Statistical Literacy for Policy Makers

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Fellow: American Statistical Association
Elected Member: International Statistical Institute
US Rep: International Statistical Literacy Project
President: National Numeracy Network

ISI World Statistics Conference Online
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Paper: www.StatLit.org/pdf/2021-Schield-ISI.pdf
Slides: www.StatLit.org/pdf/2021-Schield-ISI-Slides.pdf

Policy Makers: Subject Matter & Questions

Policy makers don't have to be experts.
They just need to ask good questions.

- Before they can ask good questions, they need to know the most important elements of the subject.
- Once they know the basics of a subject, their questions can be simple, but productive.

Here are 7 things to know about statistics.
Here are 7 questions to ask about statistics.

Subject-Matter: #1 Statistics are Numbers in Context

In math, 1+1 = 2. In statistics, context matters.

- In bunny math, adding one bunny and one bunny can yield more than two bunnies.
- In ice-cube math, adding one ice-cube and one ice-cube can yield no ice-cubes (hot water).
- A company has a 60% market share in the Eastern US (70% in Western US). What is their market share in the entire US? 130%? Hardly!

Subject-Matter: #2 Statistics: Socially Constructed

Numbers are like pebbles. They just exist.

Statistics are like diamonds. They are cut, shaped, polished and presented to maximize their beauty and their price.

Statistics are socially constructed – just like words – by people with motives and goals.

Read Joel Best's *Lies, Damned Lies and Statistics* and his sequel: *More Damned Lies and Statistics*.

Subject-Matter: #3a Statistics Can Be Influenced

Statistics can be influenced in ways numbers can't.

A statistic or comparison can be true and still be influenced. Best advice: Take CARE!

Each letter stands for a different kind of influence:

- **C**onfounding: "Found with" that confuses.
- **A**ssembly: How defined, counted, measured.
- **R**andomness: Win 2 lotteries; birthday problem
- **E**rror (bias): Subject, measurement & sampling

Subject-Matter: #3b Statistics Can Be Influenced

Statistics can be influenced **by confounders**:

- **Association:** Those who read home and fashion magazines are more likely to get pregnant than those who read car and sport magazines.
- **Causation:** If you want to get pregnant, read home and fashion magazines. If you want to avoid pregnancy, read car and sport magazines.
- Association may be true; causation is false!

Confounder is gender: confuses the association.

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Subject-Matter: #3c
Statistics Can Be Influenced

A statistic can be true and still be influenced.
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Statistics can be influenced by:

- **Assembly**: In 1998, NIH changed definition of overweight. Overnight 30M became overweight.
- **Randomness**: *Sports Illustrated* Jinx. Featured athlete never does as well afterward.
- **Error/bias**: 99% of those surveyed like Costco.

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Subject-Matter: #4
Association is not Causation

Association: As weight increases among adults, so does height. Heavier people tend to be taller.

Causation: If you want to increase your height, gain weight!

Association: People who shave their face are likely to be taller than those who shave their legs.

Causation: If you want to be tall, shave your face.

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Subject-Matter: #5
Disparity is not Discrimination

90% of those in prison are guys (10% are gals)

Disparity: Guys are….
- nine times as likely to be in prison as are gals.
- Almost twice as likely in prison as in population

Discrimination: Against men?

Disparities don't prove discrimination. Men commit 75% of the violent crimes.

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Subject-Matter: #6
Ratios may be Confounded

The best research hospital in a city or state has the highest patient death rate.

One explanation: The personnel, policies, and procedures at the hospital are inadequate.

Second explanation: Sickest patients go to the research hospital. Sickest patients are most likely to die. Rate is confounded by patient condition.

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Subject-Matter: #7
Effect Size Matters

The larger the effect size the more resistent an association is to being nullified or reversed.

Did smoking cause lung cancer? A scientific experiment was impossible. But smokers were **10 times as likely** to develop lung cancer as non-smokers. This large effect size effectively neutralized all known confounders

The smaller the effect size, the more likely an association can be influenced by confounders.

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Policy Makers Questions:
One thru Four

1. How big, how many, how much?
   Statistical claims without amounts indicate small size.
2. Compared to what?
   California had more Covid deaths than Florida
3. Why not a rate?
   S. Africa had more Covid deaths than Czechia.
4. Per what? Consider the Covid death rate:
   ** higher in Czechia than S. Africa **per person**;*
   ** lower in Czechia than S. Africa **per case**.*

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Policy Maker Questions: Five through Seven

5. How were things defined, counted or measured?
   Cuba had a lower infant mortality rate than U.S.
6. What was taken into account?
   Rates may control for size of group, but still be crude associations. Mexico has lower death rate than US.
7. What else should have been controlled for?
   Magazines-Pregnancy: Control for gender.
   Mexico-US Death rate: control for age.
   Hospital death rate: control for patient condition.

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Statistical Literacy: Seven Basics

1. Statistics are numbers in context
2. Statistics are socially constructed.
3. Statistics can be influenced. So Take CARE.
4. Association is not necessarily causation.
5. Disparity is not necessarily discrimination.
6. Rates and percentages can confounded.
7. Effect size matters

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Statistical Literacy: Seven Questions

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