Making data count

The Essentials

This guide is a summary of our popular interactive pdfs. To access these and our other free resources see the back cover.

Just the essentials

This short guide distils the essential knowledge you need to get more from your data.

It:

- **explains** the perils of relying on RAG reports for decision-making
- **introduces** you to statistical process control (SPC)
- **advises** you how to react to different types of variation
- **shows** how data presentation influences decision-making
- **gives** top tips on how to make better use of data – to make data count.

You can find much more in our interactive guides.

The RAG performance report

How confident do you feel basing decisions on a report like this?

Some people like the way this simple colour coding focuses their attention on the failing indicators – the red ones. But it largely masks improvement or decline.

Safer Staffing Report

	Assessment			Medical			Stroke			Surgical		
	Current month	Last month	Year to date	Current month	Last month	Year to date	Current month	Last month	Year to date	Current month	Last month	Year to date
Day fill rate	104	80	99	101	79	104	96	86	87	94	101	104
Night fill rate	94	70	101	105	104	93	72	97	100	85	94	71
Sickness	20	39	24	30	36	32	39	29	38	27	37	28
Vacancy	23	21	35	39	37	37	26	39	21	39	30	21

The 'sea of green'

Talking Therapies	Target	Apr 22	May 22	Jun 22	Jul 22	Aug 22	Sep 22	Oct 22	Nov 22	Dec 22	Jan 23	Feb 23
Treatment < 18 weeks of referral	>=95%	98.5%	98.5%	98.4%	99.0%	100.0%	98.7%	97.6%	98.9%	97.8%	100.0%	97.8%
Treatment < 6 weeks of referral	>= 75%	87.8%	87.4%	84.4%	86.3%	84.1%	83.3%	80.9%	75.0%	79.4%	81.1%	81.2%
Recovery rate	>= 50%	54.8%	56.0%	52.2%	59.3%	57.0%	54.0%	55.3%	56.0%	53.0%	55.3%	54.8%
1st to 2nd appointment > 90 days	<= 10%	4.0%	2.0%	2.3%	4.0%	4.2%	3.0%	4.1%	1.9%	1.7%	3.1%	3.4%

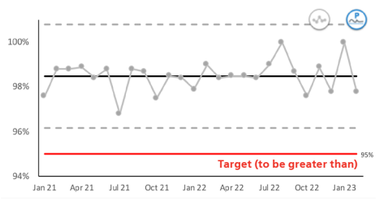
What action would you take if you saw a report like this?

Many people are immediately reassured by the green and don't probe further.

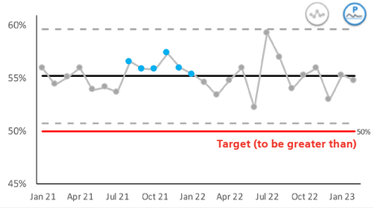
SPC charts

These SPC charts present the same data but over a longer time series.

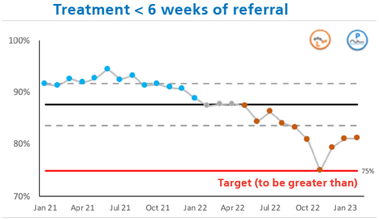
Treatment < 18 weeks of referral



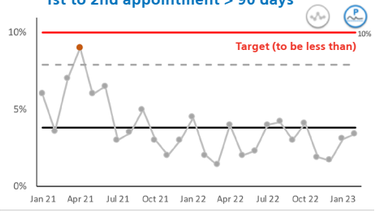
Recovery rate



Treatment < 6 weeks of referral



1st to 2nd appointment > 90 days



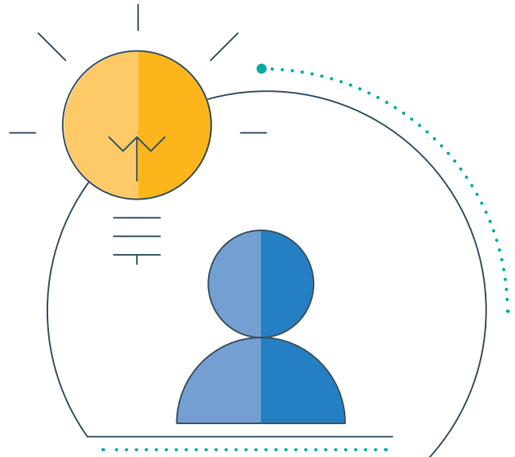
Are you concerned by what any of them show? Look at the bottom left graph and compare what it shows with the second row in the 'sea of green' chart' - many months of decline were hidden behind the green.

Evidence base

There's strong evidence that we make better decisions when we've analysed data using SPC.

Many NHS boards have started to move away from RAG reporting and to instead use SPC charts to understand performance. A research paper was published in BMJ Leader in April 2021 which describes the reasons for making this change and the benefits that have occurred as a result of adopting statistical process control.

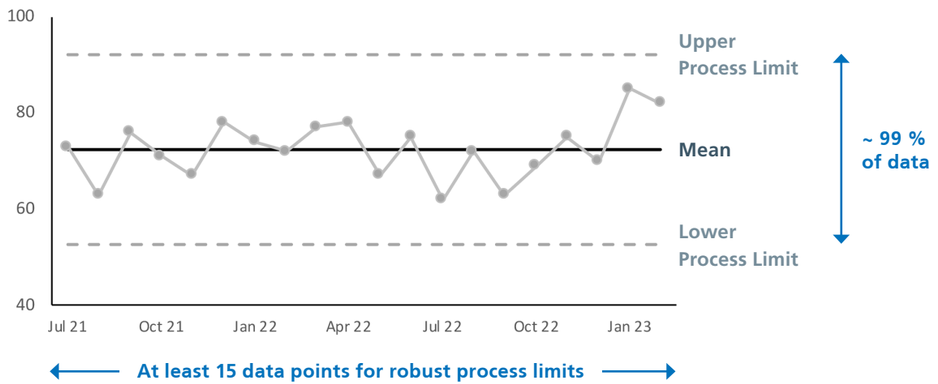
The link on the back cover of this guide will direct you to the full research paper.



Anatomy of a SPC chart

At its simplest, a SPC chart is a time series graph with three reference lines – the mean, upper and lower process limits. These limits help you understand the variability of your data.

SPC Chart



The variance of your data determines the process limits. You can expect 99% of data points to fall between them in normal circumstances.

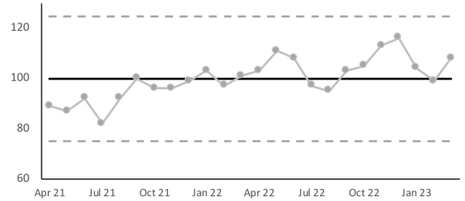
How to calculate process limits

It is important that process limits are correctly calculated. We sometimes see people incorrectly using standard deviation. You should use three sigma to calculate process limits as sigma considers the average change from one point to the next.

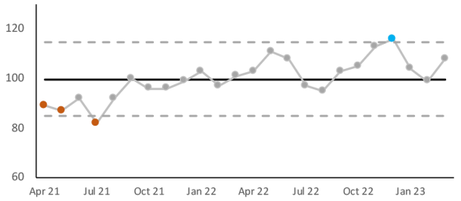
Look at the following chart with 3 standard deviation limits. Notice how wide the limits are and the lack of special cause variation.

Now look at the following chart with the same data against 3 sigma limits. Notice how the limits are much narrower and that special cause variation is now detected.

3 standard deviation limits



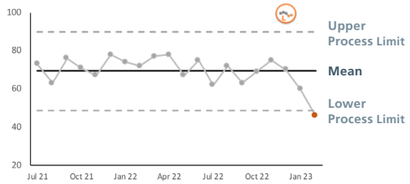
3 sigma limits



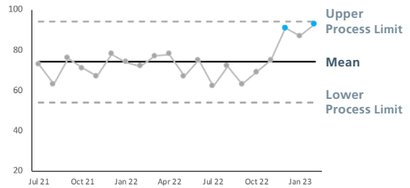
SPC rules

SPC rules are used to identify unusual patterns in the data which are unlikely to have occurred due to chance. Special cause variation is the term used when a rule is triggered. These are the rules that we recommend. We use the colour **orange** to highlight concern and **blue** to indicate improvement.

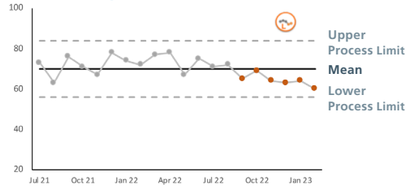
A single data point outside the process limits



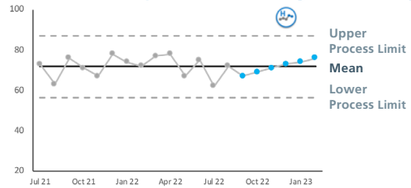
Two of three data data points close to a process limit



Shift of points above / below mean line



Run of data points in ascending / descending order



The triggering of a SPC rule tells you that something unusual has occurred.

How do we know when we have significance?

People often react to small changes and short runs in data as if they were significant. Shorts trends frequently occur by chance and reacting to these will result in spuddling which should be avoided! Imagine tossing a coin - what's the likelihood of getting 2, 4, 6 or 7 heads in a row?

2

there's a 25% chance of this happening (1 in 4)

4

there's a 6.25% chance of this happening (1 in 16)

6

there's a 1.56% chance of this happening (1 in 64)

7

there's a 0.8% change of this happening (1 in 128)

Six or seven points can be seen as a tipping point between patterns that could have been generated by chance and those that have an underlying cause.

Choosing the right number of points

When you are thinking about shifts or trends you need to decide how many points are appropriate for your data (6,7,8…). These are the key considerations.

You need to consider when you will react to significant shifts and trends in your data. The context and frequency of measurement must be taken into account.

Are you running an improvement project?

If you are undertaking improvement work it is vital that you establish a baseline. When you see a change in your data as a result of the improvement you have undertaken you will need to wait for a period of time to be sure that the change is embedded.

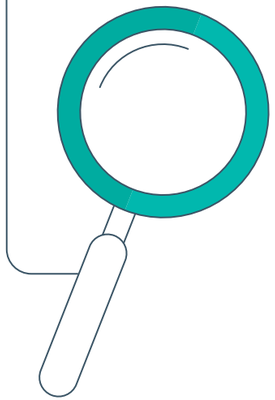
How important is your measure

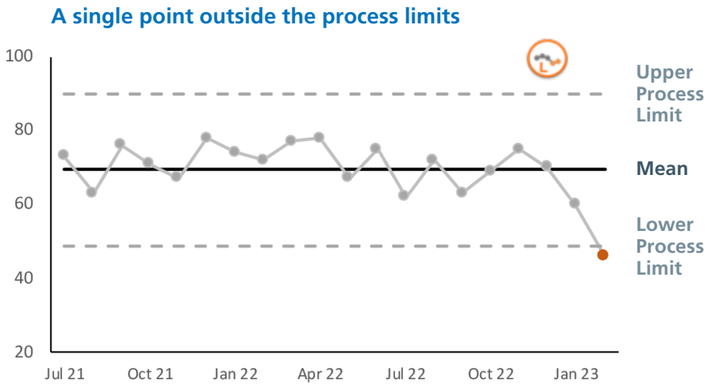
If you are measuring something of critical importance you may decide to investigate after a run or shift of only 6 points. In less critical areas you might decide to wait longer to ensure investigation is necessary.

How often do you measure

If your data is monthly, you may decide to react after 6 points to a significant run or shift whereas you might wait longer if you are measuring daily or weekly. You do not want to waste resources with unnecessary investigation, but you do want to to respond to important changes.

What you need to do if a rule is triggered



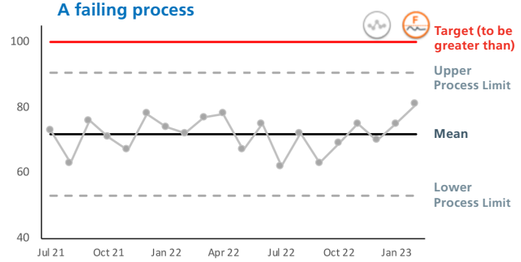


If any SPC rule is triggered, from a single data point outside the process limits to a pattern of data, you know that there is special cause variation. If you do not know the reason for this, you need to investigate.

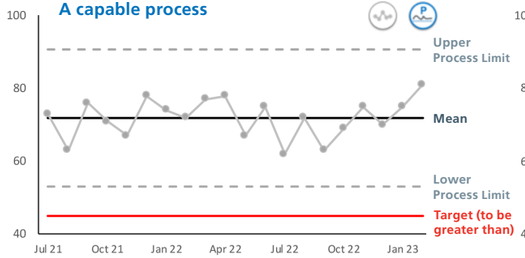
Using SPC for assurance

The location of the process limits in relation to a target line enables you to gain an understanding of whether the target will be achieved sometimes, always or never. The closer that the target is to the mean line the greater the chance of target achievement being 50/50.

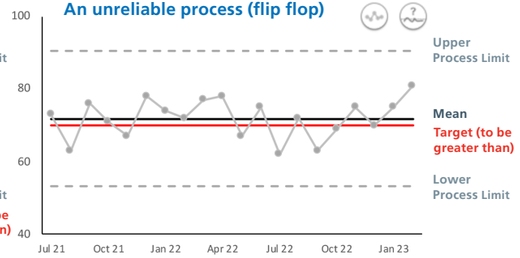
A failing process



A capable process



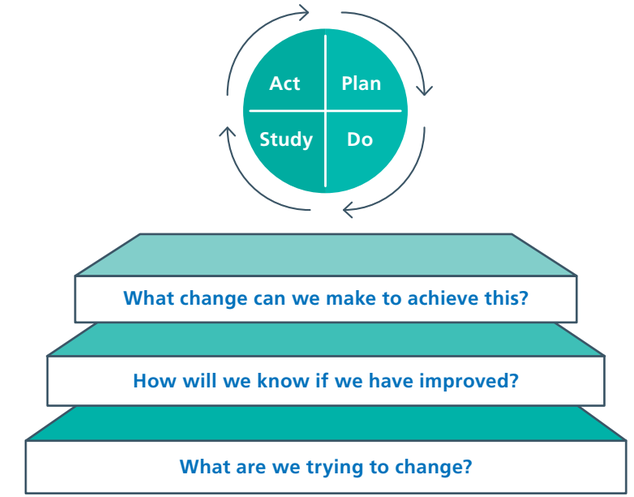
An unreliable process (flip flop)



Redesigning your system

In order to redesign your system you need to decide what changes need to be made and agree your measures. The Model for improvement* is one example of a framework to help you do this.

Remember to record a baseline before you implement any changes.



*Langley GL, Moen R, Nolan KM, Nolan TW, Norman CL, Provost LP. The Improvement Guide: A Practical Approach to Enhancing Organizational Performance (2nd edition). San Francisco: Jossey-Bass Publishers; 2009.

SPC charts will show the impact of the changes

Think carefully about which measures are the most useful to evidence whether the changes that you are making result in improvement. Then plot the data as a SPC chart and annotate the chart when changes are made.

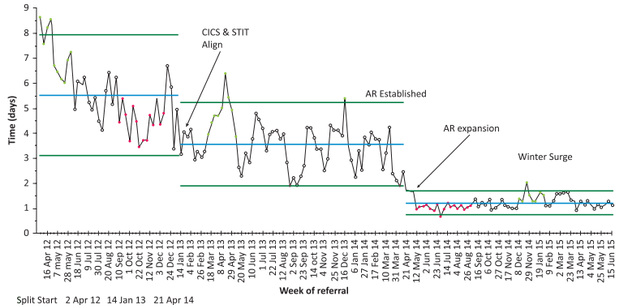


Fig 2. Reducing patient wait for active recovery from a hospital bed. AR = Active Recovery; CICS = Community Intermediate Care Service; STIT = Short Term Intervention Team

Don't forget to think about balancing measures to check that there are no negative unintended consequences.

Offord N, Harriman p, Downes T., 2017. Discharge to assess: transforming the discharge process of frail older patients. Future Hospital Journal, [pdf] 4(1), pp. 30–32. Available through: http://m.futurehospital.rcpjournal.org/content/4/1/30.full.pdf

Benefits of reducing variation

Common cause variation is the variation that exists because of the way the process was designed and is managed. It refers to the many sources of variation that are normally present within a process.

There are many factors that impact on your journey time to work – traffic, weather and parking availability. These are all examples of common cause variation.

Reducing variation makes it much easier to plan and manage systems. It can improve care by establishing consistency based on best practice.

Dr. W. Edwards Deming, the leading figure in quality management once said "If I had to reduce my message for management to just a few words, I'd say it all had to do with reducing variation".

How can data presentation influence discussion?

If you were in a meeting and presented with this data set, how would it make you feel? What kind of discussion do you think that this data might prompt?

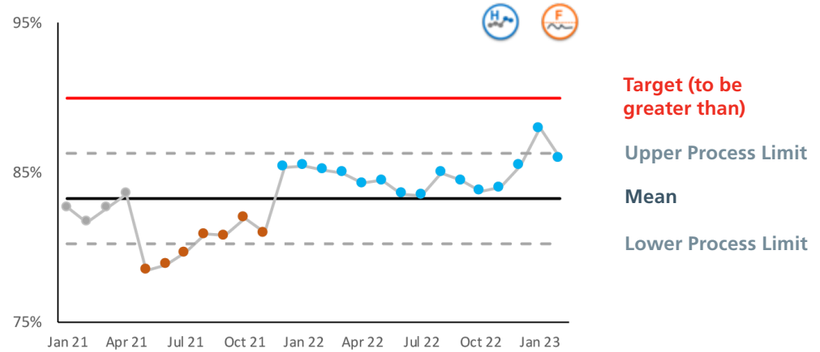
	Hospital site			
Indicator	Target	Dec 22	Jan 23	Feb 23
Mandatory training compliance	90%	85.4%	86.1%	85.5%

Does an investigation need to be undertaken to explain this pro-longed failure? Is a new plan of action required? These are common reactions to a **'run of red'**.

Same data, different story

When the same data is plotted as a SPC chart over an extended period, you can see that there has in fact been improvement. The blue dots on this graph indicate special cause variation. Although there has been significant improvement, it has not been sufficient to achieve the target. Further process re-design is required.

Mandatory Training



Using SPC has prompted a different conversation which acknowledges improvement and explores whether additional action is required.

How can data presentation influence discussion?

This **'run of green'** probably reassures you that things are going well and that the system can be left alone. The upward arrow confirms your view that things are improving.

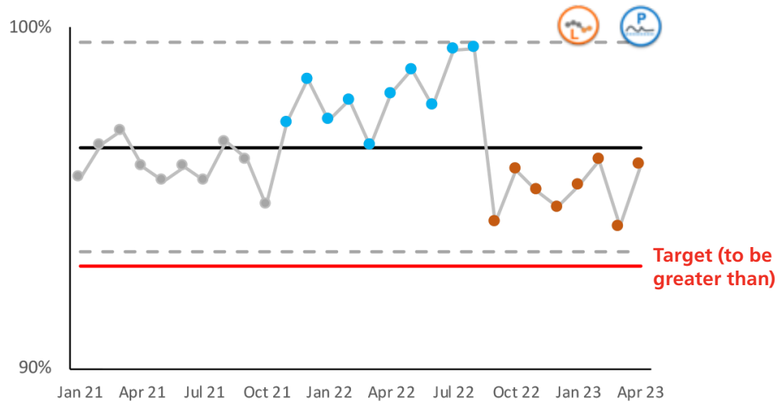
Indicator	22-23						23-24	From the last month
	Target	Nov 22	Dec 22	Jan 23	Feb 23	March 23	April 23	
Cancer 2 week wait compliance	93%	95.2%	94.7%	95.4%	96.1%	94.2%	96.0%	↑

Does the upward arrow suggest that things are improving?

Same data, different story

When the same data is plotted as a SPC chart over an extended period, you can see an early warning sign. This measure is consistently above target, however there has been recent deterioration. The orange dots indicate special cause variation. The one month trend arrow has misled you.

Cancer 2 week wait compliance



How can data presentation influence discussion?

Based on this output you may celebrate the good performance in the **'green'** months and only act when the measure slips into the **'red'**.

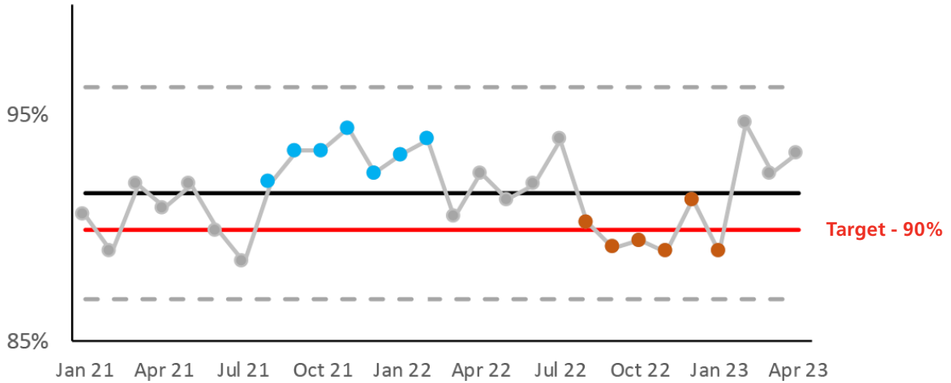
Caring Standards	Target	Aug 22	Sep 22	Oct 22	Nov 22	Dec 22	Jan 23	Feb 23	Mar 23	Apr 23
Friends and Family Test - % Likely to Recommend A&E	> 90%	90.3%	89.2%	89.5%	89.0%	91.3%	89.0%	94.7%	92.5%	93.4%

'Red' months are often investigated to find out what went wrong.

Same data, different story

When the same data is plotted as a SPC chart over an extended period, you can see that the target line falls between the process limits. This means random variation could be the reason this measure 'passes' or 'fails' in a particular month. You can see that some of the data points that are above target were recorded during a poorer period of performance!

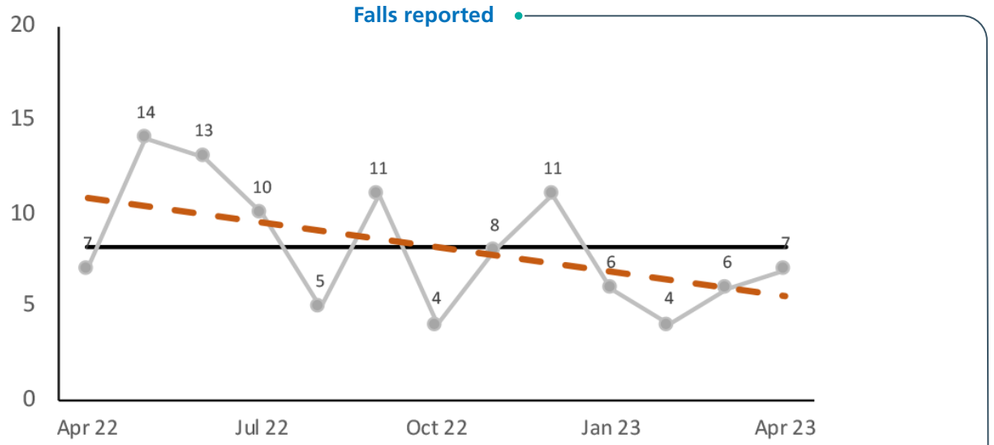
Friends and Family Test



How can data presentation influence discussion?

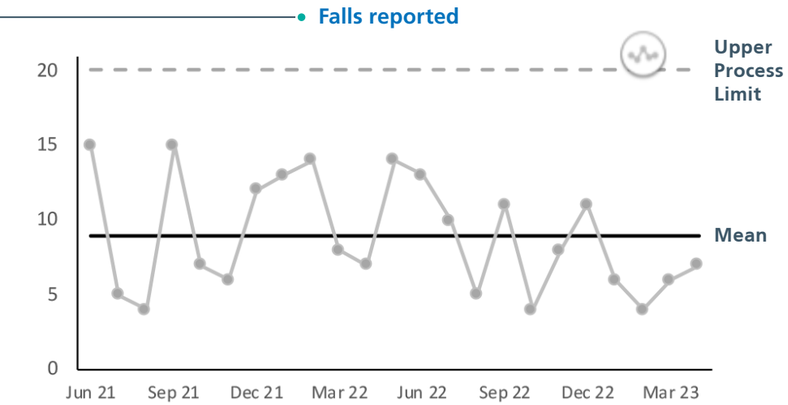
It is easy to add a linear trend line to a graph.

Here we get the clear impression that things are improving – falls reported are reducing.



Same data, different story

Looking at the falls reported data over an extended time period. You see common cause variation indicating that this is a stable system. There has been no improvement.

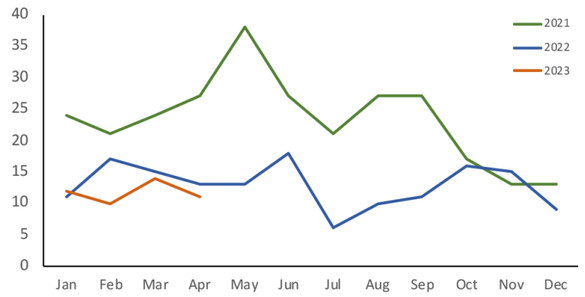


The upper process limit is 20 indicating that it would not be unusual for up to 20 falls to occur each month. Is this an acceptable level? Should work be undertaken to try and reduce this number?

How can data presentation influence discussion?

Faced with a graph with multiple lines, you may struggle to glean clear messages from the data. How long does it take you to understand whether something unusual is happening?

Number of complaints received each month 2020 -2023

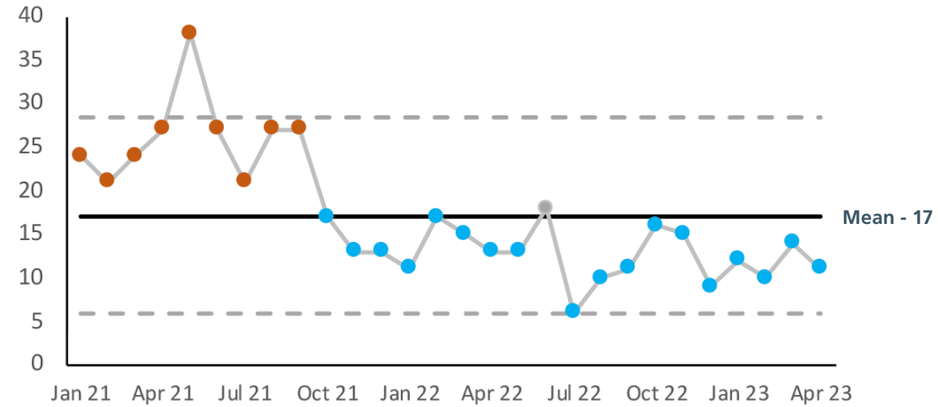


Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year	Key
24	21	24	27	38	27	21	27	27	17	13	13	2021	
11	17	15	13	13	18	6	10	11	16	15	9	2022	
12	10	14	11									2023	

Same data, different story

This is the same data presented as a SPC chart. You can quickly see that the number of complaints received has reduced. The **blue** dots indicate special cause variation.

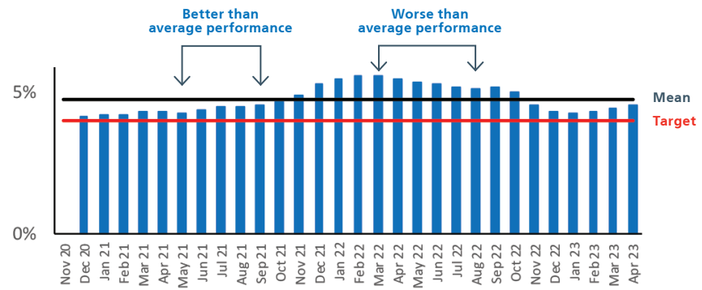
Complaints received



How can data presentation influence discussion?

We often see data presented as rolling averages – particularly workforce data.
Here's an example using sickness data.

Rolling 12 month sickness absence rate



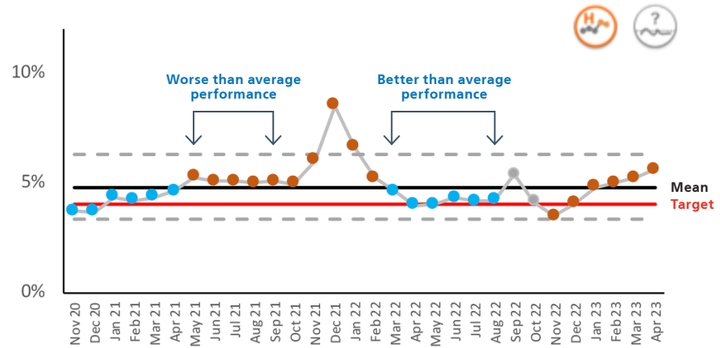
What do you learn from this chart?

Lower levels of sickness appear to have occurred between May 2021 and September 2021.
Higher levels of sickness seem to have occurred between March 2022 and August 2022.

Same data, different story

Here's a SPC chart using the same data but showing in month sickness.

Staff Sickness in month



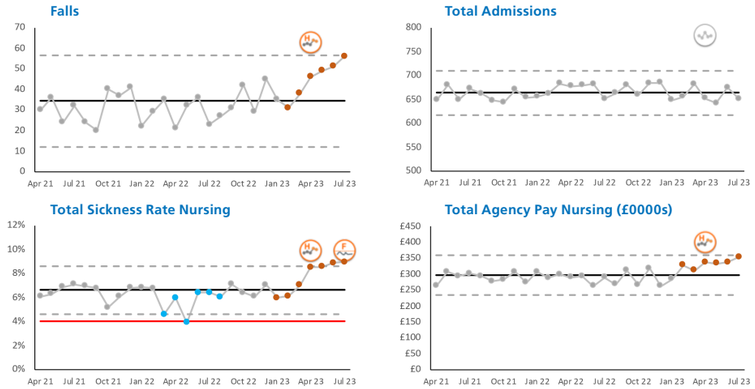
Now you can easily see the true patterns in the data. May 2021 - September 2021 is showing higher levels of sickness rather than lower levels suggested by the rolling average chart.

You can also clearly see that March 2022 - August 2022 actually saw lower levels of sickness rather than the high levels indicated my the rolling average chart.

Using in month data will best guide your discussions and subsequent actions.

Using triangulation to understand the whole story

By selecting measures that are inter-related, it is possible to gain a more comprehensive picture and to ask some insightful questions.



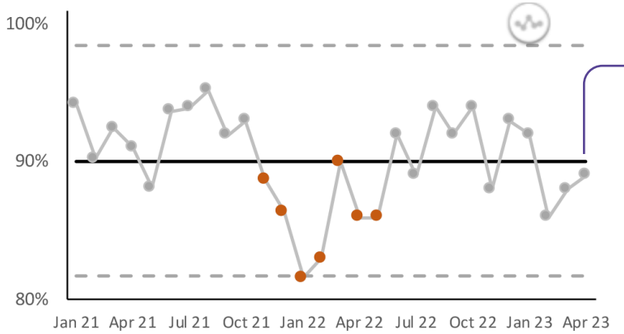
There has been an increase in falls. Why? Are there more admissions? Is there a staffing issue? The charts show no significant change in the number of admissions but sickness rates have increased. You might now conclude that the significant increase in agency staffing costs suggests that sickness is being covered by agency staff who may be less experienced or unfamiliar with the wards and this might be contributing to the increase in falls.

How to describe your data

It's easy to fall in to 'two-point comparison' thinking when describing SPC charts. We often see narrative that describes insignificant changes from one point to the next.

Let's look at an example.

Staff attendance rate



Attendance rate has improved this month from 88% to 89%

A better description would be 'there has been no significant change in the attendance rate since June '22. Attendance rates can be expected to be around 90% (mean) and vary between 82% and 98%.'

Making information digestible

We have developed icons that summarise the messages from SPC charts. Variation icons describe the type of variation being exhibited and assurance icons whether the system is capable of achieving a standard or target.

Variation/Performance Icons			
Icon	**Technical Description**	**What does this mean?**	**What should we do?**
	Common cause variation, NO SIGNIFICANT CHANGE.	This system or process is **currently not changing significantly.** It shows the level of natural variation you can expect from the process or system itself.	**Consider if the level/range of variation is acceptable.** If the process limits are far apart you may want to change something to reduce the variation in performance.
H L	Special cause variation of an CONCERNING nature.	**Something's going on!** Something a one-off, or a continued trend or shift of numbers in the wrong direction	**Investigate** to find out what is happening/ happened. Is it a one off event that you can explain? Or do you need to change something?
H L	Special cause variation of an IMPROVING nature.	**Something good is happening!** Something a one-off, or a continued trend or shift of numbers in the right direction. Well done!	Find out what is happening/ happened. **Celebrate** the improvement or success. Is there **learning** that can be shared to other areas?

Assurance Icons			
Icon	**Technical Description**	**What does this mean?**	**What should we do?**
?	This process will not consistently HIT OR MISS the target as the target lies between the process limits.	The process limits on SPC charts indicate the normal range of numbers you can expect of your system or process. If a target lies **within** those limits then we know that the target may or may not be achieved. The closer the target line lies to the mean line the more likely it is that the target will be achieved or missed at random.	Consider whether this is acceptable and if not, you will need to change something in the system or process.
F	This process is not capable and will consistently FAIL to meet the target.	If a target lies **outside of those limits in the wrong direction** then you know that the target cannot be achieved.	**You need to change something in the system or process if you want to meet the target.** The natural variation in the data is telling you that you will not meet the target unless something changes.
P	This process is capable and will consistently PASS the target if nothing changes.	If a target lies **outside of those limits in the right direction** then you know that the target can consistently be achieved.	**Celebrate the achievement.** Understand whether this is by design (!) and consider whether the target is still appropriate; should be stretched, or whether resource can be directed elsewhere without risking the ongoing achievement of this target.

Where icons indicate an area needs attention, you could provide more detail by attaching the full chart and narrative describing the context, issues and actions in an appendix.

What does good look like?

A good report based on SPC analysis should contain these elements

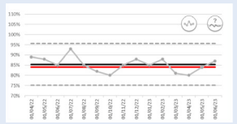
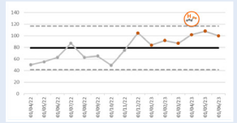
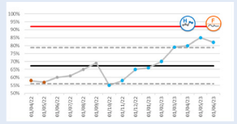
- An icon summary – a table showing the assurance and variation icons for a range of related metrics
- Exception reporting – detailed SPC charts for metrics showing significant change or failing to meet the metric target
- Supporting narrative - which explains what the chart shows and describes actions being taken

The SPC charts should

- Highlight special cause variation
- Have annotation to show where changes were introduced
- Have recalculation of limits where appropriate

Using language to drive action

It is important that SPC charts are accurately described and that narrative drives the appropriate action. Use the grid below to guide your writing.

Key Performance Indicator	What not to say	What we should say	What we should do
	The measure has improved for two consecutive months and has hit the target in both months.	Performance is not changing and is likely to hit and miss the target at random.	Consider whether this metric is a priority, if so what approaches can we take to improve performance and reduce variation?
	Performance improved last month. We expect this trend to continue.	Performance is showing special cause of a concerning nature following a shift of points above the mean.	Investigate to find out what is happening. What can we change to improve performance/prevent further deterioration?
	Performance got worse this month. We have created an action plan to mitigate worsening performance.	Performance is showing a significant improvement.	Find out what is happening. Celebrate the improvement or success. Is there learning that can be shared to other areas?

Narrative writing – who does what?

Analysts provide analytical input using non-technical language

- What does the chart show in terms of variation and assurance?
- Highlight performance which requires further attention or focus (concern or improvement)
- Report on the capability of the process to meet its target

Clinical or operational staff provide operational insight and actions

- Provide context to measures showing concern or improvement
- Add dated actions to address any issues that have been identified
- Identify risks and mitigating actions

Good practice

Lots of trusts are adopting SPC to report performance to their boards. Here is an example from Norfolk and Suffolk NHS Foundation Trust.

An icon summary provides an overview of performance. This is supplemented with narrative which accurately describes the data and priority actions.

NHS Norfolk and Suffolk NHS Foundation Trust

Operational Performance | Executive Summary

KPIs

Referrals, Crisis Service Access & Waiting Times

Metric	Value	Variation	Icon	Assurance	Icon	Target	Mean
New Referrals	12793	Normal Variation		N/A			11,468
Open Referrals	35065	N/A		N/A			33,802
Closed Referrals	10994	N/A		N/A			10,793
Perinatal Access Rate	1444	N/A		N/A		1431	657
Crisis RIA - Emergency 4 hr	78.7%	Normal Variation		Inconsistent		95%	85.2%
Psych Liaison - RIA Emergency 1 hr	69.8%	Normal Variation		Under Performing		95%	67.7%
Psych Liaison - RIA Routine 24 hr	92.3%	Normal Variation		Inconsistent		95%	89.8%

Secondary Care Access & Waiting Times

Metric	Value	Variation	Icon	Assurance	Icon	Target	Mean
RIA - Routine 28 days	81.9%	Normal Variation		Under Performing		95%	77.8%
RIT within standard	88.8%	Concerning Low Trend		Under Performing		95%	90.4%
Number of Service Users awaiting treatment > 18 we...	7020	Concerning High Trend		Under Performing		0	3,380
Total number of Service Users awaiting treatment	11818	Concerning High Trend		N/A			7,424
CP Access & Wait Time Standard	71.4%	Normal Variation		Performing		60%	71.1%
U19 Eating Disorders - RIT Urgent 1 wk	87.8%	Improving High Trend		Under Performing		95%	72.8%
U19 Eating Disorders - RIT Routine 4 wk	95.1%	Improving High Trend		Under Performing		95%	64.8%

Summary and Priority Actions

Referrals

- **Summary:** Referral numbers continue to stabilise post-Covid. Benchmarking from Dec 2022 shows NSFT referrals continuing to track above the national average, though the number of referrals received per 100,000 population has reduced by 24% since 2019/20.

Crisis emergency referral to assessment

- **Summary:** The Trust continues to not achieve the overall 4-hour crisis referral to assessment (RIA) target. Performance is at 100% for those under 18 in March 2023, but performance for those over 18 is below target at 78.3%. North Norfolk and Norwich performance was particularly low in March (54.5%)
- Priority Actions: Review in to NN&N Care Group performance. Crisis Recovery Event on the 6th June to plan work with system support.

Psych liaison wait times

- **Summary:** Significant challenges are being seen for the 1-hour target for referrals from the Emergency Department, where Trust performance in March was low with 549 of 793 referrals meeting the target (70%). Norfolk & Waveney was a particular area of difficulty at 57%.
- **Priority Actions:** A critical problem area was North Norfolk and Norwich, with a performance of 31% in March. The service continues to receive a large amount of inappropriately timed referrals where physical health prevents assessment within the timeframe (54% of breaches in March). Discussions are ongoing with N&W ICB around proposal of new metrics and how these can be incorporated into our patient administration system.

Referral to assessment and treatment

- **Summary:** Referral to assessment and treatment waiting time performance continues a long-term trend of underperformance, with children and young people's services being the lowest performing areas.
- **Priority actions:** A Trust-wide waits improvement programme is underway with workstreams including ensuring referrals are made to the right place, monitoring and validating waits, waiting list harm review monitoring, identifying and releasing short-term capacity and partnering with mental health transformation work. A waiting list working group is overseeing this work, including a re-launch of Service User Tracker Lists processes and the formation of a Trust-wide access group to monitor the waiting list improvements and hold Care Groups accountable.

Early Intervention in Psychosis (EIP) access and wait times

- **Summary:** Early intervention in Psychosis treatment times continue to perform above the national target, with 50 out of 70 service users seen within target in Q4 2022/23. There is assurance that performance will continue to exceed targets in the future. Suffolk shows a continuing high performance with a value of 88.2% against a target of 60%.

Eating disorder wait times

- **Summary:** The Trust Eating Disorder services continue to show improved performance, attributed to several factors including improved data quality and recording of data, refined referral processes, a more extensive and early triage process, additional recruitment and maximising of team resources.
- **Priority Actions:** Continued monitoring to ensure improvement continues, and that data continues to match between local and Trust-level data. Investigation into service user attributable breaches requested for next Quality Performance Meeting.

Good practice

South East Coast Ambulance Service NHS Foundation Trust use the matrix below to provide a summary of performance metrics presented in their board integrated performance report.

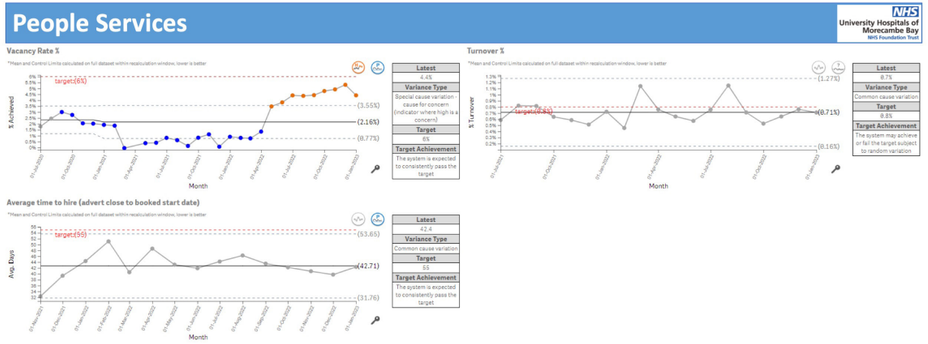
NHS 75 South East Coast Ambulance Service NHS Foundation Trust

April 2023	Pass (P)	Hit and Miss (?)	Fail (F)	No Target
Special Cause Improvement (H, L)		**Cardiac Survival ALL % Required NHS Pathways Audits Completed (Clinical) %		Count of Low Harm Incidents Count of No Harm Incidents Complaints relating to privacy and respect % Outstanding Actions Relating to SIs, Outside of Timescales
Common Cause		Acute ST-Elevation Myocardial Infarction (STEMI) Call to A... Medicines Management % of Audits Completed Duty of Candour Compliance % Hand Hygiene Compliance % Deep Clean Compliance % Complaints Reporting Timeliness %	Compliant NHS Pathways Audits (EMA) % Number of CD Breakages Single Witness Signature Use CDs Omnicell Stroke - Call to Hospital Arrival Mean	Number of Medicines Incidents Number of Datix Incidents Number of Incidents Reported as SIs Violence and Aggression Incidents (Number of Victims - St... Health & Safety Incidents Manual Handling Incidents Proportion of Complaints Relating to Crew Attitude % Number of Complaints Number of Compliments No Harm Incidents per 1000 Incidents Harm Incidents per 1000 Incidents Count of Moderate Harm Incidents Count of Severe & Death Harm Incidents
Special Cause Concern (H, L)		Safeguarding Training Completed (Children) Level 2 % Compliant NHS Pathways Audits (Clinical) %		

Not included: Metrics that are not on a story board, metrics with common cause variation with hit or miss assurance and metrics with common cause variation without a target.

Good practice

University Hospitals of Morecambe Bay NHS Foundation Trust combine measures that are interrelated. The narrative adds more granular detail and clearly describes actions being taken.

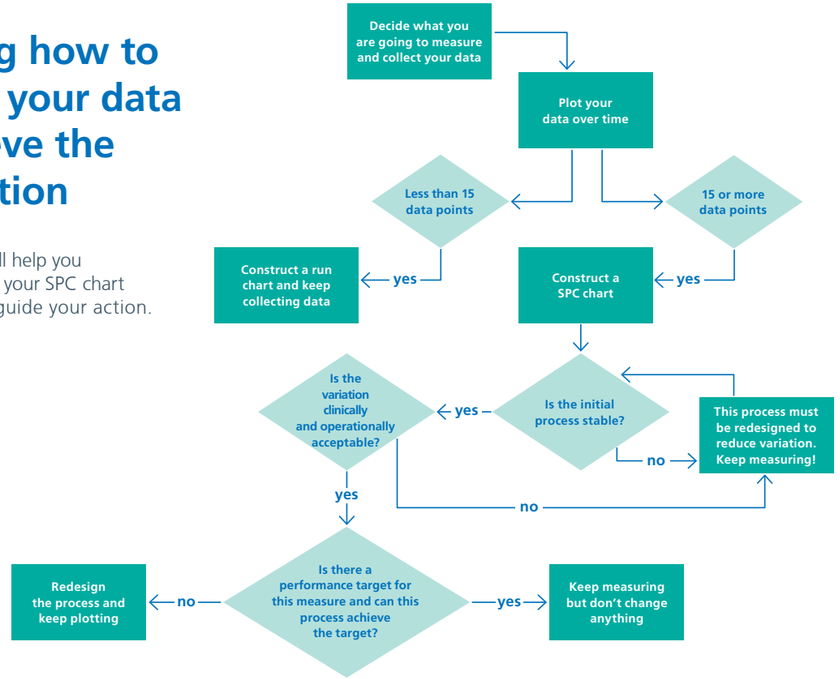


Top tips to make data count

- **keep it simple –** don't use technical language
- **search out like minded people**
- ensure that **analysts** and **decision-makers** are **connected**
- **find powerful examples** where SPC tells a different story
- **be brave** – challenge poor presentation when you see it
- **join the #plotthedots** community and sign up to our free Making data count training
- **encourage your colleagues** to read Making data count

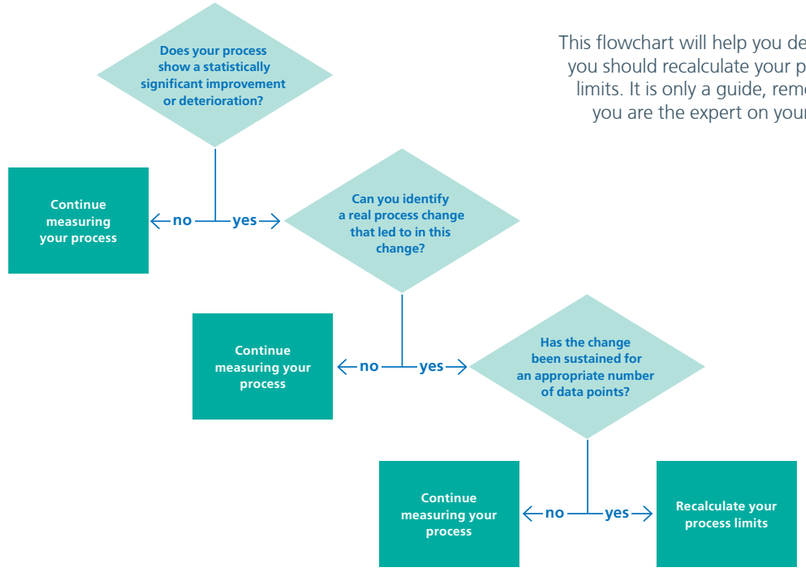
Deciding how to present your data to achieve the right action

This flowchart will help you understand what your SPC chart is showing and guide your action.



Guide to recalculating limits

This flowchart will help you decide if you should recalculate your process limits. It is only a guide, remember you are the expert on your data.



What people are saying

A revelation in the way you will look at your data

All Trusts should do this, it's like switching the light on so you can see the data

It's been really transformational in directing our attention and improvement activity

Huge added value - a game changer

Support and resources

We have a Making Data Count collaboration space which is free for anyone to join!

By joining you can connect with thousands of other people using SPC to improve the NHS. Plus you can access:

- SPC tools
- Training documentation
- Details of forthcoming training sessions
- Events calendar
- Discussion forums

Scan the QR code on the backpage or join here: https://mdc.contact/futures

If you need any further support or guidance we are here to help: https://mdc.contact/email