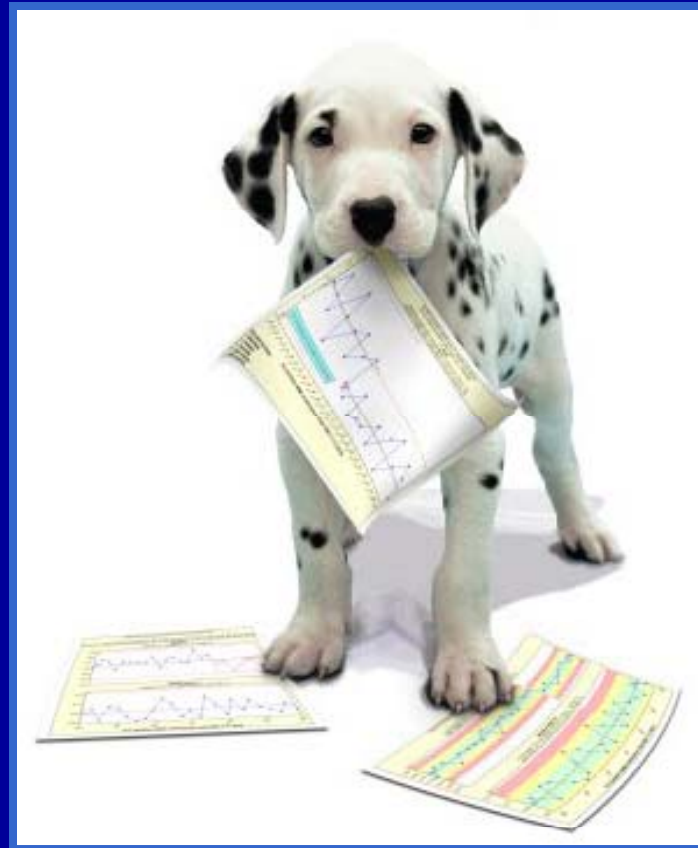


p-chart: The Pick of the Litter?



Presented by Matthew Savage

PQ Systems
incorporated

Introduction

- What are process improvement (PI) or control charts?
- Which process improvement chart is the pick of the litter?
- Which process improvement charts are full of fleas?
- The recommended approach.

Types of PI or control charts

Measurement control charts

- Individuals and Moving Range (X-Mr chart)
- X-Bar & Range chart
- X-Bar & Sigma chart
- Others: Median, Cusum, Moving Average

Attributes control charts

- Nonconforming items (p-chart, np-chart)
- Nonconformities per subgroup (c-chart, u-chart)

Purpose of a control chart

- Minimize the chance of making two types of mistakes.
 - Overcontrol
 - Undercontrol
- Help you decide when to react and when not to react.
 - Special cause variation
 - Common cause variation

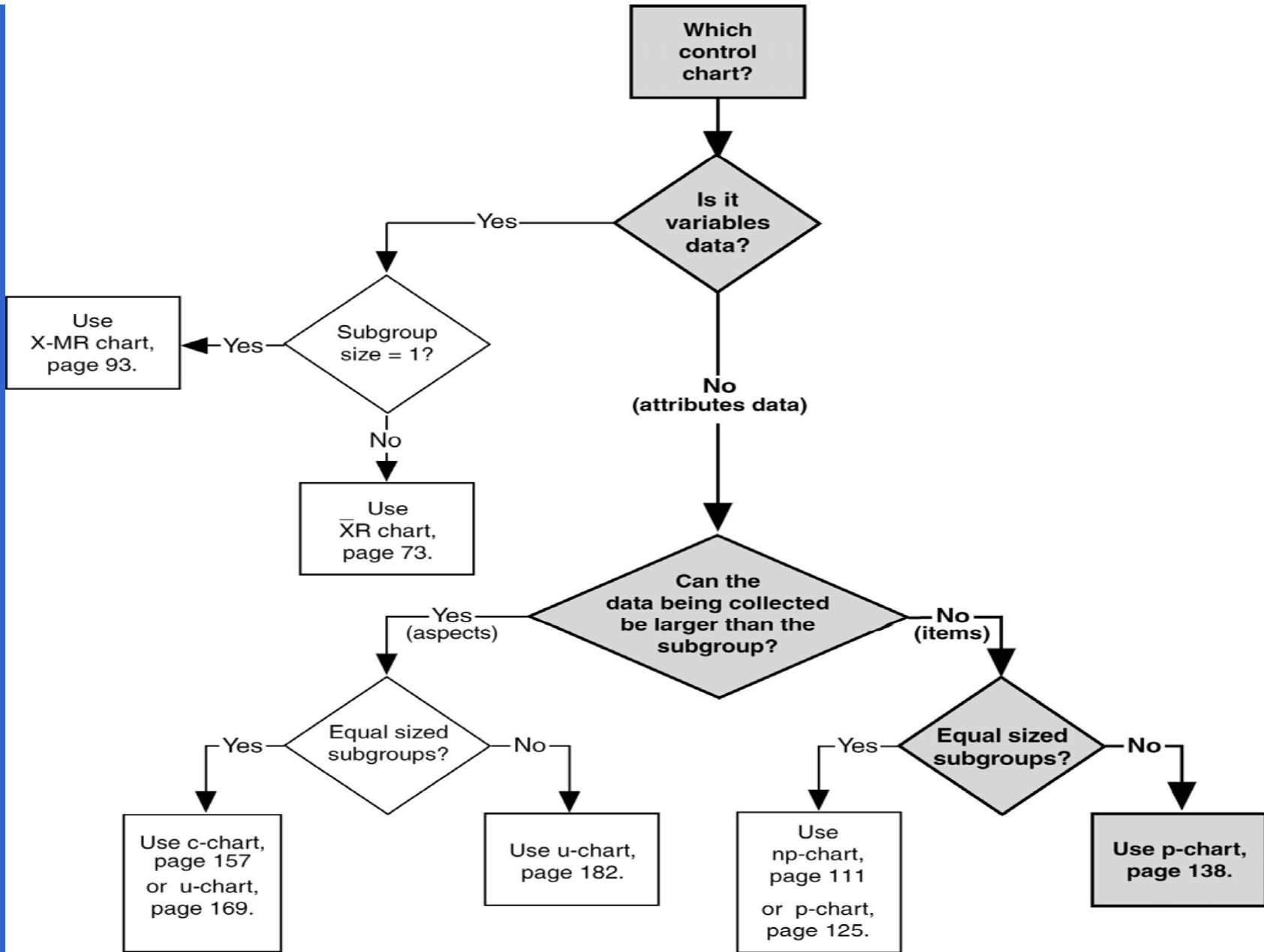


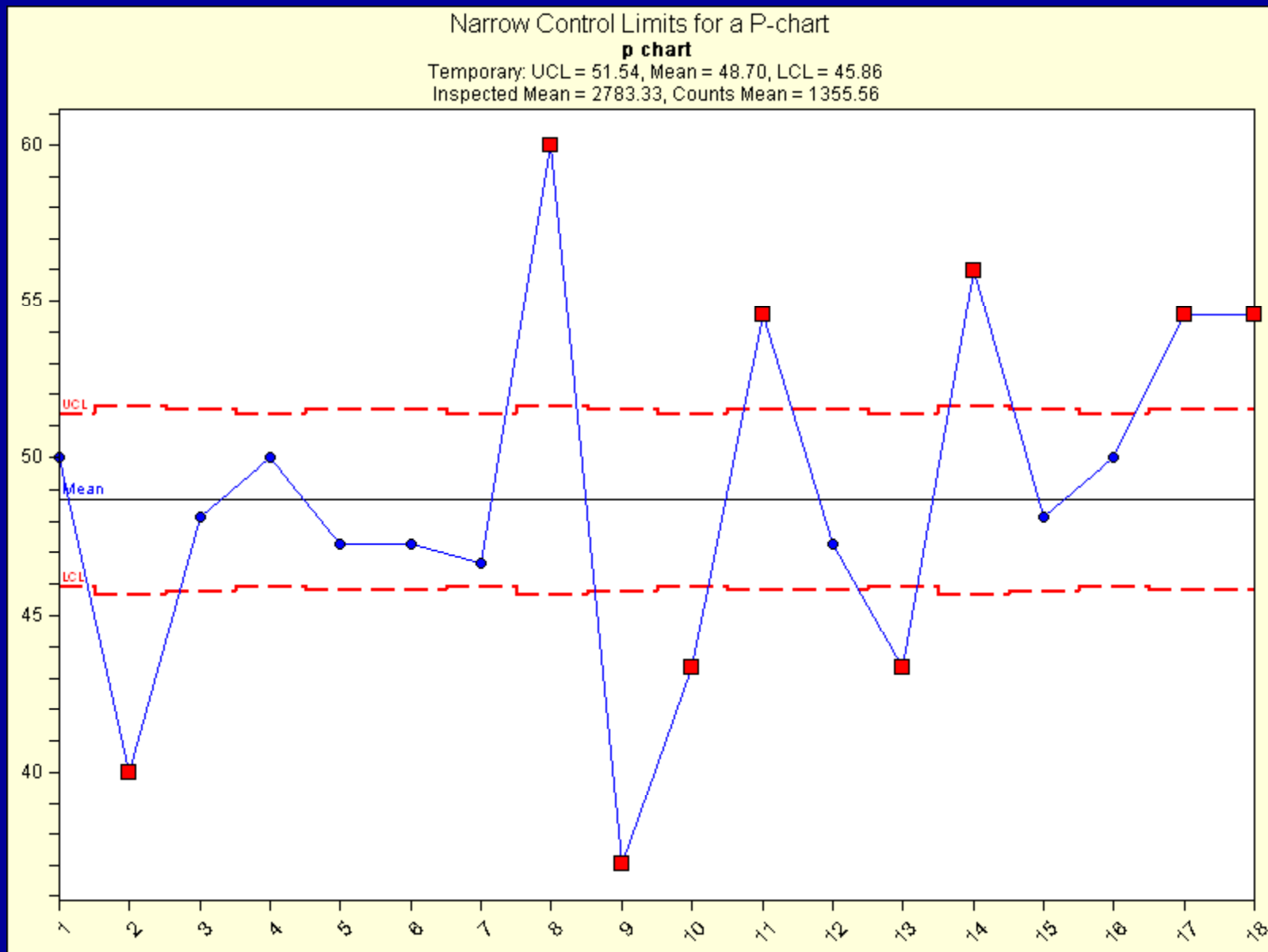
Chart selection flow chart

Benefits of attributes charts

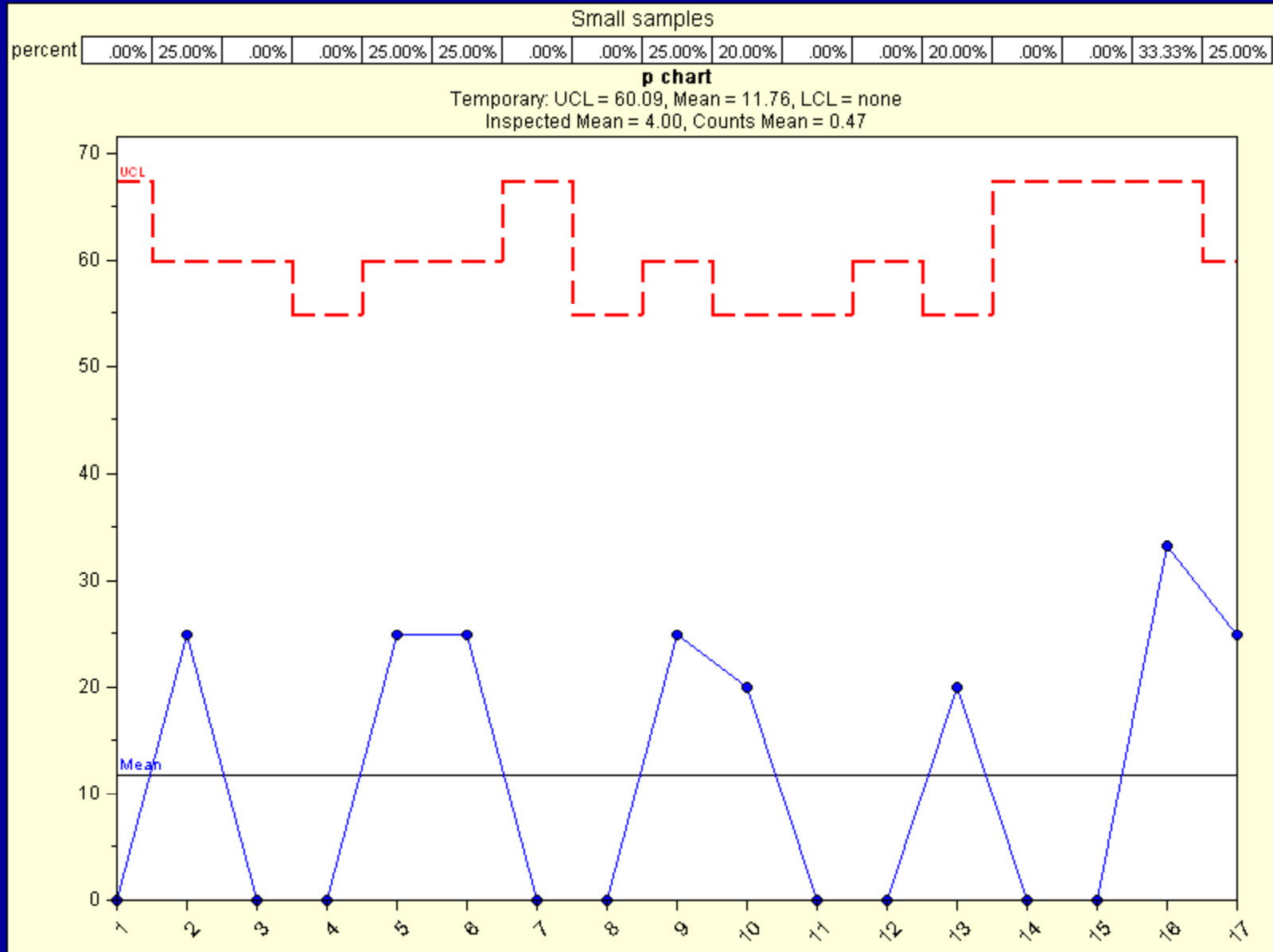
- Easy to understand data in percent form
- Percent of _____ measure is common
- Ratios are commonly used – per 1,000 patient days
- Puts data in perspective
- c-charts are easy to create and use

Common problems with p-charts

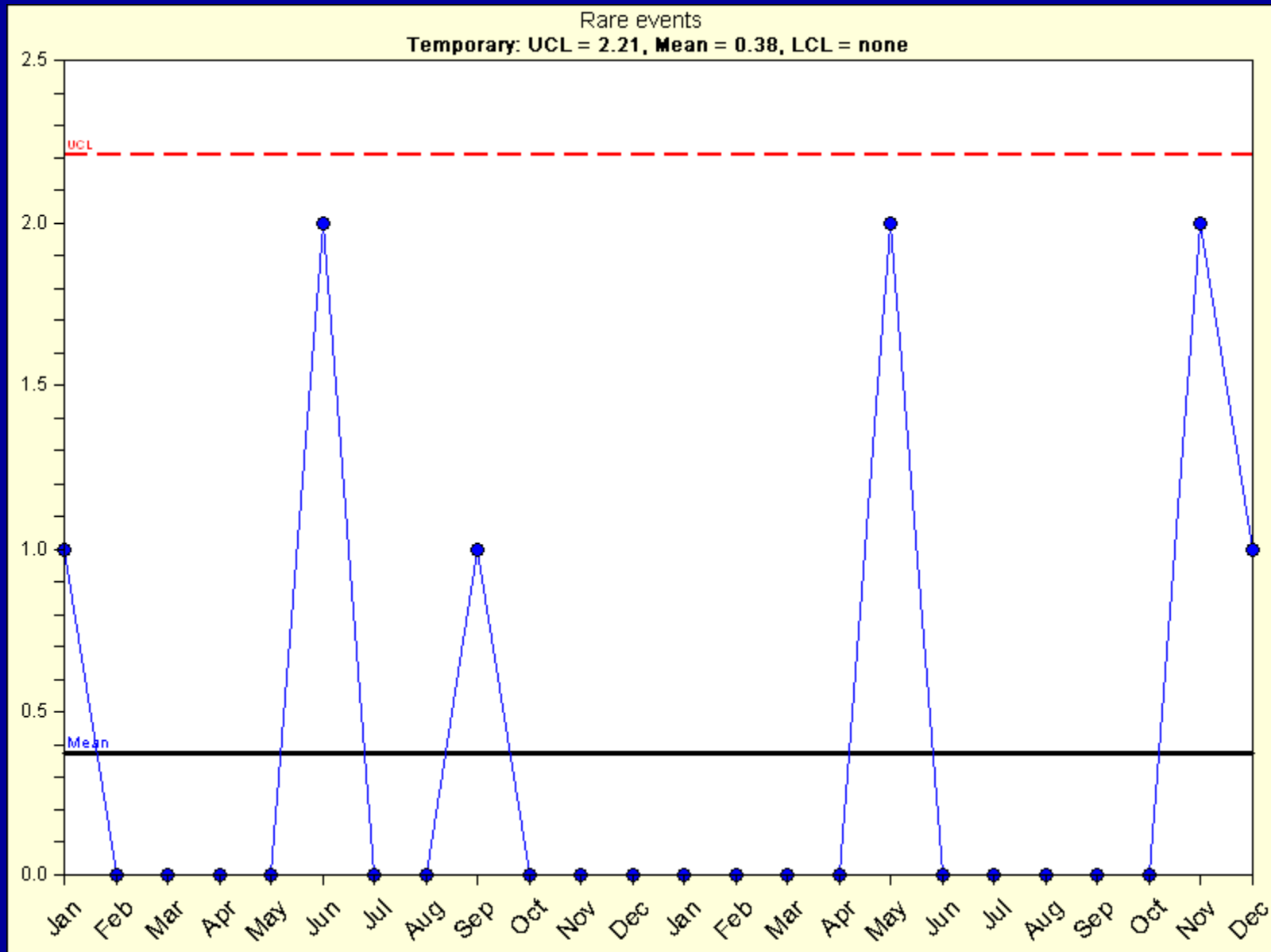
- Large samples (denominator)
- Small samples
- Rare events
- Understanding of control limits
- Detecting sample-to-sample variation
- Plotting positive vs. negative occurrences & effect on control limits



Large denominator

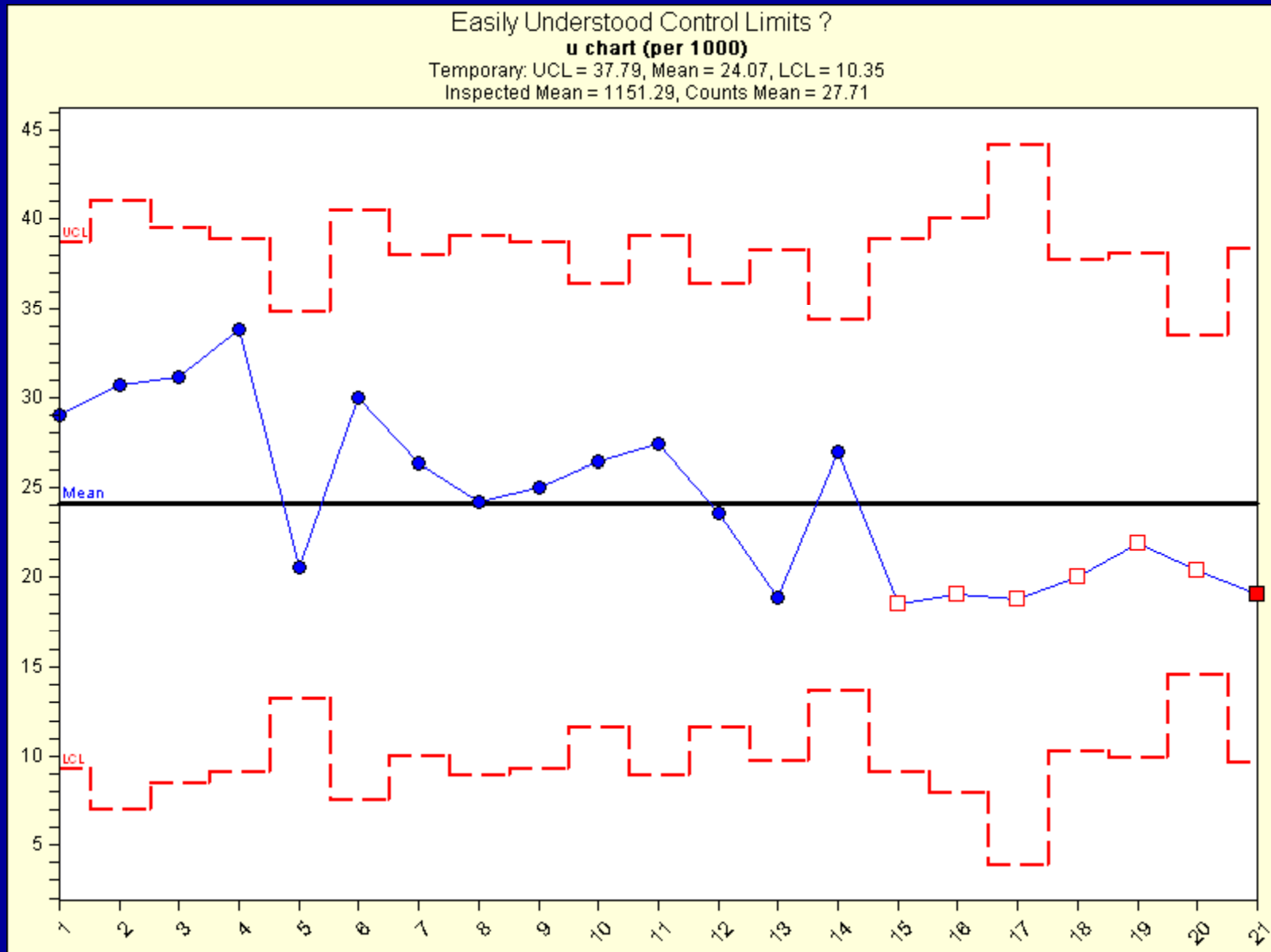


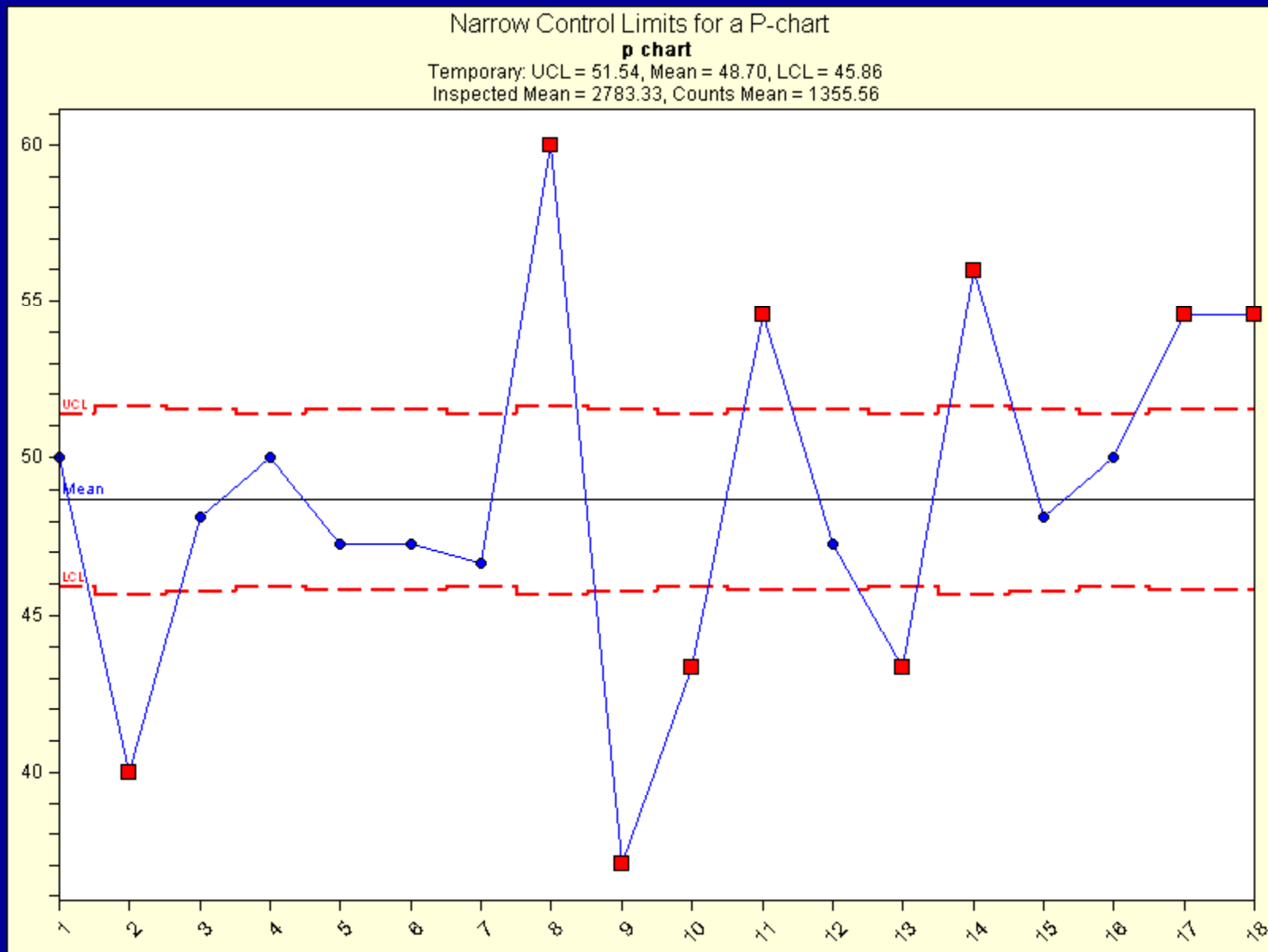
Small samples



Rare events

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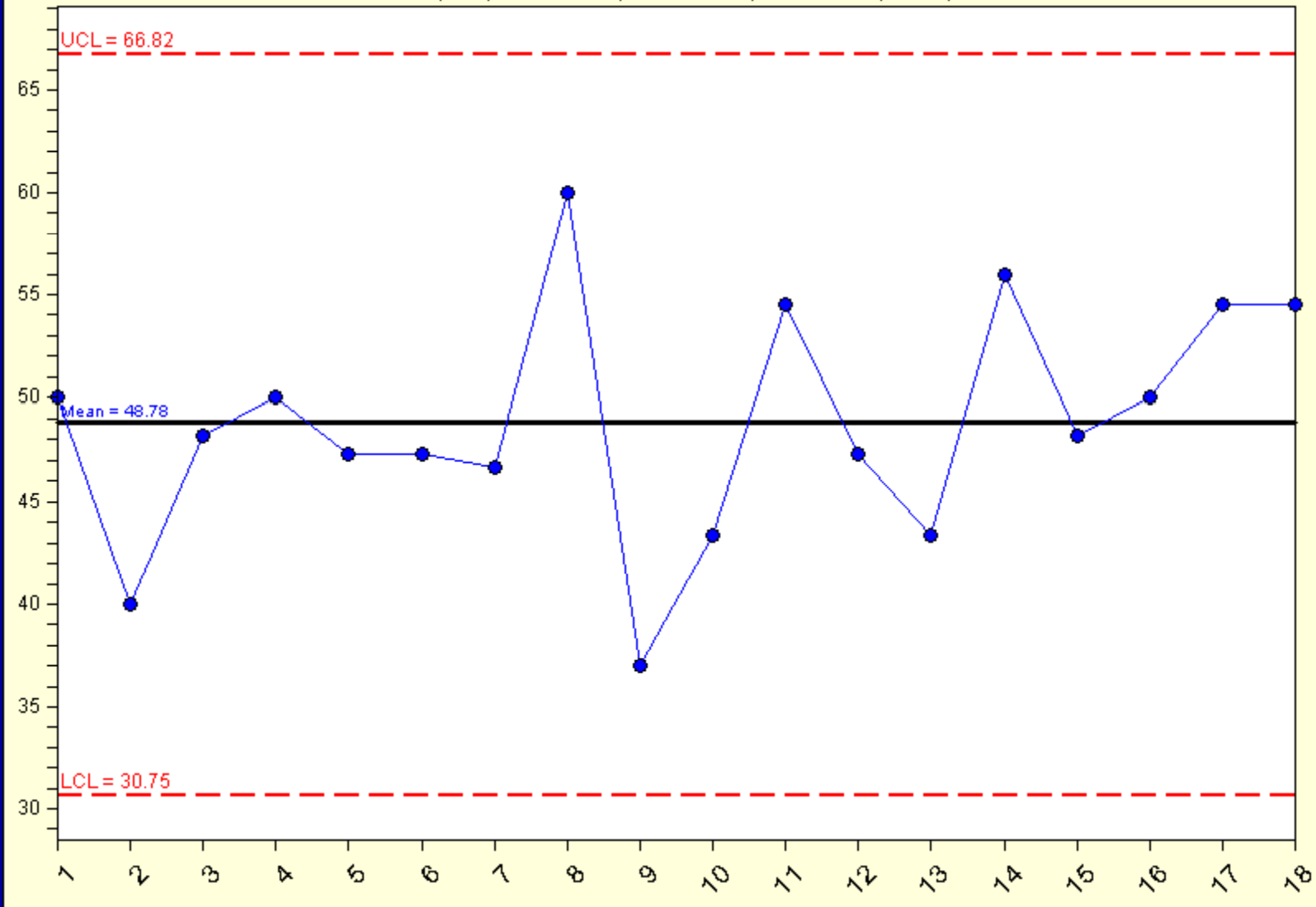


p-chart – Where do you start?

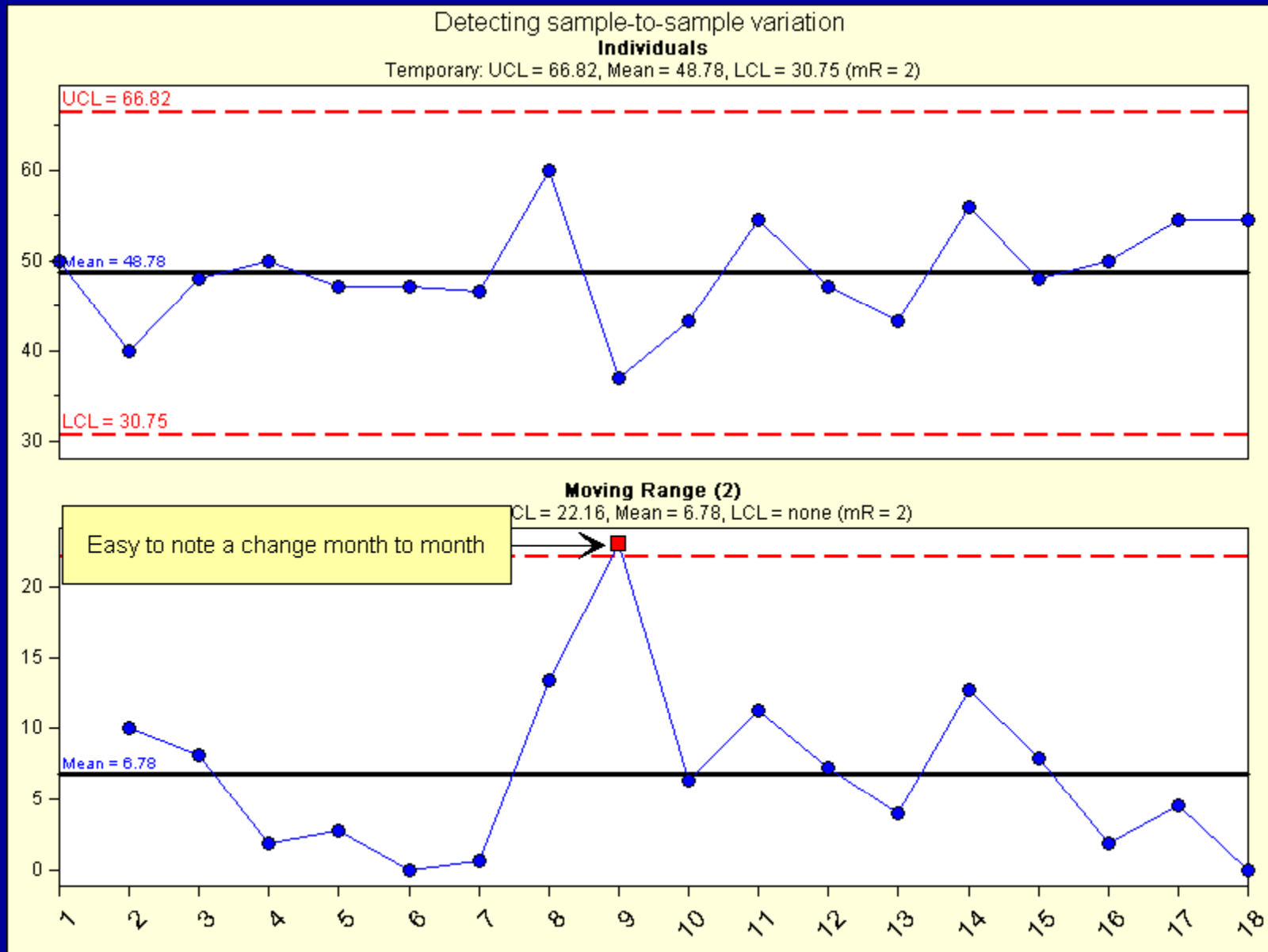
Can you detect the sample-to-sample variation ?

Individuals

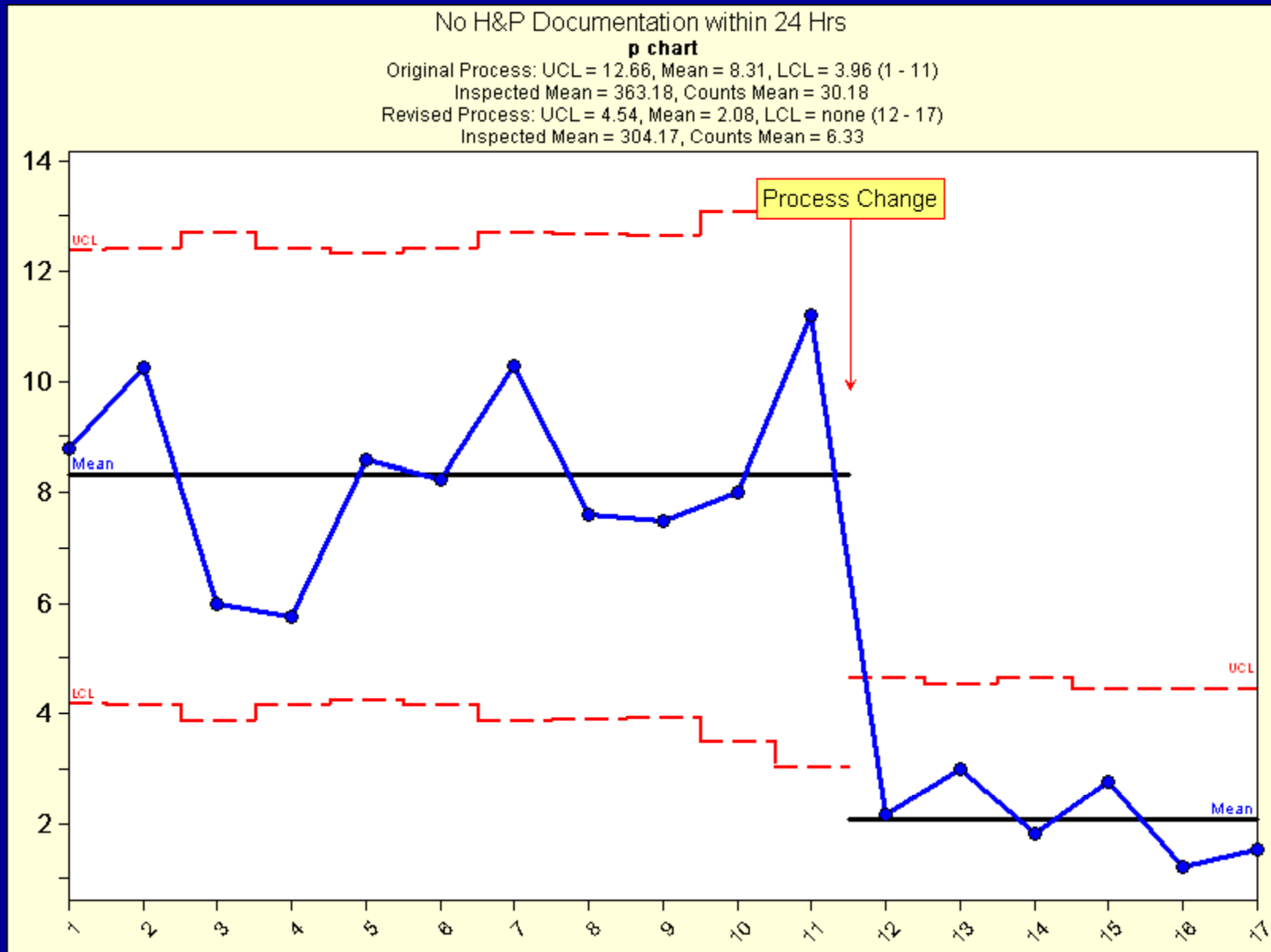
Temporary: UCL = 66.82, Mean = 48.78, LCL = 30.75 (mR = 2)



Is this process in control?



Sample-to-sample variation



Plotting negative occurrences

H&P Documentation within 24 Hrs

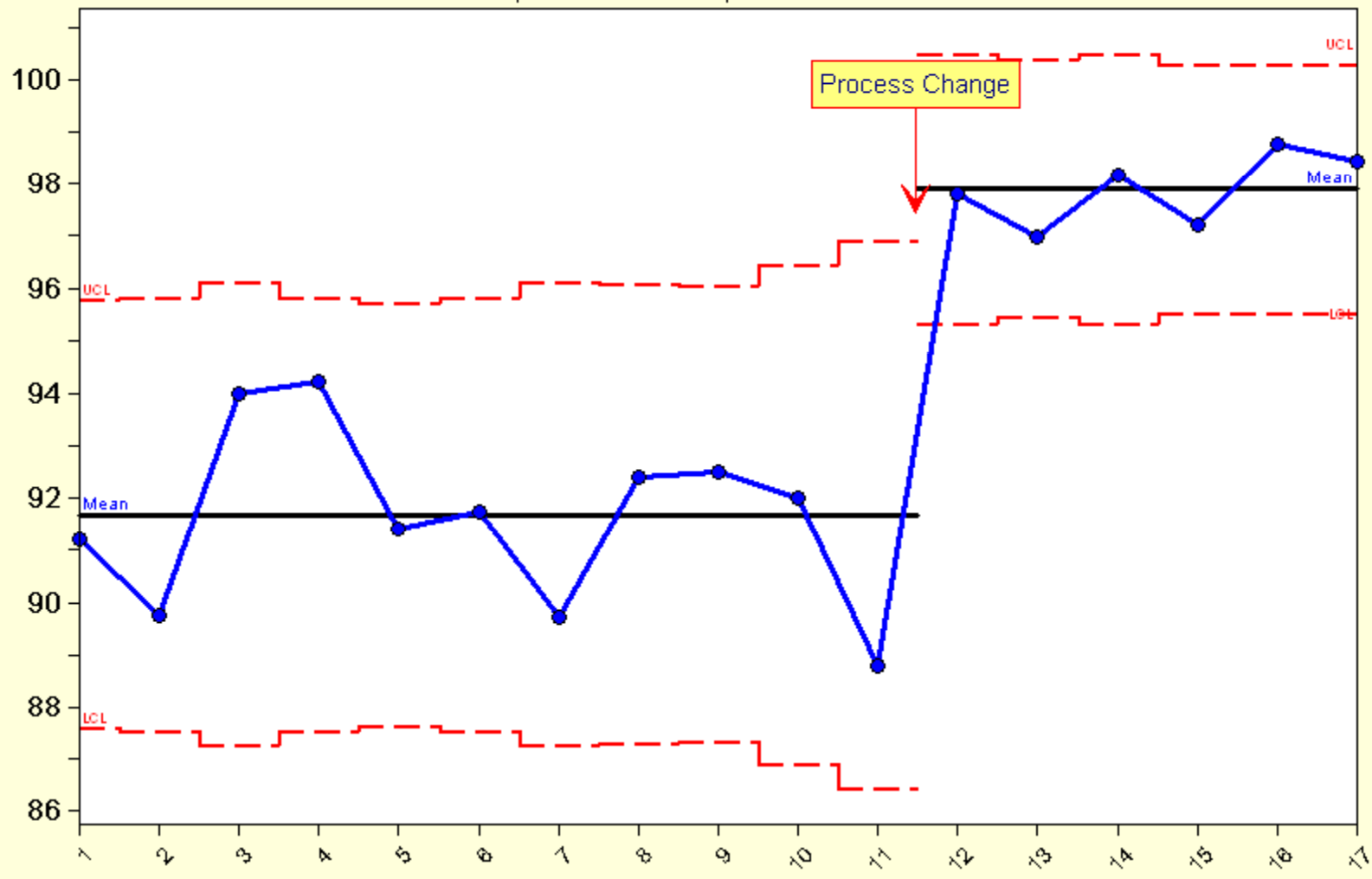
p chart

Original Process: UCL = 96.04, Mean = 91.69, LCL = 87.34 (1 - 11)

Inspected Mean = 363.18, Counts Mean = 333.00

Revised Process: UCL = 100.37, Mean = 97.92, LCL = 95.46 (12 - 17)

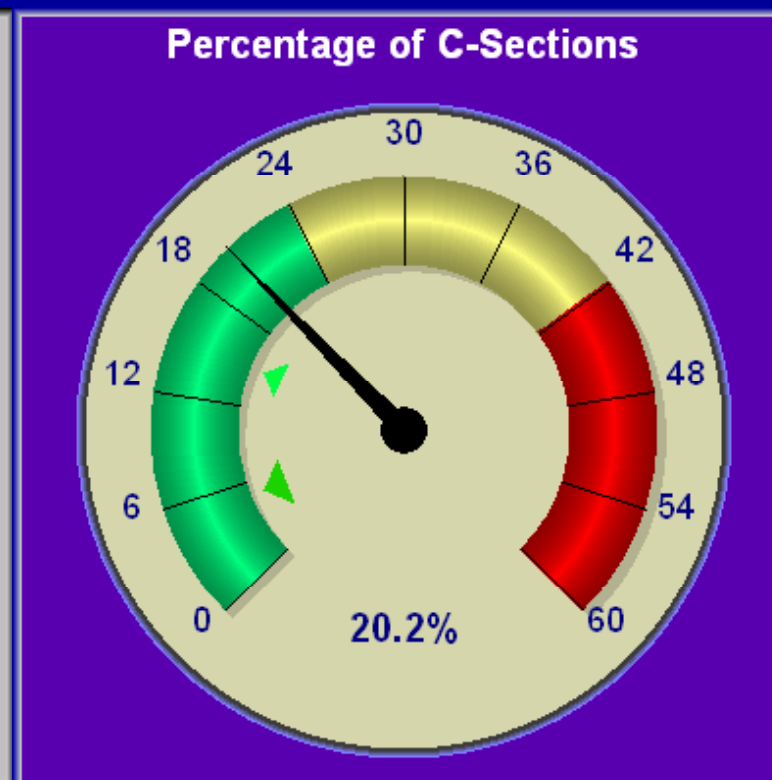
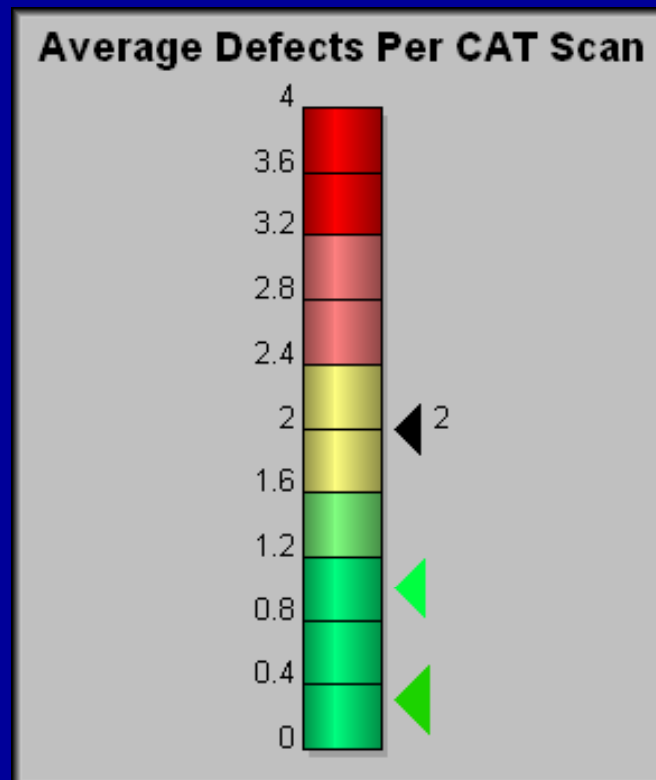
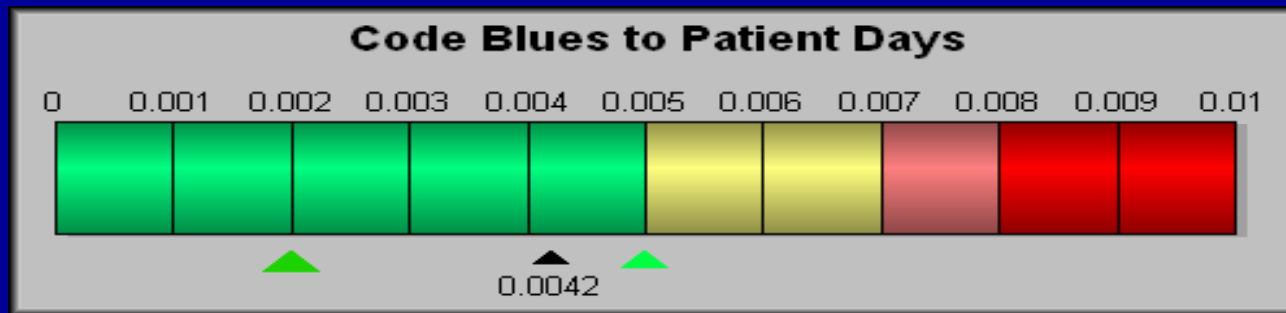
Inspected Mean = 304.17, Counts Mean = 297.83



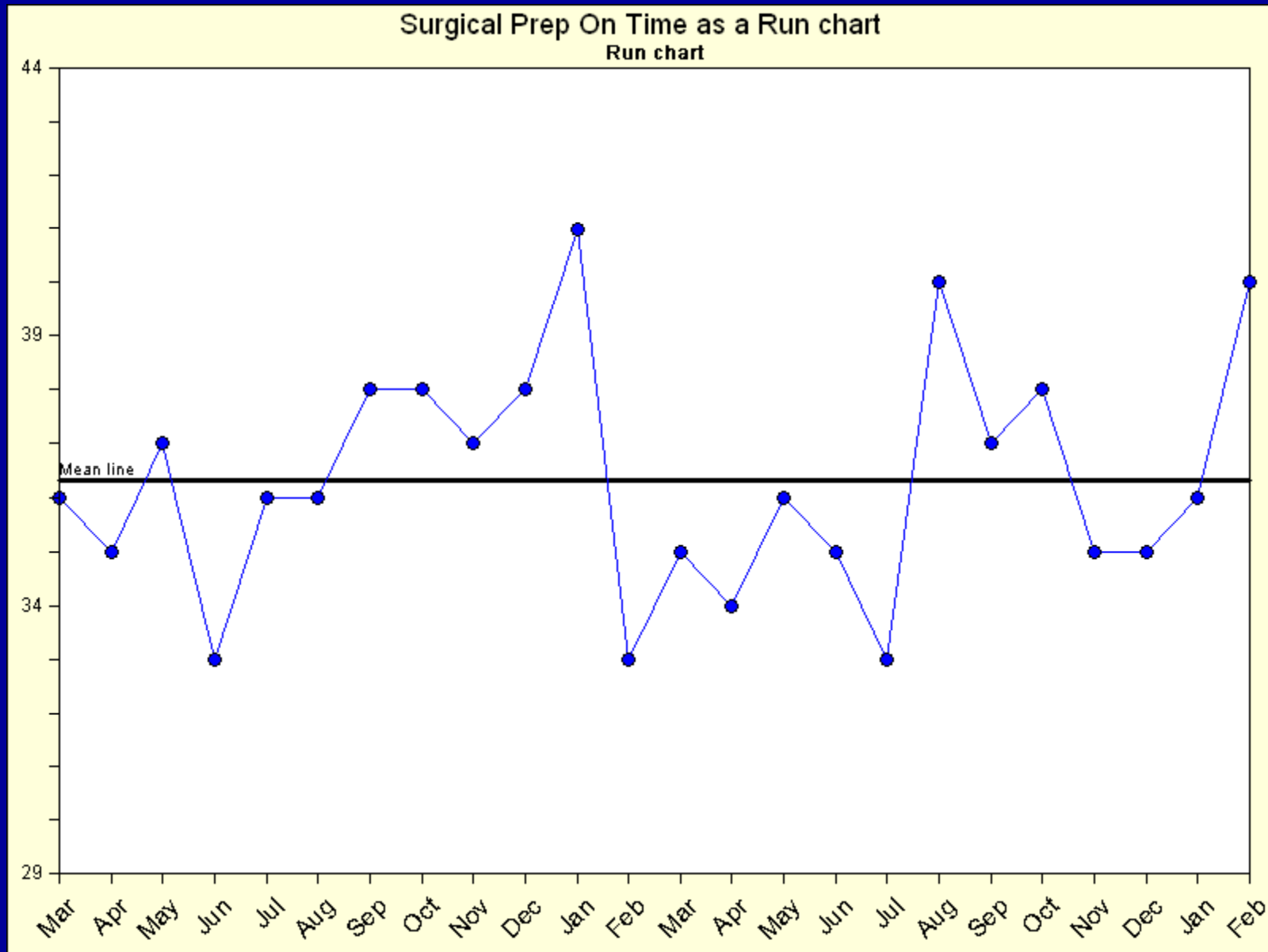
Plotting positive occurrences

Recommended approach

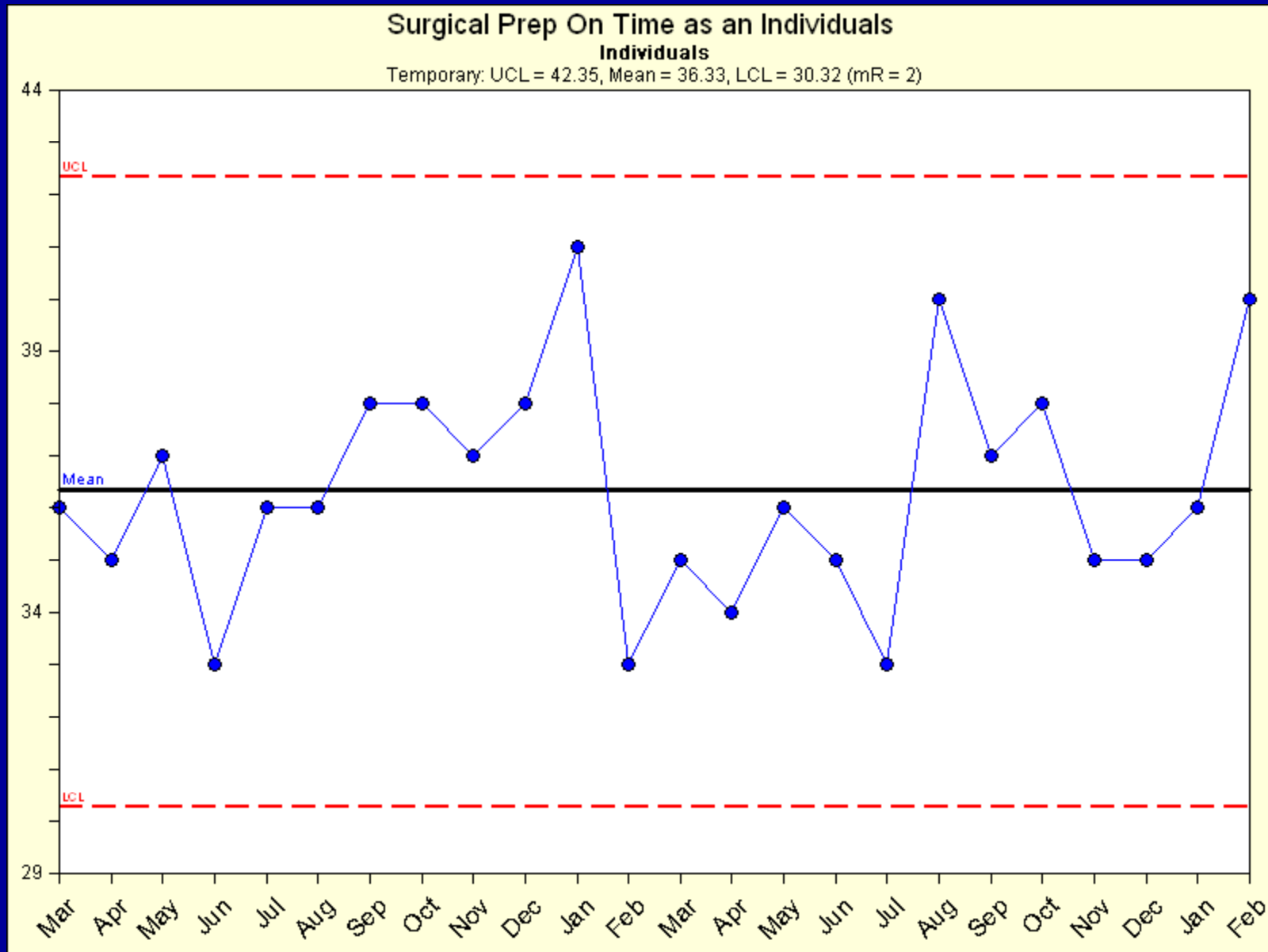
- Continue to present data in percentage form
- Consider a Dashboard chart for a snapshot
- Consider a Run chart for basic audience
- Consider an Individuals (X) chart
- Migrate toward an Individuals chart and Moving Range chart (X-Mr)



Dashboards for at-a-glance



Basic Run chart

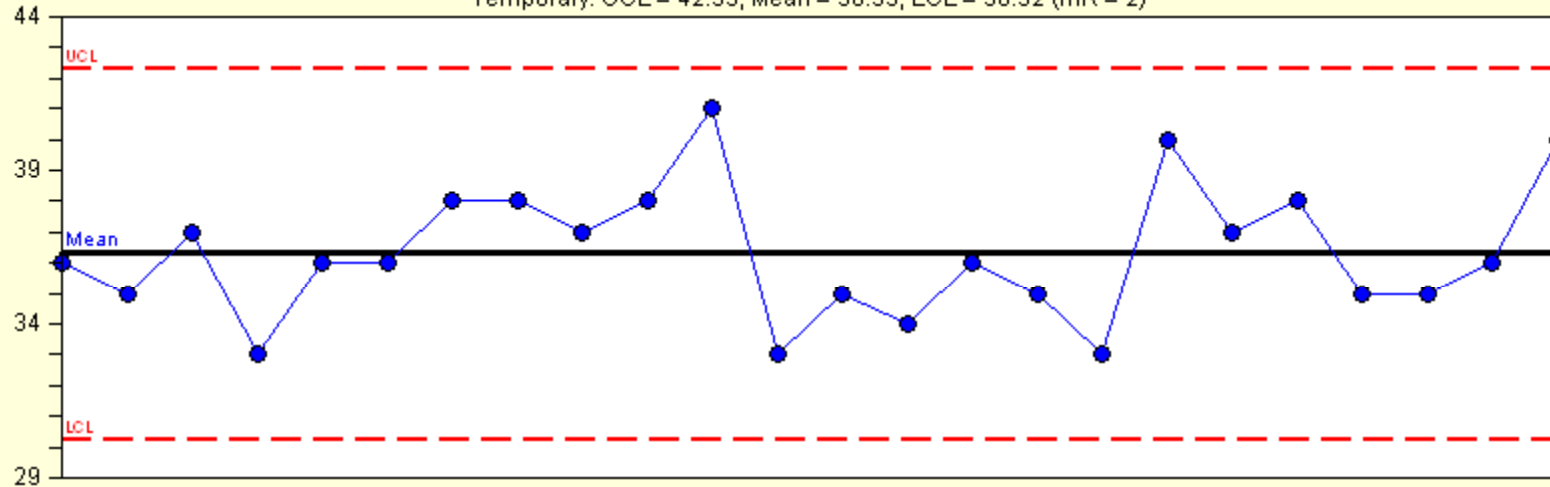


Individuals chart

Surgical Prep On Time as an Individuals & Moving range

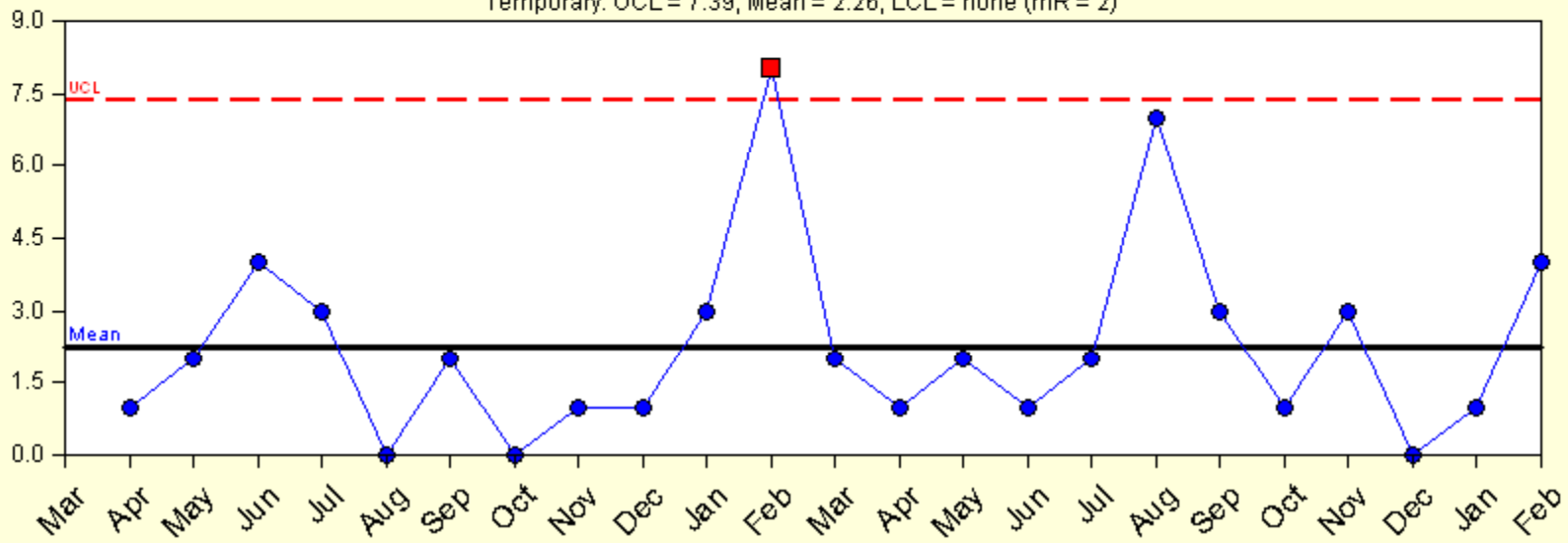
Individuals

Temporary: UCL = 42.35, Mean = 36.33, LCL = 30.32 (mR = 2)



Moving Range (2)

Temporary: UCL = 7.39, Mean = 2.26, LCL = none (mR = 2)



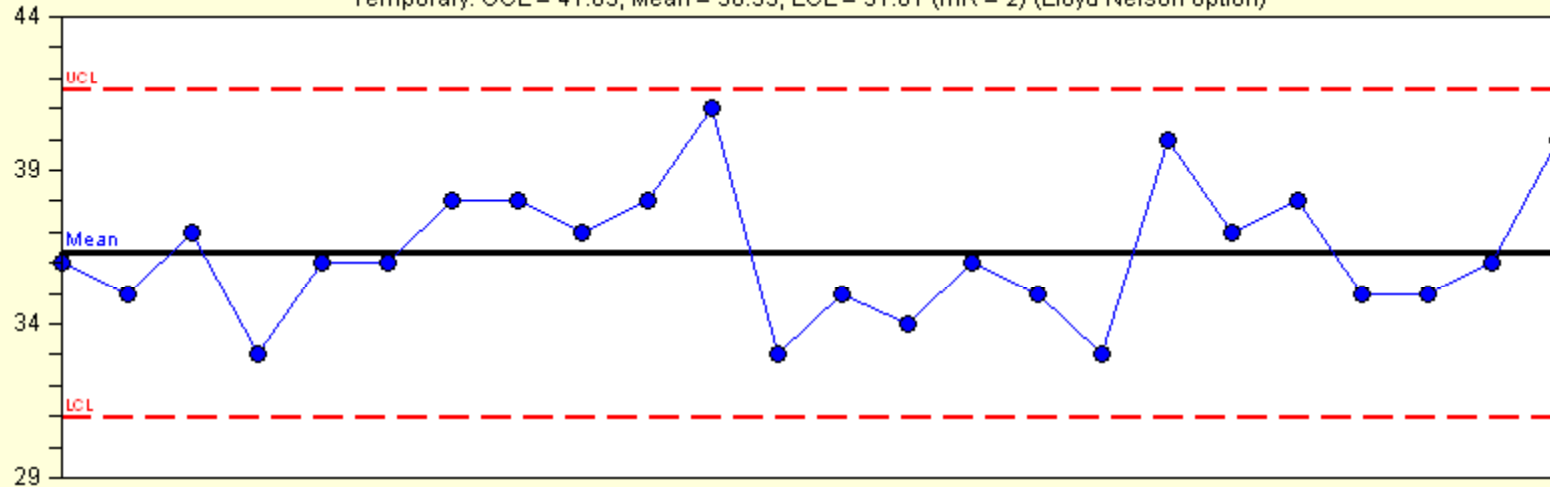
Individuals & Moving Range

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Surgical Prep On Time as an Individuals & Moving range with Nelson Rules

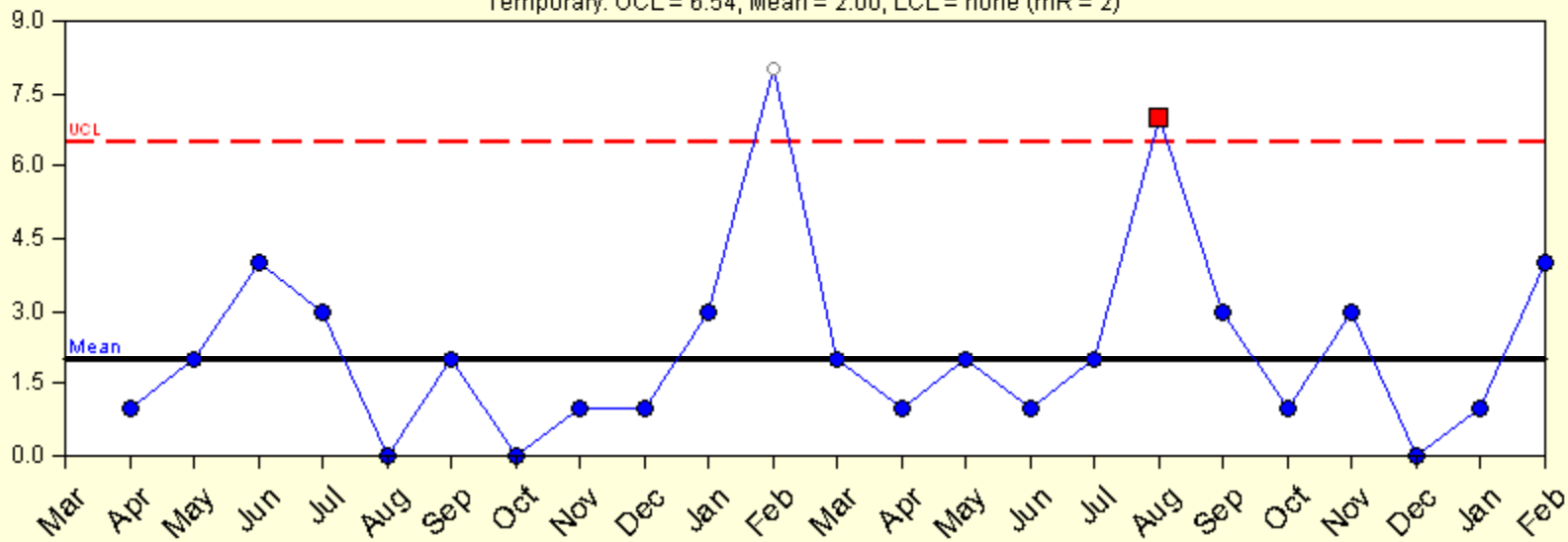
Individuals

Temporary: UCL = 41.65, Mean = 36.33, LCL = 31.01 (mR = 2) (Lloyd Nelson option)



Moving Range (2)

Temporary: UCL = 6.54, Mean = 2.00, LCL = none (mR = 2)

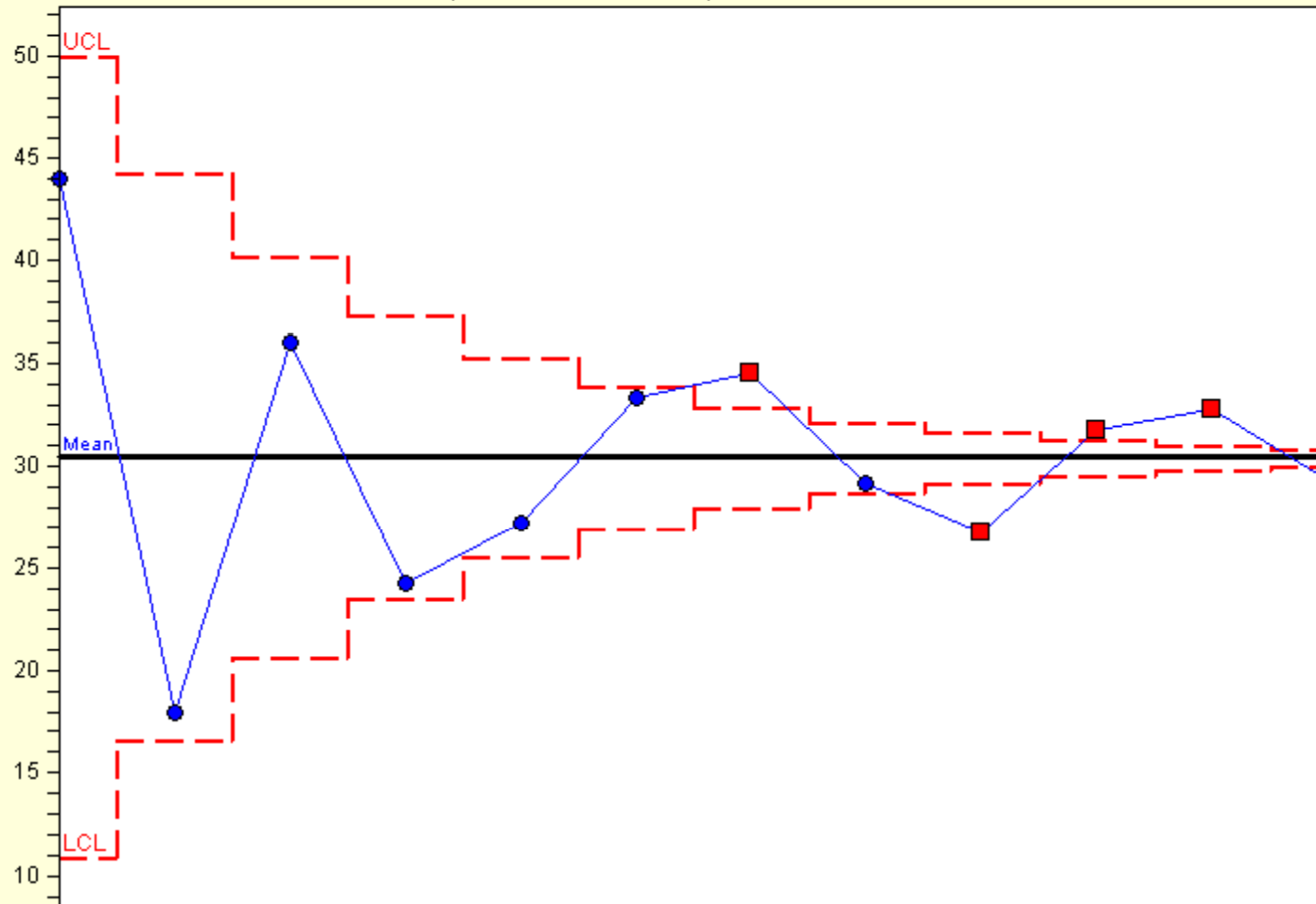


Increasing sample size

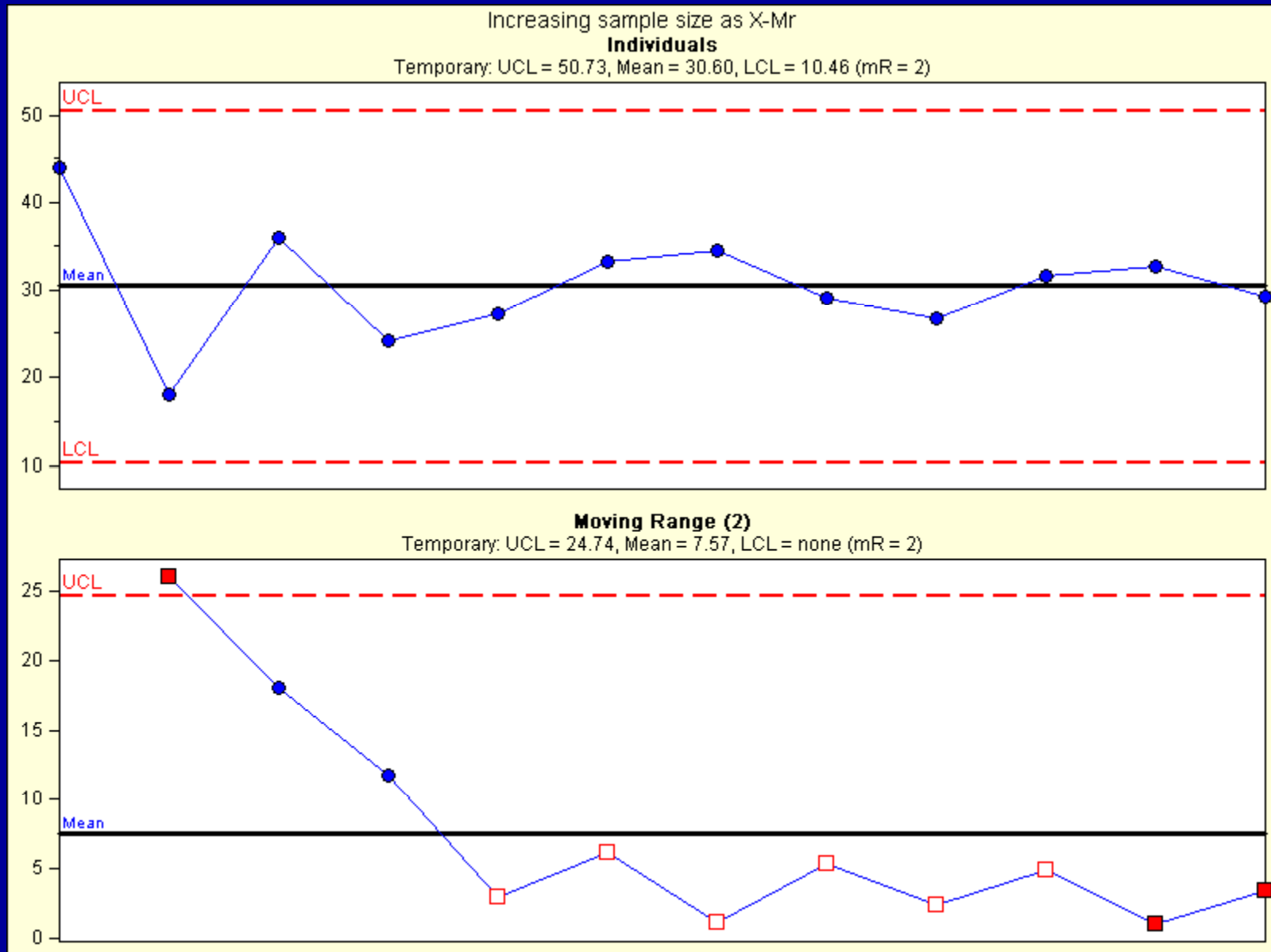
Population	50	100	200	400	800	1600	3200	6400	12800	25600	51200	102400
Count	22	18	72	97	218	534	1105	1868	3425	8124	16784	30025
percent	44.00%	18.00%	36.00%	24.25%	27.25%	33.38%	34.53%	29.19%	26.76%	31.73%	32.78%	29.32%

p chart

Temporary: UCL = 31.48, Mean = 30.42, LCL = 29.37
 Inspected Mean = 17062.50, Counts Mean = 5191.00



Summary p-chart



Summary Individuals & MR chart

Questions are welcome

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