Introduction to Causal Inference using Causal Diagrams and Potential Outcomes

Workshop | SPSP 2023 Annual Convention

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Introduction to the workshop

Do you agree with this statement?

". . . it would take about 0.4 kg of chocolate per capita per year to increase the number of Nobel laureates in a given country by 1."
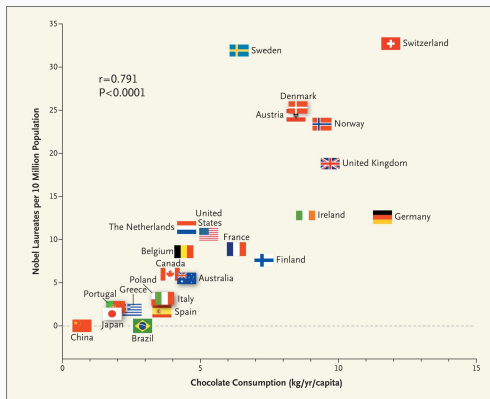

Figure 1. Correlation between Countries' Annual Per Capita Chocolate Consumption and the Number of Nobel Laureates per 10 Million Population. From: `https://www.nejm.org/doi/full/10.1056/nejmon1211064`.

Are associations adequate?

- Routine data analyses focus on associations and predictions.

- Substantive questions are often causal in nature.

- Associations can be awkward to communicate (convincingly).

- Randomized experiments: "gold standard" for causality.

- But what if unfeasible to randomize a treatment?

- How to fortify causal inferences from observational studies in practice?

Plan for this workshop

Outline

1. Potential outcomes (1 - 1:45 pm)
   - Estimands vs. estimators
   - SUTVA
   - No unmeasured confounding assumption
2. Causal diagrams (2 - 3:15 pm)
   - How to draw them
   - How to use them
3. Estimation methods (3:30 - 4:30 pm)
   - Outcome regression adjustment
   - Propensity score methods

Materials at: `https://github.com/wwloh/spsp2023-causal`

Scope

What will (not) be covered

- We will focus on:
  - Treatment at a single time point (i.e., "point" treatment)
  - Fully observed outcome
  - All variables precisely measured (without error)
  - Independent observations
- We will not be covering:
  - Mediation analysis
  - Quasi-experimental designs (instrumental variables, regression discontinuity, difference-in-differences)
  - Measurement error or latent variable analysis
  - Multilevel (clustered or longitudinal) settings
  - Philosophical or metaphysical considerations
- Clarifying questions are encouraged!