Metrics-Based Process Mapping (MBPM)

Society for Health Systems Webinar
February 17, 2009

Learning Objectives

- The key time and quality metrics for designing Lean processes.
- The difference between a value stream map and metrics-based process map.
- How to use the metrics-based process map as a standard work and process monitoring tool.
Key Lean Metrics: Time

- **Process time (PT)**
  - The time it takes to actually perform the work, if one is able to work on it uninterrupted
  - Includes task-specific doing, talking, and thinking
  - aka “touch time,” work time, cycle time

- **Lead time (LT)**
  - The elapsed time from the time work is made available until it’s completed and passed on to the next person or department in the chain
  - aka throughput time, turnaround time, elapsed time

Islands of value-adding activities
All other time is “waste.”
% Activity
- The percentage of time work is being done to the patient/item/data passing through the process/system
- \((PT \div LT) \times 100\)
- \(100 - \% \text{ Activity} = \text{Idle time of the “product” passing through the process/system}\)
- Goal – ID barriers to flow

Key Lean Metric: Quality

% Complete and Accurate (%C&A)
- % time downstream customer can perform task without having to “CAC” the incoming work:
  - Correct information or material that was supplied
  - Add information that should have been supplied
  - Clarify information that should or could have been clear
- This output metric is measured by the immediate downstream customer and all subsequent downstream customers.
**Rolled First Pass Yield (RFPY) =**

- $\%C&A \times \%C&A \times \%C&A \times \ldots$
- The percentage of occurrences where the information/data/people being processed pass through the entire process with no rework required
- Example: $(0.95 \times 0.60 \times 0.85 \times 0.75) \times 100 = 36.3\%$ RFPY
- Hint: the RFPY will always be lower than the lowest $\%C&A$ for an individual step.

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**The Work We Do:**

**Degrees of Granularity**

- **30,000 ft View (Strategic)**
- **In the Weeds (Tactical)**

**Value Stream Map**

- Process
- Process
- Process

**Metrics-Based Process Map**

- Step
- Step
- Step
### Metrics-Based Process Mapping

**SHS Webinar – February 17, 2009**

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### Outpatient Imaging

#### Projected Results

<table>
<thead>
<tr>
<th>Metric</th>
<th>Current State</th>
<th>Projected Future State</th>
<th>% Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead Time</td>
<td>32.5 hrs</td>
<td>11.3 hrs</td>
<td>65%</td>
</tr>
<tr>
<td>Process Time</td>
<td>56 mins</td>
<td>43 mins</td>
<td>23%</td>
</tr>
<tr>
<td>% Activity</td>
<td>2.9%</td>
<td>6.3%</td>
<td>117%</td>
</tr>
<tr>
<td>Rolled First Pass Yield</td>
<td>29%</td>
<td>40%</td>
<td>38%</td>
</tr>
<tr>
<td># Handoffs</td>
<td>14</td>
<td>11</td>
<td>21%</td>
</tr>
<tr>
<td>Tech turnover (annual)</td>
<td>100%</td>
<td>25%</td>
<td>75%</td>
</tr>
</tbody>
</table>

% Activity = Process Time/Lead Time x 100
Rolled First Pass Yield = %C&A x %C&A x %C&A...

### Future State Implementation Plan

<table>
<thead>
<tr>
<th>Block #</th>
<th>Goal / Objective</th>
<th>Improvement Activity</th>
<th>Mode*</th>
<th>Owner</th>
<th>Implementation Plan Review Dates</th>
<th>Date Created</th>
<th>Implementation Schedule</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Increase %C&amp;A from 65% to 85%</td>
<td>Create standard work job aids for referring physicians</td>
<td>KE</td>
<td>Sally G.</td>
<td>8-Aug-08</td>
<td>10-Oct-08</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Reduce LT and improve efficiencies</td>
<td>Merge scheduling &amp; pre-regulation; fund; create standard work;</td>
<td>PROJ</td>
<td>Claudia J.</td>
<td>12-Sep-08</td>
<td>2-Nov-08</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Remove duplicate check-in</td>
<td>Transfer copy collection function to Imaging front office</td>
<td>PROJ</td>
<td>Bob S.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Standardize patient prep process</td>
<td>Create standard work &amp; determine KPIs</td>
<td>KE</td>
<td>Sally G.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Reduce stockouts &amp; inventory expenses</td>
<td>Install kanban</td>
<td>KE</td>
<td>Sally G.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Maximize machine efficiency and reduce patient time on site</td>
<td>Reduce setup and balance work</td>
<td>KE</td>
<td>Bruce E.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>8 &amp; 9</td>
<td>Reduce LT in read and release steps; reduce batching</td>
<td>Install visual queue board &amp; simplify system</td>
<td>JDI</td>
<td>Bruce E.</td>
<td>12-Sep-08</td>
<td>7-Nov-08</td>
<td></td>
</tr>
<tr>
<td>10 &amp; 11</td>
<td>Reduce report release batching</td>
<td>Shift physicians to autofax</td>
<td>PROJ</td>
<td>Maria G.</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

*Mode: JDI = Just do it; KE = Kaizen Event; PROJ = Project

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What is a Metrics-Based Process Map (MBPM)?

- A visual process analysis tool, which integrates:
  - Functional orientation of traditional swim lane process maps
  - Key Lean time and quality metrics
- Tool which highlights the disconnects / wastes / delays in a process at a micro level
- Serves as standard work for workforce training and process monitoring
**Metrics-Based Process Mapping (MBPM)**

**When Do We MBPM?**

- **Value Stream Driven**
  - **VSM** is the *strategic* tool that identifies *when* we need to perform a more detailed analysis of a process.
  - **MBPM** is a *tactical* tool used to flesh out the details at each step to see the “waste behind the waste”
    - Enables a team to “drill down” from a few targeted blocks on the VSM
    - Often the first activity in a service/office Kaizen Event
Mapping Prep

- Select a skilled, objective facilitator
- Define the scope
  - Select the fence posts (first and last steps).
  - Select a specific situation or set of conditions.
    - There are no decisions points in an MBPM.
- Select the team
  - No more than 10
  - Include representatives from all functions within the fence posts
  - Include people who currently do the work
  - If too many people involved, narrow your scope
  - If room, include objective “outside eyes”
  - Don’t avoid including critical players – e.g. physicians, patients, physician office staff, etc.

Documenting the Current State

- Step 1 – Label the map in the upper right hand corner.
  - Include process name, conditions mapped, date, and facilitator name and/or team members.
### Step 1: Label the map

<table>
<thead>
<tr>
<th>Process Name</th>
<th>Included/Excluded Conditions</th>
<th>Current State MBPM</th>
<th>Date</th>
<th>Facilitator and/or Team Names</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

36” wide white paper with 6” swim lanes.

### Documenting the Current State

- **Step 2 – Label the swim lanes with the functions involved.**
  - Include external functions, if appropriate (e.g. customers, suppliers/contractors, etc.)
## Step 2: List functions

<table>
<thead>
<tr>
<th>Function</th>
<th>Process Name</th>
<th>Included/Excluded Conditions</th>
<th>Current State MBPM</th>
<th>Date</th>
<th>Facilitator and/or Team Names</th>
</tr>
</thead>
<tbody>
<tr>
<td>Function A</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Function B</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Function C</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Function D</td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Function E</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>Function F</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Use 36” wide white paper with 6” swim lanes (hand drawn, chalk lines, or pre-printed).

## Documenting the Current State

- **Step 3 – Document all activities/steps on 3 x 6” post-its.**
  - Use verb/noun format; clear and concise
  - Include function.
  - Separate tasks that have different quality outputs or timeframes; combine tasks otherwise.
  - Place post-its in appropriate swim lane, sequentially.
**MBPM Post-it Conventions**

- **Activity (Verb / Noun)**
- **Function that performs the task**

**Documenting the Current State**

- **Step 4 – Number the activities.**
  - Number the activities sequentially from left to right.
  - For parallel activities, add “A,” “B,” etc.
    - Example: Step 8A, Step 8B, etc.
MBPM Post-it Conventions

- Activity (Verb / Noun)
- Step #
- Function that performs the task

<table>
<thead>
<tr>
<th>Step</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Parallel Steps</td>
</tr>
<tr>
<td>2</td>
<td></td>
</tr>
</tbody>
</table>


Parallel Steps:
Documenting the Current State

- Step 5 – Add activity-specific information:
  - Key metrics – include units of measure
    - Process Time (PT) - often minutes or hours
    - Lead Time (LT) – often hours or days
    - Percent Complete & Accurate (%C&A)
  - Barriers to flow – batches, shared resources, equipment downtime, etc.
  - Number of staff involved (if relevant)

MBPM Post-it Conventions

- # Staff (if relevant)
- Barriers to flow (if relevant)
- PT (process time)
- LT (Lead time)
- % Complete & Accurate
Metrics Tips

- Typically obtained via interview; questions must be high quality
- PT & LT notes
  - You can “chunk” these metrics for a series of post-its when necessary
  - When wide variation, do one of three things:
    - Narrow your scope (pick a specific circumstance)
    - Use the median
    - Indicate the variation, but use the median for the timeline
- %C&A notes
  - Determined by immediate downstream customer and all subsequent downstream customers
  - Response is placed on the post-it for the output step
  - 0% at a particular step is not rare

Documenting the Current State

- Step 6 – Define the “Timeline Critical Path”
  - Longest LT unless “dead-end” step
  - Use colored marker
Step 6: Define the “Timeline Critical Path”

For parallel activities: Chose the longest LT unless a “dead-end” activity.

Documenting the Current State

- Step 7 – Create the timeline
  - Bring down the PT & LT from the critical path step.
Step 7: Create the Timeline

Documenting the Current State

- Step 8 – Calculate the summary metrics
  - Timeline PT Sum
  - Timeline LT Sum
  - % Activity
    - \((\text{Total PT}/\text{Total LT}) \times 100\)
  - Rolled First Pass Yield (RFPY)
    - \(\% \text{C&A} \times \% \text{C&A} \times \% \text{C&A} \ldots\)
    - Include ALL post-its, not just critical path
### Document Summary Metrics

<table>
<thead>
<tr>
<th>Metric</th>
<th>Current State</th>
<th>Projected Future State</th>
<th>Projected % Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Timeline PT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timeline LT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>% Activity</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rolled First Pass Yield</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total Process Time</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor requirements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freed capacity</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Summary Metrics: Labor Requirements

- **Total PT**
  - Sum of *all* activities, not just timeline

- **Labor Requirements**

  \[
  \text{# FTEs} = \frac{\text{Total PT (in hrs)} \times \text{# occurrences/year}}{\text{Available work hrs/year/employee}}
  \]

  \[
  \text{Freed Capacity} = \text{CS FTEs} - \text{FS FTEs}
  \]

  * FTE = Full-time Equivalent (2 half time employees = 1 FTE)
Step 9 – Identify the value-adding and necessary non-value-adding activities

- Use small colored post-its labeled with “VA” or “N”.
- NOTE – this is the first of two “bridge steps” between current state documentation and future state design.
Step 10 – Circle (with a red marker) the step-specific metrics that indicate the greatest opportunity for improvement.

- Low step-specific %activity, low %C&A, etc.
- This is the second of the two steps that provide the bridge between current state documentation and future state design

Step 10: Circle the data that indicates the greatest need for improvement
Goals

- Reduce overall LT & PT
- Improve quality (increase RFPY)
- Increase % activity
  - Note: this may actually decrease during the first round of improvement
- Improve LT, PT, and %C&A at individual steps

How?

- Eliminate non-value-adding activities steps
- Reduce handoffs
- Eliminate rework
- Reduce batching
- Reduce queuing and work-in-process
- Reduce transportation and motion

The Improved State Becomes Standard Work

Current State Metrics-Based Process Map

<table>
<thead>
<tr>
<th>PT Units</th>
<th>Process Details</th>
<th>Function / Department</th>
<th>Current State Metrics-Based Process Map</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Specific Conditions</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Domestic orders through sales force</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Date Mapped</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Occurrences per Year</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Facilitator</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Mapping Team</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Process Name</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Order Fulfillment</td>
<td></td>
<td></td>
</tr>
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</tr>
<tr>
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<td></td>
</tr>
</tbody>
</table>
Step 8 (continued): Document Results

<table>
<thead>
<tr>
<th>Metric</th>
<th>Current State</th>
<th>Projected Future State</th>
<th>Projected % Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>CP PT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CP LT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>AR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RFPY</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total PT</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Labor requirements</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Freed capacity</td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

Translating Your Results into Organizational Benefit

- **Ability to attract and retain**
  - Talented admin and clinical staff
  - Talented providers
  - Patients

- **Clinical quality**
  - Standard work = predictable results

- **Financial**
  - Quicker billing = quicker payment
  - Freed capacity = better margins
  - Market share gains = higher revenue
MBPM Tips

- Team-based activity!
  - 10 people max per team; use same people for both current and future state
- Use a skilled, impartial facilitator
- Documenting the current state takes 33-50% longer than designing the future state
- Avoid gaps between current and future state mapping
- Typical teams need 5-10 blocks to truly understand what you’re asking in terms of the metrics
- Use 36” wide white paper with 6” swim lanes; 3 x 6” post-its

Learning Objectives

- The key time and quality metrics for designing Lean processes.
- The difference between a value stream map and metrics-based process map.
- How to use the metrics-based process map as a standard work and process monitoring tool.
Additional Questions?

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