



LIH

Lean In Healthcare





Two concepts in lean



Respect for People

Continuous improvement





5 principles



1. the patient defines value

2. Deliver value to the patient on demand (flow)



3. Standardize and solve to improve



4. Transformational learning requires deep personal experience



5. Mutual respect and shared responsibility enable higher performance





8 wastes - D.O.W.N.T.I.M.E



Defects

Over- production



Waiting



Non-production

Transporting



Inventory





Motion



Express processing





Over burden



Safe

Stress free



Engaging at some level



Two categories of demand

1. real demand
2. failure demand



Steps of 6s



Sort out

Set for flow



Scrub



Safety

Standardize



Sustain





A3 thinking: Box 1



reason for action



A3 thinking: Box 2

current state



A3 thinking: Box 3

failure state





A3 thinking: Box 4

gap analysis



A3 thinking: Box 5 solution approach



A3 thinking: Box 6



Rapid experiments



A3 thinking: Box 7 completion plan



A3 thinking: Box 8

confirmed state



A3 thinking: Box 9

insights

Voice of the Customer (VOC)

needs and requirements of their customers

Cycle time

The total elapsed time to move a unit of work from the beginning to the end of a physical process

Takt Time

The rate at which a finished product is completed to meet customer demand, ensures continuous flow

Pareto Analysis

A means of focusing effort on areas that matter most

Directive Management

Do as I say

Supportive Leadership

Do as I do



Effective communication



Convey information

Facilitate discussion



Resolve conflict



Give and receive feedback

Draw out facts



Relate effectively to people



Current State

The "as is" state of a given process as represented by a current state value stream map

Customer

The recipient of the output of a process. An external customer generally pays for the deliverable. For an internal customer, the output becomes the input for a downstream process



Jidoka



Jidoka is one of the two pillars of the Toyota Production System along with just-in-time.



Jidoka highlights the causes of problems because work stops immediately when a problem first occurs. This leads to improvements in the processes that build in quality by eliminating the root causes of defects



Cycle Time

The time required to execute all the activities in a process. Other names include lead time or span time or throughput time. Cycle time includes processing time and wait time.

CV = Coefficient of Variation

Standard deviation divided by the average value.

Enterprise

One or more organizations having related activities, unified operation, and a common business purpose

Fishbone Diagram

Another name for cause and effect diagram.





Defect



Any process output that does not meet the customer's specifications.



Genchi genbutsu

The act of going to the Gemba to observe the actual work being done and talking to the actual people doing the work.

DFMA = Design for Manufacturing & Assembly

A set of practices used during design to assure the component or product can be economically manufactured and assembled.

One DFMA practice is reduction of part count.



Kaizen

The Japanese word for continuous improvement. It means constant improvement in an unending series of small steps.



DMAIC



Define

Measure



Analyze



Improve

Control



5 step process for improvement used in the Six Sigma method



Kanban

Visual cuing system to indicate material, parts, and/or information is/are authorized to move downstream.

DPMO = Defects / Million Opportunities

A measure of process quality

Kitting

Combining all relevant material, parts, and/or information into a single package that can be delivered to the point-of-use in a process to reduce unnecessary movement.

Lean Enterprise

An integrated entity that efficiently creates value for its multiple stakeholders by employing lean principles and practices.

Extended Enterprise

All the entities tied to an enterprise, from the supplier's supplier to the customer's customer.

Lean Thinking

The dynamic, knowledge-driven, and customer-focused process through which all people in a defined enterprise continuously eliminate waste and create value.

Mistake Proofing

The use of process or design features to prevent errors or the negative impact of errors.

A simple example is a gas cap tether to prevent leaving the gas cap at the gas station.

Five Lean Fundamentals

- (1) Specify value
- (2) Identify the value stream
- (3) Make value flow continuously
- (4) Let customers pull value
- (5) Pursue perfection.

Mura

Unevenness, or irregular or fluctuating production or workload due to poor planning, staffing, inoperative equipment, missing supplies, or irregular demand.

Flow Chart

A diagram representing a process or algorithm, showing each process step in a {box, triangle, diamond, bubble...} connected to other {boxes...} with lines showing flow of {material, information}. Incoming {material, information} is from "suppliers" while outgoing {material, information} is sent to "customers" for the process

Muri

Overburden of people or equipment, often leading to Muda.



Future State

A desired new state of a given process



No-Value Added

Something that does not create value for the customer.





Gemba (genba)

Place where work is being done



Point of Use (POU)

The location where supplies, tools, information, human resources are needed to execute a task

Poka Yoke

The Japanese word for mistake proofing

Histogram

A graphical representation of the distribution of a set of data in ranges of the independent variable, or "bins", with rectangles above the bin whose height represents the number of instances or "frequencies" or "count" of the dependent variable for that bin.

Process Capability

"Broadly defined as the ability of a process to meet the customer's expectations. Mathematically defined by C_p or C_{pk} . "

Ideal State

Might not be achievable with current constraints, resources, or knowledge.

Represents a "stretch goal"

Process Map

A flow chart showing all the steps or activities in a process with the output of each step/activity being connected to the input of a downstream step/activity.

IPT = Integrated Product (or Process) Team

Composed of representatives from all the functional stakeholder groups for a product or process

Processing Time

The time that activities are being performed on work in process (WIP). Processing time may consist of Value-Added Time (VAT) and Non-Valued Added Time (NVAT) activities. Other names are: Touch Time (TT), In Process Time (IPT), Response Time (RT).



Ishikawa Diagram



Another name for cause and effect diagram, derived from its creator



Kaoru Ishikawa.

Pull System

A system where a signal from downstream activity for an input results in the upstream activity delivering an output. In a pure pull system, an end customer order cascades upstream with each process delivering one unit to its downstream customer. A pure pull system has no buffers or inventory.

JIT - Just in Time

"The practice of delivering supplies to a customer just as the customer needs them. The contrast would be having supplies stored in inventory until the customer needs them. JIT is a specific example of maintaining flow. "

Push System

A system where an upstream activity delivers output as completed into a buffer or inventory for the next downstream activity.

Rapid Process Improvement Workshop

A three to five-day workshop focused on a specific process improvement opportunity and involving representatives from all the stakeholders involved or affected by the process. The output of an RPIW is a new process design. Other names are: Kaizen events, rapid improvement events



Kaizen Event



Another name for a Rapid Process Improvement Workshop.



Ironically, Kaizen means continual improvement using small steps, where a Kaizen event is a focused workshop introducing a significantly larger improvement.



Relational Coordination

An organizational paradigm centered on shared goals, shared knowledge, mutual respect supported by effective communication.

Scatter Diagram

A graph of unconnected $\{x, y\}$ data points.



SDSA

Standardize-Do-Study-Act, a variant of PDSA that emphasizes a standardized process is undergoing continuous process improvement.

Sigma ()

The standard deviation of a distribution of data

Queuing

The act or instance of waiting in lines or queues for some action to take place.

Little's Law

A conservation law for process flow expressed as $WIP = (\text{throughput rate}) \times (\text{cycle time}) = (\text{cycle time}) / (\text{takt time})$. Given any two of these three variables, the other is determined by Little's law. Little's law strictly applies to long term averages of stable systems, i.e. ones which are not starting, stopping, or surging. However, it is a useful relationship for normal systems.

Single Piece Flow

The practice of having only one unit of work in each process step of a flow line. If there were only one worker, s/he would complete all the steps in the production process for one unit, before starting the next unit. In a flow line with multiple workers, the output from one workstation is immediately worked on by the next workstation, i.e. there are no buffers between workers.

Six Sigma

Data driven philosophy and methodology to eliminate variation from all enterprise processes, named after sigma, the term for standard deviation.



Muda

Waste, or activities that do not add value (see 8 wastes)



Soft Stuff

Refers to the people or organizational practices in a workplace.

Spaghetti Chart

A plot that traces the movement of a person or object throughout a work cycle. The trace of movement back and forth from place to place resembles a pile of spaghetti on a plate.



SPC

Statistical Process Control

Statistical Process Control

The application of statistical process methods, particularly control charts, to monitor a process to determine if it is statistically stable.

Non-Value-Added Time (NVAT)

"The time in a process allocated to non-valued added activities."

Supplier

The person or organization that provides input material or information to a process.

Pareto Chart

Displays instances or counts of a (process) variable versus {categories, causes} of the variable in vertical rectangles above the {category, cause} name. The data is arranged with the tallest bar on the left-hand location, with the next tallest bar next, etc. Often a superimposed line of cumulative instances is plotted from left to right

Swim Lanes

Process or value stream flows that occur in parallel, and sometimes or eventually connect or feed into each other.

Pareto Chart

A chart named after Vilfredo Pareto



Stakeholder Value

How various stakeholders find worth, utility, benefit, or reward in exchange for their respective contributions to the enterprise.



PDCA



Plan Do Check Act - a variant of the name for PDSA



Third Party Logistics

A provider of logistics support between a supplier and a customer, e.g. FedEx might provide all shipping services between a supplier and customer.

PDSA - Plan Do Study Act

Basic Deming improvement cycle used for continuous improvement

Time in Queue

Another name for wait time.

PICK Chart

"A two by two matrix chart where one axis represents the effort or resources for an action and the other axis represents the impact of valued added of an action. The name of each quadrant characterizes the combination of the axis variables: Possibly implement, Implement, Consider, Kill. Candidate actions to address a need are placed in one of the four quadrants during a brainstorming event"

Time Value Chart

A horizontal bar chart for a process broken into sequential segments showing periods of wait time (usually in red) and process time (usually in yellow for non-value-added time and green for value added time). See definition for process time.

Total Quality Management (TQM)

A set of practices or management system focused on continuously improving the quality of products or services. TQM assumes that everyone involved in the production and delivery of the products or services is responsible for their quality. TQM practices are a subset of Lean practices.

UCL, LCL

Upper (lower) Control Limits are horizontal lines drawn on a process control chart at the distance of $\pm 3\sigma$ from the mean or average of the data.

Utilization

The ratio of work demand to work capacity, a number between 0 and 1. For example if demand for work is 13 hours and there are 2 workers who have 8 hours available, their utilization would be $13/(2 \times 8) = 0.8125$

USL, LSL

Upper (Lower) Specification Limits are the customer specified tolerances or variations for a specific process or product, e.g. a hole diameter specified to be 1 inch +/- .01 inches would have its USL = 1.01 inch and LSL = .99 inch. Or for patient falls per month, the LSL = 0, while a USL might be set from benchmark data or mandates.

Value-added Activity

An activity in the value stream that directly contributes to customer value, and which satisfies three criteria (1) the customer wants it, (2) the activity transforms or shapes material or information or humans and (3) it is done right the first time.

Value-added Time (VAT)

The part of the processing time when value added activities are being performed.

Value Stream Map

A process map with quantitative data added for each process step, including wait times and inventory. Data might include processing, wait, or cycle times; inventory; quality or yield data; labor hours; distance traveled, or more. Only valued added data should be collected and included.

Quality

A broad term that represents the fitness of a product or service for the customer's expectations.

Variation

The differences in the output of an activity for a given input due to Common Cause or Special Cause variation

Vendor Managed Inventory

"Inventory in a facility that is monitored and replenished by the vendor. An example would be items on a supermarket shelf that are replenished by the supplier's staff rather than the store's staff. "

Visual Control

Practices that make the state or steps in a process visible to the workforce. Examples include status boards, lights, colored sections of the floor for storing different items, and more.



RPIW

Rapid Process Improvement Workshop

Visual Work Instructions

"Diagrams or graphic displays that show the instructions to produce a part or subassembly. Assembly instructions for IKEA products represent good examples of visual work instruction. The opposite would be the often-frustrating wordy instructions of "insert tab A into slot B" type."

VSM

"Value Stream Mapping" Like flowcharting-
mapping the flow of a process



VSM is a lean manufacturing technique used to document, analyze, and improve the flow of information or materials required to produce a product or service for a customer



VSMA = Value Stream Mapping & Analysis

Act of creating a value stream map and then performing analysis of the data to identify bottlenecks, throughput, cycle time, etc.

Wait Time

The time that whatever is flowing in a value stream is sitting idle with no value added or non-value-added work being done.

Waste

Any activity that does not add value.





WIP

Work in Process



Work in Process

Quantity of work that is flowing in a value stream.



Stakeholder

Any group or individual who can affect or is affected by the achievements of the organization's objective.

Standard Work

The best-known process for a task, based upon the current evidence. Standard work is improved through continuous process improvement - see SDSA.

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Takt Time

The available time for performing work divided by the customer demand rate for the product or services from the work unit; e.g. if there are 40 orders that need to be filled in an 8 hour day, the takt time would be $(8 \times 60)/40 = 12$ min. Takt time represents the drumbeat or pace that the flow line needs to operate at in order to meet the customer demand. It comes from the German word Taktzeit. "takt" translates as "stroke" and "zeit" as "time."

Three Actuals

Go to the actual place, see the actual work being done, and talk to the actual people doing the work - another name for genschi genbutsu

Throughput

The number of {units, patients, documents,} processed during a standard unit of time, e.g. a throughput of 20 patients in a day

Throughput Rate

The number of {units, patients, documents,} being processed per unit of time, e.g. a throughput of 20 patients per 8-hour day would be a throughput rate of 2.5 patients per hour. Throughput is the inverse of takt time, i.e. $\text{throughput} = 1/\text{takt time}$. 20 patients per 8-hour day would correspond to a takt time of 24 min per patient.

Value

A broad definition is the features of a product or service divided by its cost. Specific definitions can be developed for a product or service, but generally value is a relative term that is evaluated by the customer, or "value is in the eyes of the beholder."

Value Stream

The linked end to end activities of a process which transform input {material, information, people) to output {product, components, data, services, people, ...}. A value stream can consist of valued added and non-value-added activities, as well as wait time.



Hippocrates



-460-370BC

-Father Of Medicine



-First do no harm



Florence Nightingale

-1820-1910

-Founder of modern-day nursing

-Authored books which called to attention the importance of cleanliness and sanitation to decrease death rates in hospitals



Dr. Earnest Codman



- Credited with initiating quality in healthcare
- Compared death rates at Boston-area hospitals





Walter Shewhart



-1931

-Statistician at western electric



-Plan Do Check Act (PDCA) cycle



PDCA cycle

-Plan, Do, Check, Act

-Define problem, collect data, determine root cause

-Develop and implement a solution and decide on metrics

-Look at before and after data comparisons

-Document and disseminate results, recommend next problem investigation (continuous improvement)

Total Quality Management Limitations

- In retrospect, many limitations were apparent
- middle management resisted it
- management environments were controlling versus empowering

Components of TQM that survived

- Plan, Do, Check, Act (PDCA) cycle
- Quality Improvement (QI) teams and tools

Healthcare Quality Campaigns

-Safer Healthcare Now (Canada)

-Dr. Donald Berwick (USA)



Dr. Donald Berwick



-USA

-Leading advocate of patient safety



-Harvard Medical School



-Institute for Health Improvement (1991)

-Save 100,000 lives campaign



-Save 1,000,000 lives campaign



-Save 5,000,000 lives campaign

IHI

-Institute for Healthcare Improvement

-1991

Six Sigma for Healthcare

- Became popular in healthcare in the late 1990's

- Customer focused, statistically based process improvement methodology for reducing defects based on process improvement

- 3.4 defects per million opportunities of error

- Six Sigma Green belts and Black belts

- DMAIC



DMAIC

-Define

-Measure



-Analyze

-Improve

-Control





JCAH

-Joint Commission on Accreditation of Hospitals

-1951





JCAHO



-Joint Commission on Accreditation of Healthcare Organizations

-1987



X-Bar R chart

-Variables control chart

-measured/continuous data

P-chart

- Attribute control chart
- count/discrete data
- %defective/proportion defective



C-chart

-attribute control chart

-count/discrete data



-# of defects





8 Wastes

-Defects

-Overproduction



-Waiting

-Non-utilized talent

-Transportation





-Inventory



-Motion

-Excess Processing





5 S's

-Sort

-Set in Order



-Shine

-Standardize

-Sustain





ED



emergency department





IOM

Institute of Medicine





SQC



statistical quality control





JIT

just in time





SPC



Statistical Process Control





ACA



Affordable Care Act



Ideal State of Error-Free Work in Health Care

- Exactly what the patient needs, defect free
- One-by-one, customized to patient to as individuals
- On demand, exactly as requested
- Immediate response to problems or changes
- No waste
- Safe for patients, staff, and clinicians

Adapting Lean to HealthCare

1. Focus on patient needs and patient safety (Specify Value)
2. Map actions needed to fulfill patient wants and needs (ID Value Stream)
3. Perform actions to end without interruption or delay (Flow)
4. Allow the patient to decide when to receive a service (Pull)
5. Continually improve performance and quality to fulfill patient needs (Perfection)

Who are the customers in healthcare?

External (Patients) and Internal (Staff, Third Party Payor)

Leadership Roles and Actions in Changing Culture

Requires personal engagement; a relationship with clinical staff, promotion/improvement of improvement -based organizational change; and procurement of organizational resources

Process Thinking

Looks at the Value Stream of a product (all processes in the value stream for a product, as opposed to the traditional method of management which focused on each process individually).

Current-State Value-Stream Mapping

Map the process exactly as it works currently,
eliminate waste by asking questions of each step,
measure process time and lead time

PDSA Cycle

Plan-Do-Study-Act Cycle; Model for Improvement:
What are we trying to accomplish? How will we know that a change is an improvement? What change can we make that will result in improvement?

Future-State Value-Stream Mapping

Basic Actions: Select a process for improvement; work with the responsible team to map out every step and time; look for steps to eliminate or combine, look for waste and opportunities to reduce delays

A3 Problem Solving Templates

"Developed by Toyota, written on A3 sized paper (11x17); systematically guides problem-solvers through a rigorous process, documents the key outcomes of that process, and proposes improvements."