Leveraging Advanced Analytics
to Successfully Reduce Hospital **Readmissions**

Executive Summary

"Que sera, sera. Whatever will be, will be. The future's not ours to see." These lyrics from the famous song recorded by Doris Day in the late 1950s have resonated with listeners for decades. Finally, though, many are starting to believe that it now is possible to predict the future. The notion is one that has piqued the interest of many. Even hospital leaders.

Fortunately, the emergence of predictive analytics is making it possible to get an accurate picture of the future. Indeed, progressive healthcare organizations are finding that applying advanced analytics to data can result in the sophisticated predictions, effective programs and targeted interventions that will improve care – and ultimately reduce unnecessary readmissions. The utilization of this technology is likely to make patients and their families happy. But that's not all. Using predictive analytics to reduce readmissions can have an impact on a healthcare organization's bottom-line, as providers in many countries are now facing monetary consequences from payers that have tied financial penalties directly to unwarranted patient readmissions.

The fall-out: Healthcare leaders are no longer dismissing the thought of predicting the future as a romantic notion but instead are latching on to powerful predictive analytic solutions that can enable their organizations to quickly and effectively implement programs that will result in vastly improved care and the reduction of unnecessary readmissions.

Readmissions Reduction

The goal of a hospitalization is to treat the patient and get him back to the ordinary fold — home, work, recreational activities. When the patient winds up back in the hospital less than 30 days after being discharged, family members, clinicians and hospital administrators alike are apt to ask the same question:

What went wrong?

Indeed, nobody wants patients to boomerang back into the hospital. It's stressful and frustrating for all involved. And, it adds costs to the equation, another source of concern for patients, providers, payers — and for entire countries as the universal struggle to produce high-quality outcomes at a low cost is well documented.

The problem, however, is one that has been looming over the healthcare industry in many countries for a long, long time. Often recognized as a quality barometer, healthcare organizations around the globe frequently target unplanned hospital readmissions as a problem worthy of significant attention.

Of course, the expense associated with hospital readmissions adds to the motivation to address the issue. In the United States, hospital readmissions costs Medicare $15 billion to $18.3 billion annually, as approximately 18 percent to 20 percent of Medicare beneficiaries are readmitted to the hospital within 30 days of their original discharge, and another 33 percent are readmitted within 90 days.

Even though healthcare organizations have been coping with a cascade of clinical care, patient satisfaction and financial pressures to reduce readmissions for many years, progress toward a solution has been slow. Consider the following: A study conducted by the Dartmouth Institute for Health Policy and Clinical Practice, found little change in 30-day readmission rates in U.S. hospitals over a five-year period ending in 2009, regardless of the cause of the initial hospitalization. Readmission rates after surgery were 12.7 percent in both 2004 and 2009, while readmission rates for medical conditions rose slightly to 16.1 percent in 2009 from 15.9 percent five years before (see figure 1).

"For a long-standing and well-recognized problem, not much progress has been made," said Dr. David Goodman, the study's lead author and a principal investigator for the Dartmouth Atlas Project.[1]

In an effort to spin the wheels in the direction of a solution, some national health systems have begun to tie payment penalties to unwarranted readmissions. In the U.K., for example, in 2010 the National Health Service began to impose financial penalties such as non-payment upon hospitals when patients were readmitted within 30 days of their original discharge.

Similarly, in the United States, the Patient Protection and Affordable Care Act (PPACA) is directly tying financial penalties to hospital readmissions. Under health reform, the federal government can withhold a portion of Medicare payments to hospitals that have excessive 30-day readmissions rates. Starting October 1, 2012, the government began to withhold one percent of base Medicare reimbursement from hospitals with excessive readmissions. In 2013, the penalty jumps to two percent of base Medicare reimbursements, then three percent the next year.

According to a report published in *Kaiser Health News*, with the government withholding Medicare reimbursements, more than 2,000 hospitals were expected to be penalized starting in October. In total, these hospitals were expected to lose about $280 million in Medicare funds because many of their patients were envisaged to be readmitted within 30 days to the same hospital that recently discharged them.

Even though it's still early in the game, the threat of reduced reimbursement has not been able to move the readmissions needle much. According to Medicare data released in July of 2012, hospitals were still making little progress in the quest to reduce readmissions.

"We've put all of this policy effort into this area, and yet we're seeing no movement," said Ashish Jha, a professor at the Harvard School of Public Health. "Either we have no idea how to really improve readmissions, or most of the readmissions are not preventable and the efforts being put on it are not useful."[2]

Figure 1: Change in 30-day readmission rates following discharge for six causes of hospitalization, 2004 to 2009

Condition	Percent Readmission 2004	Percent Readmission 2009	Relative Change (%)	Absolute Change (%)
Medical	15.9	16.1	1.2	<0.5
Congestive heart failure	20.9	21.2	1.4	<0.5
Acute myocardial infarction	19.4	25.3	-4.6	-0.9
Pneumonia	15.1	15.3	1.7	<0.5
Hip fracture	14.3	14.5	1.4	<0.5
Surgical	12.7	12.7	<0.5	<0.5

Source: Dartmouth Institute for Health Policy and Clinical Practice

A more definite definition

Therein lies the initial rub. While the push to reduce re-admissions has been around for many years, consensus on the issue is hard to come by as some industry thought leaders contend that readmissions cannot or should not be avoided. A report from the American Hospital Association, for example, points out that there is grey area regarding what constitutes a "preventable" readmission. As such, highlighting readmission rates as a quality of care indicator and reducing payments based on such measures might not prove to be a fair or useful tactic, according to the report.

"Payment penalties intended to shrink readmission rates could exacerbate inequities and leave hospitals with fewer resources to make needed investments in improving patient care," states the report. "Further, misaligned policies could direct hospitals to reduce readmissions that are appropriate for safe patient care and may actually save lives."[3]

Analytics can enable healthcare organizations to definitively navigate this slippery slope, though. Healthcare organizations can leverage data analysis to accurately define what constitutes a "preventable" readmission and what qualifies as an "expected" readmission.

For example, a study of spine surgery patients illustrates how analytics can move healthcare organizations beyond the standard method used to calculate readmission rates. Researchers examined the records of 5,780 spine surgery patients treated at the University of California San Francisco Medical Center between October 2007 and June 2011, and found that, under the standard readmission formula, 281 patients were readmitted within 30 days of discharge. However, through analytics the researchers discovered that 69 of these readmissions (25 percent) were not preventable. These included 39 cases that were planned readmissions for staged procedures, 16 cases that were unrelated to spine surgery and 14 cases that were cancelled or rescheduled due to unpreventable reasons.

"Our analysis identified potential pitfalls in the current calculation of readmission rates and highlights the need for defining a clinically relevant algorithm that accurately calculates readmission rates in spine surgery," the study reported.[4]

Leaning on advanced analytics

Defining what constitutes a potentially preventable readmission is just a first step, though. In fact, advanced analytics can move the readmissions needle in the right direction in many other ways. Advanced analytics provides algorithms for complex analyses of either structured or unstructured data (see figure 2). It includes sophisticated statistical models and other advanced data mining techniques that can be used to find patterns in data.

Advanced clinical analytics can be used to:

Prioritize which conditions should be targeted for readmissions prevention. Typically, healthcare organizations are dealing with limited resources. By leveraging advanced analytics, organizations can identify which conditions are the best candidates for quality improvement initiatives. Such analysis would take into account the cost of the interventions required to have an impact on readmission rates, compared with the total revenue reductions that a hospital would experience if readmissions rates land them in the bottom quartile, subjecting the hospital to financial penalties as prescribed by the PPACA.

Hospital leaders can then forecast the respective readmission rates and identify causal drivers for those conditions that have too many readmission cases. In addition, advanced analysis can shed even more light on the situation by identifying which conditions are expected to trend higher than the accepted threshold and then actually pinpointing the specific causes of the readmissions, making it possible to construct targeted and effective interventions. With this level of analysis, the healthcare organization can determine where it can best spend its quality improvement dollars for the greatest return.

Determine what patients are most in need of and most open to readmissions prevention. Healthcare leaders often lament the fact that many of their patients return to the hospital because the patients do not comply with dis-

Figure 2

Integrated Data: Key to Readmissions Reduction Success

Leaders at Crouse Hospital, Syracuse, NY, realized that access to data is key to effectively improving quality and reducing readmissions.

The problem: Data was often located in many disparate locations — and difficult for frontline caregivers to access and utilize. Leaders turned to SAS to help bring this data together — and turn it into the valuable intelligence that can be used to drive improvements.

Here are just a couple of examples illustrating how the hospital is relying on data analysis to improve readmissions rates:

Reducing post-surgical infections. Because studies suggest that one way to reduce post-surgical infections is to find out which patients have staph colonization before undergoing surgery, Crouse began screening and treating patients for existing staph colonization prior to hip procedures. As a result, the hospital was able to reduce post-surgical site infections by 60 percent.

Identifying the likelihood of unplanned readmissions. Analytics was also used to study patient severity to reduce unplanned readmissions. The analysts studied which factors — such as pre-existing conditions, age and reason for stay — were most highly correlated with a readmission. This information can then be used to develop a predictive model to identify those high-risk patients on admission to help avoid readmissions.

charge plans (e.g. not filling the prescriptions they get or adhering to appropriate diets). As such, it's important for healthcare organizations to understand the social context of individual patients. An in-depth analysis of socioeconomic and behavioral, consumer-based data can help organizations understand where patients come from – and then enable organizations to target patients with the most appropriate interventions. (see figure 3).

Move from a reactive model to a proactive readmissions prevention model. Currently, most readmissions prevention is performed retrospectively. Leaders examine data and determine which types of conditions and patients should be targeted with readmissions interventions. Then improvements in care transitions or patient education are implemented across large patient populations. With advanced analytics, leaders can proactively implement these interventions by analyzing readmission risk before, during and after hospitalization. Clinical leaders can look at individual hip replacement patients and anticipate or predict the readmission risk before they get to the surgical suite,

allowing them to focus their preventative efforts on the most at-risk patients.

Provide individualized readmissions prevention services. Typically, healthcare organizations use broad brush strategies to address readmission. For example, care transition programs are initiated where the same interventions are implemented for 100 percent of the patients. With more advanced analyses in place, clinicians can flag specific patients for specific interventions. The individualized plans can then be integrated into the organization's care management program. As such, different types of tools and health 2.0 applications can be used for each individual patient. For example, the analyses could reveal that heart patients more than 60 years old should receive daily phone calls to prompt certain rehabilitation actions, while those under 60 years of age will respond more favorably to SMS messaging.

Evaluate what works and what doesn't. With advanced analytics, healthcare leaders can evaluate what interventions are working and then fine tune interventions in real time for certain types of patients. For example, the analysis could drill down to evaluate what works for elderly patients who are diabetic, are members of a certain socio-economic group, have heart failure and live in a certain region.

Although the desire to reduce unwarranted readmissions has plagued the healthcare industry for quite some time, provider organizations made little real progress – until now. Indeed, recognizing readmission rates as a potential quality indicator and realizing that returning patients add costs to the overall care equation prompted many healthcare organizations to consider taking action. When payer organizations began to tie financial penalties to readmissions, providers began to more intently focus on the issue – but they experienced much frustration as they were not able to have much of an impact on readmissions reduction. The emergence of advanced predictive analytics, however, is acting as the watershed force – as such tools are proving that it is, indeed, possible to predict the future – and then take action to have a positive impact on what happens.. By leveraging advanced predictive analytics, leaders at healthcare organizations are reliably making the very specific improvements that will help them to ultimately reduce hospital readmissions and improve overall care delivery.

Figure 3

Blue Cross and Blue Shield Identifies the Right Patients

Blue Cross and Blue Shield of North Carolina (BCBSNC) realized that hospital readmissions is a problem to be reckoned with. The problem: Finding the right patients in time to help them.

"Our nurse case managers told us we were flagging patients for intervention often when it was too late – a readmission had already occurred," explains Daryl Wansink, BCBSNC Director of Health Economics.

To accurately predict and intervene, BCBSNC analyzed all its data on hospital readmissions to find patterns that could provide a much more nuanced and more timely system to identify high risk patients. The insurer discovered about 35 predictors – details like whether a patient had prior admissions or certain types of chronic conditions that indicate frailty – that were robust indicators for readmission potential.

The model doesn't simply look at prior claims history – that was a part of the crude method the insurer previously used. Instead, it looks at what a patient is currently being admitted for and combines that with their claims history. For instance, a patient with diabetes, peripheral vascular disease and hypertension might be at very high risk of readmission following an in-patient stay for heart attack – but at much lower risk for readmission following an in-patient stay for a viral infection. The more timely data is gathered from authorization data in a real-time operational system, rather than waiting for a claim to be submitted and loaded into the data warehouse.

By looking at all causes for readmissions and the data from the authorizations, the model correctly beat chance by 400 percent in identifying at-risk patients. Ongoing modeling efforts will improve predictive power by using more advanced ensemble modeling techniques and incorporating data from discharge surveys for patients.

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