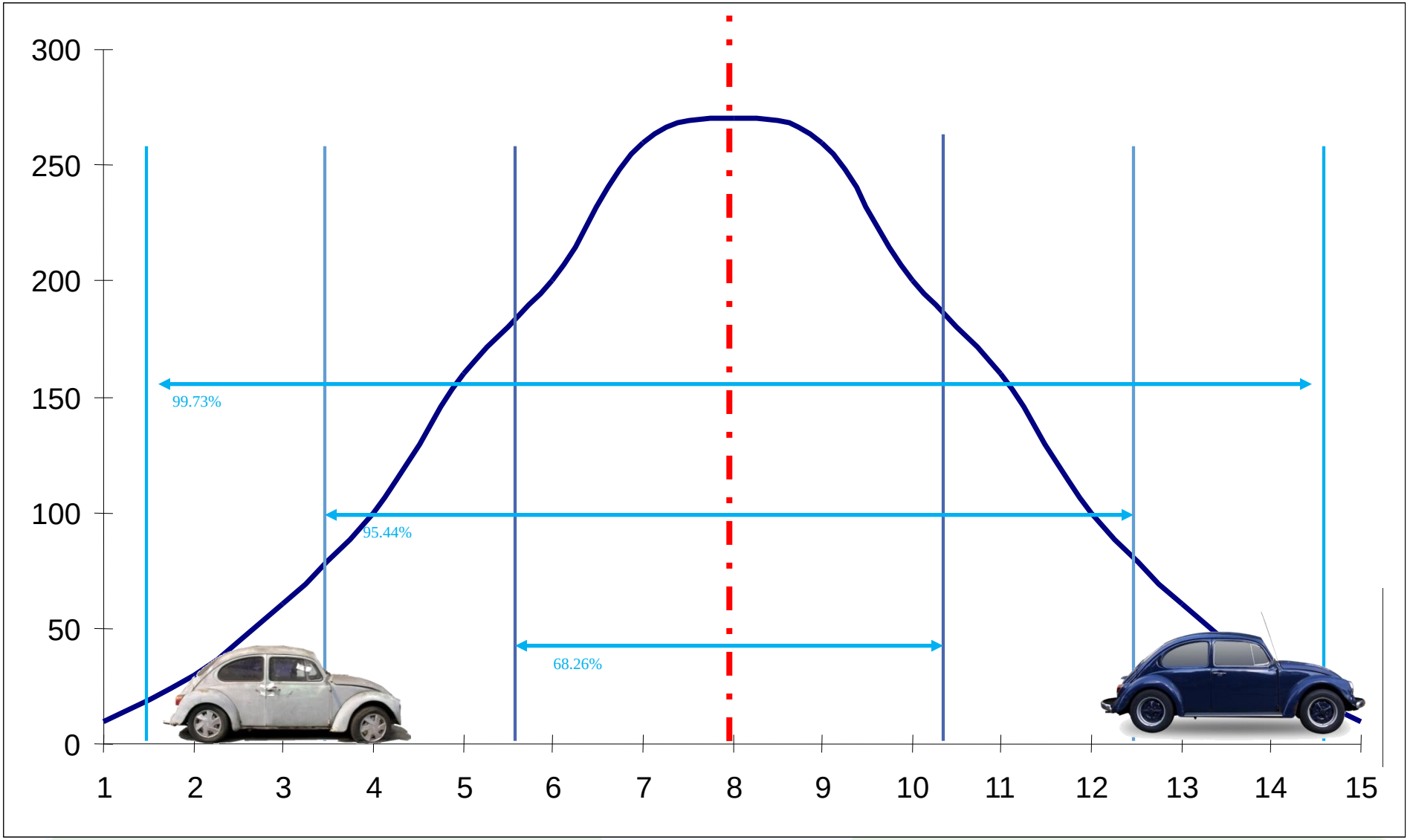
Measurement for Improvement

Matt Tite

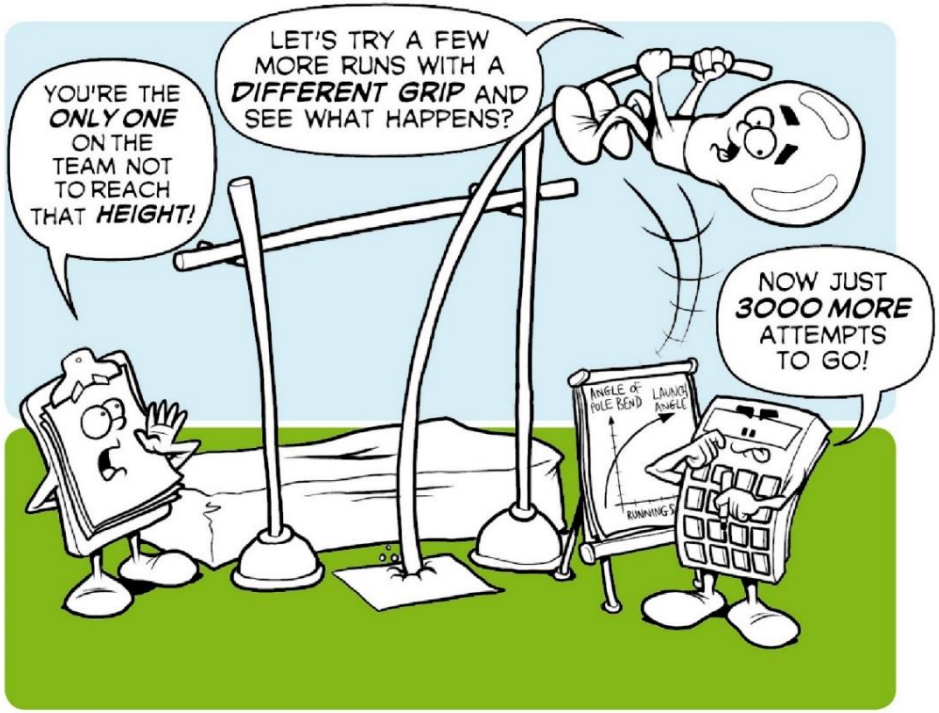
Introduction

Distributions – “How long do cars last?”



3 faces of measurement

The traditions of measurement



Research

- eg A-B comparison, average, huge dataset

Judgement

- eg one-to-many benchmarking comparision, average, large dataset

Improvement

- eg continual analysis of single changing process over time

Measurement mindsets

	Research	Judgement	Improvement
Goal	New knowledge (not its applicability)	Comparison Reward / punishment Spur for change	Process understanding Evaluating a change
Hypothesis	Fixed	None	Multiple and flexible
Measures	Many	Very few	Few
Time period	Long, past	Long/medium, past	Short, current
Sample	Large	Large	Small
Confounders	Measure or control	Describe and try to measure	Consider but rarely measured
Risks in improvement settings	Ignores time based variation Over-engineers data collection	Ignores time based variation Over-reaction to natural variation	Incorrectly perceived as 'inferior statistics'

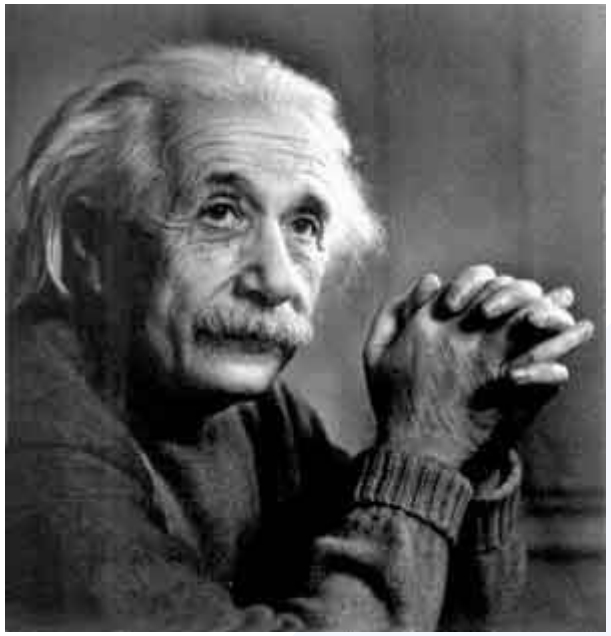
Based on L Solberg, G Mosser and S McDonald (1997) The Three Faces of Performance Measurement: Improvement, Accountability and Research, Journal on Quality Improvement, 23 (3): 135 - 147.

Measurement for improvement

"Measurement is for improvement not judgement."

D. Berwick

PDSA: Testing Ideas – How do you know if you are making a difference?



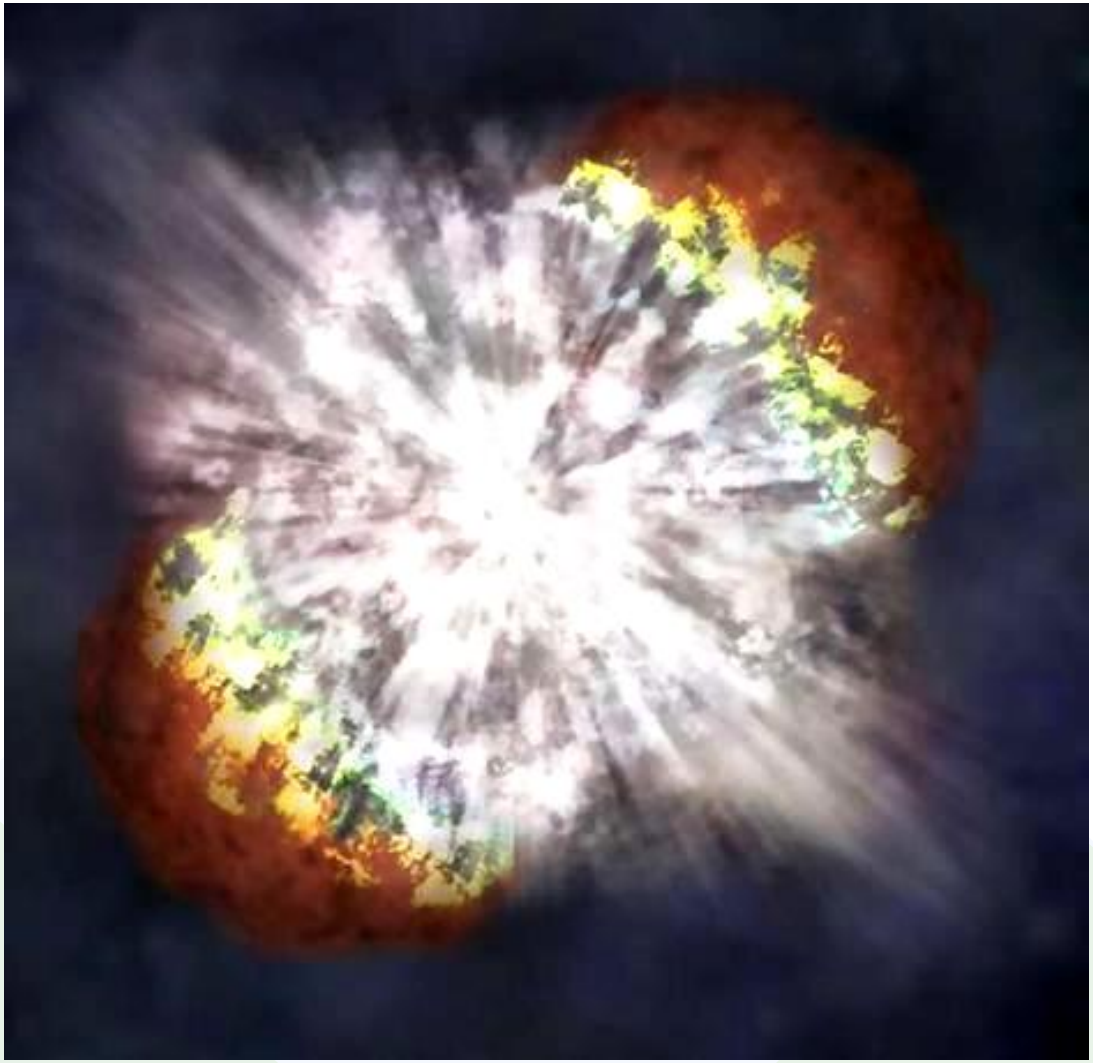
“Insanity: doing the same thing over and over again and expecting different results.”

Improvement for Harm Free Care

- Any improvement is a change
- Not every change is an improvement
- But we cannot improve something unless we change it

Goldratt E (1990), *Theory of Constraints*,
North River Press, Massachusetts

The usual approach



Model for Improvement

What are we trying to accomplish?

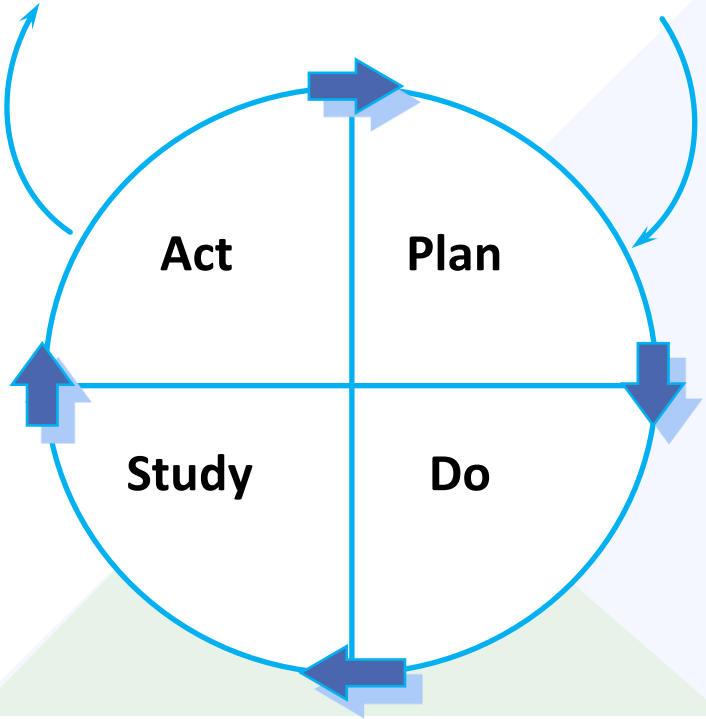
How will we know that a change is an improvement?

What changes can we make that will result in the improvements that we seek ?

Aims

measurements

change ideas



testing ideas before implementing changes

The Improvement Guide
Langley et al (1996)

PDSA Simulation

PDSA Measures

Accuracy

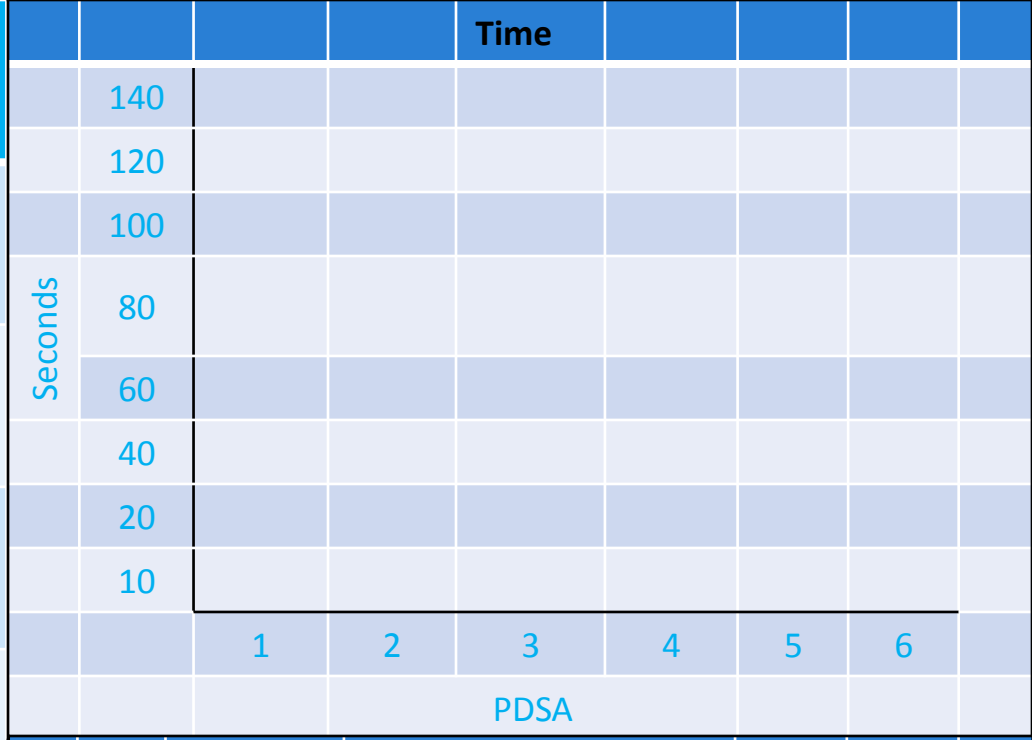
- **10** – All pieces on Sam & positioned correctly
- **5** – All pieces on Sam, but one or more is out of place
- **1** – No pieces on Sam

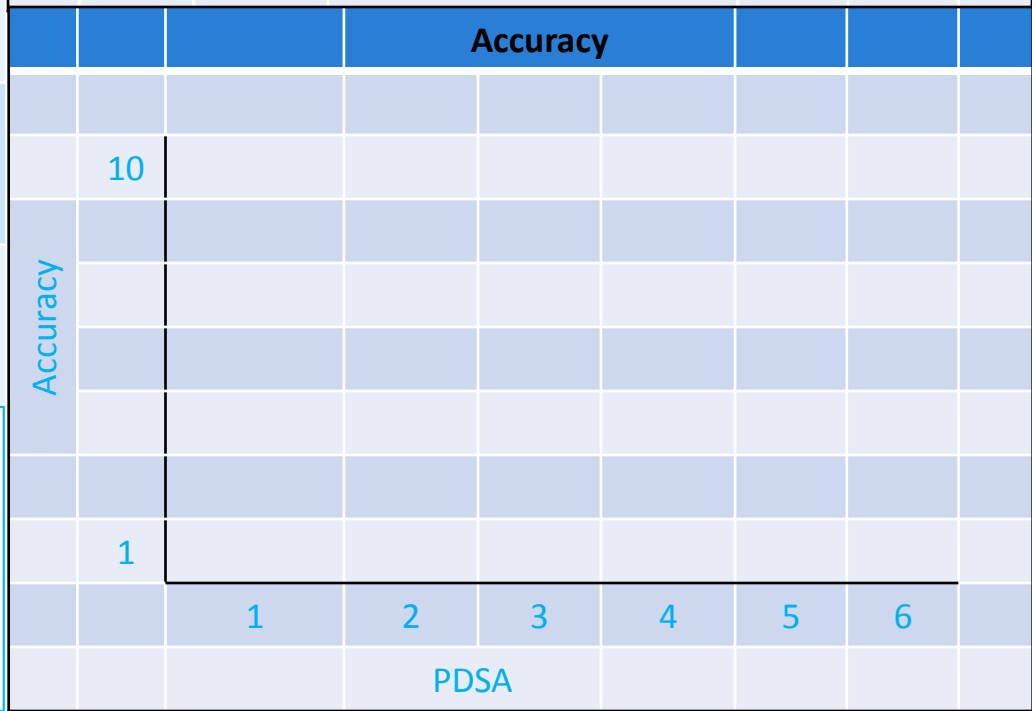
Time

- **Start**: When time keeper says go.
- **Stop:** when doctor indicates last piece is in place AND removes hand.

PDSA #	Theory	Prediction
1		
2		
3		
4		
5		
6		

3 – All pieces on Sam & positioned correctly
2 – All pieces on Sam, but one or more is out of place
1 – One or more pieces are not on Sam.





Measurement for improvement

“You can’t fatten a cow by weighing it”
(Palestinian proverb)

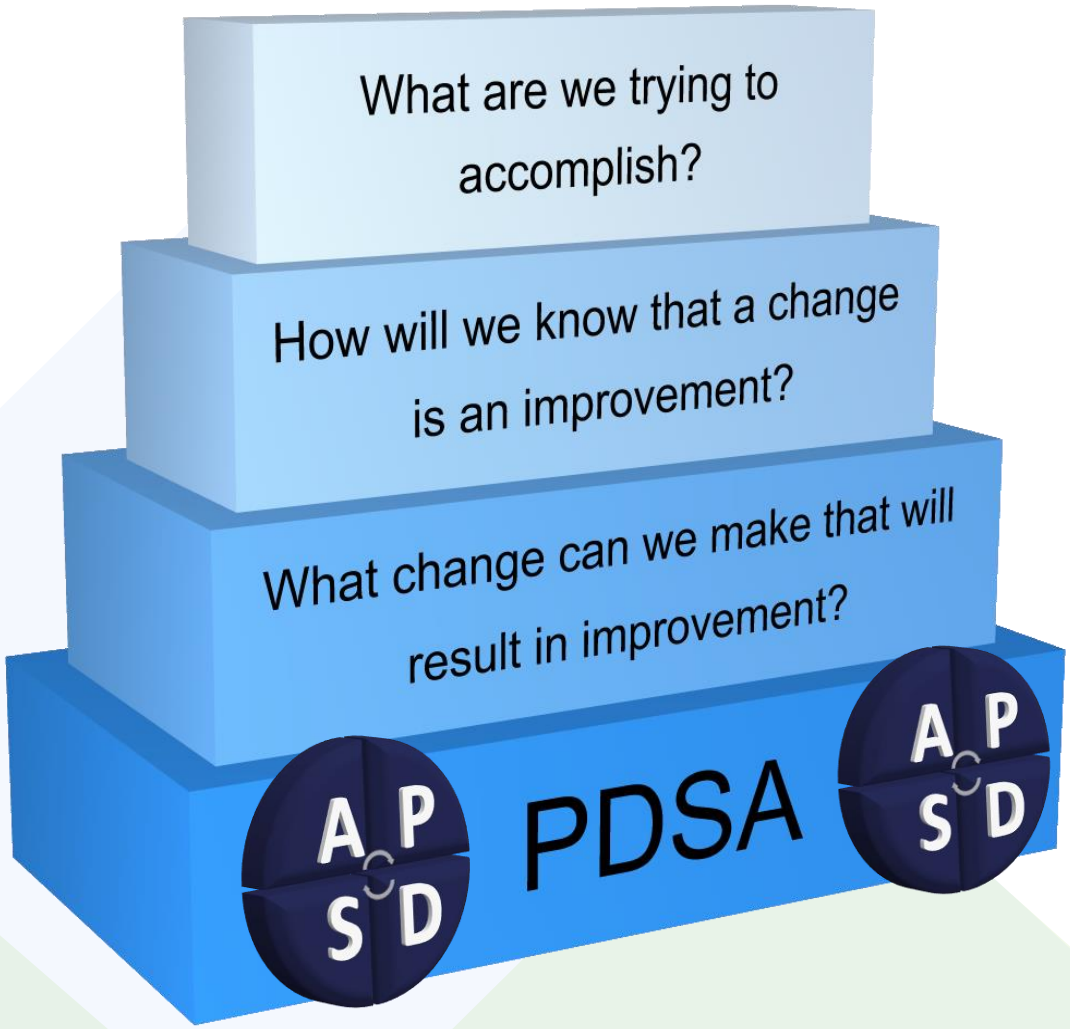
Improvement is not about measurement, but……..

How do we know if a change is an improvement?

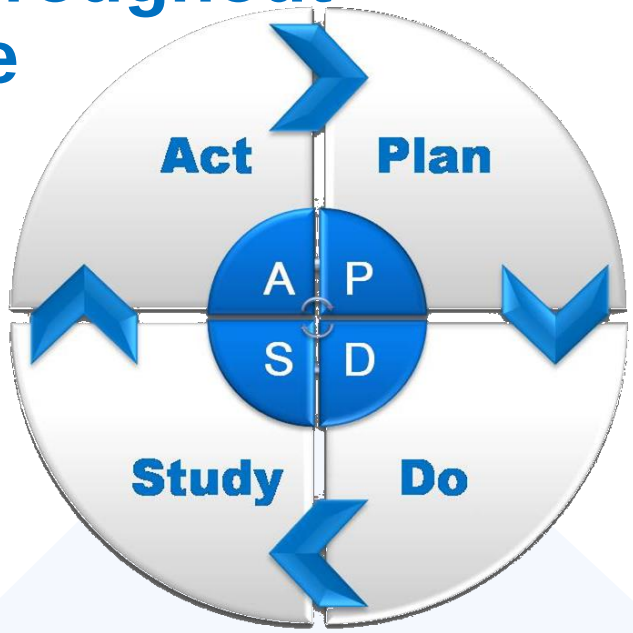
“If you can’t measure it, you can’t improve it”

How do we implement change in the NHS?

Model for improvement



Measurement throughout the project cycle



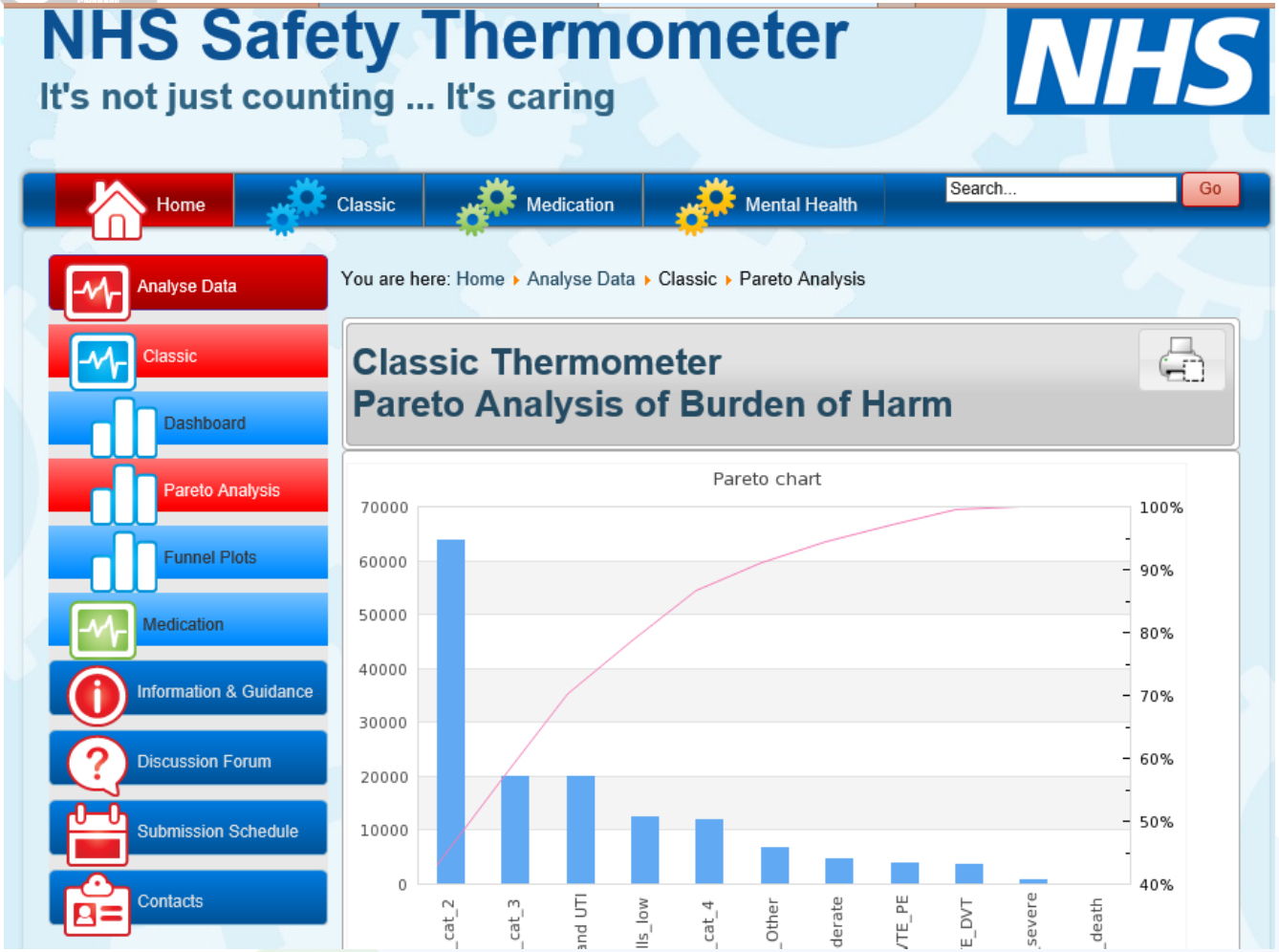
Project Identification

Getting a baseline

Did project make a difference

Will project sustain

Evaluating worth of the project

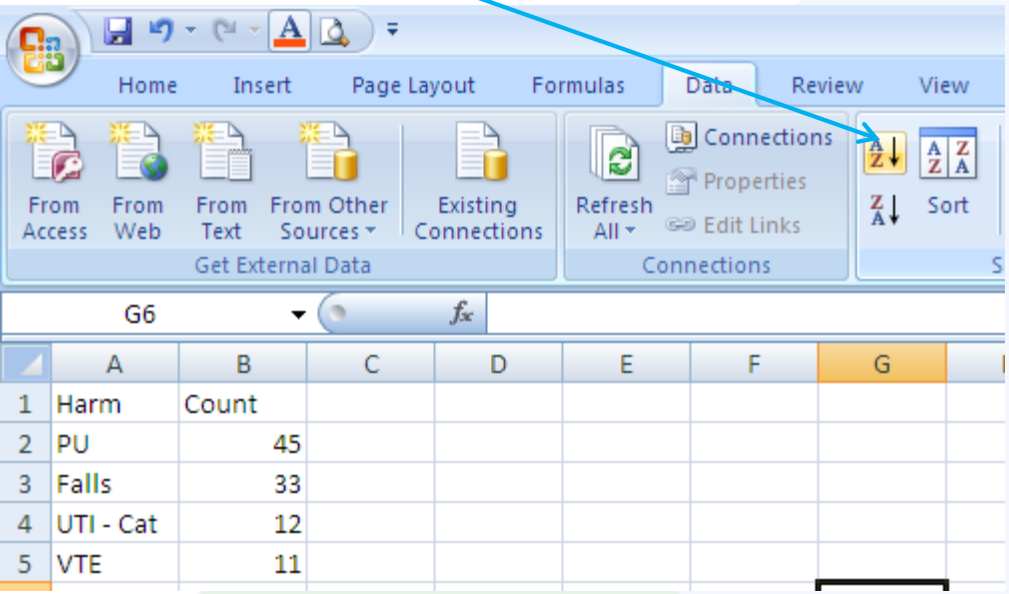


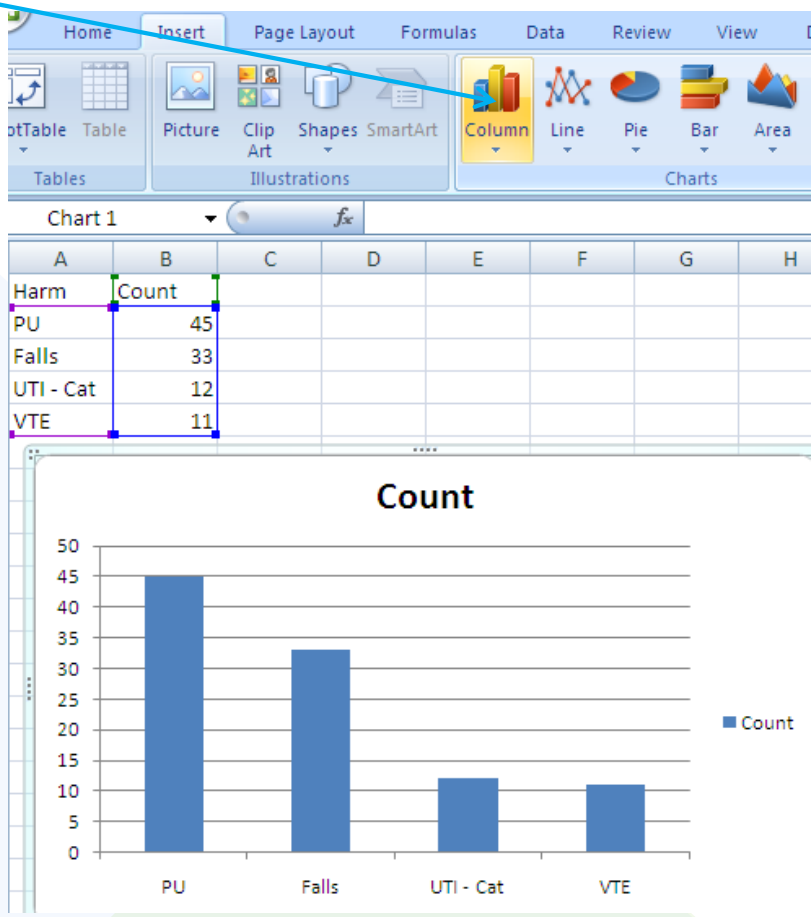
http://www.safetythermometer.nhs.uk

Using Excel to create a Pareto Chart

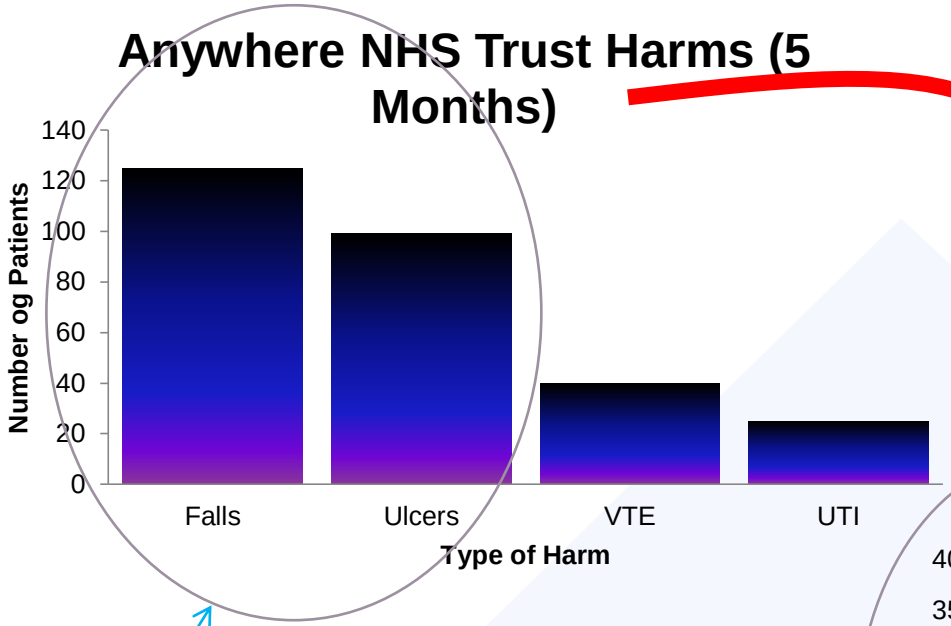
Add this data to Excel and sort

Add this data to Excel and sort

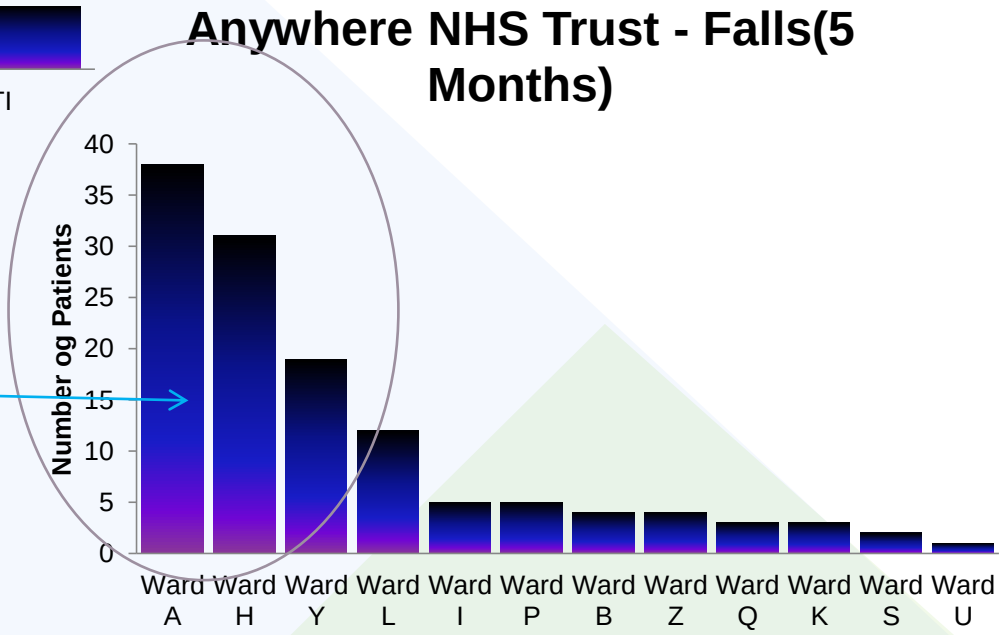




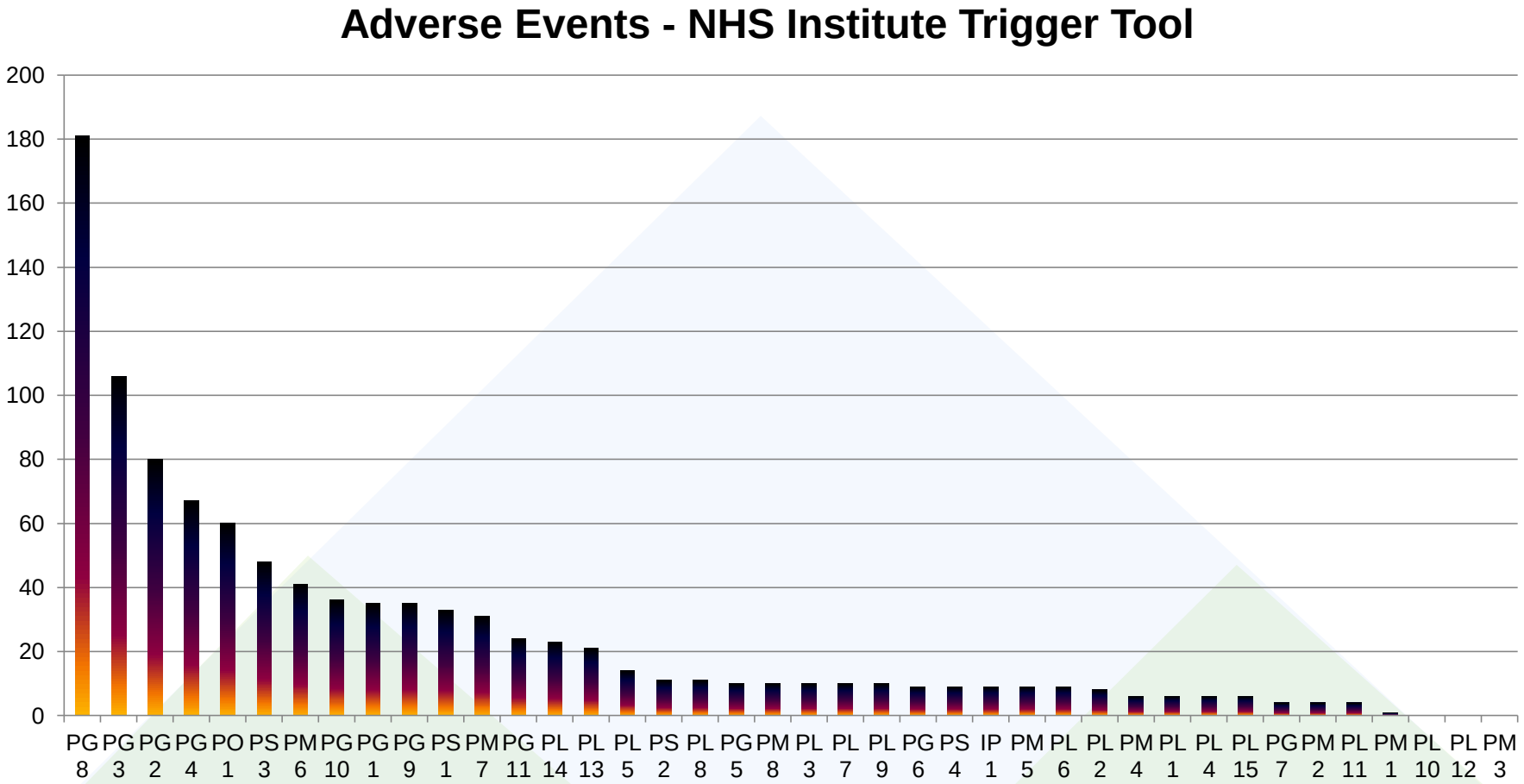
Applying Pareto to Harm Free Care

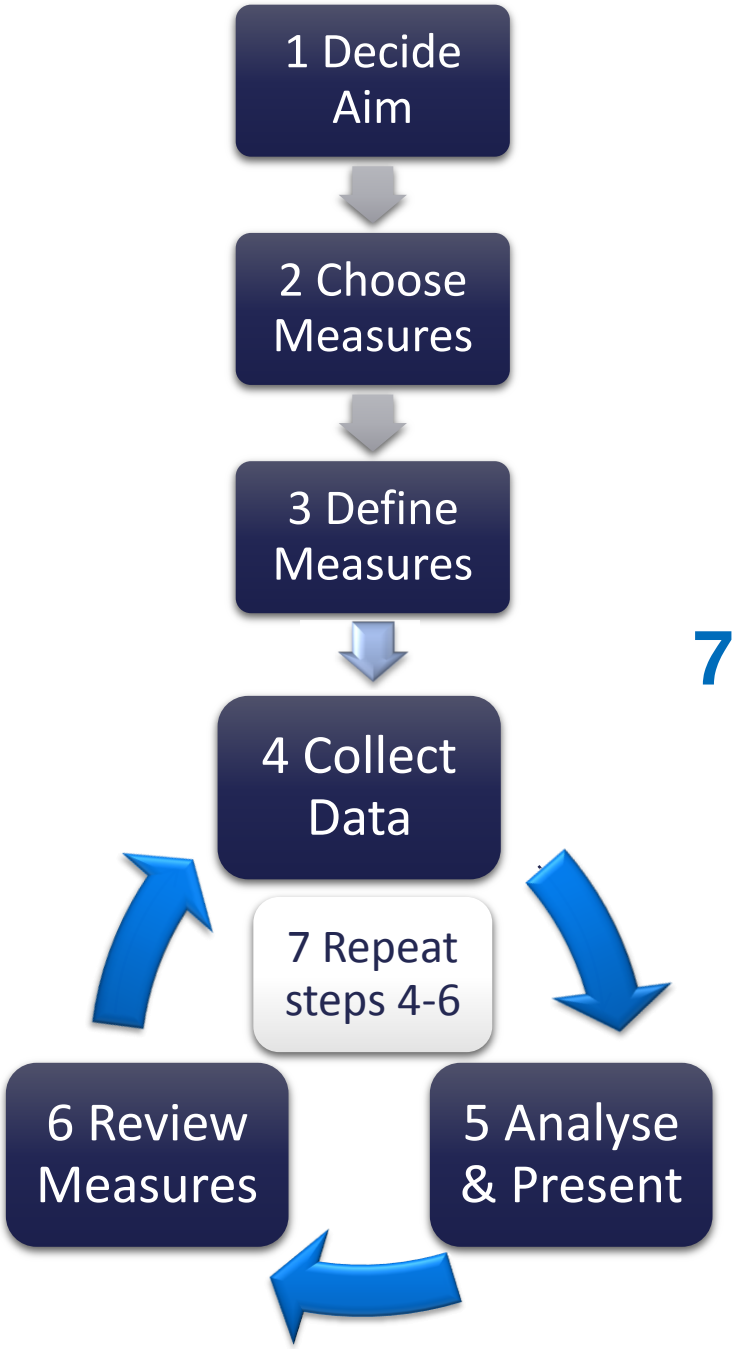


80% of the Harms



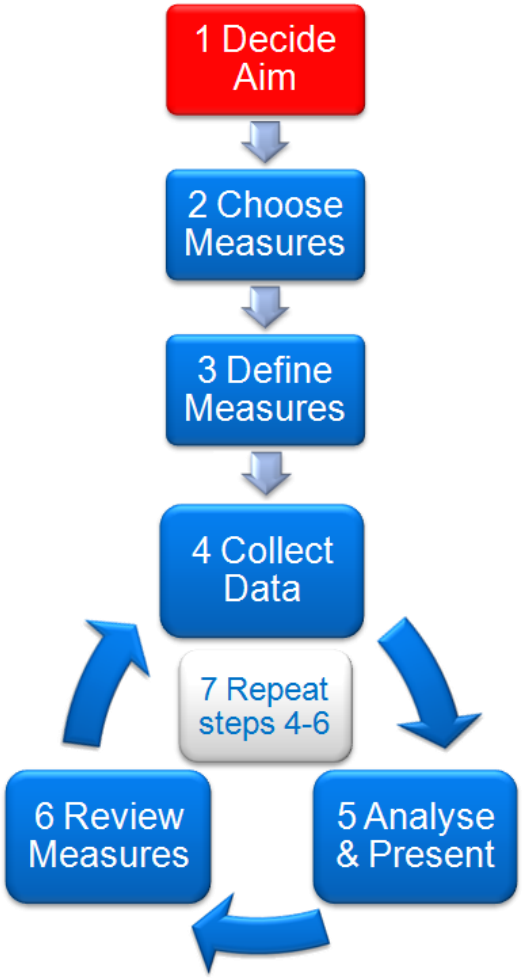
Pareto using the Trigger Tool





7 Steps to measurement

Step 1 – Decide Aim



Project Goals

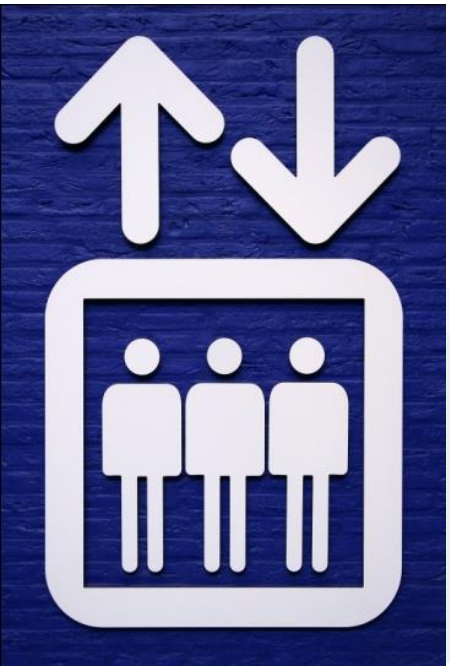
NHS Institute for Innovation and Improvement

Use **SMART** to aid in goal setting		
S	**Specific**	Clear-cut objectives
M	**Measurable**	Capable of being measured
A	**Achievable**	Can get a result
R	**Relevant**	Applicable to what you want to achieve
T	**Time-bound**	Clear dates for reviews and end of project

Exercise 1: Aims recap

For your current service improvement project – take 5 minutes to recall your project aim

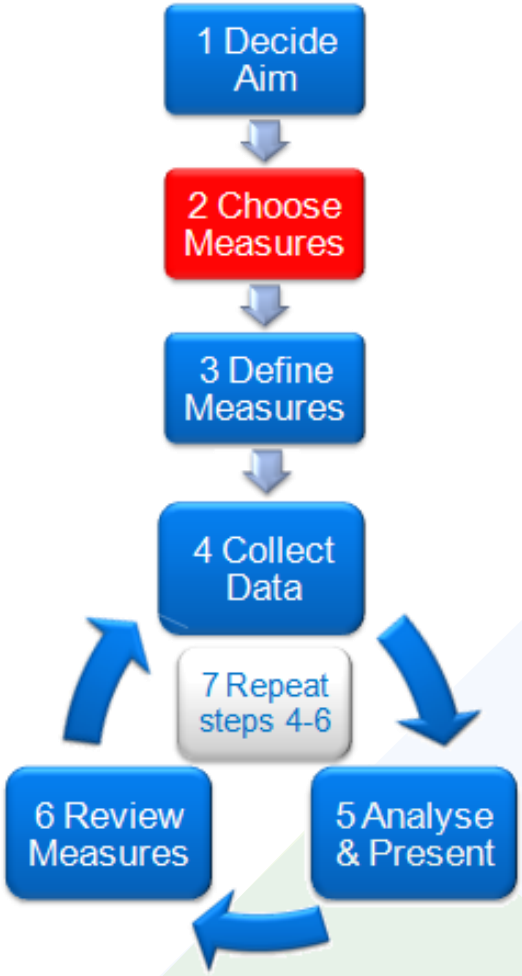
If you were in a lift with the rest of your table group could you clearly and briefly describe your aim in a sentence – i.e. the time it takes to travel from one floor to the next?



Try it!

Are your colleagues aims clear and understandable to you?

Step 2 – Choose Measures

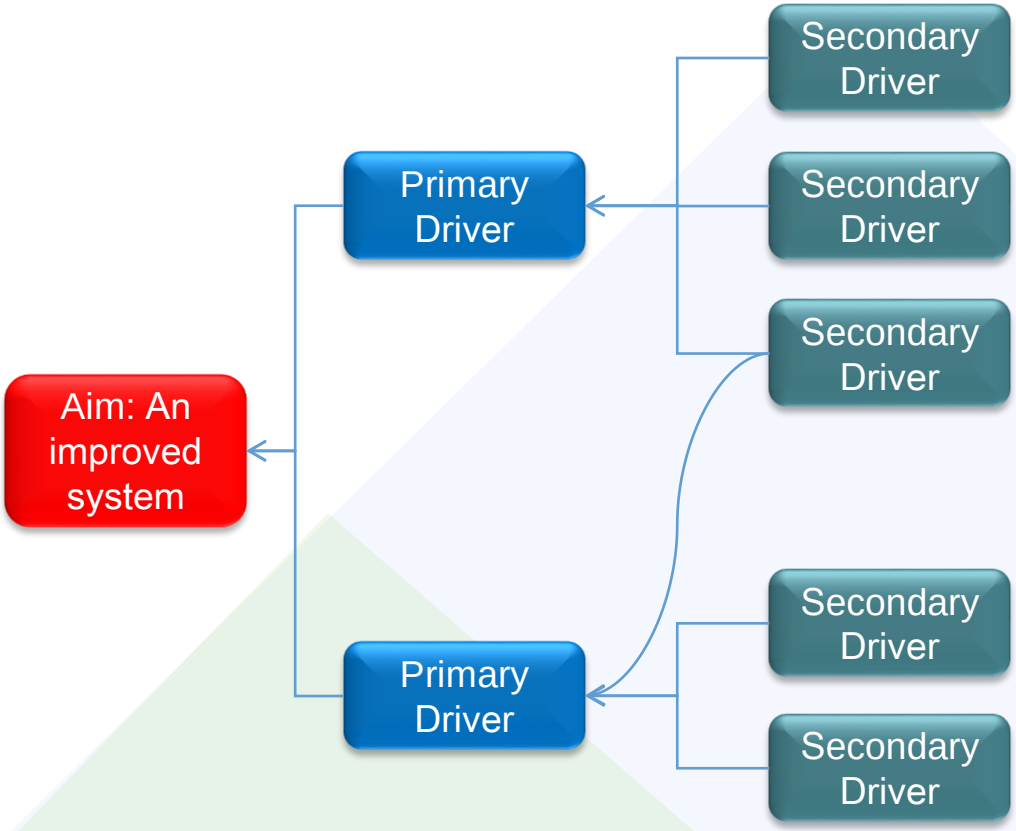


There are two tools to help you choose measures

1. Process Mapping
2. Driver Diagrams

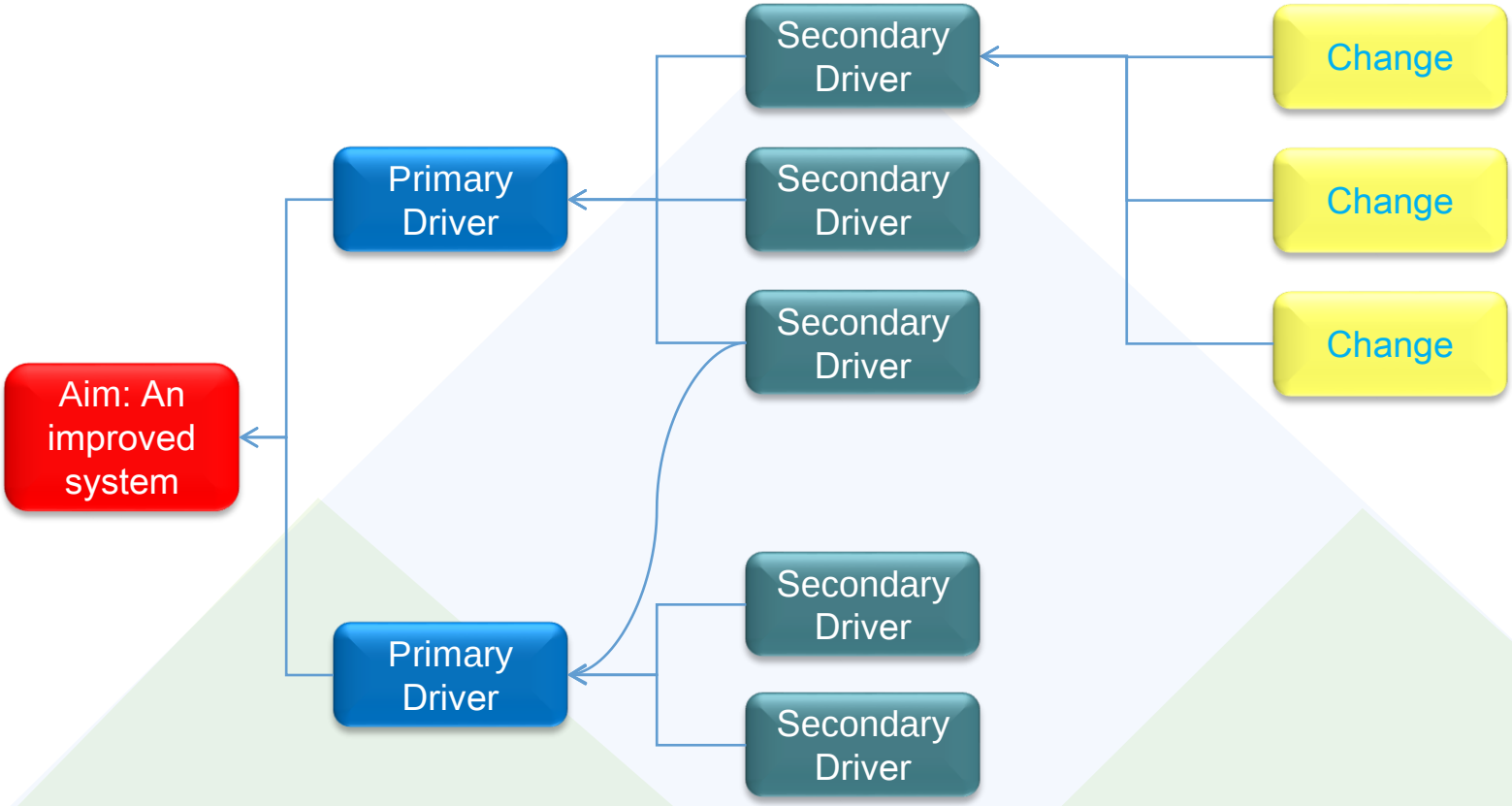
Driver Diagrams

Schematic view of a system on the left we depict outcome
As we move right we drill down into the network of causes that drive the outcome, from 'primary' to 'secondary' drivers.

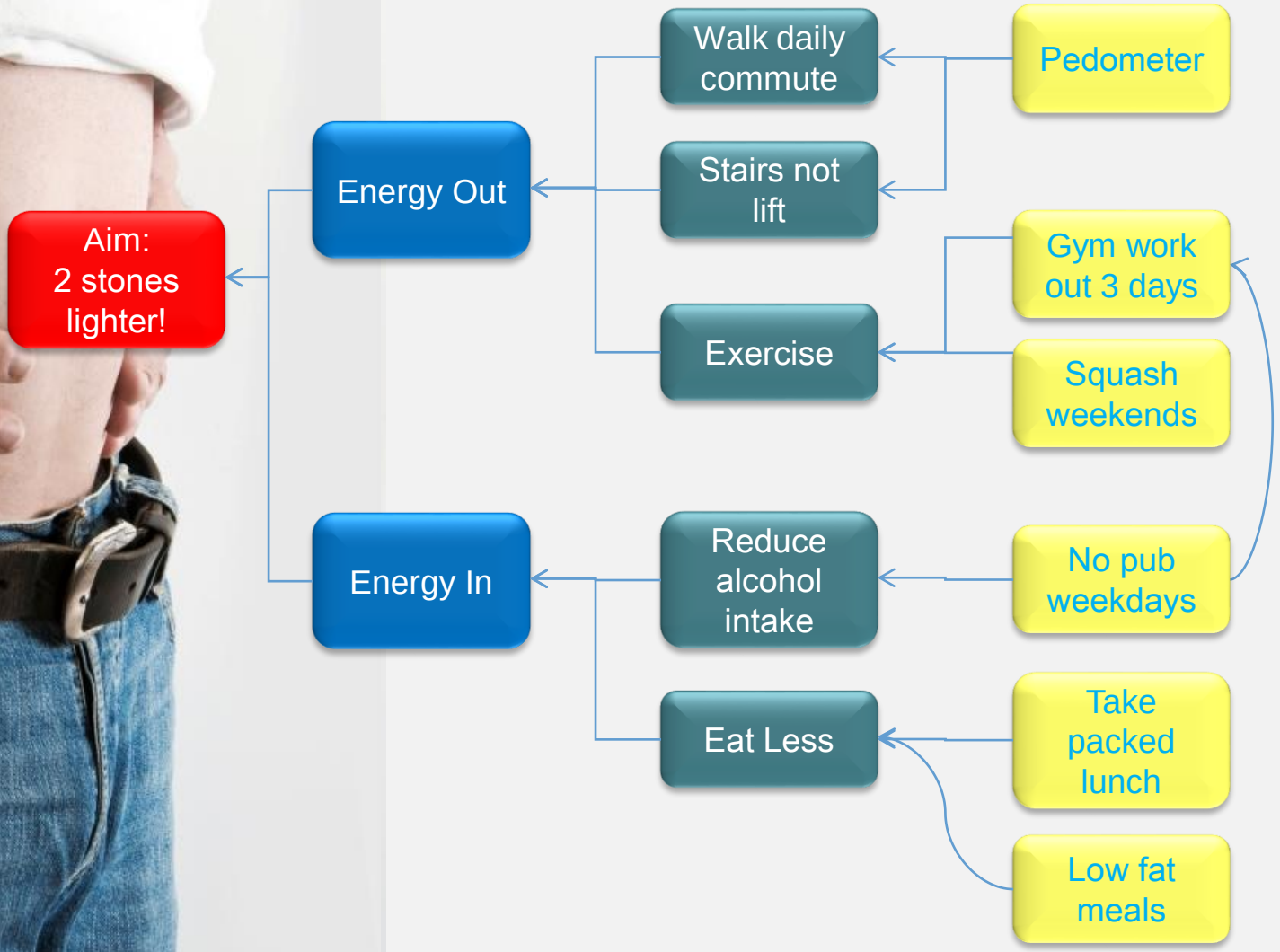


Driver Diagrams

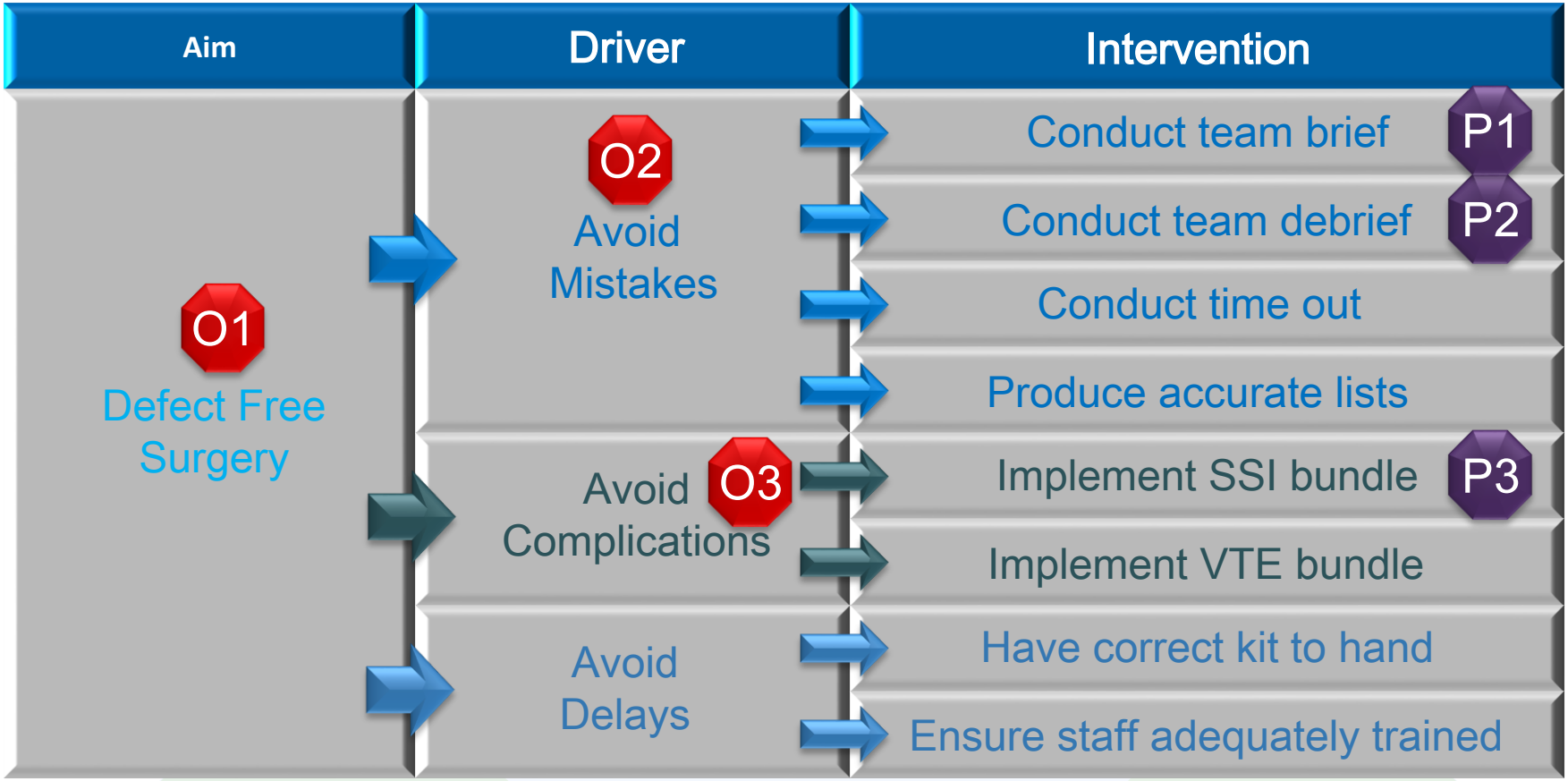
On the right we depict ideas for system changes that might ultimately impact the outcome. Diagrams represents our theory about how to modify the system to change the outcome.



Driver Diagrams – weight loss example



Driver Diagrams clinical example



O1 Overall glitch count
O2 Never events
O3 Number of surgical site infections

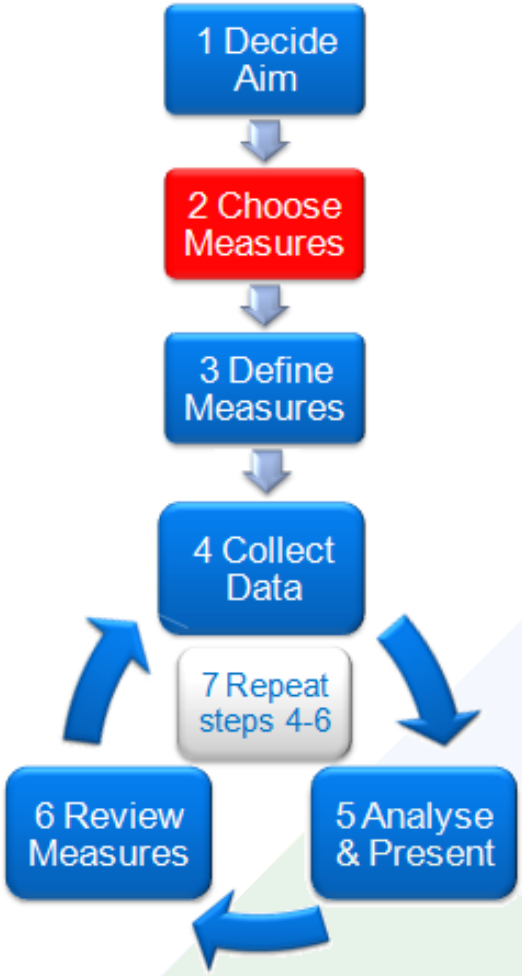
P1 % lists with Team Brief
P2 % lists with Team Debrief
P3 % compliance with SSI bundle

Exercise 2: Create your driver diagram

Thinking about your project,
- Create a driver diagram
- Complete the driver diagram to link Aims with Measures

Drivers Tip
Use the following categories to prompt you
- Equipment
- People
- Processes
- Materials
- Communication

Step 2 – Choose Measures



An important note:

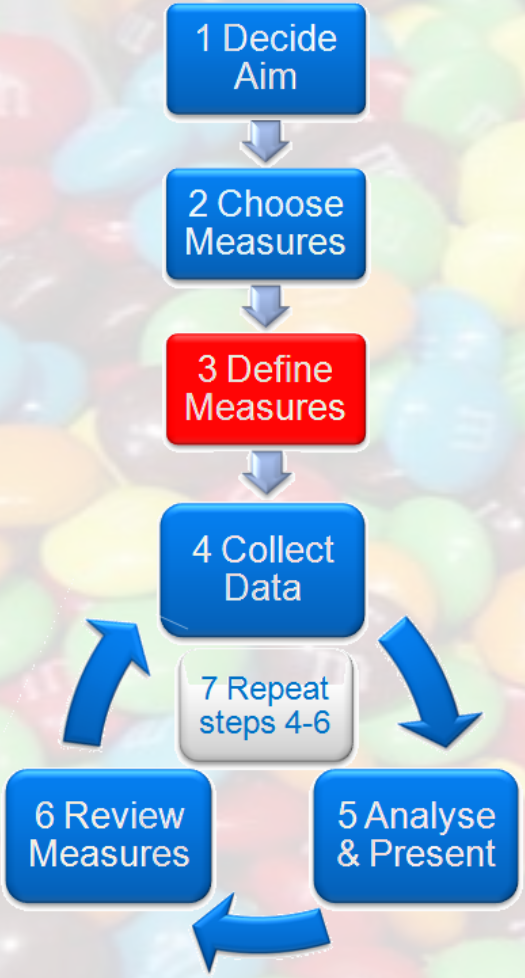
As well as clinical and quality measures – you may need to consider what financial measures are required for your project?

You may need initial and ongoing funding?

Your success in gaining access to funds will be helped if you have completed a project financial justification or return on project investment analysis

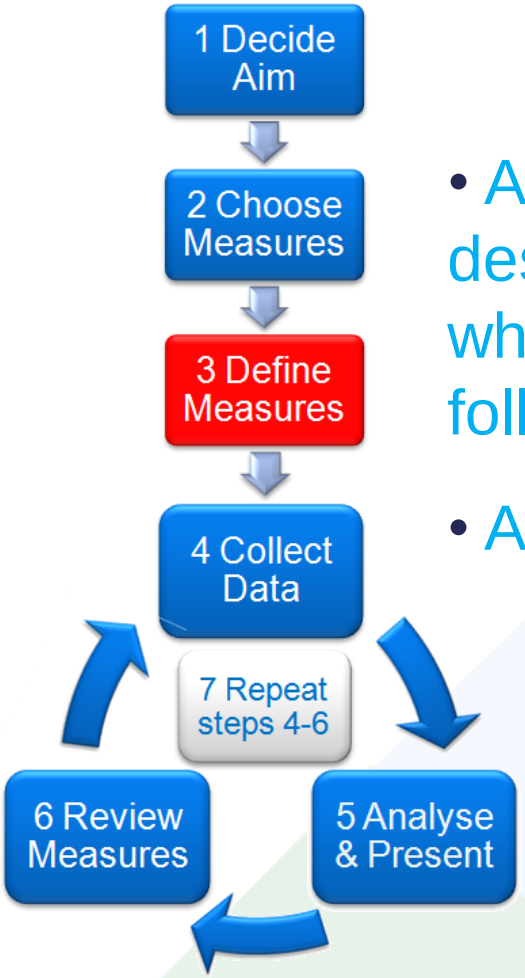
Covered in more detail later in the presentation …

Exercise 3



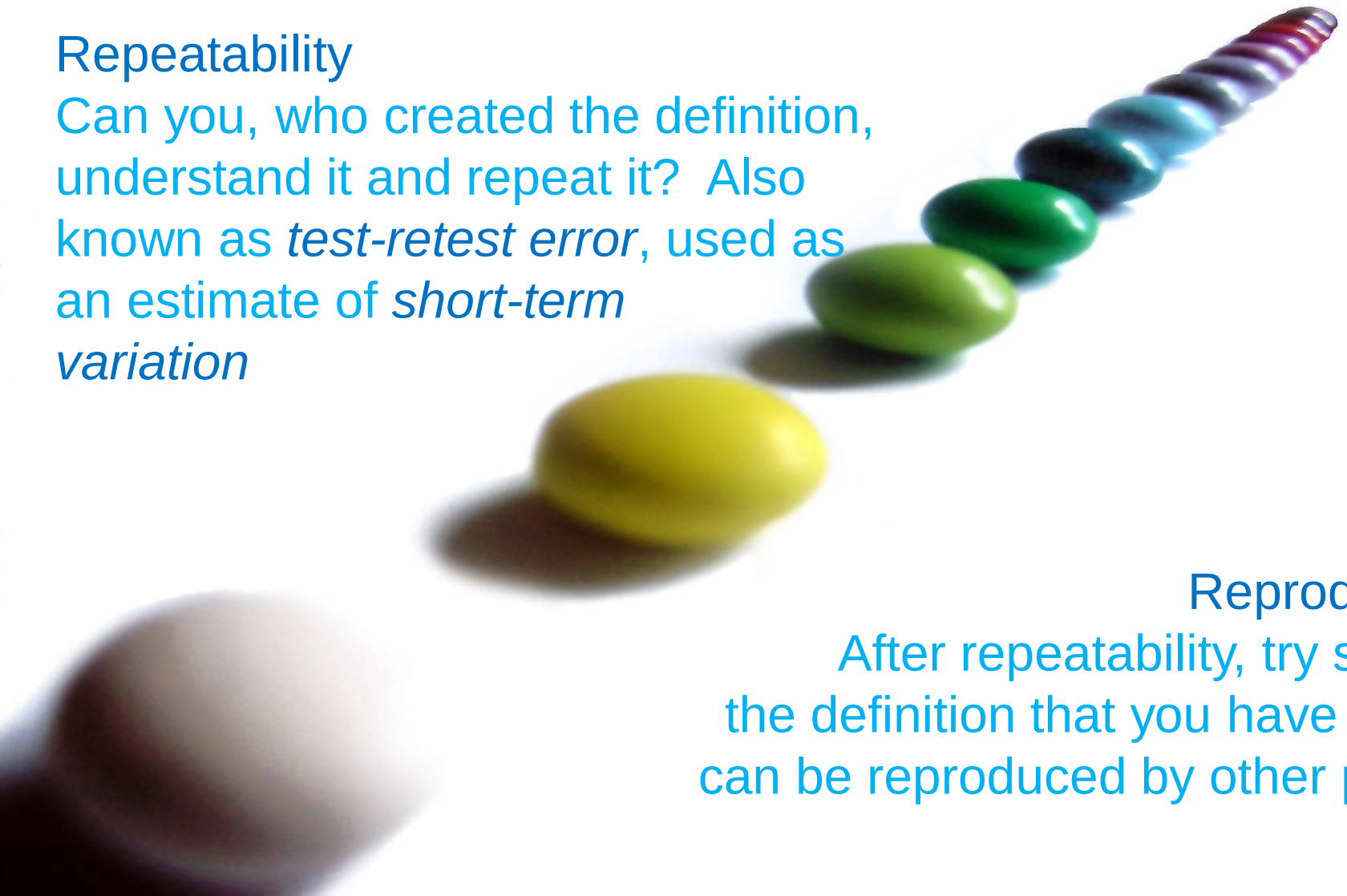
- A4 Paper exercise

Step 3 – Define Measures



- An operational definition is a description, in quantifiable terms, of what to measure and the steps to follow to measure it consistently
- Are we measuring the same thing?

Advice on creating measurement definitions



Repeatability

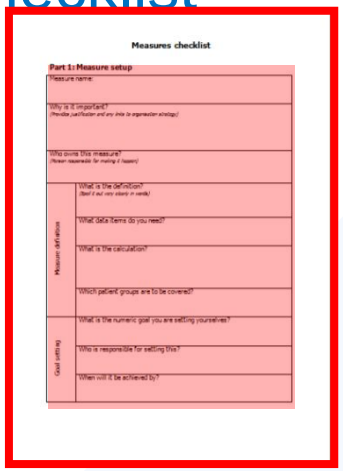
Can you, who created the definition, understand it and repeat it? Also known as *test-retest error*, used as an estimate of *short-term variation*

Reproducibility

After repeatability, try seeing if the definition that you have created can be reproduced by other people?

Exercise 4

- The Measures Checklist
- Why important?
- Who owns?
- Definitions?
- Goals?


Measures checklist

Part 1: Measure setup

Measure name:

Why is it important?
(Possible Lean/Kaizen and any links to organisation strategy)

Who owns this measure?
(Person responsible for making it happen)

Measure definition

What is the definition?
(Spell it out very clearly in words)

What data items do you need?

What is the calculation?

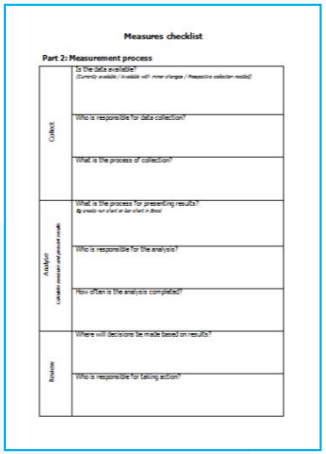
Which patient groups are to be covered?

Goal setting

What is the numeric goal you are setting yourselves?

Who is responsible for setting this?

When will it be achieved by?


Measures checklist

Part 2: Measurement process

Collect

Is the data available?
(Currently available / Available with minor changes / Prospective collection needed)

Who is responsible for data collection?

What is the process of collection?

Analyse

What is the process for presenting results?
(Eg create run chart or bar chart in Excel)

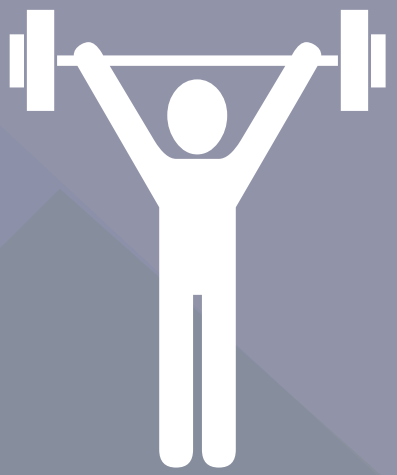
Who is responsible for the analysis?

How often is the analysis completed?

Review

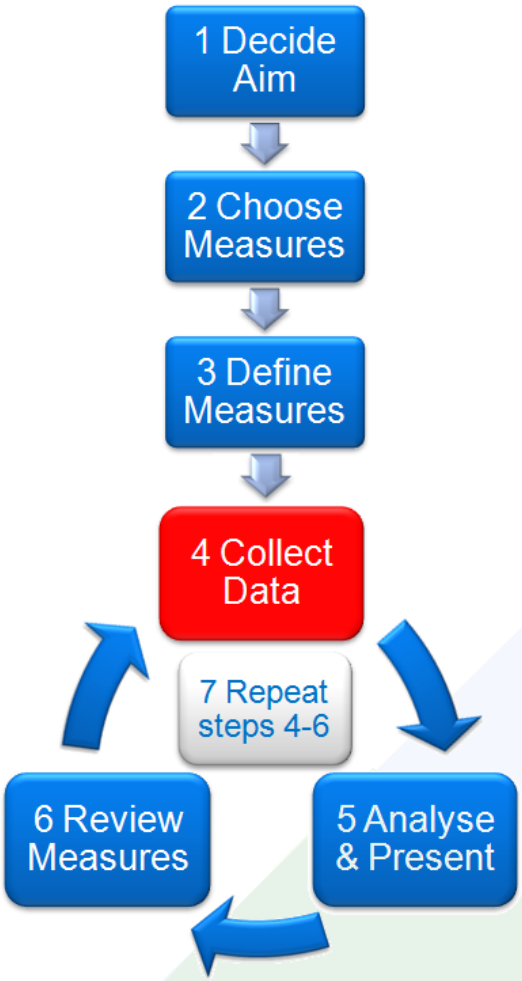
Where will decisions be made based on results?

Who is responsible for taking action?



- Complete part one of the measures checklist
- form provided - for a measure that you
- are using or are planning to use
- You have 10 minutes

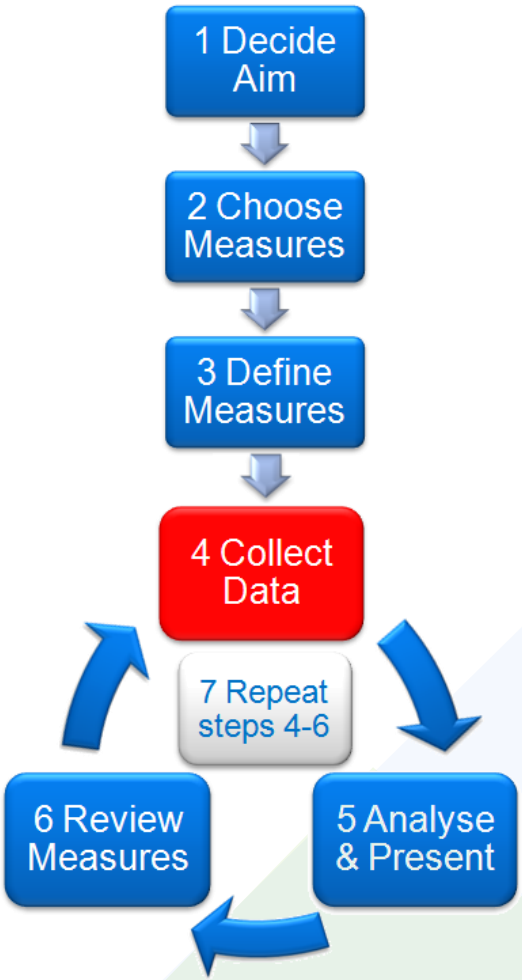
Step 4 – Collect Data



Practical considerations:

5 W's and 1H

Step 4 – Collect Data

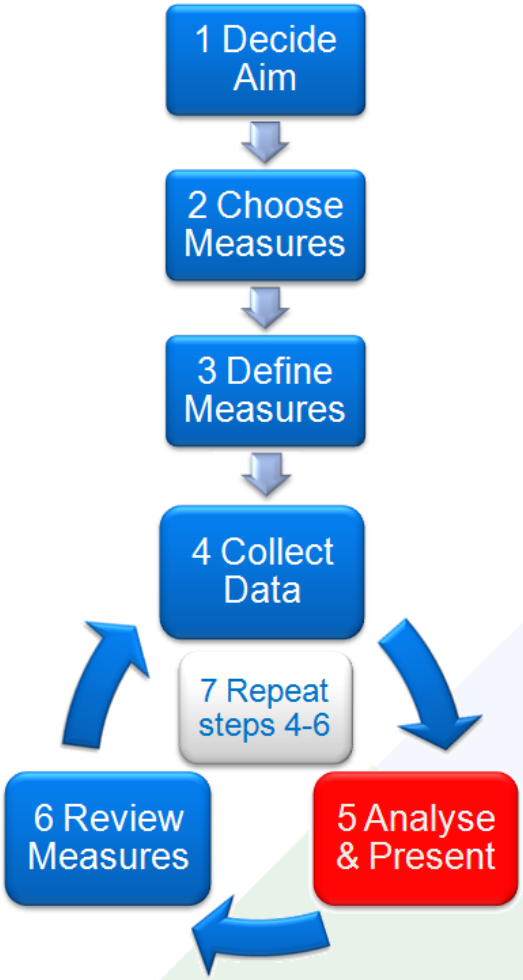


Decisions, decisions…

- What - All patients or a sample?
- Who – took the data? (what role?)
- When – When was the data taken - real time or retrospective?
- Where is the data from?
- How – was the data taken? (What process?)

- Turn the data into a different unit (hours into days)

Step 5 – Analyse & Present



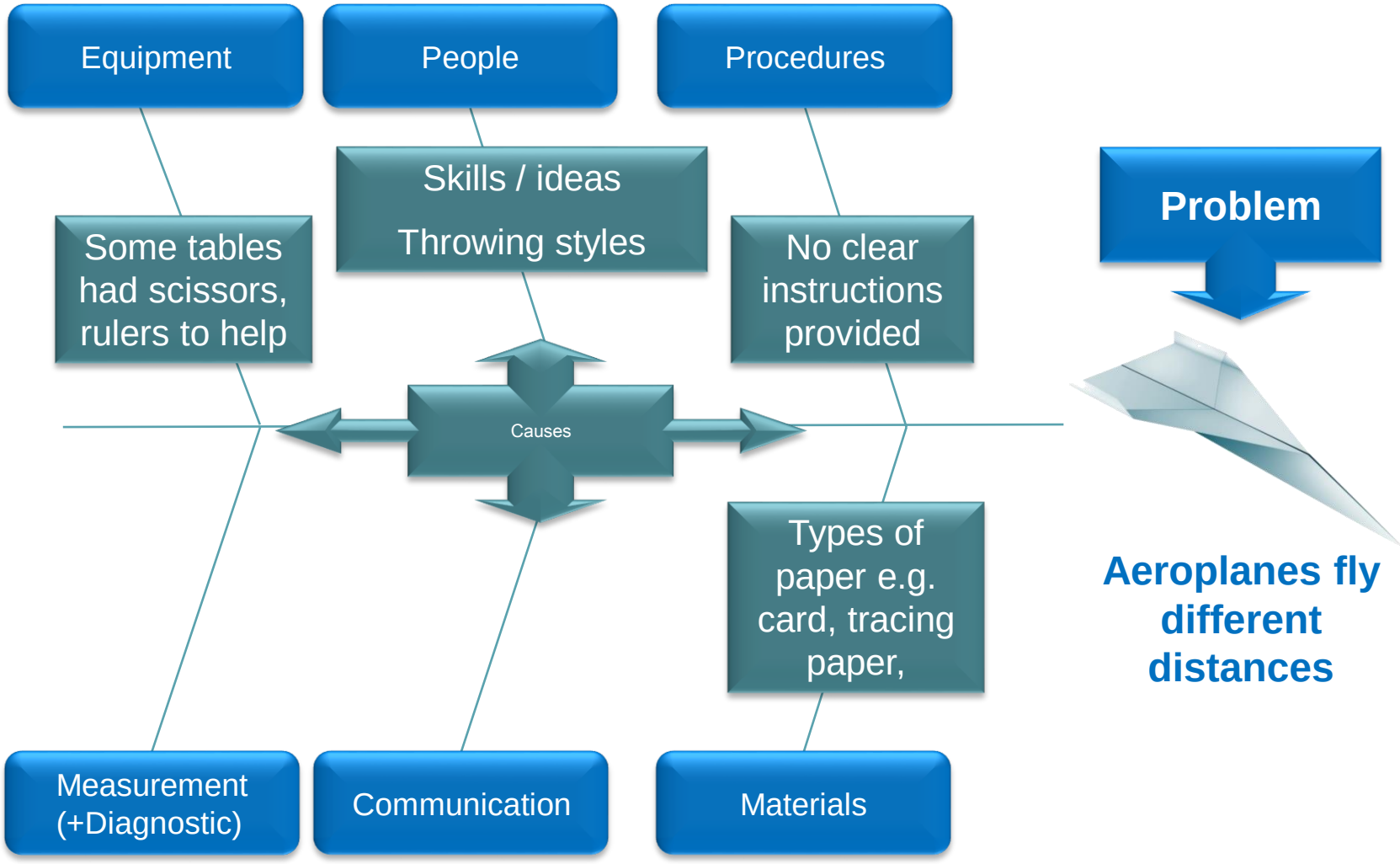
We will now focus in more detail on methods of presenting and analysing our chosen measures….

Exercise 6 – the plane game

The Airplane Game
Using the paper provided – make a paper plane
You have 5 minutes

- When instructed – throw your planes!
- What happened?
- Why are they not flying the same distance?

Fishbone diagram



Variation

What do people understand by the word variation?

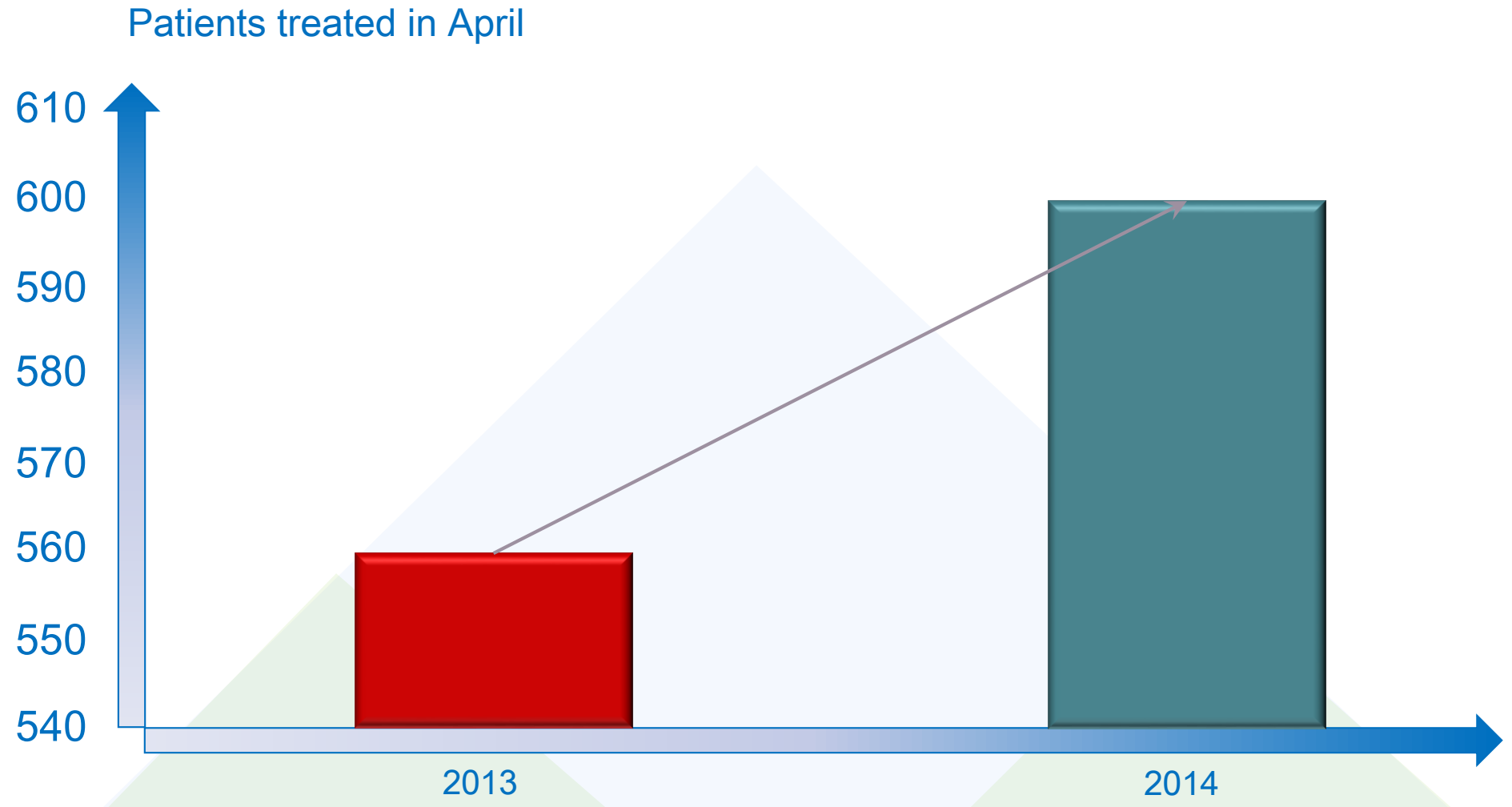
"We live in a world filled with variation –and yet there is very little recognition or understanding of variation"

William Scherkenbach

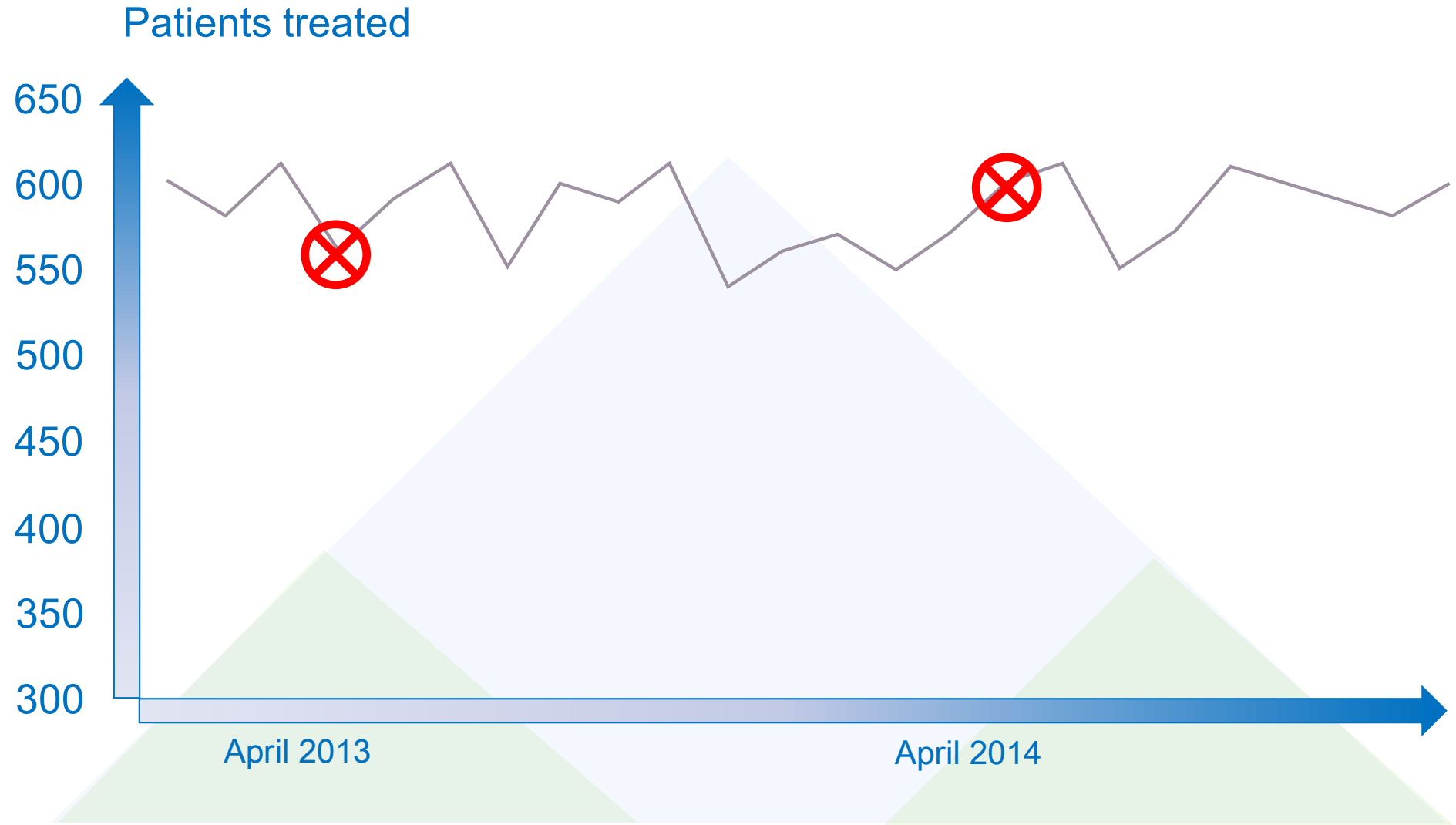
"Data should always be presented in such a way that preserves the evidence in the data…"

Walter Shewhart

What does this data tell us?

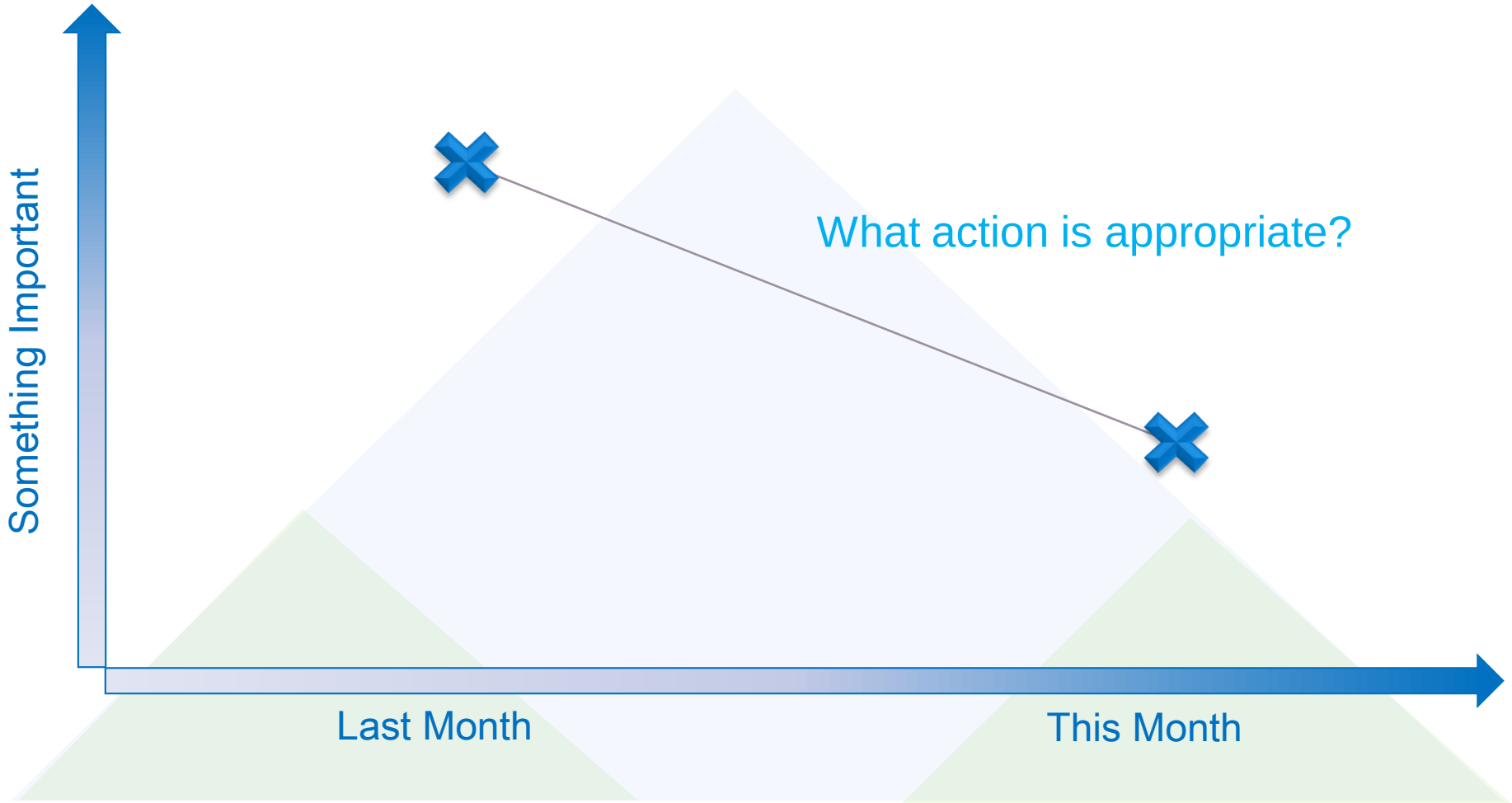


What does this data tell us?



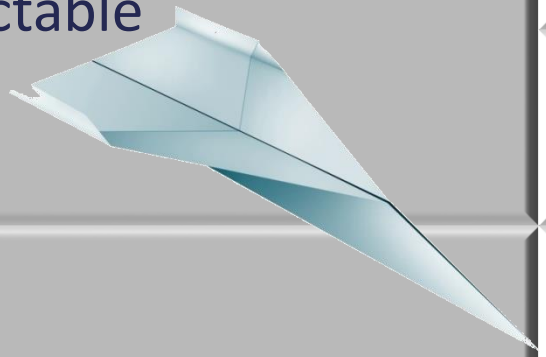
What does this data tell us?

Given two different numbers, one will always be bigger than the other!



Can we classify variation?

Common Cause	Stable in time and therefore relatively predictable	Paper selection
		Persons technique
		Design of the plane
Special Cause	Irregular in time and therefore unpredictable	Water spill
		Fire



Can we classify variation?

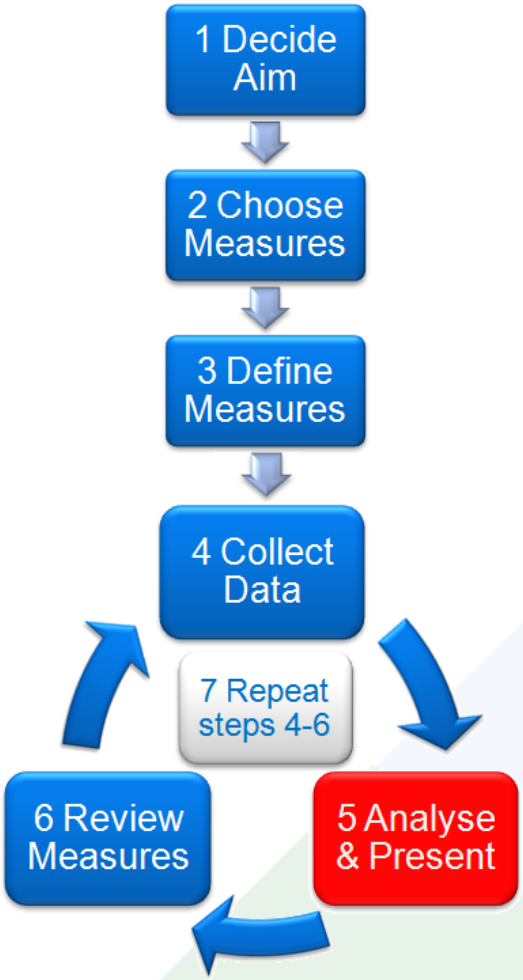
It is important to distinguish between the two types of variation because they require different approaches to deal with them

"There are different improvement strategies depending of which type of variation is present (common cause or special cause), so it is important for a team to know the difference."

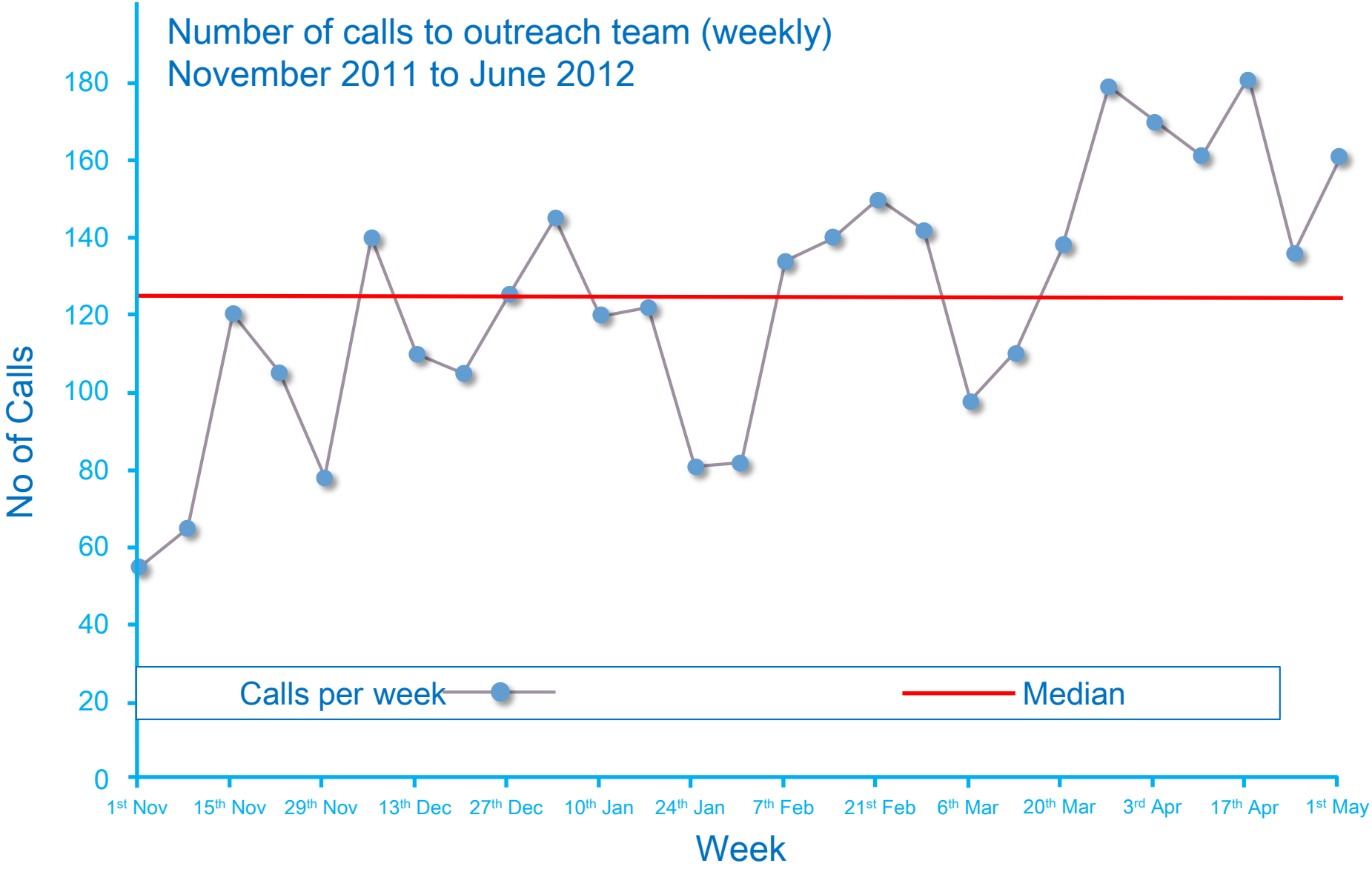
M.L. George

Understanding & dealing with variation in analysis

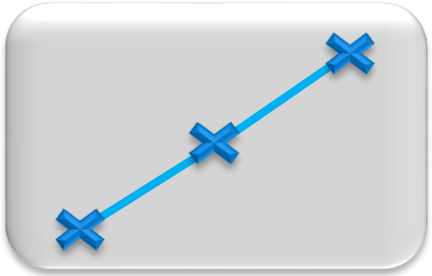
Step 5 – Analyse & Present



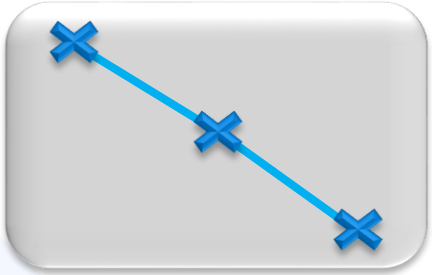
Plotting the dots - example Run Chart



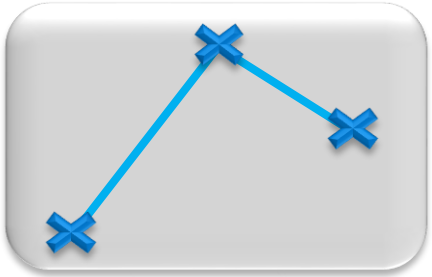
The Myth of Trends



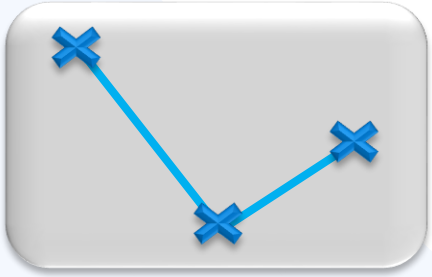
Upward trend ?



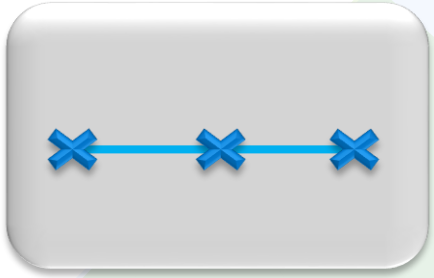
Downward trend ?



Downturn ?
Setback ?

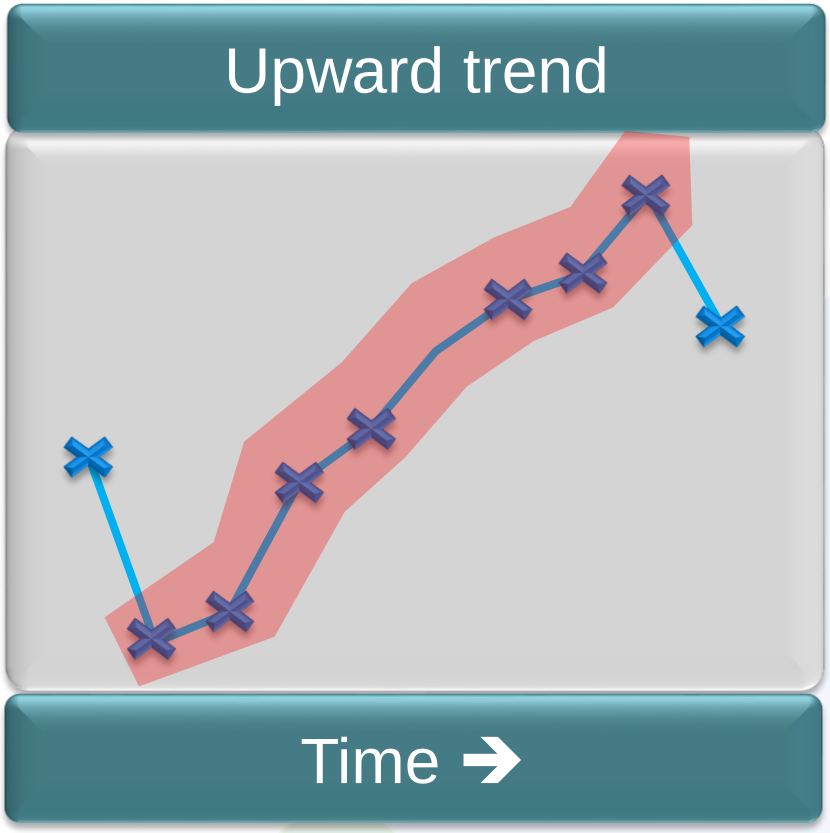


Turnaround ?
Rebound?

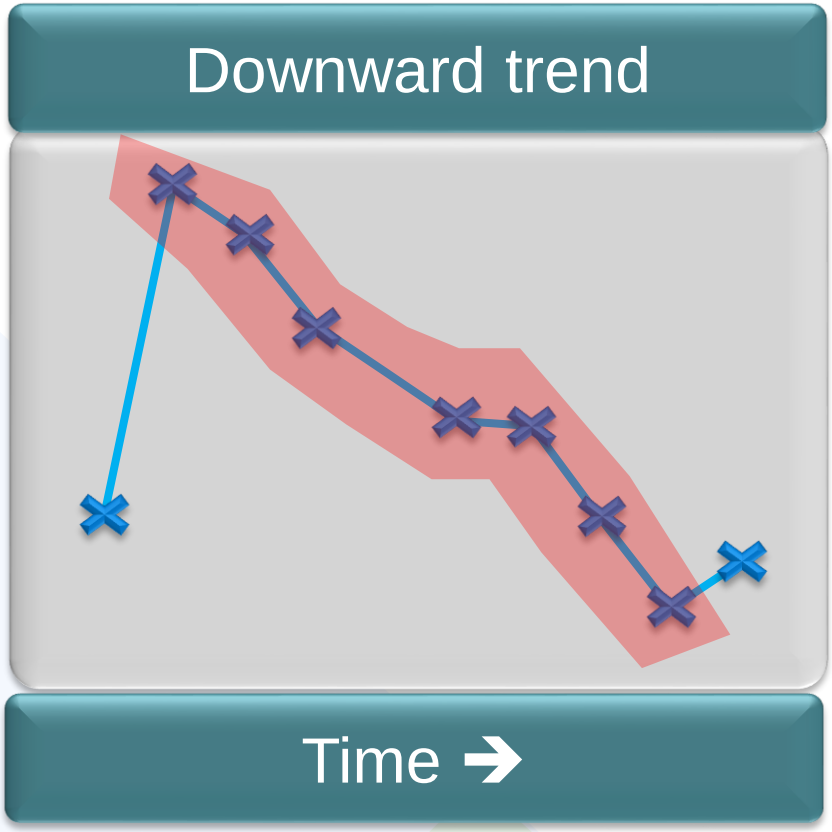


Static ?
Flatline ?

Looking for a trend



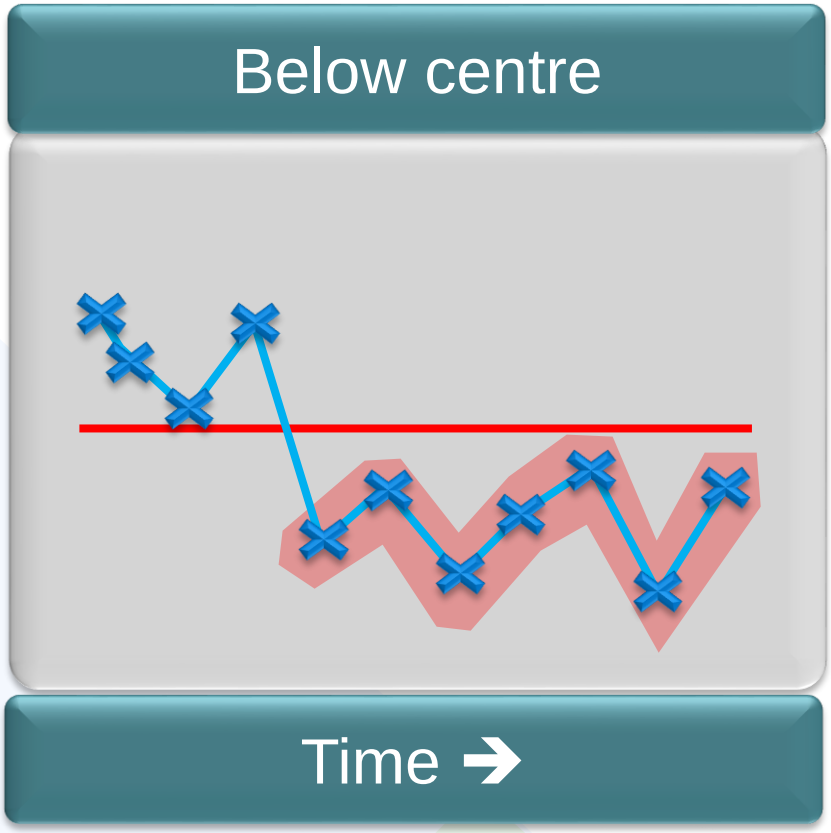
7 points all in upward direction



7 points all in downward direction

Looking for a trend

7 points above centre line



7 points below centre line

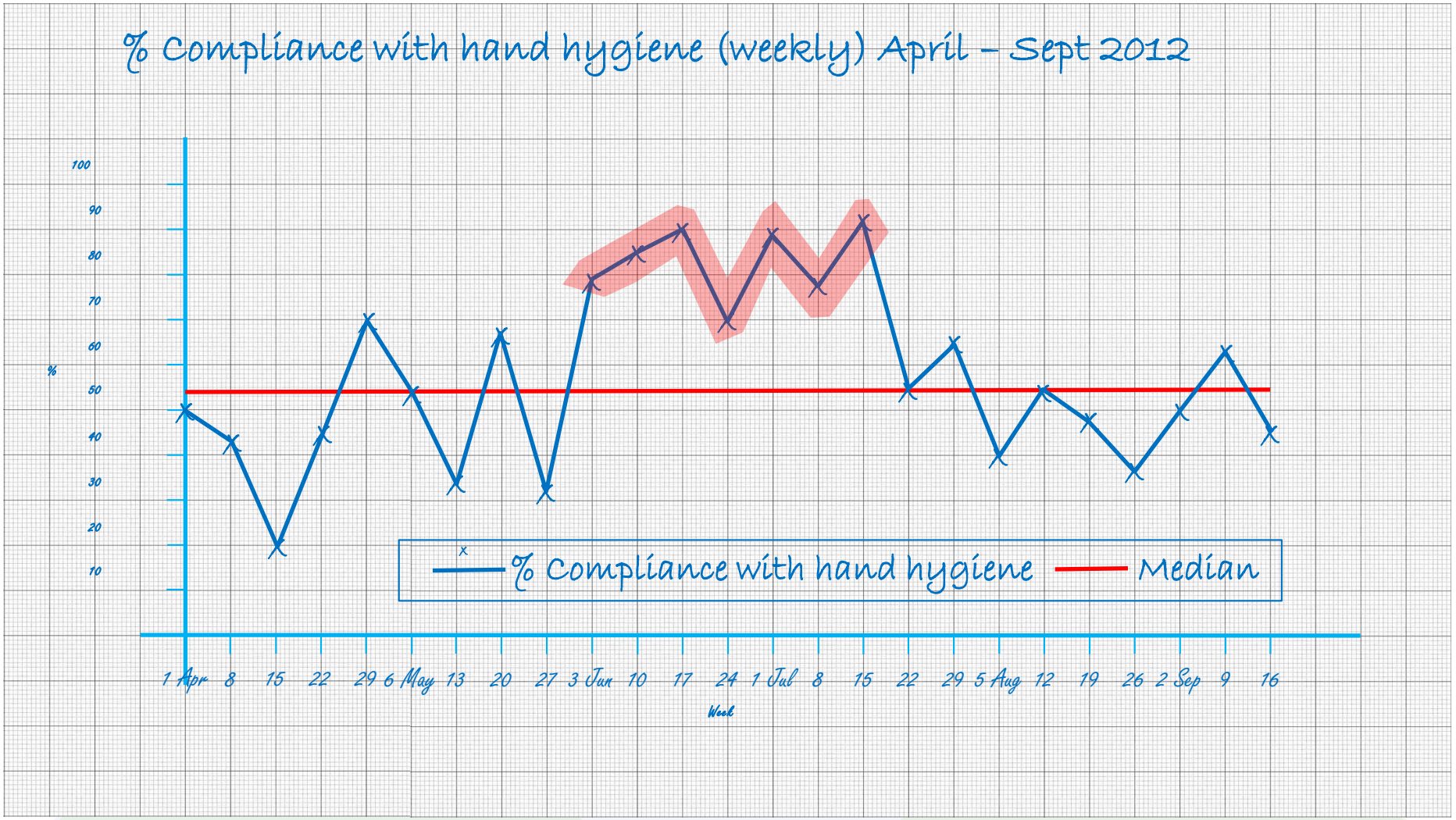
Exercise 7
Creating your own chart

- Using graph paper, ruler and a pencil:

1. Draw and label the axis
2. Plot the dots (daily or weekly data is the best)
3. Work out the median and plot it
4. Add a title (with dates)
5. Add a legend
6. Analyse it!

- You have 20 minutes

Your chart…
should look like this?

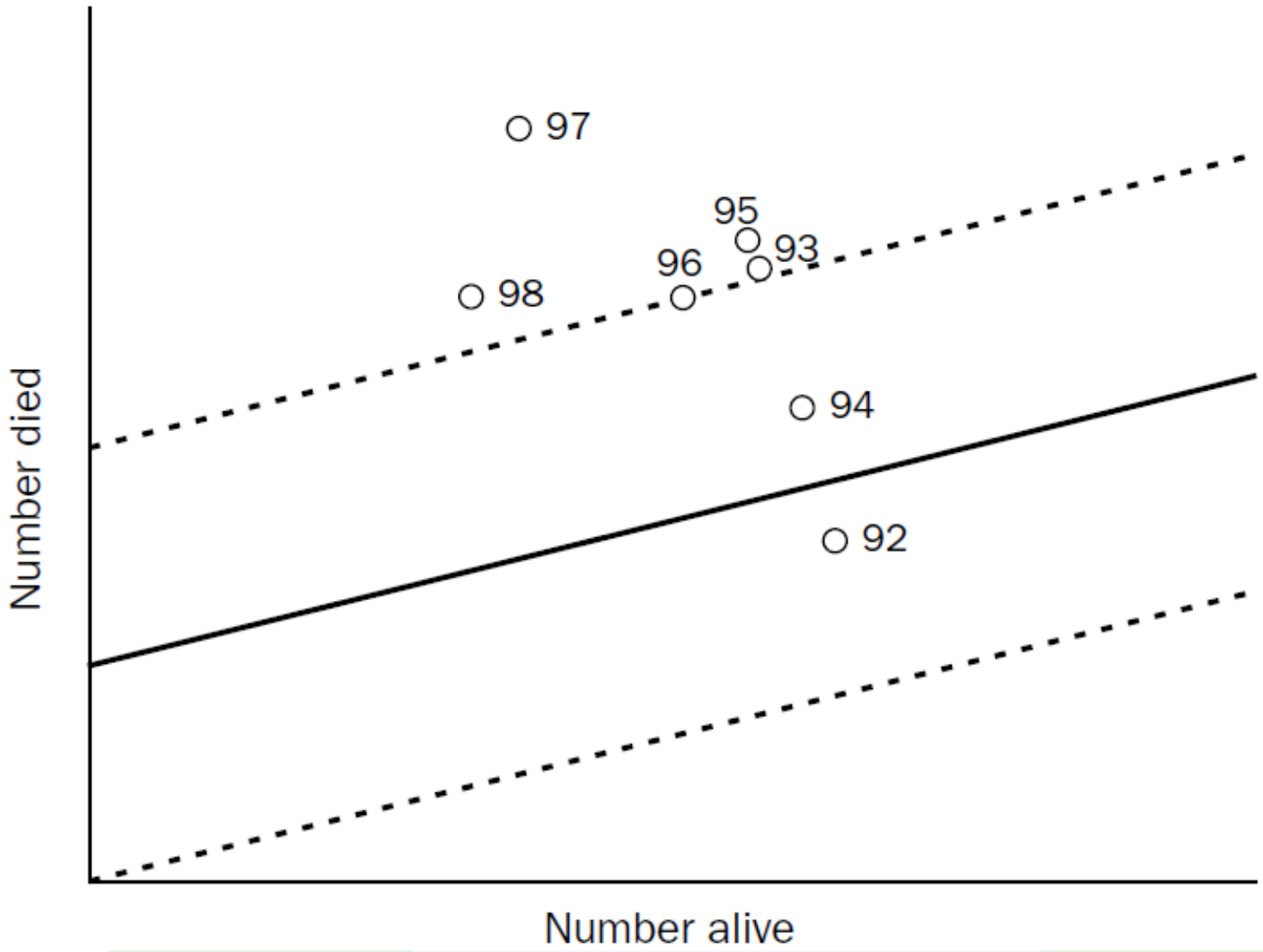


Discussion…

- How could you apply these charts to your projects?


The Quality
Improvement
Healthcare
Company
delivering your quality and value

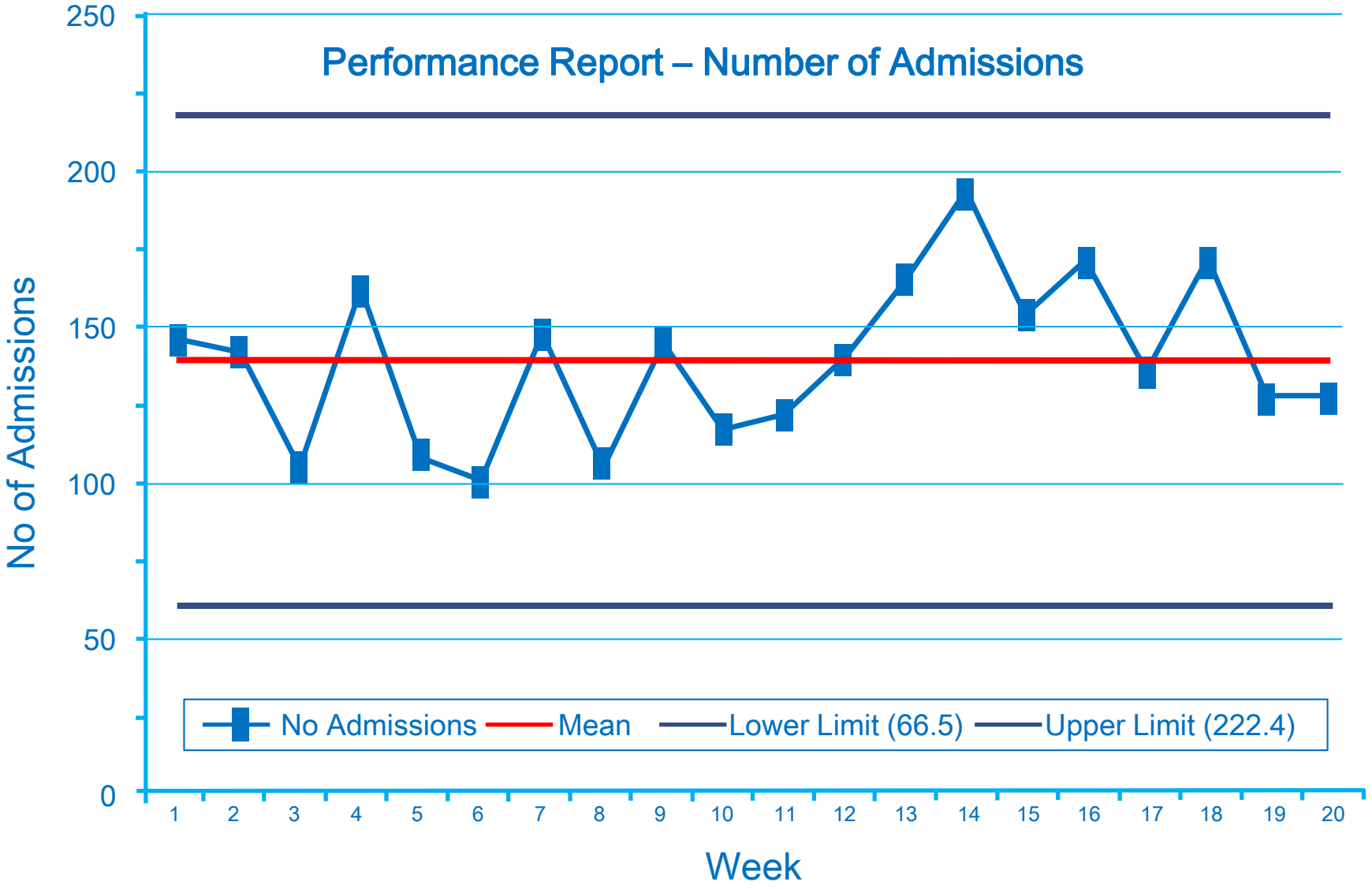
What is SPC?


97
95
93
96
98
94
92
Number died
Number alive

Statistical Process Control (SPC) charts…

- …use the pattern of events in the past to predict with some degree of certainty where future events should fall
- …distinguish between the natural/common cause
- variation and special cause variation
- …enable you to look for problems when they are there, not when they are not
- …can motivate staff to improve practice thereby reducing adverse events and minimising variation

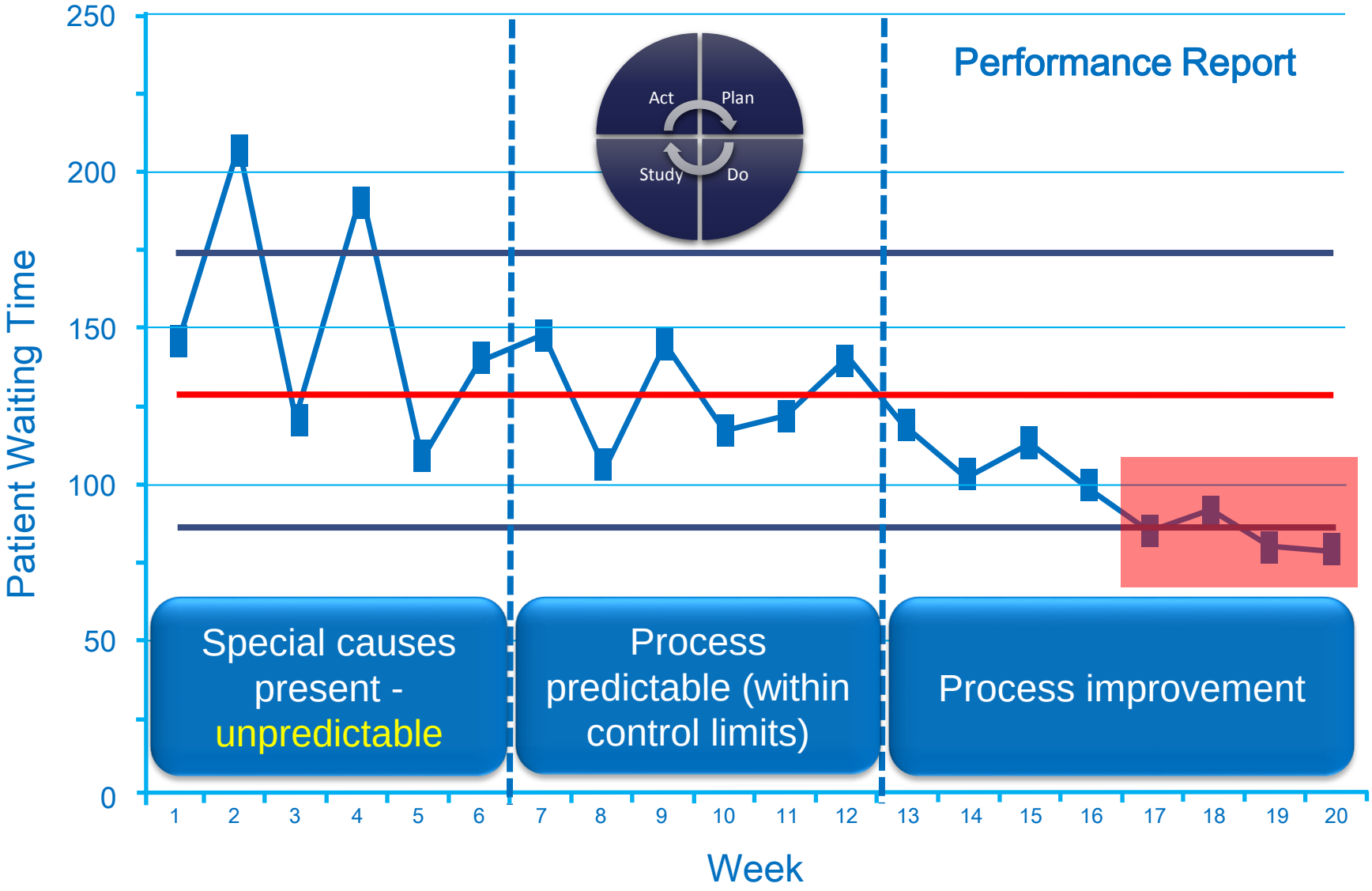
Statistical Process Control (SPC) Charts:



2 Ways to improve a process

If uncontrolled (special) variation	Process is unstable and unpredictable
	Variation caused by factors outside process
	External cause should be identified and sorted
If controlled (common) variation	Process is stable and predictable
	Variation is inherent to the process
	Therefore the process must be changed

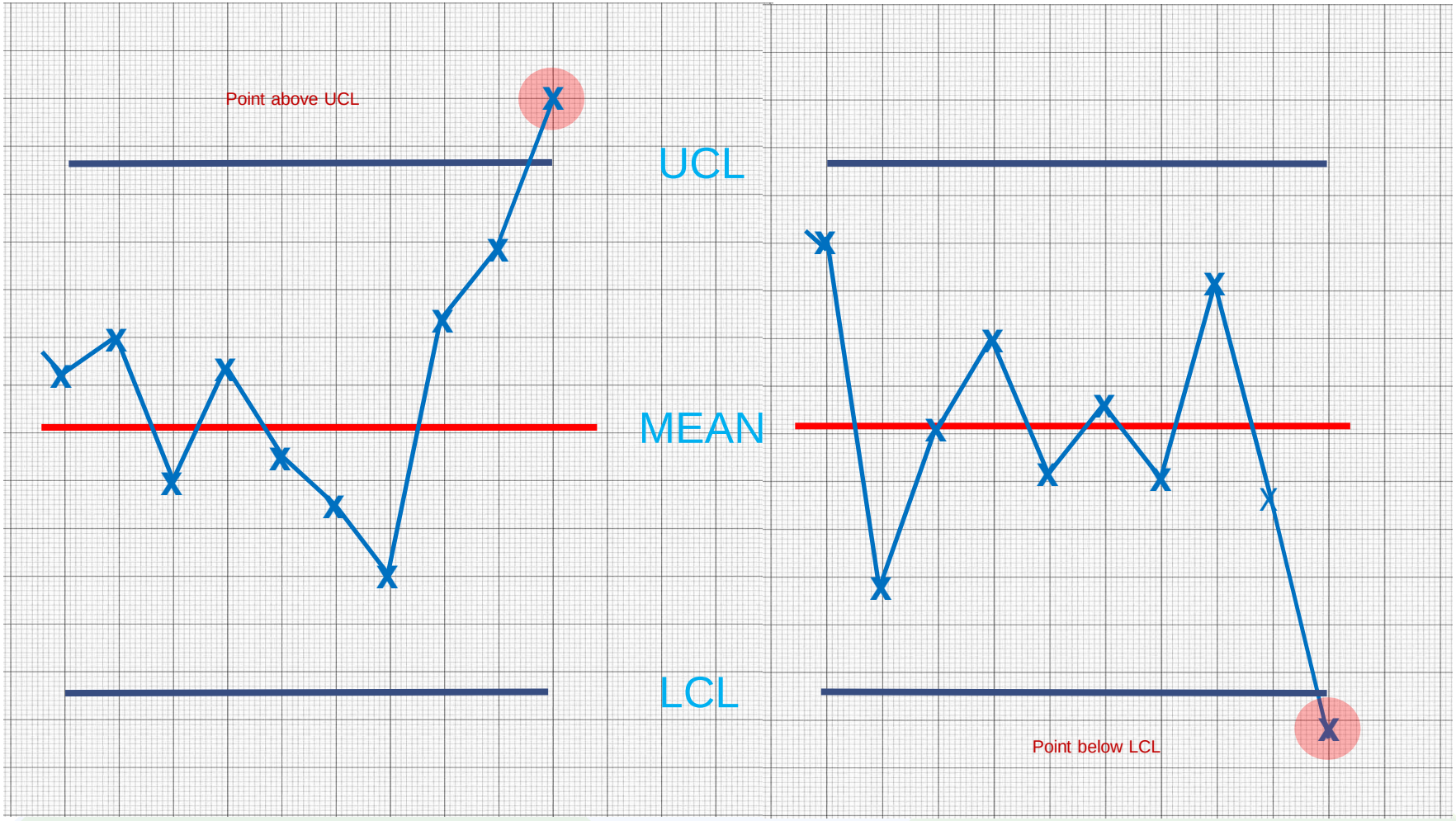
The improvement process



Interpreting Charts

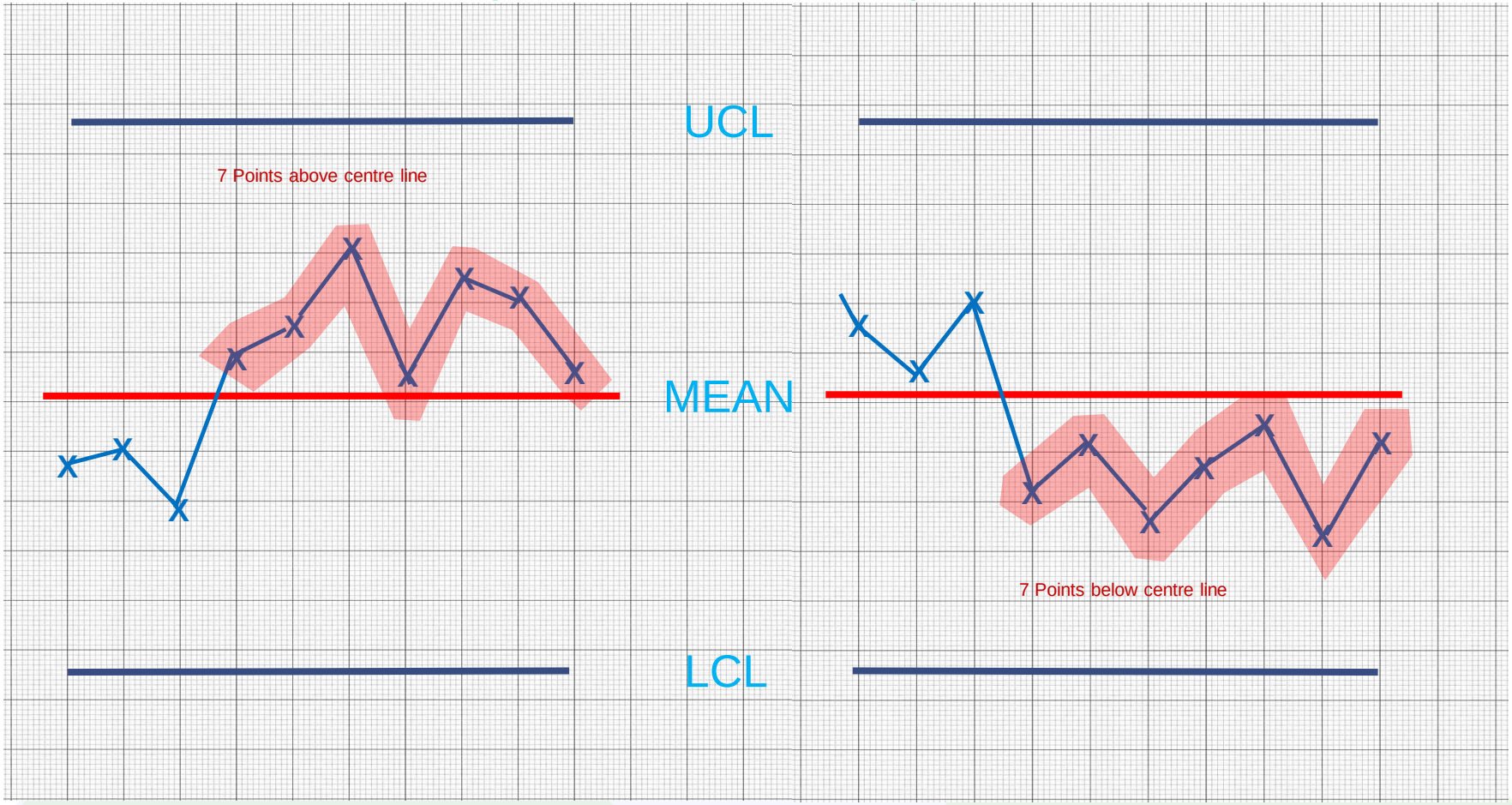
Special causes

Rule 1 - Any point outside one of the control limits



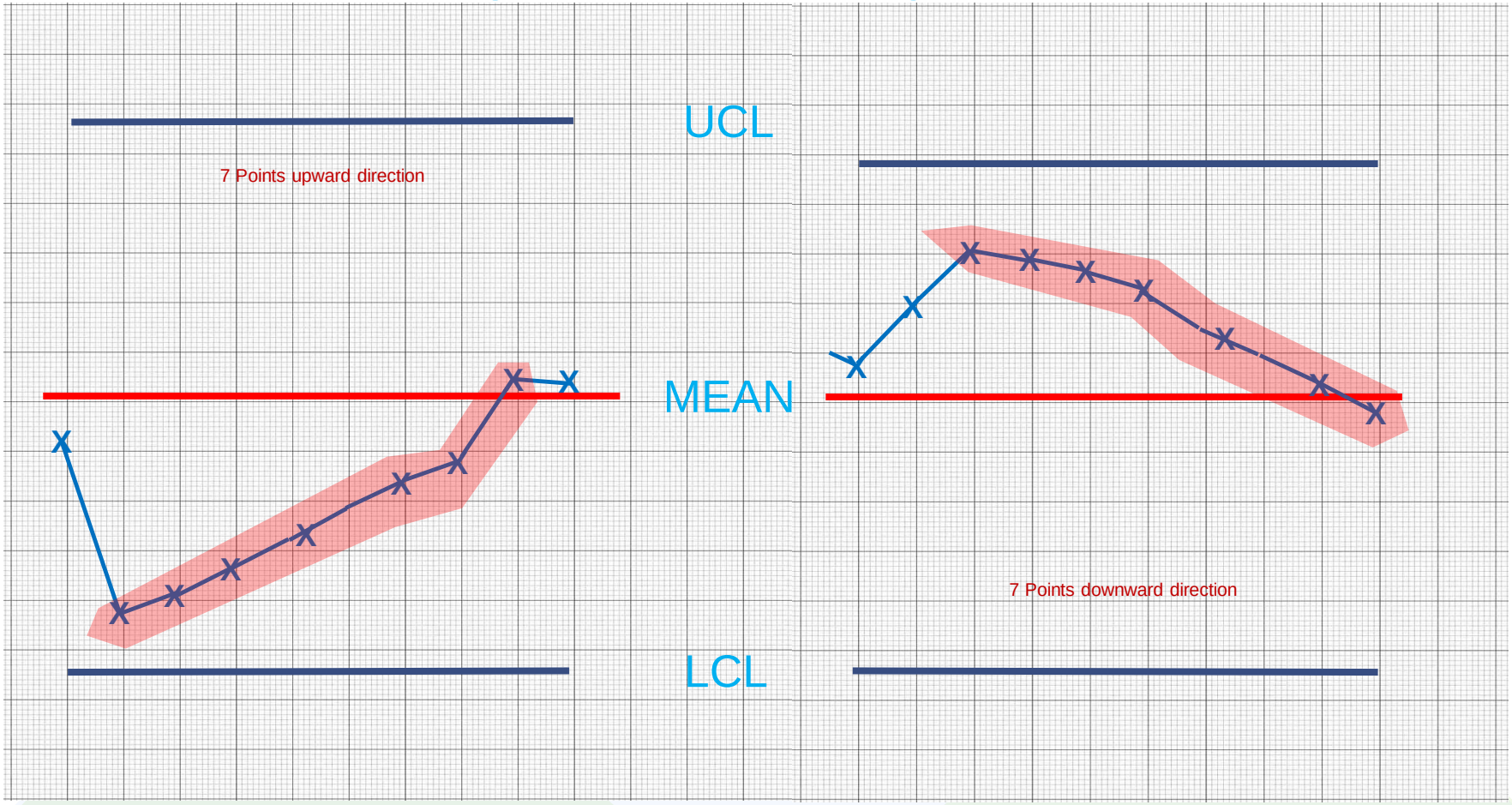
Special causes

Rule 2 - A run of seven points all above or all below the centre line, or all increasing or all decreasing



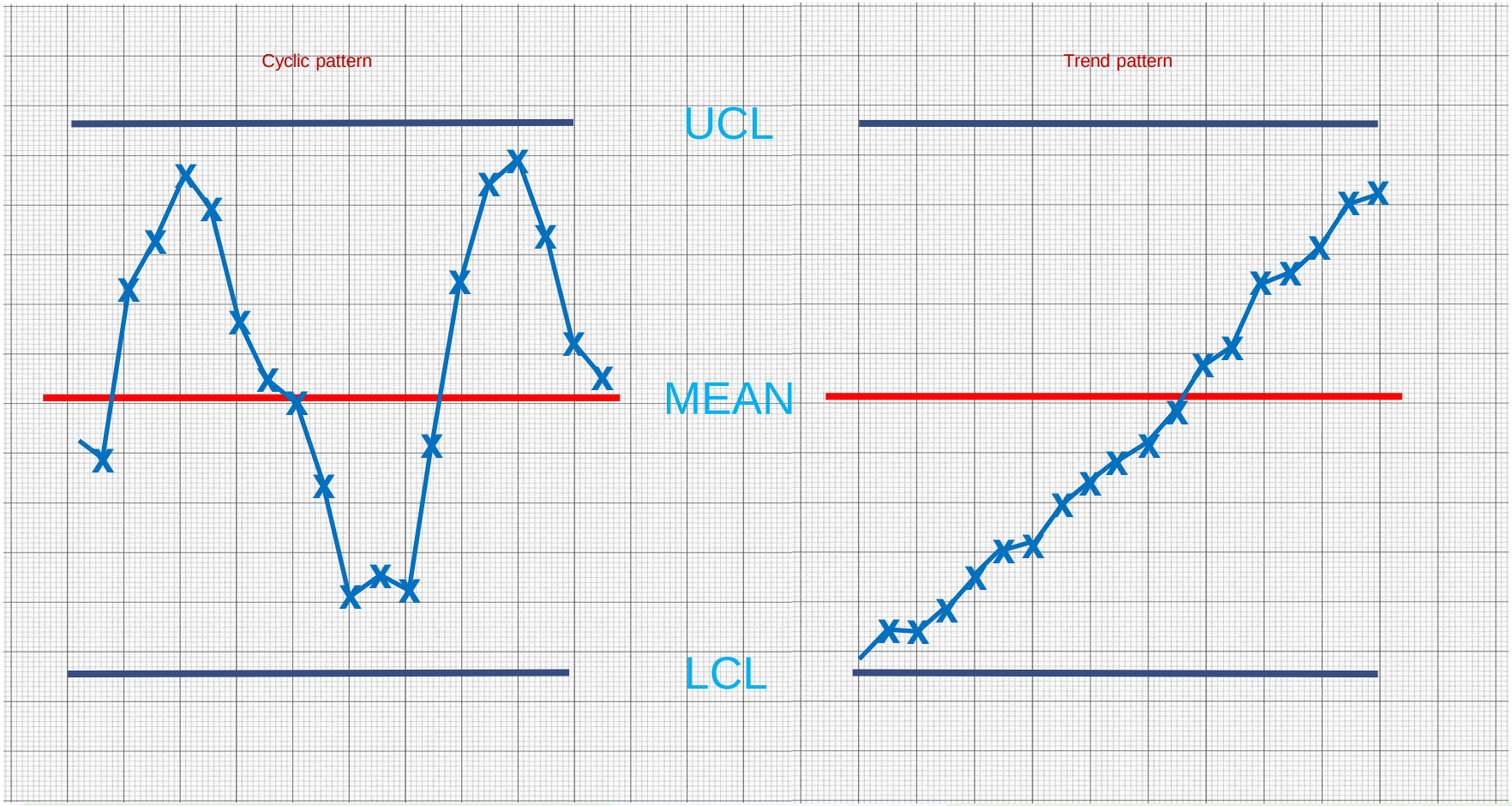
Special causes

Rule 2 - A run of seven points all above or all below the centre line, or all increasing or all decreasing



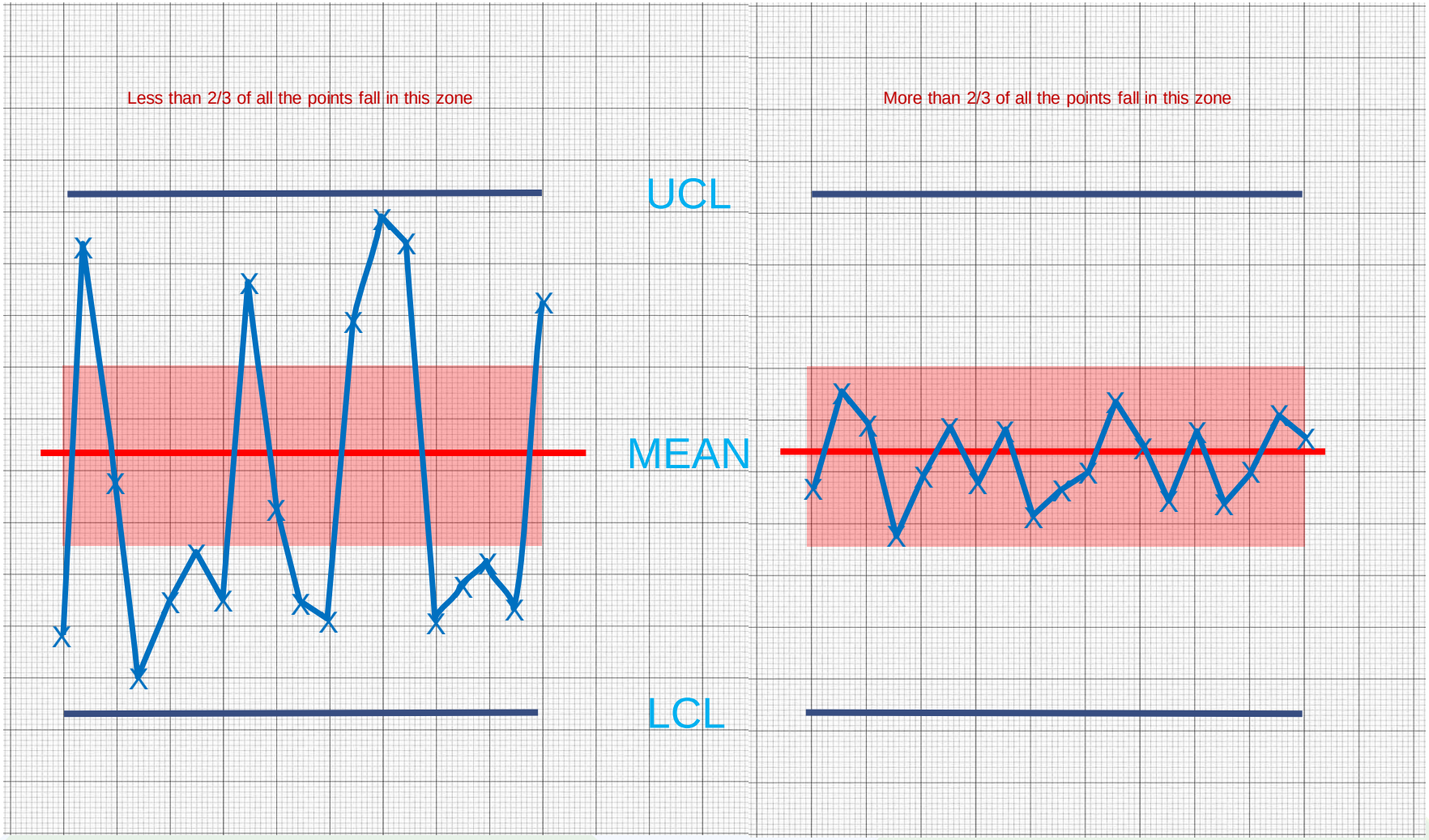
Special causes

Rule 3 - Any “unusual” pattern or trends within the control limits



Special causes

Rule 4



Process out of control

- These rules are important!
- They tell us if the process is stable or unstable
- They tell us if common or special cause
- variation is present

Remember the rules!

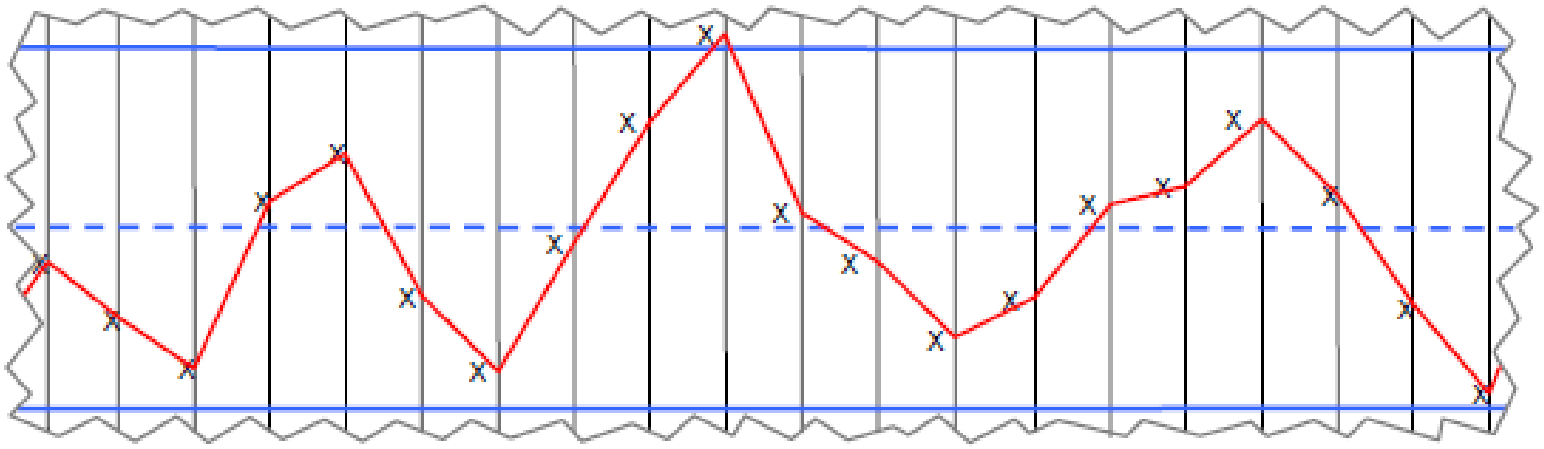
- Outside control limits
- Run of 7 or more consecutive points
- Patterns
- Rule of thirds

Exercise 8
Interpreting SPC charts

- Apply the SPC rules to the charts in the handout

- Are there rules present?
- Is the chart in control?

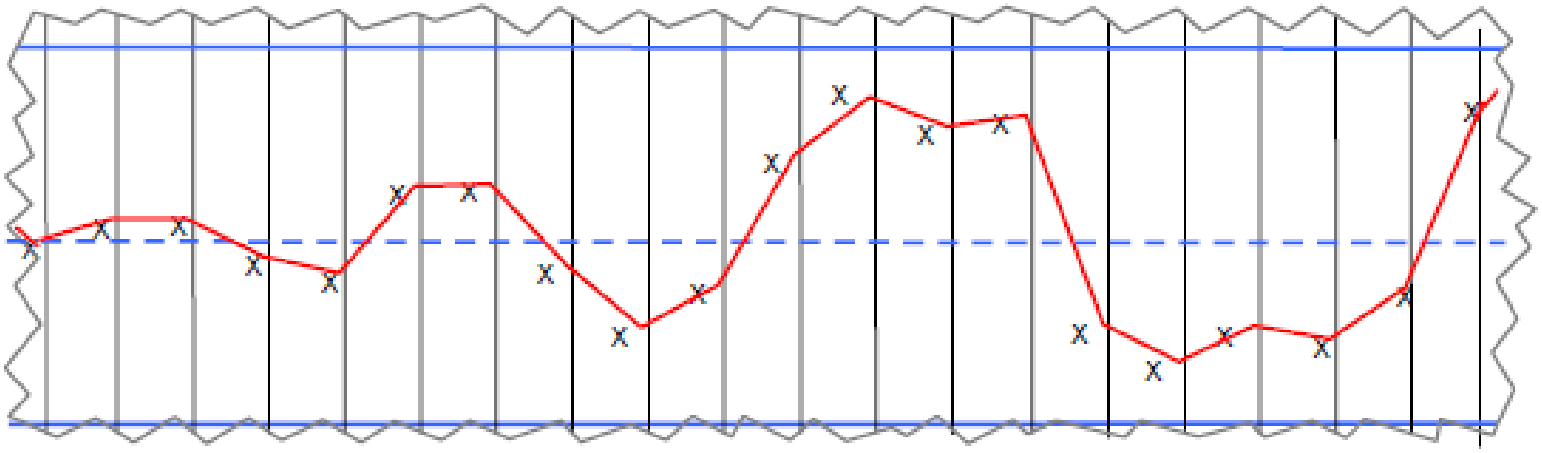
Process 1



Rule	1	2	3	4

In control?	Yes / No / Not sure

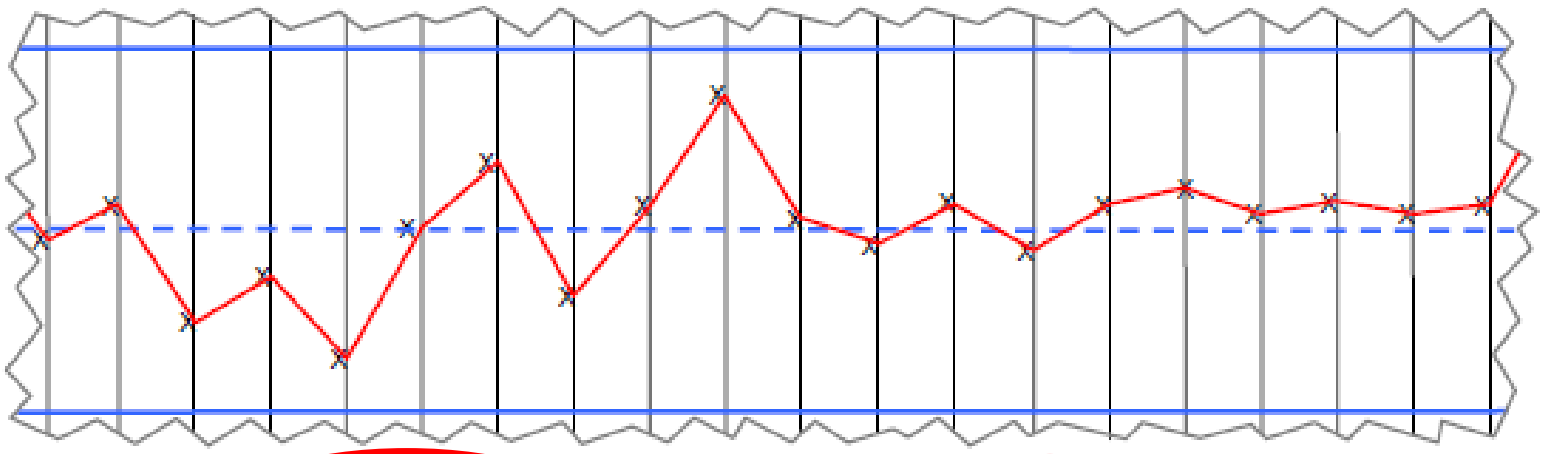
Process 2



Rule	1	2	3	4

In control?	Yes / No	Not sure

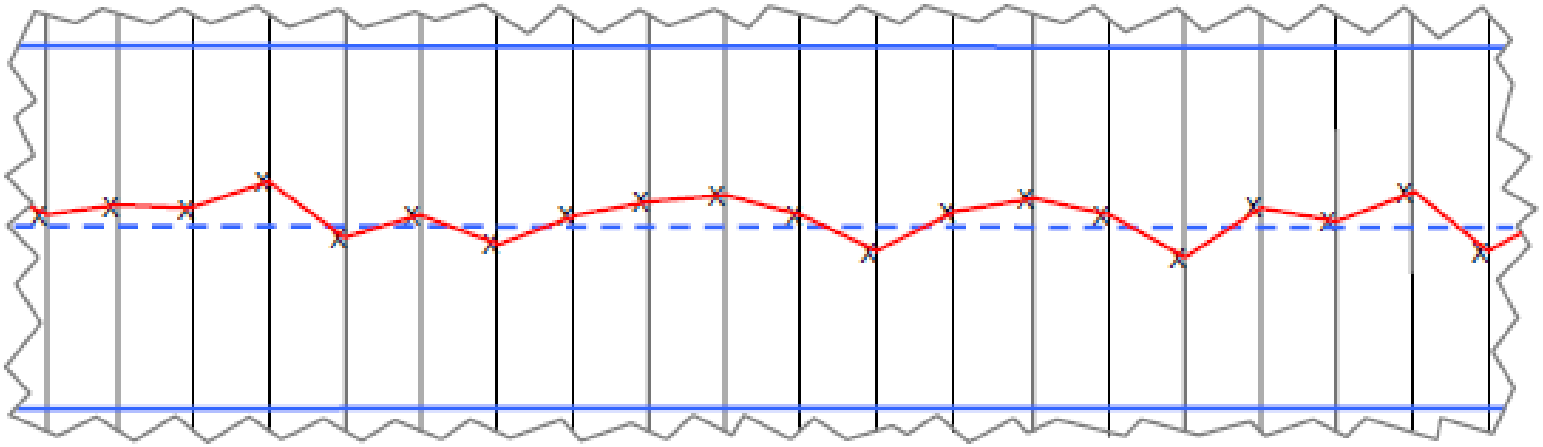
Process 3



Rule 1 2 3 4

In control? Yes / No / Not sure

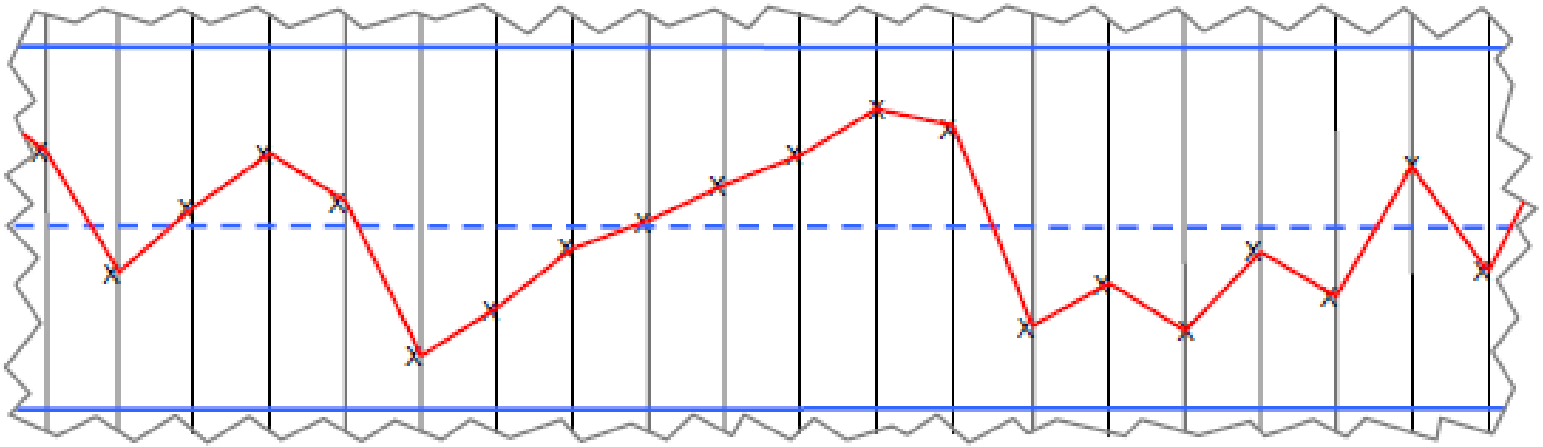
Process 4



Rule	1	2	3	4

In control?	Yes / No / Not sure

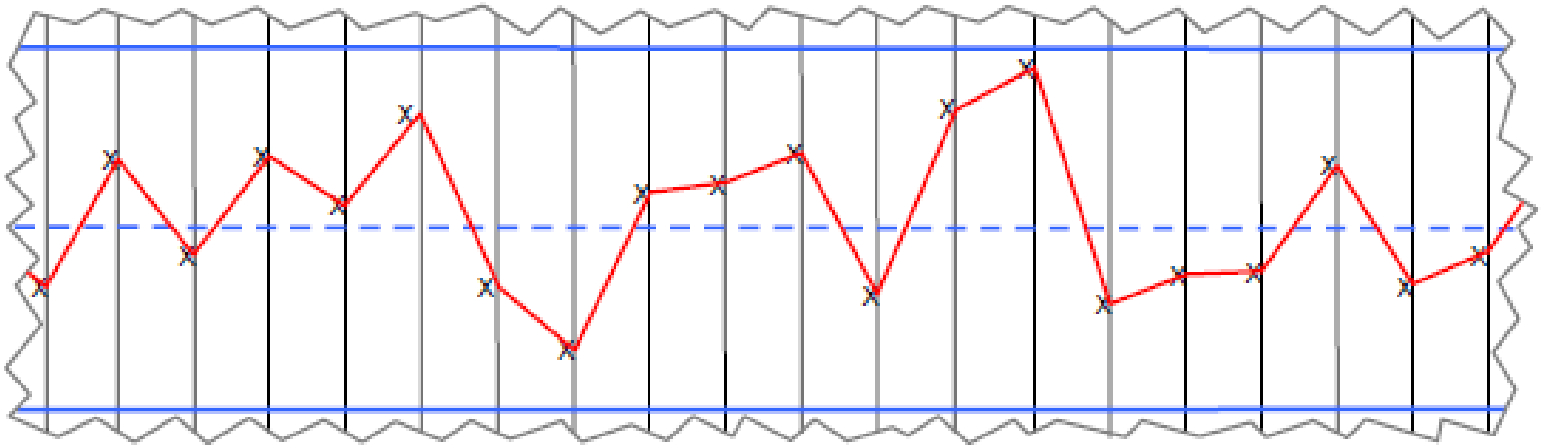
Process 5



Rule	1	2	3	4

In control?	Yes / No	Not sure

Process 6



Rule	1	2	3	4

In control?	Yes / No / Not sure

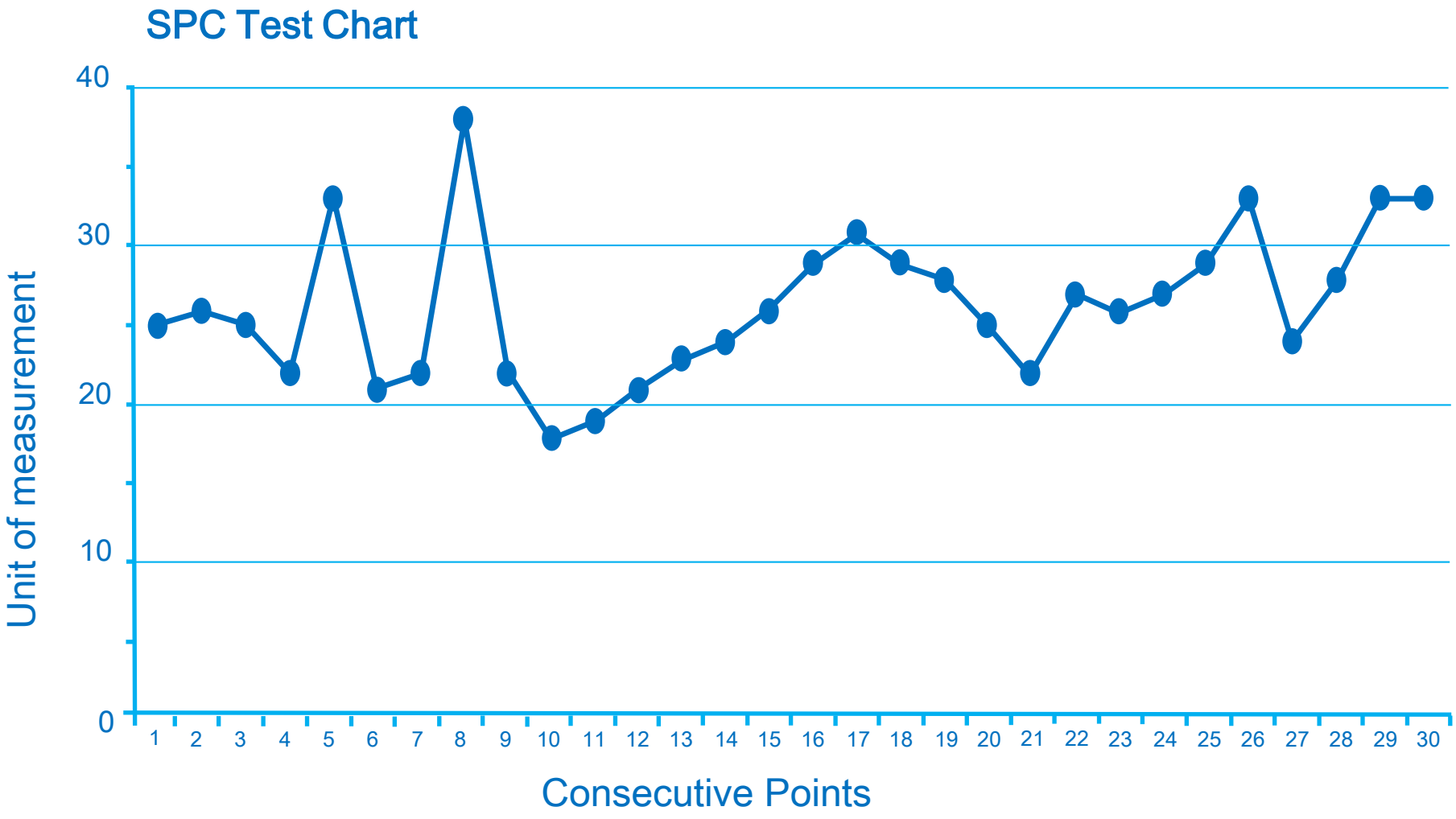
Exercise 9
Creating an SPC chart

- Creating your own chart using the Baseline software

Constructing the chart

- There are 5 steps to constructing your chart:
  1. Plot the individual values
  2. Derive the moving range values
  3. Calculate the mean (X) and plot it
  4. Calculate the average moving range (R)
  5. Derive upper and lower limits from this and plot them

1. Plot individual values



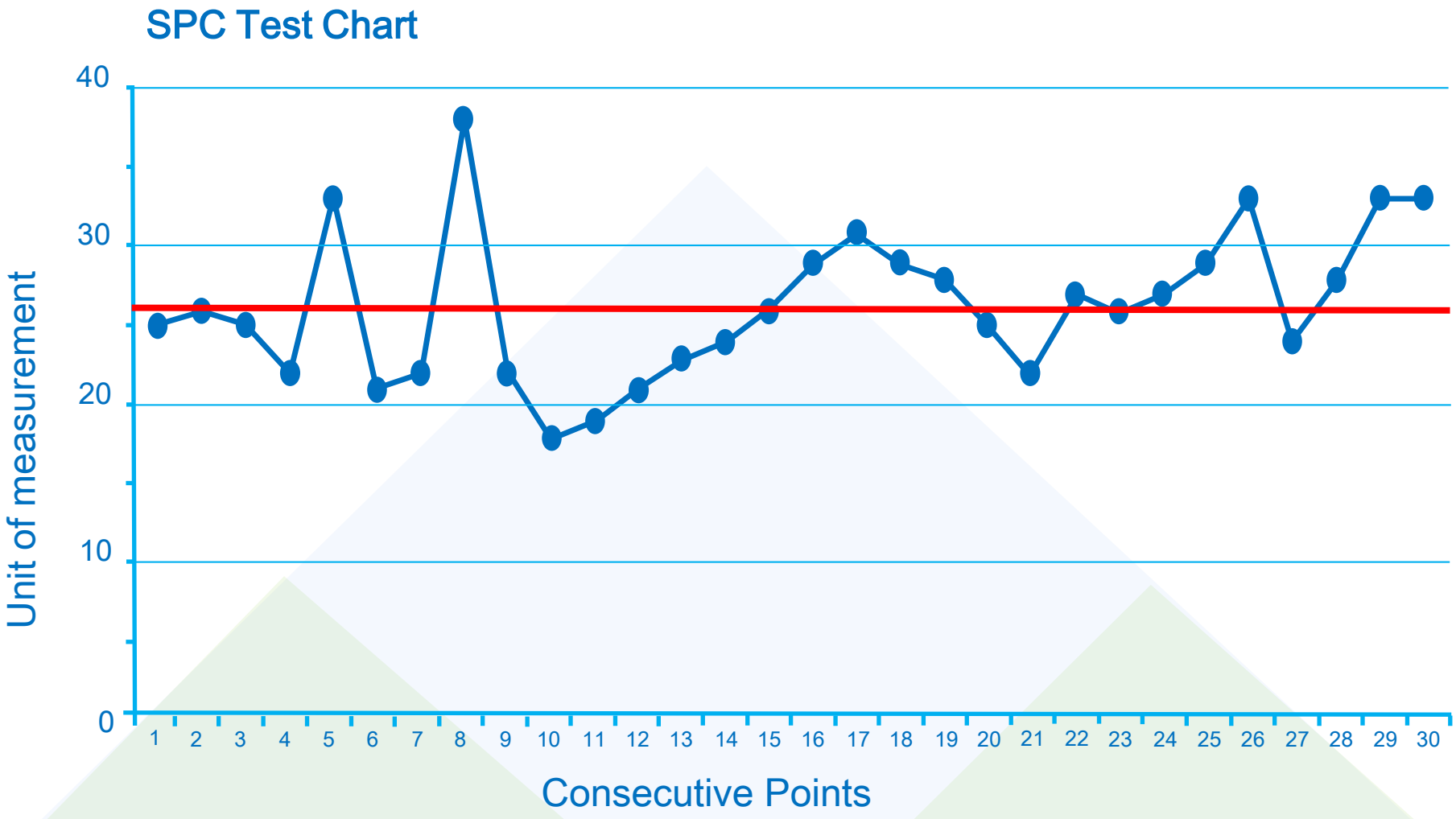
2: Derive moving range

These are required to calculate the control limits
The first row contains the chart data
Use the second row to record the difference between successive data values

The difference is always recorded as a positive value

X Data	0	0	5	4	8	9
Moving Range		0	5	1	4	1

3. Calculate Mean & plot it



4: Calculate Average Moving Range

R_1	R_2	R_3	R_4	R_5	R_6	R_7	R_8	...	R_{23}	R_{24}
60	165	75	30	150	320	155	15		155	60

Average Moving Range	$\overline{mR}$

$$= \frac{60+165+75+30+150+320+155+15 \ldots\ldots\ldots\ldots\ldots\ldots+60}{n}$$

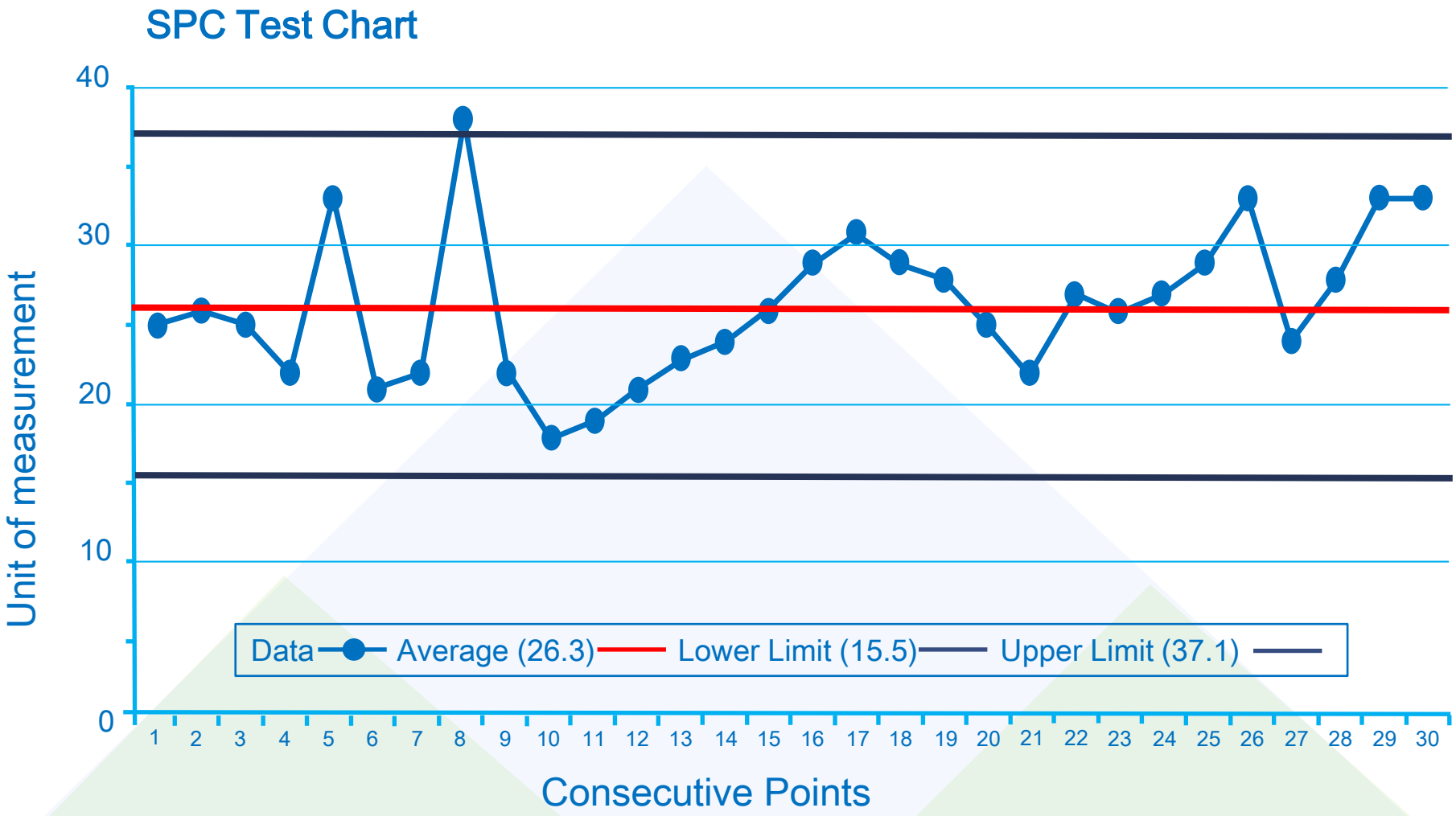
$$= \frac{24}{}$$

Sum of the R's / Number of readings	$= \frac{1960}{24}$

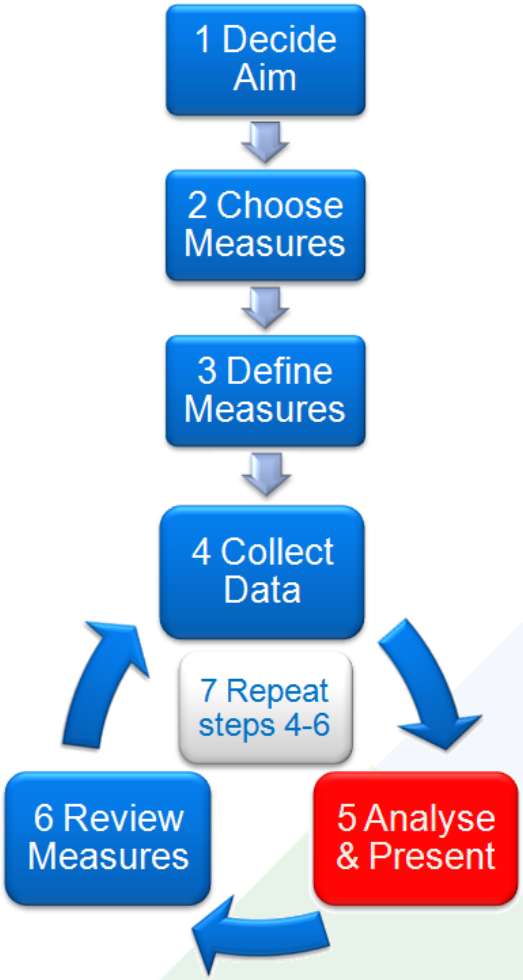
5: Derive process limits

Derive measure of variation (1 sigma) as:	Average moving range / 1.128	19.3 / 1.128
Calculate upper limit as:	Mean + 3 sigma	=58 + (3*(19.3/1.128))
Calculate lower limit as:	Mean – 3 sigma	=58 - (3*(19.3/1.128))

5. Plot process limits



Step 5 – Analyse & Present



Analytical Tools Recap

- Average (mean & median)
- Control limits
- Common vs. special cause variation
- SPC Rules

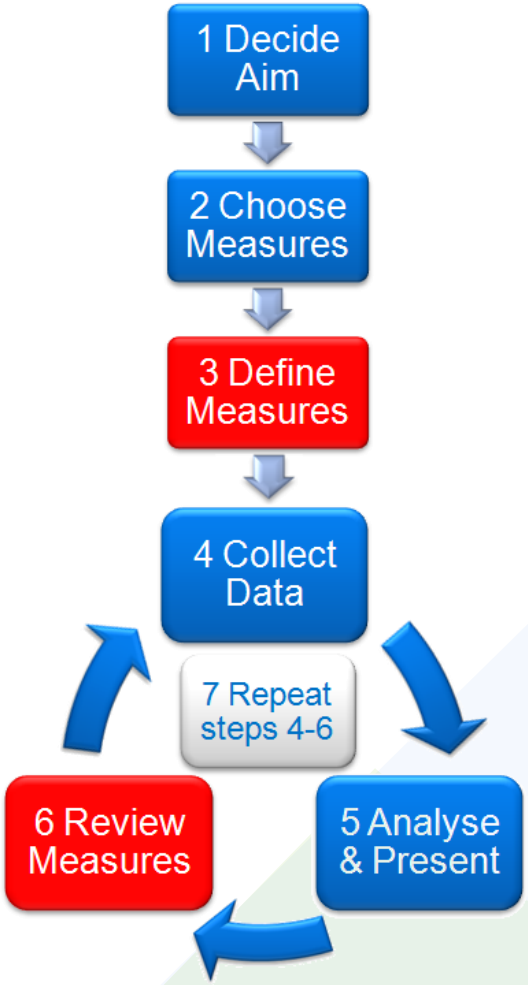
✓Outside limits

✓Run of 7

✓Patterns

✓Rule of thirds

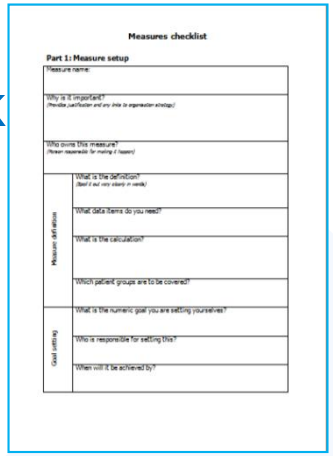
Step 6 – Review Measures



"It is a waste of time collecting and analysing your data if you don't take action on the results"

Exercise 10
Measures checklist

- The Measures Check
- Analyse
- Review


Measures checklist

Part 1: Measure setup

Measure name

Why is it important?

Who owns this measure?

Measure definition

What is the definition?

What data items do you need?

What is the calculation?

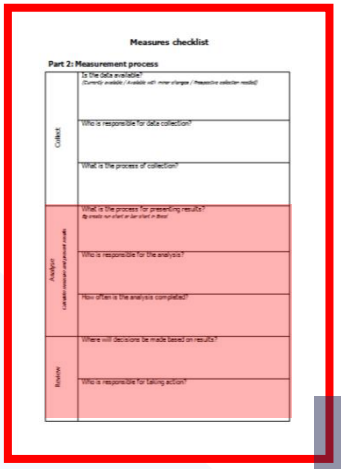
Which patient groups are to be covered?

Goal setting

What is the numeric goal you are setting yourselves?

Who is responsible for setting this?

When will it be achieved by?


Measures checklist

Part 2: Measurement process

Collect

Is the data available?

Who is responsible for data collection?

What is the process of collection?

Analyse

What is the process for presenting results?

Who is responsible for the analysis?

How often is the analysis completed?

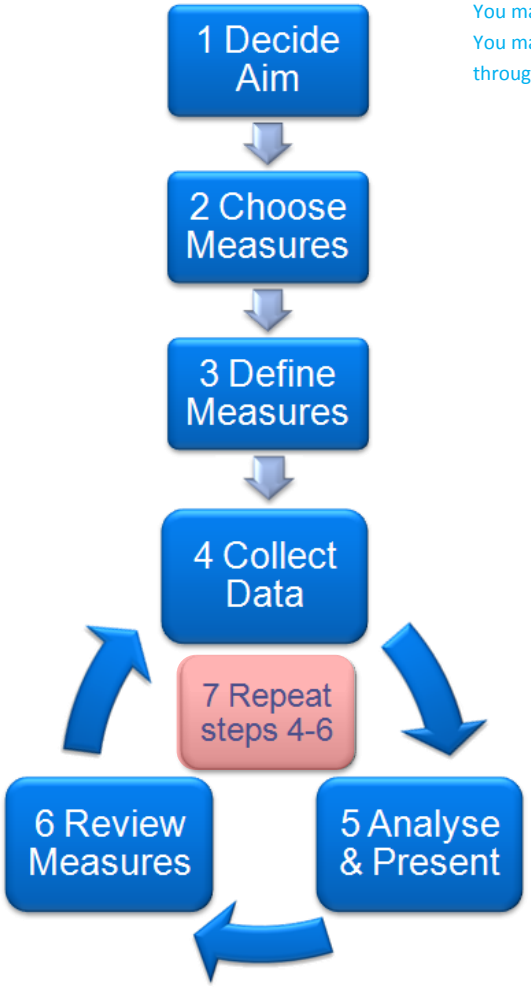
Review

Where will decisions be made based on results?

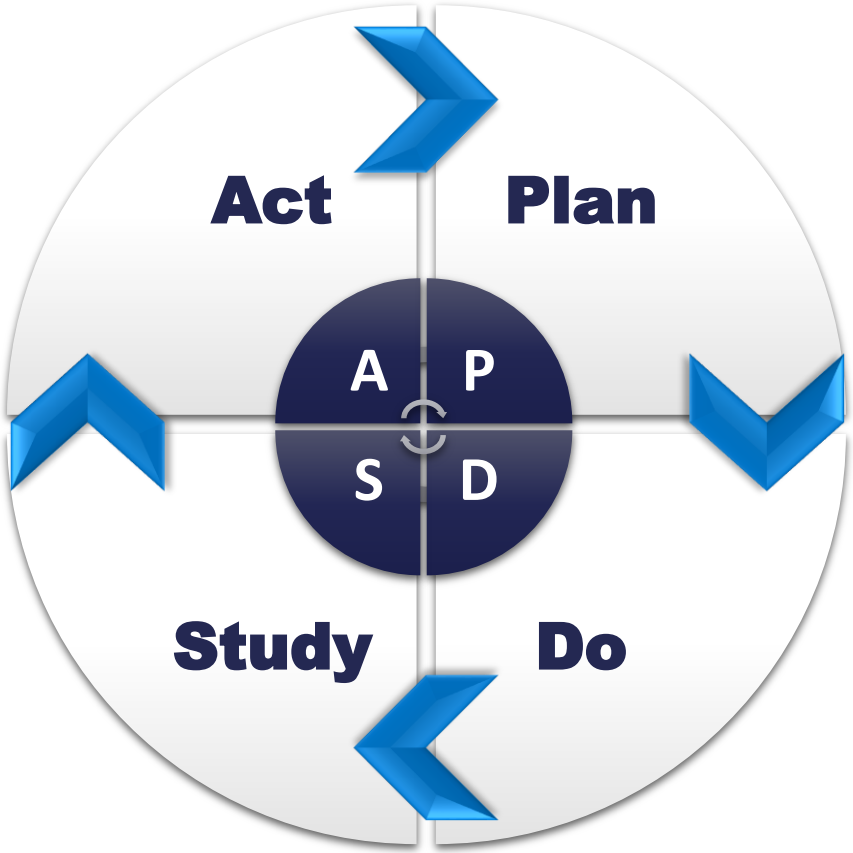
Who is responsible for taking action?

- Now complete the analyse and review
- sections of page two of the measures
- checklist
- You have 10 minutes

7 Steps to Measurement



You may not get it right first time!
You may need several iterative attempts through steps – 4 - 6



Measurement recap

1. Remember variation exists
2. Define what you are collecting clearly
3. Only interpret data using statistically significant measures
4. Use SPC for all stages of your project

Return on Investment in Service Improvement

When to use return on investment?

- To aid the decision on whether, or in what to invest
- To win support and/or funding
- To prove the point and justify continued and /or wider support

What are the essential components?

- The objectives of the investment
- A catalogue of costs
- A catalogue of benefits
- Discounting benefits
- A calculation describing the effectiveness
- Ranging or sensitivity analysis
- A payback period

Return On Investment

£ Project management time
£ Protected time cover
£ Training
£ Equipment
£ Materials

Don't forget ongoing costs

£ Equipment maintenance costs
£ New staff training / staff retraining
£ Audits

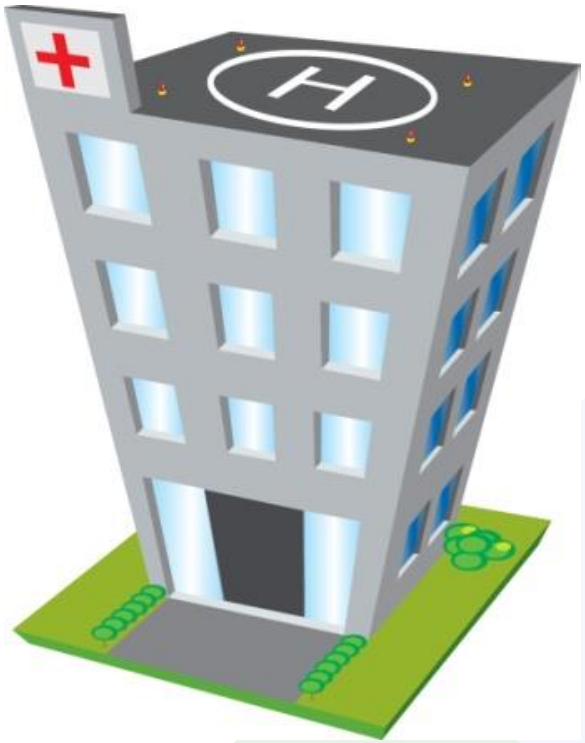
Return On Investment

BCD

- Costs avoided
- Define relevant financial measures to use to assess benefits of your project
- These are costs of the current method (in effect costs of poor quality) that you will change with your project…

Potential pitfalls to avoid

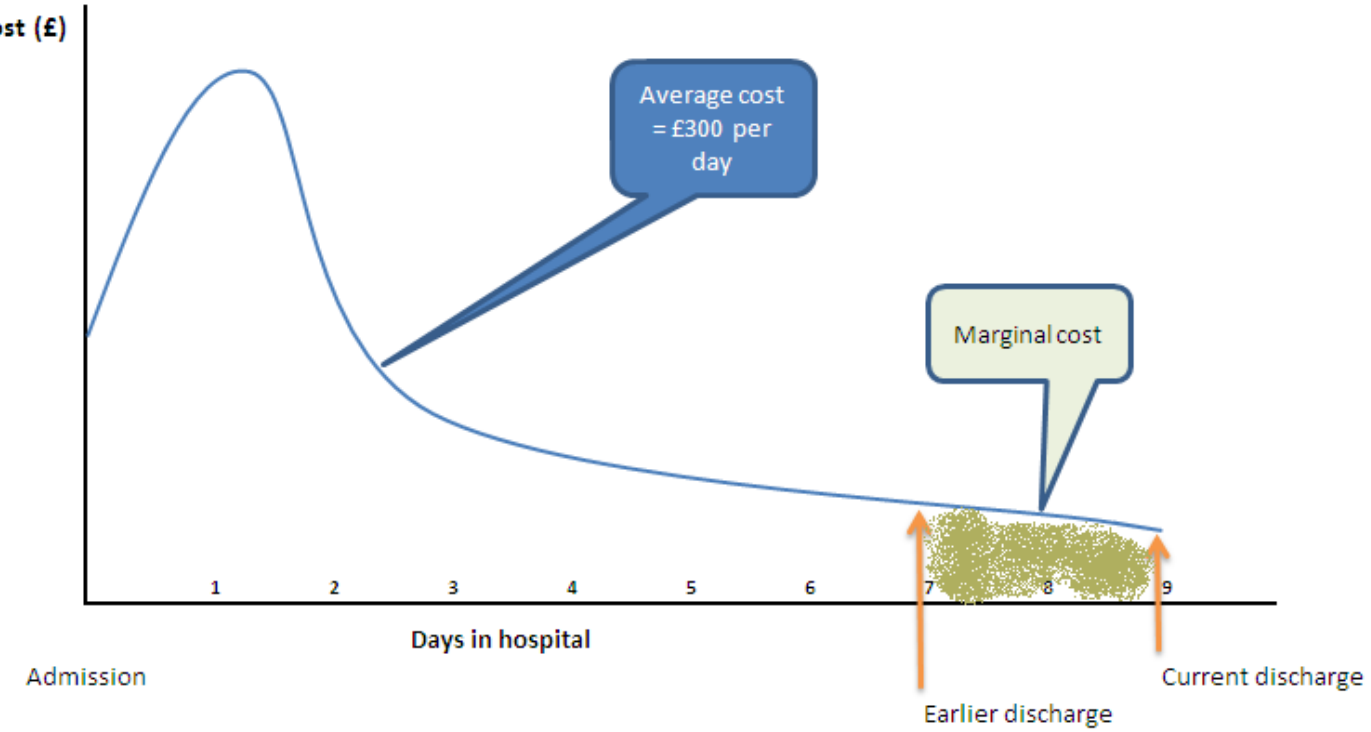
Cost per bed day:
(Direct & indirect costs)



£257	indirect hospital cost
£97	direct ward costs (staff)
£59	direct patient costs
£413	Total

Costs for non-elective occupied bed days Source: Audit Commission

Average costs: Reducing length of stay



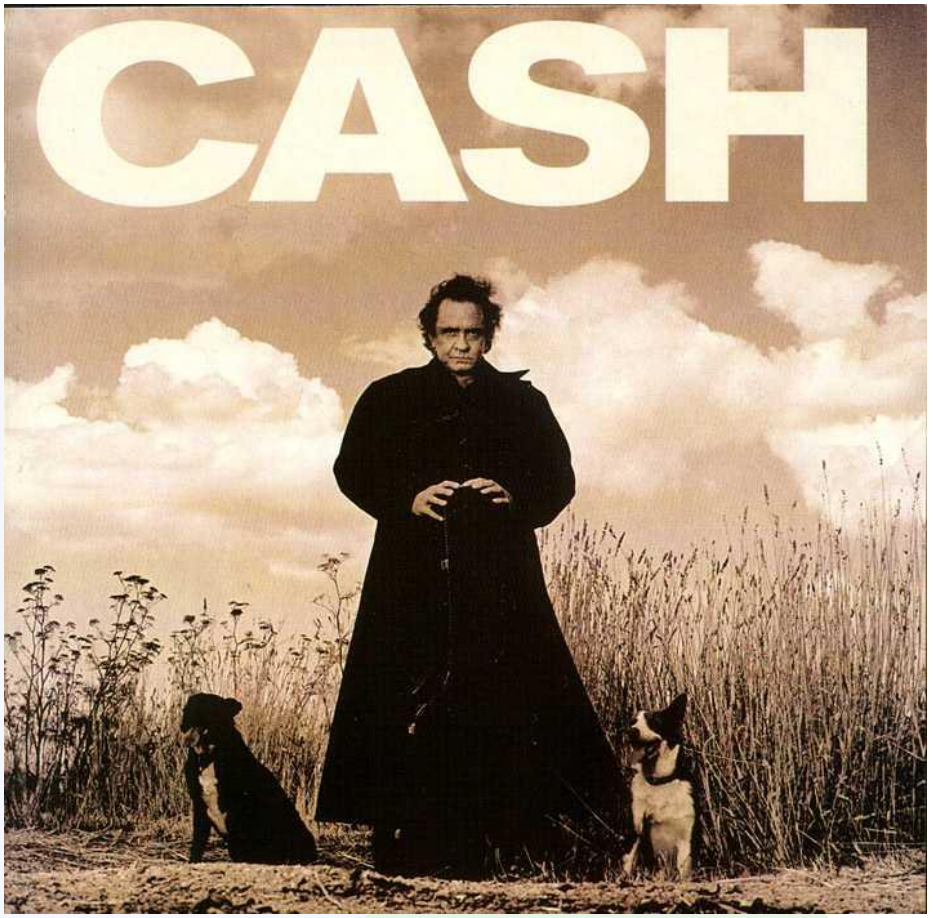
As little as 3% of the cost can be accrued on the last day of a hospital stay.

Clear perspective

The taxpayer

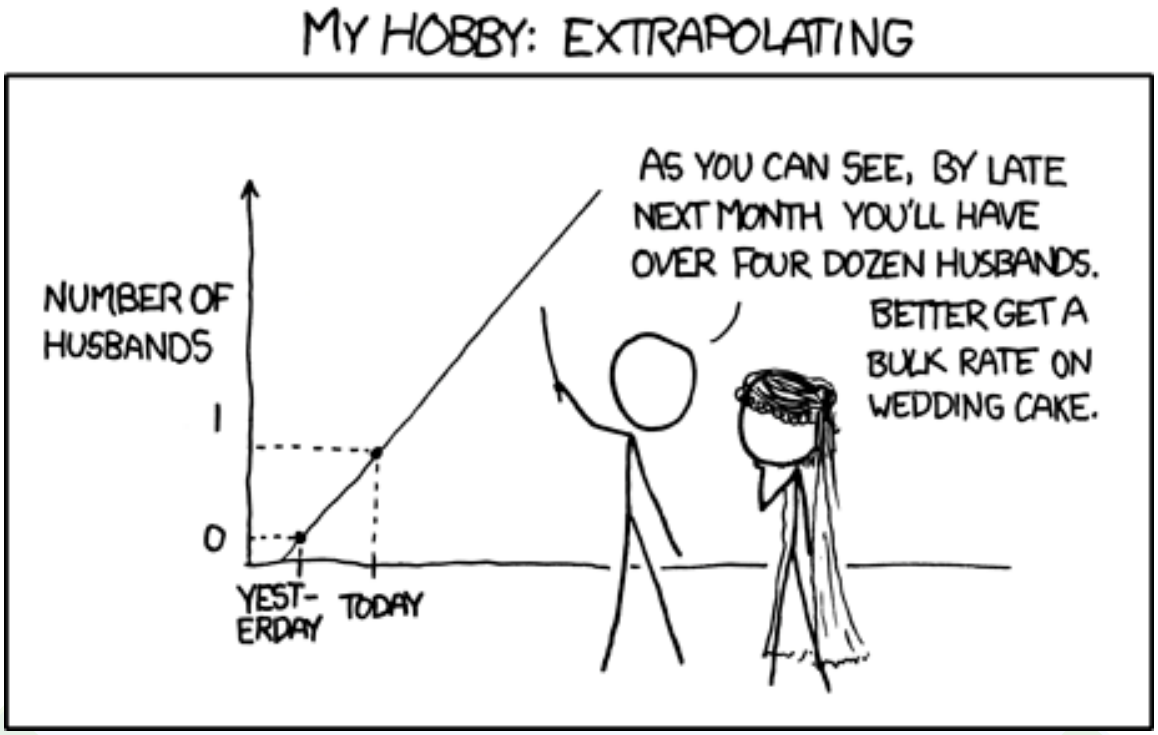
The CEO

Saving resource or cash?



ROI – Making the calculations

Dealing with uncertainty



- Ranging estimates or sensitivity analysis can express uncertainty.

Exercise 11
Using the ROI calculator

- This exercise gives you practice with using the ROI calculator. The handout contains pertinent data from another project. Use it to construct a Return on investment result for the project.

- If you have time, think about how you would use this tool in your project.

Resources

- A guide to Social Return on Investment
- (Published by the DH and Cabinet Office in 2010)

- http://www.thesroinetwork.org/

- The NHS Institute's ROI calculator

- http://www.institute.nhs.uk/roi

Any questions ?

Feedback

Things to think about

- What have you learned from today?
- How do you plan to use it for your work stream / back in the work place?
- How will you cascade your knowledge to others in your team / department so that they benefit too?
- What is your homework?!

Feedback forms

- 10 minutes for completion


The Quality
Improvement
Healthcare
Company
delivering your quality and value