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A Mobile Medical Care Approach Targeting Underserved Populations in post-Hurricane Katrina Mississippi

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Abstract: On August 29, 2005, Hurricane Katrina devastated the Gulf Coast Mississippi region, damaging health care infrastructure and adversely affecting the health of populations left behind. Operation Assist, a project of the Children's Health Fund and the Columbia University Mailman School of Public Health, operated mobile medical units to provide health services to underserved populations in the affected areas. Data collected from all patient encounters from September 5–20, 2005 demonstrate that in addition to common respiratory illnesses, skin conditions, and minor injuries, a high proportion of visits were for vaccine administration and chronic medical problems including hypertension, diabetes, and asthma. Mobile medical units staffed by primary care clinicians experienced in dealing with the clinical and social needs of the underserved and comfortable working in a resource-poor environment can make a positive contribution to post-disaster care.

Key words: Disaster medicine, underserved communities, mobile medical services, hurricane relief.

Background

On August 29, 2005, Hurricane Katrina struck the Gulf Coast of Mississippi, causing widespread and catastrophic damage to the lives, homes, and businesses of the region. There was extensive physical damage to the medical infrastructure that severely limited access to hospitals and their emergency departments, private clinics, public community health centers, dental and mental health clinics, pharmacies, and many other health-related facilities. This destruction, coupled with the displacement and loss of medical personnel, created a vacuum of care, almost eliminating acute, primary, and tertiary care in the immediate period after the hurricane hit land.

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In spite of the overall chaos, medical emergency response teams were able to set up critical care and triage locations at key sites throughout Southern Mississippi, and local and volunteer emergency medical services managed to transport the critically ill and injured. However, in this environment, patients with chronic medical problems lost access to the resources that existed prior to the storm and were left on their own. Medicines were lost, equipment was damaged, and phone service and transportation were eliminated by the hurricane's destruction. Previously manageable health conditions became dangerous, as diabetes, hypertension, asthma, and other chronic diseases went untreated. In a number of limited health assessments, these medical problems topped the list of health concerns for people affected or displaced by Katrina.^{1,2}

A primary care disaster response team, Operation Assist (OA), was launched as a joint effort by the Children's Health Fund (CHF) and the Mailman School of Public Health at Columbia University to respond to the immediate health care needs of the region and to restore lost health care resources.* Two mobile units staffed by clinical teams from the CHF network were deployed to the Gulfport-Biloxi areas of Mississippi and arrived in the region on September 5, 2005.⁴ Designed for self-sufficiency, the mobile units are recreational vehicles outfitted with two fully functional examination rooms, a nursing station, a registration area, storage areas for medications and supplies, and refrigeration for medications and vaccines.† The CHF clinical teams have an expertise in providing primary care to underserved communities, such as homeless shelters and public housing communities, in both urban and rural settings.³

Operation Assist teams focused their medical outreach efforts on populations known to be medically underserved prior to Katrina's landfall. The versatility of the mobile medical units allowed the teams to reach these people who were otherwise cut off from health services. They afforded great flexibility in providing clinical care to shifting geographic areas of need post-Katrina and to a wide variety of locations, such as indigent neighborhoods, public housing complexes, shelters, motels, houses of worship, community centers, demolition/construction sites, and relief centers. Mobile units allow for immediate and ongoing provision of care to a large number of people as was needed in post-Katrina Mississippi.⁵

This paper will examine the role of mobile medical units in disaster scenarios, contextualize and quantify patient visit data, examine the most common diagnoses encountered, chronic illness in particular, in this patient population, and draw lessons for future disaster relief situations. The knowledge gained from such an analysis can help responders prepare not only for the acute health care needs resulting from a

* The CHF is a nonprofit organization dedicated to the health and well being of underserved children and families in the United States. The CHF network provides direct clinical care, regardless of ability to pay, at 21 sites throughout the nation. The CHF has developed a model of health care delivery in which a mobile medical program becomes the medical home within the community served. Each mobile program is affiliated with an academic medical center or community health center, which functions as a resource for referral and specialty care. Columbia University's Mailman School of Public Health is an academic public health institution dedicated to the understanding and development of policy and practice to better the health of people worldwide.

† The CHF deployed similar mobile medical unit-based teams to the Baton Rouge/New Orleans and Houston areas during this same time period.

disaster, but also for those medical needs of the chronically ill that are exacerbated by the loss of the health care infrastructure.

Methods

Data collection. Data were collected from two Children's Health Fund (CHF) mobile medical units at 23 sites for all patient visits in the Gulfport/Biloxi area between September 5–20, 2005. Each patient visit was recorded in a chart that included information on the reason for visit (chief complaint), a brief description of the problem, physical exam, assessment/diagnosis, and plan. The reason for visit was collected to identify any vaccine or pharmaceutical needs that might not have been identified had only the diagnoses been collected. Two reviewers examined each chart and collected data that were consistently available: age, sex, race, reason for visit (chief complaint), diagnoses, vaccines administered, medications and/or prescriptions given, referrals made. All data were compiled into a Microsoft Excel spreadsheet form.

Data consolidation. In order for the data to be more easily analyzed, understood, described, and compared with previously published data on health care needs and services provided to similar populations after Katrina, the authors consolidated the data points into reproducible categories. The final categories agreed upon by the research team were similar to those used in a previous Centers for Disease Control and Prevention (CDC) publication,⁶ but also included categories that were more detailed than those used by the CDC. A similar process was used with the variable of race, wherein the authors consolidated a variety of self-identified race designations into categories used by the U.S. Census.

Data analysis. Counts and frequencies for each of the categories were determined using the pivot table and statistical and function capabilities of the Excel program. In addition to the counts and frequencies of the consolidated categories, counts and frequencies of specific reasons for visit and diagnoses for the whole set of patient visits as well as for each of three age groupings (0–21 years, 22–65, older than 65) were examined.

Results

Demographics. Between September 5–20, 2005, a total of 1,205 patient encounters occurred (Table 1). Fifty-four and four tenths percent ($n=611$) of encounters that had a sex documented ($n=1,123$) were female. Of those encounters that had a documented age ($n=1,057$), 29.0% ($n=296$) were between the ages of 0–21 years, 64.2% ($n=677$) between 22–65 years, and 6.8% ($n=72$) were over age 65 years. Encounters that had a documented race ($n=839$) included 61.9% ($n=519$) African Americans, 19.7% ($n=165$) Asians, 11.8% ($n=99$) Caucasians, 5.7% ($n=48$) Hispanic/Latinos, and 1% ($n=8$) other. The majority (98%) of individuals in the Asian category identified as Vietnamese. The Hispanic/Latino category included individuals who identified themselves as Mexican, Honduran, Guatemalan, Chilean, and Brazilian. The other category was made up of individuals who identified as biracial, brown, and Native American.

Reasons for visit. There were a total of 1,187 patient encounters with a documented

Table 1.
DEMOGRAPHIC CHARACTERISTICS
OF PATIENTS ENCOUNTERED

Patient characteristics	Patient encounter with documented characteristic	
	n	(%)
Total	1205	100.0
Sex (n=1123)		
Female	611	54.4
Age (n=1055)		
0–21 years	296	29.0
22–65 years	677	64.2
>65 years	72	6.8
Race (n=839)		
African-American	519	61.8
Asian	165	19.6
Caucasian	99	11.8
Hispanic/Latino	48	5.7
Native American	1	.1
Other	7	.8

reason for visit that generated 1,428 reasons for visit, as many individuals had multiple reasons (data not shown). The most frequently documented reasons that individuals visited the mobile units was for vaccines (53.7% of all persons with a reason for visit, n=638) and pharmacy needs (12.6%, 149). Within each of the three age groups, vaccination was the number one reason for visit. Pharmacy needs were more frequently a reason for visit in the two older age groups. The vast majority (98%) of vaccines requested and distributed to individuals were tetanus (Td). Hepatitis A vaccines were also requested and distributed, but to a smaller number of individuals (n=22, 2.8%). The category of pharmacy visits includes all individuals who requested refills on medications, the majority of which were for chronic illnesses that existed prior to the storm.

Diagnoses. The most frequent diagnoses in those individuals who had at least one diagnosis documented were respiratory, circulatory, minor injury, skin conditions, and endocrine (Table 2). In the circulatory category, the most common specific diagnosis was hypertension. Upper respiratory tract infection and asthma were the two most common specific diagnoses of the respiratory category. Minor injury diagnoses included abrasions, lacerations, and puncture wounds. Skin condition diagnoses included mostly dermatitis, fungal, and bacterial skin infections. The endocrine diagnoses were primarily diabetes mellitus.

The top three diagnosis categories for the 0–21 years age group included respiratory conditions, skin conditions, and minor injury. (Table 3). For the 22–65 age group the top three diagnosis categories were circulatory conditions, respiratory conditions, and

Table 2.**TEN MOST COMMON DIAGNOSIS CATEGORIES**

Diagnosis categories	n	% All diagnosis categories	% All persons with a diagnosis
Respiratory	175	17.1	27.8
Circulatory	174	17.1	27.8
Minor injury	120	11.8	19.2
Skin conditions	117	11.6	18.8
Endocrine	68	6.7	10.9
Other	62	6.1	9.9
Gastrointestinal	56	5.5	8.9
Mental health	41	4.0	6.5
Environmentally induced illness	35	3.4	5.6
Neurologic	29	2.8	4.6

minor injury. Members of the older than 65 age group were most commonly diagnosed with circulatory, endocrine, and respiratory problems.

The proportion of patients with chronic diseases (e.g., diabetes mellitus, high blood pressure and other cardiovascular disease, and asthma or chronic obstructive pulmonary disorder)⁷ increased with age (Table 4). Of the 0–21 year old age group, 18.1% had a chronic disease diagnosis (mainly asthma). In the 22–65 year old age group, 39.2% had at least one chronic disease (primarily hypertension and diabetes). Two-thirds (67.3%) of individuals older than 65 years had at least one chronic disease diagnosis (primarily hypertension and diabetes).

Discussion

Population served. The OA clinical teams sought the assistance of a local community health center partner, community leaders, government officials, the Red Cross, and the

Table 3.**PERSONS WITH AT LEAST ONE OF MOST COMMON DIAGNOSIS CATEGORIES BY AGE GROUP**

	0–21 Years			22–65 Years			>65 Years	
	n	%		n	%		n	%
Respiratory	78	41.5	Circulatory	131	34.5	Circulatory	38	77.6
Skin conditions	59	31.4	Respiratory	84	22.1	Endocrine	13	26.5
Minor injury	38	20.2	Minor injury	73	19.2	Respiratory	9	18.4

Table 4.**CHRONIC ILLNESS DIAGNOSES BY AGE GROUP**

	0–21 Years		22–65 Years		>65 Years	
	n	% ^a	n	% ^a	n	% ^a
Asthma	31	16.5	28	7.4	0	.0
COPD	0	.0	1	.3	2	4.1
Diabetes	2	1.0	46	12.1	13	26.5
Hypertension	1	.5	99	26.1	29	59.2
Other cardiovascular diseases	0	.0	13	3.4	6	12.2

^aPercentage of individuals with at least one diagnosis.

Salvation Army in finding communities largely isolated from ongoing relief efforts. These communities were often found in public housing complexes or at houses of worship that doubled as relief centers. The populations found at these sites were predominantly African American and Vietnamese.

As a result, the demographics of the patient population served in this effort diverged significantly from the demographics of Harrison County, Mississippi, where this effort took place. For 2005, the population of Harrison County was 71.1% Caucasian, 22.5% African American, 2.9% Asian, and 2.5% Hispanic or Latino.⁸ The population that sought services in this study were predominantly African American with nearly 6-fold higher percentage of Asians and 2-fold higher Hispanic/Latino population than that found in the pre-hurricane general population.

It is possible that the most economically disadvantaged populations were less able to escape the destruction of Hurricane Katrina, a circumstance seen in New Orleans. If those populations were also primarily made up of minority group members it would explain why a larger percentage of minorities sought care from the mobile units.

Reasons for visit. The predominant reason individuals visited the OA mobile medical teams was vaccination (44%), primarily for tetanus (Td). This seems to be a high percentage, though it is difficult to find a comparison in the literature. In one study of post-Katrina illness and injury, 11.6% of visits were for tetanus immunization only, but the publication does not comment on what percentage of individuals with other reasons for visit were immunized.⁶ The high percentage of tetanus vaccination in this study is likely due to multiple causes. A combination of health official recommendations and lost vaccination records led to many patients seeking tetanus protection. It is unclear how many patients were over-immunized by this drive. Many so-called *worried well* patients came to the mobile medical units healthy, but seeking out vaccinations and post-disaster health information for themselves and their families. One last factor that may explain the large number of requests for tetanus vaccination is the fact that the Operation Assist teams provided care to a significant number of the demolition/construction crews. Many of these patients were undocumented laborers with no history of previous vaccination.

Another important finding is that 12.6% of people came with a specific request for medication(s) or medication refill. This is not surprising considering the number of individuals with chronic diseases. With the flooding of residences, hurried evacuations, and widespread population displacements, medications were frequently destroyed or lost. Access to pharmacies immediately after the storm was very limited due to damage, destruction, and/or inaccessibility due to loss of public and private transportation. Access to information on where and how to get medication replacement and refill was limited after the storm as well. A retrospective review of clinical and pharmaceutical records from a Red Cross shelter in Jackson, Mississippi showed that 43% of visits to the clinic were for prescriptions only, primarily for chronic disease, with cardiovascular drugs topping the list at 30.8% of prescriptions given. Interestingly, the population served was predominantly African American, 79% from Louisiana and, of those that listed health insurance status, 53% uninsured.⁹

Diagnoses. Key phenomena emerge from the information gathered in this effort: the frequent presentation, exacerbation, and vulnerability of chronic medical problems after a disaster, and, thus, the importance of primary care in a post-disaster setting. A large percentage (35.0%) of the overall patient population seen had at least one chronic disease diagnosis (such as hypertension, asthma, or diabetes). Even more striking was that the older the patient, the more likely they were to have one or more chronic illnesses, and the care they sought was directly related to that chronic illness. Our findings were consistent with surveillance data in evacuation centers¹⁰ though with a slightly lower proportion of chronic illness than that found in a survey of Orleans and Jefferson Parish, Louisiana households.¹¹ These findings underscore the point that, though experts in disaster, emergency, and trauma medicine may be valuable in a post-disaster setting, primary care clinicians knowledgeable in the treatment of common acute and chronic disease are as important for the short and long-term recovery of populations, especially underserved populations, after a disaster.

Limitations. The areas of service and thus the populations focused on by the mobile medical teams were mission-driven. Therefore, a selection bias towards minority, low-income, and previously underserved populations was expected. While this limits the generalizability of the findings to all socioeconomic and racial/ethnic groups, it still gives important information that can guide health care providers who will serve populations left behind in areas with massive infrastructure disruption.

The initial data were collected by clinicians making up the medical teams from multiple locations around the country utilizing non-standardized data collection tools and various permutations of medical records. Thus, there was wide variability in quantity, quality, and consistency of data reporting. For both of these reasons, missing data or inconsistencies in data were found when collecting information to enter into the database.

The study team attempted to address these problems by standardizing categories for race, reason for visits, and diagnoses via a consensus process. This grouping and categorizing may have obscured more specific information. It is also possible that cases may have been misclassified, particularly for conditions that could be classified under multiple diagnostic categories; however, all original data prior to categorization were still available to the study team for analysis.

Implications

The utility of mobile medical care. As a mobile medical program, Operation Assist filled a specific niche in the chaotic post-Katrina environment. In Mississippi, the hurricane put public and private transportation out of commission, making it difficult for residents to seek assistance beyond their neighborhoods. The Operation Assist mobile medical units had a distinct advantage in providing access during the post-Katrina period. The mobile medical units

- allowed for community outreach to identify people in need of health care who might have suffered adverse health consequences and bring care to their doorstep;
- had the ability to search for patient populations who had become isolated from the wider community after the disaster;
- were self-contained and brought a wide range of medical services and medical supplies, including medications and vaccinations, to populations cut off from care;
- served for a long period of time as a substitute until permanent clinics were up and running.

As an example, the Gulfport, Mississippi mobile medical unit has now become a permanent site in the CHF network, serving the underserved in Harrison County.

It is important, also, to mention that there were some disadvantages to the mobile medical approach. External factors such as disruption of roadways (due to flooding and downed trees, for example) and availability of gas affected provision of care. Likewise, internal mechanical problems and availability of mechanics knowledgeable in the repair of such vehicles also limited their use at times. Finally, due to space constraints, limited supplies could be carried at one time so storage facilities and supply lines had to be identified and maintained.

Disaster-based primary care medicine. In conjunction with the limited data available from surveillance and operational studies of the post-Katrina medical environment, our data emphasize the need to address patients with chronic medical problems and primary care medicine in disaster situations.^{9,12-14} *Disaster-Based Primary Care Medicine* is one way in which to organize thinking and planning for a robust medical response to natural or man-made disasters, in particular those that cause widespread destruction (I.E. Redlener, personal communication). The term implies an array of services designed to meet (a) the on-going primary care needs (preventive services and health education, as well as the diagnosis and management of acute and chronic conditions) and (b) the special needs created by the particular health risks and consequences of the disaster and by the deterioration in the availability of health services in general. Whether patients are located in isolated neighborhoods, in shelters, or at home, medical providers must recognize that chronic health problems are widespread and that, in general, the patients with the least resources will be the people who require the most care. There is a role for community medicine and primary care doctors with experience in low-resource settings to play in disaster planning and response.

Systemic reform. In the United States, it is necessary to address chronic disease in

disaster preparedness, since chronic disease has become the highest cause of morbidity for the general population. Researchers at the Chronic Diseases and Vulnerable Populations in Disasters Working Group have suggested that the recognition and development of strategies for addressing chronic disease must be incorporated into disaster planning.^{14,15} These strategies include identifying pre-disaster disease burden, creating a list of essential medications for providers, ensuring individual and family preparedness, and understanding systemic support for chronic disease.

Our experience and paper reflect the need expressed by this group. With increasing age of patients, our providers saw a population increasingly affected by chronic disease. Although mobile medical units were successful in providing stopgap measures, it is clear that systemic preparedness will better serve the population as a whole.

Conclusions

While it is impossible to predict accurately the exact nature of medical needs after major natural or man-made disasters, we do know that there exists a baseline level of significant health disparities and barriers to care. In the setting of a disaster, many of these disparities and barriers to care become more recognizable if not exacerbated. The communities that suffer most, given this baseline, are those with the fewest resources to withstand the major disruption disasters can bring to a fragile health care system connection. Greater effort must be made to help such communities prepare for disasters and avoid the disastrous consequences seen after Katrina.

In the absence of a concerted nationwide effort to decrease health disparities and remove barriers to care for the underserved, we will most certainly face again the disproportionate needs of the underserved in times of disaster. Mobile medical care is a delivery model developed to reach those with the greatest barriers to receiving traditional medical services. Mobile medical units staffed by clinicians experienced in dealing with the clinical and social needs of the underserved and comfortable working in a resource-poor environment can make a positive contribution to post-disaster care. We hope that lessons learned by Operation Assist in the Mississippi Gulf will strengthen this model.

Acknowledgments

The authors would like to acknowledge all those who volunteered to participate in the provision of health care services during Operation Assist. The sacrifices made by those who gave their time and effort are greatly appreciated by your colleagues and those you served.

Notes

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