Simpson's paradox: COVID-27

New disease: COVID-27

Simpson's paradox: COVID-27

New disease: COVID-27

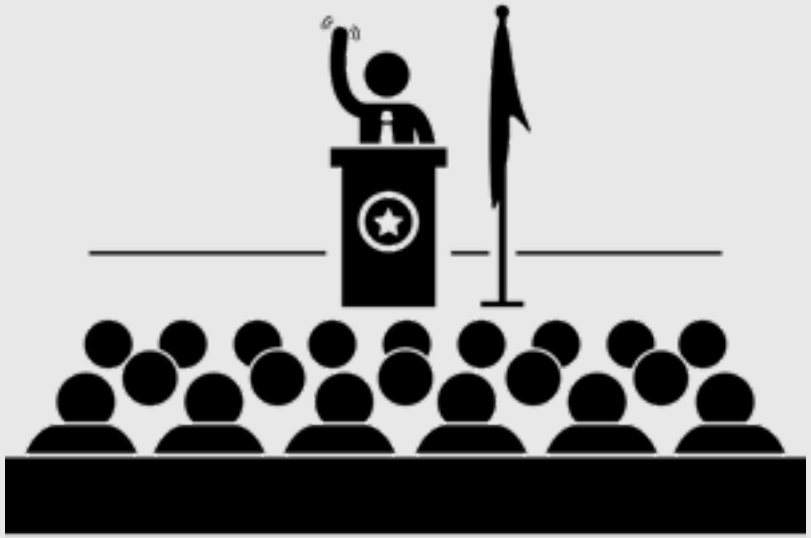
Treatment T: A (0) and B (1)

Simpson's paradox: COVID-27

New disease: COVID-27

Treatment T: A (0) and B (1)

YOU

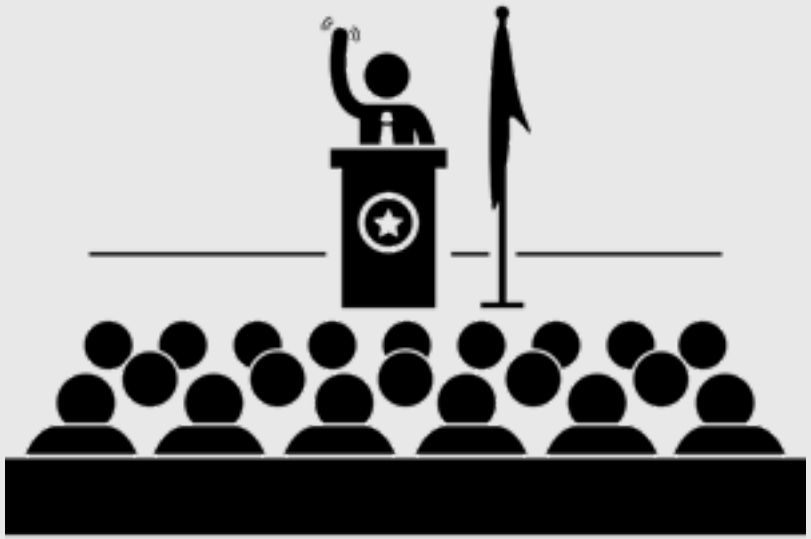


Simpson's paradox: COVID-27

New disease: COVID-27

Treatment T: A (0) and B (1)

Condition C: mild (0) or severe (1)



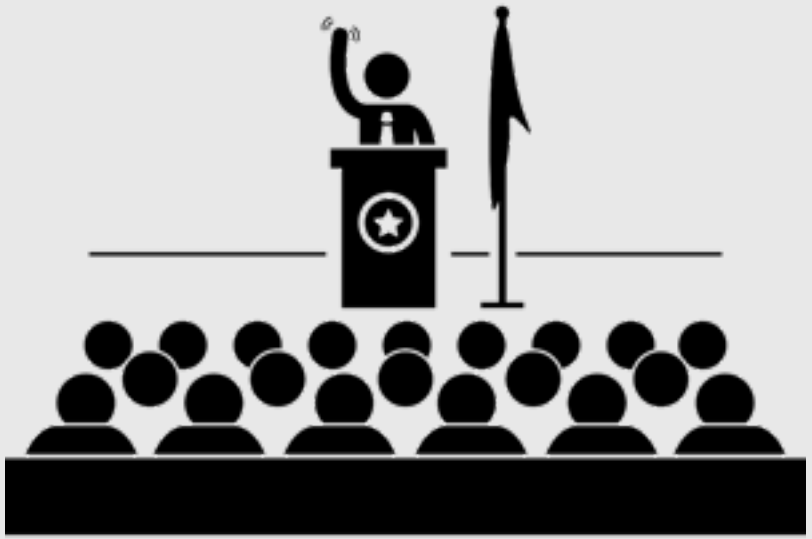
Simpson's paradox: COVID-27

New disease: COVID-27

Treatment T: A (0) and B (1)

Condition C: mild (0) or severe (1)

Outcome Y: alive (0) or dead (1)



Simpson's paradox: mortality rate table

Treatment	Total
A	**16%** (240/1500)
B	19% (105/550)

$\mathbb{E}[Y|T]$

Simpson's paradox: mortality rate table

Condition

Treatment	Mild	Severe	Total
A	15% (210/1400)	30% (30/100)	**16%** (240/1500)
B	**10%** (5/50)	**20%** (100/500)	19% (105/550)
	$\mathbb{E}[Y\|T, C=0]$	$\mathbb{E}[Y\|T, C=1]$	$\mathbb{E}[Y\|T]$

Simpson's paradox: mortality rate table

Condition

Treatment	Mild	Severe	Total
A	15% (210/1400)	30% (30/100)	**16%** (240/1500)
B	**10%** (5/50)	**20%** (100/500)	19% (105/550)
	$\mathbb{E}[Y\|T, C=0]$	$\mathbb{E}[Y\|T, C=1]$	$\mathbb{E}[Y\|T]$

$$\frac{1400}{1500}(0.15) + \frac{100}{1500}(0.30) = 0.16$$

$$\frac{50}{550}(0.10) + \frac{500}{550}(0.20) = 0.19$$

Simpson's paradox: mortality rate table

Condition

Treatment

	Mild	Severe	Total
A	15% (210/1400)	30% (30/100)	**16%** (240/1500)
B	**10%** (5/50)	**20%** (100/500)	19% (105/550)
	$\mathbb{E}[Y\|T, C=0]$	$\mathbb{E}[Y\|T, C=1]$	$\mathbb{E}[Y\|T]$

$$\frac{1400}{1500}(0.15) + \frac{100}{1500}(0.30) = 0.16$$

$$\frac{50}{550}(0.10) + \frac{500}{550}(0.20) = 0.19$$

Simpson's paradox: mortality rate table

Condition

Treatment	Mild	Severe	Total
A	15% (210/1400)	30% (30/100)	**16%** (240/1500)
B	**10%** (5/50)	**20%** (100/500)	19% (105/550)
	$\mathbb{E}[Y\|T, C=0]$	$\mathbb{E}[Y\|T, C=1]$	$\mathbb{E}[Y\|T]$

$$\frac{1400}{1500}(0.15) + \frac{100}{1500}(0.30) = 0.16$$

$$\frac{50}{550}(0.10) + \frac{500}{550}(0.20) = 0.19$$

Simpson's paradox: mortality rate table

Condition

Treatment

	Mild	Severe	Total
A	15% (210/1400)	30% (30/100)	**16%** (240/1500)
B	**10%** (5/50)	**20%** (100/500)	19% (105/550)
	$\mathbb{E}[Y\|T, C=0]$	$\mathbb{E}[Y\|T, C=1]$	$\mathbb{E}[Y\|T]$

$$\frac{1400}{1500}(0.15) + \frac{100}{1500}(0.30) = 0.16$$

$$\frac{50}{550}(0.10) + \frac{500}{550}(0.20) = 0.19$$

Which treatment should you choose?

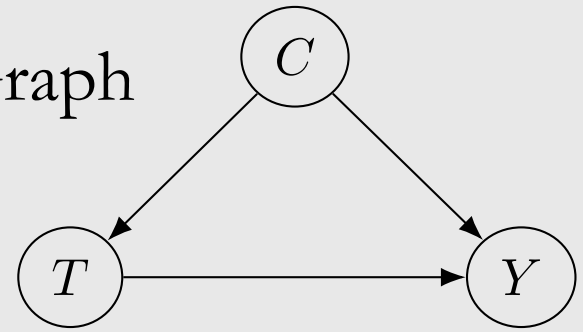
Simpson's paradox: scenario 1 (treatment B)

Treatment	Condition: Mild	Condition: Severe	Condition: Total
A	15% (210/1400)	30% (30/100)	**16%** (240/1500)
B	**10%** (5/50)	**20%** (100/500)	19% (105/550)

Simpson's paradox: scenario 1 (treatment B)

Treatment	Condition: Mild	Condition: Severe	Condition: Total
A	15% (210/1400)	30% (30/100)	**16%** (240/1500)
B	**10%** (5/50)	**20%** (100/500)	19% (105/550)

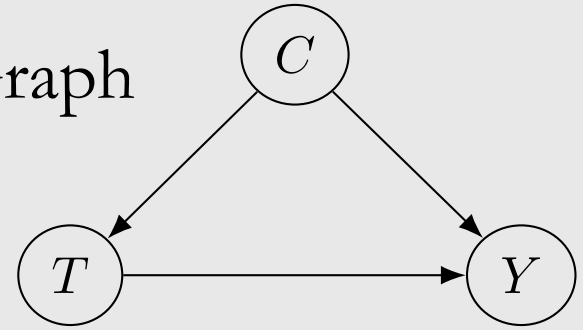
Causal Graph

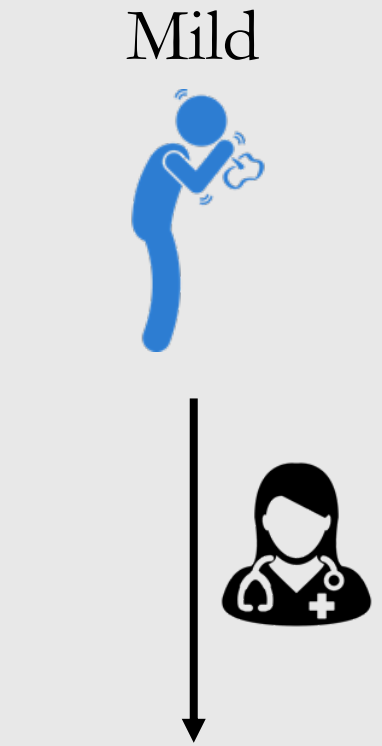


Simpson's paradox: scenario 1 (treatment B)

Treatment	Mild	Severe	Total
A	15% (210/1400)	30% (30/100)	**16%** (240/1500)
B	**10%** (5/50)	**20%** (100/500)	19% (105/550)

Causal Graph

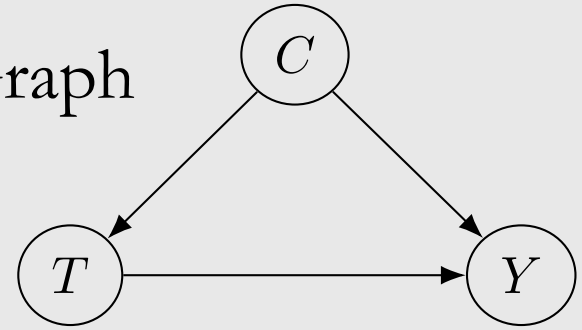


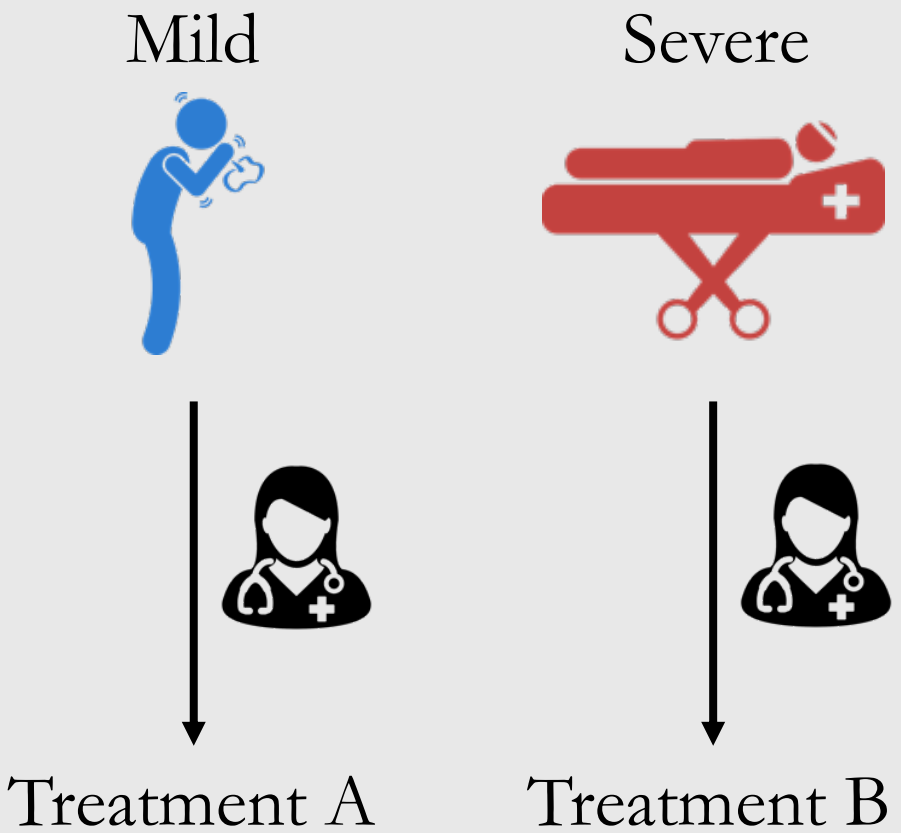


Simpson's paradox: scenario 1 (treatment B)

Treatment	Condition: Mild	Condition: Severe	Condition: Total
A	15% (210/1400)	30% (30/100)	**16%** (240/1500)
B	**10%** (5/50)	**20%** (100/500)	19% (105/550)

Causal Graph



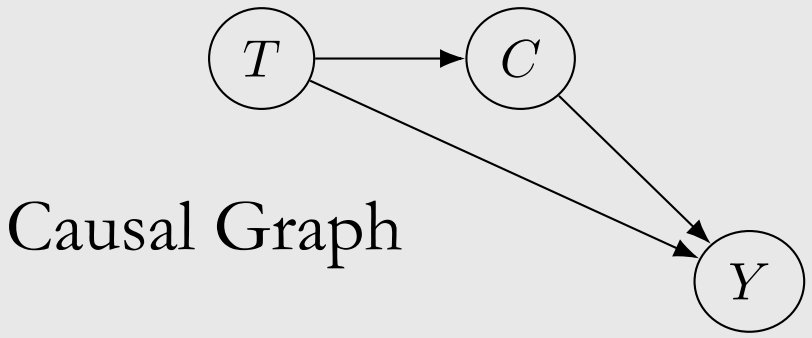


Simpson's paradox: scenario 2 (treatment A)

Treatment	Condition: Mild	Condition: Severe	Condition: Total
A	15% (210/1400)	30% (30/100)	**16%** (240/1500)
B	**10%** (5/50)	**20%** (100/500)	19% (105/550)

Simpson's paradox: scenario 2 (treatment A)

Treatment	Condition: Mild	Condition: Severe	Condition: Total
A	15% (210/1400)	30% (30/100)	**16%** (240/1500)
B	**10%** (5/50)	**20%** (100/500)	19% (105/550)

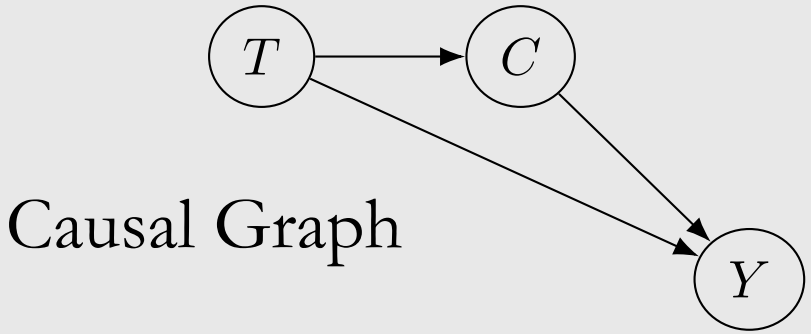


Causal Graph

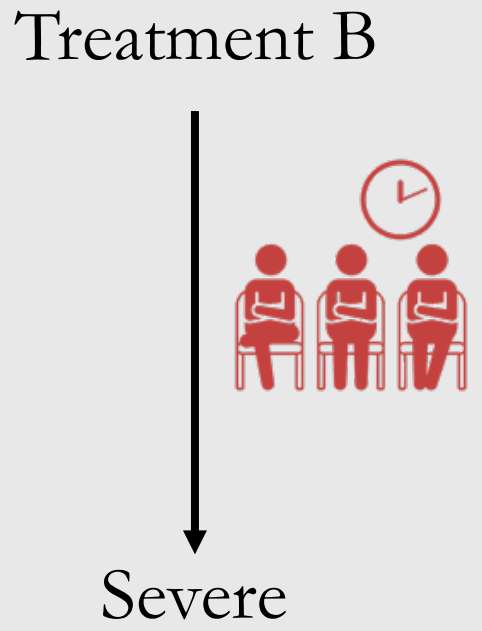
Simpson's paradox: scenario 2 (treatment A)

Condition

Treatment	Mild	Severe	Total
A	15% (210/1400)	30% (30/100)	**16%** (240/1500)
B	**10%** (5/50)	**20%** (100/500)	19% (105/550)

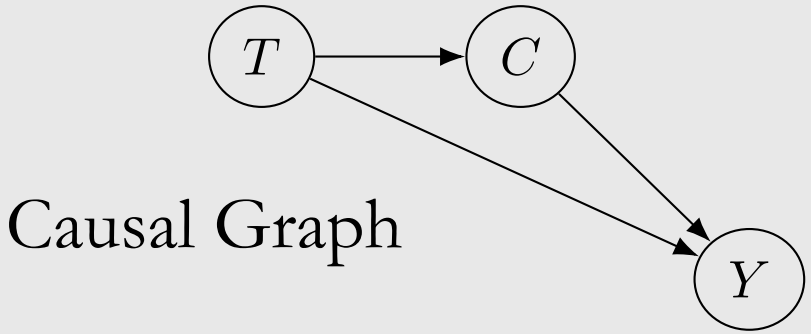


Causal Graph



Simpson's paradox: scenario 2 (treatment A)

Treatment	Condition: Mild	Condition: Severe	Condition: Total
A	15% (210/1400)	30% (30/100)	**16%** (240/1500)
B	**10%** (5/50)	**20%** (100/500)	19% (105/550)



Causal Graph