

Proposal for IMEDS Research Laboratory access

Research Objectives and Aims

Despite the universal call for evidence-based medicine, the largest information sources on treatment outcomes, namely electronic health records (EHRs) and administrative claims data, are all but unused in informing doctors and patients on expected risks and benefits of treatment. All too often, survival and physiological treatment outcomes are captured in underpowered studies with discordant or irreproducible results. Because of this, any impact on more abstract treatment outcomes such as the patient's well-being become even more subject to uncertainty. As a result, patients are frequently guiding their healthcare decisions by suspect sources discovered through internet search, and doctors are often just as much in the dark as their patients about the consequences of treatments on patient well-being. Put simply, there is limited information about if and how a patient's life will likely be positively or negatively impacted as a function of treatment, especially personalized with respect to subgroups of people with similar demographics and healthcare histories.

A number of methods gaps exist to the delivery of high quality evidence-based information on patient-centered outcomes of treatments on well-being. This is especially relevant for illnesses with high economic and personal impact owing to lengthy and repeated hospitalizations such as psychiatric diseases, which are a focus of our proposal. Missing is a mapping from select events in EHR and claims data to objective indicators of patient's well-being, scalable methods to rapidly analyze large scale observational data for treatment effects with confounders, and a framework for posing questions and presenting easy-to-understand reports that distill the evidence of tens of millions of records to give patients and doctors a concrete picture of well-being outcomes of patients.

By gaining access to the IMEDS Research Lab cloud computing platform and associated claims databases, we propose to address these objectives through the following specific aims:

1. Map medical events as reported in EHRs/claims data to specific patient-centered outcomes such as frequency and length of stay in the hospital, change of physicians, and management of chronic, somatic pathologies
2. Develop a scalable software framework to quickly and automatically cluster patients based on similarity of medical history, capable of processing records for 100M+ patients.
3. Develop scalable statistical methodology to estimate and predict treatment effects and map these to patient-centered outcomes on well-being.
4. Develop and evaluate a software framework to produce customized reports of a patient's possible changes in well-being based on observed changes in patients with similar medical history.

To this end we have assembled a competent team of researchers. PI Lambert is a member of the Observational Health Data Sciences and Informatics (OHDSI) Knowledge Base and Prediction working groups, and spent 14 years as founder and CEO of a bioinformatics company, developing scalable user-friendly software solutions for disease research. co-PI Mazurie is director of a bioinformatics core facility and has vast experience in software development for large scale data analytics. Consultant Ronald Krall, MD, was instrumental in his role as Chief Medical Officer of GlaxoSmithKline in supporting the formation of the Observational Medical Outcomes Partnership (OMOP), now reconstituted as (OHDSI) and will assist along with Matt Kuntz, Executive Director of NAMI Montana, and Berit Kerner, MD, UCLA psychiatric researcher with patient-centered requirements gathering and stakeholder engagement. Patrick Ryan worked as a principal investigator with OMOP, and will advise as a leader of the OHDSI effort. Consultants Young and Obenchain have participated in the OMOP effort and have published novel analytic methodologies for assessing treatment differences in messy observational data.

Scope/Proposed Research

We will manually extract from EHR and claim data terms that are relevant to psychiatric

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patient-centered outcome on well-being and listed in Aim 1. Patient clustering will be developed on top of a database of EHR/claims records for approximately 200 million people managed by the Reagan-Udall Foundation in the IMEDS system with which Ryan has extensive experience through OMOP and OHDSI efforts he has lead. Matching will be performed using a combination of propensity scoring and affinity analysis techniques. Local Treatment Differences and machine learning approaches will be employed to estimate treatment effects both at an individual patient level and population level. All approaches will be implemented to be scalable on the distributed Amazon Web Services platform on which the IMEDS system is currently hosted. Reports will distill information representing population averages, personalized estimates, and uncertainty bounds on patient outcomes. While the methods are general and not disease or treatment specific, computational and other limitations will force us to bound the domain of study to a manageable subset of healthcare treatments, namely psychiatry.

We will involve patient and physician focus groups through NAMI Montana in iteratively developing requirements for and assessing a prototype software system that uses the evidence of millions of EHR/claims records to inform doctors-patient conversations about well-being impact of treatment options.

Impact

Our project will allow psychiatric patients to access a composite view of the outcomes pertinent to their well-being associated with one or several treatment options—including the option of not undergoing treatment. We anticipate that this information will enhance joint decision making between patients and physicians by improving the patient's understanding of consequences of treatments based on patients with similar medical history.

Experience

We request access to the IMEDS Research Laboratory platform and datasets for the following individuals: Christophe Lambert, Ph.D., Research Professor, Department of Computer Science at University of New Mexico. Aurélien J. Mazurie, Ph.D., Director of Bioinformatics Core and Assistant Research Professor, Department of Microbiology and Montana State University (Bozeman, MT). Patrick Ryan, Ph.D., Head of Epidemiology Analytics, Janssen Research and Development.

Timeline

Anticipated start and end dates are May 2014 and December 2017, respectively, for a total of 44 months.