IMPROVING HEALTHCARE USING LEAN SIX SIGMA

An Overview of a Proven Methodology to Optimize Operations

TMFHC University
Performance Improvement
Trinity Mother Frances Hospitals and Clinics

- Located in East Texas
- Consists of 4 hospitals
- 250 providers in Trinity Clinic
- 4500 employees
- 70,000 ED visits annually
- 25000 hospital discharges FY2015
- 600,000 clinic visits annually
- Recipient of Top 50 Heart. Top 100 hospital, Leapfrog award, most wired
THE CURRENT US HEALTHCARE ENVIRONMENT AND ITS DRIVERS
WHAT WE DO KNOW

Our Health Care System Is Expensive
HOW EXPENSIVE

Percentage of GDP

National Health Spending

Australia: 9.1%
Italy: 9.2%
UK: 9.3%
Sweden: 9.6%
Japan: 10.3%
Switzerland: 11.4%
Canada: 10.9%
Germany: 11.3%
France: 11.6%
U.S.: 16.9%
OECD Average: 9.3%

NOTE: Total healthcare costs are for the year 2012, except Australia, for which 2011 data are the latest available.

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TRINITY MOTHER FRANCES HOSPITALS AND CLINICS
**IMPACT ON OUR SOCIETY**

- Approximately 41M Americans are uninsured and 29M underinsured.
- Approximately 62% of all US personal bankruptcies are based on medical expenses.
- Estimated that Medicare will be insolvent by 2030.
- Increasing burden on the insured (co-pays and deductibles).
WHAT IS OUR MONEY GETTING?

More Dollars

Better Outcomes
WHAT WE DID NOT KNOW

EXHIBIT ES-1. OVERALL RANKING

<table>
<thead>
<tr>
<th>Country Rankings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Top 2*</td>
</tr>
<tr>
<td>Middle</td>
</tr>
<tr>
<td>Bottom 2*</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Overall Ranking (2013)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>AUS</td>
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<tr>
<td>-----</td>
</tr>
<tr>
<td>4</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Quality Care</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effective Care</td>
</tr>
<tr>
<td>Safe Care</td>
</tr>
<tr>
<td>Coordinated Care</td>
</tr>
<tr>
<td>Patient-Centered Care</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Access</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost-Related Problem</td>
</tr>
<tr>
<td>Timeliness of Care</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Efficiency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity</td>
</tr>
<tr>
<td>Healthy Lives</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Health Expenditures/Capita, 2011**</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>$3,800</td>
</tr>
</tbody>
</table>

Notes: * Includes ties. ** Expenditures shown in $US PPP (purchasing power parity); Australian $ data are from 2010.
PROBLEMS ARE COMPOUNDED
MORE STRESS

**Fund Futures**
Trust-fund balances as a percentage of expenditures

Sources: Social Security and Medicare Boards of Trustees reports

The Wall Street Journal

- Social Security disability
- Social Security retiree benefits
- Medicare
THIS IS THE PERFECT STORM
PRESSURE TO CHANGE

The Healthcare Squeeze

Regulatory

Financial

Consumerism

Market
THE WRITING IS ON THE WALL

Those who change and improve their performance continually - will survive

Those who don’t - will go the way of the Dodo
CHANGE IS ACCELERATING
As a faith based organization, it is the mission of Trinity Mother Frances to enhance community health through service with compassion, excellence, and efficiency.

Some of the Major Initiatives

- Quality Department
- Huron Group
- Pillars of Excellence
- iCARE Program (Studer)
- Expanding the Existing PI Function
CHANGE OUR PARADIGM

Quality

VALUE

Service

Finance
MANUFACTURING IN THE 80’S

Toyota embraced a philosophy called **Lean Thinking** to help them compete internationally.

General Electric was an early adopter of the process improvement methodology **Six Sigma**.
APPLICATION TO HEALTHCARE?

- Univ. of Pittsburgh improved cath lab utilization by $5.2 M
- Valley Baptist decreased surgical cycle time to save $1.3 M
- Thibodaux Regional yielded more than $4 M in revenues
- Commonwealth Health Corporation saved $7 M
- Good Samaritan Hospital saved $6 M
- Virtua Health reduced LOS from 6 to 4 days for CHF
- Boston Medical increased imaging revenues by $2.2 M
LEAN MANUFACTURING TIMELINE

1850
- Eli Whitney
  - Interchangeable Parts
  - Drawing Conventions
  - Tolerances
  - Modern Machine Tool Development

1900
- Eli Whitney
  - Interchangeable Parts

1900
- Frederick Taylor
  - Standardized Work
  - Time Study & Work Standards
- Gilbreth
  - Process Charts
  - Motion Study

1950
- Henry Ford
  - Assembly Lines
  - Flow Lines
  - Manufacturing Strategy
- Taiichi Ohno
- Shigeo Shingo
- Eiji Toyoda
  - Toyota Production System
  - Just-In-Time
  - Stockless Production
  - World Class Manufacturing

2000
- Lean Manufacturing
WHAT IS LEAN?

Eliminate/reduce anything that does not add-value

Value-add is defined as an activity or service a customer is willing to pay for.

All other aspects of the process are deemed non-value-add activities or waste.
Think Like The Customer

Customer invoice concept
(Are you willing to pay for it?)
WASTE or MUDA

The activities of a process that add no value to service or product

Things to note about waste –

• Waste adds cost/time. It can also injure the patient
• **Waste is really a symptom** rather than a root cause
• Find and **address the causes** of waste
### EXAMPLES OF VALUE-ADD AND NON-VALUE ADD ACTIVITIES

<table>
<thead>
<tr>
<th>Value-Add Activities</th>
<th>Non-Value Add Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Search for charts</td>
<td>Claims Processing</td>
</tr>
<tr>
<td>Discharge instructions</td>
<td>Procedure Setup time</td>
</tr>
<tr>
<td>Inspection</td>
<td>Sorting</td>
</tr>
<tr>
<td>Transport Patient</td>
<td>Coordinate SNF placement</td>
</tr>
<tr>
<td>Educating patient</td>
<td>Faxing orders</td>
</tr>
<tr>
<td>Reminder calls</td>
<td>Consultation w/doctor</td>
</tr>
<tr>
<td>Sorting</td>
<td>Scheduling Surgical case</td>
</tr>
<tr>
<td>Dictation</td>
<td></td>
</tr>
<tr>
<td>Admin meeting</td>
<td></td>
</tr>
<tr>
<td>Taking an X-ray</td>
<td></td>
</tr>
</tbody>
</table>

- Waiting for test result
- RN responding to Patient call light
- Ordering supplies
- Perform procedure
- Insurance verification
TYPES OF WASTE


- **Defects**: Efforts caused by rework, scrap, and incorrect information.
- **Overproduction**: Production that is more than needed or before it is needed.
- **Waiting**: Wasted time waiting for the next step in a process.
- **Non-Utilized Talent**: Underutilizing people’s talents, skills, & knowledge.
- **Transportation**: Unnecessary movements of products & materials.
- **Inventory**: Excess products and materials not being processed.
- **Motion**: Unnecessary movements by people (e.g., walking).
- **Extra-Processing**: More work or higher quality than is required by the customer.
Defects

Errors or rework due to low quality or lack of information or mistakes

- Medication errors
- Wrong patient/wrong treatment
- Misfiling of reports
DEFECTS CASE STUDY

• Captured 1 month of errors by type and facility
• 6% of all transcribed reports contained errors
• Team generated mistake-proofing solution (*poka-yoke*)
• Modified process and re-educated staff

### Import Errors
tracked for 1 week

<table>
<thead>
<tr>
<th></th>
<th>CBay</th>
<th>Hancock</th>
<th>Mitchell</th>
<th>Spheris</th>
<th>Inhouse MTs</th>
<th>Home MTs</th>
<th>Patton</th>
<th>Total</th>
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<tbody>
<tr>
<td>Invalid service date/admit date/discharge date/report</td>
<td>1</td>
<td>8</td>
<td>4</td>
<td>7</td>
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<td>3</td>
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<td>Patient name errors</td>
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<td>0</td>
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<td>Invalid MR#</td>
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<td>36</td>
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<td>15</td>
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<td>36</td>
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<td>11</td>
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<td>CC MDs error/invalid copies</td>
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<td>0</td>
<td>5</td>
<td>8</td>
<td>0</td>
<td>2</td>
<td>15</td>
<td>15</td>
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<tr>
<td>Invalid MD#</td>
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<td>1</td>
<td>1</td>
<td>7</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>9</td>
</tr>
<tr>
<td>Doubles sent</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>10</td>
<td>0</td>
<td>10</td>
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<tr>
<td>Missing required fields</td>
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<td>0</td>
<td>7</td>
<td>2</td>
<td>0</td>
<td>34</td>
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<td>43</td>
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<tr>
<td>Asked to resend</td>
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<td>0</td>
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<td>0</td>
<td>0</td>
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<tr>
<td>Miscellaneous</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>2</td>
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<tr>
<td>Multiple Interface record conflict</td>
<td>572</td>
<td>701</td>
<td>759</td>
<td>1147</td>
<td>0</td>
<td>2625</td>
<td>276</td>
<td>6080</td>
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<tr>
<td>Interface record/field error</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>604</td>
<td>731</td>
<td>790</td>
<td>1238</td>
<td>0</td>
<td>2686</td>
<td>286</td>
<td>6335</td>
</tr>
</tbody>
</table>
EIGHT WASTES

Overproduction (process not in balance)

*Producing more than what the customer or patient needs right now, or producing faster than the next step requires or can handle.*

- OR case carts
- On demand meals
- Economies of scale
EIGHT WASTES

Waiting

*Idle time created when the next resource, equipment or people are not ready*

- Patient in the waiting room
- Physician waiting for lab reports
- Patient waiting for bed assignment
• Delay in CT start time
• Did workflow of patient throughput and identified wait times
• Targeted bottlenecks for evaluation
• Largest bottleneck due to contrast not being given prior to test date
• Changed process to give contrast the day prior when possible
Non-Utilized Talent

Unutilized staff knowledge, skills and energy.

Bright Ideas
Transportation

Unnecessary movement of patient/product from one place to another that does not add-value

- Patient transport for X-Rays
- Transport samples/specimens
- Repeated transportation of patient
TRANSPORTATION CASE STUDY

• Opportunity – Pre-op process was very labor intensive
• Identified stations and sequence of patient requirements
• Developed spaghetti diagram to illustrate movement.
• Clustered “like” activities together
• Reduced transportation of patient, equipment, and staff
Inventory

*Material waiting to be processed. More materials, information, or products in stock than what is currently needed.*

- Excessive amount of data
- Labs batched for analysis
- Duplicate inventory locations
INVENTORY CASE STUDY

• Radiology requested to expand space to house more films
• Lean team used “5-Whys” to validate need for expansion
• Performed root cause analysis to determine reasons we kept films
• 30% of film inventory added no clinical value or legally required for storage

  • Why do you need more space?
  • Why do you have so much film?
  • Why do you keep everything?
Motion

*Unnecessary staff movement that does not add any value. Poor ergonomics.*

- Non-optimized work room (OR)
- Searching for tools and instruments
- Using multiple applications per case
What is missing in this work station? Coffee!
Extra-Processing

Adding more value than the customer is willing to pay for.

- Capturing unneeded images
- Excessive packaging
- Multiple forms for same data
### EXTRA-PROCESSING CASE STUDY

<table>
<thead>
<tr>
<th>ID</th>
<th>NAME</th>
<th>DATE</th>
<th>CASE</th>
<th>DETAILS</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>John Doe</td>
<td>01/15/2023</td>
<td>Extra</td>
<td>Details about the extra processing case of John Doe.</td>
</tr>
<tr>
<td>2</td>
<td>Jane Smith</td>
<td>01/16/2023</td>
<td>Extra</td>
<td>Details about the extra processing case of Jane Smith.</td>
</tr>
</tbody>
</table>

---

**Note:** The table above represents a sample of extra-processing cases. For a comprehensive understanding, please refer to the full report or case database.
Mistake proofing a process

Avoiding \(\text{yokeru}\) inadvertent errors \(\text{poka}\)

- Wheel chair auto lock
- CPOE
- Angio tables
- Robotic pharmacies
Spaghetti diagrams show the overall traffic pattern. It highlights inefficient layouts and large travel distances between key steps and opportunities to optimize layouts.
SWIMLANE FLOWCHART

ECC to Bed (Detailed Process Flow)

<table>
<thead>
<tr>
<th>START</th>
<th>FINISH</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Patient</strong></td>
<td><strong>Transported to Bed on nurse unit</strong></td>
</tr>
<tr>
<td><strong>ECC Unit Secretary</strong></td>
<td><strong>Submit Transportation Request (misogram)</strong></td>
</tr>
<tr>
<td><strong>Bedboard</strong></td>
<td><strong>Request bed to be cleaned</strong></td>
</tr>
<tr>
<td><strong>Housekeeping</strong></td>
<td><strong>Clean bed/room</strong></td>
</tr>
<tr>
<td><strong>Nursing Unit</strong></td>
<td><strong>Charge Nurse Available?</strong></td>
</tr>
<tr>
<td><strong>ECC Nurse</strong></td>
<td><strong>Determine Transport needs</strong></td>
</tr>
<tr>
<td><strong>Transport Staff</strong></td>
<td><strong>Dispatch receives Misogram</strong></td>
</tr>
</tbody>
</table>

**FLOWCHART Diagram**

- **ECC to Bed**: Examined by physician and admit order written
- **Patient Waits**: Bed clean?
- **ECC Unit Secretary**: Receive admit order from ER Doctor
- **Bedboard**: Receive Misogram
- **Housekeeping**: Clean bed/room
- **Nursing Unit**: U.S. answers (Nurse station)
- **ECC Nurse**: Dispatch receives Misogram
- **Transport Staff**: Assign transporter for patient pick up & patient equip needs
LEAN TOOLS - THE 5S SYSTEM

5S is a workplace organization technique composed for five primary phases: Sort, Set In Order, Shine, Standardize, and Systematize.

SORT
Keep only necessary items in the workplace.

SET IN ORDER
Arrange items to promote efficient workflow.

SHINE
Clean the work area so it is neat and tidy.

STANDARDIZE
Set standards for a consistently organized workplace.

SYSTEMATIZE
Maintain and review standards.
BEFORE 5S
AFTER 5S

Maintain the gain
It starts with understanding and accepting why
Use tools such as checklists and inspections
LEAN TOOLS - VISUAL WORKPLACE

Tell at a glance what and how we are doing

• Use standard control devices
• Use colors
• Use signs
• Make abnormalities & waste obvious
VISUAL WORKPLACE
Value Stream Mapping is a Lean tool utilized to assess **value add** and **non-value add** steps in a system. AKA a “beginning to end” system map.

- Macro scale workflow (suppliers to customers)
- Gathers and displays a broad range of information (process times, wait time, # in queue)
- Identifies improvement activities

**Don’t Fret** – A simple workflow often accomplishes just as much
Create a high level work flow.

Step 2 – Begin to enter process data.

Process time

Wait time
LEAN TOOLS – VSM

Identify Support Groups

- Radiology
- Materials
- Lab
- Enviro Services
- Pharmacy
- Physicians
- Transport

Admitting

Admission and Registration

Triage

Labor/Delivery

Stabilize

Post Partum

Discharge

Go home
Add additional process data

- Admitting
- Admission / Registration
- Triage
- Labor/Delivery
- Post Partum
- Discharge
- Go home

- Radiology
- Materials
- Lab
- Enviro Services
- Pharmacy
- Physician
- Transport

- General
  - # of FTEs
  - Shift Pattern
  - Safety
  - Occupancy
  - Quality
  - Patient Sat. (opp)
  - Audit
  - Total Time Correct
  - Preadmit Data Awake
  - Pres. Data Inactive

- Delivery
  - Cycle Time
  - On-Time Delivery
  - Hold Time
  - Caisl

- Mort.
  - Absenteeism
  - Employee Sick

- General
  - # of FTEs
  - Shift Pattern
  - Safety
  - Incident Rate
  - Patents
  - Employees
  - Occupancy
  - Quality
  - Patient Sat.
  - Audit
  - First Time Correct
  - Delivery
  - Cycle Time
  - On-Time Delivery
  - Change Over Time
  - Wai Time
  - Cost
  - Mort.
  - Absenteeism
  - Employee Sick

- General
  - # of FTEs
  - Shift Pattern
  - Patient Safety
  - Incidence Rate
  - Patients
  - Employees
  - Occupancy
  - Quality
  - Staff Absenteeism
  - Employee Sicks
  - Staff Absenteeism
  - Employee Sicks

- General
  - # of FTEs
  - Shift Pattern
  - Safety
  - Incidence Rate
  - Patients
  - Employees
  - Occupancy
  - Quality
  - Staff Absenteeism
  - Employee Sicks
  - Staff Absenteeism
  - Employee Sicks

- General
  - # of FTEs
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  - Occupancy
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  - Staff Absenteeism
  - Employee Sicks

- General
  - # of FTEs
  - Shift Pattern
  - Safety
  - Incidence Rate
  - Patients
  - Employees
  - Occupancy
  - Quality
  - Staff Absenteeism
  - Employee Sicks
  - Staff Absenteeism
  - Employee Sicks
Add all additional data

Department specific

Quality

Patient Satisfaction
Would Recommend: 86.2%
Promptness: 82%
LEAN TOOLS – VSM
LEANTOOLS – Pull/Push - Kanban

Kanban
A signal to the upstream process to act, replenish, make, or move a product or service
STEADY FLOW

Making value flow at a steady rate which matches the rate of customer demand.

• Takt Time - pace of customer demand
• Cycle Time - current pace of production

Produce only at pace of customer demand
Takt time = Cycle Time
USED HEAVILY IN HEALTHCARE

Staffing to demand
MAIN TENETS OF LEAN ARE:

• **Define VALUE** – providing the customer with the right product, for the right price, at the right time.

• **Identify VALUE STREAM** – the set of actions that bring a product from concept to realization (order to delivery).

• **Make the steps FLOW** – seamless movement through value-creating steps. Balancing the process.

• **Demand PULL** – acting only to satisfy customer needs, rather than forcing, or pushing, a product upon the marketplace.

• **Pursue PERFECTION** – continuously and relentlessly improving the value, value stream in business operations.