EDP 613 Fall 2020
Chapter 1 Outline

Idea: Types of Data

Definitions:

- Information is collected on **elements** or **individuals**.
- The characteristics of the individuals about which we collect information are called **variables**.
- The values of the variables that we obtain are called **data**.

Qualitative and Quantitative Variables

Definitions:

- **Qualitative variables** or **Categorical variables** classify elements into categories.
- **Quantitative variables** troll how much or how many of something there is.

Example: Which of the following variables are qualitative and which are quantitative?

1. The name of the schools in your district. Qualitative
2. The number of schools in your district. Quantitative
3. The amount of each ingredient in a cake. Quantitative
4. The ingredients in a cake. Qualitative

Ordinal and Nominal Variables

Definitions:

- **Ordinal variables** are qualitative variables whose categories have natural ordering.
- **Nominal variables** are qualitative variables whose categories have no natural ordering.

Example: Which of the following variables are ordinal and which are nominal?

1. The (typical) letter grade distribution in a school. Ordinal
2. Toppings on a cheeseburger. Nominal
3. Social economic class. Ordinal
4. A telephone number. Nominal

Discrete and Continuous Variables

Definitions:

- **Discrete variables** are quantitative variables whose possible values can be listed (possible infinite). (obtained by counting)
- **Continuous variables** are quantitative variables that can take on any value in some interval. (obtained by measuring)

Example: Which of the following variables are discrete and which are continuous?

1. Time it takes to get to school. Continuous
2. Water temperature. Continuous
3. Ratings on a 5-point rating scale. Discrete
4. Number of cars currently in a parking lot. Discrete

The textbook do not discuss these items directly but we will be using these ideas throughout the term.

Idea: Designs of Experiments

Definitions:

- The **experimental units** are the individuals that are studies usually called subjects.
- The **outcome** or **response** is what is measured on each experimental unit.
- The **treatments** are the procedures applied to each experimental unit. The purpose of a treatment is to measure an outcome.
- A **randomized experiment** is a study in which the investigator assigns the treatments to experimental units at random.
- An **observational study** is one in which the assignment to treatment groups is not made by the investigator.

Randomized Experiments

1. In a **completely randomized experiment**, there is no restriction on which subjects may be assigned which treatment (considered to be the gold standard in experimental design).

   Example: A control group of pediatric patients with asthma was given standard asthma educational resources, while the experimental group of pediatric patients with asthma was given standard resources plus multimedia resources. The study found a reduction in daily symptoms, in emergency room visits, in school days missed, and in days of limited activity in the group given multimedia education resources (Krishna, Balas, Francisco & König, 2006).

2. In a **double-blind experiment**, neither the investigator nor the subjects know who had been assigned to which treatment.

   Example: Twenty two male veteran who were alcoholics received an accepted therapeutic dosage of LSD with an alcohol treatment program. These subjects were compared with two control groups. The first consisted of 22 patients who received placebo dosage of LSD (25 micrograms as opposed to the 500 microgram treatment dosage) with an alcohol treatment program. A second control group of 15 patients did not ingest LSD but did complete the same training program as other patients. Findings were such as to indicate that the long term gains through use of LSD are negligible, rather a successful post-treatment adjustment were based on pretreatment employment level, marital status, and whether or not the patient completed the treatment program (Bowen, Soskin, & Chotlos, 1970).

3. In a **randomized block experiment**, subjects are first divided into homogeneous blocks before they are randomly assigned to a treatment group.

   Example: Two hundred forty six adolescent girls incarcerated in a state reformatory were recruited and assigned to an 18-session health education program or a time-equivalent HIV prevention program. Cohorts were assigned to conditions using a randomized block design separated by a washout period (a period in a clinical study during which subjects receive no treatment for the indication under study and the effects of a previous treatment are eliminated) to reduce contamination. Post intervention, girls in the HIV risk reduction program demonstrated the acquisition of risk-reduction behavioral skills and improved condom application skill. At a follow-up assessment approximately 9 months after release from the correctional facility, girls in both conditions reported fewer unprotected sexual intercourse occasions and less sex while under the influence of alcohol or other drugs (Robertson, St. Lawrence, Morse, Baird-Thomas, Liew & Gresham, 2011).

Observational Studies

1. In a **cohort study**, one or more samples (aka cohorts) are followed prospectively and subsequent status evaluations with respect to a disease or outcome are conducted to determine which initial participants exposure characteristics (risk factors) are associated with it. As the study is conducted, outcome from participants in each cohort is measured and relationships with specific characteristics determined.

   Example: To determine the long-term effectiveness of influenza vaccines in elderly people, cohorts of vaccinated elderly and unvaccinated community-dwelling elderly were studied. The results suggest that the elderly who are vaccinated have a reduced risk of hospitalization for pneumonia or influenza. (Nichol, Nordin, Nelson, Mullooly & Hak, 2007).

   (a) Types of cohort studies:

      i. In a **prospective cohort study**, the subjects are followed over time.
      ii. In a **cross-sectional cohort study**, measurements are taken at one point in time.
      iii. In a **retrospective cohort study**, the subjects are sampled after the outcome has occurred.

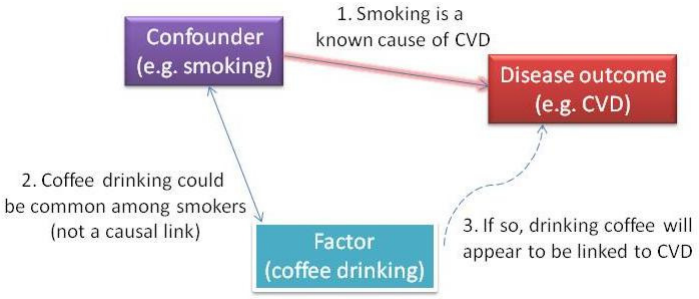
2. In a **case-control study**, patients who have a disease or outcome of interest (aka cases) with patients who do not have the disease or outcome (aka controls), and looks back retrospectively to compare how frequently the exposure to a risk factor is present in each group to determine the relationship between the risk factor and the disease.

   Example: A study matched patients with non-Hodgkin lymphoma (NHL) with control subjects and compared their history of autoimmune and chronic inflammatory disorders, markers of severity, and treatment. It found that the risk of NHL was increased in association with rheumatoid arthritis, primary Sjögren syndrome, systemic lupus erythematosus, and celiac disease. (Smedby, Hjalgrim, Askling, Chang, Gregersen, Porwit-MacDonald, et al., 2006)

Confounding

Observational studies have one major problem. It is difficult to ascertain whether a difference in the outcome is due to the treatment or some other difference between the treatment and control groups. This is known as **confounding**.

Example: In medicine, confounding occurs when a factor other than the one you are studying is associated both with the disease and the factor you are studying (drinking coffee). This can make it seem as though the factor you are studying causes the disease even if, in reality, it does not. For example, if drinking coffee is associated with smoking (perhaps people who drink coffee also tend to smoke) the smoking forms a confounding variable that can make it falsely appear as though coffee drinking leads to heart disease.



The result is that there appears to be an association between coffee drinking and heart disease when, in reality, this may be occurring just because the people who drink coffee also smoke, and it is their smoking (not the coffee drinking) which actually causes the heart disease. ("University of Ottowa," 2012)

remember: CORRELATION DOES NOT PROVE CAUSATION!

References

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