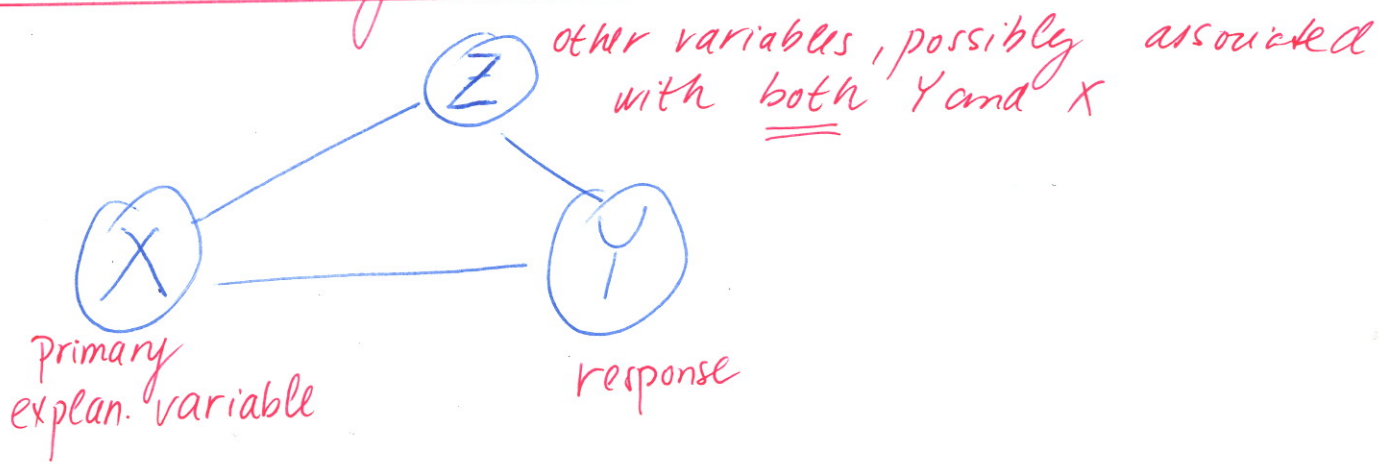


Confounding & mediation



marginal association X-Y

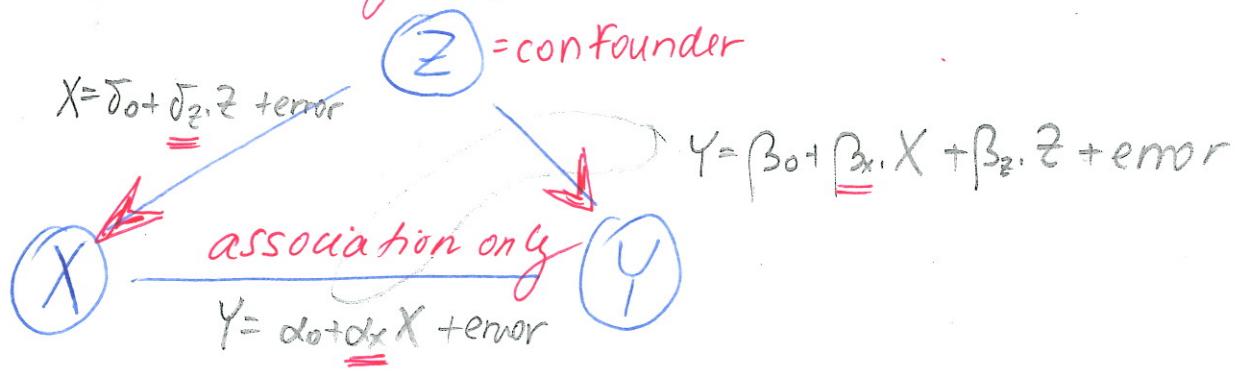
$$Y = \alpha_0 + \alpha_x X + \text{error}$$

partial association X-Y (given Z)

$$M: \quad Y = \beta_0 + \beta_x X + \beta_z Z + \text{error}$$

AIM: Interpret model M while also including some statements concerning causality.

Confounding

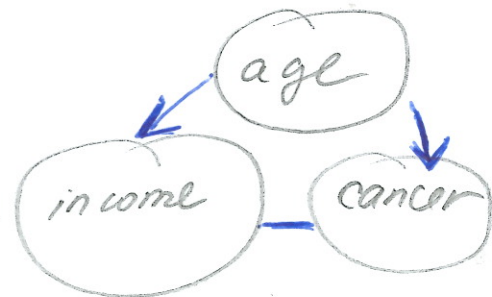
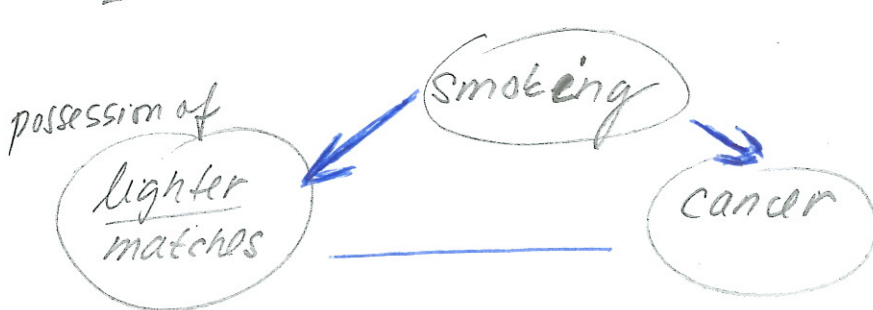


α_x : marginal association X-Y (not causal!)

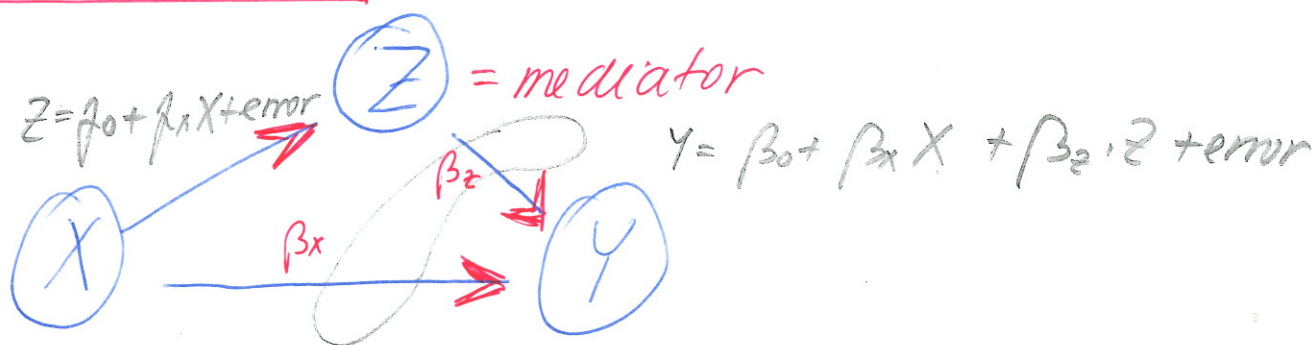
δ_z : causal effect of Z on X

β_x : only (partial) association X-Y (not causal!)
 created by associations $X \leftarrow Z, Z \rightarrow Y$

Examples



Mediation



β_x : direct (causal) effect of X on Y

$\beta_z \cdot \beta_x$: indirect (causal) effect of X on Y through Z

decomposition of α_x (from model $Y = \alpha_0 + \alpha_x X + \text{error}$)

α_x : total (causal) effect of X on Y

mediation: $|\beta_x| < |\alpha_x|$

may happen: $\beta_x = 0$ (or just not significant)

\equiv complete mediation

(the whole causal effect of X on Y goes through Z)

DANGER for conclusions

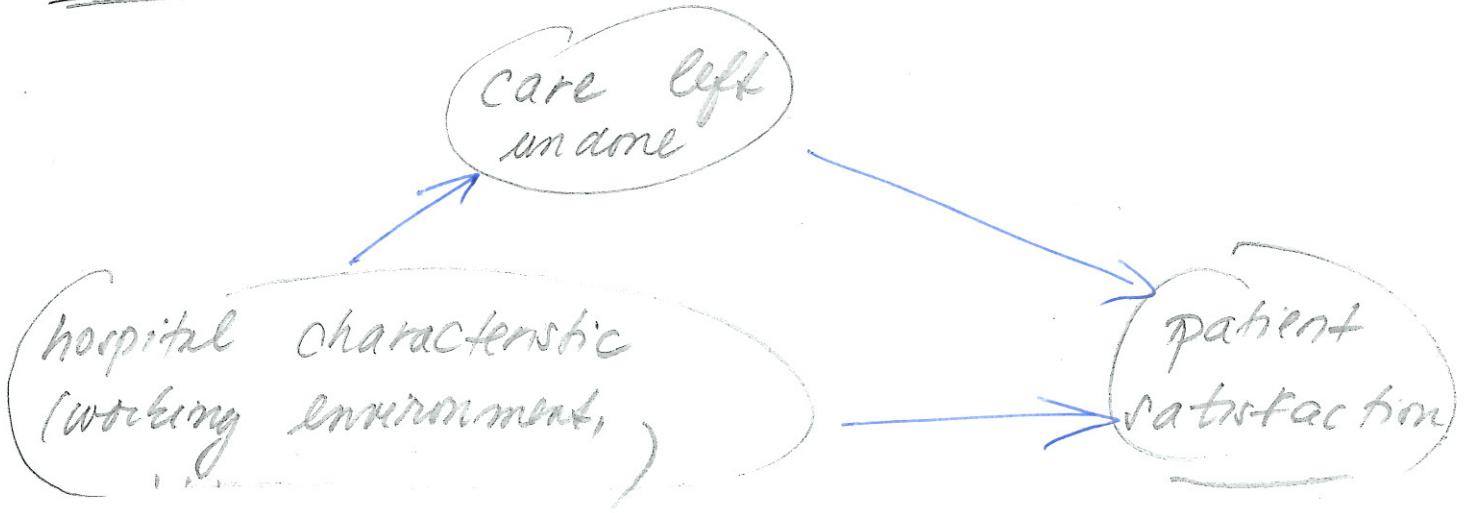
model $Y = \beta_0 + \beta_x X + \beta_z Z + \text{error}$

$\beta_x = 0$ (not significant) and we conclude

that X has NO EFFECT (causal) on Y

but it does have!

Example



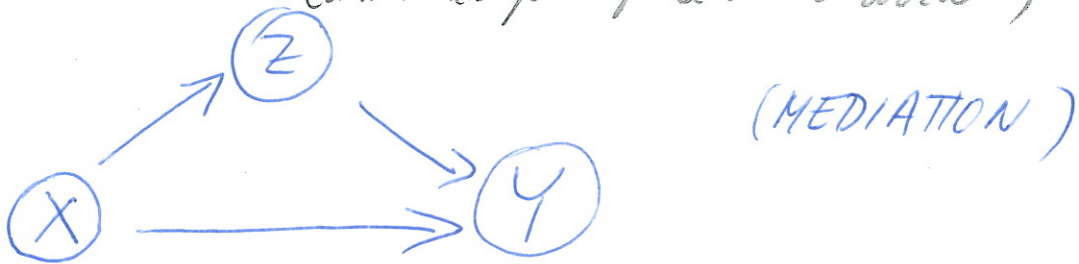
Some more example

people in "VIP"
≡ "natural" epidemic evolution
Z

government
intervention
X

COVID
deaths
Y

Blatny & Co. believes in
(trust is perhaps a better word)



Isn't it this way?

