

Replacing Complex Models for Health Decision Making with Metamodels: Three Examples

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Abstract

Models used to inform decisions in health are often complex, data- and computation-intensive, and difficult to interpret. For this reason, many models developed by operations researchers to support clinical, operational, and public health decision making are never used by decision makers. This talk focuses on the use of metamodels – that is, a statistical approximation of an original model – to replace complex models for health-related decision making. We describe three metamodels focused, respectively, on personalization of drug treatment for schizophrenia, control of hepatitis C in prisons, and use of mass prophylaxis for controlling disease outbreaks. We show how machine learning methods can be used to develop approximate models that can perform nearly as well as the original model, but with fewer data requirements, less computational burden, and often greater interpretability. Although each metamodel is specific to the original model, these examples illustrate general principles for creating simple yet useful models to support health decision making. More broadly, these examples suggest ways in which complex models used to support decisions relating to the production and provision of manufactured products and services can in some cases be replaced with simpler metamodels.

Keywords

Health, Simulation, Machine Learning, Complex models, Metamodels

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Biography

Dr. Margaret Brandeau is the Coleman F Fung Professor of Engineering and Professor (by Courtesy) of Health Policy at Stanford University, Stanford, California, USA. She is also Honorary Professor at la Universidad Nacional de Ingeniería, Lima, Peru. She earned a BS in Mathematics and an MS in Operations Research from the Massachusetts Institute of Technology and a PhD in Engineering-Economic Systems from Stanford University. Her research focuses on the development of applied mathematical and economic models to support health policy decisions. Her recent work has examined HIV and drug abuse prevention and treatment programs, programs to control the opioid epidemic, and COVID-19 response strategies. She is a Fellow of INFORMS (the Institute for Operations Research and Management Science). From INFORMS, she has received the Philip McCord Morse Lectureship Award, the President's Award, the Pierskalla Prize (twice), and the Award for the Advancement of Women in Operations Research and the Management Sciences. At Stanford she has received the Eugene L. Grant Faculty Teaching Award from the School of Engineering and the Graduate Teaching Award from the Department of Management Science and Engineering.