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JOHNS HOPKINS
BLOOMBERG
SCHOOL *of* PUBLIC HEALTH

Describing Data: Part I

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Lecture Topics

- What role does statistics have in public health?
- Types of data: continuous, binary, categorical, time-to event
- Continuous data: numerical summary measures
- Continuous data: visual summary measure
- Sample data versus population (process) level data



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Section A

What Role Does Biostatistics Play in Public Health (Why Do I Need this Stuff?)

Data is Everywhere!

- Data is utilized and summarized frequently in research literature
- From *Archives of Surgery* article, August 2000:
 - “**Hypothesis:** Surgeon-directed institutional peer review, associated with positive physician feedback, can decrease the morbidity and mortality rates associated with carotid endarterectomy.”
 - “**Results:** Stroke rate decreased from **3.8%** (1993-1994) to **0%** (1997-1998). The mortality rate decreased from **2.8%** (1993-1994) to **0%** (1997-1998). (Average) length of stay decreased from **4.7 days** (1993-1994) to **2.6 days** (1997-1998). The (average) total cost decreased from **\$13,344** (1993-1994) to **\$9,548** (1997-1998).”

Data is Everywhere!

- Data is utilized and summarized with statistics frequently in popular media
- From cnn.com, Monday July 8th, 2008:
 - “For the first time, an influential doctors group is recommending that some children as young as eight be given cholesterol-fighting drugs to ward off future heart problems . . . With **one-third** of U.S. children overweight and about **17 percent obese**, the new recommendations are important,’ said Dr. Jennifer Li, a Duke University children's heart specialist.”

Data is Everywhere!

- Data is utilized and summarized with statistics frequently in popular media
- From *Washington Post*, June 27th, 2008:
 - “The number of young homosexual men being newly diagnosed with HIV infection is rising by **12 percent a year**, with the steepest upward trend in young black men, according to a new report.”

Data Provides Information

- Good data can be analyzed and summarized to provide useful information
- Bad data can be analyzed and summarized to provide incorrect/harmful/non-informative information

Steps in a Research Project

- Planning/design of study
- Data collection
- Data analysis
- Presentation
- Interpretation
- Biostatistics CAN play a role in each of these steps! (but sometimes is only called upon for the data analysis part)

Biostatistics Issues

- Planning/design of studies
 - Primary question(s) of interest:
 - ▶ Quantifying information about a single group?
 - ▶ Comparing multiple groups?
 - Sample size
 - ▶ How many subjects needed total?
 - ▶ How many in each of the groups to be compared?
 - Selecting study participants
 - ▶ Randomly chosen from “master list?”
 - ▶ Selected from a pool of interested persons?
 - ▶ Take whoever shows up?
 - If group comparison of interest, how to assign to groups?

Biostatistics Issues

- Data collection

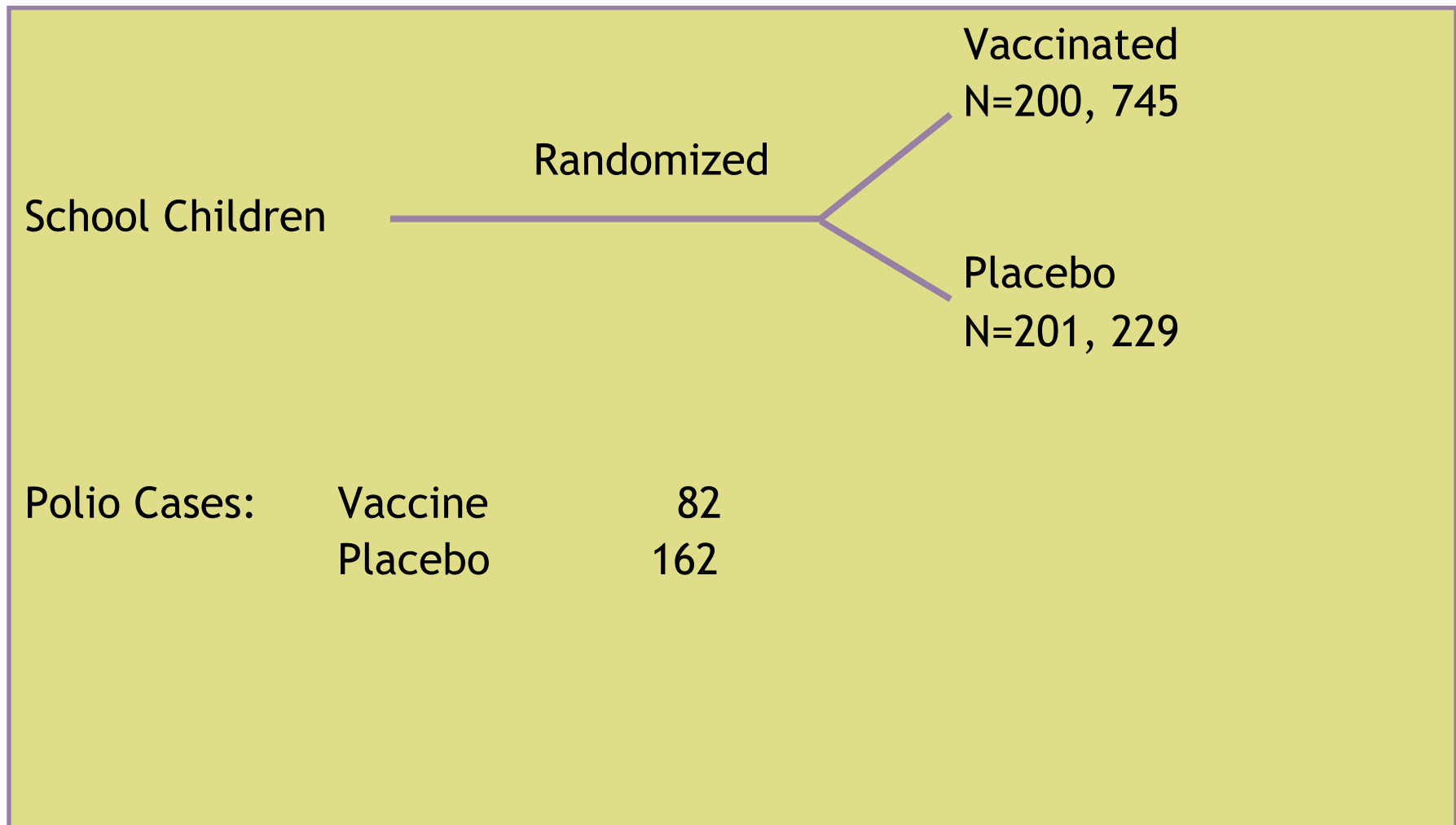
- Data analysis
 - What statistical methods are appropriate given the data collected?
 - Dealing with variability (both natural and sampling related):
 - ▶ Important patterns in data are obscured by variability
 - ▶ Distinguish real patterns from random variation
 - Inference: using information from the single study coupled with information about variability to make statement about the larger population/process of interest

Biostatistics Issues

- Presentation
 - What summary measures will best convey the “main messages” in the data about the primary (and secondary) research questions of interest
 - How to convey/ rectify uncertainty in estimates based on the data

- Interpretation
 - What do the results mean in terms of practice, the program, the population etc.?

1954 Salk Polio Vaccine Trial



Source: Meier, P. (1972), "The Biggest Public Health Experiment Ever: The 1954 Field Trial of the Salk Poliomyelitis Vaccine," In J. Tanur (Editor), *Statistics: A Guide to the Unknown*. Holden-Day.

Design: Features of the Polio Trial

- Comparison group
- Randomized
- Placebo controls
- Double blind
- Objective—the groups should be equivalent except for the factor (vaccine) being investigated

Analysis Question

- Question
 - There were almost twice as many polio cases in the placebo compared to the vaccine group
 - Could the results be due to chance?

Such Great Imbalance by Chance?

- Polio cases
 - Vaccine—82
 - Placebo—162
- Statistical methods tell us how to make these probability calculations