

# **Chapter 1**

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## *Statistical Literacy 2009* **Chapter Summaries**

by

**Milo Schield**

*[www.StatLit.org/pdf/2009StatLitText-Ch1.ppt](http://www.StatLit.org/pdf/2009StatLitText-Ch1.ppt)*

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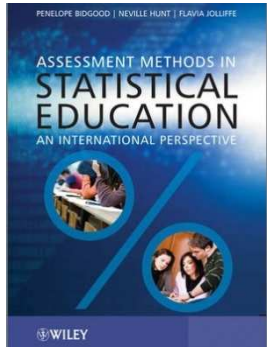
# TWO HUNTERS AND A BEAR

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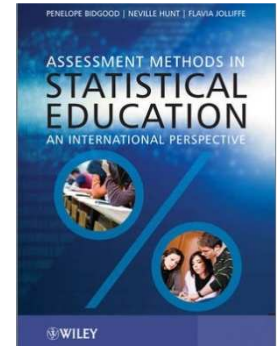
Two hunters are being chased by a bear. The first hunter yells to the second, *“It’s hopeless! This bear can run faster than we can.”*



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

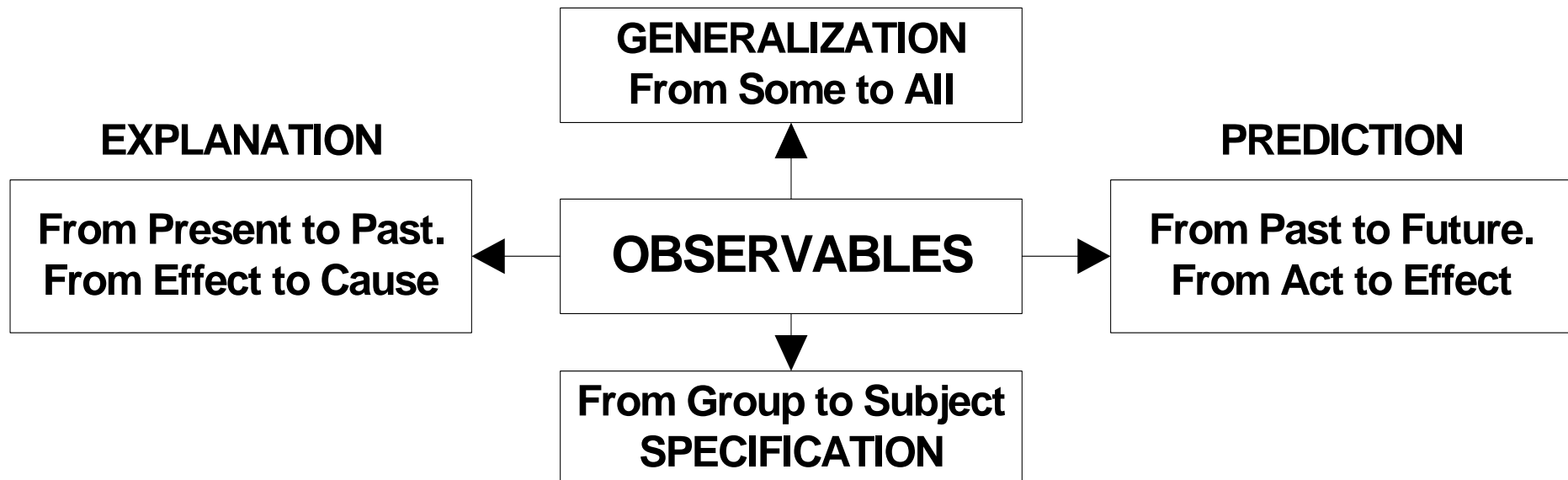
- (1) the relation between statistical associations and causation, and
- (2) the full-range of influences on a statistic or a statistical association. [Take CARE]

# Q1. What Kind of Argument?

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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?



# Association-Causation

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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.

# Grammar of Association and Causation

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**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.*

# Grammar of Association and Causation

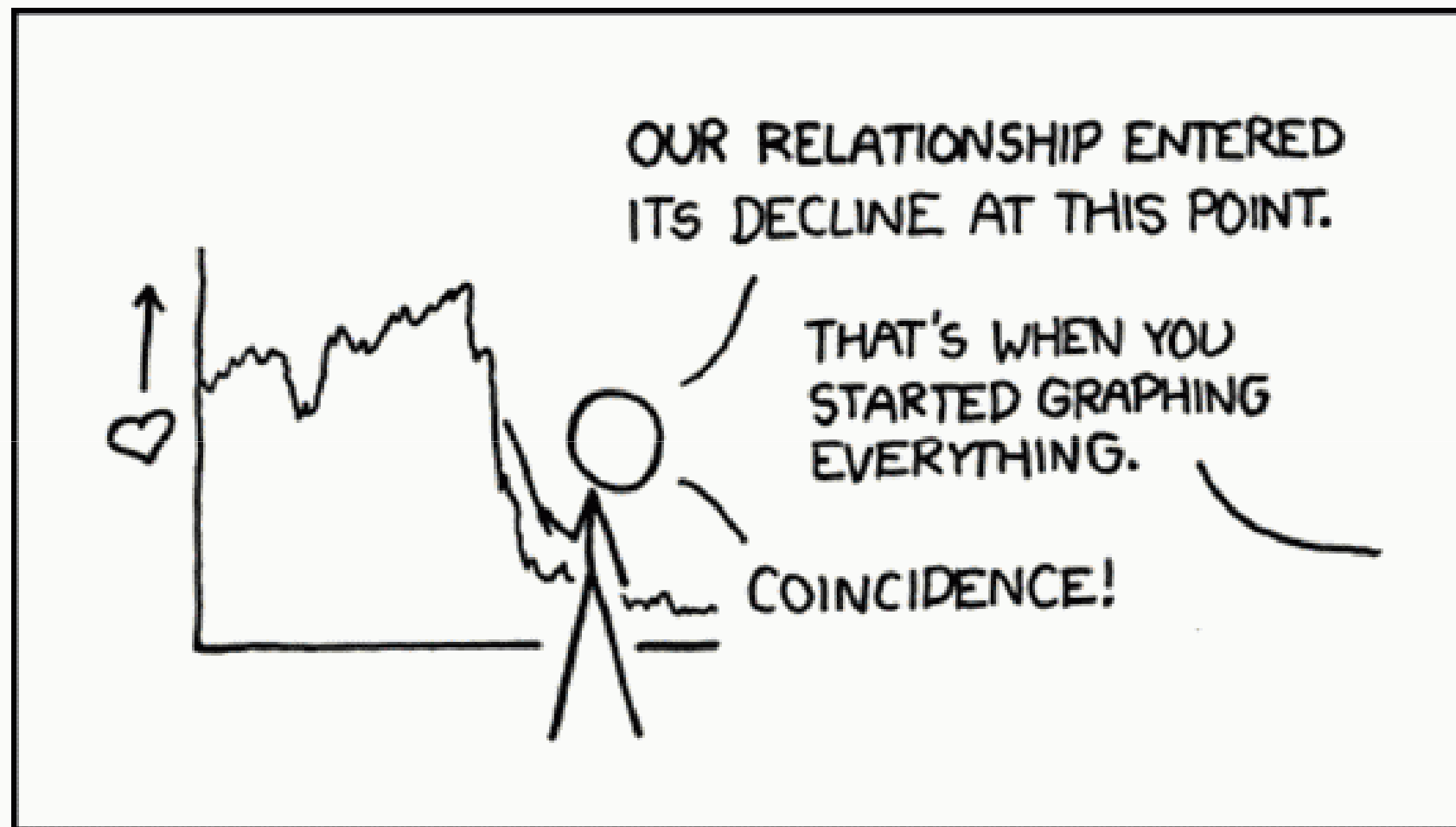
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Between association and causation are a host of words and phrases:

- 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.

# Correlation vs. Causation



&lt;

&lt; PREV

RANDOM

NEXT &gt;

&gt;

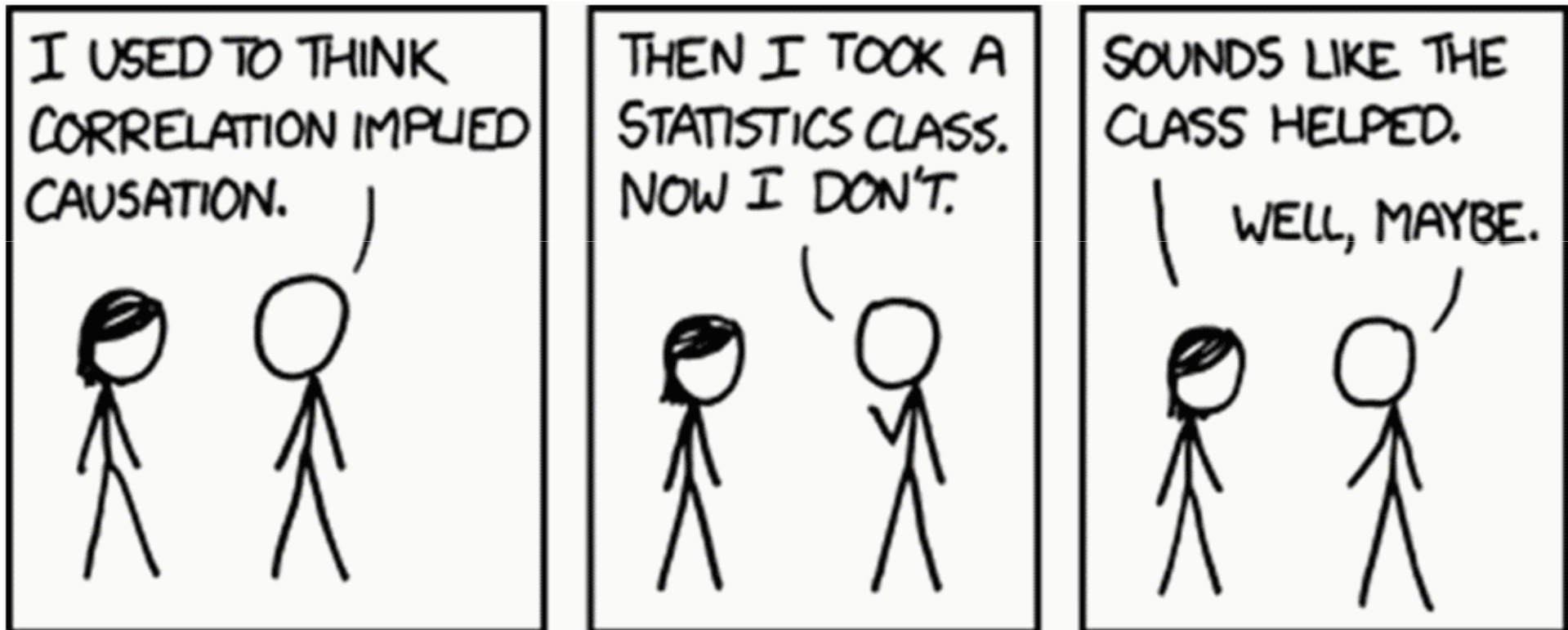
PERMANENT LINK TO THIS COMIC: [HTTP://XKCD.COM/523/](http://xkcd.com/523/)

IMAGE URL (FOR HOTLINKING/EMBEDDING): [HTTP://IMGS.XKCD.COM/COMICS/DECLINE.PNG](http://imgs.xkcd.com/comics/decline.png)



# Correlation vs. Causation

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

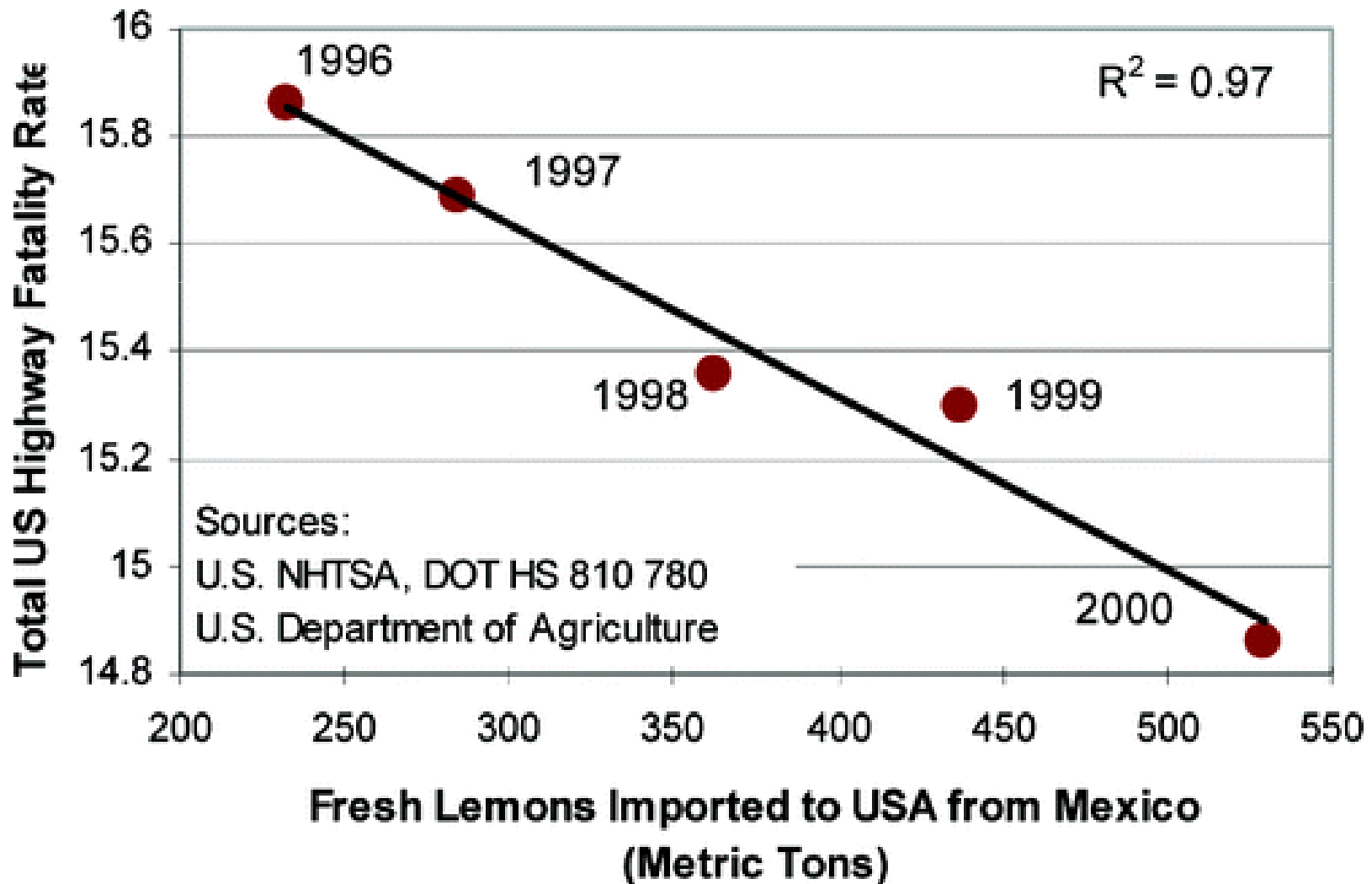
- 45 % of Americans Don't Owe [don't pay any] Federal Income Taxes.

[www.cbsnews.com/stories/2009/04/15/politics/otherpeoplesmoney/main4945874.shtml](http://www.cbsnews.com/stories/2009/04/15/politics/otherpeoplesmoney/main4945874.shtml)

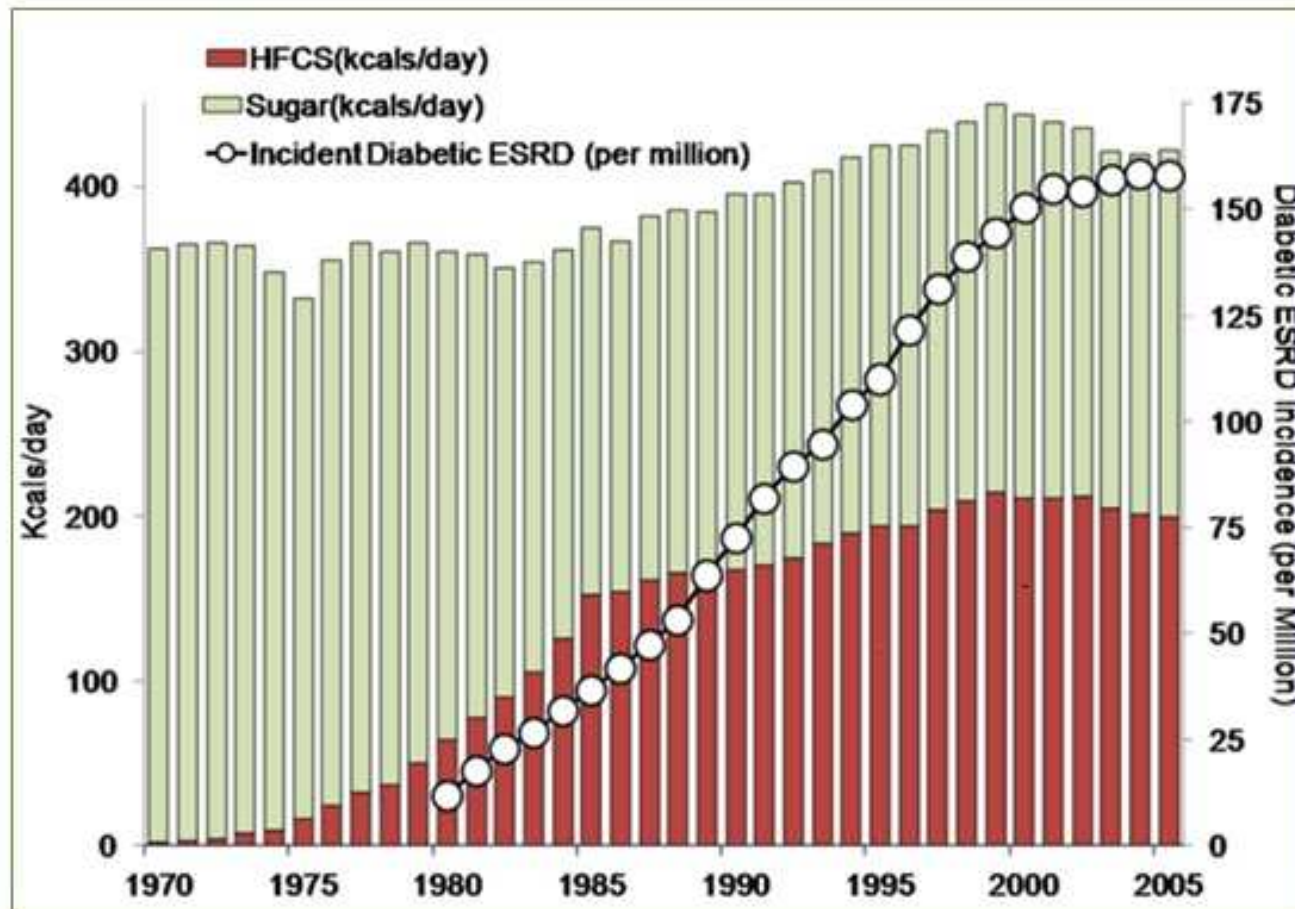
- 43% of Americans Say They Are Paying the Right Amount of Federal Income Taxes.

[www.gallup.com/poll/147152/Americans-Split-Whether-Taxes-High.aspx](http://www.gallup.com/poll/147152/Americans-Split-Whether-Taxes-High.aspx)

# Math-Stats: Association is not Causation

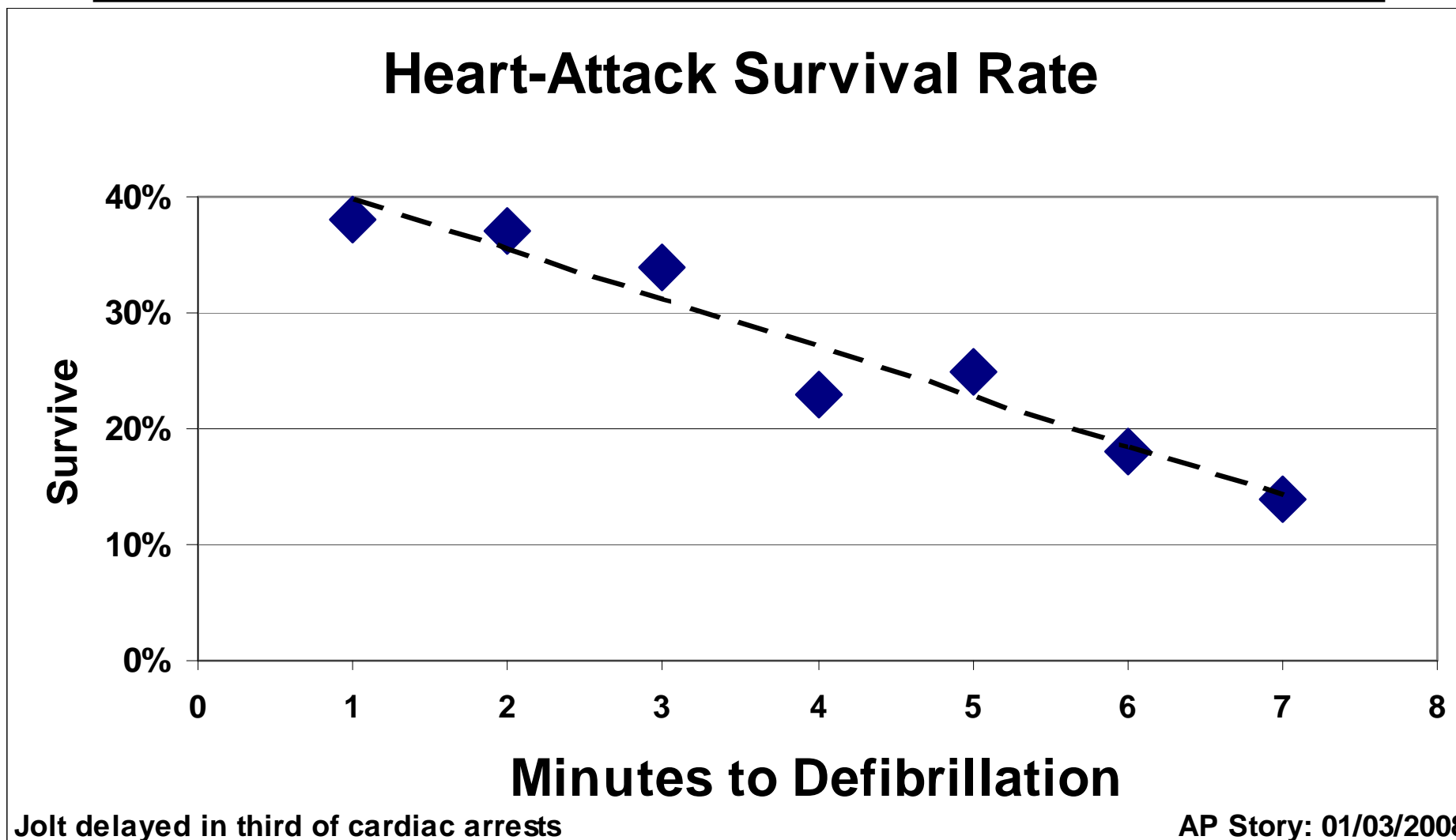


# Statistical Literacy: Association May Signify Causation



U.S. Trends in Total Sugar and High Fructose Corn Syrup (HFCS) availability, and Incident Diabetic End-Stage Renal Disease (ESRD)

# Statistical Literacy: Association May Signify Causation



# Take CARE

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## The Point or the Target



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

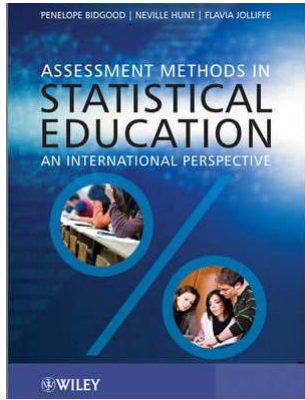
## Statistic As Evidence

**“All Statistics are Socially Constructed”**

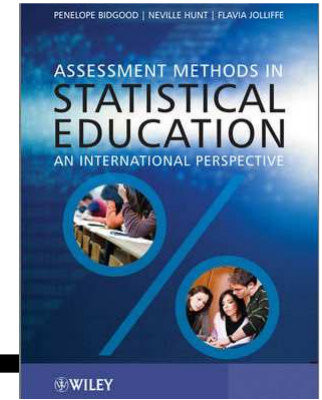
**So, “Take CARE”!!**

**Statistics may be influenced by:**

<b>C</b>	<b>A</b>	<b>R</b>	<b>E</b>
<b>Confounding</b>	<b>Assembly</b>	<b>Randomness</b>	<b>Error</b>



# 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*

# Context

# Confounding

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*Confound* means to confuse something

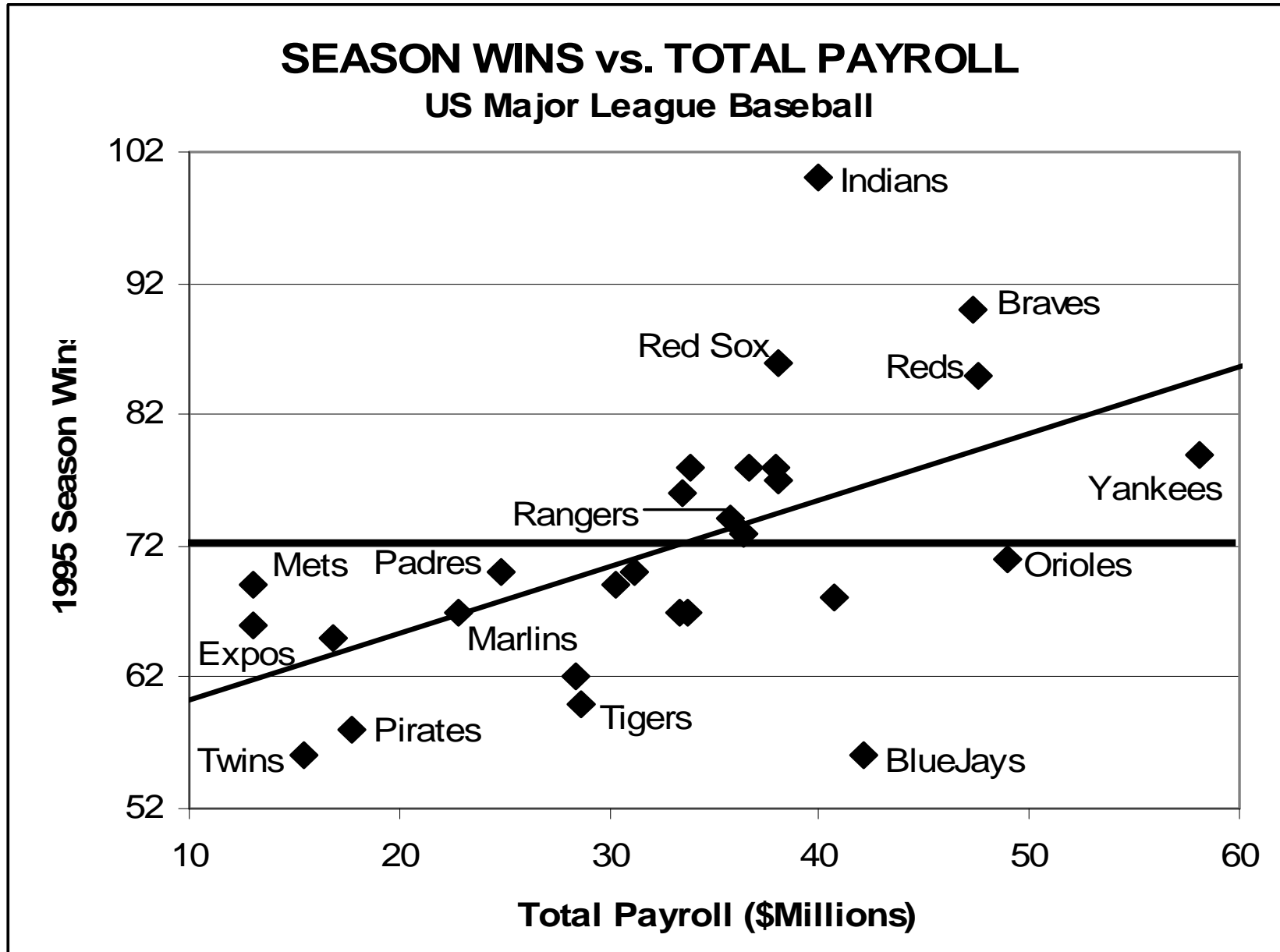
“called Babel; because the LORD did there confound the language of all” *Genesis 11,9*.

*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



# A: Can Assembly Influence the Numbers?

Half of US kids will get food stamps, study says

 Associated Press

 Buzz up! 138 votes |  Send ▼ |  Share ▼ |  Print

By LINDSEY TANNER, AP Medical Writer – Mon Nov 2, 9:32 pm ET

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]

# **R: Hot streaks just Coincidence?**

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## **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/>

# **E: Can Bias Explain Statistics?**

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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.

# Conclusion

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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.