

## Pattern Recognition, Learning, and Optimal Intervention: Models and Insights for Depression Care Management

**Shan Liu, PhD**

Department of Industrial and Systems Engineering  
University of Washington

**Abstract:** Chronic disease care often relies on one-size-fits-all monitoring and treatment guidelines. Without considering patients' heterogeneity in disease progression, these guidelines may lead to inadequate follow-up of high-risk individuals and unnecessary care of healthy individuals. Prognostic-based monitoring and adaptive treatment that stratifies patients' disease risk into different levels and adaptively allocates intervention resources to high-risk patients can improve efficiency and reduce cost. I briefly discuss our current research on designing optimal personalized monitoring and treatment strategies in depression care. Mitigating depression has become a national health priority as it affects 1 out of 10 American adults and is the most common mental illness seen in primary care. While electronic health record (EHR) provides an unprecedented information infrastructure, we need a systems perspective and associated algorithms, and a seamless integration with decision-analytic models to link the design of personalized disease interventions to cost-effective population health management. Our objective is to translate EHR data into solutions regarding who should be monitored and how often, and study how cost-effective these adaptive monitoring strategies could be. We are developing methods to 1) recognize and predict the heterogeneous depression trajectories of a treatment population from EHR, 2) characterize the hidden disease processes and design personalized interventions, and 3) evaluate the cost-effectiveness to monitor and treat depression across a range of care scenarios.

**Bio:** *Shan Liu* is an assistant professor of Industrial & Systems Engineering at the University of Washington. She received her Ph.D. in Management Science & Engineering from Stanford University, a S.M. in Technology and Policy from MIT, and a B.S. in Electrical Engineering from The University of Texas at Austin. Her research focuses on the evaluation of new medical technologies and healthcare interventions to improve patients' health and enable cost-effective care delivery. She develops methods in optimization, decision analysis, and systems modeling to solve both clinical decisions and population health policy problems. In particular, she is interested in building decision theory and applied mathematical models for optimal disease management when there is rapid technological development. Prof. Liu has collaborated with the Stanford Center for Primary Care and Outcomes Research, the Veteran Affairs Palo Alto Health Care System, Department of Radiation Oncology at the UW, and the Kaiser Permanente Washington Health Research Institute in Seattle. She is a member of INFORMS, the Society for Medical Decision Making (SMDM), IISE, and the Tau Beta Pi Engineering Honor Society.

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