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BACKGROUND


Chicago Tribune, 7/18/1995

• Heat waves: biggest weather-related killer
  – 500 deaths due to 1995 Chicago heat wave (Kaiser et al. 2007)
  – >30,000 deaths due to 2003 heat wave in Europe (Kosatsky 2005)
  – 9,000 deaths due to 2010 Moscow heat wave (Shaposhnikov 2014)
  – Demographic shifts to increase the number of people vulnerable to heat waves (e.g., the elderly, people living in urban areas) (O’Neill and Ebi 2009).
BACKGROUND


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- Previously identified characteristics of vulnerability include: advanced age, black race, poverty, lack of air conditioning, living alone, lack of green space (which provides shade and reduces ambient temperature) and low educational level.
BACKGROUND

- Race/ethnicity
- Education
- Income
- Occupation

- Cardio-respiratory, renal and endocrine health
- Mental health or cognitive or physical disability

- Medication use
- Housing characteristics
- Private air conditioning use
- Opening windows/using fans
- Use of cool public spaces
- Urban heat island

- Social isolation
- Crime and safety
- Heat risk perception
- Cultural/Linguistic isolation

- Physiologic response to heat
- Heat exposure

- Adverse health effects of heat
BACKGROUND

- These characteristics have been used to construct vulnerability maps which could help cities determine where to focus resources during extreme heat.

RESEARCH QUESTION

Michigan, a state with a cool climate and relatively low air conditioning prevalence, has been shown to have high vulnerability to heat.

Which individual-level and ZIP code-level characteristics affect vulnerability to mortality during extreme heat in Michigan?
ANALYSIS STEPS

1. Defined “extreme heat” in Michigan.
2. Assessed vulnerability by each characteristic individually.
3. Assessed vulnerability by each characteristic, controlling for the other characteristics.
DATA

- Death records with ZIP code of residence for 8 Michigan cities, May-September, 1990-2007 (94,000 deaths)
- daily temperature for each city
- Decennial Census and American Community Survey sociodemographic characteristics by ZIP code
- 30 x 30 m resolution land cover classifications which we further classified as “green space” vs. “non-green space” and aggregated by ZIP code
## RESULTS

Correlations among ZIP code characteristics

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<th>Poverty</th>
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<th>&gt;= 75</th>
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</tbody>
</table>
RESULTS

Association between natural-cause mortality among individuals 65 years and older and two-day apparent temperature (AT) on lag days 0-1 and 2-3, Detroit, Michigan, 1990-2007.
RESULTS

Odds ratios (ORs) and 95% confidence intervals for the odds of mortality during extreme heat vs. non-extreme heat.
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Odds ratios (ORs) and 95% confidence intervals for the odds of mortality during extreme heat vs. non-extreme heat.
CONCLUSIONS

• Percent non-green space may increase vulnerability to extreme heat
• Social isolation (being unmarried) may increase vulnerability to extreme heat
• Method to identify vulnerable populations
• Future research:
  – use finer geographic scale information, and
  – modifiers of morbidity and extreme heat association.
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