Running on Fumes: Preventable Public Health Failures and Mishaps Post-Hurricane María in Puerto Rico

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ABSTRACT

Emergency preparedness programs that were in place for Puerto Rico when Hurricane María struck were disconcerting on a local and national level. After highlighting some of the hurricane's physical and financial effects on Puerto Rico, I describe the emergency response survivors received in Puerto Rico after Hurricane María, or lack thereof. Lack of foresight as well as lack of support from government entities created preventable issues that affected hurricane survivors for months after the storm. I provide recommendations for how some of the pitfalls of emergency relief efforts post Hurricane María could be prevented, including verifying the legitimacy of FEMA contractors, replenishing FEMA warehouses speedily, establishing specific local procedures for disaster relief, and treating hurricane survivors across the nation equally, regardless of their ethnicity or socio-economic status. I also highlight the importance of providing fuel, electric generators, and personnel to restore electricity as soon as possible after a hurricane, given that electricity has become an essential aspect of modern life and an integral component of public health infrastructure, especially in communities with limited resources.

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INTRODUCTION

Electric grids, which provide electrical energy to whole communities and connect them to the outside world, have transformed the way we live. We use our cellphones soon after waking up to check our texts, calls, or news and media notifications. We use computers and the internet for many aspects of our lives, including work and leisure. Televisions, ovens, and fridges make hosting friends or family easier. Schools, stores, and supermarkets are brightly lit and temperature controlled, and factory machines produce many of the products we use every day. In medicine, electricity has allowed people to access health in unprecedented ways. Medical facilities are filled with high-tech equipment that help diagnose or treat people, and medical technology created ubiquitous tools for people to engage with, and make decisions about, their healthcare.

It truly is marvelous. But what happens if overnight you lose access to all these tools on which you've learned to depend? How do you carry on with your life in the 21st century without electricity for more than a few days? When a natural disaster strikes in an area with limited sources, it restricts how quickly "normal" health management resumes. In September 2017, Puerto Rico was devastated by two record-breaking hurricanes. The island of Puerto Rico is part of the U.S.A., one of the most powerful industrialized countries in the world. Medical care in the island is not that different from medical care provided in the U.S.A. However, Puerto Rico—like many states and cities in the U.S.A.—had been facing financial difficulties before the 2017 hurricanes struck. Most notably, it didn't have the resources to update its outdated electrical grid.

The same way that waste management and water sanitation systems are an integral part of ensuring public health, electricity is essential to prevent diseases and

promote health. Without electricity, there is no modern medicine, no employments, no banking, no cellphones—no life as we know it. Because we know we rely on electricity, we need to be cognizant of its importance when establishing or executing emergency preparedness procedures. Further, all (not just some) emergency preparedness programs on a local, state, and national level should include detailed plans and back-up plans that provide solutions for what to do in hurricane scenarios, not just vague guidelines that are tested after disaster strikes. In Puerto Rico, this lack of clarity as to what should be done when Plan A fails greatly affected disaster relief in the island.

Usually, after a hurricane most households in Puerto Rico will not have electricity or running water for a week or two, maybe three weeks in more remote areas near or within the rainforest. Businesses, schools, and government organizations resume operations after the week or two it takes to remove the debris from the road and fix power and communication lines. After 2017's Hurricane María, however, most of Puerto Rico did not have electricity for over 90 days. Some households did not have electricity or running water for over six months. Grade-schools and universities alike did not resume classes for months, and businesses and organizations were forced to close in the aftermath of the storm. People could not go to their jobs for months because there were no jobs to go to. This was true for people in working-class and wealthier communities alike.

The 2017 hurricanes had an immense physical and financial effect on life in Puerto Rico, yet neither the local or national government appropriately supported these hurricane survivors. The delivery and storage of disaster relief was mismanaged. Nationally, hurricane survivors in Puerto Rico were othered, treated unjustifiably differently than hurricane survivors in mainland U.S.A. Locally, emergency

preparedness guidelines did not provide enough specificity to allow for an appropriate disaster relief response.

One of the letters my family, which runs a medical clinic in the municipality of Trujillo Alto, sent to medical entities across the mainland U.S.A. to request aid and donations is representative of the despair felt in the weeks following María:

> As we strive to recover, many questions plague [us]. The absence of electric power and the uncertainty of the recovery of our power grid are challenges that have kept us awake at night. How can we go back to helping [people in Puerto Rico] with no energy and no communications? The implications are overwhelming. How can we prescribe accurately if we can't access our EMRs? How can I assure integrity of medication in this heat? How can patients contact me? How can we contact patients?

(Pérez de Céspedes, 2017.) How health be promoted in the months after a hurricane disaster without any electricity or appropriate support from the local and national government?

CHAPTER 1: HURRICANES' DEVASTATION

Late in the night of September 6, 2017, Hurricane Irma made landfall[1] in Puerto Rico, the island territory of the United States of America. Making headlines as the strongest storm ever measured in the open Atlantic Ocean, the eye of the Category 5 hurricane—the highest level on the Saffir-Simpson Hurricane Wind Scale—hovered over the north cost of the island. (Meyer, 2017.) Hurricane Irma left almost 70% of Puerto Rican households without electricity, most of the island without drinking water, and closed about half of the hospitals in the island home to 3.5 million U.S. citizens.[2] (Calabrese, et al., 2017; Ferré-Sadurní & Hartocollis, 2017.)

When Hurricane María struck less than two weeks later, about 60,000 households (roughly over 1 million residents) didn't have power yet. (DiSavino, 2017.) Hurricane María's strong winds reverberated through the island's southeast coast on September 19, 2017. By 5:00 a.m. the next morning, the center of the storm made landfall on the island. Though its record-breaking winds were not as strong as Irma's, María engulfed the 100-miles by 35-miles island. (Resnick & Barclay, 2017.) Meteorologist Jeff Weber described the storm was "as if a 50- to 60-mile-wide tornado raged across Puerto Rico, like a buzz saw." María's eye diagonally cut through the beaches, homes, cities, and mountain ranges, decimating the island. María pried roofs from buildings, shattered glass windows, and inundated houses. (Clarembaux & Maris, 2017.) Hurricane María knocked out all of Puerto Rico's power grid and the whole

[1] Landfall is when the eye of the storm moves over land. The eye is the center of the storm, which is mostly calm weather. The eyewall surrounds the eye and has the most powerful winds and rains of the storm, so a hurricane may severely affect a city without it ever making landfall on that city.

[2] Per the Jones-Shafroth Act of 1917, all individuals born in Puerto Rico are U.S. citizens by birth. People in Puerto Rico pay federal taxes, including taxes for Social Security and Medicare as well as import, export, and commodity taxes; some people in the island also pay federal income taxes. (Astor, 2017.)

island lost power. (Ferré-Sadurní & Hartocollis, 2017; Resnick & Barclay, 2017.) This would be roughly the equivalent of all the Twin Cities[3] metro area in Minnesota losing power overnight, and not being able to recuperate it for months. Except, the people of Puerto Rico did not have the option of driving to a nearby state, and the airport and sea ports limited operations to aid relief and emergency matters, so commercial traveling was very limited (and close to nonexistent in the days and weeks after María). People in Puerto Rico were stuck with little access—if any—to clean water, food, medicine, or electricity.

No Electricity, Phones, Roads, Schools, or Jobs

After a hurricane, most residents of Puerto Rico usually have electric power back in their households within a week or two. After María, however, over 85% of households remained without power for weeks, and a little over half of the island did not have power by the time Christmas Day arrived. (Schwartz & Black, 2017.)4 Whole towns were flooded; landslides buried roads, buildings were ripped apart like dollhouses; debris from fallen trees, buildings, and utility poles blocked access to many cities.5 It takes usually about three hours to drive the width of Puerto Rico. After the hurricane, the trip could take three days. (Weir, 2018.)

Though by late January 2018 the Authority of Electric Energy (Autoridad de Energía Eléctrica, "AEE") claimed that 61% of Puerto Rican households had electric power, several mayors questioned AEE's numbers, noting that only 20% to 40% of their communities actually had electricity. (Parés Arroyo, 2018.) By March 2018, about 7% of households still did not have electricity, most which were in rural areas that were

[3] The population of the communities in the Minneapolis–Saint Paul Metro area is about 3.4 million. (World Population Review, 2018.)

[4] For background on why the electric grid failed, see Appendix A.

[5] For a glimpse into how it was like to live through and after the storms, please see Appendix B.

hard to reach. (Fernandez Campbell, 2018.) Lack of electricity had tremendous consequences: light, life support devices, medication storage, land-line communication, internet, safety mechanisms, transportation, cooked food, cooling systems for portable power generators, wastewater systems, temperature control system, machines that mass-produce drinking water, fuel stations, and other electricity-dependent resources were lost or non-functioning due to the lack of electric power. With limited capacity to refrigerate perishable items or store temperature-controlled medicine, the aid received often went to waste before it could be given to a person.

Moreover, roughly half of Puerto Ricans had "no working cellphone service, creating islands of isolation within the island, cutting off hundreds of thousands of people in regions outside the largest metropolitan areas from regular contact with their families, aid groups, medical care and the central government." (Roig-Franzia & Hernandez, 2017.) In fact, the Federal Emergency Management Agency ("FEMA")'s inability to communicate with Puerto Rico after María limited their understanding of the devastation and challenges the island faced and consequently delayed the speed in which emergency supplies were sent to the island. (Davis et al., 2017.)

Aside from lacking electricity and means of telecommunications, only about 63% of the island's residents had access to clean drinking water, and just 60% of wastewater treatment plants were working—doctors saw increased numbers of patients with conjunctivitis and gastritis "brought on by contaminated water and poor hygiene." Bacterial diseases such as leptospirosis also emerged. (McLaughlin, 2017.) Since it is known that suicide rates increase after natural disasters, mental health specialists flagged the potential for a mental health crisis in the island, especially given the lack of housing as well of employment or income amongst Puerto Rico residents. (Parés Arroyo, 2018; Barbot, 2018.)

Suicide rates had been declining steadily since 2013 but increased in 2017. Though some suggested that the increase was due to Hurricanes Irma and María (Fernandez Campbell, 2018.), there is not enough data yet to determine if the hurricane indeed caused said increase. (Comisión para la Prevención del Suicidio, 2018.) Nonetheless, preliminary data suggests mental health issues have increased in the island after María. (Sutter, 2018.) There was a 78% increase in the number of calls to the suicide prevention hotline the month after María compared to the previous year's October calls, as well as a 50% increase in calls for 2017 compared to the previous year. There also may be an increased incidence of depression and anxiety: from a survey of 60,000 public school students conducted by the Medical University of South Carolina and the Puerto Rico Department of Education, 8% of children showed symptoms of depression and 7% showed symptoms of anxiety, which is twice as much as what you'd find in a non-disaster setting, according to the University researchers.

Besides people's mental health, the lack of electricity affected their wallets and ability to contribute to Puerto Rico's economy. If an employer (e.g., stores, offices, factories) could not operate, its employees—though technically employed—had no source of income for as long as the employment remained nonoperational. With no electricity, there are no banks or ATM machines to withdraw cash, nor credit card systems. Besides the cash, most if not all of the contents of a wallet were useless in the weeks and months following María. Even health insurance cards were of little use—there was no electricity or computer system to validate them. Even if your health provider knew and trusted you had insurance, they could not submit the claim for payment to the health insurance companies. After the first couple of weeks, health providers outside of hospitals operated on a trust and cash-only system.

Medical Facilities Running in the Dark

From the outside, some may have perceived the medical centers in Puerto Rico to be in adequate conditions to serve patients after María. Fifty-six of the island's 69 hospitals were closed because of María, but two weeks after the storm the Puerto Rico government announced 63 of the hospitals were "operational." (Sosa Pascual & Wiscovitch Padilla, 2017.) The effort was more confusing than helpful, however, because operational did not mean "back in full business." Many of the operational hospitals posted signs explaining that only patients for fevers or mild injuries would be admitted, leaving many in the dark as to where they should go for help for more serious injuries or conditions. The hospital or medical facility that had access to power generator(s) were able to use them to power air-conditioned rooms were often forced to create impromptu morgues for patients who passed away during or after the storm. (Sosa Pascual & Wiscovitch Padilla, 2017; Clarembaux & Maris, 2017.)

Even if a medical facility had access to power generators, people in said facilities' emergency rooms and dialysis centers were prematurely discharged because the facilities simply did not have the capacity to provide care for them. The electricity generated by the medical centers' available power generators had to be distributed to the now-pitch-black surgery rooms or treatment rooms turned de-facto sweatboxes. (Clarembaux & Maris, 2017.) The suffocating heat and lack of water intensified the angst in the medical centers. Some centers sought ventilators to turn the heat vapor into breathable air for their patients in critical conditions. This was not a dystopian film set in a faraway land. These were American hospitals operating in the days, weeks, and *months* after María.

By mid-October, 43 out of 48 dialysis centers operational; 65 of the island's 67 hospitals[6] were open, but almost half of the hospitals were not connected to a power grid. (McLaughlin, 2017.) Some of hospitals off the grid relied on power generators, which run on gasoline or diesel—a scarce commodity post María. More importantly, a generator is not a sustainable source of power beyond a few weeks if not a few days. Power generators often fail, as has been the case, for example, for hospitals in New Orleans after Hurricane Katrina, in San Diego during the 2011 city-wide blackout, in Connecticut after Hurricane Irene, and in New York after Hurricane Sandy. (Ornstein, 2012.) A generator might fail because it is located in a part of the building that gets flooded, it gets overheated, or it runs out of fuel. Sometimes, a generator may fail because it is not to code, but the hospital will not notice until an emergency actually happens or because the generator(s) had yet to be tested. (Garrett, 1998.) The Joint Commission, an organization in the U.S.A. that accredits healthcare organizations, requires that healthcare organizations test their electrical generators for four hours every three years and twelve times a year for thirty minutes in order to be compliant with the Commission's guidelines. (Hospital Safety Center, 2018.) Lack of a power generator, however, does not prohibit a medical facility from operating.

After María, healthcare organizations in Puerto Rico experienced most if not all of those circumstances. The humid, 95+ degrees Fahrenheit temperatures created an oven-like environment, often exacerbated by the loud humming of the generators. The road conditions made it almost impossible to transport fuel in the days and weeks after the hurricane, so even if a hospital or healthcare clinic had a power generator, it could

[6] For a detailed look into the medical infrastructure of Puerto Rico in the last century, including its militarization, Americanization, politization, and privatization, as well as its modern state after the latest medical reforms of Puerto Rico, please see anthropologist Jessica Mulligan's 2014 book *Unmanageable Care: An Ethnography of Health Care Privatization in Puerto Rico*. New York; London: NYU Press.

only operate for a few hours and then sit and wait for fuel deliveries. Some power generators were not appropriate for the equipment or facilities they were powering.

When power generators have failed in hospitals after a hurricane in the U.S.A., a common solution is to evacuate the hospital and send patients to the closest healthcare organizations. But what does a feasible surge capacity plan look like when all healthcare organizations are in the same boat—limited electricity, limited access to fuel, limited operating hours supported by the power generator? What can be done when there is no other hospital to which patients can be evacuated? Or when the other hospitals are too stretched with their own patients? In Puerto Rico, some hospitals had only two-weeks' worth of provisions. (Clarembaux & Maris, 2017.) The chaos that ensues the days and maybe weeks after a hurricane played out in Puerto Rico as expected. What was not expected was the need to operate in this way for months after the storm.

Death Tolls & Fake Catastrophes

Another thing unexpected aspect of the months following María was the amount of incomplete or misguided information the local and federal government provided. The number of deaths caused by or as a consequence of Hurricane María is still unknown. Two weeks after María, when the president of the U.S.A., Donald Trump, visited Puerto Rico, the death toll was only 16 people. (Sutter et al., 2017) Trump stated officials should be proud for avoiding a "real catastrophe" like New Orleans's 2008 Hurricane Katrina, implying Hurricane María was not a catastrophe. Later that day the death toll rose to 34. The official count became 55 in the following days. By February 2018, the official toll for deaths related to María was 64.

However, the impromptu morgues in the hospitals, as well as the multiple refrigerated FEMA trailers serving as an overflow morgue near the institute of forensic

sciences, were clear indicators that the official death toll was grossly inaccurate. (Schwarts & Black, 2017; Sosa Pascual & Wiscovitch Padilla, 2017.) In fact, 112 funeral homes (out of the 225 in Puerto Rico) surveyed in October identified 499 deaths they believed to be related to María—almost 10 times the official count of deaths related to the storms. (Sutter et al., 2017.) Five months after María, the Puerto Rico government commissioned a study through the George Washington University to review the number of hurricane-related deaths post María. (Sutter et al., 2018.) At that point, experts estimated the toll was probably closer to 1,000.

In July 2018, ten months after the storm, a national team of researchers—which included experts from Harvard University and the Puerto Rico Science, Technology, and Research Trust—published their findings on the topic. (Kishore et al., 2018.) They estimated 4,645[7] "excess deaths"—or deaths likely attributable to Hurricane María—happened in the three months after the storm. These included direct-deaths (e.g., death due to a flying object during the hurricane) and indirect deaths (e.g., death due to being unable to reach a hospital, or a health complication untreatable due to lack of electricity). In August 2018, the George Washington University that the Puerto Rico government commissioned to examine the hurricane-related death toll published their findings. (Andrade et al., 2018.) Taking into consideration population displacement—the number of individuals who eventually left the island during the period in question—in addition to direct and indirect deaths, the George Washington team estimated 2,098[8] excess deaths happened in those three months.

[7] The Harvard estimate of 4,645 excess deaths was with 95% confidence interval, meaning they were 95% confident that the true estimate is between 1,506 to 9,889 excess deaths. The researchers noted the resulting estimate of 4,645 excess deaths was likely an underestimate given surveyed individuals' survivor bias.

[8] The George Washington estimate of 2,098 excess deaths was with 95% confidence interval, meaning they were 95% confident that the true estimate is between 1,872 to 2,315 excess deaths.

After New Orleans's 2008 Hurricane Katrina, it was estimated that 1,170 to 1,833 people died in connection to the hurricane. (Ducharme & Aneja, 2018.) After 2012's Hurricane Sandy, which affected much of the northeast and east coast of the U.S.A., 87 to117 people died in connection to that catastrophe. For 2017's Hurricane Harvey, which affected mainly Texas, more than 100 hurricane-related deaths are estimated. A similar hurricane-related death toll was estimated for Hurricane Irma, which affected mainly Florida. Based on the most accurate estimates of hurricane-related deaths for Hurricane María, over 3,000 lives were lost in Puerto Rico. Many of these María deaths, as you'll see in the next chapter, could have been prevented.

CHAPTER 2: EMERGENCY RELIEF (AND LACK THEREOF)

Puerto Rico had three main sources of government-sponsored emergency relief: local, state-to-state relief, and federal. The island was not equipped—or was not supported—to appropriately comply with any of these sources' emergency preparedness plans.

Local Relief

On a local level, the latest iteration of Puerto Rico's emergency preparedness law is the Ley del Departamento de Seguridad Pública de Puerto Rico (Law of Puerto Rico Public Safety), which was amended only five months before Hurricane Irma hit Puerto Rico. (Ley 20-1999, 2018; Ley 20-2017, 2018.)[9] This law created the Puerto Rico Department of Public Safety, in which the Department of Emergencies and Disasters Management and the Department for Medical Emergencies were housed. The legislation notes that part of the reason for its creation is that "during the previous 15 years, the Government of Puerto Rico has not been able to abide with the [Designated Plans] created in…the management of national emergencies." (Ley 20-2017, 2018.) "Significant accomplishments have not been observed nor a strategy been established" relating to the island's emergency management and public safety legislation.[10]

The law provided guidelines of how different entities should collaborate with each other, rather than specific provisions detailing steps to be taken if disaster strikes. As part of its plan for disaster and medical emergencies, the legislation created Municipal Offices for the Management of Emergencies and Disasters, as well as the

[9] The Law of Puerto Rico Public Safety was previously known as Ley 211-1999: Ley de la Agencia Estatal para el Manejo de Emergencias y Administración de Desastres de Puerto Rico (in English, Law 211-199: Law of the State Agency for the Management of Emergencies and Disasters in Puerto Rico"). It was developed as required by the inter-state relief act, which I discuss later in this chapter.

[10] The legislative notes suggest the changes were incorporated in an attempt to streamline communication and provide relief tailored to each municipality's need.

position of Commissioner of Medical Emergencies, who would be responsible for "management and absolute control in medical emergency cases in the whole Island for the duration of the emergency." The commissioner must coordinate emergency and disaster relief efforts with the Municipal Directors of Emergency Services for each of Puerto Rico's 78 municipalities. Each municipalities' effort should be aligned with state (i.e., Puerto Rico's) plans.

Even though Puerto Rico is a small island, it is topographically very varied. Municipalities are by beaches; in rainforests, mountains, or valleys; or embedded in metropolitan hubs, some more Americanized than others. Some are fishing or farming communities, some produce coffee or tobacco, others house national and international manufacturing centers, and yet others subsist in the tourism industry. The 78 municipalities represent communities with distinctive needs, hence the need for local municipal directors.

It is unclear what each municipal director coordinated with the Commissioner of Medical Emergencies prior to María. Regardless, after María there was no electricity, cell phone towers were not functioning, and most phone lines were down. Evidently, María-specific relief could not be promptly communicated or requested. Puerto Rico had just experienced Hurricane Irma two weeks before, which also knocked out the power grid for most of the island. On the one hand, perhaps Municipal Directors were still in the midst of Irma recovery and not equipped to provide accurate updates to the Commissioner of Medical Emergencies prior to María. On the other, electricity was recovered by many municipalities and phone lines were mostly available throughout the island the week following Irma. Though the municipal directors' reports may not have been able to be completely accurate, by the eve of María the Municipal Directors had, or should have had, a good estimate of what their municipality needed for María

as well as the ability to communicate those needs to the Commissioner of Medical Emergencies.

State-to-State Relief

As a territory of the U.S.A., Puerto Rico participates in an inter-state relief act—the Emergency Management Assistance Compact or EMAC—through which a state or territory affected by a natural disaster must specifically request its needs. EMAC consists of five phases: pre-event preparation, activation, request and offer of resources, response, and reimbursement. (EMAC, 2018.) Puerto Rico's pre-event preparation was covered by the Law of Puerto Rico Public Safety that I explained above. Activation is commenced by the governor declaring an emergency or disaster on the EMAC online program. States don't have to wait until after disaster strike to make the declaration of the threat if the disaster is imminent.

After a declaration is made, the program's third phase is the request and offer stage. An affected state's request must describe the service(s) it needs, the amount and type of personnel and supplies it needs, an estimate of length of time for which it needs them, and a specific time and place for where response should be sent. (PL 104-321, 1996.) The affected state's request is sent first to the closest state time- and distance-wise. (EMAC, 2018.) The state(s) receiving a request assess the capacity they have to provide assistance based on the requests' specifications. Assisting states then make offers of assistance, after which the affected state completes an EMAC Request for Assistance Form, which "constitutes a legally binding agreement between the two states." At that point both the response and reimbursement phases take effect—the helping states send the response in exchange for the receiving state's promise to reimburse all related costs.

"[The] director of domestic operations for the National Guard Bureau said that immediately after Maria's landfall, Puerto Rico requested only communications equipment and fewer than 200 military police officers. By comparison, 17,567 guardsmen from 24 states were on duty in Florida a day after Hurricane Irma made landfall." (Davis et al., 2017.) Texas and Florida did make more requests for assistance relating to Hurricanes Harvey and Irma through the EMAC process regarding officers, volunteers, and supplies, and those requests were met more speedily than Puerto Rico's requests for supplies, officers, and communications equipment. (Flavelle & Levin, 2017.) However, the respond rate was on average twice as long as it was for Texas or Florida, regardless of the type of request. Moreover, only 20 states committed or sent help to Puerto Rico through EMAC, compared to 35 states for Texas and 39 states for Florida. (Flavelle, 2017; Flavelle & Levin, 2017.) In terms of volunteers, EMAC stated it sent 1,989 personnel to Puerto Rico, 5,260 to Texas, and 3,904 to Florida.

When questioned about the disparity in their responses, states alleged that Puerto Rico was slow in requesting or accepting assistance, but some believed Puerto Rico's debt and likely inability to reimburse other states for the relief sent was the reason for the delay. The Puerto Rico government was $72 billion in debt. Because it is not a state, the central government nor any of its municipalities could file for bankruptcy. In mid-2016, the Puerto Rico Oversight, Management, and Economic Stability Act ("PROMESA") was established, which created a Fiscal Plan Board made up of seven members appointed by the president of the U.S.A. This board has control and oversight of the finances of the Puerto Rico government. Regardless of Puerto Rico's debt or the presence of a financial oversight board, however, the delay in the initial relief request via EMAC is, or should have been, expected given the lack of electricity and communication lines after the hurricane.

Federal Relief

Two entities can expedite relief to areas affected by natural disasters in USA on the federal level: the president as commander in chief of the armed forces, and the Federal Emergency Management Agency ("FEMA"). The president overtly proclaimed his unconditional support for the survivors of Hurricanes Irma and Harvey in Florida and Texas, but he was quick to threaten to pull aid from Puerto Rico. (Merica, 2017.) He also was quick to refute information from Puerto Rico regarding the level of devastation, deaths, and infrastructure damage in the island—without providing much reasoning for his position. He did not use his executive power over the armed forces for much in relation to Puerto Rico, but he did authorize emergency relief subsidies for the island. Within two days of the federal government announcing it would pay for 100% of Puerto Rico's recovery costs for six months, states began mobilizing and making relief offers through EMAC. As mentioned above, however, relief response through EMAC was slow and Puerto Rico did not garner much support from fellow states in comparison to Florida and Texas.

FEMA, on the other hand, did send power generators to critical facilities in Puerto Rico, in addition to personnel to help restore the electric power grid in the island. (FEMA, 2017A; FEMA, 2017B.) However, with little notice FEMA de-installed power generators across the island and placed them in storage facilities for a future emergency. (Cerullo, 2018.) The communities from which FEMA removed the generators implored FEMA to not remove them given the power grid in those areas were still nonfunctioning even months after the storm, but FEMA proceeded with the removals.

Storage facilities can be helpful—FEMA's facilities usually house meals, water, tarps, and cots—but not if they store supplies that are currently needed (like the

removed power generators), nor if they are mismanaged or used with little foresight. Right before María, FEMA emptied its Puerto Rico warehouses to send relief, e.g., electric generators, tarps, and cots, to the U.S. Virgin Islands. (Flavelle, 2018.) Supplies were not replenished before María. Hurricane season is from June to November, so FEMA knows or should have known that emptying a storage facility in September is not practical unless it is immediately replenished in preparation for future hurricanes or similar natural disasters.

FEMA shipments for supplies were prioritized in Puerto Rico shipping ports, so despite the difficulty Puerto Rico faced transporting relief (see next chapter), some FEMA relief was expedited through the island. (Figueroa Cancel, 2017.) However, the preparation for the emergency relief was grossly inadequate, in large part because FEMA did not appropriately vet or verify its contractors. (Mazzei & Armendariz, 2018.) "Lawmakers fear the agency is not lining up potential contractors in advance of natural disasters, leading it to scramble to award multimillion-dollar agreements in the middle of a crisis." There are entities with which FEMA contracted that had no experience providing the supplies or number of supplies FEMA requested at the speed required by FEMA, or that had been banned from contracting with the government in the past.

In a $156 million agreement, one FEMA contractor committed to sending 30 million meals to the island. Only 50,000 were delivered. Some meals consisted of cheese crackers, a fruit cup, and cookies. Other required self-heating pouches that were not packed with the food. The government had canceled this entity's contracts on at least five occasions in relation to the Federal Prison System (for failing to deliver food products) and the Government Publishing Office (for failing to follow instructions preparing food packaging). It is unclear why or how FEMA awarded a multi-million

agreement to this contractor for María relief efforts. Another FEMA contractor won over $30 million in contracts to provide Puerto Rico with 500,000 emergency tarps (used as ad hoc roofs after natural disasters and commonly referred to as "blue tarps") and 60,000 rolls of plastic sheeting for repairs. (Abdollah, 2017.) Not a single tarp or roll had been delivered by the time FEMA cancelled the contract late October. The contractor's suppliers were mainly in Houston, which had been struck by Hurricane Harvey on August 25th—almost a month prior to María. The contractor informed FEMA of the supplier issue, so it is unclear why FEMA did not reassign the contract until a month after María.

The Inadequate Relief Response that Unfolded After María Is Not Justified

The government on a local, state, and federal level knew or should have known and predicted the major issues that came up post-María. Unlike with earthquakes or tornados, with today's technology we can predict accurately the trajectory of a storm days before it makes landfall. Plus, as you'll see in the next chapter, the basic needs of Puerto Rico post hurricane could have been anticipated without the need of idling around until an EMAC relief "acceptance" was received.

FEMA should have replenished their warehouses and vetted their contractors *prior* to the major hurricanes of the 2017 season making landfall. EMAC state representatives as well as FEMA should have sent electrical engineers and fuel to the island regardless of Puerto Rico's EMAC requests status. If electricity had been restored earlier in the island, the people and manufacturers in Puerto Rico could have provided the food and tarps that FEMA's contractors were not able to produce for weeks after María. Puerto Rico's governor, the Commissioner of Medical Emergencies, and the Municipal Directors should have modeled Texas and Florida in making pre-hurricane requests through EMAC. Prior to that, they should have focused

the debt-restructure process to prioritize restoring the island's electric grid. No matter how you slice or dice it, restoring electricity should have been the priority in emergency preparedness and hurricane relief efforts.

CHAPTER 3: RESTORING PUERTO RICO

Puerto Rico needed electricity, but the restoration and reinstallation of the electric grid system in Puerto Rico was a difficult task given the mountainous terrain of the island and the number of closed or blocked roads after the hurricanes. (FEMA, 2017B; Weir, 2018.) This meant that relying on power generators was a necessity, not a fall back. In other words, items that could provide electricity, such as fuel, batteries, and appropriate electric generators, should be delivered expeditiously to the island in the aftermath of Hurricane María.

Days after María, FEMA sent power generators to hospitals, schools, and shelters, in addition to sending personnel to help restore the electric power grid in the island. (FEMA, 2017A; FEMA, 2017B.) For context, an energy generator for a 450-bed acute-care hospital in Puerto Rico, such as San Juan Municipal Hospital,11 consumed 10 million gallons of diesel (which cost a little more than $3,000) in a three- to four-day period. (Rivera Clemente, 2017.) A lot of fuel was needed in Puerto Rico for electric generators, but medical and government facilities ran out of it within days of María. (Narayan, 2017.)

After María, fuel was rationed—only a gallon per person per day. The island doesn't locally produce it, so Puerto Rico depends on imports of fuel (and many other basic necessities). There was not enough fuel for medical facilities—or any kind of facility, really—to power their electric generator. Without fuel and without electricity, Puerto Rico could not rebuild itself. Throughout September and October 2017 many condemned the Jones Act, a decree controlling the shipment of goods in American

[11] Before the hurricane, San Juan Municipal Hospital on average had 36,012 patients per day; the average number of patients seen per day in all acute-care hospitals in Puerto Rico was 34,542 whereas the median was 29,739. (AHD, 2018.)

coastlines, as the main reason preventing Puerto Rico from restoring itself after María because of the high costs it imposes on imported goods. (Merelli & Campoy, 2017; Andrews & Page, 2017.) Under the Jones Act, formally known as the Merchant Marine Act of 1920, all foreign-originating goods transported by water from one U.S. port to another are required to be carried on U.S.-built and U.S.-flagged (i.e., registered in the U.S.A.) vessels that are owned by U.S. citizen(s) and are at least 75% crewed by U.S. citizens. (46 U.S.C. 50101 et seq.) This means that goods delivered from any U.S. port have to be sent through a qualifying ship under the Jones Act. These goods include, in relevant part, fuel, food, medicine, electric generators, cellphones, clothing, etc. This causes import fees to be high: food supplies and other goods are mostly delivered by just three U.S. transportation companies, which explains why import prices in Puerto Rico are double of those in the neighboring, Jones-Act-exempt U.S. Virgin Islands. (Carroll, 2015.)

The Jones Act applies to all of the U.S.A., but given the nation's robust networks of freight rail, only the states and territories outside of the contiguous U.S.A. feel the effects of the Jones Act. (Yglesias, 2017.) The New York Federal Reserve Bank conducted a study in 2012 which found that it costs "about $3,063 to ship a 20-foot container from an east-coast U.S. port [to Puerto Rico], but shipping the same container to another destination such as Kingston, Jamaica, would cost only about $1,687." (Leef, 2016.) Imports account for about 80% of the island's food supplies. (Merelli & Campoy, 2017.) Not surprisingly, after María many called for a temporary or permanent waiver of the Jones Act for Puerto Rico. (Yglesias, 2017.) The issue was that, even if the Jones Act was temporarily waived for Puerto Rico, fuel, food, water and medicine would still not *reach* the people of Puerto Rico.

Days after María made landfall, hundreds of ships filled with shipping containers were held up on the San Juan port. (Figueroa Cancel, 2017.) The most pressing issue was not that there weren't enough authorized ships available to deliver hurricane relief, it was that the goods could not be unloaded given the unloading docks were already packed solid, and the unloading process in and of itself was slow and burdensome.[12] Over 10,000 shipping containers filled with supplies—including medicine, food, and water—were docked at the San Juan pier the week after María. (Gillespie et al., 2017; Andrews & Page, 2017.) Goods could not be removed quickly enough from the docks because there were too few truck drivers to transport them across the island: "a shortage of truckers and the island's devastated infrastructure [were] making it tough to move aid to where it's needed most." (Gillespie et al., 2017.) Communication was difficult—only 20% of truckers could be contacted in the days and weeks after the storm because so many cell towers were down. Further, some truck drivers lost their trucks during the storm, and the ones that still had their trucks reported being unable to operate. Roads blocked by hurricane debris and the shortage of fuel also made extremely challenging the distribution of supplies, be it by truck drivers or small vans operated by church groups.

If the Jones Act would have been waived for several months after the hurricane, fuel and much needed supplies would still have been stuck in the sea ports, waiting to be unloaded. Advocates like Matthew Yglesias argued that places like Houston are thriving economies that were harshly affected by a hurricane. Puerto Rico, on the other hand, has been in a recession for over a decade and is relatively poor by U.S.A.

[12] It was important to load empty shipping containers back on the ships because there was food and merchandise reserved that were waiting for containers in which they could be shipped. (Figueroa Cancel, 2017.) Renting containers to deliver to Puerto Rico was expensive, so it was better to send back the empty ones. But many couldn't be emptied because there was no truck to remove its contents from the port.

standards (Puerto Rico's median income is $20,000 compared to the U.S.A.'s $50,000), so it can't exactly jump back on its feet after storm-specific aid is delivered; consequently, the Jones Act should be repealed, or at the very least modified to exempt Puerto Rico from it. (2017.) This argument is very valid when discussing the general restoration of Puerto Rico, but not when attempting to solve the issues plaguing the island in the weeks and months immediately after the hurricane. In the words of economist Aaron Klein, "[t]he feverish debate about whether to waive the Jones Act to expedite Puerto Rico's disaster recovery was akin to considering what to do about a paper cut for a cancer patient." (2017.) The Jones Act debates were not useful when seeking solutions for a region in which it was known there would be no electricity for months. What was needed was tools, such as fuel and power generators, that could help Puerto Rico operate as close to normal given the circumstances, and that could help hospitals and small businesses start operating again. As Justo Hernandez, FEMA's second in command in Puerto Rico, put it: "If I keep on flooding the place with food and water, when is it that the local neighbors are going to open their supermarket?" (Weir, 2018.)

Rather than fixating on the Jones Act, a better source of guidance is the response to the 2010 earthquake in the Caribbean island of Haiti. The disaster was not a hurricane, and it was not in an American territory. However, the disaster response "stands as an example of how quickly relief efforts can be mobilized." (Davis et al., 2017.) Within a day of the earthquake, an Army unit was airborne on its way to Haiti. Within two days, 8,000 troops were en route to the island. Within two weeks, 33 U.S.A. ships and 22,000 troops arrived in Haiti and 300 helicopters delivered food around the country. In the case of Hurricane María, eight days after the hurricane 4,000 service

men were sent to Puerto Rico, and 1,000 national guard members were activated. About 40 U.S. military helicopters and 10 Coast Guard helicopters delivered food to the island.

The speed in which food and medicine were expedited to Haiti indicates that sending appropriate resources to Puerto Rico after María was not impossible. The fact that Haiti is a foreign land does affect how the military can mobilize in the area. In Haiti, the US was "able to deploy active military combat brigades, quickly install a military commander and militarize the airspace at the invitation of Haitian officials," but in U.S.A. territories a "nearly 140-year-old Posse Comitatus Act limits the role that active military personnel can play." (Davis et al., 2017.) The Posse Comitatus Act of 1878 allows any county in the U.S.A. to summon all males over 15 years of age to prevent federal forces from asserting themselves in the county; "[while some] suggest the Act is obsolete [others say] the act is essential to bar misuse of the military by civilian authorities and to prevent a military dictatorship from assuming control of the nation through use of the armed forces." (Spak & Spak, n.d.)

As a territory of the U.S.A., Puerto Rico participates in an inter-state relief act—EMAC—through which a state or territory affected by a natural disaster must specifically request its needs. However, neither Puerto Rico being a part of the U.S.A. nor its mandatory participation in EMAC should have delayed supplies—especially fuel, medicine, and food—from arriving to Puerto Rico. According to investigative reporters Aaron Davis et al. (2017.), W. Craig Fugate, the FEMA director during the eight years of President Barack Obama's presidency, stated,

> [I]n a worst-case scenario, such as a tsunami, the federal government had long contemplated that Puerto Rico could be completely isolated, with its ports destroyed and all food and water needing to be airlifted onto the island or shuttled by Marine units that could land on beaches… FEMA did not have to wait for a signal from Puerto Rican authorities before activating more military assets.

Modifying the Jones Act or the inter-state relief act would not have fixed Puerto Rico's roads and electric grid system, nor would it have shortened the post-hurricane disarray felt in Puerto Rico for months instead of the usual weeks-long period of limited electricity. Typically, a hurricane leaves people in Puerto Rico without electricity for up to two or three weeks. María left 3.4 million people without electricity in Puerto Rico; three months later about half of those people did not have electricity and six months later about 20,000 people still did not have electricity. (Schwartz & Black, 2017; Fernandez Campbell, 2018.) After Harvey, more than 200,000 people were left without power in Texas, but electricity was restored for almost everyone within two weeks. (Lempriere, 2017; Acosta & Robles, 2017.) Irma left 4.4 million customers without electricity in Florida, but after 10 days power was restored to nearly all homes and businesses. (Dymburt, 2018.)

The need to restore electricity in Puerto Rico far surpassed the need for Texas and Florida to restore electricity. After Texas's and Florida's electricity was restored, all hands should have gone on deck to restore the electric grid in Puerto Rico. The FEMA and national guard electrical engineers should have been sent en masse from Texas and Florida to Puerto Rico. If sending the manpower to the island was not option, the focus should have turned to sending fuel—mostly gasoline and diesel—to Puerto Rico to power electric generators. That way medical services could be provided uninterruptedly, supermarkets and schools could have opened more quickly, and people could have returned to their jobs and produce income for their families and, by proxy, for the Puerto Rican economy.

Delivering fuel in a matter akin to how supplies were delivered to Haiti would have been a far more efficient way of consistently and periodically providing aid to Puerto Rico after María. By using military helicopters such as the long CH-47 cargo

helicopters, which are equipped to transport fuel and other sensitive loads in combat areas, disaster relief could be delivered faster and in a way that would not be inhibited by the crowded ports at sea nor the roads blocked by debris. This solution can apply to any area of the U.S.A. that is economically disadvantaged and surviving a hurricane disaster.

To effectively provide healthcare to hurricane survivors in the U.S.A., we need to ensure the critical tools that rely on electric power—from electronic medical records, to home diagnostic tools to hospital-grade treatment machines—can still be used even when the electricity that powers them is unavailable indefinitely. We also need to ensure hurricane survivors can return to their jobs as quickly as possible so as to not stagnate the economy. Ensuring fuel (in addition to food, water, and medical supplies) is delivered expeditiously at the direction of the president through military personnel that can bypass seaport and road issues would most effectively promote health for hurricanes survivors.

CHAPTER 4: NEGLECTED SURVIVORS

In the weeks and months following María, hurricane survivors in Puerto Rico were neglected by the local and federal governments. The local government waited five months before investigating hurricane-related death tolls. Before the 2017 hurricane season, the electric grid on the island—despite being in desperate need of repair—was not prioritized. FEMA overlooked the status of its warehouses in Puerto Rico and declined to check (or checked ineffectively) suppliers' ability to deliver on their contracts. Trump made no effort hiding his lack of support for Puerto Rico, and many states hid behind technicalities of the EMAC statutes and delayed sending relief to the island.

Hurricane survivors in Puerto Rico were othered—they were overtly treated differently than survivors of the 2017 hurricanes in Texas and Florida. The fact that Puerto Rico is not part of the contiguous U.S.A. should not have inhibited disaster relief as much as it allegedly did. The kind of disaster response Puerto Rico experienced should not be experienced by any other American state or territory. Though every natural disaster will have issues unique to the place, time, and political climate, there are states in this country that, like Puerto Rico, are not wealthy, are in hard-to-access regions of the U.S.A., or are not racially homogenous. Other areas in the U.S.A. may be at risk of a fate similar to Puerto Rico's after María.

We *are* able to prevent—or at the very least manage—the mishandling of disaster relief and the extended lack of electricity, an extra layer of instability in natural disasters nowadays. We were not organized, and perhaps not invested, enough to do it for Puerto Rico. There are several emergency preparedness actions related to FEMA distributions, government action, or electricity that could have prevented much of the woes the people of Puerto Rico experienced after María.

FEMA

Firstly, FEMA and emergency relief warehouses should be replenished during hurricane season as soon as its supplies have been dispatched. That way areas affected by an oncoming hurricane can have supplies handy instead of rummaging through empty warehouses, like Puerto Rico personnel did post María.

FEMA should also better vet its contractors to ensure the contractors have the capacity of following through with their agreements. The vetting process should happen prior to a hurricane disaster, or at least during the week following the emergency, instead of during the weeks or months after contractors' supplies had yet to be received or delivered. Contracts for food and tarps could have been reassigned earlier if untrustworthy or inadequate contractors would have been detected prior to the natural disaster.

Legislation

FEMA has authority to act once the president declares a state of emergency. That automatic process of activation can be useful beyond calling federal agencies into action. For example, once the president declares a state of emergency, temporary waivers of legislation can go into effect. Removing the Jones Act for the specific purpose of delivering much-needed aid throughout the island after María was not practical because of how inaccessible roads and communication lines were; even if the aid was received at the ports by multiple non-Jones-Act vessels, we would not have been able to distribute the aid. However, in terms of restoring Puerto Rico—or any other state or territory—after a natural disaster, waiving the Jones Act would make economic sense.

The Jones Act was created shortly after the first World War and was designed to give Washington State a monopoly on shipping to Alaska. (Kenton, 2018.) Its side

effect, however, was that it increased shipping costs to other U.S.A. states and territories. Because of the Jones Act, it's cheaper for Jacksonville, Florida, to ship its coal from Columbia rather than the U.S.A., Maryland and Virginia to ship road salt from Chile, farmers to ship their feed from Argentina and Canada, and northeastern states to ship oil from Europe and Africa. (CRC, 2013.) The Jones Act also slowed the response to the 2010 BP oil spill, and also causes an increase of over 25% to domestic shipping prices. Even territories that are permanently exempt from the Jones Act feel its repercussions. (Dupin, 2012.) In 2012, a legislator from the U.S.A. territory of Guam introduced a bill requesting Puerto Rico and Hawaii be exempt from the Jones Act. The Guamanian legislator noted that Guam is already exempt from the Jones Act, but shippers that bring goods to Guam stop in Hawaii first. In other words, their exemption status is moot, and Guam shoulders the increased shipping costs caused by the Jones Act.

The resolution did not pass, and other legislators since then have brought similar resolutions that have also failed. The Jones Act is arguably an antiquated piece of legislation that should be revised or eliminated for many reasons. In the context of natural disasters specifically, the speed in which relief is delivered and distributed is crucial because the faster aid is distributed throughout an affected region, the faster hunger and disease can be avoided. If there was an automatic waiver of the Jones Act once a state of emergency is declared by the president of the U.S.A., there would be no pressure in the wake of a natural disaster to scramble to find complying vessels and crew, nor would there be a worry about the increased costs associated with Jones Act compliance.

Action by the Executive Branches

Fellow states were slow or apprehensive to send relief via EMAC, the inter-state relief compact, seemingly due to concerns that Puerto Rico would not be able to repay the funds or relief sent. Once federal funding was announced for the disaster, several governors or their EMAC representatives promptly executed all phases of the EMAC process. Perhaps another automatic provision that can be activated upon the president's declaration of an emergency is automatic funding for bankrupt cities or municipalities affected by a natural disaster. That way states sending relief via the EMAC process will not limit or slow their response based on an affected region's ability to repay the helping state.

On a local level, the governor of a region affected by a large storm or hurricane should be encouraged to request supplies and personnel through the inter-state relief compact a few days prior to a hurricane making landfall so that the helping states can be ready to dispatch the needed relief as soon as possible. Governors of regions prone to more unpredictable natural disasters (e.g., earthquakes in the Pacific coast, tornadoes in the Great Plains, volcano eruptions in Hawaii) should make their EMAC requests if, and as soon as it is evident that, they do not have sufficient supplies at hand for the natural disaster. Alternatively, they can have a draft at hand of usually-needed supplies so that the request can be made as soon as the natural disaster strikes.

Requesting fuel, electric power generators, and electrical engineers should be standard in preparation for the almost certain disruption of electricity after a natural disaster. The stronger the event, the greater the electricity-related requests should be. Moreover, local governments should prioritize creating emergency preparedness policies that are specific in providing solutions for natural disasters, not just guidelines as to who should communicate with whom.

Nationally, in addition to declaring a state of emergency that would trigger legislative waivers and supplementary funding, the president of the U.S.A. should authorize the use of military vessels—be it ships or aircrafts—to expedite aid delivery. This would include transporting to rural or less urbanized regions, for example, trailers filled with food, water, and medicines. Fuel and electric generators can also be sent via military helicopters to bypass the roads blocked by debris and the ports blocked by cargo. Moreover, as tempting as it may be to play favorites, the commander in chief of this country should equally support all residents and avoid demeaning or belittling hurricane survivors, regardless of who they are or where they are located in America.

Electricity

All government and private entities—be it governors, the president, emergency and relief agencies, or donors—should prioritize the general restoration of electricity to areas affected by a natural disaster. In addition to sending fuel and electric generators, sending electrical engineers and equipment to restore an affected region's electrical grid is crucial. Poorer neighborhoods are less likely to have access to power generators or own vehicles that can travers the often-dangerous terrain caused by a natural disaster. Disregarding the electric grid's restoration is, in effect, disregarding the most vulnerable people with the most minimal resources.

Once the electric gird is restored, these vulnerable people will once again have access to their neighborhood supermarkets, schools, and medical facilities, all of which would promote the health of the hurricane survivors. In addition to electricity being essential to prevent diseases and promote health, if hurricane survivors are able to cook their food more easily, better preserve food through refrigeration, and be able to once again generate income for their families, then a contractor failing to send supplies or

food as required by its FEMA or EMAC contract will not be as much of a burden as it was in Puerto Rico after María.

Perhaps a future project can be to consider using renewable energy sources—like the Caribbean sun or the winds of the Great Plains—as direct power sources. That way when a natural disaster strikes, an affected area can focus only on its energy source rather than requiring fuel imports in addition to fixing the energy source. Until the infrastructure is in place to support said renewable energy, however, we should focus the efforts of emergency preparedness on providing fuel and restoring whichever energy source is in the affected area at the time of the hurricane disaster.

Risk Reduction & Protecting Dignity

The recommendations I offer are aligned with past and current guidelines regarding effective emergency preparedness. In discussing disaster risk reduction, the United Nations International Law Commission has focused on the protection of persons in the event of disasters in order to meet persons' essential needs with full respect of their rights, and recognizes we have a "duty to respect and protect the inherent dignity of the person." (Aitsi et al., 2018, p.23.) After all, "having regard for others is an inherent part of human identity." (Bilasová & Smatanová, 2016, p. 49.) The United Nations Caribbean Regional Platform on Disaster Risk Reduction noted that key lessons learned from Irma and María included "the need for enhanced response capacity for fast-moving, multiple and catastrophic events" and the need to "tackle environmental and development questions, such as building standards and codes for land use and management." (Waddington, 2018.) The United Nations also emphasizes the adoption of the 2015 Sendai Framework for Disaster Risk Reduction, "a 15-year, voluntary, non-binding agreement which recognizes that the State has the primary role to reduce disaster risk." (UNISDR, 2018.) The agreement stresses that the responsibility

for risk reduction should be shared amongst stakeholders, including local government and the private sector. Per the Sendai framework, every dollar spent in prevention saves $7+ in response and recovery cost. (UNISDR, 2016.)

Despite the fact that these risk reduction guidelines do not explicitly mention electricity restoration as something that should be prioritized more in emergency relief efforts, the restoration of electricity in regions affected by a natural disaster—especially in its communities with limited resources—meets these guidelines' goals. The same is true for the recommendations regarding vetting contractors prior to hurricanes and providing support equally to all hurricane survivors. After María, hurricane survivors were stripped of their dignity when they found themselves homeless or without a way of providing for their families. The relief they received, be it through the local, state-to-state, or federal programs, was subpar. I don't have perfect solutions, but I offer my recommendations with the purpose of triggering a debate that can hopefully produce other practical solutions. In the meantime, the recommendations I provide can help prevent unnecessary perils such as the ones experienced by María survivors in Puerto Rico, as well as help promote health and respect the dignity of vulnerable hurricane survivors by helping them stabilize and restore their normal life.

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APPENDIX A: Background for Electric Grid's Failure

You may wonder why it could take so long for electricity to be restored. This is in part due to the massive debt the Puerto Rico government had amassed in the decade or two prior to the hurricanes. Before the housing bubble of 2007 and the subsequent 2008 national recession, Puerto Rico experienced its recession in 2006. (Williams Walsh, 2017.) Since then, the Puerto Rican government was never quite able to recover. It issued bonds—a type of loan in which a government entity or corporation promises to pay the investor back with interests—to help with the crisis,13 but soon the Puerto Rico government amassed a $73-74 billion debt it could not repay.14 (Egan, 2017.) Part of the debt was owed by the Puerto Rico Electric Power Authority ("PREPA"), which had no funds to update the island's electric grids—the infrastructure of the island's power sources were effectively operating like those in the 1940's. (Williams Walsh, 2016A.) Not surprisingly, the electric grid in the island was no match for the hurricane winds of Irma and María.

Typically, in the U.S.A. a city or state can file for bankruptcy to help reduce said debt or negotiate payment plans for it. However, because of its status as a "freely associated state Puerto Rico could not authorize any of its 78 municipalities to declare bankruptcy under Chapter 9 of the U.S. Bankruptcy Code. (Newkirk, 2016; P.R. v Franklin, 2015.)15 After much lobbying and legislation, in 2016 the U.S. Congress issued the Puerto Rico Oversight, Management, and Economic Stability Act ("PROMESA"), which established an independent board with no Puerto Rican oversight to help restructure the island's debt. (Roselló, 2018; Williams Walsh, 2017.) PREPA was also under the control of PROMESA.

Though Puerto Rico's political status within the U.S.A. is not common, its predicament can resonate with many municipalities and states across the U.S.A. that are also in a poor fiscal state. (Flavelle & Levin, 2017.) There's an inter-state system in place for states to send aid and supplies in case of a natural disaster in exchange of a promise to pay back the supplying state. (EMAC, 2018.) Some theorize that this inter-state relief system as well as the federal government—which can decide whether to provide aid relief in kind or for a price—prevents a speedy recovery after a natural disaster in financially destitute areas of the U.S.A. (Flavelle & Levin, 2017.)

[13] These bonds were triple exempt, so the bond owners did not have to pay federal, state, or local taxes on the interest earned, so they became popular amongst hedge funds and "main street America" alike.

14 Additionally, the Puerto Rico government also owed $49 billion in unfunded pension obligations. (Williams Walsh, 2017.)

15 In 2016, Puerto Rico created a local bill that would allow some relief from creditors, but the Supreme Court found the US Bankruptcy Code preempted the island from doing so; only Congress could aid with the island's debt.

APPENDIX B: Living Through the Storms and Their Aftermath

Survivor's Accounts

For vivid accounts of the hurricanes and images of the aftermath, please see the special coverage provided by El Nuevo Día, the largest newspaper in Puerto Rico, titled "María." (Endi.com, 2017.) The site is in Spanish but can be read in English by using the "translate" feature in Google's Chrome browser. The interactive page includes before and after aerial pictures as well as video and maps of the hurricane and its trajectory. It also includes a link for donations at the very bottom of the page, if you wish to help the island be restored to its pre-hurricane state. For a photo diary described in English, please see Amaria & Barclay, 2017.

For reports on survivor's stories in the days following the hurricanes, including finding their homes, getting food, living sick and in the dark, and navigating through the island, please see Meyer, 2017; Roig-Franzia & Hernandez, 2017; Robles at al., 2017; and Gillespie et al., 2017.

There's controversy regarding the number of deaths that occurred due to the hurricanes which range from 55 to over 4,600 deaths. For more information detailing the Puerto Rico and U.S.A. government response as well as the academic communities' reactions, please see Schwarts & Black, 2017; Sutter et al., 2017; Sutter et al., 2018; and Kishore et al., 2018. On a personal note, members of my family were part of the medical team providing certificates of deaths for the bodies stored in the refrigerated FEMA trailers discussed in Schwarts & Black's piece. It was admittedly vindicating to see academic evidence reflecting the number of deaths we witnessed.

For accounts from survivors six months after the storm, please see El Nuevo Día's special edition newspaper covering six survivor's their communities' perspectives. (Endi.com, 2018.). Similarly to the 2017 accounts I mention on the first paragraph of this section, this site is in Spanish but can be read in English by using the "translate" feature in Google's Chrome browser.

Communication to and From Puerto Rico

I remember the weeks after the hurricane very few cellphone lines and few landlines were operational. My brother, who lives in Washington, D.C., and I would receive status updates about the island before any of our friends and family in the island would. Sending or receiving a text message took hours and getting a call through was nearly impossible. He and I would summarize the day's news in one message at the end of the day and send it to our parents, who live in the island. After a few days, we were able to establish phone communication with our parents. The calls would drop after five minutes or so. We were lucky, though, because my parents live near the top of a mountain near a cellphone tower that was comparatively undamaged. Cars from neighboring towns would park near my parent's street—you could see the drivers glued to their phones, raising their cellphones a bit in the air in an attempt to get better signal.

My friend Alexandra, who now lives in California, was similarly desperately looking for her parents who live in the island. She had not heard from them in days, so she called me in Minnesota; I called my parents, who were located in San Juan.

Alexandra's family used Verizon whereas my family uses AT&T, so Alexandra's calls to my parents did not go through, nor did my parents calls to her family go through. My parents eventually spoke to a neighbor who was driving that day to Caguas—Alexandra's neighborhood. At the end of the day, the neighbor reported Alexandra's parents were ok, so the Caguas to San Juan to Minnesota to California communication chain ensued. It's almost hard to believe now, but that was as smooth as communication could be during the weeks following María.

My brother and I often received calls from our parents or texts from friends in the island asking us to ship them fuel containers or bug repellent, which were nowhere to be found in the island, only for he and I to read minutes later in the news that those items had been shipped and were yet to be unloaded from the ships. While islanders could seemingly contact the outside world and ask their request be relayed, the government or local relief providers could not reach all islanders via television or radio (the usual modes of government communication) to let them know relief was on its way.