PATIENT SAFETY FIRST

Making the safety of patients everyone's highest priority

The How-to Guide for

Measurement for Improvement

Version 1.2 – 2009.03.05

To find out more visit
www.patientsafetyfirst.nhs.uk

Acknowledgements

We wish to thank and acknowledge the Institute for Healthcare Improvement (IHI) for their support and contribution to the Patient Safety First Campaign.

Thanks also to the English Campaign Team Members and others who have contributed to this guide.

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PATIENT SAFETY FIRST

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Introduction

> **"All improvement will require change, but not all change will result in improvement"**
>
> *G.Langley et al., The Improvement Guide, 1996*

To demonstrate if changes are really improvement, you need the ability to test changes and measure the impact successfully. This is essential for any area that wants to continuously improve safety. To do this you may only need a few specific measures linked to clear objectives to demonstrate that changes are going in the right direction.

This guide is designed to help you do this in your improvement projects. It is in two parts.

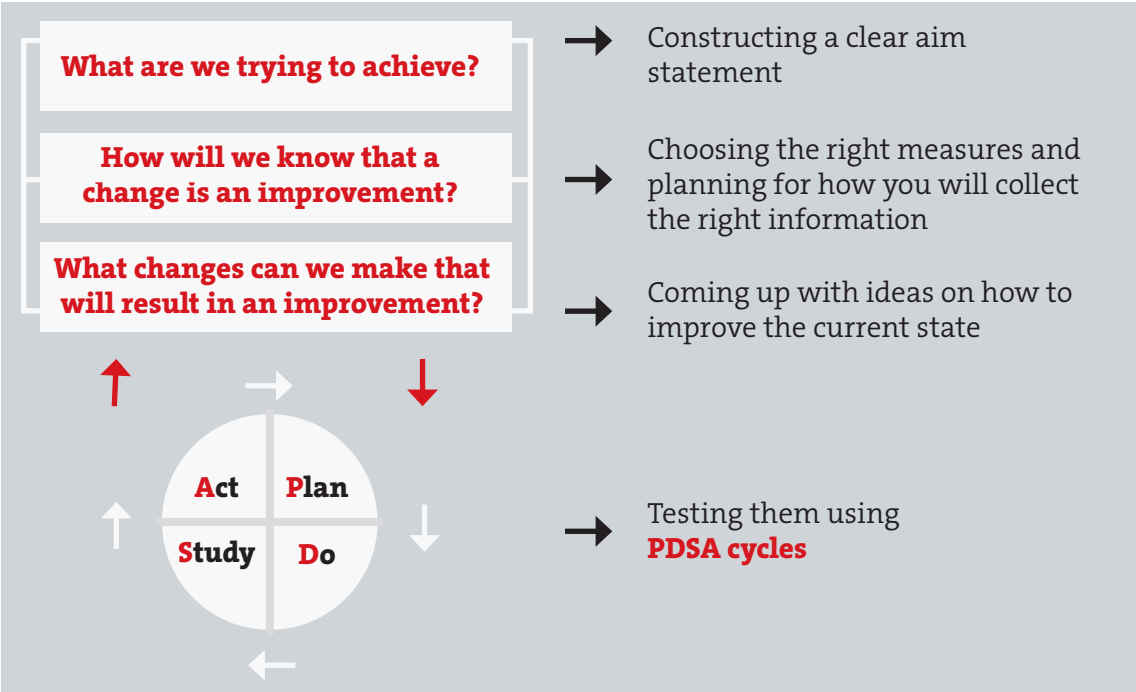
Part 1 explains what measurement for improvement is and how it differs from other sorts of measurement that you will have come across.

Part 2 talks you through the process of collecting, analysing and reviewing data.
If you are familiar with the Model for Improvement and how to use it, you can skip Part 1 and go straight to Part 2.

Part 1: What is measurement for improvement?

The Model for Improvement

The basis of measurement for improvement falls naturally out of the Model for Improvement. The Model for Improvement was developed by Associates for Process Improvement (USA, available at www.apiweb.org). It provides a framework around which to structure improvement activity to ensure the best chance of achieving your goals and wider adoption of ideas. The model is based on three key questions used in conjunction with small scale testing:



This document focuses on measurement, which is fundamental in answering the second question: "How do we know a change is an improvement?" but all parts of the model are inextricably linked. An overview of all parts of the model can be found in the accompanying Campaign document "The quick guide to implementing improvement" (available at www.patientsafetyfirst.nhs.uk).

Small tests of changes that you hope will have an impact on your rate of harm need to be measured well. This part of the model is shown in an iterative way as improvements / measures do not always work first time. The testing process not only tells you how well the changes are working but how good your measure and its collection process is. You may find after a test that your method of sampling or data collection needs refining.

Implementing changes takes time and money so it's important to test changes and measures on a small scale first because:

- It involves less time, money and risk
- The process is a powerful tool for learning which ones work and which ones don't. How many of you have ever designed a questionnaire or an audit form only to realise that it didn't give you the information you needed? This may have been because the information you requested wasn't quite right, the way people interpreted the questions or simply that the form itself wasn't clear enough for a person to complete without guidance.
- It is safer and less disruptive for patients and staff. You can get an idea of the impact on a small scale first and work to smooth out the problems before spreading the changes more widely
- Where people have been involved in testing and developing the ideas, there is often less resistance

Measurement for safety improvement does not have to be complicated. Tracking a few measures over time and presenting the information well is fundamental to developing a change that works well and can be spread.

Measurement can show us a number of important pieces of information:

- how well our current process is performing
- whether we have reached an aim
- how much variation is in our data/process
- small test of change
- whether the changes have resulted in an improvement
- whether a change has been sustained.

The 3 reasons for measurement

There are three main reasons why we measure: research, judgement and improvement. Understanding what you are measuring and why is vital as it determines how you approach the measurement process.

Characteristic	Judgement	Research	Improvement
Aim	Achievement of target	New knowledge	Improvement of service
Testing strategy	No tests	One large, blind test	Sequential, observable tests
Sample size	Obtain 100% of available, relevant data	"Just in case" data	"Just enough" data; small, sequential samples
Hypothesis	No hypothesis	Fixed hypothesis	Hypothesis flexible; changes as learning takes place
Variation	Adjust measures to reduce variation	Design to eliminate unwanted variation	Accept consistent variation
Determining if change is an improvement	No change focus	Statistical tests (t-test, F-test, chi-square, p-values)	Run charts or statistical process control (SPC) charts

Adapted from: The Three Faces of Performance Measurement: Improvement, Accountability and Research." Solberg, Leif I., Mosser, Gordon and McDonald, Susan Journal on Quality Improvement. March 1997, Vol.23, No. 3.

Clinical colleagues are often more familiar and comfortable with measurement for research on a large scale with a fixed hypothesis to reduce unwanted variation. Health service managers and those in more strategic roles may be more familiar with measurement for judgement as a way of understanding a level of performance. Measuring for improvement is different. The concept of sequential testing means that there needs to be willingness to frequently change the hypothesis (as you learn more with each test) and an acceptance of 'just enough' data, working with data and information that is 'good enough' rather than perfect. Measurement for improvement does not seek to prove or disprove whether clinical interventions work – it seeks to answer the question "how do we make it work here?"

"Seek usefulness, not perfection, in the measurement"

Nelson et al., Building Measurement and Data Collection into Medical Practice; Annals of Internal Medicine; 15 March 1998 ; Volume 128 Issue 6 ; Pages 460-466.

Making measures meaningful

Sometimes we ask staff to spend time and energy testing and implementing changes that they perceive to have only a small impact. It is understandable that teams prefer to look for the 'big win'; the one change that will get them where they want to be. Driver diagrams can be helpful in showing these teams how the work they are doing not only links to the organisation's strategic aim but how all of the smaller changes add up to achieve it. This can help motivate teams by demonstrating the importance of their role in improving the safety of their patients.

Each of the How to Guides created for the Campaign interevntions contains a driver diagram to demonstrate how the elements of the intervention link to achieving the aim.

The different types of measures

It can be helpful when you have selected a range of measures to check what type of question they are addressing. Are they telling you something about what happened to the patient? Or are they telling you something about the process of care? Knowing that you have selected all of one type might cause you to think again about your selections. The three types we use in improvement work are called outcome, process and balancing measures.

Outcome measures reflect the impact on the patient and show the end result of your improvement work. Examples within the safety arena would be the rate of MRSA or the number of surgical site infection cases.

Process measures reflect the way your systems and processes work to deliver the outcome you want. Examples within the safety arena would be % compliance with hand washing or the % of patients who received on time prophylactic antibiotics

Balancing measures reflect what may be happening elsewhere in the system as a result of the change. This impact may be positive or negative. For example if you have implemented changes to reduce your post operative length of stay, you also want to know what is happening to your post operative readmission rate. If this has increased then you might want to question whether, on balance, you are right to continue with the changes or not. Listening to the sceptics can sometimes alert us to relevant balancing measures. When presented with change, people can be heard to say things like "If you change this, it will affect that." Picking up on the 'thats' can lead to a useful balancing measure.

Of course our main purpose is to see outcomes improving but how can we do that? Reliable processes are a proven way to better outcomes. So we need to improve our processes first to make them extremely reliable then improved outcomes will follow. Therefore, we should have both process and outcome measures and where necessary a balancing measure.

Good measures are linked to your aim - they reflect how the aim is being achieved.

Ratios and percentages

Having decided on a topic for a measure, for example surgical site infections, we now need to decide how it should be expressed. Do we want to express it as a percentage of patients seen, the rate per 1000 patients or simply as a count (the number of infections)? What follows are some guidelines to help you decide which option to use.

Use Counts when the target population (for example number of patients on a ward) does not change very much. It has the advantage of simplicity but it can be difficult to compare with others or even with yourself over time. So, expressing our measure as the number of infections per month is fine as long as the patient population we are treating remains reasonably constant over time.

Use Ratios or rates when you want to relate infections to some other factor such as patients or bed days. If your target population numbers are quite variable a simple count is not sufficient without the context. In this case the measure would be infections per 100 patients or infections per 1000 bed days. Now a ratio is simply one number divided by another (infections divided by patients) and statisticians use specific words to describe the two numbers that comprise a ratio. They would call the infections number the 'numerator' and the patients number the 'denominator'.

Use Percentages when you want to make your focus more specific. For example, if you want to learn about patient falls in your organisation is your focus the occurrence of falls or the result of falls in terms of patient harm? If your focus is falls then you would measure this as a rate or ratio. If your focus is on what has happened to the patient you might select a measure such as the % of patients who were harmed by their fall. In our infection example, the measure would be the percentage of patients who had a surgical site infection that met your pre determined criteria for infection. In both examples you would probably be gathering the same information – just expressing it a different way. Notice that we have moved away from counting infections now to counting patients who had an infection to allow us the frame the measure as a percentage - if we were counting the former we could not express this as a percentage because some patients may have more than one and statistically that means it would be possible to end up with a number that is greater than 100%!

Use 'time between' or **'cases between'** when you are tracking a 'rare' event, say one that occurs less than once a week on average. If surgical infections occur this infrequently then measures expressed as rates or percentages become less useful. A count of monthly infections might look something like: 2,3,3,3,2,3,4,3,3,2,2,4. A change of 1 infection is quite a percentage shift and therefore our run chart would vary wildly but based only on 1 more or less infection. Clearly this is not very helpful. In this case express the measure as the number of cases since the last infection. We might now get values such as 75, 57, 82, 34 cases between infections. When charted this gives us something more useful to look at and it is not affected by the 'small number' problem that can impair rates and percentages.

Part 2: How do I measure for improvement?

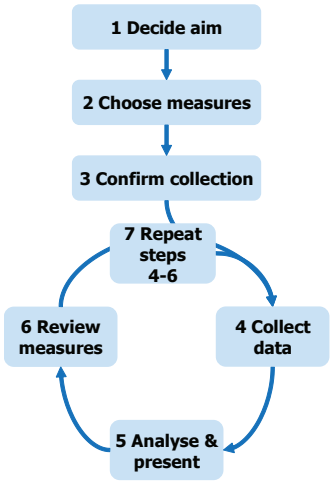
Top tips

Key things to remember when starting to measure:

- Seek usefulness not perfection - measurement should be used to focus and speed improvement up not to slow things down
- Measure the minimum. Only collect what you need; there may be other information out there but the aim is to keep things as simple as possible
- Remember the goal is improvement and not a new measurement system. It's easy to get sidetracked into improving data quality, especially if you are confronted with challenges on the credibility of the data (more commonly from colleagues who may tend to trust more rigorous research data) – just ensure it's 'good enough'
- Aim to make measurement part of the daily routine. Where possible use forms or charts that are already routinely used or add recording /collection process to one that is already in place. This minimises the burden on staff and also maximises the chances of it being done reliably.
- Don't let measure issues delay the start of your PDSA cycles. Your first few cycles should be so small that they won't affect your baseline.

The 7 steps to take

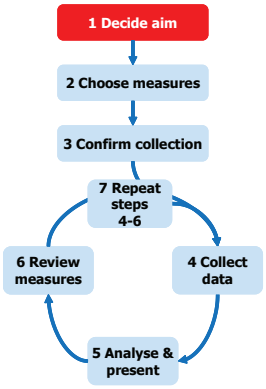
- Step 1 – Decide your aim
- Step 2 – Choose your measures
- Step 3 – Confirm how to collect your data
- Step 4 – Collect your baseline data
- Step 5 – Analyse and present your data
- Step 6 – Meet to decide what it is telling you
- Step 7 – Repeat steps 4 to 6 each month or more frequently



Steps 1 to 3 – Getting yourself ready

Step 1 – Decide your aim

More information on setting an aim is contained in the accompanying Campaign document 'The quick guide to implementing improvement' (Model for improvement section) available at www.patientsafetyfirst.nhs.uk.



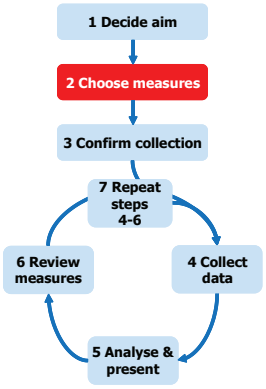
The key points to remember about aim setting are:

- Those involved in making the changes should be able understand (and translate) the project work to the strategic goals.
- The aim statement should be unambiguous clear, specific, numerical, measurable – it MUST state 'How much' and 'By when'.

If the aim seems quite along way from where your current performance level (baseline) is, it is advisable to break it down into statements that make it seem more achievable e.g. achieving 80% compliance within 1 year but improving this to 95% within 18 months.

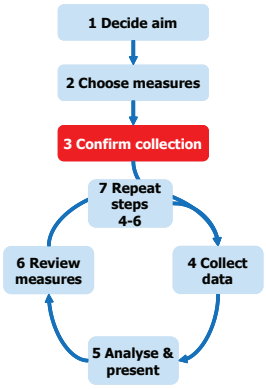
Step 2 – Choose your measures

Each of the Campaign intervention How to Guides gives you an overview of the recommended measures for each intervention as well as suggestions for optional measures. You can also view a complete list of all the Campaign measures in 'Campaign Measures Definitions. doc' (available at www.patientsafetyfirst.nhs.uk). The Campaign's Extranet site also allows you to create your own custom measures so that you can choose measures that you feel are important to you locally. Appendix 1 contains a template that helps you define your own measures (also available at www.patientsafetyfirst.nhs.uk)



Step 3 – Confirm how you will collect your data

Use the measurement template to help you work through this step. You will need to identify the data you need and where it comes from. Sometimes the data will be already collected but often you may need to set about collecting it yourself. The process of working this out helps you to define exactly what is you are measuring and sometimes you will find that it might be so complex that you need to rethink what the best measure is to ensure the data is collected reliably. It also can help you add detail to your aim statement such as what the pilot population is if you are using one.



Operational definitions

Measures nearly always require some kind of operational definition. This means specifying exactly what some terms means and applying this definition consistently. For example if you want to know how many patients had ventilator associated pneumonia (VAP) you need to be explicit about what constitutes a VAP and what does not. Sometimes these definitions can be very difficult to get consensus on. One hospital spent a year having discussions about how to define a VAP! If there is disagreement find a few examples from other hospitals and get the team to pick one and start using it. The team can then spend as long as they choose over deciding how they would like to define a VAP but in the meantime the work can progress.

The most important thing is that once you have established these definitions, they are applied consistently. If you do change them for any reason, you will need to annotate your run chart stating what you changed about what you measure or the way that you measure it.

Sampling

When do we track 100% and when do we track a sample?

If your numbers are small enough that you can track 100% without too much trouble then you should do it. If this is not feasible then you should use a sample. For the Campaign measures that require you to select a sample, 10 is sufficient. This is also the sample size used for 'Productive Ward' measures.

For example, when measuring progress in reducing VAPs then the number of VAPs is not difficult to monitor so you would count all cases of VAP that occur. When auditing compliance with use of the ventilator care bundle you would use a weekly sample of 10.

How do we select the sample?

You need to choose a sample that is representative of the overall population that you are measuring. This is so that you do not inadvertently introduce a bias into your results. For example, if you are auditing to see how many patients have had all their physiological observations completed then you could choose any 10 patients on the ward / unit at random. However, if you are auditing the number of patients who were given fumazenil you would need to select a sample from a patient group who are likely to have received midazolam (such as from a day surgery unit).

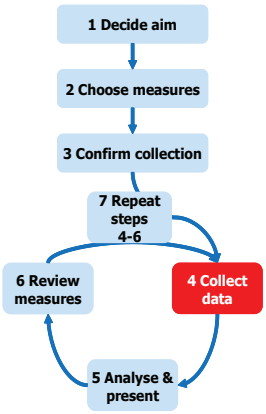
It is difficult to ensure a truly random sample if you are making the choices manually. Almost inevitably some bias can creep into those choices unless you are very careful. One way you can avoid this outcome is to use a random number generator such as the one contained in Excel. Number all the patients you want to select from and then use the Excel feature to 'select' a sample. If you are not familiar with how to do this in Excel, contact your Information Department for assistance.

Steps 4 to 6 – the CAR measurement cycle

Measurement itself is a process. In its simplest form it consists of three stages. First you collect some data, then you analyse it and present in an appropriate way to convert it into useful information and finally you review your information to see what decisions you need to make. **The Collect-Analyse-Review** or **CAR** cycle then starts all over again.

Step 4 – Collect your baseline data

You will need to know your baseline before you can track the progress of your goal against it. By starting your measurement and plotting points you will be able to create your baseline.



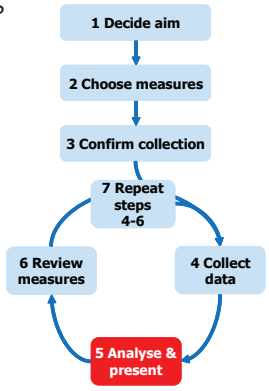
To create a baseline or identify a trend using a run chart, about 25 data points are ideal. However, 20 data points will provide a robust representation. One way to get more points is to measure more frequently. The Campaign measures have been set up on the assumption of monthly reporting. Obviously to get a robust baseline means you will need between 1 and 2 years of monthly data. This is fine if historic data is available for you to use.

Often the data you need to measure though is not being collected. If so you should start collecting your data straight away. But you do not have to wait to start testing small changes. They will not affect your overall situation so you can be doing those while creating your baseline.

Step 5 – Analyse and present your data

Use the Extranet

The Extranet is a web-based reporting tool set up especially by the Institute for Healthcare Improvement (IHI) for The Patient Safety First Campaign. You need to register via the Campaign website to gain access. Your organisation already has a 'home page' on the site. From this you can select from the campaign list of recommended measures or create your own custom measures. Then all you have to do is enter your data and run charts are created for you automatically. You can also see the charts for other Trusts although the ability to actually input and change data is restricted to those individuals that each organisation has nominated.

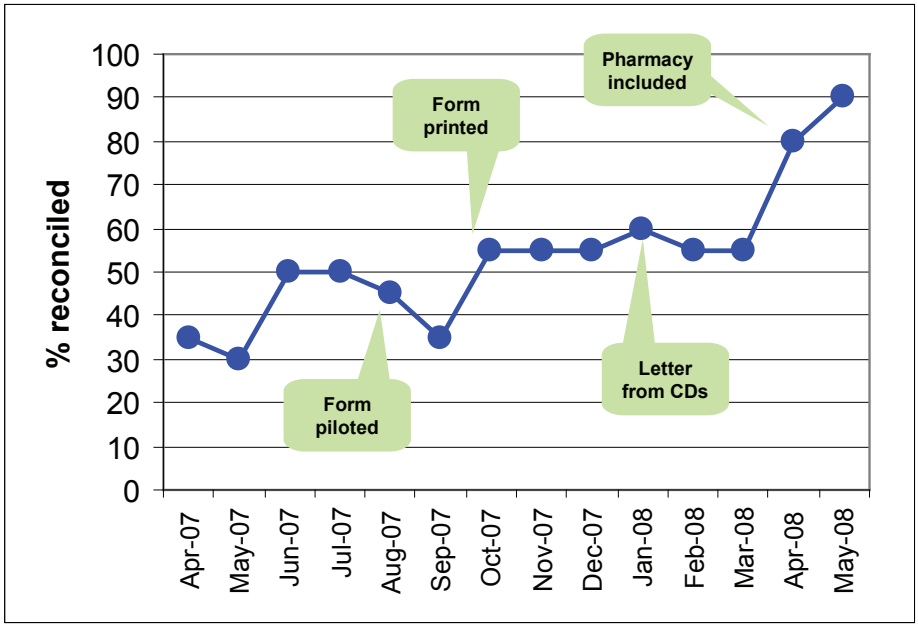


When entering your data there is also an opportunity to annotate the chart. This is an extremely useful way of noting when you have made changes so that you can see whether they are having any effect.

Why run charts?

The way you analyse and present your collected data is important. Run charts are a good way to show how much variation there is in your process over time Also, plotting data over time is a simple and effective way to determine whether the changes you are making are leading to improvement.

The figure below shows the percentage of medicines reconciled on a medical admissions unit. It has also been annotated with the dates that specific changes were tested or introduced to the medicines reconciliation process on the ward.



In the first few months, the percentage reconciled varied between 30% and 50%. Once a new form was introduced in October 2007, performance rose slightly and seemed to stabilise at 55%. The letter from the Clinical Director does not seem to have had much effect whereas the introduction of pharmacy had a more obvious one. It is too early to tell from this data whether the improvement is permanent, we would need several more months showing 90% before we could be confident about that. Nevertheless the run chart shows clearly which interventions had an impact and which ones didn't. This is important to know. We don't want to be spending time and energy pursuing something that is not helping us.

One more thing would help us in using this chart. We should add a goal or target line that represents where we are trying to get to. Keeping the **goal line** on every graph ensures everyone viewing the graph can see at a glance where the work is at in relation to achieving the aim.

How do I know whether changes are an improvement?

As you will have seen from the previous example charts may go up and down but we need to have some way of knowing whether this is just random chance or the result of a real change. There are 4 tests that you can apply to run charts to help you identify what's happening after you've made change and therefore determine whether it is really an improvement. You can apply the 4 tests to your measures in the Extranet by selecting the Run Chart option from the Reports tab.

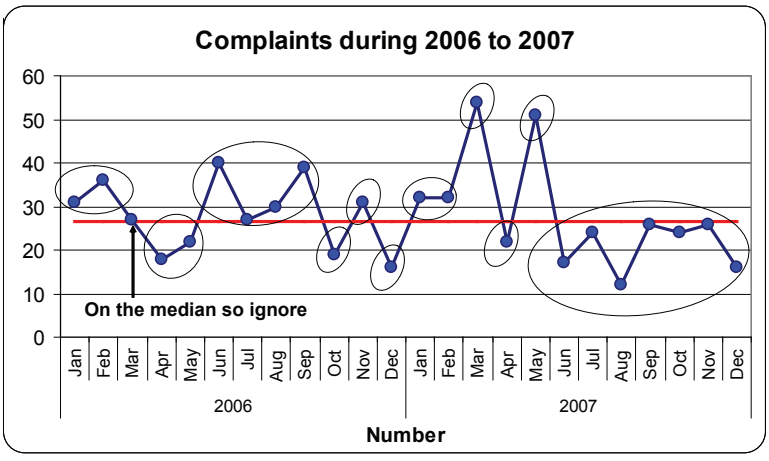
Two of the tests make use of the mean (average) or median value of your data and also the concept of a 'run'. The median is simply the middle value of all your values if they were arranged in order. If you are creating your own charts, you should calculate the mean or median and plot it on your chart – this is called the 'typical value'. A 'run' is a consecutive series of points that are above the median or below it. As a general rule use the mean. If the data points look very 'spiky' (ie there is a frequent wide variation in your lower and upper figures use the median.

The tests are:

Test #1: 6 or more consecutive points above or below the mean.
These runs indicate a shift in the process. Values are still varying but they are doing so around a new mean or average value. If this is shift in the right direction, it is likely that the change you made is having a beneficial effect. This is the most frequent type of change in the data that you will see.

Test #2: 5 or more consecutive points all increasing or decreasing.
This indicates a trend and suggests that the change you made is having an effect but you don't know yet where performance will become stable again. You need to keep measuring to find out. This situation is more likely to occur if you are rolling out a change over a period of time.

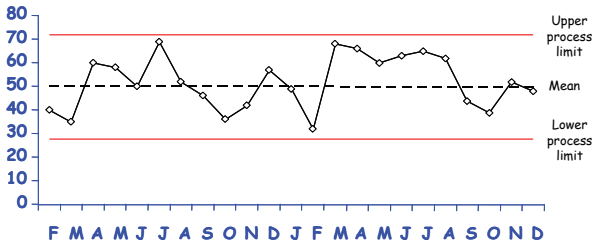
Test #3: Too many or too few runs.
Count them up by circling the runs as in the example to the right. Note that any points that fall on the mean /median line should be ignored. Use the table in Appendix 3 to work out whether your variation is due to random causes. If the number of runs is inside the range this is what we might expect by chance. If the number falls outside the range then some external factor is having an effect. Too many runs suggests the process has become less consistent and it is possible that your change has had a detrimental effect. Too few runs suggests a more consistent process.



Test #4: An "astronomical" data point.
The example of journey times in the sub section "Testing for changes with SPC charts" explains what this might look like. You should use your own judgement to assess whether the result in question really is 'odd'. Often such markedly out of range resuts are caused by a data collection or data definition problem so check that first. If the data seems ok then try to find out what might have caused such an odd result. It may cause you to think about creating a contingency plan for if such an occasion arose again.

What is the difference between run charts and statistical process control (SPC) charts?

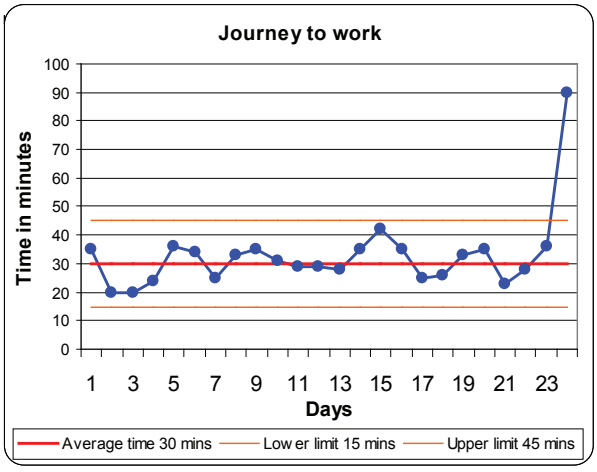
Run charts should be sufficient for nearly all your measurement but there may be occasion for you to need to understand the statistical process control or SPC chart. The SPC chart is a further refinement of a run chart. It introduces the idea of expected variation, that is, how much variation does my process typically exhibit? SPC charts still have a 'typical value' line (mean or median) but add 2 further lines, the upper and lower limits. The purpose of these lines is to show you that data points appearing within the limits, despite going up and down are doing so as part of the **normal** variation that we see in everyday life. If a data point spikes above or below these limits then you know something different has happened – a special event, hence this is called **special cause** variation. When events like this are seen on a chart you need to investigate what happened. Even though the event might be unlikely to occur again it is still worth considering if there is anything you can do to minimise the impact if it did.



If our process exhibits just random variation, we can use the SPC chart to 'predict' what future performance would be like. We would expect any future data points to vary around the average and lie within the limits.

Testing for changes with SPC charts

To illustrate how test #4 described earlier applies also to SPC charts, consider your journey to work. Some days are quicker than others but you tend know on average how long it takes you, on a 'good' day and on a 'bad' day. If your average journey time is 30 minutes and it never usually takes you more than 45 minutes or less than 15 minutes, then you know how much time to allow. But the day that it took you 90 minutes because you had a flat tyre on your car and you didn't have a jack with you to change it, you and your colleagues would know that something was different (special) about that day. Even

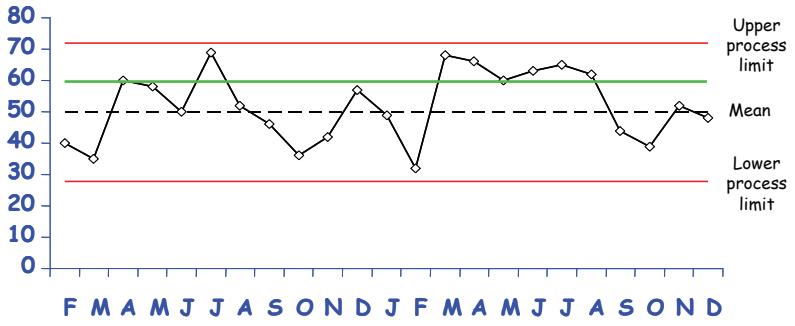


though it might not happen again you would still probably take the jack out of your garage and put it in the boot of the car so you could change your tyre more quickly if it did. If it actually didn't feel as if it took as long as 45 mins to sort out the problem you might also check your watch and the clock on the wall in the office to see if it really did take you that long or if there was an inconsistency in the recording of the time.

You can also use run chart tests #1 and #2 with SPC charts too. If using SPC charts there are a few other tests that you would do but for the purposes of most Campaign improvement work you are most likely to want to use SPC to assess how likely your current process is to deliver what you want it to.

Assessing process capability with SPC charts

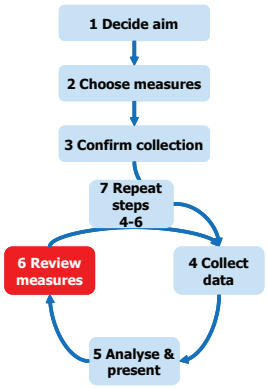
You can use the process limits of the SPC chart to help you assess how capable your process is of doing what you want it to do ie whether you are likely to reach a particular target. In the chart shown, our process is performing at an average of 50 cases per month with an expected range of 28 to 72 cases. If we have a target of no less than 40 cases per month (shown as a green line), are we likely to hit it? Yes we are but not all the time. We would need to either shift the whole range up so that the lower limit now sat at 40 cases up from 28 cases which is an increase of 12 cases. But to do this we now need to complete an average number of 62 cases per month! Alternatively we could try to reduce the monthly variation. We will still complete 50 cases on average but now the range is 40 to 60 cases. Pursuing the first option means we have to do more work to hit our target but opting for the second means we don't.



If you want to know more about variation the following book is an excellent and concise introduction: Wheeler,Donald J. Understanding variation: the key to managing chaos. SPC Press, 2000.

Step 6 – Review your data to decide what it is telling you

It is vital that you set time aside to look at what your measures are telling you. This can be incorporated into your Campaign steering group meeting if you have one or other regular meetings. If you don't have an existing meeting that includes the right people, you will need to set one up. It needn't be a long meeting, 30 minutes is perfectly adequate to review where you are and decide the next actions. Remember that the purpose of measurement is to lead you to making the right decisions about your improvement project.



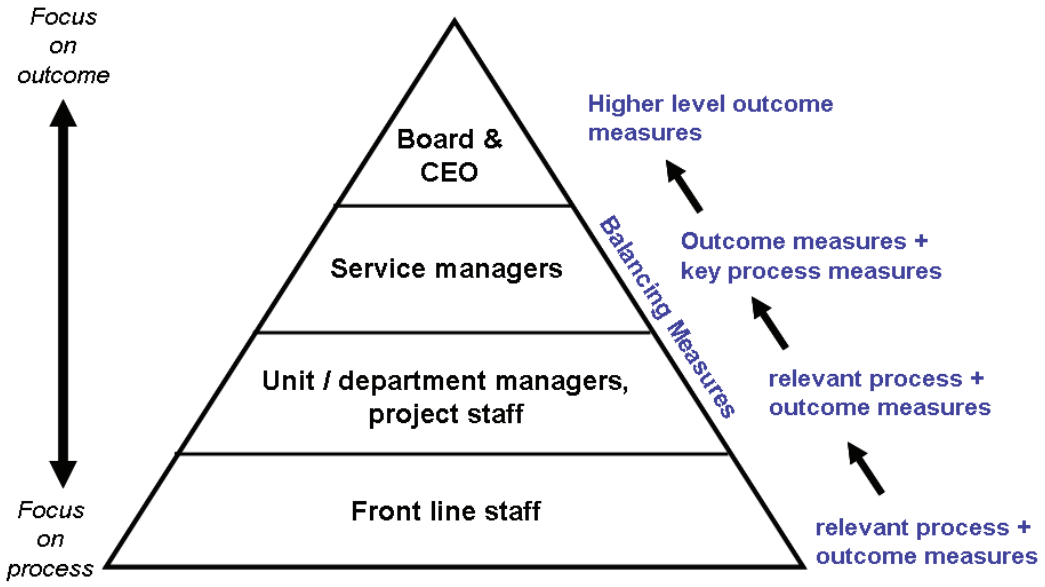
The Review meeting template in Appendix 2 may help you to set up and conduct your review meeting effectively.

Who needs to know what the data is telling you?

"The How to Guide for Leadership for Safety" (available at www.patientsafetyfirst.nhs.uk) outlines the roles senior leaders and the Board play in monitoring progress and driving the execution of projects. There is however a concern amongst this group that there is a potential for them to become overwhelmed with detailed data. For this reason there needs to be clear hierarchy of reporting so that each layer of the organisation only receives the information it requires for assurance and or decision making.

The key aim is to ensure that each layer of staff only receive the information they need to assure them that changes are progressing in the right direction and where they stand in relation to the hard red goal line. Balancing measures and lower level process measures may only need to be reported to the Board if there is a stall in progress suggesting there is a problem that requires their attention or a decision from them.

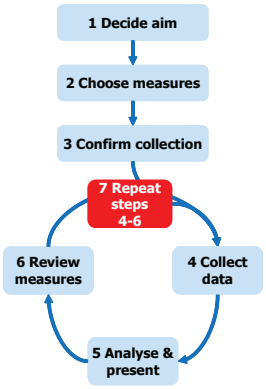
Figure: The hierarchy of measurement reporting



Adapted from Lloyd & Caldwell, IHI. 2007

Step 7 – Keep going!

Repeat steps 4,5 and 6 each month or more frequently.



If you are measuring compliance with a process (such as compliance with handwashing or the ventilator care bundle) aim for a minimum of 95% for non catastrophic processes. Obviously, for a catastrophic process (ie one where if it fails it will almost certainly result in serious injury or death) aim for 100%. Keep making changes until your data tells you this is so.

For outcomes (such as surgical site infection rate or number of central line infections), you are aiming to consistently meet or exceed your goal. If you are using SPC charts, ensure the goal sits outside the appropriate upper or lower limit.

When do I stop measuring?

The simple answer is “you don’t”. If you are consistently meeting your goal you should still look to see if there are further improvements that could be made. If you aimed for 0% or 100% and are meeting it consistently you should still continue to measure so that any deviations are picked up and acted upon quickly. In these cases you may decide to measure slightly less frequently, however be aware that the process of measuring does have a positive effect in keeping awareness high and demonstrating that the goals you are measuring are important to the organisation.

Appendix

Appendix 1: Measures template

Measures checklist

Measure setup

Measure name:	
Measure definition	What data item comprises the Numerator?
	What data item comprises the Denominator? *(Some measures do not require one)*
	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?

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 *Calculate measure and present results*	What is the process for presenting results? *Eg enter data in Extranet, create run 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?

Appendix 2: Review meeting template

Review Meeting Guidelines	
Where:	When:
Objectives	**Participants and roles**
Follow up on actions from previous meeting	Chair
Understand changes in performance since last meeting	Others
Discuss Issues, identify next steps and assign responsibility	
Who do I contact if I won't be here or can't update my chart?	
Inputs	**Outputs**
Agreed aims	Agreed action and responnsibilities
Update measures data	
Actions from previous week	
Agenda	
1. Welcome	1 min
2. Update on actions from previous week	5 min
3. Review charts and discuss changes since last week	5 min
4. Agree what actions to take to improve the measure	5 min
5. Decide who will take each action and by when	5 min
6. Confirm attendance for next meeting	4 min

Appendix 3: Expected number of runs

Tests for Number of Runs Above and Below the Median

Number of Data Points	Lower Limit for Number of Runs	Upper Limit for Number of Runs	Number of Data Points	Lower Limit for Number of Runs	Upper Limit for Number of Runs
10	3	8	34	12	23
11	3	9	35	13	23
12	3	10	36	13	24
13	4	10	37	13	25
14	4	11	38	14	25
15	4	12	39	14	26
16	5	12	40	15	26
17	5	13	41	16	26
18	6	13	42	16	27
19	6	14	43	17	27
20	6	15	44	17	28
21	7	15	45	17	29
22	7	16	46	17	30
23	8	16	47	18	30
24	8	17	48	18	31
25	9	17	49	19	31
26	9	18	50	19	32
27	9	19	60	24	37
28	10	19	70	28	43
29	10	20	80	33	48
30	11	20	90	37	54
31	11	21	100	42	59
32	11	22	110	46	65
33	11	22	120	51	70