STATISTICS POWERS DECISION-MAKING

STATISTICAL SIGNIFICANCE

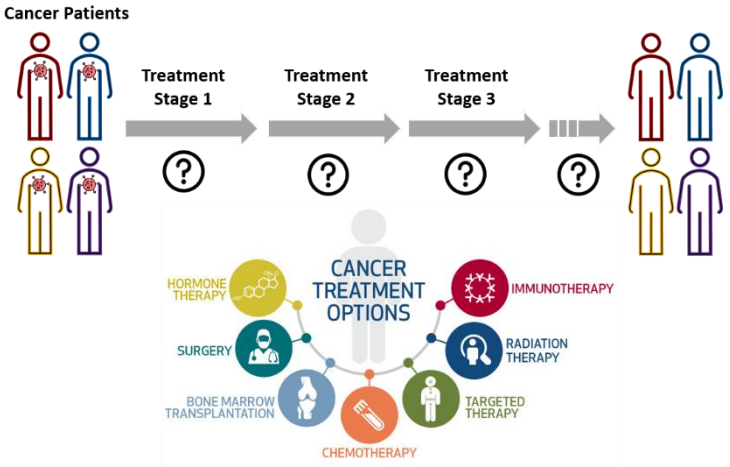
Chronic diseases or disorders such as cancer often require sequences of treatments to address patient's evolving health condition. Statisticians use data from health records and clinical trials to identify treatment strategies to aid patients and providers in treatment decisions to optimize desired outcome.

Multi-stage Treatment Decision

Treatment of chronic diseases or disorders such as depression, ADHD, autism, diabetes and cancer is often a multi-stage process where the treatment course is modified adaptively to address patient's evolving health condition. For example, treatment of acute myeloid leukemia often starts with an initial (frontline) treatment depending on patient's medical history and other characteristics at disease diagnosis. If complete remission is achieved through the frontline treatment, a post-remission or consolidation therapy is subsequently given to prevent recurrence; if resistances or relapse occurs, salvage treatments might be given. Usually, there are multiple treatment options available for frontline, consolidation, and salvage treatments. At each treatment decision point, health care providers choose treatments based on patient's characteristics, treatment history, and health condition including response status to previous treatments.

Optimizing Treatment Decision

Because of the ubiquitous heterogeneity across people and within diseases, patients often respond differently to a particular treatment. This well-established fact motivates the popularity of personalized medicine. Our study develops algorithms for choosing the best treatment at each stage with the goal of optimizing a desired outcome, e.g., expected lifespan in the case of leukemia.



How the Algorithm Works

Multi-stage treatment and outcome data along with patient characteristics and health history are accumulated from electronic medical records, clinical trials, or other longitudinal studies. Suppose the goal of the treatment is to extend the expected lifetime. At each decision point, given the characteristics of the participant and the previous treatment and response history, the algorithm uses statistical models to predict the treatment that would maximize expected lifetime for that patient, assuming the patient will make optimal choices in the future stages of treatment. Example of diseases for which such treatment optimization is applicable includes depression, addiction, obesity, ADHD, acute myelogenous leukemia, small-cell lung cancer, and other mental health.

Multi-stage optimal decision making ensures better individual patient health outcomes, increased adherence to treatment, reduction of the overall health care expenditure, and more efficient resources allocation.