Preparing a dialysis unit for operations in the midst of disastrous circumstances is a task that must be undertaken not only because it is mandatory to do so but also because of the needs of the vulnerable population served. Ultimately, however, the success of any preparation remains totally dependent on the severity of the catastrophe at hand. For instance, the scope of the damage from Hurricane Katrina, arguably the costliest natural disaster to affect the United States, was such that most of the preparedness at the local, state, and federal levels, much less that of a private dialysis facility in its path, were rendered woefully inadequate. That 1 mo later in Louisiana alone 26 of the 43 dialysis facilities that were closed by the storm remained unopened (1) underscores this statement. Moreover, preparing for “predictable” disasters, such as hurricanes or possibly ice storms, is somewhat different than being faced with unpredictable catastrophes such as a large tornado or an earthquake. With hurricanes, units usually have a few days’ notice to plan staffing, stockpile extra supplies, and communicate with patients, whereas that luxury does not exist with unexpected disasters.

A detailed cookbook discussion for preparing for various crisis circumstances is beyond the scope of this article. Rather, this serves as an overview of available references and principles for operations after disasters. What are reviewed herein include detailing available informational resources, preparations to be taken well before disasters may occur, preparations to be done in advance of a threatening disaster, and some considerations for operations in the wake of a disaster. In addition, some implications that affect the facility economics are described, which, in turn, may have a significant impact on survival of the unit.

Organizational Infrastructure for Disaster Relief

Before the earthquake that occurred in Spitak, Armenia, in 1988, which resulted in large numbers of renal-related casualties, there was no planned organizational infrastructure that focused on disaster relief on a massive scale. Problems that were encountered after this disaster included inadequate local dialysis and unprepared and unorganized relief personnel (2). In attempting to address such concerns, the International Society of Nephrology created the Renal Disaster Relief Task Force in 1989 (3), with branches serving three large areas: The Americas; Southeast Asia; and Europe, Asia Minor, the Middle East, and Africa (4). After a major disaster, this organization has the ability to offer volunteer personnel including nephrologists, dialysis nurses, and technicians; dialysis equipment; and medical and technical education and advice, as well as psychologic support (4).

The European Branch of the Renal Disaster Relief Task Force was involved in substantial relief efforts after the earthquakes in Marmara, Turkey, in 1999 (5); Bam, Iran, in 2003 (6); the Kashmir region of Pakistan in 2005 (2); and Yogyakarta in Indonesia in 2006, as well as other disasters such as the 2006 Israeli-Lebanese war and the collapse of an exhibition hall in Katowice, Poland, in 2006 (2). This organization also had some advisory role after Hurricane Katrina in 2005 (2). Vanholder et al. (2) recently published a review of problems that were encountered and lessons that were learned from the Kashmir disaster, concentrating on the effective treatment of crush casualties that all too commonly occur with earthquakes.

In the United States in January 2006, the Centers for Medicare and Medicaid Services (CMS) hosted a summit in Washington, DC, to discuss issues and potential solutions to the renal-related problems that were experienced after the catastrophic 2005 hurricane season. This meeting included approximately 100 people, who represented physicians, nurses, technicians, social workers, ESRD networks, government, kidney specialty societies, dialysis manufacturers, and large and independent dialysis organizations, among others. This group came to be known as the Kidney Community Emergency Response Coalition (KCERC). As a result of that summit, eight response groups (Table 1) were created with specific action agendas, most of which were readied for mobilization with the start of the 2006 hurricane season. KCERC’s complete report as compiled by the National Kidney Foundation (NKF) is available on line at the NKF web site (http://www.kidney.org) and the American Nephrology Nurses’ Association (ANNA) web site (http://www.annanurse.org). However, links to this report are found in many of the web sites of the organizations that participated in the summit.

In March 2007, KCERC assembled in Baltimore for its second national summit. Objectives included identifying accomplish-
And current information on avian flu and disaster preparation can be found at http://www.PandemicFlu.gov. Informational resources regarding disaster planning have been available for more than a decade, although, as expected, more is learned after each successive disastrous occurrence. In October 2001, an issue of the NKF has produced a document entitled Preparing for Emergencies: A Guide for People on Dialysis (10), can be easily located in the disaster preparedness sections of http://www.nraa.org or http://www.therenalnetwork.org. The NKF publication entitled Planning for Natural Disasters and Other Types of Emergencies (Patients) (11) can also be accessed there as well as at http://www.kidney.org.

Risk Assessment and Mitigation

When discussing disaster preparedness for dialysis facilities, it should be noted that the ESRD Regulations of 1976 required as a standard that written policies and procedures that define the handling of emergencies that affect the health and safety of patients be available, reviewed annually, and revised as necessary (12). Furthermore, this same regulation mandates the safeguarding of medical records against destruction (13). In any discussion regarding planning for emergency situations, it is generally accepted that most preparations should occur well before a crisis might. A first consideration may involve hazard assessment. The CMS Emergency Manual has modified the IBM Hazard Site Assessment Tool (14), an instrument that has been in the public domain. This tool provides a general understanding of the threats to operation of a building depending on where it is situated. For example, location of a building in an earthquake-prone or hurricane area or near a nuclear power plant would result in a higher score on this hazard assessment instrument. The score could be offset to more acceptable lower levels by the availability of services or equipment that could mitigate potential threats. An extremely high score might make relocation a consideration, but, if this were not possible, then a thorough understanding and review of emergency contingency plans will be vital.

As part of risk assessment, it remains important to have available some document, such as a building drawing or blueprint, that, in addition to pointing out exits and patient and staff relocation areas should emergency evacuation be needed, would also note the location of all utility shut-off valves. Review of existing insurance coverage with a professional may be prudent, with the intent to remedy any specific coverage weaknesses that might have been identified by the hazard site survey.

Hazard mitigation is defined as the process of minimizing losses by reducing risks in advance of a crisis (8). The CMS facility emergency guide describes detailed strategies for preparing for various circumstances, including fire, tornadoes, hurricanes, floods, earthquakes, and winter weather. Lists of specific preparedness activities for these scenarios can be located in this document. Simple examples include designating a shelter area in the unit if situated in tornado-prone locations or storing food, water, blankets, and other supplies for patients or, staff who might find themselves stranded in winter weather or, in units in areas that are prone to earthquakes, by strapping

<table>
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<tr>
<th>Table 1. The original eight focus groups created by KCERC in January 2006a</th>
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<tr>
<td>Patient Assistance</td>
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<td>Staff and Volunteer Coordination</td>
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*aKCERC, Kidney Community Emergency Response Coalition."
dialysis machines to walls. Obviously, planning for specific disaster scenarios is effort-intensive and time-consuming. These preparations, though, remain absolutely essential for the safety of all and the operability of the dialysis unit.

Communication Issues
Communication remains an important concern to plan for in virtually any emergency yet can be problematic. The CMS Emergency Guide for Facilities contains some useful information and suggestions for communications planning. In crisis situations, telephone systems often go down at a time when almost everyone needs to call someone else. Because both landlines and mobile telephone systems are built for at most 15% capacity, in emergencies, they are prone to overload. In these situations, it is always easier to receive calls than to make them, as a result of the telephone companies’ denying dial tones once certain call volumes are reached. This is known as “line load control.” Recommendations for telephone usage during those times is first to stay off the telephone if not needed. Second, when a call needs to be made, picking up the receiver and simply waiting for a dial tone perhaps up to minutes may be required. If no call is attempted within a few seconds after the dial tone occurs, then it once again will be denied.

After Hurricane Katrina, it was noted in the Baton Rouge area that cell phones with area codes from elsewhere seemed to work when local ones did not. As a result, part of emergency preparedness in that area includes having cell phones that are obtained in locales with different area codes. It is interesting that text messaging would work when attempted voice calls otherwise would not go through (14). Other suggestions for communicating information to patients and staff particularly in smaller areas may include public service announcements. Posting notices on a facility web site, if one exists, may also be effective, because some Internet service providers were operational after Katrina. Local Ham radio operators can be useful if emergency services are needed but are otherwise unable to be contacted. At times, facilities may need to resort to sending out runners with information. Since Katrina, in Baton Rouge, one large dialysis organization has established at its command center facility (the hub for a dozen or so other facilities) an area where 10 ten-line telephones, supposedly each with capability for an infinite number of voice mail messages, can be connected should the need arise.

Dialysis Infrastructure Planning
Communications or not, dialysis facilities must have electricity and water to operate. Electrical generators, using either diesel or natural gas, are becoming more commonplace. Should a facility not have backup power available, it will be necessary to partner with a facility that does so that patients can be treated if their home unit is not operational.

Disasters can also affect the quality of water that is available for dialysis. Even the best utility systems may have problems with water in these times. During emergency situations, the water company may add flocculents such as alum (aluminum sulfate) to help filter out particulate matter and increase chlorine and chloramine concentrations for disinfection purposes. This should not necessarily be a problem if the carbon tanks and reverse osmosis system are functional but can be so if the equipment is damaged in the disaster. In the event that water is not available, such as might occur with ruptured mains in an earthquake, contingencies such as tanker trucks with water (if the unit’s water treatment equipment is operational and deionized water if it is not) should be contracted for well in advance.

In any event, it needs to be understood that the facility medical director has the ultimate responsibility for deciding whether the water quality is suitable for dialysis (8).

Preparations just in advance of a threatening disaster refer to “predictable” situations such as winter storms and hurricanes. In hurricane-prone areas, all eyes are on the weather for days before potential impact. This is the time when the planning, which has been done, is cemented into place. While most everyone is scrambling to fill up with gasoline and buy extra food, water, and ice, dialysis technical personnel should be shoring up supplies, checking on fuel for generators, and confirming contracts for backup water.

Dialysis and nursing administrators and medical directors should be establishing a timeline by which they can complete dialysis on all of their patients. This timeline may vary somewhat particularly if evacuation orders are likely. In areas that are usually not evacuated, all patients undergo dialysis in advance of the storm, because no one knows which staff or patients may be able to return to the facility in the immediate aftermath as a result of flooding or impassable roads. During hurricanes, obviously units are closed with plans to reopen once people are allowed to traverse the area safely after the crisis. In addition, administration might establish a communications chain to disseminate information about the status of units once the storm has passed.

Reopening Dialysis Facilities after Disasters
After any event that could produce damage, as soon as it is safe to do so, technical personnel should inspect the general condition of the building and make a careful assessment of its ability to operate as a dialysis facility. Should the disaster be the result of an earthquake, a structural engineer (who hopefully has been made aware of his or her role in disaster assessment beforehand) will need to be involved before opening the unit. Assessments of electrical power systems, water treatment, and sewerage need to be done as well. After Hurricane Katrina the Centers for Disease Control and Prevention published a fact sheet on technical considerations in bringing dialysis water treatment systems on line (15). This document is easily accessed from the NKF web site (http://www.kidney.org).

If more than one unit is involved, then a command center is established for coordination of the following concerns. Communications as already noted can be a major challenge. If the facility is part of a large dialysis organization, then usually daily conference calls are scheduled. Planning and monitoring of which staff may be needed where and arrangements for transportation of patients (particularly if evacuees are arriving in shelters) as well as staff are other major issues. Managing resources includes caring not only for the unit’s own staff but also for volunteer staff who may arrive to help. Even with
emergency status declared, some basic credentialing by the dialysis nursing administration must be done for outside staff, even if no more than a thorough interview, to be certain that the staff member can do what he or she may claim to be able to do. Moreover, providing rest areas, food, and sometimes housing and transportation for staff may need to be arranged. It is also worth remembering that with power outages, credit card purchases and banks are usually unavailable. Having ready cash is often the best way to get food, drink, and other supplies during these times.

Special Patient Populations
What may markedly complicate operations of a dialysis unit in the wake of a disaster is how to handle evacuees who may show up in the area. After Katrina, quite a few people escaped with only the clothes on their back, much less any written orders that might have been given to them beforehand. To handle waves of dialysis evacuees, generic orders for dialysis were given. These included use of the facility dialyzers, standard treatment time such as 3 h, and a designated potassium dialysate such as 2 mEq/L. Orders were modified when patients were knowledgeable about their baths; however, the experience after Katrina was that most were not.

Among evacuees, special populations about which to be concerned include pediatrics. Obviously, the smallest children with renal failure need to be evacuated to specialized centers. The Department of Pediatric Nephrology at Texas Children’s Hospital in Houston accepted 70 pediatric patients with kidney failure before and immediately after Hurricane Katrina (personal communication, E. Brewer, Department of Pediatrics, Baylor College of Medicine, Houston, TX, March 2006). Occasionally, an older child with kidney failure may evacuate with family and present needing dialysis. Although the CMS Emergency Manual for facilities has an informative section on emergent dialysis of pediatric patients, the best allies are the parents, who often develop an expertise in the dialysis care of their child and can usually accurately communicate how their child receives dialysis and how he or she may respond during dialysis. Some may even show up with the smaller dialyzers and lines, which may be necessary when dialyzing a child who weighs <35 kg or so.

Evacuees who are on home peritoneal dialysis and may be housed in shelters pose logistical challenges to caregivers. Unless the patient evacuee has brought his or her own automated cycler, most patients may need if at all possible to be converted to manual exchanges. Supplies for the dialysis procedure as well as for catheter hygiene will be needed. Not unimportant, dialysis exchanges should continue to be delivered in relatively private settings, often not readily available in general shelters. Planning that includes dialysis patients as a distinct special-needs group housed in specific shelters may greatly expedite needed care. After Hurricane Katrina, a home dialysis nurse team, in existence in Baton Rouge since before the storm, assisted in performing some peritoneal dialysis in the team’s facility as well as delivered supplies to shelters that were housing these patients until such time as arrangements could be made for supplies to be sent to more long-term housing. Tulane University Medical Center’s peritoneal dialysis program staff was able to communicate with and manage their 22 patients with the help of text messaging and advanced planning and education (14).

Another special-needs group among evacuees may include transplant patients. Occasionally, some may present to dialysis facilities. After Katrina and the evacuation of patients as well as the transplant programs at Tulane and Louisiana State University Medical Center in New Orleans, transplant patients arrived requesting laboratory tests or immunosuppressant refills. These were best handled through nephrologists’ offices or in outpatient laboratories elsewhere so that the dialysis units could focus on evacuee dialysis.

Economic Issues Confronting Dialysis Units
No matter how quickly a dialysis unit may reopen after some local or regional disaster, there exists the real possibility that the facility may experience economic consequences that may threaten the very survival of the unit. One big advantage to being affiliated with a large dialysis organization is the ability to rely on the corporate financial strength in times of disasters. CMS recognized the predicament of the facilities that aided in the dialysis of evacuees and granted them the ability to bill for the services provided without a proper assignment of benefits. Still, after Katrina, some evacuees underwent dialysis and subsequently went elsewhere without sufficient information having been obtained for the facility to be able to submit a claim; therefore, no reimbursement was realized. The loss of patients or staff as a result of evacuations may contribute to subsequent diminished facility income.

Where damage to a facility does occur, regardless of whether the unit is operational, some financial relief may be gained from possessing adequate insurance coverage. Property insurance generally covers the structure and some contents, such as built-in equipment and appliances, but will not cover damage from floods. Business interruption insurance is designed to allow some cash flow to continue to a business that cannot function for various reasons. Most business interruption policies do not cover problems related to backup of any body of water. Depending on the specific policy terms, some will pay if civil authorities do not allow ingress to the facility for reasons such as downed power lines. Flood insurance through the National Flood Insurance Program is available with limits of $250,000 to homes (plus $100,000 for contents) and $500,000 to nonresidential buildings. There are discussions ongoing regarding raising these coverage limits. The general experience after Katrina was that payments were prompt and with relatively little hassle to those who had this coverage. By design, the Federal Emergency Management Agency offers no financial help with loss of business after disasters but did reimburse dialysis organizations for the cost of housing those who were involved in the recovery effort, including dialysis staff who were brought in from outside the area.

A useful suggestion for expediting claims is to include the insurance agent in conference calls or other communications early after the damage. One large dialysis organization did just that after Katrina in scheduled daily conference calls with peo-
ple from the areas that were heavily damaged as well as those in the recovery effort. Although the agent in no way hindered the work that needed to be done, he was helpful in giving suggestions that resulted in the claims’ being paid relatively timely. For example, he recommended that destroyed dialysis machines be lined up and photographed outside and that pictures be taken of moldy walls before they were removed.

Unfortunately, some government-sponsored programs may not be that efficient. An independent nephrologist from the New Orleans area remarked to the author that it took 1 whole year for his Small Business Administration loan to be processed. Had he not had savings, he would not have been able to survive the months of negative cash flow that occurred with the reduced number of patients in the area after his units reopened.

Conclusion

Informational resources for dialysis disaster planning are available and relatively easy to find, thanks to the Internet. Most disaster planning and preparations should be accomplished well before a crisis may occur. This statement cannot be overemphasized. Although the forces of Mother Nature may be uncontrollable, proper planning and subsequent patient and staff education may allow dialysis facilities to continue to care safely and effectively for ESRD patients who may indeed at that time need the stability that comes with being prepared.

Acknowledgments

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Disclosures

R.J.K. has participated in medical director contracts with Fresenius Medical Care–North America.

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