Henry Ford Production System LEAN Quality Initiative

Creating Quality by Streamlining Histology Workflow

Rita D’Angelo MS, ASQ COE, SSBB
Quality Improvement Specialist
Henry Ford Health System

The Skinny on LEAN

- Southeast Michigan, 22,000 employees
- 7 hospitals, 40 ambulatory centers
- Beds: 2,495, Admissions: 88,984
- HFH alone 12th largest hospital based lab USA
- System laboratory service line >11 million tests, >700 FTEs
- Teaching hospitals
  - 674 Henry Ford residents & fellows
  - >500 med students/year from 20 medical schools
The Henry Ford Production System

This is what we were about:

- Began in earnest in 2005 - LEAN management
- Perform hundreds of improvements per year

**Core Values**: Our people are our most important asset and in conjunction with our partners & patients will be treated w/ respect, understanding, & cooperation.

- **Strategy**: We will achieve these goals by working as an integrated team, adapting & innovating Lean principles to our management and operations throughout the Pathology and Laboratory Medicine Service Line.

- **Cultural change**: We will embrace change, moving daily & continuously toward the 'ideal' condition with our empowered workers, continuously learning, making scientifically based improvements that standardize processes & eliminate waste

- **Employee promise**: Together we will strive for perfection by applying principles of mutual respect, integrity and understanding, cooperation and effective communication.

- **Employee Credo**: I am empowered to work with my colleagues to make changes, based on Henry Ford Production System principles, to make things right for ourselves, our clinician customers and our patients.

**Henry Ford LEAN Journey 2004-2009**

- Cultural change to an empowered workforce using TPS Work Rules
- Visible, blameless identification of defects by workers, solutions
- Fix defects in 'real time'
- Over 500 trained employees
- Quality coordinators, Teams, Customer-Supplier meetings
- 100s improvements made each year by autonomous work cells

**The Henry Ford Production System**

Reduction of Surgical Pathology In-Process Misidentification Defects by Bar Code Specified Work Process Standardization

Richard J. Zarbo, MD, DMD, and Rita D’Angelo, MS, ASQ, CQE, SSBB

Effective Reduction of Process Defects and Waste in Surgical Pathology

Richard J. Zarbo, MD, DMD and Rita D’Angelo, MS, ASQ, CQE, SSBB

Measures of Process Defects and Waste in Surgical Pathology as a Basis for Quality Improvement Initiatives

Rita D’Angelo, MS, ASQ, CQE, SSBB, and Richard J Zarbo, MD, DMD
Mission

- Our mission is to continually perfect our laboratory work product & processes & enhance patient safety to exceed the expectations of the customers and patients we serve.

Vision

- Continually striving for zero defects to be the "Best in Class" laboratory in the world

This required a major change in culture
Goals

- To create a workplace that is constantly developing and improving from the bench level up
- To grow and develop our people
- To sustain continuous learning and improvement

Some Definitions

- **The 5S's**: A structured approach to clean and organize the workplace.
- **Bottlenecks**: Step in a process line that limits throughput of the entire process line.
- **Push**: Manufacturing dictated by a traditional production schedule where a new lot is pushed onto the first step of the process.
- **Pull**: Customer order triggers the start of production. Underlies Just-in-Time production and continuous flow.
- **One-piece Flow**: Product is moved from one workstation to next one piece at a time without inventory build up between steps.
- **Kanban**: A visual signal, typically a re-order card or container that triggers a Pull manufacturing system.
- **Value Stream Mapping**: A graphical representation of all tasks and activities needed to transform input materials and information into an output.
Creating Quality That LASTS

- Specific Organizational approach to LEAN

- Employee Empowerment

Henry Ford Production System
**Trusting the Staff in Surgical Pathology**

- Allowing workers to:
- Present ideas from the bench without bias
- Time off the bench to work on NON PRODUCTION ACTIVITIES
- Take ownership

**Leadership Message:**

It’s a new day and this is how we do work!

**How Did We Implement LEAN?**

- Empowered our worker
- Encourage workers to identify defects daily
- Support teams to work on defects
- Open lines of communication
- Establish baselines: One process improvement per month per team
Creating Quality That LASTS

- Designing a more efficient Process

“Systems do not produce quality, people do.”
-Anonymous

People are our most important asset

Henry Ford Production System
Histology Process Improvement Redesign

We empowered workers to make changes
- To be excited about improvements
- Feel part of the group
- Want their voice to be heard & opinions valued

- Create your own workcell
- Histology participation = 100%

Empowered Workers

Process Redesign Histology Team
Workcell Layout Redesign

- Employee Improvement Design

Before Lean, an inefficient equipment layout causes excessive walking for each test.

"Just Do It" = HFPS Motto

Consulting Services

After Lean, with equipment arranged in the order it is needed, operators can work by walking a steady circuit.

"WE DO IT TO YOU"

Histology - Before

LACK OF STANDARD WORKPLACE DESIGN

Henry Ford Production System
Barcode Specified Work Processes

Barcodes generated at Accession & Microtome

Specimen container
Tissue cassette
Glass slide

Process Redesign

Creating space for U-shaped individual workcells
Work Process Efficiency

Prototype

AFTER- 1x1 Slide Labeling

Old Process Eliminated

Matching Labels to Pencil Labeled Slides After Staining
New Technology

'Continuous flow' processor q15 min

Challenges

Employee Empowerment Process Redesign
  ▸ Micro manager oversight
  ▸ Persistence of blame associated with defects
  ▸ Team members reluctant to share their ideas
Creating Quality That LASTS

14 Principles by TPS

1. **Long Term Philosophy** - Base your management decisions on a long term philosophy, even at the expense of short-term financial goals

2. Create **continuous process flow**

3. Use the “**Pull System**”

4. **Level out the workload**

5. **Build a culture of continuous improvement** by stopping to fix problems to get quality right the first time. Every hand-off is correct **EVERYTIME**

6. **Standardization of tasks** are the foundation for continuous improvements & employee empowerment

7. Use **visual controls** so no problems are hidden
14 Principles of HFPS (cont)

8. Use only reliable thoroughly tested technology that serves your people and processes

PEOPLE & PARTNER RELATIONSHIPS

- 9. Grow Leaders
- 10. Develop People
- 11. Respect your suppliers, challenge & help improve

PROBLEM SOLVING & CONTINUOUS IMPROVEMENT

- 12. Go and See for yourself to thoroughly understand
- 13. Decide carefully by consensus, Implement Rapidly
- 14. Become a Learning Organization, through relentless reflection & continuous improvement

Appoint or Recruit Team Lead in Every Workcell

- Selecting team lead and supervisors in each area:
  - Histology Supervisor
  - Pathologist Assistant Lead
  - Pathologist Lead
  - Accession Leader

Team Leaders are KEY
Team Lead Training

- Each worker in Surgical Pathology required training to ensure we were consistent in our approach to change
- Create a bonding experience
- See their work differently and improve daily

Worker Training

- Primary/Team Bonding
- Train all staff
- Cultivate a culture for change
**Challenge**

- How will they find time to meet?
- Where will they meet?
- Will supervisors allow them to be free from daily tasks?
- Will the lead be supportive?

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**Creating Quality That LASTS**

- Tools for quality improvement
Tools to Improve Workflow

- Standard work
- Mistake proofing
- Batch size reduction
- Level load
- Work simplification
- Visual displays, controls & color coding
- Andon white boards
- Kanban
- Stop the line

“Today’s standardization, instead of being a barricade against improvement, is the necessary foundation on which tomorrow’s improvement will be based.”

-Henry Ford
Tools to Improve Workflow

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Activity must be Highly Specified as to:
- Content
- Sequence
- Timing
- Location
- Expected outcome

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**Standard Work**

Formalin Injection Sequence

Target Prostate Work Group

Prostate Injection

Whole mount sectioning

Specimen Inking Protocol
Target Prostate Work Group

**Eliminate Unfixed Tissue Blocks & Poorly Cut Slides**

<table>
<thead>
<tr>
<th></th>
<th>Pre injection process improvement</th>
<th>Post injection process improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Radical Prostates (January- May 31)</td>
<td>2006</td>
<td>2007</td>
</tr>
<tr>
<td>Cases Recut</td>
<td>308</td>
<td>348</td>
</tr>
<tr>
<td>% Rework</td>
<td>96</td>
<td>75</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**10% reduction rework**

**Mean & Median Days to Report Radical Prostatectomy**

<table>
<thead>
<tr>
<th></th>
<th>Number of cases</th>
<th>Time to Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre</td>
<td>136</td>
<td>Mean 4.32 days</td>
</tr>
<tr>
<td>Post</td>
<td>53</td>
<td>Median 3.0 days</td>
</tr>
</tbody>
</table>

P<.0001 Wilcoxon rank sum and ANOVA tests

**25% reduction in TAT**
Block Examination for breast calcification

2006
164 Breast cases
46 Calc’s (28%)
TAT MED: 2.0 days
Recuts
NO 32 (69%)
YES 14 (31%)
Median 12 slides/case
Radiology X-ray (40%)
TAT MED: 1.9 days

2007
193 Breast cases
48 Calc’s (25%)
TAT MED: 2.0 days
Recuts
NO 43 (90%)
YES 5 (10%)
Median 3 slides/case
TAT MED: 1.7 days

60% reduction in TAT
Tools to Improve Workflow

- Standard work
- **Mistake proofing**
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“Failure is simply the opportunity to begin again, this time more intelligently.”

-Henry Ford

Office Procedure

- Biopsy
Specimen Part Type Designation

1. Requisition
2. What is it?
3. Add information to database
4. Pick the part type

Data Collection

Henry Ford Production System
Magnitude of the Problem

PRE Total Defects - Summary chart

<table>
<thead>
<tr>
<th>Activity</th>
<th>Defects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spec. Receiving</td>
<td>24</td>
</tr>
<tr>
<td>Rehab</td>
<td>17</td>
</tr>
<tr>
<td>Accessioning</td>
<td>123</td>
</tr>
<tr>
<td>Grossing</td>
<td>99</td>
</tr>
<tr>
<td>Histo. Slides</td>
<td>151</td>
</tr>
<tr>
<td>Immuno/Sp. Stain</td>
<td>2</td>
</tr>
<tr>
<td>Recuts</td>
<td>66</td>
</tr>
<tr>
<td>Amended Reports</td>
<td>13</td>
</tr>
<tr>
<td><strong>TOTAL Defects</strong></td>
<td><strong>1690472</strong></td>
</tr>
</tbody>
</table>

Opportunity for Improvement

Henry Ford Production System

Data Collection Results

<table>
<thead>
<tr>
<th>Part Types</th>
<th>Site Code</th>
<th>Blocks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Skin Cyst</td>
<td>SKCTD</td>
<td>1</td>
</tr>
<tr>
<td>Skin tag</td>
<td>SKCTD</td>
<td>1</td>
</tr>
<tr>
<td>Skin debridement</td>
<td>SKCTD</td>
<td>1</td>
</tr>
<tr>
<td>Skin scar</td>
<td>SKCTD</td>
<td>1</td>
</tr>
<tr>
<td>Skin excision biopsy</td>
<td>SKEXX</td>
<td>2</td>
</tr>
<tr>
<td>Skin excision biopsy</td>
<td>SKEXX</td>
<td>1</td>
</tr>
<tr>
<td>Skin plastic repair</td>
<td>SKREP</td>
<td>2</td>
</tr>
<tr>
<td>Skin punch</td>
<td>SKPUNCH</td>
<td>levels x3</td>
</tr>
</tbody>
</table>

TOTAL Part Type Discrepancies = 123

Origin of the defect:
1. [Pathol’s Acc] - 28 - wrong part type
2. [Pathol’s Part Type]- 52 - wrong description
3. [PA’s Part Type]- 43 - wrong Dr./staff name
**Solutions**

**Pathologist:**
- Part Type List Review
- Part Type Corrections
- Staff Training
- Clinician Training

**Transcription/PA:**
- Part Type List Review
- Part Type Corrections
- Staff Training
- Clinician Training

**Informatics:**
- Part Type List Review
- Part Type Corrections
- Staff Training

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**Multi - Departmental Effort**

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**Pre/Post Part Type Intervention**

![Bar Chart]

- **Outcome**
- **Intervention**
- Staff Training
- Part Type Revisions
- Clinician Education

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**Henry Ford Production System**
Tools to Improve Workflow

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Batch Size

No standard batch size sent to Gross station

Work tool redesign standardizes batch size to match pathologist’s signout tray & capacity of Xpress processor

Trays contain variable number containers to produce 20 slides

Reduce Steps 6 → 4

60% time reduction

= FASTER & Fewer Defects
Tools Force Standard Work

Trays contain variable number Container slots to produce 20 slides

Henry Ford Production System

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“Having a stock of raw material or finished goods in excess of requirements is waste…”
-Henry Ford
Level the Load

- Implement pull in the system rather than letting it operate on push – thus alleviating the bottlenecks. To reduce inventory.

**Producing only items that are needed for the next step in production**

Leveling Over 2 Shifts

- Redistribution of labor to align with work
- No change in number accessioners, histotechs, PAs.
- Closer to continuous flow

<table>
<thead>
<tr>
<th>1 Shift</th>
<th>Large Batch</th>
<th>After 2PM incoming &amp; leftover work</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 8 10 12 2</td>
<td>4 6 8 10 12 2</td>
<td>4 6 8 10 12 2</td>
</tr>
</tbody>
</table>

- Embedded, cut & delivered throughout day
- Embedded, not cut

<table>
<thead>
<tr>
<th>2 Shifts- Small Batches continuous</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 8 10 12 2</td>
</tr>
</tbody>
</table>

Jan 2008

**TAT**

1 day → 12 hrs
Tools to Improve Workflow

- Standard work
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  - Visual displays, controls & color coding
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  - Stop the line

“Any fool can make things bigger and more complex… It takes a touch of a genius and a lot of courage to move in the opposite direction.

- Albert Einstein

First-In-First-Out

Specimen Holding & Discard Shelf

Week #1  Week #2  Week #3  Week #4

Mon  Tues  Wed  Thurs  Fri
Goals
- Eliminate tape dictation for routine biopsies (80% vol.)
- Remove process loop-back to transcription
- Complete all work on case at gross station
- Minimize typing by PAs

Solution
- Biopsy template in CoPath created
- Added automatically at Accession
- Tied to part type assignment
- Requires typing of only 2 numbers by PA
  - Number pieces, maximum size (or range)

Gross Description Redesign

Lose transcription, lose loop-back, gain time
Eliminate Non value-added Steps - Work Simplification

Henry Ford Production System

What dictation? 3pm Friday Jan. 4, 2008
Tools to Improve Workflow

- Standard work
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“It’s the work, not the man, that manages.”
-Henry Ford

Color Coded Tools to Match Work Station (one of 6)
**Color Coding**

Color coded trays and labels designate different production queues

- Velcro labels Assigned Pathologist

**Take Defects Off-line**

Specimen Rehabilitation Defective Specimens Received

**Improving with Color**

- Color Coded Stickers
- Color Baskets
- Instruction Sheet
- Clinician Training
- Deficiency Data Reports

- No Name
- No MRN
- No Part
- No Doctor
- Wrong Dr code
- No ICD-9 code
- Discrepant number

*Henry Ford Production System*
**Tools to Improve Workflow**

- Standard work
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**White Board Defect Display**

- Make Defects Visible
- Multi-Cell

- Queue next process improvement projects
- List defects encountered in real-time
- Document resolution

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*“We know from the changes that have already been brought about that far greater changes are to come, and that therefore we are not performing a single operation as well as it ought to be performed”* - Henry Ford
Tools to Improve Workflow

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- Stop the line

“Show me a thoroughly satisfied man, and I will show you a failure”
- T. Edison

Henry Ford Production System

Kanban

Signaling device that gives instruction

1. Restock inventory

MANUFACTURING

DISTRIBUTION

kanban card (or label) returns to table

We’re low on:
- Gloves
- Cassettes
- Stain

Red Zone

if red zone reached, then production (e.g. reconstitution of the consumption)


Henry Ford Production System
Kanban

Reorder Kanban for Inventory

1st generation

2nd generation

Histology

Henry Ford Production System

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“Don't find fault, find a remedy; anybody can complain.”
-Henry Ford
Lab Tag Redesign

LABORATORY REQUISITION REQUIREMENTS

Surgical Pathology

Examples:

1   2    3   4   5   6   7   8

1   2  3  4   5   6   7  8

Clinical History

Clinical Diagnosis or Impression

REQUIRED INFORMATION FOR EACH SPECIMEN:

• Specimen Type
• Anatomic Site
• Procedure

HFH 313.916.2600

Dr. Jack Smith

Jill Jones

Dr. Jill Jones

Date of Procedure

02/12/2006

Henry Ford Production System

Supplier Education - Owning the Process

Clinician Supplier Education & Standardization

At Source of Defect
### 4 Rules of Work Design

<table>
<thead>
<tr>
<th>Rule</th>
<th>How</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rule 1</td>
<td>How People Work (STANDARD WORK)</td>
<td>Specifications document all work processes and include content, sequence, timing and outcome.</td>
</tr>
<tr>
<td>Rule 2</td>
<td>How Work Connects (CONNECTIONS)</td>
<td>Connections with clear YES/NO signals directly link every customer and supplier.</td>
</tr>
<tr>
<td>Rule 3</td>
<td>The Physical Arrangement (PATHWAYS)</td>
<td>Every product and service travels a single, simple and direct flow path.</td>
</tr>
<tr>
<td>Rule 4</td>
<td>How To Improve (SCIENTIFIC METHOD)</td>
<td>Workers at the lowest feasible level, guided by a teacher (Sensei), improve their own work processes.</td>
</tr>
</tbody>
</table>
Creating Quality That LASTS

- Work Place Organization

5 S is the first step in creating a visual ‘factory’

Work Place Organization

- Distinguish necessary from unnecessary items: (RED TAG)
- Remove all unnecessary items from the workplace
- When in doubt remove it

Removed items not used
Challenge for Implementation

- All improvements were formed by following the scientific method of data collection
  - Problem
  - Hypothesis
  - Current condition
  - Target condition

Implementing LEAN tools requires data collection

Challenge

- Implementation of Lean Tools is a full time effort, and it’s difficult to remove people off the front line

Quality professionals
1. Play by the rules of work
2. Facilitate brainstorming
3. Assist data collection & analysis
4. PUSH PUSH PUSH
Creating Quality That LASTS

- Levels of the LEAN pyramid
- Start with a firm base

The Henry Ford Production System
LEAN Training for Surgical Pathology

Next Sessions: June 15-16, 2009
October 15-16, 2009

HTTP://WWW.henryford.com/pathology

Thank You