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An Introduction to Causal Analysis on Observational Data using Propensity Scores

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In health care studies, randomized trials are the gold standard to assess whether an intervention has a direct causal impact on an outcome. In a clinical trial, the participants are randomized into at least two groups, a control group and at least one treatment group. These groups are balanced through the randomization process by covariates such as sex, age, health status, and comorbidities. Balanced groups result in the treatment assignment being independent of the outcome so that causal effects can be estimated.

These clinical trials are expensive and time-consuming. Furthermore, they can be unethical by providing inferior treatment to those when a more effective treatment is available. Even results from clinical trials have shortcomings as they only provide an upper bound on the efficacy of the intervention and do not assess the effectiveness of the treatment in the general population. In real-life, there are issues with drug adherence and broader use as to whom receives the treatment. In observational studies, the researcher does not control the assignment of participant to group. For example, employers are providing employee discounts on health care premiums for their participation in biometrics screening programs. These programs are voluntary. If the impact of the program is to be assessed, a way to balance the groups, those who participate and those who do not, would be needed.

In this presentation, the use of the propensity score can minimize biases stemming from non-random treatment assignment, and lead to appropriate conclusions on the effect of the intervention.