iSixSigma Case Study

Reducing Delays in the Cardiac Cath Lab with Six Sigma: An iSixSigma Case Study

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Hospitals are pursuing strategies such as Six Sigma to improve throughput, maximize equipment utilization and increase efficiency. New York-Presbyterian Hospital recently embarked on an initiative to improve throughput in its three cardiac cath labs.

By [Sylvia Konopka, Margaret Millar, Bernadette O'Brien and Marie Weissman](http://www.isixsigma.com/index.php?option=com_k2&view=item&id=78:reducing-delays-in-the-cardiac-cath-lab-with-six-sigmaan-isixsigma-case-study&Itemid=156#author)

Cardiac catherization labs represent a significant capital investment for many hospitals. Realizing a return on this investment is increasingly challenging, given the introduction of advanced technologies and limitations in reimbursement. To meet the challenges and maintain fiscal health, hospitals are pursuing strategies such as Six Sigma, Lean and change management techniques to improve throughput, maximize equipment utilization and increase efficiency.

New York-Presbyterian Hospital recently embarked on a comprehensive initiative aimed at improving throughput in the cardiac catherization labs at the Columbia University Medical Center, New York Weill Cornell Medical Center and Children's Hospital of New York-Presbyterian sites. Continually striving for excellence, New York-Presbyterian Hospital was recognized this year as one of the top 10 hospitals in the United States, according to *U.S. News and World Report's* 2004 ranking of best hospitals.

The improvement initiatives at New York-Presbyterian focused on the various sub-cycle times impacting throughput - including case start time, room turnaround time and patient prep time.  As a result of these multiple projects, the hospital gained 312 hours of procedure time without incurring any additional capital expense. An overview of one project conducted at Children's Hospital of New York demonstrates how the Six Sigma DMAIC methodology provided the framework and tools to raise departmental productivity by improving first case start times.

**The Define Phase**

Improving first case start time was selected as a project by the Children's Hospital of New York for several reasons. It contributed to a significant amount of lost productivity and failure of the first case to start on time was delaying subsequently scheduled cases. This variability in start time and lack of schedule predictability also was contributing to staff, physician and patient dissatisfaction.

A charter was developed and approved by senior leadership and a team assembled to lead the initiative. The charter provided:

* **Project Scope** - This established the parameters for the project. The start point of the cycle was patient's arrival at the hospital and the end point of the patient's entrance into the cath lab.  The charter also described areas outside of the team's scope, such as room turnaround time, which was the focus of another team.
* **Business Case and Problem Statement** - Baseline data indicated that 62 percent of the first cases were not starting on time representing 267 hours of lost staff productivity and unused procedure capacity annually.
* **Goal Statement** - A goal of 80 percent on-time starts was established.
* **Team Members** - The team for the project included the cath lab director, staff, cardiologists and anesthesiologists.  The vice president of operations served as project sponsor and oversaw the work of the team.
* **Timeline** - A timeline including frequency of meetings, dates and times was agreed upon at the team's first meeting and proved essential to keeping the project on track.

The project charter provided the team with focus and direction. The team then developed a map describing the current process.

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| Figure 1: High-Level First Case Start Process Map |

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Source: GE Healthcare and New York-Presbyterian Hospital

Completion of the process flow map pointed to one opportunity for immediate improvement - streamlining the nursing assessment. One of the department's nurses routinely calls patients the night before to reinforce pre-procedure instructions. Discussion during the process flow mapping exercise revealed some redundancy in the information gathered during this phone call and the nursing assessment completed the day of the procedure. The team agreed that initiating the nursing assessment during this phone call would eliminate duplicate data collection, and shorten the time needed to complete the assessment the day of the procedure.

**The Measure Phase**

The team used brainstorming and a fishbone diagram to identify all the potential contributors to delaying the start of the first case. Some of the factors identified included:

* Patient arriving on time
* Registration process
* Transportation
* Timeliness of patient prep
* Completion of assessments by the cardiologist, anesthesiologist and nursing

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| **Figure 2:** Brainstorming and Prioritizing Critical X's |

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Source: GE Healthcare and New York- Presbyterian Hospital

Data was then collected to identify those factors having the most significant impact on delaying the start of the first case.

**The Analyze Phase**

Regression analysis, a statistical tool used to model and predict the relationship between variables, revealed that the time in which the cardiology assessment was completed was a key driver in whether the first case would be completed on time. The R-sq adjusted value showed that it accounted for about 60 percent of the variation in the process. Here is a table showing the first case start data's statistical analysis:

|  |  |  |  |
| --- | --- | --- | --- |
| **X** | **Test** | **Results** | **Statistically Significant?** |
| Nurse | Test for Equal Variances |  p=.725 | No |
| Nurse | Moods Median |  p=.583 | No |
| Nurse | Regression |  p=.762 | No |
| Latest Assessment Time | Moods Median |  p=.432 | No |
| Latest Assessment Time | Test for Equal Variances |  p=.132 | No |
| Latest Assessment Time | Regression |  p=.177 | No |
| Anesthesia Yes/No | Moods Median |  p=.710 | No |
| Anesthesia Yes/No | Test for Equal Variances |  p=.318 | No |
| Oral Pre-Med Yes/No | Test for Equal Variances |  p=.981 | No |
| Oral Pre-Med Yes/No | Moods Median |  p=.288 | No |
| Anesthesiologist | Moods Median |  p=.389 | No |
| Anesthesiologist | Test for Equal Variances |  p=.013 | Yes |
| Anesthesiologist | Regression |  p=.625 | No |
| Patient Arrival | Test for Equal Variances |  p=.909 | No |
| Patient Arrival | Moods Median |  p=.615 | No |
| Difference vs. Card Assessment | Regression |  p=.042 | Yes |
| Time Patient on Table vs. Card Assessment | Regression |  p=0.00 | Yes |
| Difference vs. Anesthesia Yes/No | Regression |  p=.532 | No |
| Difference vs. Nursing Assessment | Regression |  p=.658 | No |

                                                               Source: GE Healthcare and New York-Presbyterian Hospital

**The Improve Phase**

The team used this information to discuss and develop plans to ensure the cardiology assessment could be completed in a timelier manner. For example, since the cardiology fellow typically initiates the cardiology assessment, the director of cardiology explored other responsibilities and obligations that might be interfering with timely completion of the assessment. As part of developing a revised process, the team also completed a new process flow map indicating a target completion time for each step in the process that ultimately would lead to the desired case start time.

As shown in the table below, re-measurement of the process indicated a dramatic improvement in the number of first cases starting on time and a reduction in variation.

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| --- | --- | --- |
| **Data Categories** | **Baseline Data** | **Improve/Control Data** |
|  On-Time First Case Start |  38 Percent |  83 Percent |
|  Baseline Z |  1.44 |  2.47 |
|  Median |  13 Minutes |  0 Minutes |
|  Mean |  38.24 Minutes |  6.33 Minutes |
|  Standard Deviation |  55.62 Minutes |  22.4 Minutes |

**The Control Phase**

Process control mechanisms were implemented to ensure the changes could be sustained, and that the gains achieved from improvement activities would not be lost over time. The control plan outlined the procedure for monitoring the critical X (completion of cardiology assessment) as well as the number of on-time first case starts. Regular reporting to the project's executive sponsor reinforced the importance of the initiative and insured that changes would become imbedded into the organization's culture.

**Conclusion: Six Sigma Method Effective**

Increased pressure on cardiac catherization labs to reduce operating expenses and maximize capacity utilization necessitates the use of innovative methods to optimize departmental performance. As demonstrated in this case example, the statistical rigor of Six Sigma is an effective method for achieving rapid organizational change with measurable positive results.

**About the Authors**

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