Six Sigma Application in Health Care

Expediting Nursing Home Discharges in a Community Hospital

Long Island Chapter of American Society for Quality

Carolyn Sweetapple, R.N., C.P.A.
Six Sigma Master Black Belt
Vice President, Finance and Business Operations
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North Shore-LIJ Health System

Key:
- Health System Hospital
- Competitor Hospital

- Vital Statistics:
  - 15 Hospitals
  - 5.4 million population served
  - $4 billion in Revenue
  - 33,000 employees
Complementary Methodology

- Integration of multiple performance improvement methodologies drives performance change at North Shore-LIJ Health System
  - PDCA
  - Lean
  - Change Acceleration Process
  - Work Out
Historical Perspective of Six Sigma Methodology in Health Care

To date, North Shore-LIJ has completed close to 100 projects and 177 employees have been trained as MBB, BB, and GB.
Challenges for Application of Six Sigma Methodology in Health Care

- Difficulty in applying manufacturing methodology
  - Unit of measure is a patient
  - Variance within the unit of analysis
  - Variability in operators (physicians) based on training and region
- Cost of implementation
- Failure to acquire automation and IT systems
- Difficulty training significant number of employees - workforce shortages
- Litigious climate/medical malpractice - sharing errors and defects
Successful Application of Six Sigma in Health Care
Successful Application of Six Sigma in Health Care
Successful Application of Six Sigma in Health Care

Radiology
Case Presentation

Expediting Nursing Home Discharges in a Community Hospital
Process for Project Selection

- Project selected by CEO based on strategic priority to reduce length of stay.
- Patients who did not go home from hospital but went to nursing home had statistically different LOS than those patients who went home.
- Impact of this extended LOS impacted throughput and patient flow.
- Impact of revenue loss due to lack of available beds and extra cost of caring for the extended stay was estimated to be close to $1 million annually.
Not All Patients Discharged To Nursing Homes Are Equal

Least Variation
Most Opportunity

19.7 days

- **LT return to nursing home**
  - N = 114
  - Mean = 10.85
  - SD = 11.33

- **Short term rehabilitation**
  - N = 248
  - Mean = 20.07
  - SD = 13.36

- **New long term placements**
  - N = 109
  - Mean = 28.1
  - SD = 29.86

Not all patients discharged to a nursing home for the same reason
**Project:**
Patients discharged to a nursing home stay in the hospital longer than a patient discharged to home.

**Customer demands:**
The greatest opportunity to reduce LOS and improve margins is for patients discharged to short term rehabilitation.

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**Tools Used:**
CTQ Tree  
SIPOC  
VOC Survey  
Kano Analysis  
Threat/Opportunity Matrix  
Team Charter

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**Process mapping with SIPOC revealed areas of bottlenecks**
*Gets team in agreement on scope of project*
**Problem Measurement and Data gathering:**
Customer set upper specification limits at 10 days.
Seven months of data (n=240) was analyzed.
Mean = 19 days
Median = 16 days
DPMO = 809,000

**Tools Used:**
SIPOC
Data Collection Plan
Measurement Systems Analysis
Process Capability

**Results:**
80% of the time we do not meet our customer’s specifications

**Descriptive Statistics**

Variable: A_LOS

- Anderson-Darling Normality Test
  - A Squared: 11.453
  - P Value: 0.000
- Mean: 19.3308
- Std Dev: 13.2682
- Variance: 176.045
- Skewness: 2.59898
- Kurtosis: 11.4119
- N: 260
- Minimum: 1.000
- 1st Quartile: 11.000
- Median: 16.000
- 3rd Quartile: 24.000
- Maximum: 111.000

95% Confidence Interval for Mu

14.5 15.5 16.5 17.5 18.5 19.5 20.5 21.5

95% Confidence Interval for Median

14.724 17.000

95% Confidence Interval for Sigma

12.217 14.518
ANALYZE

Identifying independent variables that determined CTQ behavior:
Process Analysis
Data Analysis

Tools Used:
Box Plots
Pareto
Control/Impact Matrix
FMEA
Fishbone Diagram
Process Mapping

Critical X’s
X1= Lack of criteria to screen candidates
X2= Linear process with multiple handoffs
X3= Lack of prioritization for PRI completion
X4= Inconsistent follow up process with nursing homes

Results:
Process not standardized
Process inefficient with multiple handoffs
Process Analysis

Short Term Rehabilitation Discharge Process

On paper, the process looked good but in actuality…
Chaos Reigned!

Multiple handoffs, lacked standardization, lacked criteria
Data Analysis

Key Process Components

Sub Acute Placement Process

<table>
<thead>
<tr>
<th>Event</th>
<th>USL</th>
<th>Actual</th>
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</thead>
<tbody>
<tr>
<td>Patient Referred</td>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>First SW Encounter</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>PRI Completion</td>
<td>3</td>
<td>7</td>
</tr>
<tr>
<td>Nursing Home Contacted</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Nursing Home Accepts</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Discharge Patient</td>
<td>1</td>
<td>2</td>
</tr>
<tr>
<td>Total</td>
<td>10 days</td>
<td>19 days</td>
</tr>
</tbody>
</table>

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**Process Improvements:**
Redesigned process
To include criteria/SOP

**Tools Used:**
- Brainstorming
- Future State Process Mapping
- Process Capability
- Mood’s Median Test

**Results:**
The median LOS statistically significantly improved during pilot period

**Mood Median Test: A_LOS versus when**

<table>
<thead>
<tr>
<th></th>
<th>N&lt;=</th>
<th>N&gt;</th>
<th>Median</th>
<th>Q3-Q1</th>
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</thead>
<tbody>
<tr>
<td>before</td>
<td>100</td>
<td>102</td>
<td>15.00</td>
<td>12.25</td>
</tr>
<tr>
<td>pilot</td>
<td>22</td>
<td>10</td>
<td>9.00</td>
<td>10.00</td>
</tr>
</tbody>
</table>

Overall median = 14.00

A 95.0% CI for median(before) - median(pilot): (1.00, 8.00)

Chi-Square = 4.10  DF = 1  P = 0.043

Individual 95.0% CIs

When

<table>
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A 95.0% CI for median(before) - median(pilot): (1.00, 8.00)
Ensuring Sustainable Results:
Changes imbedded in departmental processes

Owners continue to:
Monitor with control charts
And intervene if Trends observed

Tools Used:
Control Plan
SPC
Risk Assessment Plan
Communication Plan

Results:
Results were sustained and LOS continues to decrease as volume goes up
Executive Summary

**Problem:**
Delays in discharges to nursing homes were impacting on costs, throughput and patient flow.

**Steps taken to solve:**
Team analyzed the variation causing delays in the discharge process using six sigma tools. Improvements were made, tested through piloting and remain in place three years later.

**Benefits:**
This community hospital has the lowest length of stay in the system.
The Krasnoff Team

- Led by
  
  **Yosef D. Dlugacz, Ph.D.**

- Diverse team composed of:
  - Six Sigma Master Black Belt & Green Belts
  - Chief Nurse Executives
  - Certified Public Accountant
  - Quality Management Executives
  - Case Management Specialists
  - Registered Nurses
  - Communication Specialist
  - Physician
  - Research Analysts
  - Data Analysts
  - Program Manager
Questions?

- For additional information, please visit our website at www.theKQMI.org or
- Contact us directly:
  Krasnoff Quality Management Institute
  600 Northern Boulevard, Suite 220B
  Great Neck, New York, USA 11024 516 465 840
  kqmi@nshs.edu
- Thank you!
Appendix
Length of Stay

- A patient stays in a hospital bed for varying number of days based on his/her treatment and response to treatment for a particular diagnosis.

- The total number of days a patient is in a hospital bed is calculated and called length of stay (LOS).

- Revenue for a patient stay is based on the diagnosis of the patient when they are discharged from the hospital not based on the amount of time a patient stays within the hospital.
Length of Stay  *continued*

- Therefore the more efficient diagnosis and treatment occurs, the shorter the patient’s LOS will be and the greater the financial margin is for the hospital.

- When bottlenecks and delays occur in the processing of a patient from one level of care to another, these inefficiencies add days to a stay and delay patient’s departure from hospital.

- These delays impact a patient in cost, throughput and efficiency.