

Q & A with Bill Crown and Kal Pasupathy

Constrained Optimization Methods in Health Services Research: An Interview with William Crown, PhD and Kal Pasupathy, PhD



The editorial staff of *Value & Outcomes Spotlight* were fortunate to sit down with William H. Crown, PhD and Kalyan S. Pasupathy, PhD to discuss their recent article, “Constrained Optimization Methods in Health Services Research—An Introduction: Report 1 of the ISPOR Optimization Methods Emerging Good Practices Task Force.” This new task force report was published in the March 2017 issue of *Value in Health*. What follows are excerpts from our conversation about how this important methodology can be used to help health care researchers and decision makers identify the best solution to an issue that has a number of potential approaches and constraints.

Crown WH, Buyukkaramikli N, Thokala P, et al. *Constrained Optimization Methods in Health Services Research—An Introduction: Report 1 of the ISPOR Optimization Methods Emerging Good Practices Task Force. Value Health. 2017;20(3):310-319.*

Value & Outcomes Spotlight: This is a new topic unfamiliar to most ISPOR members and the larger HEOR community. Can you briefly explain it?



Crown: First, when describing optimization methods, we use the term ‘optimal’ in a mathematical sense. Typically, the term is used to refer to a superior solution to a problem, but it’s not always easy to determine if it is truly *the very best solution* to the problem given the complexity of the system inputs, outputs/outcomes, and constraints. Is it optimal in a mathematical sense? So, by “optimal solution”, we mean the best possible solution among the number of choices, identified in an efficient manner, given the relevant constraints.



Pasupathy: There are a number of optimization methods that have been developed by the field of operations research. These mathematical optimization models have tremendous potential to improve the effectiveness and efficiency of health care delivery. They are very useful in this setting because many health care problems have a common mathematical structure. For example, they can be used for maximizing societal health care benefits subject to a budget constraint; identifying optimal treatment pathways for patients given their proximity to available services; or can be used to predict the optimal time to initiate a treatment given the risk factor profile of a patient.

VOS: You have mentioned several examples of problems that optimization methods can solve. What other kinds of health care problems can optimization solve?

Crown: Optimization methods have been used to determine which approaches offer the best outcomes for clinical trial design, disease diagnosis, and health technology assessment (HTA). HTA is about providing the best value to patients and the best value for money to payers. Often “best” doesn’t just involve selecting one drug versus another, but deciding on how to treat, when to treat, what technological mix to use, and how services should be configured. Optimization methods can help analysts and stakeholders sort through these types of complex choices. Optimization methods are also widely used to minimize transportation costs in delivering health care supplies and maximizing efficient use of hospital beds, emergency room facilities, etc.

VOS: For those with little understanding of optimization, what are the simple messages that you would like them to remember?

Crown: First, decision making becomes even more complex when you take into account uncertainty and decisions over time. If you want the “very best possible” solution for multi-faceted, large-scale problems with a high number of decision variables, using a mathematical optimization modeling framework is the means to that end.

Pasupathy: Also, approaching a problem in the context of mathematical optimization forces you to identify and quantify the endpoint that you are trying to accomplish. But most importantly, constrained optimization takes into account of the limits placed on the solution by real-world factors such as budgets, availability of treatments, staffing capacity, and patient characteristics. As a result, the identified optimal solution is much more likely to be feasible to implement.

VOS: Why is this task force report valuable?

Pasupathy: Up to one-third of health care expenditure is wasted—producing no clinical benefit for patients. By treating patients optimally, we have the potential to improve population health and enhance the value associated with health care expenditure. For individual patients, this means providing treatment with the proper therapy faster. For physicians, this can help provide optimal health outcomes for their patients, enhance the performance of their medical practice, and offer more efficient health care delivery. ■