An Introduction to Comparative Effectiveness Research (CER) Methods
(A Synopsis)

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Introduction to CER Methods

- Randomized controlled trials (RCTs) and observational studies based on secondary data sources form the basis for CER
  - Each of these methods face unique advantages and disadvantages
- The two methods complement each other: with RCTs establishing efficacy and observational studies establishing effectiveness
  - Observational studies do not give a consistently greater effect than RCTs (Benson and Hartz, 2000; Concato et al., 2000)

Strengths and Weaknesses of RCTs

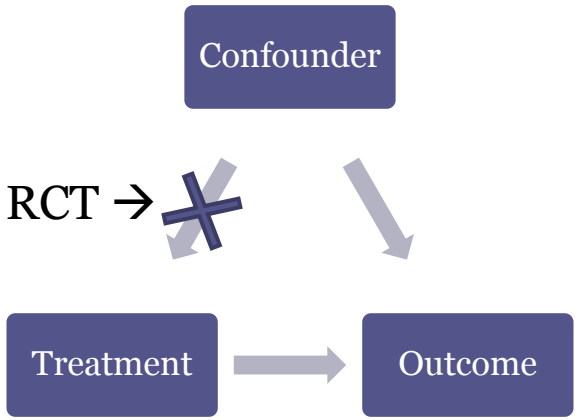
- A RCT is the gold standard to assess treatment efficacy:
  - Patients are randomly assigned to treatment and control. Treatment and control patients therefore do not differ systematically and differences in effects can be attributed to the treatment
  - In a RCT all conditions are controlled to maximize the treatment effect
- Unfortunately, RCTs cannot be used for a wide range of clinical questions, because:
  - RCTs are not always possible due to ethical concerns
  - RCTs are very costly
  - RCTs do not reflect real world behavior as patients are cared for under highly structured care of the provider

Strengths and Weaknesses of Observational CER Studies

- Observational studies are not randomized but provide a low-cost alternative to assess treatment effectiveness of real world behavior:
  - Observational studies use primary data sources and large secondary databases including patient registries, electronic medical records, and administrative claims files
  - Observational studies reflect real world behavior reflecting a wide spectrum of patient and physician heterogeneity and can be used to assess effectiveness for patient subgroups
- However, all observational studies are threatened by confounding

Confounding

- A confounding factor is a condition or a variable that is both a risk factor for disease outcome and associated with the treatment choice:



- RCTs eliminate confounding because they randomly assign patients to treatment and control groups

Confounding is a problem to observational studies

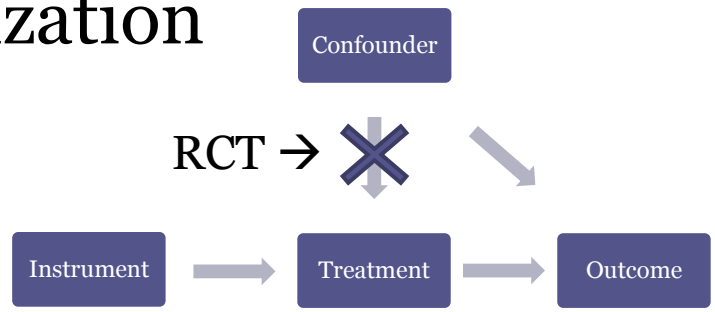
- Confounding by indication is very common in observational studies
  - For example, physicians prescribe one treatment over another depending on the severity and the perceived effectiveness of the treatment by severity level
- Confounding, if left unaddressed, biases the association between treatment and health effects
  - Propensity Scores and Instrumental Variable techniques are frequently used methods to address confounding

Propensity Scores (PS)

- Propensity Scores:
  - A PS is the conditional probability of receiving treatment given a vector of covariates including the values of all treatment confounders
- Procedure
  - Patients in the treatment group are matched to control group patients on the basis of their PS
  - Differences in outcomes are estimated between balanced patient groups
  - Knowledge over all possible confounders including observed and unobserved is necessary to evaluate the extent of confounding

Instrumental Variable (IV)

- Instrumental Variable:
  - A carefully chosen instrument is a variable that is strongly correlated with the treatment but is uncorrelated with any other determinants of the health outcome of interest
- IV Methods use an instrument to identify the random element of the treatment group and evaluate its effect on outcomes, mimicking randomization



- Propensity Score and Instrumental Variable techniques can easily be incorporated into the research design using SAS or STATA

- CECU may provide consultations for the design of comparative effectiveness research studies using observational data