Community Pharmacy Response in the Aftermath of Natural Disasters: Time-Sensitive Opportunity for Research and Evaluation

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Abstract
One year ago, Hurricane Maria passed over the archipelago of Puerto Rico, leaving widespread disruption of nearly all human services, including the health care sector. In the aftermath of the hurricane, limited access to medical care and prescription medications presented a serious challenge to maintaining control of preexisting chronic diseases. Many patients did not have access to refrigeration for heat-sensitive medications. Significant dietary changes due to the limited availability of shelf-stable foods further exacerbated chronic conditions such as heart failure and diabetes. The role of community pharmacists following a natural disaster has previously been documented, and may include the triage of evacuees, assessment of immunization needs, and provision of prescription medications under a collaborative practice agreement. However, our experience in Puerto Rico demonstrated a variety of barriers limited pharmacists’ ability to adequately respond to the magnitude of this disaster. These included medication shortages, extended loss of power, and limited telecommunications for contacting prescribers, disaster relief agencies, and third-party payers. Ultimately, the lack of preexisting emergency protocols made overcoming such barriers difficult. As the first and sometimes only accessible health care provider to many patients following a natural disaster, we must build a solid evidence base and better understanding of the individual, interpersonal, and environmental factors that contribute to the community pharmacist response. To date, however, a paucity of data exists on both the pharmacist and patient factors, which may contribute to an effective immediate response to patient needs at the community pharmacy following a natural disaster. Future research must focus on these multi-level factors to better inform public policy and effective disaster planning. Ultimately, such research and planning will lead to increased resiliency in our primary health care systems in the face of future disasters.

Keywords
emergency preparedness, natural disaster, community pharmacist, pharmacy practice, first responders, pharmaceutical care, health care policy, primary care, Puerto Rico

Following the natural disaster of Hurricane Maria in late 2017, Puerto Rico experienced widespread disruption of nearly all human services, including the health care sector.1 A near total collapse of both the electric grid and telecommunications networks immediately following the storm brought unprecedented logistical challenges to every aspect of daily life. Disruption of running water to more than half of Puerto Rico’s population further complicated things. Immediately following the storm, hundreds of businesses were closed, some of which would not reopen. In particular, small businesses, including the many independent, community pharmacies were significantly affected by power outages and supply issues.2

In the aftermath of the hurricane, limited access to medical care and prescription medications presented a serious challenge to maintaining control of preexisting chronic diseases. Early accounts surfaced quickly of exacerbations of the chronic diseases by which Puerto Ricans are already suffering.
disproportionately affected such as asthma/chronic obstructive pulmonary disease, cardiovascular disease, chronic renal disease, diabetes, and HIV.\textsuperscript{3,7} These were especially pronounced outside of the metro area where first responders did not arrive for weeks following the initial disaster. Although the initial mortality estimates following the storm were low, more recent estimates have placed the death toll in the thousands, after including indirect deaths resulting from worsening of chronic conditions or from delayed medical treatments.\textsuperscript{8-10} Countless patients lacked not only their maintenance medications but also any record of what medications of which they were in need. Many of these patients went first to their usual community pharmacy (if it was open) or the closest open community pharmacy, not only for prescriptions for their chronic diseases but also general health care consultations and first aid supplies.\textsuperscript{2} Especially in the rural areas of Puerto Rico, community pharmacists are often the first health care provider with which many patients interact, based on a long tradition of patient-pharmacist trust and increased accessibility.

Unfortunately, the increased needs encountered by community pharmacists were paired with community pharmacies themselves being incapacitated by the storm. We have already reported some of our preliminary experiences in the community pharmacy setting following Hurricane Maria.\textsuperscript{6,11} Many pharmacies experienced medication shortages due to nonexistent or severely limited distribution for weeks to months following the storm. Extended loss of power further exacerbated supply issues due to the destruction of entire vaccine stocks and other heat-sensitive medications. Limited telecommunications meant contacting prescribers, disaster relief agencies, and third-party payers was impossible. This put pharmacists in the difficult position of needing to dispense maintenance medications without prescriptions, authorized refills, or an emergency protocol to guide practice. As the vast majority of community pharmacies in Puerto Rico are independent, small businesses, the necessity of dispensing much-needed medications to patients without any guarantee of reimbursement further lead to significant concerns of financial survival. Despite these challenges, community pharmacists in Puerto Rico did the best they could to continue to provide care to their patients under these incredibly challenging circumstances.

Experience following previous natural disasters in the continental United States suggests that populations most affected by natural disasters are the elderly, those with significant burden of disease, socioeconomic vulnerability, and limited health care access.\textsuperscript{12-15} Recently, we described how the long-term financial and public health implications of the colonial/postcolonial status of Puerto Rico increases their vulnerability to natural disasters.\textsuperscript{16} The health disparities that already exist when comparing Puerto Rico to the continental United States, combined with the issues of governance and financial constraints placed on the territory, lead to an increase in vulnerability among those living in the archipelago. Puerto Rico has some of the highest rates of asthma, cardiovascular diseases, and diabetes in the United States as well as some of the worst health indicators related to control of these diseases.\textsuperscript{17-20} Furthermore, 42.7\% of those living in Puerto Rico are below the US poverty level,\textsuperscript{21} and the overall population has been declining for over a decade due to a disproportionate number of people younger than 65 years, and professionals—including pharmacists—migrating to other places in the United States, with an older population remaining behind and a weakened workforce.\textsuperscript{22,23} Ultimately, this baseline vulnerability of these patients with chronic diseases was combined with a major collapse of hospitals in Puerto Rico due to lack of electricity and missing employees: in the first 3 days following the hurricane, only 3 major hospitals were functioning and even 2 weeks later only 25 of the commonwealth’s 68 hospitals were operational.\textsuperscript{24,25} Given the decreased capacity of hospitals combined with increased demand from acute injuries and illnesses, the control of chronic diseases through self-management and outpatient care became an imperative.

Based on preliminary reports and our own clinical experience with patients following the disaster, we identified several common medication needs of patients with chronic diseases.\textsuperscript{3,4,11} The primary need was refills of medications, either due to lost or damaged supplies from the storm itself or simply not having a sufficient quantity to last through the emergency period following the storm when access to pharmacies was more difficult. Furthermore, several patients have indicated that refrigeration for heat-sensitive medications was also a problem. In addition to this, we witnessed a variety of other causes that further contributed to chronic disease exacerbations. For example, patients with heart failure presented with acute fluid overload related to a significant increase in dietary salt intake secondary to the limited availability of shelf-stable foods. Similar dietary challenges lead to uncontrolled hyperglycemia in our diabetic patients. In particular, however, our geriatric population appeared especially vulnerable to the significant disruptions in the health care system, likely due to their higher prescription medication requirements and multiple comorbidities.

The role of community pharmacists following a natural disaster has previously been documented, particularly within the context of other large events affecting the US mainland.\textsuperscript{13,26,27} Following Hurricane Katrina in 2005, the Jefferson County Department of Health (Birmingham, Alabama) developed a plan for addressing the unforeseen need for acute triage as well as routine prescription refills by evacuees from the Gulf Coast.\textsuperscript{27} This plan engaged pharmacists in the triage of evacuees, assessment of immunization needs, and provision of prescription medications under a collaborative practice agreement. Following Hurricane Matthew in 2016, pharmacists in North Carolina helped...
improve access to medications by interviewing, triaging, and assessing patient needs for treatment. Pharmacists are one of the most widely accessible health care providers following a natural disaster, in part due to the wide distribution of pharmacies throughout communities. Furthermore, pharmacists have the training to safely and effectively manage the pharmacotherapy for chronic diseases within their scope of practice. However, one of the largest barriers to the effective utilization of pharmacists in this role following a natural disaster has been the lack of preexisting emergency protocols that leverage these capabilities. Our own experience here shows us that although community pharmacists in Puerto Rico took on many of these responsibilities following Hurricane Maria, full realization of these capabilities was not possible because preexisting protocols that leverage them were not in place prior to the hurricane.

The development of resiliency in our health care system is an imperative. Geographically, as an archipelago, Puerto Rico requires a different preparation to pre-stage outside resources from other territories and states to respond as quickly as might be done in southern, continental states affected by hurricanes. Furthermore, governance limitations such as The Merchant Marine Act of 1920, also known as the Jones Act, limit Puerto Rico’s ability to receive more immediate assistance from geographic neighbors by preventing non-US vessels and crews from engaging in commercial trade with Puerto Rico (although the Jones Act was lifted temporarily following Hurricane Maria, it took 9 days to do so). Given these limitations, the development of resiliency in the face of future natural disasters is an imperative for the public health of Puerto Rico. As the first and sometimes only accessible health care provider to many patients following such a disaster, community pharmacists must play a part in that resiliency. To do so, a solid evidence base and better understanding of the individual, interpersonal, and environmental factors that contribute to the community pharmacist response are needed to inform public policy and effective disaster planning in the future.

To date, however, a paucity of data exists on both the pharmacist and patient factors which may contribute to an effective immediate response to patient needs at the community pharmacy following a natural disaster of this magnitude. Puerto Rico’s unique geographic and sociopolitical context means that the limited data that does exist from the continental United States may not be truly representative of or translatable to our reality. We believe further research must be carried out in Puerto Rico to better understand how community pharmacists can best respond to the needs of their patients following a natural disaster. Although anecdotal reports and our own experiences following Hurricane Maria suggest a variety of areas to be included in emergency protocols, more systematic research approaches are warranted. Studying the structural factors that facilitate the participation of community pharmacy care to sustain positive health outcomes among patients will support building structure and resilience within the overall health care system. Examples of these systematic research approaches include assessing laws, policies, and practices that prevent or enable community pharmacists to respond to the medication needs of patients with chronic conditions following natural disasters. Furthermore, research investigating the social determinants that led to chronic disease exacerbations among patients and affected their engagement with community pharmacists and the health care system at large following natural disasters is needed. The information gained will be essential in preparing future community response plans for Puerto Rico.

The natural disaster presented by Hurricane Maria in Puerto Rico has been unprecedented due to its scale, the preexisting political challenges, and the disruption it caused across the entire health care system. Nonetheless, the lessons we can learn may apply to many other contexts prone to natural disasters. Solid evidence and better understanding of the multilevel factors that contribute to the community pharmacist response in natural disasters is needed to inform public policy and effective disaster planning. Ultimately, such research and planning will lead to increased resiliency in our primary health care systems in the face of future disasters.

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