

Decision Making Strategies for Individualized Health Care

G. Konstantinow, S. Dasu

INTRODUCTION

Health care in America has gone through critical changes in recent years. Models for health care delivery – services and payments – have changed accordingly. Whereas these models have routinely been determined by insurance coverage and reimbursement rates for procedures, they increasingly reflect higher levels of consumer choice both in maintaining health and in managing disease. Such changes affect health care providers in the way treatments are balanced across patient populations and affect consumers by expanding the type of care they seek individually as well as with medical partners.

This study demonstrates how models and analytic methods for assessing the quality and effectiveness of health care delivery have progressed from systems engineering analysis through optimization based on evidence-based medicine from the provider’s vantage point and finally to analytics based on value-based medicine from the consumer’s vantage point. The efficacy of new, innovative models based on decision making under uncertainty is further enhanced by the rapidly growing availability of personalized datasets (such as the Personal Genome) used for individualized clinical decision making processes.

METHODS

In the Systems Engineering and Operations Research communities, researchers have routinely emphasized the “operations” side of health care delivery from the point of view of workflow among service providers and cost/benefit analysis when considering payer-provider interactions. Our approach is to shift focus to decision making that centers on the health care consumer’s experience. This approach closely follows a radical shift in the medical community from relying on evidence-based medicine (clinician’s perspective) to promoting value-based medicine (consumer’s perspective) – thus addressing both the effectiveness and the utility of treatments by taking into account consumer preferences as well as providers’ best practice.

In this study, we consider health care delivery in terms of strategic decisions that all “players” in the communal health

care system – patients, providers, and payers – make in selecting treatment paths among health care service options. We inspect several types of decision processes to see how they might apply in describing strategic interactions among the stakeholder organizations involved in health care delivery. We contrast those models with standard analytic techniques from systems engineering that tend to focus on provider-oriented delivery processes instead of consumer-oriented treatment outcomes. We also generalize the game-theoretic notion of “payoff” as it applies to the value of services delivered from the provider’s point of view and the utility of treatments and health maintenance activities from the consumer’s point of view. We present case studies using rules-based analysis for assessing optimality of treatments as well as value of treatments and wellness programs to the consumer. Finally, we discuss how the benefits of service delivery can be optimized among all the stakeholders’ concerns, both in competitive and cooperative stakeholder interactions.

RESULTS

Modeling health care interactions in terms of rational decision theory, decision making under uncertainty (“Naïve decision theory”), and game theory is an important avenue currently under development for applying behavioral economics and rules-based analysis to health care analytics. For the Systems Engineer, this model augments and expands process and workflow analysis typical of clinical environments. For the Operations Researcher, this model shows not just how consumer-provider-payer networks behave but also how the delivery of services involving all groups (i.e., compensation for services resulting in increased “health capital”) can be optimized for the benefit of all parties. For the Clinician, this model offers a roadmap for establishing patient-physician interactions that can be enhanced by a vastly larger pool of individualized patient data and outcomes (for example, personal genomic information) than currently used in clinical environments. We discuss how models from decision theory, game theory, rules-based analytics, and behavioral economics may be applied in different real-world medical organizations and what analytic methods are required to validate their application.

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George Konstantinow, Ph.D. is with OR-Analysis.com, Santa Barbara, CA 93103 USA and is Chair of the IEEE Central Coast Section and EMBS Chapter (phone: (805) 426-9246; e-mail: george.konstantinow@ieee.org).

Sriram Dasu, Ph.D. is with the USC Marshall School of Business, Los Angeles, CA 90089-0089 USA (e-mail: Dasu@marshall.usc.edu).