ATE vs ATT


ehsan.karim@ubc.ca

Oct 7, 2020

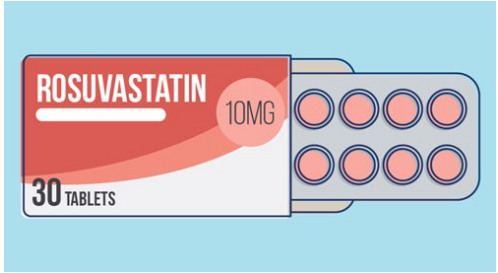
SPPH 504/007

Notations review

A: Exposure status

1 = takes Rosuvastatin

0 = does not take rosuvastatin



Y: Outcome: Total cholesterol levels

- Y(A=1) = potential outcome when exposed
- Y(A=0) = potential outcome when not exposed

Demographic	Total Cholesterol
Age 19 or younger	Less than 170 mg/dL
Men age 20 or older	125 to 200 mg/dL
Women age 20 or older	125 to 200 mg/dL

Notations: our interests 🎯

When assessing the effect of an exposure on an outcome, we are interested about the following estimands

1. treatment effect for an individual (TE)
2. average treatment effect (ATE)
3. average treatment effect on the treated (ATT)

Notations: TE

Counterfactual!

Scenario 1

- John takes Rosuvastatin (A=1) and his total cholesterol level is = Y(A=1) = 195 mg/dL (milligrams per deciliter) after 3 months

Scenario 2

- John does not take Rosuvastatin (A=0) and his total cholesterol level is = Y(A=0) = 245 mg/dL after 3 months
- Effect of Rosuvastatin on John is =

TE = Y(A=1) - Y(A=0) = 195 - 245 = - 50

Notations: ATE

Counterfactual!

Person	Y(A=1)	Y(A=0)	TE
John	195	245	- 50
Jim	100	160	- 60
Jake	210	270	- 60
Cody	155	210	- 55
Luke	165	230	- 65

$$ATE = E[Y(A=1) - Y(A=0)] = -(50+60+60+55+65)/5 = -58$$

Notations: ATT

- We have 5 Rosuvastatin-treated subjects who are all **white, male, 50 years of age** and all baseline characteristics are the same.
- We recruited additional 5 subjects (same characteristics) to non-rosuvastatin group.

$$ATT = E[Y(A=1) - Y(A=0) \mid A = 1]$$

$$= 178 - 210 = -32$$

Person	Y(A=1)	Y(A=0)	TE
John	195		?
Jim	100		?
Jake	210		?
Cody	155		?
Luke	230		?
Average for A = 1	178		
Jack		245	?
Dustin		160	?
Cole		270	?
Lucas		210	?
Dylan		165	?
Average for A=0		210	

Notations: Important concept 

- In a RCT (enough n), the ATT & ATE are equivalent
- In an observational study the ATT and ATE are not necessarily the same.
- Both of these can be estimated in sample and population level

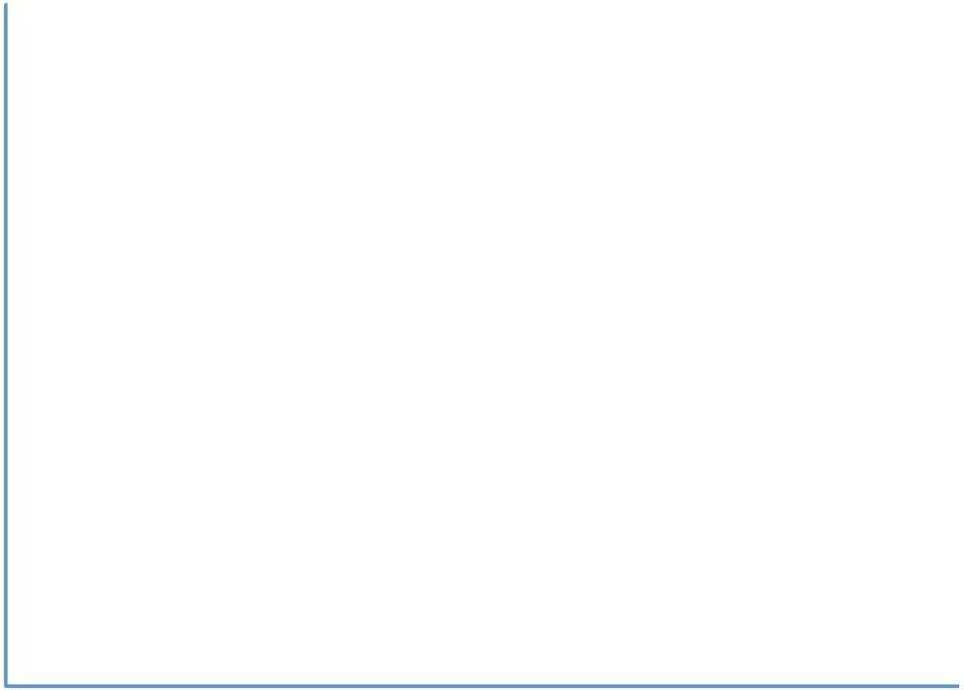
	Population	Sample
ATE	PATE	SATE
ATT	PATT	SATT

When is ATE = ATT?

When we randomize the treatment assignment (this assignment is independent of the outcome)

When we do not randomize the treatment assignment (this assignment is rarely independent of the outcome)

Trick question. They are never the same / similar.



Thanks!


ehsan.karim@ubc.ca


www.ehsankarim.com