

Report

This quarter, I participated in a Directed Reading Program under the guidance of my mentor, where we explored advanced statistical methods for analyzing platform trials, with a particular focus on variance reduction and unbiased inference. Our study centered around the use of the Entire Concurrently Eligible (ECE) population to ensure valid comparisons in dynamic clinical trial settings.

The first half of the quarter was devoted to reading and understanding key methodological papers such as “From Estimands to Robust Inference in Platform Trials,” which introduced the ECE population as a solution to population shift bias caused by the adaptive structure of platform trials. I learned about trial design structures, population definitions, and the statistical pitfalls of analyzing data without accounting for time-varying eligibility and treatment availability.

In the latter half of the quarter, we focused on advanced modeling techniques, specifically Gaussian Process (GP) regression, as a way to improve the precision of treatment effect estimation in platform trials. I studied the mathematical foundation of GP models, including posterior mean and variance formulas, and learned how GP can incorporate both concrete and non-concrete data, such as baseline covariates and control arm outcomes. We explored how GP generalizes classical covariate adjustment methods like regression adjustment, post-stratification, and inverse probability weighting.

At the end of the quarter, I worked on a presentation project that applied these concepts to a simulated platform trial structure. I compared traditional and ECE-based population definitions, evaluated variance across estimation methods, and demonstrated how Gaussian Process models could reduce variance while preserving unbiasedness. This hands-on integration of theory and application helped me understand the power of combining modern Bayesian techniques with principled trial design.

Overall, this DRP deepened my understanding of causal inference, adaptive trial design, and Bayesian non-parametrics. It also improved my communication skills as I learned to convey complex ideas in both mathematical and practical terms.