

# SPC Analysis with T Charts

January 2025

# SPC Analysis | T-Charts

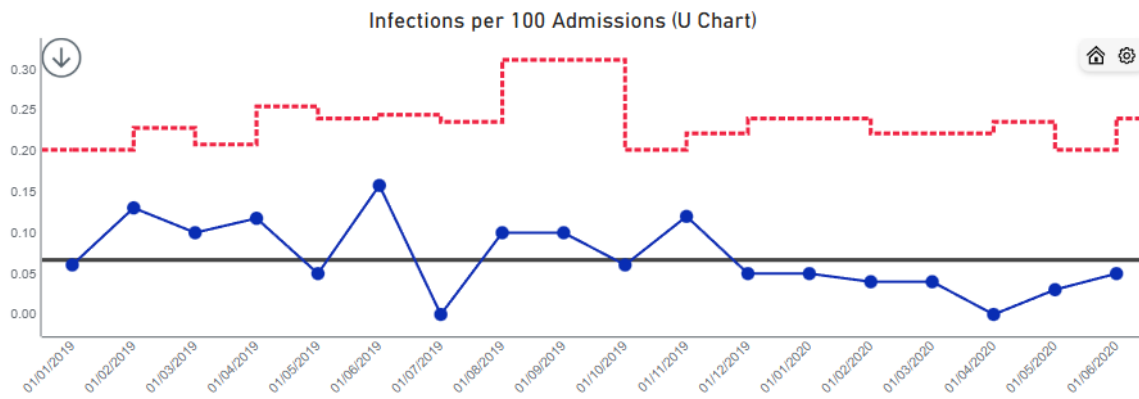
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## SPC Analysis – T Charts

Whilst attribute charts are useful in monitoring performance and demonstrating improvement, they become less useful when events are infrequent. Whether C, U or P chart, these charts should have a  $LCL > 0$  for effective interpretation of special cause signals, specifically points below the lower control limit and 8 or more data points below the centreline (Provost and Murray, 2022).

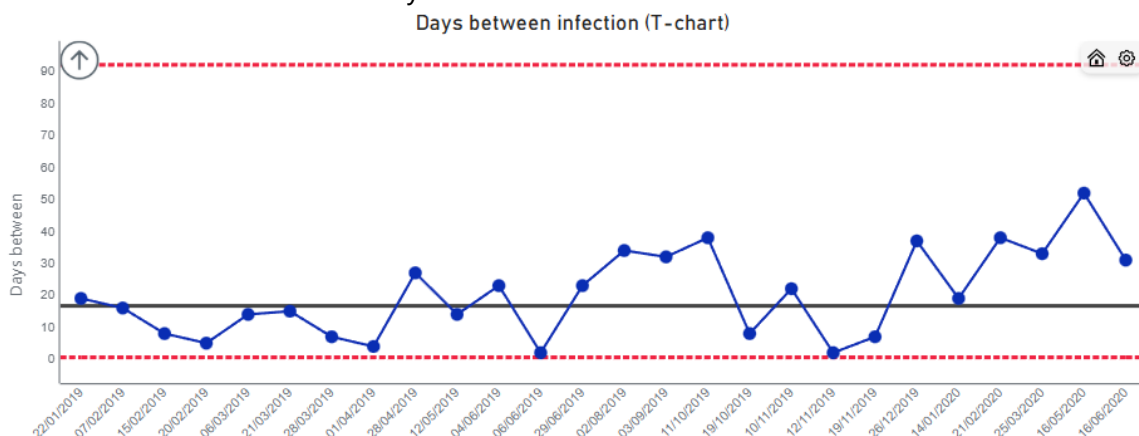
The U chart below shows a low infection rate, resulting in no LCL, making interpretation of any potential special cause difficult (Robert Lloyd, 2019).



An alternative approach to displaying the data is to use rare event SPC charts, either a T-chart (for time between events) or a G chart (for the number of opportunities such as admissions, cases, and procedures between events.). Whilst the rules for interpreting special cause is the same, the plotting of the x-axis is different (Robert Lloyd, 2019)(Provost and Murray, 2022). The interpretation of the chart applies to the plotted points, **not** gaps in time.

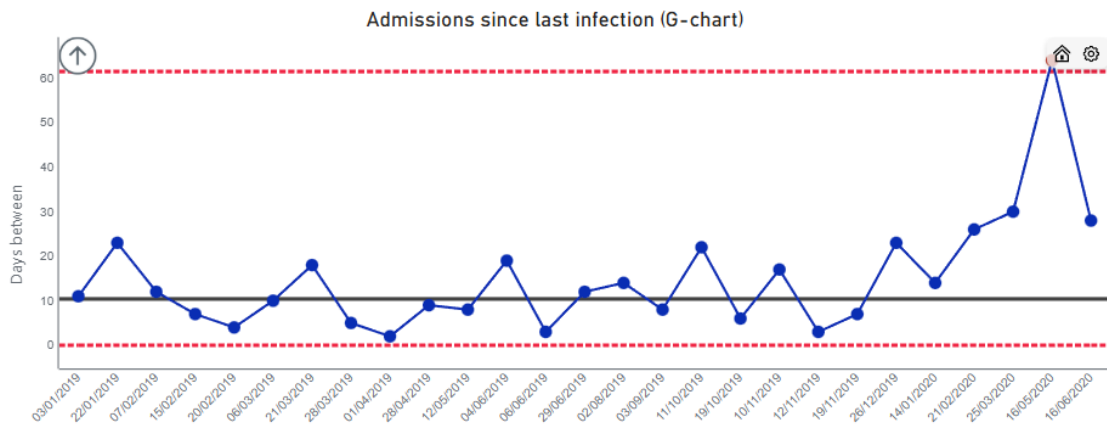
Rather than plotting data points by month, data points are only plotted when an event occurs. The x-axis is, therefore, a discontinuous time sequence. If you never have an event there would be no data plotted on the chart. This makes the plotting of both the G and T chart different from other SPC charts.

Below is a T-chart for the same unit and time period as for the U chart above but plotting the date of infection and the number of days between infection.



It is not possible for a T chart, or G chart to show monthly cumulation of days without an event due to the nature of the charts themselves.

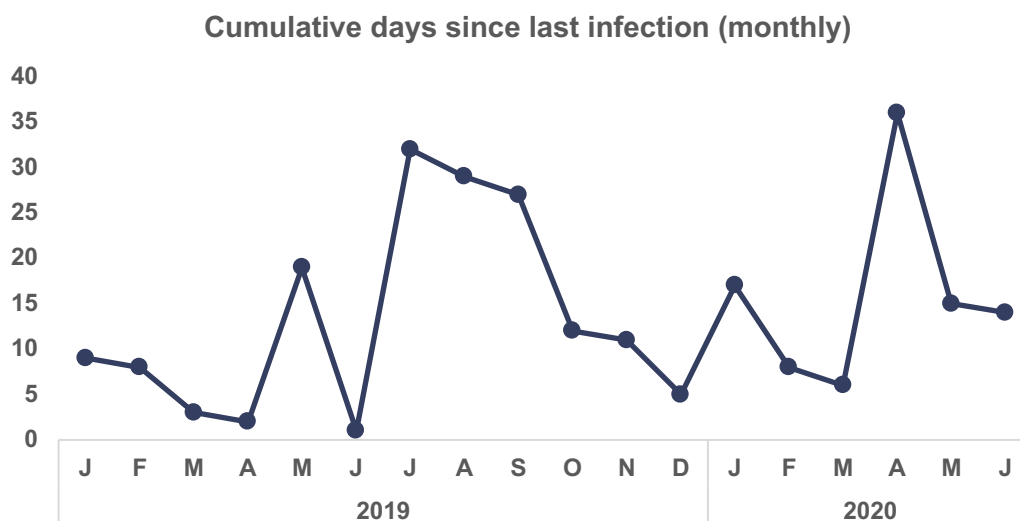
Below is a G-chart for the same unit, plotting the date of event and the number of admissions since last event, showing evidence of special cause – an increased number of admissions between infections.



## Alternative option

T- and G-charts assume each event is independent and that the opportunity/time between events resets the experiment (Provost and Murray, 2022).

Whilst not standard practice, if wanting to plot monthly cumulative data, an alternative approach would be to calculate the days since last event at each month end. This would be plotted on a simple line chart rather than SPC. SPC charts would not be appropriate for this chart type. Furthermore, it loses information as it only calculates the cumulative time since last event at month end. If there are multiple events in one month, such information would be missed off such a chart and may lead to misinterpretation.



## Data used to create charts<sup>1</sup>:

### 1. U-Chart

Month	Number of infections	Number of admissions
Jan-19	2	33
Feb-19	3	23
Mar-19	3	30
Apr-19	2	17
May-19	1	20
Jun-19	3	19
Jul-19	0	21
Aug-19	1	10
Sep-19	1	10
Oct-19	2	33
Nov-19	3	25
Dec-19	1	20
Jan-20	1	20
Feb-20	1	25
Mar-20	1	25
Apr-20	0	21
May-20	1	33
Jun-20	1	20

### 2. T and G chart

Date of infection	Admissions since last infection
03/01/2019	11
22/01/2019	23
07/02/2019	12
15/02/2019	7
20/02/2019	4
06/03/2019	10
21/03/2019	18
28/03/2019	5
01/04/2019	2
28/04/2019	9
12/05/2019	8
04/06/2019	19
06/06/2019	3
29/06/2019	12

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<sup>1</sup> Data taken from (Provost and Murray, 2022)

02/08/2019	14
03/09/2019	8
11/10/2019	22
19/10/2019	6
10/11/2019	17
12/11/2019	3
19/11/2019	7
26/12/2019	23
14/01/2020	14
21/02/2020	26
25/03/2020	30
16/05/2020	64
16/06/2020	28

### 3. Line chart

End of month	Most recent infection	Days since last infection
31/01/2019	22/01/2019	9
28/02/2019	20/02/2019	8
31/03/2019	28/03/2019	3
30/04/2019	28/04/2019	2
31/05/2019	12/05/2019	19
30/06/2019	29/06/2019	1
31/07/2019	29/06/2019	32
31/08/2019	02/08/2019	29
30/09/2019	03/09/2019	27
31/10/2019	19/10/2019	12
30/11/2019	19/11/2019	11
31/12/2019	26/12/2019	5
31/01/2020	14/01/2020	17
29/02/2020	21/02/2020	8
31/03/2020	25/03/2020	6
30/04/2020	25/03/2020	36
31/05/2020	16/05/2020	15
30/06/2020	16/06/2020	14

### References:

Provost, L.P. and Murray, S.K. (2022) *The Health Care Data Guide Learning from Data for Improvement*. 2nd ed. Newark: John Wiley & Sons, Incorporated.

Robert Lloyd (2019) *Quality Health Care: A Guide to developing and using indicators*. Second. Jones & Bartlett Learning.



