PEAK SOFTWARE SOLUTION BRIEF

Peak Control Charts

Applying Statistical Process Control Methods to Improve Clinical Performance

Clinical variation has a huge impact on quality and cost, but a recent national survey conducted by Kaufman Hall revealed that fewer than 40 percent of hospitals and health systems are addressing it as part of current improvement efforts. Lack of good data and insight was cited as the primary impediment.

In the effort to help solve this problem, Kaufman Hall's Peak Software team has found inspiration in a methodology that has proven effective in manufacturing for nearly a century.

With a 90-year history of helping streamline manufacturing processes, statistical process control (SPC) has become increasingly sophisticated in its ability to identify opportunities for process improvement. By using existing data, SPC can perform real-time or historical analyses to focus on root causes of failure or trends in batch variability, allow for real-time corrective actions and measure the effectiveness of adjustments.

New advanced Control Charts within the Peak Software system are providing health system leaders with the ability to apply SPC methods to improving clinical performance.

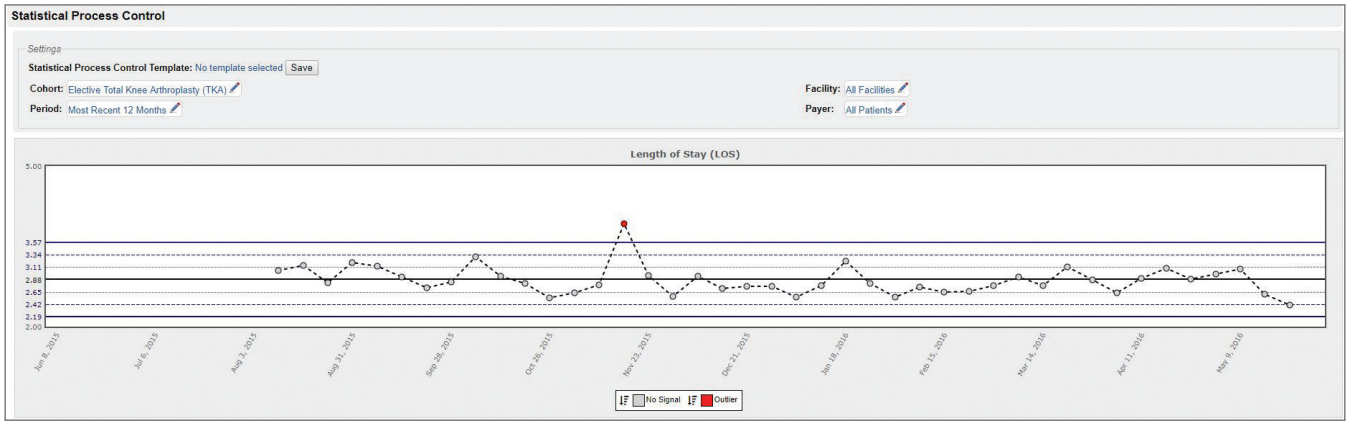
Driving Greater Consistency in Performance Evaluation

Before the result of a process can be reliably improved, it must be consistent. Peak Control Charts address this issue by developing a common understanding of the different types of variation that relate to a particular measure:

- ***Common Cause Variation*** – Variation that is inherent to the process – attributing it to specific events or people may be counterproductive
- ***Special Cause Variation*** – Variation that is not inherent to the process, but rather assignable to a specific cause

Peak also takes into account a form of variation that is a reality in medicine and not traditionally addressed in SPC – External Variation. External Variation is not an inherent part of the process or assignable to any cause that the hospital can correct. For example, weeks with low volume are more vunerable to outliers when averaging measure values over weeks.

Length of Stay Control Chart: Elective Total Knee Athroplasty Cohort



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As illustrated on the first page, Peak Control Charts empower analysts with an easy to understand, graphical representation of variation. The center line is calculated from the data, and it represents the central tendency of the process (calculated as the mean). Control limits, also calculated from data, estimate typical variation (calculated as the empirical standard deviation).

Working together, data points, the center line, and the control limits alert the user of special cause variation.

Leveraging CMS Cohorts

Organized around clinical condition cohorts defined by CMS that are further risk adjusted using Peak methodology, SPC helps ensure a clinically homogenous set of patients for process improvement. For each cohort, Peak has defined relevant measures for control charts as well as adverse events (complications) for analysis (not traditionally part of SPC).

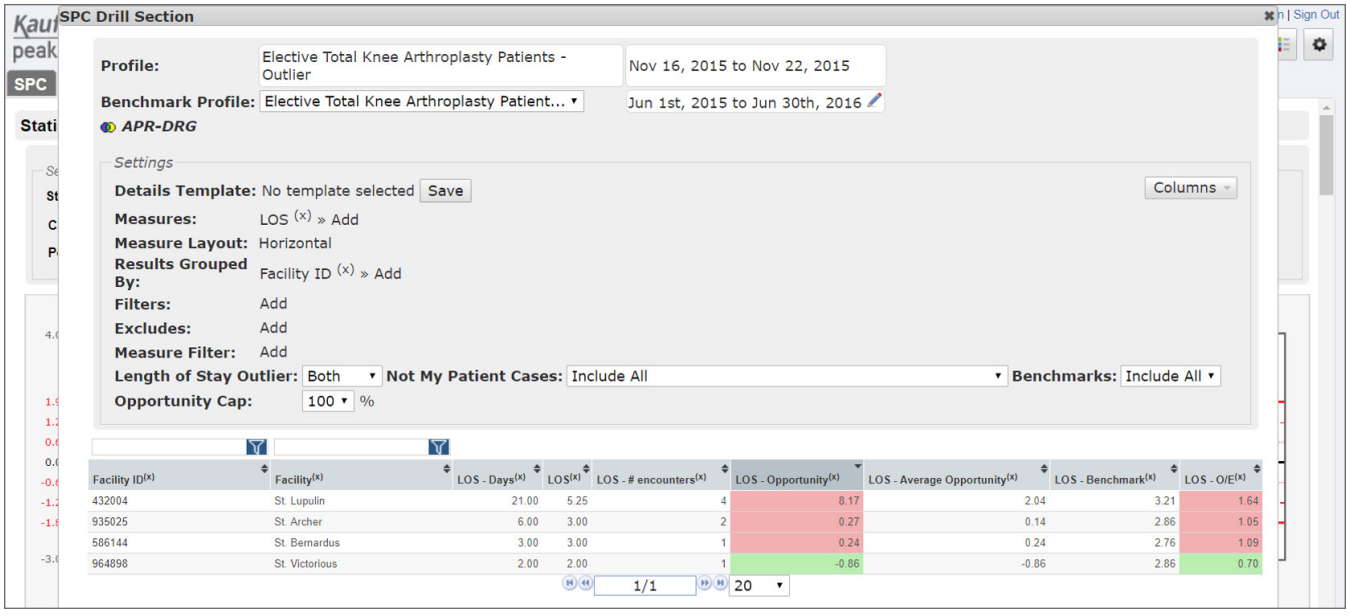
Peak's SPC analytics have logic built in that displays an appropriate control chart for each measure that includes severity, risk and volume adjustment specific to each measure and cohort.

Relevant metrics are assigned for each cohort, with drill capabilities for further analysis, as illustrated below.

Peak Control Charts address 22 of the highest volume and highest cost cohorts:

- Elective Total Knee Athroplasty
- Elective Total Hip Athroplasty
- Total Hip Athroplasty for Hip Fracture
- Coronary Artery Bypass Grafting
- Percutaneous Coronary Intervention
- Medical treatment of Acute Myocardial Infarction
- Open Heart Valve Procedures
- Cardiac Defibrillator Procedures
- Permanent Pacemaker Procedures
- Heart Failure
- Vaginal Birth
- C-Section
- Spinal Fusion Except Cervical
- Combined Anterior/Posterior Spinal Fusion
- Cervical Spinal Fusion
- COPD
- Pneumonia
- Ischemic Stroke
- Laparoscopic Appendectomy
- Open Appendectomy
- Laparoscopic Cholecystectomy
- Open Cholecystectomy

Length of Stay Drill Detail: Elective Total Knee Athroplasty Cohort



Cohort use expands outside of SPC and can apply to other analytics within Peak, which helps maintain a holistic approach to performance improvement across each cohort.

Why Peak Control Charts Use Risk Adjustment

As discussed earlier, control charts help a user differentiate between common cause variation and special cause variation. Signals in a control chart are patterns in the data that would occur with very low probability under the assumption the measure values are exchangeable – that is, the process producing the measure values is in control.

Peak Control Charts are built on outcome measures for encounters, aggregated by week. Since no two patients are the same, and volume per week can be subject to variation that a facility cannot and should not try to control, the unadjusted data points are not expected to be exchangeable — even if the process of care for the patients is in control. The weekly means plotted on Peak control charts are therefore adjusted for risk, severity, and volume in order to achieve the default assumption of exchangeability so that signals computed on a control chart are more likely to reflect real special cause variation rather than external variation that is not actionable.

How Peak Statistical Process Control Risk Adjustment Works

Risk adjustment in SPC is specific to each client, cohort, and key measure. Your data is not used for any other client's risk adjustment and no other client's data is used for yours. For each cohort and key measure, Peak Control Chart functionality looks at the list of Present On Admission (POA) diagnosis codes and the list of coded procedures for every encounter. These ICD-10 codes are cross-walked to their Agency for Healthcare Research and Quality (AHRQ) Clinical Classification Software (CCS) Categories. Diagnosis CCS Categories are further divided into Major Complication or Comorbidity (MCC) diagnoses, Complication or Comorbidity (CC) diagnoses, and other diagnoses and CCS Procedure Categories are further divided by Healthcare Cost and Utilization Project (HCUP) procedure class. Each of these categories is a risk variable that is either present or absent on each encounter. Age, gender, payer, and facility for each encounter are also included as risk variables.

The measure value for each encounter, along with the risk variables are fitted using a logistic regression for binary measures and linear regression for non-binary measures. In both cases, the regression also uses the Least Absolute Shrinkage and Selection Operator (LASSO, also called L1 regularization) to perform parameter selection while the model is fitted. This is necessary because of the large number of candidate risk variables used in the model. Peak Control Chart functionality utilizes each encounter's predicted value per the model, and this value is coupled with the cohort's mean value for the measure to compute a risk-adjusted value. Each weekly mean is then further adjusted for weekly volume in order to prevent outliers from being drowned out in high volume weeks.

The overall risk adjustment algorithm is similar to the risk adjustment performed by The Centers for Medicare & Medicaid Services (CMS) for readmission measures. It should correct for conditions and procedures consistently associated with different outcomes within a cohort and for variation in the weekly mean from changes in volume.

How to Use and Interpret Peak Risk-Adjusted Values

Peak Control Charts are meant to be a monitoring tool and, if necessary, the beginning of an investigation. The purpose of the risk adjustment is to provide more useful signals on a control chart to more effectively target investigations. A risk-adjusted measure value is not a substitute for chart review.

To learn more about Kaufman Hall's Peak Software for managing clinical performance, visit **www.kaufmanhall.com/peak**.

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