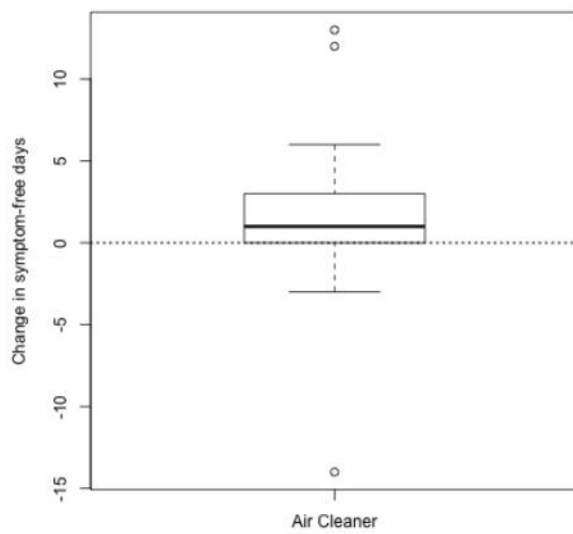# Principles of Analytic Graphics

Roger D. Peng, Associate Professor of Biostatistics
Johns Hopkins Bloomberg School of Public Health
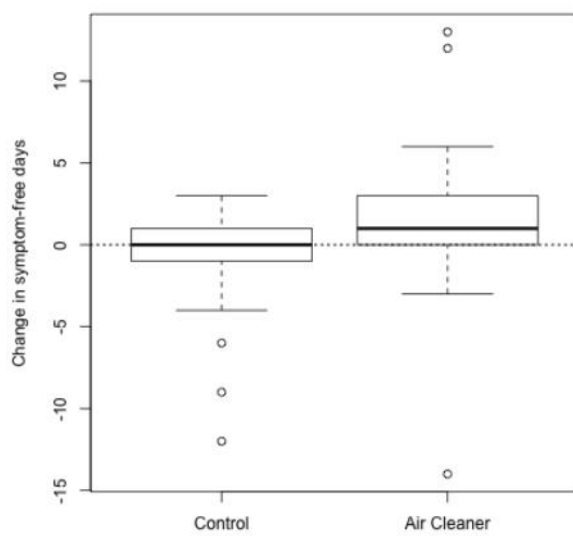
Principles of Analytic Graphics

- Principle 1: Show comparisons

  - Evidence for a hypothesis is always *relative* to another competing hypothesis.

  - Always ask "Compared to What?"

2/16

Show Comparisons

Reference: Butz AM, *et al.*, *JAMA Pediatrics*, 2011.
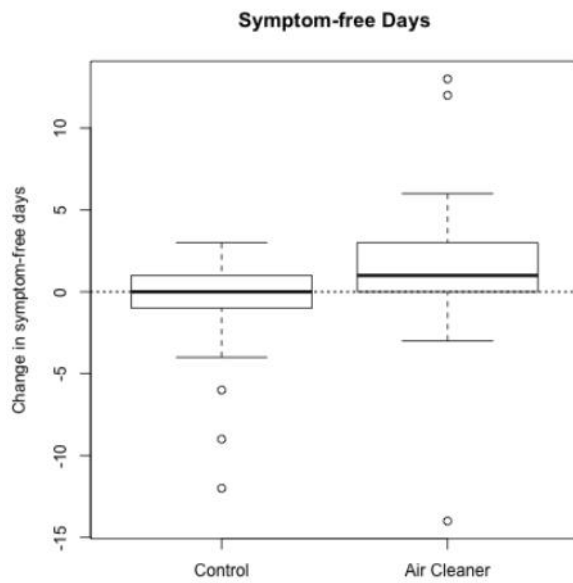
Show Comparisons

Reference: Butz AM, *et al.*, *JAMA Pediatrics*, 2011.

Principles of Analytic Graphics

- Principle 1: Show comparisons

    - Evidence for a hypothesis is always *relative* to another competing hypothesis.

    - Always ask "Compared to What?"

- Principle 2: Show causality, mechanism, explanation, systematic structure

    - What is your causal framework for thinking about a question?

5/16

Show causality, mechanism

Reference: Butz AM, *et al.*, *JAMA Pediatrics*, 2011.

Show causality, mechanism

Reference: Butz AM, *et al.*, *JAMA Pediatrics*, 2011.

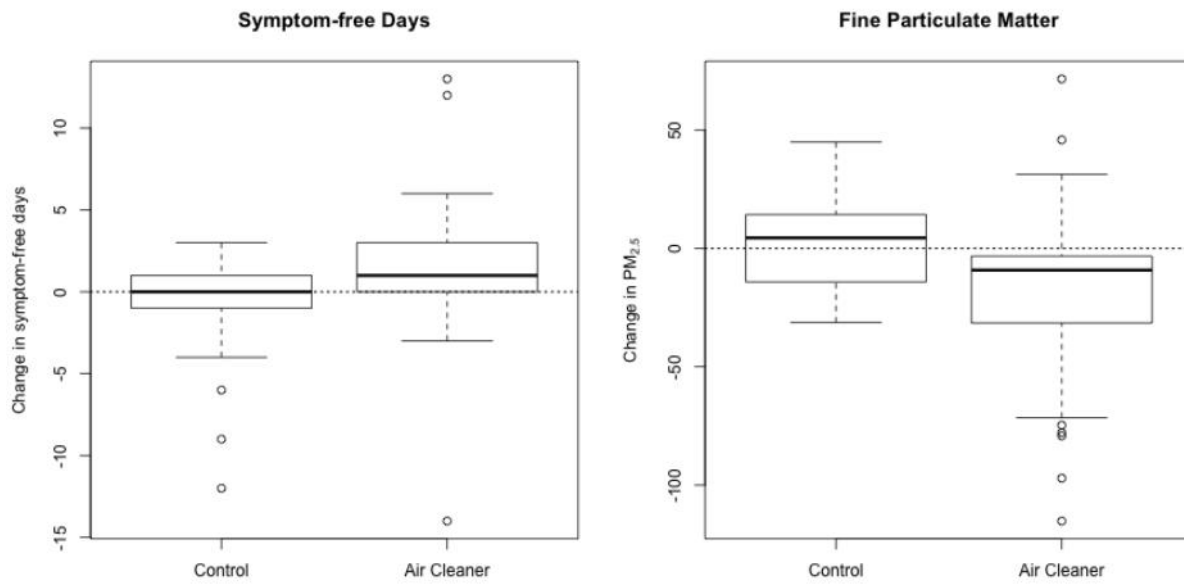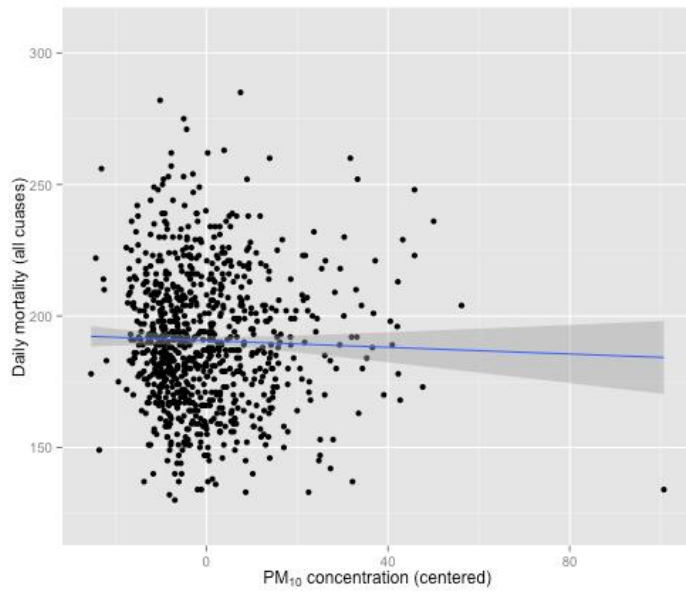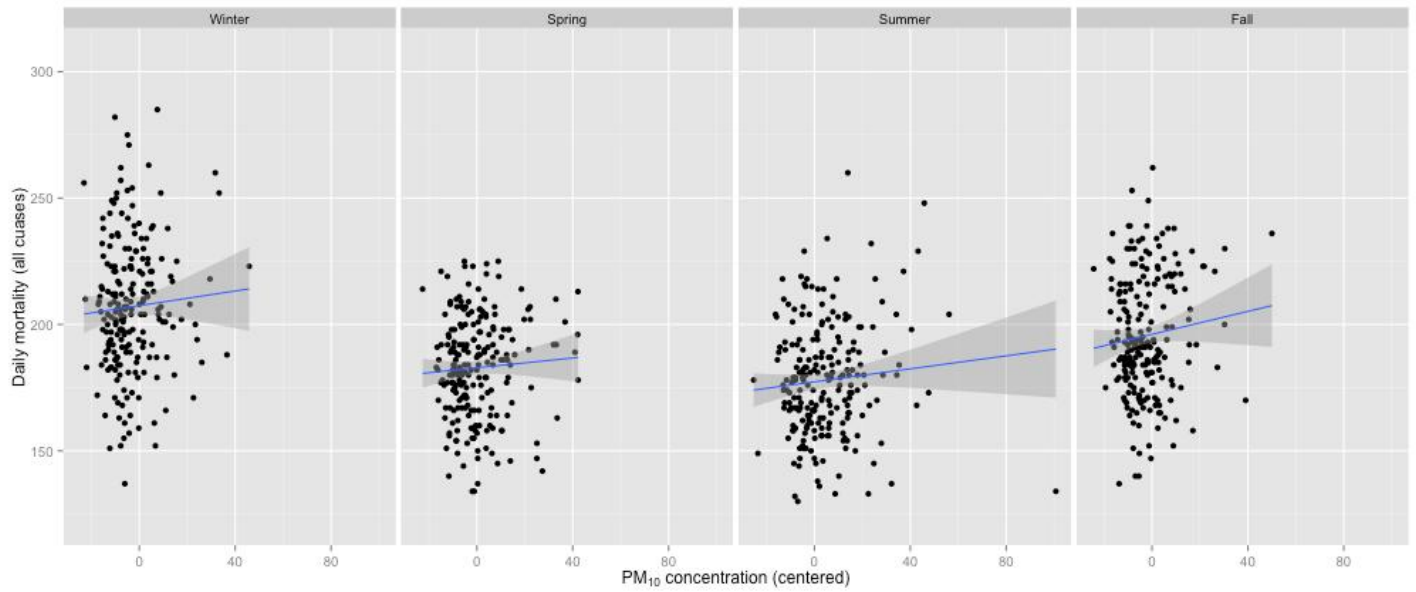# Principles of Analytic Graphics

- Principle 1: Show comparisons

    - Evidence for a hypothesis is always *relative* to another competing hypothesis.

    - Always ask "Compared to What?"

- Principle 2: Show causality, mechanism, explanation, systematic structure

    - What is your causal framework for thinking about a question?

- Principle 3: Show multivariate data

    - Multivariate = more than 2 variables

    - The real world is multivariate

    - Need to "escape flatland"

8/16

Show Multivariate Data

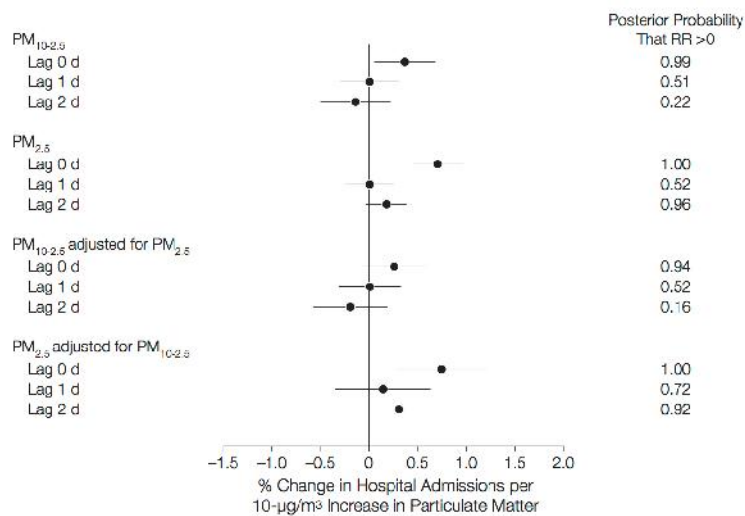# Show Multivariate Data

Principles of Analytic Graphics

- Principle 4: Integration of evidence

    - Completely integrate words, numbers, images, diagrams

    - Data graphics should make use of many modes of data presentation

    - Don't let the tool drive the analysis

11/16

Integrate Different Modes of Evidence

Figure 2. Percentage Change in Emergency Hospital Admissions Rate for Cardiovascular Diseases per a 10-µg/m³ Increase in Particulate Matter

Estimates are on average across 108 counties. PM$_{2.5}$ indicates particulate matter is 2.5 µm or less in aerodynamic diameter; PM$_{10}$, particulate matter is 10 µm or less in aerodynamic diameter; PM$_{10-2.5}$, particulate matter is greater than 2.5 µm and 10 µm or less in aerodynamic diameter; RR, relative risk. Error bars indicate 95% posterior intervals.

Principles of Analytic Graphics

- Principle 4: Integration of evidence

    - Completely integrate words, numbers, images, diagrams

    - Data graphics should make use of many modes of data presentation

    - Don't let the tool drive the analysis

- Principle 5: Describe and document the evidence with appropriate labels, scales, sources, etc.

    - A data graphic should tell a complete story that is credible

13/16

Principles of Analytic Graphics

- Principle 4: Integration of evidence

    - Completely integrate words, numbers, images, diagrams

    - Data graphics should make use of many modes of data presentation

    - Don't let the tool drive the analysis

- Principle 5: Describe and document the evidence with appropriate labels, scales, sources, etc.

    - A data graphic should tell a complete story that is credible

- Principle 6: Content is king

    - Analytical presentations ultimately stand or fall depending on the quality, relevance, and integrity of their content

14/16

Summary

- Principle 1: Show comparisons

- Principle 2: Show causality, mechanism, explanation

- Principle 3: Show multivariate data

- Principle 4: Integrate multiple modes of evidence

- Principle 5: Describe and document the evidence

- Principle 6: Content is king

15/16

References

Edward Tufte (2006). *Beautiful Evidence*, Graphics Press LLC. www.edwardtufte.com

16/16