
Causal Health Equity - Toward a Taxonomy

Drago Plecko

Postdoctoral Scholar, Department of Computer Science,
Columbia University

February 01, 2024

1:30PM-2:50PM

MSOB X303

Abstract:

The widespread adoption of electronic health records (EHRs) has allowed healthcare providers and health researchers to measure and analyze health disparities across demographic groups, which are known to cause both higher healthcare costs and losses to welfare. A number of studies reveal significant differences in treatment and outcome according to sex, gender, race, or other sensitive attributes, raising issues of health equity. At the same time, current definitions of health equity (such as those offered by WHO or CDC) do not use a formal language of data science, making it difficult to enforce principles of equity in practice. Therefore, grounding the notions of health equity in a formal mathematical language is paramount.

In this talk, we discuss the foundations of health equity through the lens of causal inference, also paying attention to how questions of equity compound with the use of artificial intelligence (AI). In particular, we distinguish between three different tasks in health equity: (i) bias detection, (ii) fair prediction, and (iii) fair decision-making. In bias detection, we demonstrate how commonly used statistical measures of disparity cannot distinguish between causally different explanations of the disparity, and we discuss causal tools that can bridge this gap. In fair prediction, we discuss how an automated predictor may inherit bias from human-generated labels, and how this can be formally tested and subsequently mitigated. For the last task, we discuss how human or AI decision-makers design policies for treatment allocation, focusing on how much a specific individual would benefit from treatment, counterfactually speaking, when contrasted with an alternative, no-treatment scenario. We discuss how historically disadvantaged groups may differ in their distribution of covariates and, therefore, their benefit from treatment (e.g., from surgery or transplant) may differ, possibly leading to disparities in resource allocation. We discuss causal

tools for analyzing such settings, and discuss how principles of equity can be enforced. The discussion of each task is accompanied by real-world examples, in an attempt to build a catalog of different health equity settings.

Reading list:

- *Background on health equity: [Braveman, Paula. "Health disparities and health equity: concepts and measurement." *Annu. Rev. Public Health* 27 \(2006\): 167-194.](#)
- *Background on causal inference: Chapter 9 "Mediation: The search for a mechanism" from the Book of Why: [Pearl, Judea, and Dana Mackenzie. *The book of why: the new science of cause and effect*. Basic books, 2018.](#)
Additional (for those who want to see a more formal introduction): [Pearl, Judea. "Direct and indirect effects." *Probabilistic and causal inference: the works of Judea Pearl*. 2022. 373-392](#) and [Pearl, Judea. *Causality*. Cambridge university press, 2009](#) (Section 3, Section 4.5).

The talk will be closely related to Drago's recent papers.

- [Plecko, Drago, and Elias Bareinboim. "Causal fairness analysis." *Foundations and Trends in Machine Learning* \(2024\), forthcoming.](#)
- [Plecko, Drago, and Elias Bareinboim. "Causal Fairness for Outcome Control." *Advances in Neural Information Processing Systems \(NeurIPS 2023\)*.](#)