Principles of Analytic Graphics

Biostatistics 140.776

Principles of Analytic Graphics

Principle 1: Show comparisons

- Evidence for an hypothesis is always **relative** to another competing hypothesis
- Always ask "Compared to What?"

Show Comparisons

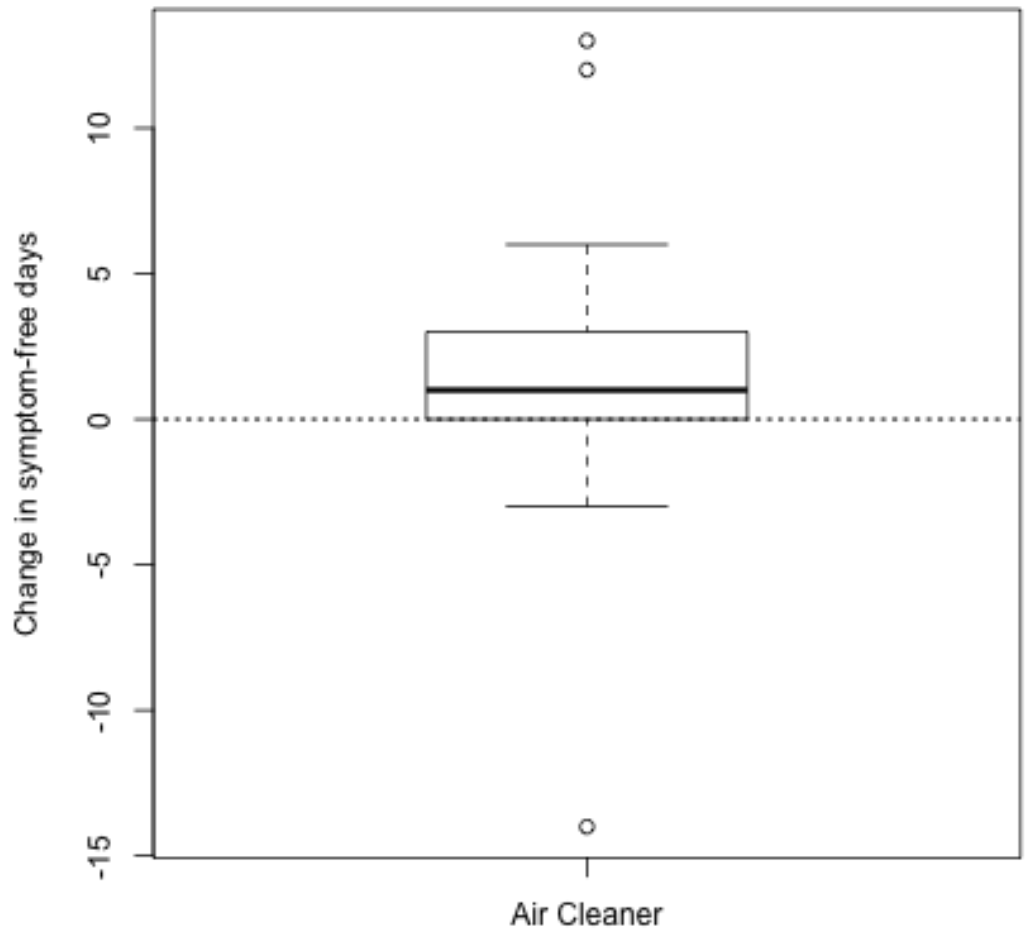

Figure 1: Show comparisons

Show Comparisons

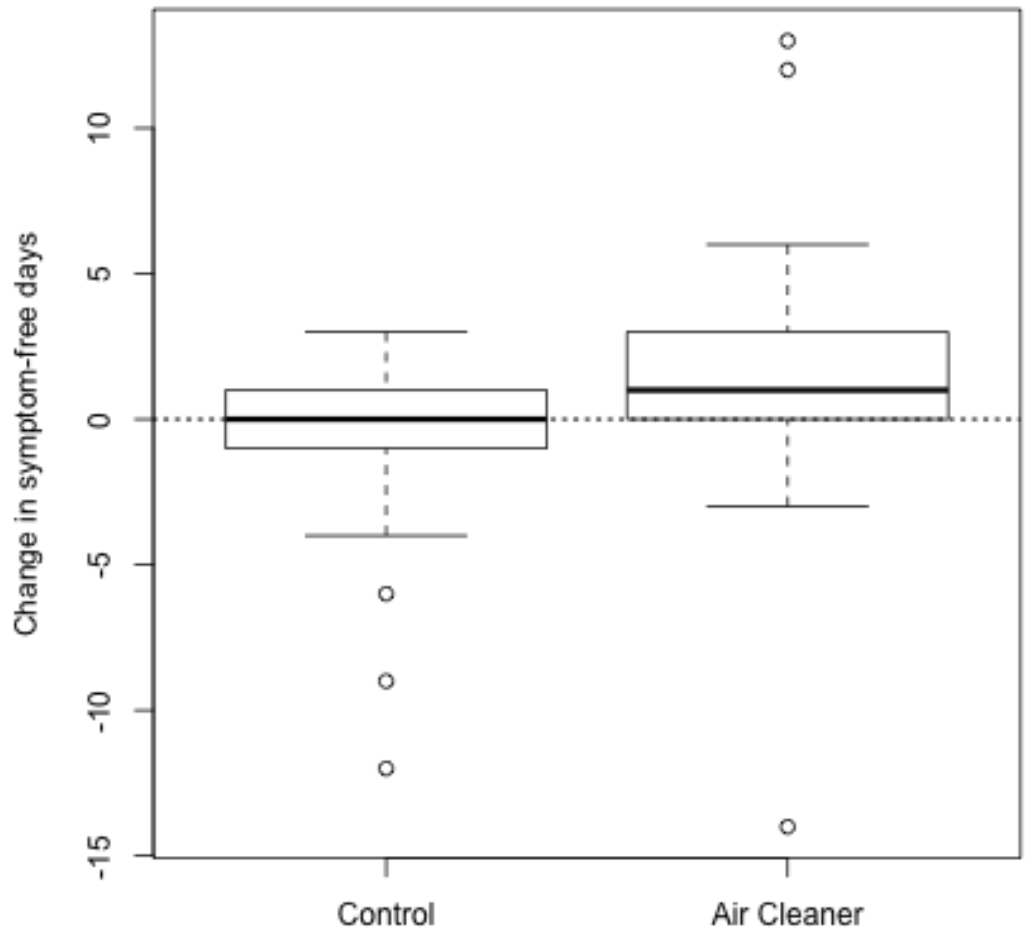

Figure 2: Show comparisons

Principles of Analytic Graphics

Principle 1: Show comparisons

- Evidence for an hypothesis is always **relative** to another competing hypothesis
- Always ask "Compared to What?"

Principe 2: Show causality, mechanism, explanation, systematic structure

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

Show Causality, Mechanism

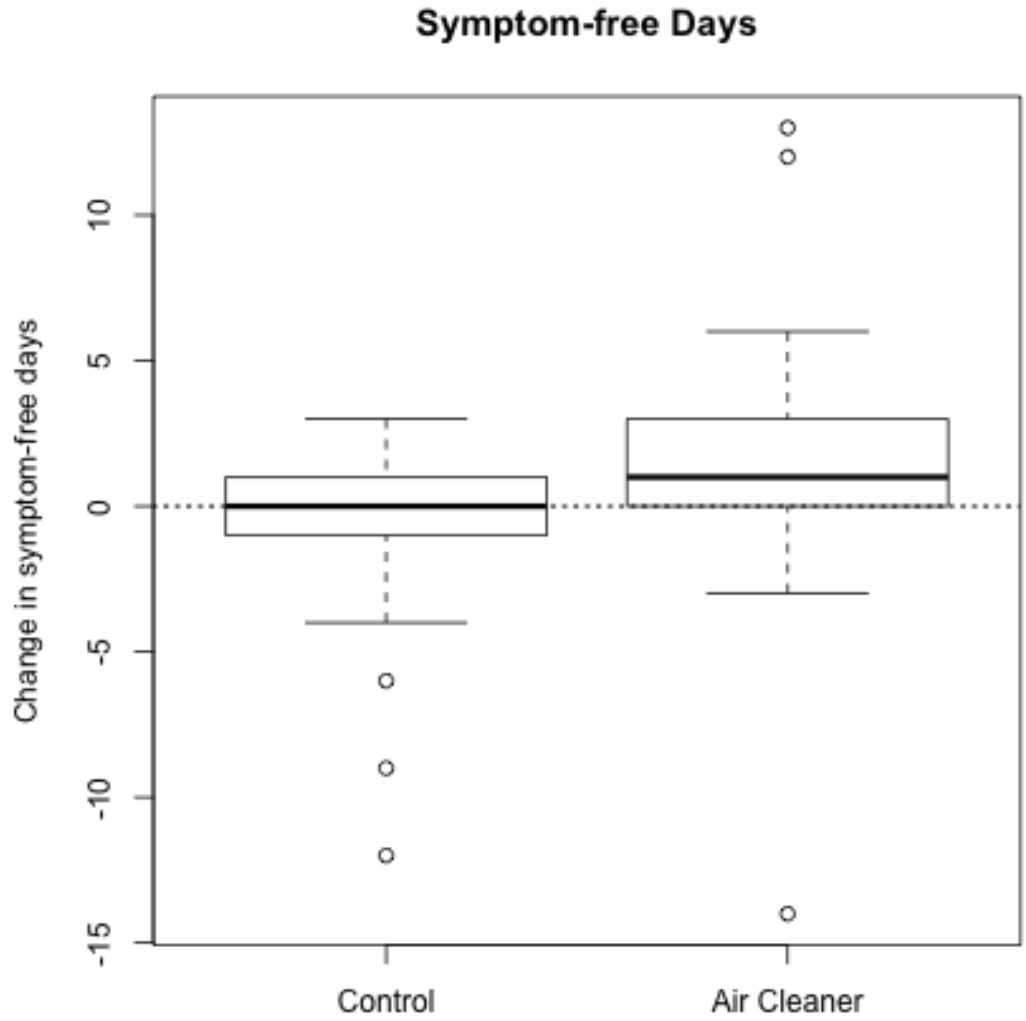

Figure 3: Show causality, mechanism

Show Causality, Mechanism

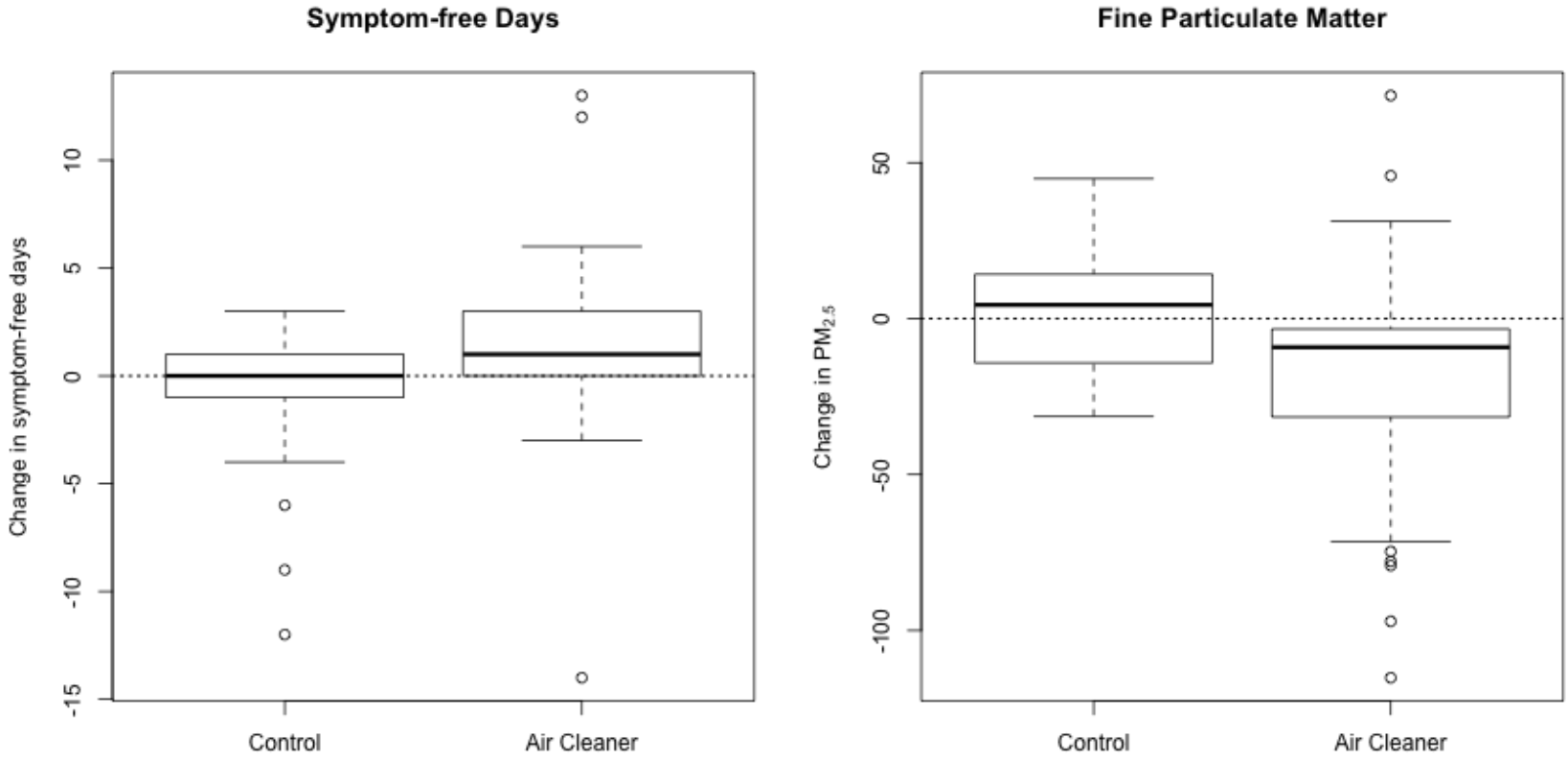

Figure 4: Show causality, mechanism

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

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- Evidence for an hypothesis is always **relative** to another competing hypothesis
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Principe 2: Show causality, mechanism, explanation, systematic structure

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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

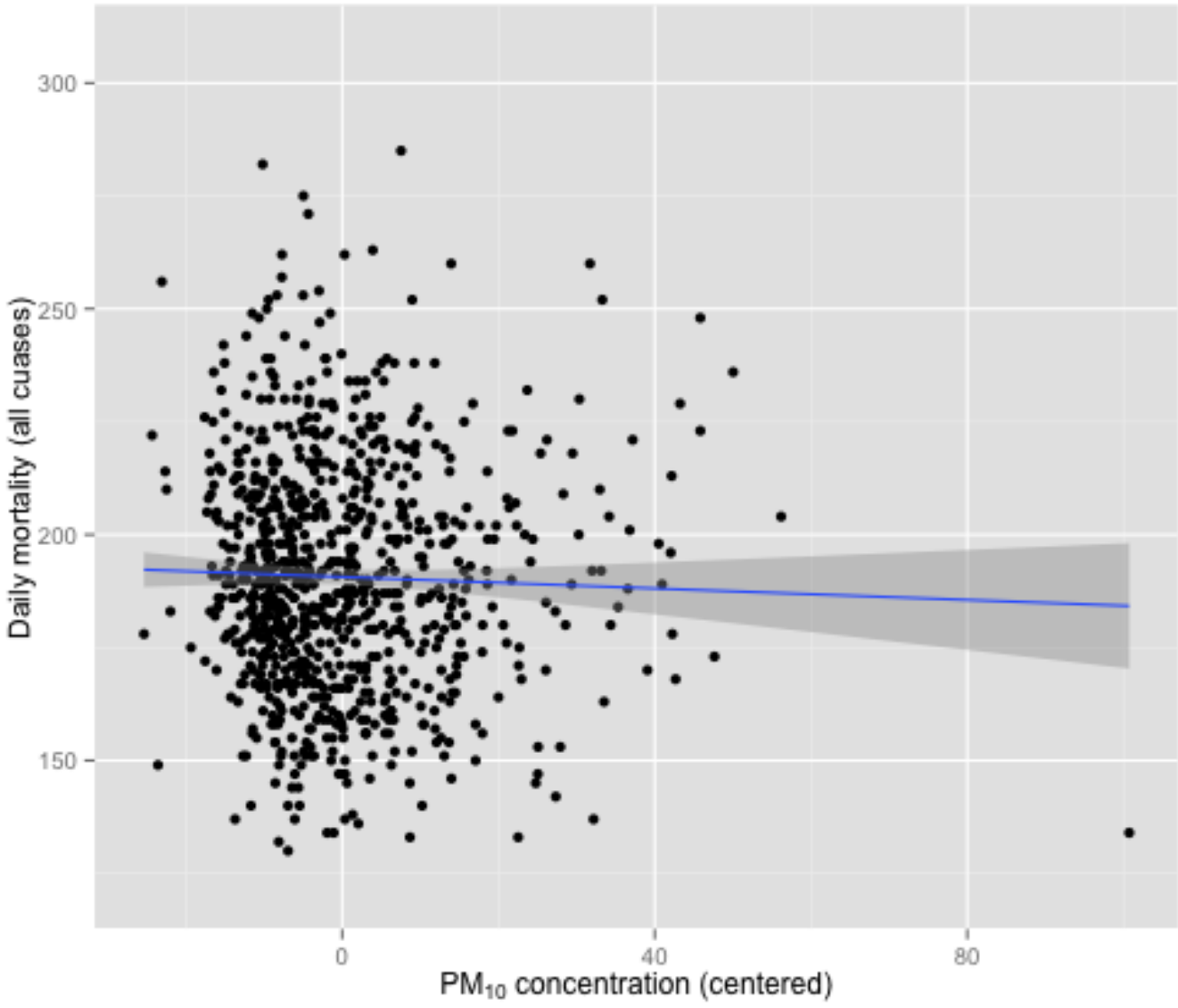

Figure 5: Two variables

Show Multivariate Data

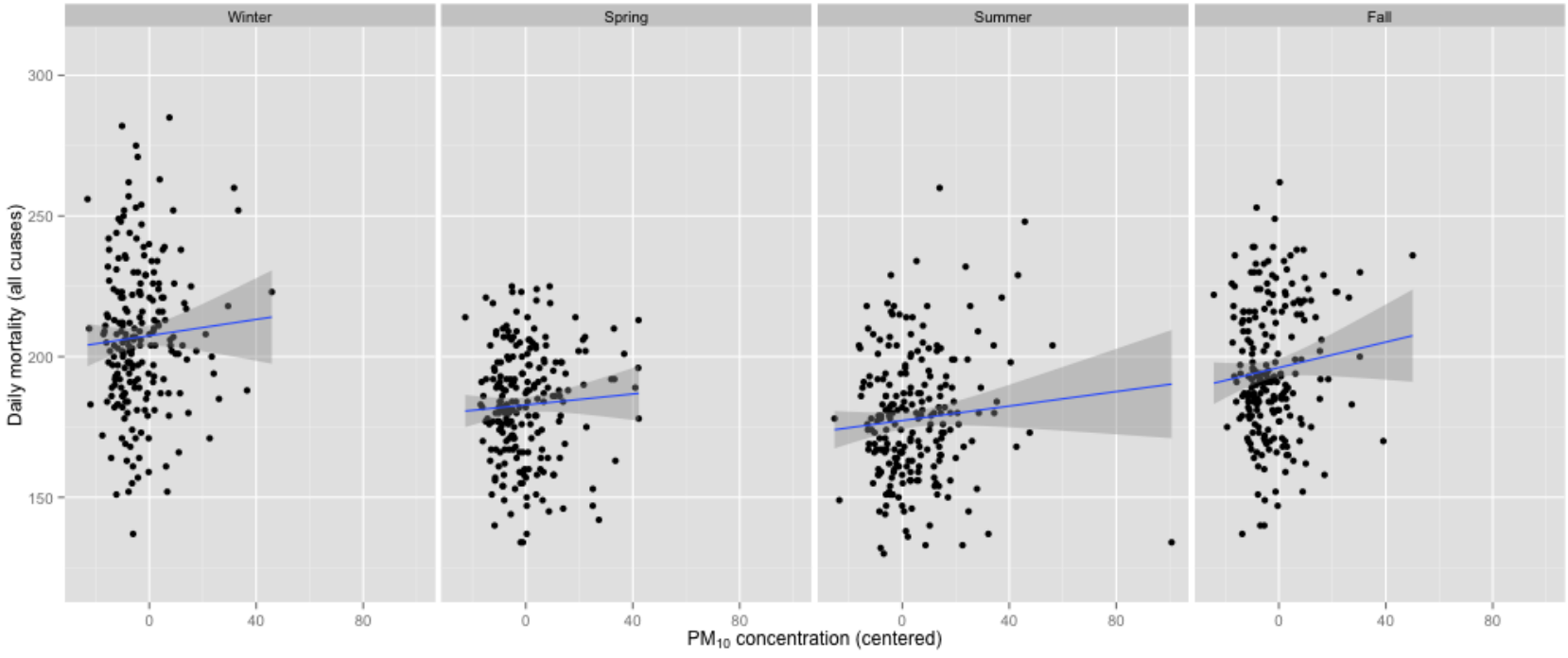

Figure 6: Three variables

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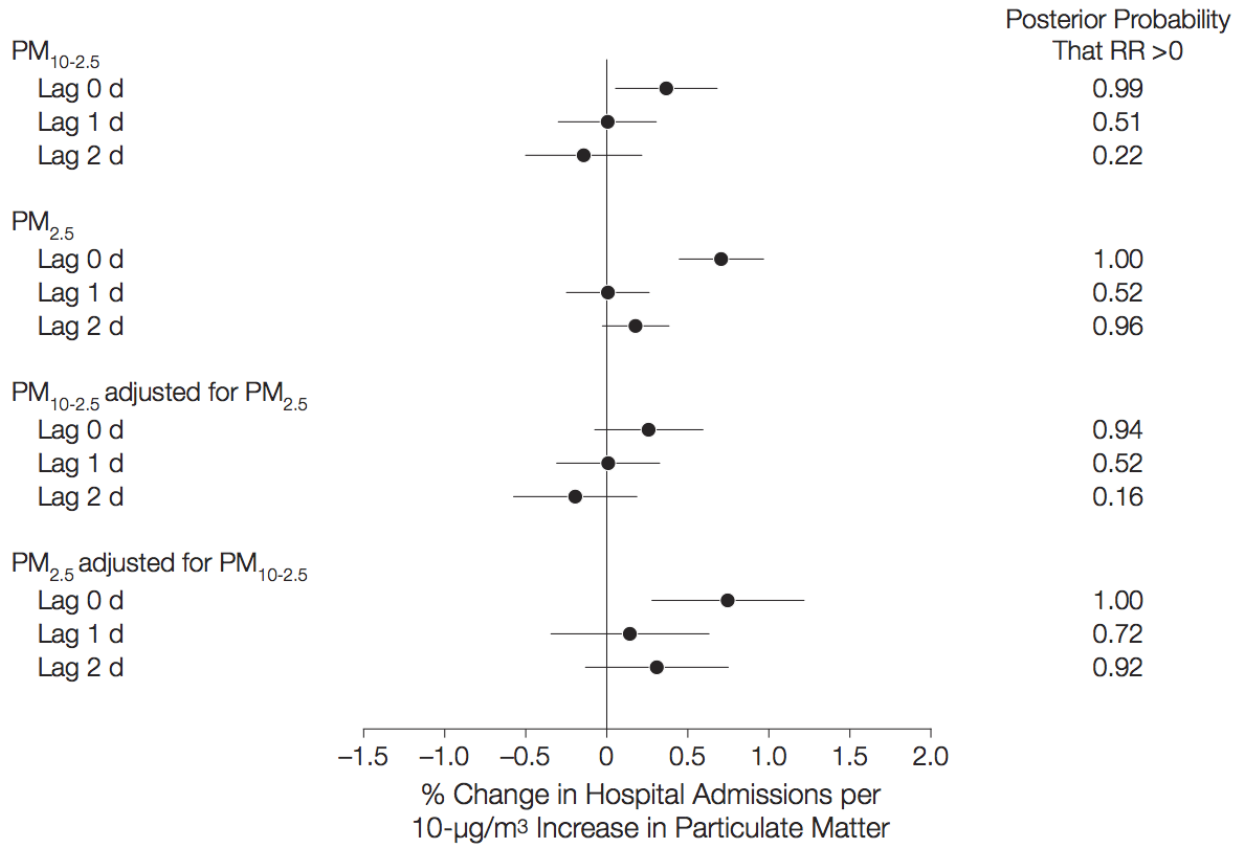
Principle 4: Integrate Evidence

- 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 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.

Figure 7: Using annotations on a figure

Integrate Evidence

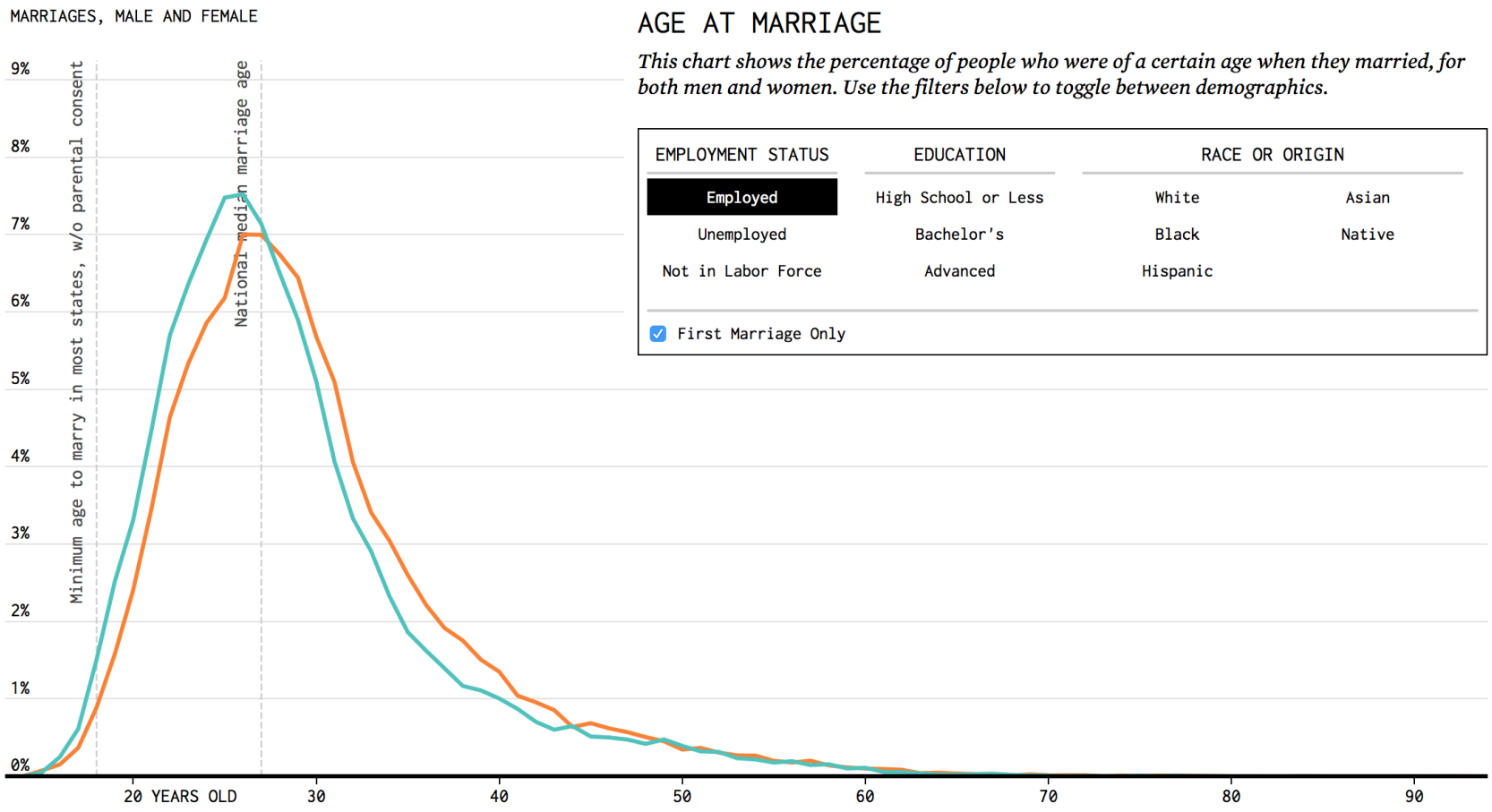


Figure 8: When do people get married?

Source: http://flowingdata.com/2016/03/03/marrying-age/

Integrate Evidence

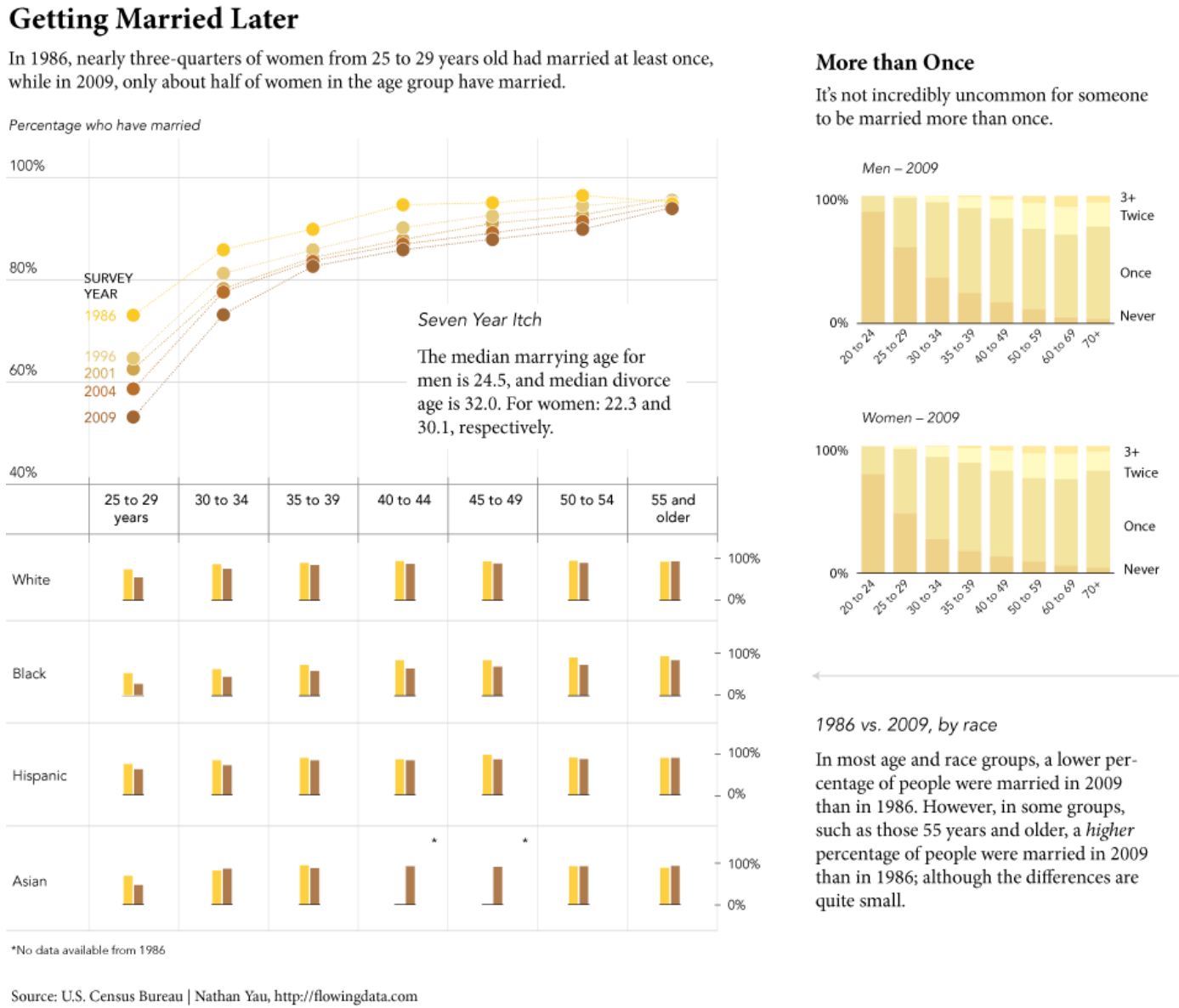


Figure 9: Getting married later

Integrate Evidence

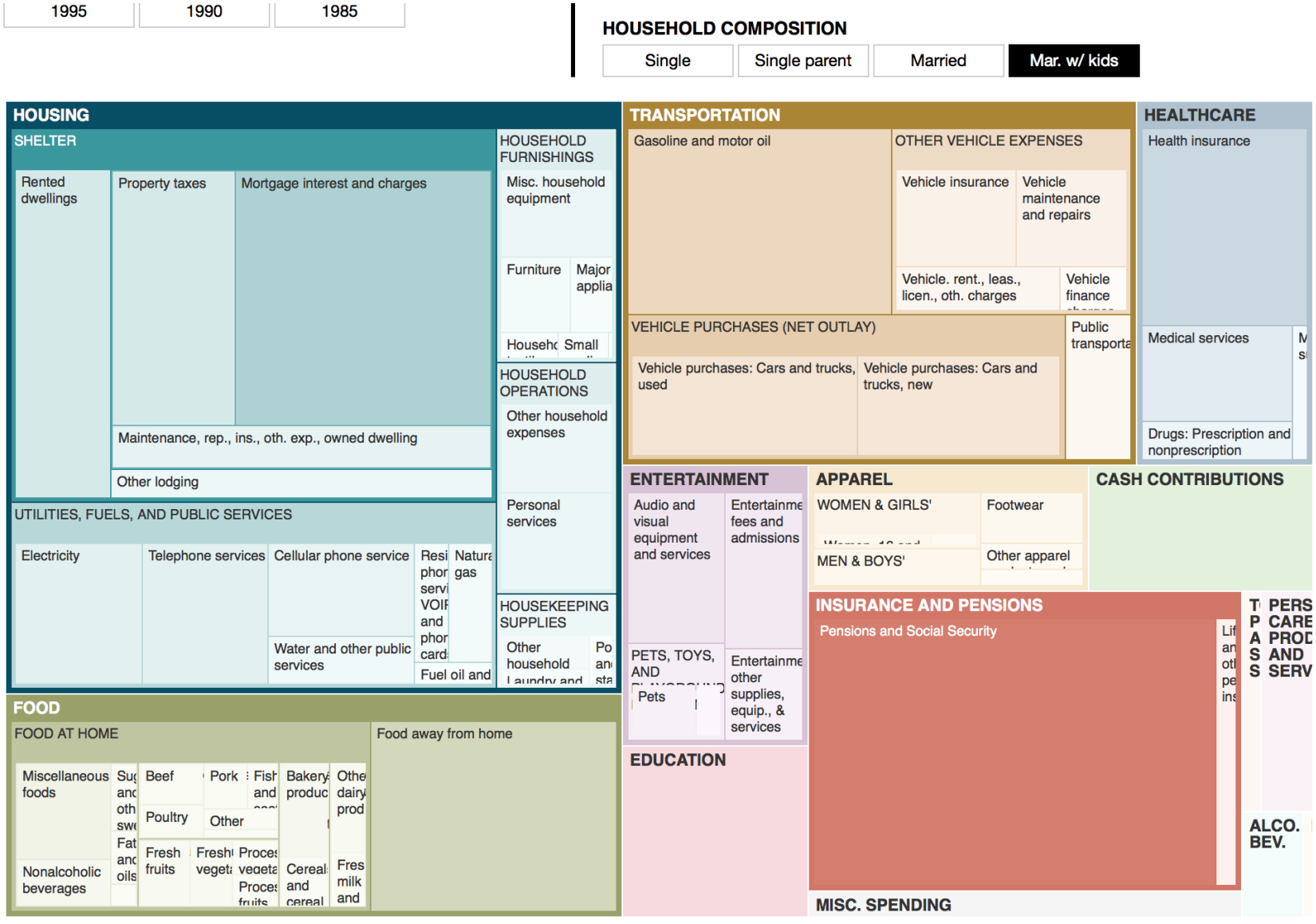


Figure 10: How we spend our money

Principles of Analytic Graphics

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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
- Same is true for a slide in a presentation

Document the Evidence

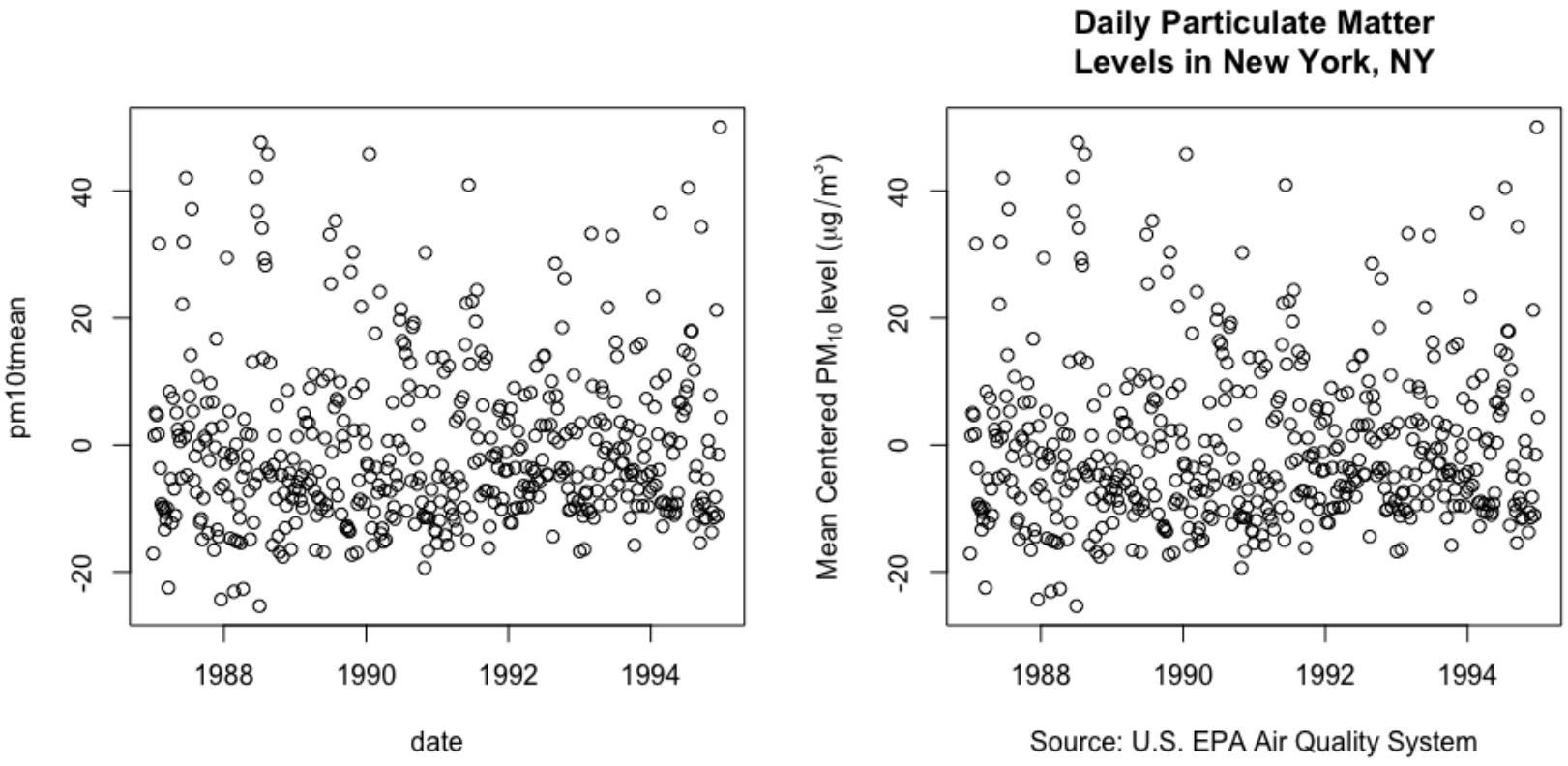

Figure 11: Unlabelled and labelled figure

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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

Reference

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