A GUIDE TO SERVICE IMPROVEMENT

Measurement
Analysis
Techniques
and Solutions

Tools and techniques for the delivery of modern health care
A GUIDE TO SERVICE IMPROVEMENT

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SECTION ONE

Introduction
1 Introduction

The Centre for Change and Innovation (CCI) is supporting the NHS to spread good practice and to increase its capacity for sustainable improvement. It works alongside the National Waiting Times Unit to improve patient access, a key challenge for the NHS over the next few years.

This Guide to Service Improvement is a simple document which introduces the tools and techniques for improvement that are fundamental to getting to grips with the challenges of delivering improved patient access. It is not intended to be a detailed guide to every concept and its applicability. Where necessary it introduces a key concept and leads the reader to more detailed information.

The principle message is the need for service leaders, clinical and managerial, to improve upon the use of data to measure and analyse services in order to manage and improve them.

The other important thing about the guide is that it introduces a range of tools and techniques that can be used together or in parts to measure, analyse and implement improvements. Whatever tool is used in a particular setting, the important thing is to ensure managerial sponsorship and clinical engagement.

The CCI national improvement programmes for Outpatients, Primary Care, Cancer Services, Unscheduled Care, Eye Care and Diagnostics are all supporting the NHS to achieve improvements in these services based on the tools and techniques described in this guide. The guide strengthens dissemination and supports basic education sessions.

The Centre for Change and Innovation gratefully acknowledges the work of others in this sphere over recent years including the Institute for Healthcare Improvement, the NHS Modernisation Agency and the National Leadership and Innovation Agency for Healthcare (Wales).

For further information on the national improvement programmes and the improvement materials in this guide log onto our website at www.cci.scot.nhs.uk

STEPHEN GALLAGHER
Associate Director
HD: Centre for Change and Innovation
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2 Understanding the Patient Journey – Analysis

2.1 Introduction

This section of the Guide to Service Improvement explores a number of tools which provide a structured approach to analysing services and care processes from both the patient and service perspective. Accurate analysis of care processes as well as a clear understanding of demand, activity, capacity and queue is essential to achieve effective and sustainable service change or redesign.

A good definition of a process describes it as a series of connected steps or actions to achieve an outcome.

2.1.1 Using mapping to analyse services:

What is Process Mapping?

Process mapping is a simple technique that can have a significant impact. It is a tool which is used to capture the patients journey of care at every stage. Process maps are an effective way to identify constraints and bottlenecks, rework (activity required to correct situations that could have been avoided) and unnecessary process steps.

Understanding care processes from the patient’s perspective is essential if patient focussed service improvements are to be made.

2.1.2 Why is Process Mapping a useful tool to begin to analyse services?

It is important to understand how patients flow through the care delivery system. Process mapping is patient focussed and helps us to understand how patients experience care delivery processes and systems.

It is unlikely that any one member of staff will fully understand the whole service until the process has been mapped. Process mapping is one of the most useful diagnostic tools for determining where problems lie and identifying areas for improvement.

2.1.3 When should Process Mapping be carried out?

Process mapping should underpin all service redesign, demand, capacity, activity and queue management, patient flow modelling and service planning. Process mapping, along with measurement of demand, capacity, activity and backlog provides the evidence base for service improvement. Without a clear understanding of the processes of care there is a risk of changing parts of a process which will not improve the service from the patients perspective and will actually lead to more waits and delays for patients.
2.1.4 How to Process Map

The best way to learn how to process map it is to do it.

The stages in Process Mapping

There are two stages to process mapping. First, understand what happens to the patient, where it happens and who is involved. Second, examine the process map to determine where there are problems such as multiple hand-offs, parts of the process that are unnecessary or do not add value, and where in the process queues occur. These include waste, error and duplication of parts of the process which would flow better if undertaken in a different order.

The process map must always depict the total number of steps taken as well as the number of people involved, the total time taken to perform the process step, and all documents used.

Preparation

Whilst process mapping is simple, good preparation in advance will ensure that the process map is useful and supports service improvement:

- Start by defining what you are trying to achieve
- The start and end point of the process – the scope
- What measures are you going to use to demonstrate that changes actually do improve the service. The Model For Improvement in Chapter 6 of this guide explains the importance of measurement. Process mapping is the first step in the improvement process and should inform the measures
- Identify which staff need to be involved in mapping the process
- Involve patients and or carers
- Identify the level of detail required

The resources required to Process Map

The process mapping exercise will usually take one day to complete. This may be one whole day or two half days.

A suitable venue is important. Dependant on the level of detail and the size and complexity of the process to be mapped you may have a small or large group of staff involved.

The materials to capture the process map. “Post-it” notes are useful to capture the information. This way they can be rearranged as the exercise progresses and the patient journey emerges. You will also need flip charts, Sellotape and coloured marker pens. The map needs to capture information at the level of one person, one place and one time. Arrange the post-it notes to ensure they capture the journey as the patient experiences it. The first step is to get a group of staff to map the process at a high level by defining key points in the patients’ journey. Use the high level map to determine who should be involved in the detailed mapping exercise. It is
essential to have representatives of all staffing groups involved in the process at the main mapping exercise. Do not forget to involve patients and or carers. The aim is to map the service as the patient actually experiences it. The patient journey needs to be captured down to the level of “one person, one place and one time”. Walk the process with a patient to check that all events are included.

The learning from service improvement in the NHS suggests there are some key causes of waits and delays, they are:

**Handoffs**

This is where patient care or information is handed from one individual to another.

**Bottlenecks and Constraints**

A bottleneck is any part of the system where patient flow is obstructed causing waits and delays. It interrupts the natural flow and hinders movement along the care pathway. However there is usually something that is the actual cause of the bottleneck and this is the **constraint**. The constraint is that part of the process which is the ultimate restriction on the amount of work that can be done.

There are two different types of bottlenecks; **process** bottlenecks and **functional** bottlenecks.

Process bottlenecks are the stage in the process that takes the longest time to complete. Process bottlenecks are often referred to as the rate limiting step or task in a process. In the following example the process bottleneck is step three of the process because it takes the longest time to complete:
Functional bottlenecks are caused by services that have to cope with **demand** from several sources. Radiology, pathology, radiotherapy and physiotherapy are often functional bottlenecks in healthcare processes. Functional bottlenecks cause waits and delays for patients because they act like a set of traffic lights stopping the flow of patients in one process while allowing the patients to **flow** in another.

**Functional Bottleneck**

The three processes queue for the functional resource and wait their turn. The functional bottleneck interrupts the flow of the patients in all three processes.
Batching of work

Batching occurs where tasks are placed in a queue before processing. An example of this might be found in the way specimens or samples are sent to the laboratories for analysis and tests.

Parallel Processes

Parallel processes are important and can be the cause of delays for patients and frustration for staff. Mapping, analysing and improving parallel processes can deliver significant improvement. A typical example of a parallel process might be the administrative process between primary care and secondary care for a hospital appointment, which is illustrated below. Parallel processes need to be mapped and understood.

![A parallel administration process](image)

2.1.5 Analyse the Process Map

Once the process map is complete the next stage is to analyse it by considering the following:

- How many times is the patient passed from one person to another (hand off).
- Where are the delays, queues and waiting built into the process.
- Where are the bottlenecks.
- What are the longest delays.
- What is the approximate time taken for each step (task time).
- What is approximate time between each step (wait time).
- What is the approximate time between the first and last step.
- How many steps are there for the patient.
• How many steps add no value for the patient.
• Are there things that are done more than once.
• Look for re-work loops where activities are taken to correct situations that could be avoided.
• Is work being batched.
• Where are the problems for patients.
• At each step is the action being undertaken by the most appropriate member of staff.
• Where are the problems for staff.

The purpose of analysing the process map is to identify if the patient is getting the most efficient care at the most appropriate time and place.

Consider the steps which cause the most delays for patients and staff. These steps should then be mapped in more detail. This can be done several times, each time getting a greater level of detail.

2.1.6 An example of a high level and detailed process map

Below is an example of the difference between a high level and detailed process map. It demonstrates the level of detail which is required to truly understand the total patient journey. This example comes from the Centre for Change and Innovation Cancer Service Improvement Programme.

High Level Map
The information from the detailed process map has led to doctors, radiologists and clerical staff in NHS Tayside making a number of changes to their working practices which has reduced the time that patients wait to be seen by a respiratory physician. Previously patients would wait an average of 23 days to be seen. This has now been reduced to an average of 8 days. Radiology staff are now making direct referrals to the respiratory clinic after reporting a highly suspicious chest x-ray. Details of the results and the patient appointment are sent to the GP.

2.1.7 What next?

Generate ideas for change that will improve the patient journey. Identify and test change ideas. Start to use The Model for Improvement in chapter 6 to test and implement changes:

- Identify the improvement areas from your process mapping and simplify them into manageable tasks **Plan**
- Initiate system redesign and carry out the test or change **Do**
- Study the data before and after the change **Study**
- Plan the next change cycle or plan implementation **Act**
2.1.7 Where can I find out more information on Process Mapping?

The Centre for Change and Innovation website:

www.cci.scot.nhs.uk

2.2 Using flow theory to analyse services

2.2.1 What is Flow?

The term flow describes the progressive movement of products, information and people through a sequence of processes. In the NHS, flow is the movement of patients, information or equipment between departments, staff groups or organisations as part of their pathway of care.

Why is flow modelling useful and how is it different from process mapping?

Process mapping looks at the care process from a patient perspective. Flow analysis builds on the work of process mapping and looks at the care process from a unit or department perspective bringing a number of patient process maps together to look at work flow.

2.2.2 When is flow modelling useful?

Understanding patient flow is vital in complex systems to fully identify repetition, queues, constraints and delays and to balance demand with capacity at each stage of the process. Flow modelling can support service improvement at specific bottlenecks or constraints, in specific clinical areas or across whole health systems. This analysis tool will not show what should be done. The tool will show how well scarce resources are used and how much room there is for improvement.

2.2.3 How to build the flow model

Define the patient group to be analysed and define the start and end points of the flow map.

Building the flow model is simple if all of the steps are followed. In straightforward care processes the process map and the process times will provide sufficient information to examine patient flow. For more complex care pathways the steps to identify patient flow are as follows:

**Step 1** Map and agree the process. The process must be mapped to a high level of detail

**Step 2** Simultaneously identify and map the communication and information steps around the patient process. The information and communication steps may be complex and cross many departmental and organisational boundaries.
Step 3 Identify who is clinically responsible for the patient. This could be the person performing direct clinical care for the patient. It may change as the patient moves from department to department and maybe within each clinical area.

Step 4 Identify who is responsible for the overall process at each point.

Step 5 Work out the time the whole process takes by identifying how long each stage in the process takes. Use a common unit to record time i.e. hours or minutes.

Using graph paper draw each patient as a horizontal bar one above the other. Set the horizontal axis to represent time with the start of the process on the left and the end of the process on the right. Colour each stage of the process a different colour.

For example in the graph below the constraint is coloured red. It is easy to see over the course of a day that the flow of work to the constraint is inefficient. By examining the flow of patients through the care process in this way it is possible to identify the scope for improvement.

Where can I find out more on Flow Modelling?

The Unscheduled Care Collaborative sponsored by the Centre for Change and Innovation is using flow modelling to support service improvement in unscheduled care. More information can be found at:

www.cci.scot.nhs.uk
2.3 Understanding the impact of variation in clinical systems

2.3.1 What is variation?

**Variation** is a part of everyday life and occurs naturally in most processes. In healthcare measuring, understanding and reducing variation is key to improving patient flow. **Variation** can be seasonal, monthly, weekly, daily or hourly. Much of the variation in clinical systems is within our control as outlined below:

Sources of variation in a clinical system

- **Staff**
  - skills
  - illness
  - shifts

- **Process**
  - motivation
  - holiday
  - training
  - unclear
  - guidelines
  - differ
  - complications
  - anaesthetics

- **Patients**
  - age
  - motivation
  - disease
  - race
  - sex
  - education

- **Resource**
  - machines not the same
  - supplies
  - rooms not the same

- **Information**
  - transcription
  - transport
  - applications

2.3.2 Why is it important to understand variation?

Being able to analyse and understand current system variation is key to being able to make changes that improve overall patient journey times. The variation between demand and capacity is one of the main reasons why queues occur in the NHS, because every time demand exceeds capacity a queue is formed showing itself as a waiting list or backlog. Chapter 3 of this guide explains how to measure demand, capacity, activity and backlog, and chapter 5 explains some practical ways to support better management of queues.

Variation is a part of every day life and it can be Natural Variation or Artificial Variation.

Natural variation is an inevitable characteristic of any healthcare system. Sources of natural variation include:

- differences in symptoms and diseases that patients present with
- the times of day that trauma cases arrive
- the socio-economic or demographic differences between patients

Natural variation cannot be eliminated or reduced it must be understood and managed.

Artificial variation is created by the way the system is set up and managed.

Sources of artificial variation include:

- the way we schedule elective admissions
- working hours of staff
- how staff leave is planned
- availability of clinical equipment
- multiple points of entry into services

Artificial variation has much more impact on patient flow than natural variation. It is usually driven by personal preferences and the priorities of staff rather than the needs of the patient.

2.3.4 How to analyse variation - Statistical Process Control

2.3.5 What is statistical process control?

In recent years the benefits of using Statistical Process Control (SPC) methodology in service improvement have been recognised by a number of improvement agencies. It is a statistical tool based on scientifically robust methodology that uses data to analyse and understand the inherent variation within processes and systems. SPC provides a tool to separate the “information” from the “noise” in data.
It does this by providing a mathematical basis for establishing the upper and lower limits of variation in processes that occur normally.

In SPC terminology variation is described as common cause variation, that is variation which is normal and to be expected and special cause variation which produces unusual or unexpected variation.

Two of the simplest SPC techniques are the run chart and the control chart. The purpose of these two techniques is to identify when a process is displaying strange or unusual behaviour. The purpose of the run chart and control chart is to distinguish between the two sorts of variation that a process can exhibit.

2.3.6 Why is statistical process control useful in the NHS?

Statistical process control is a tool to help us to identify and differentiate between the two types of variation that processes exhibit. It also helps to identify trends in data over time. It can also give us early warning signs that a process needs to be redesigned because it is showing unusual patterns of variation.

2.3.7 When can Statistical Process control be used in healthcare?

SPC can help in virtually all aspects of managing healthcare. In the context of service improvement and redesign SPC charts can be used to analyse and monitor changes made as part of the improvement process. As part of a Plan, Do, Study, Act improvement cycle the control chart can be set up to monitor the processes that are being changed. It is then possible to determine whether a change to the process has in fact led to a change in the performance of the process.

2.3.8 How do I create the statistical process control charts?

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 or patterns over time. A line graph provides an ideal method of comparing sets of data.

Control Chart

Control charts are basically run charts, but with two distinct differences:

- a line showing the average or mean values of the measure
- two lines showing the upper and lower process control limits. These show the typical extent of variation over time.

Using the data from the run chart you can calculate the mean or average and the control limits. The standard formula used in SPC produces the upper control limit and the lower control limit. These are plus and minus three standard deviations from the mean. The mean is obtained by finding the sum of all values divided by the
number of values. The mathematical formula to calculate standard deviation is simple to calculate using standard spreadsheet software designed for this purpose.

The value of the control chart is that it enables us to identify if a process is showing common cause variation or special cause variation. They key is to understand the reason for special cause variation and not to react unnecessarily to one off changes in the behaviour of a process. In service redesign you would expect to see changes in the way a process is behaving along the improvement journey as a result of introducing changes using the model for improvement described in chapter 6.

2.3.9 An example of the impact of reducing variation

The following is an example from NHS Borders Colon Service where the variation has been reduced by streamlining the referral pathway, improving the flow of patients through the care process, and improving waiting times:
2.4 Where can I find out more information

Web sites:

Centre for Change and Innovation
www.cci.scot.nhs.uk

The Modernisation Agency:
www.modern.nhs.uk

The Institute for Healthcare Improvement, USA
www.ihi.org

Further reading:


SECTION THREE
Understanding the system – Demand, Capacity, Activity and Backlog
3 Understanding the system – Demand, Capacity, Activity and Backlog

3.1 Introduction

Staff managing, delivering and planning clinical departments need to understand the factors which impact on the service they provide. There are four key measures that need to be understood to: properly manage waiting lists, deliver effective patient focussed services, and to enable informed decisions to be made when redesigning services, planning new services or changing care processes. Information and systems need to be put in place to systematically measure demand, capacity, activity and backlog. This section should be read in conjunction with the National Waiting Times Unit 10 “Golden Rules” for managing waiting lists published in 2003.

3.1.1 What is Demand, Capacity, Activity and Backlog?

- **Demand** on the service is all the requests or referrals into the service from all sources
- **Capacity** is all of the resources required to do the work and includes staff and equipment
- **Activity** is the work done, it is the throughput of the system
- **Backlog** is the demand which has not been dealt with showing itself as a queue or waiting list

3.1.2 Why is measuring demand, capacity, activity and backlog important in the NHS?

Having a clear understanding of the demand, capacity, activity and backlog in any service is essential to deliver modern, effective and patient focussed services. In the NHS accurate data on these four key measures is essential to understanding how any service is performing and to identify where improvement is needed. The mismatch between variation in demand and capacity is one of the principle reasons why queues develop and waiting lists and times increase.

3.1.3 Why is it important and useful to compare the four measures of demand, capacity, activity and backlog?

Measuring demand, capacity, activity and backlog enables capacity problems to be resolved at the appropriate point of the system. By clearly understanding these four measures and identifying the bottleneck or constraint in the process it is possible to:

**Resolve capacity problems to the appropriate point of the system:**

- Increase capacity at the stage of the process where it will create the greatest outcome
- Increase capacity of the bottleneck by moving resources from previous (upstream) steps or future (downstream) steps of the process
- Reduce inappropriate demand to the constraint

Redesign can help to balance demand, capacity and activity. By measuring these three components, services can decide which of these need to be altered and react accordingly.

Imagine an acute dermatology clinic

The demand is defined by the referrals
The constraint is clinic time to see new patients
The bottleneck may be specialist time available to see new patients

Firstly can things be altered to reduce the bottleneck and free up capacity in order to bring demand and capacity closer to balance?

In this case where the bottleneck has been defined as consultant time to see new patients, reduction in return patients may release consultant time to see new patients. A specialist nurse for return appointments or telephone follow up are examples of alternative ways of working that may release consultant time to see new patients.

Are capacity and demand still mismatched? If so can we alter demand?

A GP with special interest in the community may be able to see some new patients rather than referral to an acute centre.

Capacity has been released and demand altered where possible. What is happening with activity? No one can work at 100% of capacity all the time. Even if they could this would not allow us to manage the variations in demand that will always occur in medical services. Improvement organisations in health care have found that as a general rule, capacity should be set at the 80-85 percentile of demand, in order to
allow services to manage fluctuations in demand without developing a queue of people waiting. Activity may then vary with fluctuations in demand, however some variations in activity are unrelated. By analysing annual leave study leave and other breaks this variability may be reduced, preventing the creation of a backlog. The next graph shows where a service has been brought into balance the vertical axis refers to patient volumes and the horizontal axis refers to time.

![Graph showing patient volumes and activity over time](image)

**To identify queues**

Queues occur where demand has not been dealt with and results in a backlog. The main reasons why queues develop is the mismatch between variation in demand and capacity at specific times, because the right people or equipment is not always available to deal with the demand in a timely manner.

Every time the demand exceeds the capacity a queue is formed. However every time the capacity exceeds demand, the extra capacity is lost or it is filled from the queue. As this may be at short notice, it can involve patients across the spectrum of the queue. This is one of the factors which contributes to patients being seen out of turn and leads to waiting times growing and can distort clinical priorities.

As described in the earlier section on process mapping, a bottleneck determines the pace at which the whole process can work. If changes are made to improve the care process without addressing the bottleneck, service improvement is unlikely to succeed, because the patient will be accelerated into the queue only to be halted by the bottleneck.
To support the redesign of services

Measuring demand, capacity, activity and backlog forms part of the evidence based approach to service improvement and service redesign.

3.2 When should demand, capacity, activity and backlog be measured?

Measurement of demand, capacity, activity and backlog is fundamental to understanding how well services are performing and to identify if demand and capacity are in balance. It is good management practice and should be routinely and systematically carried out. It is an essential tool to avoid waiting lists or queues occurring or growing. When demand exceeds capacity a backlog or queue will form. Unless action is taken to address the capacity at the bottleneck or reduce demand the backlog will continue to grow.

Once demand, capacity activity and backlog have been measured the data and patterns that emerge can be used to start predicting demand and managing capacity, activity and backlog at the bottleneck.

3.3 How to measure demand, capacity, activity and backlog

Demand, capacity, activity and backlog need to be measured in the same units for the same period of time i.e. hourly, over a 24 hour period, weekly or monthly. It is not possible to compare two or more items unless they are measured in the same unit of time. It is important to compare the four measures on a single graph and the same measures must be used for each.

**How to measure demand:** multiply the number of patients referred from all sources by the time it takes in minutes to process a patient

**How to measure capacity:** multiply the number of pieces of equipment by the time in minutes available to the people with the necessary skills to use it

**How to measure activity:** multiply the number of patients by the time in minutes it will take to process a patient

**How to measure the backlog:** multiply the number of patients waiting by the time in minutes it will take to process a patient

Convert the data onto a common line graph.

3.4 An Example of how measuring demand and capacity leads to improved patient access:

The following example comes from the CCI Scottish Primary Care Collaborative Programme:

A Glasgow practice situated in an area with some challenging health statistics joined the Scottish Primary Care Collaborative in October 2003 with an average waiting time to see a General Practitioner of 4.79 days. The practice reviewed its demand:
the number of appointments requested on a daily basis and its capacity: the number of appointments available on a daily basis. This information allowed the practice to change the appointment system to match the demand and the introduction of different ways of accessing care e.g. telephone consultations and access to repeat prescriptions. Based on the demand and capacity information skill mix was introduced and a phlebotomist appointed thus ensuring that patients were seeing the most appropriate member of the health care team. The practice now has a waiting time of 0.32 days. This is an improvement of 93% which has been maintained since May 2004.

3.5 Where can I found out more information?

More information is available on the following web sites:

Centre for Change and Innovation
www.cci.scot.nhs.uk

The Modernisation Agency
www.modern.nhs.uk

The National Leadership and Innovations Agency for Healthcare (Wales)
www.howis.wales.nhs.uk

Further reading:

Goldratt E, Cox J The Goal, Gower, Aldershot.
4. Measurement

4.1 What does measurement look like in the NHS?

While the medical model of improvement has a very strong scientific and measurement ethos we have rarely applied this to service change. Instinctively we know that measurement is essential in driving forward service improvement and service redesign in the NHS. However traditionally minimal information has been routinely collected about services and where data has been gathered it is not the information we require to understand the service better. The NHS must now undergo a culture change of making robust information collection an integral part of services.

4.2 Why measure?

4.2.1 Without measurement we may make changes to the wrong area of the service

4.2.2 Measurement allows us to know that a change was an improvement

4.2.3 Measurement allows us to extrapolate further impact

4.3 When do we need to measure?

Measurement is fundamental to any model for service improvement. In redesigning services we use it for two key purposes:

- To diagnose the problems within the service. For example to identify if there is a recurring problem of capacity in a service it is necessary to properly measure demand, activity capacity and queue. An explanation of how to do this can be found in chapter 3 of this guide

- To define whether a service change has been an improvement. For example collecting data on the number of patients who fail to attend appointments (DNA’s) prior to introducing Patient Focused Booking and comparing that to DNA rates once Patient Focused Booking has been fully introduced in any specialty/site

4.4 How to introduce measurement

4.4.1 Measurement Principles:

- Develop aims before measuring
- Design measures around aims
- Have clear definitions of measures/measure points –including the measurement of journey time constraints
Ensure that measures relate to **what** happens to the patient not **where** it happens.

- Establish a reliable baseline
- Track progress over time
- Collect data/missing data
- Make results visible and feedback to those who collected the information

### 4.4.2 What Makes a Good Measure?

Measurement should be used to speed improvement up, not to slow things down. Seek usefulness, not perfection. Select measures that:

- impact directly on the service which is being analysed/improved
- are designed around locally determined aims
- are specific and clearly defined
- are balanced – add value, practical to collect and can be integrated into the daily routine
- are locally determined and owned, not imposed
- get buy in from local stakeholders
- link to improvement work with other initiatives in the health community, e.g. clinical and professional audit, clinical governance.

### 4.4.3 What Kind of Measures?

When considering the ‘basket’ of measures ensure that they define the scope of the improvement project in a balanced way:

- Impacts directly on the overall programme measure(s)
- Designed around locally determined project aims
- Locally owned, locally determined, not imposed
- Practically to collect
- Gets buy in from local stakeholders
- Easily understood/interpreted by those collecting the data
- Specific & clearly defined
- Measure points that are patient focused
Strike a balance between measures that are practical to collect and will measure the impact of the process changes being tested and introduced.

4.4.4 Collecting Data

Define the starting point or baseline. Ensure the baseline covers sufficient time before the improvement work begins. This way it is possible to demonstrate where changes have had a positive impact. In an ideal world, at least six points on a graph are needed to make an assessment of the baseline and at least 24 to have any understanding of the variation in the system. If no historical data exist begin measurement as soon as possible to establish a baseline.

It is important to agree targets that you and your colleagues want to achieve and set up a system to monitor your progress regularly on a line graph (run chart). Make sure your targets are linked to your aims and objectives and be realistic in your expectations.

When collecting data ask the following:

- How accurate is it and does it matter?
- Have I defined the data so that I get exactly what I want?
- Do I have to trade off the quality of the data for the time taken to collect it?
- Can I rely on it being consistent?
- What will I do with the data?

Poor quality data leads to an information vicious circle, where we are reluctant to use the information because we are worried about the quality. If the quality of the data is poor, we don’t want to use it. The best way to improve data quality is to start using it. It is only then that the quality of the data will start to improve.

How to Collect Data

Use existing data if possible

What data is already being collected? - uncover what already exists. Remember, if there has been an input of data, it can be extracted. Involve the information manager to the department and explain what and why data is needed. Ask them about data that has been inputted, what already exists and whether you can use it. It is important to ensure as much accuracy, completeness and consistency of the data as possible for it to be used effectively.

Collect it yourself

It may be necessary to collect the information manually at first. This is the case in many improvement initiatives and gives you the chance to learn about the data collection process. Introduce the data collection system and monitor it to ensure that it can be maintained.
Sampling

If the population is the entire number of patients, a sample is a proportion or subset of the total. Sampling is the process of selecting a small representative group in order to draw conclusions about the population as a whole.

Why sample?

If it is practical to capture the information on the entire population sampling is not required. However, that is not always possible due to time and budget constraints. To overcome this you can sample the population and use the data from the sample to make inferences about the entire population.

- How large should the sample size be?
  - For each measure sample a minimum 30 patients per month, i.e., 30 patients every month (or 50 every month, etc)

- What sampling method should we use?
  - select one that will minimise bias
  - choose a sensible and practical sampling method
  - be consistent over time

When selecting the sampling methodology consider the following factors:-

- Clinical conditions Vs Process groups
- Age Groups
- Gender
- Time of day / day of week

Sampling Methods

- **Simple random sampling** - every patient has an equal chance of being selected
  - like picking patients out of a hat, random numbers

- **Stratified sampling**
  - divide patients into groups and ensure that each group is properly represented in the sample
  - choose a suitable way to divide up the total number of patients

- **Starting at a random point sample every x patient to obtain an x% sample**
  - for a 10% sample measure every 10th patient

- **Sample up to a given number (minimum 30) e.g. first 30**
4.4.6 How to Present Data

Once appropriate measures have been agreed and data collected it may be necessary to present the data to others in the organisation and analyse it.

The key to successful presentation of data is ‘keep it simple’. Charts or diagrams need to be easy to understand. The main point is one graph, one message.

Use line graphs (run charts) and simple bar charts. The CCI suggests that graphs are created manually as some software systems which generate graphs have inbuilt adjustment features which may make the data appear less marked or powerful. Avoid stack bars and any sort of 3-dimensional graph.

Run Charts

A run chart is a line graph. It is used to show performance over time or when looking for trends or patterns over time – for example if implementing a change is making things better, worse or having no effect. A line graph provides an ideal method of comparing sets of data. It is important to determine what you will be measuring on the x axis (the vertical axis) and the y axis (the horizontal axis).

To ensure that run charts are interpreted correctly, keep a record of external factors and events that may influence the outcomes.

4.5 Where to look for further information

The following web sites all have useful sources of information on the importance of measurement in the NHS:

The Centre for Change and Innovation at:
www.cci.scot.nhs.uk

The NHS Modernisation Agency
www.modern.nhs.uk

The Institute for Healthcare Improvement, USA
www.ihi.org

Further Reading:


SECTION FIVE
Queuing Theory
5. Queuing Theory

5.1 Introduction

5.1.1 What is Queuing Theory?

“We study the phenomena of standing, waiting and serving and we call this study Queueing Theory.” “Any system in which arrivals place demands upon a finite capacity resource may be termed a queueing system.”

Source: Leonard Kleinrock

5.1.2 Why is it important to understand the dynamics of queues in the NHS?

The NHS is a classic queue system. Patients are placed in queues at various stages of their journey of care. Often they will be in a number of queues at the same time. During the last decade there has been a growing appreciation of the need to understand why the way in which we organise and manage queues in the NHS impacts on patient care. Proper queue management impacts positively on the care that patients experience and leads to more effective and efficient use of NHS resources.

The way in which queues are managed will directly affect the length of time that patients wait for diagnosis and treatment. There are a number of factors which contribute to the effective management of queues in the NHS They are:

- The way in which current services are designed and delivered – see chapter 2 of this Guide
- The relationship between demand, capacity, activity and backlog – see chapter 3 of this Guide
- The variation between demand and capacity
- The level of clinical prioritisation i.e. urgent, soon and routine
- The number of patients seen “in turn”
- The way in which referrals are processed

5.1.3 When is it necessary to examine the way in which queues are organised and managed?

It is important to understand how patients waiting for diagnosis and treatment are being managed. Ensuring proper management of waiting lists is essential to deliver services which are equitable, clinically appropriate and patient focused.
5.1.4 How can the management of queues be improved?

There are a number of ways in which the management of queues in the NHS can be improved. This can be achieved through:

- changes in the way appointments are made through the introduction of Patient Focused Booking,
- using Referral Information Services or Referral Management Services to inform referral decisions, to decide the most appropriate referral route for each patient and to promote dialogue between primary and secondary care about demand for and capacity of services,
- by ensuring that waiting list data is accurate through the process of validation,
- by avoiding wasting valuable capacity by eliminating unnecessary carve-out wherever possible and clinically appropriate

The sections that follow explore each of these in more detail.

5.2 Patient Focused Booking

5.2.1 What is Patient Focused Booking?

Patient Focused Booking – also referred to as Partial Booking is a way of managing waiting lists to ensure that when appointments are made there is direct contact with the patient. It is the dialogue with patients which introduces an element of choice about appointment dates and times for patients. Patient Focused Booking is a set of processes and procedures to manage the waiting list; a set of principles around patient booking (such that no appointment is made without the direct involvement of the patient); and a set of practices such as dedicated resources to provide a single and central point of contact for patients within the hospital.

For example in a recent survey in North Glasgow 92% of patients surveyed indicated that they were happy to phone to arrange an appointment.

5.2.2 Why use Patient Focused Booking?

There are three main reasons to change the way appointments are made.

a. Patients are seen in order

Traditional booking methods contribute to patients being seen “out of turn.”

Patient focused booking uses clinical priority and time on the waiting list to calculate when a patient will be seen. Patients placed on waiting lists are sorted first by clinical priority and then by waiting time.
An example is given below of the difference in waiting time that would have occurred had the queue been managed booking routine patients in turn. This example has been provided by NHS Dumfries and Galloway. Looking at data from September 2004 ophthalmology was modelled to compare the actual waiting time to the possible waiting time. The maximum routine wait reduces from 44 to 21 weeks:

![Ophthalmology Sept 2004: Outpatient Waiting List vs List for patients booked in turn](image)

**b. Patients have a choice of appointment date and time**

Patient non-attendances and patient cancellations consume valuable resources as well as severely affecting the flow of patients through the system of care. By agreeing a date and time with the patient the incidence of cancellations (CNA) and did not attend (DNAs) is considerably reduced. Because patients are arranging their appointment at a time that suits them approximately four weeks into the future they are far less likely to forget their appointment.

For example Dermatology DNA rates in NHS Highland reduced from 7% in April 2004 to 2% in May 2005 following the introduction of Patient Focussed Booking. In the same specialty at Falkirk Royal Infirmary in NHS Forth Valley the DNA rate reduced from 12% to 5% in the six months to January 2005.

**c. To reduce hospital cancellations**

When introducing Patient Focused Booking it is essential to have staff leave policies in place which require six weeks notice for any leave which will affect an outpatient clinic. The combination of booking patients only four weeks in advance of their appointment and the application of the staff leave policy leads to fewer hospital cancellations. The few cancellations at short notice (e.g. due to sickness) can be rescheduled into an empty clinic in five weeks time.
For example NHS Argyll and Clyde has introduced Patient Focused Booking across its four main sites and all appropriate outpatient specialties are included. By improving the way that clinics are managed and developing a robust cancellation policy, the number of cancelled clinics reduced by over 50% between January and December 2004.

5.2.3 When should Patient Focused Booking be used?

Patient focussed booking can be used wherever there is an elective waiting list of over 6 weeks.

5.2.4 How to implement Patient Focused Booking

A full guide to implementing PFB is provided in Appendix 1
The following flow chart demonstrates the process:
5.3 Referral Services

5.3.1 What are Referral Services?

It is helpful to think of Referral Services as a spectrum of possible activities ranging from basic Referral Information Services (RIS) at one end to full Referral Management Services (RMS) at the other. While this distinction is somewhat artificial (many services will display elements of both) it serves to underline the key difference between each end of the spectrum. RIS largely deal with area-wide statistical data on referral patterns and numbers, while RMS add value by considering the clinical content of individual referrals.

5.3.2 Referral Information Services

A Referral Information Service can be located in a physical or virtual centre. The purpose is to receive referrals from primary care and through numerical analysis, generate useful information for referring and receiving clinicians. An RIS is most effective when it covers referrals to high volume specialties.

5.3.3 Referral Management Services

In more advanced models, a multidisciplinary triage team (MDT) can examine the clinical content of referrals and decide the most appropriate referral route for each patient. This is a very efficient way to manage referral patterns across an area. It is much easier to enable a triage team to accurately stream referrals and to be aware of all possible referral options than it is to keep all GPs in an area fully informed and up to date on best referral practice. Often an RMS-based MDT will treat patients immediately following assessment, reducing the need for further appointments and reduce the time taken for the patient to receive appropriate care.

5.3.4 Why Introduce Referral Information Services or Referral Management Services?

The benefits of Referral Information and Management Services tend to be synergistic, with the former often supporting or paving the way for the latter.

Historically there has been a significant information gap in the referral process between primary and secondary care; GPs have tended to receive little feedback about the process until their patient returns from an appointment, while secondary care has had little idea of patterns of demand across an area. Information derived from RIS can be used to forecast demand and to plan service developments in both primary and acute care. It can also form the basis for dialogue between primary and secondary care and should encourage whole system engagement in relation to tackling waiting times. Typical results for fully implemented RMS in specialties with strong potential for MDT intervention (such as dermatology or orthopaedics) are:

a) 60% of patients triaged away from consultant clinics;
b) High new to return ratios for the MDT in excess of 2:1

c) Onward referral rates to consultants from the MDT of 10 – 20%

5.3.5 How to implement a Referral Information Services (RIS)

There are essentially 3 levels at which a system may operate a Referral Information Service. Each stage can build upon the previous one to offer an incremental method of implementation and the greatest system benefit is achieved by reaching stage 3.

Stage 1:

At this level of implementation, GP referrals (for discrete specialties and areas, or indeed for all specialties, area-wide) simply pass through the RIS and useful patient-anonymous information on numbers, specialty, hospital, or consultant is collated.

Stage 2:

As above, plus GP practices are provided with personalised feedback on numbers and routes of referrals and the latest waiting times for all referral options available to them. This information allows practices to route referrals appropriately and, if they wish, to compare their referral statistics with those of colleagues in the same practice or in other areas.

Stage 3:

As above, plus the RIS can offer to identify referrals to specialists or centres with long waits, inform the referring clinicians and suggest alternative appointments with shorter waiting times.

Referral Pooling

At any of these stages, the option exists to implement pooling of referrals to specialties in place of named referrals to consultants. In some models primary care staff refer to the RIS rather than to named individuals or hospitals. Well-founded in the practical application of queuing theory. The technical term is reducing carve-out, and rather like having a single queue at the post-office, this is an effective way to smooth demand across consultants and to reduce isolated long waiting times. Running counter to intuition but reflecting the obvious advantages of the approach, there have been few if any concerns from clinicians in those areas that have implemented pooling to date.

5.3.6 How to implement a Referral Management Services (RMS)

The essential elements of referral management are clinical triage and the availability of alternative referral options. Often the two are linked, with an extended scope practitioner or a multi-disciplinary team (MDT) both reviewing referrals and providing services to patients.
In the most effective models, all referrals for a particular specialty within a discrete geographical area are sent (electronically or by post) to a referral centre where an MDT (which may include ESP Nurses, AHPs, GPwSIs or consultants) assess the clinical content of the referral letter to decide the most appropriate referral option for that patient. In less clear cut cases, the MDT may assess the patient in a short face-to-face consultation. The potential outcomes for both approaches include:

- Immediate treatment by the MDT (e.g. physio or minor surgery)
- Referral to an alternative non-consultant service
- Further diagnostic testing
- Onward referral to consultant
- Return to GP with advice

5.3.7 When to introduce RIS or RMS

Local circumstances will determine if the introduction of RIS or RMS will add value for patients and clinicians. Most NHS Board areas are likely to be able to see the benefits of Referral Information Services. A Referral Management Centre will add most value in high volume specialties where there are a number of alternative referral options available.

5.3.8 An example of a Referral Management Service

In three of the four major hospital sites in NHS Argyll & Clyde, Extended Scope Practitioner (ESP) Physiotherapists triage most of the referrals to Orthopaedics received by Medical Records and using protocols drawn up by a multi-disciplinary team (GPs, Consultants and AHPs) they determine the most appropriate referral option for each patient.

Where physiotherapy is considered the best option, the ESP can see the patient themselves. They also have direct access to diagnostic services including X-Ray and MRI and can refer onwards to other AHP services, to consultant clinics or where appropriate, back to primary care.

Evaluation of the Renfrewshire based ESP Musculoskeletal Triage Service for lower limb and hand referrals over the six months to June 2005 demonstrated the following results:

- 77% of patients successfully triaged away from consultant clinics
- New to return ratio for the ESPs of nearly 4:1
- Onward referral rate to consultants of less than 20%
- 13% of patients did not require treatment in acute care
5.3.9 Where Can I find out more?

There are seven sites in Scotland piloting Referral Information or Management Services in Scotland over the year to April 2006. These include:

- NHS Argyll & Clyde
- NHS Grampian
- NHS Greater Glasgow
- NHS Highland
- NHS Lanarkshire
- NHS Lothian
- NHS Tayside

By December 2005, each will have a project evaluation document that can be used to share learning regarding implementation of such services. The reports will be placed on the CCI website.

www.cci.scot.nhs.uk

5.4 Validation

5.4.1 What is Validation?

Validation is the process of ensuring that everyone on the waiting list should be there. That is they are clinically appropriate, available and wish to have the designated appointment.

5.4.2 Why do we use validation?

a. So that we don’t contact people inappropriately

Over time waiting lists become out of date. This is particularly true for specialties where there are currently long waiting times. Patients may require treatment when they are first added to the list but their circumstances may change. They may have received treatment elsewhere in the NHS or independent sector. They may move away from the area or they may die. Systems should be in place to ensure that these patients are removed from the waiting list.

b. So that we know the true extent of the waiting list

Validation ensures that figures of patient numbers waiting are accurate. Where waiting lists are high performance may appear to be worse than it is if waiting lists contain large numbers of patients who are not actually waiting for treatment. It may affect information given to patients who may think they have a longer wait than is actually the case. It may also lead to valuable clinical time being wasted if clinics are booked through traditional booking methods and patients not requiring to be seen are given appointments for treatment.

c. To reduce DNAs
5.4.3 When do we use validation?

When waiting times are lengthy e.g. Validation can be used for all elective waiting lists.

5.4.4 How do we use validation?

a. Validate by mail or phone

Validation can be carried out by mail or telephone. There is a need to balance the gains from validating against the time and cost of undertaking it. Whichever method is chosen careful thought needs to be given to ensure that the validation process does not cause unnecessary concern for patients or the referring clinician.

b. Administrative Validation

Administrative validation is usually undertaken by management and clerical staff to determine the accuracy of patient details and in some cases by contacting the patient to determine if they wish to remain on the waiting list. Where Patient Focussed Booking is in place the telephone contact with the patient is the point at which this will normally occur. Therefore in long wait specialties it is particularly important that referrals are both accurate and appropriate and wherever possible follow agreed referral pathways, protocols and guidelines. The Centre for Change and Innovation has recently published Patient Pathways of Care for common conditions that traditionally result in an outpatient appointment.

c. Clinical Validation

Clinical validation is more complex than administrative validation. The primary purpose of clinical validation is to determine if the patient's condition has changed in any way which would justify either removal or suspension from the waiting list. Depending on the waiting list being validated it may be appropriate for the validation to be undertaken by clinicians in primary or secondary care, or a combination of both, where agreement is required for the future care management of a particular patient. For example, a patient removed from a surgical waiting list because of other co-morbidities which make surgery not possible at the time of review, may require more active care management in primary care to enable them to become fit for surgery at some time in the future.

d. Self Validation

Patient Focused Booking (partial booking) is often referred to as self validating. This is because no action is taken by the NHS to allocate resources to the patient’s care until the patient has confirmed the date and time of their appointment. For this reason it is assumed that validation is not necessary once Patient Focused Booking is in place. However this is only true when the maximum waiting times for treatment are short. Where waiting times are long waiting lists will remain inflated if the lists are not validated at interim stages. This is because Patient Focused Booking will
validate patients before they are called for treatment at the point that the patient reaches the top of the waiting list.

5.5 Carve-Out vs Segmentation

5.5.1 What are segmentation and carve-out?

Carve-out

Often we deal with healthcare problems by prioritising, ring fencing or carving out the time of an expert, the time of specialised equipment or by keeping resources or facilities only for one particular group of patients.

Segmentation

is about the separation of the whole process of care for one group to improve the overall flow of patients but not at the expense of other patients.

5.5.2 When do we use segmentation and carve-out?

Some of the most obvious examples that we see of carve out in health services can be found by looking at the clinic templates or booking rules for outpatient appointments. In a typical template there may be as many as five different types of appointments or patient slots i.e. urgent new patients, urgent return patients, soon new patients, routine new patients and routine return patients.

5.5.3 Why use segmentation and eliminate carve out?

When we use carve-out the process of care for one group of patients is prioritised over another irrespective of their needs. Accurate measuring of the backlog or waiting time for other groups of patients has shown that carving out capacity significantly increases waiting times overall and creates a very difficult system to manage effectively.

The following table gives some examples of the difference between carve out and segmentation:
<table>
<thead>
<tr>
<th>Segmentation</th>
<th>Carve out</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Objective</strong></td>
<td>• to improve the flow for all patients</td>
</tr>
<tr>
<td></td>
<td>• to improve the flow for a specific group of patients at one bottleneck</td>
</tr>
<tr>
<td><strong>Principles</strong></td>
<td>• looks at the whole patient process</td>
</tr>
<tr>
<td></td>
<td>• groups patients with similar processes</td>
</tr>
<tr>
<td></td>
<td>• keeps the flow through the process bottleneck constant</td>
</tr>
<tr>
<td></td>
<td>• matched demand to capacity along the process</td>
</tr>
<tr>
<td></td>
<td>• looks at one bottleneck, e.g. CT, theatre, outpatients</td>
</tr>
<tr>
<td></td>
<td>• prioritises the queue irrespective of the patient need</td>
</tr>
<tr>
<td></td>
<td>• interrupts the flow of patients and keeps them waiting at all step in the process</td>
</tr>
<tr>
<td><strong>Effect on waiting time</strong></td>
<td>• reduces/eliminates waiting for patients</td>
</tr>
<tr>
<td></td>
<td>• makes the overall waiting time worse</td>
</tr>
<tr>
<td><strong>Effect on other patient groups</strong></td>
<td>• none</td>
</tr>
<tr>
<td></td>
<td>• other patients, e.g. with non urgent chronic diseases, have a much longer wait</td>
</tr>
<tr>
<td><strong>Examples</strong></td>
<td>• optometrists diagnose, prepare and refer cataract patients directly onto the surgical list. This removes them from other ophthalmic patients in the outpatient clinic</td>
</tr>
<tr>
<td></td>
<td>• reserving slots on a CT scanner for certain groups of patients, e.g. urology</td>
</tr>
<tr>
<td></td>
<td>• ring fencing beds for certain groups of patients</td>
</tr>
<tr>
<td></td>
<td>• reserving clinic/surgery slots for specific groups of patients</td>
</tr>
<tr>
<td></td>
<td>• creating different queues for different consultant even when the process id the same e.g. endoscopy</td>
</tr>
<tr>
<td><strong>Non health care examples</strong></td>
<td>• cash dispensers where customers are totally removed from other customers at the counter in the bank</td>
</tr>
<tr>
<td></td>
<td>• bus lanes at peak times on busy roads</td>
</tr>
<tr>
<td></td>
<td>• parking for mothers and babies in supermarket car parks</td>
</tr>
<tr>
<td><strong>Summary definition</strong></td>
<td>• segmentation is when the separation of the process of care along the whole pathway for one group of patients is not at the expense of other groups or patients</td>
</tr>
<tr>
<td></td>
<td>• carve out is when the flow of one group of patients is improved at one bottleneck at the expense of another group of patients</td>
</tr>
</tbody>
</table>
5.5.4 How to implement segmentation

Before you can replace carve out with segmentation you need to be able to identify where you have unnecessary and wasteful carve out in your processes of care. In services with long waiting times some element of carve out will be necessary to ensure clinical priorities can be met. You will also need to have a clear understanding of the demand and capacity of the service you are aiming to improve. See chapter 3 of this guide.

The example below shows how replacing carve out with segmentation can improve flow and reduce waiting times for all patients in one accident and emergency department:

Previously A&E was managed as a carve out in which patients were triaged by a nurse into one of five categories. Categories one and two were prioritised and patients with minor injuries, in categories four and five were told to wait.

The A&E department has now changed, replacing carve out with segmentation. Apart from real emergencies, all patients are put into a single queue at the reception desk and the next available member of staff takes the next patient through to the appropriate treatment area: minors or majors.

The minor area is fitted with chairs in cubicles and trolleys with all the dressings required to treat any minor injury. The major area is fitted with trolleys and the equipment to diagnose and treat and emergency, e.g. ECG machines, blood bottles, etc.

Since the majority of A&E attendances are minor injury patients, there is a very fast flow through the minor’s area with the major areas moving at a slower rate. If the demand and capacity is matched by ensuring the maximum numbers of staff are available during the times of peak demand 12:00 noon to 2:30 pm and again from 4pm to 6pm, then the waiting room is empty.

5.6 Where can I find out more:

Visit the following web sites:

The Centre for Change and Innovation
www.cci.scot.nhs.uk

The Modernisation Agency
www.modern.nhs.uk

The Institute for Healthcare Improvement USA
www.ihi.org
5.6 Tools to support a better understanding of the dynamics and importance of queue management in the NHS

5.6.1 What tools are currently available to support better understanding of the importance and dynamics of effective queue management in the NHS?

There are essentially two tools which are currently in use in the NHS to support a better understanding of the importance of queue management and capacity planning in the NHS. Checklist is currently widely available in the NHS in Scotland. The NHS Modernisation Agency developed a toolkit, Clinically Prioritise and Treat (CPaT) to promote a better understanding and dialogue between clinicians and managers on the importance of understanding waiting list dynamics and the impact on waiting times.

5.6.2 What is Checklist?

Checklist planning software is a tool to support capacity planning and waiting list management. It supports capacity planning by modelling waiting lists profiles. Checklist can demonstrate if lists are being managed within agreed clinical priorities and also predict if waiting times will be breached. It can model an individual clinician’s waiting list down to type of procedure and sub specialty level.

5.6.3 Why is Checklist useful?

Checklist like any other modelling tool is most useful when the data to support the modelling capability of the tool is robust. Accurate measurement of demand, capacity, activity and queue as explained in chapter 3 of this guide will ensure that the assumptions made to generate checklist reports and profiles are evidence based.

Checklist can be used to support capacity planning, waiting list management and to identify particular pressures in services.

5.6.4 When to use Checklist

To support better management of queues and waiting times Checklist can identify if waiting lists are being managed within agreed clinical priority and waiting time targets. Analysing waiting lists using this tool can help to generate solutions to ensure that queues are managed appropriately.

5.6.5 How can I use Checklist?

Checklist is a licensed software planning product which is available in most NHS Board areas in Scotland. The system requirements to run Checklist are a Pentium II processor running Windows 95 or later, or Windows NT, with 64MB RAM and 30MB free disk space.
5.7 What is CPaT?

The CPaT Project was launched by the NHS Modernisation Agency (NHSMA) in 2003.

Essentially CPaT provides a database driven toolkit which enables three main types of charts which analyse patient and waiting data as follows:

a) The Histogram – which enables organisations to identify if patients will be seen in waiting order

b) The Rainbow Chart – did patients have different waiting times for different consultants for the same procedure?

c) The SPC (Statistical Process Control) run chart – did patients wait different lengths of time for the same procedure

What does CPaT do?

CPaT was intended to promote a simple approach supported by a toolkit which did three things:

1) Provide hospitals with tools so that they can see and understand how they are managing their waiting lists

2) Offers training techniques to promote shared understanding by clinicians, managers and staff

3) Suggests ways to improve waiting list management and introduce transparent, systematic processes that are fairer to patients and reduce maximum waiting times

5.7.1 Why is CPaT a useful tool?

CPaT provides a series of reports which promote a shared understanding between managers and clinicians of the impact of variation in, and on waiting lists - it is based on two principles:

- The proportion of patients seen by a clinician as a priority has a direct impact on the waiting time for all other patients. The higher the proportion of priority or urgent patients the longer routine patients will have to wait for treatment.

- Patients categorised as routine are not always seen in waiting time order. Some patients will wait longer for treatment as a result of displacement by “queue jumping”. If routine patients are seen broadly in turn the maximum waiting time for all patients will fall
5.7.2 When should CPaT be explored?

CPaT is a useful toolkit which can contribute to better management of waiting lists within agreed clinical priority. It helps to promote better dialogue between managers and clinicians on the importance of proper waiting list management. The NHS in Wales has found that CPaT has facilitated discussion between clinical teams. One of the most positive outcomes they have found is that the evidence from looking at waiting lists using the CPaT toolkit has led to a greater willingness amongst clinicians to pool waiting lists within specialties, leading to a reduction in waiting times.

5.7.3 How can I explore the CPaT Toolkit?

The basic systems requirements to run the CPaT database are a local hard disk with no less than 128 Mb RAM and a processor exceeding 1GHz. Microsoft Access 97 or later and Windows 2000 or Windows XP and a colour printer.

5.7.4 Where can I find out more?

The Checklist Partnership

www.checklist.co.uk

The National Leadership and Innovations Agency for Healthcare (Wales)

www.howis.wales.nhs.uk

The link for the NHS Modernisation Agency CPaT site:

http://www.wise.nhs.uk/sites/crosscutting/access/pages/CPaT.aspx
SECTION SIX
Tools to Support Service Improvement and Redesign
6 Tools to support service improvement and redesign

In this section tools to support service improvement and redesign are explained. The Model for Improvement has been specifically adapted for use in healthcare by the Institute for Healthcare Improvement (IHI) in the USA. The IHI draws on the expertise of leading thinkers from around the world on healthcare and health systems improvement.

6.1 What is the Model for Improvement?

The Model for Improvement is designed to provide a framework for developing, testing and implementing changes that lead to improvement. The Model has been developed and refined for use in healthcare systems by the Institute for Healthcare Improvement based in the USA. It has been widely used to deliver improvements in the NHS in Scotland, England and Wales and throughout Europe and the USA. It is popular with clinicians and managers because it is simple to use and is similar in many ways to processes used in clinical audit. The Framework includes 3 key questions and a process for testing change ideas using Plan, Do Study Act cycles.

The Model for Improvement is designed to break down change into manageable chunks. Each small part can then be tested to make sure that the things you are aiming to improve are actually improving.

6.1.2 Why use the Model for Improvement?

The model offers the following benefits:

- It is a simple approach that anyone can apply
- It reduces risk by starting small – this is particularly important when considering changes to clinical systems or care processes
- It can be used to help plan, develop and implement change
- It supports rapid cycles of improvement
- It is highly effective
- It supports a bottom up approach to change consistent with systems of continuous improvement
- It can also be used to facilitate large scale strategic plans
When should the Model for Improvement be used?

The CCI suggests that the model is used to support service improvement and service redesign, to analyse existing services and to help to understand how services are performing. Staff working on service change should set clear and focussed goals. These goals will require clinical leadership and should focus on areas that cause concern for patients and staff and should be consistent with national and local targets, be bold in their aspirations and have clear numerical targets.

6.1.3 How should the model be used?

Before the model for improvement is used to test and implement change ideas it is essential that the patients journey of care is understood by using process mapping (see chapter 2) and that the demand, capacity, activity and backlog data has been analysed.(see chapter 3) The information from the process map and the demand, capacity, activity and backlog data will have identified where the bottlenecks and constraints are in the service. The bottlenecks and constraints should be the principle initial focus for change (see chapter 2).

Begin by identifying the following:

**Aim**

- What are we trying to accomplish?

The aims statement should:

- Be consistent with national and local targets
- Be bold in its aspirations
- Have clear numerical targets

**Measurement**

- How will we know that a change is an improvement?

Measurement is fundamental in answering the question “how do we know that a change is an improvement”

**Change Ideas**

- What changes can we make that will result in improvement?

Generate ideas for change and use Plan, Do, Study, Act (PDSA) cycles to test ideas.

There are 4 stages to a PDSA cycle as follows:
Plan
- Plan the change to be tested or implemented

Do
- Carry out the test or change

Study
- Study the data before and after the change and reflect on what was learnt

Act
- Plan the next change cycle or plan implementation

The PDSA cycle involves testing out improvement ideas on a small scale before introducing the change. By building on the learning from the test cycle in a structured and incremental way, a new idea can be implemented with a greater chance of success. Barrier to change are often reduced when many different people are involved in trying out something on a small scale before implementation.

Why test a change before implementing it?
- Less time, money and risk are involved
- The process is a powerful tool for learning. As much is learned from ideas that don’t work as from those that do
- It is safer and less disruptive for patients and staff
- Where people have been involved in testing and developing ideas there is often less resistance on implementation
How to test

- plan multiple cycles to test. Ideas can be adapted from other services, meaning that there is already evidence that the change works
- test on a relatively small scale. Start with one patient, one clinician at one session and then increase the numbers involved as the ideas are refined
- test the proposed changes with volunteers, people who believe in the improvement that is proposed. Do not try to convert people to accepting the change at this stage
- only implement the idea when you are confident you have considered and tested all the possible ways of testing the change

Multiple PDSA Cycles

Often multiple PDSA cycles will need to be used. This approach is in contrast to using one cycle to attempt to accomplish everything. The use of multiple cycles for sequential testing and implementation reduces risk, as the change process progresses from hunches, theories and ideas to actual changes that result in improvement.

Demonstrate the change

The impact of PDSA cycles and the implemented changes should be demonstrated against your aims and measures. This data is best presented in a run chart. When creating your measures and reporting your data you must be able to link the small scale changes you made back to the overall aims for improvement. This will ensure that you will see the effect of any changes that have been made through the PDSA cycle.

What if the model is used inappropriately

There is a temptation to jump to large PDSAs; no test should take more than a few days to complete in full. The other risk is teams using Plan and Do;

Plan and Do  Vs  Plan, Do, Study and Act:-
Why should you Plan, Do, Study and Act rather than just Plan and Do?

The graphic listed below shows that by using Plan and Dos only you run risks of failure. Any improvements you would see will be short term, have little staff involvement, will be the ideas of a few individuals and not embraced by all staff, and will be focused on improving costs rather improving process.

<table>
<thead>
<tr>
<th>PD</th>
<th>Effect</th>
<th>PDSA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Short-term, dramatic</td>
<td>Long-term, undramatic</td>
<td></td>
</tr>
<tr>
<td>Large steps</td>
<td>Small steps</td>
<td></td>
</tr>
<tr>
<td>Intermittent</td>
<td>Continuous, incremental</td>
<td></td>
</tr>
<tr>
<td>Abrupt, volatile</td>
<td>Gradual and consistent</td>
<td></td>
</tr>
<tr>
<td>Few champions</td>
<td>Everyone</td>
<td></td>
</tr>
<tr>
<td>Individual ideas &amp; effort</td>
<td>Group efforts, systematic</td>
<td></td>
</tr>
<tr>
<td>Scrap and rebuild</td>
<td>Protect and improve</td>
<td></td>
</tr>
<tr>
<td>New inventions/theories</td>
<td>Established know-how</td>
<td></td>
</tr>
<tr>
<td>Large investment</td>
<td>Low investment</td>
<td></td>
</tr>
<tr>
<td>Low effort</td>
<td>Large maintenance effort</td>
<td></td>
</tr>
<tr>
<td>Technology</td>
<td>People</td>
<td></td>
</tr>
<tr>
<td>Costs</td>
<td>Process</td>
<td></td>
</tr>
</tbody>
</table>

6.1.4 Where can I find out more information on the Model for improvement?

The Centre for Change and Innovation has a wide range of experience of applying the Model for Improvement, visit our web site at:

www.cci.scot.nhs.uk

The CCI National Improvement Programmes can be contacted at:

Cancer Service Improvement Programme, Programme Manager
Pauline.Ferguson@scotland.gsi.gov.uk

Diagnostics Collaborative, Programme Manager
Chris.stirling@scotland.gsi.gov.uk

Eye Care Redesign and Delivery Programme
Carmen.mcateer@scotland.gsi.gov.uk

Outpatients Programme
Michelle.hughes@scotland.gsi.gov.uk
Scottish Primary Care Collaborative  
Catherine.buchanan@scotland.gsi.gov.uk

Unscheduled Care Collaborative  
Nicki.mcnaney@scotland.gsi.gov.uk
APPENDIX 1
Implementing Patient Focused Booking
Appendix 1
Implementing Patient Focused Booking

Chapter 6 of the Guide to Service Improvement explored the benefits of introducing Patient Focused Booking (PFB). This appendix explains the process of introducing Patient Focused Booking. The Centre for Change and Innovation has supported the introduction of PFB in outpatients through the CCI Outpatient Programme. The key learning from introducing PFB at over 30 sites in Scotland is that the maximum benefits of PFB will only be achieved when there is:

- clear managerial leadership and accountability for changing booking processes
- clear managerial and clinical leadership and accountability to ensure that policies to support the introduction of PFB, such as staff leave policies, are adhered to
- effective communication with (and involvement of) patients and all staff affected by the introduction of PFB
- accurate information that can be provided on key quantitative performance indicators, such as DNA and cancellation rates, together with regular staff and patient surveys to highlight issues to be resolved, and
- effective and consistent queue management which includes regular reviews of demand, capacity, activity and queue

With the above in place PFB will lead to significant improvement in CNA, DNA and hospital cancellation rates. Historically clinicians and staff will have taken DNA rates into account when calculating clinic sizes. An important step when introducing patient focussed booking is to review clinic profiles and templates to optimise clinic capacity and to reduce unnecessary carve out or segmentation.

Involve the clinical staff

The most efficient way to introduce patient focussed booking is specialty by specialty rather than consultant by consultant. This will lead to a smoother transition to the new way of booking patients. Evidence from Scotland and elsewhere shows that where patient focused booking and traditional booking methods and processes co-exist for lengthy periods of time that there is scope for considerable confusion amongst staff running, administering and managing clinics. In times of pressure, due to staff holiday or absence, there is a risk that people will resort to the old ways of working.

Adherence to a six week leave policy

If not already in place, it will be necessary to get the agreement of all staff whose absence would lead to the reduction or cancellation of a clinic to the adherence to a leave policy which requires six weeks notice of annual leave or study leave. Unless you have agreement that clinics will not be cancelled at short notice you are unable to give patients calling to make appointments any certainty that their appointment will take place at the agreed date and time.
Clinic cancellations lead to longer waiting times for routine patients and introduce greater risk of patients breaching waiting time targets.

**Clinic profiles**

Clinic profiles need to be reviewed to assume that there will be no DNA’s. Check that the booking rules in place are the ones that actually apply. The NHS is a system of many unspoken rules and assumptions. Start from existing clinic lists and actual attendances at the clinic. Calculate the actual demand for each clinic by reviewing the data for the previous quarter. Determine how many slots need to be made available for “urgent” patients. Identify both the average and maximum number of patients attending each clinic. Is there much variation or is the demand for this service predictable. Set the clinic capacity to match the demand.

Where clinically appropriate, aim to reduce the types of clinic slots and referrals to urgent and routine. Avoid as much carve out as possible.

Set up the new profiles and clinic rules on the system to apply from the first available clinic when Patient Focused Booking will commence.

Once several clinics have been run where all patients have been booked through the new system check with staff to see if any further changes are needed to clinic profiles and booking rules. Check demand, capacity and activity again.

**The PFB Process**

The PFB process is illustrated in the flow chart in Chapter 6, below it is explained in more detail.

**The acknowledgement letter**

The process acknowledges the referral when it is received and sends letters to patients four weeks before they need to attend asking them to phone and make an appointment.

As a patient is registered and prioritised a letter is generated telling them the approximate wait and telling them to expect another letter closer to the time.

If a patient is to be seen within six weeks they are asked to phone the hospital straight away and make an appointment.

**Generating the Pick List**

Every week staff look at clinics for four weeks ahead. For each clinic they calculate how many patients will be needed to fill the clinic and select those patients from the top of the Pick List. The pick list is sorted first by priority order and then by referral date order.
The Phone Letter

The picked patients are each sent a letter which asks them to phone the hospital as soon as possible to arrange a suitable date and time for their appointment. Once the appointment is made a confirmation letter is printed and sent.

What if not enough people phone

The system is self-balancing. If too few patients phone in any week, extra letters can be generated the following week. Similarly if more patients phone, bookings can be made into week five and correspondingly fewer patients picked the following week.

What if the patient does not phone

A reminder letter is generated automatically for those patients who do not respond to the phone letter. If they do not respond to this reminder within two weeks, the referral is automatically closed and a letter is sent to the GP as well as the patient.

Patient Focused Booking and return appointments

There are considerable advantages to be gained by applying the methodology to return outpatients as well as new referrals. However there are different issues which need to be addressed. For many return outpatient appointments there is a clinically significant time period during which the patient requires to be seen. There is a need to engage clinicians and reach agreement about the acceptable range of time within which patients with common conditions should be brought back to the hospital for review.

Introducing Patient Focused Booking for return outpatient appointments is likely to require modifications to be made to the IT systems supporting the booking process to enable appointments to be scheduled to meet clinical need.

Involve staff and patients

It is important when making changes to the ways services are organised and delivered to involve staff and patients. Local staff partnership forums should provide the basis for consulting and involving staff in implementing the changes. Patients also need to be aware that the booking systems are being improved and that in the future they will have some choice about their hospital appointment. Particular attention needs to be paid to the needs of patients who may require to return on several occasions who have traditionally been used to leaving the hospital with a date for their return appointment even if the date for return is many months in advance.

Patient focused booking – the future

The Centre for Change and Innovation suggests that NHS Boards and Operating Divisions plan the introduction of patient focused booking to all inpatient and day case elective activity including diagnostic tests where waiting times are longer than 6 weeks and clinically appropriate. This will support the NHS in Scotland to deliver the values underpinning the modernisation of health services:
• Providing services in a consistent and equitable manner across the whole of Scotland

• Ensuring that patients are at the centre of change to ensure they get the treatment they require, when and where they need it

• Removing barriers from the patient’s pathway of care

Working in partnership with patients, staff and other stakeholders
Appendix 2

Acknowledgements and useful resources

The information in this Guide to Service Improvement has drawn on the learning and expertise within the Centre for Change and Innovation, NHS Scotland and improvement agencies in healthcare elsewhere in the UK and internationally. In particular this guide has been influenced by the work of the former NHS Modernisation Agency, the National Leadership and Innovations Agency for Healthcare (Wales) and the Institute for Healthcare Improvement in the USA. Below is a list of useful web sites and publications which will be of interest to anyone who wants to find out more about the tools and techniques and service improvement theory.

Web sites

Centre for Change and Innovation
www.cci.scot.nhs.uk

The Modernisation Agency
www.modern.nhs.uk

The National Leadership and Innovation Agency for Healthcare (Wales)
www.howis.wales.nhs.uk

The Institute for Healthcare Improvement
www.ihi.org

The official Goldratt UK website
www.goldratt.co.uk

Publications

NHS Modernisation Agency Improvement Leaders Guides 2005 editions:
Improvement knowledge and skills
Managing the human dimensions of change
Building and nurturing an improvement culture
Working with groups
Evaluating improvement
Leading improvement
Involving patients and carers
Process mapping, analysis and redesign
Measurement for improvement
Matching capacity and demand
Working in systems
Redesigning roles
Improving flow
The National Leadership and Innovations in Care Agency for Wales – A Guide to Good Practice


Goldratt E, Cox J The Goal, Gower, Aldershot

