GCC and Human Health

“The biggest health threat of the 21st Century”
Impact of Climate Change on Human Health

- Injuries, fatalities, mental health impacts
- Asthma, cardiovascular disease
- Heat-related illness and death, cardiovascular failure
- Malaria, dengue, encephalitis, hantavirus, Rift Valley fever, Lyme disease, chikungunya, West Nile virus
- Respiratory allergies, asthma
- Forced migration, civil conflict, mental health impacts
- Changes in Vector Ecology
- Extreme Heat
- More Extreme Weather
- Rising Temperatures
- Increasing Allergens
- Water and Food Supply Impacts
- Rising Sea Levels
- Environmental Degradation
- Increasing CO2 Levels
- Cholera, cryptosporidiosis, campylobacter, leptospirosis, harmful algal blooms
- Water Quality Impacts
Heat Related Effects/ Clinical Presentations

- **Mild symptoms** (rash, fatigue)
- **Heat Exhaustion**
  - Thirst/Weakness/Dizzy
  - Cramps/Headache
  - Nausea/Vomiting
  - Profuse diaphoresis/tachycardia

**Heat Stroke:**
- Confusion/Syncope/Coma
- Dry skin or moist
- Core temperature > 104 F
Groups at Increased Risk

- Elderly
  - sweat less, less thirst drive/non-ambulatory/
    Cardiopulmonary and renal conditions
  - Circulatory burden and dehydration
    Mental health medications
  - Thermoregulation
- Children (0-4) and older kids – thermoregulatory issues and activities
- Sports Enthusiasts – may overdo
- Laborers – may be placed at greater risk
- Homeless – may not recognize the danger or have resources to cope
Prevention of Heat Morbidity/Mortality

- Communication by clinical teams: reach vulnerable populations
- Public Health warning systems of impending heat waves
- Temporary housing for vulnerable population
- Timely education about the risk of heat illness
- Community outreach teams organized by local public health authorities
Respiratory Effects

American tourists wearing masks to filter out smoke from forest fires surrounding Moscow, Russia. Summer 2010.

Respiratory Effects
Particulate matter and ozone

- Source: Autos, power plants and forest fires
- 43 million in US and 89% of the world live in areas in excess of WHO limit of 10micrometers/mm3.
- In 2012 7 million deaths attributable to air pollution (WHO)
- Ozone will increase to 60 ppb by 2030/irritable to alveoli/air trapping/more vulnerable to particulates
- Leads to increase absenteeism, ER visits and hospitalizations from asthma/COPD exacerbations.
Allergies and Asthma
Allergies and Asthma

- 55% of US and European population tests positive for allergens and 34 million people with asthma
- Increased length of pollen season in North America and Europe
- Increased CO2 production leads to increase growth of allergen producing weeds, grasses, trees and fungus.
- Rain and floods leads to increase mold and fungal growth
Allergies and Asthma

- **Allergies**: 11 million office visits per year
- $11.2 billion per year to treat
- **Asthma/COPD**: 2 million ED visits/.5 million hospitalization/3600 deaths
- 56 billion dollars per year
Infectious Disease
Deaths from vector-borne disease

VBD Deaths/million

0 - 1
1 - 20
20 - 50
50 - 200
200 - 500
500 - 1900
No Data

Estimates by WHO sub-region for 2002 (WHO World Health Report, 2004). The boundaries shown on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted lines on maps represent approximate border lines for which there may not yet be full agreement.

© WHO 2000. All rights reserved.
WHO Vector Borne Diseases in North American/European Region

- **Mosquito:**
  - Dengue
  - Chikungunya
  - Malaria
  - West Nile Fever

**Sandfly borne:**
Leishmaniasis

**Tick borne:**
Lyme/Anaplasma/Babesia
RISK OF MALARIA TRANSMISSION will have risen in many parts of the world by 2020 (relative to the average risk in the years 1961 to 1990), according to projections assuming a temperature increase of about two degrees Fahrenheit. The analysis was based solely on temperature threshold and did not assess other factors that could influence malaria's spread.
Waterborne Diseases
Heavy Downpours are Increasing Exposure to Disease

Climate change increases heavy downpours.

Streams and rivers rise, which contributes to flooding of homes, businesses, and critical infrastructure like sewer and storm water systems.

Sewage overflow from treatment plants, septic fields, and municipal lines can back up into people's homes.

Floodwaters can become contaminated with agricultural waste, chemicals, raw sewage, and other pollutants.

Floodwaters can contain disease-causing bacteria, viruses, and parasites.

Flooded materials in homes, schools, and businesses can cause molds to grow and be inhaled.
Association between precipitation and waterborne disease outbreaks/Toxigenic E. Coli

Amy Greer, PhD et al. CMAJ 2008;178:715-722
Bacterial Contamination

- **Toxigenic E. Coli (O157:H7)** from contaminated food and water
- Bloody diarrhea, vomiting—may lead to kidney failure and even death
- **Campylobacter**—common cause of food poisoning from meats/unpasteurized dairy products/contaminated water.
- **Salmonella**—common cause of food poisoning
- **Leptospira**—spread through the urine of infected animals, rodents, through the soil and water, and during flooding. Infections in urban kids increasing.
- Higher temperatures are associated with higher rates of production and disease.
Bacteria: Vibrio Species & Legionella

- **Vibrio** is strongly influenced by climate—both fresh and marine waters
- **V. Cholera** causes estimated 3-5 million cases and 100,000-120,000 deaths yearly world-wide. Young children in endemic areas most affected.
- Virulent **V. parahaemolyticus** strain found in Maryland shellfish & Alaskan oysters in Price William Sound (furthest north) -big public health concern.
- Climate warming can increase pathogen development and survival rates, disease transmission and host vulnerability.

- **Legionella** (Legionnaire’s Disease)-respiratory illness transmitted solely by water. Warm water and perhaps other factors, like association with amoebas, influence the potential to colonize water systems.
Parasitic Disease

- **Cryptosporidium** - 2,000-3,000 cases annually in the U.S. through livestock waste & contaminated water
  - Cryptosporidium oocytes detected in 65% to 97% of surface waters tested in the U.S.
  - Common disinfectants, like chlorination is ineffective
  - 1993 outbreak in Milwaukee was the largest outbreak ever documented in the U.S. with 400,000 cases and 100 deaths.
  - In 1997, 2,566 cases were reported from 45 states

- **Giardia lamblia** - second most common parasite in the U.S.
  - Cyst found in raw surface water from animal and human feces
  - 39% of filtered drinking water found Giardia (17%) and Crypto (27%)

- **Cyclospora** - often associated with fresh produce from contaminated water - Big outbreak in 2013 from salad bar/cilantro in TX, NE and IA.
Viruses are heat resistant and likely to survive sewer treatment processes. Viruses found in shellfish contaminated with wastewater and fecal sources.

- Hepatitis A
- Norovirus
- Norwalk virus
Food Security
Temperature and precipitation extremes (like flooding) can increase pathogen load.

Climate can also alter weed, insect, and fungal populations and increase pesticide use.

Rising carbon dioxide can directly influence nutritional content of foods.

Warmer temperatures can result in greater food spoilage.

Extreme climate events can disrupt food distribution.
Food security

- Reduced crop yields
- Increased crop losses from diseases such as fungi, bacteria and viruses
- Decreased nutrient content in iron, zinc and protein.
- Global climate change will decrease food production by 2% per year in the face of a 14% per year increase in demand.
- Reduced wheat, maize, sorghum and millet yields by 8% across Africa and Asia by 2050.
- By 2050 25 million children could be undernourished and growth stunted worldwide.
- Reduced water supply from droughts with 100 million people in areas of water shortage.
Mental and Emotional Effects
Medical and Physical Health
- Changes in fitness and activity level
- Heat-related illness
- Allergies
- Increased exposure to waterborne and vector-borne illness

Mental Health
- Stress, anxiety, depression, grief, sense of loss
- Strains on social relationships
- Substance abuse
- Post-traumatic stress disorder

Community Health
- Increased interpersonal aggression
- Increased violence and crime
- Increased social instability
- Decreased community cohesion
Mass Migration
In 2012, extreme weather drove more than 32 million people from their homes.

98% of climate refugees were from developing countries.
The Global Risks of Highest Concern, 2016

Percent of participants mentioning the respective risk to be of high concern for the time frame of 18 months or 10 years, respectively. Participants could name up to five risks in each time frame. In each category, the risks are sorted by the total sum of mentions.

For the next 18 months

<table>
<thead>
<tr>
<th>Risk</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large-scale involuntary migration</td>
<td>52.0%</td>
</tr>
<tr>
<td>State collapse or crisis</td>
<td>27.9%</td>
</tr>
<tr>
<td>Interstate conflict</td>
<td>26.3%</td>
</tr>
<tr>
<td>Unemployment or underemployment</td>
<td>26.0%</td>
</tr>
<tr>
<td>Failure of national governance</td>
<td>25.2%</td>
</tr>
</tbody>
</table>

For the next 10 years

<table>
<thead>
<tr>
<th>Risk</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water crises</td>
<td>39.8%</td>
</tr>
<tr>
<td>Failure of climate-change mitigation and adaptation</td>
<td>36.7%</td>
</tr>
<tr>
<td>Extreme weather events</td>
<td>26.5%</td>
</tr>
<tr>
<td>Food crises</td>
<td>25.2%</td>
</tr>
<tr>
<td>Profound social instability</td>
<td>23.3%</td>
</tr>
</tbody>
</table>

Read more: wef.ch/risks2016   #risks2016
Most Vulnerable Populations

- Children
- Individuals of color
- Individuals with disabilities
- Individuals with underlying medical conditions
- Low income
- Pregnant women
- Older adults
250,000 deaths per year by 2030

- Malaria
- Dengue
- Diarrheal disease
- Heat stress
- Under nutrition

Heaviest Burden:
- Children, women, older people, the poor.
- Widening health disparities
The Biggest Health Opportunity of the 21st Century
Solutions
United Nations Framework Convention on Climate Change in 2015 adopted the Paris Agreement of the Conference of Parties.

Keep global temperature rise to less than two degrees and preferably 1.5 degrees Celsius.

The agreement states: “parties should promote their obligations on the right to health when addressing global climate change”

WHO agreement includes reporting to WHO/UNFCCC on sustainable development goals
Mitigation

Three Principles

- Global effort to reduce anthropogenic greenhouse gas emissions
- The developed countries need to take a leading role in developing/implementing and monitoring the success of mitigation measures.
- Health co-benefits are an integral part of global climate change discussions
Second Global Conference on Health and Climate

- Held July 2016 hosted by the government of France (300 participants)

- Series of action items:
  - WHO announced a working group on health economics assessment and climate change, i.e. avoidable health care costs.
  - WHO/UNFCCC developed a climate and health country profile and Sustainable Development Goal indicators.
  - Strong leadership from the healthcare sector.
Mitigation Strategies

- Expanded use of low carbon or carbon neutral energy
- Improve carbon sinks by decreasing deforestation and increasing reforestation
- Increase fuel efficiency standards
- Energy efficiency standards for buildings
- Financial incentives for proper land management
The Health Care Industry is One of the Largest Consumers of Energy

- The health care sector is ranked second in energy use after the food industry
- It spends about $9 billion annually on energy costs
- Power plant emissions are connected to premature deaths, chronic bronchitis, asthma attacks, emergency room visits and more.\(^1\)
- Hospitals in the United States produce a massive amount of garbage/waste (>2.3 million tons per year)
Health Care Sector Efforts

- Energy efficient lighting
- Recycle and purchase recycled products
- Electric car charge station
- Clean energy sources (wind and solar)
- Environmentally sustainable building materials and construction.
- Reduce fleet emissions
- Waste conservation and disposal
- Green Building (LEED or Energy Star Programs)
Green Tips for Small Practices

- **Energy Efficiency** – Turn off electronics when not in use; install energy-efficient lighting; lower thermostat 74F in summer, 68F in winter

- **Renewable Energy** – Purchase renewable energy from your utility company (or credits)

- **Water Efficiency** – Use tap instead of bottled water, promptly fix water leaks, install efficient fixtures.

(Source: My Green Doctor)
Case Study: Boston Green Ribbon Commission Health Care Working Group

- 22 Boston-area hospitals participate. Commission’s goal is 25% drop in GHG emissions by 2020, 80% by 2050
- Member hospitals achieved cuts in electricity, natural gas use, GHG reductions for all fuels.
- Sector energy use dropped by 6% from 2011-2013, “equal to eliminating GHG impact of an average care traveling over 85 million miles.”
- Mass General cut GHG emissions by 35% in 2014, Boston Medical on track for a 45% cut in 2020, Brigham & Women’s will reach 35% in 2020.
- “Cost savings are conservatively estimated at $11.9 million, enough to pay for healthcare for 1055 Massachusetts Medicare enrollees.”

(1)
Case Study: Group Health Puyallup Medical Center

- Washington State facility first in nation to receive LEED for Healthcare Gold certification. (1)
- Facility includes ground-level vegetation and green roof
- Designed for water use reduction – Special sensors activate cold water for cooling sanitized medical equipment only when necessary
- Uses a more efficient steam generator boiler
- Used local and/or recycled construction materials
- Car charging stations and bike racks on site.
Personal Initiatives

- Commuting
- Electric Cars
- Walking/Biking
- Healthy foods
- Limiting air travel
- No water bottles
Greenhouse gas emissions from food, in CO2e/kg

- lentils
- fruit
- milk
- vegetables
- beans/ tofu
- nuts
- rice
- potatoes
- eggs
- tuna
- chicken
- turkey
- pork
- cheese
- beef
- lamb
There is hope and there is movement!
Share of energy from renewable sources in the EU Member States, 2014
(in % of gross final energy consumption)

Source: Eurostat Newsrelease - 30/2016 - 10 February 2016
Solid dots and lines: historical performance
Solid dots and dashed lines: enacted targets
Solid dots and dotted lines: proposed targets
Hollow dots and dotted lines: target under study

[1] China's target reflects gasoline vehicles only. The target may be higher after new energy vehicles are considered.
How Cheap Can Solar Get?

This is a future model of solar prices. Assumes 16% cost reduction of new solar electricity per doubling of scale. Solar costs unsubsidized. Natural gas prices do not include carbon pollution externalities.

Graph by Ramez Naam  rameznaam.com/tag/solar/
Greatest Public Health Opportunity of the 21st Century

- Health care system can be a leader in transformation
- Reduce global emissions of climate pollutants to gain health co-benefits.
- Fundamental and coherent approach to aligning economic development, environmental protection and health and human well being.
- Your trusted voice and strength can be a powerful force in meeting this opportunity!
Physician Advocacy/Education

- Physicians at the individual level have the trust and authority to make an impact.
- Town and County Councils and mayors (especially in low lying areas)
- Community Centers
- Schools
- Civic Organizations/Businesses
- State Health officials/Legislators/Governor
- Representatives/Senators
- ACP Chapters/International meetings
- Medical School Curriculum/Physician CME
Which World Would You Like?
Global Climate Change and Health is an Economic Imperative, a Political Imperative, a Health Imperative, a Moral Imperative
Thank you
Questions?

Climate Change and Health: A Position Paper of the American College of Physicians
http://annals.org/article.aspx?articleid=2513976
nsdamle@scim.necoxmail.com