Panacea or Poison: Can Propensity Score Modeling Replicate the Results from Randomized Control Trials? – PART II

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Current Study

- RCTs are the "gold standard" in methodological strength.
- PSM was designed to simulate the effects of an RCT.
- *Can PSM methods replicate the findings of RCTs?*
- This investigation uses multiple RCT experiments to assess the cumulative evidence of the reliability and validity of PSM in criminal justice research.

Eligibility Criteria

- We collected eligible studies from the *National Archive of Criminal Justice Data (NACJD)* using the search keywords:
  - "Randomized" and "Randomized control" – 1,319 studies
  - "Randomized controlled trial" – 429 studies
  - "RCT" – 76 studies
- Two baseline selection criteria:
  - All cases must be randomly assigned to condition.
  - Dataset must have at least 175 cases per condition.
- This process identified 46 potentially eligible studies.

Summary of Studies

1. Intensive Supervision Probation (ICPSR 6358)
   - Petersilia & Turner (1987-1990)
2. Response to Elder Abuse (ICPSR 3130)
   - Davis et al. (1996-1997)
3. Reducing Fear of Crime (ICPSR 8496)
   - Pate & Annan (1983-1984)
4. Youth Dating Violence Prevention Program (ICPSR 32901)
   - Taylor et al. (2009-2010)
5. Children at Risk Program (ICPSR 2686)
   - Harrell (1993-1997)

Analytical Procedure

- Dr. Labrecque recoded these datasets and introduced bias.
  - Significant differences in covariates between groups ≥ 10%.
  - Average percent bias in covariates between groups ≥ 15%.
  - Biased sample represents between 30-50% of treatment group.
  - AUC ≥ .714.
- Dr. Campbell removed the bias with PSM techniques.
  - In this study, we discuss only the findings of PSM 1 to 1 with caliper.
- The PSM estimates are then compared to those from the original RCT on a number of dimensions (i.e., statistical significance, direction, magnitude).

Description of Sample

- Total # of studies included = 5
- Total # of ES estimates = 49

- Mean sample size = 630
  - Range = 351 to 1,469

- Mean # of covariates per study = 76
  - Range = 33 to 99

- Mean % of treatment group identified in biased sample = 43%

Effect Size Calculation and Interpretation

- Cohen's *d* was selected as the common metric with 95% confidence intervals (CIs) to estimate the magnitude of the effect size (ES).
  - An ES of 0 indicates PSM perfectly replicates RCT.
  - A positive ES indicates PSM overestimates RCT.
  - A negative ES indicates PSM underestimates RCT.
- If a study reported multiple outcome measures, the estimates were averaged for the study.
- Random effects model results are reported.

Model Fit Summary Statistics

	Original RCT	Biased Sample	PSM
Percent significant differences	9.8		
Mean standardized bias	7.8		
Maximum percent bias	29.2		
Percent bias over 20	5.3		
Percent bias over 10	28.9		
Area under the curve (AUC)	.657		

Model Fit Summary Statistics

	Original RCT	Biased Sample	PSM
Percent significant differences	9.8	36.4	
Mean standardized bias	7.8	20.0	
Maximum percent bias	29.2	66.7	
Percent bias over 20	5.3	40.6	
Percent bias over 10	28.9	71.2	
Area under the curve (AUC)	.657	.841	

Model Fit Summary Statistics

	Original RCT	Biased Sample	PSM
Percent significant differences	9.8	36.4	2.8
Mean standardized bias	7.8	20.0	10.2
Maximum percent bias	29.2	66.7	44.5
Percent bias over 20	5.3	40.6	11.6
Percent bias over 10	28.9	71.2	39.7
Area under the curve (AUC)	.657	.841	.508

Results

	%
Same statistical significance and direction	85.7
PSM ES is larger in magnitude than RCT ES	
PSM ES falls within 95% CI of RCT ES	
Correlation (*r*) of PSM and RCT ESs	

Note: * $p < .001$.

Results

	%
Same statistical significance and direction	85.7
PSM ES is larger in magnitude than RCT ES	71.4
PSM ES falls within 95% CI of RCT ES	
Correlation (*r*) of PSM and RCT ESs	

Note: * $p < .001$.

Results

	%
Same statistical significance and direction	85.7
PSM ES is larger in magnitude than RCT ES	71.4
PSM ES falls within 95% CI of RCT ES	81.6
Correlation (*r*) of PSM and RCT ESs	

Note: * $p < .001$.

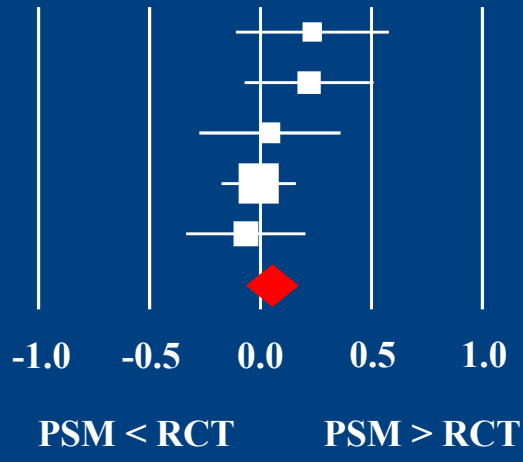
Results

	%
Same statistical significance and direction	85.7
PSM ES is larger in magnitude than RCT ES	71.4
PSM ES falls within 95% CI of RCT ES	81.6
Correlation (*r*) of PSM and RCT ESs	.947*

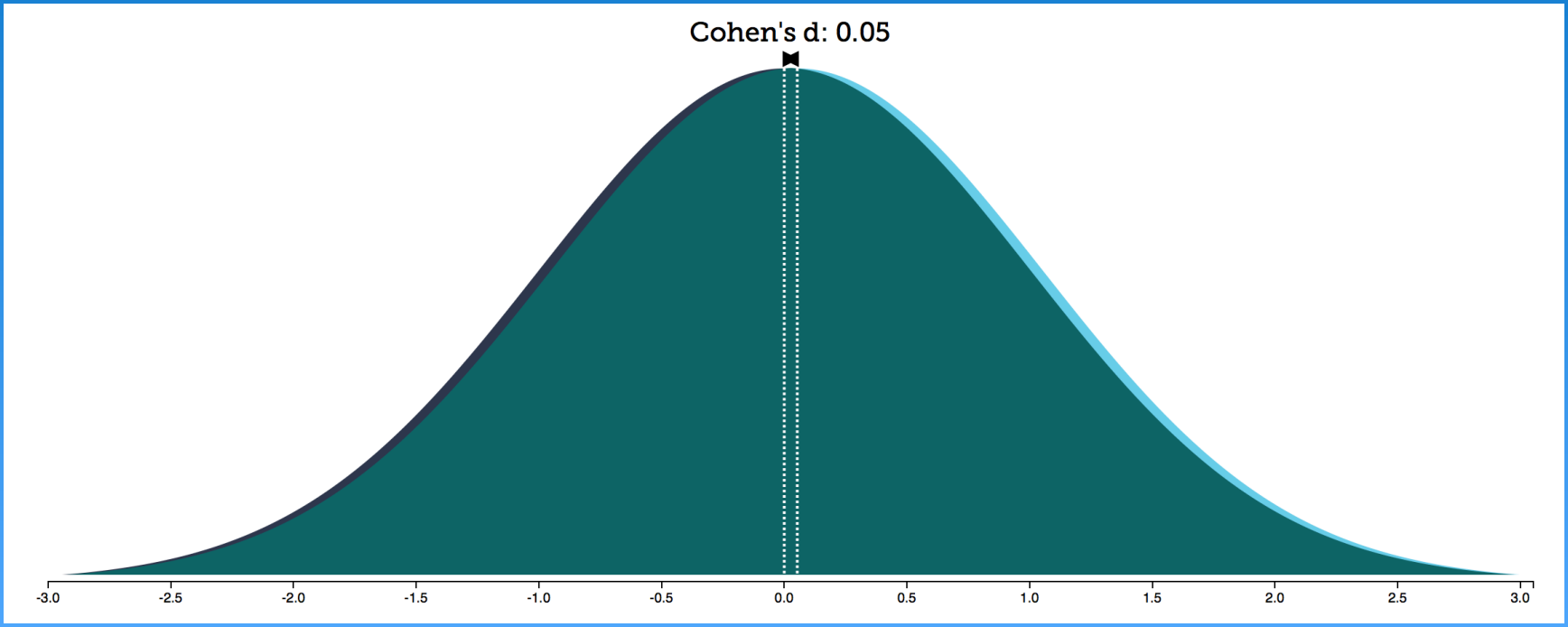
Note: * $p < .001$.

Meta-Analysis Random Effects Model

Study name	Statistics for each study			Cohen's *d* and 95% CI
	d	*s.e.*	*p*	
Intensive supervision	0.234	0.176	0.184	
Elder abuse	0.219	0.149	0.140	
Reducing fear	0.042	0.163	0.796	
Youth dating violence	-0.008	0.086	0.926	
Children at risk	-0.066	0.138	0.632	
	0.048	0.057	0.406	



Discussion



Assuming a 50% success rate for the control group:

- 52% of the PSM estimates will be above the mean of the RCT estimates.
- 98% of the two group estimates will overlap.

Conclusion

- These preliminary findings indicate that PSM—1 to 1 with caliper—is able to replicate the findings of RCT experiments.
- These results suggest that PSM is an effective method for estimating causal effects and support its continued use in criminal justice research.
- There is, however, a need for more research in this area.

Next Steps

- Recode and introduce bias in five additional RCT studies.
- Complete five PSM methods on those studies.
- Meta-analyze the final results.
- Submit final report to NIJ and main results to peer-review journal.

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