

Homework:
Experiments & Observational Studies

MATH 150

Due: Jan 24, 2024

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Problem 1

A study that surveyed a random sample of otherwise high school students found that they are more likely to get muscle cramps when they are stressed. The study also noted that students drink more coffee and sleep less when they are stressed.

- (a) What type of study is this?
- (b) Can this study be used to conclude a causal relationship between increased stress and muscle cramps?
- (c) State possible confounding variables that might explain the observed relationship between increased stress and muscle cramps.

Answer

- (a) Based on the given details researchers observed a random sample of high school students and noted associations between multiple factors. However, if the researchers manipulated variables to determine causation, it would be an experiment. But for now, this is a an **observational study**.
- (b) **No**. Observational studies generally cannot establish a causal relationship, as that would require a controlled experiment with interventions, which are not taking place in this case (to our knowledge).
- (c) There are many confounding variables that could explain the observed pattern:
 - the amount of coffee consumed
 - the amount of sleep each get
 - the amount of stressful stuff they have, or their environment's stress level
 - their diet
 - their physical activities
 - medications
 - mental health
 - etc.

Problem 2

To assess the effectiveness of taking large doses of vitamin C in reducing the duration of the common cold, researchers recruited 400 healthy volunteers from staff and students at a university. A quarter of the patients were assigned a placebo, and the rest were evenly divided between 1g Vitamin C, 3g Vitamin C, or 3g Vitamin C plus additives to be taken at onset of a cold for the following two days. All tablets had identical appearance and packaging. The nurses who handed the prescribed pills to the patients knew which patient received which treatment, but the researchers assessing the patients when they were sick did not. No significant differences were observed in any measure of cold duration or severity between the four groups, and the placebo group had the shortest duration of symptoms.

- (a) Was this an experiment or an observational study? Why?
- (b) What are the explanatory and response variables in this study?
- (c) Were the patients blinded to their treatment?
- (d) Was this study double-blind?
- (e) Participants are ultimately able to choose whether or not to use the pills prescribed to them. We might expect that not all of them will adhere and take their pills. Does this introduce a confounding variable to the study? Explain your reasoning.

Answer

(a) **Experiment variable** as it involves researchers manipulating one or more variables to observe the effect on another variable, with participants randomly assigned to the conditions.

(b) The experiment and response variables can be identified so:

The **Explanatory variable is the dosage of vitamin C** which is manipulated to observe its impact.

As the researchers measured the effectiveness of the different treatments by assessing the duration and severity of symptoms in each group, the **Response variable are the measuring factors of the common cold.**

(c) **Yes.** Blinding refers to keeping participants unaware of the treatment they are receiving to minimize potential bias. In this study, it is mentioned that the tablets had identical appearance and packaging, therefore we can assume the patients were blind tested. Moreover, even the researchers did not have the information either to minimize bias.

(d) **Yes, to a great extent.** Double-blind testing refers to both patients and researchers assessing results to have limited information about the study, preventing bias. Although nurses are not blind in this study, they are not the ones assessing or playing a deciding factor / variable in the study, therefore overall, this study is double-blinded.

(e) **Yes.** A confounding variable is generally a third variable that will influence the result or pattern of the two initial (tested) variables. In this case the chance of a patient not taking their pill, will impact the whole results and therefore it is a confounding variable.