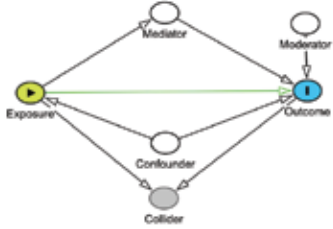


Directed Acyclic Graphs

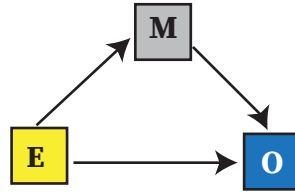
Visual representation of assumed relationships between variables

Define a clear causal question!



- > To promote understanding and communication
- > To focus research project
- > To recognize sources of bias (selection, loss-of follow-up, measurement error)
- > To inform statistical analysis

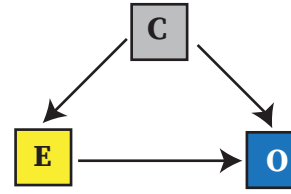
Mediator



E = exposure
O = outcome
M = mediator

Example: Opioids (=M) are given after surgery (=E) and may affect complications (=O)

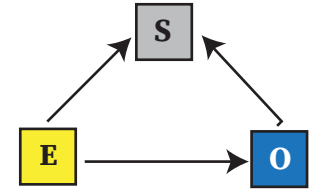
Confounder



E = exposure
O = outcome
C = confounder

Example: Age (=C) is associated with treatment of blood pressure medications (=E) and with hypertension (=O)

Collider



E = exposure
O = outcome
S = collider

Example: High training volume (=S) is affected by age (=E) and sports injury (=O)



Roles of
Variables



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2025-06-02



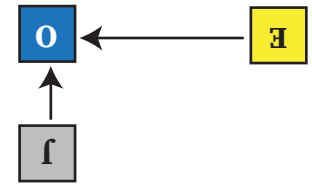
1 2 3 4 5 6

Example: Randomization to a treatment group (=I) effects the treatment (=E) but not the outcome. One-year follow-up (=Z) is a descendent of discharge from physical therapy (=O) after knee replacement (=E)

E = exposure
O = outcome
I = instrumental variable
Z = descendent



Descendent



Moderator

Example: Years of experience (=E) is associated with salary level (=O). This association is moderated by sex (=J).