

Medical Response to Hurricanes Katrina and Rita: Local Public Health Preparedness in Action

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Like more than 150 communities in Texas, our community participated in disaster response for Gulf coast citizens evacuated from hurricanes Katrina and Rita. We implemented and adjusted emergency operations plans that were designed to respond to a local disaster. Lessons learned will strengthen our disaster preparedness in the future, including the importance of a robust medical presence at evacuation shelters; the value of an accurate and timely database of medical needs for shelter occupants; the usefulness of brief paperwork; the need for a preidentified and pretrained group of healthcare workers; the necessity of timely and accurate communications with medical partners in the community; the requirement that our local city government plan, open, and operate disaster shelters in our community; and the impact of ease of travel, frequent and honest communication, and sincere appreciation on maintaining morale in our volunteers.

KEY WORDS: disaster response, emergency operations, public health preparedness

In September 2005, our community participated in a disaster response to two hurricanes that affected citizens and geographical areas over 500 miles away. Our local government implemented its local emergency operations plan, which was designed to respond to a local disaster. We had imagined that some of our local resources might be used in remote locations, but we had never anticipated local on-site participation in response to a natural disaster that occurred so far away. Our preparation and planning functioned well for this unanticipated purpose. Lesson learned will strengthen our disaster preparedness in the future, and may be of interest to others.

● Background

Amarillo (population nearly 180 000) is located in the Texas Panhandle and is relatively isolated from the rest of Texas and the Gulf coast, with a driving distance of 884 miles to New Orleans, and 685 miles to Beaumont. Amarillo has two acute care community hospitals and a Veterans Affairs hospital with a total capacity of 995 beds. The city of Amarillo Department of Emergency Management coordinates disaster planning in our community. In May 2002, Amarillo received federal designation as a Metropolitan Medical Response System (MMRS) community. The MMRS program provided federal funding to the city of Amarillo to enhance response capabilities specifically related to human health consequences of a weapons-of-mass-destruction incident. Amarillo elected to include planning for natural disasters as well.

On August 29, 2005, Hurricane Katrina made land-fall near Buras, Louisiana,¹ causing unprecedented destruction of property in coastal areas of Louisiana, Mississippi, and Alabama. In Amarillo, our emergency operations center was activated on September 2, 2005, to monitor evacuation efforts in east Texas, which at that time had already received several thousand Louisiana citizens. As the Labor Day weekend approached, medical and hotel facilities in Louisiana communities were overwhelmed and it became increasingly obvious that search and rescue efforts in New Orleans would result

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TABLE 1 ● Hurricane Katrina: City of Amarillo response

Total evacuees receiving shelter	211
Evacuees arriving by plane from New Orleans	127
Gender ^a	
Male	100
Female	91
Age, y ^b	
0–17	40
18–64	124
≥65	31
Veterans	14
Evacuees receiving 6-mo housing placement in Amarillo	111
Children enrolled in Amarillo Independent School District	29

^a Approximate count. Likely gender determined from evacuee given names. Evacuees with unusual given names were excluded from count, giving data for 191 evacuees.

^b Data available for 195 of 212 evacuees. All numbers are preliminary.

in the need for medical care and sheltering of thousands of New Orleans citizens in Texas.

On late Friday morning, September 2, our mayor received a call from the governor's office, asking for assistance in sheltering New Orleans evacuees who were being actively rescued from flooded areas of the city. The mayor agreed to establish a local shelter for up to 750 evacuees. She declared a local state of emergency. Our local emergency operations center was activated. The local Civic Center was chosen as the site of our local shelter. Weekend leave was canceled for many key city employees.

Our Hurricane Katrina shelter opened the next day and ultimately housed 211 evacuees over an 11-day period. Medical triage and care were provided as described below. The local school district enrolled 29 children in public schools and provided transportation to classes. Local organizations and the city provided assistance with temporary housing, employment, family unification services, and other social services at the shelter. The Katrina shelter was closed on September 13. Approximately 111 evacuees were provided with 6 months' local housing by the Community Services Division of the city, and approximately 143 chose to stay in our community. The city's response to Hurricane Katrina is summarized in Table 1.

Just a few days after the closure of our Katrina shelter, Hurricane Rita, a category 5 hurricane, made its way toward the Texas coast. The Texas State Operations Center requested on September 19 that we reopen our shelter to accommodate some of the 1.5 million Texans fleeing Hurricane Rita. The first evacuees arrived at the shelter on September 23. Our Rita shelter ultimately housed 146 evacuees from south Texas who arrived by private means and 167 evacuees who arrived by commercial jet directly from Houston. We were also asked to assist with the transfer of hospitalized

patients directly from Beaumont, where patients were being evacuated from a hospital. Amarillo agreed to accept 57 direct hospital transfers while hospitals in the surrounding smaller jurisdictions agreed to accept an additional 60. We ultimately received six direct hospital transfers, three of which were transferred with mechanical ventilation directly from an intensive care unit of a Beaumont hospital.

● Summary of Public Health Response

Medical triage of Katrina evacuees

On September 2, the local health authority placed phone calls to local physicians to request assistance with staffing a triage station at the Katrina shelter. The Department of Public Health drew up plans for this triage station, which would provide medical assessment and treatment of evacuees arriving at the shelter. The MMRS coordinator contacted the local school of pharmacy to address the prescription needs of the evacuees. The Department of Public Health designed forms for medical screening and prescriptions. The regional office of the Texas Department of State Health Services provided consultation regarding immunization recommendations for evacuees and shelter occupants. By early the next morning, the triage station was assembled and equipped with six examination rooms, an immunization station, a communications center, and a medication distribution station. Six personnel from the Departments of Public Health and Emergency Management organized more than 100 volunteer nurses, pharmacists, respiratory therapists, and physicians, who provided care at this triage station for the next week.

Medical and pharmacy care at the Katrina shelter

A few evacuees arrived by private car the day the shelter opened. Two days after opening, 127 evacuees arrived by commercial airliner. All of these evacuees had been rescued from their homes earlier that day, taken to an airport in New Orleans, and flown directly to our local airport. Upon arrival at the airport, local emergency medical responders screened every evacuee. No immediate medical needs were identified at the airport and all evacuees were then transported to the shelter by bus. Within minutes of arrival at the shelter, every evacuee completed a screening form (this form is available from the author). Persons with any medical problems or those needing long-term medications were then seen at the triage station. Vital signs, capillary blood glucose levels, and oxygen saturation by pulse oximetry were determined by nursing staff, and then evacuees were interviewed and examined by a physician. Eight evacuees were subsequently hospitalized. This initial

TABLE 2 • Hurricane Katrina: Healthcare response

Total evacuees receiving medical evaluation	198
Admitted to hospital ^a	8
Referrals for ongoing/special needs ^b	54
Prescriptions	
Patients with prescriptions needing refill	88
Total prescriptions filled	232
Total cost of prescriptions filled	\$12 241.90
Immunizations given to evacuees	
Tetanus	92
Hepatitis A	63
Measles-mumps-rubella	6

^a Diagnoses included post-traumatic stress disorder, severe hyperglycemia, congestive heart failure, and unstable angina.

^b Ongoing/special needs included diabetes, heart disease, hypertension, respiratory disease, dialysis-dependent kidney failure, psychiatric disease, acute dental needs, and minor injuries needing follow-up. All numbers are preliminary.

screening was completed on all 127 evacuees within less than 3 hours. Table 2 summarizes our preliminary review of the medical response for Hurricane Katrina evacuees.

Evacuees continued to arrive in small numbers over the next few days. All new arrivals to the shelter completed a similar medical evaluation process. The triage station was staffed around the clock by nursing staff and pharmacists, and physicians staffed the station for 4 hours each day to see evacuees with ongoing or minor medical problems. Referrals were made to local providers as needed.

Prescriptions for short-term or long-term medications were faxed to local pharmacies. Volunteers were assigned to pick up prescriptions and return them to the shelter, where they were distributed to patients at the shelter by volunteer pharmacists. The shelter medication station was open 24 hours for over-the-counter medications.

Communicable disease surveillance and control

Several evacuees at our Katrina shelter reported diarrhea 1 to 2 days after the arrival. This raised concern about the possibility of a communicable enteritis. The Department of Environmental Health posted signage in shelter restrooms encouraging hand-washing, and the Department of Public Health collected three stool specimens for culture, as well as four serum specimens for acute hepatitis A serology. The results of these stool cultures and hepatitis A serology specimen examinations were negative.

On September 5, the Centers for Disease Control and Prevention issued special interim immunization recommendations for Katrina shelter occupants. The Department of Public Health established special im-

munization clinics at the shelter and gave 92 tetanus, 63 hepatitis A, and 6 measles-mumps-rubella vaccinations. In addition, 43 disaster relief volunteers were vaccinated against tetanus and hepatitis B before departure to Louisiana.

Medical and pharmacy care at the Rita shelter

We anticipated that Rita evacuees would be less ill since they would be self-evacuating, would have had time to gather their medications, and would not have been subject to the problems of flooding and lack of electricity, food, and potable water faced by our Katrina victims. Therefore, our Rita shelter was initially established with a first-aid station staffed by nurses and paramedics. An assessment of the health needs of the Rita evacuees shortly after their arrival, however, made it clear that a triage station similar to the station at the Katrina shelter was required. Medical screening and care as well as prescription drug needs were provided in a similar manner to that of the Katrina shelter.

Coordination of direct hospital transfers during Rita evacuation

On September 22, the Texas State Operations Center asked us to be prepared to receive direct hospital transfers of patients from south Texas hospitals. The local health authority and the MMRS coordinator spent several hours, assessing the capacity of our local hospitals to accommodate direct transfers. The Texas Department of State Health Services contacted the nursing supervisors at regional rural hospitals to assess the bed capacity. The local health authority made arrangements with local physicians to accept 117 of these transfers. Ultimately, we received six direct transfers, three of whom were on mechanical ventilation. The coordination of care was facilitated by the transferring facility, which forwarded records by facsimile so that the receiving facility and physicians were prepared for the receipt of these patients.

Identification of special needs and integration of care into the community

At both of our shelters, the Department of Public Health identified patients with special and ongoing health needs, which included renal failure requiring dialysis, dementia, psychiatric disease, and dental care needs. This task was necessary at our Katrina shelter to assist social service agencies with integrating shelter occupants who chose to stay in our community into the usual and customary healthcare system. It was necessary for our Rita shelter to adequately plan for the transfer of shelter occupants back to south Texas

when the shelter is closed. The task was facilitated by the development of an electronic tracking system for all shelter occupants that detailed their ongoing healthcare needs. The local health authority reached an agreement with the regional campus of the Texas Tech University Health Sciences Center to assume care for those evacuees with ongoing healthcare needs who chose to stay in our community.

Summary of community's volunteer response

Our local Department of Public Health employs only six nurses, and does not have a single pharmacist, respiratory therapist, or mental health worker. The local health authority works part-time as the only physician with the health department. Therefore, the department was very much dependent on volunteer healthcare workers to staff its medical response efforts at both shelters. The local health authority's request for volunteer healthcare workers resulted in an impressive response, with 71 physicians, more than 100 nurses, and many pharmacists and respiratory therapists volunteering for more than 1 500 hours during the two efforts.

● Lessons Learned

1. A significant medical presence was required at both shelters. The number of evacuees that our shelters received was significantly fewer than the 5 000 for which an on-site clinic is considered necessary in the literature,² yet we believe that the necessity of a medical presence for both shelters is the most important lesson that we learned from this experience. We had anticipated that our Rita shelter, which accommodated Texas evacuees who had time to plan their evacuation, could be managed with a minor first-aid station staffed by nurses and paramedics. We had anticipated a similar level of medical response for shelters established in our own community should a local disaster such as a tornado occur. We learned that some displaced persons will always have major health needs (such as oxygen, dialysis, dressing changes, urgent and ongoing medication needs, and regular laboratory testing such as protimes); and that the management of these healthcare needs, at least in the first few days, would be best accomplished by a larger medical presence. This presence, in our opinion, should include initial assessment of immediate healthcare needs by a physician, determination of ongoing prescription medication needs, identification and coordination of special healthcare requirements, and arranging for postdisaster follow-up care.
2. The utility of an accurate and timely database of medical needs for shelter occupants cannot be

overemphasized. We did not develop an electronic database at the Katrina shelter until several days after the shelter opened, and in retrospect we wished that we had an ongoing electronic database that was functional from the time of arrival and populated at initial registration. The database we eventually created proved invaluable in helping us keep up with the ongoing health needs of shelter occupants, including follow-up appointments, immunization requirements, prescription medication needs, and special medical, social, and dietary concerns. One of the more surprising revelations was that we did, in fact, need some third party payer information such as Medicare/Medicaid, private insurance, and dependent coverage information.

3. Clinic flow must be optimized to prevent "bottle-neck" effects in registration and paperwork. Early in the disaster, the Department of Public Health determined that the initial screening tool provided by the Texas Department of State Health Services was too long and cumbersome to be completed in a timely way. It was our belief that a four-page screening form was unnecessary to accomplish the basic screening and assessment function at our shelter. Our form was shortened to one page to capture the needed medical history. This decision was based on conflicting reports of exactly how many evacuees were expected by aircraft into Amarillo. The consensus opinion was that we did not want the limiting factor of patient flow to be inordinate amounts of paperwork if we received hundreds of potential patients at one time. This proved to be correct: our flow was not limited by paperwork, but by examination rooms and clinicians. This maximized our medical volunteers' time and effort, avoided undue hassle for already-beleaguered evacuees, and provided sufficient information to allow high-quality short-term care. As mentioned previously, having screening or treatment information in an electronic format would have been optimal.
4. The function and efficiency of our medical station would have been significantly improved by training before the disaster. This "lesson" is well documented in disaster planning literature.³ Our medical community was very willing to volunteer and assist with the medical response at our shelter. However, the efforts of these healthcare volunteers were sometimes disorganized and inconsistent despite attempts at on-site just-in-time training and a brief orientation. We recognized that our volunteer healthcare workers would have been more effective and consistent had they received some training and orientation before the disaster. We have subsequently received designation as a Medical Reserve Corps site, and plan to preidentify and pretrain healthcare workers to work in our medical triage stations in the future. We

urge other communities of our size, which may consider themselves too small to require trained disaster medical teams, to again consider their decision and the potential benefits of official medical disaster training.⁴

5. Our local city government was the only local entity with the necessary infrastructure to plan, organize, and open a large shelter in a matter of a few hours. The importance of a clear authority and substantial resources in responding to disasters has been described by others, including field reports from the Katrina response.^{5,6} Our original disaster plans called for volunteer organizations to open our disaster shelters. As it turned out, volunteer organizations in our community were able to assist with shelter operations, but were not capable of mobilizing the workforce and organizational efforts necessary to open a large shelter in a few hours. Our city government, with hundreds of employees, a well-defined reporting structure, and the necessary equipment, was the entity most capable of accomplishing the feat of opening large community shelters.
6. Communication with multiple community health-care partners was key to the successful operation of our shelters and the coordination of a medical response. During previous disaster drills, we had rehearsed communication with hospitals and other healthcare entities via a “medical hotline,” whereby we established call-in times to a conference call. This proved extremely useful during our Katrina and Rita responses for coordinating direct hospital transfers, staffing our medical triage station, facilitating hospital transfer procedures to and from the shelters, arranging for ongoing healthcare needs, and controlling rumors. In addition, regular communication with local pharmacies, community organizations, and healthcare partners in our community facilitated the medical care of our shelter occupants.
7. Appreciation of volunteers and frequent, honest communication helped us deal with the frustrating effects of confusion and leadership problems at higher levels of government. Problems with the national and state responses to the disaster have recently been investigated by the Congress⁷ and the President⁸ and described in articles detailing local responses.^{9,10} Because our efforts relied heavily on volunteer labor, we were particularly conscious of decisions that wasted the time of our volunteers. Three times during our response, we were informed last-minute of the imminent arrival of evacuees to the Amarillo airport and called our registered volunteers to come to our shelter on short notice, only to have the promised plane never arriving. While our local volunteers continued to serve graciously through these difficulties, we are concerned that they might be less inclined to volunteer for similar situa-

tions in the future. It was also disappointing to see media reports of other facilities being overwhelmed, and yet to receive only a small fraction of the evacuees we anticipated. Although we hope that significant progress can be made on national and state levels to improve the effectiveness of future disaster responses, we recognize that some confusion is an unavoidable consequence of any disaster. For this reason, we also wish to report the strategies that kept the morale of our volunteers high and allowed us to provide excellent care and services to those evacuees we received. Certain circumstances that helped alleviate frustration are unique to a city of our size, such as the ease of travel around the city; after it became clear that volunteers who reported were not immediately needed, for example, it was generally feasible for them to easily return to work or other activities and wait for another phone call. Three strategies that we used, however, are more universally applicable: frequent communication and updates to volunteers about the status of the response; honesty about the uncertainties faced by those in charge; and sincere appreciation of volunteer efforts and time. These strategies are neither novel nor surprising, but we hope that they may be helpful to other managers of volunteer efforts in future disasters.

● Conclusions

Like more than 150 communities in Texas, our community participated in disaster response for Gulf coast citizens evacuated from hurricanes Katrina and Rita. We implemented and adjusted emergency operations plans that were designed to respond to a local disaster. We learned lessons that, we believe, will strengthen our disaster preparedness in the future. These lessons include the importance of a robust medical presence at evacuation shelters; the value of an accurate and timely database of medical needs for shelter occupants; the usefulness of brief paperwork; the need for a preidentified and pretrained group of healthcare workers; the necessity of timely and accurate communications with medical partners in the community; the requirement that our local city government plan, open, and operate disaster shelters in our community; and the impact of ease of travel, frequent and honest communication, and sincere appreciation on maintaining morale in our volunteers.

REFERENCES

1. Knabb RD, Rhome JR, Brown DP. *Tropical Cyclone Report: Hurricane Katrina, 23–30 August 2005*. Miami, FL: US Department of Commerce, National Oceanic and Atmospheric

- Administration, National Weather Service, National Hurricane Center; 2005. http://www.nhc.noaa.gov/pdf/TCR-AL122005_Katrina.pdf. Accessed February 27, 2006.
2. Mattox KL. Hurricanes Katrina and Rita: role of individuals and collaborative networks in mobilizing/coordinating societal and professional resources for major disasters. *Crit Care*. 2006;10:205.
 3. Auf der Heide E. *Disaster Response: Principles of Preparation and Coordination*. St Louis, MO: CV Mosby; 1989. <http://orgmail2.coe-dmha.org/dr/index.htm>. Accessed February 28, 2006.
 4. Campos-Outcalt D. Disaster medical response: maximizing your effectiveness. *J Fam Pract*. 2006;55(2):113–115.
 5. Greenwalt P. Hurricane Katrina response: Camp Gruber. *Okla Nurs*. 2005–2006;50(4):13.
 6. Colgan R, Davis K, Barish RA. Operation lifeline: health care professionals from Maryland respond to Hurricane Katrina. *Md Med J*. 2005;6(4):26–28.
 7. 109th Congress, Select Bipartisan Committee to Investigate the Preparation and Response to Hurricane Katrina. A failure of initiative: final report of the Select Bipartisan Committee to investigate the preparation for and response to Hurricane Katrina [preprint version]. <http://katrina.house.gov/index.htm>. Accessed February 28, 2006.
 8. Federal Emergency Management Agency. Hurricane Katrina information. http://www.fema.gov/press/2005/resources_katrina.shtm. Accessed March 3, 2006.
 9. Sproat S. Overview of the health and medical response to hurricanes Katrina and Rita. *Okla Nurs*. 2005–2006;50(4):13–14.
 10. Page S. Dealing with disaster: hurricanes Katrina & Rita. *Mo Med*. 2005;102:521–523.