Six Sigma
Process Improvement Methodology

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What is Six Sigma?

- Six Sigma is a
  - customer focused
  - project-focused
  - results-driven

...approach to Quality
Six Sigma Overview

• A rigorous methodology

• Originated by Motorola (1986)
  – A statistically-based method to reduce variation in electronic manufacturing processes

• Heavily inspired by
  • Previous quality improvement methodologies
    • Quality Control Management, CQI, TQM
  • Based on the work of quality pioneers
    • Deming, Juran, Ishikawa, Taquchi and others
Six Sigma Overview

• By late 1990s
  – 2/3 Fortune 500 companies
    • Aimed at reducing costs and improving quality

• Today
  – Utilized all over the world
    • Local governments, prisons, hospitals, the armed forces, banks, manufacturing, etc.

• In recent years
  – Six Sigma often combined with Lean Manufacturing to yield a methodology called **Lean Six Sigma.**
Why Six Sigma?

• What we were doing wasn’t working well enough!
  – Incremental improvements “not good enough”
  – Need to /Desire to:
    • Focus on customer requirements
    • Base decision on data, not anecdotal information
    • Be Proactive vs. Reactive
    • Establish a culture of ownership vs. culpability
      – It’s the processes, not the people
    • Effect rapid and effective change
  – Improvement efforts were fragmented
  – Large system-wide processes broken
  – Not “holding the gains”
What does Six Sigma offer?

- Augments traditional quality tools
- Data driven decision-making
- Focuses on customer requirements
- A focused/organized approach
- Redefines processes for long-term results
- Becomes ingrained in work and thought processes
- Relies on evidence-based solutions
- Rapid/effective change

Organizational Benefits:

- Competitive edge
- Service Excellence
- Empowered staff
- Leadership Development
- Quality/Safety
- Healthcare Costs
Six Sigma

- Methodology aimed at
  - Error reduction
  - Eliminating variation
- Goal
  - Design/improve processes so it is impossible to make an error
- Reliance on performance measurements and statistical analysis
Traditionally…..

- Businesses have described their products or services in terms of averages:
  - Average cost
  - Average time to delivery
  - Average number infections
  - Average usage
  - Average wait time
Are These Processes the Same?

Are they performing well?

Goal = less than 10

<table>
<thead>
<tr>
<th>Process 1</th>
<th>Process 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>20</td>
<td>9</td>
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<tr>
<td>5</td>
<td>11</td>
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<tr>
<td>17</td>
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<td>10</td>
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<tr>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>12</td>
<td>8</td>
</tr>
</tbody>
</table>

Are all the customers happy?
Variation = Opportunities for Errors

<table>
<thead>
<tr>
<th></th>
<th>Process 1</th>
<th>Process 2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Average</td>
<td>9.4</td>
<td>9.4</td>
</tr>
<tr>
<td>Minimum</td>
<td>5</td>
<td>8</td>
</tr>
<tr>
<td>Maximum</td>
<td>20</td>
<td>11</td>
</tr>
<tr>
<td>Median</td>
<td><strong>5</strong></td>
<td><strong>9.5</strong></td>
</tr>
<tr>
<td>Standard deviation</td>
<td>6.0</td>
<td>1.17</td>
</tr>
</tbody>
</table>

Customers feel the variation, not the average!!!!!!
Variation in the Process

**Process 1**

Histogram of Process 1

- Normal
- Mean: 9.540
- StDev: 6.149
- N: 1000

**Process 2**

Histogram of Process 2

- Normal
- Mean: 9.412
- StDev: 1.193
- N: 1000

Many Defects

Fewer Defects

*Process 1 is less capable of meeting our customer’s expectations!*

*Exact capability can be measured!*
• **Critical to Quality (CTQ)**
  – How the customer judges our products/services
• **Y** = The outcome measure of the process
• **X’s** = Inputs or variables that affect the **Y**
• **Defect** - Failure to deliver what the customer expects
• **DPMO** – Defects per million opportunities
• **Variation**
  – The enemy of predictable output and customer satisfaction
• **Sigma**
  – An expression of process yield, based on the number of defects per million opportunities (DPMO)
Six Sigma

A Philosophy of Operational Excellence

A Metric

A Measure of Process Capability

A set of Problem Solving Tools/Tactics
Definitions of Six Sigma?

- A metric
  - Greek letter
- A measure of process capability
  - How capable is our process of meeting our customer’s expectations?
- A rigorous, structured approach to problem-solving
  - Includes a defined methodology with specific tools and tactics
- A management philosophy
  - Operational excellence and continuous improvement

Definitions complimentary, not contradictory!
Six Sigma as a Metric

• A statistical concept
  – Represents the variation that exists in a process
  – Relative to the customer requirements

• A process operating at a 6-Sigma level
  – So little variation, that the process outcomes are 99.9997% defect free

• Six Sigma = 6σ, 6 Sigma, or 6s.
Process Sigma

DPMO = Defects per Million Opportunities

- A more sensitive indicator than % yield or % good

<table>
<thead>
<tr>
<th>Sigma</th>
<th>Defects</th>
<th>Yield</th>
<th>DPMO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>69.1%</td>
<td>30.9%</td>
<td>691,462</td>
</tr>
<tr>
<td>2</td>
<td>30.8%</td>
<td>69.1%</td>
<td>308,538</td>
</tr>
<tr>
<td>3</td>
<td>6.7%</td>
<td>93.3%</td>
<td>66,807</td>
</tr>
<tr>
<td>4</td>
<td>0.62%</td>
<td>99.38%</td>
<td>6,210</td>
</tr>
<tr>
<td>5</td>
<td>0.02%</td>
<td>99.977%</td>
<td>233</td>
</tr>
<tr>
<td>6</td>
<td>0.0003%</td>
<td>99.9997%</td>
<td>3.4</td>
</tr>
</tbody>
</table>
When Compared to Best-in-Class (National Data)

- Beta Blocker Use Post MI
- Antibiotic Overuse
- Inpatient Medication Accuracy
- 44,000 - 98,000 Preventable Hospital Deaths (IOM Report)
- Anesthesia During Surgery
- Domestic Airline Fatality Rate
Traditional Process Improvement

1 Sigma

2 Sigma

3 Sigma

4 Sigma

4 to 5 Sigma - 27-fold Performance Improvement

5 to 6 Sigma - Another 69-fold Performance Improvement
Measure of Process Capability

• Focus on improving what is important to the customer
  – Critical to Quality (CTQs)
  – This is generally referred to as the “Y” or outcome variable
  – Examples: wait time, response time, turn around time, % new visits, % med errors, % falls, etc.

• Measure the “Y” against the target
  – Target = customer expectations or specifications
A Problem Solving Approach

• Highly structured methodology
• Focused on identifying the root causes
• Process variables impact or influence the Y
  – Root cause analysis
• Process variables are called “X’s”

\[ Y = x_1 + x_2 + x_3 + x_4, \text{ etc.} \]

Primary metric \( (Y) = \) combination of a variety of variables (x’s)

What are the variables that influence the main metric?
A Management Philosophy

• Focus is on continuous improvement by
  – Understanding the customer’s needs
  – Analyzing business processes
  – Instituting appropriate measurement methods

• Emphasis on management of processes
  – We don’t have faulty people, we have faulty processes!

*We can’t manage what we don’t measure!*
Six Sigma Model - DMAIC

**Define**
- Charter project
- High Level Process Map
- Collect VOC
- Identify Customer CTQs
- Review historical data

**Measure**
- Select Key CTQs**
- Develop data collection plan
- Define performance standards
- Validate measurement systems

**Analyze**
- Establish current capability
- Identify key sources of variability
- Define performance objectives

**Improve**
- Optimization
  - Cycle time
  - Variability
  - Cost/LOS
- Validation of Improvements
- Implementation

**Control**
- Determine capability of new process
- Implement process controls
- Ensure Gains are Sustained

* VOC - Voice of Customer
**CTQ - Critical to Quality
Tools of Six Sigma

- $Y = f(X,x)$
- Process Map
- FMEA (Failure Mode and Effects Analysis)
- Cause – Effect Diagram
- Pareto Diagram
- Gage R&R
- Process Capability
- Multi-Vari Charts
- Regression
- Hypothesis Test
- 95% Confidence Interval
- ANOVA
- DOE (Design of Experiments)
- Control Plan
- Statistical Process Control
Six Sigma Key Players

**Black Belts**
- Full time
- Strategic Projects
- Skilled in Six Sigma Tools
- Teach Green Belts

**Champions**
- Oversee or choose projects
- Resolve Issues
- Provide Leadership

**Green Belts**
- Part Time
- Smaller Scope Projects
- Help to change culture

**Master Black Belts**
- Full Time
- Strategic Projects
- Program Administration
- Teach Black Belts and Green Belts

**Executive Sponsors**
- Full Time
- Strategic Projects
- Program Administration
- Teach Black Belts and Green Belts
The Six Sigma Process...
Launching a Project

• Identify a Sponsor/Champion
  – Energy/passion to solve the problem

• Sponsor/Champion Role
  – Define boundaries/scope
  – Establish “stretch” goals
  – Provide direction and support to the team
  – Remove barriers
  – Recognize and celebrate successes
  – Accountable for completion, implementation and sustaining results from the project
Six Sigma Model - DMAIC

- Define
- Measure
- Analyze
- Improve
- Control

- Charter project
  - Problem statement - How do we know we have a problem?
  - Goal Statement - How will we know if we have made an improvement?
  - Project Scope and Team
- High Level Process Map
- Identify Customer CTQs
- Stakeholder analysis
- Review historical data
# Example Project Charter

## QMS Project Team Charter

<table>
<thead>
<tr>
<th>Business Process Team/Svc Line:</th>
<th>Project Team Members</th>
<th>Review Timing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Name:</td>
<td>Target Completion Date:</td>
<td>Project Type:</td>
</tr>
<tr>
<td>Project Champion:</td>
<td></td>
<td>CAP WO PDSA Lean DMAIC</td>
</tr>
<tr>
<td>Process Owner:</td>
<td></td>
<td>Start Date:</td>
</tr>
<tr>
<td>Black Belt:</td>
<td></td>
<td>Milestones – TBD based on methodology</td>
</tr>
<tr>
<td>Finance Representative:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

## Project Overview

### Problem Statement (*MOMS criteria):

### In Scope:

### Out of Scope:

### Customers and Stakeholders:

### Goal (s): (**SMART criteria)

### Current Performance Indicators and Levels:

### Target Performance Indicators and levels:

### Expected Benefits/Business Case (target savings, target metric reduction):

### Assumptions:

### Constraints:

## Signatures

| Project Chair(s) Signature: | Champion Signature: | Master Black Belt signature: |
Problem and Goal Statements

- **Problem Statement**
  - How do we know we have a problem?
  - MOMS criteria
    - Measureable, Observable, Manageable, Significant

- **Goal Statement**
  - How will we know if we have made an improvement?
  - SMART criteria
    - Specific, Measureable, Attainable, Realistic, Timely
High Level Process Map - SIPOC

Purpose: To graphically display the process major events

• Suppliers
  – Who provides the inputs to your process?

• Inputs
  – What materials, resources and data are needed to execute process?

• Process Steps
  – 5-7 steps that use inputs to change into outputs. Use very specific start and stop points!

• Outputs
  – What is the output of the process? What did the customer receive?

• Customers
  – Who receives the outputs of the process?
Hand Hygiene SIPOC

**Suppliers**
- Who provides the inputs?
  - Infection Control
  - H.C Providers (Physicians, nurses, nursing assistants, therapists, technicians, emergency medical staff, dental staff, pharmacists, laboratory staff, autopsy staff, students and trainees, contractual staff not employed by the healthcare facility, and persons not directly involved in patient care but potentially exposed to infectious agents.)
  - Plant Operations
  - Patient condition

**Inputs**
- Materials, resources, data
  - Policies & Procedures
  - CDC guidelines
  - Soap
  - Alcohol hand rub
  - Dispensers
  - Sinks
  - Paper towels
  - Conscious thought
  - Clinical Routine
  - Degree of urgent care required
  - Extent of contact
  - MD orders
  - Call lights
  - Operational routines

**Process Steps**
- Enter patient room
- Wash hands upon entering
- Patient Encounter
- Wash hands upon exiting
- Leave patient room

**Outputs**
- What did the customer receive?
  - High quality care
  - Avoidance / reduction of hospital acquired infections
  - Clean hands
  - Decrease in skin irritation
  - Increased patient confidence

**Customers**
- Who benefits?
  - Patients
  - CMS
  - Third Party Payors
  - Other patients
  - Staff
  - Families
Each process has at least 3 versions

What you think it is...

What it actually is...

What you would like it to be....
Establish Voice of the Customer (VOC)

- Identify and prioritize all customers
  - Who is impacted the most by the process?
  - Who is the most dissatisfied with the current process?

- Solicit feedback
  - How does the customer view the process?
  - What does the customer value from the process?
  - What does the customer expect from the process?

What does the customer want most of the time?

What is the limit the customer is willing to tolerate?
• Who will be affected by any changes from this project?

• Begin addressing issues early!

• Not everyone needs to be strongly supportive!

Stakeholder Analysis Form

<table>
<thead>
<tr>
<th>Names</th>
<th>Strongly Against</th>
<th>Moderately Against</th>
<th>Neutral (0)</th>
<th>Moderately Supportive</th>
<th>Strongly Supportive</th>
</tr>
</thead>
<tbody>
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</tbody>
</table>
Six Sigma Model - DMAIC

Define
- Select CTQ characteristics
- Define Performance Standards
- Data Collection
- Measurement System Analysis

Measure
- Performance Standards
- Data Collection
- Measurement System Analysis

Analyze
- Performance Standards
- Data Collection
- Measurement System Analysis

Improve
- Performance Standards
- Data Collection
- Measurement System Analysis

Control
- Performance Standards
- Data Collection
- Measurement System Analysis

Process X’s (Variables) → The Process → Outputs or Y’s

X1 → Y1
X2 → Y2
X3 → Y3
X4 → Y4
CTQ characteristics

• Select the main characteristic that the customer uses to judge your performance
  – Six Sigma lingo: The big “Y”
  – How will I know if I have made an improvement?
• How will the “Y” be defined and/or measured?

<table>
<thead>
<tr>
<th>VOC</th>
<th>CTQ</th>
<th>Y</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expect to be seen within 15 min of appt.</td>
<td>Wait Time</td>
<td>Pt. check-in at front desk to first contact with staff physician.</td>
</tr>
</tbody>
</table>
Define Performance Targets

- Translate the Customer expectations into Metrics
  - Target:
    - What does the customer want most of the time?
  - Specification Limits:
    - What are the limits the patient is willing to tolerate?

<table>
<thead>
<tr>
<th>VOC</th>
<th>CTQ</th>
<th>Y</th>
<th>Target</th>
<th>Upper Limit</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Expect to be seen within 15 min of appt.</td>
<td>Wait Time</td>
<td>Pt. check-in at front desk to first contact with staff physician.</td>
<td>15 min</td>
<td>30 min</td>
</tr>
</tbody>
</table>
Identify the Key X variables

Cause-and-Effect Diagram

Process
- No training on process timeline
- People are not aware to wash hands before/after contact
- Equipment is not wiped down regularly
- Difficulty monitoring process
- Not part of the yearly evaluation process
- Lack immediate feedback/outcomes
- Skeptical about effectiveness
- Interferes w/ HOW relationship with pts
- Disagree w/ recommendations
- Family/visitors unaware re: handwashing
- Family/visitors don't see being part of PC
- Other personnel not aware
- Pts/visitors insulted when asked to wash
- Pts not at ease asking someone to wash
- People forget
- People set in their ways
- Not part of the Froedtert culture
- Not seen as a priority
- Concerned with irritation
- Don't understand need for handwashing
- Feel that no need to wash w/ gloves
- Don't know proper handwashing
- Only touch equip., no need to wash
- Feel that wash hands enough
- Too busy/Not enough time

Environment
- Clutter obstructing sink
- No sink in the room
- No reminders posted
- No ongoing education on process for
- Need to take care of patient and can't
- Carrying items into patient room
- Understaffing/Overcrowding
- Lack of institutional safety climate
- Low risk of acquiring infections from
- Don't have adequate resources
- No corrective action for non-compliance
- No incentives/rewards to comply
- Lack motivation to set an example
- No communication re: pt impact if non-compliant
- Lack of institutional priority for hand hygiene
- No role model for hand hygiene
- Inadequate org. structure for accountability
- Low risk of acquiring infections from
- Lack of immediate feedback/outcomes
- Process Environment Management

Management
- Managers not accountable
- Divisions not accountable
- Spot checks not currently done
- No incentives/rewards to comply
- Lack motivation to set an example
- No communication re: pt impact if non-compliant
- Don't have adequate resources
- Lack of institutional priority for hand hygiene
- Inadequate org. structure for accountability
- Low risk of acquiring infections from
- Lack of immediate feedback/outcomes
- Process Environment Management

People
- Materials
- Equipment
- Lack hand hygiene compliance during pt interacion
- Lack hand hygiene compliance during pt interacion
- Lack hand hygiene compliance during pt interacion
- Lack hand hygiene compliance during pt interacion
- Lack hand hygiene compliance during pt interacion
Data Collection/Sampling

• Key considerations
  – Data must be representative of the process
  – Data must be reliable
  – Must capture measurements of importance

<table>
<thead>
<tr>
<th>OBS #</th>
<th>Role(s)</th>
<th>ENTRY</th>
<th>EXIT</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Hand Hygiene</td>
<td>Notes</td>
</tr>
<tr>
<td>1</td>
<td>Group</td>
<td>Sink</td>
<td>Y / N</td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>Hand Rub</td>
<td>Y / N</td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>None</td>
<td>Y / N</td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>Did Not Observe</td>
<td>Y / N</td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>Direct Exit to Enter?</td>
<td>Y / N</td>
</tr>
<tr>
<td>2</td>
<td>Group</td>
<td>Sink</td>
<td>Y / N</td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>Hand Rub</td>
<td>Y / N</td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>None</td>
<td>Y / N</td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>Did Not Observe</td>
<td>Y / N</td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>Direct Exit to Enter?</td>
<td>Y / N</td>
</tr>
</tbody>
</table>
Measurement System Analysis (MSA)

• How accurate is the measurement process?
• How much variation is there in the measurement process?
• Attempt to minimize controllable factors that could exaggerate the amount of variation in the data

Example:
I want to measure seconds. The clock only measures minutes.

Result:
The variation of the measurement system is too large to study the current level of process variation.
MSA Examples

• Fall Risk/Pressure Ulcer Risk Assessments
  – Performed by all RNs
  – Patient’s given scores, based on assessment criteria

• Door to Balloon Time
  – Clocks

1. Reproducibility- Does RN # 1 get the same score as RN # 2?
2. Repeatability- Does RN # 1 always get the same score when faced with the same findings?

Total measurement system variability should be as small as possible, but always less than 30%.
Six Sigma Model - DMAIC

Define

- Establish current capability
- Identify key sources of variability
- Define performance objectives

Measure

Analyze

Improve

Control

How is the process performing today?

Do we need to “shift the mean” or “reduce variation”?

What are the key X’s that are driving the Y?

How do you know?
Analyze

• Graphical Tools
  • Flow diagrams, frequency plots, Pareto charts, etc.

• Statistical Testing-
  – Descriptive Statistics, Process Capability Hypothesis testing, Regression Analysis, etc.

• Designed Experiments
Displaying the Data

Descriptive Statistics

Variable: Pt Wait Time

Anderson-Darling Normality Test
- A-Squared: 32.018
- P-Value: 0.000

- Mean: 23.1551
- StdDev: 15.3332
- Variance: 235.108
- Skewness: 1.25196
- Kurtosis: 4.39234
- N: 2559

- Minimum: 0.000
- 1st Quartile: 11.000
- Median: 21.000
- 3rd Quartile: 33.000
- Maximum: 153.000

95% Confidence Interval for Mu
- 22.561 to 23.750
- 95% Confidence Interval for Sigma
- 14.924 to 15.765
- 95% Confidence Interval for Median
- 0.000 to 22.000

Boxplots of Pt Wait Time by CLINIC

(means are indicated by solid circles)

Overall Statistics By Patient:

<table>
<thead>
<tr>
<th>Metric</th>
<th>Wait Time</th>
<th>Exam Time</th>
<th>Total Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>23.16</td>
<td>18.94</td>
<td>42.10</td>
</tr>
<tr>
<td>Median</td>
<td>21</td>
<td>16</td>
<td>40</td>
</tr>
<tr>
<td>Std Deviation</td>
<td>15.33</td>
<td>11.54</td>
<td>19.76</td>
</tr>
<tr>
<td>Sample Size</td>
<td>2559</td>
<td>2559</td>
<td>2559</td>
</tr>
<tr>
<td>Min</td>
<td>0</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Max</td>
<td>153</td>
<td>99</td>
<td>183</td>
</tr>
</tbody>
</table>
Current Process Capability

How is the process performing today?
Do we need to “shift the mean” or “reduce variation”?
Hypothesis Testing
Getting to the Root Causes

Which X’s had the greatest affect on the Y?

<table>
<thead>
<tr>
<th>Test</th>
<th>Details</th>
<th>P-Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role</td>
<td>DTY, EVS, Lab, LCs, PCAs, RNs, RTs</td>
<td>0.002</td>
</tr>
<tr>
<td>RNs</td>
<td>RNs vs. All others</td>
<td>0.422</td>
</tr>
<tr>
<td>LCs</td>
<td>Long Coats vs. All others</td>
<td>0.004</td>
</tr>
<tr>
<td>DTY</td>
<td>Dietary vs. All others</td>
<td>0.005</td>
</tr>
<tr>
<td>EVS</td>
<td>EVS vs. All others</td>
<td>0.056</td>
</tr>
<tr>
<td>TSP</td>
<td>Transport vs. All others</td>
<td>0.020</td>
</tr>
<tr>
<td>THP</td>
<td>Therapists vs. All others</td>
<td>0.020</td>
</tr>
<tr>
<td>Day of Week</td>
<td>Mon vs. Tues vs. Wed vs. Thu vs. Fri</td>
<td>0.285</td>
</tr>
<tr>
<td>Time of Day</td>
<td>Observation Hours 7-16</td>
<td>0.039</td>
</tr>
<tr>
<td>Groups</td>
<td>Single HCW vs. Groups</td>
<td>0.868</td>
</tr>
<tr>
<td>Method</td>
<td>Sink vs. Alcohol Based Hand Rub</td>
<td>0.000</td>
</tr>
<tr>
<td>Full Hands</td>
<td>Empty vs. Full Hands</td>
<td>0.000</td>
</tr>
<tr>
<td>Urgency</td>
<td>Normal vs. Urgent</td>
<td>n/a</td>
</tr>
<tr>
<td>Gloves</td>
<td>Wearing gloves vs. No gloves</td>
<td>0.463</td>
</tr>
<tr>
<td>Timing</td>
<td>Entry vs. Exit</td>
<td>0.000</td>
</tr>
<tr>
<td>Access</td>
<td>Clear access to Sink/ABHR vs. Blocked Access</td>
<td>0.965</td>
</tr>
</tbody>
</table>

P-Values < 0.05 are significant factors

Must use the correct statistical tests based on types of data.
Six Sigma Model - DMAIC

Define → Measure → Analyze → Improve → Control

- Optimization of Y (Cycle time, Variability, Cost/LOS)
- Validation of Improvements
- Implementation
- Control Plan

Generate alternatives
Assess the risks
Test the alternative
Select the best alternative

% compliance

\[ X = 0.471 \]

UCL = 0.852  
LCL = 0.000
Evaluating solutions

Generate multiple options!

Evaluate how each option meets CTQs

<table>
<thead>
<tr>
<th>Key Criteria</th>
<th>Pugh Matrix</th>
<th>Alternatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>RN accountable for patient</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Efficient trouble shooting</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Utilizes RN critical Thinking</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FTE neutral</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Good judgement regarding whether to take patient off tele when off unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RN knowledge of when patient leaves unit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>RN knowledge of when patient returns</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Assurance that patient placed back on tele when returned to floor</td>
<td></td>
<td></td>
</tr>
<tr>
<td>30 Second response to sustained lethal rhythms or rate alarms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Documentation of rate/rhythm changes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Consistent/accurate interpretation of rate/rhythm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timely recognition of rate/rhythm changes</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overall high standard of care maintained</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Continuous observation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Misc. benefits</td>
<td></td>
<td></td>
</tr>
<tr>
<td>enhance current shift coor. Responsibilities</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increased awareness of unit “big” picture</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase resources avail. to unit RNs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase unit teamwork</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase staff satisfaction</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Increase coordination of care</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Sum of Positives | 8 | 10 | 18 | 1 |
| Sum of Negatives | 1 | 2 | 2 | 0 |
| Sum of Sames     | 11| 8 | 6 | 19|
Pilot/Validate Results

Pilot Planning

• Failure Mode and Effects Analysis
• Assure adequate sample size
• Validate improvements through data and statistical analysis
Six Sigma Model - DMAIC

- Define
- Measure
- Analyze
- Improve
- Control

- Determine capability of new process
- Implement process controls
- Ensure Gains are Sustained
- Close the project

Is the new measurement system measure what it is suppose to measure?
Does the new process meet the goal?
How can you sustain the gains?
Mistake proofing, Robust design, Process Monitoring
Celebrate successes!
Control

Determine new process capability
Develop control plan
- Monitor Inputs and Outputs (Y’s and Xs)
- Ensure that Gains are Sustained

Share Best Practices

Maintain the gains!

Control Chart: time to 1st antibiotic

- Baseline
- Pilot
- Post Pilot

UCL=263.8
Mean=95
LCL=-73.78

UCL=207.3
R=63.46
LCL=0
Example Six Sigma Projects

Safety/Quality

• Insulin/Diabetes
• Falls
• Anticoagulation
• Telemetry Response
• Patient Identification
• Priority Medication
• Hand Hygiene
• Medication Verification Process
• Communication of Additional Radiology Findings

Service/Process Efficiencies

Patient flow
• Ortho/Radiology
• Ortho/OR
• Pulmonary Functions Lab
• Hem/Onc Lab Process
• Hem/Onc Treatment Room
• GI Lab
• Patient Throughput
• Discharge Process

• Access
  • Diabetes Clinic
  • Urology Clinic
• Wait time:
  • Hand Center
  • OP Lab
• OP Registration
• Delays in surgery d/t missing Instruments
Lessons Learned...

- **Organizational Vision**
  - Senior Management **must** lead
    - Be focused - strategic alignment, cascading of goals, have a plan!
    - **Hold people accountable!**
    - Involve Medical Staff
    - **Stay focused for a long time!**

- **Administrative Structure**
  - Clear roles and responsibilities
  - Methodology for project selection, scoping, approval and resource allocation
  - **Don’t take key things out of scope!**
  - Establish ownership, reporting and tracking mechanisms
Lessons Learned

- **Culture Change**
  - Don’t underestimate the resistance! Expect it! Manage it!
  - Stay Focused- Counter the “flavor of the day”
  - Top-down visible leadership- Walk the talk!
  - Address Change Management Strategy from the beginning!

- **Economic Implications**
  - Decide whether economics “lead or follow” as a driver
    - Organizational focus
    - Project focus

- **Other….**
  - There are no silver bullets!!! It’s takes plain hard work!
  - Leaders not inherently good sponsors!
  - Challenging to find time, resources, data
  - Difficult to find the “right” staff
    - Facilitation skills, project management, healthcare knowledge, problem solving, movers/shakers
How will we know when we get there?

The following elements will occur on a daily basis:

– High performing hospital processes
– Data driven decisions and problem solving
– Focus on processes not people or departments
– Recognition of widespread variation and its impacts
– Acceptance of rapid change
– Enthusiasm about finding “better ways of doing things”
For More Information

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