Climate Change & its Impact on Human Health
or
“Boiling Frogs”

V. Ramana Dhara, MD, ScD, MPH
Ramana.Dhara@iiphh.org
Professor, Indian Institute of Public Health Hyderabad
The Boiling Frog Syndrome

If you throw a frog into a pot of boiling water, he will jump out. But if you place a frog into a pot of cold water and turn the heat on low, it will float there quite placidly.

As the water gradually heats up, the frog will sink into a tranquil stupor, and before long, with a smile on its face, it will unresistingly allow itself to be boiled to death.
Boiling Frogs

Crank it up a few more degrees...a nice warm bath never hurt anybody!

...but if I turn up the heat slowly, then I don't notice that I'm in here with you.
What you will learn today

• What is Climate Change & Global Warming

• What are the health effects?

• How do I mitigate the impacts?

• Are we all Frogs?
So Why Does Global Warming Occur?
Greenhouse Effect
Global Greenhouse Gas Emissions by Gas

- **Carbon Dioxide (fossil fuel and industrial processes)**: 65%
- **Carbon Dioxide (forestry and other land use)**: 11%
- **Methane**: 16%
- **Nitrous Oxide**: 6%
- **F-gases**: 2%
Global Warming & Human Health

**Atmosphere**

![CO2 (ppm) vs Years graph](image1)

**Global surface temperature timeseries**

![Temperature anomaly relative to 1961-1990](image2)

**Arctic summer sea ice extent**

![Sea ice extent over years](image3)
Intergovernmental Panel on Climate Change 1.5 Report (IPCC)

• Collection of all known scientific, peer-reviewed research on impact of global warming on natural and human systems

• Global warming to exceed 3⁰C above pre-industrial levels (1850-1900)

• IPCC 1.5 Special Report is an assessment of a 1.5⁰ C and 2⁰C warmer world
Human Health Impacts Spectrum

- Extreme weather events
- Changing distribution of health risks
- Increased risk of undernutrition
- Displacement of populations
- Greater risk of injuries, disease, death
Health Impacts

• Any increase in global warming, even by 0.5°C can affect human health

• Warming of 1.5°C not safe for most nations

• Risks to human health and food production are lower at 1.5°C than at 2°C

• 1.5°C rise can disproportionately affect disadvantaged and vulnerable populations: food & water insecurity, job & income loss, displacement

• Climate change is a poverty multiplier
Urban Heat Island

Urban areas more vulnerable due to:
- Motor Vehicle emissions
- Use of Air Conditioners
- Dark roads which absorb heat
- Tall buildings blocking wind flow
- Lack of green space
Is there a Tipping Point for human health?

- Tipping point: threshold for abrupt and irreversible change – currently unsure
- Warming ≤ 1.5 C, >350 million exposed to deadly heat by 2050
- 1.5-2 C: annual heat waves similar to 2015 heatwaves in India & Pakistan
- 3 C: substantial increase in deadly heat waves
Flooding & Sea Level Rise

• Risk of death, injury, ill-health, loss of livelihood

• Coastal communities more impacted – including loss of cultural identity and reduced coastal protection

• Small Island Developing States are more at risk
Infectious Disease

- Shift of geographic range, seasonality, and intensity of transmission of selected climate-sensitive infectious diseases

- Increases and decreases projected with additional warming depending on the disease
  - E.g. Malaria – range of Anopheles vector could increase, longer season, increase in number of people at risk
  - However, some regions may be too hot/dry for the Anopheles vector – northern China, Southeast Asia

- Vectors of Dengue, Chikungunya, Yellow fever, Zika projected to increase with larger range by 2030
Climate Change and Infectious Disease – Implications for Health Care Providers

• VR Dhara, Paul Schramm, George Luber
• Centers for Disease Control & Prevention

• Indian Journal of Medical Research – IJMR
• 2013

• http://www.ijmr.org.in/article.asp?issn=0971-5916;year=2013;volume=138;issue=6;spage=847;epage=852;aulast=Dhara
Air Quality

• Ozone formation is temperature dependant, so mortality could increase with risks greater at 2C than at 1.5C

• Particulate matter related mortality could increase or decrease, depending on climate projections and emission assumptions

• Particulate matter, including aerosols and soot, can mask the effects of temperature rise
Food Security

• Climate change can exacerbate risk of food insecurity and breakdown of food systems

• Leads to undernutrition and susceptibility to infectious disease, and increased mortality

• High ambient levels of CO2 can increase allergen production and decrease nutritional quality of crops – can also lead to faster growth rates and lower protein values in many cereal grains
Water Security

- 80% of world population already suffers from serious threats to water security in terms of availability, demand, and pollution.

- Drought frequency and magnitude are substantially larger at 2°C than at 1.5°C in the Mediterranean and Southern Africa.

- Large changes in demography will increase vulnerability.
Sustainable Development & Poverty

• Climate change expected to be a poverty multiplier making poor people poorer and increase total number of people in poverty

• >100 million people could be forced into extreme poverty by 2030, mostly through impacts on agriculture and food prices – global income inequality could be widened

• Health risks are unevenly distributed – risks are high for additional warming >2 C
Migration & Displacement

• Temperature has significant effect on outmigration in 163 agricultural countries

• 1 C increase associated with 1.9% increase in bilateral migration flows from 142 sending and 19 receiving countries

• At 2 C warming, potential for significant population displacement, mainly in tropics – populations may have to move >1000 km if temperatures rise by 2 C from 2011-2030 to end of century

• Drought may significantly increase likelihood of sustained conflict
Occupational Health

- Safe work activity and productivity can be compromised

- Warming of +1.5 C projected to reduce working hours by 6% due to heat stress

- Worldwide labor capacity projected to reduce by 20% in hot months from 10% today
Human Health Impacts of 1.5° C vs 2° C

• 1.5 C compared to 2 C would lower:
  - risk of temperature related morbidity & smaller mosquito range
  - exposure of millions to heatwaves, water stress & premature death

Limited *positive* health effects:
- Reduction of cold-related health problems in some areas
- Geographic shifts in food production
- Reduced capacity of disease vectors due to high temps

*However, the positive effects are projected to be outweighed by magnitude and severity of negative health effects of climate change*
Breaking News.......!

• Farmers in many countries are developing Chronic Kidney Disease of Unknown origin (CKDu)

• Workers dying from irreversible kidney failure due to heat stress and dehydration

• The body may have reached its physiological limit of adaptation
We are now living in an era when climate change is no longer a distant, existential threat.

It is happening now, and it is affecting human health in profound ways.

22, August 2019
Mitigation Pathways

• Limiting warming to 1.5°C can be achieved with poverty alleviation, energy security, and public health benefits

• Public health benefits of mitigation are sizeable and larger than initial mitigation costs – e.g. improved air quality prevents 100 million premature deaths over 21st century

• Transforming the food and agriculture system can have positive co-benefits

• Nuclear energy, Carbon Capture & Storage, Enhanced Weathering – pros and cons
What Can I Do?

Box 2. Discussing climate change effects with patients

- **Encourage a healthy diet**
  - eating more plant foods with vegetables, fruits, and grains will reduce your risk of obesity, diabetes, hypertension, heart disease and some types of cancer
  - buy fresh, organic and locally grown food
  - consume less meat

- **Promote healthy exercise**
  - walk or cycle wherever you can
  - use public transportation
YOU YOUNG PEOPLE DON'T EVEN KNOW WHAT YOU'RE DOING!

AND YOU DO?

*FridaysForFuture

Hyderabad Children Protest – April 2019
An Ideal Form of Life