Interference

STSCI/INFO/ILRST 3900: Causal Inference

August 30, 2023

Reminders and Announcements

- HW 2 due tomorrow (September 14) by 5pm
  - Submit a PDF from RMarkdown via Canvas
- Office Hours
  - **Sam**: Wednesdays 3-4pm ~~in Comstock 1192~~ **OVER ZOOM TODAY!**
  - **Daniel**: Thursdays 1-2pm in Uris 302
  - **Mayleen**: Fridays 9-10am in Rhodes 657 (Room 2) or Zoom
  - **Ian**: Tuesdays 10:30-11:30am in Gates 223 or Zoom

Agenda

- Reminders and Announcements
- Icebreaker Activity: Consistency and Positivity Review
- Class Discussion: Interference
- Homework Check-in and Questions

Consistency and Positivity

Icebreaker Activity

1. Introductions: Names and what is your favorite thing about Ithaca? Least favorite thing?

2. In causal inference, what are consistency and positivity? What are some examples that illustrate these assumptions?

    - Feel free to look at yesterday's slides or Chapter 3 of the textbook

3. In causal inference, what is interference? What are some examples?

    - Look at yesterday's slides or see Fine Point 1.1 in pg 5 of the textbook

Class Discussion

What is interference?

- What did you discuss in your groups?

Class Discussion

What is interference?

- What did you discuss in your groups?
- Good causal questions involve precise treatments (**consistency**) that exist (**positivity**).
- Interference occurs when an individual's outcome can be affected by the treatment of others in the population

Class Discussion

What is interference?

Example: Advertisements

- Your friend sees an ad for a new Coca Cola flavor. You don't see it, but the next time you see them, they have a can of it. You buy a can next time you go to the store.
- You didn't interact with the ad, yet you were possibly affected through your friend!
- You friend's treatment "interfered" with your outcome

Class Discussion

What is interference?

- Example: Advertisements
  - Under **NO interference**, your outcome is only dependent on your own treatment
    - You buying the new Coca Cola flavor only has to do with whether or not you saw the ad
  - Under **interference**, your outcome may depend on the treatment of your friends
    - You buying the new Coca Cola flavor depends not only on whether or not you saw the ad, but whether or not your friends saw it

Class Discussion

What is interference?

- Your friend sees an ad for a new Coca Cola flavor. You don’t see it, but the next time you see them, they have a can of it. You buy a can next time you go to the store.

Discuss: What are the possible treatment combinations in this scenario?

Class Discussion

What is interference?

- Your friend sees an ad for a new Coca Cola flavor. You don't see it, but the next time you see them, they have a can of it. You buy a can next time you go to the store.

Discuss: What are the possible treatment combinations in this scenario?

1. You and your friend both see the ad
2. You see the ad, your friend does not see it
3. You do not see the ad, your friend does
4. Neither you nor your friend see the ad

Class Discussion

What is interference?

- Possible Treatment Combinations:
    1. You and your friend both see the ad
    2. You see the ad, your friend does not see it
    3. You do not see the ad, your friend does
    4. Neither you nor your friend see the ad

Discuss: Do the following notations make sense? Why or why not?

$$Y_{you}^{ad} \text{ or } Y_{friend}^{no\ ad}$$

Class Discussion

What is interference?

Let a_1 be your treatment and a_2 be your friend's.

1. You and your friend both see the ad
2. You see the ad, your friend does not see it
3. You do not see the ad, your friend does
4. Neither you nor your friend see the ad

Discuss: How do we change the notation to reflect the interference?

From $Y_1^{a_1}$ and $Y_2^{a_2}$ to … ?

Class Discussion

What is interference?

Let a_1 be your treatment and a_2 be your friend's.

1. You and your friend both see the ad $(a_1 = 1, a_2 = 1)$
2. You see the ad, your friend does not see it $(a_1 = 1, a_2 = 0)$
3. You do not see the ad, your friend does $(a_1 = 0, a_2 = 1)$
4. Neither you nor your friend see the ad $(a_1 = 0, a_2 = 0)$

Discuss: How do we change the notation to reflect the interference?

From $Y_1^{a_1}$ and $Y_2^{a_2}$ to $Y_i^{a_1,a_2}$

Class Discussion

Write the potential outcome notation for yourself when **no interference** is present **versus** when **interference** is present. Let a_1 be your treatment and a_2 be your friend's.

NO Interference	Your friend is treated	Your friend is not treated
You are treated		
You are not treated		

Interference	Your friend is treated	Your friend is not treated
You are treated		
You are not treated		

Class Discussion

Write the potential outcome notation for your friend when **no interference** is present **versus** when **interference** is present. Let a_1 be your treatment and a_2 be your friend's.

NO Interference	Your friend is treated	Your friend is not treated
You are treated	$Y_1^{a_1=1}$	$Y_1^{a_1=1}$
You are not treated	$Y_1^{a_1=0}$	$Y_1^{a_1=0}$

Interference	Your friend is treated	Your friend is not treated
You are treated	$Y_1^{a_1=1,a_2=1}$	$Y_1^{a_1=1,a_2=0}$
You are not treated	$Y_1^{a_1=0,a_2=1}$	$Y_1^{a_1=0,a_2=0}$

Class Discussion

Write the potential outcome notation for your friend when **no interference** is present **versus** when **interference** is present. Let a_1 be your treatment and a_2 be your friend's.

NO Interference	Your friend is treated	Your friend is not treated
You are treated	$Y^{a_1=1}$	$Y^{a_1=1}$
You are not treated	$Y_1^{a_1=0}$	$Y_1^{a_1=0}$

Two potential outcomes per person

Interference	Your friend is treated	Your friend is not treated
You are treated	$Y^{a_1=1,a_2=1}$	$Y^{a_1=1,a_2=0}$
You are not treated	$Y_1^{a_1=0,a_2=1}$	$Y_1^{a_1=0,a_2=0}$

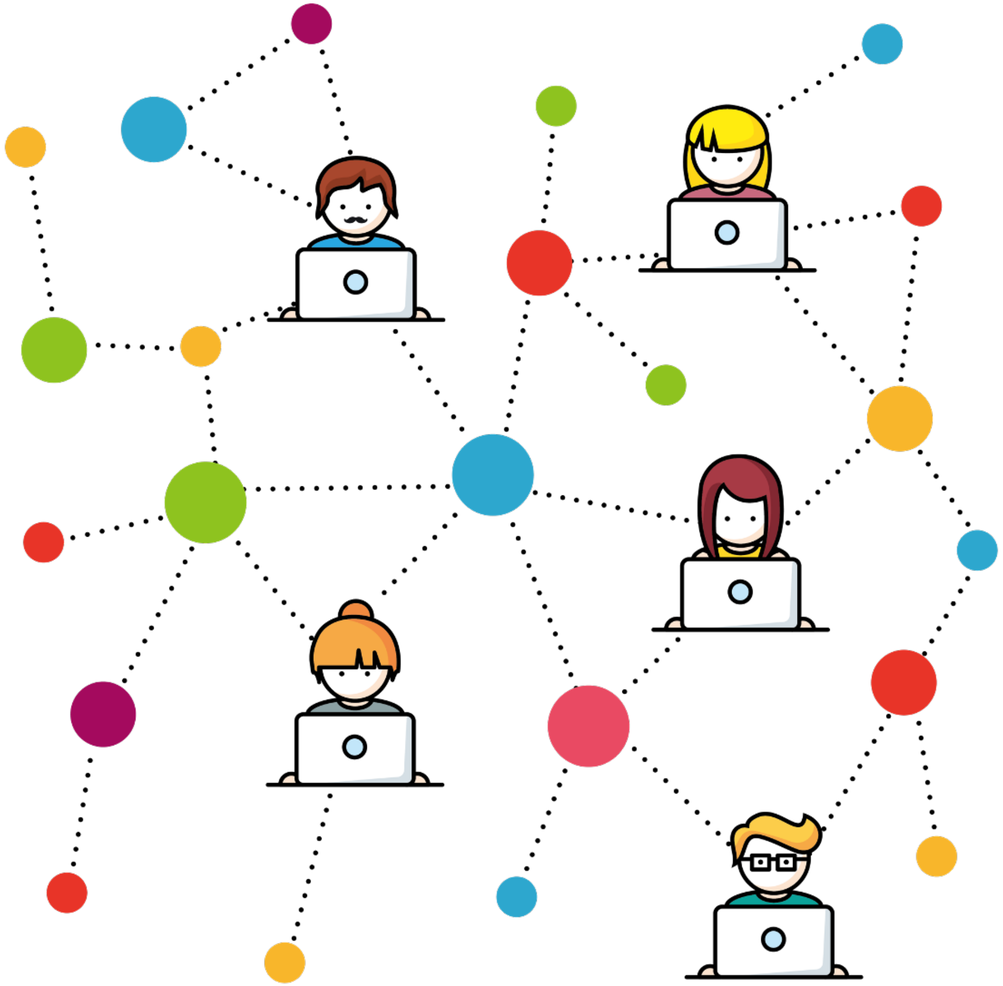
Four potential outcomes per person

Class Discussion

- In the most general settings, everyone can affect everyone's outcomes

$$Y_1^{a_1,a_2,\cdots,a_n}$$

- That's 2^n different possible potential outcomes per person!
- In some settings, assuming no interference can be reasonable
- In other settings, assuming no interference can lead to **very misleading** results (See What Do Randomized Studies of Housing Mobility Demonstrate? By Michael Sobel, 2006)



Questions about the HW?