

Statistical Literacy for Efficient Citizenship

A Blog About Statistical Literacy and Introductory Statistics Instruction

09.27.06

Statistical Literacy—It’s More Than Just Understanding the News

Posted in [Statistical Literacy](#) at 5:37 am by schaffer

The title comes from a comment I’ve heard once or twice about statistical literacy—that it’s about being able to understand statistics in the news. There’s nothing wrong with this statement, but I find it disappointing in its lack of gravity. Personally, I’d like to throttle my fellow voters and consumers to make them use evidence-based reasoning. In this post, I give three examples that demonstrate why statistical literacy is needed for efficient citizenship.

“Statistical literacy for efficient citizenship” comes from Samuel Wilks:

“Statistical thinking will one day be as necessary for efficient citizenship as the ability to read and write!”

Wilks said this in his presidential address to the American Statistical Association in 1950. Although he attributed it to H. G. Wells, Wilks’ quote is a beautifully compact paraphrase of a much longer sentence that Wells wrote in 1903. Wells provided the term “efficient citizenship” and Wilks added the modern phrase, “statistical thinking.” The combination, “statistical thinking for efficient citizenship,” is potent in its elegance. (Read the [Chance article](#) to learn about the origin and evolution of this quote).

Wilks’ quote makes this point: Each individual needs to interpret statistical arguments to make decisions about health, medical treatment, innocence or guilt when serving as a juror, investment, consumer purchases, and politics relating to health, social, economic, educational, and environmental policy. “Efficient citizenship,” I suppose, refers to the benefit to an individual in their activities as a citizen. It could also refer to a collective efficiency that we all enjoy if a majority of people understand statistical thinking—we could waste less time debating the interpretation of evidence (or being fooled by faulty evidence).

Although the quote elegantly expresses an opinion that statistical literacy is important, it does not include any evidence to support the opinion. I think a few examples can help.

Complementary and Alternative Medicine

In a U.S. senate discussion of regulations over herbal and dietary supplements, senators Tom Harkin and Orrin Hatch argued that government should not restrict the kinds of medicines and treatments Americans can use. The people aren’t stupid, the senators said. Individuals can decide for themselves what medicines will be best for them.

That sentiment has played a guiding role in the progress of health care in America in recent years. Hospitals and insurance companies are offering more choices, including many that have not previously been part of mainstream medicine.

Fair enough: freedom of choice. For such freedom of choice to work, consumers need information about safety and effectiveness, and the skills to evaluate this information for making health choices. Conclusions about safety and effectiveness are necessarily statistical conclusions. For their own health *and* for the benefit of the rest of us who suffer whenever health care spending is wasted, citizens need to be statistically literate. Only

basic concepts are needed—the placebo effect, anecdotal evidence, the importance of randomized clinical trials, the meaning of a p-value, the interpretation of effect sizes, and the difference between statistical and practical significance, for example—but citizens carry out their decisions ineffeciently without an understanding of these basic ideas.

The Spinning of Scientific Results

By spinning, I mean, of course, the attempt to influence opinions in a certain direction, as when a spokesperson spins reporters after a political debate to make it appear that his candidate won. I haven’t been aware of the spinning of scientific results until recently, but it makes sense that it happens if there is a lot of money at stake. Two recent studies opened my eyes to this, one on the relationship between obesity and mortality and one on health effects of low doses of radiation.

The weight and health evidence pitted the powerful food and beverage industry, which would benefit from a perception that being overweight is not that bad, against the also powerful weight-loss industry, which would benefit from the opposite perception. The radiation example, prompted spinning from supporters of the nuclear power industry, which would benefit from laxer regulations, and from grassroots anti-nuclear environmentalists on the other.

In both cases, conclusions about health effects were largely statistical. Although scientific debate over the interpretation of evidence is healthy, the spinning I am talking about is the direct use of misconceptions about statistical evidence to affect perceptions. Statistical conclusions are often highly spinnable to the statistically illiterate.

Efficiency here, can benefit from citizens protecting themselves against deceptive spinning of statistics. By understanding some tools for critical interpretation of statistical conclusions, individuals will be more difficult to fool. Much of the spinning in the two examples would be ineffective in convincing people who knew basic things like the fallacy of accepting a null hypothesis, the consideration of confidence intervals along with estimates, and the understanding of statistical models as useful approximations, not truth.

Statistical Evidence in Court Cases

The importance of statistical evidence in law cases, we can easily imagine, will only increase. The main roles of statistics are in the use of matching evidence, such as DNA evidence and in class action discrimination suits, such as regression analysis as evidence of disproportionate treatment of groups.

The [Sally Clark Murder Trial](#) is a classic example of a gross misinterpretation of statistics in a law case. Mrs. Clark was convicted of murdering her two sons because of a failure of the jury to understand the statistical fallacy known as the Prosecutor’s fallacy. I don’t think I need to say more about this. If you are wrongfully convicted of a crime and confronted with statistical evidence, you should hope that your jurors (and the judge and the lawyers) are statistically literate.

These examples show what “statistical literacy for efficient citizenship” means to me. Do introductory statistics classes impart the necessary skills for this kind of statistical literacy? I suppose some do and I’m sure that some don’t. That’s what I want to talk about.

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