Climate Change & Health
A Framework for Action

Linda Rudolph, MD, MPH
CAT Public Health Work Group
May 1, 2014
“Climate change is the biggest global health threat of the 21st century... The impacts will be felt all around the world – and not just in some distant future but in our lifetimes and those of our children.”

The Lancet
Why aren’t we doing more?

- No funding, no resources
- No mandate, not our job, silos
- Lack capacity
  - Funding, resources, knowledge, expertise
- Lack leadership
- Competing priorities
  - Tyranny of the urgent
- **Unclear exactly how this relates to what we do now**
- **Unclear what exactly we can do**
Physical Environments
Social Environments
Economic Environments
Place Matters
What are Health Inequities?

Differences in health that are unnecessary, avoidable, unfair and unjust.

A PUBLIC HEALTH FRAMEWORK FOR REDUCING HEALTH INEQUITIES

UPSTREAM

SOCIAL INEQUITIES
- Class
- Race/Ethnicity
- Immigration Status
- Gender
- Sexual Orientation

INSTITUTIONAL POWER
- Corporations & Businesses
- Government
- Nonprofit Organizations
- Not-for-Profit Organizations

LIVING CONDITIONS
- Physical Environment
  - Land use
  - Transportation
  - Housing
  - Residential Segregation
  - Exposure to Toxins
- Social Environment
  - Economic & Work Environment
  - Employment
  - Income
  - Retail Businesses
  - Occupational Hazards
  - Service Environment
  - Health Care
  - Education
  - Social Services

RISK BEHAVIORS
- Risk Behaviors
  - Smoking
  - Poor nutrition
  - Low physical activity
- Violence
- Mental & Other Drugs
- Sexual behavior

DISEASE & INJURY
- Communicable Disease
- Chronic Disease
- Injury (Intentional & Unintentional)

MORTALITY
- Infant Mortality
- Life Expectancy

DOWNSTREAM

Strategic Partnerships
Advocacy

Community Capacity Building
Community Organizing
Civic Engagement

Emerging Public Health Practice

Case Management
Health Care

Policy

Current Public Health Practice
Climate Change and Health: A Framework for Action

Health Processes and Strategies

Living Conditions → Health Risks and Exposures

Health Behaviors

Health & Inequities Impacts

Social Inequities

Systems

Institutional Power

Disability and Death

Health and Social Costs

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L’Rudolph April 2014
Climate Change and Health: A Framework for Action

Health Processes and Strategies

- Living Conditions
- Health Education
- Risk Reduction/Safety Net
- Health Behaviors
- Health Risks and Exposures
- Medical Care/Case Management
- Public Health Preparedness
- Health & Inequities Impacts

Community Capacity Building
- Social Inequities
- Healthy Communities Strategies
- Policy, Systems, and Environmental Change

Community Engagement
- Systems

Partnerships
- Institutional Power
- Intervention strategies

Advocacy
- Communication
- Surveillance and Monitoring

Surveillance and Monitoring

Health and Social Costs
- Disability and Death

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Natural and Human Influences on Climate

Climate Variability and Change
- Extreme Weather
  - Temperature
  - Precipitation

Regional and Local Weather Change

Change in Sea Level

Adverse Health Effects
- Heat-Related Illnesses and Deaths
- Extreme Weather-Related Health Effects
- Air Pollution-Related Health Effects
- Allergic Diseases
- Infectious Diseases
  - Water- and Food-Borne Diseases
  - Vector- and Rodent-Borne Diseases
- Malnutrition
- Storm Surge-Related Drowning and Injuries
- Health Problems of Displaced Populations

Moderating Influences and Adaptation Measures

Mitigation Policies for Reduction of Greenhouse Gas Emissions
- Energy Efficiency
- Use of Renewable Energy Sources
- Forest Preservation

Moderating Influences
- Population Density and Growth
- Level of Technological Development
- Standard of Living and Local Environmental Condition
- Preexisting Health Status
- Quality and Access to Health Care
- Public Health Infrastructure

Adaptation Measures
- Vaccination Programs
- Disease Surveillance
- Protective Technologies
- Weather Forecasting and Warning Systems
- Emergency Management and Disaster Preparedness
- Public Health Education and Prevention
- Legislation and Administration

Rudolph April 2014
Sea-Level Rise for the Coasts of California, Oregon, and Washington: Past, Present, and Future

6” by 2030, 12” by 2050, 36” by 2100
2012 WAS THE SECOND MOST EXTREME YEAR ON RECORD FOR THE NATION

RECORD HEAT ACROSS THE U.S.
STATE-BY-STATE TEMPERATURES IN 2012

WARMEST YEAR ON RECORD FOR THE U.S.
356
RECORD HIGH TEMPERATURES TIED OR BROKEN

APPROXIMATELY ONE-THIRD OF THE U.S. POPULATION EXPERIENCED 100° TEMPERATURES FOR THE WHOLE DAY.

CURRENT AND PROJECTED TEMPERATURE EXTREMES FOR THE LOS ANGELES AREA

Average annual days exceeding 95 degrees F

Current temperatures:
- Baldwin Hills: 0.3 days
- Downtown LA: 1.4 days
- Eagle Rock: 1.4 days
- El Sereno: 2.3 days
- Hollywood: 1.0 days
- Porter Ranch: 1.6 days
- San Pedro: 0.6 days
- San Pedro: 4.6 days
- Sunland: 2.3 days
- Sylmar: 2.3 days
- Venice: 0.9 days
- Watts: 1.0 days
- Westwood: 1.4 days
- Woodland Hills: 3.3 days

Projected temperatures (2041-2060 ensemble projection):
- Baldwin Hills: 0.9 days
- Downtown LA: 2.5 days
- Eagle Rock: 4.6 days
- El Sereno: 6.8 days
- Hollywood: 6.4 days
- Porter Ranch: 8.0 days
- San Pedro: 2.5 days
- San Pedro: 30.1 days
- Sunland: 2.0 days
- Sylmar: 6.8 days
- Venice: 0.9 days
- Watts: 3.0 days
- Westwood: 10.9 days
- Woodland Hills: 25.5 days

Historical Average: 63.5 °F
Low-Emissions Scenario: 67.2 °F +3.7 °F
High-Emissions Scenario: 70.0 °F +6.5 °F

Observed and Projected Temperatures

UCLA LARC 2012
Higher Temperatures Worsen Air Pollution

Ozone versus Temperature

R² = 0.80

California Ozone Standard

Daily Maximum Temperature (°F)

Daily Maximum 1-hr Ozone (ppb)

R² = 0.82

California Ozone Standard

Daily Maximum Temperature (°F)

Daily Maximum 1-hr Ozone (ppb)

Riverside, 2003-2005

Fresno, 2003-2005

Photo: Tudor Van Hampton / ENR
# Health-Care Costs of Climate Events

<table>
<thead>
<tr>
<th>Climate-related health stressor</th>
<th>Premature Deaths</th>
<th>Hospitalizations</th>
<th>Total Health-care Costs $$ (thousands)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ozone pollution</td>
<td>795</td>
<td>4,150</td>
<td>6,534,642</td>
</tr>
</tbody>
</table>

Knowlton, Health Affairs, 2011
Mitigation to cut GHG emissions
- Clean renewable energy
- Fuel/energy efficiency
- Reduce VMTs
- Low carbon fuels
- Forest preservation
- Reduced meat consumption

Moderating influences
- PH infrastructure
- Health services
- Population health status
- Level of development
- Population density

Adaptation measures to reduce impacts of climate change
- Infrastructure
- Warnings, surveillance
- Preparedness/recovery
- Sustainable agriculture
- Urban greening

Climate Change and Health: A Framework for Action

Climate Processes and Strategies

- Social Inequities
  - Systems
  - Institutional Power

Climate Behaviors

- Greenhouse Gas Emissions
- Global Climate Impacts
- Local Climate Impacts
- Intermediate Factors
- Climate Change Health & Inequities Impacts

Disability and Death
- Health and Social Costs

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Climate Change and Health: A Framework for Action

Policy, Systems, and Environmental Change

Greenhouse Gas Emissions

Climate Behaviors

Global Climate Impacts

Local Climate Impacts

Intermediate Factors

Climate Change Health & Inequities Impacts

Disability and Death

Health and Social Costs

Mitigation

Geo-engineering

Adaptation

Climate Preparedness

Disaster Recovery

Institutional Power

Social Inequities

Community Capacity Building

Community Engagement

Partnerships

Advocacy

Communications

Surveillance and Monitoring

Systems

Intervention strategies

Climate Processes and Strategies

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Climate Change and Health: A Framework for Action

Climate Processes and Strategies

- Social Inequities
- Systems
- Institutional Power
- Other Environmental Impacts
- Greenhouse Gas Emissions
- Climate Behaviors
- Global Climate Impacts
- Local Climate Impacts
- Intermediate Factors
- Climate Change Health & Inequities Impacts

Disability and Death
Health and Social Costs

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Vulnerability & Resilience

• **Vulnerability**
  - the degree to which geophysical, biological and socio-economic systems are susceptible to, and unable to cope with, adverse impacts of ecological or climate change
  - human populations at higher risk, due to both environmental and individual factors

• **Resilience**
  - the capacity of an ecosystem to respond to a disturbance – for example a flood or drought or pest invasion - by resisting damage and recovering
  - the capacity of an individual, community, or institution to dynamically and effectively respond to shifting climate impact circumstances while continuing to function and prosper

• Characteristics of resilience or vulnerability co-exist at the same time in any community or individual.

• Together, the intersection of resources, including social connection, coping mechanisms, exposures, and susceptibility that will determine the extent to which climate change impacts health and well-being.
## Individual & Community Climate Vulnerability & Resilience

<table>
<thead>
<tr>
<th>Category</th>
<th>Details</th>
</tr>
</thead>
<tbody>
<tr>
<td>Population health status</td>
<td></td>
</tr>
<tr>
<td>Public health infrastructure</td>
<td></td>
</tr>
<tr>
<td>Government function</td>
<td>• Health, social services</td>
</tr>
<tr>
<td>Food systems</td>
<td></td>
</tr>
<tr>
<td>Infrastructure</td>
<td>• Transportation, housing</td>
</tr>
<tr>
<td>Economic status</td>
<td>• Social support</td>
</tr>
<tr>
<td>Population density</td>
<td>• Population density</td>
</tr>
</tbody>
</table>
The Climate Gap
Climate Change and Health: A Framework for Action

Health Processes and Strategies
- Living Conditions: Healthy Communities Strategies
- Health Education: Risk Reduction
- Health Risks and Exposures: Safety Net
- Medical Care / Case Management: Public Health Preparedness
- Health & Inequities Impacts:

Individual and Community Climate Change Vulnerability or Resilience
- Disability and Death: Health and Social Costs
- Disaster Recovery:

Mitigation
- Climate Education: Climate Behaviors
- Geo-engineering: Adaptation
- Climate Preparedness:

Institutional Power
- Social Inequities: Policy, Systems, and Environmental Change
- Community Engagement
- Partnerships
- Advocacy
- Communications
- Surveillance and Monitoring

Community Capacity Building

Climate Processes and Strategies
- Other Environmental Impacts: Greenhouse Gas Emissions
- Global Climate Impacts
- Local Climate Impacts
- Intermediate Factors
- Climate Change Health & Inequities Impacts

Risk Reduction
- Health Behaviors:

Intervention strategies

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Climate Change and Health: A Framework for Action

Health Processes and Strategies

- Living Conditions
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- Health & Inequities Impacts

Community Capacity Building
- Community Engagement
- Partnerships
- Advocacy
- Communications
- Surveillance and Monitoring

Social Inequities

Policy, Systems, and Environmental Change

Community Engagement

Partnerships

Advocacy

Communications

Surveillance and Monitoring

Institutional Power

Intervention strategies

Climate Processes and Strategies

- Mitigation
- Climate Education
- Climate Behaviors
- Geo-engineering
- Adaptation
- Climate Preparedness
- Disaster Recovery

Greenhouse Gas Emissions

Global Climate Impacts

Local Climate Impacts

Intermediate Factors

Climate Change Health & Inequities Impacts

Other Environmental Impacts

Local Climate Impacts

Global Climate Impacts

Intermediate Factors

Climate Change Health & Inequities Impacts

Disability and Death

Health and Social Costs

Health Co-Benefits or Adverse Health Consequences

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# Active Transportation Co-Benefits

<table>
<thead>
<tr>
<th>Reductions</th>
<th>Avoidable increases</th>
</tr>
</thead>
<tbody>
<tr>
<td>- Air pollution</td>
<td>- Bike/ped injuries</td>
</tr>
<tr>
<td>- Noise</td>
<td></td>
</tr>
<tr>
<td>- Infrastructure costs</td>
<td></td>
</tr>
<tr>
<td>- Community severance</td>
<td></td>
</tr>
<tr>
<td>- GHG emissions</td>
<td></td>
</tr>
<tr>
<td>- Respiratory disease</td>
<td></td>
</tr>
<tr>
<td>- Cardiovascular disease</td>
<td></td>
</tr>
<tr>
<td>- Diabetes</td>
<td></td>
</tr>
<tr>
<td>- Depression</td>
<td></td>
</tr>
<tr>
<td>- Osteoporosis</td>
<td></td>
</tr>
<tr>
<td>- Cancer Stress</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Increases</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Physical activity</td>
<td></td>
</tr>
<tr>
<td>- Social capital</td>
<td></td>
</tr>
<tr>
<td>- Bike/ped injuries</td>
<td></td>
</tr>
</tbody>
</table>
Co-benefits of Sustainable, Local Food Systems

<table>
<thead>
<tr>
<th>Reductions</th>
<th>Increases</th>
</tr>
</thead>
<tbody>
<tr>
<td>- GHG emissions</td>
<td>- Access affordable healthy food</td>
</tr>
<tr>
<td>- Pesticide use</td>
<td>- Rural community strength</td>
</tr>
<tr>
<td>- Synthetic fertilizer use</td>
<td>- Agricultural land preservation</td>
</tr>
<tr>
<td>- Food miles</td>
<td></td>
</tr>
<tr>
<td>- Antibiotic use</td>
<td></td>
</tr>
<tr>
<td>- Water pollution</td>
<td></td>
</tr>
<tr>
<td>- Soil erosion</td>
<td></td>
</tr>
<tr>
<td>- Biodiversity loss</td>
<td></td>
</tr>
<tr>
<td>- Meat consumption</td>
<td></td>
</tr>
<tr>
<td>- Unsustainable H2O consumption</td>
<td></td>
</tr>
</tbody>
</table>

- Obesity
- Cardiovascular disease
- Cancer (breast, prostate, colorectal)
- Type II Diabetes
- Antibiotic resistance
- Pesticide illness
Heat Resilience Co-Benefits

• Urban greening
  • Places to be active
  • Healthy food access
  • Reduce storm water run-off
  • Decrease flooding risk
  • Replenish groundwater
  • Improve aesthetics
  • Reduce crime

• Reduce heat island effect
  • Reduce heat illness risk
  • Decrease energy consumption
  • Lower energy costs
  • Reduce air pollution
Climate Change and Health

- Climate change has direct impacts on health & well-being
- Climate change is a threat multiplier
  - Climate change exacerbates existing health challenges
- Climate change effects the systems on which human life depends – air, water, food, shelter, security.
- Climate change disproportionately impacts vulnerable populations and disadvantaged communities
- **Co-benefits offer many opportunities to simultaneously improve health and address climate change**
Mitigation - IPCC 5th Report

- Human-caused CAPS continue to increase (1970-2010);
- Current actions are not consistent with keeping temperature increase to less than 2°C;
- Without additional measures, project 3.7 to 4.8°C increase in global mean temperature in 2100 (high confidence);
- Require substantial cuts in emissions by mid-century through large-scale changes in energy systems and possibly land use;
- Delaying more robust GHG emissions reductions through 2030 will substantially increase difficulty of transition, costs, and narrow options.

http://www.ipcc.ch
Public believes climate change is happening & wants government to act now

<table>
<thead>
<tr>
<th>Topic</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>There is scientific consensus for climate change</td>
<td>62%</td>
</tr>
<tr>
<td>Republicans</td>
<td>69%</td>
</tr>
<tr>
<td>Tea Party supporters</td>
<td>58%</td>
</tr>
<tr>
<td>African-Americans</td>
<td>86%</td>
</tr>
<tr>
<td>Effects happening now</td>
<td>54%</td>
</tr>
<tr>
<td>Willing to assume costs to address climate change</td>
<td>88%</td>
</tr>
<tr>
<td>Believe climate change preparedness create jobs</td>
<td>60%</td>
</tr>
<tr>
<td>Local government and states should act</td>
<td>82%</td>
</tr>
</tbody>
</table>
• Climate change is a public health emergency

• It is our professional and moral responsibility to act now.
Thank you.

Linda Rudolph, MD, MH

linda.rudolph@phi.org