Strategies for a Smarter Health Care System

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Childhood vaccines are one of the great success stories of medicine. With timely vaccination, many childhood illnesses have been nearly eradicated. Yet this battle against common childhood epidemics requires constant vigilance and planning. In particular, a steady supply of vaccines needs to be made available to children. This task is especially difficult because the supply of vaccines is inherently fragile. Just in the last decade, the United States has experienced six major protracted disruptions of its vaccine supply. The Centers for Disease Control plans for such emergencies by maintaining a national stockpile. An important decision is how to set stockpile levels in order to minimize cost and the risk of a shortage in a dynamic and uncertain environment.

Such uncertainties exist in many real systems. To make a system more efficient requires an understanding of how to effectively account for uncontrollable random factors. Industrial engineers build mathematical models to capture the behavior of these systems, with the goal of simulating system behavior and optimizing system performance under economic and technological constraints.

Van-Anh Truong studies decision problems that arise in many health care systems and supply chains. Her work has application in the management of pediatric vaccine stockpiles, the allocation of operating room capacity to emergency and elective surgeries, the structuring and pricing of health care services, the tactical purchase of equipment for semiconductor fabrication facilities, and the strategic use of inventory in retailing. She develops scientific theory to design smarter systems, and to help deploy machines, staff, and materials more efficiently. By drawing on mathematics and engineering analysis and design, she develops representative models of real systems, how they interact over time, and how they are affected by random events in the environment. Her analysis of these mathematical models yields insights and algorithms for finding decisions that optimize system performance.

Truong's theoretical interests include separation methods for stochastic dynamic programming, approximation algorithms, and learning-based optimization. Prior to teaching at Columbia University, Truong was a quantitative associate at Credit Suisse and a quantitative researcher at Google. She is a member of the Institute for Operations Research and the Management Sciences (INFORMS).

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