

Evidence and Inference: Quantitative Literacy for Midcareer Journalists

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Centennial Class

The Journalism School is pleased to welcome the 2013 centennial class of M.S. students to campus. [Read more](#)



The image shows a large group of students, likely the 2013 centennial class, posing for a group photo in front of a building. A statue is visible on the left side of the building. A banner hanging above the entrance reads "WELCOME NEW STUDENTS". The students are arranged in many rows, filling the steps and plaza in front of the building.

News



Nicholas
Lemann, Dean,
Columbia
Journalism
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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

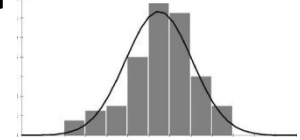
Columbia MA program

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



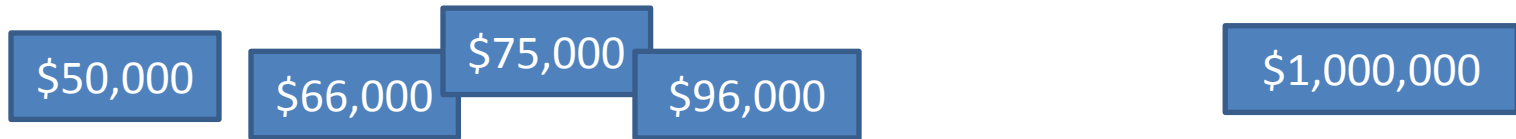
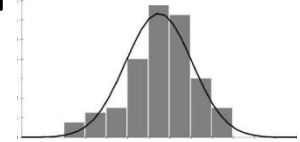
Case example: Data distributions

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



Case example: Data distributions

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

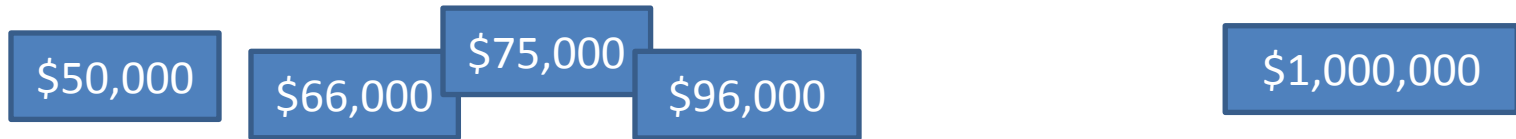
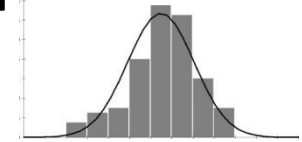


average: \$71,750

average: \$257,400

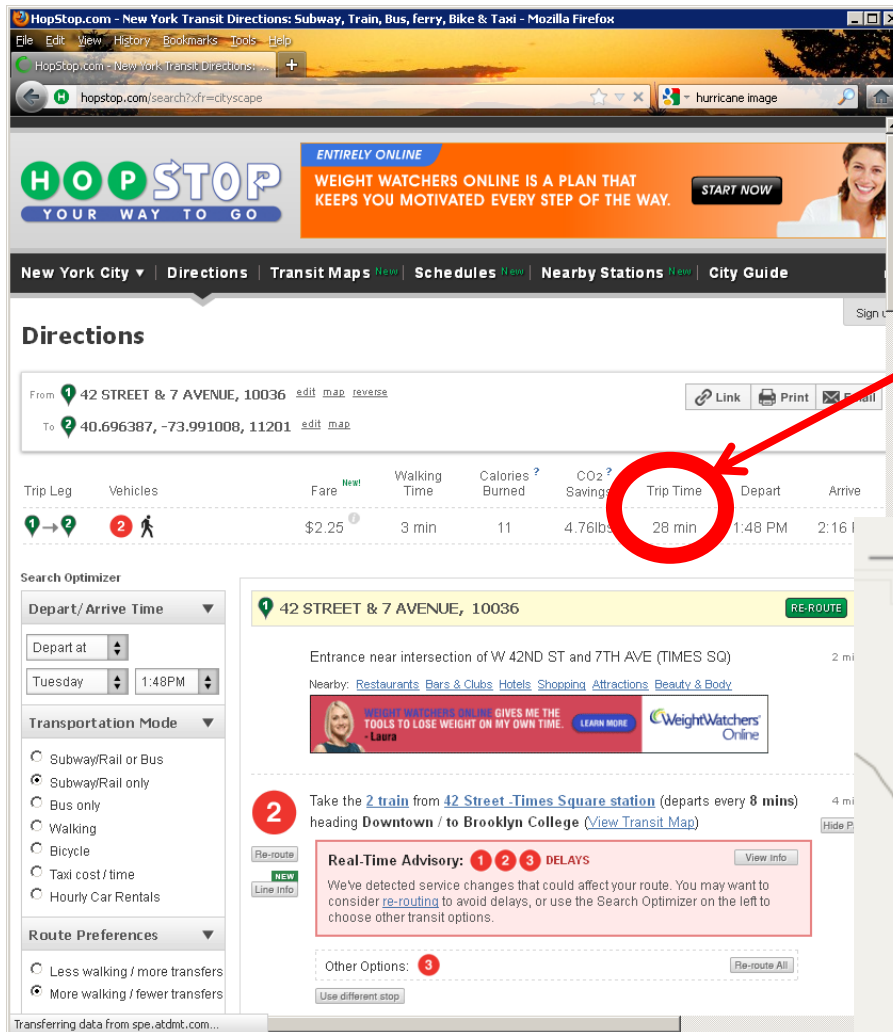
Case example: Data distributions

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



- 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

USATODAY.com - Baby teeth offer radioactive clues - Mozilla Firefox

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Course Launch

usatoday30.usatoday.com/money/industries/energy/2004-01-02-babyteeth_x.htm

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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.

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Joseph Mangano holds a baby tooth dating back to 1953.

By Todd Pitt, 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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**the Science of the
Total Environment**
An International Journal for Scientific Research
into the Environment and its Relationship with Man

The Science of the Total Environment 317 (2003) 37–51

www.elsevier.com/locate/scitoten

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

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William McDonnell^{e,4}

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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

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J.J. Mangano et al. / *The Science of the Total Environment* 317 (2003) 37–51

Table 4

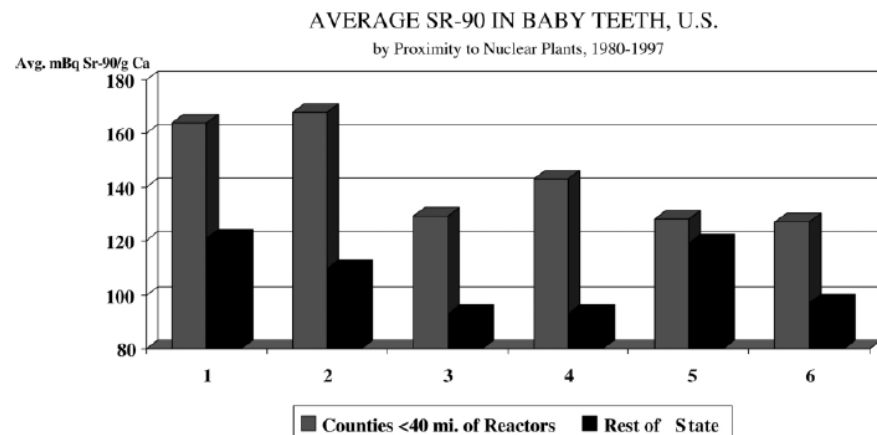
Average millibecquerels of Sr-90 per gram calcium in deciduous teeth (at birth) by proximity to nuclear power plants (persons born after 1979)

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 of significance testing. *Source:* US Nuclear Regulatory Commission (www.nrc.gov), observations and startup dates.

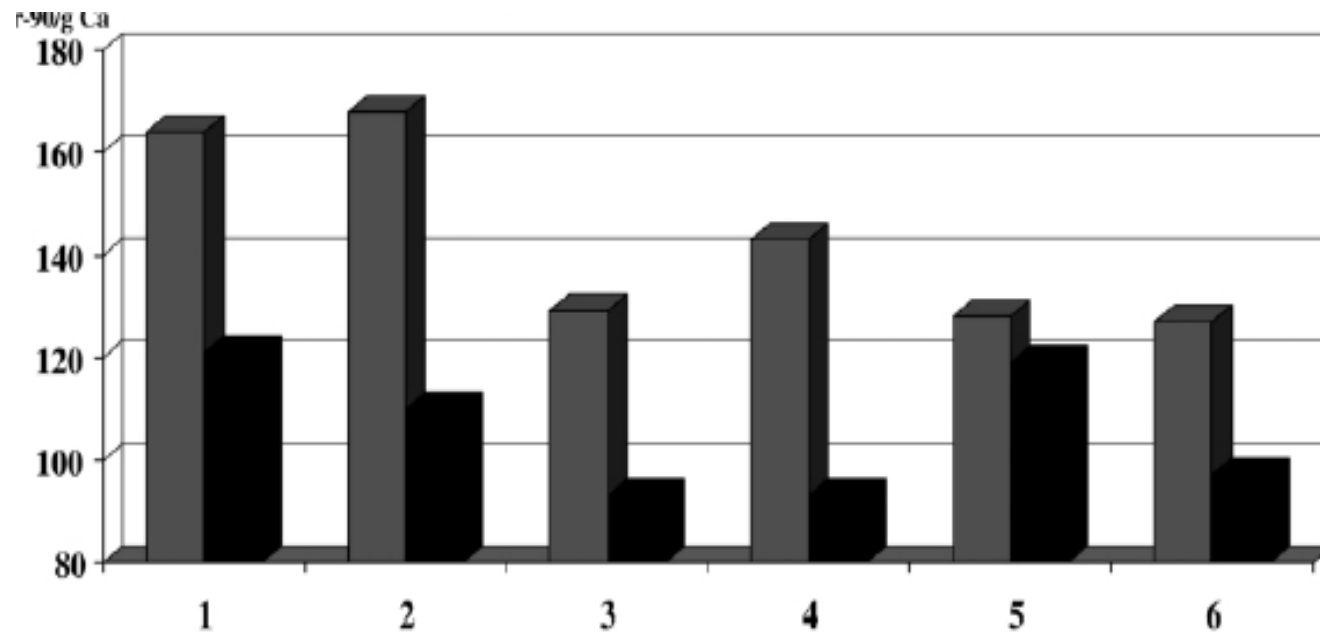
^a Average millibecquerels of Sr-90 per gram of calcium.

^b In three counties near Limerick, 94 of 98 teeth were from persons born after startup. In three counties near Limerick, 94 of 98 teeth were from persons born after startup (average 135).

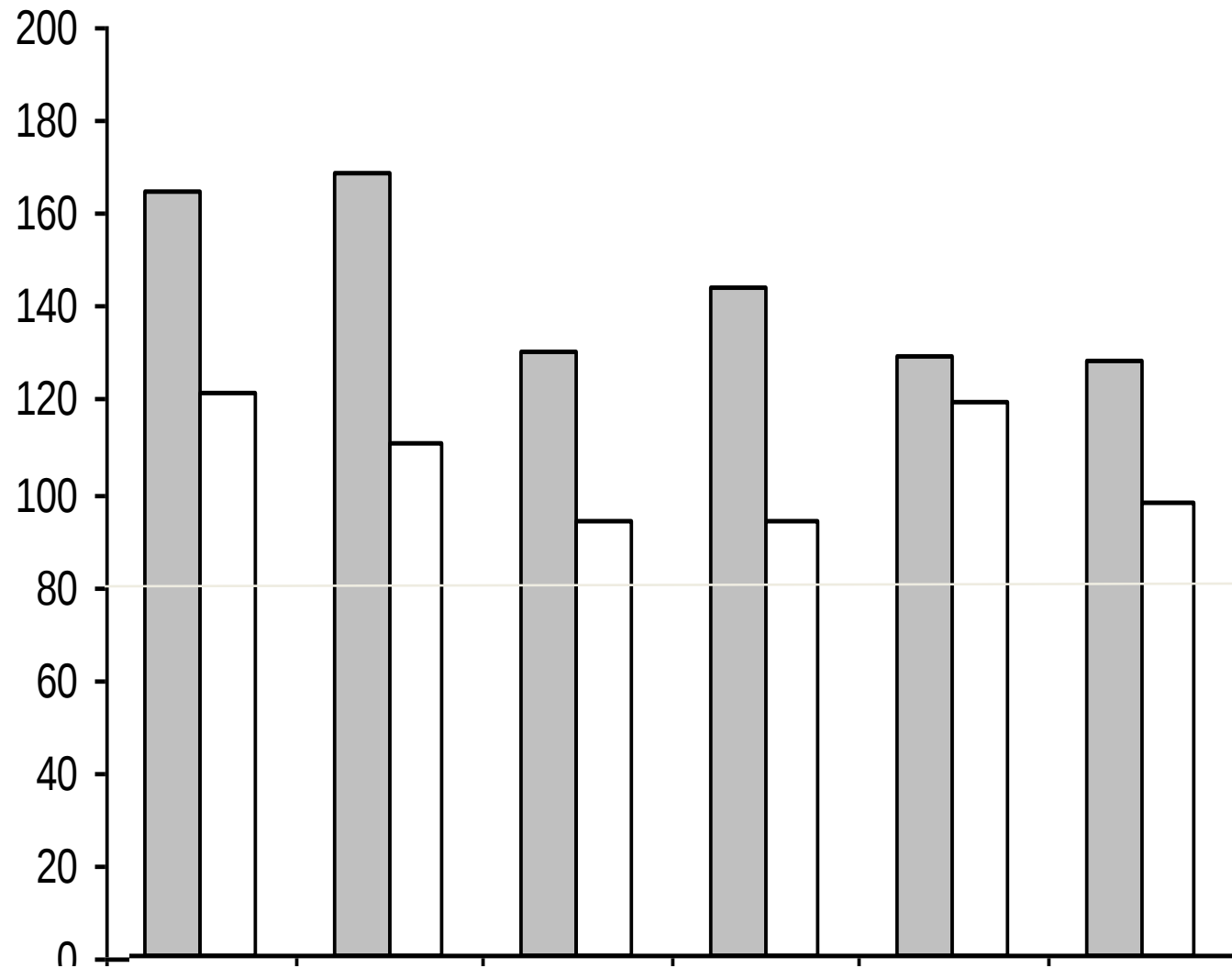


1= Indian Point (Putnam, Rockland, Westchester NY counties); 2= Limerick (Berks, Chester, Montgomery PA); 3= Turkey Point (Broward, Dade, Palm Beach FL); 4= St. Lucie (Indian River, Martin, St. Lucie FL); 5= Oyster Creek (Monmouth, Ocean NJ); 6= Diablo Canyon (Santa Barbara, San Luis Obispo CA). Differences significant at $p < .05$ for Indian Point, Limerick, St. Lucie.

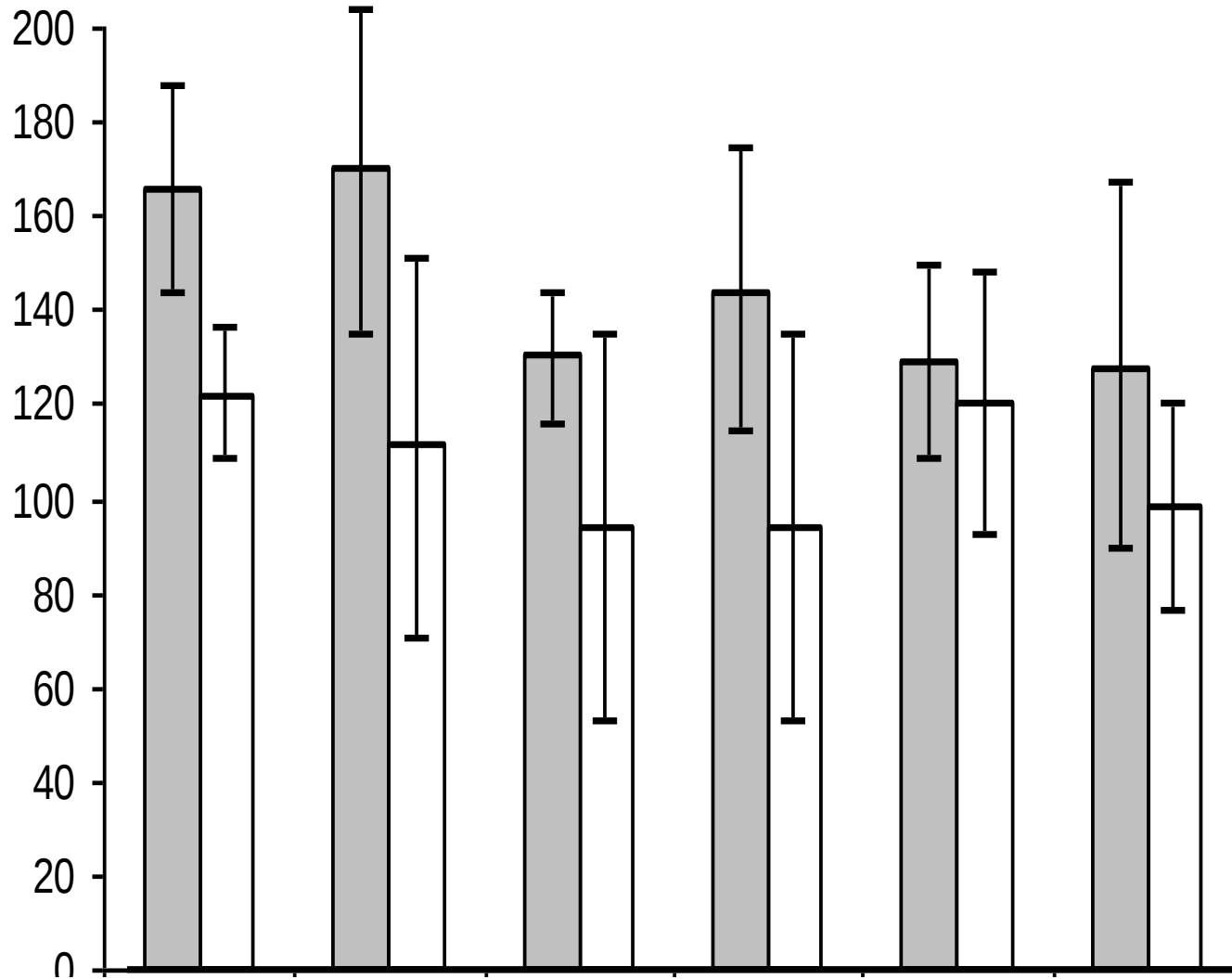
Fig. 1. Average Sr-90 in baby teeth, US, by proximity to nuclear plants (persons born 1980–1997).



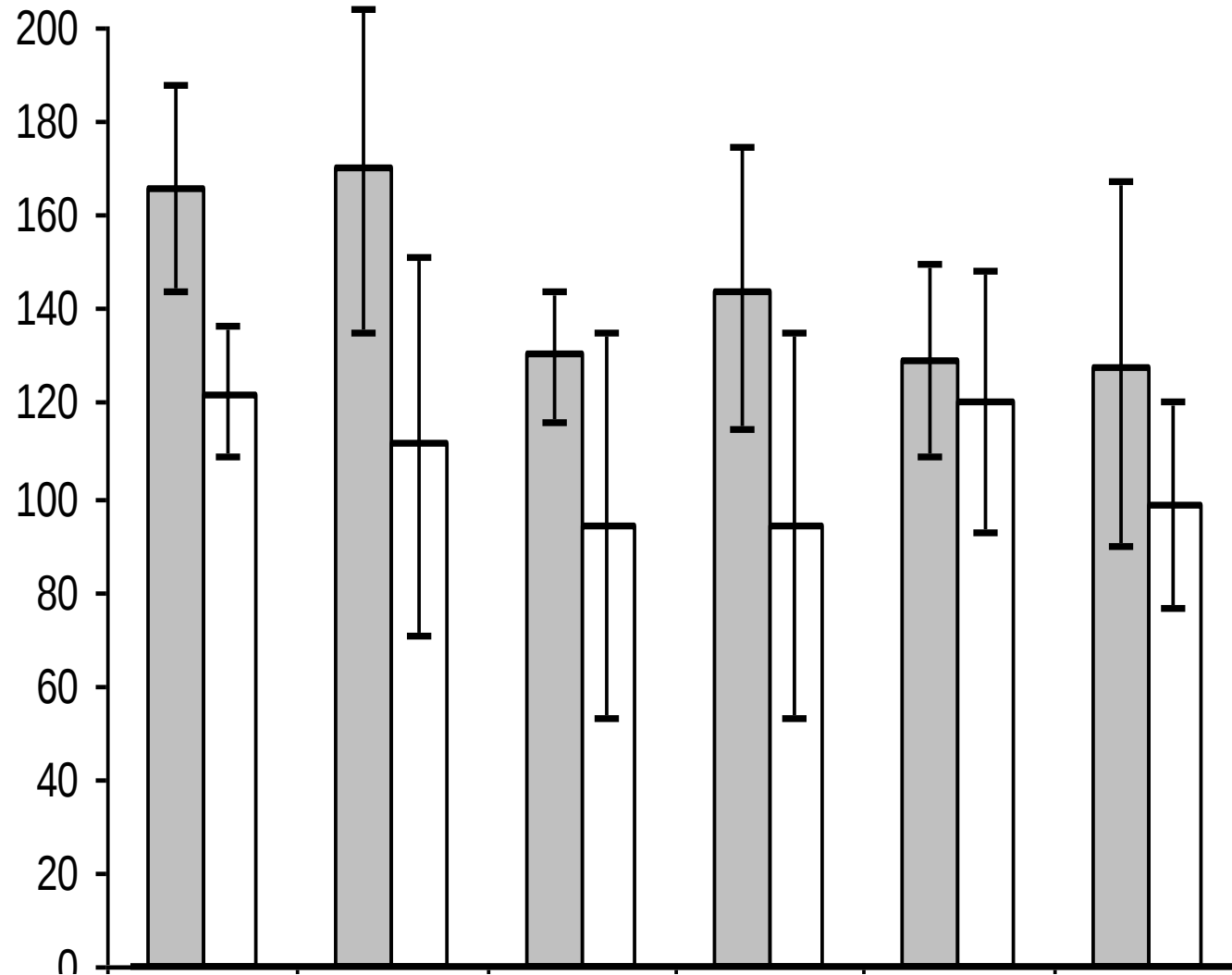
The original graph (p. 42). The claim: Strontium levels were higher in children who lived within 40 miles of nuclear plants (gray bars) than in those who lived farther away (black bars).



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!

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