Lab 2

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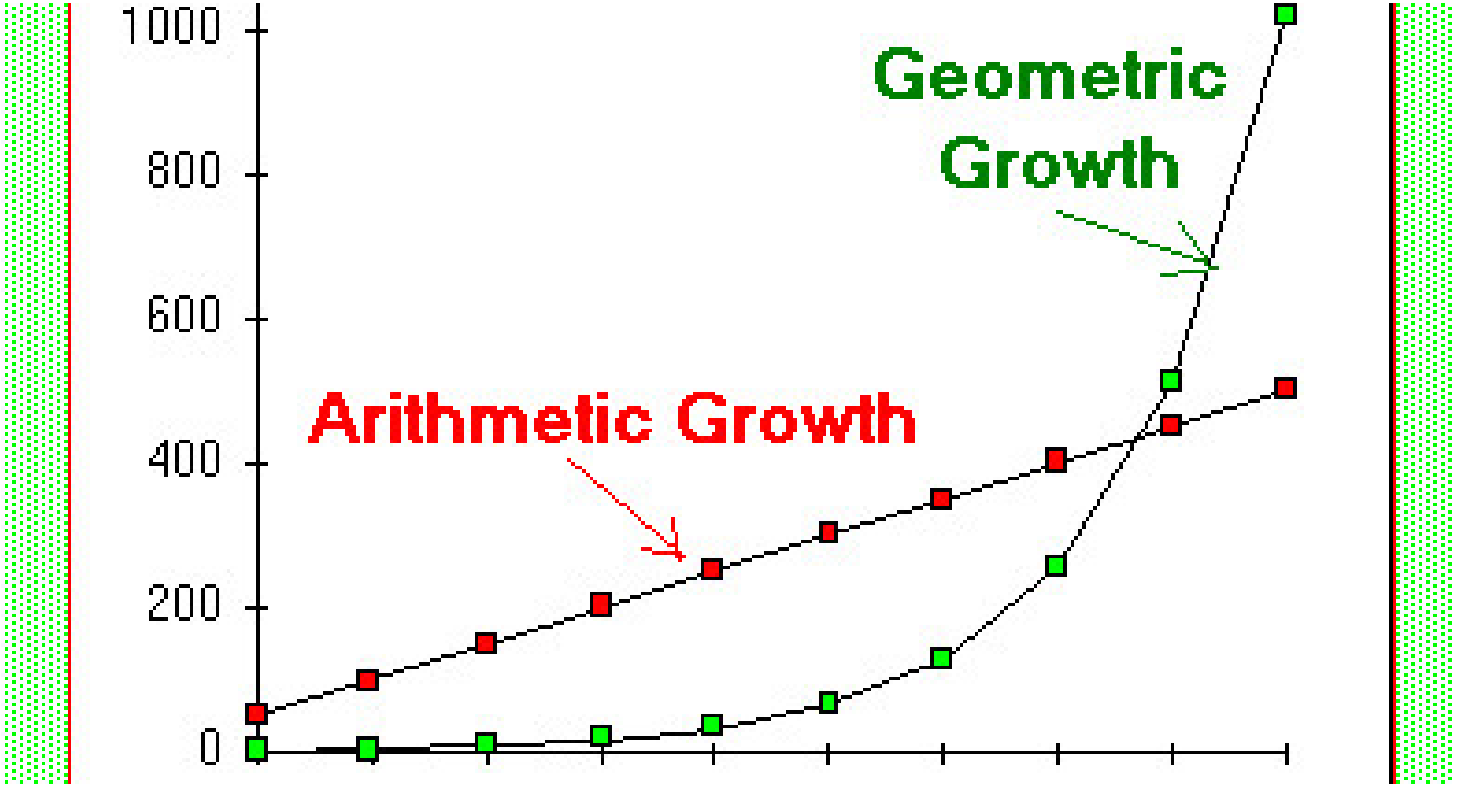
Lab 1B, MWF 12:00-12:50pm

Week 2 – August 12, 2024

Lab 2 – Computer Exercise

- For Question 6, use =GEOMEAN(array)
- When is it appropriate to use a **geometric mean** over an arithmetic mean?
  - When you are dealing with **exponential data**, or when **observations are dependent (not independent)**
  - Example: bacterial growth



Geometric Mean Equation:

$$\sqrt[n]{x_1 x_2 \cdots x_n} = \left(\prod_{i=i}^{n} x_i\right)^{1/n}$$

Arithmetic Mean Equation:

$$\frac{1}{n}(x_1 + x_2 + \cdots + x_n) = \frac{1}{n}\sum_{\{i=1\}}^{n} x_i$$

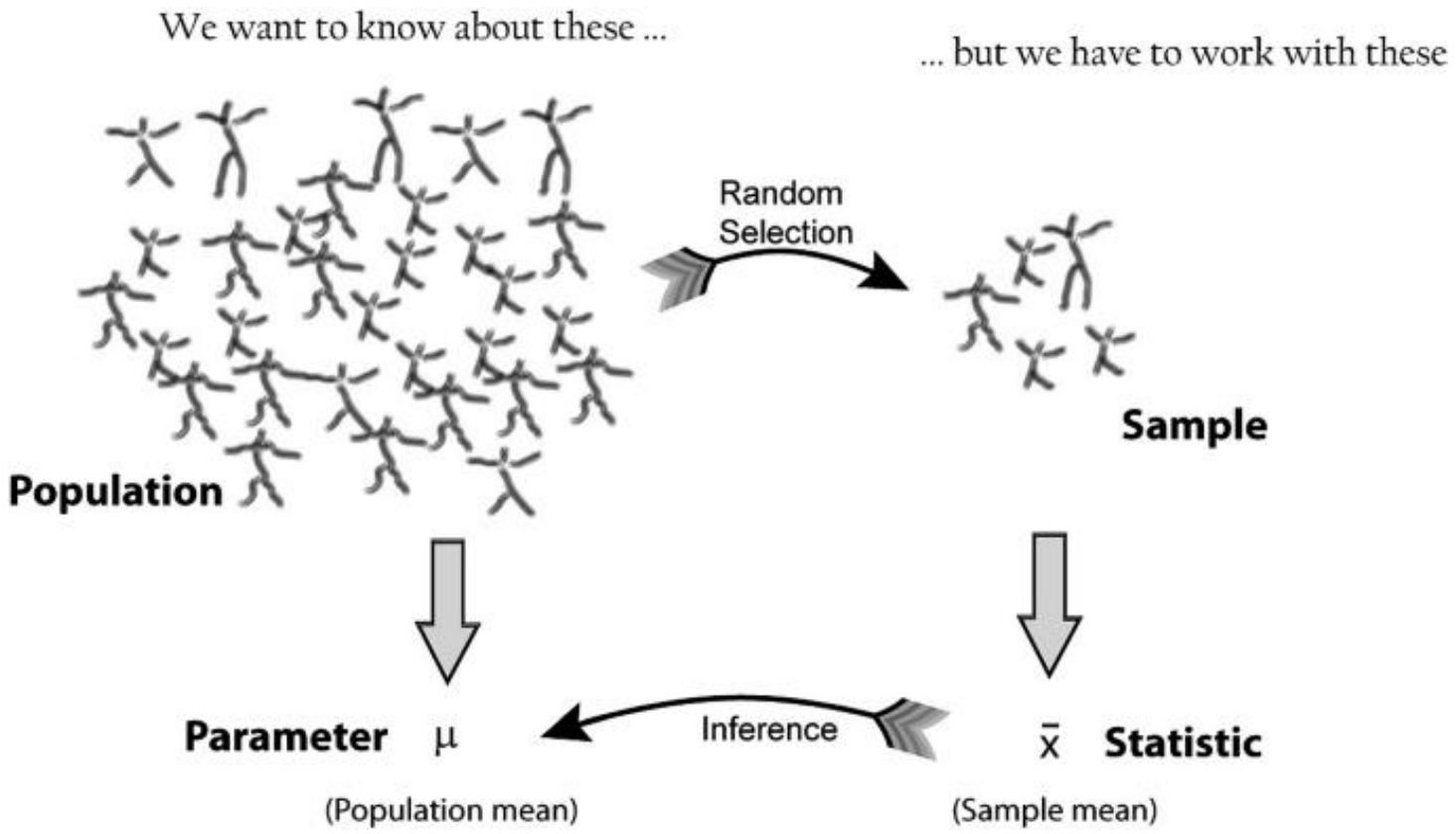
Lab 2 – Competency Assessment

- Statistic vs Parameter
- Observational vs Experimental Study
- Retrospective vs Prospective Study
- Causal vs Associative

Statistics vs. Parameter

a **Statistic** is a measurement of the **Sample**

A **Parameter** is a measurement of the **Population**



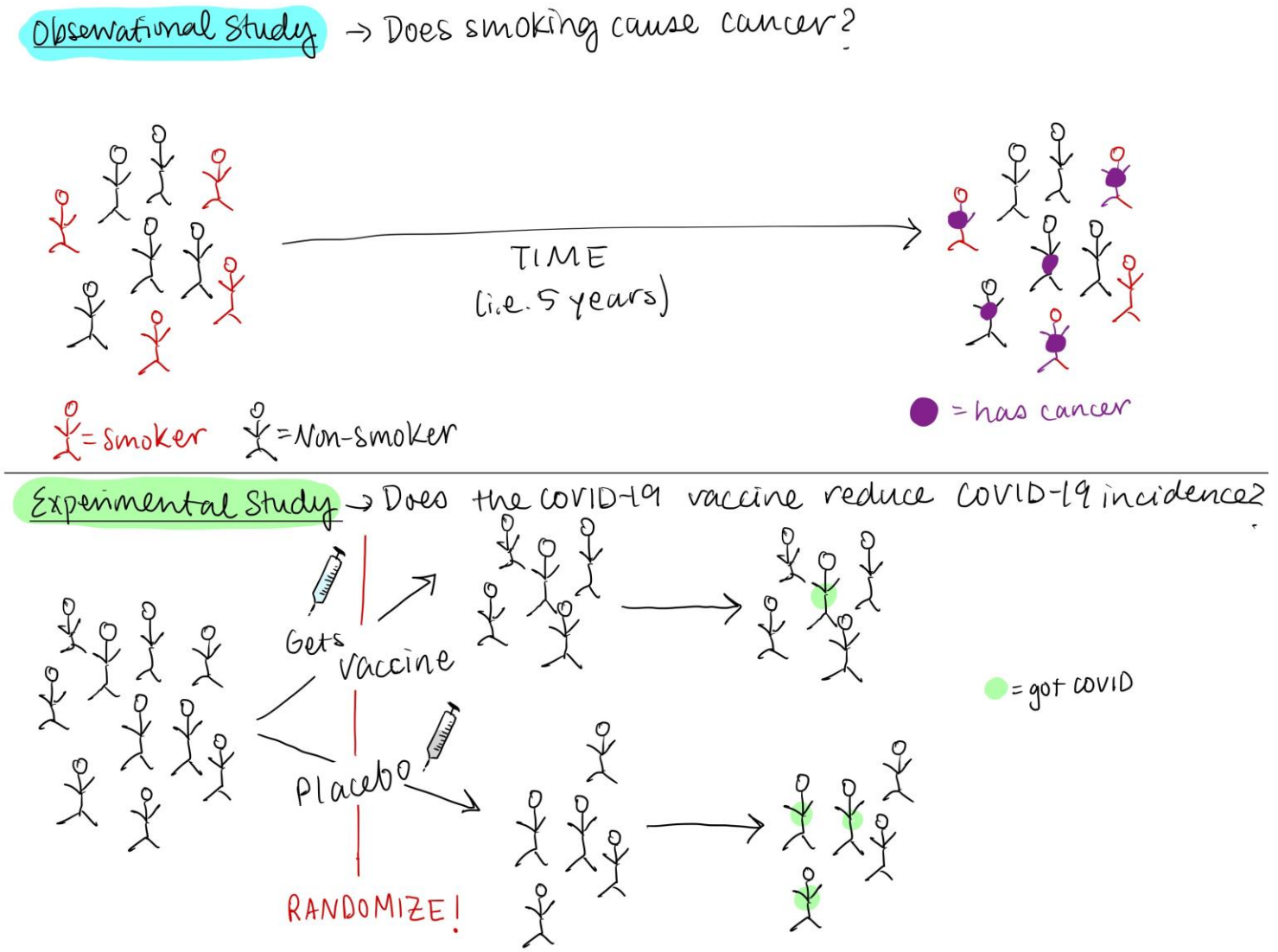
Observational vs. Experimental Study

In an **Observational study** you **DO NOT intervene** with the subjects

- Generally, there is no control group (exception: Case-Control studies)
- High external validity → reflects the behavior of the population well
- Example: cohort studies where subjects are followed for a defined period, Case-Control studies

In an **Experimental Study** there **IS AN INTERVENTION** with the subjects

- Example: Randomized Control Trials (RCT)
- Experimental Studies are great at **assessing causality** since you can control for variables



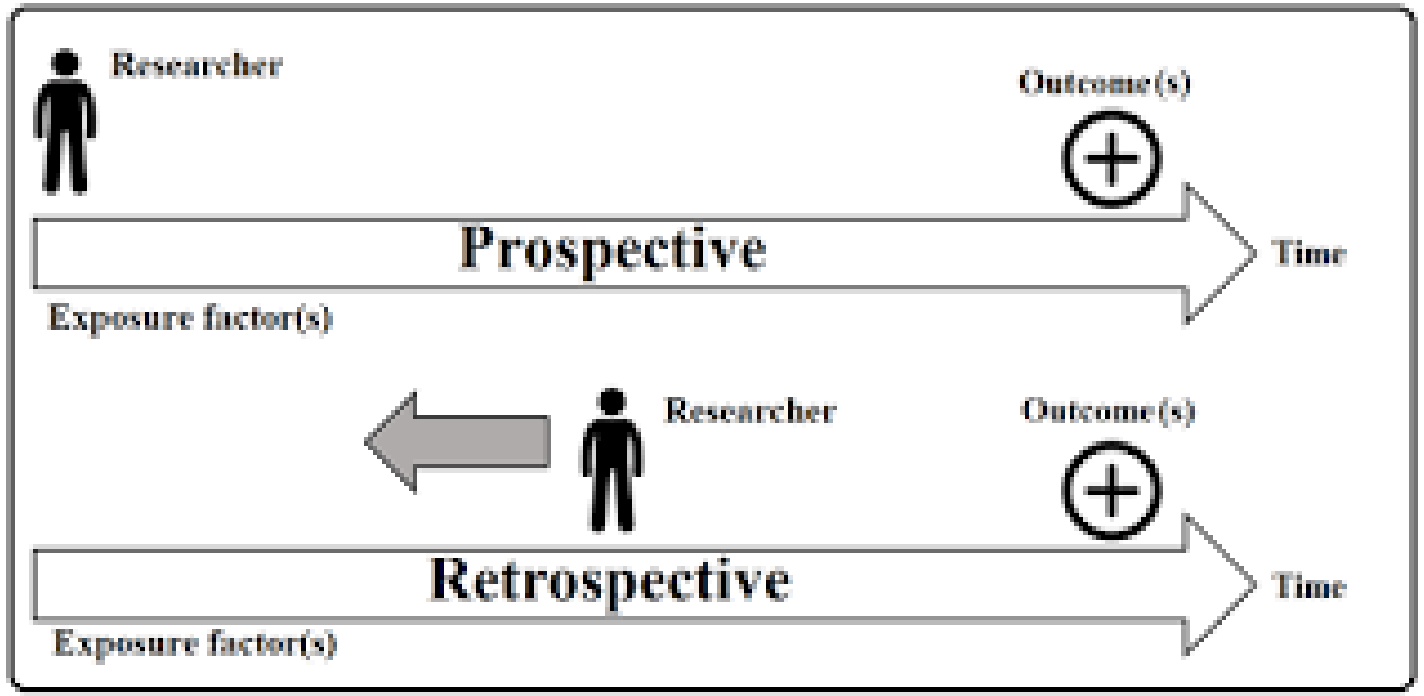
Retrospective vs. Prospective Study

In a **Retrospective Study** the event of interest has **already happened**

- You are interested in a *PAST* event

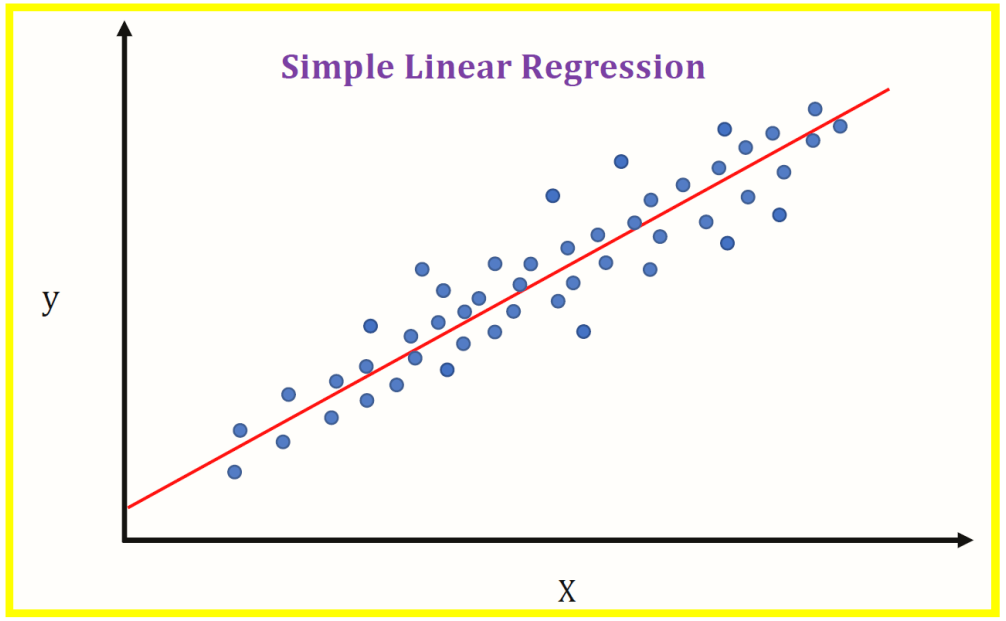
In a **Prospective Study,** the event of interest **has not happened yet**

- You are interested in a *FUTURE* event



Causal vs. Associative (Correlation)

- To have an **association**, there is a relationship between your variables
- Oftentimes, this relationship looks like a simple linear regression between two variables



Or, let's consider the relationship between the sun rising in the morning and the rooster yelling!

Causal vs. Associative (Correlation)

- The sun rises and the rooster crows
- But that **does not imply** that the *sun causes the rooster to crow* or the *crow to cause the sun to rise*…

Causal vs. Associative (Correlation)

CAUSATION IS NOT CORRELATION!!!!

Causation is **harder to claim** than correlation.

- You will need to be able to control for your variables (ex. Randomized Control Trials)
- There are many scientists who have worked on solving how to claim causality between variables:
  - Sir Bradford Hill's Criteria
  - Granger Causality
  - Causal Diagrams (DAGs)
  - Etc.

Hill's Criteria of Causation Applied to Subluxation

	Criteria	Result
1	Strength	There were no studies that found a relative risk or odds ratio linking subluxation
2	Consistency	Subluxation has not been noted to be consistently found across any studies in different people, places, circumstances or time.
3	Specificity	There were no studies that linked disease with subluxation of any specificity. Other exposures (variables) or explanations can be given to the disease complex.
4	Temporal sequence	There were no studies suggestive of a temporal sequence linking subluxation with disease
5	Dose response	There were no studies found linking incidence of disease with magnitude of the subluxation
6	Experimental evidence	There were no consistent studies demonstrating subluxation in the animal model
7	Biological plausibility	No studies were found that offered reproducible evidence to suggest a biological plausibility of the subluxation construct.
8	Coherence	There were no studies that indicated a credible level of coherence
9	Analogy	There were no studies suggestive of a casual association via a similar agent.