Control Chart Overview

Anatomy of a control chart

- Control charts plot data over time
- The centerline is the mean of the data set
- For each data set standard deviations are identified
- Control charts have upper control limits (UCL) and lower control limits (LCL) which are set at +3 (UCL) and -3 (LCL) standard deviations
- The UCL and LCL describe the control limits of a process; the area of the graph where you expect 99.7% of data points to fall

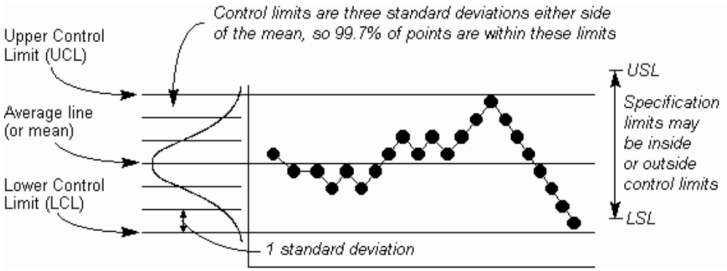


Fig. 2. Mean and Control Limits

Figure: http://www.syque.com/quality_tools/toolbook/Control/how.htm
http://www.ihi.org/Documents/OpenSchoolCourseTranscripts/BobLloydWhiteboard-controlchart1.html
http://www.ihi.org/Documents/OpenSchoolCourseTranscripts/BobLloydWhiteboard-ControlChart2.html

What do control charts tell you?

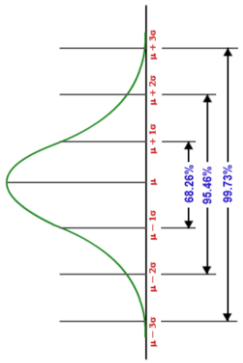
- How a process is performing
- What performance is arising from the process's design (common cause)
- What performance is arising from a change within or outside of the process (special cause)
- If your system is stable (performance is predicable within established limits)
- If your system is unstable (performance is unpredictable with data points that are not the result of the typical variation you would expect to see in a normal bell shaped curve)

Distinguishing Between Special and Common Cause Variation

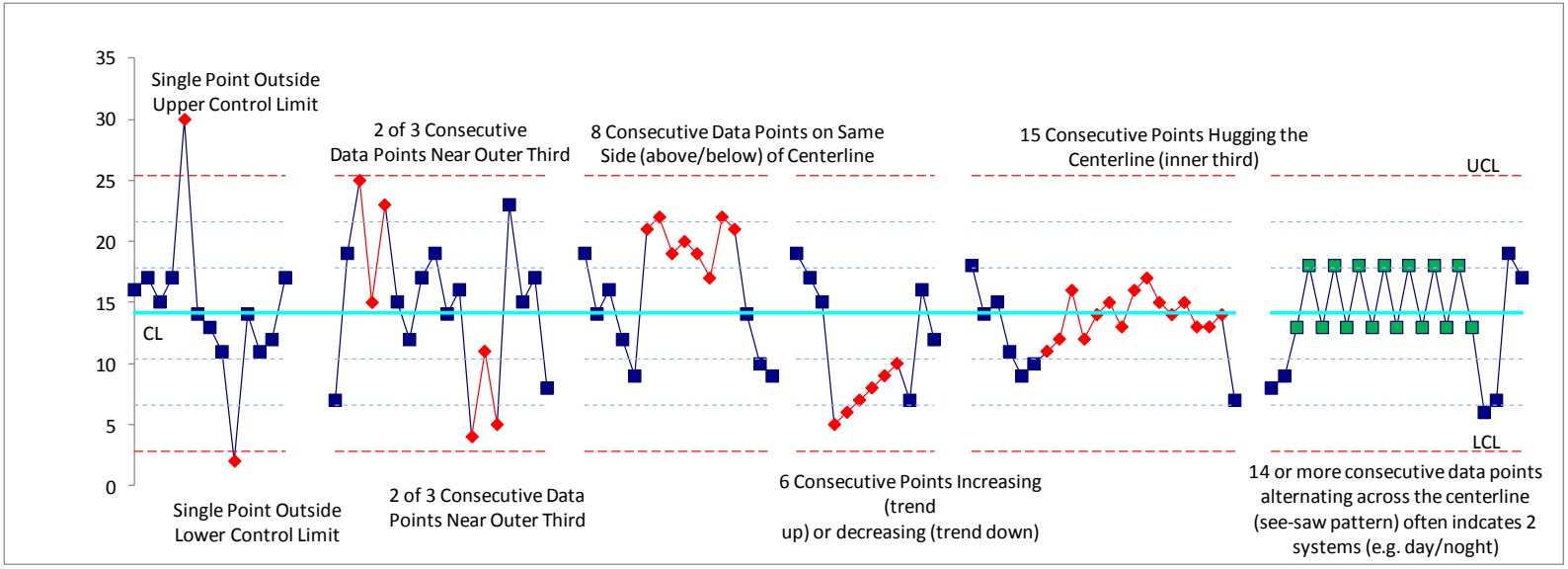
Signals of Special Cause – Non Random Variation

(e.g. Data patterns arising from a change within or factors external to your system)

- Every system is designed to deliver a range of performance which typically approximates a bell shaped curve/normal distribution and is called **common cause variation.**
- Data resulting from common cause variation will randomly fall within the Upper Control (UCL) and Lower Control Limits (LCL) of a control chart.
- When changes occur (e.g. you make improvements, your system structure changes, or factors in the external environment changes) data patterns may change from normal variation to signals of **special cause variation.**
- In the graph below, special cause variation is indicated by the red data points. The green data points indicate 2 separate systems in the same data set.



http://image.mathcaptain.com/cms/images/131/normal-distribution-curves.png



Most Frequently Used Control Charts in Healthcare

If your data does not fit into these chart types, other chart types are available

Source: QI Macro, Provost & Murray, Health Care Data Guide

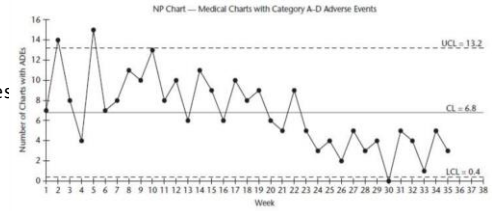
Classification Data (Is Unit Defective?)

NP Charts

NP Charts: displays the number of audits **classified** as having a desired or undesired characteristic using a **constant** sample size.

NOTE: Each item can only have one defect. Each item is classified as being one of two possible outcomes. For example: pass or fail, complete or incomplete, conforming to standard or not conforming to standard, having the characteristic of interest, not having the characteristic of interest)

Examples:
Surgeries with a Completed Time Out per 50 surgeries (conforming to standard)
Patients with Negative Biopsies per 1,000 biopsies (having the characteristic of interest)
Patients experiencing a Fall per 1000 patients (having the characteristic of interest)

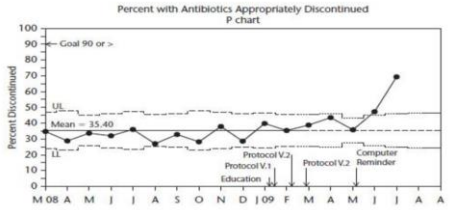


P Charts

P Charts: displays the number of **classified** as having a desired or undesired characteristic using a **varying** sample size

NOTE: Each item can only have one defect. Each item is classified as being one of two possible outcomes. For example: pass or fail, complete or incomplete, conforming to standard or not conforming to standard, having the characteristic of interest, not having the characteristic of interest)

Examples:
Percent of Surgeries with a Completed Time Out (conforming to standard)
Percent of Passing Quality Control Tests (pass)
Percent of Fully Complete Time Out Forms
Percent of Patients with Negative Biopsies (having the characteristic of interest)
Percent of Patients with drug allergies (having the characteristic of interest)



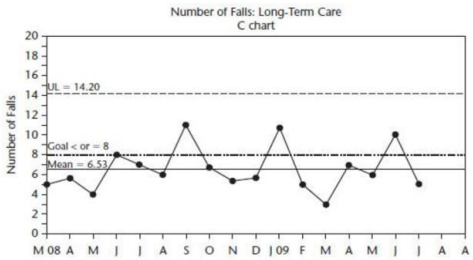
Count Data (How many defects?)

C Charts

C Charts: displays the **count** of event/defect per a **constant** sample size

Note: Each item can have more than one event/defect (1 staff member-multiple needlesticks, 1 patient - multiple falls)

Examples:
Number of needlesticks **per month**
Number patient falls **per nursing unit**
Number of missing handoffs **per shift**
Number of coding errors **per each group of 10 patient charts**

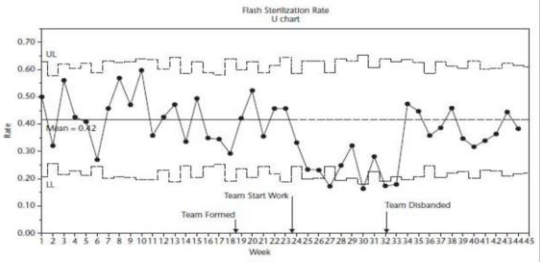


U Charts

U Charts: displays the **count** of events/defects per a **varying sample size**.

Note: Each item can have more than one defect (1 medication order can have multiple errors, 1 surgical tray can have multiple missing instruments)

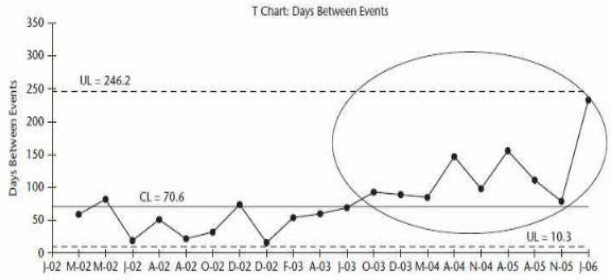
Examples:
Number of Errors/medication orders
Number of Missing Instruments/surgical trays
Number of employee accidents/hours worked
Number of complaints/admissions
Number of CLABSIs/patient days



Rare Events (How Often)

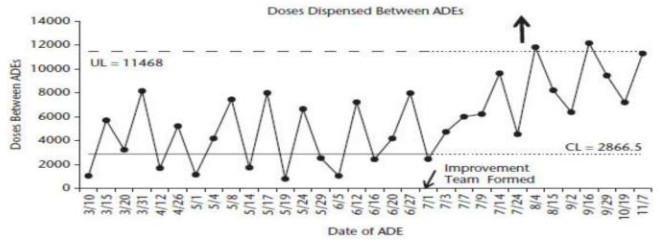
T Chart: Time Between Rare Events

T-Charts counts the time between rare events
Examples:
Days between wrong site surgeries
Days between cardiac arrests
Days between patient falls



G Chart: Units Between Rare Events

G-Charts counts the units between rare events
Examples: Number of surgeries between wrong site surgeries
Number of dispensed doses between fatal medication errors
Number of admissions between patient falls



Graph Source: Provost and Murray (2011) The Healthcare Data Guide: Learning From Data for Improvement