University of Southern California

DANIEL J. EPSTEIN DEPARTMENT OF
INDUSTRIAL AND SYSTEMS ENGINEERING

EPSTEIN INSTITUTE SEMINAR • ISE 651 SEMINAR

Patient-based Pharmaceutical Inventory Management - A Two-Stage Inventory and Production Model for Perishable Products with Markovian Demand

Julie Simmons Ivy

(Joint work with Dr. Anita Vila-Parrish)
Edward P. Fitts Department of Industrial and Systems Engineering
North Carolina State University

ABSTRACT

Drug shortages have increased over the past decade, tripling since 2006. According to a recent editorial in the New England Journal of Medicine, these shortages have caused serious concerns about safety, cost, and availability of lifesaving treatments. The implications to patient care as a result of shortages are significant. In a 2010 national survey of 1,800 healthcare practitioners by the Institute for Safe Medication Practices, 25% of clinicians indicated that an error had occurred at their site because of drug shortages.

Pharmaceutical inventory management and patient care are inextricably linked – suboptimal control impacts both patient treatment and the cost of care. The pharmacist serves as the gate keeper of drug distribution by ensuring the accuracy and appropriateness of prescribed medications, but they must also make decisions regarding drug inventory levels and when to produce drugs in response to or in anticipation of patient demand. Pharmacy material managers are challenged with developing inventory policies given changing demand, limited suppliers, and regulations affecting supply.

We study a perishable inventory problem motivated by challenges in pharmaceutical management. Inpatient hospital pharmacies stock medications in two stages, raw material and finished good (e.g. intravenous). While both stages of material are perishable, the finished form is highly perishable. Pharmacy demand depends on the population and patient conditions. We use a stochastic 'demand state' as a surrogate for patient condition and develop a Markov decision process to determine optimal, state-dependent two-stage inventory and production policies. We define two ordering and production scenarios, prove the existence of optimal solutions for both scenarios, and apply this framework to the management of Meropenem, an antibiotic.

TUESDAY, MARCH 27, 2012
ANDRUS GERONTOLOGY BLDG (GER) ROOM 309
3:30 – 4:50 PM

Julie S. Ivy

Associate Professor

Edward P. Fitts Department of Industrial & Systems Engineering
North Carolina State University

Fitts Faculty Fellow

Ph.D., Industrial and Operations Engineering, University of Michigan, 1998
M.S., Operations Research, Georgia Institute of Technology, 1992
B.S., Industrial and Operations Engineering, University of Michigan, 1991

Julie Ivy is an Associate Professor at North Carolina State University in the Edward P. Fitts Department of Industrial & Systems Engineering. She previously spent several years on the faculty of the Stephen M. Ross School of Business at the University of Michigan.

Dr. Ivy is actively involved in INFORMS and is a past president of the Health Applications Section of INFORMS. She has co-authored more than twenty journal articles, working papers, and conference proceedings.

Areas of Interest

Dr. Ivy's primary research interests are in the mathematical modeling of stochastic dynamic systems with emphasis on statistics and decision analysis as applied to health care, manufacturing, and service environments. The focus of her research is decision making under conditions of uncertainty with the objective of improving the decision quality. Dr. Ivy's research program seeks to develop novel concepts of maintenance and monitoring policies and associated scientific theories, and apply them specifically to two important application domains: industrial and medical decision making. She has experience in medical decision making as it relates to women's health including studying breast cancer screening and treatment policy development, policies for complex patients, health disparities and modeling of the patient and physician decision problem associated with birth delivery choice.