

Supplement 1: Step-by-Step Deconfounding

Step I: draw a large X through descendants of treatment (mediators)

#	ITFC←	→	PRTF	C	BH	P	A	E	Dr	DS
1		$C \rightarrow BH$		C	BH					
2		C		C	BH					
3		$C \rightarrow P \rightarrow A \rightarrow BH$		C	BH	P	A			
4		$C \rightarrow A \rightarrow BH$		C	BH		A			
5		$C \rightarrow E \rightarrow Dr \rightarrow DS \rightarrow BH$		C	BH			E	Dr	DS
6		$C \rightarrow E \rightarrow Dr \rightarrow DS \rightarrow A \rightarrow BH$		C	BH		A	E	Dr	DS
7		$C \rightarrow E \rightarrow Dr \rightarrow A \rightarrow BH$		C	BH		A	E	Dr	
8		$A \rightarrow BH$			BH		A			
9		$A \leftarrow C \rightarrow E \rightarrow Dr \rightarrow DS \rightarrow BH$		C	BH		A	E	Dr	DS
10		$A \leftarrow C \rightarrow BH$		C	BH		A			
11		$A \leftarrow C$		C	BH		A			
12		$A \leftarrow P \leftarrow C \rightarrow E \rightarrow Dr \rightarrow DS \rightarrow BH$		C	BH	P	A	E	Dr	DS
13		$A \leftarrow P \leftarrow C \rightarrow BH$		C	BH	P	A			
14		$A \leftarrow P \leftarrow C$		C	BH	P	A			
15		$A \leftarrow Dr \leftarrow E \leftarrow C \rightarrow BH$		C	BH		A	E	Dr	
16		$A \leftarrow Dr \leftarrow E \leftarrow C$		C	BH		A	E	Dr	
17		$A \leftarrow Dr \rightarrow DS \rightarrow BH$			BH		A		Dr	DS
18		$A \leftarrow DS \leftarrow Dr \leftarrow E \leftarrow C \rightarrow BH$		C	BH		A	E	Dr	DS
19		$A \leftarrow DS \leftarrow Dr \leftarrow E \leftarrow C$		C	BH		A	E	Dr	DS
20		$A \leftarrow DS \rightarrow BH$			BH		A			DS

Step II: draw a box around the remaining columns containing variables that are colliders.

#	ITFC←	→ PRTF	C	BH	P	A	E	Dr	DS
1		C → BH	C	BH					
2		C	C	BH					
3		C → P → A → BH	C	BH	P	A			
4		C → A → BH	C	BH		A			
5		C → E → Dr → DS → BH	C	BH			E	Dr	DS
6		C → E → Dr → DS → A → BH	C	BH		A	E	Dr	DS
7		C → E → Dr → A → BH	C	BH		A	E	Dr	
8		A → BH		BH		A			
9		A ← C → E → Dr → DS → BH	C	BH		A	E	Dr	DS
10		A ← C → BH	C	BH		A			
11		A ← C	C	BH		A			
12		A ← P ← C → E → Dr → DS → BH	C	BH	P	A	E	Dr	DS
13		A ← P ← C → BH	C	BH	P	A			
14		A ← P ← C	C	BH	P	A			
15		A ← Dr ← E ← C → BH	C	BH		A	E	Dr	
16		A ← Dr ← E ← C	C	BH		A	E	Dr	
17		A ← Dr → DS → BH		BH		A		Dr	DS
18		A ← DS ← Dr ← E ← C → BH	C	BH		A	E	Dr	DS
19		A ← DS ← Dr ← E ← C	C	BH		A	E	Dr	DS
20		A ← DS → BH		BH		A			DS

Step III: circle the confounders that are alone in their rows (C in row 1 and A in row 8).

#	ITFC←	→ PRTF	C	BH	P	A	E	Dr	DS
1		C → BH	C	BH		A			
2		C	C	BH		A			
3		C → P → A → BH	C	BH	P	A			
4		C → A → BH	C	BH		A			
5		C → E → Dr → DS → BH	C	BH		A	E	Dr	DS
6		C → E → Dr → DS → A → BH	C	BH		A	E	Dr	DS
7		C → E → Dr → A → BH	C	BH		A	E	Dr	
8		A → BH		BH		A			
9		A ← C → E → Dr → DS → BH	C	BH		A	E	Dr	DS
10		A ← C → BH	C	BH		A			
11		A ← C	C	BH		A			
12		A ← P ← C → E → Dr → DS → BH	C	BH	P	A	E	Dr	DS
13		A ← P ← C → BH	C	BH	P	A			
14		A ← P ← C	C	BH	P	A			
15		A ← Dr ← E ← C → BH	C	BH		A	E	Dr	
16		A ← Dr ← E ← C	C	BH		A	E	Dr	
17		A ← Dr → DS → BH		BH		A		Dr	DS
18		A ← DS ← Dr ← E ← C → BH	C	BH		A	E	Dr	DS
19		A ← DS ← Dr ← E ← C	C	BH		A	E	Dr	DS
20		A ← DS → BH		BH		A			DS

Step IV: Cross off any other paths that include these confounders (all rows except 1 and 8.) A, as shown, is a collider, requiring some additional steps to ensure that conditioning does not induce bias.

#	ITFC←	→ PRTF	C	BH	P	A	E	Dr	DS
1		C → BH	C	BH		A			
2		C	C	BH		A			
3		C → P → A → BH	C	BH	P	A			
4		C → A → BH	C	BH		A			
5		C → E → Dr → DS → BH	C	BH		A	E	Dr	DS
6		C → E → Dr → DS → A → BH	C	BH		A	E	Dr	DS
7		C → E → Dr → A → BH	C	BH		A	E	Dr	
8		A → BH		BH		A			
9		A ← C → E → Dr → DS → BH	C	BH		A	E	Dr	DS
10		A ← C → BH	C	BH		A			
11		A ← C	C	BH		A			
12		A ← P ← C → E → Dr → DS → BH	C	BH	P	A	E	Dr	DS
13		A ← P ← C → BH	C	BH	P	A			
14		A ← P ← C	C	BH	P	A			
15		A ← Dr ← E ← C → BH	C	BH		A	E	Dr	
16		A ← Dr ← E ← C	C	BH		A	E	Dr	
17		A ← Dr → DS → BH		BH		A		Dr	DS
18		A ← DS ← Dr ← E ← C → BH	C	BH		A	E	Dr	DS
19		A ← DS ← Dr ← E ← C	C	BH		A	E	Dr	DS
20		A ← DS → BH		BH		A			DS