Monitoring Performance Improvement Using Decision Support Systems

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The increasing use of clinically integrated decision support systems is creating new opportunities for HIM professionals. Here's a look at how such a system was used by one team to monitor performance improvement activities.

One of the top forces driving data automation in healthcare today is the need for comparative performance measurement databases. Such databases are now based on industry-wide mandates and reflect a need for the quantitative assessment and tracking of clinical data through the integrated use of decision support systems in day-to-day healthcare delivery. The implementation of such systems is now a requirement for accreditation by the Joint Commission on the Accreditation of Healthcare Organizations and the National Committee for Quality Assurance.

HIM professionals are becoming the preferred experts to fill career openings in this area, given their unique skill sets that combine medical terminology and data management skills with high-capacity information systems experience. Such career roles as data resource administrator, research analyst, and clinical data specialist lend themselves perfectly to positions involving the implementation and management of decision support systems.

This article shows how performance management is achieved through a data-driven decision support process that examines one surgical procedure. In a stepwise fashion, it highlights the key tasks and indicators that HIM professionals must examine when managing a decision support system.

Background

An integrated decision support system can serve a multitude of clinical research, financial performance, and marketing development activities. In this article, such a system aids a cardiac surgery team's performance improvement activities. The system allows the team to monitor clinical care goals, identify departures from the goals, and evaluate clinical interventions implemented to get the program back on track.

In the case of the cardiac surgery team, the "system" is not a single entity. This team has drawn on an ensemble of resources: M&R recommendations, Summit National Cardiac Database mortality complication standards, and QuanTIM Performance Measurement System statewide comparisons for risk-adjusted mortality and standardized cost and length of stay. The latter two resources were pivotal in establishing initial targets and monitoring and evaluating success of interventions. The team, therefore, relies on the combination of data and information to keep its performance improvement initiative on track.

The cardiac surgery team practices in a 527-bed tertiary care facility in the northeastern part of the US. The facility has an active cardiac surgery program, and the program uses an interdisciplinary, systematic team approach to quality improvement initiatives. Team members include a cardiac surgeon, an anesthesiologist, a nurse, a perfusionist, outcomes management staff, and a financial manager.

Getting Started

The team uses data three ways for decision support. First, the data is used to track trends and identify variations in care. Changes over time in the rates of monitored events and large variation among providers within a reporting period have implications for quality management. The data provides a basis for making decisions for performance improvement initiatives

and a system for ongoing feedback. And data within the decision support system allows for comparing internal data with external benchmarks.

Three years ago, the cardiac surgery team of Meridian Health System, with the help of the outcomes management staff, established a series of targets for monitoring patients' outcomes. The "value compass" concept is incorporated into quality improvement projects at Meridian. Tools for satisfaction and health status are used as well as targets for clinical and cost outcomes, the subjects of this article.

Table 1 -- *Target Values, Pre-Implementation Values, and Post-Implementation Values for CABG Patient Indicators*

Indicator	Target	Pre-Implementation	Post-Implementation
ALOS (days)	5	11.1	9.5
Direct cost per case	$7,701	$14,000	$12,800
Mortality	2.0%	6.1%	2.4%
Overall complication rate		43.7%	37.0%
Sternal infection rate		5.4%	4.2%

The targets were based on internal and external data as well as professional judgment. Outcome indicators have been developed for several aspects of surgical cardiac care, including mortality, complication rates, costs per case, and average lengths of stay. The subset of cardiac surgery patients presented in this case study are those who had coronary artery bypass graft (CABG) surgeries, defined by three New York state Version 9 DRGs. The DRGs are 106 (CABG with cardiac catheterization), 107 (CABG without cardiac catheterization), and 546 (CABG with major complications).

Selecting Targets

The team selected targets based on realistic goals or benchmarks based on best practices. For cost and length of stay, the team reviewed Miliman and Robertson (M&R) length of stay recommendations. They also reviewed statewide and peer group cost and length of stay standards contained in the QuanTIM Performance Measurement System comparative database. The target average length of stay target, set at five days, was a compromise between the aggressive M&R recommendations and current practice.

Cost targets were linked to expected decreases in length of stay, reduction in ancillary usage, and supply standardization. The cost for the days patients would not be in the hospital was estimated and served as the basis for a targeted 10 percent average cost reduction. The cost target for all CABGs was set at $7701.

The team used the Summit National Cardiac Surgery Database as a source of data for establishing mortality and complication rate targets. The mortality benchmark among CABG surgery patients is about 4 percent and, for elective cases, less than 2 percent. An aggressive mortality target of 2 percent was adopted.

Tracking and Trending

The team documented baseline performance and began to monitor progress toward meeting the targets. After an initial period of stabilization, members identified a trend in which increasing mortality was correlated with increasing cost and length of stay. During the first 15 months of the study, CABG mortality was 6.1 per 100 surgeries, average length of stay was 11.1 days, and average (direct) cost was about $14,000. In addition, the cardiac surgery complication rate was 43.7 per 100 surgeries, and the sternal infection rate was 5.4 per 100 surgeries. Thus, the problem became the identification of unfavorable variation.

The team's first thought was to manage complication rates to bring about the desired impact on the clinical targets. Surgical complications have been reported to contribute more to total expenditures for CABG than baseline patient and clinical characteristics.[1] Thus, reducing the frequency of post-operative complications should lead to cost reductions.

However, drilling further into the data and reviewing the study of primary cause of death proved to be a significant source of insight. It led to the development of protocols for management of low cardiac output failure.

Actions Taken in Response to Unanticipated Outcomes

The team then articulated an aim -- to address unfavorable variation, select measures to know if improvement occurred, select changes, plan implementation (who, what, and when), and review indicators six months after implementation. Pre-implementation indicator values appear in Table 1 along with the targets.

The aim was to reduce the cardiac surgery mortality rate by identifying the primary cause of death. The selected measures were mortality rate, primary cause of death, direct cost per case, and average length of stay. The changes, once primary cause of death was known, were to revamp the preoperative risk estimation process and develop protocols for management of primary cause of death.

Another question was whether patients who died were more likely to die based on cause of death. A tool published by the Northern New England Cardiovascular Disease Study Group helps to identify the primary cause of death. It has correlated the cause of death distributions with opportunities to improve outcomes, including overall mortality.

The primary cause of death, based on the Northern New England Cardiovascular Study Group tool, was documented by the team from July to December 1996. The results pointed to low output failure as the most frequent primary cause of death (60 percent of cases). Other causes monitored were primary respiratory failure (18 percent of cases), stroke (no cases), post-operative bleeding (9 percent of cases), ventricular arrhythmia (no cases), and other (13 percent of cases).

Pre-operative Risk Estimation Processes

One of the initiatives at the outset of the target setting process was to risk adjust patients pre-operatively. Three pre-operative risk estimation processes were initiated. The first, to answer the question of whether the appropriate patients were receiving CABG surgery, was incorporating the use of the Parsonnet worksheet,[2] which scores comorbid characteristics of the patient. The tool enables the clinician to score patient demographic characteristics as well as chronic and acute medical conditions. Some of these are, for example, gender, age, weight, diabetes, hypertension, ejection fraction, pre-operative IAPB, and so on. The risk values are added to obtain an estimate of the operative risk in percent probability of mortality within 30 days of cardiac surgery.

Table 2 -- *Trends in CABG Patient Target Indicator Changes*

	Prelim vs. First Six Months	**Prelim vs. Second Six Months**
Direct cost per case	9.8%	15.3%
ALOS	14.5%	-2.0%
Mortality	60.7%	57.7%

The second process initiated for pre-operative risk estimation was obtaining second opinions for patients whose Parsonnet risk tool scores were greater than seven. Thus, additional review of those cases would improve the measure of appropriateness for proceeding with the procedure.

The third process of pre-operative risk estimation that was implemented was an anesthesia evaluation of patient hemodynamics. This assessment provides additional information about the patient's potential physiological response to surgery generally and anesthesia in particular.

Development of Protocols

Per the American College of Cardiology, protocols were developed for management of the primary cause of death (e.g., low output failure). The protocols are specific for the three classes of post-operative failure. For example, intra-aortic balloon pumps are to be used for Class II and III patients and ventricular assist devices for Class III patients. The intensive coordination required to implement the protocols led to hiring a surgical intensivist.

Improvements Identified

Post-implementation evaluation entailed review of measurements of performance improvement initiatives at six months and one year. Selected changes in mortality, cost, length of stay, and complication rates were documented using the QuanTIM Performance Measurement System. As can be seen in Table 1, changes in the rates of outcome indicators have been positive. Cardiac surgery complication rates fell 15 percent from 43.7 per 100 to 37.0 per 100 surgeries, while sternal infection rates decreased 21 percent from 5.4 per 100 to 4.2 per 100 surgeries. Cost decreased by 10 percent from $14,200 to $12,800. Similarly, length of stay decreased by 15 percent, from an average of 11.1 days in the pre-implementation period to an average of 9.5 days in the post-implementation period. In-hospital mortality decreased the most dramatically, 61 percent, from 6.1 per 100 surgeries in the pre-implementation period to 2.4 per 100 surgeries in the post-implementation period.

As noted earlier, a direct interrelationship among cost, length of stay, and mortality was observed between baseline and pre-implementation measurements. That is, they all moved in the same direction from one measurement to the next. That relationship was preserved in the changes between pre-implementation and six months post-implementation (see Table 2). In the second six months following implementation, cost and mortality have continued to track each other, but length of stay does not. The average length of stay in the post-implementation period is as long as it was in the pre-implementation period. This trend may be explained in part by changing practices associated with decisions to discharge patients as soon as possible. Longer stays have not been associated with either increased cost or increased mortality -- rather, the opposite is true. Thus, the team is considering these interrelationships in setting future targets for all outcomes.

Mortality Risk Adjustment Models

In addition to monitoring observed outcome trends, the cardiac surgery team can review expected mortality and peer standardized length of stay and cost. Risk-adjusted mortality and length of stay and cost standardization models are resident in the QuanTIM Performance Measurement System. These adjustments allow the team to consider severity of their cases relative to other practitioners and programs statewide.

Table 3 -- *Observed and Risk-Adjusted Mortality Trends*

Quarter	Observed	Expected	Risk-Adjusted*
pre05	6.34	4.11	6.05
pre04	3.70	4.79	3.03
pre03	5.23	3.78	5.42
pre02	3.13	4.20	2.92
pre01	6.87	5.27	5.11
post01	0.83	3.08	1.06
post02	2.65	3.73	2.78
post03	2.65	4.85	2.14
post04	2.52	4.69	2.11

**Based on statewide rate of 4.51%*

Based on the mortality risk adjustment models, the expected mortality was lower than the observed mortality for three out of five quarters in the pre-implementation period (see Table 3). When observed mortality was highest, it was expected to be lower. In four quarters since implementation of the pre-operative risk assessments and post-operative protocols, the expected mortality has always been greater than the observed mortality. The lower observed mortality is even lower than expectations. This trend translates into a consistent decline in risk-adjusted CABG mortality of more than 65 percent between end of first quarter 1996 and end of first quarter 1998. It also signals breakthrough performance that has resulted not only in declining observed mortality, but also decreasing risk-adjusted mortality as well.

Changes in Primary Cause of Death

By documenting and tracking primary cause of death, the team was able to demonstrate changes in the distribution of primary cause of death subsequent to implementation of post-operative protocols. While low output failure continued to be the most frequent primary cause of death (44 percent), it accounts for a smaller proportion of deaths (formerly 61 percent). Emerging primary causes include CVA/neurological events (25 percent) and ventricular arrhythmia (8 percent).

Discussion

Using clinically integrated decision support systems in facilitating departmental performance improvement has many implications -- clinically, financially, and marketing focused. In this case, first and foremost, the system helps the cardiac surgery team get results. As a tool, it can help performance improvement teams accomplish many tasks, including:

- identifying potential projects among aspects of care through trend and comparative analysis
- allowing clinicians and outcomes managers to drill down to identify cases for review
- benchmarking, defining best practices, and setting outcome targets
- documenting baseline performance
- monitoring progress subsequent to interventions
- evaluating success of interventions
- developing future targets

Demonstrating the Cost/Quality Relationship

In this case study, an inverse relationship between cost and quality has been demonstrated -- that is, cost decreased as survival increased. This relationship ties back to the clinical and cost components of the value compass as well. The relationship was facilitated through the use of a clinically integrated decision support system. Not only is evaluating results of an intervention important, the results themselves provide support for quality improvement and the use of clinically integrated decision support systems.

There are corporate implications as well. Healthcare providers must frequently develop sophisticated data analysis and reporting strategies to respond to cost and utilization accountability demands.[3] The impact of these pressures has been an increased need for and use of decision support systems. Used correctly, these systems can facilitate effective clinical use of outcomes data and improve clinician and organizational performance.

Notes

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