

Table of Contents

Khellah, Layaal - #5763 - A Systematic Comparison of Propensity Score Matching and Structural Causal Models for Clinical Applications	1
Abstract submission for Institutional Repository	1



Research Week 2024

A Systematic Comparison of Propensity Score Matching and Structural Causal Models for Clinical Applications

Layaal Khellah, Mobasshir Arshed Naved, Riddhiman Adib, Kavish Patidar, Mohammad Adibuzzaman

Portland State University Computer Science Undergraduate and BUILD EXITO Scholar at OHSU's OCTRI Lab

Keywords

propensity score matching, structural causal modeling, structural theory of causation, acute kidney injury

Abstract

Introduction:

Causal inference methods play a vital role in health sciences research, requiring robust methodologies for treatment evaluation and clinical decision-making. Propensity Score Matching (PSM) and Structural Causal Models (SCMs) are key approaches, both grounded in the potential outcome framework but differing in their foundations — PSM follows Rubin's Causal Model, while SCMs follows the Structural Theory of Causation. Despite their shared objectives, these methods diverge significantly in methodologies and interpretations. We systematically study the methods with a specific clinical application.

Methods:

Our study compares PSM and SCMs in clinical contexts, focusing on albumin as an acute kidney injury (AKI) treatment. We examine the steps involved in each method, highlighting their differences and complexities. Using data from AKI patients with cirrhosis, where albumin therapy is common, we assess treatment efficacy with both PSM and SCMs. Our analysis aims to offer insights into the comparative performance of these methodologies in estimating causal effects. We delve into treatment outcomes and confounding variables to clarify the strengths and limitations of each approach.

Results:

Both PSM and SCM yielded similar findings regarding the effect of treatment (albumin use vs crystalloids only) on AKI recovery and in-hospital survival, showing no significant association with improved outcomes. With PSM, albumin use did not significantly affect AKI recovery (OR 0.70, 95% CI: 0.59-1.07, $P = .130$) or in-hospital survival (OR 0.76 [95% CI: 0.46-1.25], $P = .280$) compared to crystalloids. With SCM, the average treatment effect on both primary (-0.07487) and secondary (-0.09710) outcomes was not statistically significant ($p > 0.005$), indicating no discernible causal effect of albumin use on either outcome.

Conclusion:

The findings from our study offer critical insights into the practical application of PSM and SCMs in clinical research. By demonstrating their effectiveness in a real-world scenario, we highlight the relevance and utility of these methodologies in informing treatment decisions and improving patient outcomes.