Boston Medical Center – Boston, Massachusetts

Overview: Boston Medical Center is a private, not-for-profit, 626-licensed bed academic medical center located in Boston's historic South End. The hospital is the primary teaching affiliate for Boston University School of Medicine. Emphasizing community-based care, Boston Medical Center provides a full spectrum of pediatric and adult care services from primary to family medicine advanced specialty care. Boston Medical also has the largest 24-hour Level 1 trauma center in New England.

In 2004, Boston Medical Center researchers began an in-depth examination of the hospital discharge process to determine methods for minimizing deficiencies in the transition of care. These deficiencies increase illness, unnecessary hospital utilization, and cost. Preliminary work borrowed methodologies from engineering such as process mapping, failure mode effect analysis, probabilistic risk assessment, root cause analysis, and qualitative analysis. With their work supported by more than $7.5 million from the Agency for Health Research and Quality and the National Heart, Lung and Blood Institute, the research team developed **the Re-Engineered Discharge (RED) program,** a set of mutually reinforcing components that define a high-quality hospital discharge. The RED's components were endorsed by the National Quality Forum (NQF) and form the basis for the NQF "Safe Practice" on the hospital discharge.

Working with design and health literacy consultants, the research team operationalized the RED using an "After Hospital Care Plan" (AHCP) tool, a spiral-bound, color booklet that clearly presents the 11 mutually reinforcing components of the program:

In-hospital components (nurse discharge advocate)

1. Educate the patient about diagnosis throughout the hospital stay.
2. Make appointments for follow-up and post discharge testing, with input from the patient about time and date.
3. Discuss with the patient any tests not completed in the hospital.
4. Organize post-discharge services.
5. Confirm the medication plan.
6. Reconcile the discharge plan with national guidelines and critical pathways.
7. Review with the patient appropriate steps of what to do if a problem arises.
8. Expedite transmission of the discharge summary to clinicians accepting care of the patient.
9. Assess the patient's understanding of this plan.

After-hospital care plan

10. Give the patient a written discharge plan.

Pharmacist post-discharge telephone component

11. Call the patient 2 to 3 days after discharge to reinforce the discharge plan and help with problem-solving.

The pharmacist asked participants to bring their medications to the telephone to review them and address medication-related problems; the pharmacist then communicated these issues to the primary care physician or discharge advocate.

Impact: In 2008, the RED team completed a randomized controlled trial of 749 adult patients randomized at the time of hospital admission to compare the impact of the RED process with usual care. The results show a 30 percent lower rate of hospital utilization in the intervention group compared with usual care in 30 days of discharge. One readmission or emergency department visit was prevented for every 7.3 patients receiving the intervention. Further, the total cost for those who received the intervention was 33.9 percent lower than for those who received a usual care—an average difference of $412 per person. These results have important implications for quality of care and costs for the more than 38 million hospital discharges each year in the United States.

The RED tools and the nurse training manual have been downloaded by more than 500 hospitals from 49 states and 9 countries. In addition, the Centers for Medicare & and Medicaid Services recently awarded 14 grants to quality improvement organizations to improve hospital transitions; 8 of the 14 are using the RED methodology as part of their intervention.

Challenges/success factors: Although the RED was shown to be cost-saving, the research team sought to determine if they could cut down on the time needed by hospital nurses to deliver the RED components by utilizing a health information technology system. Working with Tim Bickmore, PhD, professor of computer science at Northeastern University, they created the "Virtual Discharge Advocate, or Louise™," a hospital bedside patient education system that engages with patients about their post-discharge self-care plans.

"Louise" is an animated conversational character that simulates face-to-face interaction between a patient and a nurse, and its design is based on detailed analyses of how nurses explain written medical instructions to patients. The virtual discharge advocate runs on a touch screen display mounted on an articulated arm connected to a mobile cart, so that patients can interact with "Louise" from a variety of positions in their hospital bed. The virtual discharge advocate talks using synthetic speech and synchronized animation; patients "talk" by touching what they want to say on the touch screen. The language used by the virtual discharge advocate is dynamically composed based on each patient's medical data and questions asked. "Louise" and the patient review the AHCP together. "Louise" has a copy that is displayed on-screen while the patient holds their own paper-based copy. "Louise" answers questions, and tests patients' understanding of key facts. Following the interaction, a report is produced of their issues and questions that the agent could not address for a nurse's follow-up.

The "Louise" system is composed of: (1) a networked server with relational database; (2) a GUI-based data entry and management program (the "workstation"); (3) a report generator that produces the AHCP booklet for patients to take home; and (4) the bedside patient education system ("Louise"). The system works either in a completely stand-alone fashion, in which all patient data is entered via the workstation, or with any portion of the data populated from the hospital information technology systems.

Future direction/sustainability: The next study of Project RED is in its design phase. It will again take advantage of available technology to tackle the problem of adverse drug events.

Advice to others: A Project RED toolkit is available for hospitals interested in implementing the program. The toolkit includes:

- ***After Hospital Care Plan Sample Form –*** The After Hospital Care Plan is designed to clearly present the information needed by patients to prepare them for the days between discharge and the first visit with their ambulatory care physician.
- ***Training Manual –***This workbook, targeting health professionals, details how to deliver a safe and effective hospital discharge.
- ***Computerized Workstation to Print the After Hospital Care Plan –*** This document describes the computerized workstation and the process used to create and print the After Hospital Care Plan.

More information is available at www.bu.edu/fammed/projectred/index.html.

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