1

Chapter 1

Statistical Literacy 2009
Chapter Summaries
by
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www.StatLit.org/pdf/...
2009StatLitTextHandoutCh1.ppt
2009StatLitTextHandoutCh1.pdf

2

TWO HUNTERS AND A BEAR

Two hunters are being chased by a bear. The first hunter yells to the second, "*It's hopeless! This bear can run faster than we can.*"

The second hunter yells back,
"*No it's not hopeless! I don't have to outrun the bear. I just have to outrun you.*"

Statistical Literacy

Statistical literacy is **the ability to read and interpret summary statistics in everyday life**.

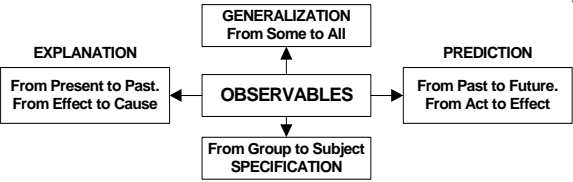Statistical Literacy studies

(1) the relation between statistical associations and causation, and

(2) the full-range of influences on a statistic or a statistical association. [Take CARE]

4

Q1. What Kind of Argument?

Is there a disputable claim that requires an argument or is this just a presentation of facts?

If there is an argument, what kind of argument is involved?

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                    GENERALIZATION
                    From Some to All
EXPLANATION                                      PREDICTION
From Present to Past.                             From Past to Future.
From Effect to Cause  ←  OBSERVABLES  →          From Act to Effect
                    From Group to Subject
                    SPECIFICATION
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5

Association-Causation

Association indicates a connection. It may be causal (thunder follows lightning). It may be coincidental (the taller candidate for US president has won every election in the last 50 years*)

Relationship between association and causation
1. Association is not causation
2. Association is not necessarily causation.
3. Association is often a good sign of causation.

Bush and Gore were extremely close in height.

6

Grammar of Association and Causation

Association: *correlation, association* and *goes together*. Also by a comparisons of groups.

Causation: *cause, effect, result* and *prevent*.
Causation is also indicated
•by sufficiency:
*The more X you do, the more Y you **will** get.*
•by a contra-factual comparison:
Those who do X get more Y than if they had not.

7

Grammar of Association and Causation

Between association and causation are a host of words and phrases:

• Action verbs: *cut, reduce, increase*
• Logical connections: *because of, due to*
• Joint comparison: *As X increases, Y decreases*.
• temporal connections: *follows, precedes*

Action verbs imply causation, but for experts they only assert association.

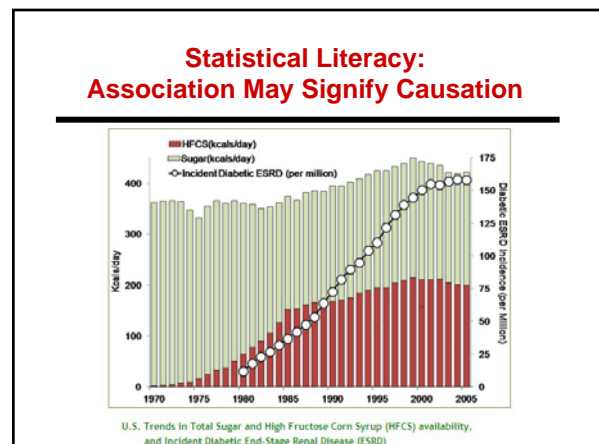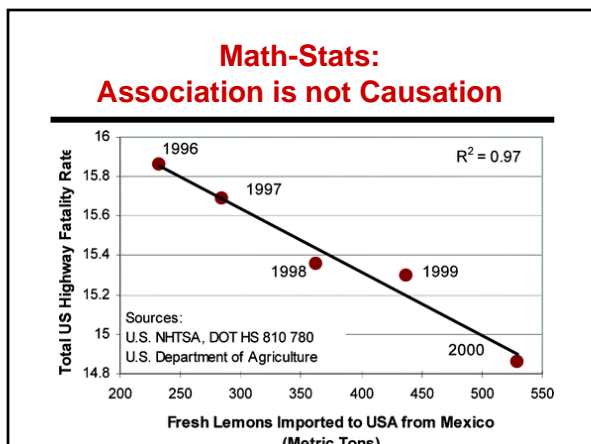
8

Correlation vs. Causation

9

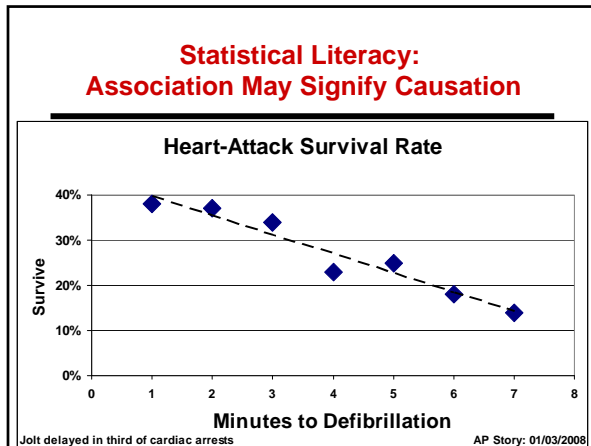## Correlation vs. Causation

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10

24 hours in a day; 24 beers in a case.

• 45 % of Americans Don't Owe [don't pay any] Federal Income Taxes.
  www.cbsnews.com/stories/2009/04/15/politics/otherpeoplesmoney/main4945874.shtml

• 43% of Americans Say They Are Paying the Right Amount of Federal Income Taxes.
  www.gallup.com/poll/147152/Americans-Split-Whether-Taxes-High.aspx

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Math-Stats: Association is not Causation

Statistical Literacy: Association May Signify Causation

Statistical Literacy: Association May Signify Causation

Heart-Attack Survival Rate

Jolt delayed in third of cardiac arrests   AP Story: 01/03/2008

14

Take CARE

The Point or the Target

The more disputable the point,
the stronger the evidence must be.

Statistic As Evidence

"All Statistics are Socially Constructed"
So, "Take CARE"!!
Statistics may be influenced by:

C	A	R	E
Confounding	Assembly	Randomness	Error

Statistical Literacy: Take CARE

Take "CARE"
Know that all statistics are influenced by:

- Context: ratios, study design and confounding
- Assembly: how groups/measures are formed
- Randomness: in small samples, in big groups
- Error/bias: subject, measurement or survey bias

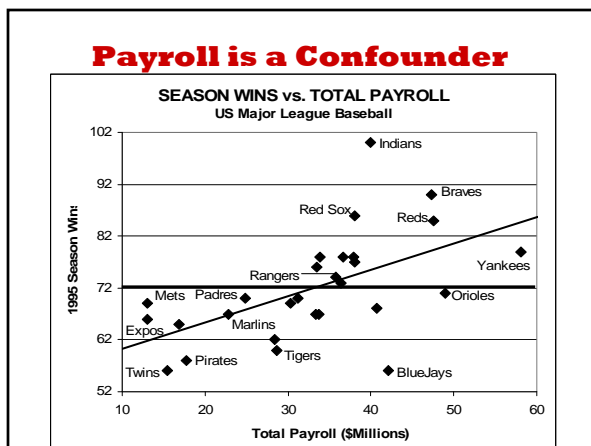From Ch 11 in *Assessment Methods in Statistical Education*

16

Context Confounding

Confound means to confuse something

"called Babel; because the LORD did there
confound the language of all" *Genesis 11,9.*

Confounder describes a cause of confounding.

- A confounder provides an alternate explanation.
- E.g., People who carry lighters are more likely
to develop lung cancer.
Smoking is the confounder.

Payroll is a Confounder

SEASON WINS vs. TOTAL PAYROLL
US Major League Baseball

18

A: Can Assembly Influence the Numbers?

Half of US kids will get food stamps, study says

SOURCE: 11/2/2009 Yahoo.com

Nearly half of all U.S. children [90% of black
children and 37% of whites] will be on food
stamps *at some point during childhood* [by age
20]

19

R: Hot streaks just Coincidence?

One Gambler's Blackjack Hot Streak Wipes Out Casino's Profit

The Tropicana lost more than $1.86 million at its blackjack tables in April [2011] thanks mostly to a single patron who won $5.8 million at the casino's high-stakes tables.

http://blogs.forbes.com/halahtouryalai/2011/05/13/one-mans-blackjack-hotstreak-wipes-out-casinos-profit/

20

E: Can Bias Explain Statistics?

Response bias: Most adults think they are above-average drivers.

Measurement bias: Do you think your child is above average or below average in school?

Selection/sampling bias: Most shoppers would rather shop at Costco than at Wal-Mart.

Based on a survey of 1,200 shoppers at Costco.

21

Conclusion

To make intelligent decisions in a data-driven democracy, *citizens be statistically literate*.

They must be able to follow arguments in the everyday media that use statistics as evidence. They must learn how to
• analyze these arguments,
• *understand the influences on the numbers*, and
• reach a reasoned, nuanced conclusion.

Once this skill is acquired, it can be used on a daily basis throughout their life.