Management Case Study: Using Lean Methodology to Improve IV Medication Preparation in Pediatrics

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Oregon Health & Science University

Disclosures
The program chair and presenters for this continuing education activity have reported no relevant financial relationships.

Learning Objectives
• Define concepts in relation to Lean and daily management systems
• Explain select lean tools to measure current and future state during process improvement kaizen events.
• List improvement strategies upon identifying waste within an IV admixture workflow

Self-Assessment Question 1
• Identify the 7 sources of waste during a waste walk
  a. Transportation, Inventory, Motion, Waiting, Overprocessing, Overproduction, Defect
  b. Transportation, Inventory, Motion, Waiting, Overanalyzing, Overproduction, Defect
  c. Transportation, Inventory, Motion, Waiting, Overprocessing, Overproduction, Discussion
  d. Transportation, Inventory, Monitoring, Waiting, Overprocessing, Overproduction, Defect

Self-Assessment Question 2
• During a lean process improvement kaizen event, all of the following lean tools can be used to measure current state except:
  a. Spaghetti diagram
  b. Waste walk
  c. Value stream map
  d. Team meeting

Self-Assessment Question 3
• During a kaizen event, excess IV waste is identified as being returned to the pharmacy. The current batch print time is 6 am and 6 pm. One strategy to reduce waste being returned includes:
  – Increasing total # of batches per day
  – Decreasing total # of batches per day
  – Educate providers and nurses about the waste
  – Recycle unused preparations being returned to pharmacy
Departmental Overview

Mission statement: “Our mission is to protect and promote the health and well-being of our patients. We are dedicated to the best use of medications to provide safe and effective care.”

Lean Assessment Tools

- Value Stream Mapping
- Waste Walk
- Spaghetti Diagram

Department vs Value Streams

Value Stream View → Value Stream (System) Approach

Building a Value Stream

Lean Assessment Tools

- Value Stream Mapping
- Waste Walk
- Spaghetti Diagram
Seven Types of Waste

- Transportation
- Inventory
- Motion
- Waiting
- Over-processing
- Overproduction
- Defects (poor quality, errors)

Rules for a Waste Walk

- Go to the Gemba (where the work is done)
- Create an inventory of the waste you find
- Talk to those that do the work – what gets in their way of providing value to their customers?

Lean Assessment Tools

- Value Stream Mapping
- Waste Walk
  - Spaghetti Diagram

Spaghetti Diagram

- A visual depiction of movement, motion, and transportation, in the current state
- Provides a foundation for physical changes to reduce waste and increase value in the future state
Daily Management Systems (DMS)

Leader Roles and Time in the Workplace

OHSU’s DMS Huddle Structure

Tiered Huddles

Daily Management Systems (DMS)

ASSESSMENT OF CURRENT PEDIATRIC IV SYRINGE CARTFILL WORKFLOW

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Lean Pharmacy Pediatric IV Cart fill Project Charter

Problem Statement: A twice daily pediatric IV syringe cart fill results in excess waste, missing medications and medication delays.

Primary Objective: Reduce cycle time of IV syringe cart fill
Secondary Objective: Reduce total wait times for first dose and urgent medications; Reduce FDR reports related to medication delays; Reduce medication waste by 20%

Objectives:
- Identify potential steps within the pediatric cart fill workflow that will reduce wait time and overprocessing
- Optimize workflow
- Optimize IV technician total process time

<table>
<thead>
<tr>
<th>In Scope</th>
<th>Out of Scope</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Optimize workflow • Print additional labels • Print syringe batch label • Nurse layout • IV label and medication • Assist IV technician workflow</td>
<td>• The additional PDFS • Chemo &amp; 输液 orders • Adult &amp; child batch • Pharmacy database and delivery process</td>
</tr>
</tbody>
</table>

Improvement Team:
Lead IV Cart Technician
Sr. RN Pharmacist
Peds Clinical Pharmacist
Peds RN Technician
Operation Manager
Technical Manager

Project Sponsor: Jana Chickamasson
Pharmacist; Annalise Vannucchi
Facilitator: Steven Lam; Linda Nguyen

Methods for Observation

- Timed First Dose orders and Cart Fill orders
  - From time label is printed until medication is placed in delivery bin outside of anteroom
  - Observe anteroom technician, IV room technicians and pharmacist to record workflow activities

Current State: Cartfill

<table>
<thead>
<tr>
<th>Cart Name</th>
<th>Label Print Time</th>
<th>Dispense Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV (Adult)</td>
<td>0400</td>
<td>0900-0959</td>
</tr>
<tr>
<td></td>
<td>0600</td>
<td>1000-1059</td>
</tr>
<tr>
<td></td>
<td>0700</td>
<td>1100-1159</td>
</tr>
<tr>
<td></td>
<td>0800</td>
<td>1200-1259</td>
</tr>
<tr>
<td></td>
<td>0900</td>
<td>1300-1359</td>
</tr>
<tr>
<td></td>
<td>1000</td>
<td>1400-1459</td>
</tr>
<tr>
<td></td>
<td>1100</td>
<td>1500-1559</td>
</tr>
<tr>
<td>Syringe (Pedi)</td>
<td>1200</td>
<td>1600-1659</td>
</tr>
<tr>
<td></td>
<td>1300</td>
<td>1700-1859</td>
</tr>
<tr>
<td></td>
<td>1500</td>
<td>1900-2059</td>
</tr>
<tr>
<td></td>
<td>1700</td>
<td>2100-2085</td>
</tr>
<tr>
<td></td>
<td>1905</td>
<td>1200-2359</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>0000-1159</td>
</tr>
</tbody>
</table>

Current State: Spaghetti

Figure 4. Current state spaghetti diagram of pharmacist and technician workflow within IV room

Current State: Value Stream Map

Observations of Waste

- Waiting
  - Waiting to be sent into the IV room
  - Waiting to be mixed
  - Waiting to be checked
  - Waiting to be sent out after mixed

- Overproduction
  - Making same product twice
  - Making discontinued orders

- Overprocessing
  - Sorting medication multiple times
  - Pulling wrong medications for mixing

- Transportation & Motion
  - Walking to pass-through to pick up and send off medications

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Kaizen Prioritization

<table>
<thead>
<tr>
<th>IMPACT</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>Easy Parking Lot</td>
<td>To Do</td>
<td></td>
</tr>
<tr>
<td>Hard No Later</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Implementation

- Standardization of preparation of ICU batch drips
  - What par levels? Kanban card?
  - Cartfill time change → q 1 hour; informatics required
  - Designate locations for urgent/routine
  - Develop DMS standards for daily check-in
  - SS (Sort, Set in Order, Shine, Standardize, Sustain)
  - Add 2nd RPh computer
  - Add 2nd printer for batch in chemo area of anteroom
  - IV Room "charge tech" role
  - Visual/sound for urgent medication (door bell)

Hard Implementation

- Change room layout/hood + Automation
- Standardize bins (different colors, same size)
- Decrease interruptions
- ED first doses have higher priority
- Add discontinuity printer in IV room near mixers
- Change practice of "doses due now" without allowing preparation time
- Purchase new repeater pump with labels that print/show volume pumped
- Standardization of table height/length → add second tier

Implementation

- Daily charge technician
  - Responsible for directing workflow in collaboration with pharmacist
  - Responsible for requesting reallocation of resources
  - Responsible for surfacing any concerns or issues

Daily Charge Technician

Daily Management System

Just-In-Time Production

<table>
<thead>
<tr>
<th>Cart Name</th>
<th>Label Print Time</th>
<th>Dispense Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV (Adult)</td>
<td>No Change</td>
<td>No Change</td>
</tr>
<tr>
<td>Syringe ( Pediatric)</td>
<td>0230, 0630, 0730, 0830, 0930, 1030, 1130, 1230, 1330, 1430, 1530, 1630, 1730, 1830</td>
<td>0830 - 1029, 1030 - 1129, 1130 - 1229, 1230 - 1329, 1330 - 1429, 1430 - 1529, 1530 - 1629, 1630 - 1729, 1730 - 1829, 1830 - 2029, 2030 - 2229, 2230 - 0829</td>
</tr>
</tbody>
</table>

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Kanban Cards for ICU Batch

ICU BATCH KANBAN
Product: Epinephrine
Strength: 1:1000

If you use this Epinephrine 5 mg/5 ml bottle, take the corresponding bag.
Mon - Fri, 12:00 to 4:00, Thurs - 6:00 to 6:30, Sat, 8:00 to 10:00
Place this card in front of the bag.

Visual controls: Colored Clip
Yellow = First Dose  Red = Urgent

Table 1. Pediatric medication costs before and after implementation of workflow improvements

<table>
<thead>
<tr>
<th>Cost Item</th>
<th>Pre Implementation (Current State)</th>
<th>Post Implementation</th>
</tr>
</thead>
<tbody>
<tr>
<td>IV Infusion Cost</td>
<td>$750.00</td>
<td>$200.00</td>
</tr>
<tr>
<td>IV Urgent Infusion Cost</td>
<td>$220.00</td>
<td>$170.00</td>
</tr>
<tr>
<td>Washed Drug Cost</td>
<td>$3,400.00</td>
<td>$3,000.00</td>
</tr>
<tr>
<td>Total Wasted Cost</td>
<td>$4,300.00</td>
<td>$3,100.00</td>
</tr>
<tr>
<td>Estimated Annual Cost</td>
<td>$275,000.00</td>
<td>$170,000.00</td>
</tr>
<tr>
<td>Estimated Annual Cost Saving</td>
<td>$100,000.00</td>
<td></td>
</tr>
</tbody>
</table>

Results

Figure 1. Value stream maps of cartfill medications pre (A) and post (B) implementation of Just in Time pediatric cartfill.
**Key Takeaways**

- **Key Takeaway #1**
  - Engaging frontline staff in identifying and undertaking process improvement efforts is critical to the overall success of those efforts.

- **Key Takeaway #2**
  - Lean analysis tools are an effective strategy to step back from daily work to see the waste.

- **Key Takeaway #3**
  - Who is TIM WOOD? He hides in all areas of your Health-System – seek him out!

**In Summary**

- **Primary objective:**
  - Reduction of total cycle time for cartfill via JIT production by 10 minutes.

- **Secondary objective:**
  - Reduction of actual medication waste by 23%:
    - Estimated medication waste avoidance ($60,000).
    - Reduction of total cycle time for first dose and urgent by 4.5 minutes.
    - No difference in reported medication delays pre/post.

**Self-Assessment Question 1**

- Identify the 7 sources of waste during a waste walk:
  a. Transportation, Inventory, Motion, Waiting, Overprocessing, Overproduction, Defect.
  b. Transportation, Inventory, Motion, Waiting, Overanalyzing, Overproduction, Defect.
  c. Transportation, Inventory, Motion, Waiting, Overprocessing, Overproduction, Discussion.
  d. Transportation, Inventory, Motion, Waiting, Overprocessing, Overproduction, Defect.

  **Answer:** a

**Self-Assessment Question 2**

- During a lean process improvement kaizen event, all of the following lean tools can be used to measure current state except:
  a. Spaghetti diagram
  b. Waste walk
  c. Value stream map
  d. Team meeting.

  **Answer:** d

**Self-Assessment Question 3**

- During a kaizen event, excess IV waste is identified as being returned to the pharmacy. The current batch print time is 6 am and 6 pm. One strategy to reduce waste being returned includes:
  a. Increasing total # of batches per day
  b. Decreasing total # of batches per day
  c. Educate providers and nurses about the waste.
  d. Recycle unused preparations being returned to pharmacy.

  **Answer:** a
Discussion

- How many Health- Systems present today are currently engaged in using Lean to optimize your daily work?
- What barriers exist that prevent you from engaging your leadership and frontline staff in adopting Lean for continuous quality improvement?