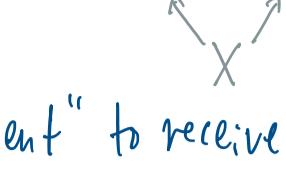


IVs in observational studies

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- IVs can be used in observational (non-randomized) studies

Z ... instrument, Y ... outcome
 A ... treatment, X ... covariates



- Z can be thought of as "encouragement" to receive treatment

\hookrightarrow if Z is binary: just encouragement (yes or no).

\hookrightarrow if Z is continuous: then it's a "dose" of encouragement.

Identifying an IV:

- IVs can be thought of as randomizers in natural experiments

\Rightarrow challenge: to think of variable that affects treatment but does not affect the outcome

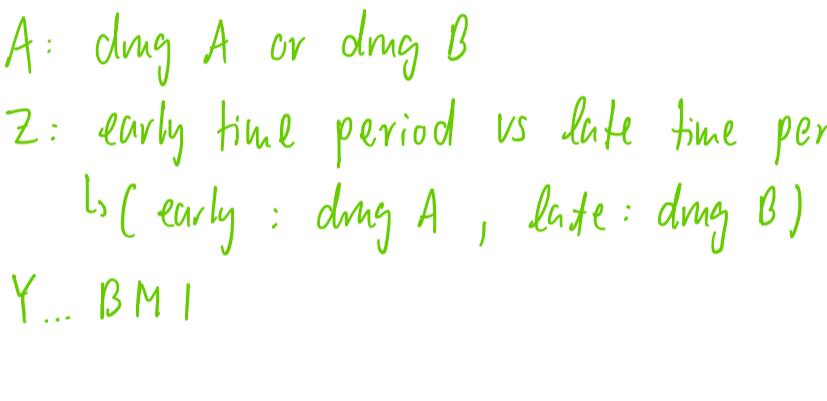
- using the observed data, we can only check the assumption⁽¹⁾

whether or not the variable (instrument) affects the outcome.

- validity of the exclusion criterion assumption⁽²⁾ will largely rely on subject matter knowledge.

Time for examples of IVs:

Example 1: Calendar time as an IV.



- sometimes treatment preferences change over a period of time

Question: Is Z a valid IV?

b(1) it is associated w/ treatment received (drug A if Z early, drug B if Z late).

b(2) exclusion criterion? Calendar time

Z could be associated w/ outcome if other treatment practices or patient behaviours changed during that time. (e.g. state of the art healthcare practices have changed)

Example 2: Distance as IV.

- distance to a specialty care center can be used as an IV for the effect of specialty care on health outcomes as compared to non-specialty care centers (e.g. regular hospitals)

- shorter distance (to specialty care center) can be considered as encouragement to visit such care centers instead of non-specialty ones

- question to consider: is distance likely associated with outcome in other ways (e.g. specialty centers only in metropolitan areas w/ high air pollution)

Y ... mortality, A ... baby delivery at NICU vs regular hospital

Z ... differential travel time from nearest high level neonatal ICU (NICU) to nearest regular hospital \rightarrow travel time difference b/w. getting to NICU and getting to standard hospital.

Other examples of instruments (IVs) for observational data:

(1) Mendelian randomization:

e.g. a genetic variant is associated w/ some behavior (e.g. alcohol use) but is assumed to not be associated w/ outcome of interest.

(2) provider preference:

use treatment prescribed to previous patients as an IV for current patient.

Iden: previous decision should be associated w/ current decision, but previous decision should not directly affect outcome.

(3) quarter of birth:

quarter of birth is associated w/ how many years of schooling you get; years in school related to income, economic status, etc.

Compliers:

- even in observational settings we can still think about compliance:

\hookrightarrow Defiers: Never take treatment even if encouraged.

\hookrightarrow Compliers: Take treatment only when encouraged.

- the instrument variable is encouragement.