Lab 2

Cindy J. Pang 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)
 - <u>Example</u>: 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:

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

Lab 2 – Competency Assessment

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

Statistics vs. Parameter

a <u>Statistic</u> is a measurement of the <u>Sample</u>

A <u>Parameter</u> is a measurement of the <u>Population</u>

Random Selection Sample Population Inference Parameter x Statistic (Population mean) (Sample mean)

We want to know about these ...

(population variance) (Samp

S² (Sample Variance)

... but we have to work with these

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
- <u>Example</u>: 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
- · High internal validity -> does not n

Hawthorne Effect People will as well control behave differently when they know they're being watched



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 <u>does not imply</u> that the sun <u>causes</u> the rooster to crow or the crow to <u>cause</u> 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: Hill's Criteria of Causation Applied to Subluxation
 - Sir Bradford Hill's Criteria
 - Granger Causality
 - Causal Diagrams (DAGs)



Outrame

	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.