

Climate Change and the Urgent Need to Prepare Persons With Multiple Sclerosis for Extreme Hurricanes

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ABSTRACT

Climate change is contributing to increasingly hazardous tropical cyclones that endanger persons living in susceptible coastal and island communities. People living with chronic illness, including multiple sclerosis (MS), face unique challenges and vulnerabilities when exposed to hurricane hazards. Disaster and emergency preparedness requires a customized approach that considers the necessary adaptations to accommodate the mobility, self-care, sensory, cognitive, and communication impairments of persons living with MS. Related considerations include the potential for worsening neurologic signs and symptoms during and after a catastrophic storm. The impact of emotional and financial stresses, as well as disruptions in health care delivery, on this population are also key concerns. This paper addresses the challenges faced by individuals with MS in advance of, during, and in the aftermath of extreme storms. We propose new guidelines on how health care professionals can assist persons with MS when creating tailored disaster readiness and response plans.

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The effects of climate change jeopardize the health and safety of vulnerable populations,¹ including those living with multiple sclerosis (MS). The effects of global warming may be particularly pronounced in individuals with heat sensitivity, which is highly prevalent among those with MS.² Beyond the direct effects of warmer ambient temperatures, individuals with MS are also at risk for adverse outcomes in the event of climate-driven disasters.³

Climate change has increasingly exposed persons with disabilities to extreme weather events, including floods, wildfires, and tropical cyclones.⁴ Moreover, the hazard properties of tropical cyclones—described as hurricanes, typhoons, and cyclones in basins distributed around the beltline of the globe—are in flux. Such storms are increasing in intensity, bringing more precipitation, and hovering longer above populated coastlines.⁵⁻⁸ Exacerbation of storm hazards is a product of climate drivers, including increasing ocean and air temperatures and rising sea levels.⁹ The impact of climate change on hurricane behavior renders these storms more dangerous, destructive, and traumatizing.

Persons living with MS are at elevated risk when hurricanes threaten or strike their communities. Those living in hurricane-prone regions, particularly along the coastlines of the Caribbean Sea, the Gulf of Mexico, and the North Atlantic Ocean, may mitigate the risks to their health and safety by preparing appropriately for catastrophic storms. Herein we elucidate the specific challenges faced by individuals with MS-related impairments and conditions in advance of, during, and in the aftermath of extreme hurricanes. Recognizing the time-urgent need for health care professionals (HCPs) to help safeguard individuals with disabilities and chronic medical conditions from the dangers of increasingly intense hurricanes, we also outline recommendations as to how HCPs can assist their patients with MS in preparing for such storms.

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TABLE. Key Roles of Health Care Providers in Emergency Preparedness and Disaster Response for Their Patients With Multiple Sclerosis

In advance of a disaster
Help patients identify what their needs might be in the event of a disaster. <i>Consider the impact of fatigue and heat on their function.</i>
Encourage patients to develop a personal support network of ≥ 3 people able to assist them in times of emergency.
Remind patients to keep a ≥ 7 -d supply of food and water on hand.
Ensure that patients have an adequate supply of medications. <i>Be especially mindful of medications with withdrawal syndromes (ie, baclofen).</i>
Review safe medication storage practices in the event of power outages. <i>Recommend the use of medication coolers for temperature-sensitive drugs.</i>
Discuss means of avoiding overheating during an emergency. <i>Encourage the purchase of battery-operated fans.</i>
Educate patients dependent on electricity for life or function on what they should do in the event of a power outage. <i>Recommend having access to a generator or power station. Help patients register for priority utility turn-on service.</i>
Order escape chairs for those who live or work in high-rise buildings who have difficulty negotiating stairs.
Educate patients to register with their local government agencies if they would require evacuation assistance or a special needs shelter in the event of an emergency.
Plan for continuity of health care service delivery.
In the aftermath of a disaster
Resume provision of outpatient care as soon as possible.
Assist patients with the replacement of damaged or lost equipment and supplies.
Help persons displaced from usual sources of care obtain necessary care elsewhere. <i>Ensure timely refills of intrathecal baclofen pumps to prevent withdrawal.</i>
Refer patients for social support and mental health services as appropriate.

CONSIDERATIONS FOR INDIVIDUALS WITH MS-RELATED IMPAIRMENTS

Mobility Impairments

Individuals with MS-related mobility impairment may experience a variety of challenges as a severe storm approaches. They may lack sufficient strength, coordination, and/or range of motion to safely prepare their homes. They may also face barriers to evacuation, especially when public transportation options are limited or inaccessible. Moreover, they often require accessible environments in which to ride out a storm and/or remain should conditions preclude a safe return home.

Mobility limitations also present challenges in a storm's aftermath. These impairments may complicate emergency rescues, particularly from high-rise buildings and via watercraft. Persons with MS may also face difficulty navigating around storm debris and in floodwaters. Hurricanes may result in damage to ramps, gait aids, and/or wheelchairs. Power outages may preclude charging, and therefore use, of power wheelchairs and scooters.¹⁰

Impaired Activities of Daily Living

Persons with MS may experience increased difficulty performing both instrumental and basic activities of daily living (ADLs) in the time surrounding a hurricane. Shopping for necessary supplies may be complicated by large crowds of frenzied shoppers making last-minute purchases. Driving conditions may be more challenging during evacuations and inclement weather due to

road damage, flooding, and debris. Medication management, food preparation, dressing, showering, bathing, and grooming are all more difficult and potentially more unsafe in low-light conditions. Moreover, worsened fatigue may also increase difficulties with ADLs during and after a catastrophic event.

Individuals who require assistance with ADLs are particularly vulnerable when disasters strike. Caregivers may be unavailable in the event of an emergency, and personnel staffing medical shelters may lack the appropriate training or experience to provide care to persons with MS. Residence in a nursing home has also been associated with poor outcomes in hurricanes, including increased risks of hospitalization and death.¹¹

Cognitive Impairments

Cognitive dysfunction is common among persons with MS and frequently involves memory and processing speed.¹² Cognitive impairment may impede the abilities of affected people to take self-protective actions in advance of an approaching storm, such as preparing the home or obtaining essential supplies. Individuals with memory impairment may forget to store adequate amounts of water ahead of the storm or where they keep key emergency supplies, such as flashlights or batteries. Persons with processing delays may not recognize threats to their safety in a timely manner and may be unable to rapidly adapt to changing conditions. Impaired judgment may prevent someone from heeding



Health care professionals caring for persons with multiple sclerosis living in hurricane-prone regions should help their patients develop comprehensive storm preparedness plans that consider the unique impairments and needs of the patient.

It is essential to promptly restore access to health care services for persons with multiple sclerosis after a hurricane. Individuals affected by the storm are at risk for injury, worsening neurologic signs and symptoms, the loss of or damage to vital equipment or supplies, and/or psychological distress. ■

the warnings of authorities to evacuate their home or community. Moreover, extreme weather events may result in a loss of the external cues on which a person with cognitive impairment relies for recall or orientation. Programmed reminders on a mobile phone or voice-controlled personal assistant device may be inaccessible. The absence of light due to electrical outages and/or hurricane-shuttered windows also deprives individuals of cues to time and place and, as such, may be conducive to disorientation.¹⁰

Speech and Swallowing Disorders

Communication disorders, including dysarthria and cognitive communication impairments, are prevalent in persons with MS¹³ and may result in several challenges during and after a hurricane. Most notably, individuals with speech disorders may have difficulty conveying their needs to family and friends, emergency responders, and shelter staff. Dysphagia is also common among persons with MS,¹³ who may have trouble accessing or preparing foods and beverages of an appropriate consistency.

Sensory Impairments

Sensory impairments can also result in challenges for persons with MS during times of disaster. Individuals with somatosensory dysfunction are at increased risk for traumatic injuries, including falls, particularly when in low-light conditions.

Visual disturbances are common in this population and may include vision loss, visual field deficits, altered depth perception, color desaturation, and/or diplopia.¹⁴ Such disturbances may complicate obtaining information

about the storm via printed sources, the internet, text message, or mobile phone weather applications. The visually impaired may also face barriers evacuating in advance of a storm and may have difficulty maneuvering in unfamiliar environments while riding out the storm. In the aftermath of a hurricane, individuals with visual disturbances may be at increased risk for injuries from storm debris, downed trees, and/or floodwaters.

Olfactory dysfunction is prevalent in persons with MS, often goes unrecognized, and may jeopardize the safety of those affected.¹⁵ Disorders of smell may make a person unable to detect harmful molds or a gas leak in the aftermath of a storm.¹⁰

Mental Health and Neuropsychiatric Disorders

Hurricanes can cause psychological distress among affected persons, especially those with special medical needs and their caregivers. This distress, in turn, may contribute to new-onset psychiatric disorders, such as posttraumatic stress disorder. Storm-related stressors may also contribute to worsening symptoms among those with preexisting anxiety and depression,^{16,17} conditions that are more prevalent in people with MS than in the general population.¹⁸

Disruption of Health Care Systems

Hurricanes can cause tremendous disruptions to health care delivery, which may disproportionately affect people with MS. They may face barriers or delays in receiving follow-up care, including scheduled intravenous infusions of medications to control their disease and/or prevent relapses. Facilities without generator backup power may be unable to safely store medications in case of the loss of refrigeration or air conditioning. Services such as home health care, day programs, and medication and supply delivery may be temporarily unavailable. Power outages and interruptions in cellular and/or cable service may preclude the use of telehealth services. Moreover, patients who evacuate from their communities may be displaced from their usual sources of care.

Persons with MS have higher burdens of several comorbid conditions, including hypertension and asthma, and management of these comorbidities is likely to also be disrupted during extreme weather events. Delays in receiving care for these conditions, in turn, may also contribute to poorer MS outcomes.¹⁹⁻²¹

Potential for Disease Exacerbation or Relapse

Exposure to hurricane hazards may increase an individual's risk of an MS exacerbation via several mechanisms, not limited to those resulting from disruptions in health care delivery. Hurricanes result in considerable physical, emotional, and financial stresses for those in affected regions. Although the mechanism is not yet known, stressful life events are associated with an increased risk of MS exacerbation.²²

Hurricanes also indirectly increase one's risk of exposure to bacteria and viruses, which may, in turn, trigger a temporary exacerbation of symptoms or relapse. Individuals living in at-risk regions may evacuate to community shelters in advance of a hurricane, where crowded conditions may be conducive to the spread of infections, including coronavirus.²³ Preliminary studies suggest that this virus may trigger an exacerbation of MS.²⁴ Other acute respiratory infections are also common after natural disasters, as are skin and soft tissue infections. Hurricanes may also contaminate the water supply, increasing one's risk of gastrointestinal infections.²⁵

Many persons with MS experience temperature sensitivity and thus may experience a temporary exacerbation of neurologic signs and symptoms with body temperature changes.² Storm-related power outages make it difficult to maintain the regulation of heat and humidity, resulting in an increased risk of heat-related illness.

Financial Issues

Natural disasters may inflict financial devastation on affected persons, and they often impact those who previously struggled financially the hardest.²⁶ People living with MS have higher rates of unemployment and health-related financial toxicity.^{27,28} Needing to prepare for a hurricane may further stress finances, particularly if there is a need to stockpile food and supplies, purchase a generator or power station, or hire help to install shutters or window protection. In the event of the need to evacuate, additional expenses may include transportation and lodging. Home, vehicle, and equipment damage may also result in the need for expensive repairs or replacements.¹⁰

Role of HCPs in Preparing Patients With MS for Hurricanes

Physicians, advanced practice providers, nurses, social workers, therapists, and psychologists can all play critical roles in helping their patients with MS improve their storm readiness and in ensuring that their needs are met after a disaster. These roles are outlined in **TABLE**. In addition, HCPs can serve as advocates for inclusive emergency management plans and policies within their communities.

In hurricane-prone regions, HCPs should help their patients identify their unique needs in the event of a disaster before the start of hurricane season. This education is especially critical in discussions with patients adjusting to new or worsening disability and with those with impaired judgment or insight into their impairments. It is essential to consider what patients' needs for help may be under conditions of severe ambient heat during and after a storm because the heat may exacerbate their functional impairments and degree of fatigue. Individuals who will need to rely on the assistance of others should be strongly encouraged to

develop a personal support network of at least 3 nearby persons willing and able to help them during a disaster.²⁹ People with communication impairments should have vital information written or printed for potential caregivers or rescuers. Users of adaptive equipment should make sure to have such equipment readily available. A standard or transport wheelchair may come in handy for users of power wheelchairs should there be a lack of accessible transportation in which to evacuate and/or prolonged power outages after a storm. An individual residing in a high-rise building should consider purchasing an evacuation chair to use in the event of a loss of elevator power.³⁰

Individuals with MS with potential needs for evacuation assistance and/or medical shelters should be educated to register for such aid with their local governments in advance of a storm. Patients should be encouraged to heed the advice of local government authorities, who typically determine evacuation protocols, while also recognizing that they may require a lower threshold or increased time for an evacuation than the general population. Persons dependent on electricity for powering life-sustaining or critical adaptive equipment will require access to a generator or a safe place to ride out the storm outside the area at risk for power outages. Such individuals should also register with their utility companies for priority turn-on service, which may require completion of paperwork by their HCP.

Patients should also be reminded to have at least a 7-day supply on hand of everything they will need for their health and safety. Supply checklists are helpful, especially for individuals with significant memory impairment. In addition to food and water, patients should have ample supplies of all necessary medications and personal equipment, including wound care supplies and urinary catheters. The HCPs should discuss the heightened importance of not running out of medications associated with dangerous withdrawal syndromes, including baclofen and benzodiazepines. Medication coolers should be recommended for those using temperature-sensitive medications, including interferon. Battery-operated lighting and cooling devices should also be crucial components of patients' emergency supply kits.

After a hurricane, HCPs should evaluate and treat their patients' storm-related injuries and exacerbations of their chronic medical conditions and help them obtain new equipment and supplies to replace those lost or damaged in the storm. Members of the care team should also promptly resume the provision of other necessary health care services, including rehabilitation therapies and infusion treatments. In case of prolonged displacement from their usual sources of care, HCPs may assist patients in identifying other sources for necessary care. In particular, displaced persons with intrathecal baclofen pumps will need assistance in obtaining timely pump refills to prevent withdrawal.³⁰ Also, HCPs should screen their

patients with MS who have been affected by a hurricane for symptoms of depression and anxiety and provide or refer them to mental health services as appropriate. Last, HCPs should help patients identify available social support programs to provide assistance in the aftermath of extreme weather events.

CONCLUSIONS

Climate-driven disasters have particularly devastating effects on individuals living with disabilities and chronic medical conditions, including MS. Future hurricanes are expected to bring greater wind speed intensities, storm surges, and precipitation totals because of global warming. As such, it is increasingly important to assist persons with MS in their readiness for such catastrophic storms. Health care providers are well-positioned to help their patients with MS identify their needs in the event of a disaster and take appropriate steps to improve their emergency preparedness. Moreover, HCPs are essential in ensuring that the needs of their patients are met in a storm's aftermath. ■

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