

## **Developing an industrial and systems engineering and health care research agenda**

Rupa Valdez, MS<sup>1</sup>, Patricia Flatley Brennan, RN, PhD, FAAN<sup>1</sup>, James Benneyan, PhD<sup>2</sup>, Isaac Kohane, MD, PhD<sup>3</sup>, Vinod Sahney, PhD<sup>4</sup>

<sup>1</sup> University of Wisconsin-Madison, Madison, Wisconsin

<sup>2</sup> Northeastern University, Boston, Massachusetts

<sup>3</sup> Harvard University, Cambridge, Massachusetts

<sup>4</sup> Blue Cross Blue Shield Boston, Massachusetts

For over a decade there has been wide-spread recognition of the potential value of applying industrial and systems engineering (ISyE) knowledge to improving the health care delivery system. The field of ISyE prides itself in improving the structure, processes, and outcomes of complex systems. Numerous reports from organizations such as the Institute of Medicine, the National Academy of Engineering, and the Robert Wood Johnson Foundation, document deliberations from consensus conferences and evidence-based practice workshops focused on this topic. Despite the interest in using ISyE knowledge to improve health care, little progress has been made in achieving an optimal health care delivery system through the application of ISyE knowledge. Recognizing this shortcoming, the Agency for Healthcare Research and Quality (AHRQ) and the National Science Foundation (NSF) sponsored a workshop to establish (1) a vision of an ideal health care delivery system; (2) the barriers to achieving meaningful change with current ISyE methods; and (3) a research and action agenda at the intersection of ISyE and health care that should be pursued to enable the field of ISyE to substantially contribute to the realization of an ideal health care delivery system.

The objectives of this effort were realized by conducting a review of the salient literature and by engaging 40 experts in the fields of ISyE and health care. A background report containing a summary and critical review of thirteen seminal reports and workshops related to the subject matter of this project was produced and disseminated among identified experts (<http://www.team-psa.com/AHRQ-HIT2009/home.asp>). During a two-day workshop held on September, 21<sup>st</sup>-22<sup>nd</sup>, 2009, in Washington, DC, these experts engaged in intense reflection and discussion about (1) a vision of an ideal health care delivery system; (2) why change using current ISyE methods remains intractable; and (3) the research and action agenda that should be pursued over the next 5-7 years to enable ISyE to meaningfully contribute to the realization of an ideal health care delivery system within the next 10-15 years. A final report will be written and circulated among all workshop participants and external reviewers for comment; the feedback obtained will be integrated into the final recommendations to AHRQ and NSF. The final report will be publicly available in April, 2010.

The vision of the ideal health care delivery system generated by participants focused on three characteristics: 1) a new system, 2) a patient-centered system and 3) an engineered system. Unlike the currently fragmented health care delivery system, the ideal system should be integrated. It should be ubiquitous, distributed, responsive, expansive, and resilient. The focal point of the system should be the patient and his/her family. Patients should have open-access to care that is personalized and focused on prevention, personal health information that is digitized and protected, and consumer health information technology (IT) that is user-centered. The ideal health care delivery system should be engineered to make appropriate use of standardization, should focus on quality planning not quality improvement, and should make effective use models for knowledge discovery.

Nine barriers were identified as having prevented current efforts at using ISyE knowledge from achieving an ideal health care delivery system. These barriers include:

- (1) Lack of widespread use of ISyE knowledge;
- (2) Inadequate ISyE knowledge;
- (3) Insufficient health IT infrastructure;
- (4) A structure of the health care delivery system which emphasizes local optimization and short term outcomes and rewards;
- (5) Insufficient pathways which promote the use of ISyE knowledge in health care;
- (6) Lack of efficient means to spread knowledge between ISyE professionals working in health care;
- (7) No clear funding structures to support development of ISyE knowledge for health care;
- (8) Current policies which constrain the level of change possible; and
- (9) Lack of professionals with an adequate understanding of both ISyE and health care.

Participants also noted four facilitators which are likely to allow ISyE knowledge to make meaningful contributions to achieving a vision of an ideal health care delivery system. These facilitators include:

- (1) Increasing recognition of the potential of ISyE to improve health care;
- (2) Progress in the recognition of the need for and development of new ISyE knowledge for health care;
- (3) Progress in the use of IT to disseminate ISyE knowledge; and
- (4) The current climate of health care reform.

The research agenda is intended to provide guidance on the types of investigation required to (1) achieve effective technology transfer of existing ISyE knowledge within health care and, more importantly, to (2) discover and develop new ISyE knowledge particularly germane to achieving the vision of an ideal health care delivery system. The technology transfer research agenda includes identification of

best practices for using and disseminating ISyE knowledge. The new knowledge research agenda was characterized from a systems perspective and included new knowledge related to

- (1) System monitoring (data collection, integration, characterization, and presentation);
- (2) System modeling (descriptive models, predictive models, prescriptive models, and models that can handle inconvenient realities); and
- (3) System manipulation (translation, top-down decomposition, and bottom-up integration).

The action agenda identifies support needed from agencies such as AHRQ and NSF to ensure that the research areas identified are pursued in a timely and effective manner and that the results of such research disseminated appropriately. The action agenda advocated for initiatives and programs needed in areas of

- (1) Collaboration (e.g. multiple stakeholder consortia, professional home for ISyE research in health care);
- (2) Education and training (e.g. professional development across ISyE and health care, library of case studies documenting application of ISyE knowledge in health care);
- (3) Funding (e.g. high-risk, high-potential research, community-based research, multidisciplinary grantees);
- (4) Dissemination (e.g. creation of journal for ISyE in health care, publication in popular media)
- (5) Administration (e.g. joint grant proposal review meetings by relevant funders, faster proposal cycle).

Program leaders and panelists drawn from participants in the workshop will present the outcomes of this workshop. Attendees will engage in a discussion about the tactics required to accomplish the research and action agenda, the potential benefits of the research and action agenda, and the required balance between new investigation, technology transfer, and system redesign.