Lean thinking and Six sigma at the level of Clinical Service Delivery

Hugh Rogers FRCS
Associate, Service Transformation
NHS Institute for Innovation & Improvement

Healthcare Events
26th February 2008

Don’t worry about the jargon!

Evolution of Quality Improvement

1920’s
W Shewhart – Statistical Process Control

1950’s
W E Deming – System of Profound Knowledge

Toyota
Tacchi Ohno
Toyota Production System
‘Lean-thinking’

Jurand
Goldratt
TQM
BPR

Motorola & 6 Sigma
Theory of Constraints

2008
‘Lean 6 Sigma’
Six Sigma

- Focuses on improving processes by reducing variation and minimising error
- Uses a systematic approach: DMAIC
- Relies heavily on statistical methods
- Emphasises ‘Voice of the Customer’
- Works best where there is a clear process to be improved

Focus on Variation

Natural variation
Inevitable characteristic of any healthcare system
Variation in patient characteristics
Take steps to manage it

Artificial variation
Created by the way the system is managed
Variation in the way the service is provided
Take steps to eliminate it

Applying systems thinking to mortality:
Crude weekly deaths on SPC chart
Six sigma core tools

- DMAIC
- SPC
- Voice of the Customer
- Analysis of variance
- Balanced scorecards
- Process management
- Continuous improvement
- Design of experiments

“Six sigma has not been widely applied to patient care”
Revere 2004

Some Criticisms of Six sigma

- Systems interactions not considered – uncoordinated projects
- Lack of consideration of human factors
- Significant infrastructure investment required
- Over detailed and complicated for some issues
- The goal ($\sigma = 3.4$ defects per million) is not always appropriate

Lean Sigma: some basic concepts
H Bevan et al, 2006: NHS Institute for Innovation and Improvement

Lean is the process of identifying the least wasteful way to provide value (better, safer care, with no unnecessary delays at lower cost) to our customers.

Value must always be determined by the customer
What is value? Who is the customer?

We spend 75-95% of our time doing things that increase our costs - and create no value for the customer
**Lean** – focuses on dramatically improving flow in the ‘value stream’ and eliminating waste

**Lean Sigma** – complementary, not competing

**Value Stream Mapping**

**Visual workplace/5s**

**Work standardisation**

**Staff involvement**

**Match resources to demand**

**Pull signals**

**Rapid Improvement Events**

**Multi-functional staff**

**LEAN TOOLS/PRINCIPLES**

**Lean thinking:**

7 wastes

- Overproduction
- Waiting
- Transport
- Inappropriate processing
- Unnecessary Inventory
- Unnecessary motion
- Defects

What does this mean for healthcare??

© NHS Institute for Innovation and Improvement
The Productive Ward: releasing time to care
Reducing wastes

Opportunity to increase safety and reliability of care

5S
Sort
Straighten/Simplify (Set in order)
Shine
Standardise
Sustain
Sustain the gains

5s work in the sluice — reduced the distance travelled to collect commodes and dispose waste on return
Reduced time spent in fetching commodes as they are now 'ready to go'

Original Layout
Revised Layout
There were some surprises!

BEFORE LEAN

AFTER LEAN

What changes can we make that will result in improvement?
1. Pay attention to patients' wants and needs
2. Improve flow and reduce delays
3. Organise your workplace
4. Improve the safety & reliability of care

What is reliability?

The capacity to perform a given function under given conditions for a specified period of time

A reliable health care system is one that is designed to ensure that every patient consistently receives evidence-based, effective care every time he or she needs it

- “Reliability means keeping a promise” (Don Berwick)
Compare Reliability and Safety

**Reliability**
- Errors of omission
- Common cause strategies
- Proactive
- Design of reliable systems

**Safety**
- Errors of commission
- Special cause strategies
- Reactive
- Focused projects

**Overlap**
Failure has high impact

| High frequency low impact | Low frequency high impact |

Increasing Reliability of Clinical Observations

First step in a system to retrieve the deteriorating patient:
- Recognise
- Report
- Respond

Example 1
Increase the reliability of therapeutic interventions through a "care bundle" approach

Example for reducing ventilator associated pneumonia:
- Elevating the head of the bed >30° (Drakulovic, 1999)
- DVT prophylaxis (Cook et al 2001)
- Peptic ulcer prophylaxis (Yang & Lewis 2003)
- Managing sedation effectively with sedation holds (Kress 2000)
- Tight Control of Blood glucose 4.4-6.1 mls (Van den Berghe 2001)

Can be applied to:
- Surgical site infection
- Central line management
- Myocardial infarction
- etc etc
Defect rates in Healthcare

The latest large study in US health care (McGlynn, et al *The quality of healthcare delivered to adults in the United States* NEJM 2003; 348) concluded that the “defect rate” in the technical quality of American healthcare is approximately 45%.

Reliable Care Reduces Complications

Medical Example: Data indicate fewer complications are associated with better patient care.

also reduces length of stay and readmissions

Reliable Care Lowers Mortality Rates

Data show lower mortality rates for heart bypass surgery patients receiving better care.
Standardisation:

- Experts produce final product
- Takes 2 years
- No changes allowed
- Measure before and after
- No new learning

Fail

Succeed

Financial Realism & transparent accountability

Systematised conceptions of clinical work

Nurse managers

Medical managers

Nurse clinicians

Medical clinicians

Clinical purism & Opaque accountability

Medicine, management, and modernisation: a “danse macabre”?
Pieter Degeling et al BMJ 2003;326:649-652
Level 1 Reliability
Personal Intent, Vigilance and Hard Work:
(80% to 95% success)
Feedback of information on compliance
Awareness and training
Personal check lists
Common equipment, standard order sheets

Level 2 Reliability
Reliability Science, System design and Human Factors
(95% to 99.5% success)
Standardise processes
Make the desired action the default
‘Opt-out’ – The desired action = flow of work
Build design aids into the system
Create redundancies and time lapses

SIP: Prophylactic AB gives <60 Minutes Prior to Incision
Baystate Medical Center, Springfield, MA USA

Principles for increasing reliability

Length of Stay and Mortality
West Middlesex Hospital
“A key function of hospitals is to save lives, so it’s surprising how little attention is paid to hospital mortality. Our work in Bradford shows that a hospital mortality reduction programme can make a big impact by significantly reducing mortality. It’s a natural top priority.”
John Wright, Clinical Director, Bradford Teaching Hospitals Trust

High quality error free care is the most cost-effective
Use 20% of Tools to Achieve 80% of Benefits

**LEAN**
- Value Stream Mapping
- Kanban signals
- Visual workplace/5s
- Match resources to demand
- Standard work
- Employee involvement
- Rapid Improvement

**SIX SIGMA**
- DMAIC
- Pareto charts
- SPC Measures
- Voice of the customer
- Failure Modes and Effects
- Analysis (FMEA)

Common themes

- The Process view
- The Systems view
- Variation (and use of SPC)
- Flow
- Identifying the customer
- Links to Human Factors?

"I am quite happy to be promiscuous... what insights does Lean tell me, what does theory of constraints tell me on the same problem and then I can reconcile those two. But people are not good at that at the moment, they don't understand either well enough to be able to reconcile."

Boaden et al: 2006
*Quality improvement: Theory and practice in the NHS*

Institute publications from:

- Going lean in the NHS
- Releasing time to care
  - The productive ward
- The NHS Productive Leader Programme
- The Productive Operating Theatre
- Reducing avoidable deaths in hospital
  - Chief executives lead the way
  - Medical directors drive improvement
- Focus on: productivity and efficiency
- Lean Simulation