

Kidney Patient Care in Disasters: Emergency Planning for Patients and Dialysis Facilities

Jeffrey B. Kopp,* Lynda K. Ball,[†] Andrew Cohen,[‡] Robert J. Kenney,[§] Kenneth D. Lempert,^{||} Paul E. Miller,[¶] Paul Muntner,** Nauman Qureshi,^{††} and Sarah A. Yelton^{‡‡}

*Kidney Disease Section, National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, Department of Health and Human Services, Bethesda, Maryland; [†]Northwest Renal Network (ESRD Network 16), Seattle, Washington; [‡]Department of Nephrology, Ochsner Clinic, New Orleans, Louisiana; [§]Renal Associates of Baton Rouge, Baton Rouge, Louisiana; ^{||}Nephrology Consultants of Northwest Ohio, Toledo, Ohio; [¶]Miller Dialysis Acadiana Region, Ville Platte, Louisiana; **Department of Epidemiology, Tulane University, New Orleans, Louisiana; ^{††}University of Alabama, Huntsville, AL; and ^{‡‡}Heartland Kidney Network (ESRD Network 12), Kansas City, Missouri

The catastrophic 2005 hurricane season alerted Americans to the need for a more effective response to mass casualty incidents. To address the needs of the nephrology community, the Kidney Community Emergency Response Coalition (KCERC) was formed, with representatives from more than 50 governmental agencies and private organizations. After completing phase 1 of its work, the KCERC issued recommendations for patients, dialysis units, and providers. During phase 2, the KCERC will promote implementation of those recommendations. During a disaster, the KCERC will host a daily conference call on which dialysis facilities, the End-Stage Renal Disease Networks, and emergency response officials will coordinate disaster response. Predisaster preparation for kidney patients should stress identification of alternative dialysis facilities, education about the renal emergency diet, and plans for early evacuation from the disaster area and for evacuating with medical documents and medications. Dialysis facilities are required to have a disaster plan; regular revision and rehearsal are essential. Critical issues for dialysis facilities include identification of partner facilities, a robust communications plan that takes into account the limitations of telephones and broadband access, staff shortages in the face of a possible influx of new patients, the delivery of service in the face of compromised utilities (water, power), and the recovery of a dialysis facility that experiences flooding or structural damage. A timeline to safety for dialysis patients can be visualized; if specific tasks are accomplished at each disaster stage, then it is likely that the health of these vulnerable patients can be protected.

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The 2005 hurricane season exposed deficiencies in the US's disaster response. More than 200,000 people with chronic medical conditions were displaced by Hurricane Katrina, with Hurricanes Rita and Wilma wreaking similar havoc in subsequent months, although on a lesser scale (1). Patients with chronic kidney disease, especially those who were receiving dialysis or had renal allografts, were particularly vulnerable. A key lesson was learned: The kidney community was not prepared.

In this article, we first review the recommendations that have been put forward by the Kidney Community Emergency Response Coalition (KCERC). Next, we consider in detail the

process of disaster planning from the perspectives of kidney patients, dialysis facilities, and volunteer nephrology professionals who wish to contribute to disaster relief. The article will not provide a detailed prescription for nephrology disaster planning that will work for all facilities under all circumstances, but instead it will raise relevant issues and identify resources that can help in planning to ensure continuity of care for kidney patients.

KCERC Recommendations

In response to the identified needs of kidney patients, the KCERC was formed in January 2006 at a meeting in Washington, DC, attended by representatives from more than 50 health care organizations from 25 states and the District of Columbia. KCERC members represent the following: Kidney patient organizations and professional organizations; practitioners such as nurses, technicians, dietitians, social workers, physicians, and surgeons; large dialysis organizations (LDO), independent dialysis units, and hospitals; medical equipment suppliers; ESRD networks; state governments; the Renal Leadership Council; and federal agencies, including the Center for Disease

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Address correspondence to: Dr. Jeffrey Kopp, Kidney Disease Section, NIDDK, 10 Center Drive, NIH, Bethesda, MD 20892-1268. Phone: 301-594-3403; Fax: 301-402-0014; E-mail: jbkopp@nih.gov

Control and Prevention (CDC), the Centers for Medicaid and Medicare Services (CMS), the Food and Drug Administration, and the National Institutes of Health.

The objectives of the KCERC include the following: (1) To develop a strategic plan for national and local responses to address the needs of kidney patients in various disaster settings, (2) to specify clear roles and responsibilities for developing and implementing the strategic plan, and (3) to disseminate best practices and strategies to the state and local levels. In July 2006, KCERC completed phase 1 of its activities, consisting of the development and initial dissemination of tools and resources, as summarized in Table 1 (2). During phase 2, the KCERC will educate kidney patients; nephrology professionals; and local, state, and federal response workers about the tools and materials available. Phase 2 will also involve testing and refining the national kidney community response plan. Specific KCERC recommendations to help kidney patients, dialysis units, and emergency response planners are provided in Table 2. KCERC recognizes that disaster planning is a process and not an end in itself and will continue its planning and coordination activities. ESRD networks, clinicians, dialysis facilities, industry, and patient representatives will be at the forefront of implementation.

Overview of Disaster Planning

Detailed planning is necessary to ensure dialysis patient safety in a disaster environment. Plans for a regional disaster should assume that dialysis units will be nonoperational and that dialysis patients must be treated away from their customary dialysis facilities. After disasters, transportation networks function poorly, and patients and dialysis facilities may need to rely on help from emergency responders and on military personnel, as directed by the local emergency operations center. Fortunately, many disasters can be predicted days ahead of time, including particularly hurricanes and to some extent wildfires, blizzards, ice storms, and floods. Advance warning and early evacuation will likely improve the safety of dialysis patients during disasters.

Orderly predisaster evacuation of dialysis patients contributes greatly to ensuring continuity of medical care. Evacuees may travel on their own to stay with friends or in hotels, or they may travel by private car, public transportation, redeployed school buses, and other means to predesignated shelter sites. Community evacuation centers are categorized into two types: General population shelters and special-needs shelters. Special-needs shelters are designed to accommodate evacuees (and their family members) who require assistance with activities of daily living (*e.g.*, patients with dementia and mobility limitations), specific medical needs that require intervention by health professionals (*e.g.*, oxygen, glucose monitoring, dressing changes, medication administration), and infectious diseases that require protective equipment or isolation.

Community evacuation shelters may be staffed by local, state, and federal emergency response personnel, as well as by volunteers. The specific criteria for admitting patients to special-needs shelters are set by each state, and states differ as to whether dialysis patients are sent to general population shelters

or special-needs shelters. During Hurricane Katrina, it became apparent that individuals were often reluctant to evacuate without their pets. In 2006, Congress passed the Pets Evacuation and Transportation Standards Act, which requires that most, if not all, evacuation shelters accept family pets and have veterinarians assigned to assist with their care. The food will vary among shelters; when Meals Ready to Eat are provided, patients with chronic kidney disease should be aware that the sodium content of each of these meals ranges from 1.7 to 2.3 g without the addition of the enclosed salt packet. Consumption of three Meals Ready to Eat will result in a very high daily sodium and potassium intake.

The special-needs shelter personnel play a key role in helping dialysis patients resume dialysis promptly. Upon arrival at evacuation shelters, dialysis patients should inform evacuation personnel of their need for regular dialysis. Likewise, emergency responders should be educated that dialysis is life sustaining; a document for this purpose has been prepared by the KCERC (3). Medical personnel should assess dialysis patients shortly after their shelter arrival, determining comorbidities and whether urgent dialysis is needed. Patients who have missed their regularly scheduled dialysis sessions are at particular risk and may report symptoms of congestive heart failure (shortness of breath) or hyperkalemia (muscle weakness). Ideally, laboratory testing will be available to determine serum potassium level; when laboratory analysis is unavailable, an alternative could be electrocardiography.

After Hurricane Katrina, some dialysis patients developed catheter-site infections as a result of prolonged immersion in contaminated water. Rapid diagnosis and treatment of these infections is important. When purulent drainage is present, patients should be isolated when they are residing in evacuation shelters, as recommended by the CDC (4). It remains to be determined whether the stringent infection control practices that are followed in dialysis units for patients with hepatitis B virus or antibiotic-resistant bacterial infections are applicable in shelters as well (5). Although some patients will not know their hepatitis B status, most dialysis patients will have this information or will know whether they receive dialysis in a segregated area of their regular dialysis unit. A number of states have laws that require patients whose hepatitis B status is unknown to undergo dialysis using infection control practices that are designed for patients who are hepatitis B antigen seropositive, with the exception of not needing isolation and not using a machine that is dedicated to patients who are hepatitis B antigen seropositive. For these patients, dialysis machines should be cleaned with bleach or equivalent solution after each treatment, and dialyzers should not be reused. Future studies will be required to determine whether there were increased hepatitis B seroconversions after Hurricane Katrina, as a consequence of dialyzing patients with unknown hepatitis B status. Early evacuation, improved access to medical records, and central coordination of evacuee referral to dialysis facilities may promote an appropriate distribution of patients with infectious complications so that patient needs are matched to facility resources.

A timeline to safety for dialysis patients is presented in Table 3, with factors affecting the timeline organized by timing relative to the disaster and level of intervention. Increased morbid-

Table 1. KCERC working groups: Resources and programs developed and under development^a

Working Group	Summary	On-Line Information Site
Patient assistance	Patient survival instructions Patient identification cards developed	KCERC report attachment, P41–45 Modeled on those provided by ESRD Network 7, www.fmqai.com/ESRD/PatientServices_emergency.html
Patient and provider tracking	On-line system to track dialysis facility status (open/closed) On-line system to track patient location created (DPAR), reports to be submitted by fifth day of disaster and then semiweekly Standardized medical record for dialysis patents	www.nephron.com (activated at time of disaster) Pending in phase 2 Pending in phase 2
Dialysis staff augmentation	Set up volunteer database (ANNA) Established volunteer opportunity for physicians, dialysis nurses, and dialysis technicians (NDMS)	www.annanurse.org www.kidney.org/help
Facility operations	Hazard mitigation plans Emergency plans Emergency response: Checklist, evacuation plans Emergency dialysis orders; rationing treatment Physical site damage assessment form Supply checklist Facility evacuation kit Facility emergency response teams Vendor services response tool to speed resupply after disaster	KCERC report attachment, P8–19 KCERC report attachment, P32–45 KCERC report attachment, P47–50 KCERC report attachment, P66 KCERC report attachment, P73 KCERC report attachment, P97 KCERC report attachment, P99 KCERC report attachment, P121–130 Pending in phase 2
Communications	Kidney Care Emergency Web Site and toll-free telephone number NKF listserv to facilitate sharing of information during an emergency KCERC daily telephone conference, beginning during predisaster evacuation	www.kidney.org/help 888-33-kidney ER@listserv.kidney.org To be activated during emergency
Federal, state, and local agency support	Educational material for first responders developed ("Risk to patients with kidney disease when disaster strikes") CMS rule change will have emergency response language for dialysis facilities	Developed; available by request from KCERC Due 2007
Shelter Transportation		On the KCERC phase 2 agenda On the KCERC phase 2 agenda

^aThe KCERC report and attachment are available at www.kidney.org/help. ANNA, American Nephrology Nurses Association; CMS, Centers for Medicare and Medicaid Services; DPAR, Disaster Patient Assistance Report; KCERC, Kidney Community Emergency Response Coalition; NDMS, National Disaster Medical System; NKF, National Kidney Foundation.

ity and mortality, as well as additional burden on the medical response effort, may occur when the interdialytic interval exceeds 5 to 10 d, although data from a disaster environment are limited. Providers should assist dialysis patients in creating

individual timelines on the basis of particular needs, the local environment, and different kinds of emergencies.

In the face of an imminent emergency situation, dialysis facilities, the ESRD community, and emergency response organizations

Table 2. Key recommendations of the KCERC

For Patients with Kidney Failure	For Nephrology Providers	For Federal, State, and Local Emergency Providers
Keep updated lists at all times medications and allergies major health problems physician and dialysis facility names and contact information emergency contact information, including a kidney care team out-of-state contact if available and the KCERC emergency number (888-33-kidney) emergency diet Make an emergency supply kit Planning create a personal evacuation plan evacuate early if authorities advise evacuation make alternate plans for transportation to your regular dialysis facility	Make an emergency plan appoint a leader and deputy to oversee preparation and operations list emergency telephone numbers for patients and staff procure and maintain emergency equipment and supplies plan evacuation of patients and staff secure equipment, supplies, and records if evacuation is needed In the event of a disaster, report facility open/closed status to the ESRD network and daily nephrology disaster conference call (number to be publicized at the time of the disaster) Help each patient develop an emergency plan as shown in the first column	Planning include a kidney community representative in disaster planning include provisions for kidney failure patients in all plans and involve ESRD networks in planning encourage early evacuation of kidney failure patients Addressing needs of dialysis facilities list facilities as high-priority locations for restoration of services such as power, water, and telephone facilitate delivery of supplies assist with security, generators, and fuel give priority to dialysis personnel for limited supplies such as housing and gasoline make arrangements for patients and staff to pass roadblocks and travel during curfews assist in identifying alternate dialysis sites when dialysis units close Addressing needs of kidney patients in evacuee shelters ask all evacuees about kidney failure, and make resumption of regular dialysis the highest priority provide renal failure diet as indicated concentrate dialysis patients in particular shelters near dialysis units with appropriate capacity group dialysis patients in a particular area of the shelter to assist with monitoring and transportation

will need to execute carefully designed plans. A sample timeline for disaster preparation and response is provided in Figure 1. This example provides a flexible and versatile template to guide development of timelines for particular emergencies.

The KCERC challenges the kidney community to develop innovative solutions to the problems that kidney patients experience during disasters. Table 4 proposes some further ideas that might be considered.

Recommendations for Kidney Patients

Predisaster Preparation

The Medicare Regulations and Interpretative Guidelines and the ESRD Conditions for Coverage include specific disaster planning regulations (6). Patient situations and capacities vary; therefore, individualized patient emergency plans are essential. CMS has provided a publication specifically tailored for patients, titled *Preparing for Emergencies: A Guide for People on*

Table 3. Timeline to safety: Factors that influence the time to resumption of dialysis treatments^a

Timing of Factor	Patient Level	Dialysis Unit and Provider Level	Regional and National ESRD Community Level (KCERC, ESRD Networks, and Others)	Emergency Response Infrastructure Level
Before disaster	Early warning (>72 h) and early evacuation	Early warning (>72 h)	Early warning (>72 h)	Early warning (>72 h)
	Dialysis before evacuation when feasible	Medical director or designate active in regional and national disaster planning	Collaboration across disciplines, involving private and public entities	Robust communications network
	Individualized step-by-step disaster algorithm, with periodic rehearsal and assessment	Comprehensive disaster plan, with regular rehearsal and assessment	Patient tracking system, with interoperability (ready access for all providers and administrators) and security	Transportation for evacuees; DIPP, especially for large-scale evacuations
	Buddy system for patients	Standardized predisaster and postdisaster needs analysis, evaluation, and assessment tools	Dialysis facility tracking system	Responders and leadership aware of kidney patient needs
	Active tracking of patients with stage 5 kidney disease and transplant patients	Standardized resource request, correctly completed to maximize chances of rapid and positive response	Plans for surge capacity in selected dialysis units in each region (especially in predicted peripheral areas)	Predesignated special-needs shelters establish partnership with adjacent dialysis facilities before emergency
During disaster, response, and recovery	Physical factors: Dementia, impaired mobility, advanced age, comorbidities	Dialysis facility electrical and water systems redundancy or back-up	ESRD networks store patient-specific medical information and release when appropriate	Transfer of hospitalized inpatients who require dialysis to hospitals beyond immediate area
	Psychological factors: Noncompliance, substance abuse, personality style	Medical information systems to store patient data, accessible after disaster		Staff augmentation from NDMs, dialysis teams if available
	Communication: Literacy; language barriers; access to telephone, radio, and television	Communication systems, ideally three independent communication modes		Supply depots stocked with dialysis supplies
	Complications: Vascular access, medication unavailable, infection	Nephrologists showing leadership by sustained presence in the facility	ESRD Network coordinates assessment and response, directing patients to functioning dialysis units with surge capacity	Severity and extent of critical infrastructure damage; adequate security
	Transportation shortages	Extent of damage to dialysis facility	Assistance with language translation by telephone or other mode of communication	Early repopulation

^aThe timeline to safety is a critical concept, allowing planners to focus on the critical issues that must be addressed to minimize the delay in resuming dialysis treatment. The table was designed to be read vertically, listing the key factors at each level (patient, dialysis unit and provider, ESRD community, and emergency response infrastructure) at which particular issues manifest or the level that is most responsible for response planning and preparation. Clearly, this is a simplification, and in many cases, responsibility for preparation will cross the arbitrary boundaries described here. DIPP, disaster information public posts.

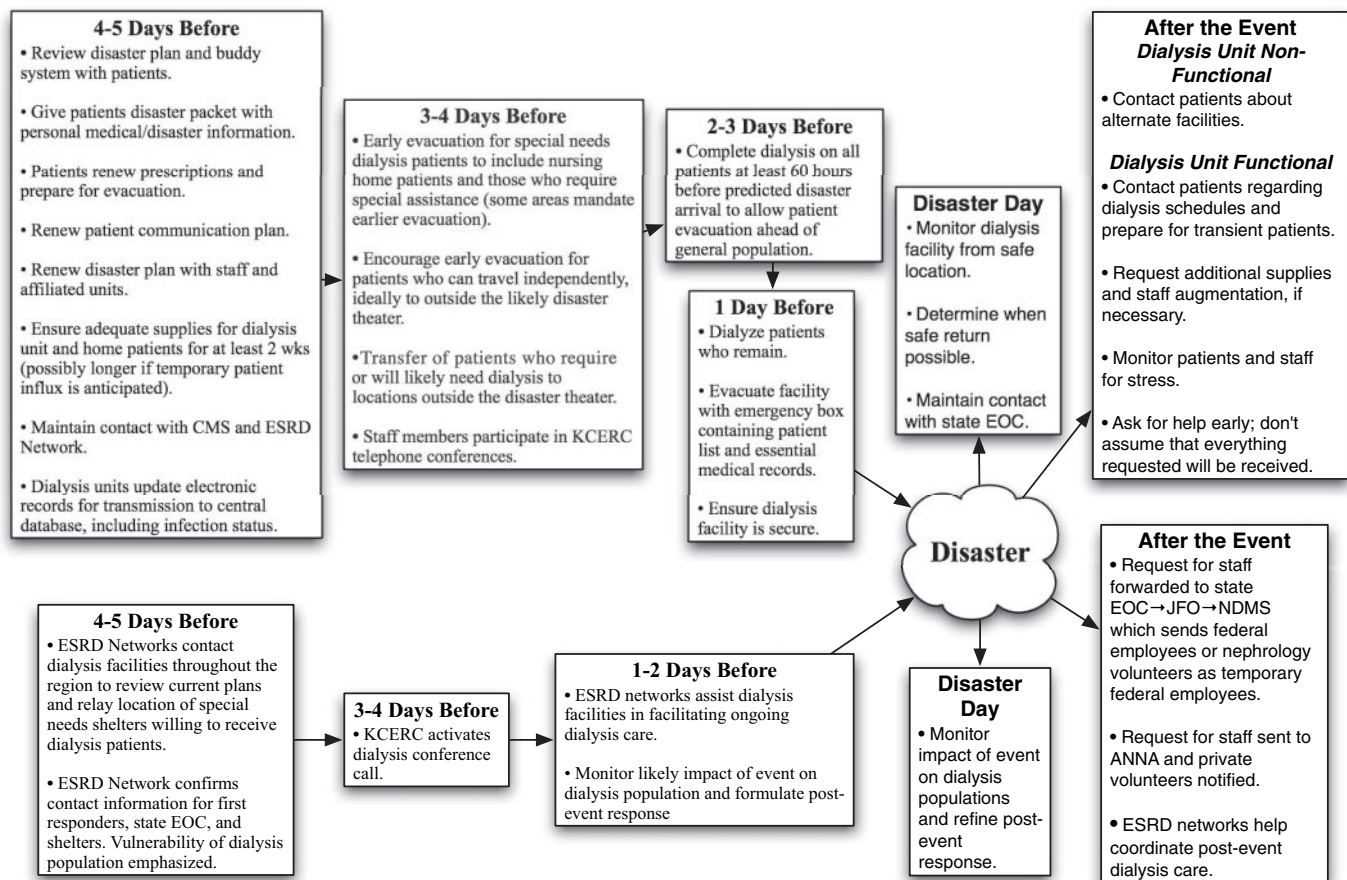


Figure 1. Sample timeline for disaster preparation and response. On the top row are the tasks for dialysis patients and dialysis facilities; on the bottom row are the tasks for ESRD networks, KCERC (Kidney Community Emergency Response Coalition), and emergency responders. The sample timeline gives only approximate days for particular activities; the specific timing will be adjusted to meet local conditions, anticipated damage, local regulations, and emergency plans. Disasters such as hurricanes, floods, ice and snow storms, and wildfires are to some extent predictable, although the number of days of advance warning will vary. ANNA, American Nephrology Nurses Association; CMS, Centers for Medicare and Medicaid Services; EOC, emergency operations center; JFO, joint field office.

Dialysis, that will assist patients in their approach to disaster preparedness and self-sufficiency (7). ESRD Network 13 has prepared a needs assessment document that will help providers prepare individual patient evacuation plans (8).

Dialysis patients and renal transplant patients should maintain a list of their medical problems, care providers, medications, and (when applicable) dialysis prescription. When these patients evacuate, they should bring this list and their medications and (when applicable) diabetic testing supplies. Dialysis patients should be familiar with the emergency renal diet (7). It is advisable to have at least a 2-wk supply of food for emergency use. After Hurricane Katrina, a number of patients who were trapped in New Orleans reported adhering to the emergency diet; that may well have saved their lives, as they waited days for their next dialysis treatment. Patients with diabetes should avoid the use of products with sugar, unless they become hypoglycemic. If patients find themselves stranded without provisions, however, dietary adherence may not be possible. Instead, patients will have to avail themselves of the disaster organization relief rations provided to them.

Americans are encouraged by the government to prepare for disasters by developing an emergency provision pack that contains food, clothing, and basic toiletries in the event of evacuation. An example of such a pack is provided by The Missouri Department of Health and Senior Services "Ready in 3" initiative (9). The ESRD networks offer educational resources for patients on a variety of topics ranging from disaster planning to coping with chronic illness (6). Finally, patients who customarily adhere to their dialysis prescription, including diet, fluids, and medication, will be in optimal shape to survive in an emergency situation.

Patients should be made aware of a useful resource that allows them to maintain contact with families and friends. In July 2006, the American Red Cross launched the Safe and Well List, which is a web-based tool that allows individuals to exchange welfare information with family members and friends in the aftermath of a disaster (10). The site allows individuals to select standard messages indicating that they are safe and well, and family and friends can search the web site using the individual's name and telephone number or name and complete address.

During the Disaster: Assessing Needs, Finding Resources, and Maintaining Homeostasis

Physical factors (overall health, functional status) and psychologic factors (degree of self-advocacy and personality type, such as introvert/extrovert, reactive/proactive) will influence how a patient responds to the disaster environment. Martin-Diaz *et al.* (11) measured indicators such as physical fitness, feelings, daily activities, social activities, change in health, overall health, and pain and found that the “process of psychologic adaptation to problems deriving from dialysis is satisfactory.” Perhaps the use of this evaluation tool could find application in evaluating dialysis patients who are involved in a disaster.

Dialysis is stressful for many patients under normal circumstances; dialysis in the chaotic disaster environment may contribute additional stress. After Hurricane Katrina, patients relocated several times as evacuation shelters changed; therefore, patients had to undergo dialysis at different centers with unfamiliar staff. In this setting, continuity of care is enhanced when medical and dialysis treatment records are readily available.

Medical staff, in the shelters and the dialysis units, can foster the patient’s emotional well-being by allowing each patient time to talk about their feelings and by stressing these points:

- Although the patient is in the midst of an extreme hardship now, the situation will improve.
- Information and updates will be provided as soon as possible.
- Experts are working together to address problems.
- The staff genuinely cares about their welfare.
- The patient retains control of important aspects of life: Diet, mental attitude, and ability to relate to others.
- There is still a degree of normalcy amid the chaos.
- Grieving is a normal response to disaster.

Resolution Stage

A patient in a temporary shelter may experience a variety of emotions, ranging from relief to anxiety, depression, and anger. Patients should be assessed for signs and symptoms of post-traumatic stress syndrome (insomnia, flashbacks, and depression). Silove *et al.* (12) found that “acute traumatic stress may be a normative response to life threat which tends to subside once conditions of safety are established. At the same time, there is a residual minority of survivors who will continue to experience chronic post-traumatic stress disorder (PTSD) and their needs can be easily overlooked.” Approximately 20% of Hurricane Katrina survivors had symptoms consistent with PTSD when evaluated 6 mo after the storm (13). Similar data specific for shelter evacuees or for dialysis patients are not currently available. Medical providers should be aware that patients will probably still be mentally processing many losses: The death of loved ones, absent friends and relatives, pets left behind, loss of property, and financial losses. Regular meetings with the renal social worker at the dialysis facility could be very beneficial in assessing psychological adjustment. Additional professional counseling might be indicated to assist the patient with any long-term effects that result from the disaster experience.

In conclusion, although the external situation may be outside

of their control, the way in which individuals react to a disaster and its aftermath is determined largely by their psychological make-up. A multidisciplinary approach to patient care will be required to assist patients in adjusting to each phase of the disaster and its response.

Dialysis Facilities: Preparation and Response

Various situations can affect dialysis centers, including facility emergencies, local disasters, and catastrophic regional events. Having a plan and rehearsing the plan on a regular basis can lessen the shock and disorganization that invariably accompany disasters. The process of planning will force modifications to the plan. This section examines facility operations before, during, and after the disaster. Government and private organizations have assembled useful information on dialysis center preparedness, much of which can be accessed *via* the Internet (Table 5) and some of which is published (14).

Mitigation: Planning for Disaster

Dialysis facilities are mandated by federal regulations issued by the CMS to develop written policies and procedures that define how to handle emergency procedures. The relevant regulations include Code of Federal Regulation 405.214(d), which covers the safety and protection of patients; 405.2160(a), which requires affiliation agreements; and 405.2139(b), which specifies protection of patient medical records.

Planning begins with a local and regional environmental scan to determine what events are particularly likely to occur (15). What type of damage could the facility sustain? What can be done to keep the facility functional? What can be done to minimize the impact on facility operations? If, for instance, the facility is located in a flood-prone area, then are the supplies high enough off the floor to maintain their sterility? In an earthquake area, are the shelves, televisions, and machines secured? Management should have blueprints of the facility and know where all shut-off valves for utilities are located.

Education and training for both patients and staff also fall under the federal mandate. Patient training includes frequent drills for hand-cranking blood circulation, clamping and cutting blood lines to disconnect patients, self-protection during an event, and knowledge of the evacuation procedure. Patients should be given written materials for a 3-day emergency diet and contact information for the facility and their nephrologist. Staff should attend mandatory annual reviews, conduct patient teaching, and document for each patient the ability level to participate in emergency preparedness activities. Facilities should document that training and drills were conducted and evaluated. A continuous quality assurance process should be in place for assessment and improvement.

A plan for the protection of patient medical records is crucial: When a disaster occurs, access to patient information will provide for safer treatments and better informed staff. LDO generally have computerized medical records and can access patient records from any location. Other dialysis units may not have electronic medical records systems and may lack that capability. All facilities should maintain off-site copies of the following: A comprehensive list of all patients, the CMS 2728

Table 4. Additional ideas to improve emergency response, with a focus on kidney patients^a

Parameter	Possible Approaches
Patient care	<p>Region-wide dialysis patient database, populated with medical data, including dialysis prescription, medications, and comorbidities, entered before disaster with patient's consent (currently in preparation by the Louisiana Health Care Review)</p> <p>Collaborative agreements between regional medical centers to transfer patients as needed</p> <p>Track patients with infection, and monitor to ensure that appropriate precautions are taken in shelters and dialysis units</p> <p>Expanded availability of alternative dialysis technologies: Sorbent-based dialysis machines, sterile hemodialysis solutions, and closed-loop dialysis machines</p> <p>Oxygen source concentrators rather than tanks</p> <p>Generous use of erythropoiesis-stimulating agents when a patient's customary dosage is unknown</p>
Dialysis unit function	<p>Satellite telephone, providing telephone and Internet access</p> <p>Redundant communication modalities, ideally three or more [e.g., regular (analog) telephone, Blackberry-type device, satellite telephone, amateur radio]</p> <p>Back-up electric power: Average-size unit with 16 to 20 dialysis machines and a water treatment system probably requires a 125-kW generator; formula available from ESRD Network 13 (17)</p> <p>Free-standing dialysis facilities should identify partner facilities for mutual support</p> <p>GPS coordinates disseminated to first responders and patients</p>
Public and professional education	<p>Provide kidney disease-focused emergency preparedness information to patients, first responders, nephrologists, dialysis facility personnel, and dialysis unit administrators</p> <p>Provide patients with customized, detailed evacuation and care plans</p> <p>Rehearse plans at all levels, and make changes where necessary</p>
Evacuation and communications	<p>Before imminent emergency, the dialysis facilities emergency response leaders should consider making a recommendation to state officials to issue mandatory evacuation order for dialysis patients</p> <p>DIPP: Predesignated location along evacuation routes (highway rest stops, service stations, Wal-Mart, Home Depot, Lowe's, banks) where up-to-date, reliable information can be posted and regularly updated, including specific directions for dialysis patients</p> <p>Information sources for dialysis patients posted on local television stations along with other emergency broadcast programming</p> <p>During evacuation, patients encouraged to check-in <i>via</i> telephone or e-mail to ESRD network or LDO provider to ascertain location of functioning dialysis units, which would also facilitate dialysis unit planning for patient surge</p> <p>Interoperable communications clearinghouse platform with a web portal available to first responders, providers, and dialysis staff; this would facilitate private communication about specific patients <i>via</i> telephone and secure communication network</p> <p>Plan for school buses, rental buses and vans, and designated drivers to transport those without private vehicles</p> <p>Designate media spokesperson for each dialysis unit and organization</p> <p>Disasters involving major trauma and crush injury will require air transport to hospitals in nearby cities and states for surgical and nephrology care</p>
Patient tracking and health records	<p>Deploy an EHR system with operability across the disaster theater; medical records could be created or updated by first responders or subsequent providers; this would facilitate evacuee tracking as they move around the disaster theater (a project under way within HHS)</p> <p>Evacuee identification system, bar-coded, possibly linked to fingerprints, iris scans, or radiofrequency-implanted chips in selected patients; preregistration of selected patients by dialysis facilities</p> <p>Data entry <i>via</i> personal digital assistants and laptop computers used by first responders, field hospitals, shelters, and dialysis units</p> <p>Maintain and update medical data for dialysis patients (including medical history, medications, and dialysis prescription) in a local database that is overseen by the ESRD networks; at the time of an evacuation, transfer data into the HHS disaster electronic medical record system</p>
First-responders	<p>Triage, treat, and transport: Triage stations should treat if necessary and transport to perimeter zones as rapidly as possible to avoid congestion in the central zone</p> <p>Improved field hospital assessment, with adequate laboratory facilities to measure patient chemistries that are relevant to dialysis patients</p> <p>KMAT: Proposed teams to be run by the NDMS and modeled on the DMAT; under consideration are four regional teams (Northeast, Southeast, Gulf Coast, and Pacific Coast), each partnering with a DMAT for training and deployment; the KMAT would have dialysis capacity using sorbent dialyzers and other technologies, and the DMAT would provide general medical care and logistical support</p>
Coordination	<p>Designate individuals to orchestrate the response to dialysis facility needs at the state EOC and federal JFO</p> <p>Prearranged collaborative agreements among large academic nephrology programs, renal transplant programs, and ESRD networks to facilitate care of dialysis patients with multisystem illnesses, pediatric dialysis patients, and renal transplant patients</p>

Table 4. Continued

Parameter	Possible Approaches
Shelters	<p>Predisaster designate particular shelters that will concentrate dialysis patients and are located near several dialysis units that are prepared to receive an influx of dialysis patients; coordinate with transportation resources; develop supply depots, either prestocked or stocked upon need from SNS</p> <p>GPS coordinates disseminated to first responders and patients</p> <p>Detailed and uniform triage protocols</p> <p>Protocols for care of kidney patients, including plans for isolation of peritoneal dialysis patients during exchanges, infection control, and diet</p>
Volunteers	<p>Local volunteers recruited and organized before disaster, using volunteer service organizations</p> <p>Pairing of dialysis units with local faith-based or service organizations to develop a plan for transportation and other volunteer services</p>
Assessment of emergency response	<p>Predisaster: Informatics tool to analyze available resources, including anticipated surge volume and surge capacity of dialysis units, shelters, hospitals, response teams, communications, and transportation</p> <p>Postdisaster: Informatics tool to analyze response efforts, including systematic collection of comments from medical professionals and patient-level data (e.g., interdialytic intervals; use of emergency transportation, emergency rooms, and hospitals; and infectious and other complications); the goal is to provide efficacy data to aid future emergency response planning</p>

^aDMAT, disaster medical assistance team; EHR, electronic health record; EOC, emergency operations center; GPS, global positioning system; HHS, Department of Health and Human Services; JFO, joint field office; KMAT, kidney medical assistance team; LDO, large dialysis organization; SNS, Strategic National Stockpile.

Medical Evidence Forms, the dialysis prescription, and care plan for each patient. These documents should be stored in a secure location within the dialysis unit, such as a fireproof and/or waterproof box; should be easily accessible when evacuating; and should be updated at regular intervals. Facility medical and financial records should be backed up on a regular basis and stored at a secure off-site location.

An affiliation agreement with another dialysis unit prepares for the contingency that a dialysis facility becomes nonoperational and helps to ensure continuity of care for dialysis patients. Choosing a nearby facility as the back-up simplifies transportation issues, but if an event is regional, then the affiliate may also be affected. Ideally, each dialysis facility would develop affiliation agreements with both local and regional partners. Similarly, the ESRD networks are developing a back-up system whereby each network would be paired with a second network. This approach is intended to facilitate the restoration of administrative services to dialysis patients and providers.

ESRD care is delivered within the context of larger medical and social communities. Dialysis facility managers should communicate with local, county, and state emergency management organizations to contribute to the development of the community disaster plan. One critical lesson learned from the 2005 hurricanes was that emergency organizations were not aware of the special needs of dialysis and transplant patients, and this delayed timely assistance to this vulnerable population. Dialysis facilities should ensure that projected security needs are addressed in the community disaster plan, with specific plans for assistance from police, the National Guard, and other assets.

Disaster Response

Disaster response for a dialysis facility consists of a sequence of events. The senior individual present should activate the

dialysis facility's emergency response plan. If a determination is made that immediate evacuation is indicated, then authorities are notified by a call to 911, patients and staff are evacuated from the building, evacuee names are listed, and the emergency box is retrieved and carried out. Next, a facility emergency command center is activated. The emergency plan should indicate possible locations, with alternates, and staff assignments, although flexibility in execution will likely be required. The ESRD networks, as part of their disaster planning process, require each dialysis facility to provide contact information for two emergency staff from each facility, including a work telephone number and with two alternative means of contact.

Communication, for both sending and receiving information, is critical to effective disaster response efforts. Standard methods, including landline phones and many mobile devices, may be inoperative during disasters. Most mobile communication devices rely on frequency modulation (FM) radio frequencies above 30 MHz (including very high frequency and ultrahigh frequency bands) to provide line-of-sight communication between the hand-held device and a relay station. Typical devices that use this approach include mobile (cellular) phones, Blackberry-type handheld devices, digital pagers, and communication *via* vehicle-mounted dishes. Most satellite telephones also use a ground station to communicate with the satellite. In a disaster, these relay stations may be rendered inoperative or overwhelmed with an extraordinary volume of calls. (Telephone networks are generally designed to provide 15% capacity, assuming that most subscribers will not be using their phones at the same time. In an emergency situation, the 15% threshold is typically exceeded.) In the setting of a functional but overloaded relay station, Internet communication that can wait for transmission may work better than telephones that require immediate access to the network. Tracking and per-

Table 5. Web resources for disaster preparedness^a

Resource Type	Organization/Topic	Web Address
Governmental	CDC: Bioterrorism information	www.bt.cdc.gov/disasters
	CDC: Environmental infection control guidelines for healthcare facilities	www.cdc.gov/mmwr/preview/mmwrhtml/rr5201a1.htm
	CDC: Prevention and control of dialysis-associated infections	www.cdc.gov/ncidod/dhqp/dpac_dialysis_pc
	CMS: Emergency preparedness for dialysis facilities: A guide for chronic dialysis facilities	www.cms.hhs.gov/ESRDNetworkOrganizations
	CMS: Infection control for peritoneal dialysis patients after a disaster	www.bt.cdc.gov/disasters/icfordialysis.asp
	CMS: Preparing for emergencies: A guide for patients on dialysis (CMS publication 10150)	www.medicare.gov/Publications/Pubs/pdf/10150.pdf
	CMS: Conditions for Medicare coverage	www.access.gpo.gov/nara/cfr/waisidx_05/42cfr405_05.html
	FEMA	www.fema.gov
	FEMA: DMIS Interoperability Backbone	cmi-services.org/capabilities-interop.html
	FEMA: Emergency preparedness courses for Federal personnel	www.training.fema.gov/EMIWeb/ISI/crslist.asp
	FEMA: Hazard maps for localities	www.hazards.fema.gov
	FEMA: National Response Plan	www.dhs.gov/dhspublic/interapp/editorial/editorial_0566.xml
	FEMA: National Incident Management System	www.fema.gov/emergency/nims
	FEMA: Preparing for disaster for people with disabilities and other special needs	www.fema.gov/plan/prepare/specialplans.shtm
	Missouri Department of Health and Senior Services: Ready in 3	www.dhss.mo.gov/Ready_in_3/
	NDMS	www.oep-ndms.dhhs.gov/
	Occupational Safety and Health Administration	www.osha.gov
	San Francisco Office of Emergency Services, Homeland Security	www.72hours.org
	White House Katrina Report	www.whitehouse.gov/reports/katrina-lessons-learned/
	Nongovernmental	American Academy of Pediatrics: Care and treatment of children in disasters
American Kidney Fund		www.kidneyfund.org
American Nephrology Nurses Association		www.annanurse.org
American Red Cross		www.redcross.org
American Red Cross: Safe and Well List		www.disastersafe.redcross.org/
ESRD Networks		www.esrdnetworks.org
ESRD Network 7: ESRD emergency information		www.fmqai.com
ESRD Network 13: ESRD emergency information		www.network13.org
Joint Commission of Accreditation of Healthcare Organizations: Standing together: An emergency planning guide for America's communities		www.jcaho.org
KCERC, including information about NDMS-sponsored nephrology volunteer program		www.kidney.org/help
Louisiana Health Care Review: Emergency preparedness and management resources for Louisiana hospitals		www.lhcr.org
National Kidney Foundation: Planning for disasters and other types of emergency: A guide for kidney patients		www.kidney.org/atox.pdf/DisasterBrochure.pdf
National Renal Administrators: Disaster Preparedness Center		www.nraa.org/Disaster_Prep.php
National Volunteer Organizations Active in Disasters		www.nvoad.org
Nephron Information Center: Disasters		www.nephron.com
The Renal Network: Disaster planning and emergency preparedness guidelines and resources		www.therenalnetwork.org/NetworkPolicies/Disaster.html
Texas ESRD network: ESRD emergency information		www.esrdnetwork.org/

^aCDC, Centers for Disease Control and Prevention; CMS, Center for Medicare and Medicaid Services; DMIS, Disaster Medical Information System; FEMA, Federal Emergency Management Agency.

sonal alert systems that are widely used as proprietary devices by home health agencies and emergency transportation services usually rely on local telephone or relay tower service; these systems also proved to be unreliable after Hurricane Katrina, when the communications infrastructure was damaged.

Bidirectional satellite service provides a good alternative to communication systems that require relay stations. These satellite systems support reliable disaster data transmission that may be invaluable for real-time response, including patient tracking mechanisms and patient data retrieval. If the broadband service capabilities allow, then voice and video applications may also be supported. Satellite systems are widely used by the military, border patrol, emergency responders, and large businesses and are now available for dialysis facilities, shelters, hospitals, and others. These systems consist of fixed or mobile platforms (some with all-in-one suitcases) with service plan options of monthly or per-transmission fees. Another alternative is ham radio, which also uses frequencies above 30 MHz; dialysis units might be able to identify a local ham radio operator who is willing to assist in an emergency. A possible resource is the American Radio Relay League, representing radio amateurs (<http://www.arrl.org>). In the absence of functioning electronic communication devices, a dialysis unit may find itself communicating by sending staff members or volunteers to deliver critical messages in person.

An intriguing approach to maintaining contact between patients and dialysis facility staff involves global positioning system (GPS) devices in cell phones. GPS receivers are present in an estimated 100 million cell phones that are in use in the United States, as a result of federal law intended to help first responders locate individuals. These systems can provide a location to within 100 meters, although function may be compromised when the phone is located indoors or in densely populated cities. A free application, Mologogo (<http://www.mologogo.com>), allows users of certain cell phones and BlackBerry-type devices to determine their location. A private network can be set up on the Mologogo web site to map the position of software-equipped phones in a particular group, such as a dialysis facilities' patients. Other companies provide cell phone users with GPS capability, but the phones cannot be accessed by Mologogo software; one hopes that this might change in the future, perhaps with encouragement from the disaster response community. This system could be readily adopted by a dialysis unit to track the movements of its patients (and perhaps staff) in the aftermath of a disaster and direct first responders to transport those in need. Practical issues in deploying a tracking system that must be addressed include privacy issues (*e.g.*, ensuring that tracking begins only after an emergency is declared) and the need for the cell phones to remain powered and in use during an emergency (when cell phones are often unreliable). If deployed, then this approach might be suitable for particular patients but not be feasible or desirable for all patients.

After a disaster, a status report should be made to the facility's management and medical director and to the KCERC web site and daily conference call. One staff member should be

assigned to monitor the CMS web site for emergency regulatory notices, such as those that pertain to starting up emergency dialysis facilities or changes in Health Insurance Portability and Accountability Act requirements. If the facility is closed (defined as not operational for dialysis, according to KCERC criteria), then patients and staff must be notified. If phone lines are not operational, then a public service announcement may be the best option. If the dialysis facility has a web site and Internet access is available, then information for patients and staff may be posted.

If the dialysis unit is open, operations may not be routine. Patients may arrive anxious, out of medication for days, with new illnesses, and in dire need of dialysis. New patients may transfer from dialysis units that have closed. The medical director will need to be available to provide emergency dialysis orders and refill prescriptions. Some staff may be absent, and alternate staff may need to be identified. Sources of staff include affiliated dialysis units throughout the country, local dialysis units, volunteer staff (including those who are on a roster that is maintained by the American Nephrology Nurses Association (<http://www.kidney.org/help>), and the National Disaster Medical System (NDMS). Water contamination is a threat, and alternative water sources (*e.g.*, tanker trucks) may be required. Source water should be tested more frequently for endotoxin than the Association for the Advancement of Medical Instrumentation standards require. CDC guidelines suggest testing for chlorine more frequently than usual when water service returns, because chlorine levels are likely to fluctuate after restoration of water supply (16). The duration of this frequent chlorine analysis will depend on local circumstances and will be guided by the pattern of results obtained.

If a dialysis facility is closed, then a preselected affiliated dialysis facility may be available. This arrangement works best in a localized disaster. The staff of the two units can work closely together to ensure continuity of care. Patient medical information from the emergency box should be made available to the alternate facility. If both the closed facility and the alternate facility are associated with an LDO, then patient information should be readily available from the computer database. When a dialysis facility notifies the relevant ESRD network that it has closed, the network enters that information onto a national web site. When an affected patient presents to a different dialysis facility, patient data are sent to the Standard Information Management System. In this national database, the patient record is coded as a transfer with a reason (*e.g.*, Hurricane Katrina). Because the alternate facility will likely experience a dramatic increase in patient load, patient schedules and shortened prescription durations may be modified. Throughout this process, psychological stress will manifest in a multitude of ways. The dialysis facility emergency response plan should include stress management approaches for patients and staff to help prevent PTSD.

Recovery from Disaster

Once the patients' needs have been met and the immediate threat of personal injury has passed, a thorough damage assessment of the facility should be initiated using a professional

inspector, working with the facility's insurance carrier. This assessment should include inspection and testing of utilities. Damaged supplies and equipment should be removed and replaced. When a closed facility is reopened, staff and patients must be notified. Patients and staff may suffer from PTSD, which may manifest as depression, acting out, and missed treatments or shifts. Re-establishing the normal routine may take weeks to months.

In conclusion, we cannot control where or when a disaster will occur, but we can and must develop comprehensive plans. Dialysis providers have a fiduciary role in making the needs of kidney patients known to the broader medical and social communities and can fulfill this role by getting involved in local, state, and national emergency preparedness planning.

Volunteer Staffing: Physicians, Nephrology Nurses, and Dialysis Technicians

Dialysis units in a disaster area or the surrounding region will frequently need additional medical staff to replace evacuated staff or to accommodate a surge of new patients. Units that are affiliated with an LDO will likely receive staff and logistical support as part of corporate disaster response plans. Free-standing dialysis units, however, may need to seek support elsewhere. The KCERC has worked with the NDMS to develop a federal response capacity to provide nephrology staff augmentation for emergency situations.

The NDMS is a section within the Department of Health and Human Services. The NDMS is responsible for supporting federal agencies in the management and coordination of the federal medical response to major emergencies and to federally declared disasters, including natural disasters, technological disasters, major transportation accidents, and acts of terrorism including weapons of mass destruction events. The NDMS meets these needs in part by supporting Disaster Medical Assistance Teams. The NDMS also maintains a roster of individuals with specialized skills, including trauma care, burn care, and pediatric care. In response to an initiative by the KCERC, the NDMS has agreed to include on this roster nephrology professionals, including nephrologists, dialysis nurses, and dialysis technicians. The specific function of these nephrology personnel will be to provide staff augmentation for existing dialysis facilities. Interested professionals may submit applications to be hired as intermittent federal employees; the application process typically takes several months. Information about the NDMS program for nephrology professionals is available at the KCERC web site (Table 5).

Dialysis units that experience staffing shortages in the context of a federally recognized emergency should contact local emergency personnel, who would contact the state emergency operations center and then the federal joint field office (JFO). If JFO personnel make a determination of need, then they will make a specific mission assignment to the NDMS to provide dialysis staff augmentation. It may also be possible to request NDMS support by participating in the KCERC daily coordination phone call, because JFO personnel are expected to be on the call. NDMS would then contact selected personnel on the roster

and ask whether they are willing to serve. Individuals would then be activated as temporary federal employees. A typical deployment duration is 2 wk, because shorter deployments are difficult to accommodate in a disaster environment. For family or other emergencies, an early return home is possible. NDMS personnel are compensated during their period of active service according to their assigned civil service pay grade and travel to the disaster area on government travel orders. NDMS professionals must be US citizens and must hold a current professional license in any state or the District of Columbia, which allows practice as federal employees in any US state or territory. NDMS personnel when deployed are covered by the Federal Tort Claims Act, which provides for government defense against any malpractice claims.

Living conditions in a disaster environment and surrounding area are likely to vary considerably. Some response personnel will be lodged in hotels and eat in restaurants. Others will live under austere conditions, staying in a field tent that holds 50 or more individuals, eating in a mess tent, showering in a communal shower facility, and using latrines. In general, assignment notification will be made 24 to 48 h before deployment; therefore the necessary equipment and supplies should be assembled in advance. We believe that this system has the capacity to save lives and improve care for vulnerable dialysis patients in the event of a disaster. From a personal standpoint, the system provides an opportunity to serve in a time of national crisis and may represent a truly life-enhancing experience for the volunteer.

Conclusions

We acknowledge the relative paucity of quantitative data on which to make policy recommendations. Instead, for the most part, we have relied on the experiences of patients, providers, and emergency responders during and after previous disasters to guide the recommendations made here. In many cases, it has been necessary to make a reasoned judgment as to what approach to recommend. We recognize that it will be important to try different approaches in different settings—and then critically assess in future disasters what has worked and what will require further refinement.

We close with a few critical points for the kidney disease community (Table 6):

- Plan ahead; rehearse, critique, and revise the plan.
- The plans should address the four phases of emergency management: Prevention, preparation, response, and recovery.
- Plan with a “what if, then what” mindset that considers various contingencies and ensures redundancies.
- No plan survives contact with disaster—be flexible and creative in an emergency situation.
- Create individualized disaster plans for each patient, and review the plan regularly with each patient.
- Anticipate barriers to evacuation of kidney patients.
- Create a plan for the dialysis unit, including emergency equipment, transportation, staffing, communications, evacuation, health records, and continuity of care.
- When a possible disaster is forecast, follow a timeline of preparation and response.

Table 6. Questions for the future of nephrology disaster response

Area	Question
Patient plans	<p>Can we identify and overcome barriers to early and complete evacuation of dialysis patients?</p> <p>Can providers motivate patients to develop and rehearse individual evacuation plans?</p> <p>Should the resuscitation status be included in each patient's disaster packet?</p> <p>Will kidney patient organizations take a leading role in the effort to educate dialysis patients about disaster response?</p>
Facility plans	<p>Will dialysis units procure redundant communications tools?</p> <p>Are web-based portals, such as the DMIS FEMA eGOV platform, a practical step toward a truly interoperable communications system?</p> <p>Will dialysis units procure appropriately sized generators and store sufficient fuel?</p> <p>Will dialysis units develop plans to back up medical records, with the ability to disseminate medical information after the unit is forced to close?</p> <p>Will dialysis units develop affiliation agreements with other units outside the likely disaster area?</p> <p>Will facilities be able to gather useful data on dialysis patient care in future disasters to facilitate future disaster planning?</p>
Community plans	<p>Is the timeline to safety a useful tool to focus planning for all organizations that cooperate in ensuring the swift resumption of regular dialysis treatments for patients?</p> <p>Will a detailed and resourced community transportation plan improve evacuation?</p> <p>Will medical personnel in evacuee shelters have dialysis patient evaluation protocols, communications resources, and appropriate laboratory support? Will they be aware of resources to facilitate dialysis referral, including the KCERC emergency telephone number (888-33kidney)?</p> <p>Will careful planning and early evacuation for dialysis patients reduce burdens on the general disaster response effort?</p> <p>Should particular shelters be predesignated for kidney patients, and what particular resources should these shelters be provided?</p> <p>Are we doing enough for kidney patient subgroups with particular needs: Pediatric dialysis patients, peritoneal dialysis patients, hepatitis B–seropositive dialysis patients, and transplant patients?</p>
Federal plans	<p>Should there be plans for emergency dialysis clinics to be set up and staffed by federal kidney medicine emergency response teams to augment the capacity of existing dialysis facilities?</p> <p>Will the newly available sorbent and closed-loop dialysis systems become readily available for disaster response?</p> <p>Will the federal government develop and deploy an emergency health records system?</p>
All-hazards planning	<p>Is the kidney community ready for a large-scale disaster involving widespread crush injury or pandemic influenza?</p> <p>The kidney community is now focused on disaster planning; will this focus be lost in the years ahead if we are spared another domestic disaster?</p>

- Strive to shorten the timeline to safety, leading to the resumption of regular dialysis treatments.
- Use existing resources, and network with others in the kidney community and beyond.
- Get involved in local response planning, and advocate for kidney patients.
- When feasible, gather data during and after the disaster to facilitate analysis and thereby improve future response planning.

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Disclosures

None.

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