast Texas, an evacuated New Orleans family (currently residing in Houston) requested the transport of their premature 29-week-gestation twins. We returned

the favor afforded to us previously by Houston's neonatology staffs and were able to charter a jet to evacuate these infants and bring them closer to home. These infants brought our census to 10 patients, which was about one third of the norm.

CURRENT STATUS

By early December, our NICU census had grown to 35 infants. Our obstetric staff expanded because we accommodated some of our area's displaced physicians. With the expected increase in the number of NICU patients, we recently petitioned the State of Louisiana for licensing of additional beds at our institution.

The infant that stayed with us in his own private NICU while on ECMO is now home and doing well.

LESSONS LEARNED AND FUTURE ACTIONS PLANNED

Our institution has addressed many of the infrastructure issues that Katrina raised. The following changes are being made as we update our emergency-management manual.

Power

- We need to move feeder lines provided from Entergy above ground, because below-ground lines may be unreachable.
- Although we had 3 generators, they were insufficient to carry the air conditioning to parts of the institution; this is being resolved with the purchase of a fourth generator and the possibility of adding 2 portable generators for additional air-conditioning support.

Water

- A backup well-water pump motor was purchased.
- Fresh water storage tanks are being fitted for more pumping capacity.
- Installation of a pump that is capable of pumping fresh water out of bulk tanker trucks has taken place.

Sewerage

- We need to purchase gas-fired sewerage-ejection pumps for when power to the city pumping station fails.

Communication

- External: We must evaluate the use of satellite phones.

- Internal: We need more SpectraLink phones, which would be assigned by function, not by person.
- Command center: We need to establish a command center for preparing a list of functions and scheduling meetings.

Laboratory

- Waterless analyzers are currently available and are being considered for purchase.

Security

- Installation of perimeter fencing with lock-down gates should be considered.
- We need National Guard presence sooner.

COMMENTS

Unfortunately, there will be disasters like Hurricane Katrina in the future. Whether they are natural or man made, these catastrophes will not be as important as how we as a society prepare, cope, and respond to them. The decision to evacuate a patient should be based on the expectation of the magnitude of the impending disaster, the institution's ability to handle its patients, families, and medical personnel during and after the catastrophe, and understanding what the local surroundings may be like throughout the aftermath. No one person or institution will be able to anticipate and respond to every challenge that awaits those who attempt to weather the storm. Indeed, no one geographic area has the capacity to provide hospital care to children in a major disaster. By planning ahead, being able to respond quickly to a changing set of circumstances, and learning from others' experiences, we can create an environment that will allow for a successful outcome from a seemingly hopeless situation. There is no doubt that we will be judged by our actions during a crisis situation, with ramifications likely being long lasting. Once the immediate threat has passed, the continuation or restoration of patient services requires planning, leadership, patience, flexibility, and commitment.

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Closing and Reopening of a Children's Hospital During a Disaster

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The author has indicated he has no financial relationships relevant to this article to disclose.

CHILDREN'S HOSPITAL of New Orleans (CHNO) is a 201-bed general pediatric hospital that provides inpatient and outpatient medical and surgical care to more than 56 000 children per year. In 1 recent year, children came from at least 40 different states and 5 foreign countries. Critical care is provided in CHNO's 25-bed PICU, the 21-bed NICU, and an 8-bed spinal unit.

PREPARATIONS

New Orleans has had many hurricane threats over the years, leading hospitals and physicians to develop emergency plans to deal with the rare but predictable consequences of hurricanes. CHNO has an extensive inclement-weather plan ("Code Gray") that is updated and reviewed regularly. For a hurricane that is stronger than Category 3, there is an automatic coordination of activities with the State of Louisiana Emergency Operations Plan and the City of New Orleans Office of Emergency Preparations.

CHNO sits 12 feet above sea level, and the building is designed to withstand up to 14 feet of water. With each major construction project during the last 20 years, the hospital has incorporated new components of their hurricane-protection master plan. Some of the projects included:

- Moving chillers to the second floor.
- Installing 5 generators on the second floor that will allow the hospital to run the air conditioning while on emergency power.
- Installing a 50 000-gallon diesel tank to augment the existing 20 000-gallon tank, which provides emergency power for 2 weeks.
- Moving the information technology department to the second floor.

- Putting in place procedures and equipment to obtain nonpotable water from the Mississippi River.
- Installing 4 water tanks (4000 gallons each) to provide fresh water for emergencies.
- Installing a redundant telephone system on an upper floor.

AUGUST 27: 2 DAYS BEFORE LANDFALL

When the staff left the hospital that Friday afternoon, the assumption was that the storm was heading to the Florida panhandle or would make landfall in Alabama. There was little probability that New Orleans would be impacted. When there is a threat of a hurricane approaching New Orleans, it is the responsibility of one the vice presidents of hospital operations to ensure that the Web site be updated with current information. When Katrina started changing course, the Web site was updated to advise staff to stay in contact and be prepared for an upgrade in the disaster plan.

AUGUST 28: 1 DAY BEFORE LANDFALL

In the morning it was clear that CHNO would be impacted. Steve Worley, CHNO's president and CEO, decided that Code Gray would go into effect that afternoon. The department heads were contacted ahead of time so that they could initiate preparations. Although

Key Words: Hurricane Katrina, disaster planning, children's hospital, evacuate

Abbreviations: CHNO, Children's Hospital of New Orleans; UH, University Hospital

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this procedure has been performed successfully several times in the last few years, it was evident that, because of the magnitude of this impending storm, CHNO would need to implement a vertical evacuation.

Staff generalists and pediatric specialists began preparing for Code Gray with their staff and patients. Everyone assumed that there would be the usual citywide evacuation but that everyone would be back to work in 2 to 3 days. Hospital-based pediatricians and residents were selected and assigned duties as detailed in the CHNO Code Gray manual. CHNO hospital-based physicians communicated with their peers throughout the community to compare activities, census, bed availability, and the medical capability for specific patients.

All of these preparations were occurring on a Sunday, which added additional complications to preparing for the disaster. Having put staff on notice via the Web site was most helpful.

Code Gray was officially called over the hospital's public-announcement system at 4:00 PM.

Before announcing Code Gray, there were 130 inpatients. Thirty patients were discharged by early evening. There were 16 patients from the PICU who were relocated from the first to the second floor, thus beginning the vertical evacuation. One patient was moved to fourth floor because of isolation requirements.

Code Gray preparations did not only include discharges. CHNO oversees an active home-ventilator program, so predictably, as the storm approached New Orleans, 3 ventilator-dependent patients were carefully transported from their group home and admitted to the PICU.

Although the staff had practiced many mock vertical evacuations, this was the first one that was executed. Everyone lent a helping hand to ensure a successful move. Everyone was primarily concerned for the patients' safety even as concerns were rising for their own families. Many family members had evacuated the city, and communication was sparse. It was difficult for the staff to be reassured about their own family's safety. Although there were horrendous reports on the news, the staff continued to be committed to taking care of the patients. Their role went further than the patients' medical needs: they also provided comfort and support as needed. The overwhelming success of disaster preparedness would not have happened if it weren't for the strength and courage of the staff, who turned it into a reality.

AUGUST 29: LANDFALL

Normal power was lost at 8:30 AM, just before the eye of the hurricane made landfall east of CHNO. The generators, which have so much capacity that staff, patients, and their families were almost totally unaffected, started immediately. Air conditioning worked in almost all ar-

reas. All the emergency red-light switches worked, and even the clinic side of the hospital had power.

Once the eye of the hurricane passed New Orleans, a temporary feeling of calm ensued. The weather cleared a bit and winds began to diminish, which allowed our administration to assess damage reported by department heads. Communications with families and other hospitals were possible and, relatively speaking, positive. Our building suffered minimal damage, there was no flooding in the immediate area, and even the cars in the parking lots were not flooded or damaged.

The situation dramatically changed with news of the city flooding.

The mayor came on the news and reported that our worst fears had been realized: our levees had been breached. What had been feared for decades had now happened. The bad situation would get worse.

The last of the hospital's supplies and support systems were vertically evacuated. Employees carried everything upstairs including huge crates and boxes. Everyone was stressed, very tired and anxious, and hadn't had much sleep in the last few days.

The media had already reported flooding in nearby neighborhoods before the news of the breaks in the levees. Staff members were hearing about flooding in the areas in which either they or some of their relatives lived. These reports added to the stressful situation. Some staff heard reports that their families were wading through the contaminated water en route to the Louisiana Superdome. Telephone communications were down, and cell coverage was at a minimum.

In the midst of all this stress, an emergency call made it through from University Hospital (UH) describing 2 neonates who would be in danger of dying if their portable generator power stopped. The risk of transport was felt to be less than the risk of staying at UH. Although CHNO was now on emergency power, the physicians involved felt it was best to attempt a transfer. The city was in chaos, the water was rising, and because of the flooding, rescue vehicles could get no closer to UH than 3 blocks. The neonates would have to be evacuated by boat.

During the evening, preparations for transporting the neonates began. An improvised rendezvous site was arranged, and bassinets were prepared at CHNO with the necessary ventilator equipment.

AUGUST 30: 1 DAY AFTER LANDFALL

When the relative safety of daylight returned, a CHNO team waited for the UH rescue team to arrive. What they saw was 2 residents paddling a boat and another manually ventilating an infant. The infants were canoed 1 at a time to the waiting fire truck, where CHNO personnel carefully and safely completed the transfer of both infants (see "The University Hospital NICU in the Midst of

Hurricane Katrina: Caring for Children Without Power or Water," pp S369–S374).

The days after Hurricane Katrina became the most challenging. With the lack of basic utilities, the deteriorating security situation, and the flooding, it was apparent that most other New Orleans hospitals would have to evacuate. Because of the rapidly changing events, the CEO began meeting with the staff. Communication was frequent with the hospital's department heads throughout the storm. There were 2 "town hall" meetings held per day. Mr Worley communicated as much information as he knew to be accurate and allowed as many questions as employees, medical staff, and patients' parents needed to ask. Obviously, frequent open communication between staff and administration is of critical importance for service, safety, and staff morale.

The hospital received very little damage during the storm, and it was believed that the rising water would not reach the campus because it is above sea level. After a call to the Office of Emergency Management, a fuel tanker was able to reach the hospital and deposited enough diesel fuel to operate the hospital's generators for 2 weeks. The CHNO pharmacy director was able to restock medication that was necessary for the next few weeks. The staff continued to fulfill their responsibilities to provide medical care for the patients and their families.

The dietary director was challenged to provide 3 nutritious meals per day for those who remained at the hospital. Additional deliveries of food to the hospital were cancelled because of the mandatory evacuation.

That night, the city's infrastructure began to crumble with looting, violence, and fires. There were serious concerns that CHNO would be looted, but fortunately it did not happen. Hospital leaders were unsuccessful in obtaining additional security from the already overworked and overcommitted Federal Emergency Management Agency, National Guard, New Orleans police, or state troopers. The dedicated staff were left to their own security. Employees and family members became even more anxious with the reports they were receiving. Patient care was not compromised after the storm, but the fear was that the unrest throughout the city would migrate to CHNO. The hospital's security team, although unarmed, did a superior job maintaining order and keeping a watchful eye over the campus throughout the ordeal.

AUGUST 31: 2 DAYS AFTER LANDFALL

With the storm over and the hospital functions leveling off, it was felt that the worst was over. Then, the city's water pumps ceased functioning. The problem with lack of city water was not that of hand cleaning or having enough drinking water but rather that the hospital's air conditioning system would not function. The system uses 150 000 gallons of water per day to cool the chillers.

There was an option to use the Mississippi River water to cool the chillers, but the impure water would soon clog the system and make it nonfunctional.

At this point, Mr Worley met with his staff, and the decision was made to evacuate CHNO. He then met with the patients' families to explain that the hospital was going to be evacuated. The families were reassured of their child's safety and medical care. CHNO staff began contacting children's hospitals around the region and country for assistance in evacuating 100 patients and their remaining families. This list included 21 PICU and 26 NICU patients. The response was overwhelming: a total evacuation of all the patients was completed in less than 24 hours (see "Preparing, Improvising, and Caring for Children During Mass Transport After a Disaster," pp S421–S427; "Interstate Transfer of Pediatric Patients During Hurricane Katrina," pp S416–S420; and "Caring for Displaced Neonates: Intrastate," pp S389–S395). There were no deaths during the entire evacuation and transporting of CHNO's inpatients.

Because the telephones in the New Orleans area were working only intermittently, the National Association of Children's Hospitals and Related Institutions and Child Health Corporation of America aided CHNO with outside communications and other assistance. Texas Children's Hospital agreed to coordinate the effort and act as the point of contact. Conference calls were held with the involved hospitals on an hourly basis.

Transportation was arranged for 9 cardiac patients to go to Our Lady of the Lake in Baton Rouge, Louisiana, via Acadian Ambulance. Woman's Hospital in Baton Rouge took over the evacuation of 26 NICU infants and safely transported them by ground.

Children's Mercy Hospital in Kansas City, Missouri, with support from administrative leadership and cooperation from Senator Bond and Governor Blunt, deployed 2 C-130 aircraft from the 138th airlift wing of the Missouri National Guard. Four Nurses, 3 respiratory therapists, and a PICU pediatrician were flown to New Orleans, as was another fixed-wing medical transport aircraft. A medical convoy transported 26 patients with diagnoses such as asthma, dialysis-dependent renal failure, leukemia with bone marrow transplant, and chronic respiratory failure requiring mechanical ventilation from CHNO's PICU. Employees volunteered to help drive patients and their families to the airport. All patients survived the incredible, rapidly arranged transport, and all but 1 survived to discharge.

During the time of CHNO's evacuation, the New Orleans airport had closed its runways to civilian aircraft. So staff set up a makeshift heliport on the grassy field next to the hospital (Fig 1). Lights for use at special events were erected to direct helicopters flying at night. The helicopters ferried patients to the Baton Rouge airport, where airplanes waited to transport them to various hospitals around the country. PICU patients were



FIGURE 1
An improvised helipad for transport of hospitalized children.

transported to Texas Children's Hospital via 2 fixed-wing planes.

Cook Children's Health Care in Fort Worth, Texas, sent a plane, Miami Children's Hospital provided 2 helicopters, and Arkansas Children's Hospital sent 2 planes and a helicopter.

Louisiana hospitals in Baton Rouge, Alexandria, Lafayette, Lake Charles, and others accepted the remaining patients. Other hospitals were on stand-by to assist if needed.

Some families of CHNO's patients had been evacuated, leaving their children to ride out the storm in the safety of the hospital. As part of the evacuation, it was the staff's responsibility to contact each family to let them know the destination of their evacuated child (Fig 2).

Seventy-two children were evacuated to hospitals out of town. By midnight, there were only 4 patients left in the hospital. They had to spend the night because of



FIGURE 2
Comforting patients during the evacuation.

limits on flying time for pilots and refueling issues. The last patients were transported via helicopter at 8 AM the following day.

Refrigerated drugs from the pharmacy were sent with patients so that the receiving hospitals could use them. The director of the Dietary Department handed out food to staff and families before leaving, because many people would be beginning a long drive to safety outside of the city.

The CEO communicated via e-mail that arrangements had been made for office and clinic space to open in Baton Rouge. He stated that the hospital was fully committed to its employees and would continue to communicate through the closure of the hospital.

A private security team was assembled to protect the hospital. The Plant Operations staff turned off the fuel to the generators so that when the reserve tank emptied, the emergency power would cease. The hospital safe was emptied and left open to prevent theft.

Once everyone was out of the building, the doors were locked. For the first time in CHNO's 50-year history, it was closed for business.

SEPTEMBER 1 THROUGH 7: 1 WEEK AFTER LANDFALL

No, that wasn't the end; it was another beginning for CHNO. More than 350 employees and physicians had worked tirelessly for days to provide superb care to our patients and as much comfort as possible to their families. We then needed to relocate our business offices to a convenient place that was not affected by Katrina. Baton Rouge was selected, and efforts were immediately initiated to acquire office space. The Louisiana Hospital Association, which is located in Baton Rouge, provided temporary space within their offices. They also gave us assistance in a wide variety of important areas. Eventually, the Louisiana Hospital Association leased 10 000 square feet of office space to CHNO.

At that point, staff of the CHNO attempted to contact specialists to inform them of the new locations. The American Academy of Pediatrics set up a Listserv to help facilitate communications between pediatricians. Evacuees were scattered primarily throughout Louisiana, Texas and northern Mississippi.

Contact was made with local hospitals in Baton Rouge and Lafayette to explain our intentions and solicit their support. The decision was made to open specialty clinics in these major locations. Within 2 weeks, CHNO was holding its first clinic in Baton Rouge.

Lafayette General Hospital was extremely helpful. CHNO currently holds clinics on their campus, and they immediately provided us with additional leased clinic space.

Three moving vans were sent to CHNO, where we loaded supplies and equipment from the ambulatory care center that were needed to open the new clinics in Baton Rouge and Lafayette.

OCTOBER 5 THROUGH 10: 5 WEEKS AFTER LANDFALL

The CHNO's Metairie Center, a specialty clinic located in a suburb of New Orleans, reopened on October 5. CHNO also provided office space for 15 general pediatricians who were unable to return to their offices. There are 25 pediatricians on CHNO's staff who currently have no practice to which to return.

CHNO reopened as a full-service pediatric hospital on October 10, 2005.

LESSONS LEARNED

Normalcy to the New Orleans area has not returned as of the writing of this article in December 2005. There are many questions as to what the future holds as the pediatric community fights to return to normalcy.

Disaster plans were essential, and most institutional plans functioned well. Such plans need to be practiced and updated regularly, and they need to provide for a complete evacuation of the facility. Hospitals function 24/7, but Katrina demonstrated that hospitals may need to evacuate and close their doors.

There was no uniform method for evacuating patients, particularly for the critically ill ones. Once all hospitals in an entire city require evacuation, usual transport is overwhelmed. Hospitals in New Orleans depended on their contacts in other states or their parent organizations or associations to help them in this emergency. The last hospital to evacuate newborns was the state-run UH, which did not have such resources.

Hospitals in New Orleans had additional problems that had not been anticipated in disaster planning. Management of patient's family members, children of staff, and pets became problems. Most staff members experienced much more stress when they received information about missing family members' homes that were totally destroyed. These areas must be addressed for the future.

Architectural design for a hospital in a flood area needs to include a power plant well above the category

5 storm-predicted water level and backup generators to run all essential equipment and fuel for at least 2 weeks. An alternative water supply such as a well should be included so that there is an alternative supply of potable water and water for plumbing services.

During a catastrophic event such as this, communication is crucial. The Internet functioned better than telephone systems. Vendors need to be chosen for their reliability, as well. A common question that has been added for interviewing prospective vendors is, "How easy was it to get in touch with your company after Katrina?" Employee communications were difficult when home telephones or a near-relative's telephones were the only numbers available. The Internet proved to be the best means of communication and a way to reestablish contact with personnel.

In many cases, physician records were destroyed, damaged or unavailable, which created an information gap. The electronic medical chart, in many ways, could prevent this from creating a larger problem. Access was provided to out-of-state providers through the Louisiana immunization registry, which highlights the value of such registries. Children with special health care needs should be the first to have their basic health information on a retrievable database system.

COMMENTS

New Orleans has undergone challenges since it was first founded, and Hurricane Katrina represented yet another challenge. With the spirit of the people shown in this article, people caring for New Orleans' youngest and most vulnerable, New Orleans will rise again.

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Code Gray: A Resident's Personal Account From Children's Hospital of New Orleans

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The author has indicated she has no financial relationships relevant to this article to disclose.

WE KNEW THERE was a storm coming. Its name was Katrina, and it was headed straight for Florida, which was unfortunate for those having just endured a recent hurricane. Katrina lulled the city of New Orleans, Louisiana, to sleep, and that night she swerved. In an unusual and ultimately devastating turn of events, the hurricane literally cut west and traversed the state of Florida to find itself brewing with room to grow in the Gulf of Mexico. Despite this, no one panicked. There still existed a wide area of uncertainty for its landfall, and New Orleans had been spared from a direct hit numerous times before. We had just been lucky, I suppose.

AUGUST 27: 2 DAYS BEFORE LANDFALL

It became apparent that New Orleans would see some part of this growing monster, and as a precaution (one to which we have become accustomed), an evacuation of the city was ordered. In the children's hospital setting, this translated to another "code gray." Given that patients are not in a position to leave the hospital during a storm, it falls on chance that a group of doctors must weather it with them. Therefore, on this day, 12 resident physicians received a call telling us that we should prepare our bags to stay at Children's Hospital of New Orleans. Neither I nor any of my resident peers had had disaster training as part of our curriculum. When I found I was chosen to be on-call, I did not envision it lasting more than 2 days. I packed only a bare minimum, invested in water and microwaveable meals, and, by sheer luck, decided to pack some important documents just in case.

AUGUST 28: 1 DAY BEFORE LANDFALL

The day was sunny and beautiful. As I drove to the hospital that morning, I was determined to remain in a chipper mood. I greeted everyone in an excited manner

and received many puzzled looks in return. I did not understand why everyone was operating in such a somber fashion, given that this hurricane would likely veer east as the others had. In the PICU, there was an element of excitement mixed with an air of concern. Efforts were already underway to move the children to higher floors, given that the PICU (on the first floor) was susceptible to flooding. As I wrote my daily notes, I asked one of the more experienced nurses about the necessity for all of the activity. She related her recollections of the last category 4 hurricane to hit the area, Betsy, in 1965 and told me of the tragedy in its aftermath. I soothed myself by saying, "This is not Betsy; this is Katrina," not knowing then that Katrina would demand her own place in history.

Over the course of the day, we transported each of the critical patients to the second floor, an area that could hardly be termed "ideal" for these children. But, we made the best of a bad situation with the expectation that we would return to the first floor in 1 or 2 days. No one predicted that these patients would not see the original PICU again. As the night wore on, sleep became an issue, given that 4 residents were sleeping in rooms built for 2. Many of us slept on the floor, and as we rested, we laughed and joked, unaware of what lay ahead.

Key Words: Hurricane Katrina, Children's Hospital New Orleans, Code Gray, disaster, evacuation

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AUGUST 29: LANDFALL

It was windy and stormy. At about 2 AM, I awoke to the sound of rain smashing against the call-room window and wondered if it would break. I could tell that I was not the only one awake. No one said a word; we just listened as the hurricane sounded its arrival. By daybreak, the winds were dying down, and newscasters confirmed my suspicion that the eye of the storm had landed east of New Orleans. This was perceived as good news for us since most of the damage of a hurricane historically lies east of the eye.

All remained quiet in the transplanted, makeshift ICU, so much so that I decided to take a brief walk to survey the surroundings in the neighborhood. Although there was no flooding (yet), there were a lot of fallen trees, scattered debris, and downed power lines. The hospital lost power and began operation via generators. Unfortunately, this marked the end of air conditioning in some noncritical parts of the hospital, but at least it ensured working medical equipment for as long as the generators would last.

Meanwhile, my colleague Dr Andrea Oleary, who was across town at the Alton Ochsner Foundation Hospital, was learning disaster pediatrics as well. She wrote:

“I woke up bright and early to write my PICU progress notes. At that time it didn’t matter how early I completed my notes, because it was taking hours for our daily labs to return. We were trapped in a bizarre situation as most of our treatment plans were based on the results from those labs. We mused that this must be how doctors practiced medicine out in the field, ‘medicine in the rough.’ It was amazing to discover how dependent we have become on labs and imaging studies. Nevertheless it was disquieting to be unable to monitor our progress. We had an acute renal failure patient on dialysis. How were we to determine his kidney function or dialysis without laboratory values? To add additional insult, we had lost our power and were running solely on generators. Both patients and staff were starting to notice the warmth.”

Overnight, all of Children’s Hospital’s resident call-room windows leaked, and water had soaked into the carpet, leaving the smell of mildew to fill the air and the damp floor to continue to serve as our sleeping environment. Cell phones were working only sporadically and were sometimes useless. The hospital telephones worked in house but had difficulty with outside messages because of overloaded circuits. We were isolated from the world, and we were beginning to feel it.

AUGUST 30: 1 DAY AFTER LANDFALL

It was gray and quiet outside. Then the floods came; more than the storm itself, Katrina’s aftermath stunned the city. When we awoke, we were shocked to learn that 80% of New Orleans and its surrounding area was under water.

Frustrated citizens who had not evacuated, predictably, began looting the stores and affected homes, un-

derstandably for water and food but later, horribly, for televisions and expensive equipment. What happened, and what would this mean for the hospitalized children? We were alone although, fortunately, part of the 20% of the city without flooding. It was a positive note for us, but also a worry, given that people on the streets might soon find their way to our haven, perhaps ready to shoot for food and water.

In the midst of the stressful, risky situation outside the hospital, one of our staff NICU physicians did the unimaginable—accepted the transfer of 2 very ill newborns. University Hospital was isolated with the flood and had no power or water to maintain life-saving care. Although our ICUs were not optimal, we had generator power, water, and support services. But how would we transport these very sick children out of a flooded area? No one had trained for this. With sheer resolve, courage, compassion, and knowledge, our staff physician drove by fire truck to the point of flooding near the hospital and received the patients coming from University Hospital by canoe through floodwaters mixed with raw sewage (see “The University Hospital NICU in the Midst of Hurricane Katrina: Caring for Children Without Power or Water,” pp S369–S374). They fought to keep these patients alive while being accosted by desperate, stranded Katrina victims who were looking for food and safety. In a moment of joy and pride, both infants made it to the hospital and were placed on life-saving breathing machines. I knew then that my hospital had outstanding staff, and their devotion to our patients linked everyone.

After a meeting of hospital leaders, we were informed that we would be staying there for an unknown length of time with an estimated 10-day supply of food. What began 2 days ago as normal meals served in the cafeteria shifted to slower service with fewer selections. Some cafeteria workers’ houses had been flooded and their families put at risk, which was associated with justifiable staffing issues. Cell-phone service remained intermittent, and questions abounded as to how we could continue to run a hospital in this way. The first whispers of evacuation were heard, but this was not an immediate option, given that other hospitals in the area were now flooded and without generators; they would need to be evacuated first.

AUGUST 31: 2 DAYS AFTER LANDFALL

Outside, the clouds were breaking and the sun was coming through. We wanted to get out of there. The despair was settling in and was not limited by race, religion, social status, or occupation. By this time, we had achieved contact with our families, who were all desperate as well. My own mother begged me to come home, and my father threatened to find a government plane to “rescue” me. I told them both that I had a duty to care for these children first. The staff had all resolved

that the children came first and that they were our foremost concern.

Along with the other residents and charge nurses, I gathered the information for all of my patients regarding their needs and ability for transport to other institutions in the event that evacuation was possible. The nurses for Children's Hospital New Orleans flew into full swing, taking care of all details and, as usual, doing their jobs with utmost care and the least appreciation. The ICU nurses were my pillars, and each of them made my job easier.

Staff morale declined even further when we learned that the toilets in the hospital were no longer functioning normally for lack of city water. We placed our personal waste into biohazard waste bins. No one felt that these were conditions under which to run a children's hospital because it was no longer sanitary for the patients. In terms of safety, firemen, staying in the hospital for our protection, alerted us to the fact that the hospital could no longer outlast a fire because there was no water.

The administration of the hospital made the decision to go into self-evacuation mode, which meant no longer waiting for government assistance and arranging ways out for all of our children, followed by staff and employees. Administrators used available telephone lines to request assistance from other children's hospitals in nearby states. Our calls were answered almost immediately, and in a scene warming to the heart, the ambulances found their way to our streets to transport less acutely ill patients, and the roar of helicopters was not far behind them.

ICU patients were shipped by helicopter one by one, which took the entire night and went into the next morning. These transporting physicians and medical personnel were heroes, willing to travel to an unsafe and unknown area to rescue children they did not even know. But, this is what defines the medical field. We take an oath to serve those who are unable to serve themselves, and that is what everyone in Children's Hospital New Orleans, in every hospital in the city, and everyone who helped transport these patients to safety holds as a creed.

The view outside the hospital that night was awe-inspiring. On the ground, 30 vans lined up in the darkness of a night no longer lit by streetlights, using their headlights as their guiding beacons. These 30 vans served as a caravan to transport to the airport patients who were healthy enough to make the ride. From there, military helicopters transported them further to nearby cities and states. Just beyond those vans were groups of helicopters on the field surrounding the hospital waiting to carry the ICU-level patients. They flew out only to return in short time to pick up the next in line. This lasted the entire night, until, at last, there was quiet.

SEPTEMBER 1: 3 DAYS AFTER LANDFALL

It was sunny and beautiful at 6 AM. My colleagues and I heard what sounded like the beginning of an important announcement over the public-announcement system: "Attention! Attention! All Children's Hospital employees and staff!" Then there was silence. About that time, rumors began to fly. All of us feared the worst. Were there looters? Was the operator hurt? Had the floodwaters reached us? We stood paralyzed while one of the residents investigated. She reported back that the announcement was still a mystery, but by the hurried look of other staff, and because all of the ICU patients had been transported, it was time to head out.

One of the residents took one of the few remaining patients and her mother to drive them out of the city. As we drove from the hospital, I glanced back and realized the oasis that it was, an island in a body of water that was once a thriving city. From then on, all eyes were fixed west. As we drove, I had a vantage point to assess the area in which I live. All that could be seen was water.

We forged forward, and on reaching the Causeway exit, there were people, hundreds, perhaps thousands, of people, standing, waiting on the interstate. I would later find out that these were just some of the evacuees, with hunger and thirst written on their faces. Was this America? The Statue of Liberty has a quote from Emma Lazarus etched on it, which has long been considered a motto for the United States:

*"Give me your tired, your poor,
Your huddled masses yearning to breathe free,
The wretched refuse of your teeming shore.
Send these, the homeless,"*

Here they were, the masses, the homeless, the tired, and the poor, and they were waiting. Waiting to be cared for by their country and given basic needs: shelter, clothing, and food. It would take days more for many of these people to find refuge.

Although we continued out, it was as if the area was a war zone. In fact, it was a war zone, with martial law in place, families displaced (even from one another), homes leveled to the ground, and disease and famine imminent. Inside my car, I cheered as 50 to 75 buses approached the city to pick up evacuees. Behind them drove lines of trucks from the US National Guard equipped with boats and military personnel riding in the back. I wondered if they knew the extent of misery that they were about to encounter, but at least they were there, and citizens in need could be rescued.

The next thing I remember is pulling up to my parents' house in Baton Rouge, Louisiana. I parked and just sat there for a moment, unaware if I was prepared to see anyone. Then I saw my mother's face and, as I embraced her, we wept. She wept for the daughter whose safety seemed questionable at times, and I wept knowing that now I, and my patients, were finally safe.

Caring for Displaced Neonates: Intrastate

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The author has indicated he has no financial relationships relevant to this article to disclose.

WOMAN'S HOSPITAL in Baton Rouge, Louisiana, one of the first women's specialty hospitals in the nation, is a 225-bed, private, not-for-profit organization that delivers more than 8000 infants each year. Sick newborns and infants less than 1 year of age are cared for in the 83-bed Center for Newborn and Infant Care, comprised of a level III-C NICU,¹ special care nursery (level II), developmental nursery, infant care center, and neonatal surgery center. A private physician group consisting of 9 neonatologists and 2 neonatal nurse practitioners (NNPs) provide in-house coverage on a 24/7 basis. The hospital employs 4 NNPs to serve as transport NNPs.

The Louisiana Office of Emergency Preparedness (OEP) designated Woman's Hospital as the referral center for high-risk obstetrical patients and neonates for both Hurricanes Katrina and Rita. In a period of 5 days, 87 neonates were transferred to Woman's Hospital during Hurricane Katrina, and transports were arranged for an additional 34 infants to other facilities. Twenty-one neonates were transferred to Woman's Hospital during Hurricane Rita.

AUGUST 26: 3 DAYS BEFORE LANDFALL

Peak Census: 61; Midnight Census: 56*

Katrina, still in the Gulf of Mexico, became a category 2 hurricane, and by 11 PM, the landfall forecast was for just east of New Orleans, Louisiana.² We knew Baton Rouge would experience some type of adverse weather. The Hospital Emergency Incident Command System contains 4 increasing states of storm readiness based on the type of tropical storm/hurricane watches and warnings issued for Baton Rouge. Level 2 was implemented, which included fueling of emergency power generator tanks, establishment of alternate communications, updating departmental emergency call lists, stocking of hospital linen, replenishment of emergency food and drinkable

water supplies, battery charging on portable equipment, and an evaluation of current medication supplies in the pharmacy, with procurement of additional needed emergency medications.

AUGUST 27: 2 DAYS BEFORE LANDFALL

Peak Census: 59; Midnight Census: 54

Katrina became a category 3 hurricane. During the day, the Louisiana OEP was activated, and mandatory evacuations for some parishes south of New Orleans were issued. At 10 PM, the National Hurricane Center issued a warning suggesting that Katrina was moving in a western direction toward an area that included New Orleans. Woman's Hospital moved to level 3 storm readiness, opening the operations center for the hospital. This area contained multiple modes of emergency communication, televisions, emergency power, and computers with Internet access. Additional hospital preparations included establishment of emergency radiology capability, provision of alternative communications in case telephone service to the hospital was interrupted (800 radio system, HEAR Radio system, Ham radio operator), assisting physicians in making rounds to discharge as many patients as possible, obtainment of additional patient

* The peak census is the total number of patients seen daily, and the midnight census is the number of patients after admissions and discharges.

Abbreviations: NNP, neonatal nurse practitioner; OEP, Office of Emergency Preparedness; OLOL, Our Lady of the Lake; LSU, Louisiana State University

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care supplies, identification of physicians who were on-call for each physician group, identification of physicians who were willing to stay at the hospital or make themselves readily available to the hospital during the storm, and establishment of an employee labor pool.

AUGUST 28: 1 DAY BEFORE LANDFALL

Peak Census: 58; Midnight Census: 54

Katrina was a category 5 hurricane by 10 AM, which prompted New Orleans' Mayor Nagin to issue a mandatory evacuation of the city except for those in prisons or hospitals and tourists, officials, and media. By 5 PM, the state police estimated that 500 000 vehicles were evacuated from New Orleans. Although we received a transport request from East Jefferson General Hospital on that evening, we were unable to comply because the evacuation was taking place on all lanes of Interstate 10 in and out of New Orleans, and the weather was deteriorating. The backup neonatologist came into the hospital that night in case the 4 daytime neonatologists would not be able to make it to the hospital for morning rounds.

The hospital was now at level 4 storm readiness. Hospital preparations at this time included reporting of staffing plans and needs to the resource pool coordinator in the command center; notification to patients of storm status and preparation activities; relocation of emergency child care; distribution of supplies such as lanterns, flashlights, batteries, bottled water, linens, blankets, and personal cleaning supplies to staff; the transfer of respiratory therapy equipment to emergency electrical outlets; and the backup of electronic patient records and storage at an off-site location.

AUGUST 29: LANDFALL

Peak Census: 55; Midnight Census: 53

The daytime neonatology staff all made it into the hospital for rounds despite high winds and severe rain. During the morning, the first levee breach in New Orleans had occurred, and warnings of flooding were issued. We finished rounds at the usual time that afternoon with no requests for evacuations from New Orleans.

AUGUST 30: 1 DAY AFTER LANDFALL

Peak Census: 79; Midnight Census: 72

During the morning, a member of our group and 2 hospital vice presidents attended a briefing at the Louisiana OEP, which is located only 1 mile from the hospital. Although their plans for evacuation of infants at this time was transportation to level IIIB units in northern Louisiana cities that were 3 to 5 hours away from New Orleans, we requested that Woman's Hospital be designated as the regional transport center for pregnant women and infants. Our plan was approved as the flood-

ing worsened in New Orleans and evacuations were imminent. In conjunction with our hospital administration, we had determined previously that we could accommodate as many infant transfers as needed in the face of an immediate evacuation. We had recently opened our 30-bed special care unit, which uses a 3-patient-per-pinwheel design with a minimum patient footprint of 120 square feet per infant. Each patient space was duplicated and stocked with supplemental/rental equipment. Fortunately, the preexisting 20-bed special care nursery space had not yet been demolished and was reopened.

In the morning, we initiated communications with several of the NICUs in New Orleans to inquire about their status; all of them felt secure and that evacuations were not yet optimal or necessary. However, as the flooding intensified in New Orleans in the afternoon, we began to receive calls for evacuation. We mobilized 5 transport teams (1 lead NNP with a nurse or respiratory therapist as the second member) by ground to Alton Ochsner Foundation Hospital to transport 5 infants (see "Disaster Preparation and Lessons Learned at the Ochsner Foundation Hospital," pp S375–S380). Ground units were provided by our usual partner, Acadian Ambulance, a private company with 205 ground ambulances, 7 helicopter ambulances, and 4 fixed-wing aircraft based in southern Louisiana. The teams arrived back at the hospital at approximately 5:30 PM. As soon as the transported infants were brought into the nursery, the transport teams were dispatched again to New Orleans for the remaining infants at Ochsner Hospital. Because of the violence reported in New Orleans, some of which was directed against emergency personnel, it was felt to be necessary for the transport teams to be escorted by state troopers.

Additional neonatologists in the group had been called into the hospital to help with admissions. At approximately 7 PM, 16 evacuated infants from Memorial Medical Center began to arrive by helicopter (Fig 1). These infants were accompanied by 2 doctors who held and hand bagged the critical infants during the trip to safely facilitate a maximum number of patients (see "Caring for and Transporting Very Low Birth Weight Infants During a Disaster," pp S365–S368). Another doctor accompanied a patient by ground, and a nurse from the NICU accompanied each helicopter. The nonventilated patients were transported in their plastic bassinets (Fig 2). The last patient from Memorial Medical Center was admitted at 9:00 PM.

As with many of the evacuations, some infants' parents had not been notified of their infant's transport because of their own evacuations and lack of communication with the New Orleans health care providers. The process of establishing communication and ultimate reunion of infants and parents would become a daily priority for the health care team. The social services depart-



FIGURE 1
Evacuation of infants from University Hospital, September 2.



FIGURE 2
Newborns arriving in bassinets.

ment at Woman's Hospital undertook the coordination of information, which required 24/7 operation (see "Reuniting Fractured Families After a Disaster: The Role of the National Center for Missing & Exploited Children," pp S442–S445).

Our transport teams were still on the road at midnight.

AUGUST 31: 2 DAYS AFTER LANDFALL

Peak Census: 105; Midnight Census: 90

Nine new infants from Ochsner Hospital began arriving at approximately 1:00 AM. The rapidly growing census was associated with increasing duties for the staff, including the attending physicians. The "scheduled" on-call neonatologist assumed responsibilities for the existing patients, and additional neonatologists would cover the "new" patients. Shortly after the neonates from Ochsner Hospital were admitted, we were contacted by

someone at East Jefferson General Hospital requesting us to take in 10 evacuated infants. We grabbed a quick nap for a few hours before these new infants began arriving around 6:00 AM.

Our first priority each day was a team meeting of physicians and charge nurses to identify discharges and infants who could be transferred to other units when new evacuations occurred. I began calling other NICUs in the state to determine their bed capacity and ability to accept transfers should the need arise. Because we were the nearest level III regional NICU to New Orleans, it was logical to keep the sickest infants and transfer the less acute infants to the remaining units in the state. During rounds, we identified 9 infants to transfer to Earl K. Long Hospital, the charity hospital in Baton Rouge.

Before work rounds were completed, I was contacted by Children's Hospital of New Orleans to arrange transport for more NICU and PICU patients (see "Closing and Reopening of a Children's Hospital During a Disaster," pp S381–S385). The infants/children with cardiovascular disease were transported to Our Lady of the Lake (LOL) Children's Hospital in Baton Rouge accompanied by their cardiovascular surgeons. Two of the infants were in need of cardiovascular surgery: one would subsequently be transferred out of state for surgery, and the other would be kept stable until surgery could be arranged.

Obtaining ground units was becoming incredibly difficult at this time, because units, for the most part, had already been dispatched to New Orleans and were already overworked. Fortunately, some emergency medical technician units from other states had begun to arrive and were integrated into service. In addition, the level IIIB NICUs in Alexandria, Louisiana, were enlisted and were able to provide their own transport units, which was a great help. During the day, I received telephone calls from Kenner Regional Hospital requesting transport of 2 infants. When it was explained that there were no teams available, the transferring physicians brought the infants to Woman's Hospital in their own private cars. The majority of my day was spent on the telephone providing overall coordination to neonatal evacuations.

I had numerous visits to the OEP during the day. Although Woman's Hospital had been designated the referral center and given authority to arrange transports, it was still difficult to obtain ground units. The proof of verification of this authority had to be repeated daily by the OEP, which was one example of the frustrations we encountered from disrupted a communication chain during the evacuations.

By that evening, the National Disaster Medical System was in place. It was the general understanding among state officials that there remained approximately 2000 hospitalized patients in New Orleans who needed to be evacuated. Essentially, a field hospital was established at Louis Armstrong International Airport, where

evacuees would be triaged and flown to facilities out of state (see “The National Disaster Medical System Response: A Pediatric Perspective,” pp S405–S411). In discussions with OEP personnel, including Federal Emergency Management Agency and Louisiana State University (LSU) Charity Hospital officials, we were informed that no additional neonatal transports needed to be done from New Orleans because all neonates had been evacuated. Late at night, we welcomed this information, felt our job was manageable, and headed back to the hospital.

SEPTEMBER 1: 3 DAYS AFTER LANDFALL

Peak Census: 107; Midnight Census: 104

A Communication Breakdown

Without a doubt, this day marked the biggest day of frustration for me throughout the Katrina experience. More infants from Children’s Hospital of New Orleans began arriving at 1:30 AM with our transport teams. The teams kept returning to New Orleans for additional patients, with the final infant arriving at approximately 7 AM. In addition, 9 pediatric patients were being transported to OLOL Children’s Hospital, as was 1 infant who was born at a women’s shelter in Chalmette, Louisiana. Touro Infirmary needed to evacuate 14 level II infants. My previous telephone calls paid off, and 2 hospitals in Lafayette, Louisiana, had available beds and independently arranged for direct transfer of these patients.

A Communication Breakthrough

Incredibly, Cheryl Ory, RN, an NICU nurse at University Hospital, got a text message out to a friend in Colorado, who was able to get in contact with the president of the Louisiana Hospital Association. The University Hospital NICU was frantically caring for sick neonates in a facility without electricity, water, or supplies. Cheryl was desperately pleading for any kind of help, but mainly to get the neonates evacuated. I can remember looking at the people in the room with me in utter amazement, because we had been informed the previous night that there were no other neonatal evacuations that needed to be done. I was able to call Cheryl immediately to confirm the message I had been given and also to speak with Brian Barkemeyer, MD (see “The University Hospital NICU in the Midst of Hurricane Katrina: Caring for Children Without Power or Water,” pp S369–S374), who confirmed the presence of approximately 28 neonates at University Hospital. I, along with the Woman’s Hospital CEO and vice president for operations, immediately headed back to the OEP, where we sought out the CEO of the LSU Health Care Services Division. He confirmed the presence of neonates at University Hospital.

A preliminary evacuation plan for all patients at University Hospital to begin the next day was being circulated. However, because of the severity of conditions at

University Hospital, as stated to me by the NICU team, as well as our previous designation by the OEP for neonatal evacuation, we began working on a separate evacuation plan for the neonates. Although every official we spoke with was concerned because newborns were in danger, we made no real headway until obtaining the help of Major General Don T. Riley, Director of Civil Works, US Army Corps of Engineers, who happened to be related to one of our hospital administrators. As I would find out later from other pediatricians in New Orleans, evacuations often happened because of personal relationships and less as part of an organized evacuation.

With General Riley’s help, we were able to maneuver through the chaos and enlist the help of the Texas and Louisiana Wildlife and Fisheries Departments, as well as members of the US Army and Louisiana National Guard (Fig 3). As soon as these individuals were made aware of sick neonates still needing to be evacuated, it became their first priority. These were great people who wanted to help the infants. Unfortunately, because of the lateness of the day, we were unable to coordinate a transfer that evening. New Orleans remained without power, and the danger of attempting rescues in the dark was too great for all concerned. An alternate plan was devised, which entailed transporting infants by air boat (Louisiana and Texas Departments of Wildlife and Fisheries)



FIGURE 3
Evacuation of infants from University Hospital, September 2.

early in the morning to a landing zone for military helicopter pick up. The briefing for the mission was to be at 7 AM the next morning, and evacuation of the infants was to start at 9 AM. I briefed Dr Barkemeyer by telephone. All we could do was wait for the morning.

Meanwhile, care continued, although we were at double our usual census.

SEPTEMBER 2: 4 DAYS AFTER LANDFALL

Peak Census: 118; Midnight Census: 114

I was supposed to have received a telephone call that morning from the Department of Wildlife and Fisheries as to the status of the mission. When the call was not received, I went back to the OEP for an update. Things were delayed. The original LSU evacuation plan was back on. However, this plan entailed having the infants being taken to the airport and then subsequently airlifted out of Louisiana. I discussed this with those present, and we agreed on a new plan, with the infants being taken to the airport and then flown to Baton Rouge Airport by Acadian Ambulance. I notified the hospital that staff and members of the transport teams were going to be needed at the airport to triage infants until we could establish multiple ground units to move the infants to Woman's Hospital.

I then attempted to call Dr Barkemeyer about the new evacuation plans. When his cell phone was answered, I was informed by the person answering that he was on the roof of University Hospital evacuating infants onto helicopters. The cell phone eventually found its way to Dr Barkemeyer, who informed me that the infants were indeed being loaded onto helicopters as we spoke. I stressed to him that flight teams would be at the Louis Armstrong Airport to evacuate them to Baton Rouge and not to board the federal planes for out-of-state transfer. To this day, I am unaware of exactly which military unit evacuated these infants, but I am very grateful to those individuals who took it on themselves to rescue the infants.

At the time of my telephone conversation with Dr Barkemeyer, I was physically present with the military pilots in Baton Rouge who were supposed to have evacuated the infants. We all just looked at each other and shook our heads. We left the OEP to head to the airport. Because we were in our car, we could see the hospital in the distance with 2 Blackhawk helicopters approaching. Unbelievably, 29 infants (some with their mothers) from University Hospital were on the helicopters. Six of the most ill infants were kept at Woman's Hospital, 6 were sent to Women and Children's Hospital in Lake Charles, Louisiana, 13 to Earl K. Long Hospital, and 4 to Baton Rouge General, Bluebonnet.

There would be no more neonatal transports.

SEPTEMBER 3 and 4: 5 AND 6 DAYS AFTER LANDFALL

Peak Censuses: 125 and 114; Midnight Censuses: 114 and 101

We continued to triage patients to other facilities as well as home. One infant was flown back home to the Netherlands. Because the press requests were overwhelming, we instituted our "media times" at 10 AM and 4 PM daily for the next 2 weeks.

The CEO of Woman's Hospital and I met with Rich McKeown (HHS Chief of Staff, US Department of Health and Human Services) and Mark McClellan, MD, PhD (Administrator, Centers for Medicare and Medicaid Services) to discuss the role of the private sector in hurricane relief. Also in attendance was the Chancellor of LSU Health Care Services, Louisiana Hospital Association representatives, and a member of the US Surgeon General's office. After reporting on the current status of the hospitals in Baton Rouge, we cautioned them that we expected a surge in Medicaid patients and that Louisiana, like many other states, has inadequate reimbursement for pediatric services.³ We felt that it was extremely important to obtain some assistance for the private providers in Louisiana who provide the overwhelming majority of services to the state's Medicaid population and would move us closer to compliance with the American Academy of Pediatrics policy statement on Medicaid reimbursement.⁴ We expected this to increase with the closure of the Charity Hospitals in New Orleans. We were trying to rid the system of financial barriers in obtaining pediatric care. (As of submission time, instead of relief, Medicaid Current Procedural Terminology code reimbursement was cut for pediatricians [see "Children's Hospitals Meeting the Challenge Together," pp S357–S358].)

SEPTEMBER 5 (LABOR DAY): 7 DAYS AFTER LANDFALL

Peak Census: 104; Midnight Census: 97

Our census remained high but was beginning to decrease, at times to below 100. The neonatologist schedule was moved back to our usual 4 rounding attending physicians during the day plus 1 NNP. We also began to receive offers from other NICUs across the country to transfer infants whose parents were relocating to their area as well as offering to send staff. In some cases, the hospitals were even willing to take families and help them relocate. The benevolence of the health care sector was refreshing and much appreciated.

In my opinion, the most significant outcome for the children of Baton Rouge occurred on this day. Representatives from the OLOL Hospital and Primary Care Physician Network and I had multiple discussions regarding pediatric care for Medicaid patients in our city. Although some pediatricians in our area accepted Medicaid, there still remained approximately 1300 infants born at our hospital who entered the charity hospital system on a yearly basis. Although we had previously

reached a general consensus on how care would be provided, a decision was made that all children on Medicaid could be cared for in the private sector through OLOL Children's Hospital and Primary Care Physicians. This agreement ensures that all of the children born at Woman's Hospital would have their own pediatrician. This was done without the promise of increased reimbursement by the Louisiana Department of Health and Hospitals or other sources. The end result was a private solution to a public problem in our city. Indeed, something good had come out of the storm.

SEPTEMBER 6 THROUGH 19: 8 TO 21 DAYS AFTER LANDFALL

Peak Censuses: 97 and 98; Midnight Censuses: 95 and 92

The next 2 weeks quickly settled into a more normal routine. The social service department generated daily lists of the location of patients' parents and daily assessments of parents' relocation areas. For the remaining hospitalized patients, transfers were initiated when the infants were stable and based on their parents' locations. Infants were transferred to Toledo, Ohio, and Atlanta, Georgia, to be with their parents. Our last infant to be reunited with his parents occurred on Friday, September 9, 11 days after the hurricane.

SEPTEMBER 22: 24 DAYS AFTER LANDFALL

Peak Census: 106; Midnight Census: 101

A warning for Tropical Storm Rita was issued in our area. We received 13 infants from Lake Charles by helicopter. Four ground-transport teams in a convoy brought more stable infants with police escort. Thankfully, the escort was only needed for traffic this time. Some of the infants we received were infants first transported to Lake Charles from Woman's Hospital during Hurricane Katrina. A military Blackhawk helicopter was secured to bring infants from Lafayette to a safer location in Baton Rouge.

SEPTEMBER 23: 25 DAYS AFTER LANDFALL

Peak Census: 104; Midnight Census: 99

I attended a meeting with the LSU Department of Pediatrics faculty regarding initiation of resident training in the NICU at Woman's Hospital. The teaching facilities in New Orleans had been heavily damaged, and providers throughout Baton Rouge had been asked to assist in resident training. Our meetings would eventually culminate in a second-year/third-year resident rotation for 2 to 3 residents per month in the NICU.

Since the hurricanes, most of the infants have been discharged or transferred nearer to their families at children's hospitals in Fort Worth, Houston, Lubbock, Galveston, and Austin, Texas, and Salt Lake City, Utah. The reimbursement for these transports was arranged through the National Center for Missing and Exploited

Children (see "Reuniting Fractured Families After a Disaster: The Role of the National Center for Missing & Exploited Children," pp S442-S445) and the Federal Emergency Management Agency.

COMMENTS AND LESSONS LEARNED

Without question, the key to our successful evacuations and provision of care for neonates from New Orleans was the Woman's Hospital administration's preparations for such a disaster. The hours spent by administration and medical staff in preparing and implementing standards and procedures at our hospital were well rewarded during Hurricanes Katrina and Rita. The presence of a crisis-response team is of the utmost importance. An established, published chain of command and responsibilities was invaluable during the evacuations.

Preparing for the surge in capacity for hospitalized children in any geographic area during a disaster is a problem. Coordination of facilities and personnel responsible for the mass evacuation of children needs to be established at the city, regional, state, and interstate level. In the case of Louisiana, this did not exist. Any type of disaster, natural or man made in any part of the country, can inflict the same effects on a city/region as did these hurricanes. A list of pediatric facilities, providers, and modes of transport as well as evacuation routes must be included in any disaster/evacuation plan. Although these plans may exist for an individual hospital, it is unlikely to be pediatric-specific. The relocation of major services such as cardiovascular surgery, extracorporeal membrane oxygenation, critical care units, and teaching programs should be included in any disaster plan.

Shelters for children and their families must be part of this plan also. As we discovered during the hurricanes, shelters do not usually accept pregnant women after 34 weeks' gestation because of the risk of delivery at the shelter, and shelters oftentimes do not have facilities for even normal newborns.

There should be several people in each state capable of serving as the overall coordinator in a crisis, and a regional plan that determines which coordinator is in charge should be established during crisis planning. During a disaster, daily calls to participating centers to assess census and capabilities should be made. These calls should originate from the overall coordinator.

The biggest obstacle in many cases during the hurricanes was communication, both hospital to hospital and hospital to parent. Landlines and cell phones can be disrupted easily. Alternative communications such as satellite phones, HEAR radio, and a NORAC system must be in place. This type of disaster planning should not be left for elected officials to do alone, because the expertise needed will not exist without the input of pediatricians. It is up to each of us in our own community to ensure

that this happens. The American Academy of Pediatrics can be instrumental in undertaking this task.

There will be a great impact on the staff of a hospital who, as in the case of Woman's Hospital, are the recipients of evacuees. While caring for patients, each staff will probably also have concerns of a personal nature. Obvious areas identified during this disaster were issues such as day care for children of working health care providers, the extra hours that providers were requested to work because of patient volumes, and the disruption of daily routines. The most important issue to be considered is time for staff to rest and recuperate, including physician caregivers. Our group quickly instituted a work schedule for ourselves, because we knew our patient census would remain elevated for a prolonged period of time.

In the first 4 weeks after Hurricane Katrina, Woman's Hospital experienced more than 100 media encounters with local, national, and international radio, newspapers, magazines, and television broadcasts. Dissemination of information during a disaster for the news media as well as family members and governmental officials is important. Accurate information is paramount to dispelling rumors during a crisis. For medical issues, a single physician spokesman should be appointed. In our case, I assumed this role, as well as the role of logistics officer. The time required for the roles may be full-time, as I

experienced during the first week of the evacuations. It is important to use preexisting personnel, such as the hospital public relations department, to help with this issue. In this experience, all of the media requests were funneled to 1 person in this department who then enlisted me as needed. The use of press conferences allowed me to function in other duties.

CONCLUSIONS

It will be incumbent on each of us in our own environment to be responsible for the care of children in times of crisis. Hopefully, the wake-up call issued to Louisiana will be heeded by pediatricians everywhere and some of the mishaps during these events can be avoided in the future.

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Baton Rouge Pediatricians' Experiences Meeting the Health Needs of Evacuated Children

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The authors have indicated they have no financial relationships relevant to this article to disclose.

ON AUGUST 29, 2005, the Gulf Coast experienced one of our nation's most devastating natural disasters in modern history with the landfall of Hurricane Katrina. Heavy damage was inflicted from Louisiana to Alabama, causing Katrina to become the most destructive and costliest natural disaster in the history of the United States and likely the deadliest since 1928. This article documents the preparations, responses, experiences, and lessons learned from the point of view of just a few of the practicing general pediatricians in Baton Rouge and New Orleans, Louisiana.

Baton Rouge is the state capital, located approximately 80 miles northwest of New Orleans and situated on the east bank of the Mississippi River. The 2000 census data list the city's population as 227 818, with the metropolitan population being 602 894. It is the closest urban area to the region of Louisiana impacted by Hurricane Katrina. Medical care is supplied to a 7-parish area of approximately 1 million people. In the days before Katrina, the population of greater Baton Rouge was estimated to have doubled.

It is interesting to note that almost 13 months to the date before Katrina, a statewide hurricane exercise involving a category 3 strike on New Orleans was rehearsed.

PREPARATIONS: 1 YEAR BEFORE LANDFALL

In July 2004, in the State Emergency Operations Center in Baton Rouge, officials from 50 state, federal, and volunteer organizations and Louisiana parishes participated in a mock scenario almost identical to the reality of Katrina. During the tabletop exercise, more than 250 planners used the scenario to develop a recovery plan for

the 13 parishes in the New Orleans area. This exercise was known as "Hurricane Pam."

The Hurricane Pam exercise envisioned sustained winds of 120 mph and up to 20 inches of rain to parts of southeast Louisiana and a storm surge that topped levees in the New Orleans area. More than 1 million residents evacuated from the 13 parishes in the surrounding area. Hurricane Pam destroyed 500 000 to 600 000 buildings.

The exercise used weather and damage predictions developed by the National Weather Service, the US Army Corps of Engineers, the Louisiana State University (LSU) Hurricane Center, and other state and federal agencies to help officials develop joint response plans for a catastrophic hurricane in Louisiana.

The Hurricane Pam scenario focused on 13 parishes in southeast Louisiana: Ascension, Assumption, Jefferson, Lafourche, Orleans, Plaquemines, St Bernard, St Charles, St James, St John, St Tammany, Tangipahoa, and Terrebonne. Representatives from other areas other than the primary parishes participated also, because hurricane evacuation and sheltering involve communities throughout the state and into Arkansas, Mississippi, and Texas.

Even knowing such a storm was approaching New

Key Words: Hurricane Katrina, disaster planning, pediatrics, evacuees, displaced persons

Abbreviations: LSU, Louisiana State University; PMAC, Pete Maravich Assembly Center; IMERT, Illinois Medical Emergency Response Team; FEMA, Federal Emergency Management Agency

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Orleans, officials expected evacuation to be only half successful. According to the Hurricane Pam scenario, only a third of the population would leave New Orleans before the storm hit, because upward of 100 000 live in households in which no one owns a car.

A list of anticipated problems to be addressed with action plans was developed from the exercise and included (1) clean up, (2) sheltering, (3) search and rescue, (4) schools, and (5) medical.

The medical care group reviewed and enhanced existing plans. The Baton Rouge medical mission was to maintain the integrity of the hospital and care systems in the community while simultaneously manning the emergency evacuation hospital to be located in a basketball stadium (see Fig 1), the Pete Maravich Assembly Center (PMAC) at LSU. In addition, a medical special-needs shelter would be established adjacent to the PMAC in a field house. Two other shelters were established to have resources to respond to more minor medical needs. Unfortunately, there were no real specific plans to deal with the medical needs of pediatric evacuees.

The group determined how to implement existing immunization plans rapidly for tetanus, influenza, and other diseases likely to be present after a major hurricane. Tactics to resupply hospitals around the state that would face heavy patient loads were developed.

The medical action plan included patient-movement details and identified probable locations at which individuals would receive care and then be transported to hospitals, special-needs shelters, or regular shelters as necessary. However, specific details and processes regarding development and implementation of medical emergency-response teams were not addressed. As a result of this exercise, a second Hurricane Pam exercise was planned for the summer of 2005 but did not take place because of a lack of funding. Agencies had anticipated expanding on aspects of medical emergency response and recovery that were not explored in the 2004



FIGURE 1
The PMAC clinic.

exercise. Ironically, the exercise for 2005 became the reality known as Hurricane Katrina.

AUGUST 27: 2 DAYS BEFORE LANDFALL

A command center was created at one of the local regional medical centers. Communication by telephone was established between local hospitals, the Louisiana Office of Emergency Preparedness, and the Louisiana Hospital Association. At the same time, the Louisiana Department of Health and Office of Emergency Preparedness began planning for the PMAC and other medical shelters in anticipation of the pending storm. The PMAC was undergoing renovation, which added complications to the plan.

To witness the size and potential destructive nature of this storm bearing down on the Gulf Coast was simply scary. No one comprehended the magnitude of what would follow.

AUGUST 28: 1 DAY BEFORE LANDFALL

Many of the 80 area pediatricians began transferring perishable vaccines and other medical supplies to community hospitals for refrigerated storage. Provisions were made to transport pediatric patients who were technology-dependent and in vulnerable areas into the pediatric hospital for shelter if they were unable to find acceptable and safe facilities in the community or unable to evacuate to the care of friends or families out of the immediate strike zone. Most of these children were ventilator-dependent.

The only existing pediatric emergency department was overwhelmed with the routine medical needs of evacuees, in addition to the usual responsibilities of providing care for local children on a busy weekend.

AUGUST 29: LANDFALL

At 6:05 AM, Hurricane Katrina began its journey through Louisiana. Pediatric offices were closed as wind ravaged the greater Baton Rouge area. Trees were down, roofs and other structures were damaged, many roads were blocked, and electricity was off for the major portion of the community. Surprisingly, there was not a great amount of rain. Plans were made for the pediatric community to return to their practices on the next day in anticipation of the increased need of evacuees. Those plans could not be implemented, because many offices remained closed as a result of power outages and traffic lights were out in most of the community.

AUGUST 30: 1 DAY AFTER LANDFALL

This day was not without predictable stress and adventure; the number of newborns in our area surged from nursery and obstetric patients who had evacuated or were transferred from hospitals in New Orleans, which was sitting in rising water. A rotating call roster for pediatricians was established to handle the surge of hos-

pitalized patients. Pediatricians also volunteered for extra shifts in the emergency departments to accommodate the increased pediatric demand.

Meanwhile, in New Orleans, Sam Solis, MD, a general pediatrician, and his family had ridden the storm out at his office near Memorial Hospital, a hospital that later would be closed because of the flooding. He was the on-call person for his group and was attempting to be available for the group's patients. His office was situated on the 9th floor of an office building from which he observed the torrents of water entering the city. Later in the day, barely escaping the raging water, he and his family evacuated to Baton Rouge.

Clemente Mendoza, MD, a general pediatrician from Kenner, Louisiana, was fortunate to be in an area that did not flood and remained in New Orleans. He was a lifeline at East Jefferson General Hospital, one of the few surviving hospitals, and cared for many of the community's newborns during the period of mandatory evacuation.

AUGUST 31: 2 DAYS AFTER LANDFALL

By the next morning, it became apparent that there was an impending mass-casualty event occurring in New Orleans, a city sinking between the Mississippi River and Lake Pontchartrain along with a suspected 100 000 people who had not evacuated and were left in the flood zone. Pediatric care was needed in anticipation of a massive influx of patients.

Physicians lost their practices, and hospitals became progressively nonfunctional, especially after the storm and as flooding continued. Roads became impassable, and resources to maintain the rescue and medical missions within the strike zone dwindled. As a result, Homeland Security Secretary Michael Chertoff described the aftermath of Hurricane Katrina as "probably the worst catastrophe, or set of catastrophes" in the country's history, referring to the hurricane itself plus the flooding of New Orleans.

One thousand four-hundred seventy-nine primary care physicians, including pediatricians, were unable to care for their patients. Tertiary health care for children decreased by 70% as a result of Katrina.

Hospital resources in both emergency department capacity and beds decreased by approximately 6000 beds immediately after the storm, which represents a decline of 40% of the entire state of Louisiana health care resources in the midst of an enormous, growing need that was well documented by the various news media outlets.

Emergency Facility and Staff

Pediatric medical directors from the area assembled a conference call and decided to centralize emergent pediatric care into a single facility (the PMAC), which was in the process of an unprecedented transformation into

a field hospital to perform hospital care including triage and emergency and intensive care. This concentration of pediatric resources into the logistic operation of a field hospital, which had at least been practiced on paper, seemed most appropriate.

It is important to note that it was decided that the field hospital would not provide inpatient pediatric care other than immediate stabilization. Children would be triaged to appropriate levels of care: a pediatric inpatient facility, medical shelter, or nonmedical shelter.

The local command center would coordinate staffing of pediatricians and ancillary personnel and assist the PMAC and pediatric medical director in matters regarding pediatric patients. Plans were to provide pediatricians for 8 days at shifts of either 8 hours (3 per day) or 4 hours (6 per day). This schedule was created to allow pediatricians to continue meeting the demands of their usual outpatient practices.

Medical care at the shelters and the PMAC field hospitals in the first 2 days was provided completely by a combination of local volunteers, interns, and residents from the LSU-New Orleans and Tulane University training programs and the local LSU Health Sciences Center/Earl K. Long Medical Center teaching hospital.

Pediatric Command

A command center for pediatrics was created as a subunit of the main hospital command center. It was decided to set up a separate, exclusively pediatric area within the PMAC including a pediatric supply area. This would allow expansion or contraction of the pediatric area on the basis of need.

The pediatric commander of the day would provide daily operational guidance to the pediatric staff and brief the PMAC clinical operations officer. The pediatric commander of the day would wear a fluorescent green hat that identified him or her as the "go-to" person for local action items. The pediatric nursing commander was identified with an orange hat. All information started and passed through these field commanders, who had complete autonomy to operate their respective areas within the PMAC field hospital on the basis of the needs of the pediatric unit and the situational mission. This included expansion or contraction of service on the basis of need. A disposition transfer desk was established to locate beds and arrange transportation.

Supplies and Logistics

Unfortunately, there were initially inadequate supplies for pediatric patients. The strategic national medical stockpile contained many useful items, but some were missing. For example, there were no nebulizers and no Pedialyte. There was no pediatric crash cart or immediate resuscitation equipment. We did not have the ability to provide medication to patients who were treated and did not require additional medical care. There were no

antibiotics, no bronchodilators, or many other items for discharge. Local pharmacies could not fill prescriptions, because patients did not have any Medicaid or other insurance identification.

In an effort to solve the supply problem immediately, a call went out to the local pediatric and pediatric subspecialty offices and hospitals. Local radio and television stations asked people to provide formula, disposable diapers, clothing, and other basic items. A Broselow cart, with colored-coded, sized resuscitation equipment, was provided by a local subspecialist's office. The response was outstanding, and within hours our supplies were plentiful.

However, resupply became a problem. The PMAC medical director contacted or was contacted by several national and international medical aid charities, all of which provided additional support for both pediatric and adult patients. Pharmaceutical and medical-device companies provided supplies as well. This influx of supplies presented another problem: where to store, dispense, and inventory the items. The University Reserve Officers' Training Corps (ROTC) initiated a command and control of supplies and performed an outstanding service. LSU provided storage.

The important issues of security and transportation within the medical response zone were also coordinated by LSU. The track stadium adjacent to the PMAC was designated a landing zone where many helicopters arrived carrying victims of this tragic event.

Pediatric Patients

Outside of usual pediatric illnesses, most of the pediatric patients from the evacuation zones were suffering from exposure and dehydration. There were a few minor snake and rodent bites, some minor trauma, and an infant near-drowning. The infant was dropped accidentally into the murky flood waters as the mother attempted to pass the infant to a person driving by in a boat in the flood-ravaged area of East New Orleans. The infant was effectively resuscitated in the field, helicoptered to the PMAC, stabilized, and transferred to the local PICU. The infant was reunited 5 days later with the mother and was later discharged in good condition.

SEPTEMBER 1: 3 DAYS AFTER LANDFALL

In the early morning, the PMAC medical facility was augmented with the Illinois Medical Emergency Response Team (IMERT). This was certainly timely, because most of the PMAC medical personnel had been at work for 48-plus hours. This was followed immediately by the arrival of the Federal Emergency Management Agency (FEMA) New Mexico Disaster Medical Assistance Team (DMAT). The New Mexico DMAT had been "in the mouth of the lion" providing medical care in the Louisiana Superdome and had a keen awareness of what would transpire in the next several days (see "The Na-

tional Disaster Medical System Response: A Pediatric Perspective," pp S405–S411).

The teams from IMERT and New Mexico provided the needed additional operational organization to accomplish the mission. They provided experience in disaster management and improved the efficiency by focusing on incident command, supply, and coordination. The IMERT team also brought a 150-bed ICU setup complete with ventilators. Through the 8 days of the PMAC field-hospital operation, more than 15 000 patients were triaged, and more than 6000 were treated and dispositioned. There were 5 adult deaths, all of which were predictable on the basis of their presentation to the facility. It is incredible that there were no pediatric deaths in the forward-triage areas in New Orleans, the PMAC, shelters, or local hospitals as a result of Katrina.

SEPTEMBER 2 AND 3: 4 AND 5 DAYS AFTER LANDFALL

Sixty to eighty pediatric patients were seen. There was a great need for written instructions to educate each volunteer physician about the triage system. A protocol was created to orient each new physician to the flow of the pediatric area to establish some consistency of practice among the various volunteers. This allowed for smooth transitions from one shift to the next.

Communication to us regarding the imminent arrival of buses of children requiring care was unreliable, because "buses" of children in need never arrived. There is a need for communications to be improved.

FEMA medical teams began to arrive in the early evening hours. Their assessment of the recently established pediatric system was such that FEMA asked us to remain in charge of providing the pediatric services. This partnership worked well throughout the remainder of our time in the PMAC, which allowed for FEMA medical teams to concentrate their efforts on the massive amount of adults who required care.

SEPTEMBER 4: 6 DAYS AFTER LANDFALL

Pediatric patient visits began to decline to about 30 per day. One response to the nation's witnessing of this disaster was to send equipment. By day 6, much of this equipment began to arrive. Although the outpouring of support was uplifting, the reality was that we were beginning to see a decline in the number of patients requiring service. Nonetheless, we were receiving a broad range of supplies and equipment including bilirubin lights, defibrillators, formula, antibiotic samples, toys, and books.

SEPTEMBER 5 (LABOR DAY): 7 DAYS AFTER LANDFALL

One pediatric patient was seen at the PMAC.

SEPTEMBER 6: 8 DAYS AFTER LANDFALL

Six days after its creation, the PMAC pediatric patient area was closed.

LESSONS LEARNED

In addition to the points made above, the greatest lesson learned from this group was the importance of decisions being made at the local level by the established medical community. Having the community designate a local pediatrician to be the point person/liason to work with the national responders was valuable. It gave the national responders 1 person to contact, who then communicated with the community's pediatricians.

Because of the efficient pediatric model already in place when FEMA arrived with their medical teams on day 3, FEMA asked the pediatric leaders to maintain and continue to administer the pediatric services. This proved to be an invaluable partnership. In streamlining and centralizing the pediatric resources in 1 location (the PMAC), we believe we increased efficiency in our system and improved our pediatric response.

In addition, existing pediatric facilities ramped up their operations to accommodate more patients during the post-Katrina time period. This enabled more capacity at known pediatric centers and allowed for less fragmentation and duplication of effort being established at new sites throughout the community.

COMMENTS

Planning and Logistics for Potential Pediatric Mass Casualty Should Include and Be Designed by Pediatricians and Pediatric Subspecialists

Medical casualties from Katrina were not massive trauma (ie, explosion, injury, etc) but were mostly semi-acute or need of medical therapies for chronic medical conditions. These types of casualties are what are likely to occur with the release of weapons of mass destruction, especially in the case of infectious or chemical weapons. Most chemical exposures do not result in death but require medical therapies. Pediatricians are capable of dealing with the emotional aspects of such trauma and are likely to recognize those needs.

The Pediatric Planning Stage Also Needs to Occur at the Grass-Roots Local-Community Level

1. Planning that occurs at the level of tertiary medical systems may become nonfunctional, as occurred during Katrina.
 - Tulane University and LSU-New Orleans became nonfunctional.
 - Residents were left in charge of relief operations in some instances, because staff members were displaced during the storm.
2. Logistics for an operation designed for mass-casualty management at a large medical complex may not be functional in another region.

Pediatric Emergency-Response Teams Should Be Established in Each State and Enhanced Nationally

1. Existing federal and state programs are slow and have multiple missions in disaster management, which forces each municipality to respond while waiting for assistance.
2. Incident command along with logistic and process development with standard operating procedures should be established before events.
3. Assured communication pathways with backup communication devices (noncellular) should be available for the emergency-response team.
4. Advance teams should be established to assess needs and assist local governments in organizing pediatric medical care.
5. Supply lists with specific needs for pediatrics should be established and revised annually.
6. Scenario-development and implementation exercises should be planned and providers certified just as occurs in advanced pediatric life support.

Data Collection Is Necessary

1. For process improvement and future design
2. To interface with present databases:
 - Red Cross
 - FEMA
 - State

The Role of the American Academy of Pediatrics

1. Convene a meeting with individuals with experience in mass casualty to interface with other pediatric professionals and model development.
2. Seek funding at the national level for development of national and international pediatric emergency strike teams.
3. Develop an emergency Listserv for professional communications.
4. Maintain a Web site for credible, timely, and easily accessible professional and lay information.

CONCLUSIONS

The official death toll stands at 1383, the third highest resulting from a hurricane strike in US history (behind the Galveston Hurricane of 1900 and the Okeechobee Hurricane of 1928). A total of 6644 persons remain unaccounted for, of which one fourth are deceased. The damage is estimated to amount to \$100 to \$200 billion, at least double from previously most expensive Hurricane Andrew, making Katrina the most expensive natural disaster in US history. More than 1 million people

were displaced, and a humanitarian crisis ensued on a scale unseen in the United States since the Great Depression.

Three months after Hurricane Katrina, the Baton Rouge region was still experiencing a strain on the local medical community (not unique to pediatricians) because of the tremendous influx of people now living in the Baton Rouge area. At the time of this writing, the local public school system was accommodating 6300 displaced students from affected areas. Many of these students will be enrolled in our school system throughout the 2005–2006 school year. Obviously, responsibility for these children's health care will need to be absorbed by our community. Some of the strain is beginning to be relieved by displaced physicians who are relocating their practices temporarily (and in some cases, permanently) to Baton Rouge.

During our work at the PMAC, we worked side by side with volunteer pediatricians who were displaced from New Orleans and had nothing but wanted to help. There were LSU and Tulane University/Alton Ochsner Foundation Hospital pediatric residents caring for patients. We met pediatricians from all over the United

States who were volunteering and willing participants here to make these patients' lives better. Pediatricians took care of the elderly, psychiatrists did their first pelvic examinations in years, and residents and medical students did heroic work beyond what anyone could have expected. The presence of the numerous local volunteer pediatricians was stellar; many of them left their offices to come straight to the PMAC after a full day in the nursery, office, and/or hospital. They still had more to give at the end of their "regular day."

The Baton Rouge community pediatricians met an unprecedented challenge and performed superbly, protecting children who were local citizens or displaced by the storm and floods. Now they are facing a longer-term challenge, but one of equal importance: helping those children grow in this environment so that they can become the best adults they can be.

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Caring for Children in a Juvenile Justice System After a Disaster

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I HAVE SEEN a lot of this country's natural disasters, having lived through hurricanes in Long Island, New York, snowstorms in Albany, New York, and tornadoes in Birmingham, Alabama. However, nothing could prepare me for the events surrounding Hurricane Katrina. In Baton Rouge, Louisiana, where I am the medical director for a long-term juvenile correctional facility, the damage from Hurricane Katrina was more collateral, as opposed to the direct hit that New Orleans, Louisiana, suffered. Nonetheless, we received the brunt of the hurricane's aftermath.

My facility, the Jetson Center for Youth (JCY), is located approximately 80 miles northwest of New Orleans. Louisiana has 2 other long-term facilities, Bridge City Center for Youth on New Orleans's west bank of the Mississippi River, and Swanson Center for Youth in Shreveport (more than 280 miles from landfall). In the past 2 years, youth from the Bridge City facility had been evacuated to JCY twice in anticipation of hurricanes. Fortunately, both evacuations were false alarms but, as it turns out, useful trial runs.

AUGUST 27: 2 DAYS BEFORE LANDFALL

As we had done in the past, 48 hours before we expected the hurricane to reach landfall, 120 youth from Bridge City were evacuated to JCY. The Bridge City youth were kept apart on the Baton Rouge campus. They were housed in empty dormitories, gymnasiums, and the infirmary, where care was provided to the kids in a coordinated, rehearsed fashion. Leadership personnel prepared to stay overnight at JCY in case transportation and communication became impossible after the hurricane reached the coast.

AUGUST 28: 1 DAY BEFORE LANDFALL

The night before we expected the hurricane to hit, the director of nursing and I decided to stay overnight at JCY. The evening was uneventful. I slept in my office without any interruptions. The rest of the staff, including nurses, was able to make it to work by 7 AM the next morning.

AUGUST 29: LANDFALL

Around 9 AM, Baton Rouge started getting pounded by wind and rain. As the weather worsened, it was fortunate that we had decided to keep the kids from moving around campus. Instead, the JCY staff had to fight 50-mph winds to bring the youth food and medication. As the news of deteriorating conditions in New Orleans spread through the facility like wildfire, the kids became anxious and restless, voicing concerns about the safety and well-being of their families and friends. The staff worked tirelessly to calm the youth, even while being troubled themselves by similar concerns. Fortunately for us, Baton Rouge was on the good side of the "eye," so we were not hit as hard as New Orleans was. By afternoon, the worst had passed. A quiet calm fell over the campus, mixed with a sense of relief that we had survived with-

Key Words: Hurricane Katrina, incarcerated youth, juvenile justice, disaster preparedness

Abbreviations: JCY, Jetson Center for Youth; LAOYD, Louisiana Office of Youth Development

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out any major problems. Little did we know what was in store for Louisiana.

On returning home in the evening, I learned that all means of distant communication were down in the state. The telephones were all dead, including cell phones and beepers as well as landlines. The power was out, so we had no Internet access. The few homes and businesses with generators kept the rest of us informed about what was going on and allowed me to contact my family out of state. We settled in for a more primitive, communication- and power-free existence.

AUGUST 30: 1 DAY AFTER LANDFALL

The next 2 days at the facility were uneventful. The biggest problem was the lack of power, or more precisely, the lack of air conditioning during the hot Louisiana August. We continued to provide basic services to the youth, although the facility was more secluded than the rest of the city from the hurricane's aftermath. It was during my few hours at home that I began to feel the real impact of the hurricane. I live very near the basketball coliseum that housed medical evacuees from New Orleans and the southern-most parishes. In Baton Rouge, people roamed the streets in search of food, shelter, and their loved ones. Throughout Baton Rouge there was the constant hum of helicopters and the endless whine of ambulance sirens. I cannot imagine a war zone being much worse.

AUGUST 31: 2 DAYS AFTER LANDFALL

Even after 2 relatively uneventful days, JCY was not yet in the clear. Late in the afternoon, we were notified that a large group of youth from detention facilities in New Orleans would be arriving some time that evening. Until that moment, we thought that all of New Orleans' juvenile detention centers had been evacuated. It turns out that, before the hurricane, these detained kids, some of whom were not yet adjudicated, had been transferred from juvenile facilities to an adult jail in New Orleans. The subsequent flooding forced the prisoners, adults and juveniles alike, to seek higher ground. These kids were some of the thousands we have seen in the media, wading through flooded streets only to be stranded on a highway overpass waiting for helicopters and boats.

Of course, we did not know any of this at the time. Without any method of communication, there was no way to know from where these kids were coming or when they would arrive. A trip that usually takes about an hour turned into a 7-hour bus ride from New Orleans to Baton Rouge. When they finally arrived at 10 PM, they were met not only by teams of nurses and physicians but also by a large contingent of Louisiana Office of Youth Development (LAOYD) staff. The adult correctional system did an admirable job coordinating the evacuation of

the juveniles and adult prisoners, especially considering the lack of resources and inability to communicate.

Forty-seven youth, 13 of whom are female, got off that bus. They were wet, hungry, scared, and visibly stressed. They gave histories of waiting on the overpass for more than 24 hours. Many had had to wade through streets full of water, sometimes up to their chests; some were not able to swim. No food or water had been available during that period of time.

JCY provided the youth with a place to shower and clean clothes. We opened the kitchen and gave each of them a hot meal (or 3). Each was given a complete medical and mental health screening. Three had psychiatric emergencies and were seen immediately by a mental health professional. Other than some mild dehydration and sunburn, there were no medical problems. At about 2 AM, 20 youth were transported to another facility in the northern part of the state. The remaining 27 youth were provided with on-site sleeping quarters. The next morning, a more complete evaluation was completed on each of them.

NOVEMBER: 2 MONTHS AFTER LANDFALL

The Bridge City staff has been living in trailers on the JCY campus for all of the previous 2 months. Although, there were no short-term detainees remaining in long-term care facilities, the Bridge City youth are still at the JCY facilities. (It is interesting to note that the first functioning trailer park funded by the Federal Emergency Management Agency, regularly shown by the national media, was developed on land donated by LAOYD adjacent to the JCY campus.) The hope is for Bridge City to reopen their facility in New Orleans soon and then slowly reaccept youth.

The LAOYD worked tirelessly to reconnect the detained youth with their families. They have transported children all over the United States by airplane, bus, and car (see "Reuniting Fractured Families After a Disaster: The Role of the National Center for Missing & Exploited Children," pp S442-S445).

LESSONS LEARNED AND COMMENTS

Some people questioned whether it was legal to keep detained youth in a secure facility during the worst of the storm. For the following reasons, I feel strongly that there was no other choice at the time. It took days, sometimes weeks, to locate families. No youth can be released without a judicial order, which was difficult to obtain during the weeks it took to reconvene the court system. Additional difficulties included a lack of hard-copy legal charges and the difficulty of ensuring that evacuation centers housing families were willing and able to provide space for detained youth. Housing previously detained kids in secure facilities temporarily was the best option available at the time.

Staff needs are paramount if care is to be provided to the needy and displaced. The LAOYD was able to acquire house trailers very early. Besides a place to stay and food for staff and their families, there were medical needs as well. Some staff with chronic conditions required medicines and medical care of their own. Having these needs included and rehearsed in an existing disaster plan was key for providing care to children in need. We now can reevaluate and modify the disaster plan.

Disasters always complicate transmission of medical information. When combined with legal records, care becomes even more complex. We look forward to an electronic medical chart system that could provide accurate, timely information.

Because the LAOYD has been under a federal settlement agreement for years, it is rare for anything positive to be heard about the office. However, I cannot say

enough about the dedication and hard work of the LAOYD employees and the staff of the Juvenile Justice Program at Louisiana State University Health Sciences Center. In the midst of chaos, the kids were provided with an emotionally supportive, safe, and secure environment. A huge amount of staff time was dedicated to connecting the youth with their families. The staff, many of whom were equally devastated after losing everything and having their own families displaced, committed themselves to ensuring the well-being of the youth. As we hear all that went wrong in Louisiana, I would shed light on all of those people who helped safeguard those who were under the state's care. Hurricane Katrina revealed not only the darker side of society but also its best. The storm also serves as a reminder that proper preparation, including dreary drills and false alarms, can make all the difference.

The National Disaster Medical System Response: A Pediatric Perspective

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A HURRICANE IN New Orleans, Louisiana, was no longer just a threat but a reality. At the New Orleans Louis Armstrong International Airport, a small group of Boston-based National Disaster Medical System (NDMS) physicians met with military officers, who informed us that 5 years ago they were charged with preparation for potential national disasters. A hurricane in New Orleans was 1 of 3 scenarios they predicted. As a nation, as individuals, and as a disaster team we were living that prediction. Although we took care of disaster victims of all ages and disaster-relief workers, for those of us in the field of pediatrics, our focus was on the youngest victims of the disaster.

LONG-TERM PREPARATION

Preparation begins not days but years before a disaster. Teams deployed to areas affected by Hurricane Katrina are part of the NDMS, a federally coordinated system that augments the nation's emergency medical response capacity. In 1984 the NDMS, by declaration of the President, became an agency of the US Public Health Service within the Department of Health and Human Services. It is a public/private partnership between government agencies, Disaster Medical Assistance Teams (DMATs), civilian hospitals, and emergency-response organizations. The role of the NDMS is to provide civilian medical support to the US government for victims of domestic disasters. A national network of teams provides a single integrated medical response to assist state and local authorities with medical care. The first NDMS team was formed in 1986. In March 2003, the NDMS was transferred from the US Public Health Service to the Response Division of the Federal Emergency Management Agency under the Department of Homeland Security.

OBJECTIVES AND ORGANIZATION OF THE NDMS

The NDMS, using government and private-sector resources, is mandated to provide medical response, patient evacuation, and definitive medical care. Specifically, the NDMS assesses health/medical needs; coordinates, mobilizes, and manages teams of medical and management support personnel for medical care, search, rescue, and mortuary services; provides equipment, supplies, and pharmaceuticals; coordinates patient evacuation; provides health surveillance; prioritizes use of health and medical support; and manages relevant congressional affairs, community relations, and public information.

NDMS teams are deployable rapid-response units that deliver immediate short-term medical services until local resources can be fully restored or government, international, or contract resources can provide these services. They are community based and cosponsored by a public or private organization such as a medical center or health- or public service-oriented government agency. NDMS teams may be deployed for local, state, federal, or international disasters or events with potential for disaster and/or may provide medical services in a site devel-

Key Words: Hurricane Katrina, National Disaster Medical System, pediatrics

Abbreviations: NDMS, National Disaster Medical System; DMAT, Disaster Medical Assistance Team; PST, Pediatric Subspecialty Team; IMSuRT, International Medical Surgical Response Team; MA-1, Massachusetts Disaster Medical Assistance Team 1; LSU, Louisiana State University; WJMC, West Jefferson Medical Center

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oped to receive victims of a disaster. Teams must have the shelter, food, medical treatment facilities, equipment, and supplies, as well as communication capabilities, to function completely independently for 72 hours.

The goal of the NDMS is to have the capacity to provide care for mass-casualty events within 24 hours of a disaster or emergency. The NDMS may serve as the primary source of medical services or may augment existing local services.

The NDMS teams that provide general medical care are DMATs. Pediatric Subspecialty Teams (PSTs), International Medical Surgical Response Teams (IMSuRTs), and burn specialty teams are specialty DMATs. Other NDMS teams include the disaster mortuary team and veterinary medical assistance teams. The critical functions of DMATs are:

- Triage: initial assessment, prioritization of treatment, and determination of appropriate treatment site.
- Stabilization: medical/surgical resuscitation.
- Definitive medical/surgical care: outpatient acute care and inpatient care for noncritical medical/surgical patients.
- Evacuation: a network of nonfederal acute care hospitals located throughout the United States have agreed to accept and provide care for a predesignated number of critically ill or injured patients.

DMATs can use existing health care facilities, convert intact structures into medical facilities, and/or set up field medical tents with generator power for minor surgical procedures, stabilization of critically ill patients, and routine care including bedside laboratory testing. This decision depends on availability and condition of existing resources as well as demand for services.

PSTs

PSTs have been developed to serve the unique needs of pediatric victims of disaster (Table 1). There are currently 2 deployable PSTs: PST-1 (Boston, MA) and PST-2 (Atlanta, GA). PST-3 (Loma Linda, CA) is in development. Meeting the needs of pediatric victims requires individuals specifically trained in the care of children and pediatric-specific equipment, supplies, and pharmaceuticals. The critical functions of PSTs are the same as for DMATs. PSTs affiliated with and augment a general or specialty team.

Pediatric-specific disaster related considerations include:

- the specific vulnerabilities of children to hazards of disaster;
- unique patterns of injury and illness in children; and
- pediatric-appropriate evaluation and management.

Provision of care appropriate for children requires:

TABLE 1 Pediatric Specialty Team Deployments

Federal Disaster Response Deployments	
September 1995: Hurricane Marilyn, St Thomas, US Virgin Islands	Deployed with DMAT MA-1
October 1998: Hurricane Georges, Caribbean, southeast United States, Gulf Coast	DMAT MA-1 deployment supported by PST-1
January 1998: ice storm, Plattsburg, NY	DMAT MA-1 deployment supported by PST-1
May 1999: Kosovo refugee importation, Fort Dix, NJ	DMAT MA-1 deployment supported by PST-1
September 2001: World Trade Center attack, New York, NY	Deployed with DMAT MA-1/IMSuRT-East
December 2002: Supertyphoon Pongsona, Guam, United States	Deployed with IMSuRT-East
December 2003: Bam earthquake, Bam, Iran	Deployed with IMSuRT-East
August to December 2005: Hurricane Katrina, LA, MS, AL	Deployed with DMAT MA-1, IMSuRT-East
Positioning Deployments	
Summer 1996: Summer Olympic Games, Atlanta, GA	Prepositioned with DMAT MA-1
April 1999: NATO 50th anniversary celebration, Washington, DC	Prepositioned, DMAT MA-1 deployment supported by PST-1
February 2002: Winter Olympic Games, Salt Lake City, UT	Prepositioned with IMSuRT-East

- pediatric-specific trained/experienced health care providers; and
- pediatric-specific equipment, supplies, and pharmaceuticals.

PST-1, established in 1995, is sponsored by Children's Hospital Boston, which provides use of pediatric supplies and equipment. PST-1 is, at a minimum, a 15-member specialty team affiliated with the Massachusetts DMAT (MA-1), which has more than 115 members, and with IMSuRT-East with more than 140 members, sponsored by Massachusetts General Hospital. PST members include pediatric emergency medicine, pediatric critical care, pediatric trauma surgery, general pediatrics, neonatology, anesthesiology, and toxicology physicians and nurses, as well as respiratory therapists and pharmacists.

AUGUST 26 THROUGH 28: 3 TO 1 DAY BEFORE LANDFALL

Each disaster is unique. It was clear that Hurricane Katrina, a Category 5 storm, could create a disaster like no other for which we had ever deployed. The major decision was not if but when and where to deploy. The strategy was to predeploy DMAT teams to multiple sites in safe proximity of the projected storm path for rapid movement into the needed areas as soon as conditions allowed safe travel. Team members were contacted for availability for a minimum of a 2-week commitment. On August 26th (3 days before landfall) the MA-1 cache, which includes field medical tents, logistics and medical equipment, supplies, and pharmaceuticals, was driven to Anniston, AL, by DMAT logistics personnel. The next day (2 days before landfall), MA-1 (including PST mem-

bers) joined them at Fort McClellan in Anniston. Other NDMS teams from throughout the country were predeployed to strategic locations in Louisiana, Mississippi, and Alabama including military bases, Louisiana State University (LSU), the Louisiana Superdome, and Louis Armstrong International Airport.

AUGUST 29: LANDFALL

Plans to deploy other teams, including IMSuRT-East, were underway. As Katrina made landfall as a Category 4 storm, it was the Mississippi Gulf Coast, not New Orleans, that sustained the greatest damage. DMAT teams were ready to provide care as soon as needs could be assessed and the teams repositioned.

AUGUST 30 THROUGH SEPTEMBER 1: 1 TO 3 DAYS AFTER LANDFALL

The change in the path of the storm, flooding in New Orleans, the widespread outage of electricity and communication systems, limited fuel, and impassable roads made assessment and repositioning extremely challenging.

For the first several days, the most emergent need was for search and rescue of victims stranded in their flooded homes and communities. Rescuing children, the elderly, and the infirm was particularly critical because of their susceptibility to dehydration and to hyperthermia from inescapable scorching temperatures during the day and hypothermia from cold, wet conditions at night.

Young children are more vulnerable than adults to serious head and multisystem organ injury resulting from blunt trauma from storm debris. They are less able to protect themselves, and their organs are proportionately larger, closer together, and less well protected. Many storm victims were in need of care for acute illnesses. In addition, untreated chronic medical conditions such as diabetes, pulmonary disease, renal failure, and seizures were quickly becoming acute emergencies.

Also in desperate need of rescue were patients in hospitals damaged by the hurricane. Critically ill pediatric patients, particularly those with serious, often rare diseases required transfer to highly specialized pediatric hospitals that, compared with adult hospitals, are fewer in number.

Unknown at this time were the number of drowning victims; drowning is often a major cause of death associated with flooding, and children are particularly vulnerable. Fortunately, the severe flooding associated with Katrina was geographically limited and the water rose relatively slowly. In most cases, adults had time to ensure the children's safety.

With the evacuation of patients from the most severely damaged areas, the needs for medical assistance continued to shift. Predeployed teams and teams actively being deployed were being positioned not only in Lou-

isiana and Mississippi but also in Texas and other states in which victims were being relocated.

August 30: 1 Day After Landfall

MA-1 was repositioned to Forrest General Hospital in Hattiesburg, Mississippi. The hospital had limited power provided by generators and no working toilet facilities. DMAT members assisted hospital personnel in the evacuation of critically ill patients and treated walk-in patients in the emergency department.

September 1: 3 Days After Landfall

Very early in the morning, the hospital lost all remaining power, so the team assisted in evacuating the remainder of the patients and set up a field medical facility for treatment of outpatients. By the end of the day, power and water had been restored to the hospital, and MA-1 was demobilized from the site.

SEPTEMBER 2: 4 DAYS AFTER LANDFALL

The MA-1 team was repositioned to Kessler Air Force Base in Biloxi, Mississippi. Team members then joined an Ohio DMAT at Biloxi Regional Medical Center that was working in the hospital side by side with hospital personnel (see "Perspectives From a Private Pediatric Practice," pp S359–S364).

SEPTEMBER 3: 5 DAYS AFTER LANDFALL

MA-1 was repositioned to Gulf Coast Medical Center in Biloxi, which now had electricity but limited clean water (see "Perspectives From a Private Pediatric Practice," pp S359–S364). More importantly, many hospital employees, some of whom were unaccounted for, were unable to come to work. The team, using a medical tent along with the emergency department, provided care 24 hours per day. The bariatric chamber anteroom of the hospital was converted into a pharmacy that provided service to storm victims who had no access to their medications. Eleven days after landfall, care was transitioned back to the hospital and its staff.

Also, IMSuRT-East was activated on this day and deployed the next day to LSU in Baton Rouge, Louisiana. Many families from New Orleans had evacuated to Baton Rouge. The Pete Maravich Assembly Center (LSU's basketball arena) had been converted into a medical facility that provided definitive medical care for walk-in patients and stabilization and evacuation for critically ill and injured patients (see "Baton Rouge Pediatricians' Experiences Meeting the Health Needs of Evacuated Children," pp S396–S401). Relief agencies also provided food, clothing, and assistance with housing. Although very busy earlier in the week, needs were now being met with the existing staffing.

As is typical for most disasters, after the first few days, medical needs shifted from patients who required care for injuries sustained during the storm to injuries and

illnesses secondary to the hazardous environment left by the storm. Contaminated water and food and crowded conditions increased the rate of infectious diseases, particularly skin infections, diarrhea, and respiratory illness. Given concerns about postdisaster exposure to tetanus and hepatitis A and B, immunization programs were initiated. In addition, there was an increasing need for medical attention for routine illness and injury unrelated to the disaster.

SEPTEMBER 7: 9 DAYS AFTER LANDFALL

Some members of the IMSuRT-East were repositioned to the Louis Armstrong International Airport (Fig 1). The airport was closed to all commercial flights, and roadblocks restricted ground entrance to agencies and individuals authorized to provide disaster-relief assistance. The airport had been converted into a medical treatment and evacuation center, with NDMS teams occupying the departure level of the airport and the military occupying the baggage-claim level. Triage was set up just inside the entrance to the airport. In the center, there was one tent for patients with emergent conditions (coded as red by disaster-medicine triage convention) and another for victims with urgent and nonurgent conditions (triaged as yellow and green, respectively). A restaurant bar was converted into a pharmacy, and the ground-transportation information desk was used to coordinate air and ground transport of patients who required evacuation to hospitals for definitive care.

Teams slept on cots in baggage carousels. The airplane tarmac was used for food service, and security, showering, and laundry facilities were provided by the military. MA-1 left the airport 19 days after landfall. DMATs from at least 7 other states also provided care 24 hours per day at the airport.

Also, the remainder of IMSuRT-East relocated from LSU to West Jefferson Medical Center (WJMC) just out-

side New Orleans in West Jefferson, Louisiana. Many people in this area had not evacuated, and many who did were starting to return. Relatives from more severely damaged areas were staying with family in Jefferson Parish. There were also large numbers of utility and transportation workers from across the country who were brought in to restore critical services, remove hazardous debris, and repair roads. In addition, military and private security firms were brought into the area to restore and maintain law and order. WJMC, built to withstand severe storms, had sustained minimal damage. The challenge was meeting the needs of an increased patient load with decreased staffing. Many employees were not able to return to work because they or their family members were storm victims. Other staff, who had become homeless, returned to the hospital with their families to work and stay. DMAT and hospital personnel worked together for the most efficient use of their combined resources.

The DMAT set up a medical facility in front of the WJMC that consisted of separate tents for triage, emergent patients, urgent and nonurgent patients, immunizations, and for command, communications, and logistics. Patients arrived by ambulance, by private transportation, and by foot. The majority of patients presented to the DMAT for triage and, if critically ill, were transferred to the emergency department. Stable patients who presented to the emergency department were triaged to us (Figs 2 and 3).

SEPTEMBER THROUGH DECEMBER: 2 TO 15 WEEKS AFTER LANDFALL

DMAT members, working in shifts, provided 24-hour coverage. IMSuRT-East staffed the WJMC DMAT facility from day 11 to day 19 postlandfall. A redeployed MA-1 team took over at the WJMC, providing service for another 14 days. On average, each day during this time



FIGURE 1
DMAT medical tents in Louis Armstrong International Airport (New Orleans)



FIGURE 2
DMAT field tent at the WJMC.



FIGURE 3
Treatment area of the DMAT tent.

period approximately 215 patients were seen in medical tents. Of these, approximately 82% were triaged as green, 14% as yellow, and 4% as red. Approximately 12% were under 15 years of age, and more than half of those were under age 2. Rotating DMAT teams from New York, Minnesota, Arkansas, Texas, California, Tennessee, Florida, and Ohio provided medical care at the WJMC until mid-December.

From October 19 (7 weeks after landfall) through 25th, the MA-1 staffed St Bernard's Parish field medical facility, which was set up on a high school football field. By that time, most of the care was being provided for routine illness and injury.

At each of the DMAT facilities, the majority of patients were adults. Initially, workers represented a significant percent of the patients. As families who had evacuated returned to their homes, the number of patients, including children, increased. Initially, nighttime volume was low because of curfews, but this volume increased as the curfews were lifted. Minor injuries, sustained while inspecting, cleaning, and repairing properties were frequent. Although some injuries were the result of violence, these were very limited in number in our experience.

For children, debris, downed power lines, generators, and animals created a dangerous environment made even more hazardous by disruptions in daily routine and supervision. The most common injuries in children were lacerations and punctures caused by debris. Several children were bitten by animals, many of which were stray pets with unknown rabies status. Many of the wounds were infected, likely because clean water and antibacterial ointment were unavailable. Cellulitis resulting from insect bites was also particularly common in children.

Children were at increased risk of ingestion of contaminated food and water. Because many families were living in new situations, medications were no longer

safely out of reach. Poison ivy was everywhere including on trees, which were being pulverized and burned, releasing allergens into the air. For children, asthma and diabetes were the most common chronic conditions for which families sought medical assistance.

Perhaps our greatest challenge in treating patients was that many of them did not know significant details about their medical conditions, medications, or immunization status. Because families' usual health care providers were not available, many brought their children for routine child care visits, well-child examinations, immunizations, and medication refills for chronic illnesses. Although most victims were coping amazingly well, many understandably experienced psychological stress, and some suffered psychiatric decompensation. For children, this was manifest most commonly as fears about recurrence, separation anxiety, and behavioral disturbances (see "Short-term Impact of a Major Disaster on Children's Mental Health: Building Resiliency in the Aftermath of Hurricane Katrina," pp S448–S453).

We quickly learned about endemic conditions. Limited access to clean water made it difficult to ensure that patients could properly care for wounds, so many patients returned for wound checks and care.

Fortunately, our diagnostic resources were excellent. In addition to our own bedside testing capabilities, which included electrocardiograms, complete blood counts, chemistry panels, urinalyses, pregnancy and rapid streptococcal tests, we had access to hospital laboratory testing and radiologic imaging. We were able to provide definitive treatment for most patients.

Most health care providers worked 12-hour shifts. Given that children have different patterns of injury and illness that require specific approaches to evaluation and management, it is important that teams have pediatric-trained physicians, nurses, and pharmacists. Pediatric-trained health care providers often worked 16-hour shifts and were on-call for the remaining 8 hours. For mental health issues, our team was able to provide some immediate care and referrals for social services, but resources for ongoing psychiatric care were limited.

We had or were able to procure medications to treat most acute conditions and vaccines. Lack of electricity challenged quality control of temperature-sensitive medications and vaccines. The pharmacist had a generator-powered refrigerator, the temperature of which was monitored constantly. For families without access to refrigeration, some medications were a problem. These children were given adult tablets, precut to the appropriate dose by the pharmacist, or capsules with instructions on how to open and sprinkle the capsule contents into food. We did not have large stocks of medications for treatment of chronic illness, but local pharmacies, including mobile pharmacies, filled prescriptions without charge for a few days (see "Providing Primary Care to Underserved Children After a Disaster: A National

Organization Response," pp S412–S415). For young children, in addition to medications, we were able to provide formula and diapers.

Follow-up compliance with return-visit recommendations was outstanding. For children who had missed routine immunizations, we worked with the state to procure the vaccines and give the immunizations and a revised immunization schedule.

Everywhere we went, people were incredibly grateful and appreciative that we were there and for the care that we could give them. For us, it was a privilege to be able to help.

Through the efforts of all the DMAT teams, as of mid-December more than 63 163 patients had been evaluated and treated, and more than 68 654 individuals had been immunized.

LESSONS LEARNED

This disaster, which resulted in a major city being entirely evacuated and shut down for the first time in US history, emphasizes once again the importance of having an organized disaster-relief system. It also taught us about some unfortunate and very real limitations of disaster systems.

1. Effective disaster-relief efforts require plans with contingencies and the elements necessary to implement them.
2. A coordinated effort with integrated communications between local, state and federal governments, as well as civilian agencies, is critical.
3. Infrastructure in the form of ongoing planning, logistics, and security is essential to coordinate and support the medical response.
4. NDMS disaster response requires a highly trained core of individuals from a variety of fields who are available for immediate response and are prepared to work in what are often austere, stressful conditions. Good Samaritans, who are not experienced or trained in disaster medicine, despite their best intentions often hinder the efforts and furthermore require the use of the very resources that they are trying to supplement.
5. Immediate and long-term effects on NDMS providers of long work hours, challenges of caring for patients outside of their specialty, unfamiliar and challenging environments with limited resources, exposure to traumatic events, personal safety, disruption of personal routine, and trying to balance the responsibilities of their personal lives and work at home while deployed should not be ignored or underestimated. It is not uncommon for workers to experience difficulty returning to their routine at home and at work and to experience fatigue and sleep disturbances (see "Pediatrician Self-care After Disasters," pp S454–S457).

The NDMS has developed a demobilization screening for the physical and mental health of team members. It is essential that resources be available for disaster-relief workers while they are on site and when they return home.

6. Children have increased vulnerabilities to the hazards of disasters, different patterns of injury and illness, and unique medical and psychosocial needs during and after a disaster. Individuals trained in the care of pediatric disaster victims are critical to the disaster-response effort. More PSTs are needed to expand the capacity of DMATs to provide pediatric care.
7. Because adults often seek care for their children before or instead of for themselves, it is important for pediatric health care providers to inquire about the health of the adults. These adults, particularly those with young children, are often in the age range and have conditions that pediatric care providers routinely care for.
8. Although more PSTs are needed to expand the capacity of the DMAT to provide specialty care, getting families prepared for disasters is equally important. Pediatricians have the opportunity and responsibility to provide information to families regarding disaster preparedness, especially for children. Specific instructions and plans should be developed for children with common chronic medical problems and those with special needs (a useful form is available at www.aap.org/advocacy/blankform.pdf).
9. Pediatricians should be prepared to provide care for children and families who have relocated and to ensure that care is available for those who do not have financial resources. Many will be without records or knowledge of their medical conditions and treatment regimes. Many will have undergone traumatic changes in their lives, loss of personal resources, and loss of community and social support networks. Children's psychological response may be highly variable in its manifestations and duration. Depression, behavioral disturbances, fears, posttraumatic stress disorder, and phobias are all common responses to disaster.

COMMENTS

As pediatricians, we are uniquely qualified to take care of the needs of the pediatric victims of disaster, making a valuable and lasting contribution to their lives and their families. For those of us who are part of the NDMS, the opportunity to use our expertise to help others during disasters is incredibly gratifying and rewarding.

Unfortunately, we have learned that, even under the best circumstances, a national/international disaster response (especially for a widespread, large-scale disaster) will likely not be adequate. Even when predeployed, it is

difficult, if not impossible, for teams to be on site soon enough to save critically injured victims who require treatment within those first hours. Also, given the huge allocation of financial and human resources required to maintain a national disaster system of the magnitude necessary to respond to large-scale disasters such as Katrina, some may question the appropriateness of such a plan. Local efforts, government and civilian, that include plans to promote and enable self-help must be used to the fullest extent possible.

CONCLUSIONS

The effects of Hurricane Katrina will be felt for years to come. The lessons from Katrina have been painful, and the future for its victims is uncertain in many ways. Unfortunately, what is certain is that Katrina will not be our last disaster. We can only hope that with every disaster we learn from our previous experiences and will have more to offer as a nation, health care providers, and human beings.

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Providing Primary Care to Underserved Children After a Disaster: A National Organization Response

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HUNDREDS OF THOUSANDS of lives in the Gulf Coast region were affected by Hurricane Katrina. The Children's Health Fund (CHF) responded rapidly to the needs of children and their families after the hurricane. CHF is a national organization that supports direct health services, education, and advocacy for medically underserved children. Although CHF's principle mission is the provision of extended primary care services for children and adolescents, the organization is capable of mobilizing rapidly in response to acute medical and public health crises. In fact, the CHF has responded to catastrophic events twice before the Gulf Coast storms of 2005. The first was the 1992 deployment of a mobile medical unit (MMU) to South Florida in the immediate aftermath of category 5 Hurricane Andrew. Then, in 2001 after the terrorist attacks on the World Trade Center in New York City, New York, the CHF deployed 2 MMUs (fully equipped, self-contained "medical offices on wheels") to the triage-and-response efforts at ground zero. Thus, in the aftermath of Hurricane Katrina, within days of the storm's landfall, the CHF was able to deploy MMUs to the Biloxi-Gulfport community in Mississippi and a number of shelter sites for displaced persons in Louisiana.

AUGUST 30 THROUGH SEPTEMBER 3: 1 TO 5 DAYS AFTER LANDFALL

The CHF developed Operation Assist and began preparations to mobilize medical teams. Developed in response to Hurricane Katrina, Operation Assist is a joint emergency-response initiative of the CHF with the Na-

tional Center for Disaster Preparedness at the Columbia University Mailman School of Public Health (New York, NY). CHF's staff determined necessary staffing, supplies, housing, and safety precautions. Clearance was obtained from the Department of Health in Mississippi and Louisiana for its clinicians not only to provide health care through MMUs but also to access gasoline (in short supply at the time), medical supplies, and pharmaceuticals. In addition, the MMUs were authorized to travel after curfew, which facilitated the provision of health care services for extended hours. Incredibly, MMUs complete with volunteer medical and support staff were sent from 13 of the CHF's 17 existing rural and urban communities across the United States. Arrangements included the very important provision of rotating personnel on a weekly basis to prevent burnout. Staff at CHF's national headquarters in New York City coordinated scheduling, supplies, and resource needs.

Mobile units from the New York Children's Health Project and the CHF program affiliated with the Aaron E.

Key Words: Hurricane Katrina, underserved children, disaster preparedness, Children's Health Fund, Operation Assist

Abbreviations: CHF, Children's Health Fund; MMU, mobile medical unit

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Henry Community Health Center in Clarksdale, Mississippi departed for Biloxi and Gulfport.

SEPTEMBER 4: 6 DAYS AFTER LANDFALL

Advance staff arrived in the gulf coast region. The focus was on finding medically underserved populations, which were in serious crisis after the storm and would benefit most from Operation Assist. After selecting appropriate sites, 2 MMUs were dispatched with the first teams of volunteers.

SEPTEMBER 5 (LABOR DAY): 7 DAYS AFTER LANDFALL

Medical teams arrived on the scene.

“As we made our way, we were struck by the sight of literally mountains of man-made and natural debris, intertwined and strewn everywhere as if a humungous mixer went on a rampage. The smell of death—dead dogs, dead cats, rotting fish, poultry, and meat and undoubtedly humans—permeated the air. No semblance of infrastructure remained. Power and communications systems were out, no potable water or proper sewage. The transportation system was fractured, and fuel was scarce. Hospitals, health centers, dental offices, and pharmacies were devastated, as were the lives of those personnel that staffed them. Starting from the moment we arrived, we were seeing 75 to 100 patients each day.”

Alan Shapiro, MD, FAAP

“We traveled south to Biloxi with the medical team of the Mississippi Children’s Health Project and their MMU. Vast numbers of local residents were without the basics—food, clothing, and shelter. It was apparent that the water supply was unsafe, and bottled water was being brought in by the truckload.”

Lynn Seim, MSN, RN

SEPTEMBER 6: 8 DAYS AFTER LANDFALL

Medical teams began providing care to victims. It rapidly became clear that efforts for disaster relief were sorely lacking.

“The first service delivery site was the Main Street Baptist Church in Biloxi. The medical team from the Mississippi Children’s Health Project quickly (within an hour) set up the MMU and began seeing patients.

Any time that we were out in the neighborhoods during the first week, a crowd immediately formed around us, with people vying for our attention, actually touching us, pulling on us to come to listen or see. There was never a moment of concern about personal safety. It was much more a matter of folks needing resources that we might have as well as needing to connect in some meaningful way.”

Lynn Seim, MSN, RN

Across CHF’s National Network, other projects began preparations to join the effort in the Gulf Coast.

“Our experiences began with the logistic and planning stage in Phoenix, Arizona, on September 6th. As medical director, I’ve had 5 years experience in mobile medical care delivery as well as wilderness medicine training. Within a 1-day period we had acquired supplies that included over 500 liters of saline, intravenous tubing,

antibiotics, acute care medications, infant formula, clothes, diapers, water, and food. Personal supplies included food to sustain the team for 2 weeks, water-purification items to purify over 2000 liters of water, tents, sleeping bags, 60 gallons of gas, an all-terrain vehicle, and a satellite phone. All these supplies were packed in a 4-wheel drive truck and single-axle trailer. Estimated weight was over 2000 lbs.”

Randal Christensen, MD, FAAP

A CHF team from Phoenix and an MMU from Arkansas arrived in Baton Rouge, Louisiana. Dr Erin Brewer, one of the extraordinary physicians running Louisiana’s emergency medical response effort, first deployed the Operation Assist team to small towns in which large numbers of displaced families from New Orleans, Louisiana, were being sheltered.

SEPTEMBER 7: 9 DAYS AFTER LANDFALL

As CHF became increasingly involved in medical disaster relief, it was apparent that not only traditional victims but also rescue-and-recovery workers were in need of medical and mental health care.

“During a lull in hours of meetings, one of the participants began to tell his story of the storm. We had heard he had lost his house and had been working around the clock from 5 days before the storm hit until this point, 9 days after the storm. He told us how slowly everything began to break down at his site—electricity, back-up generators, telephone lines, emergency telephone lines, all other communications. He told us how he passed out his 3 life jackets to others, because he knew how to swim, and placed a marker in his pocket. That reference meant little to me until I learned that he was going to use it to write his social security number on his and his wife’s bodies so they could be identified if they were to die.

It was clear to all of us that this gentleman had just gone through an overwhelmingly traumatic experience and was likely exhibiting symptoms of posttraumatic stress disorder, and this was one of the people assigned to rescue others and lead in the recovery.”

David Krol, MD, MPH, FAAP

SEPTEMBER 8: 10 DAYS AFTER LANDFALL

“I met a local councilwoman who appeared exhausted from long hours of work attempting to assess the needs of the community and provide necessary resources. There was no availability of medical services except those of the CHF. The councilwoman asked that I accompany her to a particular house within a nearby housing project. We found 2 children, a girl approximately 9 years old and a boy about 12 years old. They were alone, frightened, and without food, water, or electricity. The temperature was 100 degrees outside. The councilwoman agreed to assume responsibility for the children until family members could care for them.”

Lynn Seim, MSN, RN

SEPTEMBER 9: 11 DAYS AFTER LANDFALL

“As we administered vaccines, applied wound dressings, treated bronchospasm, and learned how to identify cu-

taneous *V[ibrio] vulnificus* manifestations, we also heard the voices of despair, observed the physical and mental exhaustion, and listened to the stories of loss and dislocation. We were continually struck by the inherent medical needs of these families, which in most instances were best attacked through education and proper application of community resources. We learned of the physical problems associated with crowding in close quarters, improper use and lack of medications, and the difficulty of accessing services in a new area. We learned of the myriad of mental health needs for children and their families in coping with this traumatic event and the trauma associated with family separation, disruption, and global loss.”

Abhay Dandekar, MD, FAAP

SEPTEMBER 10: 12 DAYS AFTER LANDFALL

“The medical team drove to the Boys and Girls Club, now a relief center, in a small neighborhood in Gulfport. There were easily over 100 residents picking up water, food, and clothing. We were immediately overwhelmed with people who wanted medical attention. Throughout the day we were vaccinating against tetanus, distributing medications, and tending small wounds. This routine was broken by a 9-year-old boy, lacking his usual medications for a behavior disorder, brought in by his mother, complaining that her son was unable to move his left arm or right leg. In fact, his pain was so severe that he refused to raise these extremities voluntarily, and doing so caused visible distress. The physical findings were incompatible with the history of falling from his bed (a mere 2 1/2 feet from the floor). Additional questioning revealed a single mother with 4 children under tremendous stress, having just lost her hope of employment at the casinos. She was now living doubled up and was clearly overwhelmed. Emergency medical services was called, and the child was sent to the emergency department for radiographs, because child abuse was our chief concern. This case alerted us to the unfortunate reality that children often become the secondary victims of stressful circumstances.”

Alan Shapiro, MD, FAAP

SEPTEMBER 11: 13 DAYS AFTER LANDFALL

As medical teams saw patients at an expanded number of sites, MMUs and their health care teams gained recognition.

“Given our mobility and preparedness, the Louisiana Health Department wanted us to deliver care to ‘region 9.’ This region was 80 miles north of the coast but suffered devastating winds, tornadoes, tree damage, and loss of power. We arrived at the fire station in Angie, a small town in the Washington Parish district. We were told that we were the first medical team to enter the area since the storm. The electricity in the fire station had just been restored, and the road had just been cleared that day. The rest of the town would not have electricity until well after our arrival.

We quickly set up a clinic at the fire station and then helped add staff to a clinic in Pine, Louisiana. During the first 7 days we saw over 300 patients for medical reasons and countless others for supplies. One hundred of these

patients were below the age of 18. Most of the care we provided could have been provided in a primary care doctor’s office. Most families sought care to obtain medications and care of chronic diseases such as asthma, chronic obstructive pulmonary disease, diabetes, and hypertension. The acute care concerns were pneumonias and skin infections.”

Randal Christensen, MD, FAAP

SEPTEMBER 13: 15 DAYS AFTER LANDFALL

Although delivering primary care is CHF’s goal, pediatricians and other health care providers are called on all too often to see adults and children with serious illness and injury.

“I saw a local police officer for a chief complaint of a bug bite and rash on his neck. When interviewing him, I found that he had just been released from the hospital a few days after the storm with a diagnosis of ‘heart attack.’ When I questioned him about present angina, he replied in the affirmative and then began looking quite ill. I opened the door and called for a nurse and paramedics. We gave him an aspirin and hooked him up to a portable monitor. His color worsened and, ultimately, he became apneic and cardiopulmonary resuscitation was started. It was difficult to determine if he was in pulseless electrical activity or other arrhythmia, given the monitor’s ability. Fortunately for us, he resumed spontaneous respirations within a few minutes. He was transported shortly afterward to the hospital with a presumed diagnosis of mitral infarction with question of pulmonary embolism. That same day we saw a teenaged girl who sustained a cervical fracture. She had fallen off a roof while trying to help her father repair a storm-damaged roof. This kind of secondary trauma in the aftermath of a devastating storm would be all too common.”

Randal Christensen, MD, FAAP

SEPTEMBER 14 AND BEYOND: 16 DAYS AFTER LANDFALL TO PRESENT TIME

Medical teams from projects in CHF’s national network continue to provide services to Gulf Coast communities in Mississippi and Louisiana. Operation Assist pediatricians were deployed to unusual working environments, hearing and seeing families and children who were surviving under very difficult circumstances.

“One of my most moving experiences was at the FEMA [Federal Emergency Management Agency] trailer site, Renaissance Village, outside of Baton Rouge. There, 527 trailers housed around 2000 hurricane evacuees, about 700 of which were children. I spoke with a young mother who had brought her 4-year-old daughter in for a rash. After diagnosing a nickel allergy, I asked the mother about other illnesses. She told me that her child also had ‘bad asthma.’ I asked how the child was being treated at the FEMA site. She said that when her daughter has an attack, she brings her to the medical tent for a nebulizer treatment by some other volunteer organization. The child was on no daily medications and had never been prescribed an inhaled corticosteroid. As we stood in this huge, dusty, dirt lot, I asked the woman

what she planned to do if her child had an asthma attack at nighttime. Before this, I don't think I've ever seen anyone really shudder; this woman truly shuddered when she considered the question. The medical facility that was present at the site closed and left each day at 4 PM."

Michael Duffy, MD

"At a large shelter in Shreveport, Louisiana, I examined an 8-year-old male with asthma. His mother explained that since having been evacuated to the shelter, the child's asthma had worsened, particularly at nighttime, despite using his regular nebulized medicines. She suspected that the shelter itself was to blame. Indeed, a quick visit to the family's living area in the shelter showed it to be located directly under a large air blower that was blowing cold, unfiltered air directly onto the family while they rested. They had been unable to find another family in the shelter that was willing to trade spots with them. Later that day, with the help of a dedicated Red Cross volunteer, we were able to relocate the family to Arkansas, where they were to be housed with extended family."

Michael Duffy, MD

Vaccines against varicella and hepatitis A and other vaccines were often not available or not offered through federal or state resources. At several times during the first few months of Operation Assist, appeals directly to vaccine manufacturers, particularly Aventis Pasteur, were very successful. The company was able to deliver large quantities of vaccines within 24 to 48 hours to sites in need.

SUMMARY OF OBSERVATIONS

Locations visited by CHF's MMUs included those typically associated with disasters, such as emergency shelters (both local and distant), tent cities, distribution centers, houses of worship, and community centers. MMUs also went to public housing complexes, campgrounds, and motels—places where displaced victims had quickly become isolated because of the loss of personal and public transportation.

The areas we served suffered from an almost total loss of medical infrastructure. There was an overwhelming loss of hospitals, community and private medical offices, pharmacies, and medical and patient information/insurance systems. The number of uninsured people (now without livelihood) rose significantly, mainly because of the loss of shrimping, fishing, and casino jobs. The predominantly Vietnamese and Hispanic workers in these industries faced additional language and cultural barriers.

Mental health issues comprised some of the most prevalent and least addressed complaints after the hurricane. Mental health is a vital component of comprehensive care and disaster relief. In addition to postdisaster posttraumatic stress disorder in victims and caretakers, preexisting mental disorders often become unveiled after a major catastrophe.

The effects of the hurricane exacerbated many preexisting problems; chronic illnesses such as diabetes, asthma, and neurologic disorders seemed to be common in those who were unable to evacuate. The disruption in their treatment was alarming; most had no access to medications or vital durable medical equipment such as oxygen. Social workers from the CHF determined the accessibility of pharmacies in the areas served, which became an indispensable component of Operation Assist. Many patients were unable to access pharmacies; only a handful of them were open, and policies differed greatly. Patients who had lost everything were often asked to pay for their medicines.

LESSONS LEARNED

The most poignant lesson was the impact of preexisting deficiencies in the local health care system on the health outcomes of hurricane victims. As CHF saw more patients, it became clear that the region desperately needed a stronger permanent public health infrastructure. There was no effective system for providing essential vaccines or health screening for people who were living in close quarters under emergency shelter conditions.

CONCLUSIONS

Although the truly emergent relief phase after the catastrophic storm passed relatively quickly, the ravaged communities of coastal Mississippi and Louisiana will have ongoing medical needs long into the future. Two harsh realities face this region: the hurricane and flooding destroyed much of the local health care capacity, and the medical infrastructure was fragile well before the storm, especially for the medically underserved population. To this end, the CHF initiated permanent mobile medical projects in a few affected areas of both states; more of these projects are and will be needed. In all such programs, as is the case throughout the national network of the CHF, the new projects are developed in partnership with local institutions. The Coastal Family Health System in Biloxi-Gulfport, Tulane School of Medicine in New Orleans, and the Louisiana State University School of Medicine are the principle affiliating institutions.

For the clinical and support staff who volunteered to provide health care during the crisis, the images of desperation, hope, and courage will leave an enduring impact. The challenge now for those concerned with the long-term health and well-being of children and families in the aftermath of Katrina is to ensure that a new, stable condition of normalcy is established as quickly as possible. In the meantime, far too many families are living in shelters with uncertain livelihoods, difficult educational challenges, and very uncertain access to appropriate medical care.

Interstate Transfer of Pediatric Patients During Hurricane Katrina

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PRACTICAL QUESTIONS: The question was, and is, “Can hospitalized children, in a geographic area, have their continuing medical needs met when capacity in that geographic area to provide care is exceeded?”

Events after the landfall of Hurricane Katrina on the city of New Orleans, Louisiana, generated significant information about pediatric care delivery during a disaster. In particular, Katrina helped answer 3 key questions regarding the care of children under disaster conditions:

1. In a disaster, will regional capabilities be used to augment local capabilities to care for children? In particular, will there be a preference for bypassing nearby providers of adult care to send pediatric patients to more specialized pediatric care facilities that are more geographically distant?
2. Can the communication and logistic challenges associated with regional pediatric patient movement be overcome during a disaster?
3. Do government disaster plans at the local, state, and federal levels facilitate pediatric patient movement across jurisdictions during a disaster?

We will provide a chronological timeline of pediatric activities related to the care of patients in 3 New Orleans hospitals (Tulane University Hospital, Children's Hospital of New Orleans, and Alton Ochsner Foundation Hospital) at the time of Katrina's landfall. After outlining the relevant sequence of activities, we will relate these activities to the 3 questions posed above.

Our discussion focuses on New Orleans, because it is an urban center with the highest concentration of pediatric inpatients that were impacted by Katrina. Our timeline is based on selected interviews and publicly available information. Despite the biased, qualitative,

and focused nature of the analysis, the New Orleans experience demonstrates the need for significant adjustments in our disaster plans for pediatric care during disasters.

2004–2005: 1 YEAR BEFORE LANDFALL

Ironically, pediatric health care providers from 5 states had been participating in the Southeastern Regional Pediatric Disaster Response Network for 1 year before Hurricane Katrina in a regional planning effort to evaluate coordination of services for pediatric patients during disaster scenarios. Representatives from several New Orleans facilities participated in regional pediatric disaster-response-network workshops. They expressed concern that state and federal planning for pediatrics did not seem to be a priority. There seemed to be little acceptance of the idea that children's needs are different and that separate planning for children might be appropriate. One week before Katrina, workgroups met not only to identify gaps but also to develop strategies that address some of the shortcomings of pediatric disaster planning. Many of the service-delivery and communication challenges identified in this conference indeed proved to be significant during Katrina.

Nonetheless, these discussions facilitated a more rapid

Key Words: Hurricane Katrina, interstate transfer, pediatrics, disaster planning, surge capacity, regionalization

Abbreviations: FEMA, Federal Emergency Management Agency; VAD, ventricular assist device; NDMS, National Disaster Medical System

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response to rescue children at risk than perhaps otherwise would have occurred.

AUGUST 27 AND AUGUST 28: 1 AND 2 DAYS BEFORE LANDFALL

General Response

Katrina became a category 5 hurricane with 160-mph winds, and Mayor Nagin ordered mandatory evacuation of New Orleans. Ten shelters were set up for citizens who were unable to leave the city. Evacuation orders were posted along the Gulf Coast.

Pediatric Response

Local preparations were undertaken at individual institutions to ensure business continuity, adequate supplies, and staffing.

Some regional communication occurred. For example, Arkansas Children's Hospital was in direct communication with Tulane University Hospital and Children's Hospital of New Orleans before Hurricane Katrina made landfall.

AUGUST 29: LANDFALL

General Response

Katrina made landfall to the east of New Orleans on the Mississippi Gulf Coast. The Federal Emergency Management Agency (FEMA) initiated the federal response by dispatching 1000 staff members to the region.

Pediatric Response

Local focus was on maintaining operational capacity during and immediately after the storm.

AUGUST 30: 1 DAY AFTER LANDFALL

General Response

Levees broke in 3 places—along the industrial canal, the 17th Street canal, and the London Street canal. Disaster medical assistance teams from Massachusetts and Washington were deployed to the Gulf Coast states to assist in the response efforts (see "The National Disaster Medical System Response: A Pediatric Perspective," pp S405–S411).

Pediatric Response

Local measures were made to manage the storm's impact on facilities. For example, the staff at Tulane University Hospital, anticipating flooding, moved the emergency department to higher ground (to the second floor).

Tulane University Hospital asked Arkansas Children's Hospital's Angel One transport service to transport 2 pediatric patients. After evacuating these 2 patients, Tulane called again to request helicopter transport for a 15-year-old patient on a ventricular assist device (VAD).

Given the device's size, a larger helicopter than traditionally is used in pediatric transports was required. Angel One was the only medically equipped critical care helicopter identified in the area with load capacity to transport the VAD and patient from Tulane to Texas Children's Hospital. This transport required a 13- to 14-hour transport, staffed with a pediatric intensivist/cardiologist, flight nurse, and 2 pilots. Local conditions were deteriorating, and the elevators in the hospital were not working, thus requiring hand transport of the patient and 500-lb VAD.

Texas Children's Hospital transported 18 more pediatric patients that day and expected to transport between 50 and 60 more patients within the next 48 hours (see "Preparing, Improvising, and Caring for Children During Mass Transport After a Disaster," pp S421–S427). The Ochsner Foundation Hospital initiated interstate and intrastate evacuation of children from their NICU (see "Disaster Preparation and Lessons Learned at the Ochsner Foundation Hospital," pp S375–S380; and "Caring for Displaced Neonates: Intrastate," pp S389–S395).

AUGUST 31: 2 DAYS AFTER LANDFALL

General Response

The National Disaster Medical System (NDMS), which had been activated, identified 2600 hospital beds in the 12-state area surrounding the affected coastal region and worked with the US Departments of Defense and Veterans Affairs to move patients to these facilities. Five disaster medical assistance teams were deployed and supporting New Orleans medical facilities (see "The National Disaster Medical System Response: A Pediatric Perspective," pp S405–S411).

Pediatric Response

Pediatric patient evacuation was not centrally coordinated. For example, a critical care transport team from Children's Hospital of Alabama evacuated 2 neonates from Ochsner Medical in New Orleans back to their Birmingham campus by using a jet, a helicopter, and several ground vehicles. Four other infants from Ochsner Foundation Hospital were taken to University of Alabama at Birmingham's regional NICU. Children's Mercy Hospital in Kansas City, Missouri, evacuated 24 patients and their families from Children's Hospital of New Orleans by using 2 C-130 aircraft.

Early on day 2, Memorial Hermann Children's Hospital of Houston sent 6 ambulances, 2 helicopters, and 2 small planes to the airport in Baton Rouge, Louisiana. From there, the helicopters flew to New Orleans, where they assumed care of the patients from Ochsner Foundation Hospital.

Although centralized management of pediatric patients did not occur at the governmental level, such coordination at a corporate level did assist Tulane Uni-

versity Hospital. According to company spokesman Jeff Prescott, the owner of Tulane's hospital, HCA Inc (Nashville, TN), hired 20 private helicopters to evacuate patients. Because of helicopter capacity, evacuation progress was slow.

SEPTEMBER 1: 3 DAYS AFTER LANDFALL

General Response

Doctors at Charity Hospital (the largest public hospital and trauma center in New Orleans) and University Hospital were calling the Associated Press in search of help with patients.

Pediatric Response

Communication failures after the breakdown of the levee system were common in the New Orleans area. For example, at Tulane University Hospital, routine long-distance lines were not functioning, and the staff relied on a single calling card to help access health care providers outside the city (W. Gill, MD, FAAP, personal communication, October 2005).

Miami Children's Hospital LifeFlight airlifted 2 premature, critically ill infants from Children's Hospital of New Orleans to Baton Rouge, and area hospitals in Atlanta, Georgia, received 3 pediatric patients by air transport.

A Miami Children's Hospital Learjet departed for the New Orleans Louis Armstrong International Airport with supplies on board, including diapers, infant formula, toothbrushes, antiseptic, scrubs, fresh fruit, juices, insect repellent, medical supplies, personal items, and water. Many of these supplies were not extraordinary but were, nonetheless, more heavily provided by institutions with significant pediatric experience.

According to hospital officials, Children's Hospital of Alabama received notification that the NDMS has been activated, and they anticipated receiving pediatric patients. Pediatric emergency physicians and staff were deployed to the airport to facilitate rapid compassionate transfer of children, allegedly on airplanes. However, despite several days of providing staff at the local airport, no pediatric patients arrived. Not only did they get incorrect patient information, they got incorrect numbers of and arrival times of airplanes, and there was no basic passenger list of patients.

SEPTEMBER 2: 4 DAYS AFTER LANDFALL

General Response

Miami Children's Hospital administrators met with Miami VA Medical Center and Coast Guard representatives to coordinate care for pediatric evacuees. The Miami VA Medical Center serves as south Florida's federal coordinating center under the NDMS and had been asked to receive, triage, and transfer patients to area hospitals.

Pediatric Response

Miami Children's Hospital assisted Miami VA Medical Center with the care and treatment of incoming pediatric patients.

SEPTEMBER 3: 5 DAYS AFTER LANDFALL

General Response

President Bush ordered 7200 active-duty forces to the Gulf Coast, and FEMA deployed 7 of 28 National Urban Search and Rescue Teams to Louisiana to assist in rescue efforts in heavily impacted areas.

Pediatric Response

Four pediatric patients were treated at Vanderbilt University Medical Center's emergency department (Nashville, TN) when they arrived on military transport jets. Vanderbilt LifeFlight dispatched its reserve helicopter and a medical team to Hattiesburg, Mississippi, to assist in disaster-relief efforts after a call for assistance was made to Tennessee Emergency Medical Services officials from FEMA.

SUMMARY OF INTERSTATE TRANSPORT OF PEDIATRIC PATIENTS

Hospitalized pediatric patients from New Orleans were transferred not only intrastate but also interstate. Most of those leaving Louisiana were taken to Alabama, Arizona, Arkansas, Florida, Georgia, Missouri, Tennessee, and Texas.

The following 5 children's transport teams worked together to evacuate more than 40 medical surgical pediatric patients and 12 critical PICU patients from Children's Hospital of New Orleans during Hurricane Katrina:

- Arkansas Children's Hospital Angel One Transport (Little Rock, AR)
- Children's Mercy Hospital Critical Care Transport (Kansas City)
- Cook Children's Medical Center Teddy Bear Transport (Fort Worth, TX)
- Miami Children's Hospital Life Flight (Miami, FL)
- Texas Children's Hospital Kangaroo Crew (Houston, TX)

We have focused thus far on patients with acute inpatient illnesses, but larger numbers of children with chronic outpatient needs were also managed outside of formal governmental relationships. According to the St Jude Children's Research Hospital Web site, it is estimated that close to 170 pediatric cancer patients had their critical treatment disrupted by the destruction caused by Hurricane Katrina as Gulf Coast hospitals were shut down and evacuated. More than 100 children were managed by St Jude and its affiliates. The Chil-

dren's Healthcare System of Atlanta assumed care of displaced children on chemotherapy.

Similar experiences have been reported with children with other special health care needs, including those under the care of endocrinologists, pulmonologists, neurologists, cardiologists, specialist surgeons, psychiatrists, or others.

COMMENTS

Before Hurricane Katrina, the cost of transporting neonates and children out of a disaster-impacted area was viewed by many as not being financially or operationally viable. There was a perception that adult care could serve as a substitute for specialized pediatric care, which suggests that regionalization of pediatric services during a disaster event would be unnecessary and impractical.

Although adult facilities and shelters were used to provide basic care to pediatric victims of Katrina, a significant portion of the pediatric inpatient population was transported out of New Orleans to specialized pediatric health care facilities both within and outside the state. Regional transfers mirrored the dispersion of pediatric care facilities and expertise across the region, as is typical throughout the United States.

The scarcity of pediatric care resources when compared with adult care venues is partly an artifact of the care demands made by the pediatric population during normal operational periods. A relatively large proportion of the adult population uses hospital facilities compared with the relatively small percentage of the total pediatric population (<5%) that uses inpatient care. As a result, pediatric inpatient capacity is more limited relative to the baseline population of children. Thus, to significantly increase pediatric capacity during a disaster, a more regionalized approach must be considered for children.

The inevitability of regionalization has serious implications for disaster management. This relates not only to the increased geographic distance that must be traversed to manage care needs but also to the associated need for interstate coordination between health care providers and state governmental agencies to accomplish such regional response. When these issues are not managed well, there are shortages of care resources as well as a waste of resource capacity that is activated but unused. Both were evident during Katrina.

Despite poor coordination at the state and federal levels, pediatric patients did receive regionalized care. Such care was delivered largely through the efforts of informal coordination among pediatric providers. Interstate collaboration between departments of public health did not filter down to pediatric providers in an organized manner. Federal efforts to coordinate care through agencies such as the National Association of Children's Hospitals and Related Institutions generated some activity, but the coordination was spotty. Some institutions in the region were not involved. Certainly, there were govern-

ment efforts to coordinate movement of individuals between states such as Louisiana and Texas. Among the subpopulation clusters being transported to shelters were children. However, children with acute care needs and those with chronic illnesses did not benefit from such efforts in general. Rather, a more informal, distributed network facilitated their care. Many private facilities sent aircraft and transport teams into the disaster-impacted areas before federal transportation was or could be provided.

Immediately after Katrina's landfall and in its aftermath, personal contact between hospital management and health care professionals within impacted pediatric hospitals and other pediatric institutions throughout the region facilitated evacuation efforts. These contacts sometimes occurred between freestanding institutions such as Children's Hospital of New Orleans and Arkansas Children's Hospital. In addition, some of this work was facilitated by corporate relationships such as Tulane University Hospital's interaction with its corporate parent HCA Inc.

The experiences in New Orleans after Katrina demonstrate that the concept of interstate transportation of pediatric patients during disasters was not only theoretically possible but was implemented on a fairly large scale even after a significant event. This occurred after Katrina despite the substantial logistic problems involved in the transportation of such patients. During Katrina, the physical challenges posed by the storm were complicated by violence directed toward those who were providing transport. Nonetheless, regional evacuation of children occurred.

Under the current structure, the formal response of a national disaster depends on the activation of the NDMS. After Katrina, activation of the NDMS produced sketchy benefits for pediatric patients. Activation did not significantly impact immediate pediatric care. Observations at several sites suggest that evacuation of pediatric patients across state jurisdiction was not formally considered part of the NDMS-response structure, and pediatric providers often were not formally involved in the local NDMS responses. When they were included (eg, in Birmingham), significant pediatric assets were deployed but not used.

Some providers felt that the hierarchical structure of disaster-response management within state governments and federal agencies tended to decrease their response capabilities once the NDMS was activated. Spontaneous efforts became subsumed in a less efficient hierarchical response that did not explicitly address the needs of children.

LESSONS LEARNED

To help answer our first question, posed at the beginning of this article, regional pediatric assets were used effectively in the care of children despite obvious logistic and

transportation disadvantages that are accentuated in a disaster. Those setting up transport for children who required hospitalization bypassed adult-oriented facilities in favor of specialized children's hospitals. However, because current disaster plans are not designed to accommodate such patient movement, they did not facilitate such efforts but actually impeded them.

To help answer our second question, many difficulties with interstate transportation of patients during a disaster were identified, but without reliable communication, chaos is predictable. Communication networks have to be improved within and outside of the institution and local community. Many gaps in meeting the unique logistic needs of children were identified.

To help answer the third question, it is policy for federal disaster plans to depend on local entities to have enough emergency provisions to operate for 2 to 3 days during a disaster. However, by its nature, pediatrics is a regionalized care model. Shortly after Katrina, the need for regional action was realized. Because state and local governments don't have such regional jurisdiction, it developed spontaneously. Within 3 days, pediatric patients were transported to at least 7 states outside Louisiana; these transports were largely coordinated by private ad hoc-response networks.

CONCLUSIONS

Hurricane Katrina documented a need for regionalization of children's services when responding to a disaster. Not only planning, communication, and lack of emphasis on the special needs of children but also transportation, finances, licensing and liability, and security issues all impede efficient responses in any disaster situation. Despite these hurdles, significant regionalization of care occurred. If better foundations could be laid to support interstate transport of pediatric patients during disasters, we would be in a better position to support our children when the next Katrina occurs.

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Preparing, Improvising, and Caring for Children During Mass Transport After a Disaster

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THE INCAPACITATING BLOWS dealt to the New Orleans, Louisiana, health care infrastructure by Hurricane Katrina and its aftermath are unprecedented in the United States. Much can be learned about disaster preparedness from the events that unfolded in New Orleans after Katrina swept the Gulf shoreline. Problem areas in the management of this disaster such as internal and external communication failures, transportation, triage, personnel allocation, and resource allocation have long been identified in the literature as core disaster-response issues.¹⁻³ In addition, damage to the physical plant, water and power system failures, and hazardous-materials exposure are encountered commonly in the face of disaster.¹

Between 1950 and 2005, 286 hospital evacuations have been described, including horizontal evacuation (within the same floor), vertical evacuation (between floors), evacuation of a ward or wing, and complete hospital evacuation.⁴⁻¹⁰ Of the 286 between 1971 and 1999, 275 were reviewed by Sternberg et al.⁸ There are 22 reported cases of complete hospital evacuation since 1950; of these, 1 occurred in Canada and 8 resulted from the 1994 Northridge, California, earthquake.^{4,5,7-18} Of 43 reported incidents for which duration is known, only 12 evacuations lasted longer than 24 hours.⁸ Eleven percent of evacuations in the series reviewed by Sternberg et al listed at least 1 casualty, and the deadliest reported hospital disaster occurred in 1971, when partial collapse of a California Veteran's Administration hospital claimed 49 lives.⁸

Hurricanes are the third most common cause for hospital evacuation, accounting for 38 of 286 reported evacuations; only internal fire and internal hazardous-material events are more common. It is notable that only 3 evacuations since 1950 involved 1000 or more patients.⁸

LOCAL EXPERIENCE WITH DISASTER

Over a 5-day span in June 2001, Tropical Storm Allison brought nearly 39 inches of rain to Houston, Texas, including the Texas Medical Center (a consortium of health care institutions comprised of 2 medical schools and 13 hospitals with more than 6000 licensed beds). Tropical Storm Allison's record rainfall and subsequent flooding, estimated by flood experts to be in the 300- to 500-year range, claimed 22 lives and caused more than 2 billion dollars in damage to the Texas Medical Center alone.^{4,19} Disaster-management issues identified during Tropical Storm Allison served as the impetus for improved interinstitutional coordination among local hospitals during disaster and ensured that institutional investment in ongoing preparedness remained a priority.

Such preparedness in each of these areas was integral to the overall positive outcome experienced by Texas Children's Hospital (TCH). Our ability to respond to Hurricane Katrina effectively was the result of previous experiences and a specific focus on disaster preparedness over several years. Our response to Hurricane Katrina resulted in additional changes in our approach to disaster planning that will be described for each aspect of disaster preparedness.

Key Words: Hurricane Katrina, pediatrics, mass transport, disaster planning

Abbreviations: TCH, Texas Children's Hospital; CHNO, Children's Hospital of New Orleans

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AUGUST 26 THROUGH 29: 3 TO 0 DAYS BEFORE LANDFALL

Preparations were in place as TCH monitored Hurricane Katrina's path through the Gulf of Mexico. Early reports on the day of landfall in New Orleans suggested minimal damage and flooding to the city infrastructure. TCH received no requests to evacuate pediatric patients; in fact, we spoke with 1 hospital that was functioning on emergency generator power without disruption. Confident of their ability to withstand the flooding, it was not until 2 days after landfall that the flooding and general deterioration of civil order required a reversal of the original decision to "defend in place."

AUGUST 30: 1 DAY AFTER LANDFALL

Interfacility Transport

On the initial day of flooding during the Katrina disaster (1 day after the hurricane), TCH received a call from the Federal Emergency Management Agency requesting rotor-wing aircraft. The TCH program consists of fixed-wing and ground vehicles, both of which were offered for relief efforts.

Later that same morning, calls requesting transport relief from TCH and other facilities started; the volume of calls and requests for assistance quickly overwhelmed the hospital's conventional transport process. TCH's internal hospital disaster plan was activated simultaneously to facilitate the increased need for services expected with the new arrivals. Concomitant with the hospital activation, the transport teams were notified to prepare for extended operations.

Communication

Initial and ongoing communication with the referring hospitals was difficult because of loss of power and normal transfer center operations. Fax communications delineating patient demographics were invaluable in planning the patient transport and assimilation process. Concurrent with the ongoing assessment of patients' needs at New Orleans' institutions, an ad hoc working group of multiple children's hospital transport teams was formed expeditiously. This group met via an extended continuing conference call both separately and simultaneously with Tulane University Hospital and the Children's Hospital of New Orleans (CHNO). The group was able to define priorities, assess patient needs, and dedicate appropriate transport resources.

The working group of 5 children's hospital transport teams enabled evacuation of most pediatric patients from Tulane University Hospital and CHNO within a 48- to 72-hour time frame, with little governmental assistance (see "Closing and Reopening of a Children's Hospital During a Disaster," pp S381-S385). This ad hoc group and the mechanism for timely accurate communication were the most important ingredients to the

timely evacuation of the children from hospitals in the New Orleans area.

Evacuation Process and Equipment

Because of flooding and impassable roads, the only evacuation route by the end of that day was rotorcraft from helipads. An obstacle to timely evacuation was obtaining sufficient rotorcraft (and rotorcraft organization) to evacuate patients. Although multiple children's hospitals were attempting to get to the New Orleans facilities, landing space and simultaneous evacuation of other hospitals proved to be challenging obstacles. The distance from New Orleans to Houston was prohibitive for helicopter transport. Therefore, an initial triage/staging area was set up in the Baton Rouge, Louisiana, airport (Fig 1) because of the lack of an operational landing field in New Orleans. TCH fixed-wing aircraft were stationed in Baton Rouge. Patients were flown by helicopter from New Orleans to Baton Rouge and then were transferred to airplanes and subsequently flown to Houston. Toward the end of the day, fuel shortages for helicopters and fixed-wing aircraft were evident. The fixed-wing aircraft began refueling only in Houston with enough fuel for both trips. At nightfall, gunfire directed at the helicopters and patients forced the termination of any transports until the second day.

AUGUST 31: 2 DAYS AFTER LANDFALL

Interfacility Transport

Two days after landfall, the intermediate staging area was moved to Houma, Louisiana. Houma is a 20-minute helicopter trip from New Orleans, compared with Baton Rouge, which is 30 minutes away. Houma's closer location to New Orleans (allowing for shorter helicopter rides) and its lack of congestion offered an advantage over Baton Rouge. A TCH respiratory therapist and nurse were left on site at Houma, which permitted on-site triage and an open line of communication for incoming transports and immediate determination of fixed-wing needs. Throughout the 48 to 72 hours, we became more efficient; with each trip we could better anticipate patient requirements and prepare for them.

Later in the day, our fixed base of operations again



FIGURE 1
Map of the region including New Orleans, Baton Rouge, Houma, and Houston.

changed to Baton Rouge with the evacuation of CHNO. By this time, we had refined our fax intake form and could begin the process of moving children with greater efficiency. When the helicopters were returning to New Orleans after dropping children off at Baton Rouge, we were able to stock them with disaster provisions from TCH supplies, thus making the return trip just as valuable for those remaining in New Orleans.

During the entire process, our partnering transport teams from other children's hospitals ferried patients to our interim fixed base of operations, to TCH, or to other children's hospitals in the Southwest. Some teams only had the capacity for neonates or pediatrics, whereas others were dedicated teams that could manage children of all ages. During the evacuation efforts, we occasionally had multiple transport teams from several different children's hospitals arriving in Houston simultaneously. Flight Explorer (McLean, VA), a software program, enabled radar visualization from our home hospital base to track and anticipate timing of incoming flights. Multiple ambulance services in the Houston area were enlisted in addition to our own preexisting ground crews to ferry children from the airport.

Flexibility was an essential factor in evacuating the infants and children. Most transport teams carried 2 children; some were ambulatory and others were immobile. Every child had at least 1 medical device; many depended on multiple medical support systems. Because of space constraints on the helicopters, families could not accompany their children on the transports.

Larger aircraft without a medical configuration were borrowed during the evacuation process (Table 1). These jets had increased ability to carry more than 2 patients, so triage for fixed-wing transport was made on site as children arrived from the helicopters. A large military aircraft such as a C-130 would have been particularly useful but could not be commandeered during the evacuation process despite repeated requests made to many levels of the Federal Emergency Management Agency and the military command structure. Although we did not have access to military aircraft, several generous philanthropists donated the use of their aircraft to expedite the transport process.

At the time of departure from the New Orleans hos-

pitals, efforts were made to preassign each pediatric patient to a specific fixed-wing aircraft. Predictably, in a disaster and with poor communications, some of the patients who arrived did not match the initial descriptions. Our team quickly triaged each patient on arrival at the airstrip by using the patient's age, physical size, medical status, and number of medical devices that accompanied the patients to make an assignment to a specific aircraft. This information was relayed to the accepting facility and the referring hospital to ensure that the medical personnel, hospital command-center staff, and families were given accurate information regarding each patient's current location and destination (Fig 2).

Health Care Personnel

Three essential components to the evacuation process were (1) the transport team (registered nurses, respiratory therapists, and physicians) from multiple children's hospitals who performed in an exemplary fashion, (2) central communication/coordinating direction from TCH's home base, and (3) on-site triage at Houma and/or Baton Rouge or in New Orleans itself.

There was no shortage of volunteers to staff the transport teams; everyone wanted to participate. Transport personnel were limited to those with specific transport experience. Trainees were prohibited because of space limitations. Supervisory transport personnel led the central communication/coordination command center at TCH 24 hours per day and provided real-time advice to the transport teams as various issues arose.

Family Support

Families were unable to accompany their child during the medical evacuation because of space constraints in the aircraft and the logical prioritization of moving critically ill pediatric patients before healthy adults. Family members sought transportation from other families as well as from strangers and were reunited with their children at TCH and other facilities as quickly as possible. Unfortunately, some family members who themselves were homeless were estranged from their child and/or from other family members and even occasionally came to the wrong hospital to find their child. This disheart-

TABLE 1 Type of Aircraft, Air Speed, Capacity, and Average Range

Aircraft	Type	Air Speed, mph	No. of Seats	No. of Aircraft Used	Average Range, Miles
Sikorsky S-76	Rotor wing	178	4	2	200
Bell 430	Rotor wing	160	4	1	150
King Air B200	Fixed wing	330	5	2	1200
King Air E90	Fixed wing	300	3	2	800
Premier 1A	Fixed wing	500	3	1	1100
Learjet 35A	Fixed wing	510	3	1	1500
Cessna Citation 3	Fixed wing	480	8	1	1500
Merlin 4 Turboprop	Fixed wing	300	13	1	1900

	Patient's Name	Age or DOB	Medical Record	Diagnosis	Sending Hospital	TCH Location	Mode of Transp.	Depart Time	Comments Weight/Car Seat/St/Stretch Special Equipment Needs
1									
2									
3									
4									
5									
6									

FIGURE 2
Patient transfer tracking sheet.

ening situation created the need for a more structured and comprehensive approach to family support. Recognizing that the needs of these families were both basic and complex, hospitality services, patient relations, child life, and social work took the lead in implementing a comprehensive support program.

Within hours a large conference center room was transformed into a support center that provided family members with multiple computers, telephones, fax machines, resource information, and basic supplies that included clothing, personal hygiene items, toys, and meals. This center was staffed 24 hours per day during the initial phase of the recovery to aid families in their very difficult hours. Notable was the opportunity to assist families in making connections with their loved ones, provide clean clothing for individuals of all ages, answer telephones from desperate family members who were out of town, and offer any other support that was requested.

After the initial recovery efforts, the main family support center closed and was replaced with the Katrina support service. This center was covered by a social worker 8 hours per day, 5 days per week, and was operational for 5 weeks. During this time, more than 100 families whose children were at TCH were provided continued assistance to recover, relocate, and restore their lives after this terrible storm.

DISCUSSION

Long-term Preparation

Institutional preparation for disasters must be focused on several areas including (1) preparing and securing the physical plant, (2) securing necessary supplies, food, and other essentials, (3) ensuring the availability of necessary health care personnel, (4) an effective communication strategy, (5) an effective leadership structure for disaster management, and (6) patient evacuation and transport issues.

Physical Plant

Typically, the physical plant issues that must be addressed for effective disaster management include the ability to provide emergency generator backup for the hospital, the ability to ensure an adequate fuel supply for extended generator use, a back-up source of clean water, and the adequacy of the physical plant to withstand high winds, flooding, and other deleterious effects of disas-

ters. In Hurricane Katrina, emergency power and the ability to sustain a functioning hospital were of paramount importance. Unfortunately, the majority of hospitals in New Orleans were unable to sustain generator power once the loss of normal power and/or water occurred. The minority of hospitals that were functioning efficiently on emergency generator power found themselves in a unique situation as the external environment around their hospital deteriorated rapidly, forcing the evacuation of all hospitalized patients from New Orleans.

Helicopter transport became the only viable option for safe patient evacuation because of impassible roads and rapidly changing external conditions. Hospitals with helipads were fortunate; others relied on parking garages and adjacent buildings for landing sites. Skilled helicopter pilots, often flying with coordinates to makeshift landing sites, navigated across broken power lines and, in some cases, ignored sniper fire to offer safe passage to critically ill patients.

Security issues such as perimeter management and personnel access to the facility were vital to ensuring safety for hospital staff, patients, and families. The unanticipated civil unrest experienced during Hurricane Katrina impeded patient evacuation from New Orleans hospitals, thwarting medical transport team efforts, and discouraging some hospitals from participating in evacuation efforts because of the potential for harm of their personnel in the New Orleans "war zone."

Supplies and Staff Provisions.

TCH has experimented with various approaches to meet the urgent need for supplies during a disaster and has developed an approach that includes the availability of at least a 3-day food supply at all times. This requires frequent checks for expiration dates, regular rotation of stock, and strong vendor relationships to augment the supply on short notice in the case of impending disaster. In the case of Katrina, the need for supplies in the disaster zone was identified as a priority versus the need for supplies at our own hospital. TCH was able to mobilize necessary supplies such as headlamps for health care staff, packaged foods, fluids, and other essentials to respond to the needs of New Orleans facilities, most of which were anticipated by TCH because of our previous experience and as a result of the supply stockpiles that we maintain routinely.

Health Care Personnel

Obviously, health care personnel of all disciplines must be available and knowledgeable about their role in disaster management. Historically, our organization has taken a traditional approach to staffing during disasters including early identification of staff who are on the "ride-out" team during the height of the disaster, with the assignment of the balance of staff that have respon-

sibility for postdisaster patient care to the “relief team.” In addition, our personnel have been categorized as “essential” or “nonessential.” Essential personnel consist primarily of direct patient care providers and associated support and ancillary personnel. Recent disaster experience suggests that communities and individual institutions require an abundance of staff to ensure the uninterrupted provision of patient care when a disaster threatens its own facility for a period of time or when it is responding to support the needs of others.

Caring for families of staff who are asked to respond to a disaster such as Hurricane Katrina is an important issue. Many staff members have young children or older parents and are unable to take care of their family and report for disaster duty simultaneously. To address this need, temporary day care for children of staff and physicians was established during this disaster response. Coordinated through the child life department, it provided necessary support for staff, particularly single parents.

Communication

The need for accurate and timely communication during a disaster cannot be overstated. Key leadership and staff are assigned to groups that are paged simultaneously to alert personnel of an impending disaster. Once staff receive the page, they have been directed to call into the command center for specific instructions. This approach has proven successful in the past for alerting key staff. However, the logistics of answering multiple telephone calls overwhelmed the command-center staff, and as a result, we now have a dedicated telephone number established for physicians and hospital staff to access that contains general information regarding the disaster and their role in responding to it. In addition, satellite phones are a necessity, because the volume of traffic stimulated by an impending disaster quickly overwhelms cell-phone systems.

Regular communication to staff, physicians, families, and the communities is critical. Within hours of learning that TCH would be airlifting pediatric patients, local and national news reporters arrived at the hospital. The 5-member public relations team went into a crisis communication mode and guided more than 100 journalists through the hospital’s relief efforts on behalf of New Orleans and the surrounding area. The most common requests were for live reunions, which were arranged after parents and family members arrived to be with their children. Members of the media also requested to ride along with the air-transport team during the evacuation of patients. This request was denied because of space limitations on the aircraft.

Media from all over the world continued to cover hospital relief efforts through Labor Day weekend (7 days after landfall). Overall, TCH was featured in multiple national news programs. In addition, more than 350 stories on TCH efforts ran in print and broadcast outlets

throughout the United States. Developing teams to work with external media inquiries while simultaneously managing the need for timely internal communications was an unforeseen challenge.

As a result of this experience, our communications team recently divided their efforts into an internal and an external communication group. A newly organized format for internal communications has been developed to allow staff to find critical information quickly. Teams that focus on external inquiries now are formalized for the duration of a disaster. In addition, TCH has developed a Web site that addresses specific clinical questions that staff may have related to the treatment of victims of any disaster including exposure to biological, chemical, or nuclear agents.

Disaster Leadership Team

One of the most critical aspects of successful disaster management involves the quality, diversity of knowledge, and formal structure of the leadership in place. Our organization historically has assigned the key leadership role to the administrator on call for the hospital, an assignment that rotates weekly. In the event of a disaster, the administrator quickly accesses the back-up administrator, the physician leadership, and any additional executive resources needed. If the administrator on call is a nonclinical administrator, a clinical counterpart is added quickly to the command center’s leadership structure.

Additional key positions include an executive to manage communication, supply-chain issues, facilities, and external organizations such as the city government, police department, and others. The physician-in-chief (or designee) is a vital part of the senior disaster-management team and, as such, plays an integral role in prioritizing risks to patients and the institution for the duration of the event. During Hurricane Katrina, the medical director for transport services joined the senior leadership team to develop an approach for assisting with evacuation, identification of available TCH staff for transport, and prioritization of patients who required evacuation from New Orleans. Other decisions such as how to stage evacuated patients were discussed and directed by the medical director of the emergency center.

In addition to the composition of the leadership team, the physical location of the command center is an important consideration. It must have auxiliary power, be located centrally but not be accessible to casual traffic, and have adequate telephone lines. Ongoing access to news media coverage is critical to monitor and respond to changes in the external environment. Access to all hospital policies is important, including a hard copy of key policies in the event that an electronic copy is not available. Traditionally, the majority of decisions regarding all aspects of disaster management have emanated

from our command center. Although this has resulted in well-coordinated decisions, it also creates a highly interactive environment in which multiple conversations may occur simultaneously. The end result often can lead to a lack of clarity about the decision, confusion related to which personnel are responsible for addressing each issue, and a generally noisy environment that detracts from concise, effective communication.

In an effort to decrease the confusion in the traditional command-center structure, TCH recently developed 4 subcommand posts that focus on patient care staffing needs, facilities operations, family/physician support, and communication. The head of each subcommand center interfaces at predetermined times throughout the day to exchange information and ensure that the subcommand centers and central command center are in alignment. Early use of this approach during subsequent crises has yielded positive results.

Patient Evacuation and Transport Issues

Internal

To create hospital capacity for incoming critically ill patients from New Orleans, patient-transport requests unrelated to the disaster were reviewed on a case-by-case basis by the medical director of transport services at TCH. This modification of our existing process created a single point of triage for all critically ill patients, whether local or from the disaster zone, thus ensuring that the most critically ill patients received the highest priority for transport.

External

Regionalization of pediatric subspecialty care has driven the development of high-quality pediatric transport teams throughout the United States. TCH has had unit-based neonatal and pediatric transport teams for more than 15 years, providing a mobile ICU for children who require specialized services throughout the Southwest.

Development and maintenance of a transport program is a dynamic process, and the single most important element of preparation is high-quality, well-trained personnel who can execute their skills in the stressful transport environment. Ongoing matriculation of new personnel and continuing opportunities for education are paramount to the skills of any transport team. Multiple staffing paradigms exist, but the common denominators are training and expertise. Collaborative leadership of physicians, directors, and team members working with personnel and providing program oversight and ongoing performance improvement is integral to the success of any program.

The personnel must be given the opportunity to execute transports within a well-defined infrastructure provided by the home institution. High-quality equipment that can withstand the rigors of transport, includ-

ing safe, efficient vehicular transport (via rotorcraft, fixed-wing planes, or ground ambulances) is essential to the working environment. Transport crews require a support system of personnel at the home institution that can facilitate and coordinate dynamic issues that require frequent updated communication and assistance. Transports are affected uniquely by out-of-hospital conditions including weather, traffic, topography, and the relationship of the referring hospital and personnel.

Before Hurricane Katrina, our disaster-planning efforts had focused on preparedness for an emergency with our own transport team, but a delineated local or national disaster transport response had not been executed previously.

LESSONS LEARNED

The experiences during Hurricane Katrina reinforced the importance of long-term disaster preparedness as well as flexibility in managing unique conditions that accompany any disaster. With Katrina, internal hospital preparedness was supplanted quickly by the need for rapid patient evacuation. Hospitals with informal or formal affiliations with other hospitals were able to mobilize transport resources. The regional network of children's transport teams emerged in response to the need to provide safe and timely evacuation of pediatric patients from the disaster zone. Conference calls with participating children's hospitals' transport teams, with the TCH command center serving as regional coordinator, afforded some organization in the patient-evacuation efforts. Formalization of this approach would create a "safety net" for pediatric patients and should be considered in future planning for effective disaster response.

The need for accurate information during relief efforts cannot be overemphasized. The dynamic external conditions such as broken levees and civil unrest added to the proliferation of misinformation during the Katrina disaster. Lack of satellite phones and intermittently functioning cell phones thwarted timely and accurate communication throughout the disaster. A secure means of communication is critical to successful disaster relief and must be part of the first line of defense for any organization.

The value of having an on-site presence in any of the intermediate stations also cannot be overemphasized. A secondary assessment at the transfer site greatly aids the receiving hospital's ability to appropriately prepare for the inbound child, which ensures better use of staff and allows for more efficient care.

Finally, teamwork and flexibility was integral to all aspects of the relief effort. The leadership demonstrated by New Orleans hospitals and the immediate responsiveness of the transport teams from many children's hospitals, along with loaned aircraft from the community, leveraged new and established partners to create a safe passage for the critically ill pediatric patients of New

Orleans; every hospitalized patient survived, and all were reunited with their families.

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Creation and Implementation of a Mobile Pediatric Emergency Response Team: Regionalized Caring for Displaced Children After a Disaster

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PREPARATION: LONG-TERM RESCUE AND DISASTER-RELIEF STRATEGIES: Located only 50 miles from the Gulf Coast and Galveston, Houston, Texas, is familiar with the challenges posed by hurricanes, tropical storms, and flooding. The hospitals of Houston and Harris County are no strangers to the aftermath of such natural disasters, themselves being victims of massive damage in 2001, when the entire Houston downtown area and Texas Medical Center complex, as well as a great portion of the city, were severely damaged by unexpected and unprecedented flooding in the wake of Tropical Storm Allison. City, county, and hospital officials are ever mindful of the need to learn lessons from the past and to have disaster-relief plans in effect. Texas Children's Hospital (TCH), in particular, has participated in numerous citywide disaster drills and is well prepared to deal with many types of disasters that may occur within its region. Indeed, the TCH emergency center (TCHEC) alone evaluates more than 80 000 children per year and serves a large populous and a large geographic area. Hence, it is poised for participation in any large disaster-relief effort.

Beginning on Friday, August 26, 2005, area officials and rescue and disaster-relief mechanisms were about to be tested. In the aftermath of Hurricane Katrina, Houston was faced with the sudden arrival of thousands of people, many in need of medical care. Although officials had prepared in advance for this event, a lack of pediatric provider involvement was associated with woefully inadequate strategies for providing emergency medical care for thousands of children and adolescents.

AUGUST 29: LANDFALL

The eye of Hurricane Katrina made landfall at 6:10 AM and crossed the wetlands/barrier islands between New Orleans, Louisiana, and the Gulf of Mexico. By 9:00 AM, officials learned that the lower Ninth Ward levee had failed to restrain the rising water of Lake Pontchartrain and that water was flowing unimpeded into the city. After the 17th Street levee was breached, more than 80% of the city experienced rising flood waters that reached heights of 20 feet in some areas.

AUGUST 30: 1 DAY AFTER LANDFALL

Within 24 hours, an estimated 50 000 to 100 000 persons were reportedly trapped in the attics and on the roofs of their homes, in the Louisiana Superdome, and in the Ernest N. Morial Convention Center. Early that morning, executives at the Tulane University Medical Center (TUMC) contacted TCH officials to request assistance, and a command center was opened to begin coordinating transports of patients. Initially, Children's

Key Words: Hurricane Katrina, emergency response, disaster planning, disaster relief

Abbreviations: TCH, Texas Children's Hospital; TCHEC, Texas Children's Hospital emergency center; TUMC, Tulane University Medical Center; CHNO, Children's Hospital of New Orleans; ED, emergency department; HCHD, Harris County hospital district; BCM, Baylor College of Medicine; HFD, Houston Fire Department; EMS, emergency medical services; MPERT, mobile pediatric emergency response team; IV, intravenous; CN, charge nurse

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Hospital of New Orleans (CHNO) sent communication stating that it had water, staff, equipment, supplies, and emergency power. Soon thereafter, however, all of the city's hospitals were frantically making efforts to find placement for their patients. For TCH, what had started as a controlled, methodically orchestrated transport of only a select group of pediatric patients from TUMC soon developed into a mass evacuation of all patients from the ICUs of TUMC and CHNO. During the next 72 hours, the faculty and staff of TUMC, CHNO, and TCH, along with other institutions around the country, worked tirelessly to evacuate all pediatric patients and their families from both New Orleans hospitals and to safer facilities in and out of state (see "Preparing, Improvising, and Caring for Children During Mass Transport After a Disaster," pp S421–S427; "Closing and Reopening of a Children's Hospital During a Disaster," pp S381–S385; "Disaster Preparation and Lessons Learned at the Ochsner Foundation Hospital," pp S375–S380; "Interstate Transfer of Pediatric Patients During Hurricane Katrina," pp S416–S420; and "Caring for Displaced Neonates: Intrastate," pp S389–S395).

AUGUST 31: 2 DAYS AFTER LANDFALL

In Houston, Mayor Bill White announced that the Reliant Astrodome was vacant and would be made available to provide shelter for evacuees from the Superdome. Buses finally arrived at the Superdome, and a slow exodus began as the first of nearly 25 000 refugees left that football stadium complex for the 350-mile trip to the Astrodome in Houston.

After watching news reports from New Orleans, members of Houston's medical community realized that

the overall number of evacuees seeking emergent medical care would be considerably higher than anticipated originally. Unless alternative locations for providing that care were created, the most likely destination for evacuees seeking medical care would be the local hospital emergency departments (EDs), many of which already were near capacity and unlikely to manage a surge. Preparing for the arrival of those patients would require every facet of the regional medical establishment to be involved.

Officials from the city of Houston and Harris County met to implement disaster plans, which included using the Reliant Park complex as the primary facility for providing shelter and medical care for evacuees. Reliant Park is a 350-acre complex that houses not only the Astrodome but also the Reliant Center, Reliant Stadium, and Reliant Arena (Fig 1). A 100 000-square-foot space in the Reliant Arena usually used for trade shows was designated for the Katrina clinic. The clinic was constructed in a 12-hour period using available display curtains and poles and Red Cross cots in place of examination tables. The Harris County hospital district (HCHD) was assigned to manage the administrative concerns and medical care at the Reliant Park facilities using volunteers and nurses from the HCHD. Staffing was organized through the Baylor College of Medicine (BCM) department of family and community medicine as well as the departments of pediatrics, internal medicine, radiology, obstetrics and gynecology, and other specialties. Calls for volunteers were issued from the BCM and TCH administrative offices (author R.D.F.).

While city and county plans were being finalized and the Reliant Park facilities were being prepared for what

FIGURE 1
A diagram of the Reliant Park facilities, where evacuees were housed. The Reliant Arena is where the Katrina clinic was situated.



would amount to the largest disaster-relief effort ever experienced on American soil, misinformation began coming from both reliable and unreliable sources. An example of such an event occurred at about 7:00 PM. The TCH command center received word that 3 C-130 aircraft were en route to Ellington Air Force Base (15 miles from TCH), each carrying possibly as many as 150 pediatric hospital patients. The first plane reportedly was 30 minutes out, and the second one was following by approximately 30 minutes. The TCHEC immediately began to prepare for the influx of patients. More than 50 non-emergent patients were discharged quickly from TCHEC while TCH faculty, staff, and administrative personnel waited for the first plane to arrive. Hours passed, and nothing happened. Other hospitals around the country reported that they were receiving the same communications. Hours later, planes carrying almost exclusively adult patients from New Orleans area hospitals, including the Veteran's Hospital, finally did arrive at Ellington. In fact, planes continued to arrive for several days, transporting healthy, ill, and injured adult evacuees and forcing many area hospital EDs to surpass their surge capacity. The 3 rumored C-130s carrying several hundred previously hospitalized pediatric patients never arrived in Houston; rather, 2 C-130s arrived in Kansas City, Missouri, with >30 children from CHNO (see "Interstate Transfer of Pediatric Patients During Hurricane Katrina," pp S416–S420; and "Closing and Reopening of a Children's Hospital During a Disaster," pp S381–S385). This unfortunate incident was only the first of numerous such instances in a plethora of misinformation that TCH faculty, staff, and administrators would receive during the next several days, which emphasized the need for better communications networks.

SEPTEMBER 1: 3 DAYS AFTER LANDFALL

Early in the morning, evacuees (healthy, ill, and injured) from the Superdome began arriving by bus at Reliant Park in Houston. Several physicians from BCM, 1 physician from the National Aeronautics Space Agency, and 1 physician and numerous prehospital personnel from the Houston Fire Department (HFD) were present at the arrival site when the first buses arrived. Medical staff, many of whom were prehospital emergency medical services (EMS) and/or emergency medicine-trained personnel were assigned to bus triage and entered the buses to assess the evacuees.

Reliant Astrodome Triage

Many healthy evacuees exited the buses without triage. Most of the evacuees in need of medical attention remained on their buses and continued to wait to be triaged. Medical personnel who entered the buses attempted to triage each evacuee as quickly as possible to 1 of 3 locations.

1. Well evacuees came to the Astrodome entrance (residential area), which would be their home for the next several weeks and where they were registered formally. Within a very short period of time, long lines of evacuees began to form outside the entrance to the Astrodome because they could not be processed as quickly as they arrived.
2. Evacuees needing urgent but not emergent medical attention were sent to the Astrodome first aid station, which was set up to handle minor medical issues and if needed, to triage patients to the Katrina clinic, which was located in the Reliant Arena.
3. The last group, evacuees requiring emergent care, was transported by waiting ambulances to area hospitals designated by the dispatch personnel.

Hospital Transport

For the first 48 hours of the relief effort in Reliant Park, ambulances from numerous private and volunteer agencies from all over the country appeared at the bus triage site prepared to transport patients to area hospitals on request. Two main dispatches were operating within the city during the Katrina response: the HFD EMS and Enterprise EMS. A previous agreement among Houston, Harris County, Reliant Park, and Enterprise EMS predetermined the role that each EMS system played during the Katrina response: the HFD dispatch managed all calls outside Reliant Park, whereas Enterprise EMS dispatch handled all calls from within the park. Those requests could come from anywhere within the Reliant Park facilities, including bus triage, the Astrodome, or the Reliant Arena itself, including the Katrina clinic. Although medical personnel from every level of the HFD performed a variety of assigned duties within the Reliant Park facilities, all dispatch and transport calls were handled by Enterprise EMS. Because notification of transports of pediatric patients was outside routine transport channels, the initial communication of the stability of these patients being transported to hospital EDs was limited.

SEPTEMBER 2: 4 DAYS AFTER LANDFALL

The Reliant Arena Katrina Clinic

The first 2 pediatric emergency physicians from TCH (including one of the authors [P.E.S.]) arrived on the scene at 1:30 AM on this fourth day after Katrina's landfall. They came in response to a call from a TCH administrative assistant who was watching the details of the crisis unfold on television, where local media were pleading for medical assistance to come to Reliant Park. Both pediatricians had spent most of the previous 2 nights assisting with transfers from New Orleans area hospitals and were getting rest, unaware that the ru-

mored buses had started arriving. Immediately after receiving the call, they headed to the Reliant Park area.

When they arrived, 1 of them went directly to bus triage and began performing triage on adult and pediatric patients, and the other one went to the newly created Katrina clinic, which was located in the southeast entrance of Reliant Arena. In addition to the Katrina clinic (which encompassed all of the adult, pediatric, and subspecialty clinics), Reliant Arena housed the pharmacy, medical control command center, central supply, food services, and, initially, residential facilities for 400 evacuees.

Inside the entrance to Reliant Arena was the clinic triage area, where people of all ages were lined up as far as the eye could see. Initially, the well-meaning medical and nonmedical staff members at the scene were outnumbered, and their supplies were insufficient to manage the pediatric population adequately. Fortunately, as a result of pleas from the media for medical volunteers, several community pediatricians, some of whom had retired years earlier, arrived to help manage the ever-growing number of pediatric patients. In addition, contact was made with the American Academy of Pediatrics in an effort to raise national awareness of the need for pediatricians at Houston's Katrina-relief effort. Within hours, pediatricians from all over the country were contacting TCH to volunteer their time at the clinic.

Initial Pediatric Space

During the first several hours of clinic operation, pediatric patients were "plucked" from the triage area, where county officials required every patient to be processed at a patient-registration desk. This registration requirement proved to be impractical during the early phase of the relief effort and was quickly ignored because of the necessity to provide hydration and other emergent care. These pediatric patients were examined wherever space was available, with or without accompanying paperwork.

At this phase of the relief effort, the pediatric clinic consisted of only 2 beds within the adult "general care" clinic space. The 2 beds eventually were replaced by 8 chairs that, although woefully inadequate, allowed pediatric staff to better evaluate and manage an estimated 100 pediatric patients during the next 8 hours. The most common complaints during this initial period were injuries, asthma, rashes, and psychological problems. Numerous personal stories involved falls from helicopters during rescue attempts, puncture wounds from roofing nails, and traumatic separations of children from their parents. In fact, early in the relief effort, most of the children arrived unaccompanied by family members.

The children with chronic diseases that required more aggressive treatment regimens and those who required more complex social or psychological support were

transported from the clinic to the TCHEC. Because of the limited space available on ambulances, EMS personnel often were forced to separate parents from their children when transporting the evacuees in need of additional medical attention to area hospitals. Fortunately, social workers were present on site early in the relief effort and helped immensely with the disposition of these children.

An immunization station was set up early in the relief effort and continued to operate in one form or another during the first week. Unfortunately, it was plagued with problems, including confusion over immunization status of children who arrived with no records, a shortage of staff to administer immunizations, and a limited supply of vaccines. County administrators from HCHD were positioned throughout Reliant Arena to oversee specific areas.

By 8:00 AM, more physicians and nurses began to arrive, and the need for more space for the pediatric clinic became obvious. The county's medical director (T.G.) of the relief effort at Reliant Park had more clinical space adjoining the initial area constructed, which enabled the TCH physicians to begin the process of creating a pediatric clinic fashioned after TCHEC. The pediatric clinic was not only facilities, staff, and space but also administration, communications, processes, and procedures, and we named it the "mobile pediatric emergency response team" (MPERT).

One of the distinct advantages of the MPERT was the relief it provided for the TCHEC and other hospital EDs that care for children. An important note is that children from New Orleans who arrived in Houston by private conveyances were seeking care independently at the TCHEC. The impact on the TCHEC (~45 non-MPERT patients per day) was greatest on days 4 through 7. As the MPERT evolved to meet the demands of the increasing number of pediatric evacuees arriving at the Astrodome, the impact of patients being transported from the MPERT to the TCHEC became almost negligible.

Creation of a Pediatric Pharmacy

During the first 24 hours of the effort at Reliant Park (3 days after landfall), the Harris County Health Department set up pharmacy services and filled more than 2400 prescriptions. However, each prescription required at least a 12-hour turnaround time, which hindered the movement of pediatric patients through the MPERT, particularly those children with asthma. Other problems specific to the pediatric demands also surfaced: many medications needed to treat the pediatric population were not available at Reliant Arena, thus slowing patient flow. Many children needed special pharmaceutical agents that could not be obtained easily. Although general medical supplies were delivered, urgently needed pediatric specialty items such as aero chambers and intravenous (IV) line start kits, did not arrive. To provide

for the special needs in the pediatric area, volunteer staff began accessing supplies from the TCHEC.

Within hours, when the need for a better system was recognized, the director of pharmacy at TCH (K.D.G.) was contacted and asked to create a pediatric pharmacy on site at the MPERT. Two hours later, members of the TCH pharmacy arrived at Reliant Arena with several boxes of medications and supplies and assessed the situation to determine the best place to set up an on-site pediatric pharmacy. Two needs were identified: (a) a protected environment with limited access and (b) accessibility to the pharmacy from 1 direction only. The director of pharmacy also determined a need to establish services for both “in-clinic” doses and “take-home” prescriptions.

In the initial area that was home to the MPERT, no space or furniture was available to establish a pharmacy. Initially, the medications were placed in white bags and labeled with the medication names so that they could be organized alphabetically for easy access. This arrangement changed once the MPERT moved into its expanded space. Ultimately, the entire south wall of the clinic was designated as the MPERT pharmacy and central supply (Fig 2).

After medication dispensing was initiated, the need for an expanded formulary was recognized, and medications were ordered and delivered by TCH pharmacy staff. An initial discussion was held, and a list of medications appropriate for the types of patients and illnesses being treated was compiled. Medications for chronic illnesses (primarily respiratory) and topical medications for patients who had waded in polluted water were those needed most critically. Several considerations were made when choosing the medications that would be included on the “formulary.” Because families sheltered in the Astrodome did not have access to refrigerators, measuring systems, or adequate storage for their



FIGURE 2
The MPERT pharmacy that was created, stocked, and staffed entirely by TCH.

prescriptions, medications and supplies had to be secured. Pharmaceutical provisions are shown in Table 1. A similar supplies list was created also and is shown in Table 2.

By day 6, the MPERT pharmacy/central supply area was fully stocked, including a fully supplied crash cart, and staff coverage was provided by TCH. This pharmacy supplied the needs of the MPERT and eliminated the use of and drains on supplies and resources at TCHEC.

SEPTEMBER 3: 5 DAYS AFTER LANDFALL

Getting through the main Katrina triage and registration areas continued to be a problem. Once the pediatric patients came to the MPERT, they were placed in a room, evaluated, treated, discharged from Reliant Arena, and returned to their home in the Astrodome. The process of patient flow improved hourly. The success of this process was the result of the synergy of effort that developed among team members. One very important team player who arrived at the clinic on that was an emergency medicine charge nurse (CN) from California. After hearing of the Katrina effort via the media, she flew to Houston to lend a helping hand. She was instrumental in maintaining patient flow.

TABLE 1 Example of Formulary for the MPERT

Antibiotics
Amoxicillin
Amoxicillin/clavulanate
Azithromycin
Ciprofloxacin
Clindamycin
Metronidazole
Steroids
Prednisone, oral
Prednisolone
Inhalers
Albuterol
Fluticasone
Antinausea/antiarrhea agents
Promethazine
Ondansetron
Immodium
Topical agents
Desitin
Hydrocortisone cream
Lubriderm lotion
Neosporin ointment
Other
Insulin
Epi-pen
Solumedrol
Diphenhydramine
Ibuprofen
Tylenol
IV fluids
1/2 normal saline
D5 1/2 normal saline
D5 1/4 normal saline
Normal saline

TABLE 2 Examples of Supplies for the MPERT Pharmacy

Coolers and ice packs for refrigerated medications
Plastic bag
Paper bags
Empty prescription bottles
Oral syringes
Pens, notepads, Sharpies
Blank prescription pads
Prescription tape
Hard-copy formulary
Antiseptic hand wash
Alcohol/gauze pads
Latex gloves and protective garb as needed
Telephone lists

By this time, the TCH physician on site, who by default had assumed the role of medical director of the MPERT (P.E.S.), was asked formally to assume that role by the Harris County Command, which had assumed overall responsibility for Reliant Center operations. Part of his responsibility was to join other medical and administrative directors for twice-daily meetings at the command center, located in the Reliant Center. These meetings proved to be very useful and essential to the success of the Katrina clinic. Numerous issues that arose throughout the life of the clinic were addressed and, in most cases, resolved as a result of the discussions held at these meetings.

The Red Cross was invited to help deal with the evacuee-identification problem. Representatives from the Centers for Disease Control and Prevention were invited to attend several meetings to discuss the prevention of communicable diseases as well as immunization issues. Local, regional, and national political leaders, as well as designated representatives from the Department of Health and Human Services, also attended some of the meetings.

MPERT Staffing

Within the first 24 hours of the arrival of the pediatric emergency medicine physicians 4 days after landfall, the consensus was reached that guaranteed separate staffing for children was a priority for the success of the MPERT. Harris County orchestrated medical staffing for the main Katrina clinic. TCH was asked to guarantee that the MPERT had around-the-clock coverage of pediatric-trained physicians, nurses, and, eventually, ancillary personnel (ie, clerks and environmental services). By morning time 7 days after landfall, the MPERT had consistent, 24/7 coverage of personnel.

The strategic placement of physicians and nurses trained in pediatric emergency medicine also was a priority of the medical director of the MPERT. One pediatric emergency medicine-trained physician was assigned to the bus triage site, and one was assigned to manage the MPERT 24 hours per day. In addition, 4 physicians,

mostly general pediatricians, were assigned to direct patient care in the clinic. The nurse staffing mirrored the physician staffing. One pediatric emergency medicine-trained CN was assigned to manage the MPERT, and 4 other nurses worked in the clinic alongside the physicians.

TCH stayed in constant communication with the county staffing office. This daily communication allowed the county to distribute their staff to various other clinics in need of coverage. Any staff designated to the MPERT clinic by the county were additional personnel, because coverage was guaranteed already by TCH.

Formal Credentials

During the first week of the Katrina-relief effort, rogue clinics appeared everywhere, adding to the frustration of county officials. At one point, an entire clinic that was set up by a well-meaning area hospital was operating without county permission and was performing abdominal ultrasounds on pregnant evacuees. Identification and credentialing of staff was at the center of the problem.

The goal of the command structure at the Reliant Arena Katrina clinic was to identify and credential thousands of staff in a timely manner without creating an unnecessary burden on the process. All medical personnel were required to be credentialed formally through the HCHD. That process worked well for medical professionals who were employed in Texas, but many of the physicians and nurses who assisted in the relief efforts were from out of state. Ultimately, the clinic closed before an ideal process was identified. By the end of the relief effort, each of the clinic medical directors had stories to tell of nonphysicians who were practicing medicine without a license; fortunately, no identifiable harm came to any patient.

Most of the MPERT physicians and nurses were able to bypass the HCHD credentialing process because they were credentialed already by TCH and/or HCHD. The State of Texas also created a fast pathway for obtaining temporary licensure for those out-of-state physicians who wanted to participate in the Katrina-relief efforts. TCH made every effort to help out-of-state pediatricians, especially those from New Orleans, practice at the clinic. Several of the out-of-state physicians and nurses who worked in the MPERT were themselves displaced evacuees from New Orleans who wanted to do their part in the relief effort.

SEPTEMBER 4: 6 DAYS AFTER LANDFALL

When the first case of diarrhea was noted in the main Katrina clinic remains unclear, but on this day it was on the rise in the MPERT. The CN kept a tally of all patients presenting to the clinic with viral, respiratory, or diarrhea complaints and then provided that information to

the physician-in-chief (R.D.F.) at TCH every morning. Stool cultures were forwarded to TCH for laboratory analysis. County leadership also responded to the rise in the number of cases of diarrhea, and every effort was made to prevent the development of an epidemic of diarrheal disease.

The MPERT was given an additional 4 beds to triage, isolate, evaluate, and treat all patients presenting with gastrointestinal complaints. Unfortunately, this space was not sufficient, and in a very short time clinic outflow came to a complete halt. As a result, a 25-bed isolation/observation area reserved for patients receiving IV fluids was constructed next to the MPERT. For those evacuees with diarrhea but not requiring medical attention, a larger (400-bed) isolation area was created within Reliant Arena. Once the isolation areas were established, the MPERT was able to decompress and flow resumed.

Toilet and hand-washing facilities for medical staff were separated from those being used by the evacuees. All evacuees were provided showers and fresh clothing. The only stool pathogen identified was Norovirus; polymerase chain reaction analyses revealed that more than half of the specimens were positive for this agent. To everyone's relief, this crisis with diarrhea eventually resolved.

At no point, from when the evacuees were first picked up in New Orleans to when they arrived in Houston, was a sustained, organized attempt made at decontamination. Many of the evacuees who made their way to the MPERT were dressed in their original clothes and were covered with mud and fecal debris. Some evacuees attempted to clean themselves in restroom sinks located throughout the Reliant Center facilities, but those facilities rapidly became unsanitary and eventually were closed to all traffic. Not until later in the relief effort were Katrina evacuees given access to fresh clothing and shower facilities.

SEPTEMBER 5 THROUGH SEPTEMBER 11: 7 TO 13 DAYS AFTER LANDFALL

Seven days after landfall (only 3 days after the TCH EMS directors had received that first telephone call), the pediatric MPERT was fully operational (Fig 3) and staffed 24 hours per day by physicians and nurses; a pharmacy was in place; and children and adolescents were receiving medical care that was similar to or better than (as they reported) they had received in their lifetimes.

Children with special needs began to present to the clinic in greater numbers. Most of the medical leadership noted this trend and determined that it likely was because of the fact that most of these children were not acutely ill and their conditions were well controlled for the short-term. However, once the family's concerns over food, water, safety, and rest were resolved, concern over their child's special health care needs became a

priority. It is notable that no patients with special needs presented to the MPERT with his/her chronic medications or prescriptions. Like most of their possessions, they were lost in the flood. As a result, physicians in the Katrina clinic found themselves writing prescriptions for children with chronic conditions such as sickle cell disease, asthma, and diabetes.

Many anxious parents who presented to the clinic requested refills of their children's medications for attention-deficit disorder, possibly because their conditions were exacerbated by the close confines in the Astrodome. In an effort to provide prescriptions expeditiously to evacuees who had lost their medications during the flood, the State of Texas temporarily waived the regulation that restricted prescription writing to physicians and allowed designated pharmacists to fill certain prescriptions for Louisiana residents without obtaining the approval of a physician.

Arranging for follow-up care for children with special needs, as well as children who were seen previously in the clinic, was another dilemma that faced the MPERT. Patients could return to the MPERT for follow-up care, and many did, but this solution was not the best one long-term. TCH leadership met with all of the ambulatory clinic directors on the main campus and created a mechanism for all pediatric evacuees with chronic illnesses to obtain subspecialty follow-up care, within 24 hours if needed. The Harris County Health Department also approved a plan that provided follow-up care at various county clinics throughout the city.

During the course of this second week, procedures for identifying staff improved. Access to the clinic and parking, which had posed yet another set of problems, also improved, and the numbers of patients began to decline incrementally. By the end of the week, the MPERT was evaluating fewer than 100 patients per day, down from the high of 400. The TCH EMS director began to develop an exit strategy. He recruited an HCHD pediatrician with experience in medical direction and, with permission from the county medical control, asked her to assume his role. He continued to have oversight of the clinic until 14 after landfall, at which time he relinquished control to her.

SEPTEMBER 12 THROUGH SEPTEMBER 15: 14 TO 17 DAYS AFTER LANDFALL

Fourteen days after landfall, with the number of pediatric patients presenting to the clinic drastically lower, the clinic hours were shortened from "around the clock" to 8:00 AM to 8:00 PM. TCH began removing supplies and equipment. Physician staffing was turned over to the county officially 15 days after landfall, nursing coverage was turned over the following day, and the day after that the MPERT formally closed patient care. Any pediatric patient who required medical evaluation and treatment that could not be provided in one of the other general

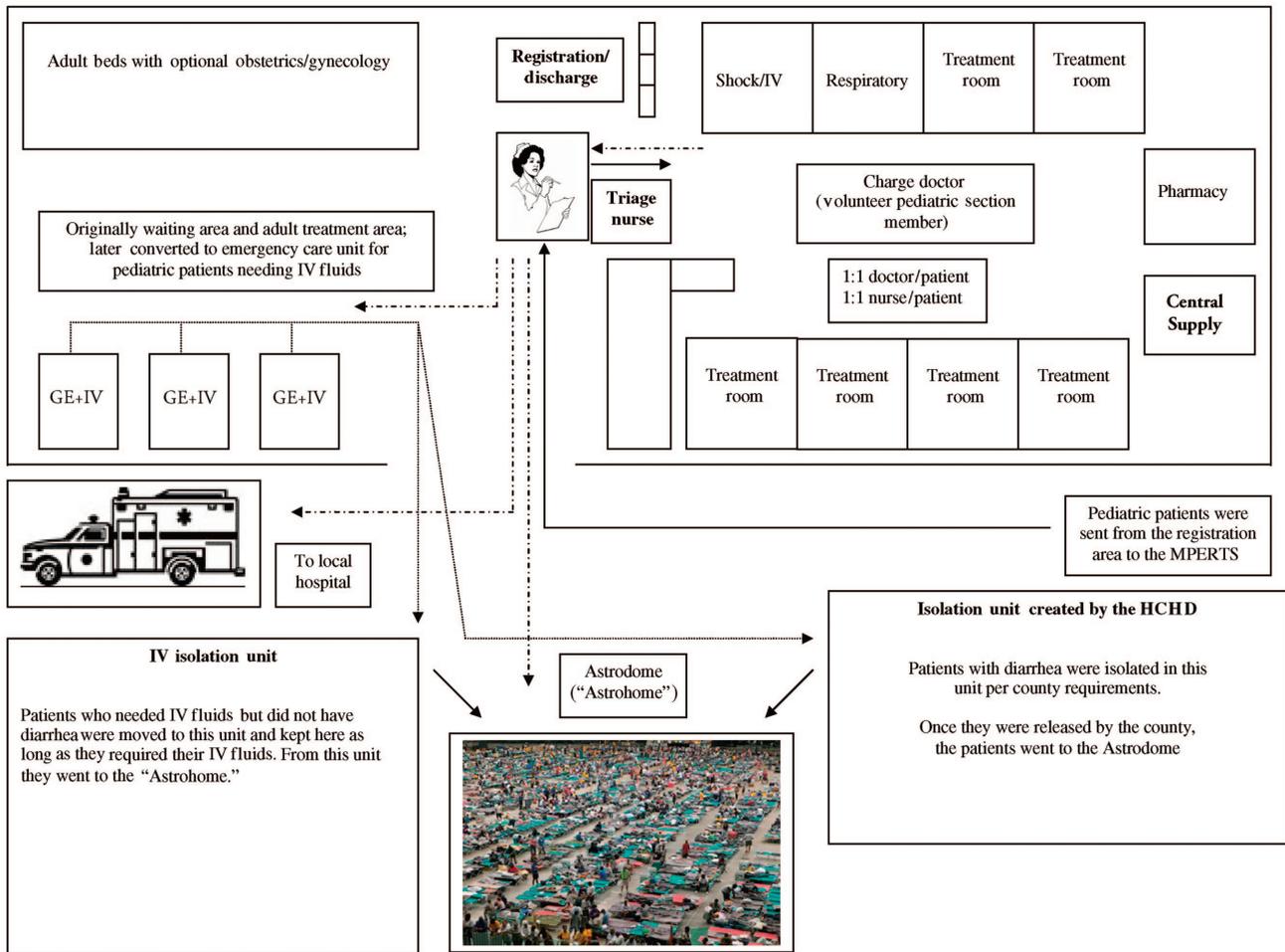


FIGURE 3

Shown is a diagram of the final triage operations (including those used during the outbreak of cases of diarrhea) that were in place and ran smoothly with the teamwork that characterized MPERT. GE indicates gastroenteritis.

medicine clinics located throughout the Reliant Park facilities was transported to an area hospital. In just 13 days, the MPERT triaged, evaluated, and managed more than 3500 pediatric evacuees. During that time, fewer than 50 patients were transported to area hospitals, and there were no patient deaths.

LESSONS LEARNED

Although the evolution of the MPERT was an unexpected and unplanned concept, it proved to be a resounding success. Many lessons were gained from this experience, and a few of them are described below.

- Physicians and nurses trained and experienced in the emergency care of children always should be included in planning for and responding to a disaster. County medical officials did not include such available pediatric expertise in their initial response plan.
- Access to local or regional tertiary pediatric care resources should be arranged in advance, and the tertiary care provider supplying those resources must

control their distribution. The tertiary care center providing the resources must be responsible for and control the organization, preparation, training, deployment, and operation of the MPERT. One of the advantages of the MPERT model is the availability of local or regional specialty care resources (in this case, pediatric emergency medicine). If managed appropriately, minimal resources are needed to carry out this effort.

- Early identification of evacuees is essential during an evacuee crisis. Identification is paramount when separation of families is unavoidable, as in the case of Katrina. In theory, the identification of evacuees could have been done while they were en route to the Reliant Park facilities. In some cases, the bus ride took more than 16 hours, which was more than sufficient time to have allowed for properly identifying evacuees, providing medical evaluations, and possibly even treating minor emergencies. Future disaster and response planning can include such provision, which

would largely preclude having the large number of minors who presented to the MPERT without accompanying guardians during the Katrina response.

- Proper identification and thorough investigation of credentials is essential in any disaster-relief effort. Rogue clinics and medical staff proved to be a problem during the Katrina-relief effort. Early in the Katrina-relief effort, volunteers could bypass check-in through a back entrance, check in at other locations within Reliant Park, or check in at the appropriate staffing area located at the entrance to Reliant Arena. Every attempt was made to ensure single-site check-in, but success was limited. Finding innovative ways to identify and credential thousands of staff in a timely manner without creating an unnecessary burden on the process is important.
- Although volunteerism is essential in the event of mass casualties, guaranteed staffing of the MPERT should be a priority. Local and out-of-state volunteers play important roles in the disaster response. Out-of-town physicians are very useful in a crisis, and most states will relax credentialing requirements once a state of emergency has been declared. All volunteers should be organized from the outset with a single-site check-in point and nonreproducible means of identification to minimize the incidence of often well-meaning but generally unwanted rogue clinics and clinicians. In addition, an orientation manual should be created, and mandatory review of that document should be required of all volunteers before they enter the clinic to practice. Although volunteerism should be embraced and supported, the clinic should not depend on volunteers to meet its staffing obligation. The clinic should be staffed around the clock, at least initially, by the local or regional resources (eg, the tertiary pediatric care hospital staff). The staffing schedule should be handled by managers normally charged with that task on a day-to-day basis. Allocation of physician and nursing resources should be based on experience, subspecialty training, and the inherent, recognizable expertise for disaster management. In addition to the medical staff, other essential personnel such as environmental services, unit clerks, office managers or administrators, laboratory technicians, and runners also should be scheduled on a daily basis. For all practical purposes, the MPERT can and should operate like the local tertiary pediatric care ED.
- Ideally, the physician and nursing directors of the MPERT will be trained and experienced in pediatric emergency medicine. A disaster requires decisiveness from experienced leaders. The physicians and nurses who manage the clinic must be comfortable with providing pediatric emergency care.
- At a minimum, the medical director of the MPERT should be knowledgeable in prehospital medicine and, ideally, should be associated with the local EMS system and be aware of their policies and protocols. The medical director for the Katrina MPERT (P.E.S.) is also an assistant physician director of the City of Houston EMS. Most of the physicians performing bus triage early in the crisis were either EMS-trained or experienced in EMS. The combined knowledge of prehospital medicine, policies and protocols, and disaster medicine and the ability to work within a variety of EMS modalities was essential to the success of the Katrina-response effort. Centralizing care responsibilities and decisions for resource use will minimize the impact to the associated pediatric hospital ED's resources.
- The efforts of the medical personnel assigned to triage proved to be critical in managing overcrowding at the main Katrina clinic. Triage and management of minor medical needs at the epicenter of the disaster relief (bus triage) was instrumental in controlling the influx of patients at the main site for medical management, which was the Katrina clinic. Critically ill patients were transported rapidly to area hospitals via waiting ambulances, and the remaining less acutely ill or injured evacuees were triaged to appropriate residential or clinic areas on site.
- The appropriate allocation of physician and nursing resources is vitally important to patient flow in the MPERT clinic, as it is in the ED. Early in the disaster response to Katrina, MPERT physicians trained and experienced in pediatric emergency medicine were placed strategically at the main triage area and as charge physicians at the MPERT. Both roles are well suited for emergency medicine physicians. The clinic depended greatly on generalist pediatricians for direct patient care and relied heavily on the pediatric emergency-trained physicians for triage and medical direction. Pediatricians with other subspecialty training were not required on site but were accessible readily at the referral hospital if needed for either their special or general pediatric expertise.
- An experienced CN is essential for optimal patient flow. Special planning must go into finding the best CN and back-up CN when developing an MPERT. Except on a supervisory level, he or she should not be assigned to patient care. The main priority of the CN is process management. The clinic must flow, and it should be made clear to all of those involved that the CN is responsible for that flow. The CN should have the autonomy and authority necessary to make spontaneous executive decisions.
- Psychiatry and social services must be made available to the evacuee population early. Children are especially vulnerable to emotional trauma. The earlier ap-

appropriate counseling is made available to the child, the better he or she will be able to cope with the event. During the Katrina response, psychiatric and social services were welcomed by everyone and present on site early during the crisis.

- MPERT must be able to mobilize rapidly. If the resource is local, it can be accomplished with relative ease. The Katrina MPERT mobilized in less than 24 hours. If the expectation is more regional, planning for relocation must be rehearsed and fine-tuned in advance of any disaster. Facilities and access to those facilities must be predetermined so that both the staff and the supplies can reach their destination in a timely and safe manner.
- Choosing the appropriate venue for the staging of the disaster response is critical. Local officials should not skimp where clinic space is concerned. At the Reliant Arena Katrina clinic, the MPERT was slow to acquire much-needed space. Providing enough room initially to create a scaled-down version of an ED, including an area for observation and isolation, might have been the better solution. Eventually, the Katrina MPERT could comfortably care for 22 patients at any 1 time (1 shock room, 1 asthma room, 6 treatment rooms, and 3 rooms for IV insertion and the evaluation of isolation patients). In addition, the team shared 25 additional rooms for isolation patients with IVs and one 400-bed space (for the isolation of patients not requiring medical oversight) with the adult patient population. Diarrhea was a concern in the Katrina response and, as a result, isolation took precedence. Ideally, an MPERT would evolve depending on its needs. For example, if mass casualties were a concern, more shock rooms could be made available.
- Cooperation with command is essential. Few people would question the importance of having an intact, well-organized command structure during a disaster response. However, finding the appropriate balance between allowing for risky, innovative decisions while maintaining a strict command structure is not easy. This is especially true when private, nonprofit, local, state, and federal agencies all are charged with the same mission and each considers its solution to the problem at hand to be the best. Although it is uncommon for bureaucracy to promote teamwork, it can be accomplished; to do so, individual egos must be put aside. The Katrina medical command on site welcomed and recognized the benefit of TCH's involvement early on in the disaster response.
- A centrally located functional communication device with a means to access essential staff and services is crucial to the successful implementation of a good disaster-management plan. At the Katrina MPERT, this device was a cellular phone, permanently at-

tached to the triage desk (so that it could not be removed) and located next to a telephone list of essential staff and supplies. On the receiving end of the telephone was the tertiary pediatric care hospital command center, operating around the clock to carry out, among other things, field requests from the clinic. Of course, depending on the specific type of disaster, the cell phone may not be the best option for all communications. No single method is failsafe and, ultimately, several alternative forms of communication should be made available to meet the needs of every possible scenario. This line of communication should include personnel designated at all of the departments impacted by such an MPERT clinic at the home institution (eg, the distributor of resources, the physicians accepting transport patients, representatives from the higher acuity units) to effectively manage the response to activities by the MPERT.

- The EMS systems on site must be able to communicate and work well with each other as well as the other various medical and nonmedical personnel present during a disaster response. With few exceptions, this was the case during the Katrina effort.
- Always plan an exit strategy. Once the cost of running the clinic exceeds the cost of referring those patients to the hospital ED, the clinic should be closed.

CONCLUSIONS

The success of the Katrina MPERT can be attributed to the following factors: (1) county disaster planners shared and participated in the same agenda as that of the local tertiary pediatric care hospital leadership; (2) TCH was willing and able to provide whatever resources were needed to set up and operate the clinic; and (3) the medical control of the clinic was delegated to the experts in pediatric emergency care. What evolved from this cooperation was an altruistic and synergistic partnership between the county and TCH that allowed for the out-of-hospital triage, evaluation, management, and disposition of more than 3000 pediatric patients.

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Hurricane Katrina Experiences: Receiving Patients in Longview, Texas, 350 Miles From Ground Zero

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The author has indicated he has no financial relationships relevant to this article to disclose.

LONGVIEW, TEXAS, IS located off Interstate 20, more than 350 miles from New Orleans, Louisiana, and 120 miles east of Dallas, Texas. It has been a wonderful place to practice pediatrics for the past 27 years. The onslaught of Hurricane Katrina would produce opportunities for many of us to volunteer our medical expertise to evacuees on a scale never before anticipated. Some providers with experience in developing nations would find, in the following days, many similarities to the styles of medical practice seen there. This observation was made independently by more than 1 practitioner.

AUGUST 27: 2 DAYS BEFORE LANDFALL

Our community was called on to provide medical services, social services, food, shelter, transportation, and clothing to as many as 500 evacuees (people who had left their homes in advance of the storm) in our community shelter. In addition, we provided the same services for an estimated 4000 to 6000 additional evacuees who were in the area and living with family or in campgrounds, motels, and churches.

Our medical community participates in disaster drills at our 2 local hospitals at least annually. The scenario usually entails a disaster at a large petrochemical plant or a massive accident on an interstate highway. The drill, which is very well scripted, is rather poorly attended. Katrina's evacuees had very different need sets in almost all situations when compared with the needs of victims of a petrochemical plant explosion in both intensity and, especially, duration of support needs.

The city and the Red Cross opened the convention center as an evacuation shelter just 2 days before Katrina hit the Gulf Coast. As the storm grew in intensity, it became obvious that a much larger number of people were seeking shelter here and in the surrounding area than was ever planned for, and more were coming.

SEPTEMBER 2: 4 DAYS AFTER LANDFALL

Relief workers delivered the first evacuees who had been trapped in New Orleans by the flood waters, mixing them with evacuees who had already arrived by their own means. Because of the total devastation and poor communications, there was a "rumor a minute." It became apparent that some structure to this effort needed to develop quickly, or the quality of services might be degraded substantially. To the credit of the Red Cross, the county officials, both community hospitals, and the multitude of volunteer service agencies with their willing workers, things quickly shaped up; services were implemented with reasonable order.

On the medical front, many nurses, pharmacists, physicians, and pharmaceutical companies stepped up immediately, identifying and filling needs. An impromptu medical clinic and pharmacy were assembled during the day. People with previous experience with command and triage developed schedules that provided 24-hour coverage. Physicians recruited to staff the clinic varied from urologists to psychiatrists, and there was a heavy emphasis on pediatrics, internal medicine, and family practice. By afternoon, the clinic became operational with 2 pediatricians, 2 internists, and 2 family practice physicians. Many others would volunteer, including emergency medicine physicians, during their off time. They all took shifts of about 6 hours, which continued over the next several days. During the course of the time

Key Words: Hurricane Katrina, evacuees, disaster response

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that the clinic was open (over 14 days), more than 50 physicians offered their services. In addition, pediatric nurse practitioners and physician assistants offered their time and were invaluable in filling in slots in the schedule. That evening was spent by many of us triaging unknown numbers of arriving evacuees with unknown conditions and ascertaining their expected needs.

Initially, all physicians cared for people of all ages. Too many problems needed solving to have the complete luxury of “limiting their practice.” We saw many people with chronic problems who were without their medications. I recall seeing patients with asthma, HIV, hypertension, gout, and a woman who was 6 months’ pregnant with abdominal pain; off to the emergency department, stat! Unfortunately, a very large number of these patients had no idea of the names of their medications.

As I read their Red Cross medical encounter forms, I recognized the street names of where these people lived before the storm from my childhood and young-adult years. I was able to find a common thread and talk to them by some geographic reportage. Talking with someone who had knowledge of their home area seemed to help them, but it clearly brought me a great deal of satisfaction.

SEPTEMBER 3: 5 DAYS AFTER LANDFALL

After 24 hours, the physician work schedule became more structured, which allowed us to revert to our own specialties a little more consistently. However, this was never a guarantee, and we continued to see both children and adults when needed. Although this medical interchange made some physicians uncomfortable, help was available at all times for adults or children if we needed it. Overall, this fostered a great sense of camaraderie, which I enjoyed greatly. Longview has never seen an outpouring of volunteerism such as this event engendered. The consistently amazing daily event was that we always seemed to have more volunteers than needed, especially for the first 4 to 5 days.

When it became obvious that evacuees would not be going home soon, some long-term needs began to appear. We found ourselves filling prescriptions from emergency supplies or donated medications or writing prescriptions to be filled by 2 or 3 large national chain pharmacies that volunteered to do so for these evacuees. The challenge of this initial full day was similar to a sentinel memory I recall as a junior medical student in an internal medicine clinic at Charity Hospital in New Orleans. I remember a small, frail, wrinkled woman who called me “Doctor” (I was impressed even if no one else was). She then proceeded to pour a shoebox full of medicine bottles onto the cubicle desk and asked, “Doctor, which one of these do ah need to be takin’?”

Nevertheless, all of us worked in conjunction with the pharmacists to find the “pink pill for pressure,” the

“white pill for fluid,” and the “red pill I take for my thinner.” I must admit that my personal digital assistant (also known as my peripheral brain) was not my savior, because it does not access medications by color—such disappointment.

We began to see more children with exacerbations of their asthma, lower respiratory infections, methicillin-resistant *Staphylococcus aureus* infections, otitis and pharyngitis, immersion wounds, rashes, and a very aggressive gastroenteritis. The gastroenteritis, which was reported initially the previous day in evacuees, began infecting volunteers by midafternoon. We were seeing equal numbers of symptomatic volunteers and evacuees. This problem continued over the next few days before finally tapering somewhat.

By that evening, a routine seemed to have established itself. This was good, but the routine was soon to be interrupted. Rumors started and spread about our receiving “8 busloads of people, some in really bad shape.” This generated unnecessary responses such as having ambulances position themselves, calling extra volunteers, and seeking backup from hospital emergency departments. Poor communication fostered this problem, which continued for at least the next 48 hours. Although we didn’t get 8 busloads of evacuees from the New Orleans Superdome, we did get 2 busloads of people with more acute levels of need.

The pediatric nurse practitioner from our practice went to the small community on the border of Texas and Louisiana to help triage and communicate to help us appropriately prepare for arriving patients. She spent several hours dressing wounds and caring for those with dehydration before they left to their next destination.

Eventually, our 2 busloads of evacuees arrived. I recall watching the bus pull up into the covered driveway at the convention center and the opening of the glass doors to let the people out to be checked in to security. The majority of the volunteers were overwhelmed by the odor. Unfortunately, these exhausted, stressed, dirty, and bewildered people smelled so much like sewage that their arrival did not need any announcement. The magnitude of this disaster intensified in our minds as we cared for them. We realized that we would be going home to our loved ones, who were all accounted for and waiting to see us, and clean, warm beds; none of this would be possible for these people for a very great while, if ever again.

SEPTEMBER 4: 6 DAYS AFTER LANDFALL

The medical clinical triage structure and volunteer schedules set up by the Red Cross were working well, and the medical clinics were proceeding relatively smoothly. The day was busy, with about 40 patients seen on my shift.

Predictably, many of the evacuees who had been in the community for several days presented with a variety

of stress-induced problems. I remember a very polite, subdued, quiet lady (she apologized for bothering me) who was wringing her hands while talking to me. She told me that she did not understand what was wrong. She insisted, "I am so upbeat and never let things get to me.... I don't know why I feel this way." She was tearful and obviously distressed. I recall thinking to myself, "Gee, let's see; you just lost your home, your job, and your city, and you don't know where half of your family is. So what could be wrong with you?" We talked for a few minutes and found a little common ground. She lived in a part of the city close to an area in which much of my mother's family lived when I was a child. She was secretary for the dean of admissions at Louisiana State University Medical Center. I learned that she had really come up the hard way and had done well for herself.... We shared a few common experiences about New Orleans. I offered to arrange some counseling the next day or maybe something for sleep if she still felt badly the next day. She smiled a little and left saying that she would return if she had problems again. I hope that she really did feel a little better and that some sense of control was returned to her for a short time.

Obviously, many patients have situational anxiety or depression. I can report that, as time has passed, this has been a frequent problem with those who have remained in the area. I still follow 4 to 5 adolescent evacuees, and depression, anxiety, or posttraumatic stress disorder seems to be a common thread among them.

SEPTEMBER 5 (LABOR DAY): 7 DAYS AFTER LANDFALL

The sheer amount of work began to stabilize and actually diminish as the early part of the new week progressed. We continued a daily pediatric and general medical clinic for the next 2 weeks until most of the evacuees were placed in the community or returned to family closer to home.

LESSONS LEARNED

1. The impact of a severe disaster on a region and the subsequent needs that are produced can be antici-

pated in part. A flexible response is very important to a successful response.

2. Those in areas of support that are closest to ground zero should concern themselves with the most immediate needs, and those in less devastated areas should focus on support of longer-term needs such as housing, social services, and long-term medical care. We were in a much better position to provide care than those in many places in southern or even northern Louisiana by virtue of our distance from impact.
3. Every state should coordinate medical care on the basis of levels of care that are available in each licensed hospital. We were asked to accept some patients who clearly were unable to receive adequate care in a community hospital. This coordinating should be updated annually and made available to a national medical database.
4. Volunteerism for acute short-term needs is highly effective in providing a rapid response, but it should be structured before the need arises; "organization" is the key word.
5. For longer-term support, some method of relieving volunteers is needed to avoid "burning out" the volunteer base.
6. Medical volunteers by specialty should be recruited ahead of time to be called on for major disasters with local or regional effects. This information could be managed through the above-mentioned medical database.

COMMENTS

The reverberations from the impact of Hurricane Katrina will continue for years, if not generations. Most of these effects have been destructive and highly negative, but they have afforded many of us with a distinct learning opportunity that can be shared with our communities, states, and nation, as well as with our profession, to better be able to manage tragedies of a similar magnitude in the future. To not extract the critical lessons from this event would be an irresponsible loss of the only positive aspect of this catastrophe.

Reuniting Fractured Families After a Disaster: The Role of the National Center for Missing & Exploited Children

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ALTHOUGH THE HURRICANE season of 2005 was one of the worst on record, 2 storms, Hurricanes Katrina and Rita, were particularly devastating to the Gulf Coast region. Among the other tragedies came the news that nearly 5000 children became dislocated from their families as a result of these 2 storms.

LONG-TERM PREPARATIONS

Before the hurricanes, the National Center for Missing & Exploited Children (NCMEC) had systems for locating missing children in place: a 24-hour hotline, a database of missing children, and connections with law enforcement throughout the United States and the world. The success of NCMEC is well documented; they have a recovery rate of 96% in the long-term cases with which they deal. They have become the nation's primary resource to work with law enforcement in the search for missing children. Technology has become the hallmark of searching for missing children. The use of computers, digital images, and the media has led to great improvements in finding these children.

NCMEC had created programs by using retired law enforcement officers to assist in the search for missing children in the many locales where there may not be adequate resources. Project ALERT (America's Law Enforcement Retiree Team) is a program wherein these retired officers assist local police and sheriff's departments who may not have officers fully trained in missing child cases.

A second program sponsored by the Michael and Susan Dell Foundation was patterned after the National Transportation Safety Board's Go Team program. When there is a plane crash or other transportation emergency,

a specialist from the Go Team is sent directly to the scene to evaluate and assist local officials. Similarly, NCMEC has developed Team Adam, a group of retired law enforcement officers and agents, each of whom is an expert in the field of child abduction and missing children. They are sent to the scene in serious abduction cases to advise and assist the local police chief or sheriff, provide technology or other support, and ensure that every possible resource is used during those early critical moments when a child's life might depend on it. They don't have law enforcement authority or arrest power or carry weapons. They purely and simply are advisors.

ONE WEEK AFTER LANDFALL

When Hurricane Katrina hit, the devastation became apparent. Although there was concern for property damage, the first priority quickly became getting people to safety. In the ensuing chaos, many families were fractured and ended up in several locations. In many cases, children were separated from parents, caretakers, or other loved ones as they moved from their homes, to the Louisiana Superdome, to the Reliant Astrodome, and elsewhere. Records were sparse or nonexistent. Because communication systems were compromised, the

Key Words: Hurricane Katrina, missing children, disaster planning

Abbreviation: NCMEC, National Center for Missing and Exploited Children

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nation suddenly was faced with an acute disaster-related missing children crisis.

In response, NCMEC was asked by the US Department of Justice on September 1 (3 days after landfall) to get involved and spearhead the effort to find these missing children and reunite them with their families. NCMEC enthusiastically responded after contacting the Red Cross to make sure that these efforts were not duplicative and were, in fact, helpful.

However, NCMEC could not divert resources that were already in place to find other children. Parents of previously missing children needed to be reassured that NCMEC was not suspending the search for their children or making their children a lesser priority in light of Hurricane Katrina. The work on the children missing or displaced as a result of the hurricane and the search for America's other missing children had to take place concurrently.

In response, NCMEC created a new hotline with a unique toll-free number and immediately began to try to establish it in the public eye and mind. The NCMEC Web site (www.missingkids.com) was used as Katrina central, a place where people could go to see photographs of the missing and access the list of reported missing children.

Retired law enforcement officers from across the country working with Project ALERT and Team Adam were brought in to answer the Katrina telephones, do the callbacks and other follow-up, perform the analytical, investigative work to locate the missing, and work with NCMEC staff in many other ways. Team Adam members were dispatched to the affected states immediately. They went into the shelters, took photographs of the children, and worked with state and local law enforcement, social services personnel, the state missing children's clearinghouses, and every other possible resource.

Generally, photographs of missing children are one of the most important tools. After Katrina, most of the parents who were separated from their children had lost everything in the storm or the subsequent flood, including photographs of their children. By and large, without photographs, NCMEC had to create its own search tools, particularly in the early days. The quality of information was very poor. There were many resources being created for people to list information about missing loved ones. As valuable as they were, they still essentially were passive vehicles. Someone had to actively go search the database to find a missing family member.

In addition, most of the technological advances developed over the past 2 decades that have led to the dramatic increase in success in finding missing children were of little value in finding and reuniting the children lost after Katrina because of lack of availability in the hurricane and shelter areas. Thus, old-fashioned techniques, including ingenuity and persistence, took precedence.

In one widely reported story, one of the Team Adam representatives went into a special-needs shelter in Baton Rouge, Louisiana, where there were a number of unaccompanied children, many of whom were very young. He worked with Louisiana social workers in trying to gather information. In one instance, he took a digital photograph of a 2-year-old. Then he showed her the picture. The little girl responded with one word: "Gabby." A lead! Thinking that might be the child's name, Team Adam notified NCMEC headquarters in Alexandria, Virginia, where caseworkers began searching databases, looking for a 2-year-old whose name could be shortened to Gabby. They found a 2-year-old named Gabrielle who had been reported missing and whose mother had been evacuated to a shelter in San Antonio, Texas. Realizing that the children in the shelter were likely from the same area, an attempt was made to match other children with the parents in the San Antonio facility. Little Gabby and other children in that same shelter were flown to San Antonio and reunited with their parents.

In another case, a 5-year-old in a Louisiana shelter was able to give a lot of information: his name, address, church, school, and even his mother's cell phone number. However, cell phones were not working. By checking with people from the child's neighborhood, the team located one of his mother's friends, who told authorities that the mother was at the Reliant Astrodome but had been moved, probably to an evacuee hotel. After calling several hotels in Houston, Texas, the mother was located, and her child was flown via Angel Flight to Houston, where they were reunited.

NCMEC essentially had created a parallel missing children's program by using space made available by temporarily suspending some noncritical activities while ensuring that its core mission of the past 21 years (finding missing children) would not be compromised.

The procedure used in processing each case was to take a call from a searching parent or close family member, make a report on the missing child, and then do callbacks to verify and validate the information. When there was enough information on the missing child, it was entered into the Federal Bureau of Investigation's (FBI's) National Crime Information Center missing person's database. NCMEC worked hand-in-hand with the FBI and state and local law enforcement. When possible, they got photographs from family members. Team Adam volunteers on the ground took photographs of children without parents in shelters or wherever they may have been located. The photographs then were circulated to television media for airing in the hope of generating calls, tips, and leads. Case analysis personnel in Alexandria, where NCMEC is housed, searched databases and looked for links and patterns in the leads received. Each child's case was assigned to a case manager, most of whom are former law enforcement professionals.

The results were staggering. Usually, the NCMEC Web site handles 1 million "hits" per day. That number grew to 20 million per day during the Katrina effort and stayed at that level for weeks. When the media started airing the photographs and information 24 hours per day, NCMEC linked their 2 hotlines to be certain that every call would be answered whenever it came in regardless of whether the "correct" number had been called. In addition, if one of the lines was busy, it would roll over to the other. After a little more than 1 month, the call volume finally began to drop, and the 2 lines were able to be consolidated. However, both numbers were maintained and still are being used for reports and leads.

The media response to this crisis was overwhelming. CNN ran photographs of the children, descriptive information, the hotline number, and Web site address 24 hours per day during the peak period. CBS ran photographs and information on every newscast every day and on their major news programs, "60 Minutes," "48 Hours," and others. They even aired these bulletins on CBS Radio news. Fox ran regular features, and NCMEC worked closely with "America's Most Wanted," which is hosted by NCMEC co-founder, John Walsh. NBC and MSNBC ran regular features. The media became a full partner in the effort to bring these families back together.

The response from corporate America was equally impressive. The many offers of in-kind assistance included:

- Canon provided digital cameras for Team Adam to use in the field.
- Nextel/Sprint provided telephones for Team Adam.
- FedEx Kinko's allowed families to use their facilities to scan or take photographs to transmit to the NCMEC.
- The National Association of Broadcasters provided portable television/radios for Team Adam along with some extras for distribution to families.
- American Airlines provided flights for 89 reunifications.
- Amtrak provided train tickets for reunification.
- Greyhound provided bus tickets for reunification.
- Angel Flight provided flights for reunification.
- Lifetouch provided school photographs of children, if available.
- ChoicePoint provided volunteers for the hotline and allowed use of their databases in the search.
- Lexis-Nexis allowed the use of their databases for the search.
- SUN Microsystems brought new servers when volume escalated.

SEPTEMBER THROUGH DECEMBER: 0 TO 3 MONTHS AFTER LANDFALL

The Katrina Missing Persons Hotline went live on September 5, 2005 (Labor Day). Through noon, December 7, 32 716 calls were handled, with 4909 reports of children missing or dislocated as a result of Hurricane Katrina and 102 children missing or dislocated as a result of Hurricane Rita (5011 total). By Christmas, 4371 children had been found and reunited with their families (87% of the total).

This still left 740 children who had not been reunited with their searching relatives. Fortunately, NCMEC since has been able to identify and reunite every unaccompanied child in the shelters. Thus, there are no more lone children for whom there are searches for parents or guardians.

It seems likely that the remainder of those who still are not accounted for is not the usual "missing child" for whom the whereabouts are truly not known. They are better described as examples of "fractured families" in which the children are with one parent or other close relatives but there still is a parent or guardian who has not been reunited with his or her family.

It also is suspected that a small number of these children did not survive the storm. The Justice Department also asked NCMEC to assist with their forensic imaging technology and specialists to help identify unidentified bodies at the appropriate time. Forensic artists routinely do facial reconstructions from skeletal remains or morgue photographs of unidentified deceased children.

MARCH 17, 2006: 6 MONTHS AFTER LANDFALL

This article was written in December 2005. Since that time, the search for the 5192 missing and dislocated children from Hurricanes Katrina and Rita has continued. On March 17, 2006, the final child was reunited with her family, meaning that all 5192 cases have been resolved.

COMMENTS

An important question is "How did so many of these families become separated?" "How were so many children left alone?" Many parents made a fundamental decision: "save my children first." When there were limited seats on the rescue helicopters or boats, the children went into those seats. When there was a crush of humanity trying to get on the buses at the Louisiana Superdome or the New Orleans Convention Center and parents were concerned about whether they actually would ever get out, in story after story, the parents pushed their children to the front of the lines and onto the buses first. There was trust that somehow this all would be sorted out later, but that fundamental parental instinct, child protection, came into play time and again.

Dealing with dislocated, fractured families in the

wake of a national catastrophe, while related, is nonetheless a different kind of challenge for NCMEC. Reconfiguring the training center as a hotline on very short notice worked in this case but would have worked better if a basic infrastructure had been in place. NCMEC is planning to create a parallel but multipurpose hotline/call-center facility. This facility will not sit idle as we wait for the next storm or disaster; it will be multiuse and become an integral part of what they do every day. Thus, it will not be necessary to create an infrastructure quite so hastily after the next crisis.

Finally, NCMEC has tried to use this opportunity to communicate directly to America's families. We live in a time in which families are separated and disjointed every day. Moms, dads, and kids head in different directions every morning, sometimes not quite getting back together. This happens for many reasons, including economic necessity. Families are advised to have a family emergency plan and know where to go and how to reconnect in case a disaster of any kind occurs. Parents are encouraged to have current photographs of their children on their person at all times and that children have some sort of ID with key descriptive information and preferably a photograph. In the old days, parents used to write down a small child's name and address on a piece of paper and put it in their shoe. In the 21st century, we can do better than that, but the basic commonsense of this old-fashioned idea has never been more evident.

Pediatricians should discuss these issues with parents as a part of health maintenance, and they can refer to the recent American Academy of Pediatrics statement on missing children for guidance.¹ Some key recommendations that relate to the Hurricane Katrina disaster are:

- Assist parents and children in putting the risk of becoming missing in proper perspective.
- Encourage families to teach children self-identifying information without connecting it to a threat of becoming missing.
- Encourage families to keep high-quality photographs of their children and keep them in a place that is readily accessible in an emergency and is safe from the elements so it will not be lost in a storm, etc.
- Tell parents (or shelter officials) to contact law enforcement immediately if a child becomes separated from his or her parents or guardians.
- Know about the NCMEC Web site (www.missingkids.com) and hotline (800-843-5678) and encourage parents to use them if their children become missing.
- Look at and encourage others to look at photographs of missing children and call if a child is recognized.

CONCLUSIONS

The challenge of bringing families back together in the wake of Hurricanes Katrina and Rita was overwhelming, but NMEC can be proud of its role and demonstrated ability to reunite moms and dads with their children after the storm. Hopefully, when the next disaster occurs, fewer children will be separated from their families and those that are separated are reunited with their families even more quickly.

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Caring for Children of Caretakers During a Disaster

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The author has indicated she has no financial relationships relevant to this article to disclose.

AUGUST 29: LANDFALL: We were ready for any disaster. As Hurricane Katrina headed straight for the Mississippi Gulf Coast, our hospital braced for what we knew would be a real disaster. The University of Mississippi Medical Center (UMC) had just revamped the disaster plan, adding an often overlooked child mental health piece that was primarily written by our social worker in the child development clinic. Our division of developmental and behavioral medicine had identified the needs and strategies for service in 3 major areas: one group would cover the emergency department to help with anxiety, grief, and separation issues; another would serve as a holding service for children not requiring hospitalization whose parents were missing or required hospitalization; the final group was in charge of any more severely affected children who required more intensive psychological services.

I met with our division; we reviewed our plan and made assignments. We were very proud of our plan and ready to implement it.

The UMC administration encouraged nonessential personnel to go home to be with their families as the weather worsened in Jackson, Mississippi, 200 miles from the Gulf Coast. Katrina was predicted to still be a hurricane when it got to Jackson, which tested our plans for the UMC to remain open.

Child Care Needs

The UMC did remain open, but the schools and child care centers closed. Suddenly, our hospital was no longer focused on just how to care for the evacuees but also how to get essential personnel in to work, not only physically but also emotionally. We quickly found out that if the clinics and floors were all to stay open, there was a very large number of staff that was essential to the running of the hospital, and their family needs would be interrupted. We did not need just medical staff; we needed many more to support the hospital. The burning issue now

was that if we were to get the hospital employees in to work, they had to have a place for their children to stay.

The hospital administration then called on our division not only to give mental health services but also to organize child care for employees. How could we do that? There was no child care facility, and we had never run such a service. This was something that many at our hospital had wanted, but it had never materialized. After some fairly panicked discussion with the chair of our pediatric department and the director of human resources, our hospital school and child-life personnel began to create a makeshift child care center.

We identified a space with power, water, and bathrooms. We sent out a call for volunteers to look after children. Incredibly, by the evening of the storm (with winds clocking up to 100 mph in Jackson), 30 children were cared for overnight by a rapidly pulled together child care center in the nursing auditorium.

AUGUST 30: 1 DAY AFTER LANDFALL

Our preparations paid off. The UMC survived the hurricane and was open to care for the ill and injured. We were prepared for but were not receiving evacuees; the majority of them were being diverted to hospitals out of state. Apparently, disaster coordinators assumed that the UMC was crippled from the hurricane.

Our well-developed mental health plan was still not being put to use, but our staff, which was prepared to handle mental health needs, was needed for the ever-

Key Words: Hurricane Katrina, child care, caretakers

Abbreviations: UMC, University of Mississippi Medical Center; MCAAP, Mississippi chapter of the American Academy of Pediatrics

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expanding child care center. Thousands in our area were without power and telephones, which complicated staffing and supply issues. The hospital was open at full capacity. We needed staff, and the staff needed a place for their families. Incredible as the day before, our make-shift child care center was caring for more than 100 children. The head of the nursing school was called in to give us more room, because we could no longer house the children in the auditorium.

We were providing care for children of all ages, from neonates to older adolescents, who obviously had very different needs. They also needed to be separated. Food, entertainment, infection control, and safety were huge issues. Our food service set up regular meals and snack times. Because there was no way to uphold the state standards for space and arrangement, the Department of Health was called for advice and clearance. We were advised to do our best.

Volunteers from all areas were called in to help. We had many donations of toys, sanitary wipes, and cleaning supplies, and all were needed. The bumps were many, but the dedication was great.

SEPTEMBER 1 THROUGH 4: 2 TO 6 DAYS AFTER LANDFALL

Feeding, comforting, and entertaining these children were primary goals, but there were other huge concerns including safety and behavioral issues. We now had between 130 and 180 children per day. There was incredible dedication from those who were helping run the center. There was also extreme exhaustion and an increasing appreciation of those who do this type of work everyday.

SEPTEMBER 5 (LABOR DAY): 7 DAYS AFTER LANDFALL

The UMC contracted with a church-run child care center to take over. Many hugs and thanks were given to all who had helped. We had made it through the initial week. Slowly, things were getting back to normal at the medical center and in the Jackson area. Many were still without power, and gas was in short supply, but we were making it.

As the child care needs were resolving, the mental health needs were growing. What had happened south of us, closer to landfall, was becoming more and more apparent.

SEPTEMBER 9: 11 DAYS AFTER LANDFALL

Chapter Involvement

The Mississippi chapter of the American Academy of Pediatrics (MSAAP) meeting was held in Jackson. We thought long and hard about having it. Should we take the time to do this meeting with all the present needs? The decision by the leadership was that it would be a great time to decide together what we could do to help further. The meeting was one of the largest that we have had. Our relief efforts were very well organized that day. There was talk of supplies and shelter that were needed

and some talk of the exhaustion and sadness, but not much about the mental health issues.

SEPTEMBER 10: 12 DAYS AFTER LANDFALL

One view of the miles of devastation made it apparent to my husband and me that there was no doubt that once people began to realize the impact of what had really happened, there would be huge future mental health needs of all those affected. We were devastated, and we had not lost our homes!

NOVEMBER 15: 11 WEEKS AFTER LANDFALL

A meeting, led by hospital administration, was held at the UMC to seriously evaluate the feasibility of having a child care center at our hospital.

NOVEMBER 29: 13 WEEKS AFTER LANDFALL

Mental Health Issues

A trip by a few representatives of the MSAAP made it clear that there would be long-term needs in the area of mental health. There are many amazing people on our Mississippi coast who have worked tirelessly to help those around them. Anxiety, depression, anger, and grief were in the faces of most of those who met with us. Determination and hopefulness of recovery was also there. The MSAAP now has a meeting planned on the Gulf Coast at which we will bring together people from several agencies to discuss a coordinated effort to help children and their families through this disaster. We will be busy implementing that plan, which will likely be needed for a very long time.

LESSONS LEARNED

Essential personnel must have a safe place for their children or they cannot come to work. Disaster planning must include a contingency plan for hospital employees who need to be assured that their children are safe, secure, and well taken care of when a disaster appears. After years of bantering as to whether our hospital should have a child care center, serious discussion is developing. Two formal meetings have been held already, and we are modifying our disaster plan to include an emergency child care center for our employees.

Our original mental health plan was not needed or used acutely, but in a situation that has an influx of evacuees, it would certainly be useful. The real mental health needs for our state's children and their parents are now (3 months post-Katrina) and expected to increase. The grief, anxiety, and adjustment to the losses are severe.

COMMENTS

Thanks to the AAP on both the state and national level, and other granting agencies, we have a plan to serve our coastal area. The needs will not end soon. I am proud of and grateful for all of the incredible teamwork that has occurred and know that it will continue.

Short-term Impact of a Major Disaster on Children's Mental Health: Building Resiliency in the Aftermath of Hurricane Katrina

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DISASTERS, WHETHER RESULTING from terrorism or natural events, have a dramatic impact on the health and well-being of children. Studies after the terror attacks of September 11, 2001, in New York City and the 1995 Oklahoma City bombing and countless reports on the impact of natural disasters on children show that a child's mental health can suffer from direct and indirect exposure to these events. Children may react to a disaster or act of terrorism in a variety of ways. These reactions are influenced by age, developmental level, intellectual capacity, individual and family support systems, personality, and other factors. Common manifestations of psychological trauma in young children include regression, clinging behavior, inattentiveness, aggressiveness, bed-wetting, somatic complaints, irritability, social withdrawal, nightmares, and crying. Longer-lasting effects may include depression, anxiety, adjustment disorders, posttraumatic stress disorder, and interpersonal or academic difficulties. Some children are particularly vulnerable to postdisaster trauma because of preexisting psychosocial stressors (homelessness, foster care, exposure to violence, etc), low socioeconomic status, or special needs (including cognitive delays and prior mental illness). These postdisaster reactions may not manifest until well after the event and could persist for years.

AUGUST 30: 1 DAY AFTER LANDFALL

The National Center for Disaster Preparedness (NCDP) at Columbia's Mailman School of Public Health gathered key staff to discuss the appropriate response to the needs in the Gulf Coast region. Over the following few days, talks were held with federal, state, and local public offi-

cial to assess immediate needs and determine what resources could be offered to the affected areas. Necessary clearances to provide medical care were obtained from the Louisiana, Mississippi, and Texas departments of health. Permission was also necessary (and obtained) for access to gasoline and necessary supplies including pharmaceuticals and to travel after curfew.

SEPTEMBER 2: 4 DAYS AFTER LANDFALL

The Children's Health Fund and the NCDP launched Operation Assist, a collaborative effort to organize programs supporting the medical, mental, and public health needs during the crisis and through the long-term recovery process. Custom-designed, fully equipped, state-of-the-art mobile medical units (MMUs) staffed with physicians, nurses, and mental health and social service professionals were sent to the hard-hit areas of Louisiana and Mississippi at the request of state authorities. These MMUs are an asset of Children's Health Fund, a national organization that provides health care to medically underserved children in 19 rural and urban sites around the United States. Irwin Redlener, MD, and singer Paul Simon founded it in 1987.

Key Words: Hurricane Katrina, disaster response, mental health, resiliency, children mental health

Abbreviations: NCDP, National Center for Disaster Preparedness; MMU, mobile medical unit; EOC, emergency operations center

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As of this writing, Operation Assist staff has spent almost 8 months in various areas of Louisiana, Mississippi, and Texas. Our model has been comprehensive health care including medical, mental health, and social service/case management services. Simultaneously, planning was done for the development of a long-standing program that would help address some of the deficiencies in the baseline availability of health care to the affected regions.

SEPTEMBER 7 THROUGH 15: 9 TO 17 DAYS AFTER LANDFALL

On September 7, Operation Assist deployed a team of experts in disaster emergency medicine, psychological trauma, and school safety to evacuation sites in San Antonio and Houston, Texas. The staff assisted in providing clinical services to evacuees in shelters in both cities and conducted an on-the-ground assessment of the health, medical, and psychosocial needs of the population.

According to a United Way of Texas report, well over half (57%) of the families there included children, with an average of 2 per family. Our team focused on helping parents and children regain a sense of safety, express their feelings and concerns, and provide support and validation while performing medical and psychological assessments to rule out the need for urgent and/or specialized services. The following describes some of our experiences and findings from our work with families and our meetings with key officials.

Toddlers and young children were clingy with their caretakers, and their affect was withdrawn, depressed, and anxious. The young mother of a 3-year-old girl commented that, for the first time, her daughter looked “out of it and too shy” and was misbehaving. Before the evacuation, the mother said, her daughter had been “extremely friendly with strangers,” verbal, and generally obedient.

School-aged children showed concern for their peers and often stated that they wanted “things to go back to normal.” They were looking forward to starting school and had a more clear understanding of what had happened and the seriousness of the situation than did the younger children.

Older children reported headaches and other minor medical concerns but said that they liked being able to spend time playing with new friends in the shelter. Many reported feeling worried about their parents, not being able to go back home, and the uncertainty of their future and expressed anxiety about not knowing the whereabouts of family members. Shelter security personnel commented on how often children would ask what type of place the shelter was and if they were going to stay there long.

Many children staying in hotels with immediate and extended families, all in 1 room, were happy to be in a “nice place” but were very much looking forward to

“going home.” Their parents, on the other hand, were concerned about other family members’ whereabouts and anxious about their future, their homes, and their belongings.

Families with debit cards, provided as part of the government relief effort, were using them to buy food and medications. We observed how a family of 8 shared a small-sized pizza pie on 2 consecutive nights in the lobby of a hotel. Many families were starting to decide whether they should attempt to find permanent housing in their new location or wait to go back home.

Two middle-aged men who had evacuated from New Orleans, Louisiana, before the hurricane and were staying in a hotel had no contact with their families since the hurricane 10 days previously. Because they were not shelter residents, they were not allowed into the shelters and were denied information about those inside because of “privacy restrictions.” Neither man had access to the Internet. The Red Cross was unable to assist them in locating their families.

Because we had better access to information, we found out that no area shelter had their family members in residence. Because the Red Cross was unable to cross-check their other area shelters, we used the names, dates of birth, and basic demographic information to search other databases, including the National Center for Missing and Exploited Children (see “Reuniting Fractured Families After a Disaster: The Role of the National Center for Missing and Exploited Children,” pp S442–S445). For one of the men, we were able to locate the children and their mother, verify their location, and obtain contact information. We put the father in contact with the mother, who had all 3 children with her in a shelter in Lake Charles, Louisiana. They were able to arrange a reunion shortly thereafter.

Situations in shelters have significant implications for children’s mental health. Many adults with chronic mental illness and no medication were with their children. Although they generally seemed to be stable, their ability to care for their children could have been further compromised because psychiatric medication refills were not available and/or dispensed. Overall, there were not many mental health professionals, including psychiatrists, available. Most volunteers in the mental health section were master’s level professionals, and some were students with a desire to help. There consistently were 5 to 10 patients waiting to be seen by each psychologist.

While working in a medical clinic, we met a middle-aged woman with a chronic medical condition and her 4-year-old daughter, who was not speaking. Our colleague sat on the floor and played with the little girl for about 15 minutes with a yellow rubber ball that lit up when it bounced on the floor. Afterward, she was asked her name. There was a pause, and then the girl clearly said her name. Her mother was astonished and declared that this was the first time she had spoken since they left

New Orleans. This is reflective of the type of “initial intervention” that can be helpful with young children. It is best to first establish rapport by engaging in activities that allow the child to feel a sense of safety and then, to the extent possible, allow expressions of their feelings. This can be done through the use of drawings, play, storytelling, and (for older children) journal writing. Whenever possible, the initial goal is to help the child and caregiver obtain a sense of “normalcy.” This has been a very challenging task given the extent of the evacuation and the lack of resources that allow caregivers to make decisions about their future.

SEPTEMBER 21 THROUGH 27: 23 TO 29 DAYS AFTER LANDFALL

In a heavily damaged east Biloxi, Mississippi, neighborhood with predominantly Vietnamese residents, volunteers washed clothes and distributed food and supplies while we delivered medical services in our MMU. The Buddhist temple there remained intact and has been used for various purposes. Residents were camping on the front porches of the remains of their homes while they were inside cleaning. There were piles of foul smelling and moldy clothes, pictures, furniture, and refrigerators strewn throughout the neighborhood. The people looked dazed and confused, and many reported feeling retraumatized from earlier experiences in Vietnam.

OCTOBER 3 THROUGH 14: 5 TO 6 WEEKS AFTER LANDFALL

The Louisiana State Director of School Health Programs organized a focus group in Lafayette, bringing together representatives from 24 of the state’s 56 school-based health centers to discuss the needs of the children and families in their care. Many of these providers had suffered significant losses themselves. On the basis of the information obtained, we developed a survey to allow systematic needs assessment of children in the Louisiana schools. We found that school health providers wanted training on children and families who have experienced trauma, and medical providers wanted extra help identifying and meeting mental health needs. Some schools’ populations grew dramatically in a short time (eg, taking in 143 new students in 4 days), creating a concern about meeting a new level of need without adequate resources.

There were consent and confidentiality issues that came up about providing needed care to children who were no longer living with their parents or guardians. Continuity of care was an issue as children were relocated from 1 temporary shelter location (and school) to another without any health and immunization records.

We attended meetings with representatives from Louisiana and Mississippi offices of public health, education, and mental health to discuss child mental health needs and initiatives. We found, as expected, that most children and families have shown a high degree of re-

siliency and were exhibiting the expected normal signs of situational stress. Families coped by working hard to stay together, sharing with others in need, being grateful for what they had, and taking care of one another.

Our work corroborated the literature reporting that a prior mental health diagnosis is a significant risk factor for increased posttraumatic symptoms, which include anxiety, panic attacks, the triggering of manic or depressive episodes, dissociation, and acute stress disorder. Some youth reported experiencing more serious symptoms of acute stress including flashbacks, dissociation, nightmares, difficulty sleeping, poor concentration, crying spells, and feeling subjectively traumatized. Assessing the exact cause of the acute stress is difficult. It could be a result of the destruction, loss of property, having witnessed and withstood the storm, the evacuation, bereavement, grief, and/or the ambiguity about how long their dislocation from home will last.

We generally used play-therapy techniques in the brief interventions we were able to provide to children. Whenever possible, we also provided brief assessments, support, validation, and psychoeducation to parents. Our colleagues reported that in a shelter in Appaloosas, Louisiana, toys and puppets were available for therapeutic use. In other sites, there were day care facilities in which children could play with each other; some (but not all) had toys and coloring books available. Many shelters focused on helping children regain a sense of “normalcy” and routine by helping them to integrate into their new schools and establish a sense of routine and predictability. This also helped parents who needed time to look for housing and jobs, find relatives and friends, and take care of their own physical and mental health needs.

OCTOBER 16 THROUGH 23: 7 TO 8 WEEKS AFTER LANDFALL

Since the first week after landfall, our MMU and its Mississippi team have been housed at Keesler Air Force Base in Biloxi. The unit was deployed daily to various sites to provide care to residents on a walk-in basis. Most adults and, to a lesser extent, children accessing services had medical complaints but were also suffering mild stress to significant posttraumatic stress and depression symptoms such as frequent crying, sadness, anxiety, hyperarousal experiences, headaches (new onset), sleep difficulties, and some generalized anxiety symptoms. Several of the children and adults who had treatment before at mental health centers were having trouble reconnecting with their previous providers. Caretakers were concerned about what the upcoming Halloween would be like for their children, who were no longer looking forward to a festive day. Families living in the various sites seemed subdued. People were friendly but clearly distracted and concerned about what would happen next.

We continued making contacts with key agencies to

outline an ongoing collaborative effort and attended debriefing and planning meetings. Some of the facilities of the main mental health agency in the Gulfport/Biloxi area had been destroyed, and others sustained damage. A residential treatment center and a local crisis stabilization unit were destroyed. Between those 2 facilities, more than 60 high-need psychiatric patients had been housed and treated.

School staff was trying to balance academic work with their students' needs for nurturing. As many as 80% of the teachers had lost their homes. They, along with the mental health and support staff, now had the additional responsibility of taking care of the students. School health providers tried to screen students and refer those in need to mental health clinicians who were overwhelmed and traumatized themselves. Emergency departments diverted psychiatric cases from hospitals, and psychiatrists were overwhelmed and unable to keep up with new psychopharmacology consults and follow-up appointments. Many psychiatric practices had been destroyed, and displaced mental health providers had not been located. Several residential treatment facilities were destroyed, causing chronically mentally ill residents to be sent to a variety of locations, some as far away as North Dakota. This was likely to have been a traumatic event for these clients, many of whom had never before left their county, much less their state.

A young mother walked into our MMU for mental health support and brought her 2 daughters, "M" and "K" (6 and 8 years old, respectively). Both children seemed subdued, depressed, and fidgety. "M" reported having frequent "bad dreams." "K" had clear signs of increased startle reaction and regression, which were verified by her mother. She was also suffering from an ear infection. We provided the mother and 2 girls with validation, support, and an opportunity to "tell their story" in their own way. We gave the girls toys and referred them to a mental health facility for follow-up treatment.

In Biloxi, we observed small groups of people sitting amid the remaining rubble of what once was their homes. Others were wandering through the apartments salvaging what might be still usable goods. They seemed dazed and dissociated and reported feeling simultaneously shocked. Everyone at this housing project was awaiting relocation and was very unsure of future. We spent several hours talking with and providing support for these individuals. The most prominent conversation topics were issues of loss and uncertainty. Our response was to validate their feelings, assist them with their attempts to normalize, and reestablish community connections and sources of support including housing, employment, and health care. Several had been clients at various mental health clinics and were now seeking care at the local emergency departments. We were able to assist several families and children.

Common complaints were sleep problems, headaches, and excessive and unsurprising concerns about death and the weather. In these more casual settings, the children seemed atypically close to the adults. There was less spontaneous play observable than expected in young children, who seemed distracted and distant. They were polite when involved in conversations but agitated when engaged in cleaning up debris.

We heard that a 10-year-old boy, living in an area where many evacuees were living, had committed suicide. We were not able to ascertain whether the boy who had killed himself was an evacuee or to what extent he had been impacted. In addition, we were informed of an increase in suicidal attempts, parasuicidal behavior, and suicidal ideation among children as young as 7 years old. Some parents had difficulty, as expected in these circumstances, enforcing limits or controlling child behavior as well as identifying red flags for further attention.

We encouraged parents and children to make connections, build relationships, and reestablish support groups. Our clinical goals included helping them develop a realistic acceptance of their current circumstances and use solution-focused approaches to their concerns. Parents reported that they would benefit from gaining a sense of the situation as manageable, feeling that change is an inevitable part of life, and establishing attainable goals. Some of the messages we attempted to convey to higher-functioning caretakers and their children were that these highly unusual circumstances presented opportunities for self-discovery, nurturing a positive view of oneself, and self-care.

A 23-year-old mother of 2 daughters aged 6 and 9 came to our MMU because of her younger daughter's sore throat and fever. The woman reported that her "story was unbelievable." She had moved to Gulfport to "start a new life" with her daughters, initially living with her sister while she enrolled the girls in school, found a job, and got a "great place on the beach." She was literally walking on the beach on the day before landfall and suddenly had to evacuate. On her return the day after the storm, "everything was gone"—her apartment, belongings, and the business where she was working. She was having symptoms of sleeplessness, headaches, depersonalization, and nightmares (classic posttraumatic stress disorder symptoms) and sought help in a series of emergency department visits. She reported that "they barely talked to me." The intervention at our MMU focused on validating her symptoms, providing psychoeducation, cognitive restructuring, refilling her prescription for an antidepressant, and offering her follow-up at the MMU if needed while waiting for her appointment at the mental health clinic in 2 weeks. She appreciated being heard and was relieved to know that she was not "going crazy." This was a fairly common set of presenting complaints, and the intervention clearly was a helpful one.

At an emergency medical services meeting at the Harrison County courthouse in Mississippi, a variety of agencies reported inconsistency of providers. Volunteers were coming and going after their specific stints were completed, resulting in a transient workforce that complicated the relief effort. There was clearly some relief when we assured the group that Operation Assist planned for a commitment of 2 to 3 years' duration.

The main psychiatric issue was the need for emergency back-up services for the cases referred from 4 smaller emergency departments to Gulfport General Hospital, which has a 20-bed inpatient psychiatric unit. Another major issue was how to address the fatigue and burnout of community officials. We joined members from the emergency management agency in Kansas who had been recruited by the Federal Emergency Management Agency to assess psychiatric needs and visit the emergency operations center (EOC) in Hancock County. We found that their need for services was enormous.

OCTOBER 30 THROUGH NOVEMBER 9: 9 TO 10 WEEKS AFTER LANDFALL

As part of our planning process for the establishment of permanent Operation Assist mental health programs in Louisiana and Mississippi, our mental health team coordinator began to make biweekly trips to the Gulf Coast to meet key state and local officials and providers. She also provided supervision and support to clinicians in the field who were treating children and families. Our contacts in both states included private and community-based mental health providers and agencies, local elementary and high schools, providers of day treatment centers and community hospitals, etc. Our clinical findings have been consistent with reports from these providers, with many children in need of psychological support. Suffering families brought their children to our MMU, requesting medical help for somatic complaints or to get vaccinations. During our mental health assessments, we found that many children were depressed and anxious yet hopeful that their lives would go back to "normal." Parents increasingly reported feeling overwhelmed, hopeless, anxious, and depressed. They noticed behavioral and emotional changes in their children, which they felt unable to address because of a lack of information and their own feelings of being overwhelmed.

We learned that 7 children from different families had been brought to an EOC in Louisiana on the third day after Katrina made landfall. They were separated from their parents for reasons that remain unknown. The adult who had been asked to care for them asked the National Guard for help, and the children were driven to the EOC. One of the little girls has been identified as "A." "A" was very frightened and only wanted to be held by men. After the children were eventually reunited with their mother, little "A's" mother reported that she had

nightmares and threw almost daily tantrums that often lasted for hours. "A" became anxious when she saw helicopters. According to one of the officials in the EOC, "A" was most likely the only child of the 7 who did not know the other children. The other children each were reportedly with at least 1 sibling.

COMMENTS

Consistent with previous findings and clinical experiences, one of the most significant consequences of the hurricane and its aftermath on children, their parents, and the professionals caring for them has been the impact of separation, relocation, and uncertainty about the future. Many children were confused and unclear as to what was going on. They had been transported from place to place without any explanation, sometimes separated from their families. At least initially, they were not able to count on any reliable caregiver, which, as expected, severely compromised their sense of trust and comfort.

Many families were deeply affected by the evacuation and relocation processes. Louisiana has a very strong culture with many subcultures, communities, and unique ways of approaching situations. Children being absorbed into new schools were faced with new challenges, because they had to learn new behavior patterns, social expectations, and even vocabulary in addition to adapting to new communities in which they may or may not stay permanently.

LESSONS LEARNED

The following are recommendations for resilient child outcomes:

- In the immediate aftermath of a disaster such as that left by Hurricane Katrina, child and family resilience may be fostered by:
 - promoting some degree of control, empowerment, and normalcy;
 - rapid family reunification;
 - helping families recognize strengths and resources;
 - assisting evacuee integration to the community;
 - encouraging proactive measures to cope with losses and changes;
 - providing ready access to basic human needs;
 - treating individuals with respect and dignity; and
 - making sure that individuals with special needs are assisted in the most appropriate way possible.
- Given the large number of black and poor underserved people directly impacted by Hurricane Katrina, it is essential to consider the cultural and socioeconomic aspects of the community and region when planning interventions and developing programs. We

suggest that minority professionals be hired and consulted, and that past discrimination, restricted access to health care, and racism be taken into account as factors that may prevent access, utilization, and acceptance of health services offered.

- It will be essential to continue helping evacuees settle into their new community, or previous community if they are able to return. They will require help obtaining medical, mental health, and financial support. To best meet the needs of children, it is imperative that day care centers, Head Start programs, and schools obtain the resources they require to meet emerging child needs. This includes increased facility capacity and training staff to identify typical child reactions to trauma and how to provide assistance. It is also essential that the health of children in host cities is not neglected.
- Addressing mental health concerns should be integral to disaster preparedness, response, and recovery, especially for children. A comprehensive list of preparedness recommendations and guidelines dealing with child mental health concerns can be found in the NCDP report of its second national consensus conference, *Considerations in Emergency Preparedness: A Two Track Conference*.
- State and local government and health care and other community-based agencies should develop lists of qualified individuals who will be available to help in case of an emergency. These lists should include clinicians who specialize in disaster and trauma, professionals familiar with community resources, and those who are able to provide short-term treatment and recognize long-term needs in children.

CONCLUSIONS

Immediately after a disaster, mental health interventions should be available, practical, and responsive to concrete needs. This includes creating opportunities for children

to express their feelings and concerns, feel safe, and establish a sense of normalcy as soon as possible. Similarly, demonstrating empathy, validating feelings, and providing psychoeducation to parents are essential components of this early stage of relief that can have a significant impact on children. Children obtain their sense of safety from cues from adults and by having a predictable routine and consistent support system. Development of more serious symptoms, especially for children with prior trauma and loss histories and with pre-existing mental illness, should be anticipated.

Although children may seem carefree and resilient in the first days after a disaster, it is important to keep in mind that posttrauma symptoms often develop weeks and months after the “trigger” event. Children may gradually become more aware of their losses, and the lack of structure, supports, and resources may take time to impact their sense of identity and self-efficacy. Psychological problems including depression, interpersonal problems, and an inability to trust and to feel safe and secure may emerge over time. The adults who care for these children (parents, teachers, pediatricians, family physicians, day care workers, etc) need to monitor each child’s reaction to trauma and stress and make sure that the child obtains adequate treatment.

RESOURCES

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Pediatrician Self-care After Disasters

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Editor's note: It is painful to report that one of our colleagues, James Kent Treadway Jr, MD, FAAP, found the stress of the disaster more than he could emotionally endure and took his own life. Unfortunately, we are not immune to the stresses that our patients have when they come to us for treatment and solace. His unfortunate demise emphasizes the importance of taking care of ourselves so that we can better take care of others. This terrible tragedy cannot be denied and emphasizes the importance of the following article. We all wish we could have prevented this tragedy, and we certainly hope we can effectively support and comfort those who are physically and emotionally overwhelmed with future disasters.

AS OF THIS writing, health care in the areas impacted by Hurricane Katrina has shifted from emergency to primary care mode. Disasters take a heavy toll not only on victims but also on professionals and volunteers who experience the immediate, short-term, and long-term impact through their patients. The impact may occur because of the helping professional's effort to empathize with and be compassionate to patients. There is a rich literature that discusses the risks and impact of vicarious traumatization on psychotherapists, rescue workers, and health care providers who work with survivors, including those who have experienced community traumas such as natural disasters, state-sponsored terrorism, torture, mass murder, and acts of war.

BURNOUT AND COMPASSION FATIGUE

The psychological impact of working with those who have suffered trauma has been variously referred to as "vicarious traumatization," "compassion fatigue," or, more simply, "burnout." Vicarious traumatization is described as the emotional and psychological reactions that are triggered by the experience of empathic engagement with patients who are survivors of trauma. This reaction is considered an inescapable aspect of trauma work.

Working with a large population of individuals who have been traumatized by a shared catastrophic event raises many challenges to the individual health care provider.

Community traumas involve multiple threats to and actual losses of life but also can cause the breakdown of social structures such as family, communities, employment, and housing, thereby dealing a blow to the basic structure of social life by damaging connections between people and their sense of community. A large percentage of health care providers had to evacuate their homes and offices after Katrina and lost their livelihoods and sense of community. It is also likely that many experienced the loss of loved ones. As a result, the emotional toll on health care professionals continuing to treat a traumatized and dislocated population is likely to be significant. The psychological strains inherent in continuing to provide treatment under these circumstances may place pediatricians and other health care providers at risk for depression, anxiety, substance abuse, and maladaptive coping responses, exacerbated by the tendency to push one's limits and neglect self-care. In addition, the culture of medicine, which emphasizes emotional control and pushing aside feelings to grapple with the crisis at hand, combined with unrealistic expectations of personal invulnerability and the strong creed of taking care of others before taking care of oneself, may intensify these risks.

Key Words: Hurricane Katrina, disaster response, mental health, pediatrician self-care, vicarious traumatization, compassion fatigue

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SIGNS AND IMPACT OF VICARIOUS TRAUMATIZATION

Managing the stress of trauma work starts with the acknowledgment that this type of work can have a psychological impact on oneself. Working with traumatized populations makes one susceptible to a host of physical and psychological symptoms such as headaches, back pain, gastrointestinal discomfort, insomnia, emotional numbing or overreactivity, anxiety, depression, irritability, fatigue, anger, confusion, difficulty concentrating, and social withdrawal. Extreme feelings of hopelessness and despair may arise, and symptoms similar to post-traumatic stress disorder such as nightmares, intrusive images, hypervigilance, exaggerated startle responses, and other forms of autonomic hyperarousal, as well as transient dissociative experiences, may develop.

The effects may be felt in one's personal life, such as experiencing a sense of inadequacy and low self-esteem and a tendency toward self-blame. These feelings may leave one with little time or energy for individual and leisure pursuits and create a sense of irritability and impatience with, even disconnection from, loved ones. Over time, decreased intimacy in relationships may result, and use of alcohol or drugs to moderate stress is not uncommon. There is often a concurrent sense of loss of personal safety or invulnerability, and there may be a reawakening of feelings of grief and loss from one's own past life experiences.

The long-term effects of vicarious traumatization can impact a caretaker's professional behavior. Pediatricians may resort to excessive emotional distancing from their patients and unconsciously discourage their expression of intense emotion or personal disclosures as a way of coping with an increased sensitivity to themes of helplessness, violence, and pain. Often, feelings of guilt arise, coming from an impaired sense of competence and feeling that one could have done, or should be able to do, more for the victims. In the extreme, these feelings may lead to professional paralysis and a sense of being unable to perform the duties that one is trained to do and capable of doing. Also common are feelings of survivor guilt, physical and emotional exhaustion, and anger and scapegoating.

In contrast, sometimes vicarious trauma creates a sense of intense connection with victims and fellow crisis workers, creating overinvolvement with the bereaved and enmeshment with their grief. Inappropriate self-disclosures, unrealistic rescue fantasies or expectations, blurring of professional boundaries, and a sense of elation, "specialness," and grandiosity may develop, further impelling physicians to push themselves past their limits.

There are factors that place one at increased risk for vicarious traumatization, such as working in isolation without adequate supervision or peer support, working with a difficult, multiproblem client population, working long hours or with large caseloads, lacking control in the work environment, and being understaffed or otherwise

lacking in sufficient resources. Current life stressors and available support systems, level of training and professional experience, and personal history of trauma or loss are also factors.

Vicarious traumatization can shake the clinician's sense of safety, trust, self-worth, capacity for intimacy, and sense of control and may manifest itself in strong reactions to particular clients. To remain clinically effective and connected with others, health care providers must address the impact of trauma work by countering its potential for negative effects with active efforts at self-care, such as participating in continuing education and supervision, balancing trauma work with other types of work, and attending to personal needs for rest and leisure.

SELF-CARE

To help ensure that patients receive the best care possible during a crisis, and to prevent burnout and foster job satisfaction, physicians have a responsibility to take care of themselves, and their colleagues, physically and psychologically. Because disasters are extreme situations in which professionals are required to work long hours in inadequate facilities and under stressful and sometimes dangerous situations, personal needs for rest and recuperation are difficult to provide for. Although long work hours and stressful work conditions are an expected part of trauma work, and many disciplines are used to working in extreme conditions, the disaster left behind by Hurricane Katrina ushered in unprecedented circumstances for health care workers. Many helpers have continued to work despite the lack of stable practices, homes, or salaries and continue to endure ongoing extreme circumstances.

It is important that pediatricians and other health care providers attend to personal needs for rest and leisure. Although it is largely accepted that this is an important part of maintaining a balanced work and personal life, it is especially easy to neglect or dismiss these straightforward practices in the face of the overwhelming needs of a traumatized population. Instead of using self-care techniques prophylactically, it is often neglected until serious signs of stress develop. Helpers ignore signs of distress, feel they have more important concerns to deal with, or wait for a calm and less busy period to ensue before focusing on their needs. Commonly, physicians and other helpers may experience guilt in taking care of basic needs for sleep, good nutrition, and relaxation when their patient population may be lacking homes, their family, a clean bed in which to sleep, or food and water. It often is easier to sacrifice rather than to take care of oneself as the question of "how can I think about my own needs when others are suffering so much more than I am" arises. For these reasons, and others, it can be very helpful to participate in an informal professional support group to help manage the anxiety that comes

from balancing the needs of self with caretaking for others and to increase positive coping. The following are red flags to be attentive to and tips for self-care.

RED FLAGS

It is important to be alert to signs of maladaptive coping patterns such as the following and to seek appropriate help when they are noticed:

- withdrawal from family and friends;
- emotional numbing or hyperalertness and emotional overreactivity;
- anxiety attacks;
- depersonalization;
- loss of interest in everyday pleasures, including loss of appetite;
- preoccupation with clients' problems;
- chronic physical symptoms such as headaches, muscle tension, and back pain;
- insomnia or weight loss;
- sexual dysfunction;
- increased consumption of alcohol, overuse of over-the-counter sleep aids, or recreational drug use;
- a sense of hopelessness or helplessness; and/or
- suicidal or violent thoughts or urges.

TIPS FOR SELF-CARE

- Eat well, and engage in pleasurable activities and rest.
- Get regular exercise such as walking, jogging, yoga, going to the gym, or even walking the dog.
- Help yourself and your children by helping establish and implement a daily routine that provides comfort and predictability. This is especially important in the first months postdisaster.
- Assess yourself subjectively and objectively. Keep in mind the importance of keeping a balance between personal and professional demands. Separate yourself from your work. When at home, it means leaving your work at work.
- Learn to notice what you do when you get stressed out, understand your own somatic signs of distress, and identify your own personal comfort level, and then take steps to rebalance your life.
- Seek or establish a professional support group as a way to discuss experiences and obtain support from others. Take advantage of continuing education and training opportunities.
- Get psychotherapy if you need or want it.

- Regularly use stress-management exercises such as deep breathing, positive visual imagery, meditation, and muscle relaxation.
- Engage in activities that help distract and soothe, such as pleasure-reading, writing, watching movies, doing crafts, listening to music, or engaging in other forms of creative expression.
- Use positive self-talk to help counteract feelings of guilt or personal inadequacy; catch yourself in negative, unproductive thoughts, challenge unrealistic expectations, and replace these thoughts with a positive message and realistic expectations.
- Balance trauma work with other types of work.
- Do things that feel personally meaningful and rejuvenating (eg, spend more time with the grandkids).
- Engage in activities that encourage personal growth or acquire new skills.
- Combat pessimism and cynicism with activities that help reaffirm your faith in the world and in others.
- Remain connected with others and build community; find social outlets and spend time with family, friends, and neighbors.
- Pace your work, take small breaks, try not to schedule difficult cases back to back, and limit shifts or tours of duty.
- Provide opportunities for case review, regular debriefings, and peer support.
- Set personal limits to help maintain personal and professional boundaries.
- Be attentive to time-management needs.
- Have your own personal and family disaster-preparedness plan.

We are entering a phase of long-term care for children with more complex needs than they had before Katrina, and with limited resources. Stress will escalate. We are not trained well to recognize our limitations or when we are becoming ineffective or placing our patients at risk. More so, we are not well trained to recognize when we are putting ourselves at risk. To prevent burnout and provide optimal care for children, we must take care of ourselves. Take time for yourself, and don't feel guilty about it. Enjoy it. Your patients, and your family, will be glad that you did.

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CONCLUSION

Summary of Issues Demanding Solutions Before the Next One

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THIS SUPPLEMENT CONTAINS many hands-on experiences of pediatricians and others who cared for children during the Hurricane Katrina disaster. They have all offered significant insightful suggestions to help planners better prepare for care of children during the next disaster. This summary focuses on a few of the key lessons learned.

DISASTER PLANNING MUST ADDRESS THE UNIQUE NEEDS OF CHILDREN

All too often, planners assume that any hospital and any licensed health care provider can care for the full range of pediatric needs, including in times of crisis. Even for those who do recognize that seriously ill or injured children need to be cared for by pediatricians and pediatric subspecialists, it is sometimes assumed that existing hospitals are, in fact, sufficiently staffed and equipped to handle unlimited numbers of such cases. Few planners recognize the limited supply of pediatric hospital beds in their area and, therefore, do not prepare before a disaster for the potential transfer of children to distant facilities as needed, even if it requires consideration of out-of-state hospitals. More study is required to determine when and how adult-oriented providers and facilities can, in fact, care for children. Special protocols and understandings for the care of children in the midst of disasters need to be refined.

Surge capacity is exceeded when the number of children requiring inpatient care exceeds the number of beds, staff, and equipment available. Obviously, with Katrina, all of the pediatric beds in Louisiana were overwhelmed, demonstrating the need to plan for care (including evacuation) of existing pediatric inpatients as well as new patients requiring admission within an impacted area.

Disaster plans for children should include regional

capacity and the likelihood that children may have to be moved a significant distance to assure proper care.

Furthermore, it is essential that pediatricians, particularly those with an interest in disaster management, should be included in all aspects of disaster planning on state, regional, and national levels.

PUBLIC AND PRIVATE HEALTH CARE RESOURCES NEED TO BE HIGHLY COORDINATED TO BEST SERVE THE NEEDS OF CHILDREN IN DISASTERS

Non-federal hospitals responded rapidly, improvising and evacuating critically ill children from the hazardous, unsecured disaster zone. By every conceivable measure, the outcome was astoundingly effective. In stark contrast, federal support for the management and care of hospitalized pediatric patients during the crisis was minimal, at best, and clearly disorganized.

There was a persistent disconnect between federal and private efforts. New strategies to coordinate between these 2 worlds must be considered and implemented before the next major disaster. Each sector has strengths, and each must contribute appropriately to the process of managing care during a crisis. As in the immediate post-Katrina period, the next disaster may well also see volunteer physicians, hospitals, transport teams, etc providing care before the government resources can start functioning. The government will provide broad services under the most austere conditions that are otherwise not

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available. Both systems need to function collaboratively and optimally during a disaster.

There is need for enhanced collaboration of public and private skills, resources, talents, and facilities.

FINANCIAL ACCESS TO HEALTH CARE SERVICES FOR CHILDREN MUST BE AVAILABLE RAPIDLY DURING A MAJOR EMERGENCY

Many evacuees had limited or no financial access to health care before the disaster, which complicated post-disaster care. It is axiomatic that displaced evacuees likely need more care, not less. Yet, even months after the disaster in the Gulf Coast, there still was not availability of emergency Medicaid. As we write this, access to care continues to be a growing problem for children and families in the Katrina-affected states.

Clearly, it is noble (and typical) for pediatricians to offer free care after a disaster. Volunteer organizations have provided short-term care, and some have committed to long-term care. However, providing care with no or limited financial resources beyond the first few days after a major disaster is unreasonable and unsustainable.

Provisions for health care, medicines, and durable medical equipment have to be automatically assured in a disaster. Families who have lost their possessions and identification should not be subjected to an arduous application procedure for Medicaid or verification of private insurance, a painful reality for many victims of Hurricane Katrina.

Every effort should be made to ensure equity between private- and public-sector reimbursement schedules. Discrepancies between the 2 sectors only serve to create barriers to care and substantial confusion among patients and providers. Attempting to work through these challenges in the aftermath of a major disaster is problematic.

Patients would benefit from active reimbursement negotiations among Medicaid, provider organizations, purchasers, insurance companies, and relevant state health organizations before the next disaster.

PEDIATRICIANS SHOULD TAKE AN ACTIVE ROLE IN HELPING FAMILIES PREPARE FOR DISASTERS

Pediatricians and other providers need to educate families on many aspects of disaster planning. Families should know that help may not be available for many hours or even days in the immediate aftermath of a major community-wide disaster. Pediatricians can help by advising families directly or providing information with respect to available resources, online or otherwise. Discussing and even rehearsing a family emergency plan and developing disaster kits with essential supplies are essential. Pediatricians and families should be aware of the superb informational resource available from the American Academy of Pediatrics at www.aap.org/terrorism.

Also, there is a need to prepare for the possibility that family members may become inadvertently separated during a disaster. This was a major problem during and after the Gulf Coast storms. Pediatricians could suggest that children learn to identify themselves and their parents. Children can carry self-identification, and parents should carry pictures of their children. Each family also should have a plan of how to reunite if they become separated.

Primary care physicians should counsel families to think about and prepare for disasters.

FOCUS ATTENTION ON THE PEDIATRIC WORKFORCE

As patients are evacuated, so are physicians, many out of state. The need for care of those displaced patients continues, requiring increased demands of the local workforce. The displaced physicians have the skills to meet medical needs, especially of the patients who were under their care before the evacuation. However, licensing, credentialing, and insurance issues present real and perceived barriers for displaced physicians in other states, as well as for those who volunteer in affected regions but may have come from different states.

Systems have to be clarified for licensed physicians in one state to provide care to patients in other states in declared disaster situations.

EFFECTIVE COMMUNICATIONS SYSTEMS ARE ESSENTIAL

This supplement contains many examples of fragile or absent communications capacity in the affected region. This problem took on broad and important ramifications, frustrating attempts to organize care efficiently. For instance, many physicians reported that advisories of “incoming patients” were often incorrect, causing unnecessary deployment of limited workforce to prepare for patients who never arrived. In other cases, hospitals needed to actually send staff to the disaster area to obtain and communicate necessary identifying and diagnostic information regarding incoming patients. There also were reports of critically ill neonates who were on life support and needed evacuation but were, at least transiently, “lost” in the system.

Many authors reported a lack of any medical information, much less credible medical or medication history, on patients for whom they were caring. Although there are efforts to fill this gap with an electronic medical chart, there is a need for patients to be better educated and to have some record with them. Children with special health care needs are a readily identifiable target group that should have emergency information on a piece of paper or a chip. Fortunately, a form has been approved and is readily available for printing and copying at www.aap.org/advocacy/blankform.pdf.

Reliable and effective patient and crisis-management information must be organized before any disaster and be in place when needed to ensure effective patient care.

Critical specific health information on every patient should be available electronically or, at least, in paper form.

CONCLUSIONS

A concise but complete summary of the essential lessons learned by our collective experience in the Gulf Coast

after Hurricane Katrina is impossible. However, a reading of all of the contributions in this supplement will surely provide more detailed insights that we believe will help practitioners, disaster-preparedness planners, research scientists, bureaucrats, hospital workers and administrators, legislators, and others to understand the complexity of effective planning for major disasters.