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## CLINICAL RESEARCH STUDY

# A Katrina Experience: Lessons Learned

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### ABSTRACT

**PURPOSE:** Almost no data exist on how best to respond to the medical needs of civilians displaced by natural disasters. After Hurricane Katrina destroyed the Gulf Coast and seriously damaged the infrastructure of Jackson, Miss, the University of Mississippi Medical Center (UMMC) was challenged with serving a large group of evacuees at a major Red Cross evacuation shelter near our campus. We reviewed our experiences and share lessons learned.

**METHODS:** This is a retrospective review of administrative and clinical records for patients served by a medical clinic established emergently after Hurricane Katrina.

**RESULTS:** Red Cross regulations precluded their volunteers from providing medical care other than first aid. Faced with numerous evacuees seeking medical assistance, UMMC established an ambulatory clinic at the shelter. The majority of patients had multiple medical problems, no medical insurance, and limited ability to purchase medications. The greatest need was for management of chronic illnesses. The clinic provided 2394 patient visits and filled more than 4902 prescriptions over 17 days.

**CONCLUSION:** While medical facilities have emergency response plans for epidemics and mass trauma, little attention has focused on plans for care of evacuated populations. Shelter operators should consider advance coordination of medical care with existing health care systems. Medical facilities along evacuation routes should be aware that they may be asked to provide care for sheltered evacuees. © 2006 Elsevier Inc. All rights reserved.

**KEYWORDS:** Emergency preparedness; Natural disasters; Chronic disease; Disaster plans

On August 29, 2005, Hurricane Katrina made landfall on the Gulf Coast as a Category 4 storm. Orders were issued for evacuation of the Gulf Coast counties on August 27-28, 2005.<sup>1</sup> Interstate 55, originating in New Orleans, La, and US Highway 49, originating in Gulfport, Miss, brought thousands of evacuees to Jackson, Miss, the state capital, 180 miles due north of the Gulf of Mexico. On August 27, the American Red Cross opened a hurricane evacuation shelter in the 10,000-seat, 6237 square meter (67,140 square foot) Mississippi Coliseum and the adjacent 2364 square meter (25,449 square foot) Mississippi Trade Mart at the Mississippi State Fairgrounds in Jackson.<sup>2</sup> These facilities

rapidly filled with evacuees from Mississippi and Louisiana, peaked at a population of over 1600 the first week, and remained open until September 15, 2005.

During the afternoon of August 29, Katrina came north through Jackson, and the city experienced sustained winds of 63 miles per hour, with gusts of 84 miles per hour.<sup>3</sup> The winds caused significant infrastructure damage with widespread power, telephone, and cell phone outages lasting from days to more than 2 weeks.<sup>4,5</sup> The University of Mississippi Medical Center (UMMC) disaster plan was activated to receive casualties from the south, while automobile gas shortages developed as few service stations had electric power and fuel deliveries were interrupted.<sup>6</sup>

The UMMC, Mississippi's only academic health center, is composed of 7 hospitals located approximately 3 miles from the Mississippi State Fairgrounds. Physicians quickly became aware of the presence of large numbers of chronically ill evacuees as they began to present to area emer-

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gency rooms. We also discovered that American Red Cross evacuation shelters provide basic first aid for shelter residents and refer all other medical care to community health care providers.<sup>7</sup> To provide care for the evacuees and to conserve existing medical facilities for acutely injured individuals, we organized and staffed a free health care clinic at the evacuation shelter from August 30 until September 17, 2005 (Figure 1). In this article, we describe our experience with the organization, staffing, and administration of this facility.

## METHODS

On August 30, 2005, the Chair of the Department of Medicine called a meeting to organize the department's response to the hurricane. Among other actions, a physician team was dispatched to the Red Cross shelter at the Mississippi State Fairgrounds to assess needs and resources. The urgent need for onsite medical services was identified, and permission was obtained from the shelter supervisor to establish a clinic. The department chair appointed a physician with experience in public health to serve as the medical director, a doctor of pharmacy with mission experience to serve as the pharmacy director, and an administrator with experience in clinical services to serve as the administrator of what came to be called the "Katrina Clinic." We reviewed clinic notes, e-mails, patient encounter and pharmacy records, photographs, newspaper articles, and American Red Cross operational manuals in the preparation of this report. Patient encounter records were entered into a Microsoft Access database, and analyzed in Microsoft Excel (Microsoft Corporation, Redmond, Washington). Computer-

based searches of the medical literature published in English were used in our attempt to identify models to guide the development of our response.

## RESULTS

The clinic medical, pharmacy, and administrative directors mobilized a large team of volunteers and worked continuously to improve the efficiency of relief efforts. The clinic registered patients from 1 PM to 3 PM and was open to complete care for at least another hour daily. Staff meetings took place before and after each clinic. The Red Cross coordinated security with local law enforcement, as well as the National Guard. Modifications in the scope of service and location of clinic operations were required each day as circumstances and patient populations constantly changed.

## CLINICAL SIGNIFICANCE

- No published guidelines exist for developing a medical care system for sheltered populations during natural disasters.
- Medical centers, especially academic medical centers, should be prepared to provide chronic disease care, including medications, for sheltered individuals during natural disasters.
- This article should be a guide for planning and preparedness.

## Communications Issues

Telephone outages were expected after the hurricane, but we did not anticipate that damage to cell phone towers would result in limited and unpredictable cell phone service. The hospitals functioned on "weekend staffing" schedules because many employees were initially unable to reach their work places because of damage to their homes and blocked roads. Fortunately, the number of Emergency Department patients needing treatment for acute injuries was fewer than expected.

Functional e-mail within the medical center provided a mechanism for rapid recruitment of volunteers and for clinic organization. A single administrative assistant was given the task of compiling a list of potential personnel classified

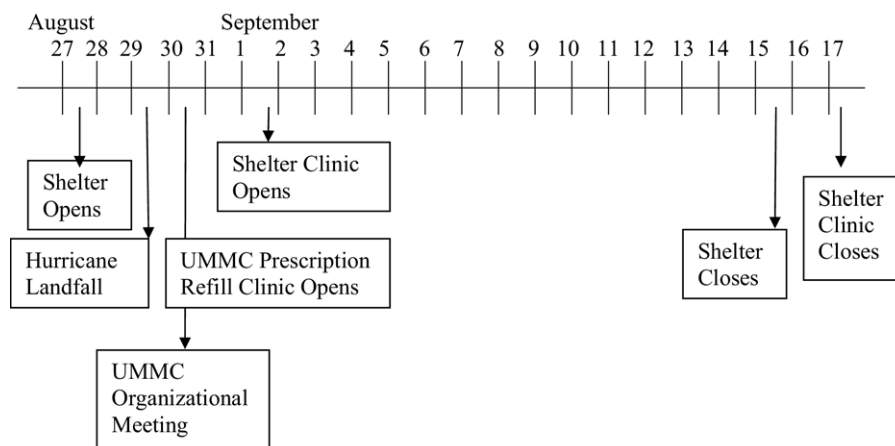


Figure 1 Chronology of Katrina-related activities.

by profession and level of expertise along with appropriate contact information. More than 375 individuals from our campus, local communities, and later, from out-of-state, volunteered to help during this period.

## Clinical Services

**Providers.** The clinic directors identified individuals in adult and pediatric primary care, pharmacy, nursing, and administrative services to coordinate volunteers in their respective areas. Other needs such as dental, psychiatric, obstetric, dialysis, and asthma care services became apparent as the clinic progressed, and volunteer coordinators were assigned in these fields as well. Clinical volunteers were required to have active medical licensure or to be trainees enrolled in professional programs at the Medical Center. We were able to include out-of-state physicians and nurses in our clinic operations, as state law allows physicians and nurses with licenses in other Emergency Management Assistance Compact member-states to be deemed licensed in Mississippi.<sup>8</sup>

Although the original plan was to operate the Katrina Clinic for a week or less, many evacuees were unable to return to their homes and interim care had to be provided until long-term health care arrangements could be made. Cooperation was sought from local, federally funded community health clinics that were in a position to provide long-term care, regardless of ability to pay. Transportation to those clinics was arranged by Red Cross volunteers, largely through local churches and individuals with vans or buses. Medical professionals opened several small medical shelters at local churches during the second week of September. These allowed us to refer some chronically ill patients and families with pregnant women to a more medically secure environment.

## Clinical Operations

**Space.** Fortunately, electrical power remained on at the shelter and at UMMC while most of the city and region experienced outages. When the Katrina Clinic opened, the original space occupied for medical evaluation was 320 square meters (3447 square feet), curtained off from the living space of the evacuees. The pharmacy was housed in a large recreational vehicle (RV). Clinic and pharmacy services were eventually moved to secure space within the shelter.

**Supplies.** We developed a simple but specific list of supplies required for daily operation (Table 1). The shelter initially experienced difficulties locating enough electrical outlets to power continuous positive pressure devices (CPAP), nebulizers, and oxygen concentration machines. This problem was rapidly identified and alleviated by Red Cross personnel working with facility staff.

**Daily Staffing.** The Red Cross leadership was unclear how long the shelter would be open. For this reason, the administrative director and administrative volunteers developed job titles and descriptions and used this information to develop a list of prospective volunteers needed to operate

**Table 1** Suggested Supplies for a Shelter Medical Clinic

Administrative	Filing system	
	Maps and written directions for patients	
	Medical and pharmacy forms	
	Paper, pens, staplers, scissors	
	Signage	
	Tables and chairs	
	Xerox machine, facsimile machine, computers with printer, telephone lines, cellular telephones	
	Medical	Blood pressure cuffs (all sizes)
		Disposable sheets and gowns
		Examination tables and disposable covers
Gloves, wipes, alcohol pads, hand sanitizers		
Glucometers and supplies		
Local anesthetics		
Nebulizers and tubing		
Needles and syringes (including vaccine syringes)		
Otoscopes and pen lights		
Prescription pads		
Soap and antiseptics to clean wounds		
Suture kits		
Thermometers and thermometer covers		
Tongue blades		
Sharps containers		
Wheelchairs, crutches, walkers		

each service on an ongoing basis (Table 2). Although the clinic operated for 3 hours each day, many volunteers were needed to organize and re-supply the clinic and pharmacy before and after the clinic hours.

A threat to the clinic staffing occurred when gasoline became limited shortly after the hurricane.<sup>6</sup> Leadership at UMMC were able to secure gasoline from another region and to establish a supply system for medical center employees. This became available on September 6 and remained operative until September 27. Additionally, medical center administration established a temporary daycare service for employees with children, as most schools and daycare centers were closed.

**Medical Records.** An encounter form was developed and revised as needed over time. There were 2394 patients cared for in the clinic and of those, 2299 had records available for analysis. Forty-three percent of the patients were triaged to the pharmacy unit only, 55% were triaged to the medical unit, and 2% received dental care. The majority of patients (78%) seen in the medical unit also received prescriptions. The average patient age was 40.6 years, 15% were children 18 years of age or younger and 10% were adults aged 65 years or older. Most of the population were African-American and 62% were female (Figure 2). Of the 1696 patients for whom home state was listed, 79% were from Louisiana and 20% were from Mississippi. Of the 1142 patients with medical insurance information recorded, 23% had private insurance, 13% had Medicaid, 10% had Medicare, 1% had both Medicaid and Medicare, and 53%

**Table 2** Job Titles and Descriptions of Personnel for the Katrina Clinic

Personnel	Duties
<b>Administrative*</b>	
Administrative Director	Oversees operation/implementation of administrative functions Coordinates with UMMC main campus Coordinates with shelter manager Oversees set up of clinic Assigns personnel to administrative functions
Clinic Manager	Recruits and schedules volunteers Collects volunteer licensure documentation Registers volunteers/maintain volunteer database Coordinates EMS/ambulance and other transportation
Registration	Collects demographics and insurance information Witnesses consent to treatment signature
Runner	Performs miscellaneous duties (patient direction, run errands, assist in clinic organization)
Discharge Assistants	Collects and files patient forms Distributes maps/directions
<b>Medical</b>	
Medical Director	Reviews set-up with Administrative Director before clinic opening Assigns medical team leaders Troubleshoots as needed in all phases of medical evaluation Serves as liaison with other medical facilities, and volunteer agencies/hospitals/clinics and personnel
Medical personnel	Serves as media spokesperson for clinic Examine and evaluate patients Administer or initiate treatment
Nursing personnel	Write prescriptions for pharmacy-only patients Obtain vital signs Assess chief complaint Obtain medication list and allergies Note any special needs Triage to appropriate medical evaluation station (general medical, pediatric, asthma treatment, dental, mental health, obstetrics, etc.)
Pharmacy	Fill prescriptions with donated medicines (substituting as needed) Solicit and organize medication donations Ensure security of medications during and outside of clinic hours Educate patients on use of medications Update clinicians on current medication stock, etc. Procure pharmaceuticals

\*We suggest a Director of Procurement be added (see text).

had no insurance. For those with no insurance information recorded, it is reasonable to estimate that most had no medical insurance. Therefore, approximately three fourths of the patients were uninsured. The shelter population continuously fluctuated as new evacuees arrived and others went to smaller shelters, friend's homes, or hotels. The number of evacuees in the shelter had little impact on the number of patients seen in the Katrina Clinic (Figure 3).

**Pharmacy Services.** Most patients seen in the Katrina Clinic needed prescription medications. Many of the hurricane evacuees left the Gulf Coast with only enough prescription medications to last for a day or 2. Our first tasks were to write prescriptions, identify the few pharmacies that were open to fill them, and to obtain medications for those who could not pay. On August 30, UMMC opened a temporary prescription refill service on the main campus using sample drugs from pharmaceutical representatives and phy-

sician offices. The Katrina Clinic and Pharmacy opened at the shelter on September 1 (Figure 1) and absorbed the campus operation.

The onsite pharmacy at the Katrina Clinic was staffed with licensed pharmacists and other volunteers. Storage and security of large quantities of donated drugs, which arrived daily, and separation of useful and in-date drugs from less useful or outdated ones, required a large secure space and coordination of many volunteers.

The onsite pharmacy operated for 17 days and filled more than 4902 prescriptions. The number of recorded prescriptions filled (4902) is a gross underestimate, as many people had prescriptions written, but not recorded on the medical record form. Originally, we dispensed a 14-day supply of medications but realized this would not meet the needs of this population. Therefore, when possible, a 30-day supply was provided. Another challenge included the length



**Figure 2** Evacuees in the living area of the Red Cross shelter the Jackson, Mississippi Coliseum on the state fairgrounds, September 2005. Photo courtesy of the *Clarion Ledger* and used with permission.

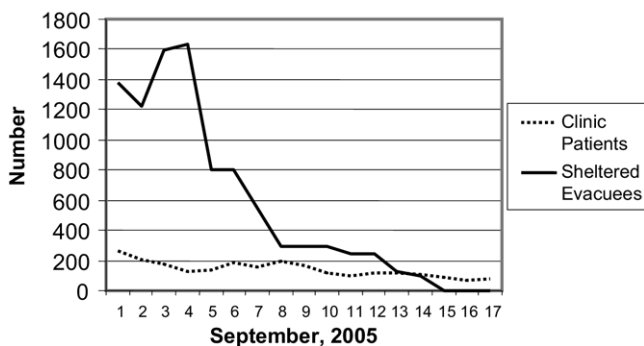
of time it took to acquire the most needed medications and supplies for chronic diseases (Table 3), as these medications are not typically stocked in warehouses or coordinating centers for disaster response. As the scope of the disaster became clear and many residents realized they no longer had homes to which to return, medications for depression, anxiety, and other psychiatric disorders were increasingly requested. The initial need for antibiotic, antifungal, and antiparasitic agents was low but also increased over time. For certain needs, such as antiretroviral drugs, dialysis, or methadone therapy, arrangements were made for referral to clinics or physicians identified by the clinic staff. Ameri-cares (Stamford, CT) and MAP International (Brunswick, GA), along with several pharmaceutical companies, played a vital role in organizing and obtaining the contributions of medications needed for this population.

Assistance was also requested and obtained from local retail pharmacies. Wal-Mart and Walgreen Pharmacies joined the clinic operation at the shelter. They were especially helpful in providing generic medications, which were

in short supply among the donated drugs. Their representatives received prescriptions onsite, filled the prescription at their local retail sites, and delivered them back for dispensing at the shelter at a minimal or no cost to the patient.

**DISCUSSION**

Hurricane Katrina posed challenges and opportunities for our academic health center. A large number of evacuees with chronic medical conditions and few resources were



**Figure 3** Number of Katrina Clinic patients and onsite sheltered evacuees by day, September 2005.

**Table 3** Medication Categories Prescribed at the Katrina Clinic

Medication Category	Number (%) Prescribed
Cardiovascular*	1512 (30.8)
Antihistamine/decongestants	490 (10.0)
Psychotropic†	437 (8.9)
Analgesics	430 (8.8)
Diabetes	390 (8.0)
Asthma	360 (7.3)
Tetanus/diphtheria vaccine	305 (6.2)
Antibiotics	284 (5.8)
Gastrointestinal drugs	237 (4.8)
Sleep aids	79 (1.6)
Local antibiotic and steroid creams‡	73 (1.5)
Antiepileptics	62 (1.3)
Birth control pills	35 (0.7)
Muscle relaxers	28 (0.6)
Osteoporosis	21 (0.4)
Miscellaneous other	159 (3.2)
<b>Total</b>	<b>4902 (100)</b>

\*Largely antihypertensives, but also medications for heart failure, dyslipidemia and arrhythmia.

†Largely antidepressants but also antipsychotics and anxiolytics.

‡An underestimate as most creams and ointments that were distributed were without a prescription and therefore not recorded.

**Table 4** Important Contacts for Planning

Academic Medical Center Contacts	Upper level administration Departmental Chairmen Point persons for staffing Medical Nursing Pharmacy Administration Social work Campus Police (for after hours on campus access)
For clinic organization and cooperation	American Red Cross Emergency Management agencies Health department Centers for Disease Control and Prevention Director of clinic physical facility
For patient referral	Local medical clinics Transportation resources (local churches and other volunteers)
For supplies and assistance	Ambulance services Pharmacy supply resources: Americares MAP International Local retail pharmacies Pharmaceutical company representatives Medical supply companies Home health care companies

housed near the medical center. Had the expected number of acutely injured patients arrived in our storm-damaged city, it is improbable that the medical support provided to the shelter evacuees would have been possible. Thus, state, regional, and hospital disaster plans must be prepared to provide for the care of displaced individuals with chronic diseases, as well as for those with the acute injuries usually associated with natural disasters. Planning should include networking with other agencies and organizations (Table 4).

Although the American Red Cross is internationally recognized for its response to disasters, the specifics of its mission are often unclear to local medical personnel. The specific health-related aims of the American Red Cross include the provision of first aid and identification of local resources to meet the health needs of people affected by disaster.<sup>7</sup> Thus, we learned from this experience that although the Red Cross response to disasters is rapid and broad, that response is not designed to meet the health care needs of a population sheltered for days or weeks except through arrangements made with local providers.

Motels and hotels in our region were filled with evacuees who could afford to pay. Individuals in the shelter at the Mississippi Coliseum included disproportionately large numbers of evacuees with chronic medical conditions and

limited financial resources. Although demographic data on populations from similar shelters opened for natural disasters are not available, we postulate that this socioeconomic profile is consistent with most shelters. Thus, the health care needs of evacuees in these shelters can place significant financial demands on medical services.

We learned from our experience that a medical response to the needs of a sheltered population includes: a defined leadership group, a system of communication, an effective organizational plan, on-site management of medical services, availability of pharmacy support, security services, and a referral system for chronic care. The 2 biggest risks to the effectiveness of this response were the communications system and the shortage of fuel for volunteers. The availability of satellite-based telephone and wireless Internet access will be vital to the success of similar efforts in the future.

Our record-keeping was rudimentary, although adequate for our needs. It would have been facilitated by having a form prepared before its need. An accurate medical and medication history was difficult and time-consuming to obtain, as many patients had multiple chronic illnesses, were on multiple prescription drugs, and had brought no records with them. A solution would be the population-wide implementation of a personal medical information form. The Centers for Disease Control and Prevention has developed the Keep It With You—"KIWY" form that contains patient history and current medications, as well as other pertinent information.<sup>9</sup> Licensure documentation for all professional volunteers and close supervision of medical and pharmacy services by the directors are essential for the protection of patients.

Rapid acquisition and organization of supplies is critical to providing an efficient response. The medical and pharmaceutical supplies donated for the Katrina Clinic were abundant but frequently inappropriate, out of date, or not needed. Fortunately, local retail pharmacies participated to provide otherwise unavailable medications. A designated director of procurement will improve the efficiency of supply acquisition, organization, and distribution. We have added this position to our personnel list (Table 2).

An exit strategy should be kept in mind. The goals of the clinic and the indicators used to determine when these goals have been met should be determined early on. Thought also should be given to the needs of patients who may have obstetric, dialysis, postoperative, psychiatric, oncologic, organ transplantation, or life support requirements.

Because of the diversity and quantity of health care professionals within academic health centers, they will be called upon to assume a leadership role in response to natural disasters. In the event of such disasters, emergency departments may be overwhelmed by trauma victims and have limited capacity to meet the needs of patients with nonemergent acute or chronic diseases who could more appropriately be managed elsewhere. Moreover, existing hospital clinics may not be operational for extended periods. Thus, an alternative ambulatory care system in close proximity to evacuees should be considered in advance.

## CONCLUSION

We could find no published guidelines that describe a model for developing a system of care for sheltered populations during natural disasters. Recognizing that the type of response needed will vary depending on the situation, location, and resources, an emergency response plan that addresses care beyond first aid is important. Medical centers in general and academic health centers in particular should have a plan in place to provide care for large numbers of individuals housed in shelters during such natural disasters.

The Katrina Clinic experience refreshed the spirit of professionalism and service that motivates health care providers to choose careers in the healing professions. At a critical time for our region, volunteers made personal sacrifices to assist in this effort. They brought credit to the health care profession and themselves. We salute them.

## ACKNOWLEDGMENT

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## References

1. Mississippi Emergency Management Agency. Mississippians urged to take precautions for Hurricane Katrina. August 28, 2005. Available at: <http://www.msema.org/newsreleases/documents/katrina8.28.05.doc>. Accessed March 24, 2006.
2. Lake R. A day in the life. *Clarion Ledger* [serial online; Available at: <http://www.clarionledger.com/>]. September 6, 2005; 8A. Accessed March 22, 2006.
3. National Weather Service Forecast Office. A look at hurricane Katrina. Available at: <http://www.srh.noaa.gov/jan/katrina>. Accessed March 24, 2006.
4. Mississippi Emergency Management Agency. Hurricane Katrina update. September 12, 2005. Available at: <http://www.msema.org/newsreleases/5pmupdate91205.doc>. Accessed March 24, 2006.
5. Valcourt J. Katrina's fatal blow. *Clarion Ledger* [serial online; Available at: <http://www.clarionledger.com/>]. September 1, 2005; 9A. Accessed March 23, 2006.
6. Lindsay A. Hurricane Katrina. *Clarion Ledger* [serial online; Available at: <http://www.clarionledger.com/>]. September 6, 2005; 1B. Accessed March 23, 2006.
7. American Red Cross. Disaster Health Services ARC 30-3042: 1998:16.
8. Mississippi Code of 1972 as amended, Emergency Management Assistance Compact of 2000, Title 45, Chapter 18-3, Article 5. April 17, 2000.
9. Centers for Disease Control and Prevention. Keep it with you: Personal medical information form. Available at: <http://www.bt.cdc.gov/disasters/hurricanes/katrina/kiwy.asp>. Accessed April 12, 2006.