NICU Care in the Aftermath of Hurricane Katrina: 5 Years of Changes

Geographic circumstances: I was on duty in the NICU of a flooded downtown New Orleans hospital during Hurricane Katrina and returned to the NICU when it reopened.

About the author: I am a professor of pediatrics and the division head of neonatology at Louisiana State University Health Sciences Center in New Orleans. With 7 dedicated and resilient colleagues, I practice neonatology at 4 area hospitals and am active in medical education. I spent 4 days in a flooded downtown New Orleans hospital immediately after Hurricane Katrina and have been involved in the evolution of hospital, local, and statewide hurricane-preparedness efforts as they relate to NICU patients.

When I entered University Hospital on August 28, 2005, I did not realize how much the events of the next few days would change my life both personally and professionally. As division head of our 12-person Louisiana State University Health Sciences Center (LSUHSC) neonatology group, I was assigned to be the in-house attending at University Hospital; several of my colleagues were similarly moving into 1 of the other 8 local hospitals in which we provided neonatology care. University Hospital was the site for maternal-child services of the modern-day Charity Hospital, a series of hospitals that had survived various floods and fires over the years to provide indigent care in New Orleans dating back to 1736. The following morning, August 29, 2005, Hurricane Katrina would arrive and bring a massive storm surge that would breach an inferior levee system. More than 80% of New Orleans was covered by floodwater, including the area surrounding University Hospital.

Katrina’s wrath resulted in more than 1800 deaths and more than $80 billion in damage, and the greater New Orleans area was the site for most of these losses, including more than 700 deaths. The experiences and losses of thousands of greater New Orleans and Gulf Coast residents have been well documented. My personal experiences during the days immediately before and after Katrina were published in a supplemental issue of Pediatrics in May 2006. Although the events of those days were compelling, they were only the beginning of a story that continues today as my hometown recovers and a maternal-child health care system continues to evolve.

THE BABIES

Despite harrowing circumstances, every NICU patient at University Hospital during Hurricane Katrina survived the storm and the evacuation process. The 2 sickest NICU patients at the time of the storm were premature infants with progressive chronic lung disease who were dependent on high-frequency ventilators. By the morning after the storm, the lack of reliable electric power and running water made...
Further care for these infants impossible at University Hospital. They were transported to Children’s Hospital through floodwaters via canoe and then fire truck. Both infants were able to survive this primitive means of critical care patient transport only to face additional transfer the next day after the closure of Children’s Hospital. One infant eventually ended up with family in Fort Worth, Texas, and was subsequently lost to follow-up, and the second infant remained hospitalized for 3 additional months in Baton Rouge, Louisiana. During the spring of 2006, this infant was briefly rehospitalized at Children’s Hospital for a viral respiratory infection. Like many other families at that time, her family was trying to resettle in New Orleans.

Early in the morning 4 days after Katrina’s landfall, a preterm (25 weeks’ gestation) girl was born to a mother who had been hospitalized with threatened preterm labor before Katrina’s arrival. After being carried with flashlight guidance to the NICU, she was cared for with equipment powered by a portable generator and without routine services such as blood gas determination, laboratory studies, and radiography. Eight hours later, help arrived via US Army helicopters. This micropreemie and almost 30 other NICU and well infants were transported from University Hospital to Women’s Hospital in Baton Rouge attended by University Hospital staff. Some of these infants continued to receive care at Women’s Hospital, whereas others were triaged to hospitals with available capacity for further care. The process of reuniting these patients with their families was difficult, because family members of this primarily indigent patient population had likewise hurriedly evacuated New Orleans before or after the storm. Typical methods of communication and contact information were no longer reliable.

Together, these patients and their families are part of the great diaspora that resulted after Katrina. Although follow-up care of an inner-city indigent population is challenging under normal circumstances, the ability to follow-up with this population after Katrina was made impossible by widespread loss of housing coupled with the loss of available follow-up clinics that traditionally served these infants. Some of these families likely have returned to New Orleans, but many have not made their way back—either by circumstance or by choice. Using the movements of other former New Orleans residents as a guide, some families are in surrounding suburban communities, some are in neighboring states, and a few have settled even further away.

THE HOSPITAL

Extensive flood damage to University Hospital and nearby Charity Hospital resulted in the closure of both facilities that comprised the Medical Center of Louisiana at New Orleans. Temporary emergency medical care was provided at various sites, but full-service health care was limited in the first few months after Katrina as returning residents and relief workers repopulated the city. Suburban hospitals that escaped storm damage and less severely damaged hospitals within New Orleans assumed care of patients previously treated at University and Charity hospitals. After months of repairs, University Hospital was restored to its status as a full-service hospital, albeit at a lower capacity than before Katrina, and maternal-child services eventually returned.

In February 2007, for the first time since the micropreemie was delivered on the day of evacuation and hospital closure, a newborn infant was born at University Hospital. This milestone birth was uplifting to the hospital obstetric and nursery staff, who were now able to return to work in familiar surroundings. Neonatal care was increased stepwise from level 2 to level 3 status as patient volume increased. It was hoped and anticipated that with the progressive repopulation of New Orleans, the number of deliveries would gradually be restored close to pre-Katrina numbers.

Over the ensuing 3 years, this restoration of births at University Hospital failed to occur as delivery numbers reached a plateau at approximately one-quarter of the number of pre-Katrina deliveries. By July 2010, the lack of patient volume coupled with state budget cuts to the hospital resulted in the closure of obstetric and neonatal care services at University Hospital. Two major factors for the lower-than-anticipated number of births at University Hospital after Katrina were the aforementioned failure of many indigent residents to return to New Orleans and the establishment of other area hospitals as preferred sites for obstetric care during the interval in which University Hospital remained closed.

THE CITY

At other hospitals around the metropolitan area, changes in population, changes in hospital corporate ownership, and the failure of some damaged hospitals to reopen after Katrina resulted in differences in the logistics of neonatal care. All 3 major tertiary care NICUs for the metropolitan area were able to reopen and reestablish their roles relatively quickly after Katrina. Children’s Hospital reopened in October 2005 and completed work on a family-friendly state-of-the-art NICU in the spring of 2006. Tulane Medical Center moved its obstetric and neonatal services from its damaged downtown hospital to its suburban Lakeside
Hospital. Ochsner Medical Center expanded its referral network through the purchase of several community hospitals previously owned by the Tenet Healthcare Corporation.

Of the 9 hospital NICUs where I worked with my LSUHSC colleagues before Katrina, 1 hospital remains closed, 1 hospital reopened without obstetric and neonatal services, 2 hospitals were purchased by the Ochsner Health System, and University Hospital reopened and subsequently closed. The net result was a 9-hospital network being reduced to 4 and a 12-person neonatology division being reduced to 8. Similarly, adult medical services were also altered significantly after Katrina; these dramatic changes in the delivery of inpatient care are relatively unique to this postdisaster metropolitan area.

Two novel patterns in NICU patients emerged after Katrina. First, a massive influx of Hispanic workers to the metropolitan area resulted in significant increases in Hispanic NICU patients, which created communication problems resulting from cultural and language barriers that were far less common before Katrina. Second, an increase in the number of infants with symptoms of withdrawal from opiates was noted in community hospitals, which is consistent with reported increased illicit use of prescription narcotics after Katrina.

THE TRAINEES

During and immediately after Katrina, resident housestaff at various hospitals served heroically in providing patient care. After several days of providing patient care with limited hospital resources, housestaff served key roles in the prompt and safe evacuation of patients, whether paddling critically ill premature infants by canoe or carrying adult patients through sweltering, dark stairwells. Other housestaff and medical students served key roles in triage centers outside of New Orleans. Patients’ medical needs were complicated by the evolving social complexities that resulted from the disaster.

The sudden loss of both patient population and training sites created huge voids in educational opportunities. Although some residents left local programs, most were able to continue their training thanks to the creativity of residency program directors, the hospitality of medical education leaders across the South, and new patient care opportunities afforded by the migration of Katrina evacuees. As the population of New Orleans returned, training programs likewise made their way back to the city. Medical students and clerkship directors from LSUHSC and Tulane Medical Center faced similar challenges. Graduating medical students made leaps of faith in committing to residency training programs in a recovering city.

With progressive repopulation and shifts in medical facilities, matching trainees with appropriate patient care sites has been an ongoing dilemma. Predicting the return of evacuees and potential patient volumes has not been an exact science. LSUHSC pediatric residents have used 3 different hospitals for well-infant care nursery experiences since Katrina. New outpatient opportunities for housestaff education have resulted from an increased number of decentralized outpatient clinics.

Adjacent to Charity Hospital in downtown New Orleans, the LSUHSC building, which served as headquarters for the medical school since the school’s inception in 1931, was damaged by flooding. This building housed the main offices of our department of pediatrics before Katrina, and a decision was made to consolidate all pediatric offices to Children’s Hospital in uptown New Orleans after Katrina. In the spring of 2006, department members returned to musty eighth-floor offices to remove their professional belongings. The site of our neonatology call schedule from August 2005 on the bulletin board was a reminder of how things were, but the residual smells from Katrina in the air and the view of surrounding buildings in disrepair outside the windows served notice of how things had changed.

THE FAMILY

Hurricane Katrina affected citizens of the Gulf Coast from all races and socioeconomic groups in large and small communities. My neighborhood in New Orleans was one of the most severely affected as a result of Katrina’s floodwaters; most houses were rendered uninhabitable. Three of my neonatology division colleagues experienced similar severe flood damage to their homes. After living for 3 months in Baton Rouge, my family and I relocated to a house in a New Orleans suburb to allow my 5 children to return to their schools and friends as soon as possible. Similar to their peers, my children showed remarkable resiliency in tumultuous times, aided by the provision of consistent support and stability in their immediate environment. We were fortunate to have school administrators and teachers who were able to make their schools functional when everyday things that we take for granted, such as grocery stores and stoplights, remained nonfunctional.

After some indecision about returning to our flood-damaged house, dedicated repair work began in August 2008. By June of 2009, our once-flooded house was fully repaired, and my family was finally able to return home. By the time we returned, my oldest child had gone away to college and my next 2 daughters had entered high school. Our neighborhood continues to recover, and the majority of the houses have been repaired or rebuilt. After sitting on folding chairs in our repaired...
church for more than 2 years, we now have pews again. The nearest grocery still isn’t as near as it used to be, but our old grocery is expected to reopen in the near future. We are surrounded by families who have overcome similar obstacles and who do not take simple things for granted and appreciate being home.

The recovery of our city would not have been possible without the determination of locals and the help of outsiders. Volunteers too numerous to count have come to New Orleans to see the destruction firsthand and to offer help with the recovery by clearing debris, gutting and repairing houses, planting trees, and performing various other tasks to help make our city whole again. Tourism is a major part of our city’s economy, and visitors have realized that the food, festivals, and fun are better than ever.

THE LESSONS LEARNED

The threat of hurricanes or other natural disasters remains, and efforts to provide for the safety of lives and property should be an ongoing effort. In south Louisiana, work to improve the flood-protection system continues. Much has been written describing the shortcomings in preparation for and initial response to the destruction caused by Hurricane Katrina. Over the ensuing 5 years, collectively and individually, hospitals have put in place mechanisms to allow for the safe care or transport of critically ill patients in the face of such threats. Depending on the risk each hospital’s location and physical plant faces, some hospitals have opted for patient evacuation, whereas others have implemented plans and preparation to shelter in place.

Large-scale safe evacuation of NICU patients from an entire metropolitan area such as New Orleans is not always possible given the short time frame that hurricane predictions currently allow. Hospitals that choose to evacuate NICU patients have plans in place to use local, regional, and potentially national resources to do so. Hospitals that choose to shelter in place have preferred flood-zone status and enhanced physical plant preparations. Children’s Hospital, located in a relatively higher area of New Orleans that did not flood after Katrina, has been built with the ability to withstand high-force hurricane winds. Hospital leaders have put in place several layers of safeguards in the event that local utilities such as electric power and water are unavailable, as happened after Katrina. Raised generators are able to provide extended periods of electric power with the aid of large underground fuel tanks. An on-site well has been drilled to provide necessary non-potable water to allow for cooling of chillers and human waste disposal. These efforts, coupled with stockpiling food, potable water, and hospital supplies, allow for provision of safe patient care for several weeks after a disaster. An elevated heliport has been built to allow for any necessary transport when typical ground routes after a disaster are no longer available.

In late August of 2008, eerily exactly 3 years after Hurricane Katrina’s landfall, Hurricane Gustav threatened the Gulf Coast as a category 4 hurricane at its peak strength. This threat coupled with lessons learned from Katrina prompted the largest hurricane evacuation in US history as more than 3 million people sought shelter. Evacuation and shelter-in-place plans were implemented effectively for area hospitals. The neonatal patients involved in this plan were cared for effectively. Ultimately, Gustav weakened to a category 2 storm by landfall in south Louisiana, but it still resulted in 53 deaths and $4.3 billion in damage in the southern United States. Because of the course traversed by Gustav, there was greater disruption of patient care and damage to hospitals in Baton Rouge than in New Orleans, despite Baton Rouge’s location further inland. These events allowed for fine-tuning of the hurricane-preparation process in the greater New Orleans area, and the unexpected impact on the Baton Rouge area served as a reminder of the need for ongoing reassessment of such plans for coastal regions.

THE CURRENT ASSESSMENT

In the 5 years since Hurricane Katrina, significant improvements have been made in hurricane protection and preparedness. Similar to the post-Katrina recovery of the entire region and individually affected families, the process is ongoing and probably never complete. Preparation is a key component for limiting loss of life and property, but resiliency and resourcefulness of communities and individual people to face the unique threats that nature poses are essential.
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