

Emergency Preparedness and Hurricane Maria: The Experience of a Regional Academic Medical Center in Southwest Puerto Rico

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The Situation

"In life, very few opportunities give you the chance to show your real value. This adversity gave us the chance to demonstrate our courage, leadership, and commitment with our careers."

—A family medicine resident at Southwestern Regional Academic Medical Center

Puerto Rico was hit by 2 consecutive hurricanes in September 2017: Hurricane Irma (September 6) and Hurricane Maria (September 20). Hurricane Irma passed 80 km (50 mi) from San Juan and caused the collapse of the electric power system and significant infrastructure damage in the northeast region of Puerto Rico. The southwest region of the island was spared. Puerto Rico had not completely recovered from Hurricane Irma when Hurricane Maria hit. Winds of 249 km per hour (155 mi per hour) at landfall classified Maria as a strong Category 4 storm, nearly a Category 5. On September 21, Puerto Rico awakened to a new reality: a fully devastated island.

Maria disabled radars, weather stations, and cellular telephone towers across Puerto Rico. This created a communication vacuum, in which officials initially were unaware of the extent of damage to the island's infrastructure and the number of dead or injured individuals. Electric power was lost on the entire island a few minutes after the hurricane struck. Only 1 radio station was operational, and it could only transmit information provided by individuals able to get to the station. Drinking water was not available to many residents, roads were obstructed with fallen trees or landslides, and many areas were inaccessible because of flooding.

The impact on health care was significant; hospitals had power only from generators, water supplies were limited to what could be stored in tanks, physicians had difficulty getting to the hospitals, and hospitals

could not communicate with their staffs. Medical residents and teaching staff became key players to help facilitate access to health care for the island's population. In this article, we describe the impact that this severe hurricane had on the health care of the inhabitants of southwest Puerto Rico and the contribution of our residents and faculty during the hurricane and subsequent chaos.

Southwestern Regional Academic Medical Center

Ponce Health Sciences University and its affiliates compose the Southwestern Regional Academic Medical Center (SW-RAMC), a nonprofit organization created in 2006 under Puerto Rico State Law 136 to ensure that there are sufficient clinical sites on the island to train medical students and residents. The law offers support to private hospitals in their role as hosts of graduate medical education programs as well as benefits to faculty participating in medical education. Hospitals with graduate medical education programs affiliated with SW-RAMC include Hospital Episcopal San Lucas, Hospital Damas Ponce, Hospital de la Concepción-San Germán, Mayagüez Medical Center, Manatí Medical Center, and Hospital Bella Vista. SW-RAMC operates 14 core and 4 fellowship programs, most of them in primary care, with approximately 259 residents and fellows.

In this article, we summarize key strategies of the SW-RAMC residency programs to prepare for Hurricane Maria and what we did in the aftermath to benefit faculty, residents, and patients seeking care.

Preparing for the Hurricane

Preparation before the hurricane was key to continuing operations of the SW-RAMC institutions under adverse conditions. Hurricane threats are frequent in Puerto Rico. Fortunately, the last major hurricane that hit the island was Hurricane Georges in September 1998. Before Hurricane Maria, hospitals and their residency programs followed emergency preparedness protocols that included reducing the number of patients, ensuring adequacy of supplies,

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and formulating contingency plans for staff to cover hospital services during the storm.

All residency programs organized teams of residents and faculty members who stayed in the hospital for at least 3 days. They were provided with food and sleeping spaces. A schedule was developed to ensure adequate resting time. Models varied. Some allowed residents to bring close family members to the hospital so all could be together during the hurricane. Other hospitals provided food and shelter to residents in need. Residents not on call were instructed to report to their program directors as soon as the emergency ended. Clear instructions about the priority to safeguard themselves and their families were provided, including instructions to protect their computers, back up important documents, print out contact information, prepare for their own safety, and communicate with the program director as soon as possible. Residents and fellows also helped patients and others prepare for the hurricane and ensured that they had sufficient medication and other provisions at home.

In preparation for the hurricane, residency programs compiled contact lists of all residents and faculty members with physical addresses, telephone numbers (at least 2), e-mail addresses, and emergency contacts. This facilitated the interaction and transport of residents and faculty to and from the hospital. If communication lines were down, residents were instructed to report to the hospital as soon as weather and roads allowed them to get there safely.

Each residency program prepared a schedule for coverage during the emergency. At least 2 groups stayed in each hospital to provide 8 to 12 hours of continuous coverage of care. Each group included a faculty member. These groups were housed in the hospital before the hurricane hit and could only leave when it was safe. Warm food, water, and sleeping rooms were provided.

Residents on outside electives were called and instructed about safety and told to report to the hospital when roads and weather safely allowed them to travel. The parking lot was evaluated, and cars were transferred to safer areas. Some hospitals relocated patients to lower floors, where they would be safer, and some provided fuel to residents, faculty, and employees for transportation after the hurricane. Other hospitals paid residents and faculty stipends in advance of the hurricane so that they could have available cash for the emergency.

After the Hurricane

Teams of residents were in the hospitals as the hurricane hit Puerto Rico. The island-wide power

Box Lessons Learned

- In the period before, during, and immediately following a disaster, maintain open lines of communication between all departments in your institution and conduct meetings at least twice a day to assess the status of the institution and its programs. Include residents; they are always on the front lines and can provide valuable contributions.
- Think about all possible means for communication: from verbal, messenger, and other nontechnological means (eg, bicycles) to satellite telephones. Provide for redundant communication approaches with hospital leadership, including the medical director, department chairs, director of graduate medical education, chief executive officer, chief operating officers, and any other relevant leaders.
- Anticipate challenges to your programs and try to solve outstanding issues, like dates of in-training examinations, reports, and site visits, as much as possible before an event such as a hurricane. If necessary, call the corresponding entity in advance to discuss.
- Keep an inventory of supplies, medications, and equipment that are used frequently, and ensure you have enough supplies on hand for at least 2 weeks.
- Have a 2-week supply of food and water for faculty and residents in the hospital. Less than that may not be enough.
- Cancel patient appointments and all surgeries scheduled 24 hours prior to the event. Discharge as many patients as possible from the hospital, and ensure they go to safe places.
- Do disaster drills regularly. This will better prepare staff to address any emergency.
- Be prepared to make changes and improvise. Not all challenges of a disaster are predictable.
- Do frequent assessments of status; changes may occur at any time.
- Ask for help. Collaboration helped us save lives. For example, some of our surgical teams had to perform surgeries at a nearby nonteaching hospital where the operating room was fully functional.
- The impact of limited communication and the important role of social media was underestimated in our preparedness plans. Social media was very helpful once communications began to be reestablished. It allowed coworkers, family, and friends to communicate. The WhatsApp messenger was effective and used often after Hurricane Maria. Including communication through social media in the emergency preparedness plan can be helpful.
- Ensure that individuals and institutions have enough cash to purchase goods and gasoline after the emergency. Communication and power outages make it impossible to conduct electronic financial transactions.
- Demonstrate empathy to residents, faculty, administrators, employees, and patients; they are all living the same tragedy.
- Monitor stress and burnout in residents, and instruct them about self-care to improve well-being during difficult times.
- The “old way” may be the best way after a disaster. We relied on telephone landlines, flashlights, gas stoves, messengers to communicate among units and with governmental agencies, cash instead of cards, hard copies of key information, books in the library, blackboard and chalk instead of PowerPoint presentations, riding a bike instead of driving a car, etc. These were all valuable in the immediate postdisaster period and helped us maintain educational and service missions in a time of turmoil.

outage after the hurricane hit was anticipated, and the hospitals had power generators. The storm lasted close to 24 hours. Residents focused on providing service to the areas with the highest need: intensive care units and the emergency department. Surgery was limited to emergencies. Due to the collapse of electronic communications, hospitals relied on word of mouth for internal communication. Communication with the outside was nonexistent except through satellite telephones that were available to just a few individuals.

After the hurricane, SW-RAMC residents waited for instructions before leaving the hospitals. Program directors and chief residents coordinated outreach to other residents to find out their status during and after the emergency. Most of the residents were able to get to the hospital. Three residents experienced significant losses of their homes and most of their belongings. However, they and their families were unharmed. Financial support was provided through the hospitals and through donations from community organizations.

Continuity of education and high-quality services, balanced with the wellness of our faculty, residents, and staff, were a high priority after the storm. Morning reports and ward rounds were done with a faculty member in charge to avoid interruption of the residents' education. Scheduled didactics continued within a week after the storm. Program leadership conducted daily evaluations of the needs and concerns of residents and faculty. Psychological and spiritual support were offered and lectures were given to help them cope with the storm and its aftermath.

No residency program experienced a negative impact on its curriculum. In fact, there were enhancements. For example, 1 program developed a natural disaster rotation for Puerto Rico's children. There were other efforts to avoid disruption of resident education. Family medicine program directors coordinated with the American Board of Family Medicine to change the date of the in-training examinations to December.

To help residents and faculty access the hospitals, arrangements were made with gas stations for physicians, residents, and health care personnel to have priority in the lines. Some of the hospitals paid for gasoline for faculty and residents. To address communication challenges, satellite telephones were made available at most of the hospitals. The system did not work well at all sites, but it served as an alternative for some until telephone communication could be reestablished. Landlines were the first ones to become available, followed by cellular phones. The "old style" telephones that connected directly to a

landline and did not require electricity were invaluable during the first weeks after the storm.

Due to the full blackout of the island and slow recovery from the power outage, the government established a curfew. During the curfew, hospitals provided transportation for residents to their homes with security personnel in official vehicles.

Management During the Subsequent Recovery

Hospital leadership included the graduate medical education staff (program directors, designated institutional officials, and residents) as part of the leadership team that monitored events after the emergency. Leadership meetings occurred every 6 to 8 hours in the first few days after the hurricane, and then daily until electrical power was fully restored. The Puerto Rico government prioritized energizing hospitals, and most hospitals had their power restored by the second week after the hurricane.

Strategies to ensure access for patients were implemented by all hospitals. Hospitals provided free transportation for patients to their homes and gave them medication for about 5 to 7 days. Two hospitals used their helicopters to expedite the transportation of patients requiring emergency or special care to hospitals in the San Juan area.

The hospital with the cogeneration system received an unprecedented high number of patients from across the island. The government of Puerto Rico established an emergency operations center in each region with key leadership from Puerto Rico and federal agencies. Hospitals sent a representative to each center, and hospitals and ambulatory health centers in southwest Puerto Rico established a Health Coalition and met daily for close to a month until health services in the region returned to normal. The coalition dealt with issues such as the sufficiency of generators to supply needed power; ensuring oxygen supply to the hospitals (the 2 oxygen manufacturers on the island were destroyed by the hurricane); ensuring availability of medications, immunizations, and hospital supplies; monitoring potential outbreaks; communication; and many other tasks. Members of the Federal Emergency Management Agency, the National Guard, and nongovernmental organizations attended the meetings. This model enhanced communication among agencies, allowed prioritization of areas of need, and ensured that southwest Puerto Rico was adequately served by all agencies.

Service to the community was a high priority for all residency programs affiliated with the SW-RAMC. The aftermath of hurricane Maria limited access to

water, food, and health care for many people on the island. Individually, but with a sense of unity and commitment, residents from all programs, their faculty, and medical students of the Ponce Health Sciences University School of Medicine organized to bring food, water, medications, and other supplies and offered health care to people in shelters, remote areas, and damaged homes. The Ponce Research Institute, affiliated with the Ponce Health Sciences University and the SW-RAMC, was the hub to receive donations from companies and individuals in Puerto Rico and the United States. The center established a warehouse with supplies that were used by students and residents for distribution in the communities.

What Was Learned

Hurricane Maria taught us a number of lessons, the most important being that while we cannot prevent disasters such as a hurricane, we can mitigate the damage they produce. A disaster preparedness plan that includes adequate infrastructure, storage of essential supplies, and a comprehensive communication plan is key to limiting damage, saving lives, and managing the aftermath. Another key lesson is that after a major disaster, there may be a need to operate the “old way”—without technology, at least temporarily. Key lessons that are relevant to the larger graduate medical education community are shown in the BOX.

Conclusion

Hurricane Maria provided a unique learning experience to residents of the SW-RAMC. Residents faced adversity with courage and resilience and did not

hesitate to do their best to help others. Although many residents witnessed the impact the storm had on their families, friends, communities, and themselves, the vast majority coped with it. Fortunately, we did not lose any residents after the storm. Outreach to communities in need demonstrated the humanistic component of the medical profession in our residents.

More than 10 months after Hurricane Maria, Puerto Rico continues to recover. Teaching hospitals and their faculty and residents became the backbone of health care, showing the value Puerto Rico's teaching hospitals bring to the island's health care system and its communities. Being able to help those devastated and displaced by this severe storm was one of the greatest achievements in our residents' lives. We are proud of what they did and thankful for their commitment and sense of duty.



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