Caribbean Climate and Health Responders Course

Extreme Weather Events: Hurricanes - April 13, 2022
Dr. William Hamilton
Climate Change and Health Leaders Fellow
Disclosure

- No disclosures or conflict of interest
Learning Objectives

• List pre-determined learning objectives:
  1. Describe the ways in which climate change increases the risk of extreme events such as hurricanes.
  2. Identify short-term and long-term health threats to patients impacted by extreme weather events and steps that health professionals can take to reduce these risks.
  3. Define the roles of disaster risk reduction, public health communication, early warning and regional cooperation in the prevention of the health impacts of extreme weather events.
  4. Explain how the health impacts of climate change will vary within and among different communities by applying concepts of vulnerability, resilience and adaptive capacity.
What is a Hurricane?

- A form of tropical cyclone
- Winds Speeds >74mph

- Parts of a Hurricane:
  - The Eye
  - Eye Wall
  - Rain Bands
Saffir-Simpson Hurricane Wind Scale

Types of damage due to Hurricane winds

Source: US National Hurricane Center

1. **Category 1**
   - Winds of 119 to 153 kilometers per hour
   - Dangerous: Damage to poorly constructed homes; large tree branches will snap and shallowly rooted trees may be toppled.

2. **Category 2**
   - Winds of 154-177 kph
   - Extremely dangerous: Damage for roofs, windows, walls; shallow-rooted trees blown down; severe power outages

3. **Category 3**
   - Winds of 178-208 kph
   - Devastating: Damage to building structures; many trees uprooted; flooding near coastal areas; power and water shortages.

4. **Category 4**
   - Winds of 209-251 kph
   - Catastrophic: Roofs and walls collapse; most trees and power lines destroyed; flooding; areas up to 10 kilometers from coast evacuated.

5. **Category 5**
   - Winds of 252 kph or higher
   - Utterly catastrophic: Buildings destroyed; roofs torn off; floods; areas up to 16 km from coast evacuated.

Graphic by Nam Kyung-don
don@heraldcorp.com
Recent Extreme Weather Events in The Bahamas

**HIGHEST PRIORITY CLIMATE-SENSITIVE HEALTH RISKS FOR THE BAHAMAS**

<table>
<thead>
<tr>
<th>Direct effects</th>
<th>2015 Hurricane Joaquin Category 4</th>
<th>2016 Hurricane Matthew Category 4</th>
<th>2017 Hurricane Irma Category 5</th>
<th>2018</th>
<th>2019 Hurricane Dorian Category 5</th>
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</thead>
<tbody>
<tr>
<td>Health impacts of extreme weather events</td>
<td></td>
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<td>Heat-related illness</td>
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<td>Indirect effects</td>
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<td>Water security and safety (including waterborne diseases)</td>
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<td>Vector-borne diseases</td>
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<td>Air pollution</td>
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<td>Allergies</td>
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<td>Diffuse effects</td>
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<td>Mental/psychosocial health</td>
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<td>Noncommunicable diseases</td>
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<td>Mitigation actions to reduce emissions through sustainable procurement</td>
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<td>Mitigation measures to reduce emissions of health facilities</td>
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<td>Mitigation measures by coordinating with other sectors</td>
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**2015**
- Severe flooding (including a 4.6 metre storm surge), contamination of freshwater wells, and destruction of roads and infrastructure.
- Total cost for The Bahamas estimated at over US$ 120 million (14).

**2016**
- Many households had not yet recovered from Hurricane Joaquin.
- Damage to the electricity system took months to repair.
- Total cost for The Bahamas is estimated at a minimum of US$ 600 million (14).

**2017**
- First mandatory evacuation in Bahamian history (5000 people were transported to the capital).
- Ragged Island was hardest hit and is uninhabitable.
- Total cost for Ragged Island alone is estimated at US$ 7.8 million (14).

**2018**
- Devastated the island of Abaco, its surrounding cays, and Grand Bahama.
- Houses, schools and business were flattened in and around Marsh Harbour in particular.
- Unprecedented flooding, with roads and bridges unpassable and/or collapsed (15).
- Electrical power losses meant some health services were unable to fully operate.
- Mental health impacts were widely reported, including post traumatic stress disorder (PTSD), sleep disorders, depression, and grief and traumatic bereavement (16).
- At least 70 people died.
- Total cost for The Bahamas is estimated at US$ 3.4 billion (equivalent of one quarter of national GDP) (15).

Source: Adapted and updated from the PAHO Health and Climate Country Survey 2017 (b)
Zoom Poll Question 1
Which changes to Hurricane profiles are due to Climate Change?
A. Stronger
B. Wetter
C. Slower Moving
D. A and B Only
E. All of the Above
Does Climate Change alter Hurricanes?

Hurricanes are becoming:

- STRONGER
- INTENSIFYING FASTER
- WETTER
- SLOWER-MOVING (forward speed)
Stronger

**Hurricane Weakens**
- Warm seawater
- Cooler surface
- Cooler deep water mixing

**Hurricane Strengthens**
- Warmer surface
- Warmer deep water mixing

**Average Global Sea Surface Temperature, 1880–2020**


Wetter

- For every degree of warming, the atmosphere can hold 7% more water vapor that could fall as rain.
Intensity and Speed

- Most dangerous storms:
  - Catch forecasters and populations off guard
  - Risking inadequate evacuation efforts
  - Large casualties

- Odds of a hurricane intensifying by 70 mph or more in the 24 hours just before landfall were about once every 100 years in the climate of the late 20th century.

- In the climate of the year 2100, these odds increased to once every 5 – 10 years.
Impacts of Climate Change on Health

Physical Injuries

Unintentional Injuries

**Treating Dorian survivors**

Medical presentations:

- Deep lacerations
- Abrasions
- Head trauma
- Antenatal Emergencies
- Fractures
- Amputations
- Gunshot wounds
- Eye Injuries
- Skin infections
- Dialysis/Chemo Rx
- Uncontrolled Chronic Diseases
Psychological consequences are:

• Widespread
• Pervasive

In a disaster, the size of the psychological footprint greatly exceeds the size of the medical footprint.

In a disaster, psychosocial consequences extend along a spectrum of severity.

Severity relates to the degree and intensity of exposure.

In a disaster, psychosocial consequences expand across a prolonged range of duration.
Solutions to Support Mental Health Well Being

- Conduct Outreach, Surveillance, and Screening
- Use task sharing to expand capacity
- Mental Health and Psychosocial Support

Case Study
Shortly after Hurricane Dorian passed, staff from the Sandilands Rehabilitation Centre, Public Hospitals Authority, the Bahamas Psychological Association, and a number of NGOs and INGOs were dispatched to the islands and different tent shelters to provide MHPSS. More than 3000 children and 3000 adults received MHPSS either face to face and/or by the telepsychology method. Helplines were also established immediately after the hurricane and more than 500 calls were received, between March 2020 and September 2020, from five islands and also Bahamians in universities outside the country.
Climate Change Impacts on Mental Health and Adaptation Responses

IPCC AR6 Working Group II report, 'Climate Change 2020: Impacts, Adaptation, and Vulnerability.'
Chronic Diseases

- Dialysis Patients
- Patients dependent on medical devices that require electricity (e.g., oxygen concentrators, ventilators, and home dialysis systems).
- Patients who are receiving hospice care.
- Patients whose conditions must be continually managed by prescription medications (e.g. seizure disorders, diabetes).
- Patients with mental health diagnoses and/or alcohol or drug dependency.

Recommendations:
- Evacuations
- Consideration for Peritoneal Dialysis
- 3 Day Diet Emergency Kits
- Diabetic Disaster Preparedness Plan
- Month supply of Medication(s)
Disaster Risk Reduction

- Disaster risk reduction is aimed at preventing new and reducing existing disaster risk and managing residual risk, all of which contribute to strengthening resilience and therefore to the achievement of sustainable development.
The Hospital Safety Index:

- Tool developed by the Pan American Health Organization and a group of Caribbean and Latin American experts to gauge the overall level of safety of a hospital or health facility in emergency situations.
- The Hospital Safety Index helps health facilities to assess their safety and avoid becoming a casualty of disasters.
- The final Safety Index score places a health facility into one of three categories of safety:
  - Category A - facilities deemed able to protect the life of their occupants and likely to continue functioning in disaster situations.
  - Category B - facilities that can resist a disaster but in which equipment and critical services are at risk.
  - Category C - a health facility where the lives and safety of occupants are deemed at risk during disasters.

PAHO
Guiding Principles:
- Risk-Based Approach
- Comprehensive Management
- All Hazards Approach
- Inclusive, people- and community-centered approach
- Multisectoral and Multidisciplinary collaboration
- Whole-of-health system based
Zoom Poll Question 2
Zoom Poll

- When would be the best time to communicate a hurricane message?
  A. Pre-season
  B. Pre impact
  C. Impact
  D. Post impact
Public health communication is the development, dissemination, and evaluation of relevant, accurate, accessible, and understandable information shared with and received from intended audiences to protect and advance the health of the public.
Hurricane Communications

Preparation

Prevent Illness

Returning Home

VectorBorne Diseases

Immunizations

Vulnerable Populations
Preparation

- Make a Plan
- Prepare an Emergency Food Supply
- Prepare an Emergency Water Supply
- Safety and Personal Care Products
- Prepare Your Family for the Storm
- Get Your Home Ready for the Storm
- Prepare Your Car for the Storm
- Evacuate or Stay at Home
Prevent Illness

- Flood Water Safety
- Stay Safe in Extreme Heat
- Protect Yourself From Air Pollution
- Odor
- Personal Hygiene and Handwashing
- Diarrheal Diseases
- Tetanus
- Wound Infections
- Food and Water Safety After A Storm
- Food Water
- Medications
- Stay Safe in a Shelter or in Crowded Living Conditions
Vector Borne Illness

- Prevent Mosquito Bites
- West Nile
- Dengue
- Zika

South Carolina Emergency Management Division
Early Warning Systems have been broadly defined by The United Nation International Strategy for Disaster Reduction (UNISDR, 2009) as “the provision of timely and effective information, through identified institutions, that allows individuals exposed to a hazard to take action to avoid or reduce their risk and prepare for effective response.”
Early Warning Systems

- 66M known hypertensive and chronic smoker sought medical care at the hospital due to severe chest pain lasting for 24 hours. Without any prior symptom, he started to have severe chest pain described as “weight on the chest” and sought emergency medical care after about 24 hours, due to pain persistence.
- Vitals: Blood Pressure 110/70 mmHg Heart Rate 90bpm Respiratory Rate 18bpm Temp 98.6F O2 sat 99% on room air.
- Examination: Within Normal Limit except CVS finding - systolic murmur in the lower left sternal border and mitral area.
- Investigations: CXR – Normal; ECGx2 – ST elevations II,III,AVF
Case Study: Hurricane Katrina – What went wrong?

- Prior Risk Knowledge
- Technical Monitoring and Warning
- Dissemination of Warnings
- Response Capacity
Zoom Poll Question 3
In your respective countries which element of the Early Warning System needs more attention?
A. Risk Knowledge
B. Monitoring and Warning Service
C. Dissemination and Communication
D. Response Capability
Regional Cooperation

- Caribbean Agriculture Research and Development Institute (CARDI)
- Caribbean Community Climate Change Centre (CCCCC)
- Caribbean Environment Health Institute (CEHI)
- Caribbean Disaster Emergency Management Agency (CDEMA)
- Caribbean Meteorological Organization (CMO)
- Caribbean Institute for Metrology and Hydrology (CIMH)
- Caribbean Telecommunications Union (CTU)
- Caribbean Development Bank (CDB)
- Organization of Eastern Caribbean States (OECS)
Regional Cooperation

Climate services for health are an emerging field of applied science, defined as “the entire iterative process of joint collaboration between relevant multidisciplinary partners to identify, generate and build capacity to access, develop, deliver, and use relevant and reliable climate knowledge to enhance health decisions” (WMO/WHO, 2016).

Figure 1. Consortium of Sectoral EWISACTs Coordination Partners – a group of six regional sector agencies and a regional climate service provider (CIMH) – committed to the co-design, co-development and co-delivery of user-specific and actionable climate information products.
Vulnerable Populations

- Outdoor Workers
- Pregnant Women
- Immigrants
- Persons with:
  - Chronic Diseases
  - Disabilities
Potential effects of global climate change on child health.
Adapted from American Academy of Pediatrics policy statement “Global Climate Change and Children’s Health” (2007).
Older Adults

- Consequences of Environmental and Social factors:
  - Drowning
  - Trapped in the house
  - Injuries
  - Infections
More than two-thirds of studies find women face greater health risks from climate change.

Bar chart displaying the findings of 130 studies on climate change and health. 89% of studies found women were more affected than men, 20% found men were more affected than women and 11% found no difference in how men and women were affected. Rounding errors mean the proportions may not add up to exactly 100%. Data source: Global Gender and Climate Alliance (2016). Additional analysis by Carbon Brief.

Nearly two-thirds of studies find women are more likely to suffer death or injury from extreme weather.

Pie chart displaying the findings of 33 studies examining the rate of death and injury from extreme weather events. 32% found women were more likely to suffer death or injury from extreme weather than men, 12% concluded that men were more likely than women and 4% found no gender difference. Rounding errors mean the proportions may not add up to exactly 100%. Data source: Global Gender and Climate Alliance (2016). Additional analysis by Carbon Brief.

Women are more likely to be affected by most climate impacts on health.

Bar chart showing the proportion of men and women affected by climate change impacts, including: death and injury from extreme weather; food insecurity; infectious disease; mental illness; and poor reproductive and maternal health. Data source: Global Gender and Climate Alliance (2016). Additional analysis by Carbon Brief.
Pregnancy

### Table 4. Potential impact of climate change on occupational sectors by exposure source.

<table>
<thead>
<tr>
<th>Contaminant Type</th>
<th>Occupation at Risk</th>
<th>Exposure Route</th>
<th>Health Effect</th>
<th>Reason for Likely Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pesticides</td>
<td>Agriculture, landscape</td>
<td>Dermal, inhalation, ingestion</td>
<td>Numerous: carcinogenic, Asthma, COPD, cardiopulmonary etc.</td>
<td>Increase in plant disease</td>
</tr>
<tr>
<td>Veterinary medicines</td>
<td>Veterinary, agriculture</td>
<td>Dermal, ingestion</td>
<td>Antimicrobial resistance</td>
<td>Increased temperature</td>
</tr>
<tr>
<td>Ozone</td>
<td>Construction, transportation, energy, agriculture, traffic warden, oil and gas etc.</td>
<td>Inhalation</td>
<td>Asthma, COPD, cardiopulmonary</td>
<td>Increased temperature</td>
</tr>
<tr>
<td>PAHs</td>
<td>Construction, transportation, energy, agriculture, traffic warden, oil and gas, firefighting etc.</td>
<td>Inhalation</td>
<td>Cardiopulmonary, carcinogenic</td>
<td>Increased dust, forest fires</td>
</tr>
<tr>
<td>Pathogenic microorganisms</td>
<td>Fishing, agriculture, sanitation, most outdoor work</td>
<td>Dermal, Inhalation, ingestion</td>
<td>Infectious disease</td>
<td>Increased flooding, soil and water contamination</td>
</tr>
<tr>
<td>Vector-borne infectious agents</td>
<td>Food-animal production, most outdoor work</td>
<td>Dermal</td>
<td>Infectious disease</td>
<td>Increased range of vectors</td>
</tr>
<tr>
<td>Soil dust</td>
<td>Agriculture, construction, most outdoor work</td>
<td>Inhalation, ingestion</td>
<td>Silicosis, cardiopulmonary</td>
<td>Drier conditions</td>
</tr>
<tr>
<td>Industrial processing chemicals</td>
<td>Chemical manufacture, emergency response operations</td>
<td>Dermal, Inhalation, ingestion</td>
<td>Numerous: Carcinogenic, Asthma, COPD, cardiopulmonary etc.</td>
<td>Flood, wildfires</td>
</tr>
<tr>
<td>Wildfire smoke</td>
<td>Firefighting, agriculture</td>
<td>Inhalation</td>
<td>Respiratory</td>
<td>Drier conditions</td>
</tr>
<tr>
<td>Exposure to extreme condition (temperature and humidity)</td>
<td>Firefighting, oil and gas workers, and all outdoor workers exposed to direct sun</td>
<td>Dermal, Inhalation, ingestion</td>
<td>Heat exhaustion, heat stroke, chronic kidney disease, chemical poisoning, injury</td>
<td>Fatigue condition</td>
</tr>
<tr>
<td>Other indirect climate-related hazards</td>
<td>Low-income groups with limited health protection; workers with existing non-climate health problems affected by heat</td>
<td>Dermal, Inhalation, Ingestion, other</td>
<td>Infectious diseases, non-communicable diseases, mental health issues, etc.</td>
<td>Others</td>
</tr>
</tbody>
</table>

Adapted and modified from Applebaum et al. [20] and Kellstrom et al. [36]
Spencer Kimball said “Preparedness, when properly pursued, is a way of life, not a sudden, spectacular program”

- Climate change is not a distant threat. It’s a growing reality. The harsh reality is that we in the Caribbean are not exempt from Climate Change.

- Extreme weather events such as hurricane profiles have changed.

- We must continue to create a regional body of literature - because it is our own local data which will drive decision making.

    Remember when disaster strikes the time to prepare has passed!
CODE GREEN

“DISASTER PREPAREDNESS IN AN ERA OF CLIMATE CHANGE” CONFERENCE

25TH & 26TH APRIL 2022

5:00PM - 8:30PM

4 CME CREDITS

SAVE THE DATE

PLEASE DIRECT ANY QUESTIONS TO CODEGREENCONFERENCE@GMAIL.COM
References