Value Stream Mapping: A Powerful Tool for Improving Healthcare Processes

Society for Health Systems
San Diego, CA
February 10, 2006
Session Objectives

- Understand what a value stream is
- Learn the benefits of value stream mapping
- Learn how to create current state value stream maps
- Learn how to create future state value stream maps
- Learn how to prioritize improvement opportunities and create an actionable implementation plan
“Where there is a product (or service) for a customer, there is a value stream. The challenge lies in seeing it.”

- Jim Womack, *Lean Thinking*
Introduction to Value Streams
What is a “Value Stream?”

All of the activities (value and non-value adding) required to bring a service / product from customer request to fulfillment (and beyond to receipt of payment).
Defining Value

- **Value-Add (VA)** - any operation or activity the customer *values* (and would be *willing to pay for*).
  - Who are your customers? What do they *really* want?

- **Non-Value-Add (NVA)** - any operation or activity that consumes time and/or resources but does not add value to the service provided or product sold to the customer.
  - Necessary – regulatory requirements, etc.
  - Unnecessary – everything else
Non-Value-Added

Those activities between the value-added steps that typically account for 70-95% of steps, process time and non-material costs

= WASTE
Healthcare Value Stream

Start

Patient Arrival / Admission → Evaluation & Testing → Diagnosis & Treatment → Patient Discharged

Appointment Scheduled → Need Determined

Patient Follow-up

Payment Received → Claim Submitted

End
The Lean Journey

1. Define value from the customer’s perspective
2. Map the Value Stream
3. Create Flow; Eliminate the root causes of waste
4. Create pull where flow is difficult to achieve
5. Seek perfection via continuous improvement
Value Stream Mapping

- Diagnostic tool
  - Reveals hidden symptoms of larger problems
- Blueprint for change; strategic planning activity
  - Helps prioritize opportunities for improvement
  - Results in an implementation plan
- Macro level visual representation of:
  - Information flow
  - People & material flow
  - How macro? Each process block represents a handoff or a break in the timeline
- Contains relevant metrics:
  - Lead time – throughput / turnaround / flow time
  - Cycle time – “touch / process time
  - % Complete & Accurate
  - Additional “flowstoppers”
Benefits of Value Stream Mapping
Why Value Stream Mapping?

- Helps visualize process steps and WASTE in the process
  - View process flow from “the thing’s” perspective

- Helps “see the whole”
  - Helps focus on maximizing overall flow rather than sub-optimizing specific functions/departments

- Easy to learn; paper and pencil
  - Have a darn good reason for putting maps into electronic form!
Why Value Stream Mapping? (continued)

- Shows the linkage between information and material flow
- Makes the disconnects and obstacles to flow stand out
- Metrics-based decision making: What you are going to do to affect the numbers?
- Provides visibility to product/service families. Separate maps are drawn for each product/service family – product groupings based on shared process steps
Mapping the Current State
Mapping Team Composition

- VSMs are strategic in nature
  - The resulting implementation plan is the tactical component
- Team composition
  - Leadership
  - People with process knowledge
  - Outside eyes
“Products” with similar processing requirements are grouped into product families.
Healthcare Service Families

- **Primary Value Streams**
  - Emergency Services
  - Surgical Services
  - Imaging Services
  - OB Services
  - Etc.

- **Support Value Streams**
  - Billing
  - Payroll
  - Medical Records
  - Housekeeping
Reiterative Process

- **Product Family**
  - What are we mapping?

- **Current-State Drawing**
  - What is the current state - where are the opportunities?

- **Future-State Drawing**
  - What could flow look like for this value stream?

- **Implementation**
  - The goal of mapping

Eventually REPEAT
Basic Mapping Icons

- Process Box
- Data Box
- Worker
- Push Arrow
- Inventory
- Supplier or Customer
- Finished Goods
- Truck
- In - box
- Go See Scheduling
- Electronic Flow
- Manual Info Flow
Mapping Details

Order Initiation
Current State Map
May 8, 2003

Be sure to place title block in lower right
Mapping Details

SUPPLIER

“Production Control”

CUSTOMER

Process 1

I

Process 2

I

Process 3

I

Process 4

Data Box

Hours

Minutes

Minutes

Minutes

Minutes
Current State Value Stream Map
Outpatient Cardiac Lab

Cardiology Group

Primary Care MD

Schedule Appt

Admission

Prep

Procedure

DX/RX

Discharge

CT = 10 min
LT = 1 hr
%C&A = .90

CT = 12 min
LT = 3 days
%C&A = .60

CT = 20 min
LT = 45 min
%C&A = .85

CT = 30 min
LT = 50 min
%C&A = .75

CT = 15 min
LT = 30 min
%C&A = .90

CT = 6 min
LT = 8 min
%C&A = .95

1 hr
24 hrs
0.75 hrs
.83 hrs
0.5 hrs
.13 hrs
0.1 hrs

10 min
12 min
20 min
30 min
15 min
6 min

Total Lead Time = 27.31 hrs
Total Cycle Time = 1.55 hrs
%VA = 5.7%
RFPY = 29%

Joann Mapper
4/23/2005
The Value Stream: Micro to Macro

Process Level
Facility Level
Between Facilities
Suppliers and Customers

(what can you impact?)
Creating the Current State VSM

- In the conference room:
  - Define which product or service to map (if not predetermined)
  - Determine start & end fence posts (boundaries)
    - Order to delivery to revenue receipt
    - From customer’s perspective
  - Narrow focus to a specific type of situation
  - Obtain customer demand
  - Outline the major process blocks
    - Chunk of activities that occur before a handoff
    - OR... major stop in time line
Creating the Current State VSM (continued)

- On “the floor”
  - Walk the process; be “the thing”
    - Start with the final step and walk upstream (backwards)
  - Viewing a snapshot of today’s process
    - Take current state photos, if relevant
  - Stay focused on “the norm”
    - Use the “70% rule” to avoid getting bogged down with exceptions
  - Interview workers to obtain relevant data
    - CT, LT, %C&A, other barriers to flow
    - Anecdotal metrics are usually fairly accurate
    - Use data sheets or something similar
  - Create a spaghetti diagram, if relevant
<table>
<thead>
<tr>
<th>Process Data</th>
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<tbody>
<tr>
<td>Activity: ____________________________</td>
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<tr>
<td>Dept performing: ____________________</td>
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<tr>
<td>Cycle (touch) time: _________________</td>
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<tr>
<td>Lead time: _________________________</td>
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<tr>
<td>% C&amp;A: ____________________________</td>
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<tr>
<td>IT systems used: ___________________</td>
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<tr>
<td>Current backlog / WIP: ______________</td>
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<tr>
<td>Demand rate: _______________________</td>
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<td>Longest throughput: ________________</td>
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<td>Number of people: _________________</td>
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<tr>
<td>Prioritization rules: ______________</td>
</tr>
<tr>
<td>Shared resource?, if so, % of total load? ______________</td>
</tr>
</tbody>
</table>

- **What else?**
  - Changeover time
  - Batch size
  - Run frequency
  - Equipment availability
  - What else…?
1. Start with the customer – information flow
2. Identify the product or service which is being worked on (“the thing”)
3. Determine your process steps from “cradle to grave”
4. Determine the “trigger” that initiates action at each process (it may be information flow)
5. Identify the time it takes to perform the task **without** delays (starting or within the process) or interruptions within the process – “cycle time”
6. Identify and quantify the time it takes to perform the task **including** delays and interruptions – “lead time” (LT = CT + delays)
7. Investigate the causes of the waste between processes - what are the “**barriers to flow**”
8. Map what “typically” happens (70% rule)
9. Calculate total processing time (cycle time) versus total lead (throughput/turnaround) time
10. Remember: You’re an investigator. Do whatever it takes to understand all aspects of the current state.
Back in the conference room
  - Classify each step as VA or NVA
  - Consider dividing map into sections:
    - Pre-production
    - Production
    - Post-production
  - Calculate relevant metrics:
    - CT sum
    - LT sum
    - CT/LT ratio (CT divided by LT x 100)
    - Rolled first pass yield (product of % C&A’s)
Common Current State Findings: Issues

- Lots of waiting
- Lots of travel
- Lack of communication (or lots of poor communication)
- Lack of skills / relevant training
- Too many handoffs
- Too many approvals / inspections
- Too many IT systems / workarounds
- Different prioritization rules in different departments / areas
Common Current State Findings:

- High LT (slow throughput / turnaround)
- Low % C&A (poor quality)
- High WIP (bottlenecks and backlogs)
- Low CT/LT Ratio (lots of waiting)
Create the Current State Value Stream Map for Outpatient Imaging

Exercise
Current State Value Stream Map
Outpatient Imaging Services

Service: Scheduled CT Scans
Demand = 15 per day

Customer Demand:
15 pieces per day
(Takt Time: 5,760 seconds)

2 shifts
8 hours per shift

% C&A = 65%

% C&A = 90%

% C&A = 90%

% C&A = 95%

% C&A = 75%

% C&A = 99%

% C&A = 29%

% C&A = 25%

% C&A = 25%

% C&A = 25%

% C&A = 25%

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Designing the Future State
Achieving the Future State

- Target: 6-9 months out
- Design considerations:
  - Eliminate steps / handoffs
  - Merge steps
  - Create parallel paths
  - Implement pull if flow isn’t possible
  - Reduce / eliminate batches
  - Improve quality
  - Create standard work
  - Create an organized, visual workplace
  - Eliminate unnecessary approvals / authorizations
  - Stop performing nonessential (NVA) tasks from the customer’s point of view
  - Co-locate functions based on flow; create teams of cross-functional staff
  - Balance work to meet takt time requirements
Lean Objectives

- **ELIMINATE** Unnecessary NVA
- **REDUCE** Necessary NVA
- **OPTIMIZE** VA
Target All Waste!
Revisiting “Value-Add”

- **Value Add**: Is the customer willing to pay an incremental cost for the activity?

- **Non-value Added (NVA)**
  - Necessary
    - Regulatory requirements and accreditation standards
    - Customer requirements due to poor performance and lack of trust
  - *Unnecessary NVA = WASTE*

- **Challenge the “purpose” of the administrative processes within your organization**

- **Challenge** *EVERYTHING*
“Muda” equals “Moola”
Eight Wastes (NVA)

- Overproduction
- Inventory / WIP
- Waiting
- Unnecessary Processing
- Errors / Defects
- Motion (people)
- Transportation (product)
- Underutilized people
Waste Considerations

- **Waste** = The elements of the process flow (or lack thereof) that add no value to the service provided
- **Waste** adds cost and time, but not value
- **The enterprise objective** is to eliminate / minimize non-value added steps
- **Caution:** Remember waste is a symptom – it is not the root cause of the problem!
The Future State Map

1. This is your foundation (and the basis) for the future state
2. 70% accurate is acceptable

1. Design the lean flow by “carving” out the waste (it is now obvious from your current state map)
2. The challenge is to “create flow” and minimize the “hand-offs” with your changes
Metrics to Consider

- **Quality:** First Pass Yield / effectiveness
- **Delivery:** Lead Time
- **Customer Service:** Your metrics must include some measurement of how well you provide service to your internal and external customers
- **Cost:** Reducing defects, rework, surrogate tasks, hand-off’s, waiting and lead time will result in drastically reduced costs
Eight Questions for Future State VSM

1. What are the customer requirements?
2. Will we produce to order or to finished goods inventory?
3. Where can continuous flow be put in place?
4. Where should pull systems be implemented?
5. What is the single point of scheduling?
6. How do we level the load and the mix?
7. What should the management time frame be?
8. What process improvements are necessary to achieve the future state?
**Future State Icons**

- **Supermarket**
- **Production Kanban**
- **Withdrawal Kanban**
- **Signal Kanban**

**Icons with Descriptions**

- **Kanban Path**
- **Kanban Arriving in Batches**
- **Withdrawal**
- **Leveling Mix and-Or Volume**

**Additional Icons**

- **Kanban Post**
- **Max. 50 pcs. First-In First-Out Flow**
- **Kaizen Lightning Burst**
Create the Future State Value Stream Map for Outpatient Imaging

Exercise
Service: Scheduled CT Scans
Demand = 15 per day

Future State Value Stream Map
(without Kaizen Bursts)
Outpatient Imaging Services

<table>
<thead>
<tr>
<th>Activity</th>
<th>Cycle Time</th>
<th>% C&amp;A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Schedule appt</td>
<td>11 mins.</td>
<td>90%</td>
</tr>
<tr>
<td>Pre-register</td>
<td>4 mins.</td>
<td>90%</td>
</tr>
<tr>
<td>Referring Physician</td>
<td>45 mins.</td>
<td>95%</td>
</tr>
<tr>
<td>Hospital</td>
<td>5 days</td>
<td>98%</td>
</tr>
<tr>
<td>Symposium</td>
<td>3 mins.</td>
<td>100%</td>
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<tr>
<td>E Pay</td>
<td>11 mins.</td>
<td>98%</td>
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<tr>
<td>Excel</td>
<td>11 mins.</td>
<td>98%</td>
</tr>
<tr>
<td>Meditech</td>
<td>5 mins.</td>
<td>90%</td>
</tr>
<tr>
<td>Internet</td>
<td>1 mins.</td>
<td>98%</td>
</tr>
<tr>
<td>Waiting Room Management System</td>
<td>45 mins.</td>
<td>98%</td>
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<tr>
<td>Fax Order Solutions</td>
<td>2 mins.</td>
<td>100%</td>
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<tr>
<td>PACS</td>
<td>2 mins.</td>
<td>100%</td>
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<tr>
<td>Prep Patient (Tech)</td>
<td>10 mins.</td>
<td>100%</td>
</tr>
<tr>
<td>Complete Exam (Tech)</td>
<td>2 mins.</td>
<td>95%</td>
</tr>
<tr>
<td>Transmit Images (Tech)</td>
<td>15 mins.</td>
<td>95%</td>
</tr>
<tr>
<td>Read/Dictate Exam (Radiologist)</td>
<td>1 mins.</td>
<td>98%</td>
</tr>
<tr>
<td>Review Draft/Sign (Radiologist)</td>
<td>1 mins.</td>
<td>95%</td>
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<tr>
<td>Print Reports (Imaging)</td>
<td>1 mins.</td>
<td>99%</td>
</tr>
<tr>
<td>Send Reports (Imaging)</td>
<td>3 mins.</td>
<td>95%</td>
</tr>
</tbody>
</table>

Customer Demand: 15 per day
(Takt Time: 5760 seconds)
2 shifts
8 hours per shift

CT = Cycle Time
LT = Lead Time
%C&A = % Complete & Accurate

Rework Loop via Fax 10% of the time

Auto Fax 80%
Us Mail 15%
MD Mailbox 5%

Meditech Fax Order Solutions Meditech Meditech

<table>
<thead>
<tr>
<th>Activity</th>
<th>Cycle Time</th>
<th>% C&amp;A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Check-in Patient (Imaging)</td>
<td>3 mins.</td>
<td>100%</td>
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<tr>
<td>Prep Patient (Tech)</td>
<td>35 mins.</td>
<td>98%</td>
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<tr>
<td>Complete Exam (Tech)</td>
<td>5 mins.</td>
<td>90%</td>
</tr>
<tr>
<td>Transmit Images (Tech)</td>
<td>5 mins.</td>
<td>90%</td>
</tr>
<tr>
<td>Read/Dictate Exam (Radiologist)</td>
<td>120 mins.</td>
<td>95%</td>
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<tr>
<td>Review Draft/Sign (Radiologist)</td>
<td>420 mins.</td>
<td>99%</td>
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<tr>
<td>Print Reports (Imaging)</td>
<td>1 mins.</td>
<td>100%</td>
</tr>
<tr>
<td>Send Reports (Imaging)</td>
<td>2 mins.</td>
<td>90%</td>
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</tbody>
</table>

VSM Champion: Paul Scanner
Created: July 20, 2005
Future State Value Stream Map

Outpatient Imaging Services

Service: Scheduled CT Scans
Demand = 15 per day

Customer Demand: 15 pieces per day
(Takt Time: 5760 seconds)
2 shifts
8 hours per shift

CT = Cycle Time
LT = Lead Time
% C&A = % Complete & Accurate

0.0833 hrs. 0.583 hrs. 0.333 hrs. 0.0833 hrs. 2 hrs. 15 mins. 7 hrs. 1 min. 0.0333 hrs. 0.5 hrs. 3 mins.

CT = 43 mins.
CT/TT Ratio = 6.32%
Rolled First Pass yield = 40%

VSM Champion: Paul Scanner
Created: July 20, 2005
The House of Lean Tools

Continuous Improvement via Rapid Improvement Events

- Multi-functional workers
- Quality at the Source (Poka Yoke)
- Standard Work
- Workplace Organization / 5S
- Value Stream Mapping
- Value Stream Alignment
- Work Balancing
- Batch Reduction / Continuous Flow
- Visual Workplace
- Teams
- Total Productive Maintenance
- Pull Systems
- Layout for Flow

Continuous Improvement via Rapid Improvement Events
Implementing Improvements
# Implementation Plan

**Value Stream:** _____________________

**Implementation Plan Owner:** _____________________

**Date Created:** _____________________

<table>
<thead>
<tr>
<th></th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
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Rapid Improvement: Kaizen Events

- Focused improvement activity
- Aggressive objectives
- Short duration, but 100% of time (typically 2 - 5 days)
- Emphasis on the elimination of unnecessary non-value-adding activities (waste / muda)
- Cross-functional team of front line workers design and implement improvements
  - Implementation occurs during the event
  - Not simply planning for change…
## Outpatient Imaging Improvement Results *

<table>
<thead>
<tr>
<th>Metric</th>
<th>Current State</th>
<th>Future State</th>
<th>% Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lead Time</td>
<td>1949 mins 32.5 hrs</td>
<td>680 mins 11.3 hrs</td>
<td>65%</td>
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<tr>
<td>Cycle Time</td>
<td>56 Mins</td>
<td>43 Mins</td>
<td>23%</td>
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<tr>
<td>CT/LT Ratio</td>
<td>2.9%</td>
<td>6.3%</td>
<td>117%</td>
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<tr>
<td>** RFPY</td>
<td>29%</td>
<td>40%</td>
<td>38%</td>
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<tr>
<td># steps</td>
<td>14</td>
<td>11</td>
<td>21%</td>
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<tr>
<td>Morale</td>
<td>Poor</td>
<td>Good</td>
<td>Significant</td>
</tr>
</tbody>
</table>

* Results obtained after 5 Rapid Improvement Events

** RFPY = Rolled first pass yield, the product of each process block’s quality metric (% complete & accurate)
Technologist Freed Capacity

- Blocks 8 & 9: Reduction of 6 mins/scan
- 6 mins/scan x 250 scans/yr
  - = 1,500 mins (25 hrs) in freed tech capacity per year
  - 1,500 / 12 mins tech time per scan = 125 additional scans possible per year
- 125 additional scans = $437,500 ($3,500/scan) in additional revenue potential without adding additional staff
Future Improvements to be Made

- Mistake Proofing
- Layout for Flow
- Heijunka / Level Loading
- Cross-training
Summary

- Identify your product families (based on commonality of process steps)
- Select an important product family and map the value stream (people, product, process and information)
- Use data from value stream maps to identify where to drill down analysis to the next level
Recommended Reading

- **Lean Solutions**, Jim Womack & Daniel Jones, Free Press, 2005
- Lean Enterprise Institute – www.lean.org
- Society for Health Systems – www.shs.iienet.org
Acronyms

- **CS**  Current State
- **CT**  Cycle Time
- **FS**  Future State
- **LT**  Lead Time
- **NVA** Non-value-added
- **RFPY** Rolled First Pass Yield
- **VA**  Value-added
- **VSM** Value Stream Map
- **WIP** Work-in-process
Takt Time

- German word that means “pace” or “beat”
- Average demand expressed in time per unit (e.g. takt time of 12 minutes per “thing”)
- Sets the pace for the operation - all processes need to produce at rate of demand
  - To avoid bottlenecks, each process step’s cycle time must be at or below takt time
- Calculation:
  \[ \text{Takt time} = \frac{\text{Available time} / \text{shift}}{\text{Customer demand} / \text{shift}} \]
Available work time

\[
\text{Takt time} = \frac{\text{Customer demand}}{\text{Available work time}}
\]

\[
\begin{align*}
\text{Takt time} &= \frac{540 \text{ minutes/day}}{15 \text{ scans/day/scanner}} \\
&= 36 \text{ mins/scan}
\end{align*}
\]