



Communicating the Value of Statistics

Jessica Utts
ASA President
University of California, Irvine

Promoting the Practice and Profession of Statistics

(Don't!) stop me if you've heard this one...

“What do you do for a living?”

“I'm a statistician.”

“Ewww. I had to take that in college and I barely passed.” (or) “...and I hated it.”

“What's that? Is that like doing math?”

“Do you work for a baseball team?”

What we *should* be hearing

Thank you!! Thank you for...

- Helping advance medicine
- Increasing the quality & safety of products
- Helping businesses succeed
- Improving the environment
- Providing personalized results & recommendations
- Increasing food production
- Making transportation more efficient
- Providing information about what others think

And on and on and on and on.....

Why don't people know about us?

Searched NY Times for past 30 days:

- “economist” 193 results
- “physician” 85 results
- “psychologist” 50 results
- “biologist” 36 results
- “astronomer” 12 results
- “computer scientist” 8 results
- “statistician” 1 result, in an editorial by a CS PhD student, who identified herself as a statistician.

Why aren't we in the news?

- Economists work on problems in economics
- Biologists work on problems in biology
- Psychologists work on problems in psychology
- Astronomers work on problems in astronomy
- And so on.....

But with a few exceptions, statisticians don't work on problems in statistics, we work on problems in economics, biology, psychology, astronomy, and on and on and on! We are...

- The wizards behind the curtain!
- The wind beneath the wings of progress!



Why Does Recognition Matter?

- Statistical tools are readily available, so many naively believe they must be easy to use.
- We have spent many years refining these tools, and understand the bigger picture:
 - How to deal with uncertainty.
 - How to obtain and recognize high quality data.
- There is danger of people reinventing the wheel, and not doing it as well!

More about image: Hollywood, Part 1

How is the use of statistics and probability portrayed in film and TV?

- Thanks to James Bush for these videos
- Sometimes Hollywood gets it right:
 - Numb3rs, pilot episode, 2005
- And sometimes they get it wrong:
 - Idiocracy, 2011

Let's look at the value of statistics for some different audiences

- For a college student who needs a quantitative general education course
- From behind the scenes – hidden value in everyday life
- For a college student choosing a career
- For a policy-maker

Value for a college student who takes a statistical literacy course

Do you want to:

- Learn something (many things!) useful?
- Make better decisions on a daily basis, about health, money, risk, personal choices?
- Understand the news better?
- Understand research results discussed in your other courses?
- Impress your friends with fun examples?

In a statistical literacy course, a student learns how to:

- Appreciate variability
- Understand when causation is likely (or not)
- Think about multiple testing issues
- Assess data quality, missing data, bias
- Differentiate practical / statistical significance
- Understand “confusion of the inverse”
- Think about tradeoffs
 - In risk
 - When making decisions

Appreciating variability

- Should you buy an extended warranty?
 - *On average* the company wins
 - But *some* consumers will be winners, and some will be losers.
 - You can use knowledge of your own circumstances to assess which is likely for you.
- Flood year (again!)? Drought year (again!)?
 - Annual rainfall in Sacramento: *average* \approx 19 in.
 - *Ranges* from about 6 inches to 32 inches;
 - 20% chance of $<$ 13.5 in. and 20% of $>$ 25.7 in.

Causation versus association and Multiple testing: Some of my “Favorite” Headlines

“6 cups a day? Coffee lovers less likely to die, study finds”

“Oranges, grapefruits lower women's stroke risk”

“Yogurt reduces high blood pressure, says a new study”

“Breakfast cereal boosts chances of conceiving boys”

“Breakfast cereals prevent overweight in children”

“Walk faster and you just might live longer”

- “Researchers find that walking speed can help predict longevity”
- “The numbers were especially accurate for those older than 75”

“Confusion of the Inverse”

Confusing $P(A|B)$ with $P(B|A)$

- $P(\text{disease} | + \text{test})$ with $P(+ \text{test} | \text{disease})$
- 2001 study (cell phones much less common)

Argued that cell phones were not as big a problem as other occupants in the car

$P(\text{cell phone} | \text{accident}) = .015$ (1.5% on phone)

$P(\text{distracted by another occupant} | \text{accident}) = .109$

Want $P(\text{accident} | \text{phone})$ vs $P(\text{accident} | \text{occupant})$

Issues involving risk

- Reported risk versus your risk
- Tradeoffs in risk
- Relative risk versus absolute risk
- Psychological impact of risk in the news:
 - Low risk, scary events in the news are perceived to have higher probability than they have (readily brought to mind).
 - High risk events where we think we have control are perceived to have lower probability than they have.

And, in an introductory statistics course you learn cute, surprising results to entertain your friends!

- The birthday problem
- The Monty Hall problem

More about image: Hollywood, Part 2

How are these cute probability problems portrayed in film and TV?

- Thanks to James Bush for these videos
- Sometimes they get it right:
 - “21” movie from 2008, on Monty Hall
- And sometimes they get it wrong:
 - Johnny Carson, on the birthday problem

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Value of statistics in everyday life!

Example from John Sall's blog, 1/14/13

<http://blogs.sas.com/content/jmp/2013/01/14/why-statistics-is-essential>

You brush your teeth. Consider the toothpaste:

- Fluoride studied using designed experiments
- safety, effectiveness, proper concentration
- Toothpaste production; stat process control
- Attributes studied in consumer trials with stat
- Pricing, packaging, marketing – all used statistics

- Location on supermarket shelf based on statistical studies
- Advertising monitored using statistical studies
- Your purchase transaction became data to be analyzed statistically
- Credit card checked against a statistical model for fraud

And you benefit from all that while you're still in your pajamas!

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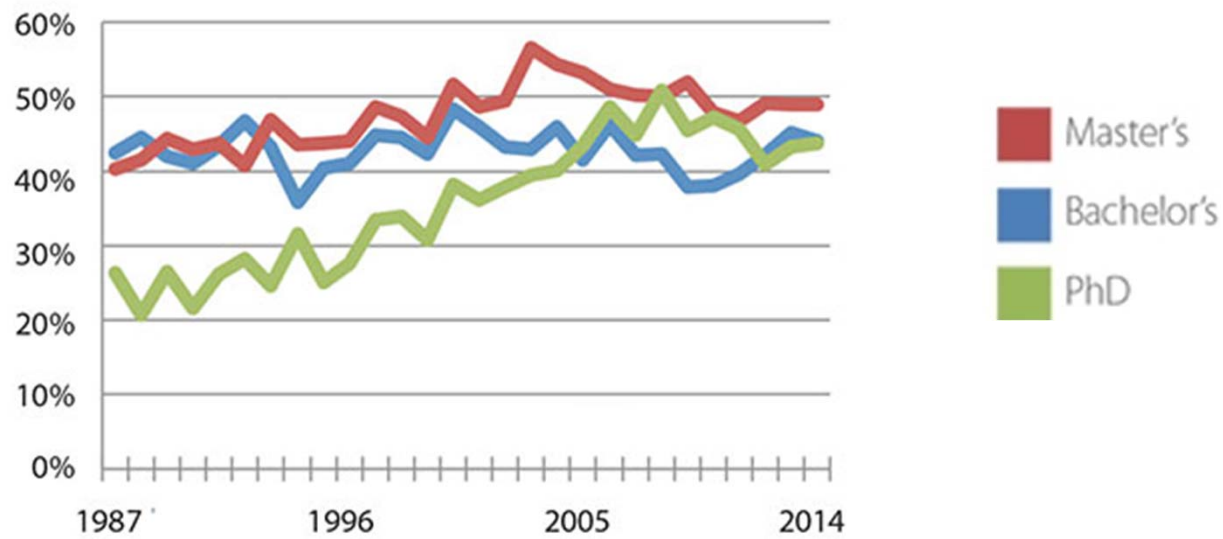
Choosing a career

Do you want a career that:

- Is predicted to be one of the fastest growing?
9th in BLS projections; 3rd in those requiring college; projected 34% growth in next 10 years
- Has high salaries?
~\$80K median in 2014; 3rd highest median among the predicted top 10 fastest growing occupations (after nurse practitioner and physical therapist)

- Has a higher proportion of women than other STEM careers?

**PERCENTAGE OF US STATISTICS AND
BIOSTATISTICS DEGREES AWARDED TO WOMEN**



Source: <http://magazine.amstat.org/blog/2015/10/01/statistics-degrees-continue-strong-growth/>

A career that enables you to...

- Work on important issues, and make a difference?
- Collaborate with researchers in almost any discipline you like?
- Travel to interesting locations for your work?
- Provide useful advice to friends and family?

All of this and more is yours with a career as a statistician!

More about image: Hollywood, Part 3

How are statistics experts (aka geeks) portrayed in film and TV?

- Thanks to James Bush for these videos
- Sometimes Hollywood gets it right:
 - “A Different World” on the binomial distribution
- And sometimes they get it wrong:
 - “The Double” on hypotheses and p-values

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Value of Statistics for Policy Makers

Some examples:

- Keeping the census and ACS mandatory
- Forensic science: error rates, quality control, double-blind testing, etc.
- Role of statistics in assessing climate change
- Detecting election fraud
- Interpreting evidence-based medicine results

“Using Statistics to Drive Sound Policy”

Peter Orszag (as OMB Director), May 08, 2009

<https://www.whitehouse.gov/omb/blog/09/05/08/UsingStatisticstoDriveSoundPolicy/>

“The President has made it very clear that policy decisions should be driven by evidence – accentuating the role of Federal statistics as a resource for policymakers.

Robust, unbiased data are the first step toward addressing our long-term economic needs and key policy priorities.”

Blog continued with examples of policy decisions in health care and education that are informed by data.

We know the value of statistics

What needs to be done to educate others?

- More focus on statistical literacy & usefulness
 - In introductory statistics courses
 - In educating the media about statistics
 - In educating statisticians about the media
- More promotion about statistics as a career, especially with high school students
- Provide communication skills for students and practicing statisticians
- Educate policy-makers on uses of statistics



**What ASA is
doing to
educate the
media and
the public**

Media and the Public

[Stats.org](http://www.stats.org)

- Website with critiques and commentary on statistics in the news
- Joint venture of ASA & Sense about Science
- Resource for journalists
- Articles written by statisticians who volunteer
- Examples: bias from “predictive policing;” the graph that launched 1000 news stories; death by bacon: <http://www.stats.org/blog/>

More Media-Related Activities

- Two of my presidential initiatives
 - Media training for ASA members
 - “Statistical ambassadors”
- Advice on what makes a statistics story newsworthy
- Best practices for using statistics in public relations
- Media Experts list

More Statistical Literacy Activities

- Stats for Staffers (for Congress staff)
- “Statistical significance” topical one-page descriptions of important contributions
<http://www.amstat.org/policy/statsig.cfm>
- Significance magazine and website, joint with Royal Statistical Society (UK)
<http://www.statslife.org.uk/significance>
- Chance magazine <http://chance.amstat.org/>



What ASA is Doing for Educators, Students, Parents...

Some of ASA's Education Activities

- Website with detailed resources for educators at all levels
- Reports with recommendations for degrees, curriculum, teacher training, instruction, etc.
- Workshops for teachers, held at JSM
- Journal of Statistics Education
- Joint committees: NCTM, MAA, AMATYC
- Section on Statistical Education

ThisIsStatistics.org



- ASA campaign to get information on statistics to high school students.
- For students, parents, educators, school counselors
- Goals are to increase awareness of statistics as a career option, and help students, parents and educators understand the value of taking statistics courses

Another presidential initiative:

- Get career information into Advanced Placement Statistics and other classes. Over 200,000 students a year taking AP Statistics! Initiative Working Group is creating materials and advice.
- If everyone here were to visit just one AP Statistics class, we could reach about 15,000 students!
- Next set of slides are part of promotional toolkit for anyone who wants to give a talk to students or other audiences about careers in statistics. Download at <http://thisisstatistics.org/educators>

19 slides from “ThisIsStatistics” were removed because they substantially increase the file size, and can be downloaded at <http://thisisstatistics.org/educators/>

or directly here:

http://thisisstatistics.org/wp-content/uploads/2015/06/ThisIsStatistics_PPT_Presentation_06_12_15_Final.pptx

Talking points to accompany them:

http://thisisstatistics.org/wp-content/uploads/2015/06/Toolkit_PowerPoint_TalkingPoints_06_12_15_Final.docx

Statistics on *ThisIsStatistics*

- Over 64,000 views of the videos
- Over 6000 unique site visits to the website in January (up from lows during holidays of 4000 in November and 5000 in December)
- Almost 5100 Facebook and 2900 Twitter followers
- Stories in various media outlets

More about image: Hollywood, Part 4

How are statistics careers portrayed in film and TV?

- Thanks to James Bush for these videos
- Don't hate the statistician
 - House
- Baseball - Sabermetrics
 - Simpsons "MoneyBart" episode, 2010



What ASA is Doing to Communicate with Policy-makers

ASA's Science Policy Work

Goals:

- Raise profile of statisticians in policymaking
 - Statisticians should be at the table in many/most policy discussions
- Advocate on behalf of statisticians
 - For instance, issues affecting jobs

Who Does This Work?

- ASA staff, especially the Director of Science Policy (Steve Pierson)
- ASA Board
 - Presidents as spokespeople
 - Board actions and statements
- ASA members
- Webpage: <http://www.amstat.org/policy/>

Examples of Activities

- Letters to appropriate congressional committees, for instance to keep the census mandatory.
- Nominations of statisticians to federal boards and commissions
- Statements by the ASA Board, advocating for proper use of statistics in policy-making

Examples of Board Statements

- Role of Statistics in Data Science
- Statement on using value-added models for educational assessment
- Statement on risk-limiting audits of federal and state elections
- Qualifications for teaching an introductory statistics course

White Papers

(<http://www.amstat.org/policy>)

- Statistical Science: Contributions to the Administration's Research Priority on Climate Change (5 pages)
- Discovery with Data: Leveraging Statistics with Computer Science to Transform Science and Society (27 pages)
- Statistical Research And Training Under The Brain Initiative
- Statistics and Precision Medicine



How You Can Help: Get Involved!

How To Get Involved: Profile-Raising Activities

- Stay informed through ASA communications, even if you are not a member
- Join with other statisticians to advocate for proper use of statistics by government agencies, and to help inform policy-makers
- Volunteer to write a white paper or one-pager on an issue involving statistics
- Write an article for Stats.org

How To Get Involved, continued

- Help spread the word on the excitement of statistics:
 - Share “This is Statistics” website and videos with teachers, students, parents
 - Post the “ThisisStatistics” logo and link to your website
- Form a special interest group, which requires a petition from 25 members, or form a virtual community at community.amstat.org, and get others to work with you for change.

How To Get Involved, continued

- Volunteer to give a talk in your local secondary school math/statistics class
- Volunteer to mentor a statistics teacher who isn't trained in statistics
- Learn how to explain the value of statistics and take every opportunity to do it – CSP is a great resource for learning more!

Final thought...

*In the oceans of data
and the seas of uncertainty*

*Statisticians
are the life boats!*



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