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IMPROVEMENT CYMRU ACADEMY

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Improvement Cymru Academy Toolkit Guide

Understanding Variation

Introduction

Variation is a key principle of improvement, therefore we need to understand and control it. When seeking to understanding variation there are several ways to do so. This guide is a comprehensive way of looking at variation, describing what it is, why it occurs and how to understand it. The only variation that we do not need to concern ourselves with, is that which is valued by our customer.

Rationale

Variation is a principle within improvement, the more we understand variation, the better we can control it and work to improve safer working environments that ultimately benefit patient safety and quality care for both organisations, staff within them and the patients that access them.

What is variation?

Variation is the difference between two or more similar things. All processes have some degree of variation built into them, either intentionally or through a miscellaneous result.

Variation creates lack of consistency and impacts on the quality of the service and outcome. To understand the types of variation it's important to look at processes not the people. It's not about blaming individuals or processes, it's a collaborative effort to understand ways of improving tasks or services. The aim of understanding variation is to limit the amount of variation occurring, saving time, cost and waste, whilst utilising resources, staff expertise and maintaining staff retention.

The types of variation

There are two types of variation, each of which requires a different approach:

- Common cause
- Special cause

Special cause variation is not part of the day to day or regular processes. It can be carried out in different ways and can either be improved or avoided by addressing the cause alone.

Random Variation (Common cause): Random variation is built into every process and is predictable. This type of variation is stable with a consistent pattern of variation, i.e. 'chance'. Typically, this type of variation occurs as a result of day-to-day variation in a process. For example, the time it takes to drive to work, or the number of steps you take in a day.

Random variation represents 94% of all variation seen in processes. This type of variation requires changing the process to reduce the variation – a process with limited variation will deliver standard results.

Non-random Variation (Special cause): Non-random variation is seen when changes in the pattern of data can be assigned to a specific cause i.e. performance is unpredictable. The cause may or may not be beneficial or intentional and usually occurs due to external factors outside of the process. Beneficial non-random variation, can help you to identify positive effects on a process and result in a learning opportunity. Unwanted non-random variation or 'bad' variation needs to be eliminated from a process.

Respond to this by understanding: if the cause is beneficial, you may want to do more of it. If it was not beneficial, you may want to avoid it happening again.

When variation is:	Common cause	Special cause
Action required	Change the process (QI)	Fix or mitigate the issue (not a QI project)
Frequency	94% (Deming)	6%
Who	QI team/project	Managers or staff

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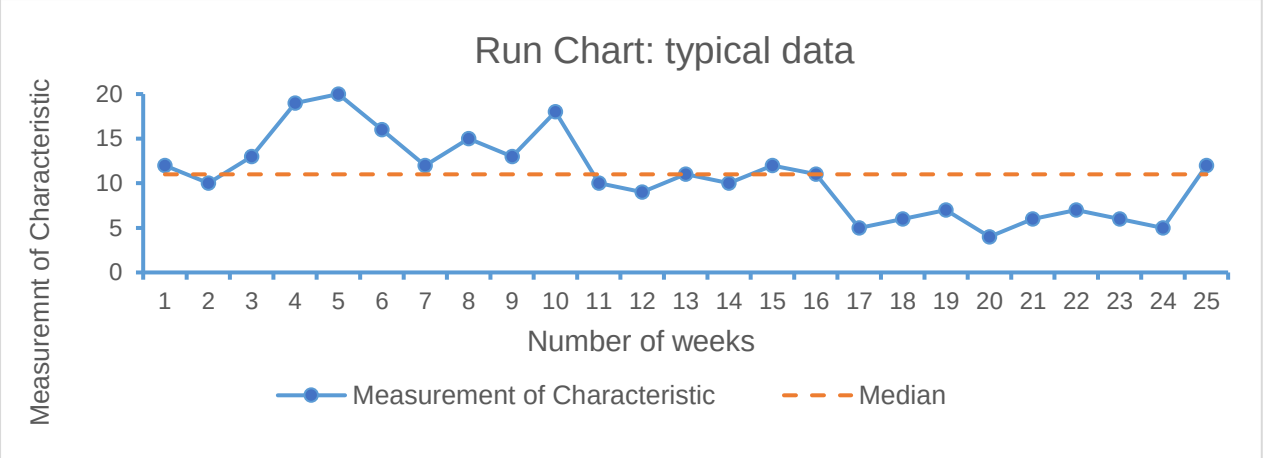
Understanding variation

Run Charts are graphs of data over time and allow us to see whether the tests of changes we have introduced have had the desired effect and resulted in an improvement. Run charts are one of the most useful tools in improvement. By using Run charts we get to see the visual representation of variation. We call the points data points and the line across the middle represents the median.

Run chart example

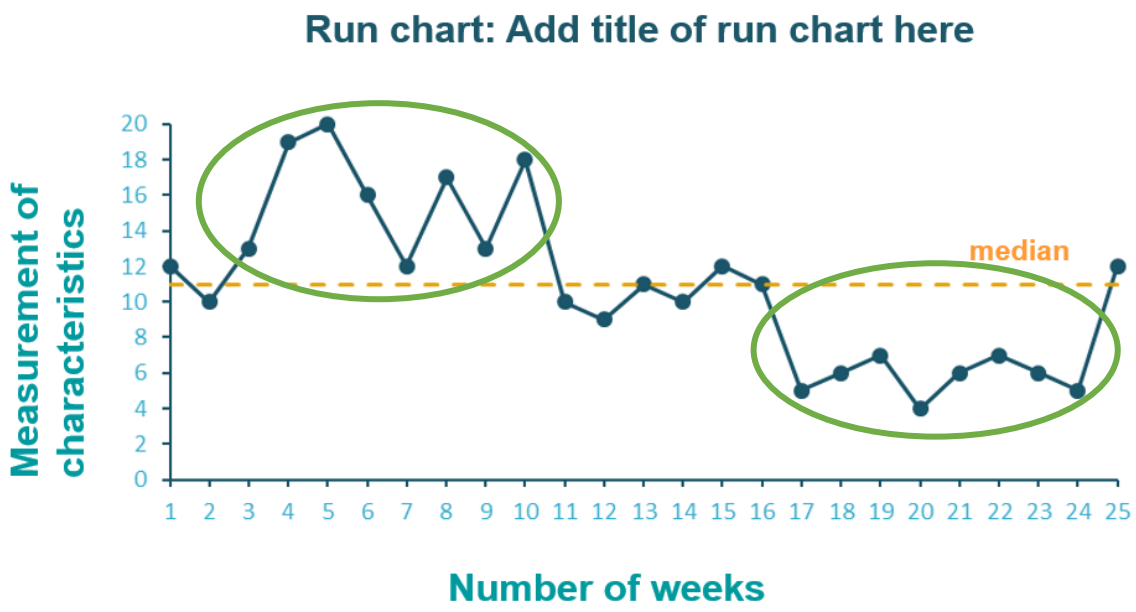


For more information on run charts please see the academy's 'Run Chart toolkit guide'.

Interpreting a Run Chart: Variation is part of everyday life and every process has variation. Your approach must depend on which type of variation is present.

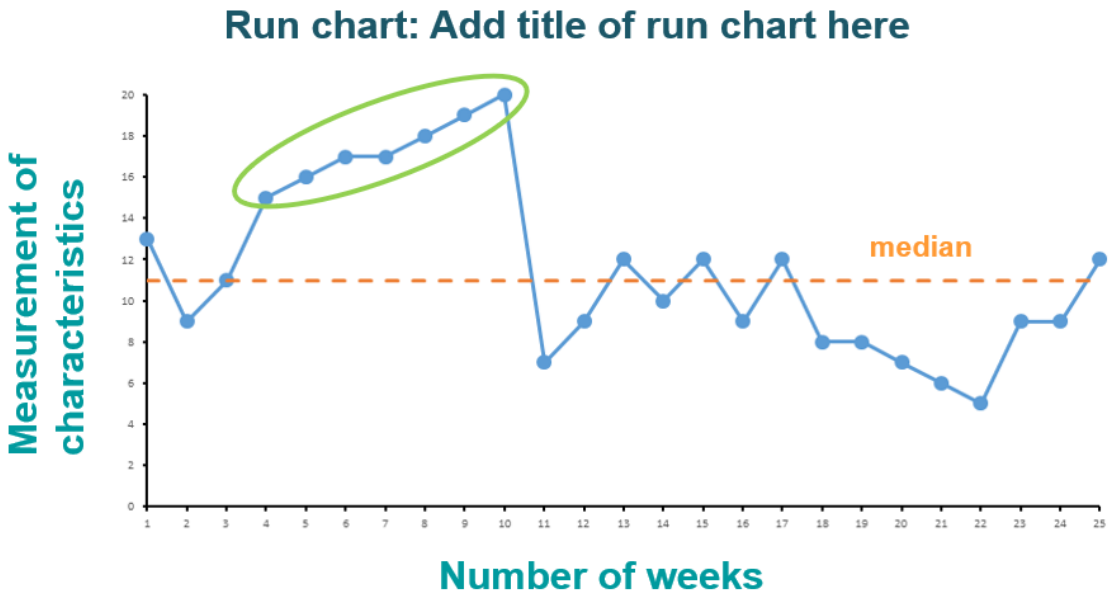
There are four rules to help you identify non-random variation. There is evidence of improvement if one or more of the circumstances depicted in the four rules below are seen when you analyse your data. To help you remember them- we have called them the **S.T.A.R**. rules (**S**hift, **T**rend, **A**stronomical point and **R**uns).

Rule 1: Shift



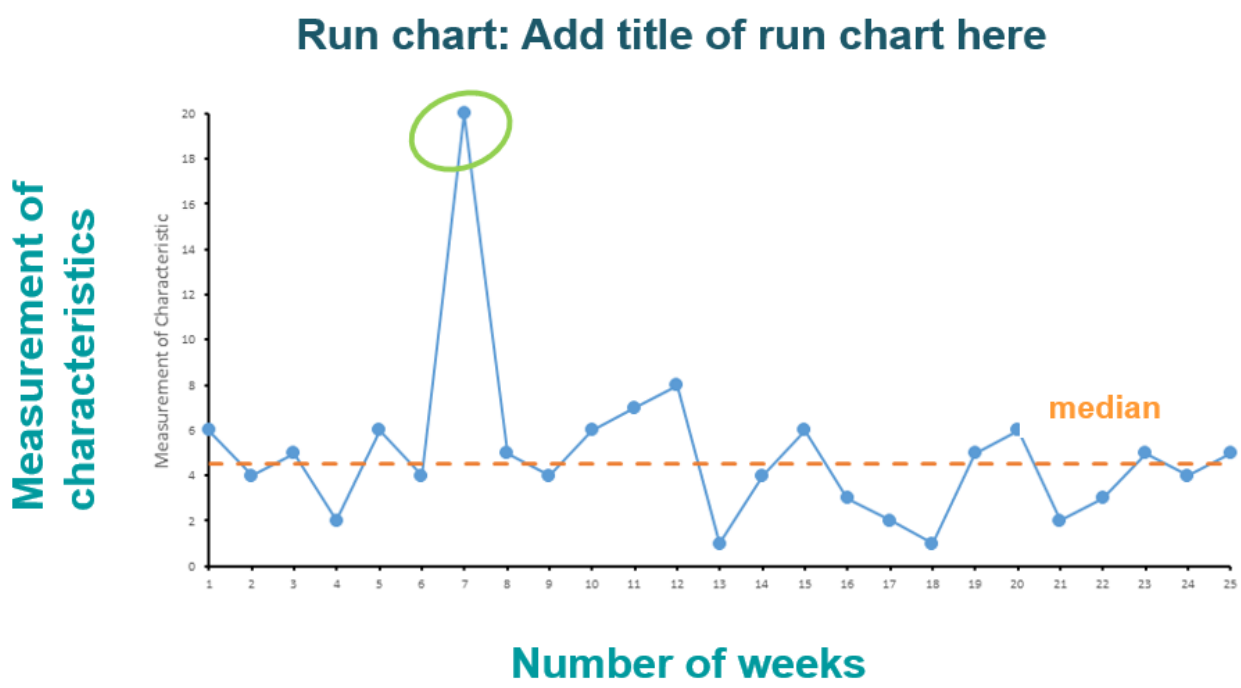
A **shift** on a run chart is **6 or more consecutive** points either all above or all below the median. Values that fall on the median do not add to nor break a shift. The shift and run rules require more than 10 points before they are applicable.

Rule 2: Trend



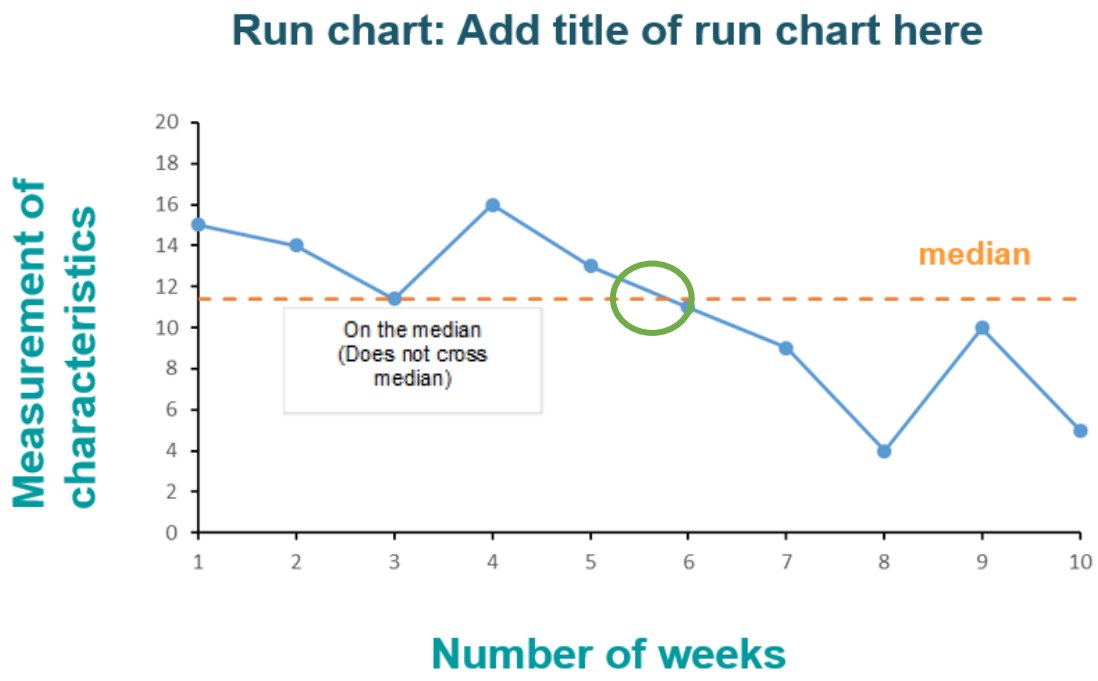
A **trend** on a run chart is **five or more consecutive** points all going up or all going down. If the value of two or more successive points are the same, ignore the successive points of equal value when counting.

Rule 3: Astronomical point



An astronomical point is an obviously blatantly different value which is clearly highly unusual. Be aware **-** every dataset will have a high point and a low point. This does not make them astronomical.

Rule 4: Runs



Count the number of runs and **always add one extra** – this is the number of times the line crosses the median. Refer to the runs table (Table 1 below): If the number of runs falls **within** the range between the lower and upper limit – this is random variation. If the number of runs falls **outside** the range between the lower and upper limit – this is non-random variation.

Total number of data points on the chart that do not fall on the median	Lower limit for the number of runs (< than this number is 'too few')	Upper limit for the number of runs (> than this number is 'too many')
10	3	9
11	3	10
12	3	11
13	4	11
14	4	12
15	5	12
16	5	13
17	5	13
18	6	14
19	6	15
20	6	16

21	7	16
22	7	17
23	7	17
24	8	18
25	8	18
26	9	19
27	10	19
28	10	20
29	10	20
30	11	21
31	11	22
32	11	23
33	12	23
34	12	24
35	12	24
36	13	25
37	13	25
38	14	26
39	14	26
40	15	27

Table 1: Runs Table

Potential causes of variation

Every process will incur a form a variation. This can be caused by:

- Technology that someone maybe using, it could be outdated or could be different to what the person uses or trained in.
- Types of people and personality, people work in different ways and find different ways of completing tasks.
- Shift patterns from day and night time shifts.
- A difference in the ways and methods people use to complete tasks.
- Our environment can occur variation, e.g. a different clinic to the one the person is used to working in.

Helpful tips

- Look to understand the process and not blame the person carrying out the process.
- Some variation is intended for the purpose of the organisation.
- Unintended variation can cause harm and cost to an organisation.

- Be sure to measure data frequently daily, weekly, bi-weekly as data can be lost over time if measured monthly.

Additional resources

If you are interested learning more about improvement please visit our website https://phw.nhs.wales/services-and-teams/improvement-cymru/improvement-cymru-academy/. We also have a range of other toolkit guides that compliment this resource, or email us improvementcymruacademy@wales.nhs.uk

Further resources

Quality Improvement Zone [online] Available at: Testing change ideas | Turas | Learn (nhs.scot) [Accessed 27 February 2023]

Science of Improvement: Testing Changes [online] Available at: Science of Improvement: Testing Changes | IHI - Institute for Healthcare Improvement [Accessed 27 February 2023]

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