Propensity Matching, Ancova, and Gain Scores When Some Covariates Affect Group Allocation

a shorter title would be good . . . this is what I gave them: Ideas?

I submitted a proposal for a paper a few months ago to a (pretty good) journal to write a paper and Monday got a note asking me to submit the paper. Great. But. The due date is August 15, which is a pretty quick turn around particular as my methods book is "due" about now. The editor (who 20 years ago made this video: `https://www.youtube.com/watch?v=vJG698U2Mvo`, which has made a big impact) suggests between 3–5k words. It is supposed to be accessible to people who may have had only one or two graduate statistics courses and these may have been long ago.

Here is a draft outline for your comments.

1. Describe situation. Following Rubin (1977), use the example of a math intervention study. Explain why random allocation is problematic.
2. Review methods used and show that they can produce different results: Lord's Paradox (1967; 1969).
   (a) Mimicking experiment with Propensity Matching (Rosenbaum, 2002).
   (b) Ancova (Kahneman, 1965; Meehl, 1970). The controlling for black box and magic (i.e., people assuming Ancova magically controls the covariates Braun, 2013).
   (c) Gain score. Vertical scaling.
3. Advice on which to use and why.
   (a) Regression towards the mean (Galton, 1886). Baseball examples from Efron & Morris (1977) and Wright (in press).
   (b) Rubin's causal model (Holland & Rubin, 1983) and graphical causal models (i.e., directed acyclic graphs, or DAGs, Pearl, 2016). Discussion of colliders and infant weight/smoking paradox.
   (c) Simulation methods (Wright, 2006, under review). Table showing for single predictor that Ancova and PM are biased if the covariate is associated, but does not influence, group allocation. Gain scores are biased if covariate does influence group allocation. Discuss some of the general advantages of simulation and its use as a teaching devise (Simon & Holmes, 1969, and his and other resampling methods).
4. Simulation study with models where covariates are all associated with group allocation, but some are causally related, some are not. This is the main "empirical" part of the paper, but will likely just be just one table with the code all archived or placed in supplementary materials. Each covariate and group allocation can be related in one of three ways: covariate $\rightarrow$ group, covariate $\leftarrow$ group, and covariate $\leftrightarrow$ group.

Rubin's (1977) will be introduced with each of these (the one where group influences covariate is where the covariate is measured after the intervention starts, like using a test early in the academic year as a covariate).

5. In practice, what to do. How to decide which are causally related. What happens when the cases in the sample have the causality work differently? Other issues.
6. Snappy conclusion.
7. Supplementary materials. Reproducible document and code for §4.

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