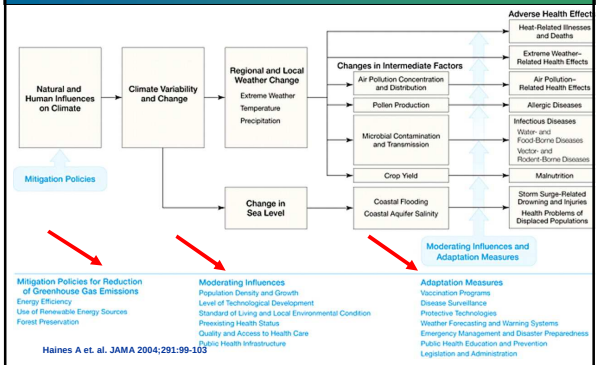
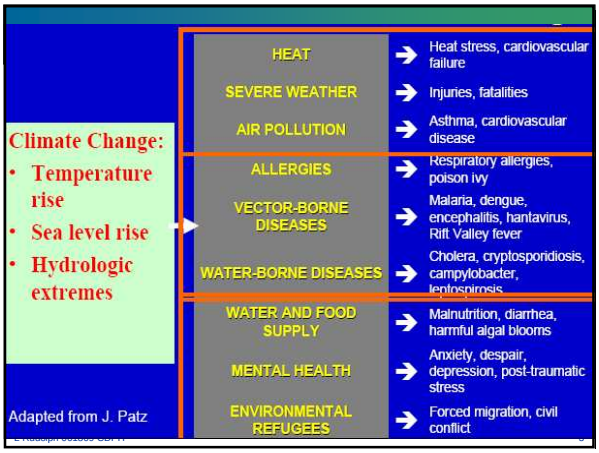
Climate Change:
The Public Health Response

Linda Rudolph, MD, MPH
June 18, 2009

Opportunities for Public Health Intervention



Haines A et. al. JAMA 2004;291:99-103

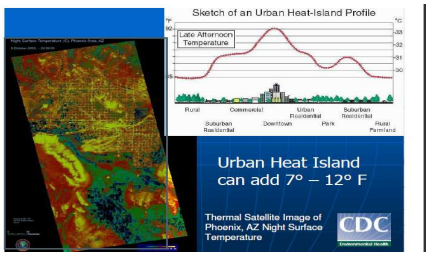


Vulnerability Assessment

- Vulnerability Assessment
  - Exposure to climate change
    - Varies by geography
    - Requires "downscaling" to local communities
  - Sensitivity to climate change
    - Varies by individual
      - Age, pre-existing illness
      - Fair skin and sun damage with reduced stratospheric ozone
    - Varies by community
      - Urban, housing stock, infrastructure
  - Preparedness and response capacity
    - Varies by individual and community ability to minimize adverse consequences
      - Social network, access to services
  - Health impacts

Heat and Urban Heat Islands

- Estimate 70,000 deaths Europe 2003
- Estimate 655 excess deaths California summer 2006



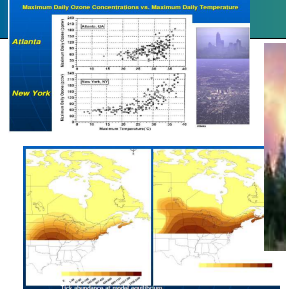
OEHHA Studies: Direct Health Effects of Higher Temperature

- Higher temperature and mortality (Epidemiol, 2008)
- Examining mortality susceptible subgroups (Am J Epidemiol, 2008)
- The mortality effects of the 2006 heat wave (Env Research, 2009)
- Higher temperature and hospital admissions (Int J Pub Health, forthcoming)

Climate Change and Pesticides

Climate change may have impacts on pest pressures:

- *Increased pest pressure may increase pesticide use (for both agricultural and home-use pesticides)*
- *Invasive pests may establish more easily therefore the need for controlling those pests with pesticide products may increase.*
- *Weather changes impact seasonality of infectious disease vectors (mosquitoes, ticks, fleas, etc) and the use of pesticides to control those vectors may increase.*



Extreme Precipitation

Lyme Disease Distribution Over Time

Public Health Adaptation Strategies

- Promote community resilience to reduce vulnerability
- Educate, empower, engage to take action
- Promote mitigation/adaptation with PH co-benefits
- Robust rapid surveillance systems
- Improve PH preparedness & response capacity
- Lead by example

- Cross-sectoral partnerships
- Research
- Multi-level policy change
- Resources – staff & funding

Promote community resilience

- Promote built environments that mitigate climate change and/or reduce impact of climate change on health
  - Smart growth
  - Open space & parks
  - Buildings designed to weather wildfire
  - Reduce urban heat islands
    - Trees, cool roofs/green roofs, cool pavement
  - Reduce flood risk
    - Permeable surfaces, modernize sewage systems
- Reduce baseline exposures to toxic air and water pollutants
- Promote sustainable local food systems
- Promote strong social support networks
- Enhance public health infrastructure

Environmental Justice – Global and Local

- Global equity
  - US = 1/20 world population but 28% GHGs in atmosphere
  - Natural debt per capita: US 135 tons C vs India 4 tons
  - Climate change impacts most severe in low income countries
    - Billions of poor lack basics (e.g. electricity, adequate protein intake)
- Contraction and convergence
- Local environmental justice
  - Climate impacts likely to most impact low-income, communities of color

Promote mitigation/adaptation with co-benefits

- Health Impact Assessments on proposed mitigation and adaptation strategies
  - Impacts on vulnerable populations
  - Cumulative health impacts
- Health and public health participation in policy discussions

Key Mitigation Technologies & Practices

- Transport
  - Fuel efficiency
  - Hybrids
  - Road to rail
  - **Public transport**
  - **Non-motorized transport**
  - **Land-use planning**
- Buildings
  - **Green building**
  - **Energy efficiency**
  - **Daylighting**
  - **Improved cook stoves**
  - Solar heating & cooling
- Agriculture
  - Crop & land management
  - **Livestock & manure management**
  - **Improved N fertilizer use**
- Industry
  - Energy efficiency
  - Heat & power recovery
- Energy supply
  - Coal to gas
  - Nuclear power
  - **Renewable energy**

Transportation Sector Mitigation Strategies & Co-Benefits

Mitigation strategies	Effects	Health Co-Benefits
• Fuel efficiency • Hybrids • Biofuels	Reduced: • GHG emissions • Air pollution	Reductions in: • Respiratory disease • Heart disease
• Public transport • Active transport • Land-use planning • Reduce speed	• Noise • Community Severance Increased: • Physical Activity • Social Capital	• Traffic injuries • Depression • Osteoporosis • Diabetes • Cancer • Stress

Co-Benefits of Adaptation Strategies

- Reducing Urban Heat Islands
  - Cool roofs, cool paving, urban trees
- Urban trees also
  - Reduce electricity consumption (shading)
  - Improve air quality
    - Absorb polluting gases
    - Attach PM to leaves
  - Reduce ozone levels (with cooling)
  - Improve quality of life – reduce stress

Robust surveillance

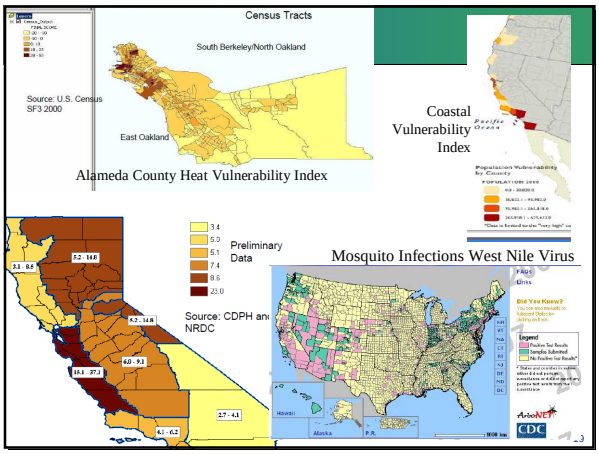
- Environmental conditions
  - Heat
  - Air pollution
  - Vectors
  - Water contamination
- Climate-related illness
  - Real-time
  - Post-disaster
- Vulnerabilities and protective factors
  - Chronic disease
  - Social support networks
- Adaptive capacities
  - Access to cooling centers

Environmental Health Indicators of Climate Change
(CSTE – P English)

- Quantitative summary measures to track changes over time
  - assess climate change determinants of health
  - identify areas for intervention and prevention
  - evaluate the outcomes of specific policies or programs
  - project the impacts of climate change on human health
- Holistic approach
  - environmental, health outcome, vulnerability, public policy indicators

Environmental Health Climate Change Indicators

- Environmental Indicators
  - GHG emissions, ozone, air mass stagnation events, max/min temps, heat index, pollen counts/ragweed, wildfire frequency/severity/distribution/duration, droughts – precipitation index, surface water supply index, harmful algae blooms, shellfish poisonings
- Health outcomes indicators
  - Excess M/M due to heat, M/M extreme weather events, human cases infectious disease/positive tests reservoirs/sentinels, respiratory/allergic disease of air pollution & pollens
- Population vulnerability indicators
  - Heat-flooding: Elderly, poverty, children, people w/disabilities
  - Sea-level rise
- Mitigation indicators: energy efficienies, use renewables, VMTs
- Adaptation indicators: access cooling centers, heat warning systems, heat island mitigation plans, relevant surveillance systems, PH workforce
- Policy indicators
  - Cities covered by Kyoto, participating in climate change initiatives



OEHHA: Indicators of Climate Change

- **CLIMATE CHANGE DRIVERS**
  - GHG emissions, Atmospheric CO2 concentrations
- **CHANGES IN CLIMATE :**
  - Temperature, State, Regional Air Temp, Air Temp by County Population
  - Extreme heat events
  - Accumulated winter chill hours
  - Precipitation, annual state/regional
- **IMPACTS OF CLIMATE CHANGE**
  - Impacts on physical systems:
    - snwomelt runoff, snow H2) content, glacier change, sea level rise, Lake Tahoe H2O temp, Delta H2) temp, ocean temp, O2 concentrations Ca. current,
  - Impacts on biological systems
    - Humans: mosquito-born diseases, heat-related M/M
  - Impacts on vegetation
    - Tree mortality, large wildfires, forest vegetation patterns, alpine/subalpine plant changes, wine grape bloom
  - Impacts on animals
    - Migrating bird ararivals, small mammal migration, spring flight of CV butterflies, copepod pops, Cassin's auklet pops