



Commentary

Preparing individuals with spinal cord injury for extreme storms in the era of climate change

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Increasing population exposure to extreme weather conditions, a hallmark of this era of progressive climate change [1], creates a compelling urgency to safeguard individuals living with special medical needs who may be particularly challenged by such events. Here we discuss the heightened vulnerabilities and unique preparedness needs of individuals with spinal cord injury (SCI) in the context of climate-driven hurricanes. We outline a set of physician roles aimed at preparing patients, caregivers, and providers to proactively mitigate these risks.

1. Climate changes hurricanes

Since the 1970s, anthropogenic climate change has very likely contributed to increasing Atlantic hurricane activity [2]. Powered by anomalously warm ocean temperatures, climate-driven hurricanes are trending **stronger** (intensifying rapidly and attaining uncommonly high peak wind speeds) and **wetter** (producing extraordinary precipitation rates and rainfall totals - and triggering floods) and **slowing down** as they move across land [2,3]. Hurricane Dorian's catastrophic passage over the northwest Bahamas exemplified all three trends [4].

2. Hurricanes threaten the health of individuals living with SCI

Individuals with SCI will suffer more than most. In the pre-impact phase, as a hurricane approaches, individuals with SCI grapple with

complicated logistics. For example, the choice to evacuate requires pre-planning and a team effort. Coastal and island-based SCI patients may have no viable evacuation option unless special transport can be prearranged, and those who cannot evacuate may be subjected to the full fury of the hurricane.

When a hurricane strikes, persons with SCI face daunting mobility challenges. Patients living in high-rise buildings may become trapped if elevators are not operating. Emergency rescues for patients with paralysis are complex even when performed by professional responders - and much more so when lay rescuers are the only available resources. Propelling wheelchairs around storm debris or through floodwaters is physically demanding and dangerous, especially for persons with impaired or absent tactile sensation. Wind and flood damage may deprive individuals with SCI of access to their customized living quarters, designed to facilitate mobility and maximize independent functioning.

Hurricanes dismantle infrastructure, frequently producing widespread power outages that can disable healthcare systems. Hurricanes also impede access to health services, thereby elevating risks for individuals living with SCI, especially those who depend on others for assistance with mobility and activities of daily living. Home health providers are generally unavailable during a disaster. Personnel staffing medical shelters lack familiarity with the care needs of this population. Physician offices and outpatient therapy clinics may be closed for weeks, interrupting both routine SCI care and treatment for storm-related medical issues.

Post-storm, hurricane survivors are exposed to such adversities as hazardous debris, impassable roadways, fuel shortages, unrelenting heat and humidity, contaminated water supplies, food insecurity, insect vectors, and air pollution [5]. During the post-impact phase, persons living with SCI who have impaired thermoregulation are at increased risk for heat- and cold-related illnesses when the temperature of their environment cannot be controlled. Extremely humid conditions may contribute to moisture-related skin damage. Individuals' abilities to perform their bladder or bowel programs may be diminished by the unavailability of a caregiver and lack of supplies. This may result in autonomic dysreflexia with increased risks for complications, including

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seizure, stroke, and death. Abrupt discontinuation of spasticity medications may lead to dangerous withdrawal syndromes. Patients with intrathecal baclofen pumps for spasticity management may face barriers to obtaining pump refills.

Hurricane-related psychological stress is exacerbated for persons living with SCI. This population has higher pre-storm prevalence rates of major depressive disorder (MDD), posttraumatic stress disorder (PTSD), and anxiety disorders, likely related to the initial traumatic injury and stressors inherent in living with life-changing disability [6]. When a storm strikes, direct exposure to hurricane hazards makes persons living with SCI hyperaware of their physical limitations and profound dependence on the actions of caregivers to safeguard them, and elevates risk for new-onset PTSD [7]. Perception of life threat – a common experience for persons during the impact phase of a severe storm – is magnified by their SCI condition. Climate-driven storms can be extremely destructive, resulting in post-impact resource losses and life changes that amplify risks for new-onset MDD [7].

3. Physicians and health professionals can play critical roles

Given the increasing prospects for hurricanes wreaking havoc in this era of climate change, healthcare providers who support

individuals with SCI can engage in personal, provider, patient, and community hurricane preparedness [8].

3.1. Personal preparedness

Ideally, health professionals should develop an all-hazards household plan for likely disasters in their communities, stockpile and replenish supplies, determine contingencies regarding sheltering versus evacuation, and design a family communication and reunification strategy.

3.2. Provider and facility preparedness

Clinical care facilities should be retrofitted to withstand stronger storms. Personnel should be educated and ready for predictable disaster scenarios.

3.3. Patient preparedness

Patient preparedness includes several necessary components (see Fig. 1).

Preparing patients living with spinal cord injury (SCI) for hurricanes

- Ensure that persons with SCI are able to direct their care. In an emergency, they must have the skills to verbally direct an untrained caregiver, step-by-step, regarding how to meet their needs.
- Encourage individuals with SCI to develop a local personal support network of at least three people who know their care needs and are willing and able to help in an emergency.⁸
- Encourage individuals and caregivers to develop a comprehensive evacuation plan that incorporates such critical elements as transportation and a meeting place.⁸
- Educate patients about registering for evacuation assistance through their local government in advance of a storm.
- Complete physician certificates with utility companies for priority turn-on service for all individuals dependent on electricity for life or function.
- Ensure that ventilator-dependent individuals have a generator and bag-mask equipment.
- Discuss methods of cooling and heating during an emergency for those with impaired thermoregulation.
- Order escape chairs for those who live or work in high-rise buildings.
- Make sure all individuals with SCI maintain a 7-day supply of essentials, including food, water, catheters, and medications.
- Assist patients after the hurricane to repair and replace damaged equipment and resume home health services. Refer as needed to community and mental health services.

Fig. 1. Preparing patients living with spinal cord injury (SCI) for hurricanes.

3.4. Consultation to community leadership

Health care professionals experienced in the care of patients with SCI can provide valuable consultation to public health and emergency management partners, educating them on how to best protect and maintain care for populations with special medical needs, including SCI [9,10]. Optimally, health professionals can have a seat “at the table” throughout the preparedness and response process and provide real-time guidance during hurricanes.

4. Concluding comments

Climate change is altering the hazard properties of hurricanes while increasing the vulnerability of island and coastal populations. Health professionals can play a vital role in enhancing the level of hurricane preparedness for individuals living with SCI and other special medical needs and can help ensure that their needs are met in the aftermath.

Declaration of competing interest

We have no competing interests.

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