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Higher quality and lower cost from improving hospital discharge decision making☆

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ABSTRACT

This paper reports research on improving decisions about hospital discharges – decisions that are now made by physicians based on mainly subjective evaluations of patients' discharge status. We report an experiment on uptake of our clinical decision support system (CDSS) which presents physicians with evidence-based discharge criteria that can be effectively applied at the point of care where the discharge decision is made. One experimental treatment we report prompts physician attentiveness to the CDSS by replacing the default option of universal "opt in" to patient discharge with the alternative default option of "opt out" from the CDSS recommendations to discharge or not to discharge the patient on each day of hospital stay. We also report results from experimental treatments that implement the CDSS under varying conditions of time pressure on the subjects. The experiment was conducted using resident physicians and fourth-year medical students at a university medical school as subjects.

1. Introduction

In 2010 Americans spent 17.6% of GDP on healthcare, which was eight percentage points above the OECD average (Organization for Economic Cooperation and Development, 2012).[1] The objective of decreasing medical costs, or at least reducing their outsized rate of increase, would seem to be well served by reducing hospital length of stay (LOS). But discharging patients earlier can increase the rate of unplanned readmissions, an indicator of low quality and a cost inflator. In 2010, 19.2% of Medicare patients were readmitted within 30 days of discharge, resulting in additional hospital charges totaling $17.5 billion (Office of Information Products and Data Analytics, 2012).[2]

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[1] Medicare, Medicaid, and CHIP (Children's Health Insurance Program) spending alone made up 21 percent of the 2012 federal budget (Center on Budget and Policy Priorities, 2013). In addition, both Medicaid and CHIP also require matching expenditures by the states.

[2] Beginning in October 2012, the Centers for Medicare and Medicaid Services began publishing hospitals' readmission rates and penalizing those with "excess over expected" readmission rates for heart attack, heart failure and pneumonia patients. In 2012, a total of 2217 hospitals were penalized; 307 of

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Hospitals and physicians are encountering increasing pressure both to reduce costs of hospital stay and to reduce unplanned readmissions. The research question we take up is how to assist physicians in making discharge decisions that decrease LOS as well as the likelihood of unplanned readmissions. Physicians have rapidly increasing access to large amounts of raw data on each patient they treat through electronic medical record systems. The problem for improving discharge decision making is not shortage of data on the patient but, rather, absence of evidence-based discharge criteria that can be effectively applied at the point of care.

Our central activity is a collaboration between physicians who make discharge decisions and economists – with expertise in research on decisions under risk and mechanism design – aimed at improving hospital discharge decision making. The objectives are to design, experimentally test, and disseminate a clinical decision support system (CDSS) that can be used to lower medical costs – by reducing average length of hospital stay – while increasing quality of medical care by decreasing the likelihood of unplanned readmissions.

An outline of current practice sheds light on the nature of the problem and a possible solution. Prior to deciding whether to discharge a patient, a physician examines the patient and reviews his or her electronic medical records. Criteria applied to making a discharge decision are derived from the physician's medical training and own previous practice and, perhaps, recommendations of one or more colleagues. The evidence base of these typical discharge criteria is extremely limited in comparison to the voluminous information that could be derived from the electronic medical records of a hospital. A typical hospital will serve many thousands of patients per year. Each surviving patient will be discharged from the hospital and it will subsequently be revealed, in most cases, whether the discharge was successful or unsuccessful (i.e., led to unplanned readmission within 30 days). The central question addressed in our research is an operational use of this mass of data – from current and former patients' electronic medical records and outcomes from previous discharges of patients – by developing evidence-based discharge criteria that can be *effectively* applied at the point of care where the discharge decision is made.

Our collaborative research began by analyzing a large sample of (de-identified) patient data to identify risk factors for unplanned hospital readmissions at a large southeastern teaching hospital (Kassin et al., 2012). We subsequently elicited the hospital discharge criteria reported by physicians (Leeds et al., 2013) and compared these self-reported criteria to (a) discharge criteria that can statistically explain actual discharges and (b) patient clinical and demographic data that predict successful or unsuccessful discharges (Leeds et al., 2015). Although many self-reported criteria coincide with (statistically explanatory) actual criteria, and many significant predictors of actual discharges coincide with significant predictors of successful discharges, various inconsistencies were identified which suggested the importance of research on creating and experimentally testing CDSS for improving discharge decision making.

In building the CDSS, we start with estimation of a probit model of determinants of unplanned readmission (i.e. unsuccessful discharge) probability. The probit model is estimated with data for about 3200 patients from the electronic medical records of a large southeastern hospital. The estimated probit model provides the empirical foundation for a decision support model that is instantiated in the CDSS. The CDSS is designed to present the discharge decision implications of the underlying probit model to physicians in a user friendly way that can be applied at the point of care. The central research question for assessing the value of the CDSS is whether it is efficacious in improving discharge decision making. There are two ways in which the CDSS can fail to be efficacious: (1) the probit model underlying the CDSS may *not* be a good model and hence fail to provide the empirical foundation for good discharge decisions; or (2) the implementation of CDSS may fail to support uptake by physicians of the information in the underlying probit model. The laboratory experiment reported herein provides a test for uptake. Such a test is a practical and ethical requirement before application of the CDSS on patient wards in hospitals.[3] If the CDSS is effective in supporting uptake then the planned next phase in our research program is a field experiment in the form of an intervention on patient wards. Such intervention will provide a joint test of items (1) and (2) above.

The organization of the rest of the paper is as follows: the next section discusses related literature, Section 3 describes the CDSS, and Sections 4 and 5 report on the design and results from an experimental test of uptake of the CDSS. A summary of the main findings and conclusions in Section 6 completes the paper.

2. Related economic and medical journal literature

The use of advanced information technology has been advocated as a method to increase healthcare quality and reduce costs (Cebul et al., 2008). Our research is part of a larger program in economics that aims at the creation of information technology for medical decision making and its application in clinical environments intended to improve quality and lower costs of healthcare. A seminal contribution by economists to improving healthcare is the mechanism design incorporated into information technology for kidney exchange by Roth et al. (2004, 2007). Their work provided a foundation for the New England Program for Kidney Exchange, and subsequent kidney exchange programs, which have led to increases in quality and length of life by matching patients with donors for transplant surgery while lowering the informational costs associated

them were assessed the maximum penalty of 1 percent of their total regular Medicare reimbursements (*Kaiser Health News*, October 2, 2012). The scheduled penalties escalate in future years and apply to broader classes of treatment diagnosis codes.

[3] Further evaluation of econometric modeling underlying our development of CDSS is also a practical and ethical requirement. Such results are contained in Leeds et al. (2015) wherein, for example, the mean in-sample and out-of sample C statistics (Uno et al., 2011) for our latest econometric model are reported as 0.806 and 0.780.