Preparing for Disasters for Patients on Dialysis

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Hurricanes and other natural and manmade disasters pose risks that disruption of transportation and electrical power distribution systems will cause dialysis units to cease operations for a period of time. For patients on chronic dialysis, missed treatments can have serious consequences. After landfall of Hurricane Katrina in 2005, individuals who missed three or more hemodialysis sessions had an adjusted odds ratio (OR) of 2.2 (95% confidence interval [95% CI], 1.0 to 4.4) for hospitalization compared with other patients on hemodialysis (1). Fortunately, there was no evidence for increased mortality among patients on dialysis over the ensuing 6 months in the regions most heavily affected by Hurricane Katrina (2).

Hurricane Sandy occurred in October and November of 2012 and was a category 3 hurricane at peak intensity. Although it weakened to a category 2 storm, it also enlarged to become the largest Atlantic hurricane on record when it moved into the northeastern Atlantic coast of the United States. New York City was especially affected, with loss of electricity for several days, flooding of the subway system, and closure of a number of hospitals and dialysis units. The effects of Hurricane Sandy on public health have been well documented, with PubMed listing 130 publications to date on public health and medical issues relating to Hurricane Sandy, including papers relating to patients on dialysis. Previously, three papers have examined the effects of Hurricane Sandy on dialysis care (3–6). In this issue of *CJASN*, Murakami *et al.* (7) address factors associated with missed dialysis treatments. Two other recent papers from Lurie and colleagues (8,9) have addressed the role of early dialysis (defined as extra dialysis sessions) in reducing adverse outcomes. Taken together, these papers provide new data on factors associated with missed dialysis treatment and evidence supporting aggressive efforts to provide additional dialysis treatments before predictable disasters.

Murakami *et al.* (7) performed a retrospective cross–sectional survey to analyze factors relating to the likelihood of missed hemodialysis treatments by patients in eight dialysis facilities located in lower Manhattan, New York City (7). Of 357 patients, 94 (26%) missed a median of two dialysis sessions. The reasons for missing dialysis sessions included unit closure (40%), transportation (15%), and both unit closure and transportation (45%); 62% received early dialysis. There was an increase in hospitalizations, emergency department visits, and mortality among the patients on hemodialysis of New Jersey and New York City when matched to the comparison group of patients who did not miss dialysis treatments during Hurricane Sandy.

Murakami *et al.* (7) analyzed factors that predicted the likelihood of missed dialysis sessions using Poisson regression analysis. In this analysis, the response variable (number of missed dialysis sessions) is considered to have a Poisson distribution to describe the probability of each event occurring over a period of time. Dialysis-specific preparedness was assessed in a survey that addressed whether, before the storm, patients had elements of the National Kidney Foundation 13 essential items, including insurance information, their medication list, and sodium polystyrene sulfonate. The model suggested that other racial identity (*i.e.*, not white or black; incident rate ratio [IRR], 0.34; 95% CI, 0.20 to 0.57 for missed dialysis), dialysis treatment in a unit affiliated with their usual dialysis center (IRR, 0.69; 95% CI, 0.51 to 0.94), dialysis-specific preparedness (IRR, 0.91; 95% CI, 0.87 to 0.98), and older age (IRR, 0.98; 95% CI, 0.97 to 0.99) were associated with a lower risk for missed dialysis treatments. In contrast, requirement for evacuation (IRR, 1.6; 95% CI, 1.1 to 2.3) and disturbed living situation (IRR, 2.3; 95% CI, 1.6 to 3.2) were associated with an increased risk for missed dialysis treatments. These data suggest that having access to alternate dialysis in an integrated system, getting access to transportation, and having a stable social situation may be the important factors in avoiding missed dialysis treatments. The list includes both sociodemographic factors that indicate which patients on dialysis will require particular attention and factors that can be addressed with new intervention strategies.

A group led by investigators at the US Department of Health and Human Services (Office of the Assistant Secretary for Preparedness and Response and Centers for Disease Control and Prevention) has recently published two papers that address the role of the efficacy of early dialysis (defined as additional treatments before the storm) in improving outcomes for patients on dialysis after Hurricane Sandy (8,9). Kelman *et al.* (8) reviewed Medicare claims data for states affected by Hurricane Sandy during October of 2012 (study group) and compared these with two control groups: the dialysis population in states unaffected by the storm (comparison group 1) and the affected area population 1 year earlier (October of 2011; comparison group 2). The study included 15,212 patients in 221 dialysis units, and these individuals were older, more often nonwhite, and dually eligible for Medicare and Medicaid (a marker for

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lower income) compared with comparison group 1, whereas demographics were similar in comparison group 2. Thus, comparison group 1 has features that would suggest a population relatively unaffected by medical complications relating to natural disasters.

Kelman *et al.* (8) reported that 59% of patients received early dialysis in dialysis facilities on Saturday, Sunday, or Monday of the storm week. Despite these high rates of early dialysis, rates of emergency department visits were significantly higher in the study group (4.1%) compared with both control groups (2.6% and 1.7% for comparison groups 1 and 2, respectively), and rates of dialysis during an emergency room visit were much higher in the study group (23% versus 9.3% and 6.3% for comparison groups 1 and 2, respectively). Similarly, hospitalization rates were higher in the study group (4.5%) compared with the control groups (3.2% and 3.8% for comparison groups 1 and 2, respectively). Finally, the 30-day mortality rate was higher for the study group (1.8%) compared with the unaffected states' population (1.5%) but similar to the same population 1 year earlier (1.6%). These data suggest that we can improve the care provided to patients on dialysis before and during natural disasters.

In a second report from the same group, Lurie *et al.* (9) studied a slightly smaller group of patients (13,386), of whom 60% received early dialysis before Hurricane Sandy. In multivariable logistic regression, patients who had early dialysis were less likely to visit an emergency room visit (OR, 0.80; 95% CI, 0.67 to 0.96) or be hospitalized during the week of the storm (OR, 0.79; 95% CI, 0.66 to 0.94) compared with those who did not receive early dialysis, and they were less likely to die during the period of 30 days after the storm (OR, 0.72; 95% CI, 0.52 to 0.99). The statistical model was adjusted for age, sex, race, dual-eligibility status, dialysis vintage, and health care characteristics that would denote more underlying illness (prior emergency visits, hospitalizations, and evidence of cardiovascular disease).

Recently, the US Department of Health and Human Services released a software tool that will help medical providers locate patients on Medicare, including those in the ESRD program (10). The Health and Human Services emPOWER Map uses geospatial information to allow emergency personnel to quickly locate individuals who have submitted Medicare claims for equipment that uses electricity, such as home dialysis machines for both hemodialysis and peritoneal dialysis. This will allow community organizations, including first responders, hospitals, dialysis units, and community organizers, to locate individuals in areas that are without power or projected to lose power and carry out effective interventions.

As a nation, we have greatly improved dialysis preparedness in response to predictable natural disasters, which is evidenced by the rate of approximately 60% of early dialysis preceding Hurricane Sandy as noted above. However, there is room to reduce rates of missed dialysis. Various factors likely limited the ability of all patients on dialysis to avail themselves of early dialysis, including access to transportation and unstable living environments. This can be improved through the efforts of dialysis providers to continue the process of educating patients, identifying those at greatest risk for missed dialysis sessions during predictable disasters, and providing the structure and resources to ensure that these individuals receive early dialysis.

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Disclosures

None.

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See related article, "Disaster Preparedness and Awareness of Patients on Hemodialysis after Hurricane Sandy," on pages 1389–1396.