NHS
Improving Quality

BRINGING LEAN TO LIFE

Making processes flow in healthcare

Acknowledgements

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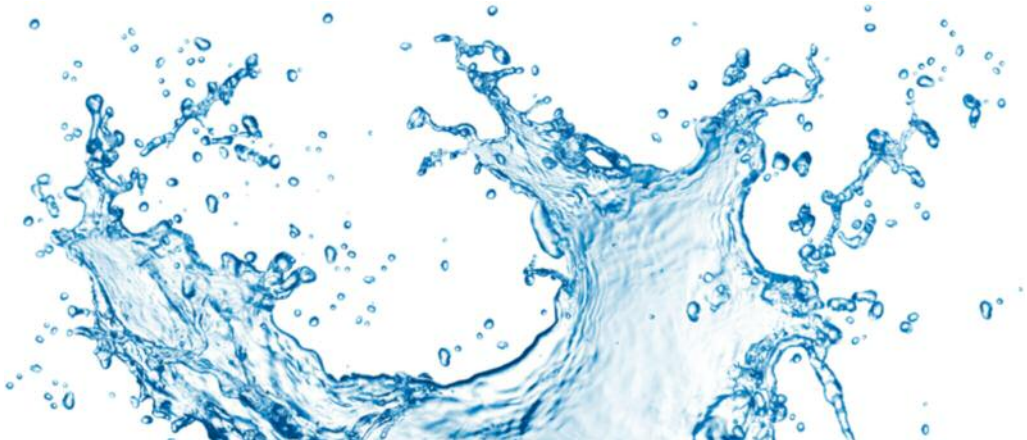


Contents

Introduction - what is the problem in healthcare?

We all come to work to do our very best - to achieve what we are capable of and to add real value for our patients and ensure clinical expertise is supported by process excellence to enable processes to flow at the rate of patient demand. Healthcare teams are dedicated and skilled professionals who are often under pressure to do their best and work terrifically hard - but often the processes are inadequate.

Each year, the National Patient Safety Agency handles over one million reported medical incidents in England alone. Figures illustrate that approximately one in every ten patients are unintentionally harmed by their healthcare providers. Most of these are not necessarily the result of medical errors or poor clinical decisions, but are caused simply by the way the system has been set up.

"...the best hope for saving lives lies in raising performance..."

Atul Gawande, *Better*, 2007

The processes are to blame, not the people

Often, there is ambiguity in how certain tasks should be performed – so people work it out for themselves to secure the best outcome and get the job done. However, whilst everyone develops their own bespoke solution, the variations introduced by different people can be significant and harmful.

Departments continue to work hard in isolation to ensure they improve their services and practices. However, such silo's often mean that any good practice is lost which increasingly impacts upon the patient flow between services.

This booklet provides a basic introduction and overview of Lean; the culture, principles and tools to understand to enable you to tackle and resolve issues within healthcare. It is not intended as a complete guide to implementing Lean as a management system.

NHS Improving Quality has been using Lean with clinical teams and has proven that the methodology can improve quality, increase safety, reduce turnaround times, increase efficiency and productivity, improve staff morale and reduce costs. The NHS Improving Quality website www.nhsiq.nhs.uk has details of numerous case studies and other titles in this series.

“Improvement usually means doing something that we have never done before.”

Shigeo Shingo

What is Lean?

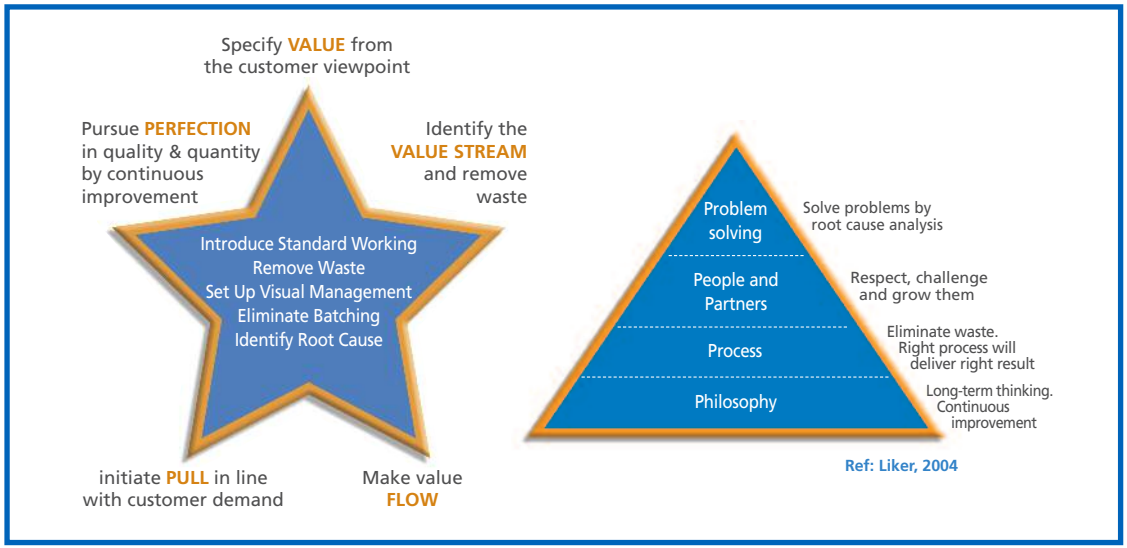
Lean is the culture of relentless elimination of 'waste' to ensure all the services provided are safe, high quality, available at the time it is required and delivered at the appropriate cost. It is also about developing people to problem solve everyday to pursue perfection.

Lean was a term coined by researchers when studying the philosophy of the management system in place at Toyota and the culture they had created amongst their workers to improve processes which led to the final product.

The researchers noticed five key steps were in place to deliver what the customer wanted at the highest quality and safety level possible, with the lowest associated costs from a workforce which also had high morale.

The five steps were:

1. **Specify value;**
2. **Identify the value stream steps;**
3. **Make value flow;**
4. **Supply what is pulled by the customer; and**
5. **Continually improve and strive for perfection.**



Lean is the continuous and systematic elimination of waste

In short, Lean is about building the problem solving capabilities of the team to produce experts who can perform daily work to the best standard – everyday. These key steps and the necessary tools to implement Lean are explained in this booklet.

A3 thinking

All Lean improvement work should begin with A3 thinking as it is a methodical approach to problem solving.

Lean is primarily the description of a methodology to routinely solve problems everyday so that the work is delivered to specification. A3 thinking is the rigorous application of something known as the Plan, Do Check, Adjust (PDCA) approach.

The PDCA (sometimes known as PDSA - Plan, Do, Study, Act) cycle provides a means of conducting safe experimentation or a number of trials to see the effect of any changes made in a bid to make improvement (see page 25).

The A3 report is literally a one-page document (42 x 29.7 cm [A3] sheet of paper) that records the agreed points of discussion in a systematic way.

The structure of the A3 (see pages 8 and 9) takes individuals and teams through the process of agreeing the problem statement or opportunity, reviewing and analysing the current state and identification of a desired future state with a subsequent action plan for any agreed actions.

Describing the entire process from current state, through analysis and onto future state just on a single sheet of paper requires concise information. This prevents excessive amounts of information being overwhelming, misinterpreted and incorrect conclusions being reached.

The best A3s:

- are handwritten in pencil with minimum text;
- contain pictures/diagrams to convey the problem or opportunity;
- are concise and hold all the relevant information;
- represent the shared consensus;
- do not need verbal explanation; and
- are agreed by the entire team.

The A3 represents the shared consensus towards solving the problem. As a document, it encourages reflection on the learning that has taken place and ensures that a consistent message is discussed and scrutinised.

TOP TIPS

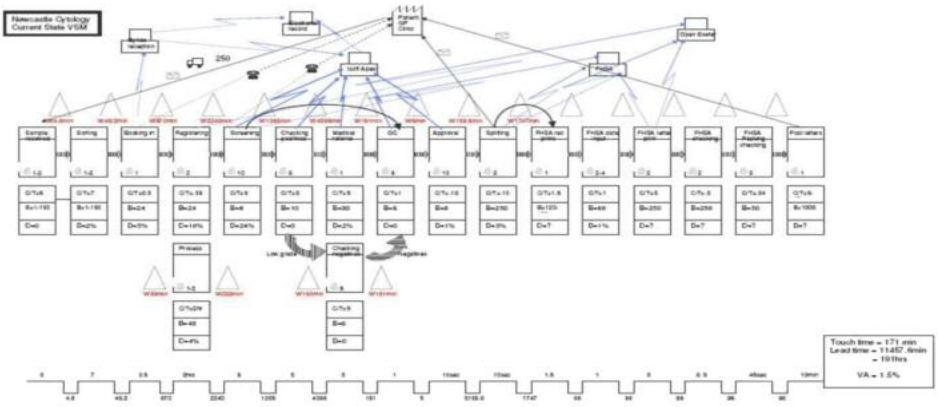
- **Teach, coach and use A3 thinking as a standard tool for all new projects and problem solving**
- **Complete the A3 report with a pencil (corrections can be made following further consensus with the team)**
- **This is a working document – each box should contain only the information that has been agreed**
- **Resist the temptation to 'type' up the report. If an electronic version is required, consider taking a digital photograph instead to share across the wider organisation.**

An example A3 report

Define the problem/opportunity: (Why are you talking about it? What are you trying to solve/improve?)

Waiting times for turning around cervical screening samples are protracted.
This could potentially delay any treatment required by the woman.

Current state: (What happens now? Be visual - value stream map, graphs, facts and measurements etc.)



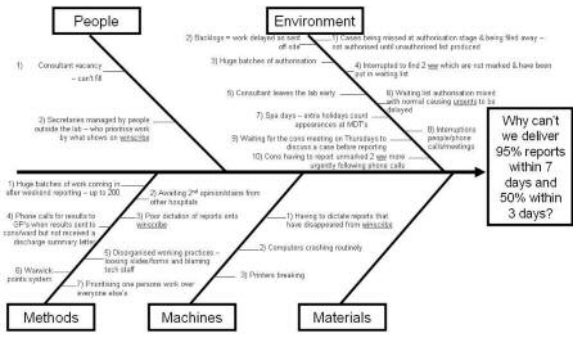
Goal: (State the specific target(s). State in measurable or identifiable terms)

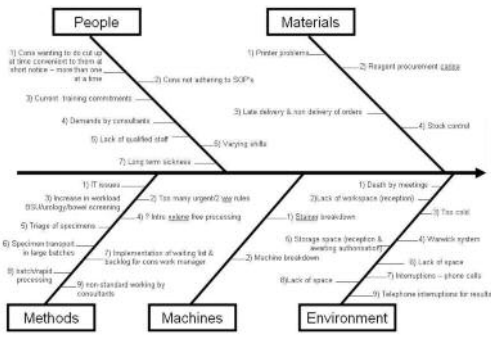
100% in 14 days
50% in 7 days
Zero defects

Waste identified: (Transport, Inventory, Motion, Automation, Waiting, Overproduction, Overprocessing, Defects, Skills.)

Transportation – up to 15 days 'lost'
Waiting – average TATs of 41 days from specimen taken to report issued
Defects – 40% defects received from primary care

Root Cause Analysis: (What is the root cause of the problem? Use fishbone/cause and effect diagram, five why analysis)



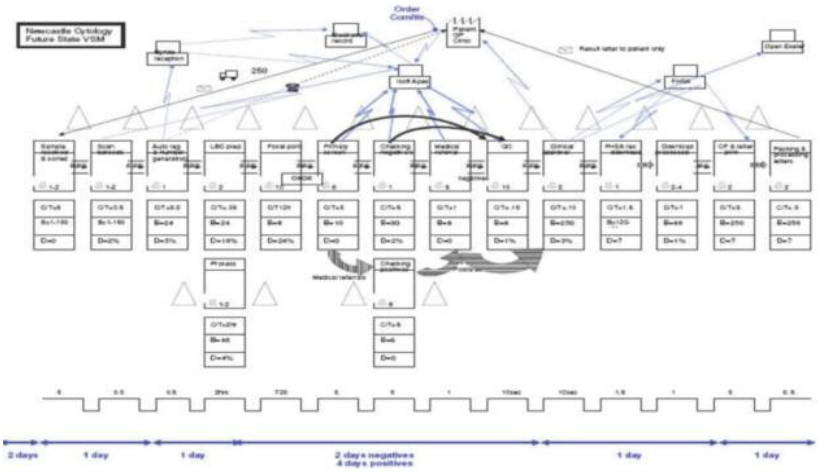


NHS Improving Quality

Department Cervical Cytology Department **Date:** June 2012 **Author:**

Team members: **Agreed by:** **Version:**

Future state: (What will it look like? Be visual - future state value stream map)



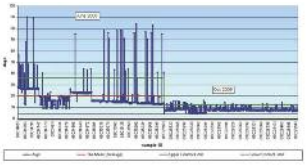
Action plan

Action - what, why and how?	Who?	When?	Progress status (ie completed, in progress)
Establish core transport group	RS	Jan 2012	Completed
Implement zero tolerance policy of defects from 1˚ Care	ML	Jan 2012	Completed
Reduce backlog			
Goal V actual measures	RS	Mar 2012	Ongoing
Capacity and demand	RS	Feb 2012	In progress
Reduce batch sizes from 16 to 8	ML	Mar 2012	In progress
Introduce water strider	ML	Apr 2012	Ongoing

Results and measures:
(What was your PDSA cycle? How long did you run it for? What data did you collect before and after the change? What did you find? Add charts, tables, and cost benefit analysis)

Transport group reduced delivery times by an average of 12 days

Zero tolerance policy has reduced defects from 40% to 20% within 6 weeks, with a further reduction in 10% anticipated within next 2 weeks



Next steps: (Are there any remaining issues/problems? Is there any further follow up required?)

Levelled workloads are required in laboratory.
This is being taken up by laboratory subgroup – April 2012.

The importance of data and measures

In healthcare, we are used to taking clinical measures such as temperature, pulse, blood pressure, respiration rates, urine outputs etc. in order to understand if the condition is getting better or worse. To understand if the process is improving, we can collect and analyse data and use statistical methods, programs and charts to demonstrate, for example, the number of patients on a waiting list, length of stay or admissions.

Data and measures are important to demonstrate and factually prove that change has occurred or needs to occur. Whether the change was a success or a failure, you still need to demonstrate it!

Before starting your Lean journey, it is essential to understand what your aim is and what are your measures.

Measures might include:

- **numbers of patients on waiting lists;**
- **length of stay;**
- **admissions and readmissions;**
- **patient experience;**
- **waiting days;**
- **staff morale;**
- **turnaround times;**
- **number of incidents or defects;**
- **number of complaints;**
- **cost; and**
- **quality.**

Once you have agreed your aim and measures, you will need to collect current state data for a baseline. If you can't get the information from the electronic systems, you will need to collect the information manually. Manual data collection might feel like hard work at the time, but if you don't collect this information **before** you start:

a) how will you know what your current state looks like?
b) how do you know where to focus your efforts?
c) how are you going to know if you have made a difference?

When you have made a small incremental change using the PDCA (PDSA) approach (page 24), review your original measures and collect the same data to see if your trial has made a difference.

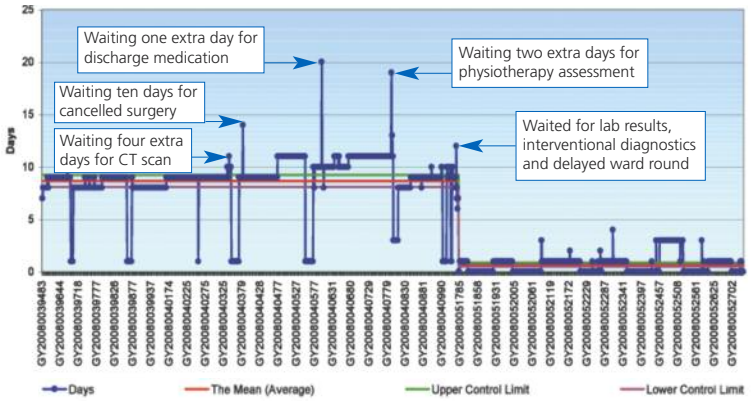
Data analysis doesn't need to be complicated. Line graphs, bar charts, scatter graphs and statistical process control charts can all be used to visually show the before and after status (see examples on the following page).

Don't forget 'better' is not measurable, 'soon' is not a timescale and 'some' is not a number! 'More', 'faster', 'safer' or 'cheaper' can all be measured, but only if you know how many, how fast or how expensive things were to begin with.

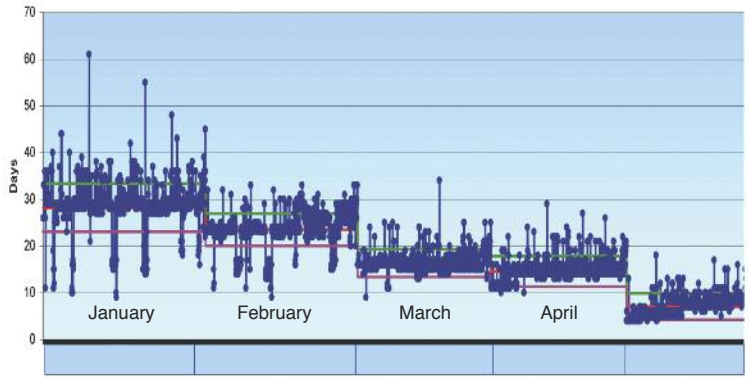
It is not satisfactory to say "it feels better", "I think it's better", "it seems better" - establish factual data and measures.

Example statistical process control (SPC) charts

Inpatient stay showing root cause analysis



End to end turnaround times in a pathology department

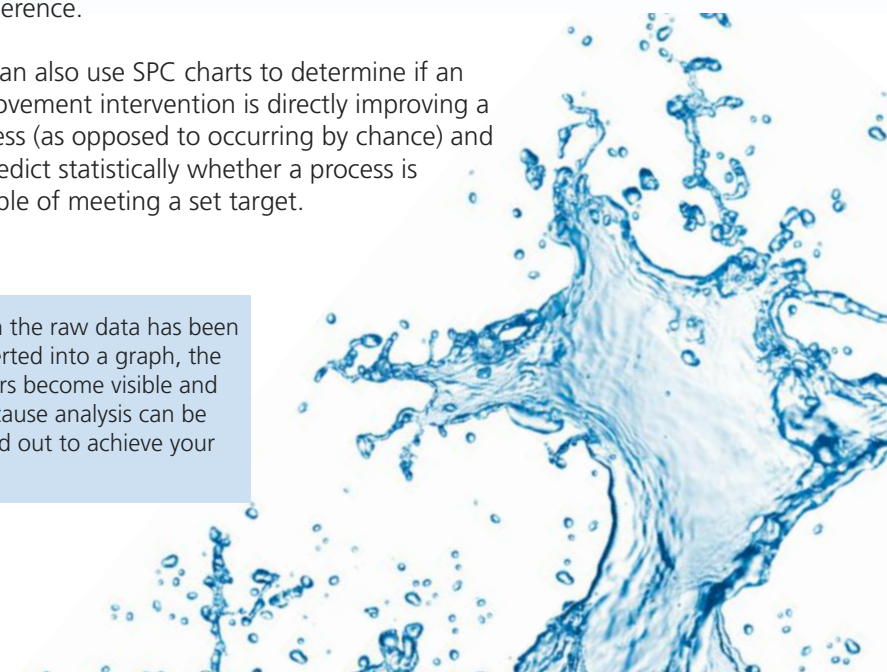


Statistical Process Control (SPC) is a simple and visual way of observing variation in your systems and processes. Every process is subject to variation but generally speaking, the more variation there is in a system or process, the less reliable it is, and the less certainty there will be that the process or system will produce the outputs or results expected or desired. SPC can help to identify variation as a first step in trying to reduce and control it.

An SPC chart is essentially a run chart with statistically calculated lines of variation with the main aim to understand what is 'different' and what is 'norm' within a process. By using these charts, you can then understand where the focus of the work needs to be concentrated in order to make a difference.

We can also use SPC charts to determine if an improvement intervention is directly improving a process (as opposed to occurring by chance) and to predict statistically whether a process is capable of meeting a set target.

When the raw data has been converted into a graph, the outliers become visible and root cause analysis can be carried out to achieve your aim



Current state value stream mapping

A critical starting point in any problem solving or improvement work is to map the situation (process) in its current state. This should be done as a team and then added to the A3 document.

One of the tools used to capture the current state or 'as is' performance is the value stream map (VSM).

"If you don't know where you are going, you will probably end up somewhere else."

Dr Laurence J Peter, Founder of The Peter Principle

What is value?

Value can only be defined by the end customer. In healthcare the customer is usually the patient. Value is any activity that directly contributes to satisfying needs of the patient. Any activity that doesn't add value is defined as waste.

Value stream map

A current state value stream map is a visual representation of all the actions currently required to deliver a product or a service.

The map documents work activity and the movement of information across the entire patient pathway from origin to final point of delivery.

How to make your value stream map (VSM):

- Establish key start and stop points (agree the scope)
- Document the key process steps
- Add the data box below each process step (cycle time, batch size at each step, number of defects/errors at each step and the trigger that starts the process step)
- Add a timeline at the bottom of your VSM and below each process step document the cycle time (how long does it take to process accomplish the task?)
- On the timeline between each process step, add the delay which occurs between each step
- Show all information flows
- Work out the total time taken to get a patient through the value stream by adding all numbers in the timeline
- Calculate the 'touch time' - the time actually required to get the patient through the value stream if seamless care were being delivered (i.e. all waste removed)
- Agree the value added (VA) activities and the non VA activities, identifying those 'must do's' (i.e. business essential but not really adding value directly to the patient)
- Determine the percentage of VA activities - don't be surprised if this is very low!

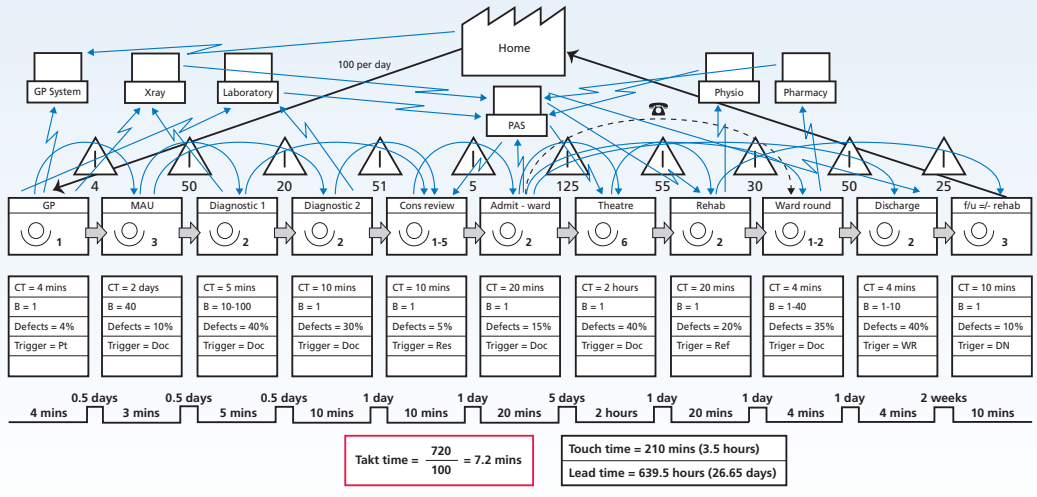
Remember

- Keep your value stream map high level, don't focus on the detail
- Only focus on the main pathway – what happens 80% of the time?
- Collect true and accurate information by walking through the pathway yourself.

Why map the value stream?

- The mapping process is a powerful tool to look strategically at your process and quickly identify opportunities for improvement
- Non value adding activities i.e. wastes can be identified and documented
- This provides a basis for a discussion around 'what should be the process?'

Current state value stream map



See page 27 for the value stream mapping symbols

The current state map above indicates that it is taking almost 27 days for a patient to get through a system (Lead time) where there is only 3.5 hours of professionals 'hands on' time actually required (touch time). On this map, there is a legitimate 14 days of 'waiting' before the follow up appointment; however there is still a considerable difference between the lead time and touch time. This should promote some discussion amongst staff: Have we documented this 'snapshot in time' correctly? Is some of the waiting time between steps actually necessary? Is there an element of 'recuperation' or 'watchful waiting' before further intervention or follow up is required? Concentrate on getting a shared understanding of the true picture without justifying whether your current processes are the best for the service.

Analysing your current state & designing your future state value stream map

Once you understand the current picture of what **really** happens throughout the value stream, you can begin to agree what **needs** to happen and then analyse the gap between the current and future states.

From your current state map you will be able to identify where the significant problems occur. This might be the most prevalent waits and delays, the largest amount of work in progress between process steps or where there is considerable duplication.

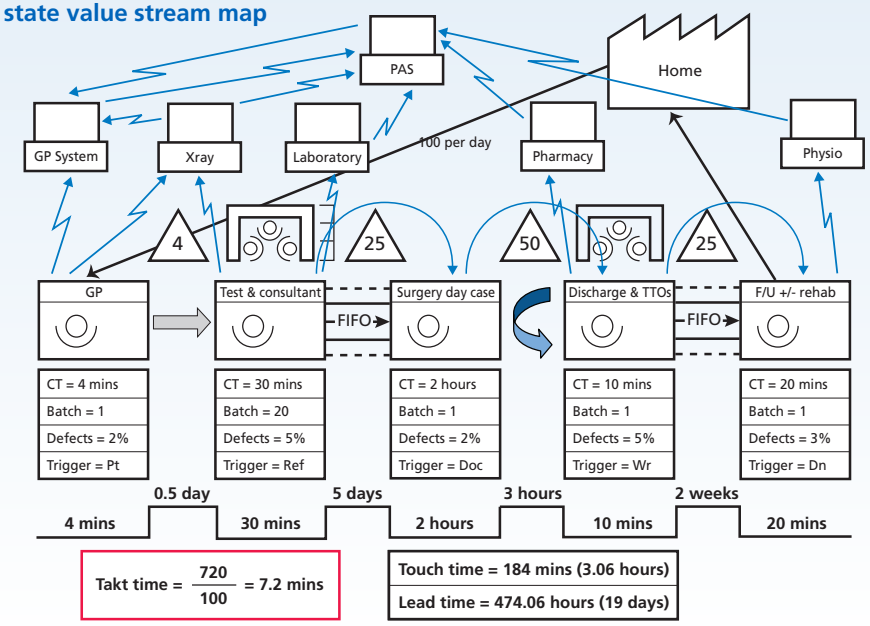
There are four main techniques to design your future state:

- **Eliminate**
- **Combine**
- **Simplify**
- **Sequence.**

Where possible, try to eliminate any process steps. If it isn't possible to eliminate any steps, look to combine steps. After combining, consider where the system can be simplified. Once steps in the system have been have been eliminated, combined and simplified, review the sequence of events to promote efficiency.

When designing a future state, the takt time, the removal of waste and the introduction of flow must be considered – all of which are discussed in this booklet.

Future state value stream map



The aim is to produce a service where each process step links seamlessly to the next, in the shortest amount of time at the highest quality and safety by a group of staff with a high morale.

Once the future state value stream map is completed, it is then essential to review measures, analyse the gap between current and future state and then agree an action plan of PDCA cycles to trial the changes.

Be clear about the purpose before designing the process – then, organise the people!

Standard work to produce high quality every time

Lean is about developing the people who perform the work to be 'the best' – utilising their 'expert talent' and establishing excellent ways of working.

Standard work is about establishing out of all the possible ways, the best work method of conducting a task and then ensuring that everyone always works to this gold standard.

The gold standard should have the least amount of waste, with the highest quality and safety. These standard procedures create stability and consistency in the system to produce high performance results every time.

There are three key elements to standardised work:

- **Takt time – how fast we should be working (page 23)**
- **Work sequence – the order that work should be done**
- **Work in progress – defining the working inventory to make abnormalities obvious.**

It is important to understand that standard work is not static. Standards are actually the basis for subsequent improvements. Once a better method is found, the team should agree on the new standard, update the processes, procedures and visual management and then ensure that it is adopted by all.

Standardisation should exist for every process, including ward rounds, meetings, health and safety procedures, budget reports, cleaning equipment, consultations, all paperwork etc.

One of the Lean tools which promote standardisation is 5S, the foundation for safety and quality.

Standardised work:

- Ensures safety and maintains high quality and efficiency
- Ensures process stability and therefore repeatability
- Allows us to assess if we are in control, ahead or behind schedule
- Preserves the organisational expertise
- Allows us to identify and rectify problems
- Provides a gauge by which we can error proof for the future
- Gives us a baseline from which to measure improvement and continually strive for a better way
- Provides a basis for employee training.

Visual management

Visual management is everywhere, from the green man at the cross roads, to the numbers on the front of busses, petrol indicator lights in cars, a water level on a kettle, to a cricket scoreboard. These visual indicators allow us to easily understand the situation and take action where necessary.

Visual management is a simple, yet highly effective way of indicating what should happen (by setting a standard) and what is actually happening in the work environment.

At a glance, colleagues, supervisors, managers and visitors to the area should be able to understand the process and see what is under control and what isn't without having to ask a question.

Visual management allows teams to:

- **See the work in progress**
- **Recognise flow stoppers**
- **Assess inventory levels**
- **Identify defects**
- **See deviations from the standard**
- **Enable interventions**
- **Improve safety.**

There are two types of visual management:

- **Visual display; which is the provision of information**
- **Visual control; which is associated with action.**

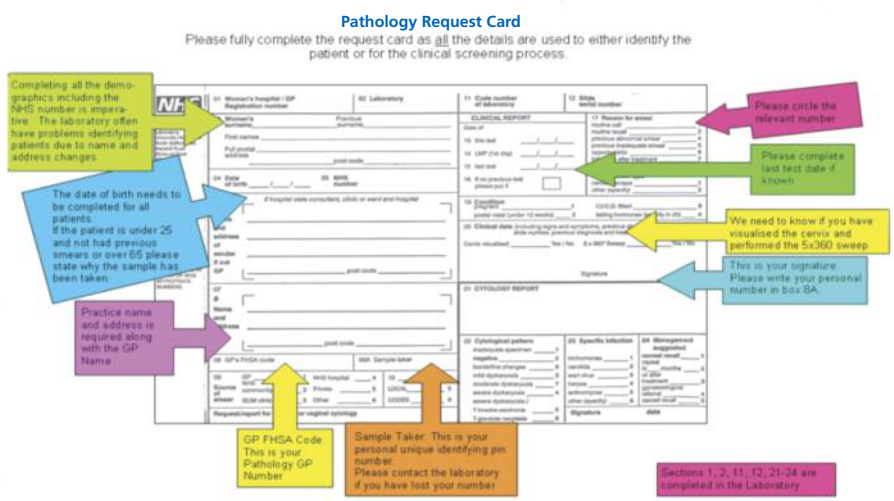
Both types of visual management allow individuals to gain the maximum amount of information without having to leave the work environment or access a computer system.

Visual management provides the knowledge and certainty to make the lives of staff and patients safer.

Visual management can be used to answer the following questions. Give some thought to how you could use visual management to answer the following questions in your work area:

1. **Are we up to date with the work?**
2. **What are our three biggest problems in the area and what is being done to resolve these problems?**
3. **How do you know that your ideas have been listened to?**
4. **How can you tell who is trained to perform each task?**
5. **Is there daily accountability? Who is it today?**
6. **How do you know where staff are - breaks, annual leave, study leave?**
7. **How do you know if the stock has been ordered?**
8. **Number of patients on the waiting list**
9. **Which patients should be discharged**
10. **Number of patients on disease register who require an annual review.**

Cytology request form: Visual management has been sent to smear takers to ensure zero defects on the request form.



Communication board

The board keeps all team members up to date with the recent data, changes and improvements made, 5S scores, team ideas which includes action taken against the ideas.

Identifying waste

The elimination of waste is the main characteristic of Lean. Waste is everything that doesn't add value to the patient or process.

There are three types of work:

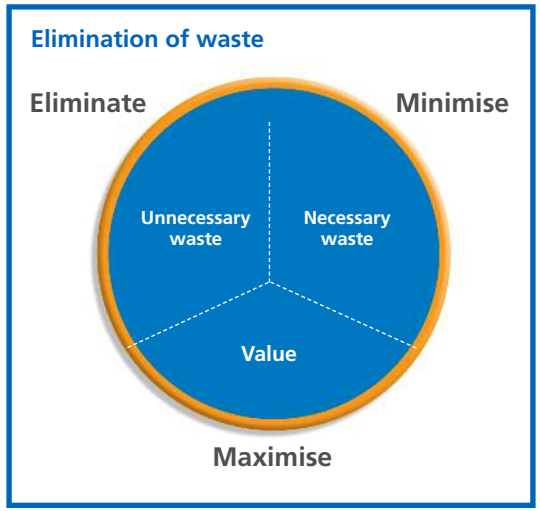
1) Value add - When you are adding value to the patient/process (e.g. prescribing medication, providing physiotherapy, reporting an image)

2) Necessary waste - This is when you are not adding value but it is a necessary step. (e.g. incubation in a microbiology laboratory, vetting requests prior to radiology examination)

3) Unnecessary waste - This is where you are not adding value and these steps could be removed (e.g.searching for items, waiting for consultants or medication, not having the right equipment).

There are seven formally recognised wastes, however additional wastes identified: the waste of unused staff creativity (skills utilisation) and automating an already inefficient process.

These wastes can be remembered by remembering the name **TIM A WOODS** (this acronym originated at Cooper Standard Automotive, Plymouth UK).



T **TRANSPORT**

Transport is the unnecessary movement of items and materials. How often do we see people moving items (notes, reports, slides, supplies etc.) from one locality to another - and back again? Stand for a short while in a hospital corridor or GP practice and observe these activities - you'll be surprised.

For example:

- Moving drugs, samples, equipment, supplies excessively
- Moving paper notes excessively
- Transporting equipment or consumables from one location or site to another.

Remove the waste of transport by:

- The elimination of process steps
- Co-locating departments/processes/supplies
- Introducing work cells
- Redesigning the flow of work e.g. introducing work cells.

I **INVENTORY**

Inventory is work in progress and stock. A common problem is lack of space. By reducing inventory and by combining process steps, staff have more space to carry out duties in a safer working environment.

How frequently do you run out of supplies only to find another department has stock?

For example:

- Over-ordering - consumables or drugs
- Different batch sizes at each process step
- Overstocked medication
- Overstocked items in the supplies department because it was cheaper to buy in bulk without thinking about the costs of storage, stock taking and distribution
- Staff hiding extra stock for 'just in case'.

Remove the waste of inventory by:

- Implementing the Lean tool of 5S (page 24)
- Establishing visual systems (kanbans) - aid visibility for stock counting (page 22)
- Understanding what is needed to keep up
- Establishing first in first out principle with demand - implement 'just in time'
- Keeping stock audits correct and current.

M MOTION

The waste of motion is any unnecessary movement by people. This is mainly related to poor ergonomics, bending, stretching, moving items etc.

How many times during your working day do you have to get up and walk to use a certain piece of equipment just because it is located in the wrong place? How often do you find yourself searching for vital items because they were not put back in the right place?

For example:

- Poor layout of wards/surgeries/departments /laboratories/offices
- Searching for equipment or stock
- Location of printers, faxes, copiers and computers
- Looking for information and people.

Remove the waste of motion by:

- Introducing standard layout
- Introducing a standard way of working
- Developing flow in work cells/areas
- Initiate and sustain 5S.

A AUTOMATING

Automation of poor processes just serves to automate waste. The poor understanding of work content and takt time (page 23) can result in purchase of large pieces of expensive equipment that actually hinders flow of the overall process. The result, is an expensive poor process!

For example:

- Did radiology reporting times reduce when PACS was implemented?
- Do samples get turned around any quicker with track systems in biochemistry?

W WAITING

The waste of waiting usually transpires when there is an in balance of process steps which all take different timings or the batch sizes are different in each process step. The waste of waiting has a direct impact on flow as waiting creates a 'stop-start' process.

Do you ever find yourself becoming frustrated and your working day hindered because you are waiting for a colleague to do their role or for equipment to become available.

For example:

- Waiting for shared equipment (telephone/ computers)
- Staff waiting for machines, deliveries, other members of staff
- Waiting for decisions
- Waiting for meetings to start
- Patients waiting for appointments, in emergency departments/clinics, waiting for discharge
- Samples waiting in a batch to be analysed in the laboratory
- Requesters waiting for results or medication.

Remove the waste of waiting by:

- Evenly spread (levelling) the work and balance tasks
- Eliminating or reducing batch sizes
- Smooth the flow and volume of work which enters and exits your area.

O OVER PROCESSING

The waste of over processing is all the things we do that don't add any value to the process - producing excess.

How many tasks are repeated simply because we don't have a system to ensure it serves the needs of the patient or process throughout the whole healthcare journey?

For example:
- Duplicate testing/inappropriate testing
- Duplicate data entry
- Duplication of checking cards/slides
- Excessive bed moves
- Excessive paperwork
- Manual checking electronic data.

Remove the waste of over processing by:
- Eliminating non-value added steps
- Combining process steps and paperwork
- Simplifying tasks.

O OVER PRODUCTION

Over production is about doing too much, too soon or 'just in case'.

How many times do we complete the same information and have to file it or store it in many different ways? How often do we see queues build up in one part of the process because the previous department kept producing more, regardless of whether subsequent processes were ready or could cope?

For example:
- Doing more, making more, faster than or earlier than is required by the next process step
- Duplicate entries in medical records
- Results sent in both electronic and paper formats
- Repeating tests before next test scheduled.

Remove the waste of over production by:
- Removing all unnecessary paperwork
- Reducing batch size - establish a visual system
- When the process can't flow, introduce 'pull' systems with buffers and kanban's.

D DEFECTS

Defects are all the errors that compromise quality, safety, cost and staff time. Make it right, first time, every time.

Do you tolerate errors by reworking someone else's mistakes? How often do you accept incomplete or inaccurate information?

For example:
- Wrong patient, wrong test, wrong procedure, wrong form
- Inappropriate/inadequate referrals
- Chasing inadequate patient information
- Repeated checking
- Medication errors.

Remove the waste of defects by:
- Making the system mistake proof
- Introducing a zero tolerance to defects
- Introducing standard work to ensure the same process is completed every time ensuring high quality process repeatability.

S SKILLS UTILISATION

Every department has unused staff potential. There is someone in every department that knows the issues and has the possible solutions. If only they were asked, listened to and action was taken - the people doing the job are the experts.

Unused skills and creativity also include highly skilled staff undertaking duties that do not reflect there skills, e.g. band 8 staff routinely performing band 3 duties.

How many times do we see supervisors/managers routinely booking appointments?

The intellect and skill of staff should be used to guide the continuous improvement of procedures and processes. The inclusion and insistence of staff in problem solving and decision making will also support recruitment, retention and improve morale.

Making value flow

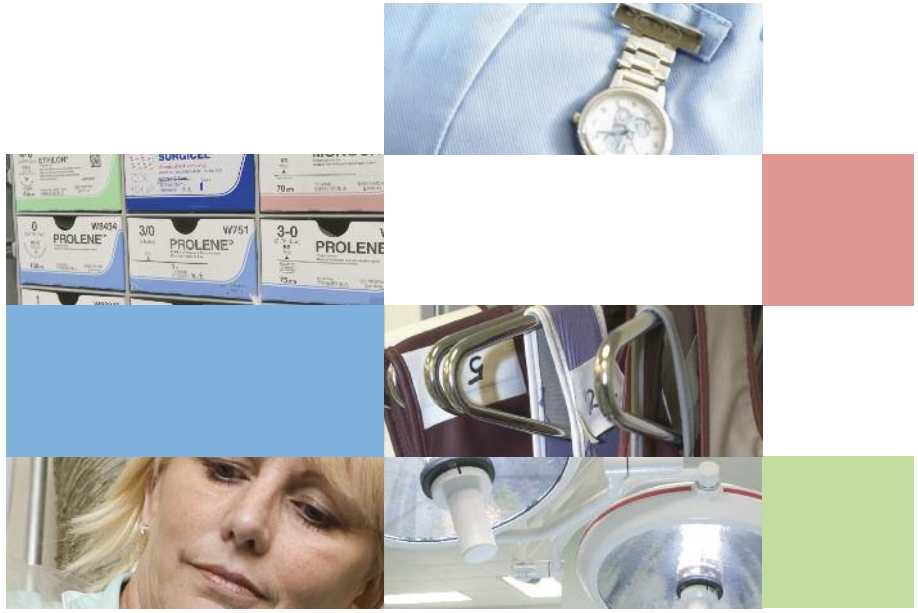
Flow is the continual movement of value adding activities from the beginning to the end of the value stream.

Processes which add value to the patient should not be delayed by any non value adding steps or waste in the system. Waste and non-value adding steps create a 'stop-start' effect which prevents the flow of value adding steps the value stream.

Systems which promote batching can hinder flow, create waste and queues. Batching can be seen across healthcare. For example, ward rounds completed at the same time of day causes a batch of work for the nursing staff and every support service that follows i.e. pathology, radiology and pharmacy.

To promote flow, batches should be reduced and where possible removed to achieve the optimal flow - one piece flow. When flow is achieved, it becomes easier to spot problems and patients are no longer unnecessary held up in the health system.

All Lean tools work towards promoting flow. Visual management can be used to highlight flow stoppers. Standard work can be used to ensure processes are repeatable and reliable, with no variation. 5S can support workplace organisation ensuring no time is lost trying to find the right tools to do the job.



Understanding pull

Flow and pull work to keep the entire value stream moving. Flow is the goal, but on occasion, flow may not be achievable and in these situations the concept of pull can be introduced to respond to demand.

Pull is a short term notion to gain control and process stability.

Pull works with buffers and kanbans:

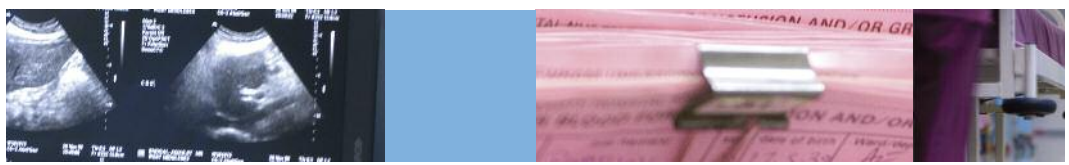
Buffer

A buffer is a clearly defined holding area at the interface between two processes allowing patients, paperwork, information or items to wait for a defined amount of time between two process steps. A buffer could be a waiting room, empty beds, trolleys or chairs, or even a space for stock and inventory. Buffers are actually a 'waste' and should only be introduced when flow is not possible and the process needs to be controlled and stabilised. Over time, the buffer should be gradually reduced and ultimately removed.

Kanban

Kanban signs/signals are a form of pull. These visual signs are mechanisms for the patient or internal customer (i.e. ward nurse, radiologist, discharge staff) to say "I am ready for more." There are many different forms of Kanban - an empty container, a box, a marked area, an empty shelf or a card.

> **"Flow where you can, pull where you must"**
>
> **Jeffery K. Liker,** The Toyata Way, 2004



Understanding takt time

Takt time is simply the rate at which we need to work to keep up with demand.

The calculation for takt time is:

$$\frac{\text{Available work time}}{\text{Demand}} = \text{takt time}$$

This sounds too simple, yet the ability to achieve takt is the fundamental question to whether the system is set up to deliver what is required. If teams cannot achieve takt, waste in the system needs to be removed and each process step needs to be smoothed (levelled) to ensure takt is met.

Worked example:
A general surgical pathway open and staffed for 12 hours per day has a daily demand of 100 referrals (see Value Stream Maps).

$$\text{Takt time} = \frac{12 \text{ hours}}{100} \quad \frac{720 \text{ min}}{100} = 7.2 \text{ mins}$$

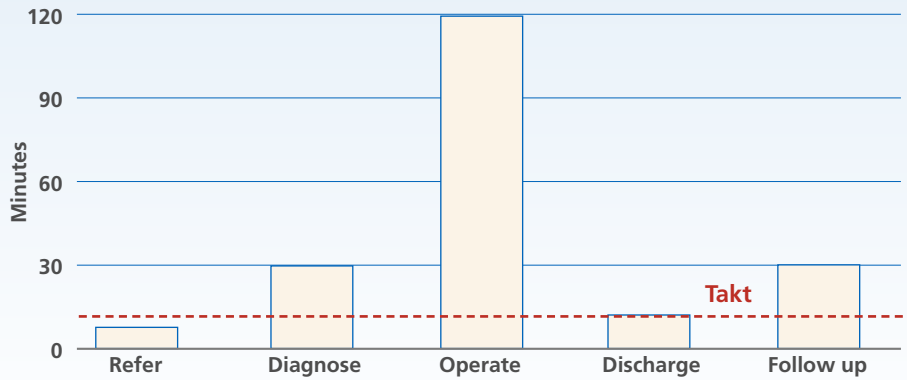
True to the first principle of 'delivering customer value,' patients must be able to access each of the services required along the whole clinical pathway in referring, diagnosing, operating, caring, providing medication and rehabilitation the moment they require it. In this case, for this system to be capable of delivering patients needs, every 7.2 minutes a patient should be able to move through the value stream i.e. the patient should be able to 'pull' the service they require at a rate of 7.2 minutes.

The cycle time is the time it takes to actually 'do' the task and the aim is to match (where possible) takt time.

If the cycle time is going to be the same as or less than takt, all the non value adding activities need to be removed from each step. Only when the non value adding activities have been removed from each step should additional resources be considered.

As you can see from the graph below, the team would possibly need to either: remove more waste from the individual processes; extend diagnostic hours, theatre time and follow up clinic; or secure additional resource in order to achieve takt.

Balance chart prior to achieving takt time



Using 5S to improve safety

5S is occasionally misinterpreted as being a 'tidy up', but when approached properly it is much more than that.

5S is the basis for standardising work and is used to improve efficiency by eliminating waste, promoting flow, improving staff morale and most importantly improving safety.

Ultimately, it is about making the processes and environment safe.

5S - What does it mean? How do I do it?

Sort - *'When in doubt, move it out!'*

1) Remove everything from the defined area.
2) Only return what is necessary for the daily duties.
3) Discard any broken, unnecessary items – e.g. clutter, old equipment, old unused paperwork.
4) Move any items that you are unsure of into a holding bay for a team decision.
5) If shelving or cupboards are not used or required, remove them too – this will prevent unwanted items being stored there.
6) Items necessary to complete the job need to be 'set in order' 2S.

Set in order - *'A place for everything and everything in its place.'*

1) Give every item a location - Items used on a regular/daily basis need to be placed within arms length/accessible location:
   - Items used on a weekly basis should be stored on a shelf or in a cupboard in the work environment.
   - Items used on a monthly, quarterly or annual basis should be stored in an appropriate location – possibly outside the work area.
2) Mark off (with electrical tape or permanent marker) and label each location.

Shine - *'Lean means clean'*

1) Clean the area – it should be easier to clean now you have removed the clutter and every item has a location.
2) Develop a plan where cleaning is incorporated into the daily routine.

Standardise

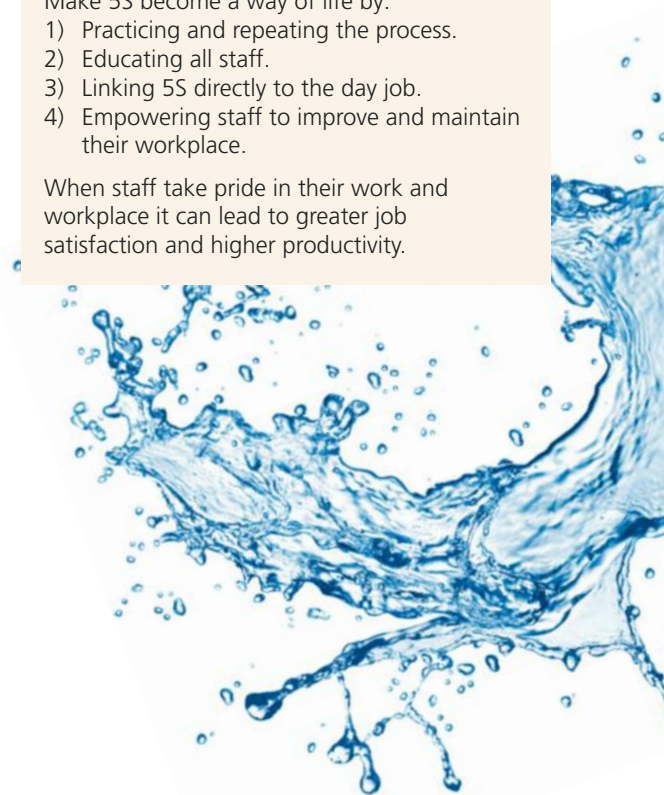
Create a consistent approach for carrying out tasks and procedures.

Sustain - *'Sustain all gains through self discipline'*

Make 5S become a way of life by:

1) Practicing and repeating the process.
2) Educating all staff.
3) Linking 5S directly to the day job.
4) Empowering staff to improve and maintain their workplace.

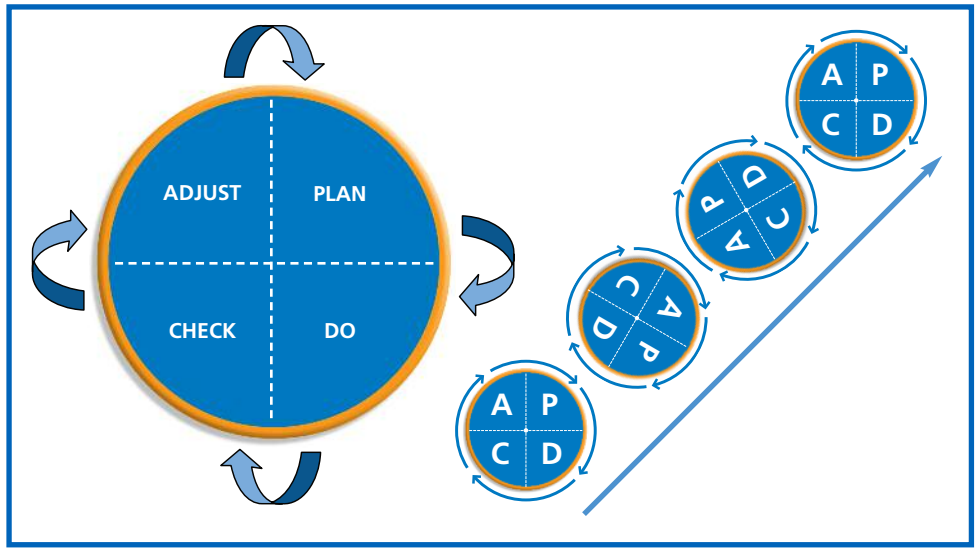
When staff take pride in their work and workplace it can lead to greater job satisfaction and higher productivity.



Plan, Do, Check, Adjust (PDCA) Sometimes called a Plan, Do, Study, Act (PDSA)

Change on a large scale can be daunting but you should not let that deter you.
Before implementing a full proposal for change a PDCA cycle (sometimes called a Plan, Do, Study, Act (PDSA) cycle) can be used. A PDCA cycle will provide the opportunity to test out an idea on a small scale, without risking too much.

New ideas should be introduced only after sufficient testing (or evidence) on a smaller scale has proven to have a positive effect. PDCA cycles allow us to introduce an idea in a safe, controlled way which will have less resistance, be less disruptive and use less resources.
By building on the learning from each PDCA cycle, new processes can be introduced with a greater chance of success.



P - Plan: The trial
This is the most important part of the process.
- What you are planning to trial?
- What are your objectives?
- Who is needs to be involved/informed?
- How are you going to do it?
- How long will the trial run?
- How are you going to measure improvement?
- What is your communication plan?

D - Do: Carry out the trial
- Test the change and collect the data.

C - Check: Study the results
- Analyse the data you collected in the 'plan' and 'do' phase
- Discuss outcomes with colleagues?
- What went well?
- What went wrong?
- Did anything unexpected happen?
- Could the process be improved?
- If the trial didn't go to plan, what was the root cause?

A - Adjust: Act on the results
- If the trial did not improve the process, could you treat the root cause in your next PDCA cycle?
- If the change was a measurable success, adopt and spread the improvement in your PDCA cycle.

Continuous improvement

Continuous improvement is the final Lean principle, which is to strive for perfection through continuous improvement. This is done by embracing the Lean philosophy and tools as described in this booklet.

The staff are a fundamental part of Lean. It is important to develop staff and give them the capability, autonomy and empowerment to solve the problems as they encounter them on a daily basis. Teaching and expecting rigorous problem solving by all staff is the only sustainable way to strive for perfection.

Communication is imperative to develop staff to continually improve the process. A five minute daily meeting for all staff around a central communication board to discuss real time issues relating to waiting times, quality, safety, morale and cost is essential to ensure the work for that shift/day proceeds as planned.

For Lean to be a success, the Lean culture needs to be accepted and embraced by all.

When implemented, the tools and techniques can have an immense beneficial effect, but to be sustainable, they need to be applied with a Lean culture.

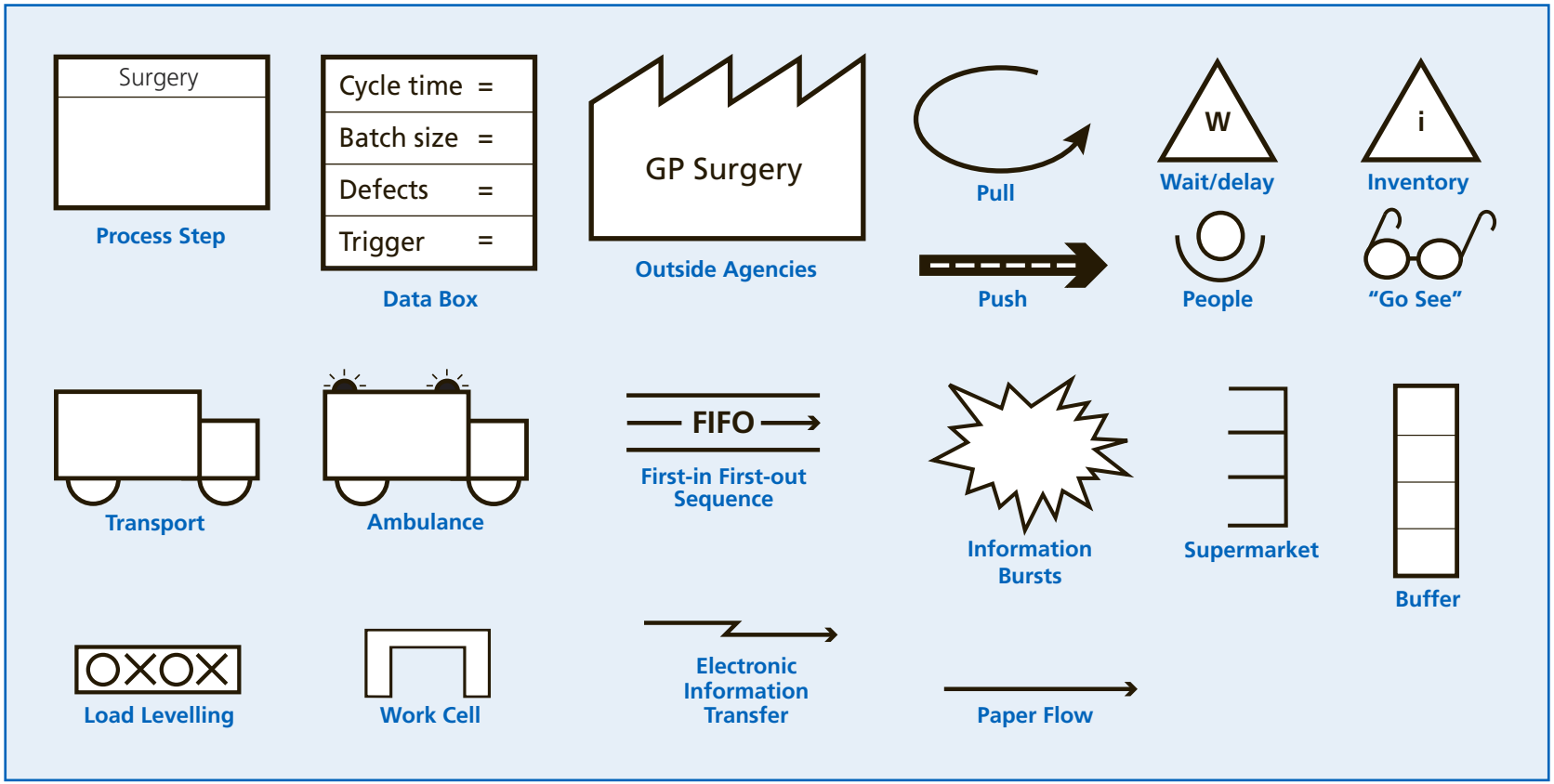
The key to success is small, daily incremental improvements.

During your Lean journey, don't lose sight of perfection and what perfection means:

- **the right patient journey;**
- **the right support services when they are required by the patient;**
- **the highest level of quality and safety**
- **no defects or incidences;**
- **delivered at the right price; and**
- **delivered by a staff group with high morale and pride in their work.**

Act like a sponge - soak it up and squeeze out improvements everyday

Value stream mapping symbols



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