Evidence and Inference: Quantitative Literacy for Midcareer Journalists

Jessica S Ancker, MPH, PhD, assistant professor, Weill Cornell Medical College

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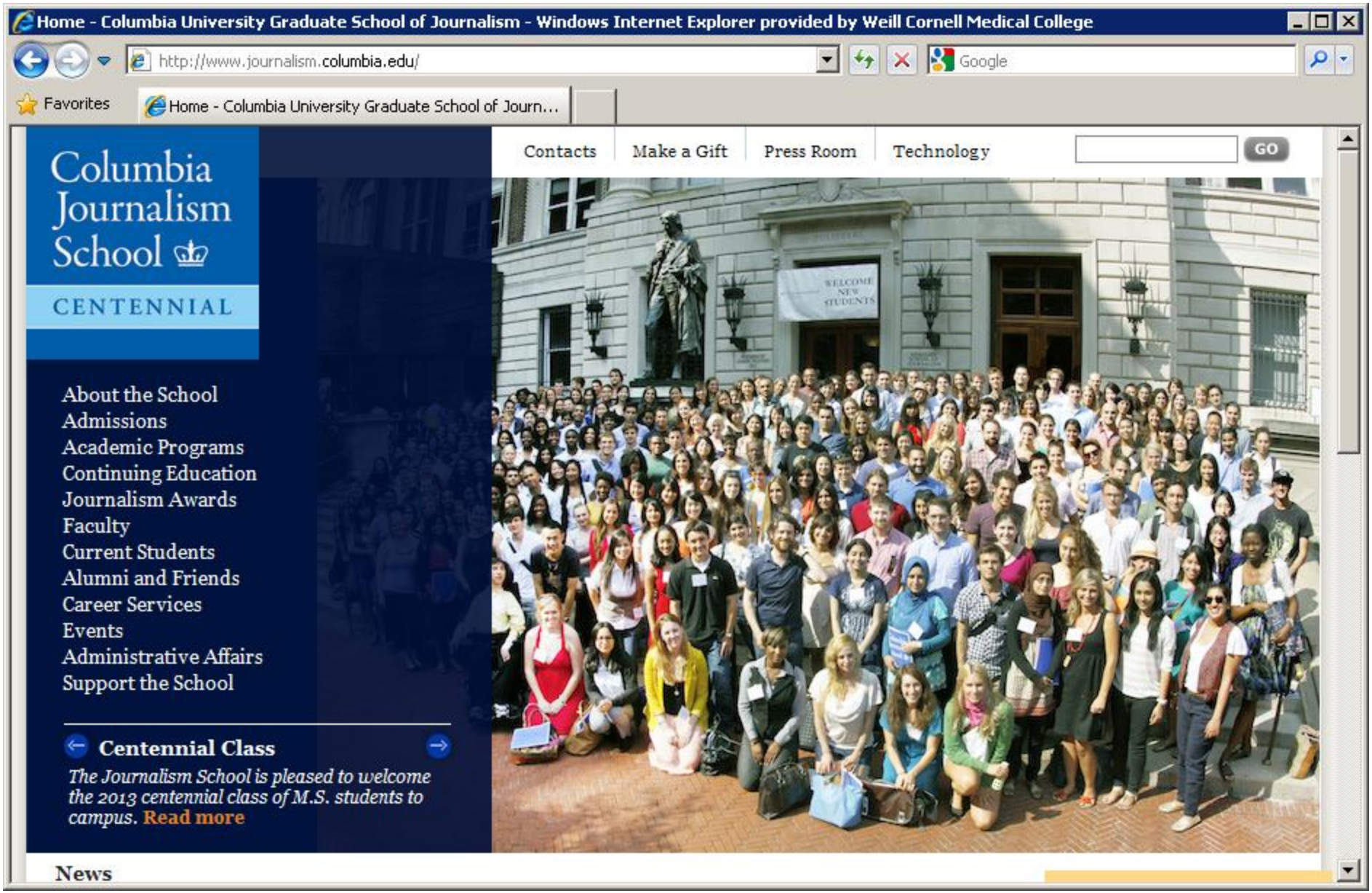
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Nicholas Lemann, Dean, Columbia Journalism School

Evidence and Inference

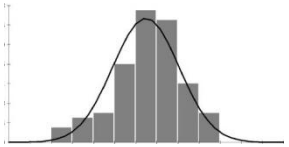
- Advanced research techniques
- Gathering and assessing information
- Statistical literacy
- Cognitive/psychological biases
- Rigorous interviewing techniques
- Understanding the work of experts
- Locating material in historical archives and databases
- Testing assumptions and hypotheses
- Recognizing ways stories can distort the truth
- Making sure that reporting firmly proves its points

Columbia MA program

- Students:
  - Midcareer
  - PowerPoint-naive
  - Intense listeners/notetakers
  - Recognize value in topic
  - Uninterested in grades
  - Interested in defense and offense
  - Have never *opened* Excel
  - Math-phobes

Case example: Data distributions

- Measure heart rates in class, captured in spreadsheet, graphs



Case example: Data distributions

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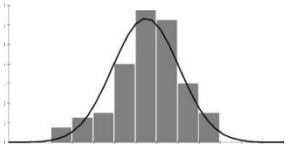


- Income

$50,000

$66,000

$75,000

$96,000

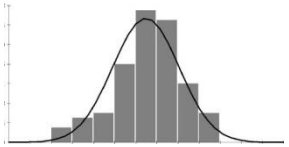
$1,000,000

average: $71,750

average: $257,400

Case example: Data distributions

- Measure heart rates in class, captured in spreadsheet, graphs



- Income

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$66,000

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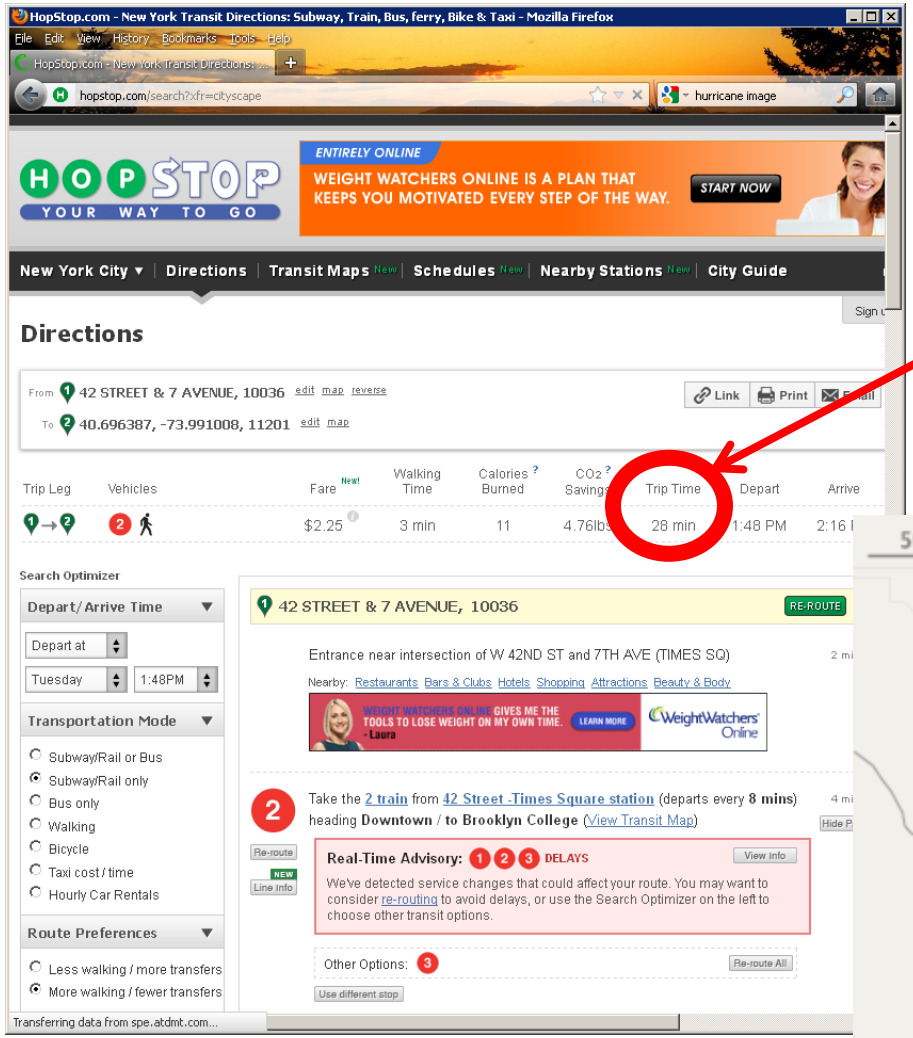
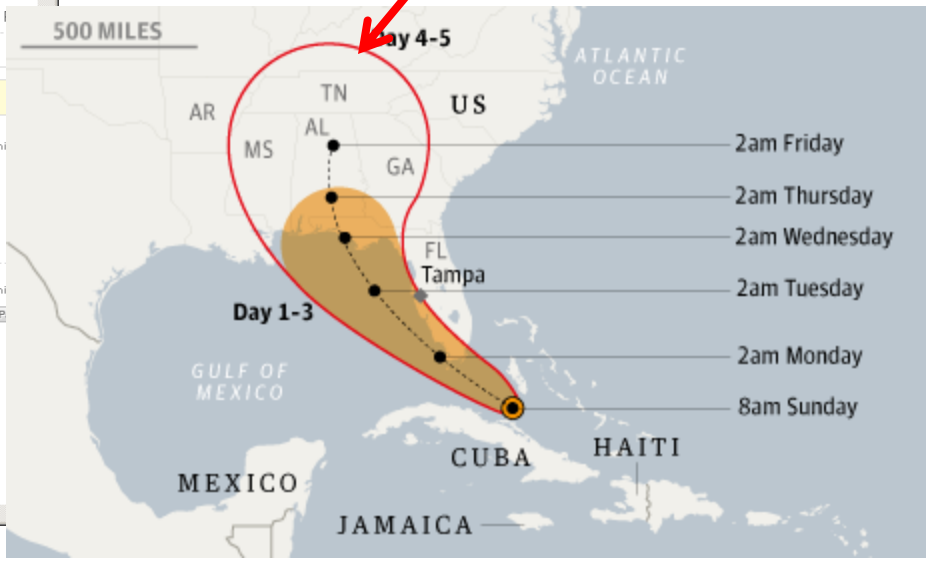
- Malcolm Gladwell: “Million-dollar Murray”

Case example: Margin of error



Margin of error exists but is not acknowledged

Margin of error exists and is illustrated



Case example: Margin of error

"Mr. Obama is ahead in Florida by 49 percent to 46 percent and in Wisconsin by 49 percent to 47 percent — differences within the polls' margin of sampling error of plus or minus three percentage points."

– Cooper and Sussman, "In poll, Obama is given trust over Medicare," *The New York Times*, August 23, 2012

Case example: Article critique

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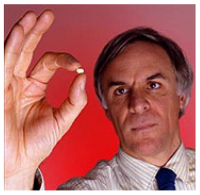
Posted 1/1/2004 9:24 PM

Baby teeth offer radioactive clues

By Gary Stoller, USA TODAY

A new study concludes that counties within 40 miles of six nuclear power plants have higher levels of radioactive strontium-90 than other counties in their states.



Joseph Mangano holds a baby tooth dating back to 1953.

By Todd Plitt, USA TODAY

Strontium-90, a byproduct of uranium fission, is one of the pollutants emitted into the air by nuclear reactors. If inhaled or ingested, it collects in bones and tissue and increases the risks of cancer and leukemia, according to the Environmental Protection Agency.

The study, published this week in the journal *The Science of the Total Environment*, was done by the Radiation and Public Health Project (RPHP), a New York-based non-profit group that analyzes baby teeth for strontium-90. Baby teeth from counties near two nuclear plants in Florida and plants in California, New York, New Jersey and Pennsylvania were compared with baby teeth from other counties in the same states.

Nuclear power companies denounce the RPHP study. They and some scientists say RPHP's findings are not based on sound science. "I don't question finding

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An unexpected rise in strontium-90 in US deciduous teeth in the 1990s

Joseph J. Mangano[a,*], Jay M. Gould[b,1], Ernest J. Sternglass[c,2], Janette D. Sherman[d,3], William McDonnell[e,4]

[a]*Radiation and Public Health Project, 786 Carroll Street, #9, Brooklyn, NY 11215, USA*
[b]*Radiation and Public Health Project, 302 West 86th Street, #11B, New York, NY 10024, USA*
[c]*Radiation and Public Health Project, 4601 Fifth Avenue #824, Pittsburgh, PA 15213, USA*
[d]*P.O. Box 4605, Alexandria, VA 22303, USA*
[e]*Radiation and Public Health Project, P.O. Box 60, Unionville, NY 10988, USA*

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Abstract

For several decades, the United States has been without an ongoing program measuring levels of fission products

Case example: Article critique

Table 4
Average millibecquerels of Sr-90 per gram calcium in deciduous teeth (at birth) by proximity to nuclear power plants (persons born after 1979)

Nuclear power plant, location	Proximate counties	Average Sr-90[a] (No. teeth)		% Difference average Sr-90
		Proximate	Other state	
Indian Point, Buchanan NY (2 reactors, startup 1973, 1976)	Putnam, Rockland, Westchester, NY	164 (217) ±11	121 (317) ±7	+35.8% $P<0.001$
Limerick, Pottstown PA (2 reactors, startup 1984, 1989)	Berks, Chester, Montgomery, PA	168 (98)[b] ±17	110 (32) ±20	+53.2% $P<0.03$
Turkey Point, Florida City FL (2 reactors, startup 1972, 1973)	Broward, Dade, Palm Beach, FL	129 (350) ±7	93 (24) ±20	+38.6% $P<0.08$
St. Lucie, Hutchinson Island FL (2 reactors, startup 1976, 1983)	Indian River, Martin, St. Lucie, FL	143 (97) ±15		
Oyster Creek, Forked River NJ (1 reactor, startup 1969)	Monmouth, Ocean, NJ	128 (169) ±10		
Diablo Canyon, Avila Beach CA (2 reactors, startup 1984, 1985)	San Luis Obispo, Santa Barbara, CA	127 (50)[b] ±19		

Counting error listed for each sample of teeth. See Appendix B for explanation o
significance testing. *Source:* US Nuclear Regulatory Commission (www.nrc.gov), ob
and startup dates.
[a] Average millibecquerels of Sr-90 per gram of calcium.
[b] In three counties near Limerick, 94 of 98 teeth were from persons born after startu
Canyon, 47 of 50 teeth were from persons born after startup (average 135).

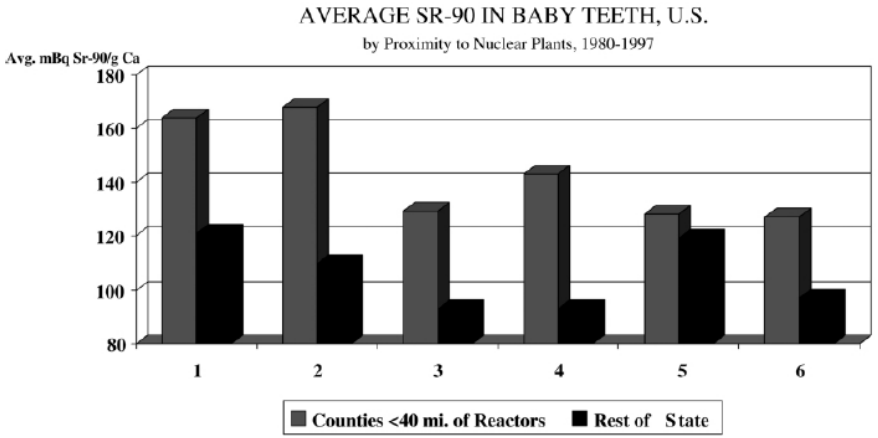
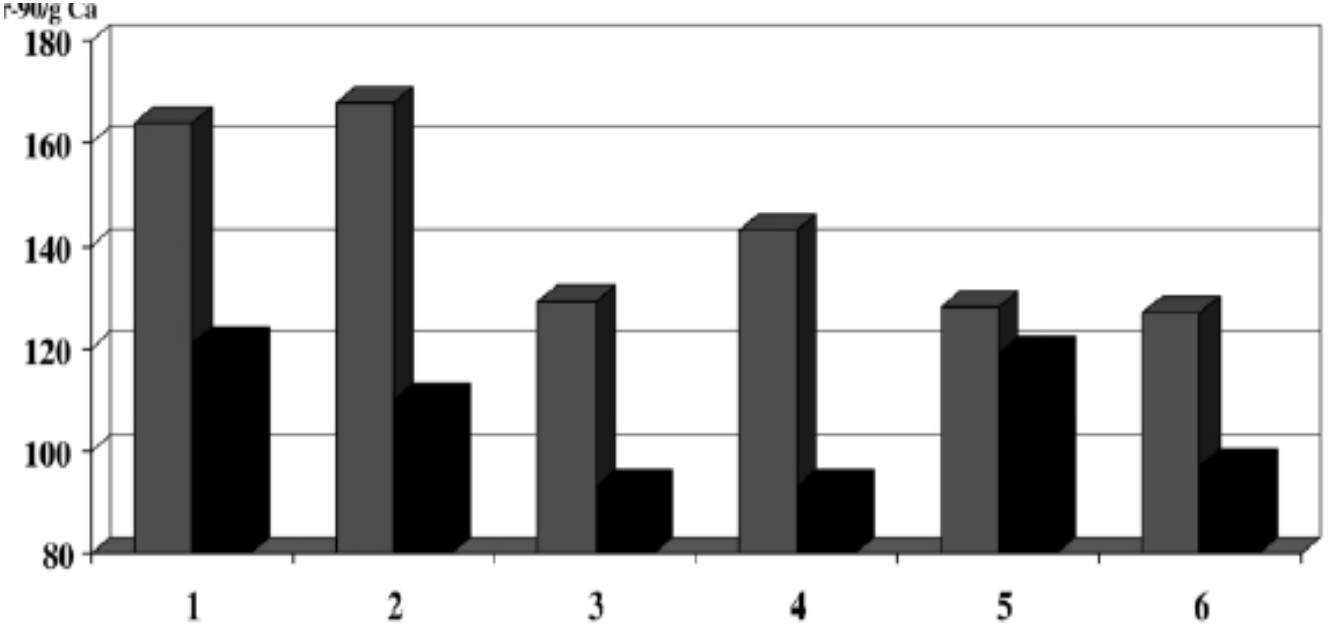
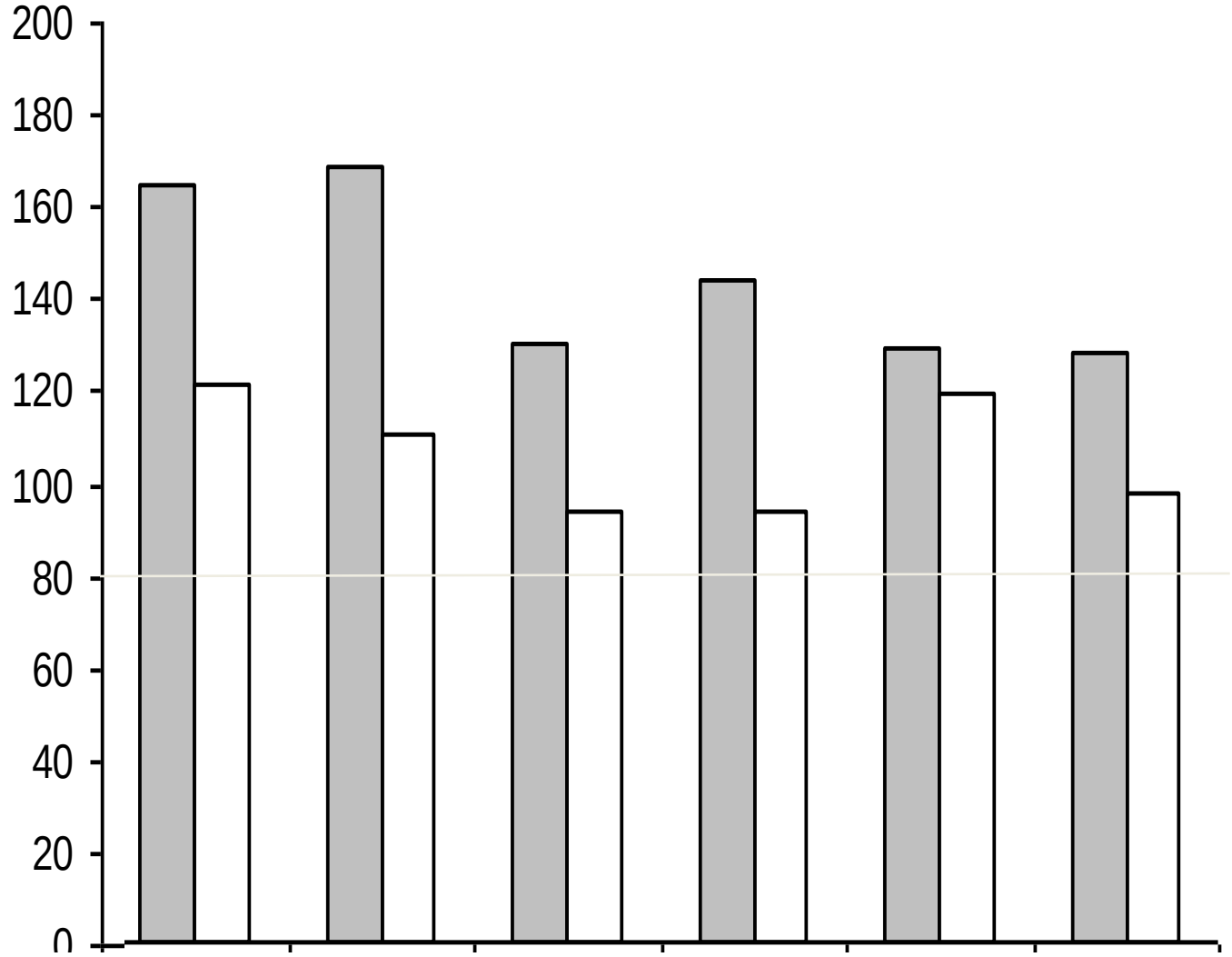


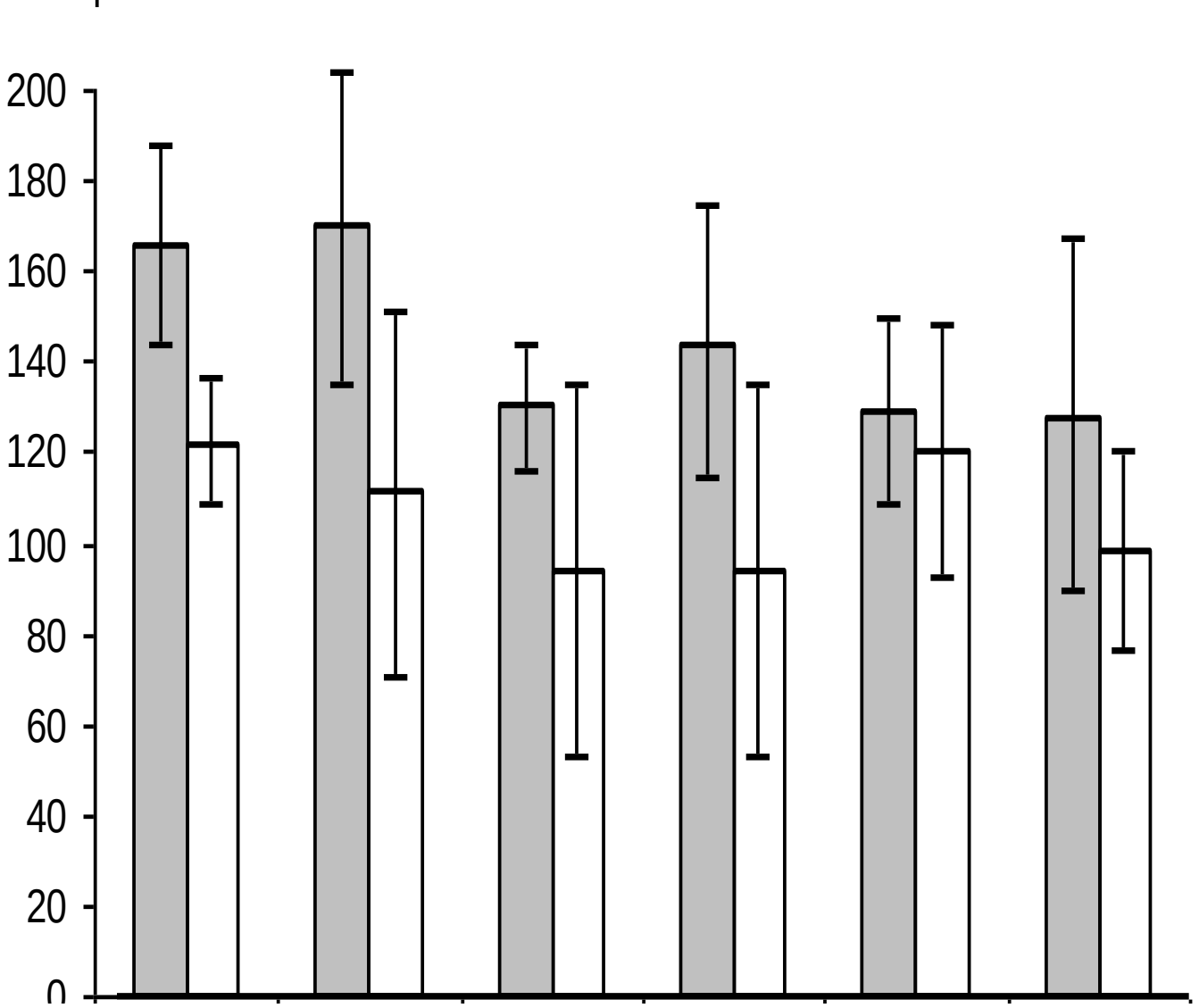
Fig. 1. Average Sr-90 in baby teeth, US, by proximity to nuclear plants (persons born 1980–1997).



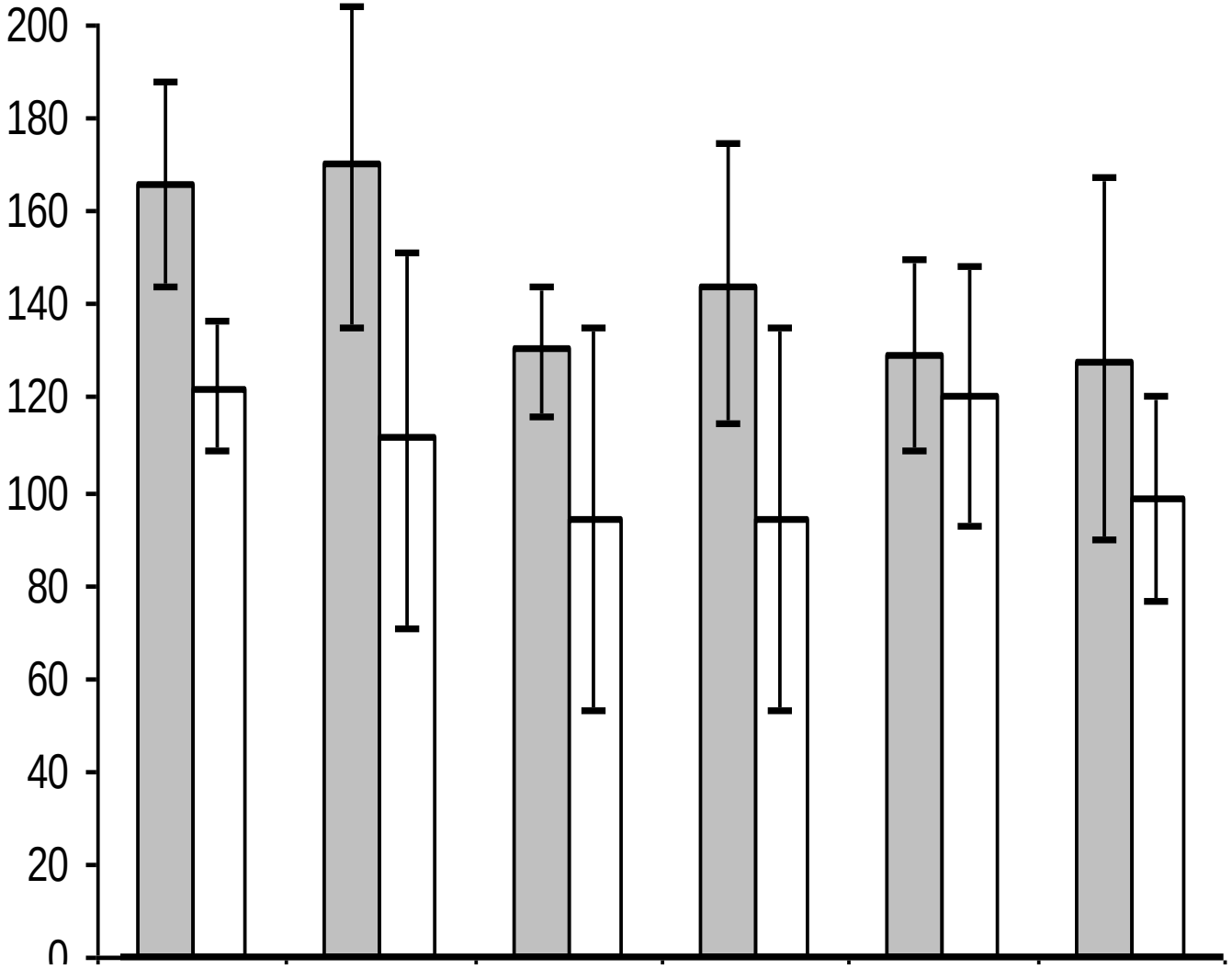
The original graph (p. 42). The claim: Strontium levels were higher in children who lived within 40 miles of nuclear plants (gray bars) than in those who lived farther away (black bars).



If we fix the y axis,
the bars will be proportionate



Sample data are merely estimates of population values. The 95% confidence intervals ("margins of error") show ranges for the population numbers that are compatible with the sample data, given the errors



Now we can see that in 3 of the 6 comparisons, the mean from one bar is within the margin of error for the other one. For these comparisons, we are less sure that the means are different.

Approach and lessons

- Keep it grounded in current events
- Goal should be for every single person to take away something useful
  1. Begin with intuitive gist and examples
  2. Follow with simple math
  3. Recap with gist and examples
- Don’t underestimate the degree of math anxiety in this population!

Thank you!

Jessica S Ancker, MPH, PhD
Center for Healthcare Informatics and Policy
Weill Cornell Medical College
jsa7002@med.cornell.edu

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