

Understanding variation

Overview

Variation refers to the measurable differences, fluctuations, or changes observed in a set of data or a process. In healthcare, it represents the inherent diversity in patient characteristics, care delivery processes, and patient outcomes – it is very rare to get the exact same performance or outcome. There are two types of variation, common and special cause. These terms are often used interchangeably with random and non-random variation. Reducing and managing variation enables systems to become more predictable, efficient and produce better outcomes. For quality improvement you need to understand where it comes from and the tools to make it visible.

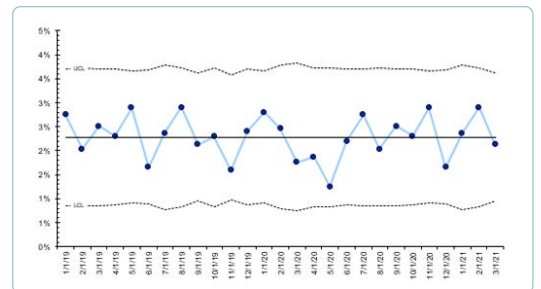


Types of variation

Common cause variation

- Occurs due to regular, natural causes that are inherent in the design of a system or process
- Affects all the outcomes of a process
- Results in a 'stable system' or one in statistical control.
- A stable process indicates that the variation is predictable
- Also referred to as random variation

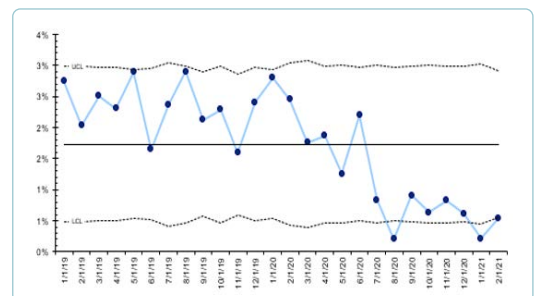
Figure 1. Example of common cause variation



Special cause variation

- Occurs due to irregular or unnatural causes that are not inherent in the design of the process
- Acts as a 'signal' to investigate what is causing the non-random pattern
- Affects some but not all aspects of the process
- Results in an 'unstable' process that is not predictable.
- Also referred to as non-random variation

Figure 2. Example of special cause variation



Where does variation come from?

Understanding and controlling variation is a central tenant of quality improvement. To do this, we must understand where variation comes from. Variation can either arise from either intended or unintended causes.

Intended variation refers to deliberate changes or adjustments made to processes or systems to achieve specific goals or outcomes. Intended variation is an important part of effective patient-centred healthcare. It is desirable to have variation with the intent to best match the care being provided to patient preferences. Quality improvement initiatives also

be another source of intended variation within a system

Unintended variation occurs due to changes introduced into a healthcare process that are not purposeful, planned or guided. Usually, these changes arise from factors such as equipment, supplies, environmental or human factors. This variation creates inefficiencies, waste, re-work, ineffective care, errors, and harm in our healthcare system.

Focussing on reducing unintended variation that is occurring within a process/system usually results in improved outcomes and reduced costs.

Making variation visible

In quality improvement, visual presentation of data over time such as well-annotated run charts and control charts are used to identify and learn from variation in our data.

A **run chart** is a type of line graph showing data over time (figure 3.). They are easy to construct, simple to interpret and can help you to understand your system and determine if the changes you made are leading to improvement and begin to distinguish between common and special cause variation.

For a more statistically robust understanding of your system, its stability, or if you have more than 30 data points a control chart is required.

A **control chart** looks very similar to a run chart. However, it includes an upper control limit (UCL) and a lower control limit (LCL) (figure 4.). These are lines marked above and below a mean line (instead of a median line).

Be aware that both run and control charts have an individual set of rules for interpreting data. More information on run charts and control charts can be found in the [SCV Quality Improvement Toolkit](#)

Figure 3. Example of a run chart

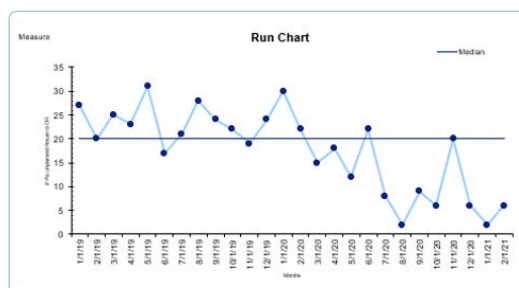
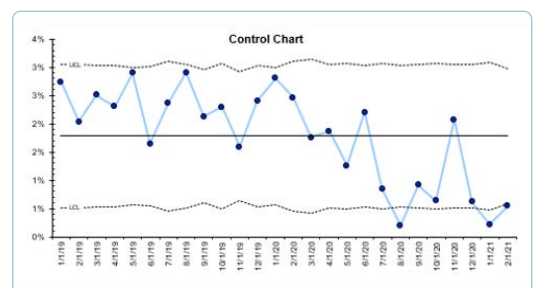


Figure 4. Example of a control chart



Responding to variation

Understanding the difference between common and special cause variation enables us to ensure we are responding appropriately to what is occurring within the system.

Common cause variation (act on system):

- In a stable system, the system is performing as well as possible and would require a process redesign to improve.
- If you're not satisfied with current level of performance of a system that only displays common cause variation, you should first develop and test theories that might result in improvements to the system before implementing changes.
- Reacting by making adjustments to a stable process can lead to increased variation and inefficiencies. This is called tampering.

Special cause variation (act on points):

- The response should be focused on the circumstances surrounding the special cause, not the underlying system or process.
- If the outcome of the variation is undesirable: investigate to find the assignable causes and take steps to eliminate the opportunity for this to reoccur.
- If the outcome of the variation is desirable: investigate to find the assignable causes and take steps to ensure this is instituted as part of the standard process.

Additional resources

To learn more about Quality Improvement you can access the following resources:

- [SCV Quality Improvement Toolkit](#)
- [Institute for Healthcare Improvement website](#)
- [NSW Clinical Excellence Commission Quality Improvement Tools](#)
- [IHI Video: Learning about Variation by Counting Candy \(2mins\)](#)

References

Bennett, B., Grunow, A., Park, S. (2022). Improvement Science at your fingertips. ISC LLC

Lloyd & Provost (2011): The Health Care Data Guide – Learning from Data for Improvement

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