Air Quality in Utah
Science for Solutions

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Why do we need research on air pollution and health?
Deaths attributable to ambient air pollution

3.7 million people died in 2014 from causes directly attributable to ambient air pollution (WHO 2014).
Increased rates of health problems due to ambient air pollution

- Strokes
- Accelerated loss of mental function
- Emphysema and chronic bronchitis
- Asthma
- Severe pneumonia
- Lung Cancer
- Heart attacks
- Arrhythmias
- Sudden death
- Increased rates of health problems due to ambient air pollution
Deaths attributable to ambient air pollution by disease

WHO data for 2012

Percentage represents percent of total AAP burden (add up to 100%).
AAP: Ambient air pollution; ALRI: Acute lower respiratory disease; COPD: Chronic obstructive pulmonary disease; IHD: Ischaemic heart disease.
Living in a community with worse air quality shortens life expectancy

However, efforts to improve air quality over years resulted in decreased particulate pollution and improved life expectancy.

S- Steubenville, H- Harriman, T- Topeka, W- Watertown, L- St Louis, P- Portage
Air quality improved over time across the country
Life expectancy increased (2.72 years)
During each period, cross-sectional data showed negative association between life expectancy and pollution levels
Reduction of 10 $\mu$m/m$^3$ resulted in increase of 0.61 ± 0.2 years life
Benefit regardless of baseline level; in fact greater increase for those areas with less pollution initially
From 1980 through 2000, improved air quality accounted for approximately 15% of change in life expectancy
Why Do We Need More Study of Air Pollution?

• We have only scratched the surface of the biological responses to air pollution
  – Mechanisms
  – Better understanding of specific diseases and relationships to specific pollutants
  – Allows most rational intervention to alleviate effects of pollution

• Why do individuals exposed to the same pollutants have different responses?
  – Why are some individuals particularly susceptible to the effects of air pollution?
  – Contributions of genetics, underlying health, other aspects of environment
Daily Average $\text{PM}_{2.5}$ Concentration at Hawthorne Monitor

We need to understand the impact of cumulative exposure vs. acute exposures vs. repeated exposures
PM$_{2.5}$ are largely composed of secondary particles

Emissions

Chemistry

Air Quality Model

Modeled PM$_{2.5}$ Concentrations

Meteorology

1/3 primary emissions

2/3 secondary particles
Average PM$_{2.5}$ Composition for Fifteen US Cities

Average composition during an inversion in Salt Lake City

EPA Air Trends 2010
Why Do We Need More Study of Air Pollution?

• What are the contributions of specific components of air pollution?
  – Evidence suggesting secondary particles are more toxic compared to primary particles
  – All particles are not the same – how does composition influence health effects?
  – Are the health effects of particulates related largely to size or chemical composition?

• Economic and behavioral aspects of the burden of air pollution?
Take home messages

• We know that air pollution harms health and well-being
• We know that decreased exposure to air pollution decreases this health burden
• By increasing our understanding of the relationship between air pollution and health, we can
  – better target individuals for interventions,
  – better target emissions to be controlled
  – better understand the most effective ways to alleviate the effects of pollution on human health