Homework for Chapter 10: Treatment Effects

1. Define *in your own words* (i.e., don’t just copy down what’s written in the glossary) each of the following terms:
   1. Conditional average treatment effect

Answer: Conditional average treatment effect refers to the average treatment effect among a certain group of people with certain values.

* 1. Average treatment on the treated

Answer: Average treatment on the treated refers to the average treatment effect among the people who actually get treated in a study.

* 1. Average treatment on the untreated

Answer: Average treatment on the untreated refers to the average treatment effect among the people who does not get treated in a study.

1. Provide an example of a treatment effect that you would expect to be highly heterogeneous, and explain why you think it is likely to be heterogeneous

Answer: The effect of covid on human taste systems could be highly heterogeneous. The people who already have some gustatory problems will be easier to get their taste system affected by covid; the people with a great immune system or a good taste system might not be affected by the covid on their taste. Besides, some people might not taste sweatiness while some people might not taste piquancy with the effect of covid on taste systems.

1. Consider the data in the table below that shows the hypothetical treatment effect of cognitive behavioral therapy on depression for six participants. For the sake of this example, the six participants represent the population of interest.

|  |  |  |  |
| --- | --- | --- | --- |
| Case | Age | Gender | Effect |
| A | 15 | Man | 7 |
| B | 40 | Woman | 3 |
| C | 30 | Woman | 7 |
| D | 20 | Non-binary | 8 |
| E | 15 | Man | 7 |
| F | 25 | Woman | 4 |

* 1. What is the overall average treatment effect for the population?

Answer: (7+3+7+8+7+4)/6=6 The overall average treatment effect for the population is 6.

* 1. What is the average treatment effect for Women?

Answer: (3+7+4)/3=14/3 (4.667) The average treatment effect for Women is about 4.667.

* 1. If nearly all Non-binary people get treated, and about half of all Women get treated, and we control for the differences between Women and Non-binary people, what kind of treatment effect average will we get, and what can we say about the numerical estimate we’ll get?

Answer: We can get variance-weighted average treatment effect here. The estimate weighs more on the average treatment effect of women since the variation of women group is greater than that of non-binary people group. So this estimate will be closer to the average treatment effect of women.

* 1. If we assume that, in the absence of treatment, everyone would have had the same outcome, and also only teenagers (19 or younger) ever receive treatment, and we compare treated people to control people, what kind of treatment effect average will we get, and what can we say about the numerical estimate we’ll get?

Answer: I think we could get the average treatment on treated by comparing treated people to control people. By comparing treated people to control people, we can get the difference of the average outcome of treated people and the average outcome of control people. Though the treated group and the untreated group differ in age, both groups of people would have had the same outcome, in the absence of treatment, which means that age will not affect the outcome in a way so it probably is not a back door. So we could get the average treatment on treated by comparing treated people to control people.

1. Give an example where the average treatment effect on the treated would be more useful to consider than the overall average treatment effect, and explain why

Answer: If we want to know the effect of Alcoholics Anonymous Meetings for alcoholics, the average treatment effect on the treated might be more useful to use the overall average treatment effect. Because only alcoholics will go to AA meetings and the AA meetings might be more effective for alcoholics than other people. So in this circumstance, using average treatment on treated will more useful than using the overall average treatment effect.

1. Which of the following describes the average treatment effect of assigning treatment, whether or not treatment is actually received? Answer: c. Intent-to-treat.
   1. Local average treatment effect
   2. Average treatment on the treated
   3. Intent-to-treat
   4. Variance-weighted average treatment effect
2. On weighted treatment effects:
   1. Describe what a variance-weighted treatment effect is

Answer: A variance-weighted treatment effect is a weighted average treatment effect based on how much variation in treatment variables after closing all the back doors, which means that it will weigh more heavily on those treatment variables with more variation than those with less variation.

* 1. Describe what a distribution-weighted treatment effect is

Answer: A distribution-weighted treatment effect is a weighted average treatment effect with weighing more heavily on the individuals that have common values of the variables that we are matching on while selecting a sample where the treated and untreated groups have similar values of variables on back door paths.

* 1. Under what conditions/research designs would we get each of these?

For a variance-weighted treatment effect, we can get it when there is different variation in treatment variables. For example, if we have 90 percent of variable A get treated, 60 percent of variable B get treated, and 20 percent of variable C get treated, we could have a variance-weighted treatment effect here. For a distribution-weighted treatment effect, we can get it under the conditions that researchers select a sample where the treated and untreated groups have similar values of variables on back door paths.

1. Suppose you are conducting an experiment to see whether pricing cookies at $1.99 versus $2 affects the decision to purchase the cookies. The population of interest is all adults in the United States. You recruit people from your university to participate and randomize them to either see cookies priced as $1.99 or $2, then write down whether they purchased cookies. What kind of average treatment effect can you identify from this experiment?

Answer: Conditional average treatment effect for the university students.

1. For each of the following identification strategies, what kind of treatment effect(s) is most likely to be identified?
   1. A randomized experiment using a representative sample (Average Treatment Effect)
   2. True randomization within only a certain demographic group (Conditional Average Treatment Effect)
   3. Closing back door paths connected to variation in treatment (Variance-weighted average treatment effect)
   4. Isolating the part of the variation in treatment variable that is driven by an exogenous variable (Local average treatment effect)
   5. The control group is comparable to the treatment group, but treatment effects may be different across these groups (This could be distribution-weighted average treatment effects if the word “groups” in “…may be different across these groups” refers to the pairs in control group and treatment group with similar values of variables on back door paths)