Spillover

1. Spillover (effects of one person’s treatment on the outcome of another person regardless of whether the second person was treated) and Experimental Design
   1. Examples:
      1. Person A in ad campaign treatment discusses the ad with person B in the control group. The interaction causes B to make a purchase he/she would not have made otherwise.
      2. Job-Performance Monitoring (Nagin et al., 2002): are employees padding their results to qualify for bonuses?
         1. Measuring effect of increased monitoring on quality of job performance. Telemarketing firm solicits donations for charity; employees earn bonus for each successful pledge; and some reported pledges never materialize.
         2. Approach: spot-check a fraction of each employee’s reported donors through callbacks. “Bad Calls” are removed from the employee’s bonus. Some may be employee’s bad luck, but some may be deliberate cheating. Minimize expensive spot-checks.
         3. Experiment: how does the audit probability affect employee job performance?
            1. Originally 10%.
            2. Treatment: Told employees it will vary between 0%, 2%, 5%, and 10%. Actually 25% audited. 2% is minimum to affect performance. Not statistically different between 2%, 5%, and 10%.
            3. Control: 0% audited. Fraction of bad calls increased by 3%.
         4. Employees may compare notes and underestimate the effect of the experiment.
            1. Without spillover effect, treatment should show what would happen if company switched policy from 0% to 5% on every employee.
            2. With spillover effect, 5% treatment should create spillover effect while the 0% group should expect more auditing and make fewer bad calls.
            3. How to avoid spillovers: randomize at work-site level (e.g., different cities) instead of at individual level (represents clustered design and has less precision in estimated treatment effect). Cross-site variation in treatment provides basis for results. Within-site variation obtained by reshuffling treatments after 6 weeks (addresses concerns about everyone in a given treatment group having correlated behavior f or reasons other than the treatment).
   2. Identifying Causal Effects in the Presence of Spillovers
   3. Time and space
      1. Spatial Spillovers: draw diagram to show spatial spillover. Arbitrary assumptions about geographic extent of spillover can radically change estimates, and spillover may not be constant.
         1. Contrast with usual virtue of experiments: make measurements with minimal assumptions.
         2. Assumption problems not unique to geography (e.g., social networks).
      2. Spilling Across Time:
         1. Examples on the Effects of Advertising: Used a differences-in-differences (DID) design and may have caused overestimation. Results show evidence of long-term effects of advertising.
         2. Affect future self
   4. Within-Subjects Design and Time-Series Experiments
      1. Pros
         1. Variance in y always reduces precision of estimated treatment effects. Using a person as a control for themselves reduces variance and is the ultimate paired-subject design.
         2. Statistical inference difficult without multiple repetitions of treatment and control.
      2. Cons
         1. Benefits of randomization lost (e.g., independence from other factors might cause outcomes., impossible to predict in advance what other events might influence outcome).
         2. Ampule permutation space for statistical inference (best attainable p-value is 0.5).
      3. Including many time periods can solve this problem. Room for randomization, enough data for valid standard-error estimates.
2. Waitlist Designs/stepped-wedge design: every subject is treated eventually, but random assignment determines when they receive treatment.
   1. Benefits
      1. Allows experimentation
      2. Allays concerns about withholding treatment
      3. Can delay widespread treatment long enough to see effects in early treatment groups before administering to all groups
      4. Long-run and simultaneous treatment effects