Comparing Lean and IHI Quality Improvement

Richard Scoville, PhD
IHQI Speaker Series
February 9, 2015

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  - Institute for Healthcare Improvement
  - Dentaquest Institute
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  - NHS UK
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"Do not seek to follow in the footsteps of the old masters. Seek instead what the old masters sought."

–Basho (1644-1694)
Knowledge for Improvement

Subject Matter Knowledge

Knowledge basic to the things we do in life. Professional knowledge.

Improvement Science

The interaction of the theories of systems, variation, knowledge, and psychology.

QI:
Combining subject matter knowledge with improvement science to develop effective changes.

Some Healthcare QI Milestones

Frederick Taylor
- Experiments in workplace
- Process analysis, measurement
- Top-down design: unskilled labor
- Japanese trainees visit U.S.

Henry Ford
- Assembly line
- Standard product
- Vertical integration

Walter Shewhart
- At Western Electric
- Statistical process control
- PDCA cycle

Edwards Deming
- Student of Shewhart
- Statistician/mathematician
- SPC lectures in Japan 1950

Joseph Juran
- Student of Shewhart
- Quality as a system of management
- Lectures to JUSE 1954

Kiichiro Toyoda
- Toyota Motors founded 1937

Shigeo Shingo
- TPS rapid turnover

Taiichi Ohno
- Toyota Production System 1950s-70s
- Kanban, andon, JIT, pull, Kaizen
- Workers solve problems

Ford Motors
- Invests in SPC 1980s, Mazda Lean Lessons
- Deming Consultants in U.S.
- APS Principles are students
- TV show 1980

Don Berwick founds IHI
- Curing Healthcare 1989
- API: Tom Nolan, Lloyd Provost are QI mentors

Some Healthcare QI Milestones

Womack et al.
- Machine That Changed The World 1990

Virginia Mason, Seattle
- Adopts Lean methods
- Virginia Mason Production System 2000

Resnik et al.
Profound Knowledge

“A system cannot understand itself. [That] requires a view from outside – a lens – that I call a system of profound knowledge.”

Domains of Profound Knowledge

- Appreciation of a System
  “System” = an interdependent group of items, people or processes working together to a common purpose.

- Psychology
  How do people respond to change? How can we encourage constructive change and commitment to excellence? How does human perception and decision making shape process design?

- Understanding Variation
  How should we interpret and respond to the variation that continually occurs in every system?

- Theory of Knowledge
  How can we learn to predict the impact of planned changes? How can we develop sustainable changes that will lead to improvement?
Appreciation of a System

A system is an interdependent group of items, people or processes working together to a common purpose.

“Every system is perfectly designed to achieve the results that it gets.”

- Paul Batalden

Systems

Physical systems

Functional systems (processes)

Social networks
Sizing the System

D: The environment (policy, payment, accreditation, etc.)

C: Organizations that support Microsystems

B: Microsystems

A: Experience of Patients

Population Without Health Insurance, By State

Health-Care Spending as Percent of GDP

When Your Health Coverage Can't Buy You Health Care

Source: Commonwealth Fund
5S = seiri, seiton, seiso, seiketsu, shitsuke
(sort, straighten, shine, standardize, sustain)

Where Do We Lay the Blame?

Case: Wrong procedure. Carpal tunnel release instead of trigger finger release.

Variability is an inherent characteristic of any system. Measures and data are useful to guide future action, provided we can discern patterns in such variation and respond appropriately ... A key distinction is between common cause variation produced by a stable, predictable process and special cause variation that results either from unstandardized, uncontrolled operations or from intentional process changes.

"Variation is a thief...The enemy is not considered, intentional variation, but rather unintended or misinterpreted variation.."
- Don Berwick

"Management is prediction!"
- W. Edwards Deming

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The Bell Curve

Every illness is a story, and Annie Page's began with the kinds of small, unexceptional details that mean nothing until seen in hindsight. Like the fact that, when she was a baby, her father sometimes called her Little Potato Chip, because her skin tasted salty when he kissed her. Or that Annie's mother noticed that her breathing was sometimes a little wheezy, though the pediatrician heard nothing through his stethoscope.

The detail that finally matter was Annie's size. For a while, Annie's fine-boned pettiness seemed to be just a family trait. Her sister, Lauryn, four years older, had always been at the bottom end of the pediatrician's growth chart for girls her age. By the time Annie was three years old, however, she had fallen off the chart. She stood an acceptable thirty-four inches tall but weighed only twenty-three pounds—less than ninety-eight per cent of girls her age. She did not look malnourished, but she didn't look quite healthy, either.
Figure 2. Distribution of age at death for patients with CF dying in 2001 as listed in the National CF Registry.  

Figure 3. Percentage of patients with weight below the 5th percentile receiving supplemental nutritional feedings at each CF care center with >50 patients. Each vertical bar represents one CF center. Centers with <50 pediatric patients are not shown. The mean for all centers is 61.9% ± 21.3%.
Improvement is Temporal

Percent of ER patients with Chest Pain Seen by a Cardiologist within 10 min

<table>
<thead>
<tr>
<th>Week</th>
<th>Date</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>3-Oct</td>
<td>88%</td>
</tr>
<tr>
<td>2</td>
<td>16-Oct</td>
<td>88%</td>
</tr>
<tr>
<td>3</td>
<td>23-Oct</td>
<td>94%</td>
</tr>
<tr>
<td>4</td>
<td>30-Oct</td>
<td>71%</td>
</tr>
<tr>
<td>5</td>
<td>6-Nov</td>
<td>88%</td>
</tr>
<tr>
<td>6</td>
<td>13-Nov</td>
<td>73%</td>
</tr>
<tr>
<td>7</td>
<td>20-Nov</td>
<td>78%</td>
</tr>
<tr>
<td>8</td>
<td>27-Nov</td>
<td>67%</td>
</tr>
<tr>
<td>9</td>
<td>4-Dec</td>
<td>87%</td>
</tr>
<tr>
<td>10</td>
<td>11-Dec</td>
<td>93%</td>
</tr>
<tr>
<td>11</td>
<td>18-Dec</td>
<td>98%</td>
</tr>
<tr>
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<td>25-Dec</td>
<td>60%</td>
</tr>
<tr>
<td>13</td>
<td>1-Jan</td>
<td>93%</td>
</tr>
<tr>
<td>14</td>
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<td>70%</td>
</tr>
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<td>12-Feb</td>
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<td>20</td>
<td>19-Feb</td>
<td>80%</td>
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<td>26-Feb</td>
<td>95%</td>
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<tr>
<td>22</td>
<td>5-Mar</td>
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</tr>
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<td>91%</td>
</tr>
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Did we improve?
What will happen next?
Should we do something?

Source: R. Lloyd

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Did We Improve?

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Did we improve?
What will happen next?
Should we do something?

Source: R. Lloyd
Run Charts

Nonparametric rules for significant change ($p<.05$):

- **Shift** – 6 or more consecutive points above or below the median
- **Trend** – 5 or more consecutively increasing or decreasing points
- **Astronomical Point** – A dramatically different value
- **Runs** – Too many or too few runs if only by chance
Tests for special cause
- One data point that falls outside the limits
- Eight or more consecutive subgroups above or below the mean
- Six points all going up or all going down.
- Two out of three consecutive points in either outer third of the limits.
Psychology deals with the behavior of humans as social actors, their interactions with one another, and their interactions with the systems of which they are a part.

“First we build people, then we build cars.”
- Toyota saying

“Drive out fear.”
- W. Edwards Deming

“Doh!”
- Homer Simpson

Homo Economicus?

- Who are we really?

Are we rational actors who evaluate options carefully and dispassionately?

Or are our actions driven by appetites, reflexes, and faulty logic?
Adhere to Best Practice?

Do you use lung protective strategy in ventilating acute lung injury patients?

Results of A Level 1 Reliability Processes.

Of course we do it every time
‘Heuristics’

- Anchoring
  ‘Manufacturers suggested retail price’

- Availability
  High salience events over-predicted

- Representativeness
  Patterns, patterns everywhere

- Optimism
  All the children are above average

- Loss Aversion
  Losing is worse than not winning

- Status Quo Preference
  The ‘whatever’ principle

- The Herd Instinct
  ‘Everybody’s doing it!’


A Choice Architecture

http://www.youtube.com/watch?v=2lXh2n0aPyw
Culture =

• **Beliefs**
  Ideas and values that the group accepts as ‘self evident’, ‘reasonable’, ‘right’, ‘just’, etc.

• **Rituals**
  Things we do together: work, play, worship, etc.

• **Norms**

*To change culture, change behavior; the rest will follow.*

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An Effective Improvement Culture Requires…

**Transparency!**
Principles from Social Psychology

Asch: “Collective Conservatism”
- People are likely to conform when they know that other people will observe what they have to say
- Newly formed groups establish beliefs and norms quickly

Gilovich: “Spotlight Effect”
- We tend to believe that others are attending to and care about what we do or believe


Lots of Advice Out There…
The development of practical knowledge of “what works,” grounded in predictions about the results to be achieved through system changes. Knowledge is gained through a process of stating a theory, making a prediction based on the theory, comparing observations with predictions, and revising or abandoning the theory accordingly.

“If you don’t try, you’ll never know”
The Model for Improvement

- What it’s **NOT**:  
  - The (entire) IHI-QI approach to improvement  
  - A project plan  
  - Engineering  
  - A ‘toolkit’  
  - A collaborative

- What is **IS**:  
  “A heuristic for learning from experience and guiding purposeful action.”

- At all levels of scale...
“An algorithm for achieving an aim at any scale”

AIM: What are we trying to accomplish?

MEASURES: How will we know if a change is an improvement?

CHANGE: What changes can we make that will result in improvement?
Projects

"All Improvement Takes Place Project by Project. There is no such thing as improvement generally. All improvement takes place project by project and in no other way.

As used here, “improvement project” means “a chronic problem scheduled for solution.” Since improvement project has multiple meanings, the company glossary and training manuals should define it.”

–Joseph Juran - *Handbook*

Planning – Improvement - Control

[Diagram showing quality planning and control processes over time with cost of poor quality and operations begin getting better with lessons learned.]

*Figure 5.3* The Juran trilogy diagram. (Adapted from Juran, J. M. 1998, The Quality Trilogy: A Universal Approach to Managing for Quality, Juran Institute, Inc., Wilton, CT.)
BTS Collaborative: A Learning Model

Select topic and target system, population

Identify subject matter & improvement experts to support the collaborative

Engage local partners

Programme design including spread strategy

Recruit participating teams

Baseline data

Drivers, changes, measures

Expert Meeting

AP1

AP2

AP3

AP4

LS1

LS2

LS3

LS4

LS5

12 – 18 months

KEY
LS = Learning Session
AP = Action Period
Planning & Preparation
Implementation
Spread Activity

Evaluate, Publish, Organize material for future projects

“Without theory, there are no questions; without questions, there is no learning.”
- W. Edwards Deming

“Avoid going through the motions.”
- Xi Jinping
Patients of the NSLIJ system with advanced illness reliably receive care that is trustworthy and aligns with their needs & preferences. They avoid unneeded or undesired tests and treatments, engage with patients and families as respected partners in care, and encourage patient and family responsibility. Measures for improving care include:

1. Patient/family satisfaction
2. ICU days in last X months of life
3. Acute admissions in last X months of life & LOS
4. Cost of care in last X months (to payer, system, and family)

Outcomes

Primary Drivers

- P1: The system of care reliably identifies patients with advanced illness.
- P2: Informed patient preferences and hopes are understood by families and clinicians.
- P3: Services align with patients’ needs and preferences: accessible, appropriate, respectful, coordinated across time and place.
- P4: Financial and payment arrangements support the aim.

Secondary Drivers

- Reliable process for early identification of patients with advanced illness via standard criteria
- Community awareness encourages early self-identification, use of advanced directives
- Preferences are reliably documented and communicated multiple ways
- Team provides curative and palliative care
- Business models are explicit and include supporting care and services outside the hospital

Changes

- Tagger: Notice, The Surprised question, multiple hospitalizations, and criteria
- Providers included and selected for conversations
- Patients with community agencies for awareness programs & recruitment
- Advanced directives, personal health records, electronic sharing with families
- Process to assemble individual care team and communicate to patients
- Partner with community agencies for awareness programs & recruitment

Version 9/13/2013 - Notes (n) in slide notes

Chronic Care Model

- Community Resources and Policies
- Health System
- Health Care Organization
- Self-Management Support
- Delivery System Design
- Decision Support
- Clinical Information Systems
- Informed, Activated Patient
- Productive Interactions
- Prepared, Proactive Practice Team

Functional and Clinical Outcomes
**ECC Phase III – Execution Theory**

AIM: Reduce incidence of caries, pain & referrals by participating practices through application of disease management model. Develop content for campaign to follow.

**ECC Phase III – Execution Theory**

<table>
<thead>
<tr>
<th>Change Concepts</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Eliminate things that are not used</td>
</tr>
<tr>
<td>2.</td>
<td>Eliminate multiple entry</td>
</tr>
<tr>
<td>3.</td>
<td>Reduce or eliminate overkill</td>
</tr>
<tr>
<td>4.</td>
<td>Reduce controls on the system</td>
</tr>
<tr>
<td>5.</td>
<td>Recycle or reuse</td>
</tr>
<tr>
<td>6.</td>
<td>Use substitution</td>
</tr>
<tr>
<td>7.</td>
<td>Reduce classifications</td>
</tr>
<tr>
<td>8.</td>
<td>Remove intermediaries</td>
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<tr>
<td>9.</td>
<td>Match the amount to the need</td>
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<tr>
<td>10.</td>
<td>Use Sampling</td>
</tr>
<tr>
<td>11.</td>
<td>Change targets or set points</td>
</tr>
<tr>
<td>12.</td>
<td>Synchronize</td>
</tr>
<tr>
<td>13.</td>
<td>Schedule into multiple processes</td>
</tr>
<tr>
<td>14.</td>
<td>Minimize handoffs</td>
</tr>
<tr>
<td>15.</td>
<td>Move steps in the process closer together</td>
</tr>
<tr>
<td>16.</td>
<td>Find and remove bottlenecks</td>
</tr>
<tr>
<td>17.</td>
<td>Us automation</td>
</tr>
<tr>
<td>18.</td>
<td>Smooth workflow</td>
</tr>
<tr>
<td>19.</td>
<td>Do tasks in parallel</td>
</tr>
<tr>
<td>20.</td>
<td>Consider people as its the same system</td>
</tr>
<tr>
<td>21.</td>
<td>Use multiple processing units</td>
</tr>
<tr>
<td>22.</td>
<td>Adjust to peak demands</td>
</tr>
<tr>
<td>23.</td>
<td>Match inventory to predicted demand</td>
</tr>
<tr>
<td>24.</td>
<td>Use pull systems</td>
</tr>
<tr>
<td>25.</td>
<td>Reduce choice of routes</td>
</tr>
<tr>
<td>26.</td>
<td>Reduce multiple brands of the same item</td>
</tr>
<tr>
<td>27.</td>
<td>Give people access to information</td>
</tr>
<tr>
<td>28.</td>
<td>Use proper measurements</td>
</tr>
<tr>
<td>29.</td>
<td>Take Care of basics</td>
</tr>
<tr>
<td>30.</td>
<td>Reduce de-motivating aspects of pay system</td>
</tr>
<tr>
<td>31.</td>
<td>Conduct training</td>
</tr>
<tr>
<td>32.</td>
<td>Implement cross-training</td>
</tr>
<tr>
<td>33.</td>
<td>Invest more resources in improvement</td>
</tr>
<tr>
<td>34.</td>
<td>Focus on core process and party</td>
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<tr>
<td>35.</td>
<td>Share risks</td>
</tr>
<tr>
<td>36.</td>
<td>Emphasize natural and logical consequences</td>
</tr>
</tbody>
</table>

**Figure A.1 Complete List of Change Concepts**

1. Develop alliances/cooperative relationships
2. Listen to customers
3. Coach customer to use product/service
4. Focus on the outcome to a customer
5. Use a coordinator
6. Reach agreement on expectations
7. Source for “Free”
8. Optimize level of imports
9. Work with suppliers
10. Reduce setup or start-up times
11. Set up timing to use discounts
12. Optimize maintenance
13. Extend specialty in time
14. Reduce wait time
15. Standardization (Create a Formal Process)
16. Stop tampering
17. Develop operation definitions
18. Improve predictions
19. Develop contingency plans
20. Sort product into grades
21. Desensitize
22. Exploit variation
23. Use reminders
24. Use differentiation
25. Use constants
26. Use affinities
27. Mass customize
28. Offer product/service anytime
29. Offer product/service anywhere
30. Emphasize intangibles
31. Influence or take advantage of fashion trends
32. Increase in % with reduced risk
33. Reduce referrals by 50%
34. Team based care models
35. Increase in % with reduced risk
36. Reduce referrals by 50%
37. Develop alliances/cooperative relationships
38. Listen to customers
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40. Focus on the outcome to a customer
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60. Use differentiation
61. Use constants
62. Use affinities
63. Mass customize
64. Offer product/service anytime
65. Offer product/service anywhere
66. Emphasize intangibles
67. Influence or take advantage of fashion trends
68. Reduce the number of components
69. Disguise defects or problems
70. Differentiate product using quality dimensions
71. Change the order of process steps
72. Manage uncertainty, not tasks

**Change concepts compatible with Lean production**

Source: The Improvement Guide p. 359
North Shore Long Island Jewish – Reducing Sepsis Mortality

A fundamental assumption of clinical QI: Reliable execution of key clinical driver processes improves outcomes measured at the population level

  - 439 indicators of clinical quality of care
  - 30 acute and chronic conditions, plus prevention
  - Medical records for 6712 patients
  - Participants received 54.9% of scientifically indicated care (Acute: 54%; Chronic: 56%; Preventive: 55%)

- The “defect rate” in the quality of American health care is approximately 45%
Getting Consistent, at Scale in Systems

What Can Go Wrong in a Process?

Problems in hand-off between steps

Problems in execution within steps

Source: Peter Margolis, CCHMC; Moira Inkelas, UCLA

Every Step Counts

How many people get what they need from a process that has multiple steps – if there is 90% reliability in each step?

66%

Source: Peter Margolis, CCHMC; Moira Inkelas, UCLA
### Staph aureus (SA) Screening and Decolonization Process Example

<table>
<thead>
<tr>
<th>Schedule procedure</th>
<th>Insert lab request for SA culture</th>
<th>99%</th>
</tr>
</thead>
<tbody>
<tr>
<td>TKA or THA</td>
<td>Inform patient of SA screening</td>
<td>90%</td>
</tr>
<tr>
<td>No</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pt presents for nasal swab</td>
<td>Notify hospital</td>
<td>90%</td>
</tr>
<tr>
<td>Yes</td>
<td>Process specimen</td>
<td>100%</td>
</tr>
<tr>
<td>Results to surgeon &amp; hospital</td>
<td>Positive for SA (90%)</td>
<td>99%</td>
</tr>
<tr>
<td>Contact patient</td>
<td>Confirm Rx complete</td>
<td>75%</td>
</tr>
<tr>
<td>1-4 weeks pre-procedure</td>
<td>Document in record</td>
<td>99%</td>
</tr>
<tr>
<td>2-3 weeks pre-procedure</td>
<td>Surgery</td>
<td></td>
</tr>
<tr>
<td>Day of surgery</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**KEY RELIABILITY MEASURE**

% of colonized patients with completed Rx: 50%

**Source:** IHI Project Joints

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### Building Belief

- Tests increase in scope and scale.
- Learning from data

- System changes that will result in improvement

- Change ideas, suggestions, intuition

- Change

- Change

- Change
IHI-QI Roadmap

- Plan the Initiative
  - Content Theory and Aim
  - Execution Theory and Plan
- Develop, test, and pilot changes
- Implement, sustain and control
- Spread throughout the System
- Evaluate results and ‘pass forward’
What is ‘Value?’ - the Lean Ideal

- The output is defect free.
- The product or service is delivered in response to customer need (pull, on demand).
- The response is immediate.
- Products or services are provided 1x1 in the unit size of use [i.e. tailored to the identified needs of the consumer –the authors].
- Work is done without waste.
- Work is done safely.
- Work is done securely.

Two Systems

Deming: “By what means” the ideal?
- Production System
- Management System

The Production System

Two fundamental operating principles to achieve the ideal
- **Jidoka**: Highlight and visualize problems--stop when defects are detected, continuous inspection at all levels.
- **Just In Time**: each process produces only what is needed by the next process in a continuous flow.

http://www.toyota-global.com/company/vision_philosophy/toyota_production_system/
Concepts To Support Lean Production

- Value versus waste
- Kaizen
- Value stream:
  - Production stream: customer desire → production → consumption
  - Information flows to control production
- A few Lean change concepts
  - standard work • flow • load leveling • poke-yoke • kanban • andon • visual control

Value Stream Map of Current State: Phlebotomy

Source: AHRQ Publication # 05-0108-EF
Waste = ‘Negative Value’

Source: Virginia Mason Health System

Lean Production Roadmap

- Specify value in the eyes of the customer
- Map the value stream
- Eliminate waste and variation
- Make value flow at the pull of the customer
- Continuously improve in pursuit of perfection

Management System

Ideal management system to support value-based production:

• Leader standard work
• Visual controls
• Daily accountability and planning
• Respect for people who do the work
• Unity of purpose


Source: Virginia Mason Health System
Standard Work for Managers

Managers have standard work processes, primary role as coaches for front line staff. Improvement is integrated with standard work.
Daily Management

Lean System Deployment – Road Map

Source: Rohit Ramaswamy, Adapted from MIT Lean Aerospace Institute
For IHI-QI, What is Lean?

“Lean is, in a sense, a complex and deep ‘application’ of Profound Knowledge, a particular deployment of improvement in the realm of production systems... The TPS package of interdependent change concepts ... represents a ‘template’ for improving [production] systems, with a set of predefined aims, change concepts, implementation roadmap, and tools.”

Scoville & Little 2014 - Comparing Lean and QI p. 18

Key Similarities

• Purpose of the system guides improvement: Aim / Value
• Change Concepts
• Continuous Quality Improvement at the front line
• Simplified heuristic for problem solving: MFI, A3
• Shared tools & methods
• Measured feedback
• Emphasis on analytical, blame-free culture
Key Differences of Emphasis

• Blank slate?
  ✓ IHI-QI: Theory drives aims; eclecticism
  ✓ Lean: Aims based on lean ‘ideal’

• Organizing for improvement
  ✓ IHI-QI: Improvement based in projects
  ✓ Lean: Improvement focuses on daily production and management standard work

• Approach to reducing variation (‘what do we think of first?”)
  ✓ IHI-QI: SPC, distinguish common from special causes
  ✓ Lean: Standardized work with kaizen

• Role of leaders
  ✓ IHI-QI: Sponsors, resources, accountability
  ✓ Lean: Coaching, standard work, accountability

Complementary Benefits

IHI-QI
• Go to gemba
• “Bring the improvement initiative to the workplace”
• Management system improvement is essential for sustainable results

Lean
• Key concepts (e.g. “value”, “flow”) must adapt to healthcare.
• Diverse conceptual frameworks offer valuable change concepts for Lean healthcare
• Project formats as a method for Lean deployment
Waste = ‘Negative Value’

Dimensions of Care Value

- Safe
- Effective
- Efficient
- Timely
- Pt Centered
- Equitable

Wasteful Health Care

- Unsafe
  - Care that causes harm
  - Infections
  - Falls and injuries

- Ineffective
  - Care that does not conform to protocol
  - Unnecessary care
  - Insufficient care

- Untimely
  - Waiting for information
  - Scheduling problems
  - Life time for people, equipment

- Inefficient
  - Unnecessary tests, procedures
  - Unnecessary transport or motion
  - Inspection
  - Reports that are not used
  - Readmissions

- Inequitable
  - Care based on ability to pay
  - Care is based on ethnicity, language, culture

- Not-Pt-Centered
  - Disrespectful
  - Patient not informed
  - Families not included
  - Unwanted care

6 Healthcare Wastes
The Model for Improvement

AIM: What are we trying to accomplish?

MEASURES: How will we know if a change is an improvement?

CHANGE: What changes can we make that will result in improvement?

“Deploy a Lean production system in our multi-site health care system.”

Sustained adoption of Lean production and management systems

Improvement in process, outcome metrics

Use a BTS collaborative format focused on process flow, management system

Questions