Complexity Science and the Readmission Dilemma

The increasing proliferation of articles dealing with hospital readmission is in no small part a response to the recommendations in the 2007 Medicare Payment Advisory Commission report to Congress (http://www.medpac.gov/documents/Jun07 _EntireReport.pdf). These recommendations became the basis for the Hospital Readmissions Reduction Program in the Affordable Care Act altering the criteria for hospital payment reimbursement. Enforcement of these criteria by the Centers for Medicare & Medicaid Services reduces Medicare payments to hospitals that exceed preset all-cause readmission rates. As health care policy and aspects of care delivery are increasingly influenced by reimbursement, it is important to ensure that the attenuation of the overall health care financial burden is accomplished by research-driven improvements in the quality and safety of care that minimize the potential for unintended outcomes.

The percentage of hospital readmissions that are potentially preventable is unknown. In a systematic review that included studies using various methodologies and criteria, van Walraven et al\(^1\) reported that the median proportion of readmissions that could be classified as avoidable was 27.1% (range, 5%-79%); the true proportion is unclear. Most readmission research has been either to define reliable and generally reproducible factors that identify patients most at risk for readmission or to develop the required interventions to modify these risk factors and modulate their effects. Donzé et al\(^2\) describe a 7-component prediction score based on a validated analytical approach identifying generic factors associated with 30-day readmissions. These factors deal primarily with severity of illness as represented by clinical markers, intensity of therapeutic interventions, prior admission frequency, as well as admission to an oncology service. Severity of disease categorized in various ways is commonly identified as a major contributor to the risk of subsequent admissions, but specifics as to how these risks can be modified or contained continues to be an issue. Severity is directly associated with the intensity and
frequency of the care activities that occur during the patient’s index admission. Heightened attention to issues of patient safety has identified specific areas of concern. A study in Veterans Affairs facilities exemplifies this association between adverse events and subsequent readmission. The occurrence of any Agency for Healthcare Research and Quality Patient Safety Indicators event during an index admission increased the odds of readmission by 23%. Of note, documented adherence to specific interventions designed to improve quality and safety has not been shown to consistently affect readmission frequency. The effect of reportable Centers for Medicare & Medicaid Services–specific process of care performance measures for pneumonia, heart failure, acute myocardial infarction, and surgical care improvement was evaluated, and it was revealed that hospitals with greater adherence to the process of care performance measures did not demonstrate significant changes in 30-day readmission rates. This lack of a significant improvement in readmission rates suggests that there is a much more complex relationship between risk factors, interventions, and intended outcomes.

The relative stability of the incidence/prevalence of reported all-cause readmissions between 16% and 20% or more during the past 5 years in the face of the intensive research/implementation efforts suggests that perhaps a better approach to a study of hospital readmission would be through the use of a complexity science analysis. Complexity science recognizes and focuses on the identification of participating agents, the unpredictability of agent actions, the interactions between multiple agents, and the resultant effect on intended outcomes. In a complex adaptive system model, there is a necessity to look beyond single causative factors and the expectation of linear responses to interventions.

Oduyeb et al report that the single intervention of direct provider-to-provider communication does not affect the readmission rate. The study also confirms length of stay and severity of disease as 2 of the significant predictors of readmission. Their data provide several additional important findings concerning the independent actions of their physician participants, demonstrating the variability inherent in a complex system composed of autonomous acting agents. They found most (54.4%) in-house providers did not attempt to directly communicate with the outside physician as part of the discharge process. Many contributing reasons are postulated, but primarily there was an expectation on the part of staff providers that the written discharge summary was sufficient. This decision identifies another unanticipated variable concerning what quality control measures or standards as to content and comprehensiveness were applied to these summaries on which the physicians based their decision.

To pursue this line of reasoning that the occurrence of a readmission, an unintended outcome, is the result of a series of complex interactions by multiple agents, it is necessary to identify the factors/interactions involved. A short list includes the severity of a patient’s underlying illness, the quality of care delivered at all stages, staffing levels, continuity and coordination of care across the delivery spectrum, multiparticipant communication, and assessment of all resources available in the environment into which the patient is discharged. This complex combination of agents and their interactions may be the reason why several large meta-analyses have failed to demonstrate significant changes in readmission rate following various limited interventions. Hansen et al, in a systematic review, evaluated predischarge and postdischarge interventions and bridging interventions for continuity of care and was unable to confirm that any single intervention implemented alone had an effect on readmission rates. In contrast, 2 programs whose design demonstrates an appreciation of multiple agents and complex interactions have been successful in reducing readmission rates. The Re-Engineered Discharge program developed at Boston University and funded by the Agency for Healthcare Research Quality is available for general use in the form of a web-based toolkit adaptable to site-specific conditions (http://www.bu.edu/fammed/projected). At the University of California, San Francisco, a multifaceted comprehensive integrated approach linked to an active hospital patient safety program reduced hospital readmission for elderly patients with heart failure by 46% during a 2-year period.

Recommended established interventions are clearly resource-intensive in terms of time, people, and finances. A well-designed survey of 537 hospitals participating in the Hospital to Home program focused on the range and prevalence of individual hospital participation using 10 key practice recommendations for patients with congestive heart failure and acute myocardial infarction. Marked variability was noted in extent of utilization of the defined program practices with an average use in hospitals of 48.8 of 10 practices and less than 3% of hospitals using all 10. Resource availability was an important contributing factor to the number and specific practices implemented. The ability to initiate and sustain a readmission risk intervention program based on resources is increasingly important, since a recent assessment of the contribution of patient cohort socioeconomic and other social factors noted variable effects on increased risk of readmission in general and for patients with congestive heart failure and pneumonia. These findings are of particular concern on the basis of evidence that the proportion of “safety-net” hospitals potentially subject to the payment reduction may be disproportionally higher because of the populations they serve.

The societal and personal costs in terms of health and finances related to hospital readmission are significant. Current literature about risks associated with readmissions provides a spectrum of criteria necessary to identify specific cohort populations of patients at risk. The use of proven interventions applied through a complex adaptive system approach has demonstrated success in individual environments. High-quality health service research science studies will be necessary to develop and validate this complexity science-based approach for broader application. The magnitude of the problem warrants this effort.

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