Health-Sector Resiliency, and Interjurisdictional Learning in the Face of Climate Change and Extreme Weather

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Introduction

Extreme weather events are becoming more common, and climate change seems to be a driving factor. Scientific evidence has linked climate change to extreme weather. For instance, global warming raises ocean levels and makes many temperate locations hotter, which will only worsen the intensity and effects of these extreme weather phenomena. According to John McQuaid (2012), “High sea surface temperatures lead to the evaporation of moisture, which provides fuel for the storm. Then it gives up the latent heat: that is what powers the storm. Together they provide for stronger storms. The evidence is abundantly clear.” As C2ES writes, “Research shows that changes in climate that create warmer, drier conditions, increased drought, and a longer fire season are boosting these increases in wildfire risk”. Thus, anthropogenic climate change will make hurricanes and wildfires, along with many other extreme weather events, more common and that will detrimentally affect our existence as a species.

The effects that extreme weather events have on health have been repeatedly described. Respiratory health issues have been discussed at length, as well as temporal and mental health issues that also spawn from being afflicted by such events. There is nothing incorrect with such a laser focus on the health effects of these storms, tornadoes, or fires. It is necessary to know how these events will affect people directly. However, such an acute focus leads to other effects of these events not being researched as much as warranted. One big neglected consideration is the effect that these extreme weather events have on Healthcare/ Public Health infrastructures, an unintentional oversight that nonetheless can have large consequences on a community’s holistic health.

Healthcare infrastructures face great strain as a result of the health issues that are caused by these extreme weather events. Especially in the United States, an effective or ineffective response by a healthcare/public health infrastructure can be the difference between the loss of hundreds and potentially thousands of lives. Healthcare infrastructures are the linchpin in a community’s wellbeing; if the infrastructure bends or breaks, the community will feel the full

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repercussions of it. As a result, it is imperative that the effects of these extreme weather events on healthcare infrastructures are studied, so that as these various storms become more common, we are ready and able to combat their worst effects.

This paper will utilize six case studies on the effects that Hurricanes Katrina, Sandy, Harvey, Irma, and Maria, and the 2017-2019 wildfire seasons in California to accomplish a couple of objectives. Firstly, this paper will analyze the interjurisdictional learning (referred to as “learning” throughout this paper) from the various public health and healthcare systems affected by the storms to see if necessary life-saving measures were either implemented or discarded. This is an important analysis, as it shows what policies most healthcare and public health systems are willing to or able to change or implement in response to being hit by an extreme weather event. The inclusion of the California wildfire seasons will illustrate the broad applicability of these policies. Second, this paper will analyze what must be done in order to build resilient healthcare systems. By discussing the inherent need to “build back better” through improving interdepartmental coordination, harnessing an effective governmental response, and implementing new technologies and policies that are able to ease healthcare delivery, this paper illustrates what healthcare and public health leaders should learn to ensure that resiliency is built up for future storms.

Overall interjurisdictional learning was a mixed bag with many of the major extreme weather events in the United States. In cases like Hurricanes Sandy and Harvey, learning was clearly present; in cases like Irma, learning was less present but still evident; and in cases like Hurricanes Maria and Katrina, there was an abject failure in learning. In the case of the California wildfires, there was limited but evident learning in terms of California adapting new responses from previous wildfire seasons. As a result, public health policymakers the nation over have demonstrated clear deficiencies in both the presence, and expression, of interjurisdictional learning. These deficiencies are, however, not insurmountable, and these policymakers can make improvements. It may be difficult, but with the correct mindset and resources, the public health infrastructure can be improved, and the health of the nation of a whole will be in a much better place.

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Healthcare/Public Health Infrastructures: An Overview

Before proceeding, a quick definition of what is meant by a healthcare or public health infrastructure, (which due to their similarity in definition will serve as interchangeable terms), is necessary. According to the World Health Organization, a public health infrastructure is defined as the “formal and enduring structures that support public health”, comprising of “institutions and capacity, knowledge (of public and professional), and commodities (physical infrastructure).” Think of it as both a physical and policy-based entity. A public health infrastructure involves the active role of people in hospitals, and in legislative offices working together in their highest capacity to improve a community’s health. Thus, developing a public health infrastructure is a process that requires the development of various policies and structures. Requiring physical capabilities, health knowledge, legal structures, and policies, healthcare infrastructures require a complex web of interconnecting ingredients in order to function properly. One single disruption, and this entire network of public health can disintegrate.
This image encapsulates the intricacies and interconnectedness inherent in a public health infrastructure, By: NIH

The public health/healthcare infrastructure must be clearly defined and well-understood. In many of the responses to the various extreme weather events that were studied by this paper, there was an inability to conceptualize the intricacies of this infrastructure. There are so many gears in the healthcare machine to consider. However, the inability to see how external outpatient clinics such as dialysis centers and mental health clinics are affected by these hurricanes and wildfires, and the consequences of them being out of commission for extended periods of time, lead to inadequate recovery of a community’s health and wellbeing. The Healthcare infrastructure is more than just large networks of hospitals, it is a community-wide apparatus of public health workers, nurses, clinics, policymakers, and insurance providers, who work together in order to promote the community’s wellness, and resiliency.

Interjurisdictional Learning: What did Each City’s Healthcare System Learn from Each Other?

No person, or system is omniscient. Thus, it is important that when the inevitable mistake is made by not only one city or region’s own healthcare system, but by another city or region, it is learned from, so that the mistake is not repeated. This interjurisdictional learning is utilized in other sectors of governance and policy, as well as in the scientific community in general, as being able to gather and synthesize knowledge is important in every field in order to allow progress to occur. Thus, as a result, it is especially important for officials and policymakers who are concerned about recovering from extreme weather events, to focus on previous occurrences of said event, so that response to it can be as expedient and encompassing as possible. This is the only way that large-scale resiliency can be built.

Hurricane Katrina: A Rocky Beginning

Hurricane Katrina was a storm that would have been extremely difficult to adequately manage. A category 5 storm that would usurp Hurricane Andrew as the deadliest in United States history, Katrina would strike the Gulf Coast of the United States with nearly 175 mile per hour winds,
The accompanying 12-to-14-foot on average, 20-at-its-maxima, storm surge would flood 80% of the city of New Orleans, and devastate many Louisianan, Alabamian, and Gulf Coast communities. Over 100 billion dollars of damage were racked, making this the most expensive storm to ever strike the United States to this time of this paper’s writing. Even with all those considerations in mind, the response to Katrina by both the Federal Government, and the public health infrastructure in general, showed no learning whatsoever in respect to previous storms that struck the Gulf Coast region.

The inadequate response that FEMA delivered to New Orleans especially, outlines the overall failure of the Federal Government to promote recovery in the region. In 2006, the Urban Institute detailed a plethora of shortcomings that were evident in the response to Katrina, one key failure being an overall lack of coordination between the state, local, and federal governments. (Gray and Hebert, 2006). Many of the overly bureaucratic communication systems broke down, potentially leading to more fatalities than there should have been. Urban Institute also detailed how poor emergency preparedness was across the healthcare system because evacuations were hasty, health records were not digitized and they were destroyed, and backup and redundancy power systems were not established. Morial (2007) detailed how a loss of many businesses to the storm led to a decrease overall in the healthcare coverage in the city. The poorer residents of New Orleans were more likely to be uninsured, and were especially hurt when Charity hospital, that served many Medicaid recipients, shut down.

Thus, there were expectations that after Katrina that there would be great changes and vast differences in the way that the overall public health infrastructures would deal with future hurricanes. NIH detailed how important it is to have an expanded healthcare system, with expanded Medicaid insurance being a major point (Morial, 2007). Gray and Hebert (2006) detailed how important it is to have backup generators, evacuation plans, and a coordinated comprehensive plan for a disaster recovery. Chandra and Anita (2015) discussed how important it is to have a community health programs that strengthen societal engagement and networks in order to improve emergency preparedness. Overall, Katrina was seen as a blunder by many governmental and non-governmental entities, and as a result, for future Hurricanes and other
natural disasters, people hoped, if not expected, that the government and overall healthcare infrastructure would respond better. Unfortunately, there were no evident improvements in the majority of the United States’ hurricane and wildfire responses.

**Hurricane Sandy: Where Learning Seemed Evident**

Hurricane Sandy greatly affected the United States and proved that not much was learned from the catastrophic and inadequate response to Katrina. Striking central New Jersey on October 29, 2012, it would not bring the high winds of Katrina, but the storm surge that was able to bring water back up the Hudson River and meet a maximum height of 14 feet, caused profound damage to New York City and the general coastal tri state area. According to Toner, McGinty, Schoch-Spana, Rose, Watson, Echols, and Carbone (2017), Sandy would cost 67.7 billion dollars in damages to the region, and profoundly impact the greater New York-New Jersey area for weeks and months to come. As a result, a complete and comprehensive recovery from this storm was imperative not only for the sakes of New York and New Jersey, but also for the entire nation as a whole. With Katrina as a backdrop for a large-scale Hurricane Recovery, the Sandy Recovery demonstrated the learning, or lack thereof, of local and Federal public health infrastructures.

Gostin, Hanfling, and Powell (2012) detailed how “The emergency hospital evacuations of 2 of Manhattan’s landmark medical facilities—NYU Langone Medical Center … and Bellevue Hospital—struck a similar chord to the catastrophic loss of medical infrastructure in New Orleans in 2005.” However, they would also detail the successes that were met with many of the other healthcare institutions’ strategies in response to Sandy, such as an increase in emergency preparedness planning, and an increase in (well-placed) generators. The NIH, in an analysis completed in 2017, discussed how 9 hospitals had plans to evacuate early, while other outpatient facilities successfully implemented their own emergency plans. Ladislaw (2014) reported how the Federal Government was able to proactively and adequately respond to the storm, with FEMA being granted 10 billion dollars from the Federal government. The government was also able to procure 50 billion dollars under the Defense Relief Appropriation
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Act. Overall, it seems that NYC and the surrounding area was able to adequately handle the storm. There were notable shortcomings in select areas of the recovery, however, making the response far from perfect.

The main issue with the recovery was its unevenness. Not every area of New York was able to recover as well as the best ones were able to. Schmeltz (2013) from NIH discussed how the vulnerable community in Red Hook, Brooklyn, was forced to rely on itself due to slow Federal response, which resulted from its location on Rockaway island and its high concentration of poverty, meaning a lack of essential services like medical clinics were available. Georgetown discussed how situational awareness—a holdover from Katrina—needed to improve. The NIH detailed how coordination needed to improve, among the Federal government, local government, and public health actors (Toner, 2017). Dr. Toner from the NIH also detailed how outpatient facilities like dialysis centers were not as prepared for the storm and as a result, were unable to open up as quickly as many hospitals.

Hurricane Harvey: Another Good Response from the Public Health Infrastructure

The sheer destruction wrought upon Houston and Harris County by Hurricane Harvey is nearly immeasurable. According to NOAA in 2017, the storm submerged one third of the city underwater due to an equivalent of 27 trillion gallons of rainwater raining down upon it. The 125 mph winds would lead to the storm being cited as the second most expensive storm in United States history with the damages at approximately $70-90 billion, while other estimates are closer to $190 billion. Hurricane Harvey was nearly as difficult to respond to as Hurricane Katrina was, but there were fortunately clear signs of learning evident, even if it was not perfect or entirely comprehensive.

In contrast to Katrina, and similarly to Sandy, the major factor of success in the recovery efforts after Harvey is the active role that the Federal Government had in repairing and improving the infrastructure. Dr. Robert Kadlec, the Assistant Secretary for Preparedness and Response (ASPR), testified before Congress in 2017 on the effectiveness of his bureau’s response. He discussed how important it was for the NDMS to be activated and the 2,500
personnel to be directly able to liaise with FEMA and CDC and other local and state partners in order to make an effective response. The Constable (2018) described how the South East Texas Regional Advisory Council was able to adequately coordinate and direct the evacuations of 1,500 patients. Thus, overall, the public health infrastructure seemed ready and able to respond to Hurricane Harvey, however challenges remained in making the response completely effective.

In 2019, the National Association of Counties detailed how difficult it was for the Harris County Public Health board to envision the long-term nature of the recovery. They also discussed how difficult it was to reach and aid poor and immigrant populations. The Texas Health Association (2017) discussed multiple points of improvement that could have been made during the recovery after the storm. Some salient recommendations were the improper reliance of hospitals to serve as shelters, the integrity and continuation of operations of outpatient facilities like dialysis centers, effective vetting and use of volunteers, and adequate communications. Harvard Business Review discussed how it would be beneficial for public health officials to creatively deploy existing capabilities, establish clear and trusted lines of communications, and adequately schedule time off for overburdened medical response teams (Gandhi, Dhillon, 2017). Harvey serves as an example of how to best respond to a hurricane and how necessary a multifaceted public-health response is. Learning here was clearly evident, and good lessons should be taken from the Federal Government, Harris County, and other healthcare institutions, on how to respond to extreme weather events.

**Hurricane Irma: A similar, but somewhat worse, response to Harvey’s**

When Hurricane Irma made landfall over Florida on September 11th, 2017, there were many similarities between it and Hurricane Harvey. The storm would also slow itself over Florida, dropping torrential rain alongside its dangerous wind speeds, according to NOAA. As a result, millions would lose power, and Hurricane Irma would cause approximately one-foot high storm surges that would flood many on the Floridan and Alabama coast. Even though Irma was a lower stakes storm in comparison to Harvey, it still required a large, focused, and concerted effort to ensure that life was able to return to some form of normality after the storm hit.
Overall, there was a good response to Hurricane Irma on the mainland of the United States. HHS discussed their prepositioning of emergency response personnel in the path of Irma, so that response could be quick and adequate, during their emergency declaration in 2017. FEMA discussed the response that they took in order to adequately respond to the storm, discussing how agencies ranging from the EPA to the Red Cross to the CDC are putting resources into all areas afflicted by Hurricane Irma. This is seen clearly by the agency discussing how the Federal Disaster Declaration freed up resources that can be given to the Virgin Islands. Thus, the coordination efforts and the Federal Governmental responses seemed to be adequate, and learning was evident, however, unlike Harvey’s response, there were more shortcomings in the response.

One major issue primarily came with the response in Florida, which tragically left many of the elderly and disabled behind. As the American Magazine reported in 2018, many shelters were unable to provide adequate care for those who needed it the most, due to inherent lack of capability. Communication on the opening of the shelters was lacking, and the evacuation transportation was inherently substandard (Stein, 2018). What was even worse than that was the response that was given to the Virgin Islands. As the Virgin Islands are only an Unincorporated Organized Territory, they are unable to get full federal funding from programs like Medicaid, being capped at 55%. According to Hall, Rudowitz, Artiga, Lyons, B. (2018), a lot of Virgin Island healthcare facilities were therefore destroyed, and had a difficult time being rebuilt due to the slow FEMA response. Thus, historical inequities, as well as the government’s incapability to respond well to the territories it owns, hampered a fully effective recovery, and as will be seen in the analysis on Hurricane Maria, points to larger, disturbing trends in the United States’ response to natural disasters.

**Hurricane Maria: An Unfortunate Redux of Katrina**

When Hurricane Maria impacted Puerto Rico, the devastation it wrought was ubiquitous across the island, and it caused great economic catastrophe. This was primarily due to the inherent strength that the storm possessed. As NOAA reported after the storm landed, when Hurricane
Maria struck Puerto Rico on September 20, 2017, its Category 4 strength would lead to 135 knots (155 mph) of wind beating down on the island, while the rains of up to 38 inches and storm surges of between 2-4ft would lead to the mass destruction on the island. As a result, 80% of the island would lose their power, and infrastructure the island-over was either gravely damaged or completely destroyed. Puerto Rico, especially due to the historical financial challenges that have plagued the island, had a weak public health infrastructure and needed considerable Federal help. Unfortunately, the response would show the failures of health infrastructures both locally and Federally, as well as an abject lack of learning.

Rivalling the inept response to Katrina, the government's response to Hurricane Maria lacked timely funding to allow for quick reconstruction of infrastructure. In 2018, the Center for American Progress discussed how The NRDC took testimony from Dr. Matos on how difficult it is to access healthcare on the island post-Hurricane Maria. She describes how “After Maria, the Puerto Rican government contracted with insurance companies to manage health plans; these companies were affected by the disaster and stopped paying medical care providers” (2018), which clearly hurt the recovery. In 2018, the Commonwealth Fund described how FEMA provided less funding and less personnel to aid Puerto Rico, which exacerbated the already-fragile pre-Maria public health infrastructure (Blumenthal. 2018). This, coupled with the fact that both local and Federal officials incorrectly tallied the death toll, led to Maria’s inability to adequately recover from the storm.

This failure to respond showed profound failure in learning, and thus as a result, much of the progress that seemed evident from previous storm responses were essentially undone. The NIH discussed how Puerto Rico has essentially been failed by the Federal government since the passage of the Jones Act in 1917 (Rodríguez-Díaz, 2018). Dr. Diaz discussed how, as a result, the island’s debt crisis has been mismanaged for decades, and led to the island being unable to invest in needed areas such as Healthcare. The APA discussed in 2019, how the “aftermath to the aftermath” was difficult to recover from, due to the inadequate Federal response. Mental health issues such as PTSD afflict 7% of the school age population, according to Greenbaum, and psychologists on the island have great difficulty in managing and implementing programs that
can boost the island’s mental health. In 2019, NPR profiled why the response failed and condensed it down to these salient points: “…many deaths were a result of the failures by both the Puerto Rican and federal governments, from the lack of disaster planning to the inaccurate death toll that minimized the scale of the disaster to the disorganized effort to restore power” (Pascual). Thus, the consequences of the failure to learn from previous storms and respond fully to this one, led to Puerto Rico being harmed for potentially decades to come.

**California Wildfires: An example of Intra and Inter-jurisdictional Learning**

California Wildfires have been getting increasingly more violent and destructive, especially in the latter half of the decade. 2019 would prove to be one of the worst California fire years on record. According to Cal Fire, the wildfires of that year would end up burning 259283 acres, damaging 732 buildings, and causing approximately 3 fatalities. This damage was caused by an aggregate of 7860 separate instances of wildfires, with the Kincaid fire being the most notorious, burning 77758 acres. These fires are also getting more costly, with the National Interagency Fire Center detailing how, in 2018, fire suppression cost $3,143,256,000 alone. The public health infrastructure is not immune from these fires, and they were able to, with great difficulty, somewhat adapt to the new reality they faced.

Health Affairs published an article in 2018 discussing how important it is for healthcare infrastructures to adequately help build resilience in their communities (Dean, 2018). They discuss how important it is for health infrastructure to become sustainable, and lead sustainability initiatives, so that the community they serve has improved health. They also discussed how important it is to prepare to have more staff for wildfire related medical conditions, like pulmonary embolisms, so that they can adequately be treated. The Sacramento Bee discussed how difficult it was to respond to the wildfires in 2019, due to PG and E power shutoffs, which is tied to the inherent need to have adequate physical infrastructure (Anderson, 2019). What ended up being useful during these power shutoffs was the expansion of telehealth capabilities, backup power systems as well as established coordination channels for evacuations. Overall, even with
the difficulties faced due to these fires, California healthcare systems have learned that they need to adapt and prepare themselves for the new status quo that has been foisted upon them.

What Still Needs to be Learned?

Interjurisdictional Learning was unfortunately a mixed bag, with places such as New York and Houston able to adequately learn from previous storms, and respond to the storm, while in places like Puerto Rico and the Virgin Islands, there were woefully inadequate responses on both fronts. Even with that in mind, there are a plethora of lessons that still need to be learned by healthcare professionals, which will make future responses to these worsening extreme weather events even better. Overall, these following areas of the public health should be improved so that the best possible recovery outcomes can be achieved.

**Building Back Better**

The need to build back better is one of the most important takeaways that can be found from every single disaster response. Rebuilt infrastructure needs to be more resilient so that it is possible to use the new infrastructure for longer periods of time. With storms are worsening due to climate change, it is imperative to ensure that all rebuilt infrastructure can survive the onslaught of a storm that is worse than what is usually expected. The “one-in-a-hundred-years” storm is becoming more of a one-in-fifteen- or ten-year occurrence, so the old modalities of reconstruction can no longer be utilized.

Building back better was done in New Orleans approximately a decade after the onslaught of Hurricane Katrina. The University Medical Center built to replace the irreparably damaged Charity Hospital. According to a 2015 NOLA article, the new hospital is able to withstand a 2-by-4 slamming into it at around 200 miles per hour and possesses generators that are safely placed outside out of most flood zones. Of course, this does not just apply only to physical hospitals, but to other portions of the infrastructure, such as outpatient clinics, dialysis centers, and even physical infrastructure components like roads and electrical grids. Building back better not only shows that learning has been done by public health infrastructure officials,
but it also shows a commitment to ensuring that a community is able to remain as healthy and resilient as possible.

**Ensuring Coordination Channels Remain Open**

The most important part of any disaster recovery is ensuring that a coordinated response can occur. That means that a concerted effort must be made in order to ensure that coordination channels remain open, between both private and public health care providers, the local government, federal government, and other federal government officials. There was mixed success with this in each of these responses and as a result, it is clear that coordination needs to be improved within various medical, emergency evacuation, and other related components of the public health infrastructure.

The benefits of good coordination are clear and can be seen from the various analyses of effective and ineffective responses. Sandy responses showed progress after Katrina in this respect, but noted that progress was still necessary, same with the responses to Irma and to Harvey. Overall, as coordination was better in comparison to other storms, fewer mortalities occurred. In contrast, the responses to Maria showed that work is still needed on this front because Maria resulted in increased mortality and inadequate delivery of care. Methods that can be used to improve coordination involve hiring logistics teams, as seen by some clinics in California, as well as ensuring that the local and Federal public health officials have ways to contact potentially affected healthcare clinics. Interregional healthcare alliances should be strengthened, and preparedness plans should be implemented with all potential stakeholders involved in the process. Multiple forms of communication should be implemented as everything from analog phone use, to direct messaging on social media platforms ensure that everyone is on the same page.

**An Effective Government Response is Critical**

It is imperative that state, but also the Federal Government, use resources as effectively as possible. The Federal Government usually has more resources in its purview, and thus can
contribute the most to ensuring that a public health infrastructure in a region is able to recover. This has to come from every portion of the Federal Government; departments such as FEMA, CDC, FDA, and EPA, along with a host of others need to ensure that they are able to respond as efficiently as possible. This can be accomplished in a multitude of ways.

First things first, the government should be expedient in declaring a state of emergency when needed. On that line of logic, it is prudent that the government works in a unified fashion in order to pass legislation that grants direct aid to a region. The aid needs to also be consistent with the size and potential effect of the extreme weather event; attempting to underfund a relief response will only prove to be costly in the long run. Government bureaus should have plans in place to respond to extreme weather events, so that all responses are efficient and effective—it is better to be proactive rather than reactive. Dr. Quinn from NIH pointed this out in 2006 after Katrina, exclaiming how key it is that the government remain proactive, especially with liaising with disenfranchised community. State governments should be proactive as well, being able to liaise effectively and quickly with both local partners and Federal officials. If all of these recommendations are heeded, then future recoveries should be more comprehensive and effective.

**Implementing New and Better Technologies and Policies**

This final set of recommendations involve a multitude of good technologies and policies that can be adopted at any level of the public health infrastructure in order to ensure that resiliency is built up, and responses to disasters are improved. One recommendation is that health leaders look into the burgeoning field of telehealth and employ it if possible. Being able to dispense health while the patient is in the comfort of their home can be especially useful in times where transportation is difficult to obtain. It is also recommended that governmental officials look into making electrical grids that function more like microgrids. Having grids that can detach when need be in order to serve as “islands” can be especially useful after an extreme weather event knocks out certain portions of a centralized electrical grid, which the NIH discussed as a useful consideration after Sandy occurred (Toner et al. 2017).
On the policy front, there are some recommendations that were found to be extremely salient. After Hurricane Harvey, a couple of Harvard Business Review strategies were suggested that involved having policy to aid the poor and disenfranchised before and after the storm. Describing it as mitigation, they posit that policies such as on-the-job obesity training, expansion of the Early Childhood Tax Credit, as well as moving people near public transportation, saved Houston a plethora of money for the recovery, and increased the resiliency of the community (Galea, 2017). Finally, after Katrina, the NIH (2007) detailed how difficult it was for hospitals to treat uninsured patients, thus they recommended the expansion of healthcare, especially Medicaid, to increase the rate of insured people.

The final, and perhaps most important, recommendation is that leaders and officials and public health infrastructure should be willing to research and try new ways to promote health resiliency within their jurisdiction. Openness to adopting new technologies should always be looked into by members of a public health infrastructure, as healthcare is a dynamic field where new breakthroughs can revolutionize the field in what seems like an instant. Being able to quickly adapt demonstrates: good leadership, a willingness to adapt and creatively think of long-term solutions, as well as adept research skills as one must undertake the time-consuming process of locating and vetting new policies for effectiveness. Learning from other jurisdictions is of course a good way to do so. There are many ways to build healthcare resiliency, and if each jurisdiction researcher finds separate ways to do so, and shares what is the most effective, then disaster recovery can occur effectively, resiliency will be built, and the entire community will live in a healthier, better place.

**Conclusion**

This paper defined the public health infrastructure and described the importance of understanding all its nuances and intricacies. Second, this paper defined and discussed interjurisdictional learning, and how important it is for that to be demonstrated. This paper then analyzed the responses to Hurricanes Katrina, Sandy, Harvey, Irma, and Maria, as well as
California’s response to the wildfires. This paper discussed why the responses to the wildfires, Sandy, Harvey and, to a lesser extent, Irma were effective and how learning was evident, while explaining how the Maria and Katrina responses failed to be effective or demonstrate learning. Finally, this paper gave suggestions on what can be learned by public health sector officials in order to build up resiliency in as many ways and places as possible. Thus, this paper serves as an explanation of what should be done, and what should not be done, to build healthcare resiliency.

One last thought that should underscore the importance of having a public health system that is resilient also serves as a contextualization for this entire paper. This paper was written in the midst of the Covid-19 pandemic of 2020, which showed how entire medical systems in the developed and developing world alike were at the mercy of the enigmatic and lethal Sars-Cov-2 virus. Countless fatalities and infections could have been avoided if federal governments and policymakers saw the importance of funding public health infrastructures, particularly if they provided adequate resources to many of the public health officials on the frontlines. The lessons from this paper can be applied to more than just extreme weather situations—in fact, it would be ideal if they were recontextualized for other situations. If health officials are able to read these suggestions, they should hopefully employ the strategies that can be expediently implemented as building health-sector resiliency brings benefits to the global community. If we are able to become resilient, we will be able to survive the new status quo, the new world that we have created.

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