



Earthquakes and People on Dialysis



Kidney Relief in Disasters
TASK FORCE



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Earthquakes occur frequently in some regions of the world and cause widespread human, material, economic, and infrastructural losses. Although all individuals living in the affected area are adversely impacted, people on dialysis are at greater risk because they require regular treatment for survival. However, dialysis provision may be severely disrupted during earthquakes due to several factors: (i) dialysis facilities or machines may be damaged, (ii) supplies may be insufficient, (iii) electricity and water outages may occur, and (iv) dialysis personnel may be unavailable. In short, the possibility for dialysis provision decreases significantly after earthquakes, posing additional risks to people on dialysis beyond those faced by the general population in the affected area.

This booklet will first describe general measures applicable to all individuals, followed by specific precautions and measures for people on dialysis.

OVERALL MEASURES VALID FOR ALL INDIVIDUALS

1. BEFORE THE EARTHQUAKE

First and foremost, whenever possible, live in an earthquake-resistant home. However, finding such a home may not always be possible. Therefore, assess the structural integrity of your residence and reinforce the building, if technically and financially possible, though this process can often be challenging.

That said, without neglecting essential precautions, you can also take simpler safety measures that are easy for everyone to implement. Here are some key precautions to consider:

Creating a home earthquake plan

Hold a family meeting with all household members to establish a "home earthquake plan".

This plan should outline how to act during and after an earthquake, where to take cover for security. The safest spots are typically next to structural columns, solid large household devices like washing machines, refrigerators or freezers, dishwashers, steel safes and divans.

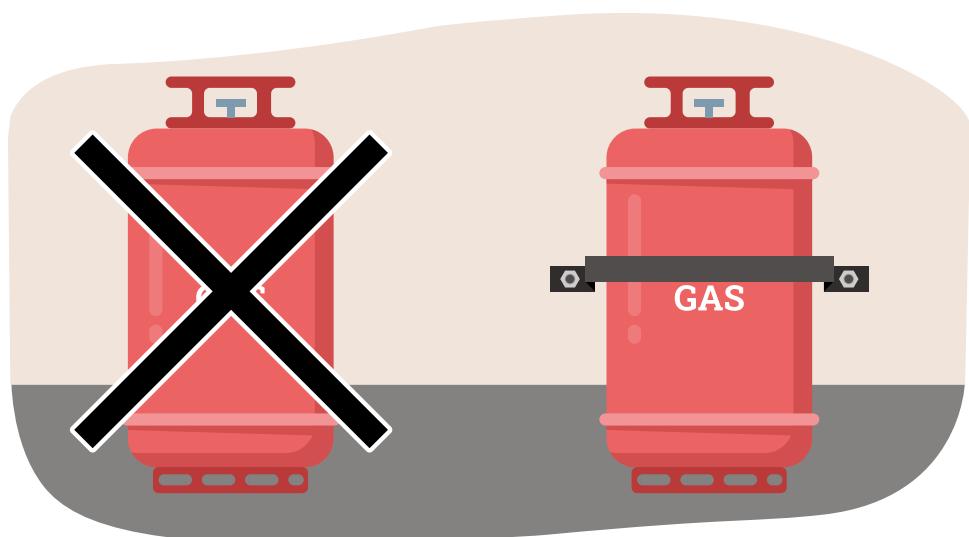
It is also highly beneficial to keep a flashlight within easy reach near the beds.





Bed placement: Avoid placing beds near windows or heavy wall-mounted pictures. Keep curtains closed, as they can prevent injuries from broken glass.

Gas and electrical safety: Secure liquefied petroleum gas cylinders and water heaters, and keep them turned off when not in use.



Securing furniture: Firmly anchor bookshelves, wardrobes, cabinets, and other heavy furniture to the walls to prevent them from toppling over.

Although these precautions may seem minor, they can be life-saving. Falling heavy objects may not always be fatal, but they can trap individuals and prevent them from escaping.



Other issues

First aid training: Make sure to acquire knowledge about first aid.

In the aftermath of disasters, you may need to perform simple medical interventions yourself until expert teams arrive.

Emergency bag: An important measure is the preparation of an earthquake emergency bag.

This bag should contain:

- high-energy, non-perishable food items (such as candies, sweet biscuits, and cookies) that can last for a few days,
- 1-2 liters of bottled drinking water,
- canned food and a can opener,
- a battery-powered radio with spare batteries,
- a flashlight, and first aid kit,
- personal medications,
- adhesive bandages,
- a mask,
- a multi-purpose knife,
- a whistle,
- power banks for cellphones
- water, food and food-container for your pet.

This bag should also contain a waterproof folder with contact details of people to reach out to and photocopies of essential documents. Those who wear glasses should include a spare pair in their emergency bag. Special items for children, the elderly, and individuals with disabilities should also be added. Keep this bag in an easily accessible place close to the main exit of your home.



Importantly, all the above-mentioned precautions also apply to your workplace. Please inform your colleagues about earthquake threats and preventive measures and organize periodic drills to help reduce panic after an earthquake.

2. DURING THE EARTHQUAKE TREMORS

You may be in various locations when an earthquake strikes.

If you can leave the building within 10-15 seconds (such as from the ground floor, or in some cases, one floor above or below the entrance depending on the building's structure), evacuate immediately. Otherwise, take shelter in one of the safe spots described in the previous section.

Be sure to stay away from breakable glass, windows, mirrors, and picture frames. Areas near unsecured mirrors, bookshelves and heavy furniture are hazardous.

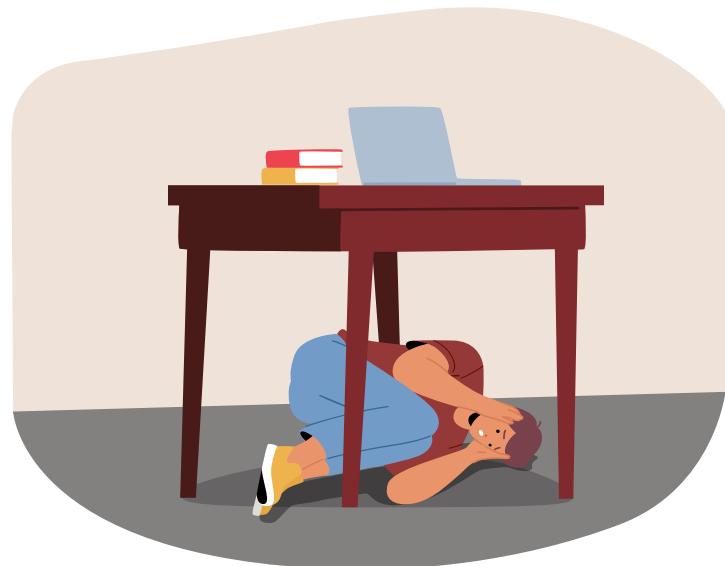
Door frames and the sides of steel doors are also not safe.

Wherever you take shelter, make sure to adopt an appropriate position.

The best way to protect yourself from trauma is to lie on your side in a fetal position. In this position, shield your head with a soft object, if available.

If nothing is within reach, use your hands to protect your head. If you become trapped under debris, maintaining this position will help safeguard your internal organs as much as possible.

Below, you will find information on how to act in different locations during an earthquake:





At home

If you are on the ground floor and near a window, you may quickly exit and move away from the building. However, if you are on the upper floor, do not attempt to leave.

To protect yourself from falling objects, taking cover under a sturdy table or next to a solid piece of furniture, such as a chest, armchair, sofa, or bed can help minimize the risk of injury.



Stairwells and elevators are among the most dangerous places during an earthquake.

The area beneath structural columns is generally safer than the center of a room. During earthquakes, columns may help create 'life-triangles' (potential survivable spaces under rubble) for victims who try to protect themselves by taking the fetal position.





Do not touch electrical appliances, as there may be an electrical short circuit.



If there is an open flame on the stove, turn it off immediately.
If you are nearby, also shut off the gas and electricity valves.



If you are in the kitchen during an earthquake, lie down next to the counter or refrigerator or dishwasher.
In the worst-case scenario, even if your home collapses, you may survive in the "life triangle" spaces formed between these objects and structural columns.

If you are on a balcony during an earthquake, quickly move inside and avoid stepping back onto the balcony until the shaking stops.

Never jump through the window during an earthquake.

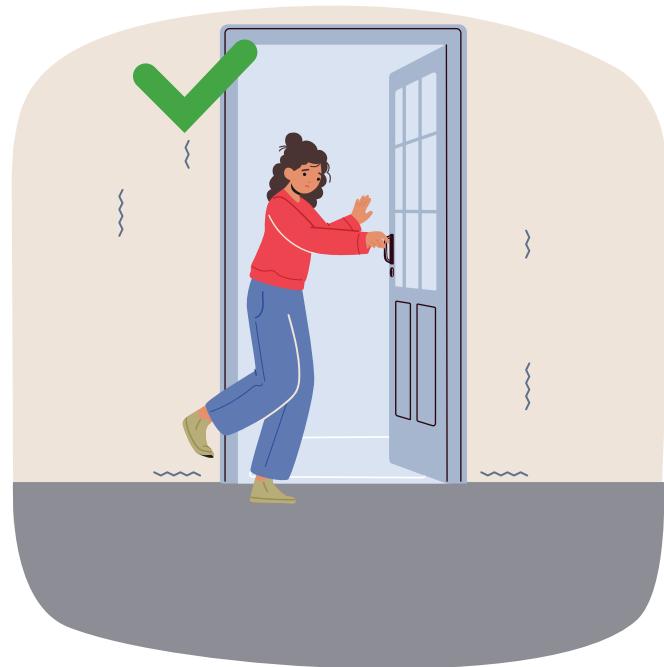




Protect yourself by standing near the door and wait for the shaking to stop before evacuating as soon as possible.

If you are in an elevator when an earthquake occurs, exit immediately and use the stairs to evacuate if it is safe to do so.

If you are near the building's exit door, keep it open, as doors may jam during an earthquake, potentially trapping you and others inside.



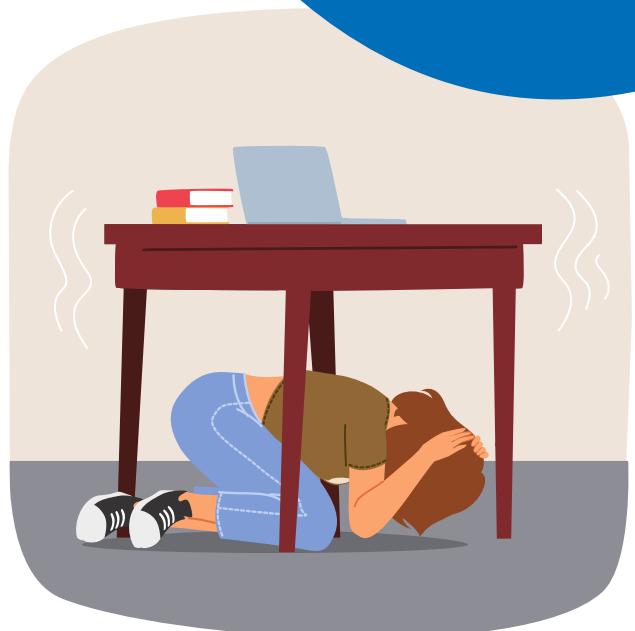
In summary, as soon as you feel the tremor, quickly but calmly move to your designated safe spot and focus on protecting your head first. The precautions described in this section also apply when you are in other buildings such as offices, schools, and hospitals.



At school

Do not panic. During the shaking, immediately take cover under your desk and hold onto it firmly.

Follow your teacher's instructions.



In the hospital

Lie down next to or under your bed and follow the instructions of nurses and doctors.

In public places

If you are in a shopping mall, cinema, theater, conference hall, sports facility or stadium, do not rush to staircases or elevators. Instead, crouch next to columns, sturdy seats or barriers and protect your head. Follow the instructions of the authorities and evacuate the building quickly after the earthquake.

If you are inside an elevator in a high-rise building, stop the elevator and try to exit using the stairs.

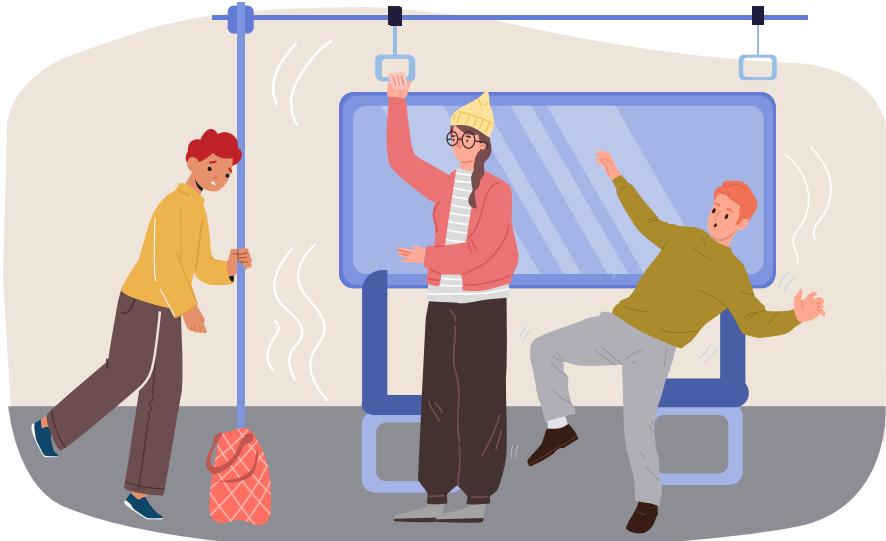




Inside transportation vehicles

Hold onto stable structures tightly. Do not leave the vehicle and follow the driver's instructions. Be aware that objects placed on shelves may fall on your head, so protect yourself. After the shaking stops, exit the vehicle and move to an open area.

If you are near or on train tracks, be cautious of high-voltage power lines and the possibility of oncoming trains from the opposite direction.



While you are driving

If you are in an open area, stop and remain inside the vehicle. If you are not in a safe location, exit the vehicle immediately and move away.

If you are inside a tunnel and not near the exit, stop the vehicle, get out, and lie down beside it in a fetal position. The same method applies if you are in an underground parking lot. Do not remain inside the vehicle in these situations, as

collapsing ceilings or large concrete structures could crush the car, posing a fatal risk. However, if you lie down next to the vehicle, its wreckage may provide some protection.

Under no circumstances should you drive over ramps or bridges that may have been damaged by the earthquake.



On the sidewalk

If you are walking, protect your head and move away from anything that could collapse, such as buildings, billboards, and overpasses. Stay away from electric poles and wires. Seek shelter in the nearest open area and be mindful of any cracks that may form in the ground. Crouch down for safety.

3. AFTER THE EARTHQUAKE

If you are trapped under the rubble

If you can move and see a clear exit, try to reach it. Otherwise, stay in place and remain calm. Avoid unnecessary movement or exertion, as it will deplete your energy and water reserves.

Do not shout unless you hear rescuers nearby, as shouting can quickly exhaust you. When you hear a sound, call for help and try to describe your location and position. Use your mobile phone (if it works). If it does not work, use any available object to make noise, such as a whistle, a metal object to strike against a pot, or glass bottles, to signal your location to rescuers.





If your building is still standing

After a major earthquake, aftershocks are inevitable. Take the necessary safety precautions as soon as possible and leave the building in a calm manner.

Remain composed while evacuating. Take your pre-prepared earthquake emergency bag, as well as any essential valuables and keys that you can quickly access.



When you have escaped from the building

Once outside, first check yourself for injuries. After confirming that you are uninjured, check on your beloved ones and ensure they are safe. If anyone around you is injured,

try to reach the nearest healthcare facility or medical personnel. If professional help is unavailable, provide first aid based on what you know.

At this stage, communication is crucial for coordinating general rescue efforts. To avoid overloading the phone system, do not use your phone unless absolutely necessary. Instead, listen to portable radios for information and updates. Do not re-enter your building, even if it appears undamaged, unless the authorities permit it. Aftershocks may cause structures that are weakened by the initial earthquake to collapse completely.



if it appears undamaged, unless the authorities permit it. Aftershocks may cause structures that are weakened by the initial earthquake to collapse completely.

Assist injured individuals and those trapped under debris. Do not wait for specialized rescue teams to arrive with advanced equipment. In many past earthquakes, most survivors were rescued by their neighbors using only their hands or simple tools such as pickaxes and shovels. After these initial efforts, discuss how to provide essential needs such as food and shelter with your family and neighbors. Work together to overcome the serious challenges of the first few days with minimal harm.

SPECIFIC MEASURES TO BE TAKEN BY PEOPLE ON DIALYSIS

1. BEFORE AN EARTHQUAKE

Collect identification and medical documentation

Identity and medical records file: Preferably, keep a special folder protected in a plastic envelope containing: 1) Identity card and/or passport, and 2) additional basic personal information (the names, addresses, and phone numbers of your relatives both in your area and in other regions).

In addition to the identity details mentioned above, this folder should also include:

- **medical reports,**
- **the name of your dialysis center,**
- **contact details of the responsible doctor and nurses.**

Store copies of this folder both at home and at your workplace.

These documents are crucial if you are rescued with injuries, as they provide essential information for your medical care.



Your records should include details about: Your kidney disease diagnosis, medications you are taking, any drug allergies, the type of dialysis you receive, and technical information related to your dialysis treatment. These technical details should cover: the frequency and duration of dialysis sessions, the type and brand of filters used in your treatment, dry weight, heparinization protocol, hepatitis status, any other relevant medical details. The best approach is to request a medical report containing this information from your dialysis center and store copies in multiple locations.

If you are on **peritoneal dialysis**, in addition to your identity details, you should keep technical information related to your treatment, such as: the type of peritoneal dialysis you receive, the number and volume of daily exchanges, the type of dialysate used (brand, dextrose, and calcium content), the average amount of ultrafiltration (fluid removal). If you are on automated peritoneal dialysis (APD), the brand and

type of the machine, the duration of nightly treatments, the volume of solution used per session, the time required for filling and draining your abdomen, (if performing daytime exchanges) details about the procedure, the frequency of peritonitis episodes you have experienced and their treatments. If you have diabetes, relevant details about your treatment are necessary as well.

Similar to patients on hemodialysis, patients on peritoneal dialysis should also carry a medical report prepared by their dialysis center, as this information may be crucial in emergencies.

Stock medications and supplies

Having a stock of medications and supplies sufficient for approximately two weeks can prevent difficulties after a disaster. Store these medications in a dedicated bag and check their expiration dates at regular intervals. Use medications that are nearing expiration and replace them with new ones.

When dialysis cannot be performed on time, the two most concerning issues are an increase in blood potassium levels and fluid retention in the body. The most important measure to prevent high potassium levels is to avoid foods that are high in potassium. Additionally, keep drugs that prevent potassium absorption from guts. People on peritoneal dialysis should store a two-week supply of dialysis solution (dialysate) and any other necessary supplies. The expiration dates of dialysates should be checked every six months, and older ones should be used first, while replacing them with new ones. Keep a five-day supply of antibiotics used for treating peritonitis, as the incidence of peritonitis tends to increase after earthquakes.

If you are undergoing automated peritoneal dialysis (APD), consider the possibility that the machine may break down for whatever reason. Therefore, get training on

how to perform peritoneal dialysis exchanges manually as an alternative.

Medications for other conditions: The medications that need to be stored vary for each patient. Commonly used medications include blood pressure medications, iron supplements, vitamins, insulin and artificial sweeteners for people with diabetes, and injectors.

If you have diabetes, store insulin in the refrigerator. However, it can also be kept at room temperature for about one month. Additionally, store spare batteries for

your blood glucose monitor, special lancets for pricking your finger to test blood sugar, alcohol swabs, and other necessary medical supplies. Always keep sweet foods, such as candies, wafers, or sweet biscuits, in your emergency bag to avoid/treat hypoglycemia.

If you have a heart problem, store about one month's supply of your medications, including blood pressure medications, blood thinners, and other related drugs.

If you are working, prepare a similar emergency medication kit at your office in case an earthquake occurs while you are at work.

2. DURING THE EARTHQUAKE

The first section provided general guidelines on how to respond to an earthquake at home, in the office, or in other locations. In summary, stay calm, evacuate quickly if you are on the lower floors, and take cover in pre-identified safe spots if you are on the upper floors.

If you are connected to a hemodialysis machine during the tremors:

If you are undergoing dialysis during the earthquake, the medical staff, including doctors and nurses, will try to disconnect you from the machine as quickly as possible. However, since there may be multiple patients, this process might take some time, and the termination of dialysis may be different from what you are used to.

At this stage, the doctor or nurse will quickly stop the machine and close your dialysis lines to prevent bleeding, then disconnect you while the needles are still in your arm. They will also give you instructions on what to do next.

Do not attempt to remove the dialysis needles yourself until you have reached a safe location and have some supplies (such as swabs, plasters) and someone can assist you.

You will likely feel intense panic. To minimize this panic as much as possible, participate in virtual earthquake advance drills in the dialysis unit and learn the necessary steps to follow in such a situation.

Since there is a possibility that you may not receive immediate assistance, it is essential to learn how to disconnect yourself from the machine. For this purpose, (if you are living in an earthquake-prone region) keep a pair of scissors within easy reach before starting dialysis. Additionally, make sure you know the location of the machine's power switch.

If you do not receive immediate assistance after the earthquake, you may disconnect yourself from the machine using the CLAMP-and-CUT technique by following these steps:



Reach out from where you are lying or sitting and stop the machine.
Check if the blood pump has also stopped.



Close the clamps located on both the short arterial (red) and venous (blue) access needle lines, as well as those on the long arterial and venous thicker blood lines coming from the machine. (In other words pinch all four clamps closed).



Take your scissors and cut each line in the middle **between the two clamps**. Do not attempt to remove the needles, and do not try to return the blood from the set back into your body. Your priority should be your safety, so disconnect yourself from the machine as quickly as possible.

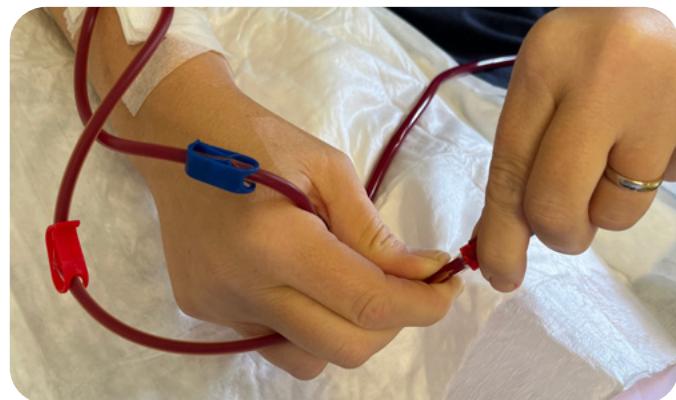


If the earthquake is still ongoing, try to take cover in a pre-planned safe location. If no such place is available, lie down at the foot of the bed. Do not lie next to the dialysis machine, as unsecured machines may fall on you.



Once the shaking stops, leave the dialysis unit quickly but without panicking. After exiting the building, proceed to the designated safe area and wait calmly. **Do NOT attempt to remove the needles yourself under any circumstances until medical personnel arrive to assist you.**

There is also another technique called **CLAMP-and-DISCONNECT**. This method is similar; however, after clamping, the lines between the closed clamps is unscrewed, which means that you are disconnected from the machine.



Use your non-fistula hand to clamp **both the red and the blue clamp** on the part of the tube that goes towards the dialysis needles. Press on the clamp until you hear the click sound, that's when it is clamped. **Always close both of the clamps (red and blue).**

Note: this is a picture of one type of dialysis tubing and clamps. If your center uses another a different kind of dialysis tubing, ask your dialysis nurse to show you the appropriate four clamps that have to be closed prior to disconnecting.



If you are receiving dialysis with a catheter, do not try to disconnect yourself from the machine, but wait for the nurses to help you. However, if there is no possibility of getting help of a nurse, try to disconnect yourself very carefully.

Consider the following steps:

- 1.** The dialysis catheter has two lumens: 1. Arterial (red): Blood flows out to the dialysis machine. 2. Venous (blue): Blood returns to the body. Each lumen has a clamp that can stop blood flow.
- 2.** Locate the clamps on each catheter lumen, and firmly close both clamps to prevent bleeding and air entry. (If the clamps are missing or broken, use a hemostat or forceps if available).
- 3.** Make sure the clamps are fully secured and locked before proceeding.
- 4.** Cut the bloodlines from the dialysis machine by using clean scissors or a blade. Do NOT cut the catheter itself, but only cut the external tubing attached to the machine. Place sterile caps or gauze over the catheter hubs.
- 5.** Dress the catheter ends and seek immediate medical attention.
- 6.** Patients undergoing dialysis with a femoral catheter should clamp the two catheter lumens and cut the blood lines beyond the catheter approximately at knee level, and evacuate the building.
- 7.** DO NOT remove the catheter yourself.
- 8.** Go to a hospital as soon as possible for catheter flushing and proper disconnection.

If you are receiving APD during the tremors:

Disconnecting from the machine will be much easier.



As soon as you feel the earthquake, close the clamps on both the connection set and the set coming from the device.

Disconnect carefully but quickly. Close the clean cap that you have ready nearby. Do not worry about filling or emptying your abdomen.

Then, take cover in the fetal position in a pre-planned safe area of your home. Once the shaking stops, leave the building immediately.

Do not perform any exchanges until you find a suitable and safe environment and are able to set up the machine with fresh bags.



3. AFTER THE EARTHQUAKE

Checking for health problems

After an earthquake, people on dialysis are at a higher risk for certain complications, such as bleeding, injuries, and fractures. Until medical personnel arrive, which can be very late under disaster conditions, you may have to manage simple problems on your own. For this reason, it is important to have detailed knowledge of first aid procedures.

Once you have survived the disaster and exited the building, first check yourself for any injuries, because in the chaos of the moment, you may not immediately notice wounds or other injuries. Treat minor issues such as bleeding, bruises, and wounds according to basic first aid principles.

Looking for dialysis options

After addressing immediate concerns, check whether your dialysis center is still operational and safe. If it has been damaged, look for alternative treatment options at other dialysis centers in your area or in nearby cities. Even if your dialysis center remains functional, access to care for people on chronic dialysis may become more limited in the disaster zone because:

1. Even if the building remains intact, dialysis machines or water systems may be damaged during the earthquake due to falling or toppling objects. More importantly, city water or electricity may be cut off during the earthquake, making dialysis impossible.
2. If other dialysis centers in the area are damaged, their patients may be admitted to your center, causing a sudden increase in the number of patients.
3. Other disaster victims who do not have a pre-existing kidney disease may develop acute kidney failure. As they may also require dialysis, the available machines may become insufficient.
4. The medical staff at your dialysis unit, including doctors, nurses, and other healthcare personnel, may be injured or unable to reach the facility.

In summary, dialysis possibilities may become limited after an earthquake, so it is crucial to know exactly what to do in this situation. The most important point in this regard is strictly adhering to dietary restrictions.

Points to consider in your diet

If you strictly adhere to dietary restrictions, temporarily reducing the frequency of dialysis sessions (for example, from thrice weekly to twice or even once weekly) or shortening the duration of dialysis sessions (from four hours to three, two, or even one hour) will not cause significant problems. At this stage, the two most critical factors that may urgently necessitate dialysis are fluid overload and elevated potassium levels.

Fluid overload: Even under normal conditions, restricting fluid intake is extremely important in people on dialysis, as excessive weight gain between dialysis sessions can cause problems such as edema, high blood pressure, and heart failure.

After an earthquake, fluid restriction becomes even more crucial because thrice-weekly dialysis may not be possible. Therefore, take extreme care to limit water intake and foods high in water content, such as vegetables and fruits. Reduce your fluid intake to approximately half of what you normally consume. If you were already gaining excessive weight between dialysis sessions, restrict your water intake even more strictly.

Whenever possible, choose salt-free foods, as excessive salt consumption increases thirst.

High potassium levels: If you cannot receive your regular dialysis dose, the most serious risk is an increase in blood potassium levels. Therefore, after a disaster, strictly avoid foods high in potassium. Information about the potassium content of various foods can be found on the last page of this booklet.

In addition to careful food selection, the use of certain potassium-binding medications can help to minimize the risk of dangerous potassium elevations in your body.

Other measures:

- After an earthquake, the consumption of protein-rich foods (such as meat and meat products) should be reduced to approximately half of the normal intake to minimize the risk of high serum phosphorus levels and uremic toxicity.
- If you have diabetes, consider the high risk of low blood sugar episodes (hypoglycemia) during disasters. Always carry foods that can quickly raise blood sugar levels, such as honey, wafers, sugar, candy, or low-potassium fruit juices.
- Whenever possible, use bottled water. If bottled water is unavailable, boil tap water before drinking to ensure it is safe. Preparing food under disaster conditions can be very difficult. For this reason, ready-to-eat foods play an important role in temporarily solving the problem. However, be aware that canned foods often

contain high amounts of salt, and some also have excessive potassium. When selecting canned foods, choose those with the lowest possible salt and potassium content. Most food packages list their nutritional content, so be sure to check this information carefully.

Foods with high levels of potassium

Highest content (>25 mEq/100 g)	High content (>6.2 mEq/100 g)
VARIOUS FOOD	VEGETABLES
Dried figs	Spinach
Molasses	Tomatoes
Seaweed	Broccoli
Very high content (>12.5 mEq/100 g)	Squash
Dried fruits (dates, prunes)	Beets
Nuts	Carrots
Avocados	Cauliflower
Bran cereals	Potatoes
Wheat germ	FRUITS
Lima beans	Bananas
	Cantaloupe
	Kiwis
	Oranges
	Mangos
	MEATS
	Ground beef
	Steak
	Pork
	Veal
	Lamb

Adapted from: Gennari FJ. Hypokalemia. *N Engl J Med* 1998; 339:451.

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Disclaimer

This manual offers general information for patients. It does not provide medical advice. Always consult your doctor or other qualified healthcare professional before making decisions about your treatment or care.