Optimal Design of Prostate Cancer Screening Policies

Brian Denton, PhD

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Prostate cancer is the most common solid tumor that affects American men. In the past, screening typically involved the use of prostate specific antigen (PSA) tests. However, the imperfect nature of PSA tests, and the potential for subsequent harm from unnecessary biopsies and treatment, has raised debate about whether and when to screen. In this talk I will provide some background on prostate cancer, current screening guidelines, and a summary of the recent controversy over PSA testing. Next, I will discuss a partially observable Markov decision process (POMDP) model to investigate the optimal design of screening policies that use a patient's history of PSA tests. The model-based screening policies are defined by the patient's probability of having prostate cancer which is estimated from their history of PSA tests results using Bayesian updating. Transition probabilities among health states are estimated using a large longitudinal dataset from Olmsted County, the Mayo Clinic Radical Prostatectomy Registry (MCRPR) and the medical literature. Reward functions that are considered include quality adjusted survival (patient perspective) and costs (third party payer perspective). Results will be presented for the optimal policy over the course of a typical base case patient's lifetime starting at age 40. Sensitivity analysis will be presented to demonstrate the relative importance of factors that define patient specific preferences and risk factors. Finally, future research directions will be discussed.

Dr. Brian Denton is an Associate Professor in the Department of Industrial and Operations Engineering at University of Michigan, in Ann Arbor, MI. Previously he has been an Associate Professor in the Department of Industrial & Systems Engineering at NC State University, a Senior Associate Consultant at Mayo Clinic in the College of Medicine, and a Senior Engineer at IBM. He is a Fellow at the Cecil Sheps Center for Health Services Research at University of North Carolina. His primary research interests are in optimization under uncertainty and applications to health care delivery and medical decision making. He completed his Ph.D. in Management Science at McMaster University, his M.Sc. in Physics at York University, and his B.Sc. in Chemistry and Physics at McMaster University in Hamilton, Ontario, Canada.

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