

Individuals and Organizations Completing Research in the IMEDS Lab  
**Zach Shahn, PhD candidate, Columbia University**

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**Research Objectives and Aims:** Develop methods for predicting health outcomes from high dimensional longitudinal health histories. Develop methods for performing causal inference on time series in the presence of unmeasured confounders using graphical models.

**Proposed Approach:** Empirically evaluate the performance of time series causal discovery algorithms using positive and negative controls for which ground truth is known. Under a wide class of possible true underlying data mechanisms, certain combinations of conditional Granger causality relationships among multiple time series can imply true causal relationships between certain pairs of time series even without assuming no unobserved confounders. (This approach is due to Michael Eichler, but its application to observational health data will be novel.)

These causal discovery algorithms are built on multiple conditional Granger causality tests, which rely on prediction from high dimensional longitudinal covariates. To develop better algorithms for prediction that incorporate high order temporal interactions between health events, I will build on prior work I have done on this data.

**Impact:** Methods for identifying causal relationships (side effects of drugs, for example) from longitudinal observational data. Methods for predicting health outcomes (strokes in the next year, for example) in individual patients.

**Timeline:** 24 months (from February 2014)