Human Health and Economic Costs of Air Pollution in Utah

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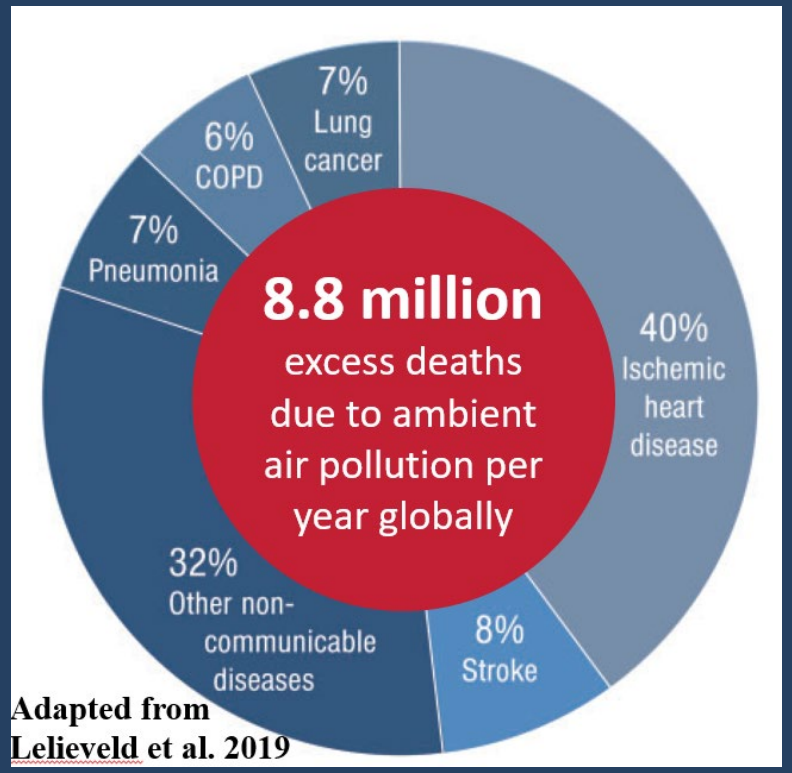
Air pollution: killer without a cause

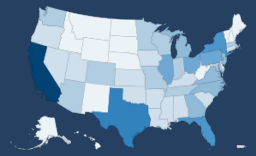


Adapted from Lelieveld et al. 2019

Each year, air pollution kills 8.8 million people, which is…

- 15-times more people than all homicides and war combined
- 3-times more people than tuberculosis, malaria, and AIDS combined
- More people than smoking
- Many times more people than all car accidents

It costs about $5 trillion, 7% of the global Gross Domestic Product

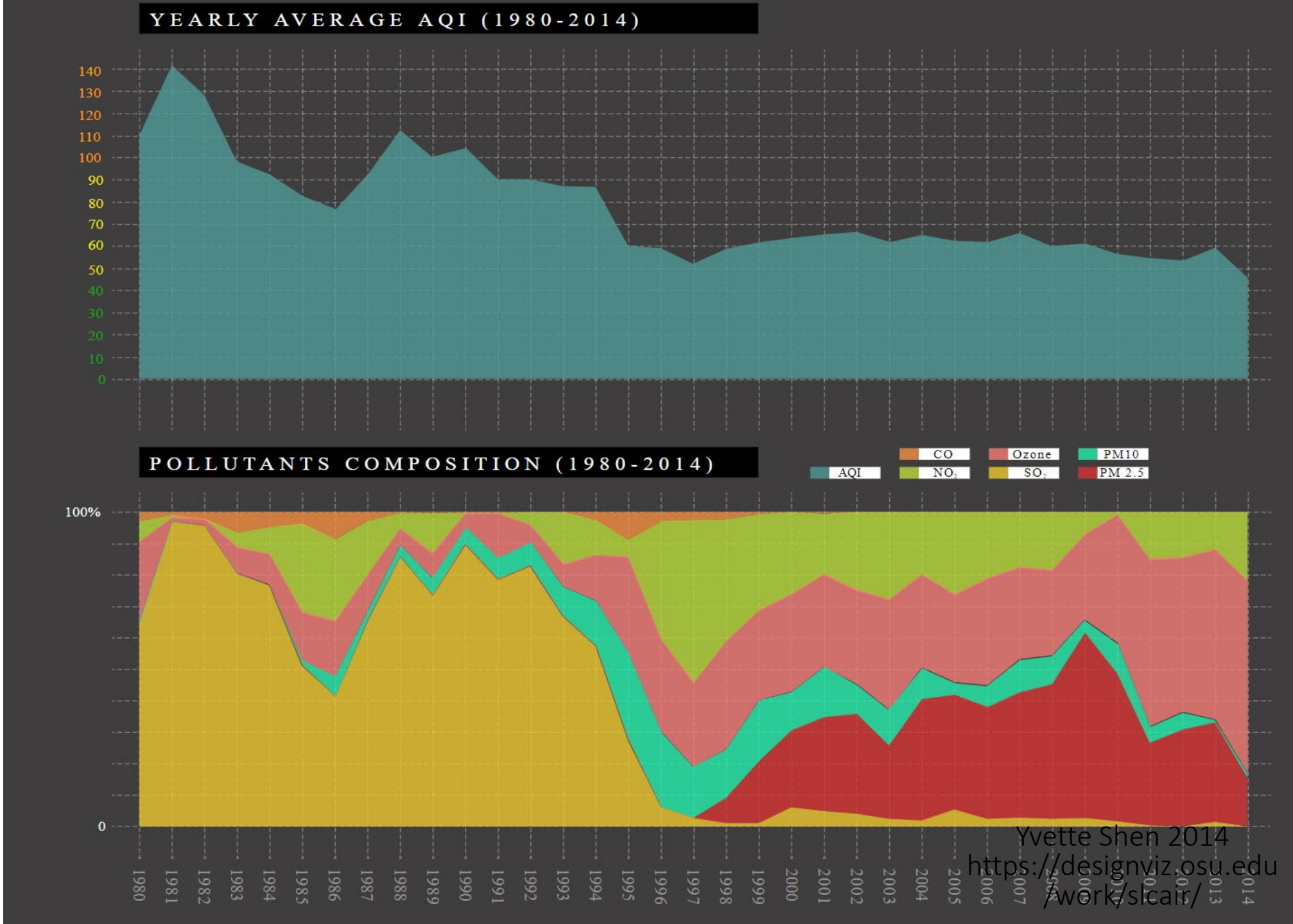


Air pollution causes the premature deaths of 100,000-300,000 and costs at least $886 billion dollars

Utah's Trends

In the 1980s-90s there was significant improvement in air quality in the US.

Since then, air quality has mostly leveled off. Depending on the specific pollutant, some have generally stayed the same, while others are becoming more abundant in the atmosphere.



Yvette Shen 2014
https://designviz.osu.edu/work/slcair/

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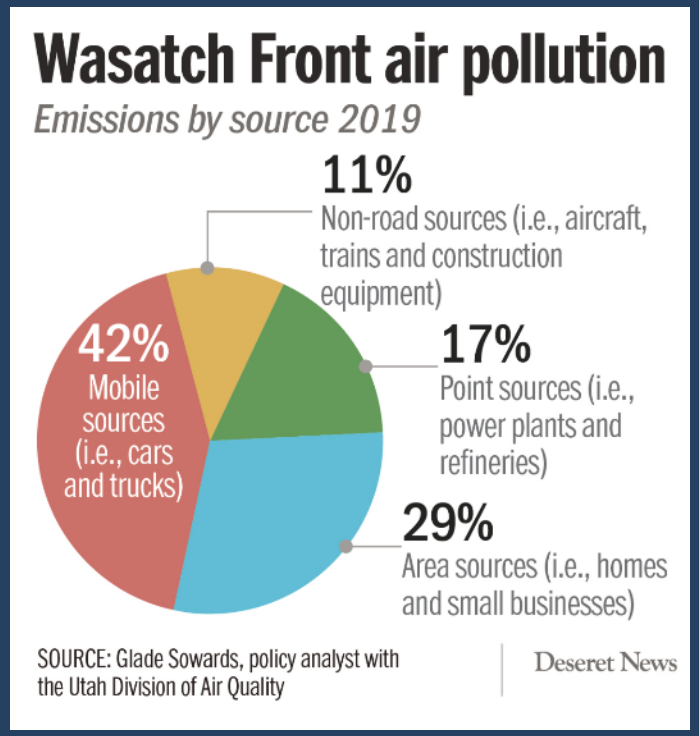
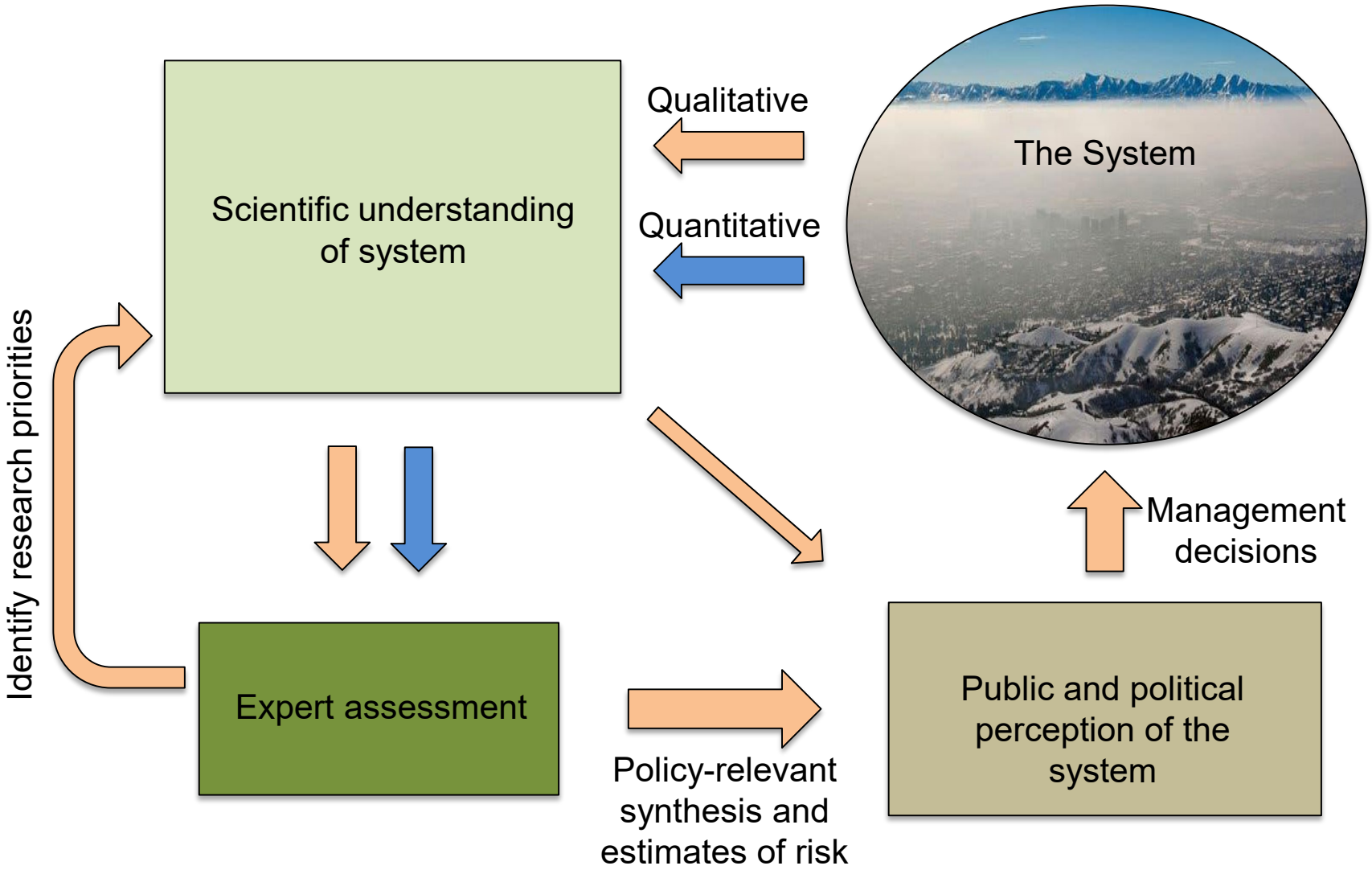
Air pollution in Utah

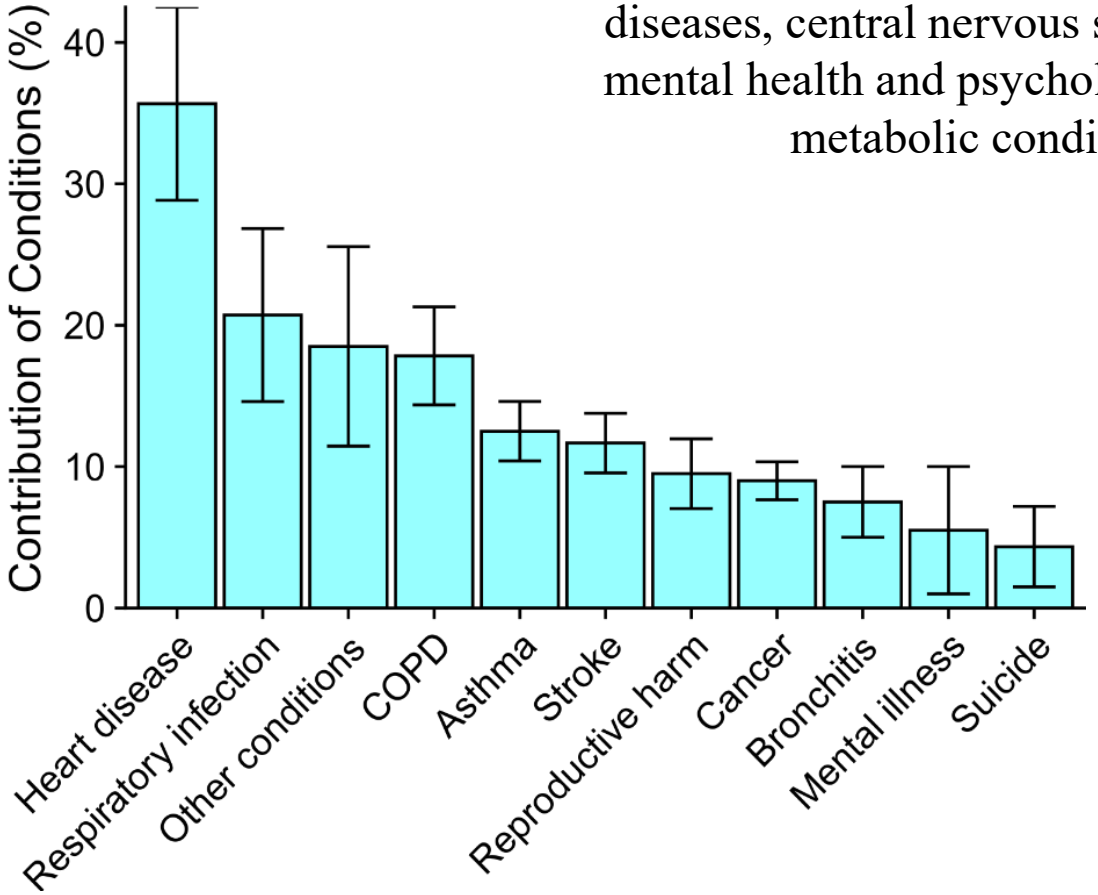


Expert assessment methods

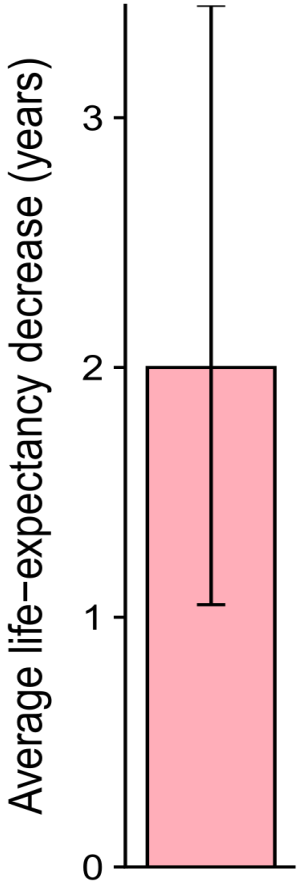


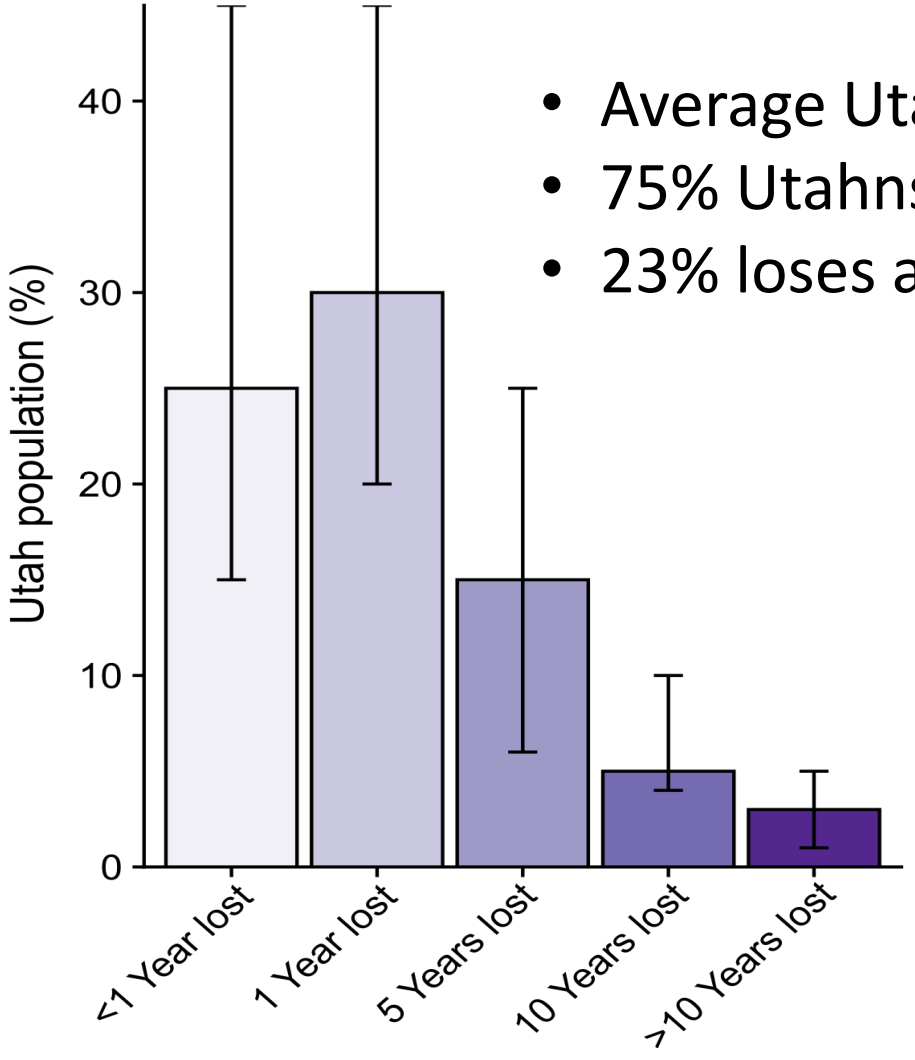
Air pollution affects more than just your lungs

Reproductive disorders, neurodegenerative diseases, psychological disorders, cognitive dysfunction, respiratory and cardiovascular diseases, central nervous system disorders, mental health and psychological problems, metabolic conditions…



Human Health Costs in Utah

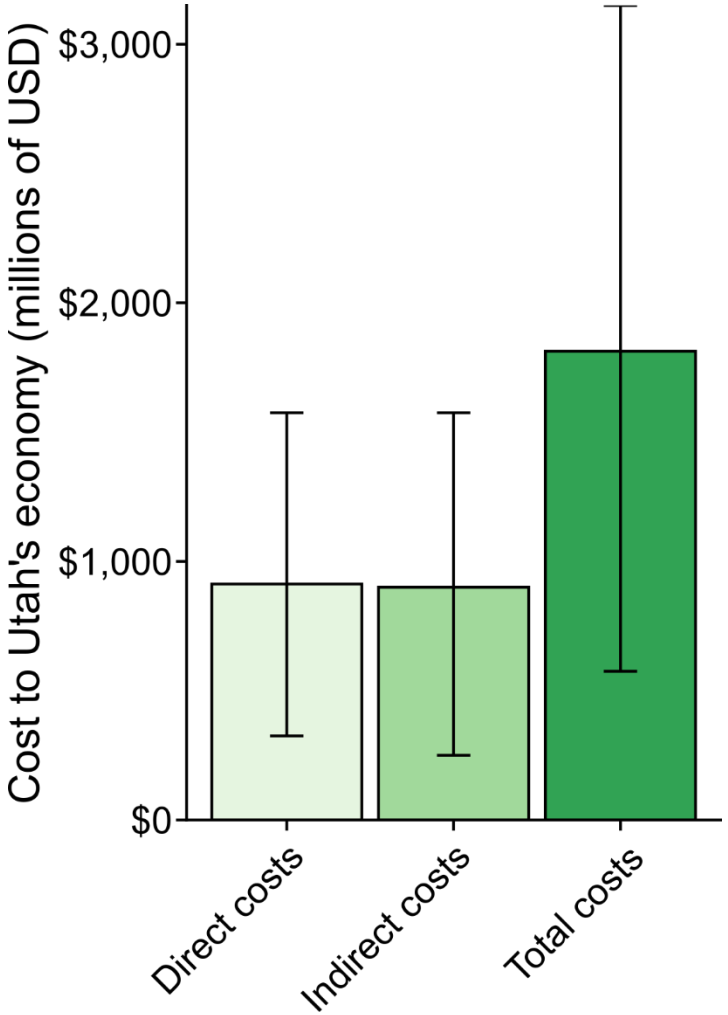




- Average Utahn loses 2 years off life-expectancy
- 75% Utahns lose a year or more of life
- 23% loses at least 5 years of life

No such thing as "sensitive groups"

Economic Costs in Utah

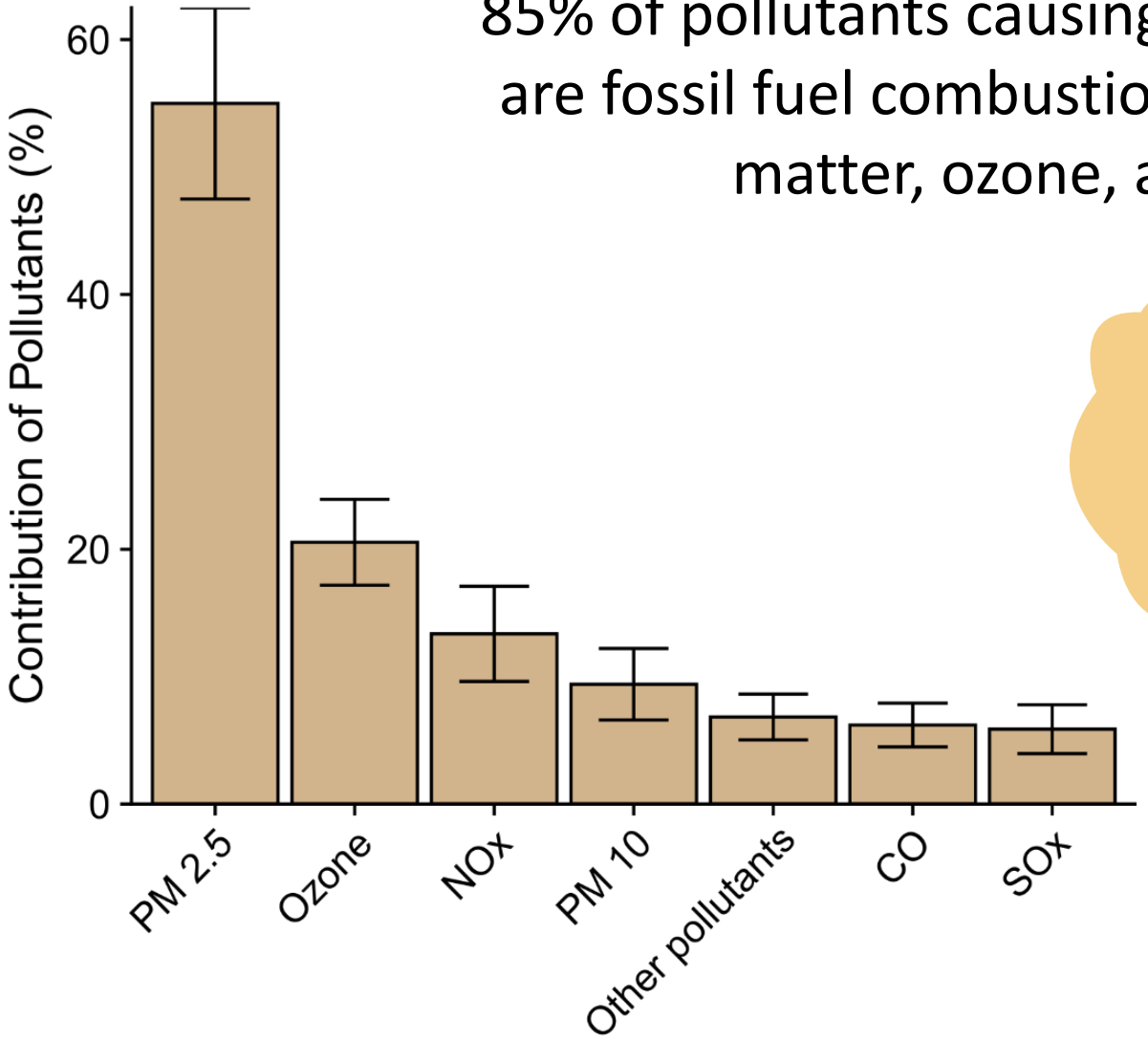


- Air pollution costs Utah's economy **$1.8 billion** annually
  - Direct costs: healthcare expenses and lost earning potential
  - Indirect costs: such as loss of tourism, decreased growth, regulatory burden, and business costs

- Our estimates are more conservative than national economic studies
  - Down-scaling from national studies show the cost to be closer to **$7.4 billion**

Contributing Pollutants

85% of pollutants causing health and economic harm are fossil fuel combustion products (fine particulate matter, ozone, and various oxides)



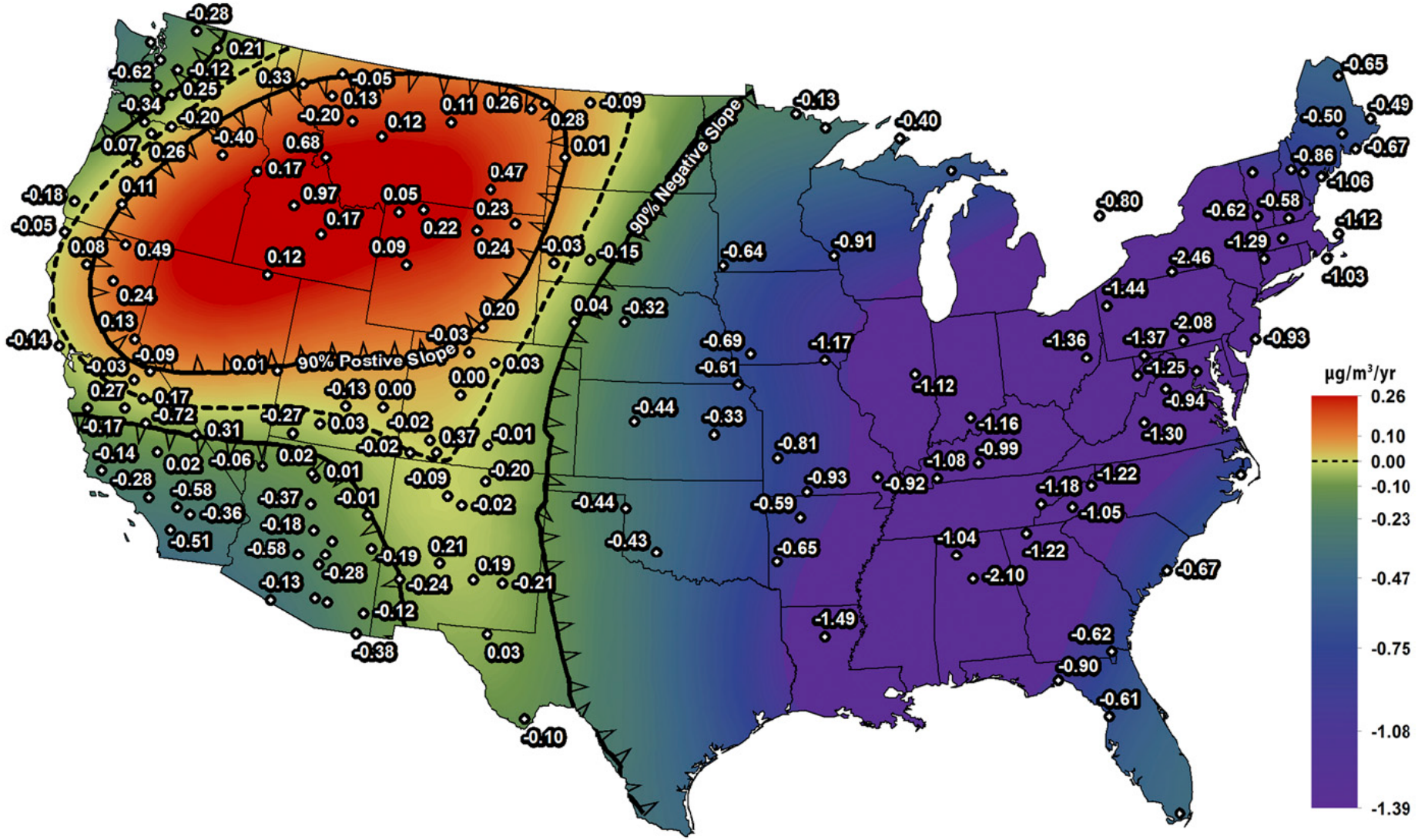


Fig. 1. The 98th Quantile Regression of $PM_{2.5}$ trends. Observed PM trends for 1988–2016 (calculated using QR methods) from IMPROVE sites are shown by black dots with corresponding values in $\mu g \cdot m^{-3} \cdot y^{-1}$. Krige-interpolated values (calculated from observed data) are shown by the color ramp. Solid black lines with arrows (indicating direction) show the boundary where the Krige-interpolated $PM_{2.5}$ trends within have a 90% probability of being positive or negative. Of the 157 sites, 92 show statistical significance (8 positive/84 negative).

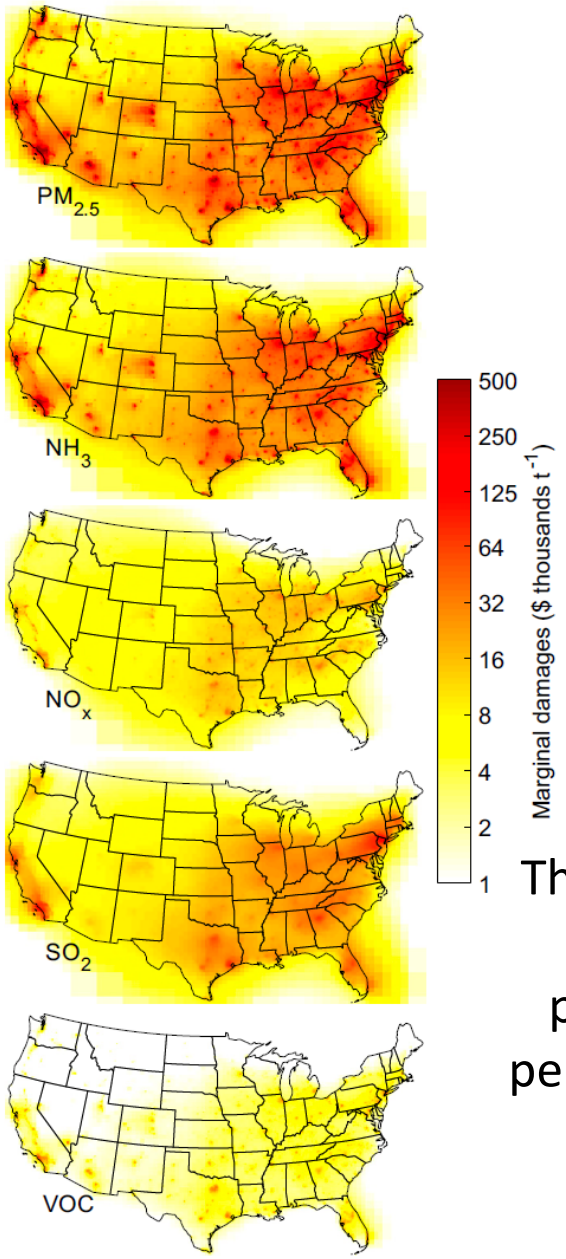
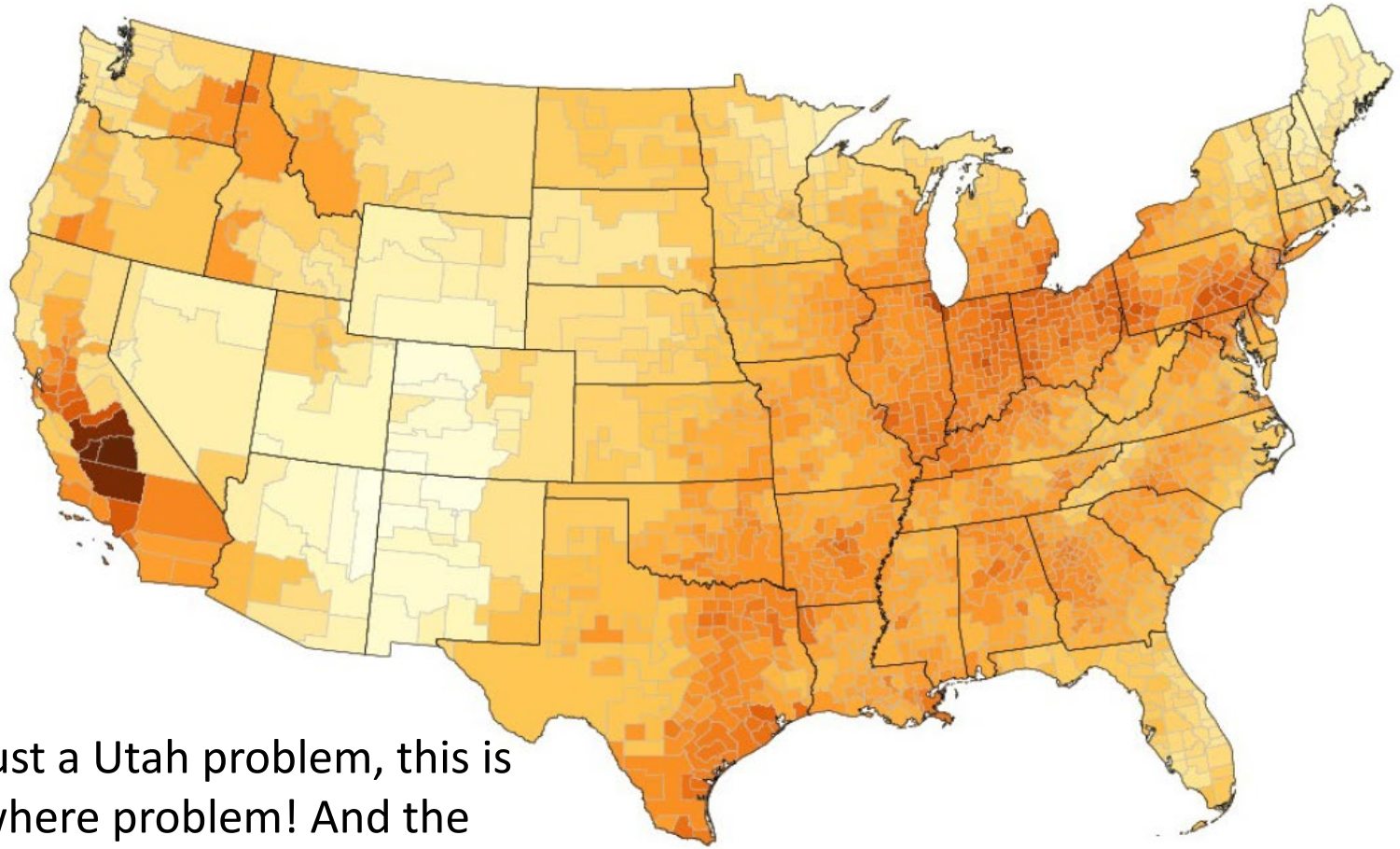


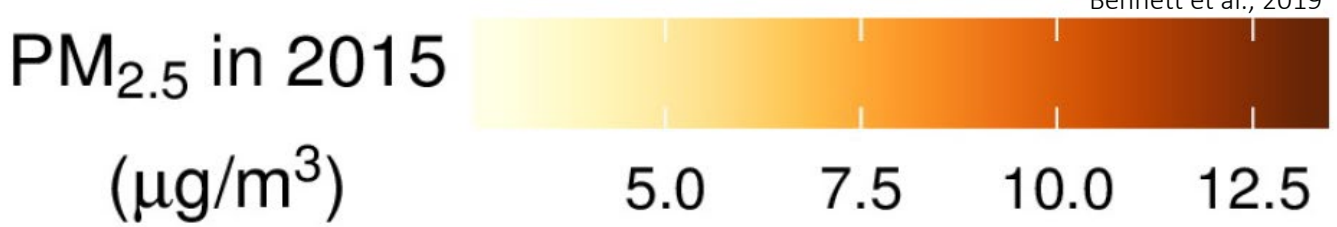
Fig. 1. Marginal damages of emissions ($ t^{-1}; logarithmic scale) by emitted pollutant and emission location. Damages are generally higher for emissions upwind of population centers, but the relationship with population density varies by pollutant. The value displayed in a location represents the combined mortality impacts (in terms of dollar damages) to all downwind receptors from 1 t emitted at that location.

Goodkind et al., 2019 PNAS

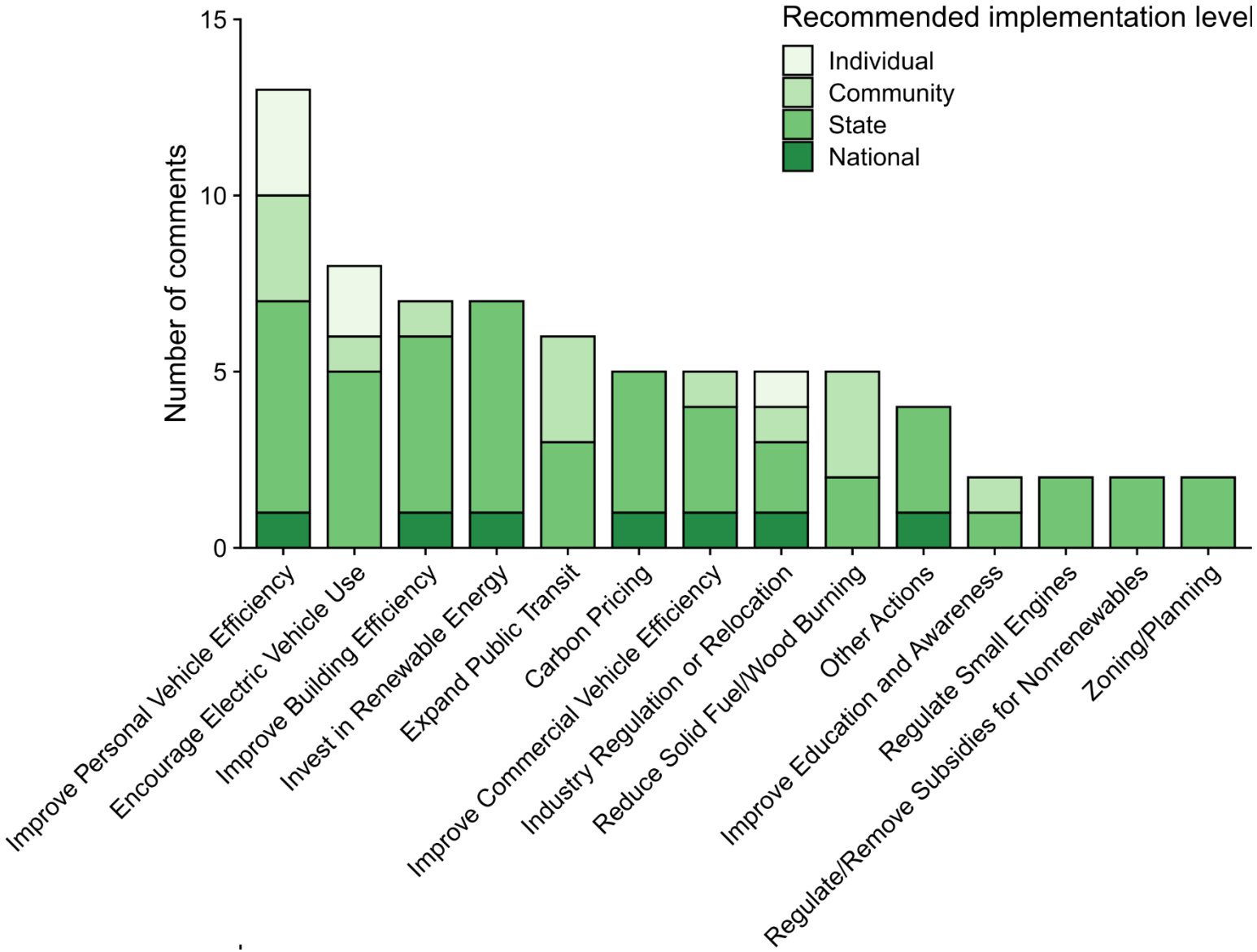


This is not just a Utah problem, this is an everywhere problem! And the problem (the costs of air pollution) persist, even on "good' air quality days

Bennett et al., 2019



What do we do?



Important to combine public will AND political organization in order to bring about effective change

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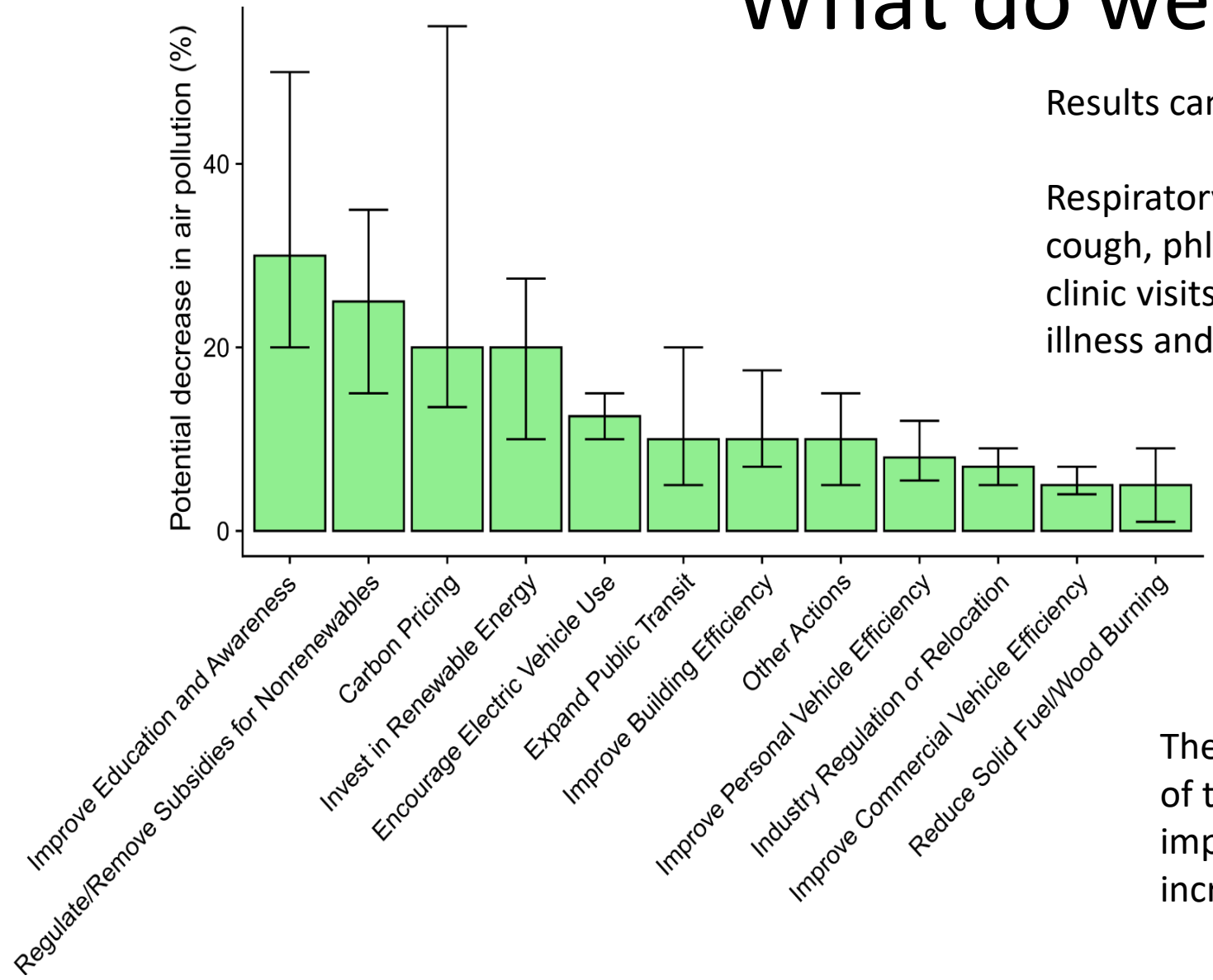

Results can be seen within a few weeks!

Respiratory and irritation symptoms, such as shortness of breath, cough, phlegm, and sore throat, disappear; school absenteeism, clinic visits, hospitalizations, premature births, cardiovascular illness and death, and all-cause mortality decrease significantly.

Although regions with high air pollution have the greatest potential for health benefits, **health improvements continue to be associated with pollution decreases even below international standards**.

The large response to and short time needed for benefits of these interventions emphasize the urgency of improving global air quality and the importance of increasing efforts to reduce pollution at local levels.

Schraufnagel, D. E. et al.