



Turgay Ayer, PhD

Prioritizing Hepatitis C Treatment Decisions in U.S. Prisons

October 10, 2016

4:40PM

About one out of six inmates in the United States (U.S.) is infected with hepatitis C virus (HCV). HCV prevalence in prison systems is ten times higher than the general population, and hence prison systems offer a unique opportunity to control the HCV epidemic. New HCV treatment drugs are very effective, but providing treatment to all inmates is prohibitively expensive, which precludes universal HCV treatment in prison systems. As such, current practice recommends prioritizing treatment based on clinical and incarceration-related factors, including disease staging, remaining sentence length, and injection drug use (IDU) status. However, there is controversy about how these factors should be incorporated because of the complicated tradeoffs. In this study, we propose a restless bandit modeling framework to support hepatitis C treatment prioritization decisions in U.S. prisons. We first prove indexability for our problem and derive several structural properties of the well-known Whittle's index, based on which, we derive a closed-form expression of the Whittle's index for patients with advanced liver disease. From the interpretation of this closed-form expression, we anticipate that the performance of the Whittle's index would degrade as the treatment capacity increases; and to address this limitation, we propose a capacity-adjusted closed-form index policy. We parameterize and validate our model using real-world data from Georgia state prison system and published studies. We test the performance of our proposed policy using a detailed, clinically-realistic simulation model and show that our proposed policy can significantly improve the overall effectiveness of the hepatitis C treatment programs in prisons compared with the current practice and other benchmark policies, including the commonly used Whittle's index policy. Our results also shed light on several controversial health policy issues in hepatitis C treatment prioritization in the prison setting and have important policy implications including: 1) prioritization based on only liver health status, a commonly practiced policy, is suboptimal compared with many other policies we consider. Further, considering remaining sentence length of inmates and IDU status in addition to liver health status in prioritization decisions can lead to a significant performance improvement; 2) the decision of whether to prioritize patients with shorter or longer remaining sentence lengths depends on the treatment capacities inside and outside the prison system, and prioritizing patients with shorter remaining sentence lengths may be preferable in some cases, especially if the treatment capacity inside the prison system is not very tight and linkage-to-care level outside prison system is low; and 3) among patients with advanced liver disease, IDUs should not be prioritized unless their reinfection is very-well controlled.

Turgay Ayer is the George Family Foundation Assistant Professor of Predictive Health at Industrial and Systems Engineering, and is the research director for medical decision-making in the Center for Health & Humanitarian Systems at Georgia Tech. In addition, Dr. Ayer has a courtesy appointment at Emory Medical School. Dr. Ayer conducts research on stochastic modeling and optimization, with applications in predictive health, medical decision making, healthcare operations, and health policy. He has been working on various projects related to different aspects of healthcare, including health outcomes research, disease prevention & control modeling, infectious disease modeling, healthcare delivery planning, new payment models, and health information exchanges. His research has been published in top tier engineering, management, and medical journals. Together with his students, Dr. Ayer has received several awards for their work, including an NSF CAREER award, first place in the 2011 & 2015 INFORMS Doing Good with Good OR Student Paper Competitions, first place in the 2016 INFORMS Decision Analysis Society Best Student Paper Award, finalist in the 2015 INFORMS George Nicholson Student Paper Competition, 2012 & 2014 Seth Bounder Foundation Research Award, and second place in 2011 MSOM Student Paper Competition. Ayer received a B.S. in industrial engineering from Sabanci University in Istanbul, Turkey, and his M.S. and Ph.D. degrees in industrial and Systems Engineering from the University of Wisconsin - Madison. He is a member INFORMS and the Society for Medical Decision Making, and currently serves as the president of the INFORMS Health Application Society.

The seminar series "Providing Better Healthcare through Systems Engineering" is presented by the U-M Center for Healthcare Engineering and Patient Safety: Our mission is to improve the safety and quality of healthcare delivery through a multi-disciplinary, systems-engineering approach. For additional information and to be added to the weekly e-mail for the series, please contact geneh-kim@umich.edu **Please note on location: 1123 LBME** is room 1123 in the Ann & Robert H. Lurie Biomedical Engineering Building (LBME). Street address is 1101 Beal Avenue, link to map and directions: <http://www.bme.umich.edu/about/directions.php>.



CENTER FOR
HEALTHCARE ENGINEERING & PATIENT SAFETY
UNIVERSITY OF MICHIGAN