

The Medical, Public Health, and Emergency Response to the Impact of 2017 Hurricane Irma in Cuba

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ABSTRACT

In 2017, Cuba was pummeled by Hurricane Irma, one of the strongest and most devastating Atlantic basin hurricanes in history. Twelve of Cuba's 15 provinces and 90 percent of the population were affected, and there was island-wide loss of electrical power. Despite the significant damage, ongoing economic hardships, and the political realities that required Cuba to handle the situation without response support from other nations, Cuba's recovery was swift and effective. Cuba's disaster self-sufficiency and timely response to Hurricane Irma was grounded on 5 decades of disaster planning coupled with ongoing evolution of disaster risk reduction and management strategies. While the central command center, with local dispatch response teams, and mandated citizen engagement are features unique to Cuba's political structure, in this study, we highlight 5 defining attributes of Cuba's hurricane response that can constructively inform the actions of other island and coastal nations vulnerable to Atlantic tropical cyclones. These attributes are: (1) actively learning and incorporating lessons from past disaster events, (2) integrating healthcare and public health professionals on the frontlines of disaster response, (3) proactively engaging the public in disaster preparedness, (4) incorporating technology into disaster risk reduction, and (5) infusing science into risk planning. In terms of hurricane response, as a geopolitically isolated nation, Cuba has experienced particular urgency when it comes to protecting the population and creating resilient infrastructure that can be rapidly reactivated after the onslaught of storms of ever-increasing intensity. This includes planning for worsening future disaster scenarios based on a clear-eyed appreciation of the realities of climate change.

Key Words: Hurricane Irma, disaster response, Cuba, public health, citizen engagement

The 2017 Atlantic basin hurricane season was disproportionately destructive, deadly, and destabilizing for residents of the Caribbean region's 29 small island developing states (SIDS).¹ Indeed, during September 2017, Hurricane Irma tracked closely along Cuba's northern coastline, causing widespread damage to the built environment and affecting one-fifth of the Cuban population. Effects on critical infrastructure were more widespread and electrical power was initially disrupted nationwide. Hurricane Irma challenged Cuba's emergency management capabilities. Cuba's strategy involves the integration of disaster medicine and public health assets into the frontline response. Physicians and allied healthcare personnel are central to the operation.

HURRICANE IRMA IMPACTING CUBA

September 2017 was the Atlantic hurricane basin's most energetic month on record and a major contributor was Hurricane Irma, the Atlantic basin's strongest tropical cyclone in the satellite era.^{1,2} Hurricane Irma was producing Category 4 and 5 wind speeds as it moved in a long-duration arc,

hugging Cuba's northern coast during September 8–10, 2017. Having made 3 landfalls in the Northern Leeward Islands and a fourth in the Bahamas, Irma made its fifth landfall in Cuba at Category 5 wind speeds near Cayo Romano, Cuba, late in the day on September 8 (Figure 1).³

As it traversed Cuba, Irma generated an assortment of tropical cyclone hazards. These included Category 4/5 hurricane winds, low central pressure dipping to 933 mb, wave heights of 5–6 m near Cayo Coco, unprecedented storm surge in coastal locales close to Havana, and deluging rains, including a maximum observed rainfall of 23.90 inches measured in Topes De Collantes.³

Twelve of Cuba's 15 provinces were affected by Irma's wind and water hazards.^{4,5} The hardest-hit were Ciego de Ávila and Villa Clara. Tourist areas along the northern coast received catastrophic impacts, particularly the "Cuban Keys" of Cayo Coco, Cayo Guillermo, and Cayo Santa Maria, and the town of Caibarién.

FIGURE 1.

Category 5 Hurricane Irma Approaching Cuba, 8 September 2018.



Electrical power was initially disrupted for most of the nation's 11.5 million citizens, while 3.1 million lost access to clean water.^{5,6} One-fifth (19.5%) of Cuba's residents (2,150,000 citizens) were directly affected, with almost 800,000 severely exposed to Irma's winds.⁵

PUBLIC HEALTH CONSEQUENCES

Mortality

Cuba has regularly weathered strong Atlantic storms, and impact-phase mortality is generally low. This was once again the case during Hurricane Irma; 10 deaths were attributed to the impact phase effects of Irma.⁴ Most were related to various types of structural deficiencies or failure to evacuate. In the Havana province, 2 men died in the rubble of their collapsed home. Two women passengers were killed when a balcony toppled onto the bus in which they were riding. Storm surge was blamed for the drowning death of an elderly woman outside her home in Havana's Vedado district. Additional deaths occurred inside storm-damaged homes in 3 geographically dispersed provinces.

Information is not available regarding poststorm mortality in Cuba. Based on the experience in Puerto Rico following Hurricane Maria where the official death toll has been recalibrated to 2975,⁷ we have recommended the importance of conducting surveillance of postimpact hurricane mortality.⁸ Nevertheless, we have no reason to believe that the Irma mortality figures in Cuba (low numbers of impact phase deaths) are any less accurate than the Irma death tolls elsewhere in the Caribbean or in the United States. As will be

discussed in detail, the fact that power was rapidly restored and healthcare systems remained functional in Cuba suggests that storm-associated postimpact deaths remained low. However, we argue that this assumption needs to be backstopped by systematic poststorm surveillance in the future.⁸

Morbidity

According to the 3-month postdisaster report from the United Nations, the Cuban Ministry of Public Health conducted ongoing epidemiologic disease surveillance throughout the storm-affected provinces. No infectious disease outbreaks occurred in the hurricane shelters.⁶ Three months postimpact, there were no reports of outbreaks of gastrointestinal diseases or water- or vector-borne diseases.⁵

CUBAN EMERGENCY RESPONSE TO HURRICANE IRMA

Coastal evacuation is a proven emergency management strategy for safely moving citizens away from an approaching tropical cyclone. Citizens who evacuate are spared from direct and potentially traumatizing exposures to storm winds and surge. Evacuation is used routinely for mainland populations, and during Irma, governors of several US states issued mandatory evacuation orders. Indeed, as Irma was striking Cuba, hundreds of thousands of Floridians were already packing and moving northward away from Irma's projected south-to-north trajectory through the state.

In the case of Cuba, as an island nation, large-scale off-island evacuation was not an option to safeguard the population.

The identical situation prevailed across many other island-based populations throughout the Caribbean that were affected by 1 or more of the 2017 storms.¹ Even for a small subset of Cuban citizens with identified medical needs who might have been able to secure priority seating on a limited number of outbound flights before the arrival of Irma, decades-old political sanctions precluded just-in-time travel to the United States, the nearest mainland destination.

Absent the option to evacuate, Cuba was nevertheless well experienced with safely sheltering the population. During Hurricane Irma, more than 1.7 million people, representing one-sixth of the nation's population, were moved into 1441 evacuation centers distributed across 13 provinces.⁹ "Evacuation center" is Cuba's term for a structurally fortified citizen shelter. Schools and civic facilities are often selected for this purpose. Other citizens were moved inland, away from dangerous coastal areas, to bivouac with family members in soundly constructed homes.

HEALTHCARE SYSTEM PREPAREDNESS AND RESPONSE

The Cuban Civil Defense System is a nationwide state-operated system that protects the population and the national economy against natural disasters, environmental emergencies, and potential terrorist threats. As Hurricane Irma was approaching, Cuban civil defense placed health centers throughout Cuba on alert. A total of 9344 hospital beds were cleared throughout the country to create a buffer of available beds to absorb a potential surge of patients.⁹ In the Province of Havana, patients from the maternal hospital, América Arias, were relocated to other facilities due to the high likelihood of coastal inundation.⁶ More than 1000 high-risk elderly residents were preemptively evacuated from 22 vulnerable nursing homes.⁹

In Cuba, physicians and allied healthcare personnel have an active role throughout the phases of disaster preparedness and response. During Irma, 7366 healthcare professionals were deployed to support citizens' health needs throughout the nationwide network of activated evacuation centers.⁹ These healthcare professionals were in place before Irma arrived, and they served during the storm and after impact. Within this total, more than 1400 healthcare personnel served in 100 shelters in the nation's capital city of Havana and the surrounding province.⁹

Seventy-eight specialized medical-surgical "brigades" (the Cuban term for various types of emergency response teams) were placed on active duty.⁹ Many of these brigades were preemptively dispatched and staged to augment the staffing in remote rural hospitals and clinics. Some of these healthcare facilities were situated in mountainous regions that were likely to become geographically isolated due to flooding or mudslides, or to lose their communications capabilities following

the passage of Irma. Additional medical personnel were assigned to staff a fleet of emergency transport vehicles, ranging from jeeps and buses to helicopters.

Throughout Cuba, access to healthcare is simplified by placing "polyclinics," the equivalent of neighborhood-based walk-in medical centers, in each community. Among Cuban citizens in urban settings, the nearest polyclinic is usually no more than a few blocks away. Hospitals and polyclinics are equipped with emergency generators, allowing a high proportion of these facilities to remain open and operational during a hurricane. Sporadic generator failures did occur during Irma, prompting relocation of patients to nearby hospitals and care settings.

This grid-like geographic distribution of clinics and healthcare facilities, coupled with medical staff deployed throughout the national network of civilian shelters, maintained the continuity of health sector operations. Basic medical services and life-saving care were available for most Cuban citizens before, during, and after Irma. Uninterrupted access to healthcare services occurred across settings of care, including hurricane shelters, community polyclinics, and local hospitals. Although widespread power outages were experienced during the immediate impact phase of Hurricane Irma, some affected shelters and clinics were able to switch to generator power to provide healthcare services with minimal disruption.

Cuba's healthcare system was generally able to address the disaster health needs of Cuba's citizenry. Moreover, Cuba also deployed contingents of medical personnel to assist storm-affected populations throughout the Caribbean. During the 2017 storms, Cuba dispatched medical brigades, numbering more than 750 physicians, to support the medical response in Antigua and Barbuda, Saint Kitts and Nevis, Saint Lucia, Bahamas, Dominica, and Haiti.¹⁰ The Vice Minister of Foreign Relations offered to send a field hospital, staffed by Cuban physicians, to provide care for the people of Puerto Rico following the devastation of Hurricane María.¹¹

POSTIMPACT RESTORATION OF INFRASTRUCTURE Healthcare System

According to Oakland California-based MEDICC, 70% of hospitals and polyclinics suffered damages in the 7 provinces that sustained the most direct impact.⁶ Healthcare assets affected by Irma included 71 hospitals and 122 community polyclinics,⁵ along with 1958 neighborhood doctor's offices (usually staffed with a family physician and nurse), and 139 care facilities including senior residences and maternity homes.⁶

During Irma, a primary challenge was back-up generator failure in 3 major hospitals. In Havana's Hospital Universitario General Calixto García, 1 of the main generators failed, requiring replacement of key components. Generator failures occurred in hospitals in Cienfuegos and Matanzas; in fact,

in Matanzas, the generator ignited and caught fire. Going forward, Cuba will use a different procedure to conduct a weekly stress-test on generators where they are directly connected to the electrical systems they are expected to support in times of emergency.

Electrical Power

In the early 2000s, Cuba recognized the extreme fragility of the nationwide electrical system. Not only were blackouts occurring at high frequency, but the unreliable power system posed a threat to national security. Beginning in 2005, Cuba overhauled and decentralized its electrical power generation and distribution infrastructure. Cuba also created a system for mobilizing personnel to rapidly restore power following disaster-related electrical outages.¹²

When Irma battered the northern coastal areas of Cuba in 2017, electrical service was initially disrupted for a high proportion of the 11.5 million citizens throughout the entire nation. In addition to damaging 2 high voltage towers, the storm toppled 3616 poles and 2176 kilometers of electrical power lines, and affected 1379 transformers and 1003 kilometers of electrical grid connections.¹³

Yet, despite the severity of Irma's initial impact on the electrical grid, and the serious damage inflicted on the cooling system of the Antonio Guiteras de Matanzas thermoelectric center, one of Cuba's major electrical sources, the national power supply was offline for a relatively brief period.¹⁴

The reconfigured micro-grid electrical system expedited the rapid restoration of power. Electrical power was back on in the capital of Havana within 72 h. Over 87% of the electrical grid was restored within 9 days.⁶ Within 3 weeks (20 days), more than 99% of the population had basic electrical service operating in their homes.^{13,15}

Engineering design and skilled human resources contributed to Cuba's ability to restore electrical service rapidly. First, the newly installed and noncentralized network of generator sub-stations are distributed throughout the country, allowing regional production of electrical power using a micro-grid approach.^{12,16} Sectors of the national grid that were damaged by Irma were temporarily shut down for repairs while still-operational segments of the grid maintained the flow of electrical current.

Second, Cuba's revamped power-generating technology was augmented by highly trained electrical grid technicians. Cuba implemented a system of "mixed brigades" composed of electrical network specialists, who are dispatched to repair storm-damaged portions of the grid, working alongside local, less-specialized electrical services personnel, including linespersons.¹⁷

Not only did this approach quickly restore power throughout Cuba, but skilled Cuban power technician teams were sent to assist Dominica and Antigua and Barbuda with their crippling power outages. Cuba also offered to send 4 electrical brigades to Puerto Rico after Hurricane Maria.¹¹

The closest parallel in terms of the speed of power restoration following Irma's impact was the state of Florida, Irma's next target after moving across Cuba. Statewide, 15 million Florida citizens initially lost power but most homes had their electrical service operating again within several days to 3 weeks. There were 2 distinctions. First, Florida is not an island and thousands of electrical crews from areas unaffected by Irma were able to caravan into the state as soon as the winds died down. Second, Irma's winds had diminished considerably before moving northward over western Florida compared with the intensities previously experienced along Cuba's north coast.

Schools

Before impact, teachers and school workers were guided by civil brigades to cover and protect computers and learning resources in each school. A total of 2186 schools were affected by Irma, although only 4 sustained catastrophic damage, including 3 in Holguin and 1 in Mayaguez.¹⁸ Schools and academic institutions were rapidly reopened throughout Cuba starting within the first week after Irma's impact along the northern coast.¹⁹ In fact, even in hard-hit Holguin, some schools reopened just a few days after Irma's passage.²⁰

Housing

More than 150,000 homes sustained significant structural damage, including 15,000 that were completely destroyed. Irma damaged 2264 schools (21.2% of schools nationwide), including 500 in Havana.⁵ Almost 95,000 hectares of productive agricultural croplands were flooded and 500 poultry farms were destroyed. The total uninsured losses were estimated at 13 billion USD.^{4,5}

Repair and reconstruction of damaged housing will continue into 2019. To aid homeowners with uninsured losses, the Government of Cuba announced a plan to pay partial costs for housing reconstruction and to provide subsidies of 50% for the purchase of building materials to repair damaged homes and rebuild dwellings that were completely destroyed. The Cuban government also assisted storm survivors to procure bank loans for financing home reconstruction.²¹ Reconstruction on all levels is particularly challenging for Cuba given the 59-year-old US embargo of Cuba. This causes constraints in purchasing power as Cuba must pay cash for all imports. Loan availability on the international level is very difficult while the sale of US products is blocked directly from the United States or potentially from US subsidiaries globally. The US embargo of Cuba has cost Cuba over \$4 billion from 2016 to 2017 alone and is considered a violation of international law.²²

DEFINING FEATURES OF DISASTER PREPAREDNESS AND RESPONSE IN CUBA

Here, we describe 5 distinguishing characteristics that were evident in Cuba's emergency response to 2017 Hurricane Irma: (1) learning and incorporating lessons from past disaster events, (2) integrating healthcare and public health professionals at the forefront of disaster response, (3) actively engaging the public in disaster preparedness, (4) incorporating technology into disaster risk reduction, and (5) infusing science into disaster risk planning. These characteristics are simultaneously applied by Cuba's Civil Defense System, considered to be "the central command," with province-based local dispatch response teams, which are multidisciplinary in nature. It is the expectation and culture of Cuba that the populace plays an active role in recovery postdisaster in Cuba.

Learning and Incorporating Lessons from Past Disaster Events

Cuba has used disaster events, and hurricanes in particular, to refine its disaster risk reduction and management strategies. In addition to the metrics of storm-related mortality and morbidity, for each province, the Cuban government carefully tracks recovery time, itemized disaster recovery costs (eg, gasoline, food, salaries for rescue team personnel), cost savings for preventive action, and material damage estimates cross-classified as preventable or nonpreventable.

Cuba's response to Hurricane Irma was grounded on more than a half century of iterative disaster planning. In 1963, just 1 y after it was established, the civil defense system was challenged to respond to Hurricane Flora. Flora's Category 3 winds and unrelenting flooding rains created Cuba's second-highest-fatality storm.²³ In the aftermath, Cuba constructed a network of dams and flood abatement systems throughout the country to mitigate the deadly effects of hurricane-triggered precipitation and inundation. The system of dams decreased the flood threat and offers protection against periodic droughts.

Several decades later, the hurricanes of the 1980s shaped the formation of the civil defense command and control protocols. Retired Lieutenant General Russel L. Honoré, who gained renown for effectively commanding the US military response to Hurricane Katrina, has stated, "Cuba manages hurricanes well. We could be learning from them."²⁴

Integrating Healthcare and Public Health Professionals at the Forefront of Disaster Response

Cuba's network of community-based polyclinics brings physicians and patients into close proximity. Many of these healthcare centers remain staffed and accessible during disasters. In addition, as occurred during Irma, thousands of physicians are prepositioned in the emergency evacuation centers and remote clinics or are assigned to medical transport vehicles. Cuba not only delivered disaster medical care to the Cuban

people, but also dispatched hundreds of its healthcare professionals to aid other storm-affected Caribbean SIDS.

Actively Engaging the Public in Disaster Preparedness

The Cuban governance structure plays a coordinating role here. Cuban law centralizes decision making during emergencies in the hands of the President, head of civil defense, and minister of the armed forces. The 1976 National Civil Defense Act mandated that every Cuban adult undergo civil defense training. Natural disaster preparedness was added to the national educational curricula, beginning with the primary grades and extending all the way through university and postgraduate education. Any school-age child is able to explain how they prepare and describe their role in emergencies, by disaster phase.

Repeated encounters with strong hurricanes in the 1980s prompted Cuba to involve citizens in nationwide disaster drills. Citizens regularly participate in disaster planning and contribute actively to the response when disaster strikes. Immediately following Irma, crews of cleanup workers in Havana were augmented with more than 10,000 medical students and 2000 university students.

Citizen preparedness focuses on developing a culture of safety with a specific focus on hurricanes.²⁵ Citizens are schooled in the stages of emergency warning, how to secure homes, where to shelter, and procedures to follow. Through this process, the government instills a sense of its political commitment and capacity to protect citizens.

Cuban citizens participate in a range of social organizations, including local mitigation committees. Disaster risk issues are routinely discussed in these social organizations. The mitigation committees develop systematic strategies for using human resources with specific roles for doctors, teachers, engineers, and other professionals. These committees also engage in risk mapping and guide the community's participation in local and national disaster simulation drills.

Citizen training extends to, and prioritizes, family-level preparedness. This entails: keeping a complete inventory of property and possessions, safeguarding important personal documents in a safe deposit box, learning about the local public shelter operations and evacuation routes, keeping a list of emergency numbers, knowing how to turn off water and gas, maintaining adequate insurance coverage, and knowing the warning messages and sources of emergency information.

Incorporating Technology into Disaster Risk Reduction

During the 2000s, the National Defense Council issued a series of directives focusing on disaster planning and preparedness. As described earlier, one of the most ambitious initiatives was Cuba's Energy Revolution of 2005. The nationwide restructuring and decentralization of the electrical power grid was performed in parallel with developing regional emergency

response.^{12,26} To decentralize the national electrical system, almost 2000 micro-generators were installed across 110 municipalities. Thousands of emergency backup generators were distributed nationwide to maintain power for critical infrastructure (eg, schools, hospitals, food plants) in times of emergency. With nationwide emphasis placed on end-user efficiency, old electrical appliances and energy-wasting incandescent bulbs were swapped out and replaced by their energy-efficient equivalents.^{12,27}

A triplet of strong 2008 hurricanes, Gustav, Ike, and Paloma, provided a real-world demonstration of the resilience of Cuba's power grid.¹² Despite extensive structural damage throughout Cuba, the system of distributed power generators and networked mini-grids maintained essential electrical services. Portable diesel generators were used to run islanded micro-grids in areas that were severely damaged. Progress continues into the present as Cuba is shifting toward renewable energy sources. This includes wind and solar farms and micro-hydro systems. Training for Cuba's specialized energy technicians is updated as new energy technologies come onboard.

Cuba's power grid was challenged once again during Irma and restoration of electrical power was quite swift and efficient. The Cuban healthcare system was operational throughout all phases of Irma and most schools and worksites reopened quickly because the power disruption was brief. The public health implications are particularly pronounced when comparing the 2017 experience of Cuba to Puerto Rico and multiple Caribbean SIDS populations that experienced months-long, life-threatening power outages. Cuba's approach to energy self-sufficiency could be replicated by other Caribbean SIDS.

Less successful were efforts to restore clean water to the population. During Irma, the process took months. Improving this aspect of disaster response is a future priority.

Also, on the technology frontier, the Cuban Meteorologic Institute's National Prognostic Center is recognized for its ability to forecast and monitor dangerous weather systems and issue timely warnings to the population. Collaborations have been forged between Cuban atmospheric scientists and their counterparts at the US National Hurricane Center in Miami. The open exchange of meteorological data, storm models, and population preparedness communications between Cuba and the United States benefits both nations.²⁴

Infusing Science Into Disaster Risk Planning

Cuba uses multi-year plans to create the framework for achieving national strategic goals. The Energy Revolution has been a prime example.

Working in tandem with the United Nations Development Programme (UNDP), Cuba and UNDP's Caribbean Risk Management Initiative, the Risk Reduction Management

Center (RRMC) was established in 2005.²⁸ The RRMC is not only a model of risk reduction management that features local level decision making, its programs are informed by scientific evidence. The RRMC combines coordinated early warning systems with geographic information system and mapping technologies and communications systems.²⁸ With a focus on improving community preparedness and resilience, the RRMC conducts community hazard, vulnerability, and risk studies on an ongoing basis.²⁸

In 2011, Cuba set its sights on "The Life Task to Face Climate Change." This national science-based initiative, with strong disaster risk reduction implications, focuses on confronting climate change as a priority for the state, under the direction of the Ministry of Science, Technology, and the Environment.²⁹ The climate connection to the 2017 Atlantic storms was clearly apparent, underscoring the importance and timeliness of Cuba's current planning focus.³⁰

Among the most powerful lessons learned in an era of potentially accelerating climate effects that are rapidly approaching key tipping points is that extreme storms are likely to produce worsening effects on impacted populations. SIDS are disproportionately vulnerable, and damage to infrastructure creates cascading effects on health.^{1,8,30} This is due to incapacitation of the healthcare system and direct effects of subjecting storm survivors to heat, humidity, contaminated water, and insect vectors. Therefore, SIDS need to reconfigure their electrical systems to allow rapid power restoration, plan for continuity of healthcare operations, and develop mental health and psychosocial support capabilities. Cuba's coordinated disaster planning in the context of climate change could be considered pace-setting for Caribbean SIDS and mainland coastal populations alike.

CONCLUDING COMMENTS

The hyperactive 2017 hurricane season was notable climatologically and in terms of the severity of detrimental effects on human populations. Caribbean SIDS were disproportionately vulnerable to the 2017 storms and multiple island-based populations sustained catastrophic strikes.^{1,30} Cuba was no exception. Despite the devastation faced during hurricane Irma, the Cuban response both nationally and internationally was unique and contributed to a swift recovery of essential services.

The healthcare system remained functional throughout all phases of Irma, and Cuba rapidly restored power throughout the island. Despite being on the receiving end of Irma, Cuba actively engaged in supportive response to worse-off Caribbean SIDS.

While Cuba's political system and its centralized control during emergencies is not exportable to any other population that is regularly affected by Atlantic tropical systems, we have identified 5 characteristics of the Cuban response to natural

disasters that may be adaptable for Caribbean SIDS and Atlantic coastal nations. First, Cuba very systematically learns from disaster experience and transforms lessons into future modifications in emergency response. This is not unique to Cuba, but Cuba does this well. Second, Cuba is a standout in terms of prioritizing a role for healthcare professionals in frontline response. Third, Cuba is successful in garnering large-scale citizen participation in disaster preparedness and response; responsibilities are broadly shared across the populace. Fourth, Cuba has recognized and effectively addressed the need to upgrade the national power grid and related technologies to rapidly rebound and regain function following a natural disaster. The resilience of these systems contrasted sharply with the experience of nearby island populations that were staggered and brought to a standstill by prolonged power outages. Fifth, Cuba is dealing straight-up with the reality of climate change and the increasing threats this poses for upcoming storm seasons; as part of this initiative, Cuba is moving quickly to achieve energy independence based on renewal sources. Taken together, these effective and pragmatic dimensions of Cuba's response to Hurricane Irma are worthy of consideration by other nations preparing for upcoming Atlantic seasons.

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