

# Modern Statistical Learning Methods for Observational Biomedical Data

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## Chapter 0: Overview of the course

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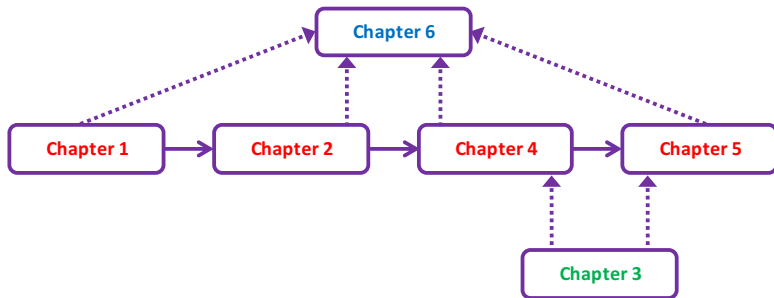
### MODULE 8

**Summer Institute in Statistics for Clinical and Epidemiological Research**  
July 2023

# Organization of this course

- 1 Introduction to causal inference
- 2 Basic identification and estimation of an average treatment effect
- 3 Super learning
- 4 Efficient, doubly-robust estimation of an average treatment effect
- 5 Identification and inference on the average treatment effect of a time-varying intervention
- 6 Additional topics

## Organization of this course



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## LEARNING OBJECTIVES:

At the end of this short course, we expect each student to have an understanding of:

- 1 the role of a causal model in making explicit the available background knowledge;
- 2 the definition of counterfactuals and their role in defining causal effects that address the scientific question of interest;
- 3 the key identification formulas for linking counterfactual and observed data parameters in the context of observational data;
- 4 the various traditional techniques for causal inference and their limitations;
- 5 the benefits of the Super Learner as an optimal, data-driven and pre-specified approach to flexible estimation;
- 6 the benefits of more advanced techniques for causal inference, including the augmented IPTW and TMLE estimators;
- 7 the difficulties associated to inference on the average treatment effect of a multi time-point intervention, and the extension of objectives 3 and 6 to this context.

We expect that familiarity with the above concepts will allow students to effectively communicate and collaborate with biostatisticians on causal analyses.

# Organization of this course

## **A few guidelines for the week. . .**

- Audience is heterogeneous — we will try to cater to everyone as best we can.
- Slides include more details than strictly needed to understand the material.
- Please feel absolutely free to ask clarification questions at any time, but reserve 'enrichment' questions for the online chat or for the end of the session.
- This course is always evolving, and there is still plenty of room for improvement. Feedback is very welcome.