Extreme Heat and Physical / Mental Health among Adults in the United States

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Why is climate change a threat to 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
- Forced migration, civil conflict, mental health impacts
- Respiratory allergies, asthma
- Extreme heat
- Air pollution
- Changes in vector ecology
- Increasing allergens
- Sea level rise
- Rising temperatures
- More extreme weather
- Water quality impacts
- Water and food supply impacts
- Cholera, cryptosporidiosis, campylobacter, leptospirosis, harmful algal blooms
- Malnutrition, diarrheal disease
- Environmental degradation
Background

- Seven of the warmest years on record for the contiguous 48 states of the US have occurred since 2014
  - 2016 warmest on record
  - 2020 now ranked as the second warmest year in the available 141-year record
- Climate change will lead to more extreme weather events, including heat waves, storms, wildfires, drought…
- Example: as climate change leads to more days with extreme summertime temperatures, the burden of disease associated with heat is expected to increase
Temperature and physical health in the US

- The impact of extreme heat on physical health outcomes has been well documented
  - Direct effects – heat stroke, heat stress, edema, heat strain, heat rash, syncope
  - Indirect effects – stress on underlying physiological systems (patients with cardiovascular disease, renal insufficiency)
Temperature and mental health in the US

- Impacts of elevated temperature on specific mental health outcomes remain poorly understood.
- We quantified the association between ambient heat and mental health-related emergency department (ED) visits in the contiguous US among adults, overall and for specific causes.
- We also focus on effects among potentially sensitive subgroups:
  - Age, gender, region within the US.
Exposure data

- County-specific daily maximum ambient temperature
- Defined extreme heat as the 95th percentile of the county-specific warm-season temperature distribution
Outcomes data

- ~3.5 million ED visits for mental health among 2.2 million unique individuals
- Primary or secondary discharge psychiatric diagnosis
- OptumLabs® Data Warehouse
  - commercial and Medicare Advantage health insurance
  - adults aged 18 years and older
  - 2,775 US counties
Cumulative exposure-response curve and time course of association for overall MH
Childhood onset emotional and behavioral disorders

Adolescent-onset emotional and behavioral disorders

Mood disorders

Anxiety, stress, and somatoform disorders

Substance use disorders

Schizophrenia

Self-harm

Childhood onset emotional and behavioral disorders

Miscellaneous

Adult personality and behavior disorders

Incidence Rate Ratio

Odds Ratio

Warm Season Temperature Percentiles

Ambient temperature (°C)

9.2 25.7 31.4 39.4

9.2 25.7 31.4 39.4

0 25 50 75 100

0 25 50 75 100

0% 9.2% 25% 50% 75% 100%

0% 9.2% 25% 50% 75% 100%
Potential pathways?

- External stressors are well known to exacerbate existing mental health conditions.
  - Supported by our finding that heat was associated with a similar increase in the rate of ED visits for a variety of different mental health conditions; consistent with heat as an external stressor that is not specific to any given mental health condition.

- Disrupted sleep during periods of high ambient temperature, which may lead to adverse mental health outcomes

- Relatedly, daytime discomfort or irritation due to elevated temperature may be stressor that exacerbates preexisting conditions.
Potential pathways?

- Increase in hopelessness, maladaptive anxiety and stress due to the anticipation of climate change and associated extreme events
  - PTSD?
City of Boston, Climate Adaptation Plan
Example of adaptation strategy - cooling centers
Thank you!

- Questions?

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