

Optimizing Healthcare Interventions and Incentives: Models and Insights for depression and influenza

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Abstract: Improving healthcare interventions and incentives have received much attention due to excessive costs and poor quality of care. The goal is to identify optimal strategies to improve population health outcomes, while accounting for patients' heterogeneity in disease progression and population dynamics. I present two applications under U.S. healthcare settings.

First, I discuss our research on designing predictive and optimization models to adaptively monitor chronically depressed patients. Mitigating depression has become a national health priority as it affects 1 out of 10 adults in the U.S. Prognostic-based monitoring that stratifies patients' disease risk and adaptively allocates intervention resources to high-risk patients can improve overall health outcomes. Our objective is to translate electronic health record data into solutions regarding who should be monitored and how often, and study how cost-effective these adaptive monitoring strategies could be.

Second, I present our research on optimizing incentives to prevent outbreak of seasonal flu. We propose an integrated health insurance mechanism, including vaccination reward and treatment cost-sharing policies, and formulate the dynamic interaction between a single insurer and multiple insureds as a Stackelberg game. We then embed the game into an agent-based simulation to model the spread of flu in a large population. We present optimized incentive policies in a Seattle setting using machine learning and simulation optimization approaches. Simulation results indicate that the proposed methodology efficiently identifies optimal incentive policies under different scenarios of flu vaccine efficacy and flu attack rates.

Bio: Shan Liu is an associate 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. 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 the Institute for Operations Research and the Management Science (INFORMS), the Society for Medical Decision Making (SMDM), Institute of Industrial and Systems Engineers (IISE), and the Tau Beta Pi Engineering Honor Society.