stl2137_p8122_hw1

Question 1

Part A

For all individuals calculate the effect of treatment on the outcome and interpret.

Individual	Y_0	Y_1	$Y_0 - Y_1$
1	0	0	0
2	1	0	1
3	0	1	-1
4	1	0	1
5	1	0	1
6	0	1	-1
7	1	0	1
8	0	0	0

- For individuals 2, 4, 5, and 7, Treatment 0 had a positive causal effect.
- For individuals 3 and 6, Treatment 0 had a negative causal effect.
- For individuals 1 and 8, neither Treatment 0 or Treatment 1 had a causal effect.

Part B

Calculate the average causal effect of treatment on the outcome and interpret.

$E[Y_0] - E[Y_1]$

$= \frac{4}{8} - \frac{2}{8} = \frac{1}{4}$

- Treatment 0 is better on average than treatment 1.

Part C

Calculate the association of the treatment with the outcome under the following treatment assignment for subjects $i = 1, .., 8 : A_1 = 1, A_2 = 0, A_3 = 1, A_4 = 1, A_5 = 0, A_6 = 0, A_7 = 0, A_8 = 1$. Interpret the result, compare with the effect computed in question 1b.

Individual	Y_0	Y_1	Treatment
1	0	0	$A_1 = 1$
2	1	0	$A_2 = 0$
3	0	1	$A_3 = 1$
4	1	0	$A_4 = 1$
5	1	0	$A_5 = 0$
6	0	1	$A_6 = 0$

Individual	Y_0	Y_1	Treatment
7	1	0	$A_7 = 0$
8	0	0	$A_8 = 1$

$E[Y|A = 0] - E[Y|A = 1]$

$= \frac{3}{4} - \frac{1}{4} = \frac{1}{2}$

The difference in observed group means and apparent effects between Y_0 and Y_1 is $\frac{1}{2}$, meaning that Treatment 0 is better on average. The derived apparent effect is higher than the ACE of $\frac{1}{4}$ from part 1b.

Part D

Show a random assignment of the treatment for this population. Explain your work. Compute the association of the treatment with the outcome under the random assignment and compare with the treatment effect computed in question 1b.

```
set.seed(21)
rbinom(8, 1, 0.5)
```

```
## [1] 1 0 1 0 1 1 0 0
```

Individual	Y_0	Y_1	Treatment
1	0	0	$A_1 = 1$
2	1	0	$A_2 = 0$
3	0	1	$A_3 = 1$
4	1	0	$A_4 = 0$
5	1	0	$A_5 = 1$
6	0	1	$A_6 = 1$
7	1	0	$A_7 = 0$
8	0	0	$A_8 = 0$

$E[Y|A = 0] - E[Y|A = 1]$

$= \frac{3}{4} - \frac{2}{4} = \frac{1}{4}$

The difference in observed group means and apparent effects between Y_0 and Y_1 is $\frac{1}{4}$, meaning that Treatment 0 is better on average. The ACE derived from part 1b states that the causal effect is also $\frac{1}{4}$. In this case, the difference in observed group means and the average causal effect are the same and come to the same conclusion that Treatment 0 is better on average.

Question 2

Part A

What are the units?

The units for this problem are each of the blood pressure tests performed per visit.

Part B

What is the treatment?

The treatment is dosage of medication (either high dose or low dose).

Part C

What are the potential outcomes?

The potential outcomes are that the patient's blood pressure levels is not normal (high or low) or the patient's blood pressure level is normal.

Part D

Show the calculation that the physician conducts to conclude that the patient should remain on the low dose (compute the causal effect of the treatment).

Test/Visit	Y_0	Y_1	Treatment
1	?	0	$A_1 = 1$
2	1	?	$A_2 = 0$
3	?	?	$A_3 = 0$

where Y = 1 if the patient blood pressure test comes back normal & Y = 0 if the patient blood pressure test comes back not normal and where A = 1 if the patient receives a high dose & A = 0 if the patient receives a low dose.