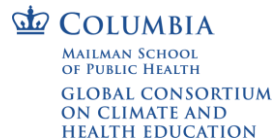


# Caribbean Climate and Health Responders Course

**Extreme Weather Events: Hurricanes - April 13, 2022**

Dr. William Hamilton

Climate Change and Health Leaders Fellow



# Disclosure

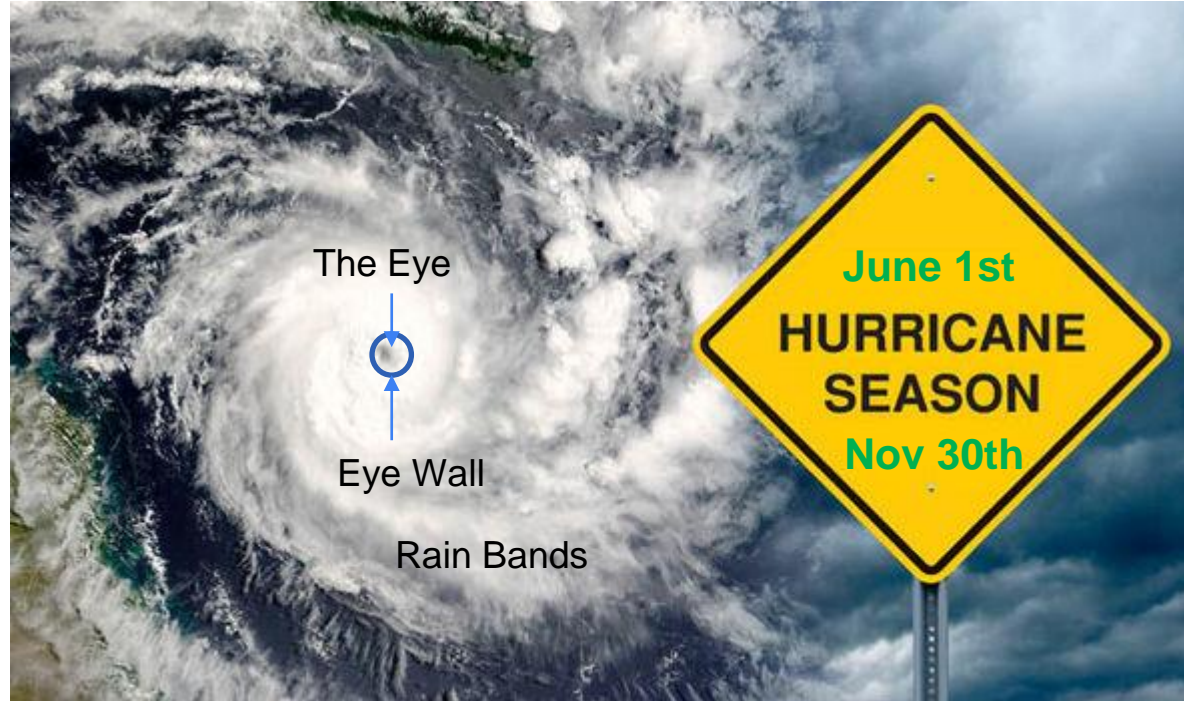
- No disclosures or conflict of interest

# 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

(154-177 kph)

Extremely dangerous: Damage for roofs, windows, walls; shallow-rooted trees blown down; severe power outages

3

## Category 3

(178-208 kph)

Devastating: Damage to building structures; many trees uprooted; flooding near coastal areas; power and water shortages.

4

## Category 4

(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

(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

Direct effects	
Health impacts of extreme weather events	✓
Heat-related illness	
Indirect effects	
Water security and safety (including waterborne diseases)	
Food security and safety (including malnutrition and foodborne diseases)	✓
Vector-borne diseases	✓
Air pollution	✓
Allergies	
Diffuse effects	
Mental/psychosocial health	✓
Noncommunicable diseases	✓
Mitigation actions to reduce emissions through sustainable procurement	
Mitigation measures to reduce emissions of health facilities	✓
Mitigation measures by coordinating with other sectors	

Source: Adapted and updated from the PAHO Health and Climate Country Survey 2017 (5).



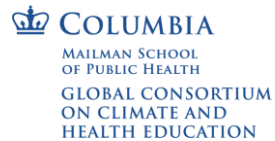
- Severe flooding (including a 4.6 metre storm surge), contamination of freshwater wells, and destruction of roads and infrastructure.
- Total cost for The Bahamas is estimated at over US\$ 120 million (14).

- 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).

- 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).

- 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).

# Zoom Poll Question 1



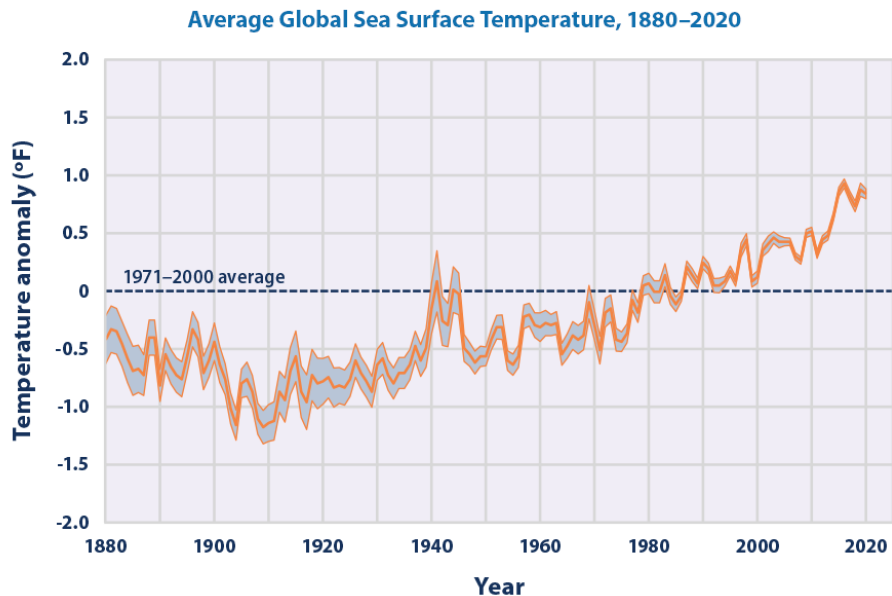
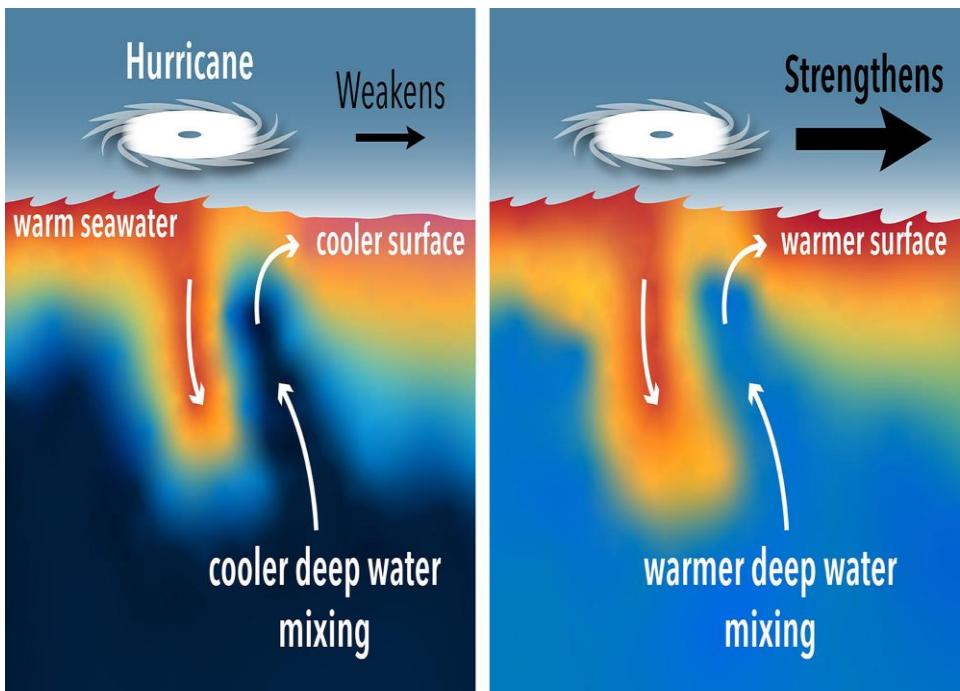
# Zoom Poll

- 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





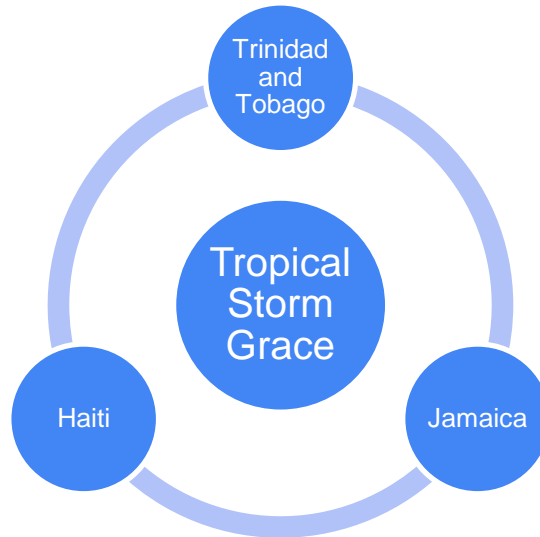
# Stronger



Data source: NOAA (National Oceanic and Atmospheric Administration), 2021. Extended reconstructed sea surface temperature (ERSST.v5). Accessed February 2021.  
[www.ncdc.noaa.gov/data-access/marineocean-data/extended-reconstructed-sea-surface-temperature-ersst](https://www.ncdc.noaa.gov/data-access/marineocean-data/extended-reconstructed-sea-surface-temperature-ersst).

# Wetter

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



Ramon Espinosa/AP

# 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



Clayton, S., Manning, C. M., Krygsman, K., & Speiser, M. (2017). *Mental Health and Our Changing Climate: Impacts, Implications, and Guidance*. Washington, D.C.: American Psychological Association, and ecoAmerica.

# 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.

Fear and  
distress

Harmful  
behaviors/  
risky  
actions

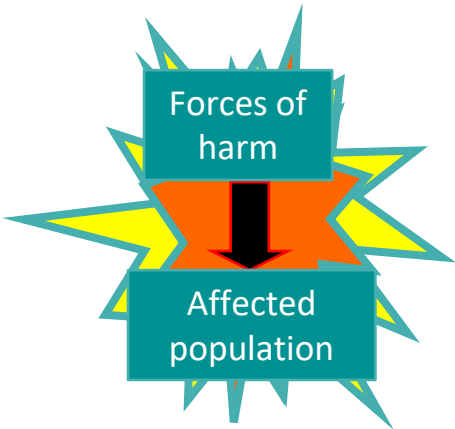
Psychiatric  
disorders

Disaster  
impact





In a disaster, psychosocial consequences expand across a prolonged range of duration



Disaster impact



Hazard

Resource/human losses

Enduring life changes

Time from impact

# 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.

## ENVIRONMENTAL HEALTH

DOI: 10.1037/0893-3200.30.12  
HEALTH AFFAIRS 39,  
NO. 12 (DECEMBER 2020): 2120-2127  
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The People-to-People Health  
Foundation, Inc.

By James M. Shultz, Duane E. Sands, Nadia Holder-Hamilton, William Hamilton, Sandeep Goud, Krista Marie Nottage, Zélie Espinal, Stephanie Friedman, Craig Fugate, James P. Kociss, and Sandro Galao

## ANALYSIS

# Scrambling For Safety In The Eye Of Dorian: Mental Health Consequences Of Exposure To A Climate-Driven Hurricane

**ABSTRACT** As climate change alters the behavior of Atlantic hurricanes, these storms are trending stronger, wetter, and slower moving over coastal and island populations. Hurricane Dorian exemplified all three attributes. Dorian's destructive passage over the Abaco Islands, Bahamas, on September 1, 2019, exposed residents of its capital, Marsh Harbour, to a prolonged encounter with the storm's core. After Dorian's fierce front eyewall and towering storm surge tore apart shanty town habitats and eviscerated concrete homesites, residents desperately sought refuge during the brief respite when Dorian's eye passed directly overhead. The category 5 winds then resumed abruptly and Dorian continued its relentless destruction. This article focuses on the storm's mental health consequences, drawing on observations of on-site clinicians as well as findings from previous research on the mental health effects of Atlantic hurricanes and the transformation of hurricane hazards resulting from climate change. To protect island and coastal populations against climate-driven storms, disaster planning policy should emphasize resilience-focused prevention and mitigation strategies. In the aftermath of these events, health system response should include community outreach, case finding, and evidence-based interventions that optimize the use of mental health professionals.

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**Nadia Holder-Hamilton** is a physician at the Department of Public Health, Ministry of Health, in Nassau.

**William Hamilton** is a physician at the Department of Public Health, Ministry of Health, in Nassau.

**Sandeep Goud** is on the Faculty of Medical Sciences at the University of the West Indies, in Nassau.

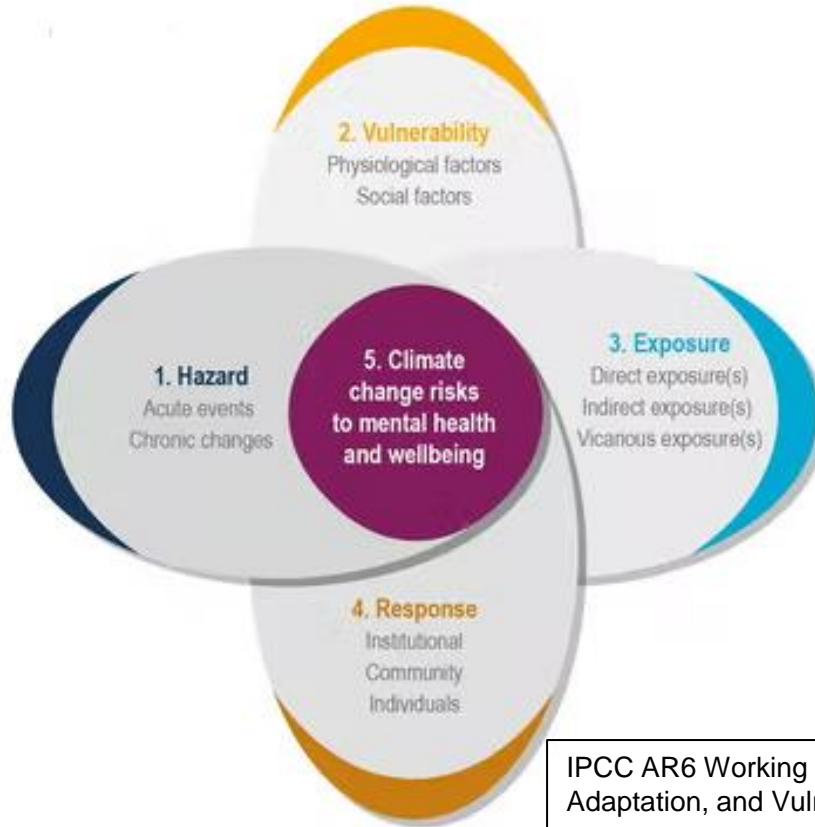
**Krista Marie Nottage** is a resident in the General Surgery 5th Programme, School of Medicine and Clinical Research, University of the West Indies.

**Zélie Espinal** is a psychiatrist and psychoneurologist in the Department of Psychiatry and Behavioral Sciences at the University of Miami Leonard M. Miller School of Medicine.

Survivors of landfalling hurricanes and persistent mental illnesses whose care routines are disrupted.<sup>1,2</sup> Survivors' experiences in the aftermath of Hurricane Dorian, which struck Marsh Harbour, the capital of the Abaco Islands, the Bahamas, on September 1, 2019, provide a consummate example of the traumatizing mental health impact of an exceedingly powerful hurricane bearing the hallmarks of a climate-driven storm.<sup>3,4</sup>

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# 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.

**KCER** Kidney Community Emergency Response

### 3-Day Emergency Diet Shopping List

This shopping list is for six days of foods and water, so you can repeat the 3-Day Emergency Diet a second time, if needed.

**Review this list with your dietitian to tailor it for your needs.**

**DRINKS**

- ✓ Water is the best choice to drink.
- ✓ No sport drinks or beverages that contain phosphate

WHAT TO BUY	HOW MUCH TO BUY
<b>DRINKS</b>	
Distilled or bottled water	1 to 2 gallons
Dry milk OR evaporated milk	3 packages of dry milk OR 4 cans of evaporated milk (8 ounces each)
Cranberry, apple, or grape juice	6 cans or boxes (4 ounces each)
<b>FOOD</b>	
Cereal: <i>No bran, granola, or cereal with dried fruit or nuts.</i>	6 single-serving boxes (or 1 box)
Fruit, or "fruit cups," with pears, peaches, mandarin oranges, mixed fruit, applesauce, or pineapple packed in water or juice. <i>No heavy syrup, raisins, or dried fruit.</i>	12 cans (4 ounces each)
Low sodium asparagus, carrots, green beans, peas, corn, yellow squash or wax beans. <i>No dried beans such as pinto, navy, black, ranch style or kidney. No potatoes or tomatoes.</i>	6 cans (8 ounces each)
Low sodium or No-salt added Tuna, Crab, Chicken, Salmon, or Turkey	6 cans (3 ounces or 4 ounces each)
Unsalted peanut butter or almond butter	1 jar
Mayonnaise	3 small jars (or 8 to 12 single-serve foil wrapped packs)
Jelly (if you don't have diabetes)	1 small jar
Sugar-free jelly (if you have diabetes)	1 small jar
Vanilla wafers, Graham crackers, or Plain unsalted crackers	1 box
Sugar-free candy, like sourballs, hard candy.	1 package

2 | 3 Day Emergency Renal Diet, August 2015

## DDRC PATIENT PREPAREDNESS PLAN

### DO YOU OR A LOVED ONE HAVE DIABETES AND USE INSULIN?

*Make a plan to stay healthy during natural disaster or emergency*

Managing diabetes can be even harder when you are dealing with a major storm, loss of electricity, and possible evacuation from your home. Building a "diabetes kit" now can save a lot of worry and time when a disaster strikes. A checklist template is included for your use.



Your diabetes kit can be stored in an easy-to-carry waterproof bag or container to hold the documents, information, and supplies that you will want to have with you.

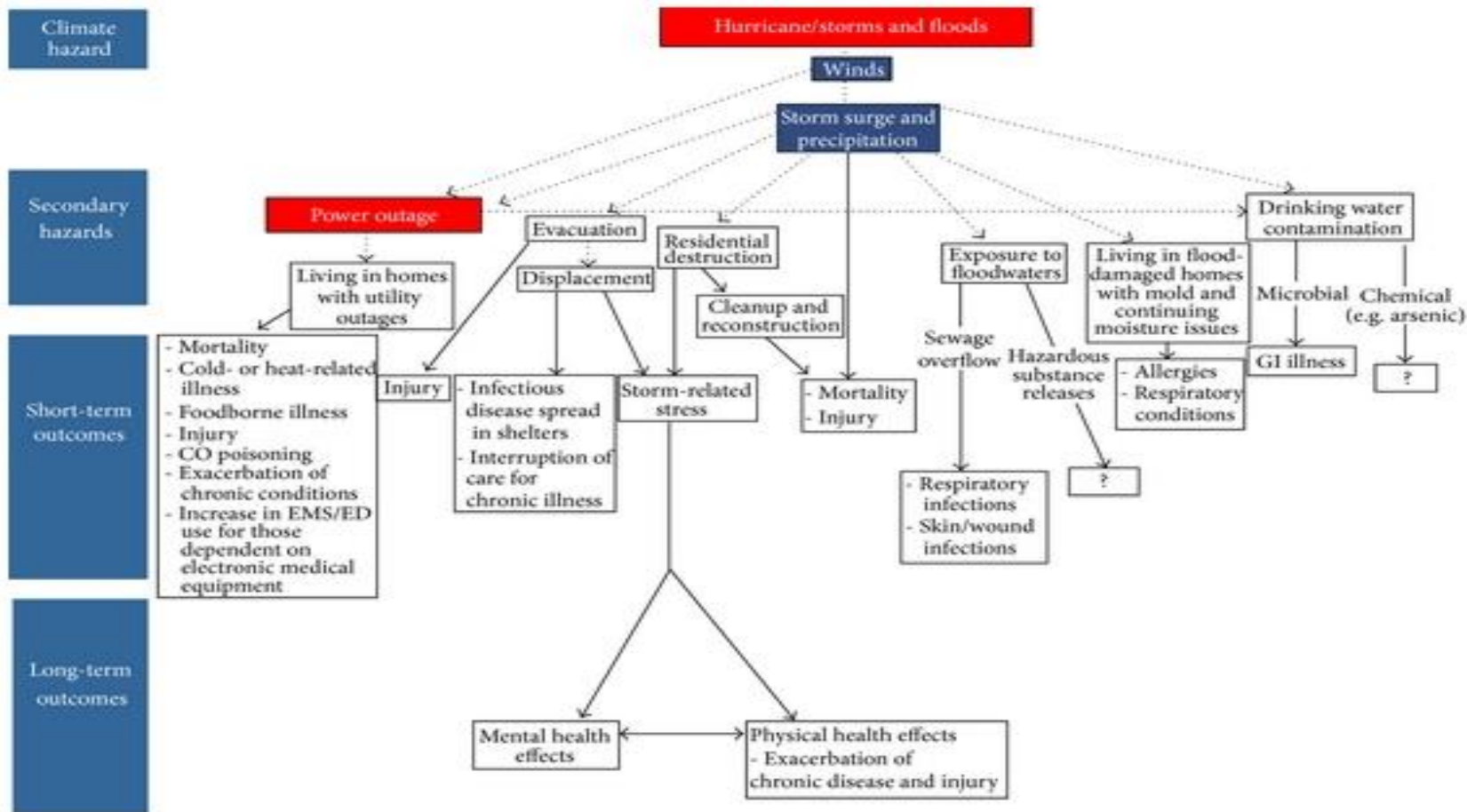
#### Important Information to Keep In Your Kit - Write down or copy the following:

- Type of diabetes you have
- Other medical conditions, allergies, and previous surgeries
- Current medications, doses, and time you take them. Include your pharmacy name, address and phone number.
- Previous diabetes medications you have taken
- A letter from your diabetes care team with a list of your most recent diabetes medications, if possible.
- A copy of your most recent laboratory result, like A1C results
- Make, model and serial number of your insulin pump or CGM. Include pump manufacturer's phone number in case you need to replace your device.
- Doctor's name, phone number, and address
- Phone numbers and email addresses for your family, friends, and work. Include out-of-town contacts.
- A copy of your health insurance card
- A copy of your photo ID
- Cash



## Recommendations:

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



Outcomes denoted with a "?" reflect uncertainty since risk and impacts depend on specific substances and severity of exposure.

# 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.

## Disaster Risk Reduction For Health

Not a new concept; however it is a new priority

### What is a disaster?

Disasters occur when vulnerable individuals and communities are impacted by environmental hazards.



**Disaster = Hazard x Vulnerability**



### What is DRR?

Disaster Risk Reduction (DRR) is a systematic approach to identifying, assessing, and reducing risks of disasters before they occur.



### Why DRR for Health?

The majority of disaster deaths occur during impact, yet historically efforts have focused on response. DRR for health addresses the causal factors of disasters to prevent or mitigate illness or injury from ever occurring.



**100 million**

people were affected by disasters in 2014<sup>2</sup>



### Disaster risk is rising

due to urbanization, population growth, poverty, and climate change<sup>3</sup>

### Vulnerable Populations

continue to be disproportionately affected by disasters



**30-50%** of disaster fatalities are children<sup>4</sup>



**50%** of disaster fatalities in Hurricane Katrina were over the age of 75<sup>5</sup>



**70%** of casualties in the 2004 Indian Ocean Tsunami were women<sup>6</sup>



**Every dollar spent on DRR saves \$4 in response and recovery cost<sup>7</sup>**

### DRR at CDC



#### Science – Understanding disaster risk

- Contribute to the growing scientific literature on DRR

#### Practice – Community efforts and best practices

- Identify baseline DRR efforts and build capacity
- Evaluate effectiveness of community DRR strategies and implementation
- Provide technical assistance to Federal, state, local, territorial, and international stakeholders to build capacity

#### Policy – Inform national and global strategies

- Represent public health on the US National Platform to implement the UN Sendai Framework for DRR
- Represent health in the broader multi-sectoral DRR network

# 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



What it looked like



What was designed



Result of retrofit

# Health Emergency and Disaster Risk Management Framework



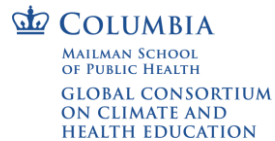
## Guiding Principles:

- Risk-Based Approach
- Comprehensive Management
- All Hazards Approach
- Inclusive, people- and community-centered approach
- Multisectoral and Multidisciplinary collaboration
- Whole-of-health system based

FROM	▶ TO
Event-based	➔ Risk-based
Reactive	➔ Proactive
Single-hazard	➔ All-hazard
Hazard-focus	➔ Vulnerability and capacity focus
Single agency	➔ Whole-of-society
Separate responsibility	➔ Shared responsibility of health systems
Response-focus	➔ Risk management
Planning for communities	➔ Planning with communities



# Zoom Poll Question 2



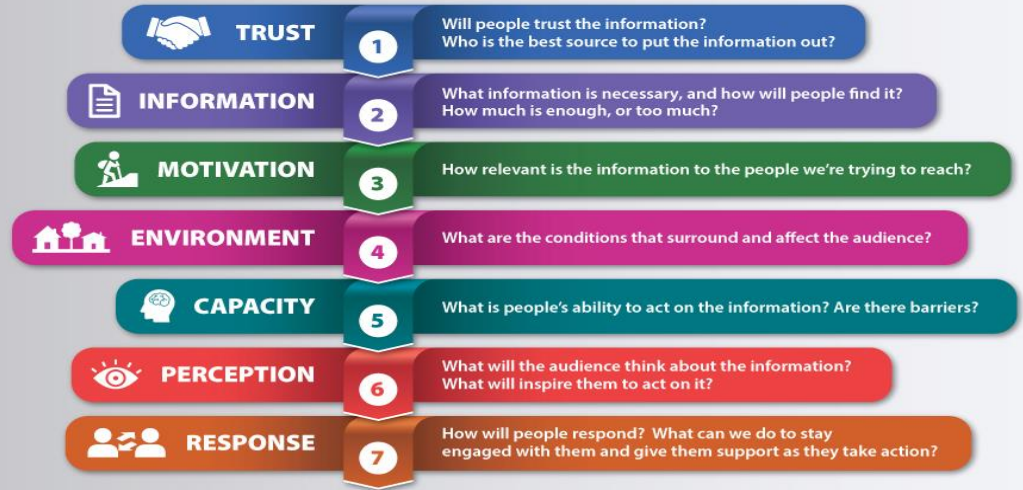
# Zoom Poll

- 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

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.

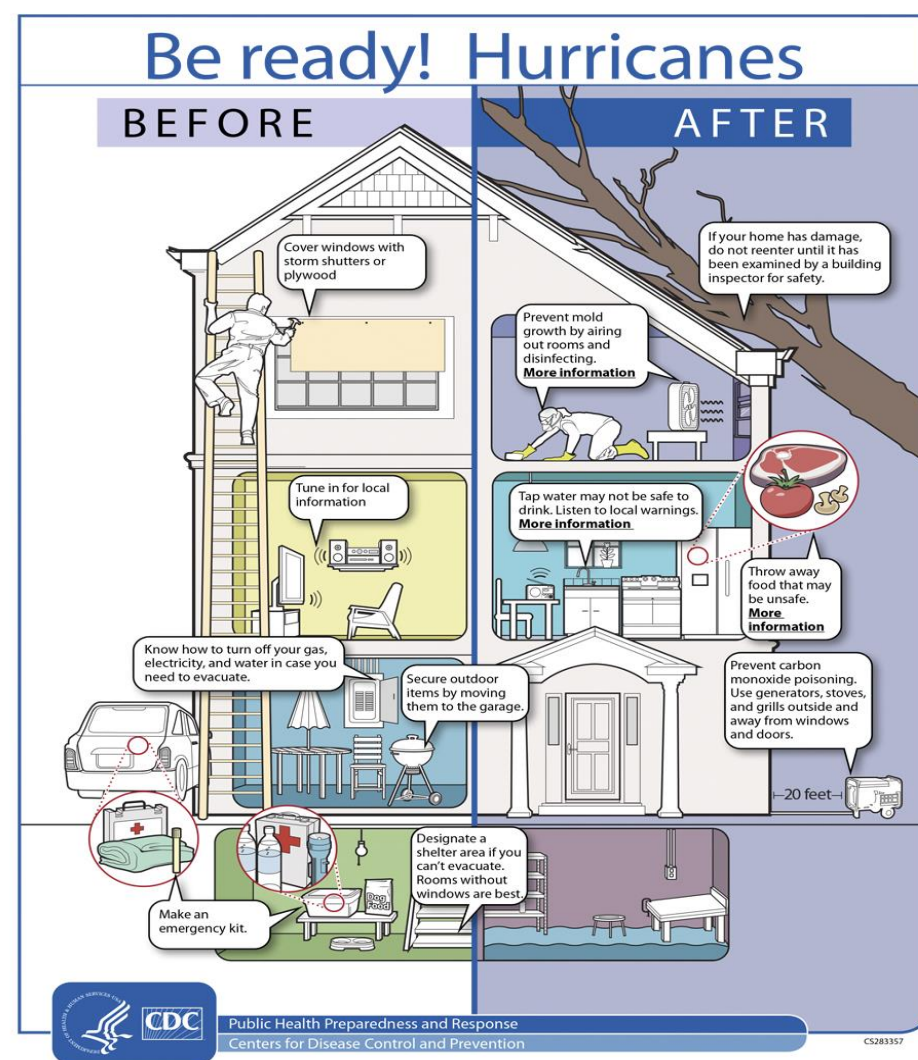
## 7 Things to Consider When Communicating About Health





# 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




**PROTECT YOURSELF** from **MOSQUITO BITES**



**Use insect repellent**  
**It works!**  
Look for the following active ingredients: DEET, picaridin, IR3535, oil of lemon eucalyptus or para-menthane-diol, or 2-undecanone



**Wear protective clothes**  
Wear long-sleeved shirts and long pants or use insect repellent. For extra protection, treat clothing with permethrin.

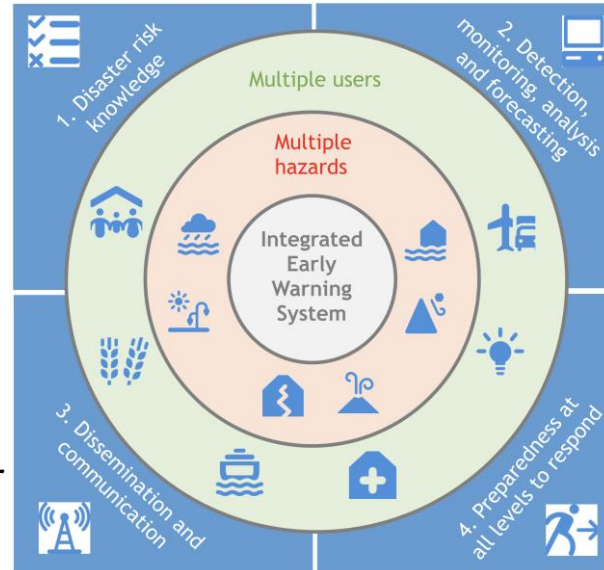


**Mosquito-proof your home**  
Use screens on windows and doors. Use air conditioning when available. Keep mosquitoes from laying eggs near standing water.

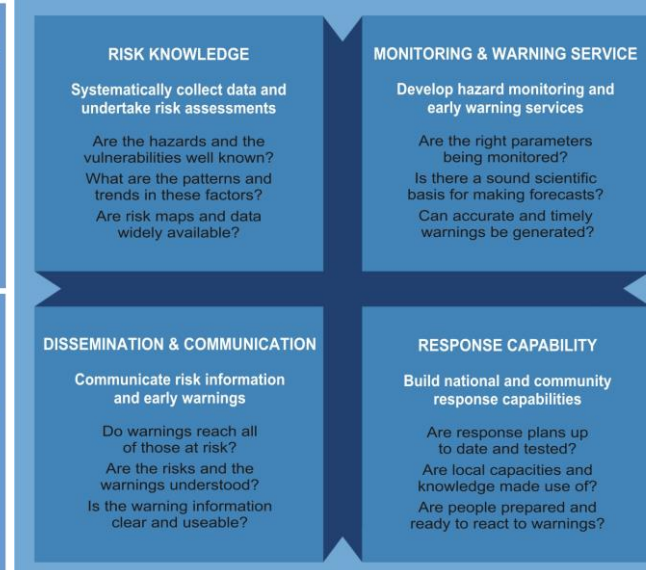
South Carolina Emergency Management Division

# Early Warning Systems

- 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.*”



Source: World Meteorological Organization



Source: UNDRR



# 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

**TIME  
EQUALS  
MUSCLE**

# Case Study: Hurricane Katrina – What went wrong?

• Prior Risk Knowledge

• Technical Monitoring and Warning

• Dissemination of Warnings

• Response Capacity



## Hurricane Katrina: A Dire Warning (August 28, 2005)

Now a Category 5 with a minimum central pressure of 902 millibars, the fourth lowest air pressure on record for an Atlantic storm, and maximum sustained winds of 160 mph with higher gusts. The Moderate Resolution Imaging Spectroradiometer (MODIS) captured this image from NASA's Terra satellite at 1:00 pm EDT.

URGENT - WEATHER MESSAGE  
NATIONAL WEATHER SERVICE NEW ORLEANS LA  
1011 AM CDT SUN AUG 28 2005

...DEVASTATING DAMAGE EXPECTED.

HURRICANE KATRINA, A MOST POWERFUL HURRICANE WITH UNPRECEDENTED STRENGTH...EVALUATING THE INTENSITY OF HURRICANE CAMELLE OF 1969.

MOST OF THE AREA WILL BE UNINHABITABLE FOR WEEKS...PERHAPS LONGER. AT LEAST ONE HALF OF WELL-CONSTRUCTED HOMES WILL HAVE ROOF AND WALL FAILURE. ALL GABLED ROOFS WILL FAIL...LEAVING THOSE HOMES SEVERELY DAMAGED OR DESTROYED.

THE MAJORITY OF INDUSTRIAL BUILDINGS WILL BECOME NON-FUNCTIONAL. PARTIAL TO COMPLETE WALL AND ROOF FAILURE IS EXPECTED. ALL WOOD-FRAMED LOW-RISE APARTMENT BUILDINGS WILL BE DESTROYED. CONCRETE BLOCK LOW-RISE APARTMENTS WILL SUSTAIN MAJOR DAMAGE...INCLUDING SOME WALL AND ROOF FAILURE.

HIGH-RISE OFFICE AND APARTMENT BUILDINGS WILL SWAY DANGEROUSLY...A FEW TO THE POINT OF TOTAL COLLAPSE. ALL WINDOWS WILL BLOW OUT.

AIRBORNE DEBRIS WILL BE WIDESPREAD...AND MAY INCLUDE HEAVY ITEMS SUCH AS HOUSEHOLD APPLIANCES AND EVEN LIGHT VEHICLES. SPORT UTILITY VEHICLES AND LIGHT TRUCKS WILL BE MOVED. THE BLOWN DEBRIS WILL CREATE ADDITIONAL DANGER TO PERSONS, PETS...AND LIVESTOCK EXPOSED TO THE WINDS WILL FACE CERTAIN DEATH IF STRUCK.

POWER OUTAGES WILL LAST FOR WEEKS...AS MOST POWER POLES WILL BE DOWN AND TRANSFORMERS DESTROYED. WATER SHORTAGES WILL MAKE HUMAN SUFFERING INCREDIBLE BY MODERN STANDARDS.

THE VAST MAJORITY OF WATVE TREES WILL BE SNAPPED OR UPROOTED. ONLY THE HARDEST WILL REMAIN STANDING...BUT BE TOTALLY DEFLATED. FEW CROPS WILL REMAIN. LIVESTOCK LEFT EXPOSED TO THE WINDS WILL BE KILLED.

AN IN-LAND HURRICANE WIND WARNING IS ISSUED WHEN SUSTAINED WINDS NEAR HURRICANE FORCE...OR FREQUENT GUSTS AT OR ABOVE HURRICANE FORCE...ARE CERTAIN WITHIN THE NEXT 12 TO 24 HOURS.

ONCE TROPICAL STORM AND HURRICANE FORCE WINDS ONSET...DO NOT VENTURE OUTSIDE!

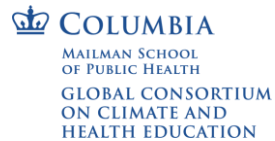


**Dire Warning**  
Forecasters Robert Ricks of the National Weather Service in Slidell issued a very rare, dire warning to the residents of Louisiana on the morning of Sunday, August 28, 2005...nearly 24 hours before landfall. This warning may have saved many lives.



David J Phillip, AP

# Zoom Poll Question 3



# Zoom Poll

In your respective countries which element of the Early Warning System needs more attention?

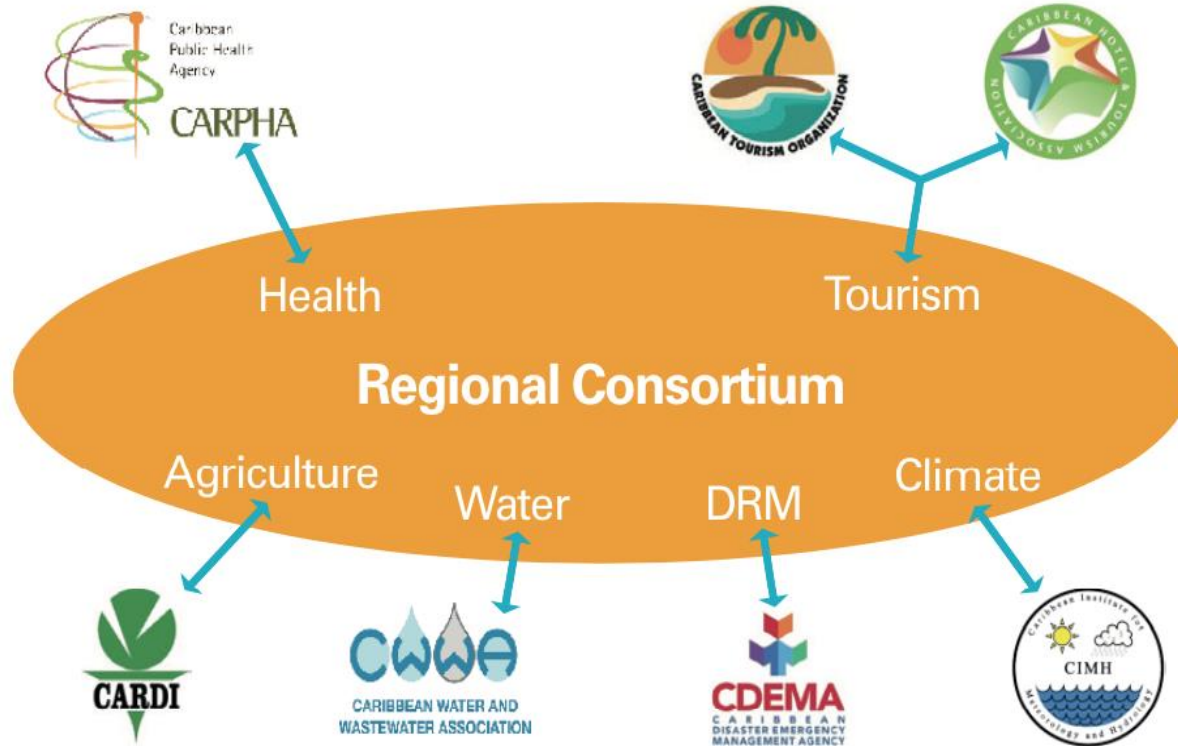
- A. Risk Knowledge
- B. Monitoring and Warning Service
- C. Dissemination and Communication
- D. Response Capability

# 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.

# Climate change

## Vulnerability

### Vulnerability factors

- Demographic factors
- Geographic factors
- Biological factors & health status
- Sociopolitical conditions
- Socioeconomic factors

### Exposure pathways

- Extreme weather events
- Heat stress
- Air quality
- Water quality and quantity
- Food security and safety
- Vector distribution & ecology

### Health system capacity & resilience

- Leadership & governance
- Health workforce
- Health information systems
- Essential medical products & technologies
- Service delivery
- Financing

## Climate-sensitive health risks

### Health outcomes



Injury and mortality from extreme weather events



Heat-related illness



Respiratory illness



Water-borne diseases and other water-related health impacts



Zoonoses



Vector-borne diseases



Malnutrition and food-borne diseases



Noncommunicable diseases (NCDs)



Mental and psychosocial health

### Health systems & facilities outcomes

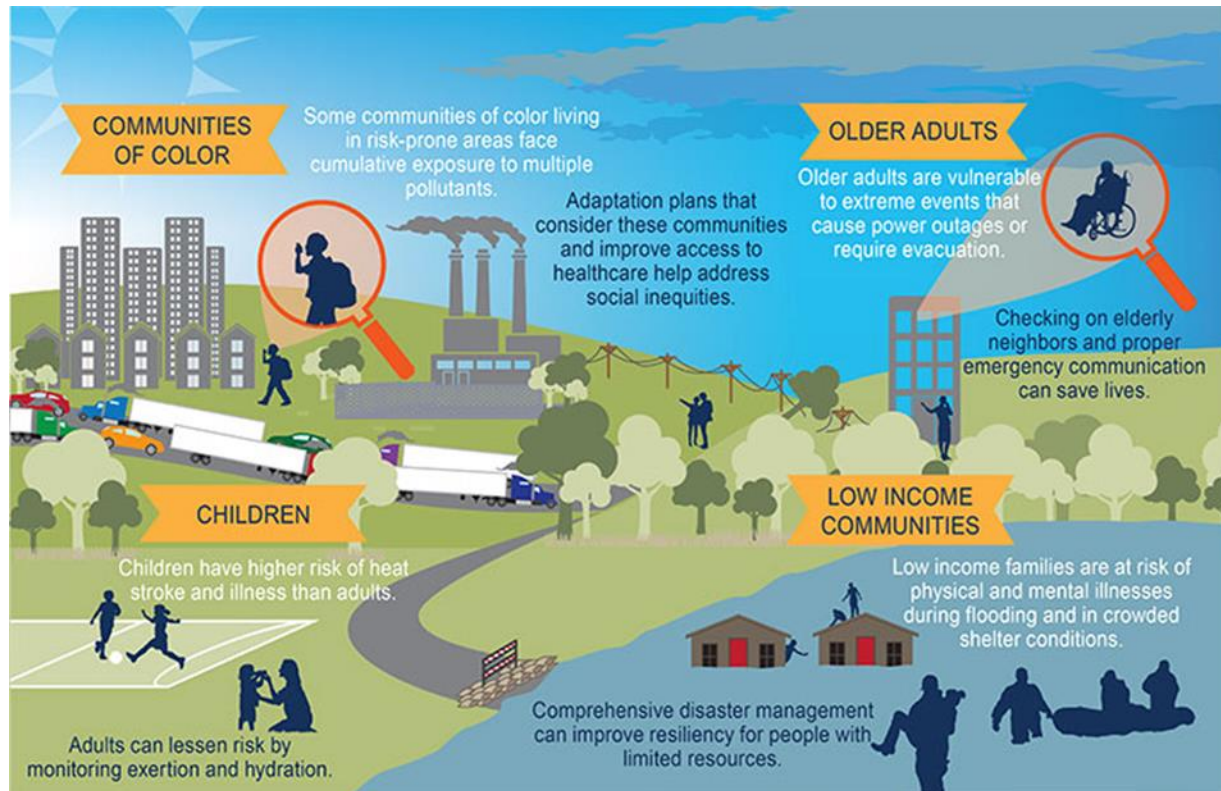


Impacts on healthcare facilities



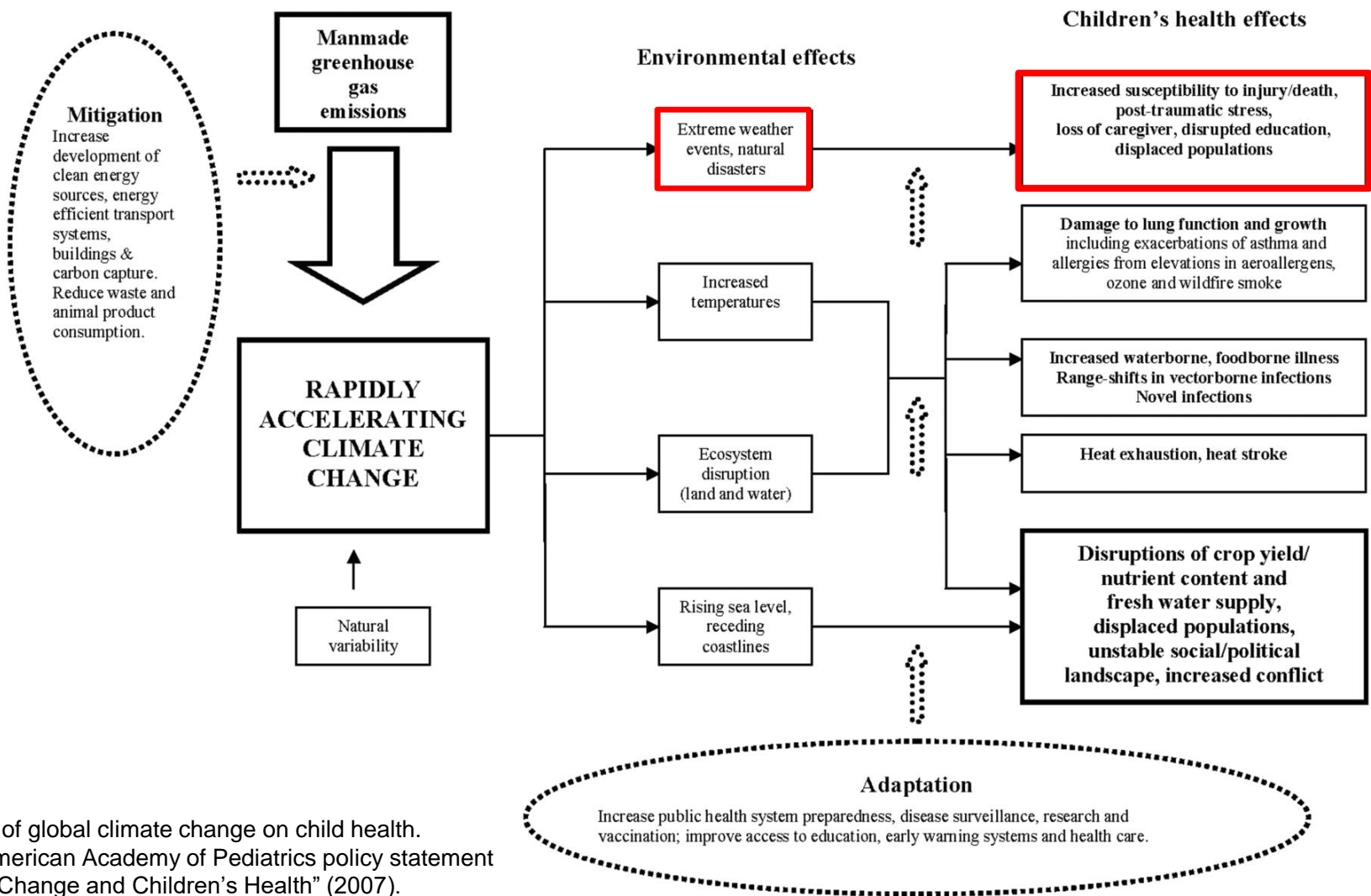
Effects on health systems

# 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

## Ageing by numbers

**12.3%** of today's population are 60+

(Source: UNDESA Population Division, World Population prospects: the 2015 revision)

By 2050



**1 in 5** people globally will be 60+

(Source: UNDESA Population Division, World Population prospects: the 2015 revision)



**2/3** of people aged 60+ currently live in developing countries

(Source: UNDESA Population Division, World Population prospects: the 2015 revision)

In 2050 the proportion of people aged 60+ projected to live in developing countries is

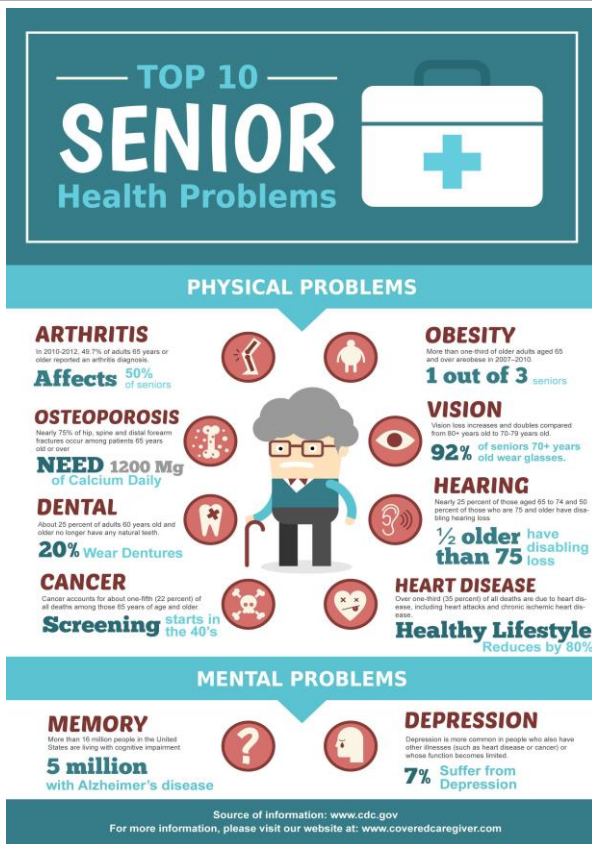


(Source: UNDESA Population Division, World Population prospects: the 2015 revision)



**75%** of those who died during Hurricane Katrina in 2005 were aged over 60 (16% of local population)

(Source: N Wilson, Public Policy and Ageing Report, 2006)

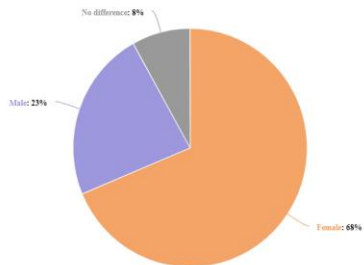


- Consequences of Environmental and Social factors:

- Drowning
- Trapped in the house
- Injuries
- Infections

# Women

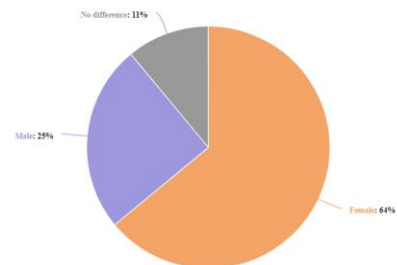
More than two-thirds of studies find women face greater health risks from climate change



CB

Pie chart displaying the findings of 130 studies on climate change and health: 89 studies found women were more affected than men, 30 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.

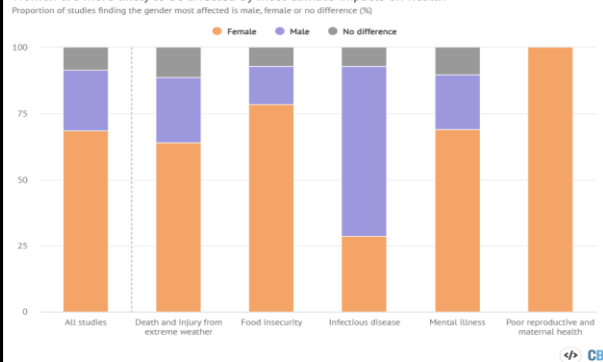
Nearly two-thirds of studies find women are more likely to suffer death or injury from extreme weather



CB

Pie chart displaying the findings of 53 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 six 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.

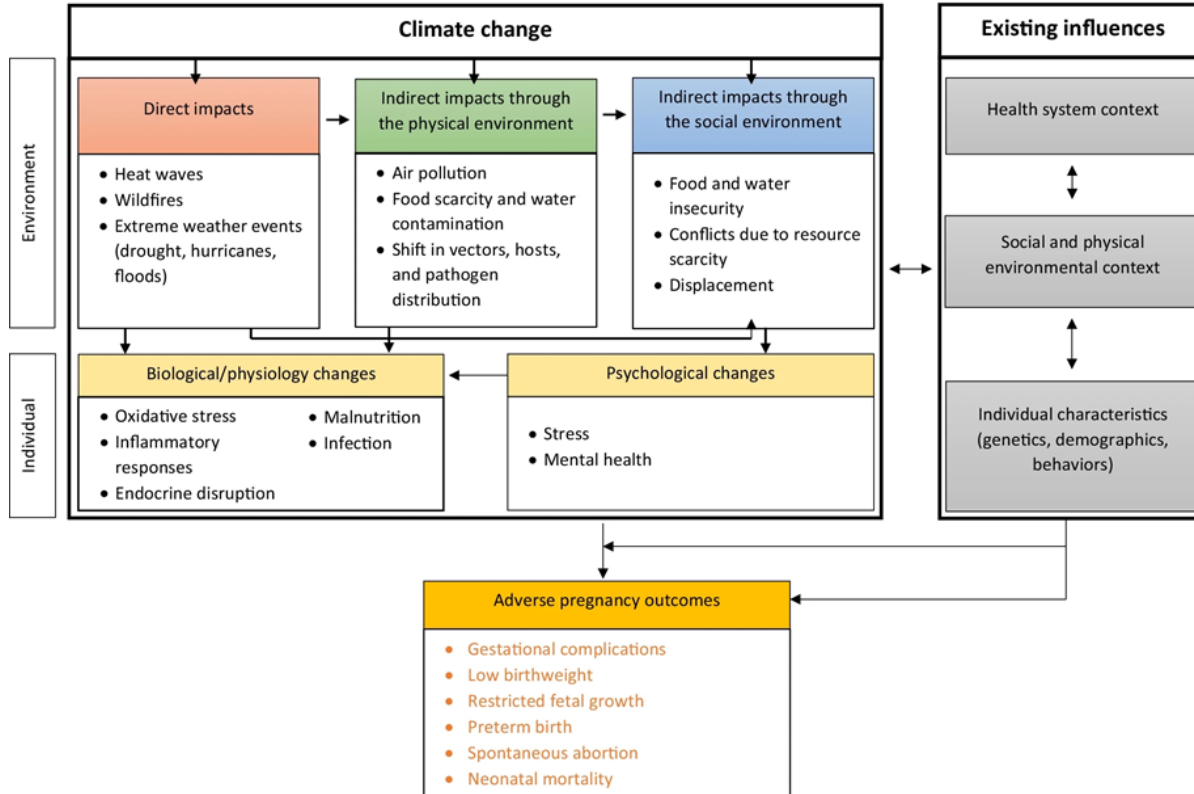
Women are more likely to be affected by most climate impacts on health



CB

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



## PREGNANCY and CLIMATE CHANGE

**The PROBLEM**

Climate change worsens air pollution and extreme weather which can have severe impacts on health during and after pregnancy including:

- PRETERM BIRTH
- LOW BIRTHWEIGHT
- STILL BIRTH
- EFFECTS ON BRAIN DEVELOPMENT

**What WE CAN DO**

Advocate for public policies that lead to:

- GLOBAL REDUCTION IN AIR POLLUTION EMISSIONS
- STEADY DIVESTMENT FROM FOSSIL FUELS
- REDUCING TOXIC EXPOSURES

*"The health impacts of our global climate crisis on maternal and child health can no longer be ignored."*

International Federation of Gynecology and Obstetrics (FIGO)

**FIGO**  
International Federation of Gynecology and Obstetrics

**HEAL**  
HEALTHY AND EQUITABLE ENVIRONMENTAL JUSTICE

**UCSF**  
Program in Reproductive Health and the Environment

# Outdoor Workers

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

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

Adapted and modified from Applebaum et al. [20] and Kjellstrom et al. [36].



# Conclusion

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!



Pan American  
Health  
Organization

# CODE GREEN

**“DISASTER PREPAREDNESS IN  
AN ERA OF CLIMATE CHANGE”  
CONFERENCE**

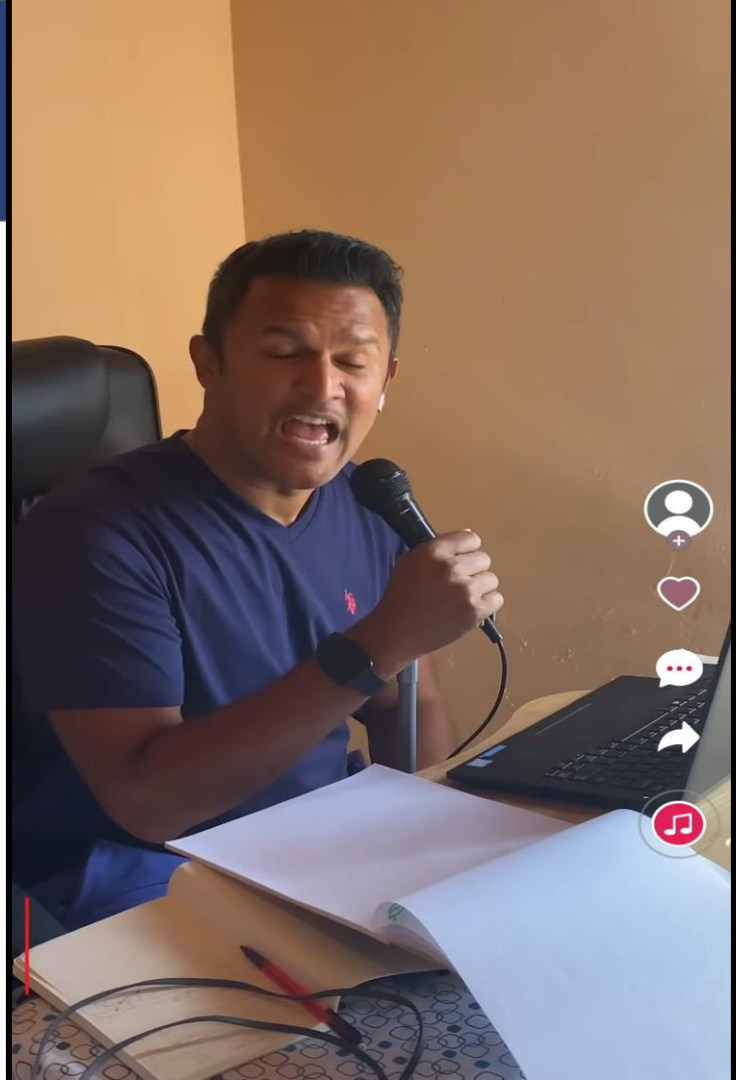
**25TH & 26TH APRIL  
2022**

5:00PM - 8:30PM

**4 CME CREDITS**

## SAVE THE DATE

PLEASE DIRECT ANY QUESTIONS TO  
[CODEGREENCONFERENCE@GMAIL.COM](mailto:CODEGREENCONFERENCE@GMAIL.COM)



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