METR/ENVS 113
Health Effects of PM2.5 by Arden Pope (Summary)

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SJSU Spring Semester 2020

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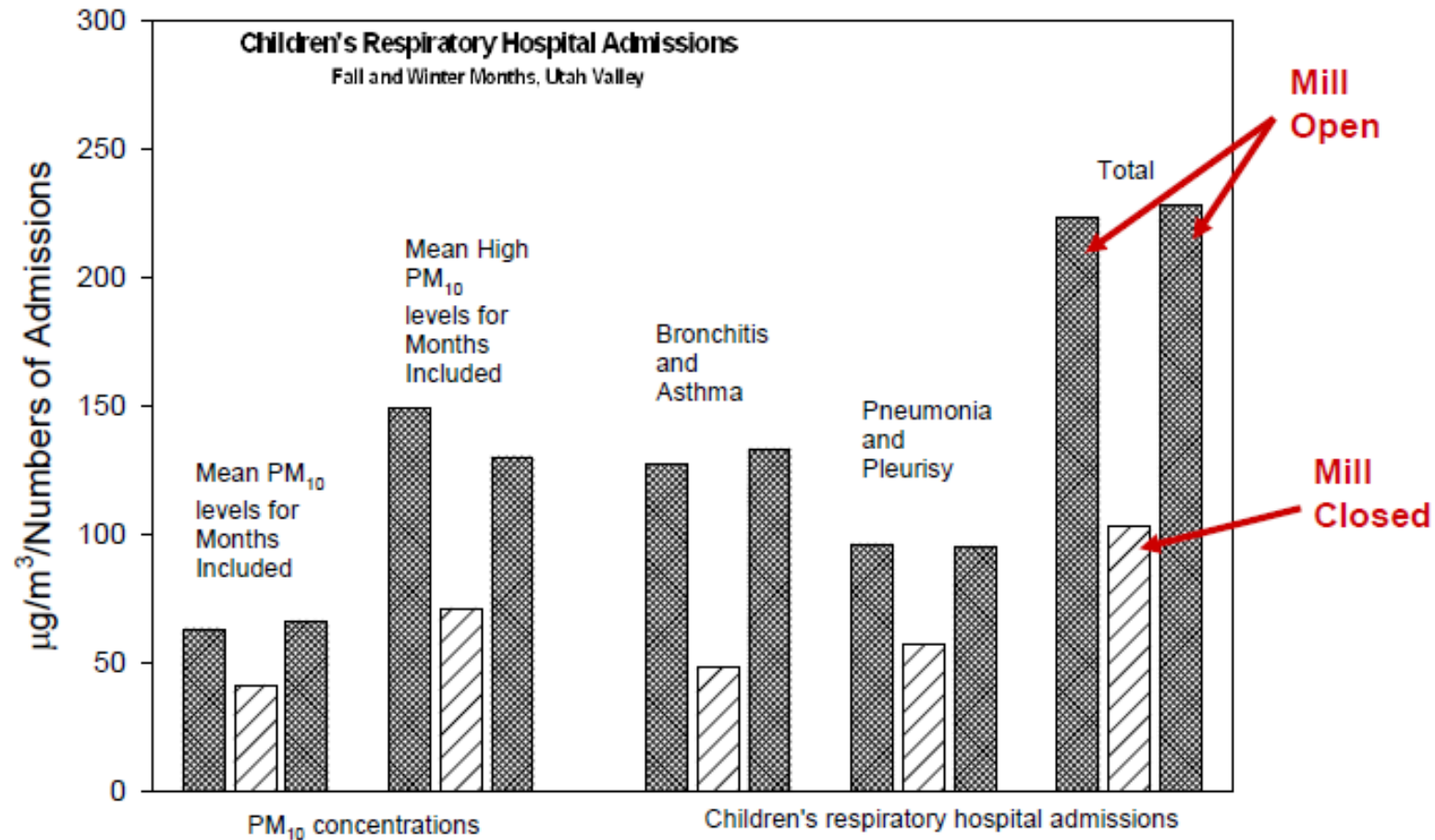
Health Effects of PM2.5

- **Writing Assignment #2:** https://www.youtube.com/watch?v=fNSD33SzYj0
- **See also** http://www.4cleanair.org/Spring2013/CPope.pdf

Utah Valley Studies

- <u>Study type</u>: Cross-Sectional

- <u>Description</u>: PM air pollution & short-term health effects

- <u>Exposure</u>: PM pollution before/after mill closure (exposed) vs. during mill closure (non-exposed)

- <u>Outcome</u>: Hospital admissions

- <u>Findings</u>: Reduced PM pollution and hospitalization when mill was closed

PM – Particulate Matter (for example, PM2.5)

When the steel mill was open, total children's hospital admissions for respiratory conditions **approx. doubled.**

Children's Respiratory Hospital Admissions
Fall and Winter Months, Utah Valley

Sources: Pope. Am J Pub Health.1989; Pope. Arch Environ Health. 1991

Six-City Study

- <u>Study type</u>: Prospective cohort

- <u>Description</u>: PM air pollution & long-term health effects

- <u>Exposure</u>: PM pollution in six U.S. cities (two dirty, two clean, two average)

- <u>Outcome</u>: Survival rates (mortality)

- <u>Findings</u>: Increased mortality rates of cohort in dirty compared to clean cities. Relative risk of all-cause mortality of around 1.25 for participants in dirty compared to clean cities (after 14 to 16 year follow-up period).
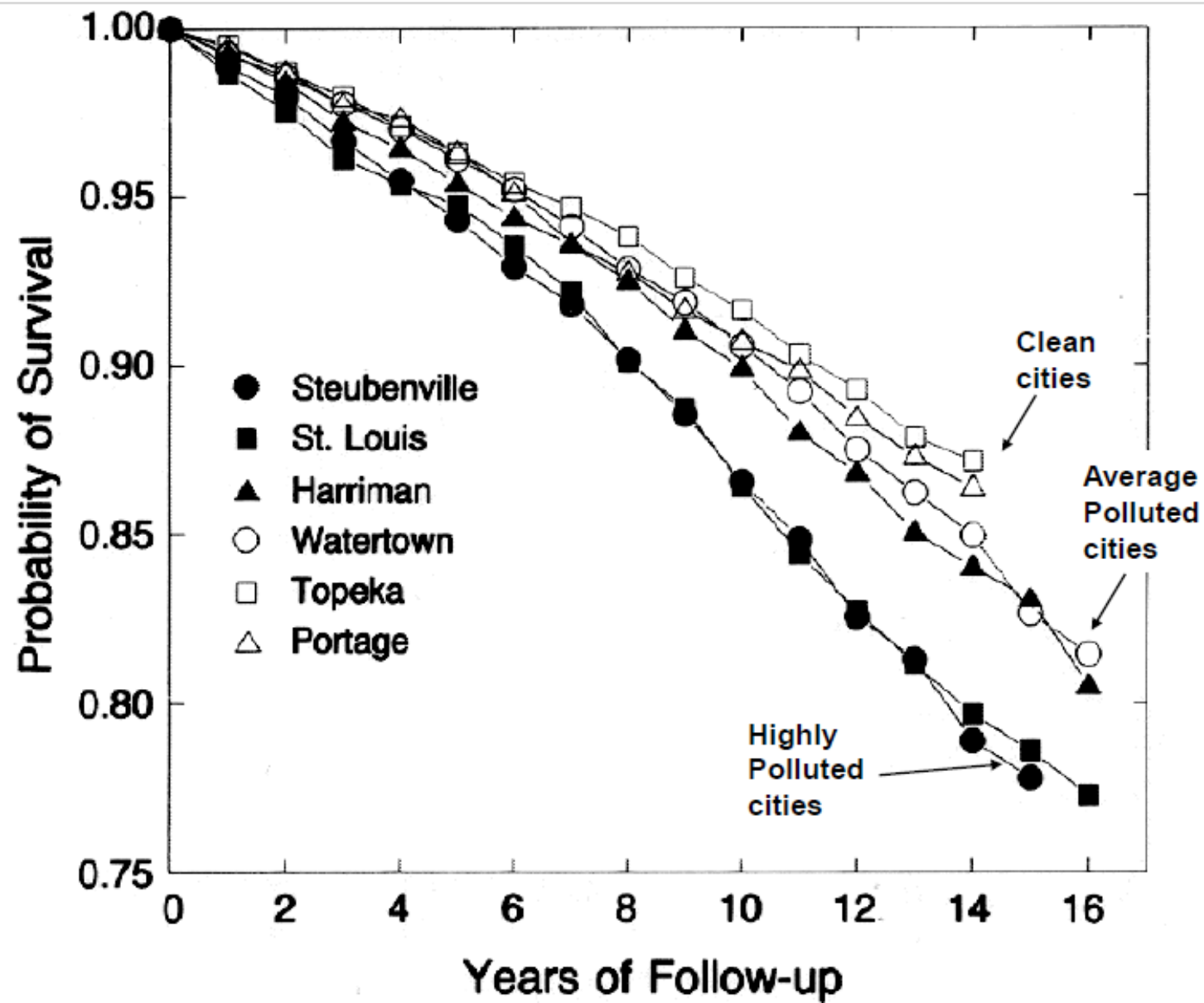
Adjusted risk ratios (and 95% CIs) for cigarette smoking and $PM_{2.5}$

Cause of Death	Current Smoker, 25 Pack years	Most vs. Least Polluted City
All	2.00 (1.51-2.65)	1.26 (1.08-1.47)
Lung Cancer	8.00 (2.97-21.6)	1.37 (0.81-2.31)
Cardio-pulmonary	2.30 (1.56-3.41)	1.37 (1.11-1.68)
All other	1.46 (0.89-2.39)	1.01 (0.79-1.30)

All cause mortality around 25% higher in most polluted cities (i.e. RR approx. 1.25)

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95% Confidence Intervals

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Statistically significant (95% CI does not contain RR=1)

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Smoking 25 packs of cigarettes per year leads to double the risk of pre-mature death (RR = 2)

PM2.5 pre-mature mortality equivalent to smoking 25 pack-years on a population level …

Air Pollution mortality

- RR = 1.25 for pre-mature mortality (most vs. least polluted cities)

Smoking mortality

- RR_smokers = 2 for pre-mature mortality compared w non-smokers (assumes smoking 25 pack years … typical amount)

- RR_nonsmokers = 1 for non-smokers (by definition)

- An average across U.S. 25% of the population smokes

- Therefore 3 non-smokers for every 1 smoker

PM2.5 pre-mature mortality equivalent to smoking 25 pack-years on a population level …

Smoking mortality on population level (RR_pop)

RR_pop = (# smokers)(RR_smokers) + (# non-smokers)(RR_non-smokers)/(Total # of people)

RR_pop = (1)(2) + (3)(1) / (3+1=4)

RR_pop = 2 + 3 / 4

RR_pop = 5 / 4

RR_pop = 5/4 = 1.25 <mark>*same as due to PM2.5 pollution for most vs. least cities*</mark>

American Cancer Society (ACS) Study

- Study type: Retrospective cohort

- Description: PM air pollution & long-term health effects. Used data from previous ACS study, and re-analyzed the data by linking to air pollution. Larger cohort than Six-City study.

- Exposure: PM pollution in many U.S. cities

- Outcome: Mortality

- Findings: Increased mortality rates as PM2.5 pollution increases. RR = 1.17 all-cause mortality.

Children's Health Study

- <u>Study type</u>: Prospective cohort

- <u>Description</u>: PM air pollution & health effects in children.

- <u>Exposure</u>: PM pollution in different cities across Southern California

- <u>Outcome</u>: Lung development and capacity.

- <u>Findings</u>: Reduced lung capacity and development in children living in more PM polluted cities.