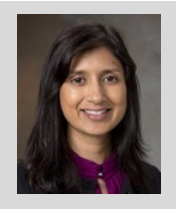
Applying the Tools of Engineering for Safer Healthcare



In 2005, the National Academy of Engineering and the Institute of Medicine sought to leverage the expertise of both groups in producing a joint consensus report, Building a Better Delivery System—A New Engineering/Health Care Partnership. The report, based on a well-thought-out series of contributing papers, set out specific recommendations for advancing the application of engineering in medicine. But the response to the report was only limited.

Still, the Agency for Healthcare Research and Quality (AHRQ) remained committed to the concept of applying procedures from engineering to healthcare; these had amply proved their worth in other industries.

AHRQ, in its call for proposals for a new series of grants in November 2013, noted what had been missing in work done to date on health systems engineering: "...[T]there has been a scarcity of programmatic activity that actually engages in new design and systems engineering effort, and that is focused on more than singular patient safety concerns."

Hoping to encourage the sorts of new ways of thinking and learning that would foster this vision of a more closely integrated healthcare system, in 2013 AHRQ solicited proposals for what it termed "Patient Safety Learning Laboratories," that would utilize "new design and systems engineering efforts." Critically, these projects would "focus on more than singular patient safety concerns."

A learning laboratory was to consist of both "places and professional networks," where, it was hoped, "interrelated threats to patient safety can be identified, where multidisciplinary teams generate new ways of thinking with respect to the threats, and where environments are established conducive to brainstorming and rapid prototyping techniques that stimulate further thinking."

Another concept taken from engineering and specified in the AHRQ Funding Opportunity Announcement was the application of "multiple develop-test-revise iterations of promising design features and subsystems of the sort that can be found in larger-scale engineering projects."

The final phase of each Learning Laboratory project was to evaluate what had been developed within a realistic setting, either clinical or simulated, with its full complement of facility design, equipment, and professionals.

To highlight the specifics of one particular project, Inside Medical Liability *spoke with* ***Sarwat I. Chaudhry, MD,*** *Associate Professor of Medicine (General Medicine). She is the Principal Director of a Learning Laboratory initiative, at Yale University—its Yale Center for Healthcare Innovation, Redesign and Learning (CHIRAL).*

Inside Medical Liability: How does your work utilize a new approach, and how does that work to ensure patient safety?

Chaudhry: CHIRAL's mission is to serve clinicians and patients through the creation of a dynamic, innovative environment where threats to patient safety are assessed and solutions are implemented and then evaluated to advance breakthroughs and improvements in the delivery of healthcare.

We apply innovative, flexible methods which allow researchers and clinicians to comprehensively understand and remediate deviations from safe, high quality care.

All CHIRAL projects are built on a framework that draws from improvement work in design and engineering. Our approach begins with a problem analysis, and then proceeds through design, development, implementation, and evaluation phases.

IML: How does that play out in practice?

Chaudhry: There are several steps in our process. In the first, "Problem Analysis," the research teams gain a comprehensive understanding of the environment through in-depth qualitative research. A thorough problem analysis may include:

- Day-in-the-life observations on our units of study and in-depth interviews with key stakeholders including front-line and ancillary staff
- Process mapping exercises
- Baseline electronic medical record data.

Drawing on these diverse data sources, we develop a nuanced understanding of the processes involved, as well as the challenges and strengths of the current environment and system. This data collection also provides us with feedback from staff on ways to improve processes.

IML: And the second phase—"Design"?

Chaudhry: Yes, in this step, working with participants, stakeholders, and consultants, teams use techniques employed by leading design firms, such as brainstorming, rapid prototyping, physical mock-ups, and storyboarding.

After analyzing the data collected, we hold feedback sessions with staff and leaders from each unit of study to confirm findings and discuss intervention ideas that were grounded in staff suggestions collected during problem analysis.

We then convene a group of representative hospital and unit leaders for a joint session, to further hone our intervention ideas and develop a path forward.

IML: What happens in the "Intervention" phase?

Chaudhry: Next, the teams iteratively test and evaluate prototype interventions in a simulation laboratory, hospital unit, or outpatient setting. Intervention development has been a collaborative and iterative process that requires CHIRAL to be embedded in hospital procedures.

CHIRAL staff attends weekly hospital-based meetings. We have held a series of additional meetings with unit leadership to move interventions forward.

IML: "Implementation"—how broadly based is it?

Chaudhry: The interventions are implemented across the entire service to discover what bugs and glitches need to be addressed. The final step is evaluation, wherein the effectiveness of each intervention is rigorously evaluated.

IML: What does the phrase "stakeholder involvement" mean within CHIRAL?

Chaudhry: CHIRAL is committed to involving stakeholders in our research. We have worked to build relationships with frontline staff and leadership from clinical, administrative, and support services.

They have become our partners in collecting rich, comprehensive data, understanding problems in the real-world setting, and developing solutions that create lasting change.

IML: And what does CHIRAL's collaborative approach entail?

Chaudhry: First, we host member-checking sessions to review the qualitative research findings. We also organize feedback workshops to refine and expand pilot programs into full interventions. Third, we facilitate discussions between sending and receiving teams to identify common concerns and work collaboratively on improvements. Recent topics include revisions to the referral requests for skilled nursing facility care and handoff guidelines for complicated patients. Fourth, we regularly share findings and updates on CHIRAL work through presentations, meetings, and outreach efforts.

IML: What's new and different about the approach assumed in the CHIRAL project?

Chaudhry: Traditional quality improvement approaches in the hospital setting often presuppose a problem, and then prematurely identify a solution.

The framework used by CHIRAL allows researchers and clinicians to fully understand the problem in terms of the environment, challenges and strengths, and develop sustainable change by integrating stakeholders into the process.

The intensity and depth with which CHIRAL integrates stakeholders aids in ensuring there is buy-in from clinicians on the frontline. They are encouraged to help identify the precise problem that is causing the deviation from safe care, involved in intervention design, and empowered to own rollout and evaluation of the solution.

IML: Are the results generalizable to a wide range of hospitals and healthcare systems?

Chaudhry: It is tough to say whether our results are fully generalizable to a wide range of settings. Each setting, or threat to patient care, will contain distinct nuances that must be considered when designing effective, sustainable interventions.

There will also be variations in stakeholders from one setting to the next.

IML: How does the idea of "shared sense-making" as used in CHIRAL fit into all this?

Chaudhry: We use this term in this way: CHIRAL examines patient care through similar conceptual lenses of shared sense-making, which is the collective ability to make sense of complicated, dynamic, and ambiguous information without oversimplifying or ignoring discordant data, and latent systems conditions which takes into account the influence of workflow, skills, culture, staffing patterns, equipment, incentives, and information technology.

Shared sense-making ensures that all stakeholders involved in or affected by the problem have a shared awareness and understanding of the problem, need to correct the situation, and potential solutions.

Sample: MICU to General Medicine RN Handoff Intervention [2016-2017]

Ethnographic observations and qualitative interviews performed as a part of Problem Analysis revealed that nurse-to-nurse verbal handoff from the [medical intensive care unit] MICU to the General Medicine floors was greatly appreciated by nursing staff and helped with the transfer process, but was done inconsistently. The hospital nursing policy does not require verbal handoff, so MICU nurses used their discretion regarding if and when to call a receiving nurse on the General Medicine unit. General Medicine nurses found the inconsistency frustrating and felt unprepared for specific types of patients.

During the MICU feedback session where results of Problem Analysis were discussed, an idea was proposed for a short verbal handoff for MICU patients with special circumstances. A small group of key staff was formed to develop and roll out the intervention.

A pre-survey of General Medicine and MICU nurses' perception of communication for patients with special circumstances was developed and implemented. An intervention was developed which required a short verbal handoff for patients with special circumstances (e.g., patients with respiratory issues, patients in restraints) transferring from the MICU to a General Medicine floor. Intervention materials were developed. One example of these materials, a double-sided, laminated card which summarized the intervention. This card was provided to all MICU nurses who were participating in the intervention. A post-intervention survey was administered to General Medicine and MICU nurses to evaluate the intervention. The post-intervention survey repeated the questions asked in the pre-intervention survey to detect any changes in the staff experience of patients transferring from the MICU to the General Medicine floor. Overall, compared to the pre-intervention survey, MICU nurses' perception of frequency of calls placed increased. Compared to the pre-survey, more General Medicine nurses were likely to perceive getting calls for special circumstances sometimes, and less likely to report rarely, often, or always getting these calls. To further support this intervention and identify areas for targeted improvement, the Project 2 team completed four days of process observations and conducted twenty-five staff interviews to gather data about adherence to the intervention and suggestions for improvement. Overall, nurses reported positive experiences with the verbal handoff. Most of the General Medicine nurses reported receiving calls from MICU nurses prior to patient transfer. Staff feedback was summarized and provided to leadership.