

Home Parenteral and Enteral Nutrition During Natural Disasters: A Guide for Clinicians and Consumers

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Abstract

Natural disasters are most often weather related but can also be unrelated to weather. Either way, these disrupt “normal” life for a short or extended period of time. When someone depends on electricity, clean water, and transportation services for life-sustaining therapies such as home nutrition support, it is important to have a plan in place—even if it is never used. Understanding supply needs, access to home utilities, and when to change location should be discussed, determined, and defined. In this article, the authors strive to provide this information for home parenteral and enteral nutrition support patients (consumers), caregivers, and clinicians. (*Nutr Clin Pract.* 2019;34:216–219)

Keywords

disasters; disaster planning; home care; home enteral nutrition; home parenteral nutrition; nutrition support

Home parenteral nutrition (HPN) and home enteral nutrition (HEN) are lifesaving and life-sustaining therapies for many.^{1–3} Lifetime or long-term dependence on HPN or HEN (HPEN) can significantly improve quality of life for someone that cannot absorb adequate nutrients through an oral or enteral route. Once therapy is transitioned to the home, nutrition products, devices, and supplies must be delivered to the patient. When natural disasters, such as hurricanes, fires, earthquakes, or tornados occur, these deliveries can be interrupted or delayed, so pre-preparation is key (Table 1). Even in non-weather-related emergency situations, patients may experience a prolonged electricity outage causing their refrigerated medications, including their bags of parenteral nutrition (PN), to become unusable. Barrocas and colleagues described the effects of Hurricane Katrina on a hospital nutrition support team that provided great insight into emergency preparedness for hospitals, long-term care facilities, and skilled nursing facilities.⁴ Trento and Allen provided key information for HPEN consumers after Hurricane Sandy, which is applicable today.⁵ This paper will review how to prepare for and survive an emergency/disaster situation for people receiving HPEN as well as present a case study.

Home Parenteral Nutrition

HPN therapy is complex, with distinct sterility and refrigeration requirements. There are 2 types of PN formulas available for use—compounded (requires refrigeration) and premixed (does not need refrigeration). Along with HPN,

compounded medications, additives, and multivitamins may also require refrigeration. These additives may include ingredients that are not stable in a mixture for long periods of time and are to be added by the patient prior to infusion. Common examples of these additives are folic acid, ascorbic acid, vitamin K, and insulin. Supplies such as syringes, alcohol wipes, gauze, dressing change items, tubing, etc, should be kept in a designated, clean cabinet or storage area at room temperature. The bag of PN is removed from

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Table 1. Emergency & Disaster Planning Check list for HPEN consumers.

Items to have on hand in case of an emergency or disaster

- Have an emergency/disaster plan in place; leave early rather than staying in a potential disaster zone.
- Maintain a health information card or summary that is easily accessed and carried.
- Stock 1 week of bottled water for hand washing, flushes, oral rehydration preparation.
- Keep a stock of hand sanitizer; keep some separate for HPEN use.
- Have battery-operated flashlights on hand.
- Maintain a list of emergency contacts including the HPEN physician. Assure the home infusion provider or home enteral provider has all information needed to keep in contact with the patient.
- Keep a list of local hospitals.

HPEN, home parenteral and enteral nutrition.

refrigeration approximately 4 hours prior to infusion for proper warming.

An additional concern for the HPN patient is Beyond Use Dating (BUD), described in the United States Pharmacopeia (USP 797). HPN is a Category 2 compounded sterile product in accordance with the USP 797 guidelines. HPN patients are affected by the USP 797 guidelines, which enforces a BUD of 9 days at refrigerated storage conditions. Research is currently ongoing to support an extension of the BUD for sterile compounded HPN from 9 to 17 days if certain criteria are met by the 503A pharmacy.

HPN patients must also take into consideration the operation of the pumps used to infuse PN over long periods of time. Often patients utilize a wall-to-pump alternating current adapter to power their pumps during their infusions. However, in the case that the electricity is down and the patient must use batteries to power to their pumps, the patient should be aware of how long their batteries will last and how many batteries they will need to make it through their infusions.

Patients requiring HEN may infuse their enteral nutrition in bolus, gravity drip, continuous, or cyclic feedings. For those who use a feeding pump, loss of electricity may impact the ability to use the pump. As with home PN patients, many HEN patients use a pump if they are receiving bolus feedings. Most if not all pumps have a battery backup power source and can therefore be operated by battery power if needed for a short period of time (ie, 18 hours). HEN patients should know the battery life of the pump (check with the pump manufacturer) and develop an alternate plan if the power is out for longer than the battery life. If the water supply is affected, the patient will need an adequate supply of bottled water to use for hydration, tube patency, and hygiene. Daily tube stoma care should be maintained to prevent bacterial growth. The feeding formula may be a challenge for those patients who rely on homemade blenderized tube feeding, as refrigeration and food safety are paramount in avoiding foodborne illness. Patients who use a product that comes in a single-serving container with an amount of nutrients that is appropriate for 1 feeding will likely be able to feed normally in a disaster situation. A convenience store may carry single-serve shakes that may be appropriate for some HEN patients to avoid missing nutrition for a day; however, these may be milk based, so they should be carefully assessed. Those who utilize a larger amount or a larger self-contained bag may have more challenges. Enteral safety practices specific to the type of container (open or closed system) to prevent contamination should be followed.⁶

When disaster strikes, the HPN or HEN patient and provider should remain in close contact to ensure there are no interruptions in therapy. The elements of disaster planning for HPN and HEN patients are listed in Table 2. For HPN dependent patients, lack of calories may be a challenge, but lack of intravenous (IV) fluid may be of more concern, especially in those with high fluid requirements. It is essential that advanced preparations be made for emergency/disaster planning. First, having an emergency/disaster plan in place and discussing this plan with the patient/family before it is needed is important; it is always

Table 2. Emergency/Disaster Planning.

HPN	HEN
Maintain an inventory of 3–4 days of HPN and essential supplies (syringes, flushes, tubing, batteries, dressing supplies, and masks).	Keep several extra enteral feeding bags and HEN supplies prepared (HEN emergency kit: syringes, tubing, batteries, etc).
Maintain a 3–4 days inventory of IV fluids for hydration.	Maintain a 2-3-day supply of commercial enteral products during natural disasters (hurricanes, earthquakes, extreme weather conditions).
Ensure that all essential drugs and supplies are in date. Ensure that any expired products are properly disposed of and replaced.	Maintain an adequate inventory of more specialized feeding formulas (adult and pediatric). Especially important for pediatric patients with specialized enteral formulas (ie, metabolic).

HPN, home parenteral nutrition; HEN, home enteral nutrition; IV, intravenous.

better to be prepared. A major component of this plan is developing and maintaining a list of emergency contacts. The home infusion provider should have all information needed to keep in contact with the HPN patient. Often the patient and family may be required to relocate quickly and may not be able to contact the provider. It is helpful to have a list of alternate locations so that the provider can keep in contact with the patient and ensure their nutrition regimen is able to continue uninterrupted.

A health information card or summary that is printed and in a waterproof sleeve or small enough to carry in a wallet is useful for a patient requiring chronic therapy of any kind, including HPEN.⁴ This should include patient name, address and phone number, diagnosis, physician name and phone number, allergies, medication list, and HPEN prescription at a minimum.

When possible, maintaining an inventory of 3–4 days of HPN and essential supplies in an “HPN emergency supply kit” (syringes, flushes, tubing, batteries, dressing supplies, and masks in a waterproof container) will prevent the need for quick turnaround shipping, especially when areas may be difficult to access. Similarly, maintain 7–10 days inventory of IV fluids for hydration if clinically indicated, which could suffice in an emergency if HPN is not available. Regular checks of expiration dates should be done to ensure that all essential drugs and supplies are in date and any expired products are properly disposed of and replaced. This is especially true if a patient lives in a weather-prone area (hurricanes, winter storms) and the HPN emergency kit is restocked yearly.⁴ Because HPN (and HEN) pumps require charging (although may run on batteries for an infusion cycle), this is an important consideration for planning timing of evacuation and where the patient will go.

Consider maintaining a limited inventory (7–10 days) of premixed bags of PN, which do not require refrigeration and have an extended shelf life when stored at room temperature. Such products may include Clinimix (Baxter, Deerfield, IL) or Kabiven/Perikabiven (Fresenius Kabi, Uppsala, Sweden), which are available in various volumes and contents. Although these products are not patient specific like their compounded PN, they can provide sufficient nutrients and electrolytes to keep the patients stable during a natural disaster, especially when their home nutrition support team is unable to get PN to the patient in a timely manner. Patients may also utilize these products during times when there is no electricity to properly store compounded PN. They will be able to take these bags with them if they need to evacuate and can store them at room temperature as needed during the disaster until they are able to receive compounded PN and properly store it in refrigerated conditions. This may be considered if the patient lives in an area that is difficult to access or prone to flooding, hurricanes, or other forms of hazardous weather. These products must be kept

up-to-date, with expired products disposed of and replaced with non-expired products. The limitation of this option is the finite expiration of the products and the risk of wastage.

Home Enteral Nutrition (HEN)

For HEN patients, keeping a supply of batteries and canned or already prepared enteral formula is of critical importance. A standard formula or peptide-based formula may be purchased at a local pharmacy or online to keep on hand for this purpose if the infusion provider is unable to provide enough inventory. For patients utilizing homemade blenderized enteral feedings, there are commercially prepared formulations that can be used in substitution during emergencies related to natural disasters. It is essential that advanced preparations be made for disaster planning. The elements of disaster planning for HEN patients are listed in Table 2. Although it may seem that an enteral feeding will be “easier” in a natural disaster, cleanliness and availability of feeding supplies and formula must be assured. This is not a time to “see if a patient could consume some oral intake.” With HEN, maintain several extra enteral feeding bags and HEN supplies (syringes, tubing, batteries, etc. in a waterproof container) along with a 2–3 day supply of commercial enteral products. For patients receiving a standard enteral formula or less specialized formula, a substitution may be acceptable if the preferred formula is not available. However, for pediatric patients, it will be important to maintain an adequate inventory of more specialized feeding formulas compared with the adult population.

Although anyone receiving HPN or HEN requires their therapy to be delivered as ordered, adult patients may have slightly more resilience than pediatric patients. Therefore, for the HPN provider, enteral provider, and/or durable medical equipment provider, prioritization will be important. It may be best to send pediatric patients to the hospital in anticipation of power outages and lack of access. Fragile adults and pediatric patients should always be in close communication with their physician. A small local hospital may be more appropriate than their primary center if time is of the essence.

One of the biggest challenges for home nutrition support patients who have a disaster plan is maintaining a clean environment (hands, surfaces, products). It will be important to maintain an inventory of hand sanitizer, sterile covers, and plenty of water on hand. Everyone should have a disaster plan, with or without HPEN, especially if they live in an area subject to natural disasters. The plan should be made before an emergency occurs and updated often.

Case Study

A real-life example (used with permission): Jana is a 32-year-old woman who receives HPN therapy 4 days per week and IV fluids on the other 3 days per week. She lives

Table 3. Web-Based Resources for Emergency Needs.

Website	Description
http://dps.texas.gov/dem	Texas Division of Emergency Management (check for your state)
http://texasprepares.org	DSHS website (check for your state)
http://redcross.org	American Red Cross website
http://redcross.org/cruz-roja	American Red Cross website in Spanish
http://ready.gov	Plan Ahead for Disasters
http://noaa.gov	Weather information
https://oley.org/page/emergencyprepared	Emergency preparedness for HEN and HPN

DSHS, Department of State Health Services; HEN, home enteral nutrition; HPN, home parenteral nutrition.

in Beaumont, Texas, which is about at sea level. In 2017, Hurricane Harvey was making its way to Houston and was supposed to miss Beaumont. Since Jana's dad is a fire chief, he suggested she move to higher ground, where he lives. Jana and her husband relocated to her parent's house as a precaution. She brought her supplies along but, thinking this was an area that would be dry, she didn't worry much. Her HPN provider spoke with her and arranged to send her supplies to Austin, Texas, where an employee would pick them up and deliver them to a friend who was driving back to where Jana was, since it was very quickly recognized that Houston/Beaumont airports would be closed. Hurricane Harvey landed exactly where Jana believed she was safe! Jana almost had to be rescued by boat, but was transported from her "safe" house to a car. She then drove to Dallas, Texas, where she could receive her supplies. As a long-term HPN patient, she took this in stride. A short-term patient might have been more worried. Had Jana had extra supplies at home, she might have been able to take more than IV fluid with her. Also, because of the 9-day HPN BUD, there was no way to ensure that she would have HPN, because of the challenges with transportation from provider to patient in the wake of not only airport closures but also street closures. One HPN consumer in the area was told to go to the hospital—but was unable to get there. A family member and his home infusion provider improvised delivery and were able to get his HPN to him (ASPEN website, September 2017).

Summary

As a HPN or HEN consumer and provider, it is always best to be prepared and have a working plan for dealing with disasters. HPN and HEN consumers need to have access to formulas, supplies, pumps, and their care providers. The Oley Foundation, a support and educational organization for people receiving home nutrition support and their caregivers and clinicians, has a page dedicated to emergency preparedness (<https://oley.org/page/emergencyprepared>) (Table 3). Even if you do not anticipate your HPN or HEN patient will experience a natural disaster or challenge getting their nutrition therapy, it is of vital importance to have a predetermined disaster plan and be prepared.

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Statement of Authorship

C. Ireton-Jones, K. Nishikawa, and R. Nishikawa equally contributed to the conception and design of the work; C. Ireton-Jones, K. Nishikawa, and R. Nishikawa contributed to the acquisition and analysis of the data; C. Ireton-Jones, K. Nishikawa, and R. Nishikawa contributed to the interpretation of the data; and all authors drafted the manuscript. All authors critically revised the manuscript, agree to be fully accountable for ensuring the integrity and accuracy of the work, and read and approved the final manuscript

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