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

Avi Dor, Professor of Health Policy and Health Economics, George Washington University
Ellen Umapathi, Research Associate, George Washington University, Department of Health Policy

Comparative Effectiveness Consultative Unit (CECU)
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