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# Disaster and end-stage renal disease: targeting vulnerable patients for improved outcomes

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**Natural catastrophes disproportionately affect ill and socioeconomically disadvantaged populations. Patients with end-stage renal disease are particularly vulnerable. Recent events have led to the creation of national and international institutions that provide assistance before and during such tragedies. Disaster planning by dialysis centers, providers, and patients can also help improve outcomes during a catastrophe. Greater governmental resource allocation is needed to adequately prepare for disasters and to help the disadvantaged during the relief and recovery phases.**

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On 7 December 1988, a severe earthquake struck the Spitak region of Armenia. This catastrophe claimed 25,000 lives. By day 5 of the tragedy, only 2% of the people who had been successfully rescued from collapsed buildings were still alive.<sup>1</sup> Many of the potential survivors had succumbed to crush injuries and subsequent hyperkalemia and renal complications. The lack of a coordinated, effective nephrologic response contributed to this renal disaster.<sup>2</sup> In the aftermath of the Armenian quake, the International Society of Nephrology founded the Renal Disaster Relief Task Force (RDRTF) to organize the efficient deployment of renal supplies and trained personnel to a disaster setting. Since that time, the RDRTF, in collaboration with Médecins Sans Frontières, has responded to earthquakes in Marmara, Turkey (1999); Bam, Iran (2003); Kashmir, Pakistan (2005); and most recently Sichuan, China (2008). The proficient

and well-coordinated emergency response provided during these international calamities helped save many lives.

On 29 August 2005, the United States suffered a disaster that revealed its acute need for improved communication, coordination, and patient education within the renal community. Hurricane Katrina was the greatest natural catastrophe to strike the United States in a century.<sup>3</sup> After the storm, New Orleans residents who remained in the city endured a lack of food, water, and sanitation.<sup>4</sup> Those evacuated to shelters, including the Louisiana Superdome and the New Orleans Convention Center, faced squalid and chaotic conditions. These men and women represented the most vulnerable of New Orleans's population: the poor, the elderly, the disabled, and the chronically ill. Lacking essential supplies and medications, they were ill-prepared for a disaster. Approximately 40% of those seeking respite in shelters suffered from chronic illnesses,<sup>4</sup> including kidney transplantation and end-stage renal disease. Their care would undergo significant disruptions in the aftermath of the storm.

Anderson *et al.*<sup>5</sup> (this issue) now report their survey-based findings on predictors and outcomes of missed hemodialysis sessions following Hurricane Katrina. The researchers conducted a telephone survey of chronic hemodialysis (HD) patients from nine HD centers in New Orleans and its surrounding parishes. The study found that more than 40% of participants missed at least one dialysis session and nearly 17% missed three or more sessions in the month after the storm. In a multivariable-adjusted analysis, failure to evacuate before landfall, lower HD compliance in the 3 months prior to the storm, being placed into a shelter, living alone, and lack of awareness of a dialysis facility emergency plan were associated with missing HD treatments. Patients who missed three or more HD sessions in the month following the hurricane had higher rates of hospitalization during that time period.

The strengths of this unique study include the high response rate with over 85% of the target population surveyed, a remarkable achievement given the logistical barriers and the high rate of displacement at the time of the study. Respondents also shared demographic and disease-related characteristics with the general New Orleans HD population, supporting the representative nature of the study sample. However, the findings must be interpreted in light of several limitations. As the authors acknowledge, 19% of the initially eligible population died before the study, which introduces possible survival bias. Reasons for hospitalization were not obtained, which further weakens inferences about their association with missed HD sessions. Finally, the authors' assessment of pre-storm HD compliance during the period of 1 June 2005 to 31 August 2005 is problematic. The ability to obtain HD on 29–31 August (that is, on or after the date of the hurricane's landfall) would affect the assessment of baseline compliance. Given that the typical thrice-weekly HD patient would have only 38 possible sessions in the 3 months prior to Katrina (excluding extra sessions), achieving at

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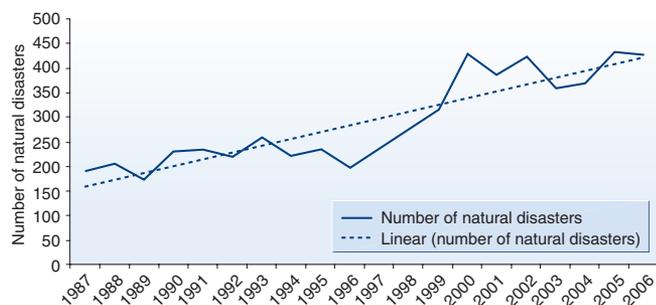


Figure 1 | Natural disaster occurrence, 1987–2006.<sup>3</sup>

least 39 treatments (highest baseline compliance group) may have necessitated receiving dialysis immediately after the storm.

Despite these limitations, this study and literature published after the hurricane<sup>6,7</sup> highlight critical lessons for our community. Natural disasters distress populations unevenly; vulnerability is a function of risk exposure and the ability to resist and recover from catastrophes.<sup>7</sup> As natural disasters increase in frequency and affect more lives<sup>3</sup> (Figure 1), those unable to cope will bear the heaviest relative burden.<sup>7</sup> This group includes minorities, the elderly, the poor, and the chronically ill—characteristics that also describe the end-stage renal disease population in the United States. At the time of the hurricane, 69% of the New Orleans population was African-American, and 23% lived below the poverty line (almost identical to the demographics of the end-stage renal disease patients surveyed by Anderson *et al.*<sup>5</sup>). These were the women and men most frequently left behind without food, water, or medical care in the days after the storm.

The necessity of evacuating special-needs patients early is one crucial lesson from this disaster.<sup>6</sup> The foremost predictor of missed HD sessions after Hurricane Katrina was failure to evacuate before the storm.<sup>5</sup> Unfortunately, patients of lower socioeconomic status face a multitude of barriers to evacuation before a catastrophe.<sup>8,9</sup> One obstacle is financial, including the cost and accessibility of transportation, fuel, and temporary lodging. Another hurdle is inadequate communication. Late

evacuation announcements, inconsistent messages on the mandatory nature of the evacuation, distrust of conventional media sources, scarce information on how to evacuate, and the dearth of explicit details on where to go all hindered the departure process. The influences of social networks must also be considered. People often evacuate as family units and are unlikely to leave if doing so requires abandoning relatives, especially a disabled, elderly, or ill family member.<sup>9</sup> The failure of state and local disaster planning to anticipate and address these impediments left the most susceptible individuals in the most exposed conditions. As physicians, we must advocate for greater disaster preparation and resource allocation for the socioeconomically disadvantaged.

Even with vigorous efforts, some people will not evacuate.<sup>4</sup> Further, many disasters, such as earthquakes, strike suddenly, making evacuation impossible. In this setting, efforts must turn to efficient relief and recovery. National, state, and local institutions must allocate adequate resources to allow for life-saving rescue efforts in the immediate aftermath of the disaster. Modes of communication must be maintained to allow for rapid, coordinated assistance.<sup>6</sup> Whenever feasible, patients with special needs, including end-stage renal disease, should be brought to designated shelters where trained staff are available to provide appropriate medical attention,<sup>6</sup> including psychosocial support. In disaster-prone areas, consideration should be given to increasing chronic peritoneal dialysis use as appropriate. Although

peritoneal dialysis requires the availability of dialysis solution and a clean environment, it can be performed without access to electricity, a water supply, or a water treatment system. In addition, the role of novel home HD technologies in future disasters needs to be explored. The Kidney Community Emergency Response Coalition (KCERC), formed following the US hurricanes of 2005, has developed resources and key programs to help kidney disease patients, nephrologists, and dialysis facilities in a catastrophe setting.

During the relief and recovery phase, socioeconomic status remains a powerful predictor of outcomes. The poverty-stricken will have higher morbidity, mortality, relative financial losses, and psychological distress.<sup>7,10</sup> They are likely to face conditions of privation without the support of insurance coverage or government-sponsored financial loans. Given these circumstances, the recovery process may be protracted, requiring more than one generation. In one survey, over 35% of Hurricane Katrina evacuees felt they would never recover.<sup>4</sup>

Throughout a disaster, individual planning remains critical to survival. Patient-education interventions focusing on exploring possible disaster scenarios, producing a disaster plan and survival kit, and practicing the plan are steps that can help all patients improve their ability to anticipate and cope with a catastrophe.<sup>6,9</sup> This may be particularly beneficial for patients of lower educational background. Dialysis centers and their staff should assist their patients in making these preparations. Multiple resources are available online through the KCERC webpage (<http://www.kcercoalition.com>). Improved patient education and dissemination of resources are essential to improve on the 62% patient awareness of their dialysis clinics' evacuation plans.<sup>5</sup>

The catastrophe that followed Hurricane Katrina was a product of overwhelming natural forces, tragic social conditions, and ineffective preparation and emergency response. We must continue to address each of these issues if we are to diminish the devastation caused by future disasters. We must continue to confront social and health-care

inequities that leave populations vulnerable and exposed. We must continue to equip individuals and institutions with the skills and resources needed to survive and recover from a disaster. We must continue to examine our successes and failures and establish best practices to deliver optimal care to patients in a catastrophe. The activities of the RDRTF and KCERC are excellent steps along this path. With proper effort and resources, we can avert disaster experiences similar to Hurricane Katrina in the future.

#### DISCLOSURE

All the authors declared no competing interests.

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## The importance of increased dialysis and anemia management for infant survival in pregnant women on hemodialysis

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**Despite advances in recent decades, infant survival in pregnant women on hemodialysis remains suboptimal. Asamiya *et al.* found that higher maternal hemoglobin was associated with successful pregnancy and maternal blood urea nitrogen (BUN) was negatively correlated with infant birth weight and gestational age. Their study suggests that increased or intensive dialysis to achieve predialysis maternal BUN levels < 48 mg/dl along with increased doses of erythropoietin to ensure maternal hemoglobin levels  $\geq 9.6 \pm 0.9$  g/dl, should be the standard for pregnant women on hemodialysis.**

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Since Confortini *et al.*,<sup>1</sup> first reported a successful pregnancy in a woman on chronic hemodialysis in 1971, the incidence of pregnancy in hemodialysis patients has risen from 1 to 7%.<sup>2</sup> Recently, Barua and colleagues reported a pregnancy incidence of 15.6% in women on nocturnal hemodialysis.<sup>2</sup> Moreover, during the past 37 years the survival of infants born to women on chronic hemodialysis has improved from 20% to as high as 85%.<sup>3–5</sup> The improved infant survival is a result of changing medical practices involving maternal dialysis care, obstetrical care, and neonatal care (Figure 1). Pregnant hemodialysis patients are now generally dialyzed six times a week for 3–4 h each session; optimal blood pressure management and

improved nutritional and anemia management are also stressed.<sup>3,4,6</sup> Obstetrical care includes close monitoring of the mother and fetus, with more frequent visits, biophysical profiles, nonstress testing, and fetal ultrasounds.<sup>4</sup> Over the past three decades there have also been advancements in neonatal care, particularly in technological monitoring and interventions. Yet despite these improvements in medical care, present-day infant survival for women on hemodialysis remains suboptimal. Prematurity is associated with neonatal death and other permanent organ damage and is seen in 80% of infants born to pregnant women on hemodialysis.<sup>3,4,6</sup> Additionally, as birth weight corresponds to gestational age, infants born to women on chronic dialysis typically weigh less than 2000 g and have an average gestational age of 32 weeks or less.<sup>6</sup> Asamiya *et al.*<sup>7</sup> (this issue) conducted a retrospective study analyzing maternal data in relation to fetal gestational age and birth weight, as these factors impact infant survival. A negative correlation between gestational age and birth weight and maternal blood urea nitrogen (BUN) level, and a positive correlation between these variables and successful pregnancy were

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