Assessment of Extreme Heat and Hospitalizations to Inform Early Warning Systems

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The findings and conclusions in this presentation have not been formally disseminated by the Centers for Disease Control and Prevention and should not be construed to represent any agency determination or policy.
Heat-Health Activities: Background

Evaluating Extreme Heat (EHE)

Definitions Development of Exposure - Response (E-R) Profiles for Summertime Temperature Ranges


CDC-NOAA Joint Meeting (Silver Spring, MD)
Heat-Health Activities: Background

- Conduct heat-health risk assessments to support public health interventions
Heat - Health Activities: Partnerships

CDC: Centers for Disease Control and Prevention
NCEH: National Center for Environmental Health
AHRQ: Agency for Healthcare Research and Quality
LSHTM: London School of Hygiene and Tropical Medicine
CPR: Center for Preparedness and Response
NASA: National Aeronautics and Space Administration
NOAA: National Oceanic and Atmospheric Administration
NWS: National Weather Service
CPO: Climate Program Office
WFO: Weather Forecast Office

Regional
Local WFOs

State & Local
State & Local Health Dept.

Local Services Health Emergency

NOAA / NWS

Organizations Hospital Data

Academic Partners

Other NOAA offices (e.g., CPO)

Other NOAA

Other CDC offices (e.g., CPR)
Summary of Data Sources

- Meteorological / Environmental Data
- Health Data / Climate Regions

- Daily heat metrics and air pollutants (1999 - 2016)
- Hospital admissions data from 22 states (2003 - 2012)

Time period for this Study: 2003-2012

States with Health Data / Climate Regions
States with Environmental Data
Heat-Related Health Outcomes

Increasing Population Frequency

Emergency medical calls

Emergency department visits

Hospital admissions

Deaths

Cause-Specific Outcomes Identified for this Study

- Diabetes-related disorders
- Fluid and electrolyte imbalance
- Acute renal failure
- All respiratory diseases
- All cardiovascular-related diseases
- All-cause
Two-stage analysis to estimate heat-health risk relationships for hospitalizations

The first stage involved a county-level time-series quasi-Poisson regression using a distributed lag nonlinear model for the summer months (May through September 30) and pooled analysis conducted using standard meta-regression techniques to summarize county-specific risks across larger geographic scales.

Health risks estimated for a cumulative lag period of 2-3 days.

Second stage involves a pooled analysis:

- Controls for air pollution, seasonality, long-term trends, day of the week, etc.
- Health outcomes reflected on local epidemiology/county-level results
Results: E-R Relationships
Results: Evaluation of Existing Heat Alert Criteria

Legend:

- New York (Northeast)
- Georgia (Southeast)

Graphs showing the impact of daily maximum heat index on hospitalizations.
Results: Health Burden Associated with Heat Exposure

All-cause ED visits and hospitalizations associated with heat exposure, per summer (May – Sep)

Georgia (Southeast)

New York (Northeast)
**Results:**

Region-Specific Heat-Sensitive Zones

<table>
<thead>
<tr>
<th>Region</th>
<th>Heat-Sensitive Zones</th>
<th>Specific Heat of Heat-Sensitive Zones</th>
</tr>
</thead>
<tbody>
<tr>
<td>Central</td>
<td>Renal Failure</td>
<td>Fluid and Electrolyte</td>
</tr>
<tr>
<td></td>
<td>Diabetes</td>
<td>All Respiratory</td>
</tr>
<tr>
<td></td>
<td>All Cardiovascular</td>
<td>All-Causes</td>
</tr>
</tbody>
</table>

Heat index ranges used for issuing alerts:
- Heat index ranges with positively significant peak heat-attributable health risk / burden are observed.
Results: Region-Specific Heat-Sensitive Zones

Risk sensitivity (slope) and magnitude of cause-specific E-R associations tend to differ across heat-related health outcomes which in colder regions are well below the alert ranges used by the National Weather Service.

Heat-related illnesses start to occur at moderate heat-index values, chosen for this study.

The findings highlight opportunities for using local epidemiological data to refine heat-alert criteria and to potentially reduce the substantial burden of disease associated with extreme heat.
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