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# Interstate Transfer of Pediatric Patients During Hurricane Katrina

Steve Baldwin, MD<sup>a</sup>, Andria Robinson, MBA<sup>b</sup>, Pam Barlow, BS<sup>b</sup>, Crayton A. Fargason, Jr, MD, MM, FAAP<sup>a</sup>

<sup>a</sup>Department of Pediatrics, University of Alabama at Birmingham, Birmingham, Alabama; <sup>b</sup>Department of Pediatrics, Children's Hospital of Alabama, Birmingham, Alabama

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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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Address correspondence to Crayton A. Fargason, MD, Children's Hospital of Alabama, ACC Suite 512, 1600 7th Ave S, Birmingham, AL 35233. E-mail: [crayton.fargason@peds.uab.edu](mailto:crayton.fargason@peds.uab.edu)  
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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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