

Management of Hypertension Following Hurricane Katrina: A Review of Issues in Management of Chronic Health Conditions Following a Disaster

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Abstract Following Hurricane Katrina many residents of the Gulf Coast had difficulties managing their cardiovascular risk factors especially hypertension. Care for patients with chronic diseases can be an enormous challenge after any disaster. The difficulties are compounded if the population prior to the disaster was already experiencing major health disparities. Focusing on hypertension we review the issues confronted by residents of the Gulf Coast following Hurricane Katrina in managing their health care. In addition, we address possible solutions to these problems. Pre-disaster preparedness is essential and requires multidisciplinary efforts including patient education. Being certain that patients with chronic diseases have enough medical supplies to last through the immediate disaster period and for portability of medical records are essential interventions in maintaining control of blood pressure in the post-disaster period.

Keywords Hypertension · Disaster preparedness · Chronic disease · Health disparity · Hurricane Katrina

Introduction

Disaster preparedness and response models prior to Hurricane Katrina were grounded in the belief that (bio)terrorism

was the major potential threat to public safety and these programs stressed preparation for mass casualties. Tertiary health care (emergency departments and hospitals) is the critical piece in the response to such threats [1]. Hurricane Katrina landed on the Gulf Coast on August 29, 2005 and hopefully forever changed the way disaster preparedness and response will be addressed. It was the deadliest storm in the history of the United States, impacting an enormous geographic area both directly and indirectly. It caused at least 1.5 million Gulf Coast inhabitants to become displaced and destroyed or seriously damaged infrastructure for health care and other services for those remaining in the area [2, 3].

Providing continuity of care for chronic diseases to affected and displaced persons became an extraordinary challenge post-storm [4–6]. Up to 75% of persons affected by Katrina had one or more chronic illnesses [6, 7]. A large proportion of these affected persons were from health disparate populations, something that was vividly depicted in news reports from New Orleans and other parts of the Gulf Coast. Against such a scenario, primary, rather than tertiary, care is proposed as the most effective health care model to the many health care needs of these patients [1, 6–8].

Hypertension, which affects up to 70 million Americans and 1.5 billion people worldwide, is common in the southeastern United States [9, 10]. As such, hundreds of thousands of individuals in the area affected by Hurricane Katrina had hypertension. Individuals with hypertension and their health care providers experienced innumerable problems in Katrina's aftermath in managing both hypertension and the other chronic diseases contributing to cardiovascular disease mortality and morbidity. This article reviews the issues regarding management of hypertension following Hurricane Katrina. It addresses the factors contributing to the problems and offers solutions.

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Methods

We review the literature surrounding the management of chronic health conditions following Hurricane Katrina, with a focus on hypertension. Most of the data examining health conditions in the aftermath of Hurricane Katrina are derived from surveys and reports of clinical experiences. The clinical experience data come from both displaced and non-displaced groups. In addition, we include a summary of our experiences that developed from our study of the impact, contributing factors, and potential solutions to chronic disease management after Katrina. We conducted a three-phase study using key informants from June 2006 to July 2007 in an effort to address the hypothesis that a network approach to chronic disease management would be best in the aftermath of a disaster like Hurricane Katrina. The key informants were health and social service providers to under-served, Katrina-affected populations of the Gulf Coast ($n=30$) and patients suffering from chronic diseases from the Katrina-affected area ($n=28$) [11, 12•, 13•]. In this article we reviewed data from our analyses coded to hypertension and chronic health conditions. Our review of this topic is limited in that there are really no rigorous studies on cardiovascular disease outcomes among Katrina-affected cohorts. We expect that such data will be available in the future after a longer period of time from the storm has past. However, the widespread displacement of many Gulf Coast residents, particularly those from New Orleans, will complicate the ascertainment of such data.

Why Focus on Chronic Disease Management After Disasters

At least 41%, and perhaps as many as 74%, of Katrina-affected individuals had at least one chronic illness [4, 12•, 14] In our work, the chronic illnesses that were identified as most pressing with regard to requiring immediate attention were end-stage renal disease (ESRD), insulin-requiring diabetes mellitus, and respiratory illness such as asthma and chronic obstructive pulmonary disease (COPD) [11, 12•, 13•] In patients with ESRD requiring dialysis, the need for immediate attention was apparent. Similarly, the needs for supplemental oxygen in patients with severe COPD or severe exacerbations of bronchospasm due to increased allergen exposure and dampness in patients with asthma often created emergency situations for patients with these respiratory conditions. In addition, the requirement for refrigeration of insulin for patients with diabetes and their special dietary needs frequently created scenarios where urgent plans had to be created immediately [11, 12•, 13•]. In many cases, the unique needs of these patients were solved with medical evacuation or special-needs shelters.

Cardiovascular disease and hypertension were also major problems among Katrina-affected individuals. Almost one third of adult displaced and non-displaced Katrina survivors were found to have hypertension [1, 6, 15•]. The key informants in our study estimated that that at least 70% of those with diabetes had hypertension, and the combination of these two chronic health conditions resulted in more serious, immediate complications, particularly in the presence of the increased stressors experienced at that time [11]. Mental illness, cancer, and HIV were other chronic diseases that were identified as being highly prevalent and challenging to manage in the post-disaster period [11, 12•, 13•]. It is clear that the impact of all of these chronic conditions is greater in health-disparate populations, and members of these health-disparate groups were at greater risk for prolonged adversity after Katrina [11, 12•, 13•, 15•, 16]. Moreover, the medical infrastructure that cared for all patients was virtually destroyed and large numbers of providers were displaced [2]. The part of this infrastructure focusing on health-disparate populations, specifically federally funded community health clinics, appears to have suffered disproportionately [2, 17–19]. Therefore, the immediate problems in chronic disease management become long-term problems that resulted in more serious complications, worse morbidity, and probably increased mortality in the future. Data of increased cardiovascular events in post-Katrina New Orleans has emerged and point to the importance of long-term management of cardiovascular disease risk factors in populations affected by disasters [20•]. Clearly, it is critical that disaster preparedness includes management of common chronic illnesses such as hypertension.

Factors Affecting Hypertension Management After Hurricane Katrina

The major issues affecting the control of blood pressure after Hurricane Katrina are summarized in Table 1. Interestingly, most of the factors outlined are very similar to those that are present in the management of hypertension in the general population at any time. However, in the disaster scenario, these issues are magnified and in many instances cannot be addressed by the individual patient with hypertension. In fact, the most compliant and conscientious patient is at high risk for experiencing gaps in management of their blood pressure in the aftermath of a disaster like Katrina.

A major challenge to managing hypertension after a disaster is the perception that daily blood pressure management is not crucial [11, 15•]. The challenges of managing basic life needs such as food and shelter take priority in the immediate post-disaster period. In many

Table 1 Factors affecting management of hypertension following Hurricane Katrina

Factor	Specific challenges
Knowledge of the condition	<ul style="list-style-type: none"> • Many individuals were unaware of specifics of their diagnosis, particularly complications, importance of blood pressure control, and when they were diagnosed • Symptoms were ignored due to other immediate stressors • Inability to monitor blood pressure
Medication compliance	<ul style="list-style-type: none"> • Did not know medications, and local pharmacies and clinics were not operable • Did not recognize importance of adherence with medications, particularly in the immediate post-disaster period • Were not able to get medications due to fractured infrastructure or financial issues • Stress of acute situation took precedence to medication adherence
Communication with health care providers	<ul style="list-style-type: none"> • Health care infrastructure in disarray • Communication systems were not functional • Many medical records were destroyed
Financial stressors	<ul style="list-style-type: none"> • Loss of job and insurance • Lack of new jobs • Financial resources needed to be diverted to other essential needs
Non-pharmacologic treatment	<ul style="list-style-type: none"> • Healthy foods were less available • High-carbohydrate and high-sodium foods predominate immediately after disaster • High-stress environment that persists for long period of time

instances, there is not time to focus on diseases like hypertension where symptoms of poor blood pressure control are not as evident as those of severe problems such as asthma or diabetes. The physical, financial, and mental stressors experienced in the post-Katrina period resulted in several individuals presenting to clinics with significantly elevated blood pressures [11, 15•]. In many cases, the patients were unaware that their blood pressures were elevated or that they had a problem at all [11, 13•].

The most frequently cited issue in management of hypertension among Katrina-affected individuals and their providers is the procurement of medications [13]. Immediately following the storm there were significant problems with the supply line of medications as pharmacies, clinics, and medical records at most sites were either destroyed or not operable. Many of the temporary clinics had blood

pressure-lowering medicine available, but many patients did not know which anti-hypertensive medications they had been taking. Therefore, treatment plans had to be started from scratch and titration toward blood pressure goals was often fragmented [11, 12•, 13•, 15•, 21]. In the recovery period, financial issues significantly contributed to the challenge of medication procurement. Loss of jobs and health insurance, poor job availability, and the need to devote many financial resources to basic needs made medicine unaffordable for many patients, particularly those in health-disparate populations [11, 12•, 13•, 15•, 22]. The consequences of these challenges resulted in a large percentage of patients with hypertension running out of medicine and/or having their medications changed after the storm had passed [13•, 15•].

The stressors of a disaster are very likely to affect adherence to treatment of chronic diseases like hypertension. Krousel-Wood et al. [15•] examined adherence to anti-hypertensive medications among patients in post-Katrina New Orleans [15]. Using a standard survey tool to assess adherence, they found that patients younger than 65 years of age and non-whites had worse medication adherence and that nearly half of the cohort reported challenges with adherence. There were trends for men, those not married, those with complete damage to their residence, and those with less than a high school education to be more likely to have worse adherence. In a separate study, the group found a correlation of the degree to which a patient was affected by Katrina with the likelihood of low medication adherence to anti-hypertensive medication up to 2 years after the storm [22]. Individuals that had lost family members or had to move to another residence were more likely to have low adherence, as were individuals with lower scores on hurricane coping self-efficacy measures [22]. Taken together, these data give direct evidence that individuals at highest risk for health disparities are less likely to adhere with their prescribed anti-hypertensive medication regimen and, therefore, are at higher risk for poor blood pressure control.

Methods to Improve Management of Hypertension Following Major Disasters

Understanding the challenges in management of hypertension and other chronic conditions at the time of a disaster allows for the advance design of solutions to those problems. Unlike other types of disasters, communities are aware of a hurricane's approach and have time to prepare. This allows for patient and provider preparedness efforts that should moderate the effects of the disaster on management of conditions such as hypertension.

Table 2 summarizes some interventions that will improve patient and provider preparedness and the manage-

Table 2 Potential interventions to improve management of hypertension after hurricanes

Challenge	Intervention
Pre-disaster preparedness	
Knowledge of hypertension	<ul style="list-style-type: none"> • Patients carry written (and electronic) documentation of diagnosis of hypertension and other chronic conditions • Patients have written list (and electronic) of all medications, including doses (consider including other anti-hypertensive medications that have been tried without success) • Patients are counseled on the course and consequences of hypertension to improve adherence with therapy
Availability/procurement of medications	<ul style="list-style-type: none"> • Educate patients to get sufficient supplies and medications before event, be prepared for at least 2 weeks (this may require special permission from insurance providers) • Have patients communicate with pharmacy regarding mechanisms to fill prescriptions in the event they have to evacuate for prolonged period • Clinics should stockpile commonly used anti-hypertensive agents
Communication with providers	<ul style="list-style-type: none"> • Clinics to provide patients with alternative numbers and plans if clinic is not operable after disaster
Post-disaster issues	
Financial constraints limiting medication procurement and visits to providers	<ul style="list-style-type: none"> • Patients have to remember health needs when discussing assistance issues with case workers • Take advantage of medication assistance from aid agencies • Providers need to manage donated medications and supplies after disaster [12•, 13•] • Relax regulations limiting amount of medicines that can be obtained
Re-establishing patient-provider relationship	<ul style="list-style-type: none"> • Patients should contact their providers to determine their status and any alternative mechanisms for communication • Use medical home model [30]
Stress of re-establishing home, relocating, or loss of loved ones	<ul style="list-style-type: none"> • Providers must account for the impact of life stressors on control of hypertension and adherence with medications and lifestyle recommendations

ment of hypertension immediately after and for prolonged periods after a hurricane. These interventions focus on patient education regarding the specifics of their diagnosis of hypertension and how it is being treated. Prior to Hurricane Katrina, it was recommended that patients prepare to be away from home for 2 to 3 days when a hurricane threatens their area. Subsequently, it is clear that inhabitants of a hurricane-threatened area should prepare for minimal services and a prolonged displacement/evacuation. As such, it is important to have patients with hypertension have at least a 2-week supply of their medicines and be prepared to procure medications through alternative mechanisms after those initial 2 weeks. Many recommendations are for patients to stockpile a 1-month supply, but there are some regulatory difficulties that make it difficult for patients to get these purchases covered by their insurer. This issue appears to be the most pressing barrier among those with the least resources to buy medicines out of pocket, such as those on Medicaid [11, 12•, 13•].

Patient education is of utmost importance to maintain control of blood pressure among patients with hypertension at any time, but this is particularly important in the post-disaster period. It is critical that patients with hypertension know the importance of having their blood pressure at goal, that they are aware of their goal blood pressure, and that they recognize compliance as critical to reaching these goals [10, 15•, 22]. Because hypertension is often associated with other cardiovascular risk factors, if not established cardiovascular and renal disease [10, 23], patients should have documentation of diagnoses and medications on their person. This documentation should be written and in electronic format if at all possible [13•]. Several tools have been developed to facilitate this process, including some Internet-based resources that allow individuals to create a personal health record that can be accessed by designated health care providers in the event of evacuation or destruction of clinic records.

Clearly, the most important interventions to manage hypertension after disasters are done before the disaster. However, there are several post-disaster interventions that

can improve management of hypertension in severe disasters such as Hurricane Katrina. Table 2 summarizes these issues that, like pre-disaster interventions, focus on maintaining adherence to the therapeutic regimen. In addition, there has to be recognition by both patient and provider that the mental stressors of such an event will have an effect on biological and non-biological factors impacting hypertension. For example, there will be a high likelihood of post-traumatic stress disorder and depression that will affect adherence to medicines, diet, and physical activity regimens [15•, 22, 24]. In addition, the added stressors of such an event may have biologic influences that directly or indirectly influence hypertension and cardiovascular disease [25, 26•]. Finally, the disruption of the local economy creates barriers that lead to loss of access to medication and healthcare providers. Disasters lead to simultaneous loss of employment and insurance. Therefore, alternative strategies to secure blood pressure medications must be considered by both patient and provider. Although multiple aid agencies are usually rapidly mobilized to the affected areas, the procurement of medications is often not raised by affected individuals as they primarily concentrate on the pressing life needs of food and shelter.

The effects of the environmental, mental, and physical stressors on Katrina-affected individuals have been examined. Gautam et al. [20•] examined the rates of myocardial infarction at Tulane University Medical Center in New Orleans after Hurricane Katrina and compared that rate to a period before the storm. They discovered a threefold increase in acute myocardial infarction in the 2-year period following Katrina (2.18% of admissions) when compared with the period before Katrina (0.71% of admissions) [20•]. Those in the post-Katrina group were more likely to have the characteristics of health-disparate groups (i.e., higher rates of unemployment, lack of medical insurance, first time hospitalizations). They were also more likely to live in temporary housing, smoke, have a history of substance abuse, and be non-compliant with medications. These data demonstrate the potential adverse short-term and long-term health outcomes in populations affected by disasters. Therefore, the interventions identified by our key informants to enhance management of chronic conditions such as hypertension after disasters can have long-term implications on rates of cardiovascular disease. The development of a solid health care and community health infrastructure prior to a disaster is critical if we are to be successful in managing hypertension and its complications after a disaster [26•].

Other Issues for Health Care Providers

In addition to those already outlined, health care providers will face several additional challenges in caring for patients

with hypertension after a disaster such as Katrina. For providers and patients able to stay in the affected area, there is likely to be an interruption in the provider-patient relationship. The loss of jobs and loss of insurance, even for relatively brief periods of time, may impact how often consumers will seek health care [27]. Once the time for lack of insurance exceeds 6 months, these patients will start to seek health care again [27], but in patients with hypertension, modestly uncontrolled blood pressure for periods as short as 6 months may have a clinically significant impact on cardiovascular outcomes [28].

In addition, providers will often find themselves caring for a new patient population, as patient demographics before and after the event may vary considerably in affected areas. Depending on where one is located in relation to the affected area, a provider may be caring for evacuees or for those moving in to rebuild the damaged area [21, 29]. These changes in patient demographics may be a challenge to the existing health care infrastructure in both number to serve and cultural competency. For example, the post-Katrina safety net health care infrastructure of New Orleans found itself caring for a much larger population of Hispanics who had moved to New Orleans to take jobs rebuilding the city's infrastructure [29]. Finally, those providers along the evacuation route, both near and far, need to prepare for an increase in activity, especially in the provision of prescriptions and/or medications for hypertension and other chronic conditions if the storm damage is severe and delays patients' return to home [7, 21].

Conclusions

Hypertension was one of the most prevalent chronic health conditions in persons living in Katrina-affected areas. Hypertension management was a challenge after the storm, particularly in health-disparate populations, but the experiences of patients and providers along the Gulf Coast provide valuable lessons that should lead to the design of programs that enhance hypertension management when disasters occur in the future. The foundation for improving hypertension management after disasters is in pre-disaster preparedness of patients with hypertension and requires public health initiatives aimed at community-based health education. In addition, individual healthcare providers have an obligation to provide education tailored to their individual patients on disaster preparedness and the importance of maintaining control of their blood pressure at all times. Moreover, portability of health information will enhance continuity of care for all persons affected by the disaster, especially when there is major damage to infrastructure or prolonged evacuation is required. To meet these requirements, the "medical home" model should be

adopted, as this model brings multidisciplinary resources to the management of a chronic condition such as hypertension [30].

For members of health-disparate populations, the impact of a disaster on health care can be enormous, but still not as great as the impact of the immediate basic needs to maintain their lives and the lives of their families. Therefore, particular attention should be paid to these groups in preparing them for disasters and for re-establishing health care after the disaster. We believe that combining the resources of institutions caring for these health-disparate groups into networks will improve their ability to respond to the needs of their clients after a disaster [13]. Such a network approach will facilitate management of hypertension and other chronic health conditions in these high-risk groups after a disaster. If we achieve this goal, we will have a healthier, more humane nation.

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