Introduction to healthcare quality improvement

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Director, Quality Improvement
Agenda

• Why is process improvement important to clinicians?
• Review leading approaches
  – Lean
  – Six Sigma
  – Model for improvement/PDSA
• Scenarios
• Take-a-ways
• Questions
Key dates in health care QI

• 1910: Ernest Codman, MD, proposes “end-result” system
• 1918: American College of Surgeons first hospital inspections using “minimum standard”
• 1945: W. Edwards Deming and Joseph Juran emerge as quality leaders
• 1951: The Joint Commission on Accreditation of Hospitals is founded
• 1966: Avedis Donabedian, MD, publishes “Measuring the Quality of Medical Care”
  – Focus on Structure, Process, Outcome
• 1999: IOM Report – To Err is Human; up to 98,000 deaths due to medical errors
• 2001: IOM Report – Crossing the Quality Chasm; suggest major system changes
• 2003: The Joint Commission publishes first set of National Patient Safety Goals
• 2010: ACA legislation is enacted
Business and patient care imperative

- Up to 98,000 deaths and 1 million harmed every year due to medical errors, IOM, 1999
- $19 billion in direct hospital costs, Society of Actuaries, 2009
- 200,000 to 400,000 deaths from medical harm, *Journal of Patient Safety*, 2013
- Penalties and rewards based on quality, ACA legislation, 2010
  - Prevented 15,000 deaths and 560,000 patient harms
  - Saved $4.1 billion
Why is process improvement important?

- Empowers the people who do the work
- Breaks down barriers
- Builds a sense of team and shared purpose
- Helps define goals and ways to achieve them
- Focuses on systems, not individuals
- Improves care processes and outcomes
- Makes work more efficient
- Increases sense of control and professional satisfaction
General quality improvement work flow

1. Use data to identify a problem
2. Evaluate data and look for causes
3. Develop improvement ideas
4. Implement improvement ideas
5. Monitor and sustain
6. Adjust, revise and repeat
What are Lean and Six Sigma?

• Structured approaches to problem solving
• Methodologies and tools
• A starting point to help us to…
...see what is in plain sight,...
...as well as address workarounds and overcome obstacles.
How well do we see individually?

Note: The risks of analytical thinking and fragmentation of knowledge
Lean

- **Focus**: Reduce waste; centered on people “on the line” making improvement 
  - The Andon concept
- **Deployment**: program and project level
- **AKA**: Toyota Production System (TPS)
- **Key tools**: Kaizen, 5S, value stream mapping, SIPOC, Gemba walks, spaghetti diagram, root-cause analysis, visual management, Kanban (pull systems), Poke-a-yoke (error-proofing), PDSA
- **Structure**: A-3 thinking: Background, Current State, Goal, Analysis, Recommendations or Future State, Follow up (How and Who to Sustain)?
- **Key metrics**: Wait, Lead, Process and Cycle Times, First Time Quality, financial impact, and customer satisfaction
- **Proponents**: Cleveland Clinic, Denver Health, Intermountain Healthcare, Pittsburgh Regional Health Initiative, ThedaCare, Virginia Mason Health
- **Practitioners**: Sensei – Industrial Engineers, others who have been trained
Wastes

“DOWNTIME”

- Defects
- Overproduction
- Waiting
- Non-utilized/underutilized talent
- Transportation
- Inventory
- Motion
- Excess Processing
Scenario

“I can’t easily schedule my rounds or assist my patients when the needed supplies aren’t readily available. I am never quite sure whether or not the nurse is clear about what I need and often find myself asking multiple people for the same things. I’ve started carrying some of my own supplies on me.”
Six Sigma

• **Focus**: Reduce variability
• **Deployment**: project-oriented
• **Key tools**: Strong focus on Voice of the Customer and statistical analysis
• **Key metrics**: Customer satisfaction, DPM – Defects Per Million, DPMO – Defects Per Million Opportunities
• **Structure**: DMAIC – Define, Measure, Analyze, Improve, Control
• **Conceptual goal**: 99.9996% accuracy, 3.4 defects per million
• **Practitioners**: Green Belts, Black Belts, Master Black Belts
What would 3.4 defects per million look like?

According to the CDC, in the U.S. during 2010, there were:

- 35.1 million hospital discharges
  - 119 defects (Defects defined as death, harm or near misses)
- 54.4 million hospital procedures
  - 184 defects
- 136.3 million ED visits
  - 462 defects
- 100.7 million outpatient visits
  - 340 defects

Total defects = 1,105

Compared to 98,000 deaths and 1 million patients harmed annually due to preventable medical harm.
Model for Improvement - PDSA

**PLAN** - Identify a goal or aim; formulate a theory; and define success metrics

**DO** – Implement the plan

**STUDY** – Monitor outcomes for signs of success or problems

**ACT** - Adjust the plan, change methods or reformulate the theory

What one test of change can you implement tomorrow?
### Scientific Method VS. Lean Thinking/PDSA

<table>
<thead>
<tr>
<th>Scientific Method</th>
<th>Lean Thinking*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observation</td>
<td>Go see, ask why, respect</td>
</tr>
<tr>
<td>(Personal and history)</td>
<td>Observe the actual work!</td>
</tr>
<tr>
<td>“What brings you to the doctor’s office today?”</td>
<td>What’s happening v. what should be happening?</td>
</tr>
<tr>
<td></td>
<td>Draw a map or a diagram. Do we all agree?</td>
</tr>
<tr>
<td></td>
<td>Like a Differential Diagnosis - What might be causing the problem? (root-cause analysis). Methods, Materials, Machines, Men and Women? What do we know? How do we know it? What do we need to know? How will we find out?</td>
</tr>
<tr>
<td></td>
<td>Don’t jump to solutions; don’t tell people what to do! Trust those closest to the work; help them try their ideas. If it doesn’t work, ask what they learned and what they want to try next.</td>
</tr>
<tr>
<td>Hypothesis</td>
<td><strong>P – Plan</strong> (Determine the problems with current conditions, goals, and the needed change)</td>
</tr>
<tr>
<td>Intervention</td>
<td><strong>D – Do</strong> (Try out the changes. In other words, experiment or have a trial of the new approach.)</td>
</tr>
<tr>
<td>Results/reflection</td>
<td><strong>S – Study</strong> (Analyze the results of the experiments and reflect on the learnings.)</td>
</tr>
<tr>
<td>Revise hypothesis</td>
<td><strong>A - Adjust, Act</strong> (Incorporate the new learning or knowledge into the process and work to standardize the change.)</td>
</tr>
<tr>
<td>New intervention</td>
<td>Repeat</td>
</tr>
<tr>
<td>Review results again to ensure goals (care plan) are being met</td>
<td>Monitor, control performance</td>
</tr>
<tr>
<td>(Modify care plan as necessary)</td>
<td>Re-evaluate as necessary</td>
</tr>
<tr>
<td>Record results (in the medical record)</td>
<td>Use A-3, Value-stream Map</td>
</tr>
</tbody>
</table>

*Adapted from: John E. (Jack) Billi, MD, University of Michigan Health System, May 3, 2016 PCPI webinar: Transforming Care: The Value of Lean to Physicians.

NOTE: Color bars identify common, cross-cutting elements among the approaches.
## Defining the current state - SIPOC

<table>
<thead>
<tr>
<th>Supplier</th>
<th>Inputs</th>
<th>Process</th>
<th>Outputs</th>
<th>Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>The group or individual providing the <em>Input</em> to the process.</td>
<td>What the <em>Supplier</em> adds or provides to the process step to take place.</td>
<td>Individual step(s) listed in sequence to complete the process.</td>
<td>The result of the <em>process</em> step being provided to the <em>Customer</em>.</td>
<td>Who receives the <em>Output</em> of the <em>process</em>.</td>
</tr>
</tbody>
</table>

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### SIPOC: Real-world example – Feed the dog

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<th>Outputs</th>
<th>Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dog food manufacturer</td>
<td>Go shopping</td>
<td>Open cupboard</td>
<td>Dog eats</td>
<td>Dog</td>
</tr>
<tr>
<td>Grocery store</td>
<td>Buy dog food</td>
<td>Get bowl</td>
<td>Dog fertilizes garden</td>
<td>Family</td>
</tr>
<tr>
<td></td>
<td>Return home</td>
<td>Fill bowl</td>
<td></td>
<td>Garden</td>
</tr>
<tr>
<td></td>
<td>Put groceries away in</td>
<td>Place on floor</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>cupboard</td>
<td>Call dog</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Real World Example: Feed the Dog

INPUTS
- Go shopping
- Buy dog food
- Return home
- Put groceries in cupboard

Suppliers
- Dog food manufacturer
  - Grocery store

Value-added steps

Outputs
- Dog eats
- Dog fertilizes garden
- Fresh vegetables

Customers
- Happy Dog Family Garden
Root-cause analysis

5 Whys
1. Why?
2. Why?
3. Why?
4. Why?
5. Why?

4Ms and 7Ms
• Manpower (People)
• Machine
• Method
• Material
• Money
• Measurement
• Mother Nature (Acts of God/Bad Luck)
Ishikawa (AKA: Fishbone or cause-and-effect) diagram
Failure Modes and Effects Analysis (FMEA)

• Used prospectively in planning and design
• Brainstorm all potential failures in advance
• Design systems to address the identified potential failure modes
  – Develop standard work
  – Create check lists
  – Modify systems and work stations as necessary
Opportunities for improvement

• Breakdowns
• Workarounds
• Delays (bottlenecks)
• Missed steps
• Too many steps
Improvement ideas or “counter measures”

• Brainstorm moving from the current state, through root-cause analysis to a better future state
  – What do the opportunities for improvement tell you?
  – Based on what you have seen, what are your ideas?
  – What’s beyond the responsibility or ability of the assembled team members to address (management issues)?
5S

The Five S's of Lean

Sort
Eliminate all the things in the workspace that are not being used and store them away.

Set in Order
Arrange the items used on a daily basis so that they can be easily accessed and quickly stored.

Shine
Remove all dirt and grime and keep it that way daily. Ensure all equipment is running correctly.

Standardize
Create a system of tasks and procedures that will reinforce the steps of 5S on a daily basis.

Sustain
Create a motivational culture of 5S in the workplace and maintain the results of your efforts.
Visual management
Central line infections – Allegheny Hospital

1. **Establish current condition:** Chart review of 1,700 MICU and CCU patients for past year
   - 5.1 infections per 1,000 line days
   - 37 had contracted central line infections, some more than once
   - 19 died (51%)
   - Goal: ZERO infections

2. **Observe the actual work in detail, over time**
   - 40 hours of observation
   - Noted procedures followed by line placements, line maintenance (e.g., dressing changes), and communication during activities
   - Noted that femoral lines took longer to dress than subclavian lines

3. **Use real-time data and act on it immediately**
   - Reverted to using data from the lab
   - If infection revealed, team went to bedside within six hours to determine the root cause.

Adapted from the *Pittsburgh Way to Efficient Healthcare*, N. Gruden, 2008.
## SIPOC – Central line infection – Current state

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<th>Inputs</th>
<th>Process</th>
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<th>Customers</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Catheter manufacturer</td>
<td>• Catheter</td>
<td>• Assess patient</td>
<td>• Infection</td>
<td>• Patient</td>
</tr>
<tr>
<td>• Medical Products distributor</td>
<td>• Tape</td>
<td>• Insert femoral line</td>
<td>• Sick patient gets sicker</td>
<td>• Family</td>
</tr>
<tr>
<td>• Hospital Materials Management Dept.</td>
<td>• Gauze</td>
<td>• Respond to infection</td>
<td>• Well patient (eventually)</td>
<td>• Physician</td>
</tr>
<tr>
<td>• House physician</td>
<td>• Wipes</td>
<td>• Remove femoral line</td>
<td>• Death</td>
<td>• Health care team members</td>
</tr>
<tr>
<td>• Nurse</td>
<td>• Antiseptic</td>
<td>• Insert subclavian line</td>
<td>• Adrenaline</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Other</td>
<td>• Administer antibiotics</td>
<td>• Anxiety</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• Frustration</td>
<td></td>
</tr>
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Value stream map - Current state

Current state
Central line insertion
Allegheny Hospital

Supplier

ED: House officer

Assess patient → Insert femoral line → Infection develops → Bedside team assesses patient → Remove femoral line; insert subclavian → Administer antibiotics

Customers

Patient Family
Physician Health Care team

4 days after line insertion

6 hours

Patient recovers from infection
Central line infections – Allegheny Hospital

Root-cause analysis: Lines inserted into the femoral, or groin, area are more likely to become infected despite campaign to use subclavian or jugular area.

1. Why did the patient have a femoral line?
   – The line was inserted emergently at night

2. Why would a physician choose to insert a femoral line at night?
   – At a teaching hospital, fellows usually end their shift at 6 pm. House officers must call a fellow in from home or insert themselves.

3. Why would house officers choose a femoral line?
   – Because many house officers had not been trained yet to insert the subclavian lines, and femoral lines were safer and easier to insert until they were trained.

4. Why would a femoral line be left in for four days?
   – Because the risk of infection had been understated, there was no sense of urgency to remove and insert a new line in a preferred place.

Adapted from the *Pittsburgh Way to Efficient Healthcare*, N. Gruden, 2008.
4. Address problems, one by one, as close to the time and place of the occurrence as possible.

As a result of the root-cause analysis, staff members created standard work (countermeasures):

– Remove femoral lines within 12 hours and replace with a line at a preferred site.
– Replace dysfunctional catheters; do not rewire them.
– Replace lines present on transfer.
– Prefer the subclavian position for central lines
  • Training module developed, including use of simulator
  • All new clinicians trained
  • Paid for using money saved by having fewer central-line infections

**Results:** 1,898 lines inserted, 3 infections, ZERO deaths.

>95% reduction in central-line infections in the MICU and CCU

Adapted from the *Pittsburgh Way to Efficient Healthcare*, N. Gruden, 2008.
Value stream map: Future state

Supplier

ED: House officer

Future state
Central line insertion
Allegheny Hospital

Assess Patient → Insert femoral line → Remove femoral line; insert preferred line → Maintain site

Customer

Patient Family House Officer Medical Team

CHANGES:
- Automatic time limit on femoral line – replaced after 12 hours
- Implemented training

RESULTS:
- ↓Wait Time - 4 days + recovery time
- Prevents infection; ↓ sick patients
- ↓ need to administer antibiotics
- Standardized process

OUTPUTS
- Better Care – no harm
- Healthy patient
- Happier medical/health care staff
Which approach to use?

It depends!

• Lean and Six Sigma are complementary
• Start with Lean (low-hanging fruit) to reduce waste
  – Initial goal is to cut waste by 50%. And then another 50%
• Continue with Six Sigma to optimize and make more precise
• Model for Improvement/PDSA works well for small projects
  – Test an improvement idea before committing to widespread implementation
Take-a-ways

• Lean and Six Sigma are structured approaches to problem-solving
  – Lean focuses on reducing waste
  – Six Sigma focuses on reducing variability
• Help us “see” when, where and why problems occur, rather than assume
• Allows us to produce real improvement instead of prematurely jumping to “solutions”
• Create improvements by those who actually do the work
• Process improvement is NEUTRAL – It’s about the systems, not blame
• Cross department lines and break down barriers
• PDSA allows us to test and modify changes before widespread implementation
• Produce robust processes (lasting and sustainable)
• Don’t let perfection be the enemy of good
Thank you!