0. Causation from Association

Statistics are man-made, socially constructed.
Motto: “Take CARE!”
- C = Confounding (Predictors tangled up)
- A = Assembly (Define/Choose/Present)
- R = Randomness (Chance)
- E = Error or Bias (Mistakes, Sampling bias)

Different Emphasis

Confounding: Predictors are tangled up.
- ‘Take control of’ by random assignment.
- ‘Control for’ by standardizing (regression).
Assembly:
- defining groups (bullying, heat-wave deaths)
- choosing statistics (centers, rates, percents)
- presenting statistics (graphs & comparisons).

Traditional Statistics

<table>
<thead>
<tr>
<th>Association</th>
<th>Descriptive Statistics</th>
<th>Randomness</th>
</tr>
</thead>
</table>

Statistical Literacy

To be literate about everyday arguments that use statistics as evidence

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Table 1: State Prison Expenses: MN vs. IA

<table>
<thead>
<tr>
<th>State</th>
<th>Total</th>
<th># Inmates</th>
<th>Per Inmate</th>
</tr>
</thead>
<tbody>
<tr>
<td>MN</td>
<td>$186M</td>
<td>4,917</td>
<td>$37,825</td>
</tr>
<tr>
<td>IA</td>
<td>$146M</td>
<td>6,012</td>
<td>$24,286</td>
</tr>
<tr>
<td>%</td>
<td>27%</td>
<td></td>
<td>56%</td>
</tr>
</tbody>
</table>

Table 2: State Prison Expenses: MN vs. ME

<table>
<thead>
<tr>
<th>State</th>
<th>Total</th>
<th># Inmates</th>
<th>Per Inmate</th>
</tr>
</thead>
<tbody>
<tr>
<td>MN</td>
<td>$186M</td>
<td>4,917</td>
<td>$37,825</td>
</tr>
<tr>
<td>ME</td>
<td>$52M</td>
<td>1,543</td>
<td>$33,711</td>
</tr>
<tr>
<td>%</td>
<td>260%</td>
<td></td>
<td>12%</td>
</tr>
</tbody>
</table>

Controlling for the influence of a confounder can ↑, ↓, or reverse an association of totals.

Q. Can we show this for an association of ratios?
A. YES!

Table 3: State Prison Expenses: CA vs. NY

<table>
<thead>
<tr>
<th>State</th>
<th>Total</th>
<th># Inmates</th>
<th>Per Inmate</th>
</tr>
</thead>
<tbody>
<tr>
<td>CA</td>
<td>$3.0B</td>
<td>140</td>
<td>$21,385</td>
</tr>
<tr>
<td>NY</td>
<td>$2.2B</td>
<td>77</td>
<td>$28,426</td>
</tr>
<tr>
<td>%</td>
<td>36%</td>
<td></td>
<td>-25%</td>
</tr>
</tbody>
</table>

Married couples are 75% (35 percentage points) more prevalent among white families than among black families.

A = Assembly: Choice of Time Period

Top states in library items circulated (per person)

Ohio: 14.6  Oregon: 13.4  Utah: 11.7

By Ashley Smith and Ron Coddington, USA TODAY
Source: American Library Association

Upset by cellphone chatter

42% YES  58% NO

By Mary Odell and Keith Carter, USA TODAY
Source: Direction's Research
Statistical Literacy: An Overview

A = Assembly
1M Scouts; 2M Badges

Badges of honor Boy Scouts earn

93,056 93,502 73,871
First Aid Swimming Environmental Science

By Cindy Clark and Rod Coddington, USA TODAY
Source: Boy Scouts of America

A = Assembly
How Much More?

Would pay more for “green” products

<table>
<thead>
<tr>
<th>Agree</th>
<th>35%</th>
</tr>
</thead>
<tbody>
<tr>
<td>No opinion</td>
<td>22%</td>
</tr>
<tr>
<td>Disagree</td>
<td>34%</td>
</tr>
</tbody>
</table>

By Anne R. Carey and Jerry Noseman, USA TODAY
Source: Simmons Market Research

A = Assembly
“Many”: 30% or 9%

Types of bumper stickers we have

Promotional 6%
University-related 6%
Political 4%
Humorous 4%

By Justin Dickerson and Rod Coddington, USA TODAY
Source: Roper for Mercedes-Benz

A = Assembly
Full Comparatives

- Women live longer than men.
- Autism more prevalent among boys than girls.

Incomplete (Null) comparatives.

- More doctors like Crest.

Superlatives (Majority vs. Plurality)

- Most doctors like Crest.

A = Assembly
Part vs. Whole

Difficulty reading graphs in USA Today

$35,000 or less 16%
$35,001-$50,000 18%
$50,001-$75,000 24%
Over $75,001 41%

Guests who bring gifts (by household income)

R = Randomness: Not Due to Chance

Too Unlikely to be Due to Chance so the association must be causal.

- This statistic is central to arguments about ESP and Intelligent Design and to arguments about the safety of nuclear power plants, cell phones and cell-phone towers.
- These arguments are central to education, to moral decisions and to legal liability.
**R = Randomness**

**Evolution**

Too Unlikely to be Due Just to Chance

- Evolving life by chance alone is as likely as having tornado turn a junk yard into a 747.

If a Robin = 1,000 “ones” on a 10-sided die.

- $10^{990}$ years by chance alone (~300/sec)
- 30 seconds by chance plus “genetic inheritance” or “natural selection”

**E = Error/Bias:**

Casino’s Loose Money?

- Winning lottery twice.
- 9/11 coincidences.

**Law of Large Numbers**

- Unlikely is almost certain given enough tries.
- 60% chance of 8 heads in 8 flips in 256 tries.

**SUMMARY**

Peter Holmes (2003)

- “is different”: “different emphasis”, “different background”, “a different package”
- “goes beyond Numeracy”
- is more in line with the statistical literacy “needed by most people in everyday life to read the news, by those in business commerce or management, and by policy makers.”

**To Get Educated**

1. Read “Statistical Literacy and Liberal Education at Augsburg College” by Milo Schield (2004 AACU Peer Review)
2. Read Damned Lies & Statistics and More Damned Lies & Statistics by Joel Best
3. Read “Statistical Literacy – Online at Capella University” by Mark Isaacson.
4. Investigate Stat Lit at www.Statlit.org

**Next Steps**

1. Network with faculty interested in critical thinking about arguments involving statistics.
2. Read “The Case for Quantitative Literacy” by Lynn Steen (or any of his other QL books)
3. Schedule faculty workshops to discuss different approaches to QR/QL.
4. Consider adopting Statistical Literacy as a QR/QL course for humanities majors.