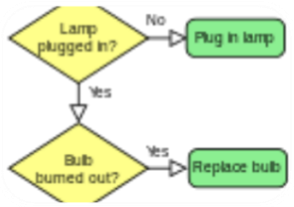
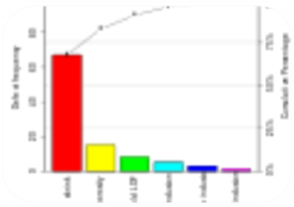
The 7 Quality Improvement Tools



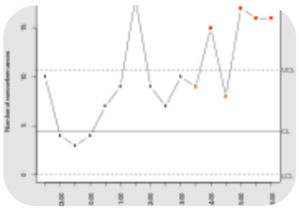
Flow chart/ process map

Check sheet

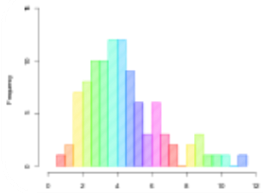


Pareto chart

Fishbone diagram



Control chart



Histogram

Scatter plot

> *"From my past experience as much as 95% of all problems within a company can be solved by means of these tools"*
> ***Kaoru Ishikawa***

Kaoru Ishikawa made many contributions to the field of quality improvement, including a range of tools and techniques. His emphasis was on the human side of quality. The concept of quality improvement as a fundamental responsibility of every member of staff became a key component of the Japanese approach to QI. Ishikawa's work focuses on the idea of kaizen (a Japanese word that can be roughly translated as 'continuous management'). This concept developed by Japanese industry in the 1950s and 1960s, is a core principle of quality management today, and holds that it is the responsibility of every staff member to improve what they do.

Flow Charts / Process Maps

What is Process Mapping and How Can it Help?

Processes within healthcare have evolved over many years and through many organisational changes; this means there are often many layers to pathways and complicated systems that have built up over time.

A good way to review systems and/or pathways to understand where improvements are needed is to work with frontline teams to process map. This is a simple exercise which facilitates a positive and powerful opportunity to create a culture of ownership within the multidisciplinary team to focus on areas for improvement.

A process map is a visual way of representing and understanding a step-by-step picture of processes, either one aspect or a whole patient pathway. It helps staff to understand the way the system works, and reviews each step of the process to understand those adding value and those that do not currently work well for service users or staff.

As a team, process mapping can support open communication and consideration of all improvement areas, engaging representatives from different parts of the system to consider all interdependencies across the system. This can be a positive strategy for engaging stakeholders, all members of the multidisciplinary team and those resistant to considering new ways of working.

It also provides a measureable baseline on ‘ where are we now’.

When Does it Work Best? Top Tips

- Map the process first to make sure that everyone involved agrees each step of the process. Avoid focusing on the challenges and solving them before your process map is complete.
- Sessions facilitated by someone outside the immediate team can allow all members to participate fully in the mapping exercise, and provide an opportunity for someone who is removed from the process to ask challenging and clarifying questions
- Having a large wall space! If you are mapping the process by hand you will need a long stretch of wall to put up a continuous piece of paper, to identify each step with lots of coloured post its and flip chart paper and markers to capture comments along the way
- If mapping electronically during session it is essential that the team can see the process as you map; consider using a projector and a confident typist to keep up!

- Put down **all steps** of the process, the map will only be useful to the team if it is an honest illustration of the system. The map should show how things are and what happens now, rather than what should happen. Only when you see the current state, wards and all, can you work with staff to make improvements
- Have the right people in the room—it is essential to have representatives from all aspects of the process involved in this mapping activity; everyone's input is needed to fully understand each step. This supports highlighting areas where there is variation in understanding the process and capturing if there is duplication of tasks/roles

- Undertaking this activity close to the environment where the process happens allows the team to 'walk' the process if required to gain further insight or clarity of understanding

Mapping—How You Do It

- The map must have a title, date, and colour key. You can use different colour 'post it' notes, pens or coloured boxes along the process to mark details e.g.

Process Step Issue / Problem Ideas/Suggestions

- Discuss the key players in the process, write them individually on a post it note and place them on the very left hand side of your process map back drop. This allows you to map when in the process there are transition points between departments/services/professionals
- Use different shaped boxes or notes to mark decision points along the process, including points of entering or exiting the process
- Consider rating the steps with dots to show large, medium or small value to the patient
- Define the start and end points preferable head of time—not too big a chunk. Other processes may be identified and can be parked and dealt with later
- Include time frames on stages in the process if possible. It is useful to have flip chart/magic white board for ideas, discussion points and 'parking' ideas.

Next Steps

Once the map is completed:

1. identify areas that do not add value and consider removing them:
2. Identify bottlenecks, constraints, waste or duplication - understand how you can deal with them
3. Identify and understand variations in clinical practice - how can this be standardised? Identify areas/opportunities for improvement—generate ideas for improvement
4. Using all the above 3 points, talk through the ideas and identify the ones that will convert into actions. Organise/prioritise them within your project and develop an action plan to test them using PDSA Cycles as part of your improvement framework

5. Use what you learn from the current state map to develop your ‘future state map’

Check sheet

What is a check sheet?

- A simple way of recording events, issues, defects as they occur. Also known as Tally sheets
- Requires some planning about how and when to capture the data

Why use one?

- Requires no equipment apart from a pencil and paper
- Allows the people doing the work to collect data
- Provides a way of capturing data over time
- You don’t need to know the categories in advance; build the list as you go

An example

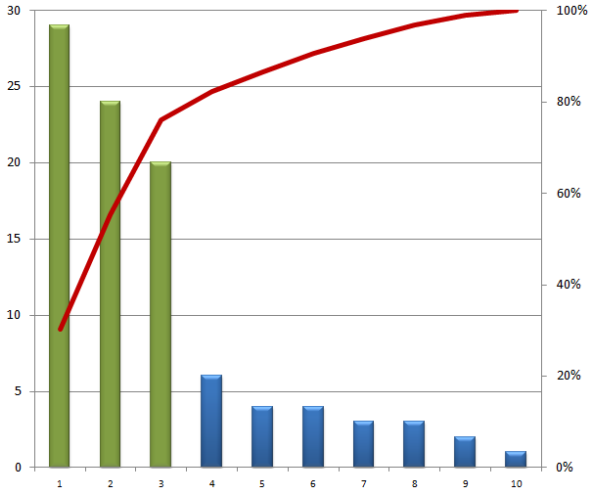
- Junior doctors attending Board Round in an acute hospital
- Discussion about patients but no learning. It was almost like Groundhog Day!
- Instead they started to capture and record the issues raised
- When looked at over a period of time it told them which were the most commonly occurring issues

(Day 1) 17/2/15 – doctors, nurses, social work, OT

- 17 patients in total
- 10 medical patients
  - IV treatment 4
  - Awaiting results
  - New on ward
  - Unwell 2
  - ** 8 patients with reasons documented*
- 7 patients medically ready for discharge
  - No delay
  - Awaiting SSR 3
  - Awaiting family meeting regarding housing
  - OT assessment
  - Ongoing PT

Pareto Chart

What is a Pareto chart?



- It is a special form of bar chart used to show the frequency of occurrence.
- The categories or items are sorted with the most frequently occurring category on the left. Values are read on the left hand scale.
- The cumulative percentage of the count of values is shown as a line and read on the right hand scale
- Data can be obtained from Check or Tally sheets
- Pareto chart first named and used by Joseph Juran. He borrowed the work of Vilfredo Pareto and said that about 80% of events or items come from 20% of sources

Why use one?

- Used to display the number of times distinct things happen such as:
  - Reasons for cancellation
  - Types of complaint
- To separate the 'vital few' from the 'useful many' (the 80/20 rule)
- Use a Pareto chart to know where to start work. Which category do we want to start with first?

An example

Remember the tally chart example? The chart on the right is a Pareto chart of the delays caused for patients ready for discharge over a 2 week period. It shows clearly which issue is happening most frequently.

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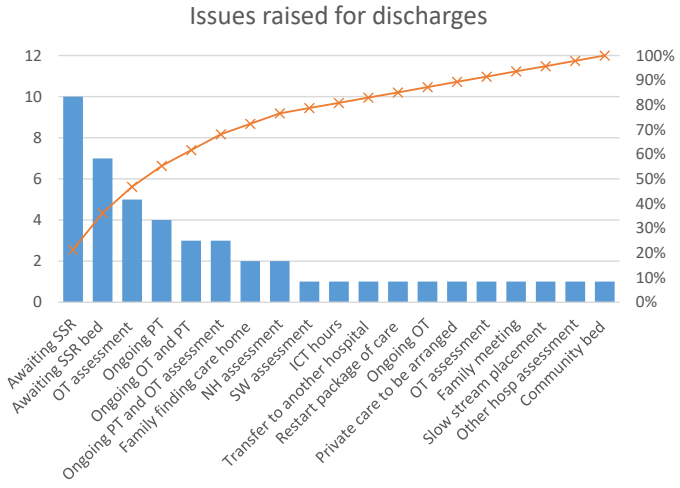
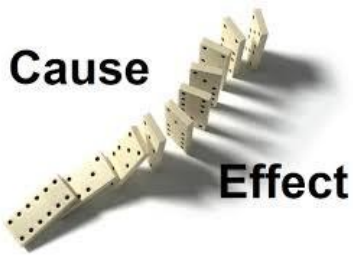


Fishbone Diagram (Cause and Effect)

What is it and how can it help me?



Cause and effect analysis helps you think through causes of a problem thoroughly, including its possible root causes. It is only by identifying the main causes that you can permanently remove the problem, or reduce the delay.
A cause and effect diagram is a tool that helps you do this. The 'Effect' is the problem you are working on, for example 'waiting times'. The tool can help you identify major causes and indicate the most fruitful areas for further investigation. It will help you understand the problem more clearly.
By going through the process of building the diagram with colleagues, everyone gains insights into the problem, alongside possible solutions. The people involved benefit from shared contributions, leading to a common understanding of the problem. The cause and effect diagram is sometimes called a fishbone diagram (because the diagram looks like the skeleton of a fish) or the Ishikawa diagram (after its inventor, Professor Kaoru Ishikawa of Tokyo University).

When does it work best?

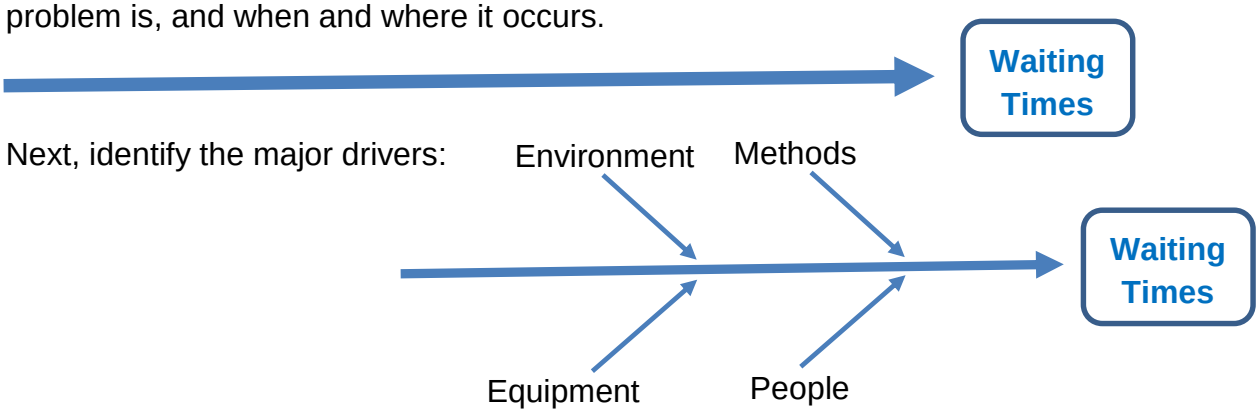
The tool quickly helps you to fully understand an issue and to identify all the possible causes—not just the obvious. If you know the cause of the delay, you are then better placed to implement the solution.

What does it do?

- The tool enables a team to focus on the content of the problem rather than its history or the differing interests of team members.
- Creates a snapshot of the collective knowledge and consensus of a team around a problem
- Focuses the team on the root cause of the problem—not its symptoms

How to use it

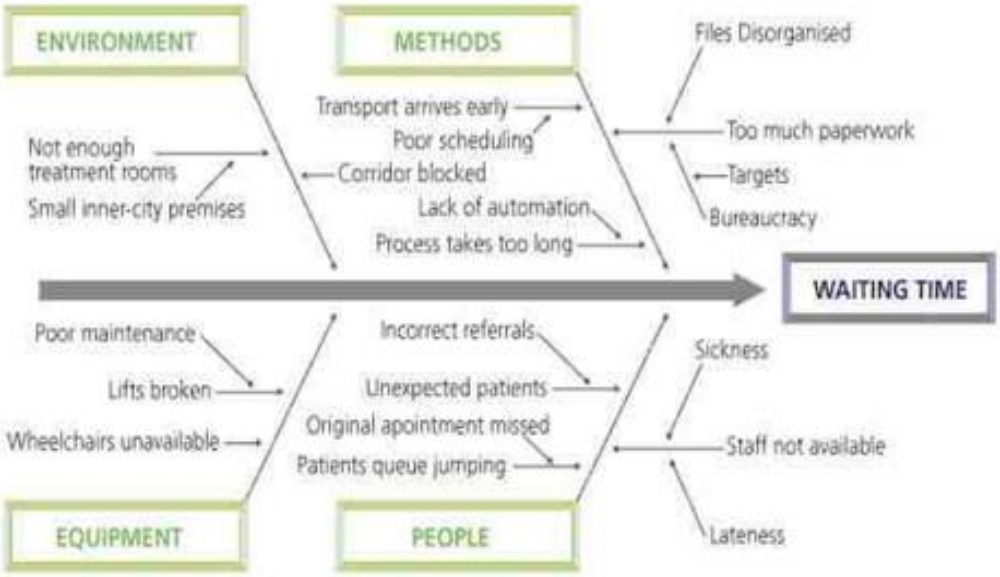
First identify the problem. Write it in a box and draw an arrow pointing towards it. Think about the exact problem in detail. Where appropriate, identify who is involved, what the problem is, and when and where it occurs.



To complete the diagram

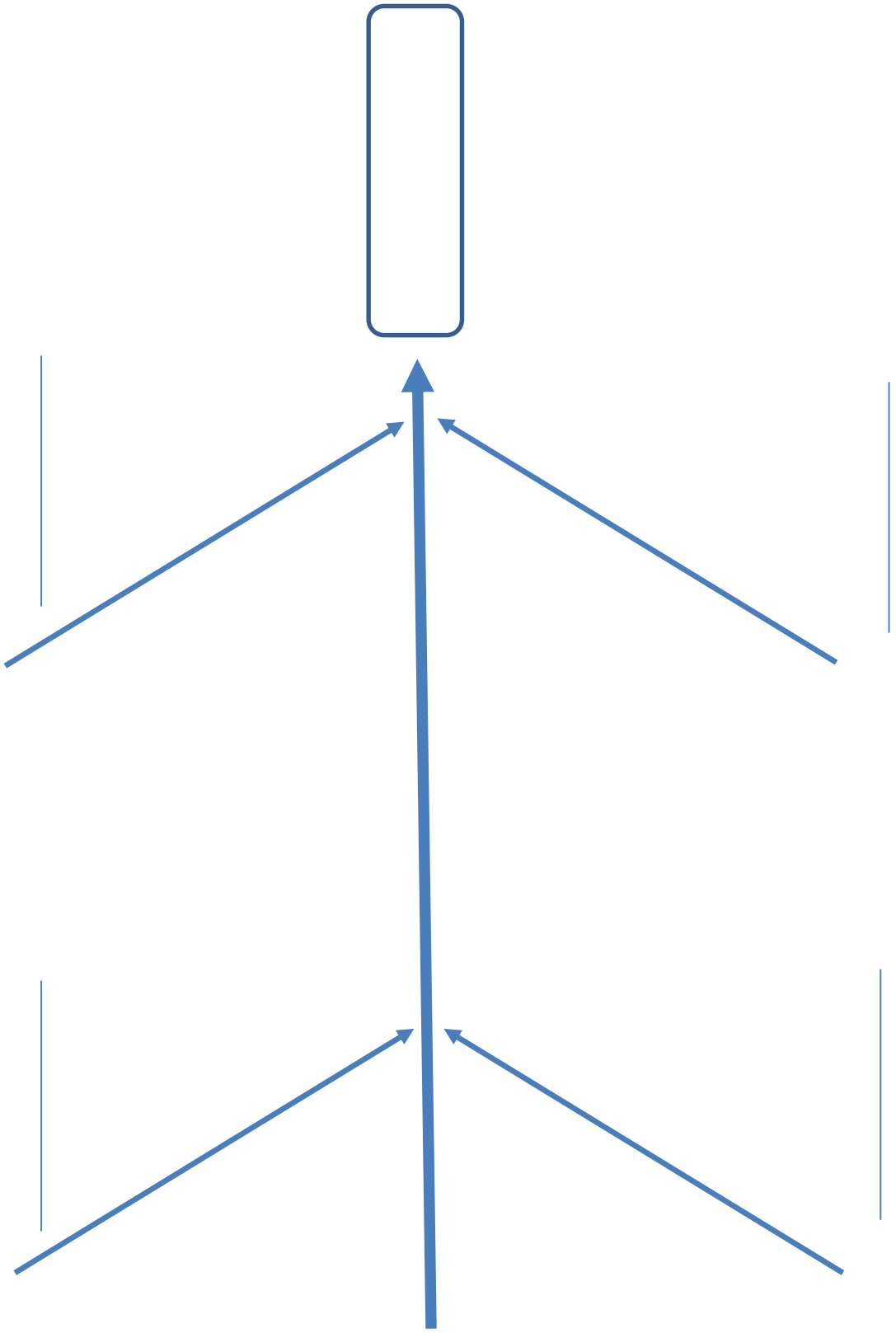
Take each of the main categories and brainstorm possible causes of the problem. Then, explore one to identify more specific 'causes of causes'. Continue branching off until every possible cause has been identified. Where a cause is complex, you might break it down into sub-causes. Show these as lines coming off each cause line.

Analyse your diagram. By this stage you should have a diagram showing all the possible causes of your delay/problem. Depending on the complexity and importance of the problem, you can now investigate the most likely causes further. This may involve setting up interviews with patients and staff, undertaking process mapping etc.



Tips

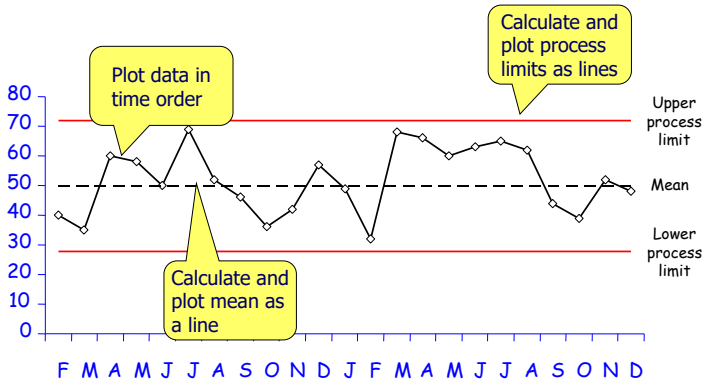
- Make sure that your team agree on the problem statement. Include as much information as possible in the 'what', 'where', 'when' and 'how much' of the problem. Use data to specify the problem if possible
- Aim to construct the diagram with the people involved in the problem
- You can use the cause and effect diagram as a working document that is updated as and when you collect more data, or to trial various solutions
- Use a paper surface so that you can transport the final diagram
- Ideally, causes should appear in only one category.



Control Chart (SPC)

What is a control chart?

The control chart is a graph used to study how a process changes over time. Data are plotted in time order. A control chart always has a central line for the average, an upper line for the upper control limit and a lower line for the lower control limit. These lines are determined from historical data.



Why use one?

Use a control chart to:

- help you make better decisions about how to react to your data
- Show whether you are likely to hit a target in future

Making better decisions

No two weeks are the same are they? Whenever we plot performance data over time the numbers are always different (as in the example above). Walter Shewhart, who invented the control chart, discovered that he could classify variation into 2 types:

Common cause variation: Sum of many small variations from real but small causes that are inherent in any process. They cannot be traced back to a root cause but are stable over time & therefore predictable. This is often referred to as “chance” or “normal variation”.

Special cause variation: Variation arising from a single cause not part of the normal process. It can be traced and identified. It is however irregular in time and therefore unpredictable.

Decision	Because
Do nothing	Performance ok
Contingency plans	Special cause variation
Process redesign	Common cause variation

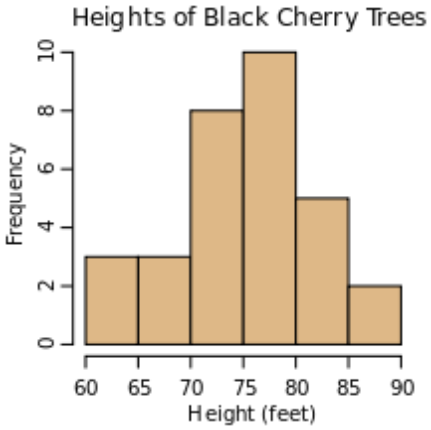
Once you know which you are dealing with, it leads to fundamentally different decisions about what to do next (see table).

Hitting a target

The control or process limits (red lines in example above) are an estimate of the range of common cause variation in your data. If there are no special causes present values will fall between these two lines. This gives us a limited ability to predict the future. Plot the target as a line on the control chart and see where it falls. Is it outside the lines or between the lines? This will tell you how likely the process is to hit the target in future.

Histogram

What is a histogram?

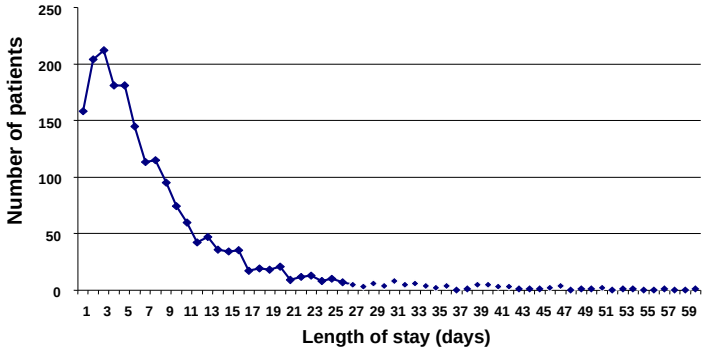


- A histogram is a form of bar chart where the horizontal axis describes a continuous variable such as length of stay rather than individual categories (A,B,C etc)
- It shows how much variation there is and the shape of that variation. Is it symmetrical around the average for example? Is there just one peak?
- The Mode is the most frequently occurring interval and can be easily seen on the chart (75-80 feet in the example chart right)
- The range (minimum to maximum values) is also easy to see

Why use one?

Use it to quantify the variation and look for patterns that can be investigated.

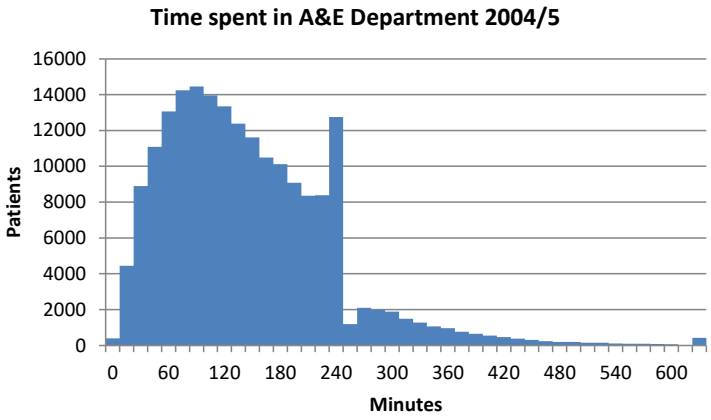
Variation



In the chart right, there are a lot of patients that stay 1 to 5 days. After that the number of patients falls away rapidly but not in a linear fashion. There are a few very long stay patients.

Patterns

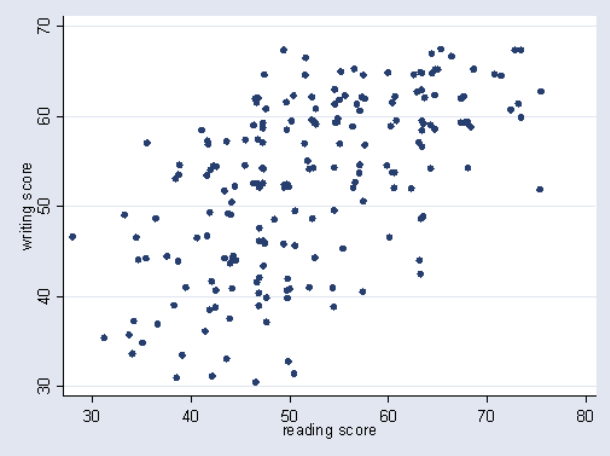
In the example right of time in an A&E department, there is a sharp divide at 4 hours. This shows how those working in the department are trying to manage the 4 hour target. This behaviour would not be obvious from the normal percentage achievement statistics that are reported.



Scatter Plot

What is a scatter plot?

- It is a graphical display of 2 continuous variables. Each is plotted on a separate axis.
- It shows how the data are distributed across the two variables
- Patterns or relationships are much easier to see

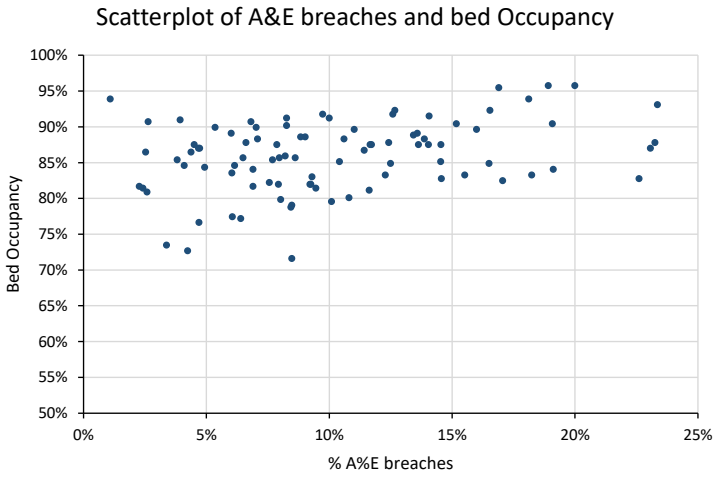


In the example right, Reading score is plotted on the X (horizontal) axis and Writing score is plotted on the Y (vertical) axis. Does a high Reading score automatically mean a high Writing score?

Why use one?

- It is used to see if there is any relationship or correlation between two variables.
- It can be usefully used to counter widely held beliefs e.g. X is always caused by Y.

Note: correlation does not always mean causation



In the example on the right, % A&E breaches have been plotted against average bed occupancy for a number of hospitals. Are A&E breaches caused by high bed occupancy? The chart seems to show that this is not the case as high breaches are accompanied by widely different occupancy levels.

Coaching the team…

Questions to ask to ensure the team has identified the real root cause.

What have you already tried?

Do they know the extent to which it worked or didn't work?

What choices do you have here?

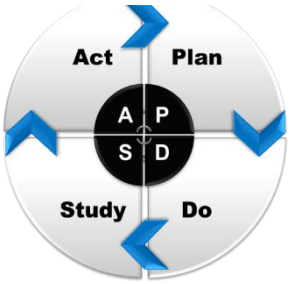
Can they explain why they think these are good options? If they've done their diagnostic work they will be able to.

Plan, Do, Study, Act (PDSAs)

What is it and how can it help me?

Once a team has set an aim and developed measures to determine whether a change leads to an improvement, the next step is to test a change in the real work setting. The four stages of the PDSA cycle:
Plan - the change to be tested or implemented
Do - carry out the test or change
Study - data before and after the change and reflect on what was learned
Act - plan the next change cycle or full implementation

When does it work best?



You may not get the results you expect when making changes to your processes, so it is safer, and more effective to test out improvements on a small scale before implementing them across the board. Using PDSA cycles enables you to test out changes before wholesale implementation and gives stakeholders the opportunity to see if the proposed change will work. Using the PDSA cycle involves testing new change ideas on a small scale. Trying out a new way to make appointments for one consultant or one clinic.

Why test change before implementing?

- Learn and adapt
- Increase degree of belief
- Build a common understanding
- Evaluate costs and side effects
- Reduce total lead time of full implementation
- Test ideas under different conditions

Steps in the PDSA Cycle

Plan

- Plan the test or observation, including a plan for collecting data
- State the objective of the test
- Make predictions about what will happen and why
- Develop a plan to test the change (Who? What? When? Where? What data needs to be collected?)

Do

- Try out the test on a small scale
- Carry out the test
- Document problems and any unexpected outcome
- Begin analysis of the data

Study

- Review the data and study the results
- Complete the analysis of the data
- Compare the data to your predictions
- Summarise and reflect on what was learned

Act

- Refine the change based on what was learned from the test
- Determine what modifications should be made
- Prepare a plan for the next test