NHS Improvement

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Managing variation



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Managing variation

What is it?

There are many sources of variation in healthcare that can affect the flow of patients through care systems. Reducing and managing variation enables systems to become more predictable and easier to manage so allowing improvement of quality and safety. To effect successful service improvements, you need to understand the source of variation and use a range of tools to reduce and manage it.

When to use it

Reducing and managing variation are essential approaches to reducing delays in services and increasing the quality of the patient experience.

There are two reasons for this:

1. Waiting lists can build up because demand for work exceeds capacity. The mismatch is due to variation in both demand for work and in our capacity to deal with it. Evidence suggests that our capacity varies more than our demand (see **demand and capacity management**).
2. Variation in the way we work, such as dealing with paperwork and the timing of decision making along a clinical pathway all impact both the pace of patient progress and the number and length of unnecessary delays.

How to use it

There are two main types of variation: natural and artificial. Natural variation is an inevitable feature of healthcare systems. Sources of natural variation include:

- differences in symptoms and diseases that patients present with
- times of day that emergency patients arrive
- socio-economic or demographic differences between patients
- staff skills, motivation, etc.

Artificial variation is created by the way the system is set up and managed. Sources of artificial variation include:

- the way we schedule services
- working hours of staff and how leave is planned
- the order in which we see and treat patients
- how much work we group and deal with in batches
- how we manage clinics to deal with priority or urgent cases.

There are two further categories of variation, known as common cause and special cause variation.

Common cause describes variation that is predictable and expected and is:

- the sum of many small variations from real but small causes that are inherent and therefore cannot be traced back to a root cause
- stable in time (follows the laws of probability) and therefore relatively predictable
- random variation is a matter of measurement, not goal setting.

Special cause describes variation that is unusual or unexpected and includes:

- variation arising from a single cause that is not part of the process and therefore can be traced, identified and eliminated (or implemented)
- irregular in time and therefore unpredictable.

Figure 1

	Common cause **Predicted or expected variation ie random**	**Special cause** **Unusual or unexpected variation ie assignable**
Source of variation is natural	Patient's age, gender, disease, condition, personal circumstances.	An exceptionally underweight child turns up at a health clinic triggering social welfare concerns. It's the first time the clinic has seen this child.
Source of variation is artificial (ie comes from the systems we develop)	Some doctors make decisions weekly while others do this daily. Ordering different tests for the same clinical presentation. Different systems to manage consultant to consultant referrals from referrals from GPs. Patients or tests being seen/dealt with out of turn.	A series of things go wrong, the patient is 'lost' in the system and waits for three years. Someone coded in the wrong number. The patient's surname was Smith. The test results were put in the wrong pile. The paperwork couldn't be found, the patient moved GP.

Understanding what type of variation you have before you start improvement with your baseline data is important as it should influence your improvement strategy.

Figure 2

Common cause variation	• Process is stable and predictable. • It is inherent to the process. • If the current performance is acceptable, do nothing. If it is not acceptable, redesign your processes.
Special cause variation	• Process is unstable and unpredictable. • Variation is caused by factors outside process. • External cause should be identified and tackled. • You can develop contingency plans.

Statistical process control (SPC) is a complementary tool that looks at variation using a statistical methodology to help you identify and tackle predictable and unpredictable variation.

1. Identify the service area in which you want to understand the variation. This might be referrals into a service (the number of appointments available to meet the demand and the actual activity that takes place) or the variation in specific hospital acquired infections by procedure.
2. Collect data, ideally through existing systems such as your patient administration system or using MS Excel/Access or data collection sheets.
3. Using run charts, plot the information on a graph.
4. Use **statistical process control** (SPC) to help understand the variation.
5. Analyse variation in capacity and demand.

Helpful questions to ask:

Is the source of the variation mainly natural?

- Identify patient characteristics – age, gender, clinical presentation – to find patterns that may be associated with delays or resources being wasted (eg patient 'did not attends'). Seasonal patterns may be relevant.
- Identify patient characteristics that may be associated with procedure or care pathways. For example, Wirral Hospital found that when they looked at one admitting ward, only seven procedures accounted for 52% of theatre throughput. These procedures have the potential for pooling and therefore reducing delays.
- If you are able to link specific patient characteristics to these procedures, you are using natural variation to your advantage. Some people call this segmentation (see the **demand and capacity management** and **identifying problems** sections)
- Present what you find graphically. You may wish to involve your information department or analysts in this.

Is the source of the variation mainly artificial?
Select a patient pathway, procedure or administrative process and map it out to identify sources of variation. Some techniques you could use include:

- **Process mapping** techniques that involve the team. These will help you collectively spot opportunities for improvement and redesign to reduce variation along the pathway.
- Comparison of journey times using case files, a source of information along key stages of the last 10 patients who received treatment (see example) or shadow a patient (see **gaining insights from/working with health service users**) to collect information.
- Comparison of administrative time for 10 items of paperwork/10 patient case notes using a **tracer study** approach – a form people fill in whenever they 'touch' a patient's notes (see **process mapping**).

Take a complementary approach to looking at variation in demand and capacity. To identify variation in demand, look at patterns in terms of the time of day, day of the week, weekly and monthly demand. How much does it vary?

To identify variation in capacity, look at patterns in terms of leave, staff sickness, skill mix and rooms/equipment. The key here is to look at mismatches in demand and capacity and link this to the activity, which is the actual work done in a day, week or month.

Present what you find graphically. Your information department or business analysts may be able to help you to do this.

You are aiming to understand the real cause of variation – the *why* and not the *what*. **Root cause analysis using five whys** and **cause and effect (fishbone)** are just two of the tools available to help you identify the root cause of artificial variation.

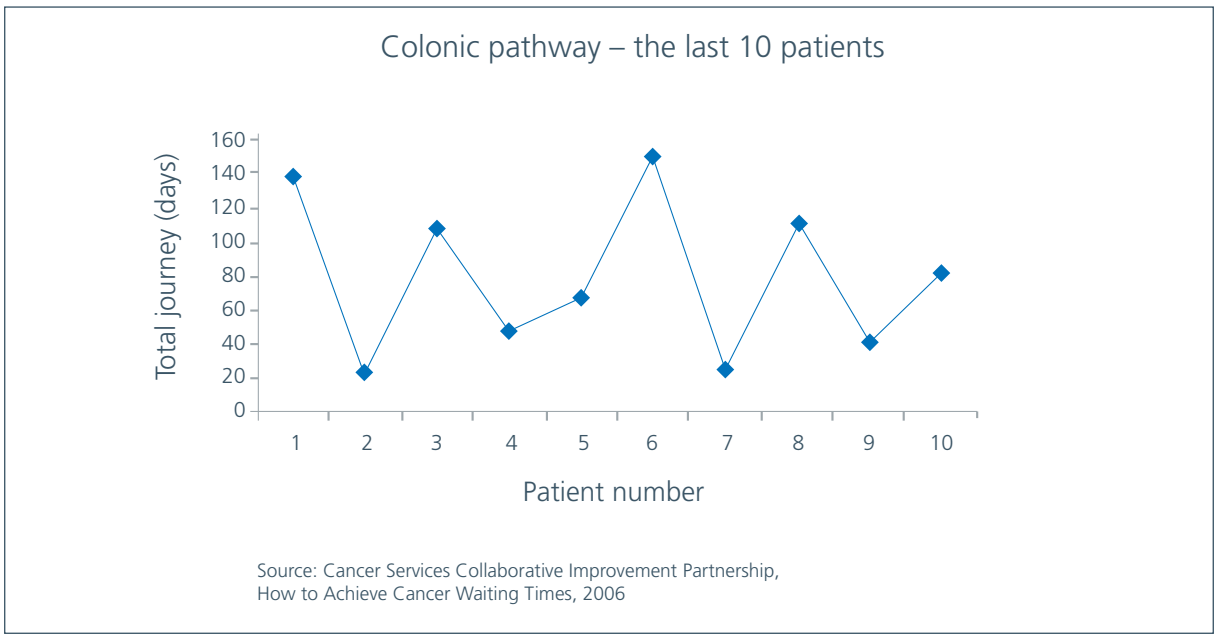
Examples

Mapping what happens to patients' test results paperwork against key stages can highlight differences. Figure 1 in **mapping the last 10 patients** shows the locally agreed timescales for the current colonic pathway, accompanied by an illustration for the last 10 patients who went through this pathway under the care of three consultants. It shows variation from referral to treatment of 21 to167 days.

This is enough to have a useful discussion to try and understand the causes of the differences and identify potential solutions.

Taking the information from the mapping exercise, the next step is to plot the total journey time in days on a **run chart** (see graph). A run chart is a great way of creating a visual picture of variation. If you have more than 25 data points you could use a **statistical process control** (SPC) chart. This draws in lines to demonstrate how much variation you can expect in the system.

Figure 3: run chart showing variation



Source: Cancer Services Collaborative Improvement Partnership, How to Achieve Cancer Waiting Times, 2006

What next?

If you are to reduce or manage variation, you need to engage other members of staff. The **clinical engagement** and **gainging insights from/working with health service users** tools may help you do this.

The source of variation is important: we should aim to reduce artificial variation and manage natural variation.

Sometimes there is so much variation – say in referral to treatment times – that things seem chaotic. Spend a bit of time understanding why. It is possible you are looking at two or more very different clinical pathways. If so, look at the pathways separately to understand where you should focus improvement efforts. An alternative explanation is that there is no set agreement for the way things are done – one improvement focus could be to show staff the impact this has on patient care.

Other useful tools and techniques that may help you

- **Statistical process control** looks at variation using a statistical methodology to help you to identify and tackle predictable and unpredictable variation.
- **Reliable design** shows how reducing variation is key to higher reliability.

Additional resources

Perla, RA, Provost, LP, and Murray, SK (2011) The run chart: a simple analytical tool for learning from variation in healthcare, *BMJ Quality and Safety*, Vol.20, Issue 1: 46-51

Raleigh, VS and Foot, C (2010) *Getting the Measure of Quality: opportunities and challenges*, London: King's Fund

Background

The principle of looking at variation and keeping a steady flow of work originates from William Edwards Deming, an American engineer, statistician and management consultant. Many improvement methodologies have reducing variation at their core, for example Lean, Six Sigma, clinical systems improvement and reliable design.