Lean Six Sigma

Rapid Cycle Improvement
1. History of Lean and Six Sigma
2. DMAIC
3. Rapid Continuous Improvement
   - Quick Wins
   - PDSA
   - Kaizen
Lean Manufacturing
(Toyota Production System)

- T.I.M.W.O.O.D
- 5S
- SMED
- TAKT TIME
- KAN BAN
- JUST IN TIME
- ANDON
- KAIZEN
- VALUE STREAM MAP

Six Sigma
DMAIC

- PROJECT CHARTER
- FMEA
- PDSA/PDCA
- SWOT
- ROOT CAUSE ANALYSIS
- FMEA
- SIPOC
- PROCESS MAP
- STATISTICAL CONTROLS

Process Improvement
Lean Manufacturing

• Lean has been around a long time:
  – Pioneered by Ford in the early 1900’s (33 hrs from iron ore to finished Model T, almost zero inventory but also zero flexibility!)
  – Perfected by Toyota post WWII (multiple models/colors/options, rapid setups, Kanban, mistake-proofing, almost zero inventory with maximum flexibility!)

• Known by many names:
  – Toyota Production System
  – Just-In-Time
  – Continuous Flow

• Outwardly focused on being flexible to meet customer demand, inwardly focused on reducing/eliminating the waste and cost in all processes
Six Sigma

- Motorola was the first advocate in the 80’s
- Six Sigma Black Belt methodology began in late 80’s/early 90’s
- Project implementers names includes “Black Belts”, “Top Guns”, “Change Agents”, “Trailblazers”, etc.
- Implementers are expected to deliver annual benefits between $500,000 and $1,000,000 through 3-5 projects per year
- Outwardly focused on Voice of the Customer, inwardly focused on using statistical tools on projects that yield high return on investment
DMAIC

Define

• Project Charter
• Voice of the Customer and Kano Analysis
• SIPOC Map
• Project Valuation / ROIC Analysis Tools
• RACI and Quad Charts
• Stakeholder Analysis
• Communication Plan
• Effective Meeting Tools
• Inquiry and Advocacy Skills
• Time Lines, Milestones, and Gantt Charting
• Pareto Analysis

Measure

• Value Stream Mapping
• Value of Speed (Process Cycle Efficiency / Little’s Law)
• Operational Definitions
• Data Collection Plan
• Statistical Sampling
• Measurement System Analysis (MSA)
• Gage R&R
• Kappa Studies
• Control Charts
• Histograms
• Normality Test
• Process Capability Analysis

Analyze

• Process Constraint ID and Takt Time Analysis
• Cause & Effect Analysis
• FMEA
• Hypothesis Tests/Conf. Intervals
• Simple & Multiple Regression
• ANOVA
• Components of Variation
• Conquering Product and Process Complexity
• Queuing Theory

Improve

• Replenishment Pull/Kanban
• Stocking Strategy
• Process Flow Improvement
• Process Balancing
• Analytical Batch Sizing
• Total Productive Maintenance
• Design of Experiments (DOE)
• Solution Selection Matrix
• Piloting and Simulation

Control

• Mistake-Proofing/Zero Defects
• Standard Operating Procedures (SOP’s)
• Process Control Plans
• Visual Process Control Tools
• Statistical Process Controls (SPC)
• Solution Replication
• Project Transition Model
• Team Feedback Session
Quick Wins

- Strategic - Analysis Focused
  - Advanced Lean and Six Sigma Tools
    - More Complex analysis and improvement tools, Pull Systems, FMEA, Statistical Analysis, DOE, Kanban, Inventory Sizing, WIP Control, etc.
    - Most Complex analysis and improvement tools, RSM, EVOP, Mixture Designs, S&OP, Product Reconciliation, Supplier Kanbans, Marketing Strategy, etc.

- Tactical - Solution Focused
  - Early Project Quick Wins, PCR, 5S, Setup Reduction, Operational Flow
  - ‘Quick Wins’ or Kaizen

- Time to Execute
Quick Wins

• The Lean Six Sigma training focuses on a disciplined roadmap to Process Improvement.
• The key to effect process improvement is successful completion of the Measurement and Analysis phases.
  – They set the stage for improvement
• However:
  – Opportunities may be identified early in the project that do not warrant extensive analysis.
    • ‘Quick Wins’ bypass the Analyze phase and go straight to Improve
    • Kaizen improvements still follow the DMAIC format but the Define, Measure, and Analyze portions are accelerated.
Quick Wins

• The primary difference is in the work required to implement the idea.
  – A ‘Quick Win’ is already a developed solution idea, i.e., it is in the Improve Phase already.

• The only determination left is ‘how to implement.’
• There is still a requirement to complete Define and Measure, to clarify scope and to be able to measure a change, but there is no need to go through Analyze Phase.
  – A Kaizen Event is essentially an accelerated DMAIC.

• Focuses on specific improvement objective;
  – Setup Reduction, 5S, Process Improvement, Line Balancing, etc.

• Although the Vision of the ‘Future State’ may be in place, there is still a requirement to go through the Analyze Phase to determine HOW to make it happen (as opposed to just ‘how to implement’ a developed idea, as in the case of the ‘Quick Win’).
Quick Wins

What do you think might be the benefits of Quick Improvement?

• Provides momentum for the project
• Drives value ($) early, thus improving ROI
• Provides confidence to the broader organization that Lean Six Sigma is a viable approach to process improvement
• Reduces stress on project team to ‘Get Something Done!’
Quick Wins

- Often we are able to find some opportunities for immediate improvement early in the project using our basic tools
  - Process map
  - Pareto chart
  - Fishbone Diagram
  - Metric Implementation (Hawthorne effect)
Quick Wins

• Just because we learn statistical methods does not mean we always need statistics.

• Sometimes the Answer hits us right between the eyes early in the project!

• This may be referred to as the “Inter-Ocular”* analysis.
‘Quick Win’ Improvement Criteria

- Minimal or no Capital Expenditure
- Low Risk
  - Narrow scope
  - Buy-in to solutions by all Stakeholders
  - Certainty the change will generate a positive impact
- Improvements May be Implemented Quickly (within 1-2 weeks)
- The project team has the authority to implement the desired changes
Quick Improvement Control Plans

- Quick Improvements, whether ‘Quick Wins’ or Kaizen improvements, **must** have implemented Control Plans in place before being considered complete.

- It is desirable to implement improvements as soon as possible but implementation **without control can be worse than no implementation at all.**
PDSA Cycle

- A process improvement approach to evaluate change
- This model allows for integration of new and existing systems.
- This model promotes small-scale rapid cyclic change over short periods of time
Stage 1: PLAN

- Recruit Team
- **Draft Aim Statement**
- Describe Current Context and Process (Brainstorm)
  - SWOT
  - Process Map
- Problem Statement
- Identify Causes and Alternatives
  - Root Cause Analysis
Stage 2: DO

- Start to implement your action plan
- Collect data
Stage 3: STUDY

Using the aim statement drafted in Stage 1: Plan, and data gathered during Stage 2: Do, determine:

- Did your plan result in an improvement? By how much/little?
- Was the action worth the investment?
- Do you see trends?
- Were there unintended side effects?
Stage 3: ACT

- Reflect on Plan and Outcomes
  - If your team determined the plan resulted in success, **standardize** the improvement and begin to use it regularly.
  - After some time, return to **Stage 1: Plan** and re-examine the process to learn where it can be further improved.
  - If your team believes a different approach would be more successful, return to **Stage 1: Plan**, and **develop** a new and different plan that might result in success.

The PDSA cycle is ongoing, and organizations become more efficient as they intuitively adopt PDSA into their planning.
Kaizen

- Kaizen is the organized use of common sense to improve cost, quality, delivery, and responsiveness to customer needs.

- Kaizen assembles cross-functional teams aimed at improving a process or problem identified within a specific area.

- Kaizen is the continuous improvement vehicle utilized by the Toyota Production System.
• Any narrowly scoped problem may use the “General” process improvement Kaizen methodology to find solutions. Some problems however require a specialized Kaizen methodology.
  – Set Up Reduction (i.e. Discharge Process)
  – Throughput
  – Product Cost Reduction
  – Infection Prevention
  – 5s
Kaizen

- When obvious waste sources have been identified
- When the scope and boundaries of a problem are clearly defined and understood
- When implementation risk is minimal
- When results are needed immediately – i.e., capacity constraints, setup reduction, acute quality problems, safety/ergonomic issues
- In the early stages of a project to gain momentum and build credibility

As the result of Process Mapping, work area tour, data collection, etc., obvious sources of instability and waste are identified.
Kaizen Deployment

• Kaizen is a vehicle to implement ‘Quick Improvement’
  A. **Pre-Event Prep**: Identify and plan narrow scope events
  B. **Kaizen Event**: Implement do-now quick hit solutions during the Kaizen event
  C. **Follow-up Action Items**: Kaizen activity typically ends 20 days following Kaizen

• The Kaizen approach follows the DMAIC process – it is a “DMAIC Workout!”

**Kaizen! Timeline**

(Maximum of 30 Days from Start of Event Prep, Through Event, to Final Follow-up)

| Pre-Event Prep (3-15 days) | Kaizen! Event (3-5 days) | Event Follow-up (15-20 days) |
Kaizen Preparation

Preparation Phase (1-2 Weeks before start of event)

- Data Collection/Analysis
- Team Selection/Notified
- Scope Identified
- $$ Savings Determined
- Process Map

- Resources Alerted
- Create “Specialized” Training
- Logistics Arranged (Appendix)
Kaizen Follows the DMAIC Structure

Team Training → GEMBA/Observations → Cause & Effect → Brainstormed Ideas

Final Presentation → Implementation → Action Items → What, Who, When, Status → Benefit, Effort
Kaizen-Discharge Process

Current Condition
- No Continuous Flow
- 95%
- 9 PODS 14 Unstable
- 3%
- Triage 3 Room
- ED Quick Look Register
- Walk-In Patient
- Waiting Room
- System Not Visible
- 9 PODS 110 Stable
- Waiting to Move
- 14 Hours

Long Change Overs
- Cant see why patients are waiting

No Problem Solving Culture

LET’S KAIZEN

Information System
- House Cleaning
- Moved to the floor
- Dr. Visit
- Surgery
- Other Care
- Rehab
- POS EMD Pharmacy
- Discharge
- Home
A 3-day workshop was held from 4/11/16 to 4/13/16 jointly by Toyota and Operational Excellence to analyze and improve the selected process

- Workshop Facilitators: Scott Dickson and Ben Naughting (Toyota), David Garcia, Gabriel Fruge (Parkland OPEX)
- Team: ED Nursing, UTSW Medical Staff
Training/Introduction to TPS

- Use and teach TPS Philosophies
  - Customer 1st,
  - People Most Valuable Resource
  - Kaizen (Continuous Improvement)
  - Shop Floor Focus

- Grasp current condition – Visualize problems / stagnation

- Standardize discharge process and utilizing TPS

  Technical Tools:
  - Implement Jidoka (Built-in Quality) thinking
  - Visualize abnormalities' Understand Ahead/Behind condition in 3 seconds
  - Standardized Work
• The team developed a standard process for ED discharges using the Single Minute Exchange Die (SMED) methodology to identify internal and external elements.

• The methodology showed the opportunity to reduce the discharge turnaround time (order to DC) from an average of 52 minutes to 15 minutes (≈70%)
The group performed several trials and observations before reaching to the optimal sequence.

- Early Providers Notification
  - Allows the nurse to proactively initiate the preparation (PREP) or discharge

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<thead>
<tr>
<th>Final Sequence</th>
<th>Owner</th>
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<tbody>
<tr>
<td>1</td>
<td>Pre- Discharge Notification to RN and Patient</td>
</tr>
<tr>
<td>2</td>
<td>Request Patient to get Dress</td>
</tr>
<tr>
<td>3</td>
<td>Collect Equipment</td>
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<tr>
<td>4</td>
<td>Call Social Worker (If necessary)</td>
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<tr>
<td>RN</td>
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<tbody>
<tr>
<td>5</td>
<td>Acknowledge order</td>
</tr>
<tr>
<td>6</td>
<td>Request Translator (If Required)</td>
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<tr>
<td>7</td>
<td>Print AVS</td>
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<tr>
<td>8</td>
<td>Obtain vitals signs &amp; Chart</td>
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<tr>
<td>9</td>
<td>Remove PIV &amp; Chart</td>
</tr>
<tr>
<td>10</td>
<td>Perform DC Instructions</td>
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<tr>
<td>11</td>
<td>Complete DC Note</td>
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<tr>
<td>12</td>
<td>Remove from EPIC</td>
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<tr>
<td>13</td>
<td>Remove from Room to:</td>
</tr>
<tr>
<td></td>
<td>- Chair</td>
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<tr>
<td></td>
<td>- Discharge Lounge</td>
</tr>
<tr>
<td></td>
<td>- Waiting Room</td>
</tr>
<tr>
<td>14</td>
<td>Push &quot;Red&quot; button</td>
</tr>
<tr>
<td>15</td>
<td>Clean Room</td>
</tr>
</tbody>
</table>

Patient can be removed from system if waiting for ARC and/or Social Worker
Andon (Signal System)
- Transition from Signal to Action
- Re-defined Light System
- Re-configured Responder 5 Configuration

**Sequence**
1. Provider determines when patient will be discharged
2. Provider presses "Discharge Pending button"
3. Nurse acknowledges green light and begins Discharge process

**Before**
1. Patient is discharged
2. Nurse walks patient out of the room
3. Nurse presses "Clean the Room button"

**Current**
1. RN/Tech cleans room
2. Nurse presses "Bring a patient" button
3. Nurse takes patient from waiting room to POD room

**Solution**
- Radiology Tech gets to the ED Pod area
- Takes Patient to ED radiology
- Radiology Tech presses "Patient at Radiology" button
Kaizen team met with Parkland’s leadership to show and explain the story (all work done) during event.

Great opportunity to discuss opportunities and areas for support.
Summary

• The rapid improvement work must be seen as the Work and not a separate project.

• Implementation and holding the gains requires integration into daily work and meetings

• Start work with those interested in change

• Communicate what is happening persistently

• Provide support to providers and staff who take on this new work
References