For further information see
www.modern.nhs.uk

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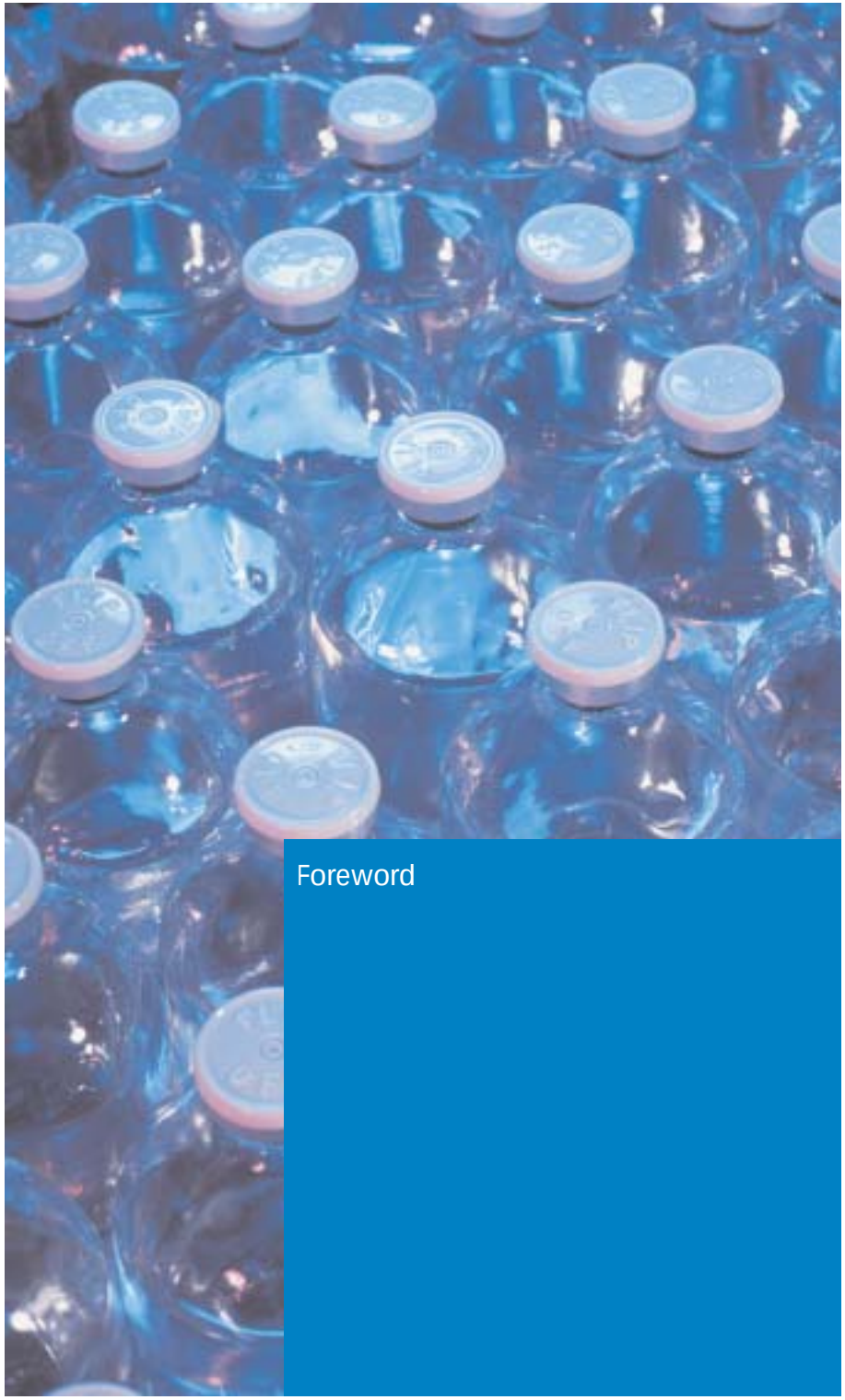
NHS
Modernisation Agency

Improvement Leader's Guide to

Measurement for improvement



Foreword

I am pleased to present this guide – one of a series for Improvement Leaders in the NHS.

A key objective for all of us in the NHS, whatever our role, is to continually look for ways to improve the experience and care of patients. Many improvements have been achieved already, whether as part of a large national programme, or on a much smaller scale, through the commitment of a small team of healthcare staff. Everyone involved in such projects has gained so much knowledge about initiating and sustaining these improvements.

The aim of this set of guides is to gather this knowledge into a summary of current thinking. We've put them together in response to a huge demand for tools and techniques to support improvement in patient care. All the guides include useful, practical advice that can be applied in healthcare settings. Written by experienced healthcare staff, they are aimed at all Improvement Leaders in the NHS – by which we mean everyone who wants to improve the care and experience of patients, whether a manager of a small team in general practice, a director of modernisation for a large Trust, or the clinical leader of a team of doctors, nurses or therapists.

As I said, the guides are based on current learning and thinking – but this is constantly changing. If you've found this printed version useful, keep checking the website on www.modern.nhs.uk/improvementguides
Here the guides will be regularly updated as we learn more and have new things to share.

Improvement and modernisation is really just beginning. It's an exciting time, and a great opportunity to develop and share new skills and understanding so we can truly make things better for our patients.

David Fillingham, *Director NHS Modernisation Agency*
April 2002

The Improvement Leaders' Guides

Collectively the Improvement Leaders' Guides form a set of principles for creating the best conditions for improvement in healthcare. The greatest benefit is when they are used to support a programme of training in improvement techniques.

Where should I start?

The seven guides are not sequential and ideally you should read them all at an early stage in your improvement project, to be aware of the tools and techniques in all the guides. However there are some things we would suggest you should do first, as you develop your plan based on local needs and experience.

Each guide includes

- some background information on the topic
- some activities which you, as an Improvement Leader, may find useful to help the teams you work with understand the basic principles
- questions that are frequently asked about the topic and suggested ways to answer them
- guidance on where to go for more information. Sources include the excellent toolkits that have been produced to support improvement programmes in specific services, such as Cancer, Critical Care, Mental Health and Clinical Governance. Useful books, papers and websites are also listed

Measurement for improvement

What's in each guide?

Improvement Leaders' Guide to…	What the guide has to offer an Improvement Leader
Process mapping, analysis and redesign www.modern.nhs.uk/improvementguides/process	This is definitely the place to start. This guide offers help in the use of the 'Model for Improvement'. This is a framework for setting aims, identifying the possible changes and beginning to think about measures that will show that your changes have made an improvement. Then there is the vital first stage of mapping your chosen patient process and analysing it to really understand what is happening.
Measurement for improvement www.modern.nhs.uk/improvementguides/measurement	Question: how do we know a change is an improvement? Answer: by measuring the impact of the changes. This guide should also be considered very early on in an improvement project and gives valuable advice on what and how to measure for improvement and how to present the data to interested parties.
Matching capacity and demand www.modern.nhs.uk/improvementguides/capacity	In our experience the process of truly matching capacity and demand has led to some of the most exciting changes in a healthcare process. This guide explains the most effective ways to understand the capacity and demand of a service and the 'bottlenecks' in the system which often cause patients to wait. It goes on to suggest ideas to reduce or eliminate these queues and waiting lists for patients. It is vital that process mapping and analysis is done prior to using this guide.
Involving patients and carers* www.modern.nhs.uk/improvementguides/patients	Everything we do should be focused on patients and their carers. They must be involved in our improvement programmes and projects from the very beginning. We are able to offer advice based on current thinking and experience of how to involve patients and carers in the most effective way, with warnings of possible pitfalls.
Managing the human dimensions of change* www.modern.nhs.uk/improvementguides/human	Some of us take to the idea of change more easily than others. Some like to develop ideas through activities and discussions, while others prefer to have time to think by themselves. We are all different and need to be valued for our differences. This guide gives ideas of how to ensure the best possible outcome when working with different people.
Sustainability and spread* www.modern.nhs.uk/improvementguides/sustainability	It is fundamentally important that after making improvements they are sustained and built upon. This is a real challenge to anyone involved in improvement projects. It is also important that we share our learning and ideas with other areas of healthcare so that the maximum number of patients can benefit. This guide suggests methods and principles based on experience from healthcare both in England and beyond for sustaining and spreading improvement ideas.
Setting up a collaborative programme* www.modern.nhs.uk/improvementguides/collaborative	Experience has shown that working collaboratively produces the best environment for creating and sharing improvement ideas. Use this guide when a group of healthcare staff want to work in a different way, to innovate and test new models of delivering care, to dramatically improve the service for a group of patients and to create learning for their own organisation and the whole of the NHS.

* Available July 2002

A few additional thoughts

The guides are based on current thinking and experience.

Be aware that this is constantly changing. Check updates on the Improvement Leaders' Guides website, www.modern.nhs.uk/improvement guides which will be updated often as we test out and learn from new techniques.

Be aware of your own experience.

If this field is totally new to you, plan how you can find out more through further reading or development courses. If you are more familiar with leading service improvements, can you share your experiences and knowledge with others in your healthcare community and the wider NHS?

Make contact with others who have improvement skills.

Many people in healthcare have had training in the improvement skills contained in these guides. Their training will most likely have been for a particular service such as primary care, dermatology or cancer. Make contact with them to form a health community improvement network to support and learn from each other.

Try it for yourself.

These guides don't represent the only way to do things, but they provide a good starting point. Create your own case studies and then share your experiences.

Take the thinking forward.

The website will be a dynamic medium. Please contribute to the discussion if you can. We would welcome and value your experience

Have fun.

Many have said that leading an improvement project has been one of the most enjoyable and fulfilling roles of their careers!

Let us know what you think of the guides.

We want your comments and thoughts about the Improvement Leaders' Guides. Our aim is to keep improving them so let us know what you think.

- how can we improve the guides? Is there anything we have left out?
- have you found them useful? If so which guide in particular and which section?
- how have you used them? Can you tell us any stories?
- if there were to be other guides, what topics should they be on?
- have you visited the web site? How can we improve it?
- is there any thing else you would like to tell us about the Improvement Leaders' Guides

Email us now on
improvementguides@npat.nhs.uk

Measurement for improvement

"The first step is to measure whatever can be measured easily. This is OK as far as it goes. The second step is to disregard that which can't easily be measured or to give it an arbitrary quantitative value. This is artificial and misleading. The third step is to presume that what can't be measured easily really isn't important. This is blindness. The fourth step is to say that what can't easily be measured really doesn't exist. This is suicide."

Charles Handy

Contents

1. Introduction

You are about to set off on your journey of improvement. You have agreed your overall aims and objectives and an outline project plan. You have contacted key stakeholders and got their support. You may have produced your first process map and are beginning to really understand the whole patient's journey. www.modern.nhs.uk/improvementguides/process
Before you do anything else, just take a little time to imagine yourself at the end of your journey:

- along that journey, you will have made many changes, ones which worked and some that didn't!
- how will you know which are the important ones?
- how will you know that the changes you have made have resulted in an improved service?

If you did not collect the right information to measure progress, you will not have the evidence to back up your gut feeling that things have got better. So how do you go about collecting the evidence to demonstrate the impact you've had? How can you impress colleagues with graphical representations of improvement?

2. Measurement for improvement

Measurement can be used in several ways.

- measurement for judgement: where measures are used to judge us against performance targets, other Trusts, etc. For this exercise, we are NOT interested in this. However, you can use measures to judge and manage your own progress

- measurement for diagnosis: where data is gathered to understand the process, to see if there is a problem and how big it is. This is a useful technique, especially early in your project – for example, to really understand the demand and capacity at a bottleneck in the process

- measurement for improvement: where a few specific measures, linked to the programme objectives and aims, demonstrate whether the changes are making improvements

The basis for our measurements falls naturally out of the Model for Improvement, opposite. This model asks three key questions. In answering them, you move towards improving your service. Measurement is fundamental in answering the second question: "How do we know a change is an improvement?"

Measuring is one part in the whole model. The Model for Improvement is a really useful framework for setting objectives and targets, as well as using Plan, Do, Study and Act (PDSA) for testing out ideas. This helps to ensure they are the changes which will make the improvement you want before you implement them. For more information about the Model for Improvement refer to the Improvement Leaders' Guide on Process Mapping, analysis and redesign www.modern.nhs.uk/improvementguides/process

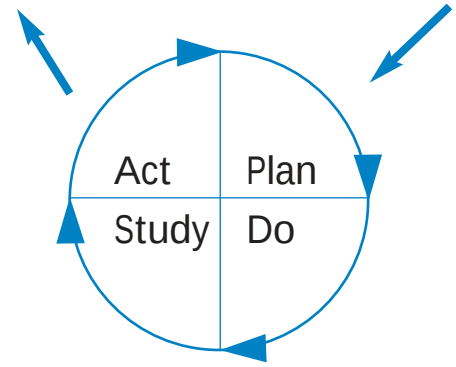
There are a variety of other models to help teams set their aims and targets, measures and then plan the introduction of changes that will result in improvement. RAID is another model for change currently used by the Clinical Governance Support Team of the Modernisation Agency.

RAID stands for

- review:
  look at the current situation and prepare the organisation for change
- agree:
  ensure staff are signed up to the proposed changes
- implement:
  put in place the proposed changes
- demonstrate:
  show that the changes have made improvements.

The Model for Improvement (© IHI)

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 improvement?



The Model for Improvement
Langley G, Nolan K, Nolan T, Norman C, Provost L, (1996), *The improvement guide: a practical approach to enhancing organisational performance*, Jossey Bass Publishers, San Francisco

Remember: All improvements involve a change, but not all changes are improvements

3. What measures to choose

Case study
The Cancer Services Collaborative
One of the objectives of this national programme is to reduce the number of days between date of GP referral to first definitive treatment. This is the measure that is reported monthly. However, the data is collected at different stages between those two points including:

- date of GP referral
- date of first visit to hospital
- date of referral to specialist team
- date of first visit to specialist team
- date of first diagnostic test
- date of histiological test results being available
- date of decision to treat
- date of admission for first treatment
- date of first definitive treatment

This makes it more manageable and meaningful for the different teams involved along the whole patient journey, and allows the project team to see where there may be major hold ups for patients

3.1 Key tips to remember when starting to measure

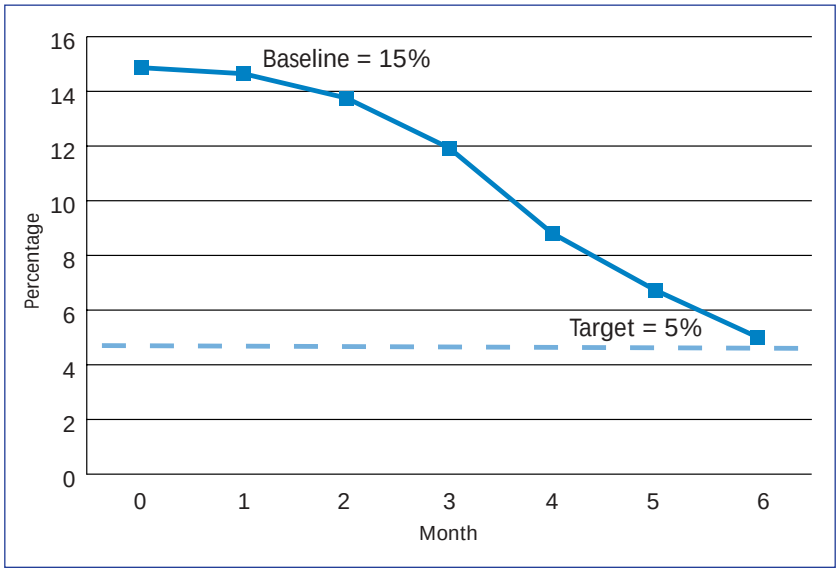
- measurement should be used to speed improvement up, not to slow things down. Seek usefulness, not perfection. Remember, the goal is improvement, not the development of a measurement system
- key measures should clarify your project team's objectives and make them more tangible
- link any measure to an objective, so examine each of these in turn making sure each objective has a specific measure
- link the measures for the improvement project with other initiatives in the health community, eg clinical and professional audit, clinical governance
- make sure you involve all your stakeholders in these discussions
- you should aim to integrate measurement into your daily routine, so it is not a chore but a pivotal component to your project. To do that, you'll need a balanced set of measures – no more than six – to assure the team that the care process is being improved. The table opposite gives some examples:

TIP
Specify each measure very precisely so that you avoid confusion over meanings.

Objective	Suggested measures
Improve access for patients	• number of days/hours between two defined points in the patient's journey
Provide a comprehensive pre-operative assessment service	• % of patients receiving a pre-operative assessment
Improve theatre utilisation	• % of patients who DNA at admission • % of hospital and/or patient cancellations
Place patients on the right route of care	• % of patients who follow an agreed protocol
Provide certainty and choice for patients	• % of patients having a 'booked appointment' at defined stages in the patient journey
Improve patient and carer experience	• everything we do should be focused on patients and their carers – so they must be involved in our improvement programmes and projects from the very beginning. The Improvement Leaders' Guide to Involving Patients and Carers www.modern.nhs.uk/improvementguides/patients offers advice on how to involve patients and carers and how to measure the effects of changes on their experiences.

- it is very important to establish definitions of the measures you are going to use from the start of the project. The definitions have to be clear and easily understood, particularly when a lot of people are involved in the collection of the data
- you may need to divide the overall measure into more manageable parts
- once the measures are agreed and the improvement teams are formed you should do three things as soon as possible:
  – define the starting point or baseline. Ensure your baseline covers sufficient time before the improvement project began. This way you will be able to show that your project has had a positive impact

Example of a run chart: Percentage of hospital led cancellations measured monthly



– set a target
– set up a system to monitor your progress regularly on a line graph (run chart) and feed back to your stakeholders. The figure above was created in Excel. It shows the baseline and target, and progress toward that target over a six-month period

3.2 Measuring capacity and demand

In our experience, the process of truly matching capacity and demand at a 'bottleneck' in the system has led to some of the most exciting changes in a healthcare process. One of the first things to do is to measure capacity, demand, backlog and activity accurately. This is so important that there is an Improvement Leaders' Guide specifically on this topic. It explains the most effective ways to measure and understand capacity and demand at the 'bottlenecks' in the system which often cause patients to wait. It goes on to suggest ways to reduce or eliminate these queues and waiting lists for patients. It is vital that process mapping and analysis is done prior to using this guide. www.modern.nhs.uk/improvementguides/capacity

3.3 Setting a target

- spend some time at the beginning of your project setting a target with your stakeholders that is both realistic and ambitious
- make sure your targets are linked to your project aims and objectives
- be realistic in your expectations – don't think you can totally eliminate all inappropriate admissions or DNAs
- express the target as a value, not as an improvement. For example, if baseline throughput in a clinic is 5 patients / hour and you want to improve by 10%, then state target as 5.5 patients/hour
- avoid confusion over percentages: if the baseline is 10% DNA rate and you want to improve (reduce) by 25%, then state the target as wanting to achieve a 7.5% DNA rate

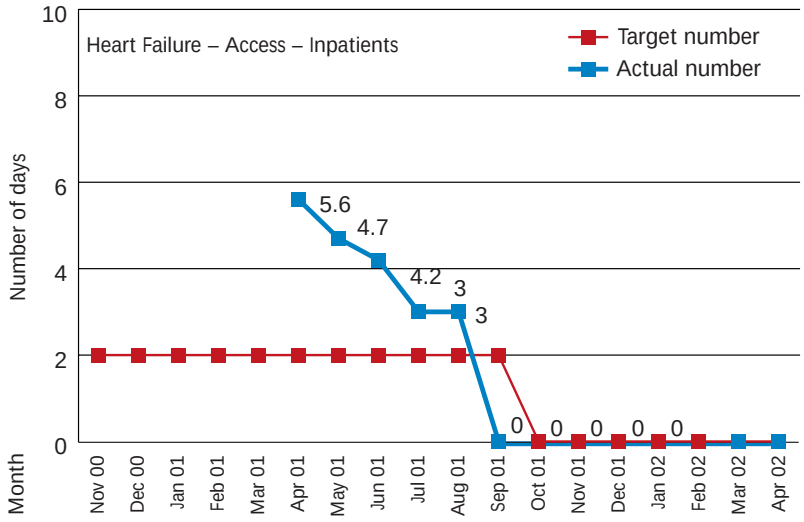
Remember that targets are not entirely set in stone

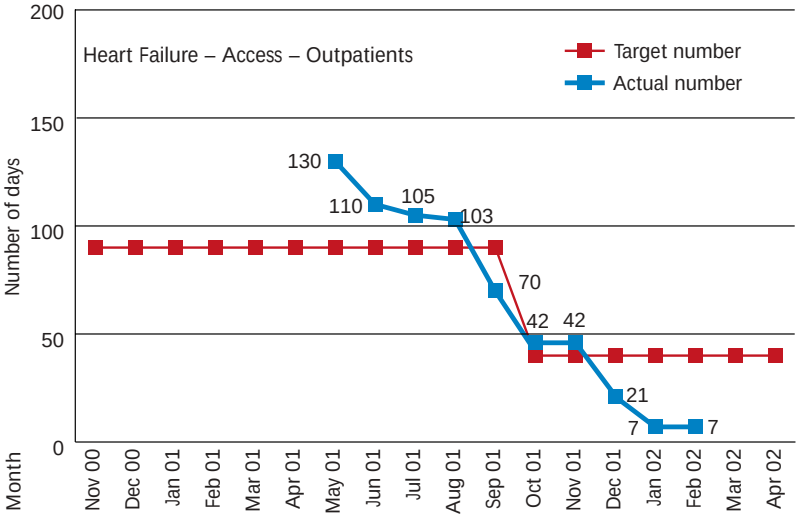
- set a time at some early stage in the project to reassess the target in light of problems you have found, willingness of those involved to try new things, etc.
- if the target is too ambitious, agree a more realistic one that still stretches the team
- if the target is too 'easy', encourage the team to set a more ambitious one
- reassessment of targets must be agreed with your stakeholders and, if it is part of a national project, with National Project Managers

Case study
Echocardiography Service in London
The team measured time, in days, from the request for echocardiography to the results being obtained by the referring clinician for inpatients and outpatients. The team's initial targets were soon achieved by some of the early implemented changes. Motivated by their success and confident that they could make things even better, they set a more ambitious target. Within another six months, they had achieved the new targets as well!

Case Study: Echocardiography Service in London

The team measured the time in days from requesting echocardiography to the time the results are available for the clinicians. There was a great difference for inpatients and outpatients. The team worked hard and drastically reduced the delay for both groups of patients.





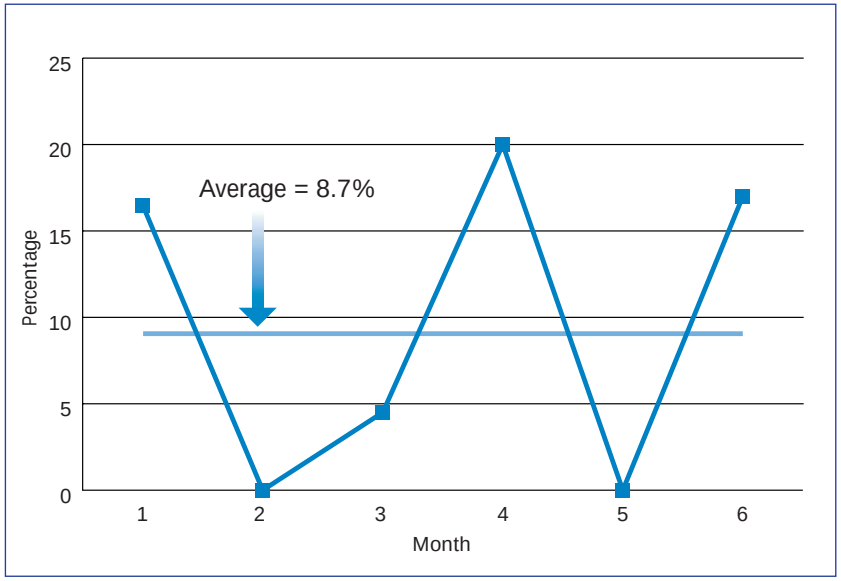
3.4 Establishing your baseline

It is very important that the period you choose for your baseline is representative. In the figure below, the DNA rate is very variable from month to month. Taking the whole six month period, the average is just under 9% but it had been as little as 0% and as high as 20%. You will get very variable rates when the actual numbers involved are small.

This graph shows the danger of making a measure for judgement. Measuring at month 1 and then at month 5, it would be easy to conclude, wrongly, that there had been a vast improvement in the DNA rate.

In an ideal world, you need at least six points on the graph to make an assessment of the baseline, and at least 24 to have any understanding of the variation in the system. But remember, this is in the ideal world – don't use it as an excuse to stop measuring.

Example DNA rates with large variation



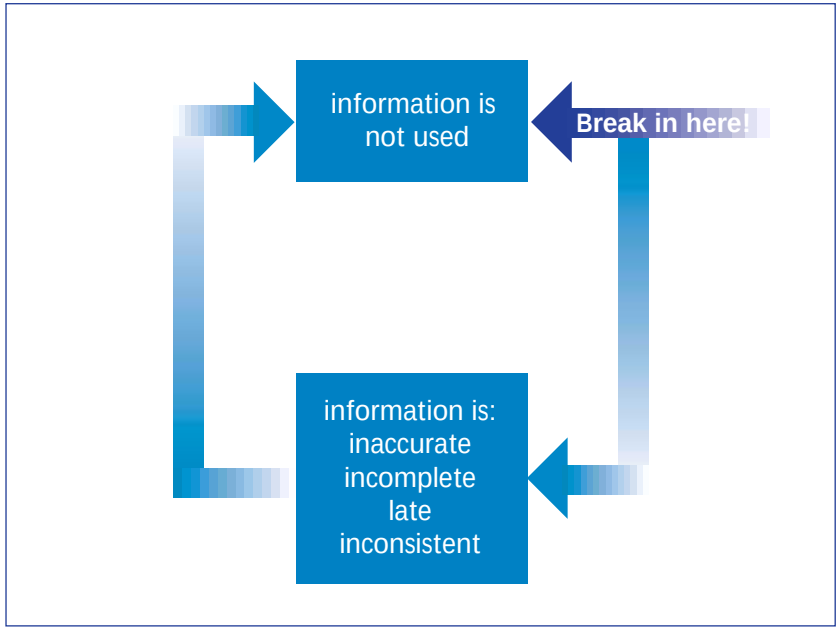
3.5 Collecting data

Whatever your measures are, you will be collecting data. For quantitative measures, that means numbers of patients, of events etc. For qualitative measures, it means more descriptive information in text form. When collecting your data, ask yourself these four questions:

- have I defined the data so that I get exactly what I want?
- how accurate is it and does it matter?
- can I rely on it being consistent?
- do I have to trade off the quality of the data for the time taken to collect it?

Poor quality information leads to the information vicious circle shown below. We are reluctant to use the information, because we're worried about the quality; and if the quality is poor we won't use it. The best way to improve data quality is to start using it for real. So start using it – it's only then that quality can start improving.

The Information vicious circle



3.6 Establish channels for getting data on a regular basis

- use existing data if you can
  This is data that is already being collected. Your job is to make friends with your Information Manager and uncover what exists. Remember, if there has been an input of data, it can be extracted – it's just that no one has asked for it before. Invite the Information Manager to the department, show them what is already input and explain what's needed. Then ask them to find what exists and whether you can use it. Remember, you need to ensure accuracy, completeness and consistency of the data for it to be used effectively.

- collect it yourself
  You may find that you need to collect the information manually at first. This is the case in many improvement projects. Introduce the data collection system and monitor it to ensure that it can be maintained. Neither you nor the team should be disheartened: it does not take long before people adapt it into their daily routines and it becomes mainstream.

3.7 Sampling

When you're collecting a sample, for example of patient data, knowing the overall patient volume will allow you to work out whether your sample is 0.01% or 10%. The former is probably too small a sample to be representative, the latter is probably acceptable.

Some of your numeric data will be census data, which is collected at a particular day or time of day. Other data will be measured continuously over a period of time (eg 24-hour period).

The main thing is to be consistent. If your target is a census number, then measure progress at fixed points in time too. Do not suddenly change your sample size and method half way through the reporting period.

TIP
Make your Information Manager your best friend! They can be an invaluable source of help and advice.

4. Presenting your data

4.1 Keep the presentation simple

You have carefully set up your measurement strategy and diligently collected the data. Don't ruin it by sloppy or unimaginative presentation! Remember that a picture is worth a thousand words and much easier to read than tables.

You should aim to make your charts or diagrams easy to understand. The main point to remember is one graph, one message.
Use line graphs (run charts) and simple bar charts when creating your charts in Excel. Avoid stack bar charts and any sort of three-dimensional graphs. There is a place for three-dimensional graphs; it's on the front cover of your report to make a pretty picture. Use pie charts sparingly and, ideally, have between three and six slices.
Look at the data below. Presented as a table, it is difficult to see the trend.

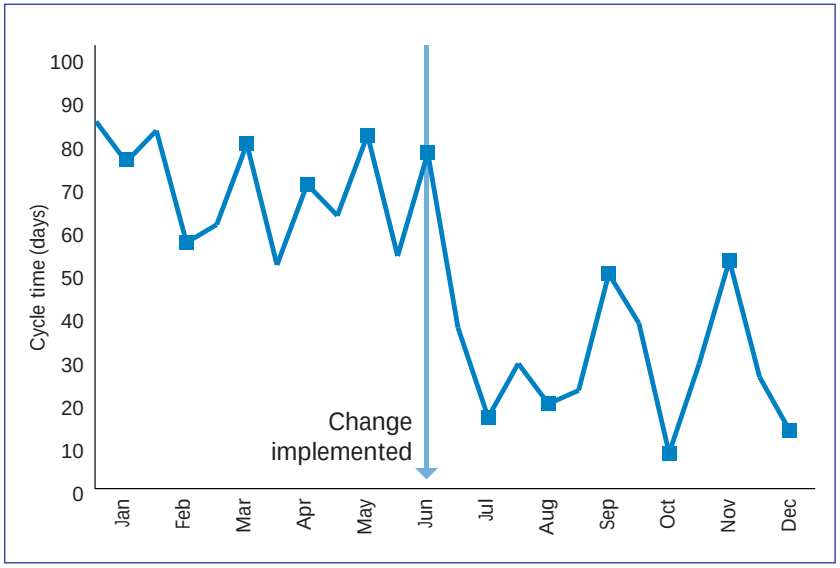
Example of poor presentation data – number of days between GP referral and appointment with specialist

Date	Cycle time *(days)*	Date	Cycle time *(days)*
	85		39
Jan	76	Jul	19
	83		31
Feb	58	Aug	22
	62		25
Mar	80	Sep	51
	53		40
Apr	71	Oct	11
	64		31
May	82	Nov	54
	55		28
Jun	78	Dec	16

Change implemented in June

TIP Using the Drawing toolbar in Excel you can add where you've made changes so the impact on the measure is highlighted

Same data presented as a run chart – number of days between GP referral and appointment with specialist



However, the same data presented as a line graph (run chart) shows the impact of an implemented change on the cycle time.

4.2 Run charts

A run chart is a line graph. It is used when you want to show performance over time, or when you want to look for trends and patterns over time – for example, if an implemented change is making things better, worse, or having no effect.

Look at the example of the run chart above. If just two points – eg February and September – were considered in isolation, one would be tempted to say that the cycle time has hardly changed, but with at least six points it is clear that the cycle time goes up and down. This is the variation. From June onwards, there is still variation in the system but the implemented change has improved the system overall.

To ensure that run charts are interpreted correctly, keep a record of external factors and events that may influence the outcomes eg when a clinician is absent because of illness.

4.3 Reporting

The best way to demonstrate improvement is via your measures and run charts. They are a powerful visual aid to keep your team, your service and your health community informed of your progress.

If the improvement project is not part of a national, regional or local programme where the reporting system is specified, you should set up your own reporting system.

It may help you to consider the following points:

- who should the measures be reported to? Consider the Chief Executive, Trust Board, key stakeholders, steering group, as well as all those involved in the project
- how often should the reports be made? A regime of monthly reporting helps to keep the momentum of a project going
- what else besides the measures on run charts could be reported each month?

Consider including in your monthly reports:
- project aims statement, so that everyone knows exactly what you and your team are trying to do
- definition of measures with target, baseline and measure achieved this month
- the change ideas you have tested that month (PDSA cycles) and changes implemented. People reading your report may want to test these useful ideas in their areas
- the changes you have implemented. These should be marked on the run chart, so you can clearly see the relationship between the change and the effect it has had
- other progress you have made such as arranging a meeting for a group of people who have previously never worked together
- any issues and challenges you have had in that month and how you are going to address them
- key actions for the following month

Make sure you and the improvement teams use the reports as an aid to your project:
- take them to meetings to highlight issues, gain support and agree actions
- celebrate when the run charts start to show improvements!
- but be aware of the consequences of a change in one patient process on other systems

4.4 Measuring variation for sustainability

Control charts

When a process or service has been improved to meet the target set, the next big challenge is to keep that improvement. This can be helped by continuing to measure regularly, using a control chart.

We use the principles of control charts in everyday healthcare: monitoring temperature, pulse, and respiration on TPR charts. Here the data is collected regularly. Small amounts of variation are acceptable, but if the measure, eg respiration, were to go beyond an acceptable limit, you would do something.

You can use a similar method to ensure that all the improvements you have made are continued.

Control charts are basically run charts, with two distinct differences:
- a line showing the target achieved in the improvement project that needs to be sustained
- two lines showing the upper and lower process control limits. If the entry falls outside these limits, you and the team should find out what has caused it and, possibly, take action to bring the measurements back within acceptable levels

This is the principle of **Statistical Process Control**[1] (SPC). This is something we need to learn a lot more about. Watch the website for more information as our experience grows: www.modern.nhs.uk/improvementguides

Exemption reporting in care pathways

Care pathways are an excellent way of recognising and reducing variation in patient care. A good care pathway includes:
- a clear description of the ideal patient journey
- what is to happen, where, and by whom
- clear specific and measurable goals for each step of the patient journey based on good clinical evidence
- notes on patient care

Also there should be space to record variations from the plan. It is in the examination of this section, and the actions taken to reduce or eliminate variation, that the improvements will be made. Any variation from the desired plan should be clearly stated and the cause identified. Variations should be discussed by the team and actions agreed as part of a continuous quality improvement programme.

[1]Reference: Shewhart WA, Deming WE 1987 *Statistical Methods from the Viewpoint of Quality Control*, Dover Publications

5. Activities to support measurement for improvement

Before organising any activity, consider the following:

- who is the audience?
- what is their prior knowledge?
- are the location and timing of the activity correct?
- recognise and value that participants will want to work and learn in different ways. Try to provide information and activities to suit all learning preferences

Why is this important?

Some of us take to the idea of change more easily than others. Some like to develop ideas through activities and discussions, while others prefer to have time to think by themselves. We are all different and need to be valued for our differences. The Improvement Leaders' Guide to Managing the Human Dimensions of Change gives ideas of how to ensure the best possible outcome when working with different people.
www.modern.nhs.uk/improvementguides/human

5.1 The messages of run charts

Objective

- to improve the understanding of the use of run charts in measuring for improvement

Benefit

- easy to do, but you need to be quite clear about the measures and the details behind the run charts for discussion

Time required

- 30 minutes

Preparation

- collect a selection of run charts, some showing improvement, some showing things getting worse, some showing fluctuating results, some showing targets already being met and some with inadequate labels
- paper and pens for all participants
- participants work in small groups of 5-8, preferably on round tables in cabaret style
- each group has a selection of run charts

Instructions to participants

- consider each run chart in turn
- consider the following questions:
  - is this run chart demonstrating improvement? Yes or No
  - what are the reasons for the improvement, or the reasons why no improvement is being demonstrated?
  - how could the run chart be improved?

Learning points

- the use of run charts to show improvements
- the need to measure over time
- the impact of the data on the run charts
- the importance of correct labelling on a run chart

6. Frequently asked questions and answers

Question
Where do we start?

Answer
First you have to decide what you want to improve, and then decide how you can best measure that improvement. Involve the whole team – this will help them to own the measures, especially as they may well be measuring manually to begin with. It's good to have a mixture of both qualitative and quantitative measurements.

Question
We have no baseline data – can we still start to measure?

Answer
Yes, you still need to collect data and it is best to start as soon as possible. You may even use the first month as the baseline. This way you can see what things were like before you start to make changes.

Question
How will all this really help us?

Answer
It will show when changes introduced begin to make improvements for patients – a great boost for the team. The combination of measurement, along with process mapping, and analysis and all the redesign ideas behind matching capacity and demand, will help to show other areas for change. They will also provide wonderful support in business cases for extra resources, as you can show that all other options have been considered and tested.

Question
How do we get our clinicians on board?

Answer
Find out what it is that will make their lives easier: for example, no longer having to vet referral letters because **all** patients will be seen in two weeks, or not having to deal with regular complaints from patients who have been waiting hours. Make sure you work on these areas early on in the project.

Question
How can I collect all this data when we are up to our eyes in data collection already?

Answer
It is difficult, but a good starting point is to contact the information department of your healthcare organisation. They may be already collecting the data. Meet with the Information Manager, discuss your data requirements and agree a plan for how that information will get to you – eg in what format, agreed timescales, etc

If the data is not already available, you will have to set up your own system. The best way is to bring the clerks in on the act. If they are involved in the process mapping exercise initially, they can often see the need for shortening the process time for patients – after all, they have to deal with all the complaints. Involve them in the design of the data collection, and ask them to test it out in one clinic and see how easy it is to use.

Question
How can you justify making changes with such an unscientific method?

Answer
Statistical process control (SPC) is a scientific method developed by an economist, Shewhart, in the 1930s. The statistical method behind measuring for improvement in an environment in which one cannot do a double blind trial is different from the statistics we learn for judgement in our professional training.

Also, the improvement method recommended is not about creating new knowledge, but testing change ideas that already exist. Just make sure you collect the right data and involve as many people as possible. That way you should have the evidence and the support to make the right changes.

Question
Why do we have to report monthly – can't we report every three months?

Answer
Reporting regularly is essential for measuring improvements. The more often you take your measure, the more quickly you can see if you have made a difference. A lot can happen in three months and by measuring monthly, you are more aware of the situation. Then you can intervene and take action if things are not improving as quickly as you would like them to. To make a valid assessment of impact, you need six points (six months) showing a sustained improvement after the implementation of the change.

Question
The measures in this guide tend to be based on quantitative measures. How can we make sure that we involve patients and their carers and measure their experience?

Answer
This is so important that there is an Improvement Leaders' Guide dedicated to this topic. Everything we do should be focused on patients and their carers, so they must be involved in our improvement programmes and projects from the very beginning. We are able to offer advice based on current thinking and experience of how to involve patients and carers, and measure their experience in the most effective way. www.modern.nhs.uk/improvementguides/patients

Question
We have set up all our improvement initiatives as projects. Should we carry on measuring after the end of the project?

Answer
Yes, it is fundamentally important that after making improvements that they are sustained and built upon. This is a real challenge to anyone involved in improvement projects. The Improvement Leaders' Guide to Sustaining and Spreading Improvements www.modern.nhs.uk/improvementguides/sustainability suggests methods and principles based on experience from healthcare, both in England and beyond, for both sustaining and spreading improvement ideas. Developing measurement systems along with a feedback mechanism is vital to this.

7. Case study: Developing measurement for improvement – Cancer Services Collaborative Phase 1

As Improvement Leaders you will probably find that measurement is one of the most challenging areas you will face. It is not easy to choose what to measure and collect good data. So we have included this case study to explain the development of the system to measure improvement for the Cancer Services Collaborative (CSC) Phase 1. We are telling the story because we have to see measurement as part of a bigger picture. We cannot look at measurement in isolation from other aspects of an improvement innovation.

The case study starts with the background to CSC, explains how it was set up, goes on to discuss the science underpinning the programme and explains how teams were asked to prepare for the programme. The last three sections summarise some of the learning that came from this early national improvement programme and makes recommendations which you as Improvement Leaders should consider before starting out. We hope you find it useful and that it links together the advice given throughout this guide.

Key lessons
As the Cancer Services Collaborative demonstrates, we rarely get measurement systems 'right first time'. We have to start somewhere but we must keep reflecting, learning and improving our systems of measurement for improvement.

Background
Phase 1 of CSC involved 51 project teams in nine cancer networks across the NHS. They worked intensively for 18 months until March 2001.

Each participating cancer network undertook projects focusing on patients with a specific cancer: bowel, breast, lung, ovarian and prostate.

The goal of the CSC was to improve the experience and outcomes for patients with suspected or diagnosed cancer by optimising care delivery systems. This was to be achieved by:

- providing certainty and choice for patients across the process of care
- predicting patients' requirements in advance and pre-planning and pre-scheduling their care at times to suit them

- reducing unnecessary delays and restrictions on access
- improving patient and carer satisfaction by providing a personalised consistent service
- ensuring the patient receives the best treatment, in the best place, by the best person/team

Another aim of the CSC was to provide learning for the wider NHS about improving healthcare systems.

The basis for the methodology used in CSC was the collaborative improvement method developed by the Institute of Healthcare Improvement (IHI) in the USA. It has been tested in more than 100 improvement programmes around the world. The collaborative improvement method is an approach that relies on spread and adaptation of existing knowledge to multiple settings to accomplish a common aim.

The key ingredients of the collaborative method are:
- a flexible approach to testing, adapting and implementing changes
- packaging of specific evidence based subject matter and knowledge (best practice)
- small scale testing to create momentum for making big changes to the system
- effective use of data for learning
- collaboration with other teams and experts in the subject matter

The programme tested improvements with small groups of patients before sharing the learning and the most effective improvements to other cancer networks, other groups of patients with cancer and the wider NHS.

To know more about 'collaborative thinking' look at the Improvement Leaders' Guide to setting up a collaborative. www.modern.nhs.uk/improvementguides/collaborative

The science underpinning CSC

Improvement Science was the basis for CSC. By 'improvement science' we mean the disciplines of quality assurance and improvement, which includes such things as process analysis, design, statistics, customer needs, research, and so on. These concepts and methods have been formally developed and studied in general industry for over 70 years and have become more widely known, studied, and applied in healthcare around the world in the past decade. We use the term 'science' here because we want to emphasise the deliberate use of cycles of observation, hypothesis or theory generation, testing, measurement and reflection as the means for building knowledge for improvement.

The following table contrasts the methods of Improvement Science with Traditional Clinical Research.

Standard research methods/ traditional clinical research	Improvement science
Aim: new healthcare knowledge	Aim: improvement in healthcare practice
Methods: • blinded tests • eliminate bias • collect large amounts of data • fixed hypothesis • one large study	Methods: • observable tests to build a will to change • stable bias over time • collect 'just enough' useful data • continual adaptation of the changes • many sequential tests

Standard research methods were not considered appropriate for a number of reasons. These reasons are outlined below:

Standard research methods	Cancer Services Collaborative
• research studies are usually designed to avoid the technical difficulties caused by complex social situations	• recognition that the journey of a patient with cancer through a healthcare system is extremely complex
• new knowledge from clinical trials is often slow to be adopted to standard practice	• the emphasis was to accelerate the testing and implementation of changes to make improvements in line with the programme and project aims
• opportunities for learning and improvement from observation are not usually incorporated into research design	• CSC was an innovative programme designed to test, learn and make improvements not only in the care of patients with cancer but also in the methodology used
• the number of changes identified within the CSC would require an extensive number of clinical trials	• each project started from a different basis to any other project even when considering patients with the same cancers. Therefore each project identified and tested changes relevant to that system of care.

Preparation of teams for CSC, November 1999

- identifying a patient 'slice' for each project
  Each project focused on redesigning the system of care delivery for a specific group or 'slice' of cancer patients across the total process of patient care. The slice approach was chosen because there are typically too many patients within a cancer network to pilot new ways of working. The slice approach concentrates on a specific group of patients and follows them through every stage of their healthcare journey. We wanted to transfer the learning from the initial 'slice' of patients to all the other patients in the network over a period of time.

- writing an aims statement and targets
  Each project team was expected to develop a written aims statement related to the group of patients or slice, stating what the team expected to achieve over the 18 months of the project.

- developing measures for improvement
  Each team was expected to develop a set of measures to reflect improvement against their project aims. There were five categories of measurement within the Cancer Services Collaborative and project teams were expected to adopt at least one measure from each category.

The categories of measurement were:
- access
- patient flow
- patient and carer satisfaction
- clinical effectiveness
- capacity and demand

- establishing the baseline situation
  Each project team was asked to establish the baseline situation for their measures using a sampling system. This enabled the teams to work out their starting point.

- reporting data
  Each project team was expected to submit a monthly report including run charts of their selected measures.

Learning from CSC phase 1

Much was learnt about measuring for improvement during the programme and at the same time, the teams made many impressive improvements for patient with cancer.

- identifying a patient 'slice' for each project
  The concept of a patient slice was new to all project teams. Some teams initially identified a slice, which was later realised to be far too 'thick' and complex, difficult to manage and extremely difficult to measure. This was often due to the motivation of clinical staff and their wish to be involved in CSC.

Examples of slices:
- a slice that is too 'thick': all referrals for patients with suspected bowel cancer, to several consultants in several different hospitals who in turn refer to one oncology service
- a slice that worked: all patients with suspected bowel cancer referred from one PCG, to one surgeon in one Trust and on to one oncology centre and back to primary care.

- writing an aims statement
  Initial attempts at written aims statement were often too vague. This was due to unfamiliarity with the rigours asked in setting the aims statement, reluctance of some teams to be 'tied down', and confusion, especially when the patient slice was not clearly defined and when measures were still evolving.

Examples of aims statements:
- poor aims statement: To improve the experience and care for patients with bowel cancer by implementing booked appointments and reducing the time from referral to treatment
- good aims statement: To improve access, speed of diagnosis, speed of starting appropriate treatment and patient and carer experience for those with suspected or proven bowel cancer. This will be achieved by:
  - introducing booked admissions and appointments.
  – target – more than 95% of patients will have a booked appointment
  - reducing time from GP referral to first definitive treatment
  – target - less than 50 days
  - ensuring patients are discussed by the multi-disciplinary teams
  – target – more than 80% of patients
  - efforts and measurements will be concentrated on a defined slice of patients, at four key stages of care: GP referral, first specialist appointment, first diagnostic test and first definitive treatment.

- agreeing targets, measures for improvement, baseline measurements and methods of reporting data
  These four factors of the programme are directly linked together with the aims statement. This caused understandable confusion and frustration in the early stages on the CSC programme:

- if teams had not defined the slice, they could not measure the baseline situation
- if teams did not know what the measures for improvement were, they could not measure the baseline situation
- if teams did not know what the baseline situation was, they could not set a realistic target
- if teams did not know what the target was, their aims statement was incomplete
- if all of the above, it was very difficult to complete the monthly report in a way that was meaningful for the teams

When trying to start measuring and identifying the baseline situation, teams found that there were few data collection systems in place to record process data. This meant they had to set up their own systems, which took a lot of time and effort.

Reporting the data, which was difficult to collect, caused more frustrations. Many found the monthly report to be an added chore and few teams considered it a valuable tool for themselves, particularly in the first half of the collaborative. Teams were also frustrated that much of the valuable progress being made did not show on monthly run charts, eg achieving a regular meeting between two different groups of clinicians who previously had never met or developing a multidisciplinary care protocol.

Recommendations for Improvement Leaders

The rich learning from CSC phase 1 has been incorporated into many subsequent improvement projects. As Improvement Leaders it would be useful for you to consider each of the following recommendations for your improvement initiative.

Slice:
As the aim is to improve the care delivery system, it is vital to identify a system to test improvement ideas on. If you want to make improvements to a patient's journey that go across agencies, organisations and departments, we would advise you to use a slice. An 'all inclusive approach' is not the best foundation for systems improvements and makes measurement even more difficult.

Recommendation:
Be clear about what you mean by a 'slice'.

- if the improvement initiative were for a group of patients that goes across multiple agencies, organisations and departments, then your slice would be one group of patients whose process goes across all those agencies, eg all patients with suspected bowel cancer referred from one PCG to one surgeon in one Trust and on to one oncology centre and back to primary care
- if you were looking at the whole of the histopathology service your slice would be very different. You would identify a number of slices within histopathology including patients needing cytology tests, biopsy tests, post mortem examinations etc
- the key is to keep the slice as small as possible to make it manageable but big enough to be informative
- you should help your improvement teams to be very precise in defining their 'slice' but make sure you find ways to keep others, not in the slice, motivated and engaged.

Measures:
It is a fine balance between encouraging local ownership and setting a direction for a programme, eg defining compulsory programme measures.

Recommendation:
As leaders of improvement programmes and projects, you should discuss measures with all your stakeholders and team members. You need to define and agree common measures at the earliest possible stage. Leaving teams to develop their own measures, even within certain parameters, creates too much variation. If you are part of a national programme, there will be a process for discussing and deciding common programme measures nationally.

Baseline assessment:
All teams need to accurately assess the baseline of the measure.

Recommendation:
Encourage your teams to get at least six points on the run chart to make an assessment of the baseline and begin to understand the inherent variation in the system.

Reporting:
Some teams consider the reporting systems to be a method of performance monitoring for someone else, not a tool for their own use.

Recommendation:
Encourage your teams to see the benefit of regular reporting and the use of statistical process control as a means to improvement and help them to use the monthly reports as a means of local communication with all team members and stakeholders.
You might find it useful to return to some sections for more information about these measurement issues.

- setting an aims statement
  see the Improvement Leaders' Guide to process mapping, analysis and redesign, section 2.2
- deciding what to measure
  see section 3.1 and 3.2
- setting a target see section 3.3
- establishing a baseline
  see section 3.4
- presenting data
  see sections 4.1 and 4.2
- reporting,
  see section 4.3

Conclusion

The basis of the methodology described in the Improvement Leaders' Guide to Measuring for Improvement is to study the statistical variation in one system. This is followed by improving that system's performance by making small incremental changes to it and noting the effect that the change has on the variation in performance within the system. It is not an easy approach to take and this national programme, Cancer Services Collaborative Phase 1, was the first opportunity to learn how to do it.
One of the initial aims of CSC was 'to provide learning for the wider NHS about improving healthcare systems'. This aim was achieved especially with respect to learning about measuring for improvement. All the Improvement Leaders' Guides are strongly influenced by the learning from the CSC and subsequent improvement initiatives.

8. Useful reading for more information and ideas

Much has been written about improvement and change. So much, that it is very easy to get overwhelmed by all the material. So we've gathered together the things that we think you might find most useful. We would like to guide you in three directions:

1. Toolkits
These have been developed by national and regional programmes for staff addressing the issues for one particular aspect of care. This can range from general workforce planning issues to addressing the problems of a particular service, eg mental health, endoscopy or orthopaedics. They are written for clinical staff in the specific service and will give you many more change ideas, lots of case studies, national contact names and information on how to access up-to-date improvement activity in that particular area or service
Use: when you have identified a problem associated with a particular service.

2. Books, papers and articles
These have been written by international experts in their field addressing the science and theory behind many of the tried and tested tools and techniques in the guides.
Use: when you want a deeper understanding in any of the topics.

3. Websites
Time is precious and the World Wide Web is vast. Therefore we want to guide you to the selected websites designed to extend your knowledge and thinking on improvement theory.
Use: when you want to extend your general knowledge and gain access to improvement thinking around the world.

So visit the Improvement Leaders' Guide website for the useful reading section www.modern.nhs.uk/improvementguides/reading This will be continuously updated as new editions are published and you tell us what you find useful.

9. Glossary of terms

Some of the words used in improvement have been defined. Use them carefully.

Activity	All the work done. This does not necessarily reflect capacity or demand, as the activity in June may well include demand carried over from May, April, or even March
Backlog	Previous demand that has not yet been dealt with, showing itself as a queue or a waiting list
Batching	Piling up a type of work as it comes in until a later time when all this type of work is done together
Bottleneck	Part of the system where patient flow is obstructed, causing waits and delays
Capacity	Resources available to do work. For example, the number of pieces of equipment available multiplied by the hours of staff time available to run it
Constraint	The actual cause of the bottleneck. Usually a necessary skill or piece of equipment *[NB Goldratt uses constraint to mean the same as bottleneck, but recognises that there are different types of constraints]*
Demand	All the requests/referrals coming in from all sources
Hand-off	When the patient is passed on from one healthcare professional to another
Parallel processes	Different activities that take place in the same time period
Queue	Work waiting to be done at a given point. For example, patients waiting to be seen in the clinic or people on a waiting list to come in to hospital for surgery.
Scope	A definition of the boundaries of the area under examination. For example, the beginning and end points of the stage of the patient journey under review