Predicting and Preparing for the Public Health Impacts of Climate Change in California

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Presented at the Impact Relevance and Usability of High Resolution Climate Modeling and Datasets
Aspen Global Change Institute, August 5, 2015
Outline

- Climate Change, Health and Health Equity
- California Use Cases of Climate Data in Public Health
- Public Health Programs
- Relevance/Barriers
What is the existing burden of disease?

What are the existing inequities in health outcomes?

What is producing population vulnerabilities and inequities in the health outcomes?

How will climate change impact health outcomes and the factors producing health inequities?

“Climate change will, absent other changes, amplify some of the existing health threats the nation now faces. Certain people and communities are especially vulnerable, including children, the elderly, the sick, the poor, and some communities of color.” - 3rd National Assessment of Climate Change, 2014
“How serious of a threat is global warming to the economy and quality of life for California’?”

Burden of Disease and Injuries: Leading Causes of Death, California

![Graph showing age-adjusted rate per 100,000 population for various causes of death over time. The causes include Heart disease, Cancer, Stroke, Respiratory disease, Unintentional injuries, Alzheimer's disease, Diabetes, and Influenza & pneumonia. The data is from California Department of Public Health, Vital Records, 2012.]
Health disparities are pervasive and occur between and within communities

A White child from the Oakland Hills can expect to live to 85 years old, whereas an African-American child living in West Oakland—just a few miles away—can expect to live only to 70.

<table>
<thead>
<tr>
<th>The child from West Oakland is:</th>
<th>As an adult, he or she is:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• 1.5 times more likely to be born prematurely</td>
<td>• 5 times more likely to be hospitalized for diabetes</td>
</tr>
<tr>
<td>• 7 times more likely to be born into poverty</td>
<td>• 2 times more likely to be hospitalized for heart disease</td>
</tr>
<tr>
<td>• 2 times as likely to live in a home that is rented</td>
<td>• 2 times more likely to die of heart disease</td>
</tr>
<tr>
<td>• 4 times more likely to have parents with only a high-school education</td>
<td>• 3 times more likely to die of stroke</td>
</tr>
<tr>
<td>• 2.5 times more likely to be behind in childhood vaccinations</td>
<td>• 2 times as likely to die of cancer</td>
</tr>
<tr>
<td>• 4 times less likely to read at grade level by fourth grade</td>
<td></td>
</tr>
<tr>
<td>• 4 times as likely to live in a neighborhood with double the density of liquor stores and fast food outlets</td>
<td></td>
</tr>
<tr>
<td>• 5.6 times more likely to drop out of school</td>
<td></td>
</tr>
</tbody>
</table>

Life Expectancy by Census Tract, Alameda County, 2000

<table>
<thead>
<tr>
<th>West Oakland</th>
<th>Oakland Hills</th>
</tr>
</thead>
<tbody>
<tr>
<td>High school grad</td>
<td>65%</td>
</tr>
<tr>
<td>Unemployment</td>
<td>12</td>
</tr>
<tr>
<td>Poverty</td>
<td>25</td>
</tr>
<tr>
<td>Home ownership</td>
<td>38</td>
</tr>
<tr>
<td>Non-White</td>
<td>89</td>
</tr>
</tbody>
</table>

Sources: Alameda County Public Health Department, 2008, 2012
What is producing population vulnerabilities and inequities in the health outcomes?

- Disparities in health determinants mirror health disparities
- Climate change will impact along this continuum
- Indirect impacts on health through human systems and ecosystem perturbations may eclipse direct impacts of environmental exposures (via food/economic insecurity)
- A population that has a high burden of chronic disease (heart disease, obesity, diabetes, asthma, mental health, etc.) is not as climate-resilient as a population with a low burden

Source: Robert Wood Johnson/University of Wisconsin, Commission for a Healthier America, County Health Rankings, 2012
California Use Case: State Agency Response

Downscaled data
- 4 models
- A2/B1 SRES
- Climate risks: temperature, sea level, precipitation, snowpack, wildfire

Statewide Adaptation Strategy and Guidance

Statewide Planning

4 Volumes, 285 p

BRACE funding

Priorities
- Sea Level Rise
- Heat
- Wildfire

Catalogue of public health impacts
2 Volumes, 540 p

- 58 County Climate & Health Profiles, 16p
- Census tract vulnerability assessment
- Burden of disease projections
Cal-Adapt Content in California County Health and Climate Profile Reports

- **Heat**
  - Ave, Min, Max (mo., annual, decadal)
  - Extreme Heat Days
  - Heat waves

- **Sea Level Rise**
  - 100 year flood + 50, 100, 140 cm rise

- **Wild Fires**
  - Relative change from baseline
## Vulnerable/Disadvantaged Populations and Spatial Resolution of Statewide Data Sources

<table>
<thead>
<tr>
<th>Climate Change Vulnerability Indicators, CalBRACE CDPH</th>
<th>Resolution</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Exposure and Environment Domain (current &amp; projected)</strong></td>
<td></td>
</tr>
<tr>
<td>Heat (mean, min, max, extreme heat days, heat waves) - projected</td>
<td>7.5 mi grid</td>
</tr>
<tr>
<td>Risk of wildfire &gt;200 hectares (projected risk)</td>
<td>7.5 mi grid</td>
</tr>
<tr>
<td>Percent of the population living in 100-year flood zone</td>
<td>Census block</td>
</tr>
<tr>
<td>Percent of population currently living in high risk wildfire zone</td>
<td>Census block</td>
</tr>
<tr>
<td>Annual average PM2.5 concentration (µg/m³)</td>
<td>Census tract</td>
</tr>
<tr>
<td>Unhealthy days of ozone exposure</td>
<td>Census tract</td>
</tr>
<tr>
<td><strong>Population Sensitivities Domain (current)</strong></td>
<td></td>
</tr>
<tr>
<td>Children aged &lt; 5 years</td>
<td>CT</td>
</tr>
<tr>
<td>Adults aged ≥ 65 years</td>
<td>CT</td>
</tr>
<tr>
<td>Educational attainment</td>
<td>CT</td>
</tr>
<tr>
<td>Population living below federal poverty level</td>
<td>CT</td>
</tr>
<tr>
<td>Race/ethnicity</td>
<td>Census block</td>
</tr>
<tr>
<td>Households paying &gt;30% (or 50%) of income for housing costs</td>
<td>CT</td>
</tr>
<tr>
<td>Jobs working outdoors</td>
<td>CT</td>
</tr>
<tr>
<td>Car ownership</td>
<td>CT</td>
</tr>
<tr>
<td>Linguistic isolation</td>
<td>CT</td>
</tr>
<tr>
<td>Comorbidities</td>
<td>County</td>
</tr>
<tr>
<td>Population living with a disability</td>
<td>CT</td>
</tr>
<tr>
<td>Health care access</td>
<td>CT/Zip code</td>
</tr>
<tr>
<td><strong>Adaptive Capacity Domain (current)</strong></td>
<td></td>
</tr>
<tr>
<td>Air conditioning ownership</td>
<td>Zip code</td>
</tr>
<tr>
<td>Impervious surfaces</td>
<td>30 m</td>
</tr>
<tr>
<td>Tree canopy</td>
<td>30 m</td>
</tr>
<tr>
<td>Population residing &lt;½ miles of transit stop with headway &lt;15 min.</td>
<td>Census block</td>
</tr>
</tbody>
</table>
Overlay of Climate Risks and Vulnerable/Disadvantaged Populations (Census tract)

- Single Factor

- Cumulative Index

Sources: California Department of Public Health
Predictive Modeling of Health Outcomes and Climate Change Scenarios (county level)

- Comparative Risk Assessment models

Comparing 2025 and 2050 Estimated Temperature-Related Mortality with Projected 2025 Disease-Specific Mortality (in thousands)

Technical/Methodologic Issues in Using Climate Projections and Health Data

- Geospatial resolution and limits of statistical reliability of many health data sets are between census tract and county in California.

- To maintain a consistent resolution, health and population data may require statistical downscaling - not common in PH practice or research.

- Linking health (models) to other sectors’ models:
  - Air shed models of PM$_{2.5}$ linked to models of regional transport of wildfire emissions.
  - Land use and travel demand models used in urban and regional transportation planning (MPOs):
    - Creation/exacerbation of urban heat islands from smart growth strategies to reduce GHG emissions in housing-transportation.
    - Coordination of adaptation and mitigation strategies.

- Vulnerable populations in specific geo-spatial settings:
  - E.g., residents in an urban heat island or micro-environment (top floor of heat absorbing building).

Public Health Core Functions and 10 Essential Services

Source of Ten Essential Public Health Services: Core Public Health Functions Steering Committee, 1994
Where Does Climate Change Fit in Public Health Practice?

- Emergency preparedness
- Built environment/healthy planning
- Health equity/vulnerable populations
- Environmental health
- Epidemiology/health policy
- Health promotion/chronic disease
- Nutrition, local food security, urban agriculture, farmer’s markets
- Health education, community education/engagement
- Infectious disease/vector borne disease
- Public Health Nursing
- All programs are touched!
Strengths of Local Health Departments

- Know and work with disadvantaged communities
- Communications expertise on health issues
- Role of downscaled climate data
  - Creates engagement by localizing/personalizing impacts
  - Inputs to adaptation planning/public health preparedness
  - Communications
    - Localizing impacts
    - Needs to be tied to relevant and meaningful action ("So, what am I supposed to do?"))
Barriers Faced by Local Health Departments for Engagement on Climate Change

- Inadequate funding and categorical constraints in programs
  - “Climate specialists” vs. building capacity into existing programs
  - California AB32/Cap & Trade funding for mitigation, not adaptation
- Start-up: health departments struggle with where to start
  - No single entry-point or model of engagement
- Framed as an environmental, rather than health issue
- Lack of internal education on climate and health, and tools
- Existing climate projections and data are highly technical and often not accessible and underutilized
- Challenged and/or unengaged leadership
- Political: in some locales, climate change cannot be openly discussed
Summary and Conclusion

- Data are sufficient to take immediate actions on mitigation and adaptation.

- In general, public health does not suffer a “science deficit disorder” with downscaled climate projections at 1/8°. For some jurisdictions, additional downscaling would be welcome.

- Data are often:
  - Not accessible to many public health staff
  - Not linked to programmatic activities

- Existing data are underutilized

- Data translation into useful information is needed for a range of internal and external public health audiences

- Public health departments are:
  - interested in climate change
  - few are actively engaged, but momentum is building
  - impacted by resource and political constraints

* * * * * Thanks * * * * *