Propensity Scores

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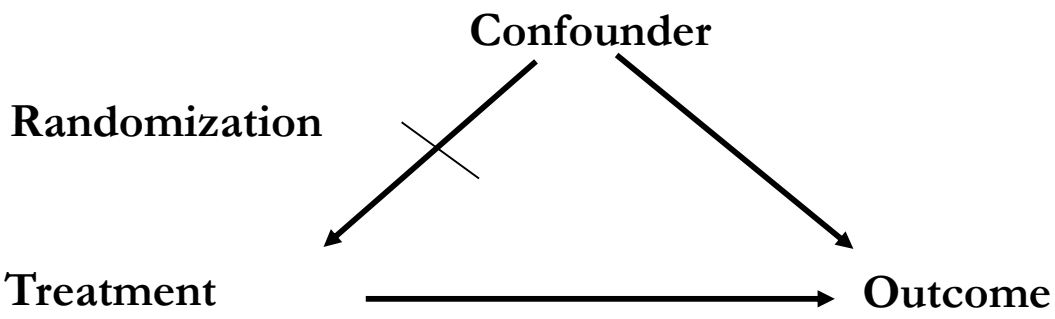
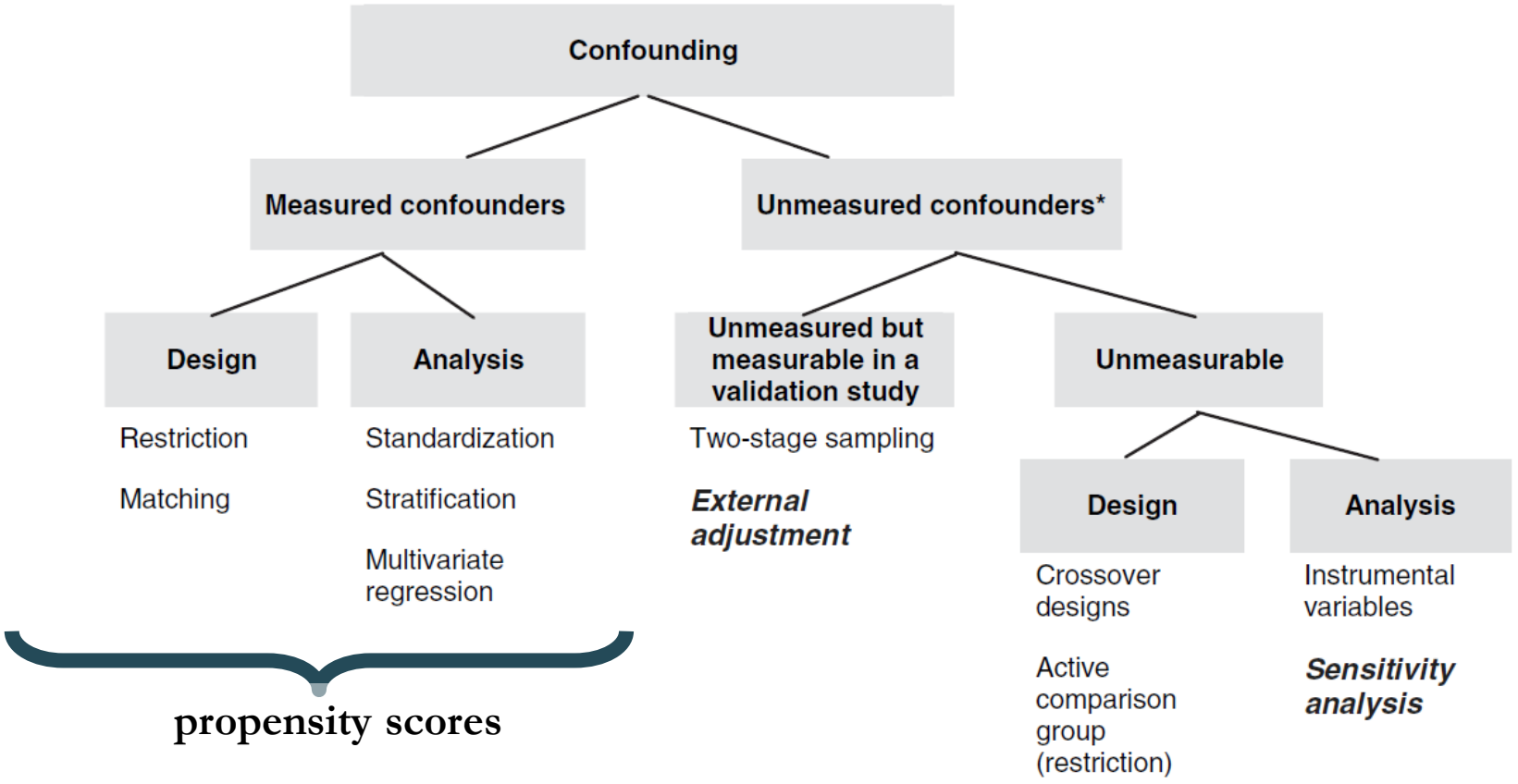
Imbalances between groups in observational studies

Indication
Subtype of indication
Severity of illness
Concomitant illness(es)
Concomitant medications
Contraindications



Ways to control confounders



* These strategies generally also adjust for measured confounders but come with additional assumptions or restrictions to generalizability

Adapted from Schneeweiss S: Confounding. In: Hartzema A, Chan A, Porta M, Tilson H: Pharmacoepidemiology, 4th edition in press.

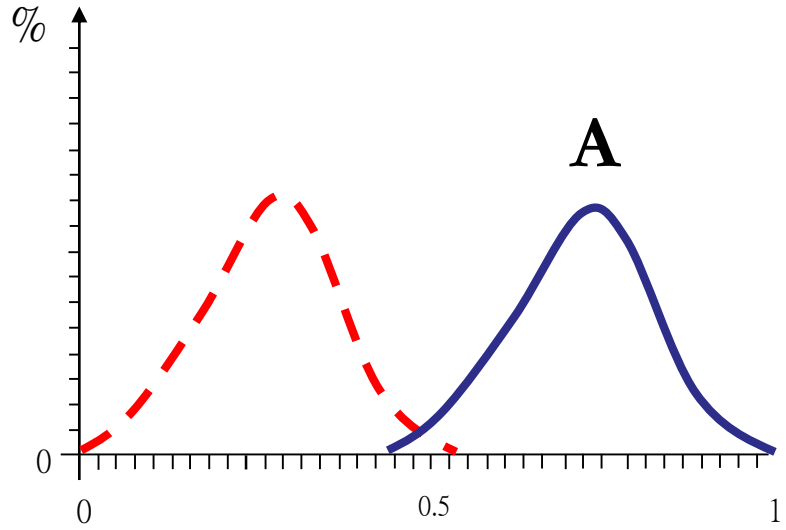
Figure 1. Strategies to control for unmeasured confounders in pharmacoepidemiology

Propensity scores in a sentence

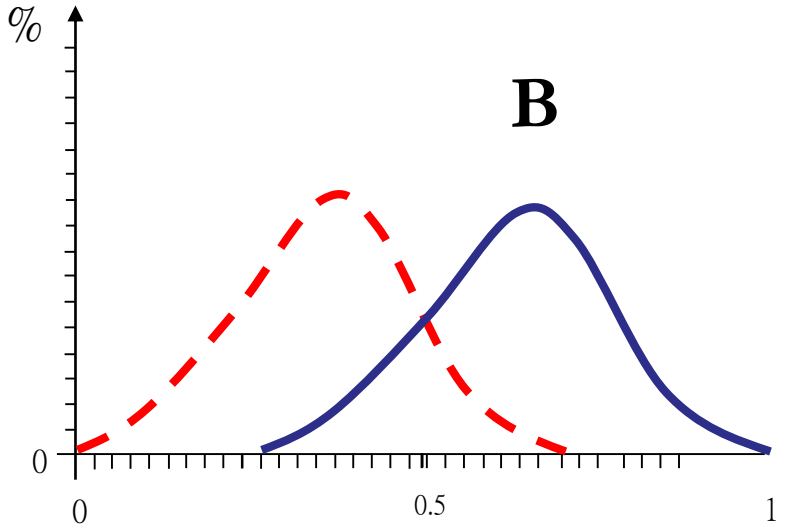
- A patient's propensity to be treated (propensity score) is his predicted probability of treatment, given his characteristics (everything that is known about him).

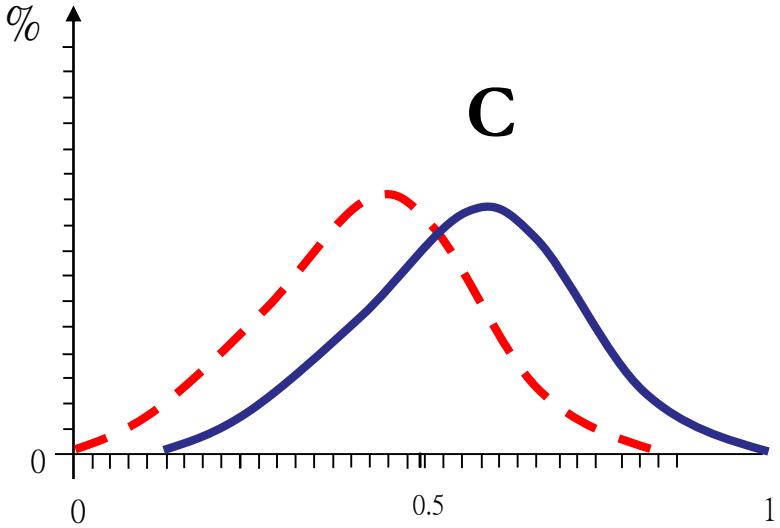
- A few observations:
  - A propensity score is a number (a probability).
  - A propensity score can range from 0 to 1.
  - A propensity score is predicted from what is measured.

Propensity scores distribution

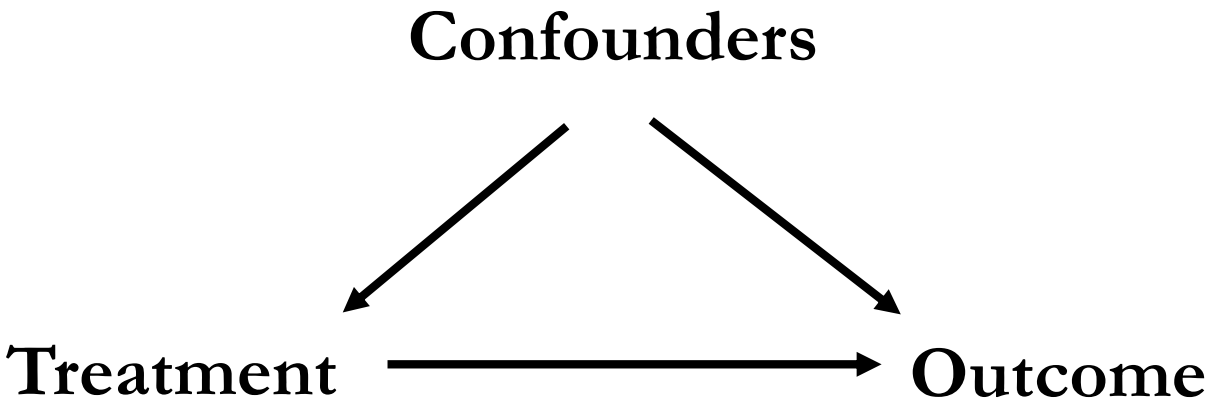


- A Extensive selection
- B Moderate selection
- C Little preference





Propensity score matching

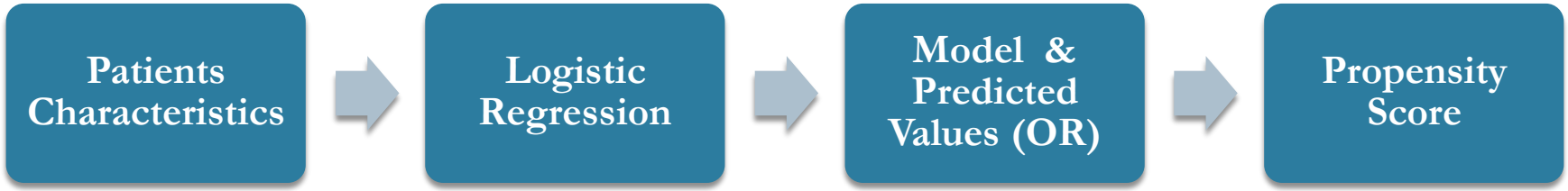


- Patients with equivalent probabilities of treatment will have no confounder

Steps for propensity score analysis

- Goal: Balance patients between treatment groups
- Two steps:
  - Step 1: Estimate propensity scores:
    - Collect potential confounders
    - Calculate the probability for treatment in all patients (propensity score) by logistic regression
  - Step 2: Apply propensity scores :
    - Matching
    - Stratification
    - Restriction
    - Model adjustment
    - Weighting

Example



- Age
- Sex
- Schizophrenia
- Depression
- Antidiabete
- CCB
- …

Treatment (y) = Age + Sex + Schizophrenia + Depression + antidiabete +

CCB ...

Age: 1.04
Sex: 0.91
Schizophrenia : 1.03
Depression : 2.40
antidiabete : 2.68

CCB: 1.22

…

Patient 1: 0.92
Patient 2: 0.17
Patient 3: 0.22
…

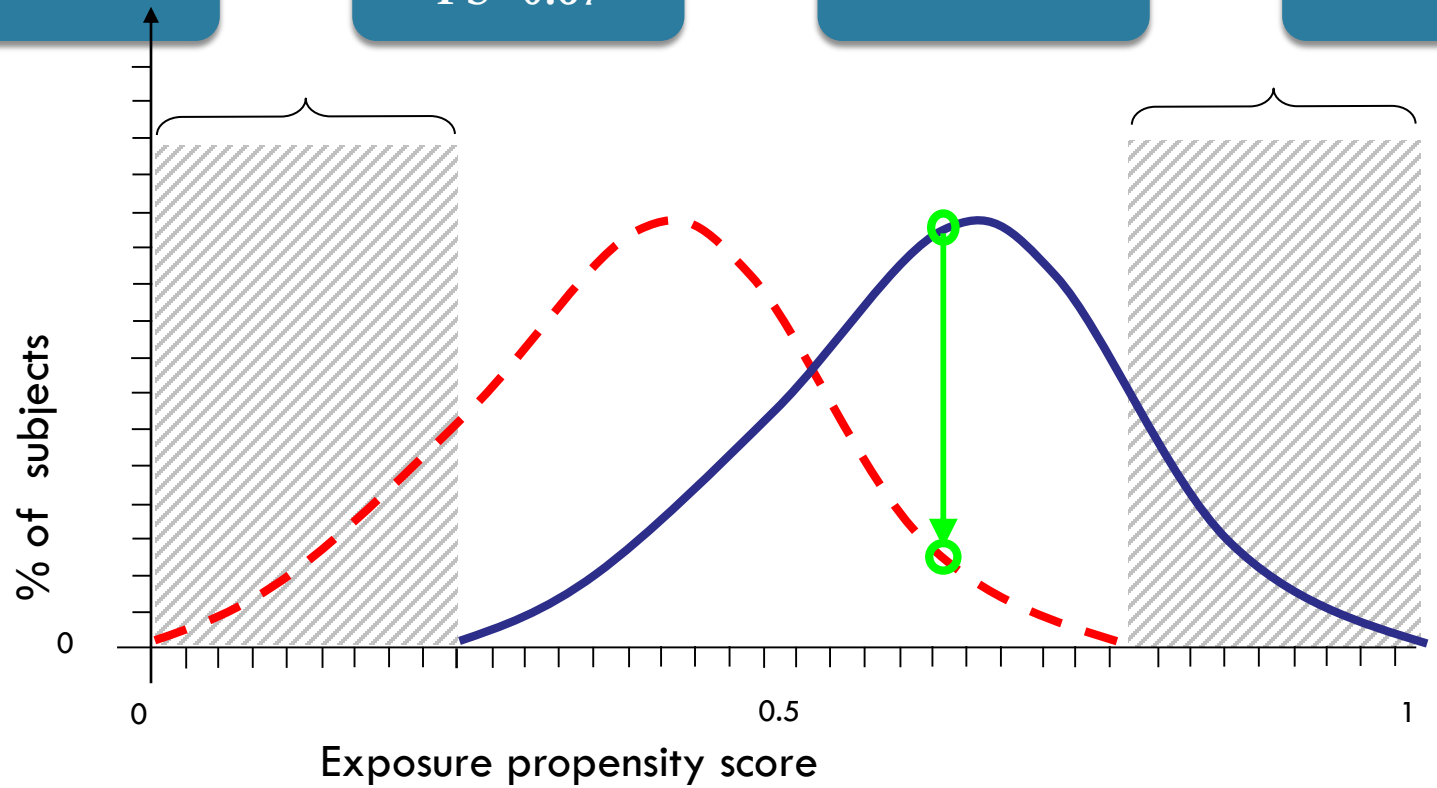
Propensity score matching

Treated patient has PS of 0.67

Identify referent patient with PS≈0.67

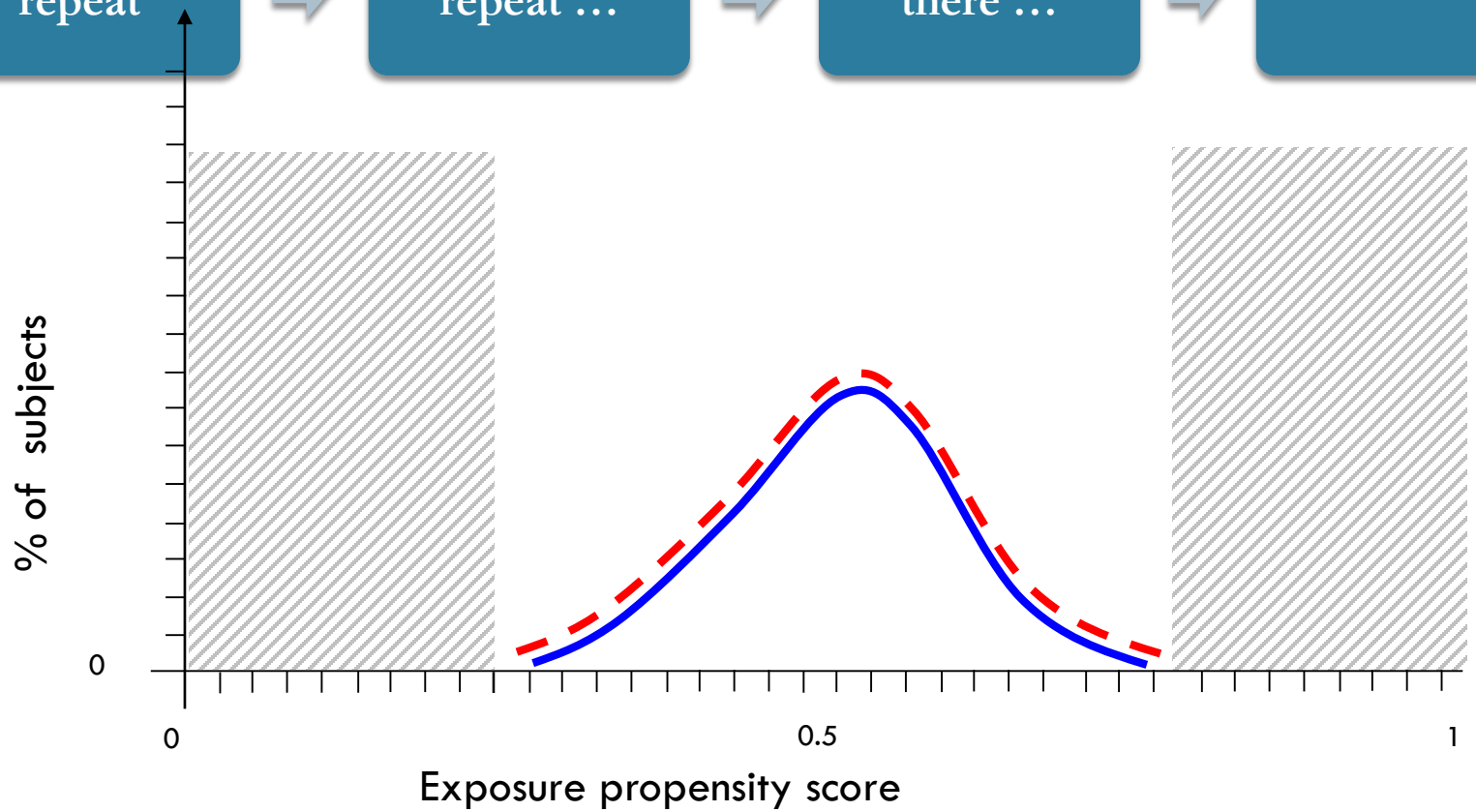
Make match

Repeat …



Propensity score matching

… and repeat → … and repeat … → … almost there … → Finished.



Trade off

- After propensity score matching, your study will
  - Lost some patients
    - Decrease the precision of estimate
    - Decrease the generalizability
  - Balance patients' characteristics
    - Increase the validity of estimate

RCT versus PS matching

- Table look like it came from an RCT, but:
  - Balance is by construction, not by design.
  - Balance is only among the measured covariates.
  - No balance among unmeasured covariates is implied.

- But…
  - Can be treated analytically like an RCT.
  - Has a notion of "equipoise" (equivalence at baseline) like an RCT.

Thank you!

- Question?
- Let's start the SAS demonstration now!