case study: death penalty

(effect)

outcome variable ($Y$): \[
\begin{cases}
1 & \text{if death penalty} \\
0 & \text{not} \end{cases}
\]

cause)
predictor variable ($X$): \[
\begin{cases}
1 & \text{if defendant white} \\
0 & \text{not} \end{cases}
\]

basic design: threat to validity: bias

observational from potential confounding study factors ($PLFs$) $Z_1, \ldots, Z_k$

one possible

$PLF$ ($Z$): \[
\begin{cases}
1 & \text{if victim white (VW)} \\
0 & \text{not (VB)} \end{cases}
\]

as $Z$ changes from VB to VW, quite possible that $P(DP)$ $\uparrow$ 

as $Z$ changes from VB to VW, quite possible that $P(OW)$ $\uparrow$ so $Z$ (ethnicity of victim) is a PCF. Control for it by holding it constant.
study relationship between DP imposition and ethnicity of defendant separately for VB and VW

naive analysis based only on top (aggregate) table:

\[ P(DP) = \frac{36}{326} = 11.0\% \]

\[ P(DP|DV) = \frac{19}{150} = 11.9\% \]

\[ P(DP|DB) = \frac{17}{166} = 10.2\% \]

it appears that white defendants receive the death penalty more often than black defendants, which is a surprise

analysis of middle table (VW)

\[ P(DP|VW) = \frac{30}{214} = 14.0\% \]

\[ P(DP|VW, DW) = \frac{19}{151} = 12.6\% \]

\[ P(DP|VW, DB) = \frac{11}{63} = 17.5\% \]

holding ethnicity of victim constant at white, the rate of imposition of the death penalty rises (!!), from 11.0\% (top table) to 14.0\%, and now black defendants get the DP more often than white defendants
Analysis of bottom table (VB)

\[
P(DP | VB) = \frac{6}{112} = 5.4\%
\]

\[
P(DP | VB, BW) = \frac{0}{9} = 0\%
\]

\[
P(DP | VB, DB) = \frac{6}{103} = 5.8\%
\]

holding ethnicity of victim constant at Black, the rate of imposition of the death penalty falls (!), from 11.0% (top table) to 5.4%, and (again) now Black defendants get the DP more often than white defendants.

so: overall, in the aggregate (top table), as ethnicity of defendant moves from Black to White, \(P(DP)\) goes up, but separately for each of VW (middle table) and VB (bottom table), as ethnicity of defendant moves from Black to White, \(P(DP)\) goes down (i.e., the relationship reverses direction): this is a Simpson's Paradox and there's nothing paradoxical going on.
why did ① murder victims typically ④ know their murderer.

② In the U.S., white people tend to hang out with white people, and Black with Black. ③ Therefore, white defendants are mostly murdering white victims.

④ Judges & juries in the U.S. impose the death penalty more often when the victim is white than when the victim is Black.

Homework for you, not to turn in:
show that ethnicity is indeed a PCF here, by computing and comparing

\[ P(D|P) \quad P(D|W) \]
\[ P(D|1|P) \quad P(D|1|W) \]
\[ P(D|V|P) \quad P(D|V|W) \]