Principles of Analytic Graphics

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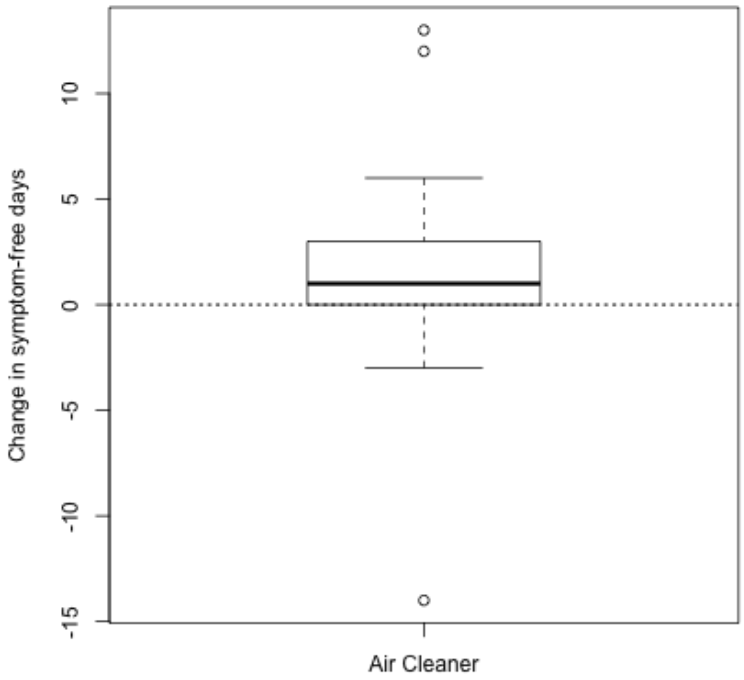
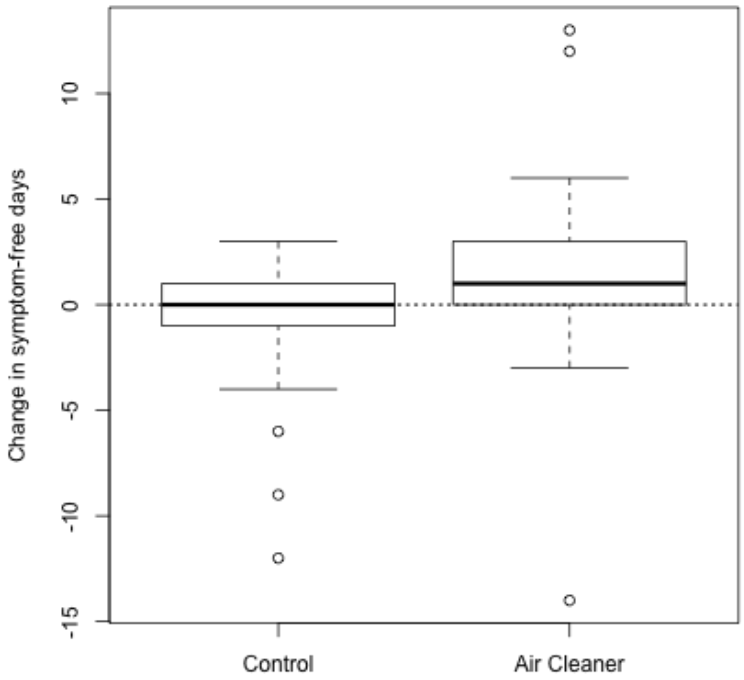
- Principle 1: Show comparisons
    - Evidence for a hypothesis is always *relative* to another competing hypothesis.
    - Always ask "Compared to What?"

Show Comparisons



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

Show Comparisons



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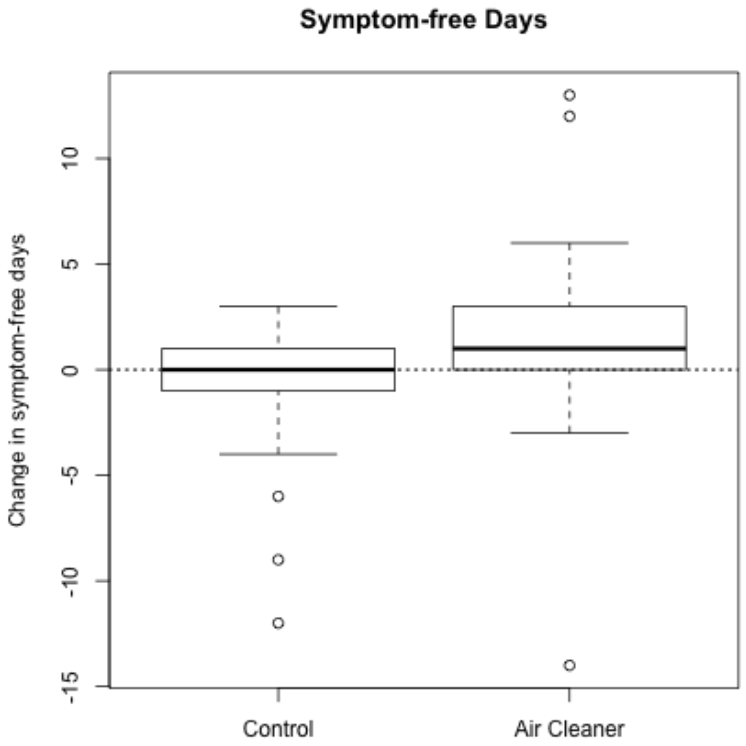
- Principle 1: Show comparisons
  - Evidence for a hypothesis is always *relative* to another competing hypothesis.
  - Always ask "Compared to What?"
- Principle 2: Show causality, mechanism, explanation, systematic structure
  - What is your causal framework for thinking about a question?

Show causality, mechanism



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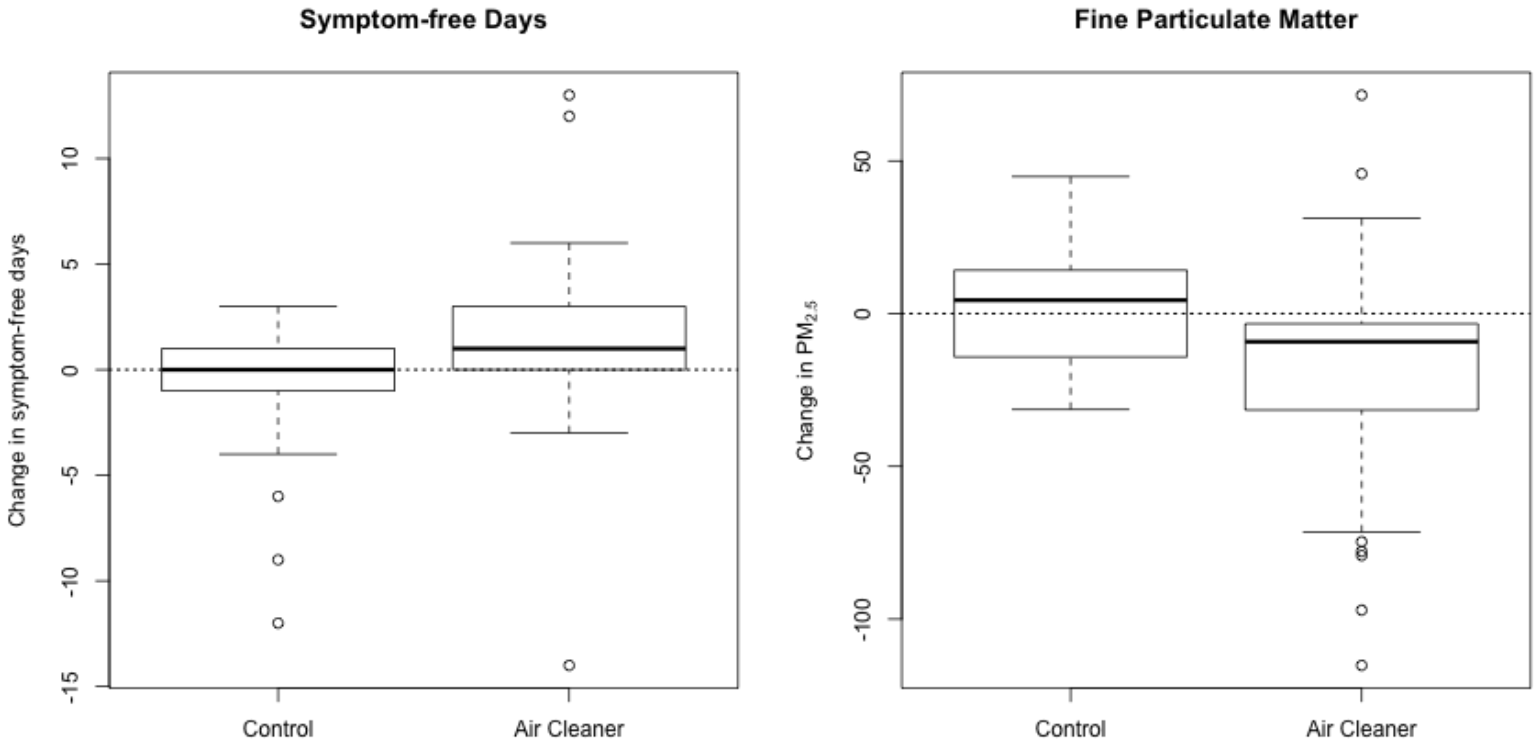
Show causality, mechanism



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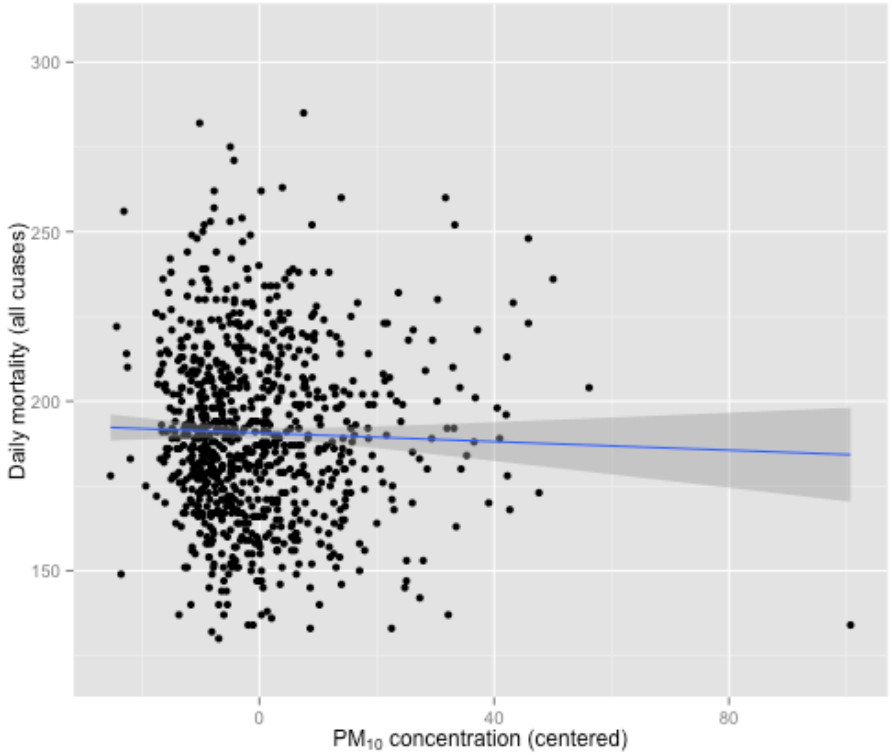
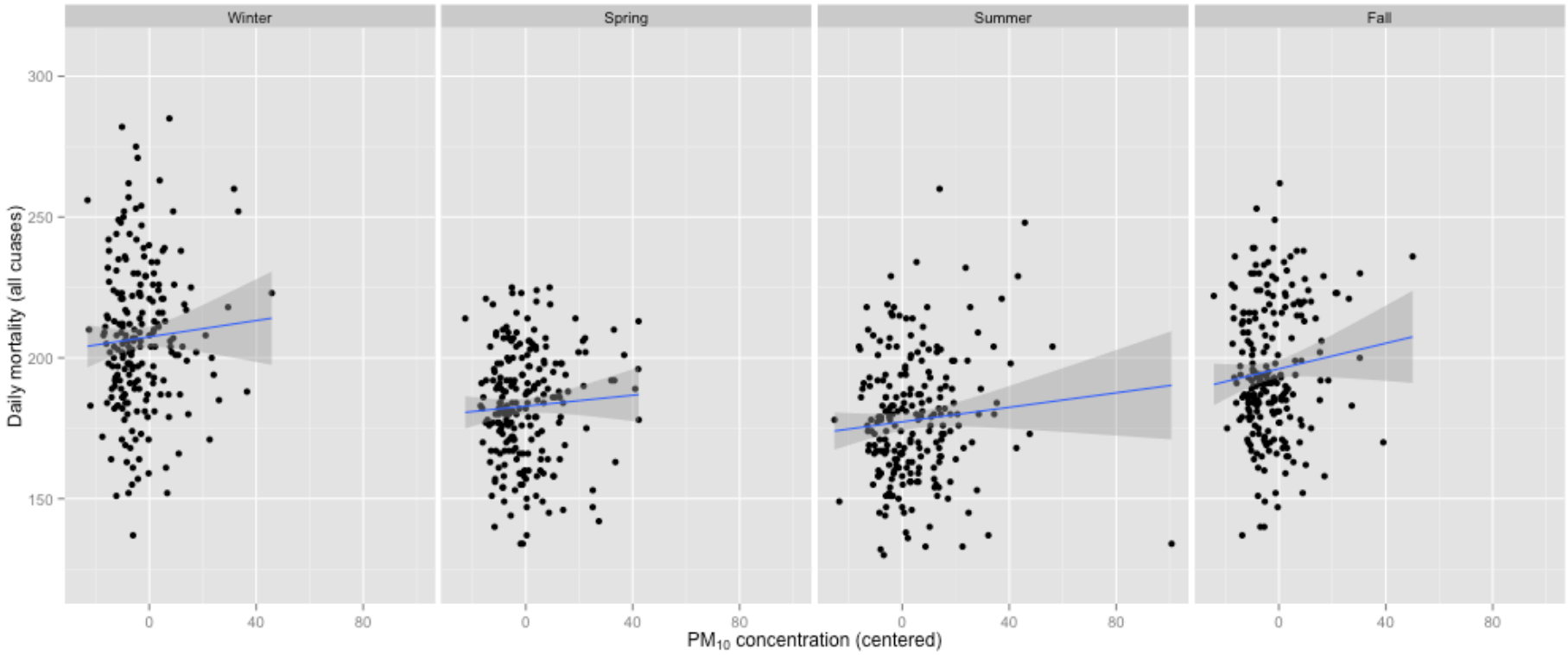
- Principle 3: Show multivariate data
  - Multivariate = more than 2 variables
  - The real world is multivariate
  - Need to "escape flatland"

Show Multivariate Data



Show Multivariate Data

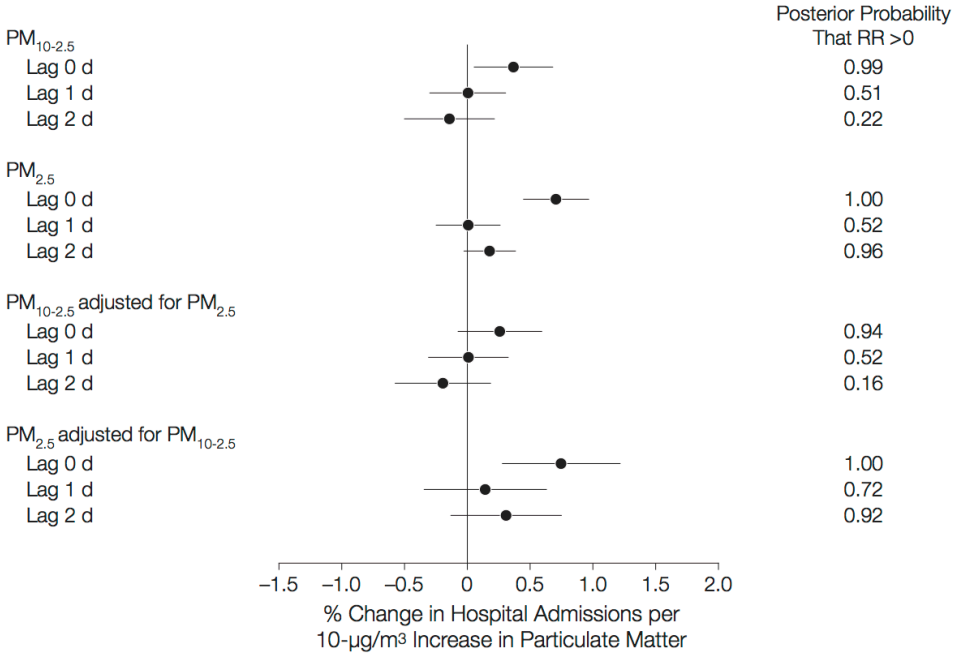


Principles of Analytic Graphics

- 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

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.

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- Principle 4: Integration of evidence
  - Completely integrate words, numbers, images, diagrams
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- Principle 5: Describe and document the evidence with appropriate labels, scales, sources, etc.
  - A data graphic should tell a complete story that is credible

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  - 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

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

References

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