

Public Health Performance Management Centers for Excellence

Welcome!

Monitoring Quality Improvements: Introduction to Variation Theory

will begin shortly

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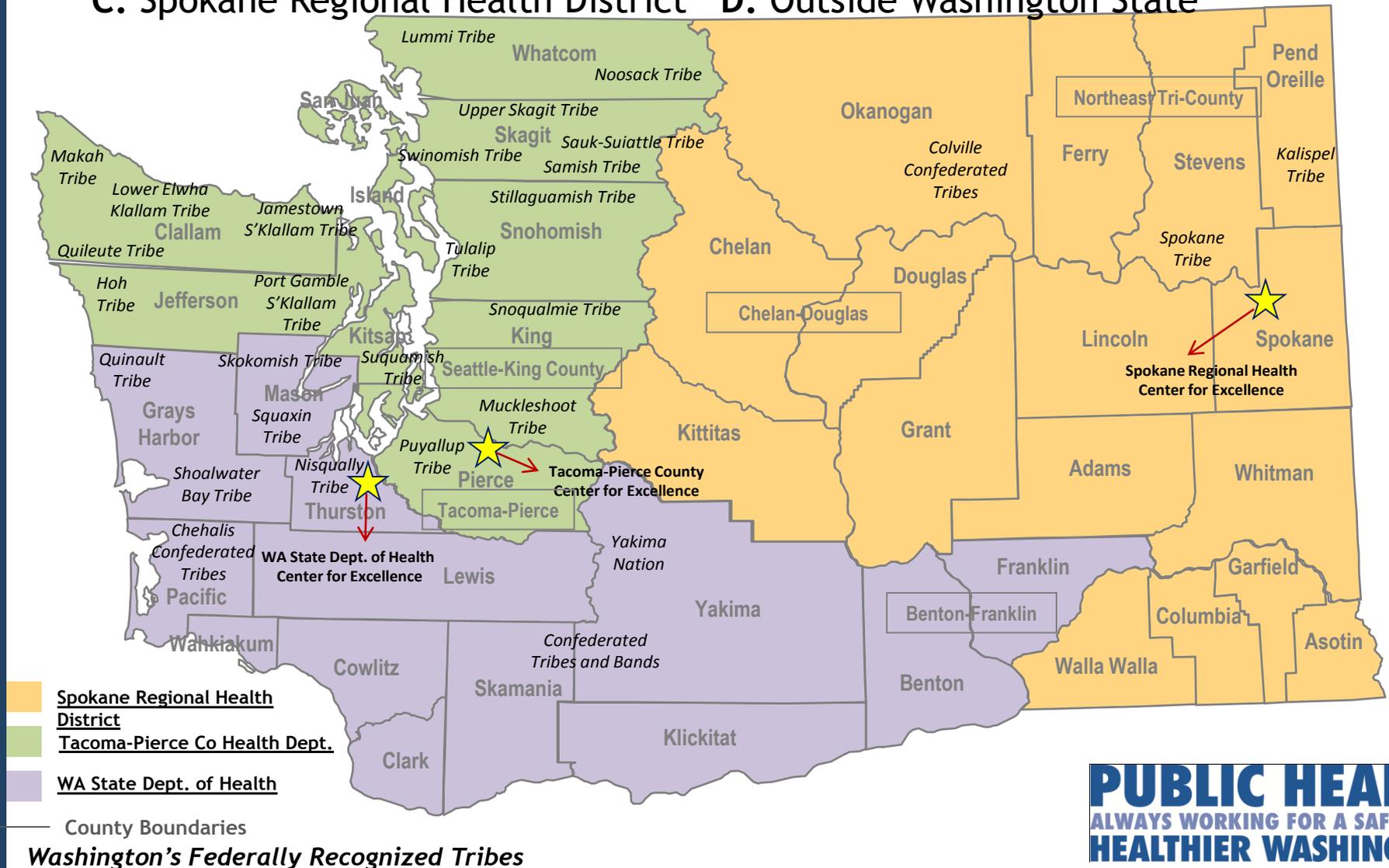
Monitoring Quality Improvements: Introduction to Variation Theory

May 8, 2013

Stacy Wenzl,
Spokane Regional Health District
Megan Davis,
Washington State Dept. of Health

Which Center for Excellence Region are you located in?

- A. Department of Health
- B. Tacoma-Pierce County Health Department
- C. Spokane Regional Health District
- D. Outside Washington State



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Learning Objectives

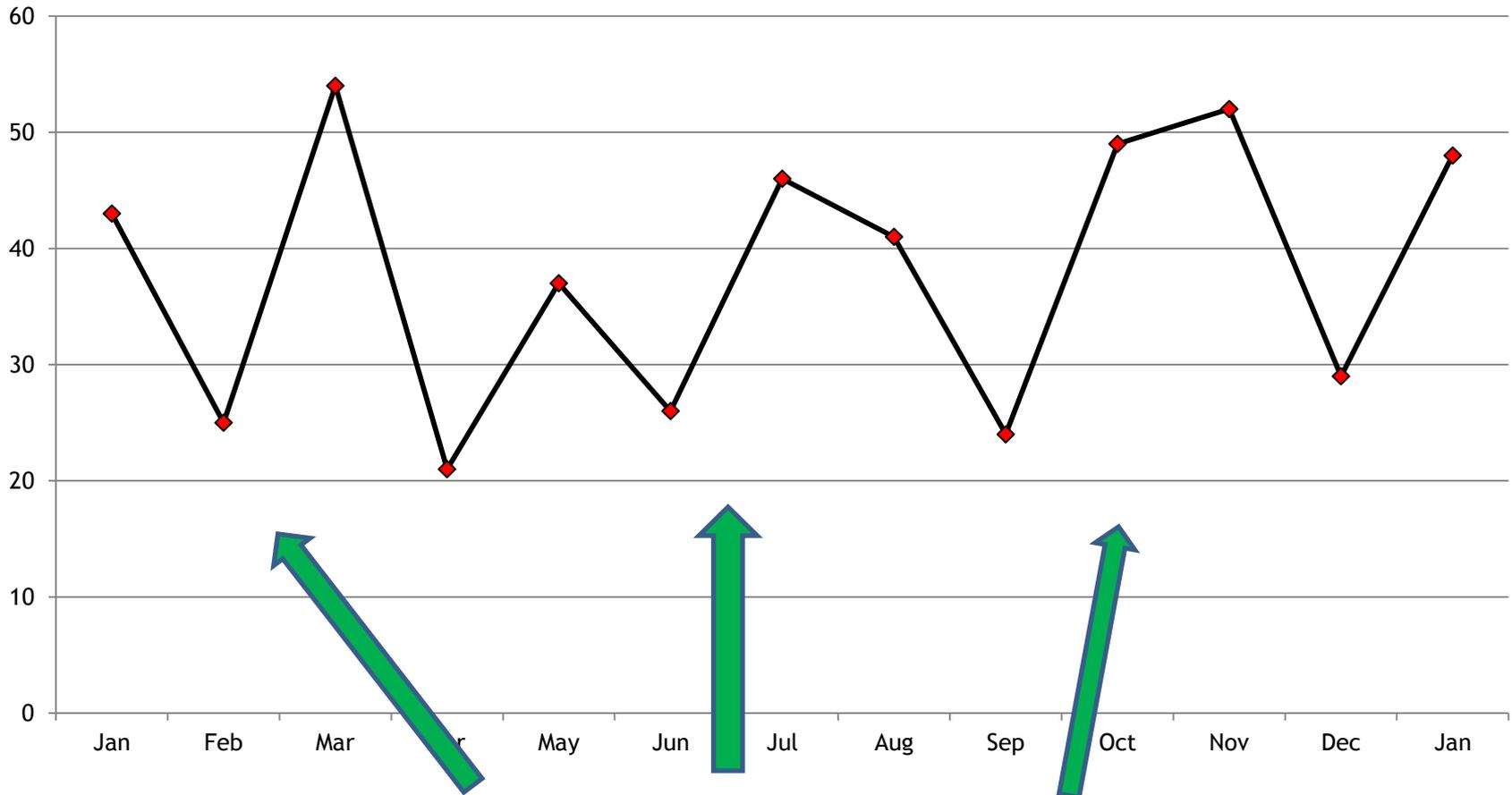
- Upon completion participants should be able to:
 - Explain why understanding variation is so important to controlling for quality and improving processes
 - Describe how variation is demonstrated in work processes and the impact on QI efforts
 - Describe trend lines, run charts, and control charts and their uses
 - Identify examples of each chart type
 - Analyze data displayed in each chart type

Why is variation important?

- All activities and services are comprised of work process- a series of steps to produce an outcome
- All work processes have variation
- The underlying process determines performance
- Improving work processes requires understanding and reducing variation

Process Variation

Incidences per Month



Hmmm. Why does it vary so much?

Sources of variation

- Methods
- Materials
- Environment
- Staff
- Measurements
- Customers



Which among these are variable?

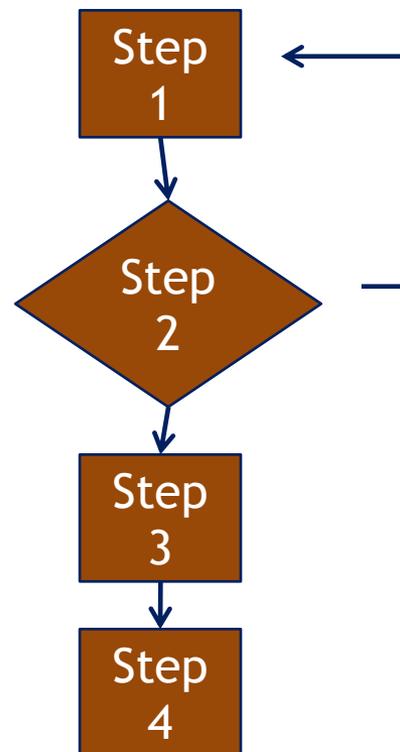
Which among these are controllable?

POLL:

Which procedure is more likely to take longer to complete? And why?

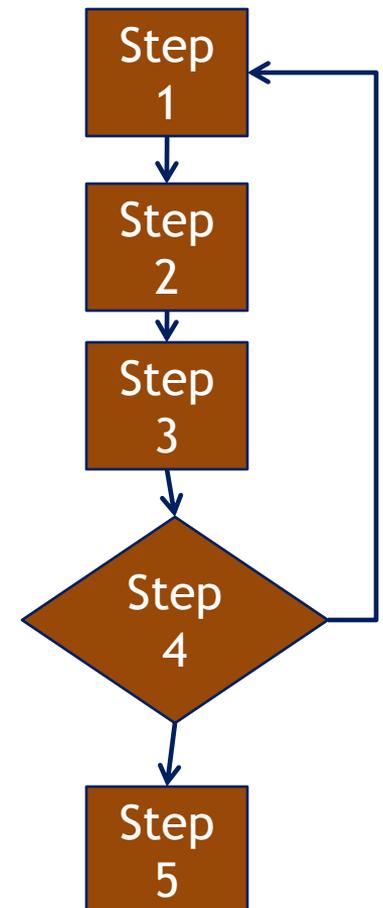
A.

Inputs:

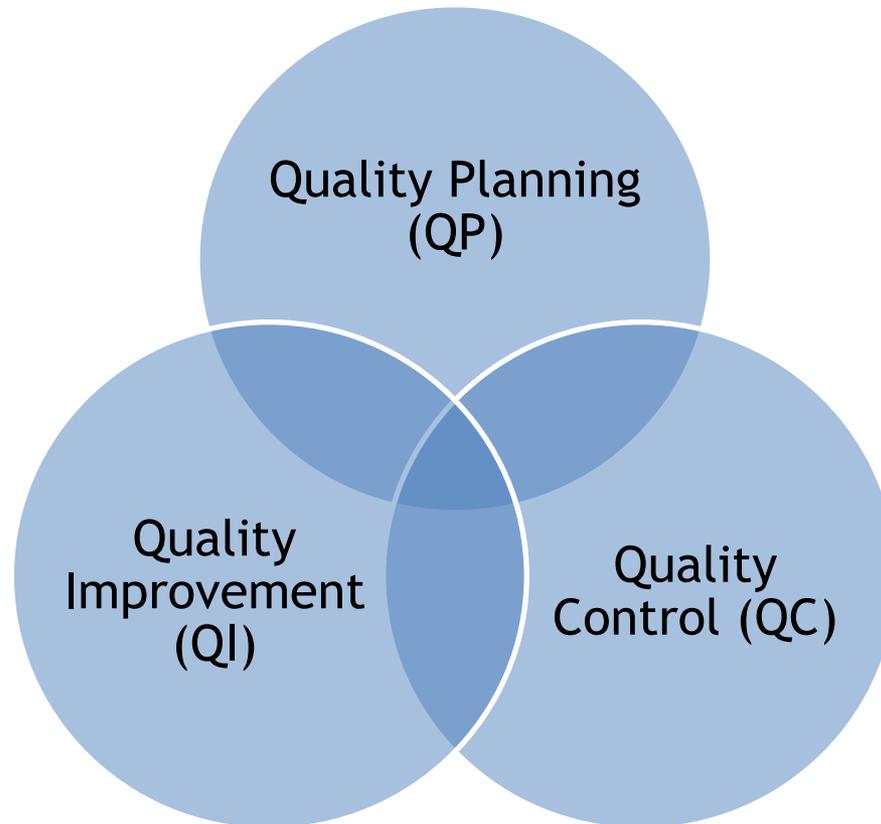


B.

Inputs:

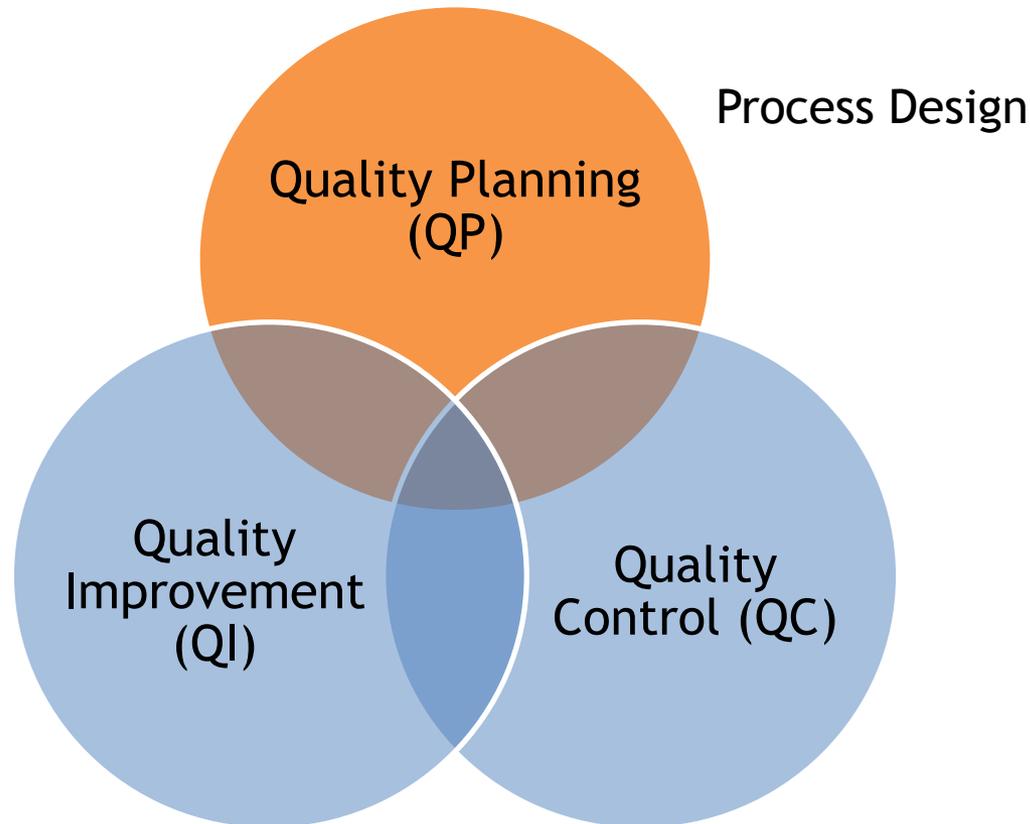


The Quality Management Trilogy



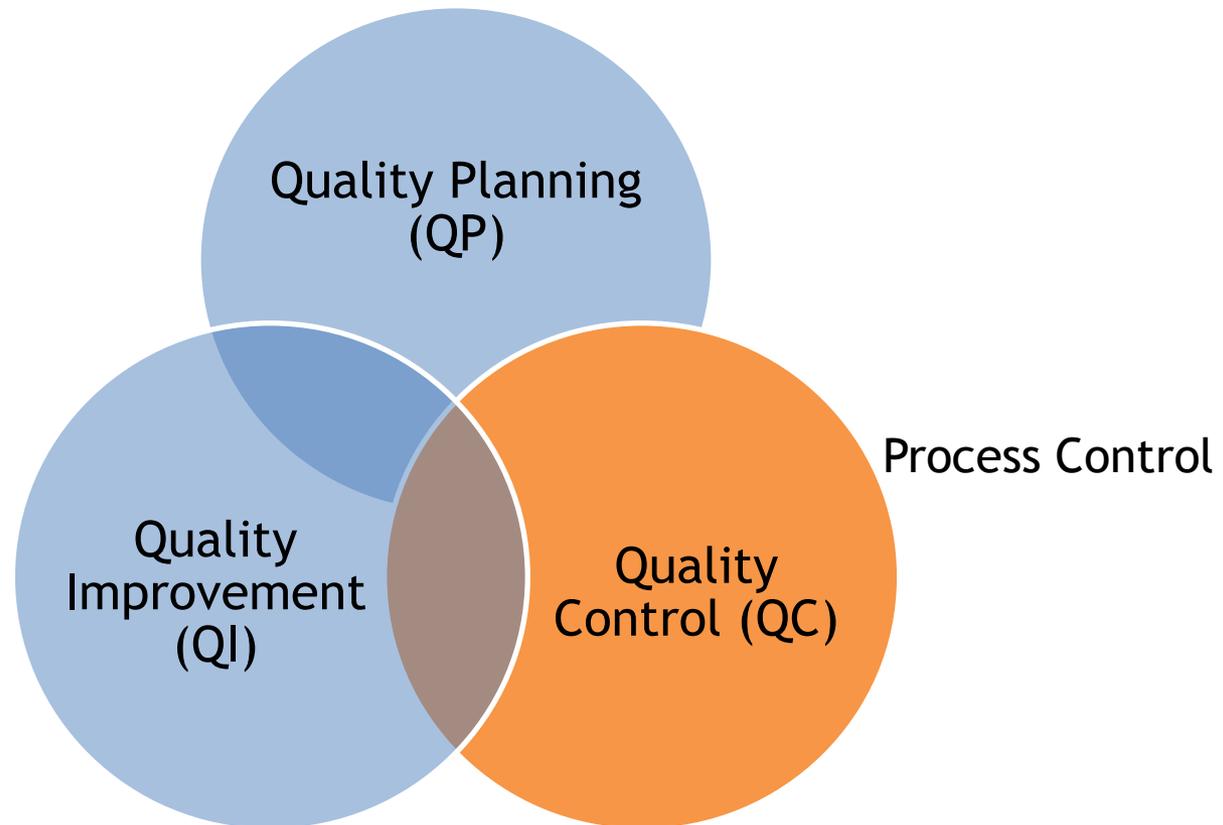
Joseph Juran, 1950's
Juran on Leadership for Quality, Free Press, 1989

The Quality Management Trilogy



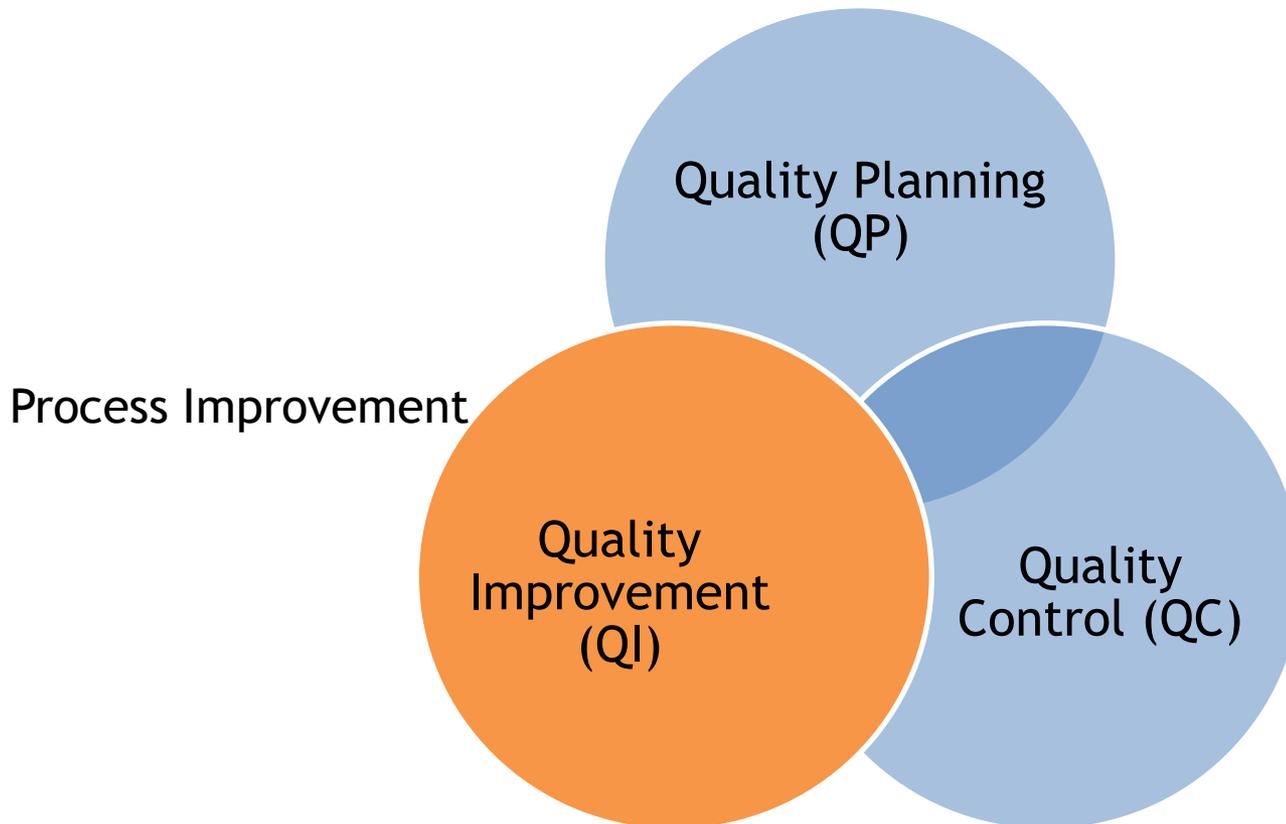
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The Quality Management Trilogy



Joseph Juran, 1950's
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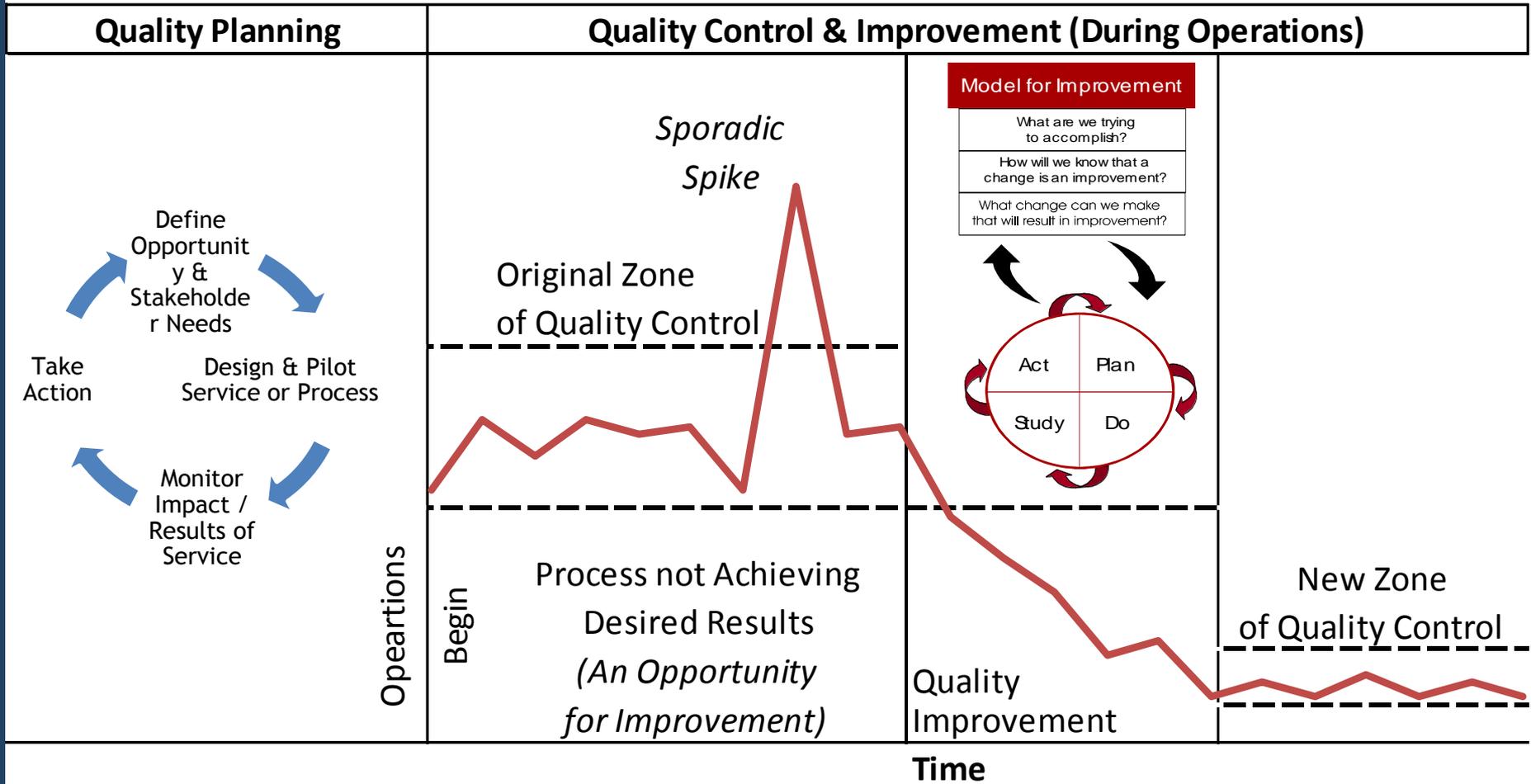
The Quality Management Trilogy



Joseph Juran, 1950's
Juran on Leadership for Quality, Free Press, 1989

The Quality Trilogy

(adapted from Juran Trilogy)



The Quality Management Trilogy



Joseph Juran, 1950's
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Process Capability and Stability

- Process Capability
 - The performance level is capable of meeting customer needs and expectations within a stable process.
- Process Stability
 - Whether process is in control and produces predictable results.
 - Must understand variation in process.

Process Capability and Stability

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Process Capability

- Does the process meet or exceed the customer's specification? (aka, expectation, requirement, etc.)
 - All the time?
 - Some of the time?
 - None of the time?
- If the process is not capable, controlling existing variation will not be your first priority

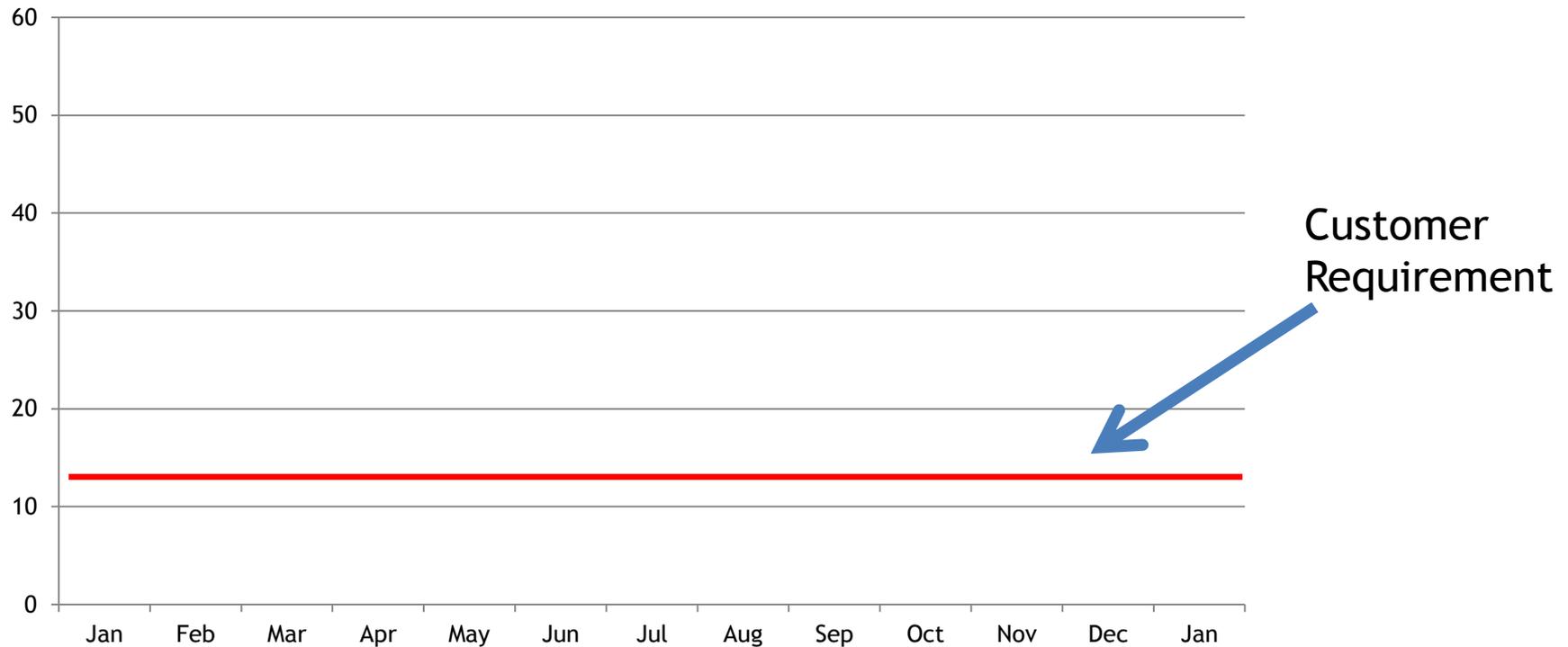
Process Specifications

- May have an upper specification
 - Data point *less than* x is good
- May have a lower specification
 - Data point *greater than* y is good
- May have both
 - Data point *between* x and y is good

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Process Capability

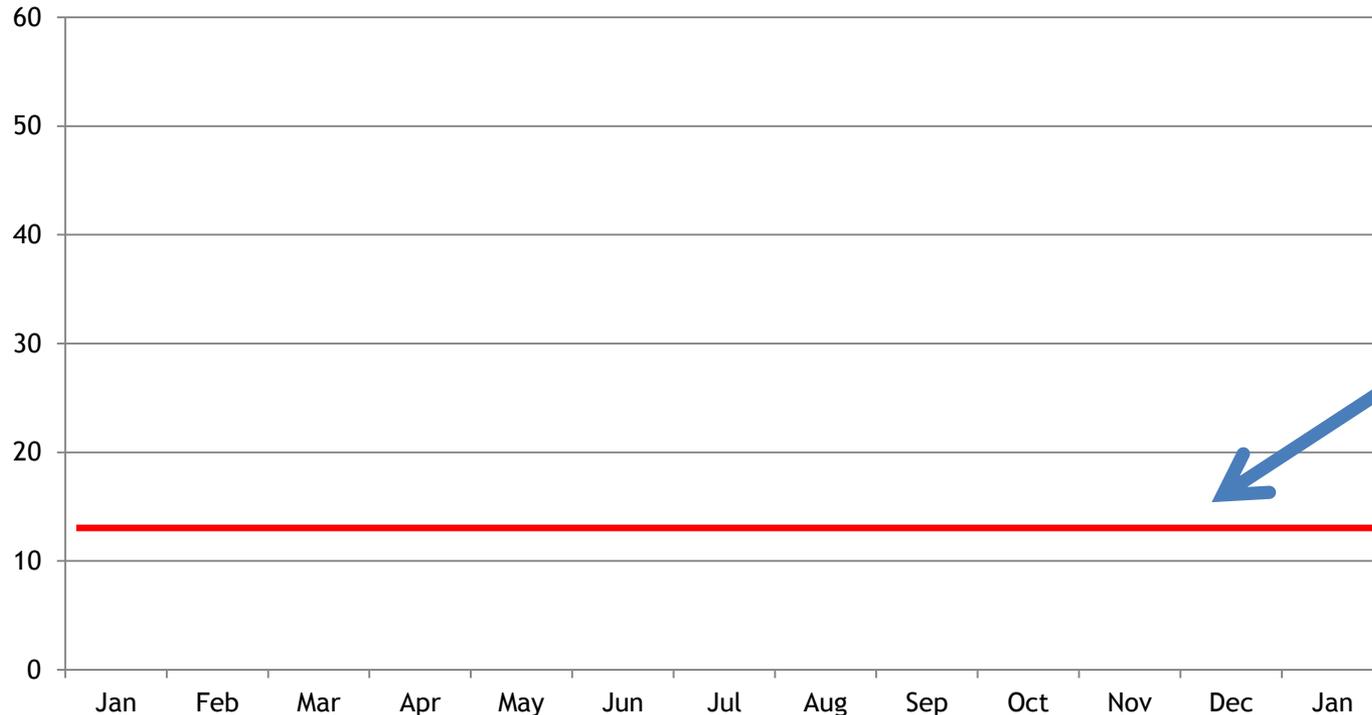
Days to Complete Request



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Process Capability

Days to Complete Request

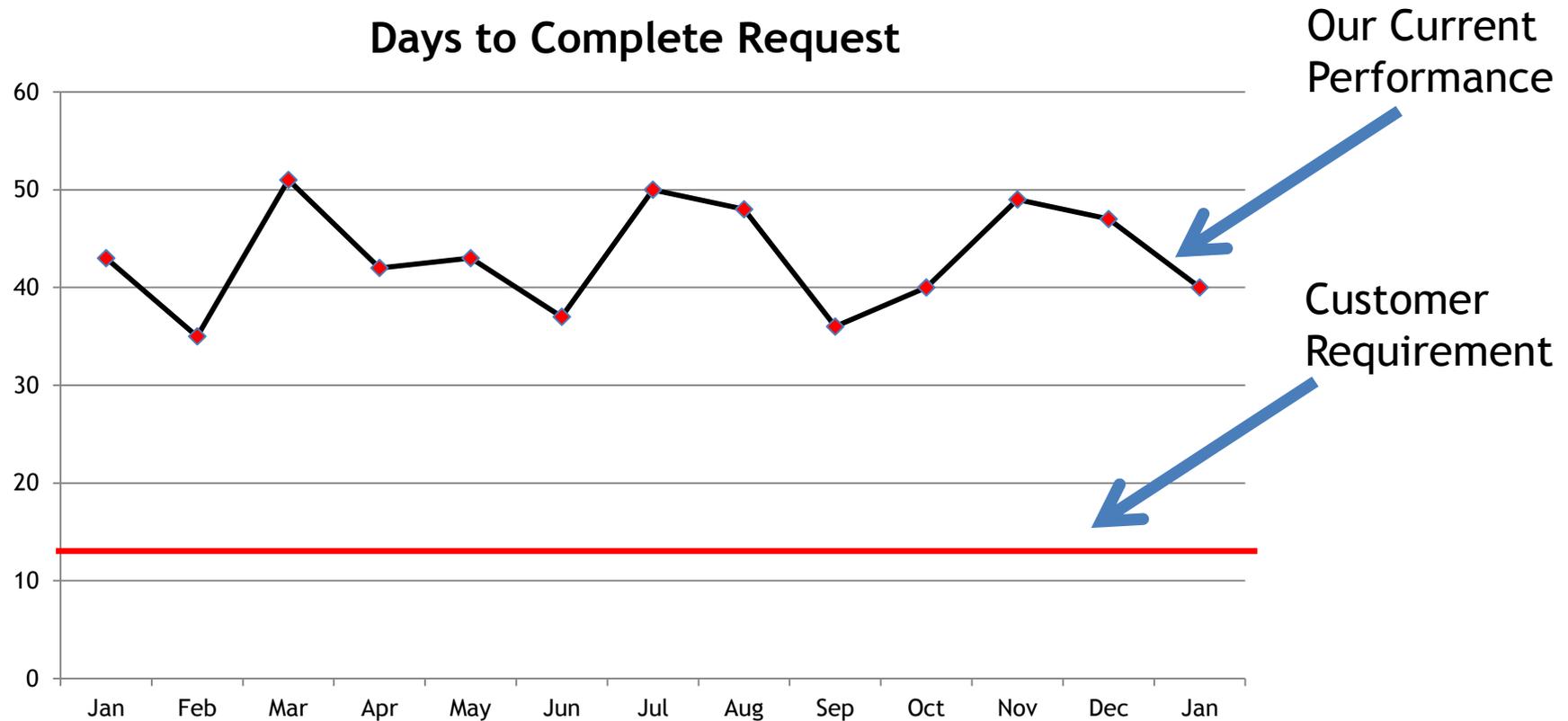


Customer Requirement

No “lower” specification because no wait is a good thing!

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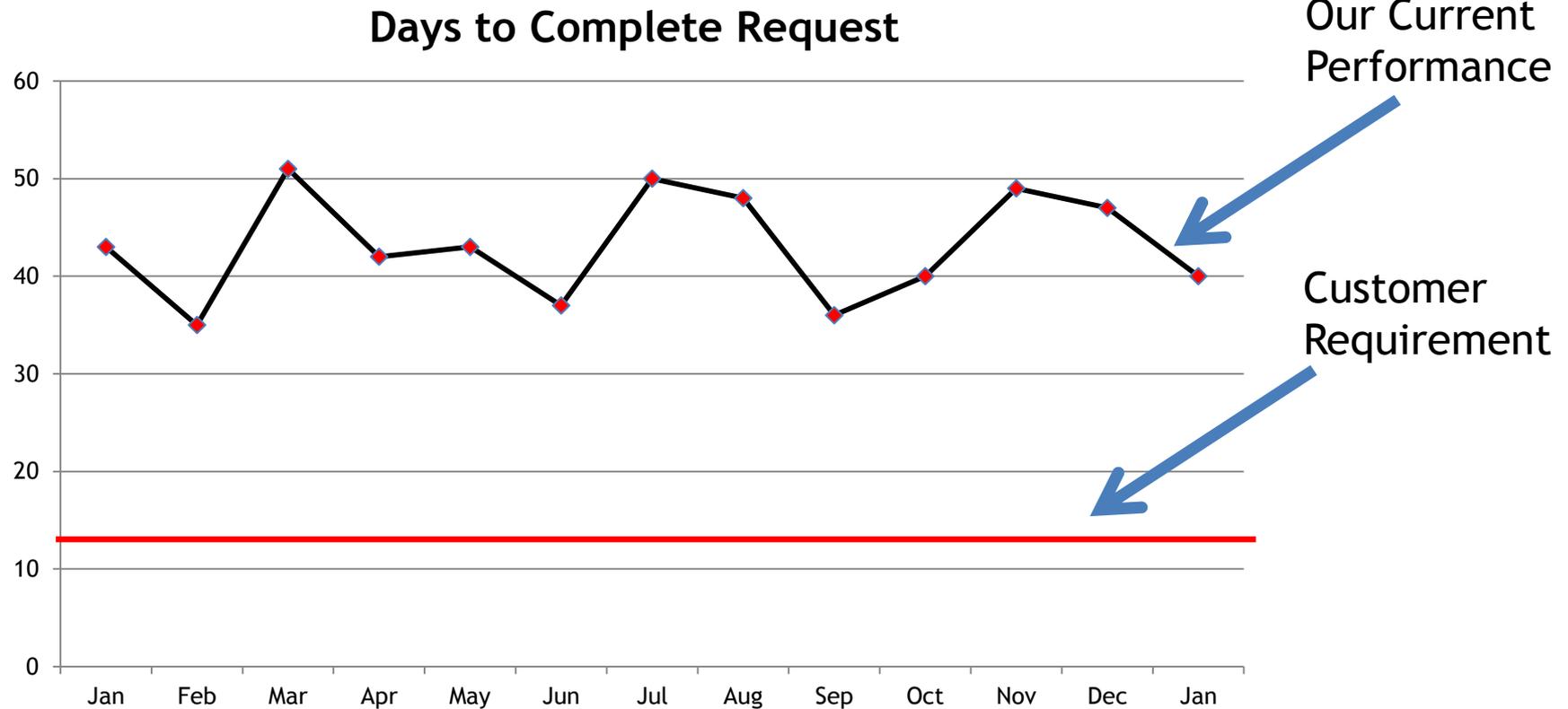
Process Capability



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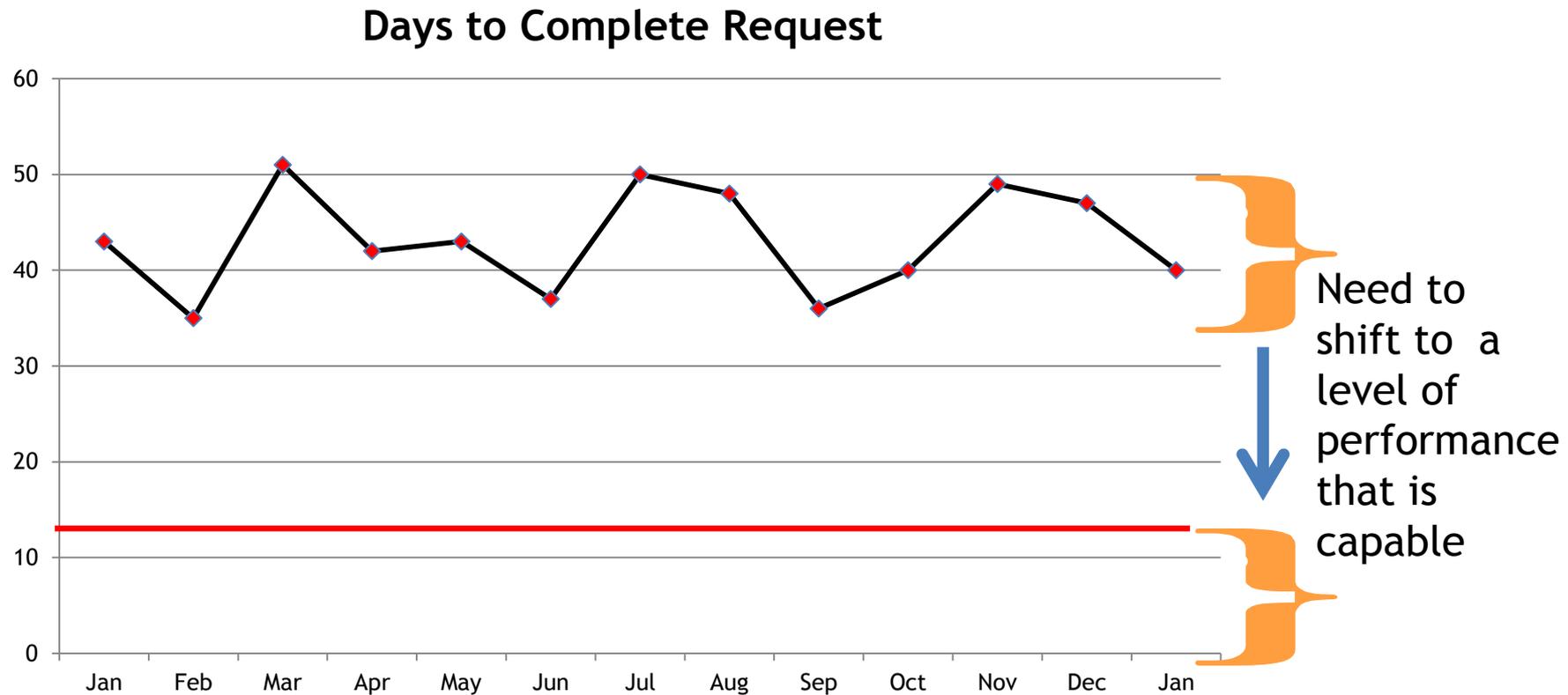
Hmmm...

If my process is not capable ...
Do I care if it stable or not?



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It doesn't matter that my process isn't stable, it's not even capable!



Process Capability and Stability

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Why Understand Variation?

A major principle underlying quality improvement is that any substantial improvement must come from a change in the work process (data driven), rather than focusing on an individual occurrence or event (anecdotal).

- Common Causes (94%) belong to the work process
- Special Causes (6%) are the result of fleeting or unusual occurrences

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Stability - Understand Variation

- Sources of variation include: technology, materials, methods, culture, people, environment
- Common cause variation occurs if the process is stable— variation in data points will be random and obey a mathematical law—it is said to be in statistical control, with a large number of small sources of variation
- Reacting to random variation in a process that is stable/in statistical control, it is called tampering and leads to further complexity, increasing variation and mistakes

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Stability - Understand Variation

- Special cause variation arises because of specific circumstances which are not part of the process all the time and may or may not ever recur—if the recurrence is periodic, clues to the root cause may emerge
- If variation is special, then process not stable
- Special causes should be investigated

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Two Types of Variation

- Common Cause
 - Built into every process
 - Reflects a stable process because variation is predictable
 - Also called random variation
 - Requires changing the process to improve results
- Special Cause
 - Not part of “daily” or “regular” process
 - A single data point outside control limits OR a noticeable shift in data points over time
 - Can be improved or avoided by addressing this cause alone

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Stability- Understand Variation

- Failure to distinguish between common and special cause variation can be hazardous to organizational performance
- Addressing a single occurrence of common cause variation is called TAMPERING with your process



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Tampering

If process is capable and stable ...

- Want to avoid confusing expected/common cause variation with un-expected/special cause variation

“Wait ...What?”

- Beware over interpreting a few data points (or worse one data point) as indicating your process is deteriorating when it really isn't
- Managing to “last month's number” ... is a ticket to tampering
- Managing to a target without a picture of process variation is a ticket to tampering

“So?...”

Identify the expected range of variation and limit reaction to unexpected variation

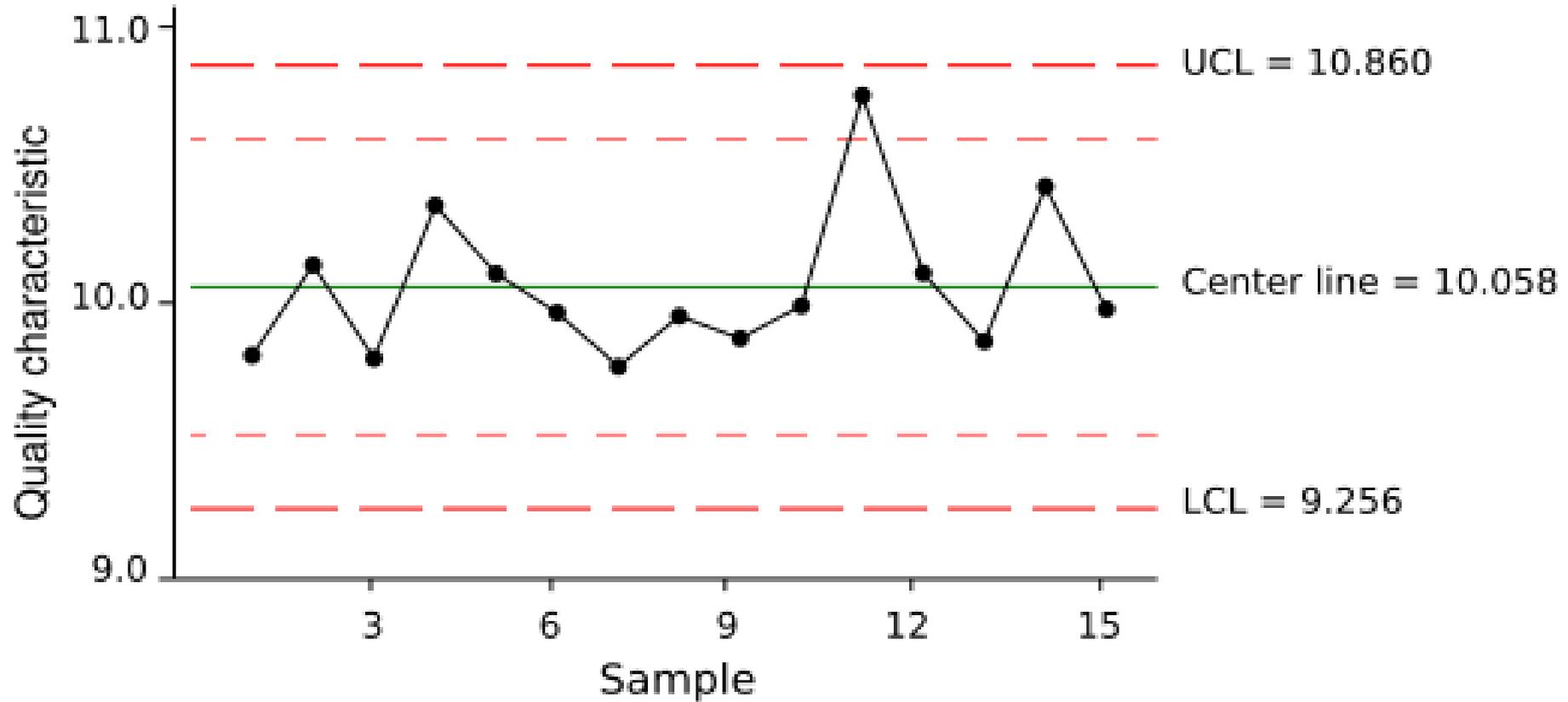
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The dangers of tampering

- At best ... you waste time and effort
- Likely introduce more variation
- Perhaps ... make things worse

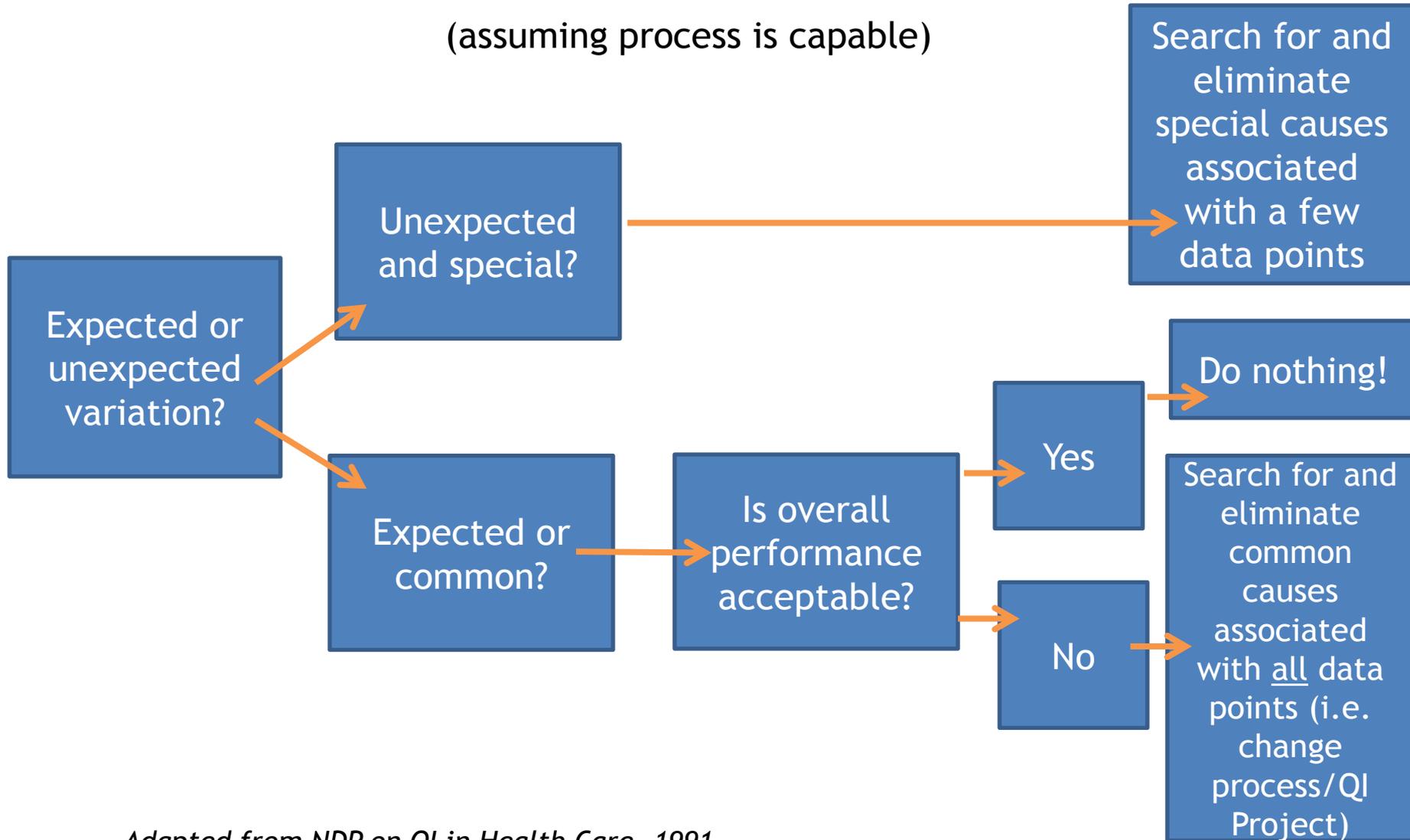


Control Chart



Acting on Variation to Ensure Stability

(assuming process is capable)



Adapted from NDP on QI in Health Care, 1991

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When to Improve the Process

| Cause of Variation : | Common Causes | Special Causes |
|----------------------|----------------------------|--|
| Action Required : | To 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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Let's Discuss



*Please unmute phone or use
chat window*

What experiences have you encountered with variation in a work process?

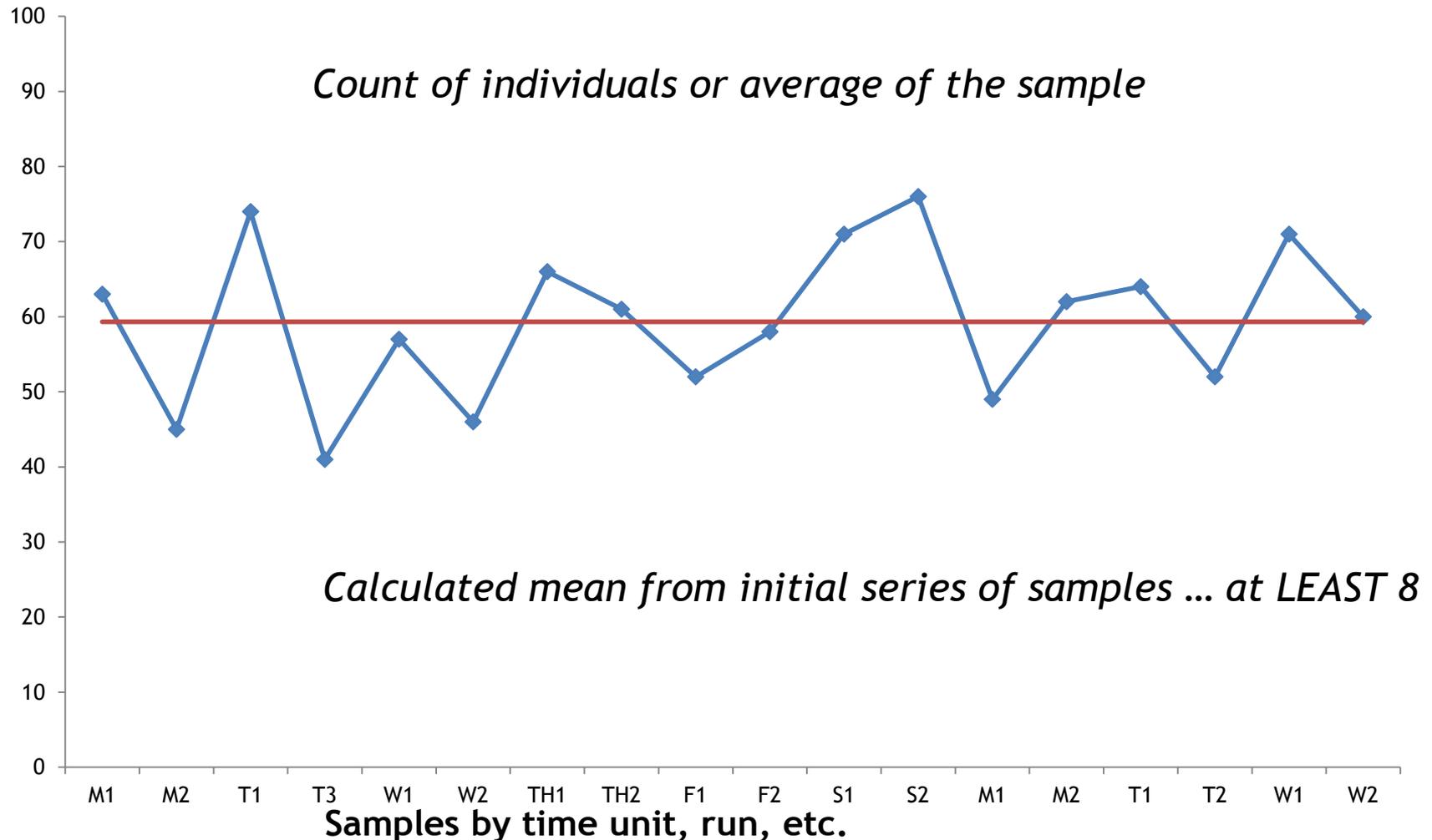
Examples might be inconsistently meeting regulatory deadlines or responding to requests.

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Charts:

**RUN CHARTS, TREND CHARTS
AND CONTROL CHARTS**

Run Chart Elements



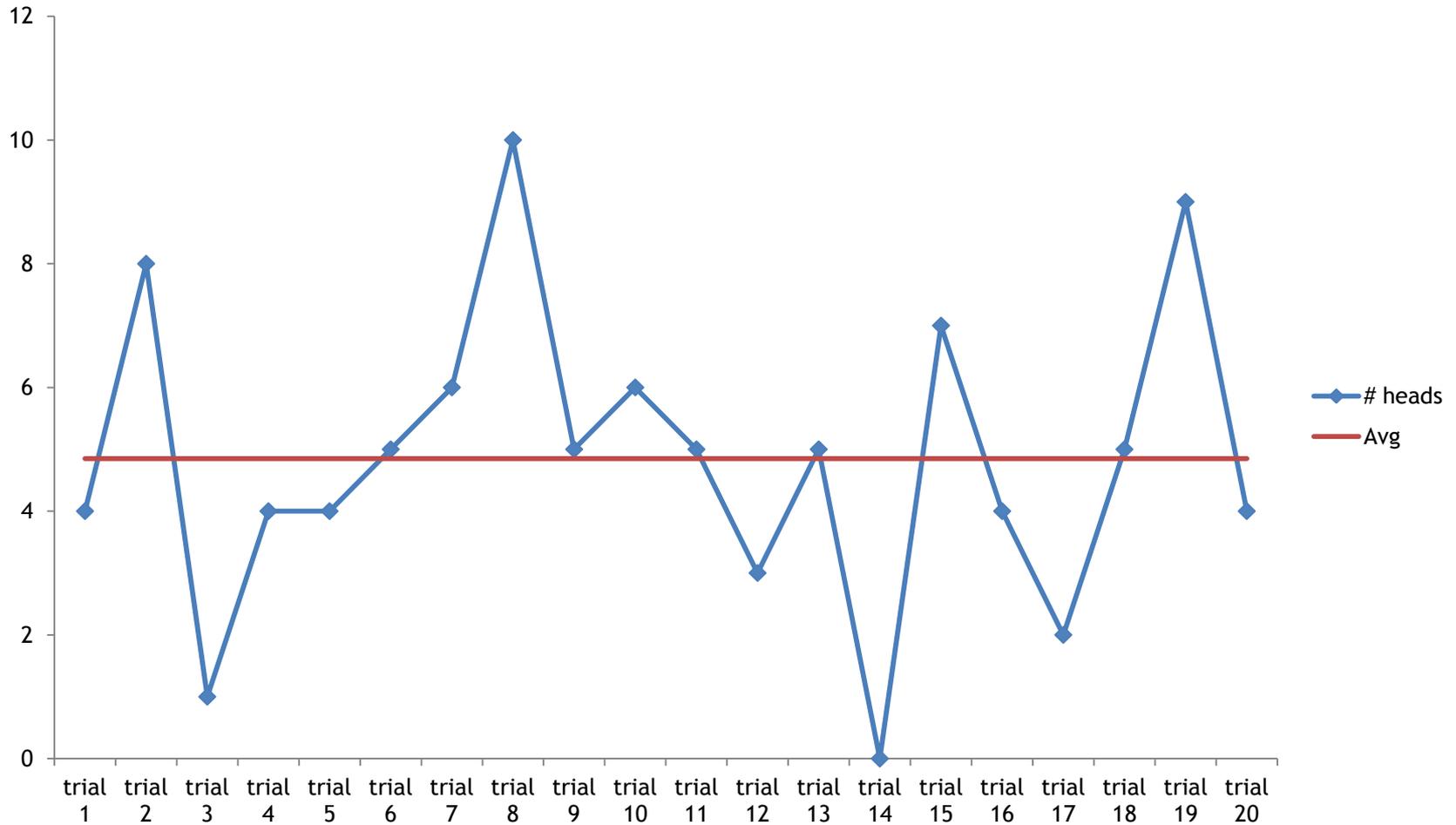
Line/Run/Trend Charts

- Indicates pattern of variation over time
- Helps avoid over-interpreting a particular result/sample
- Can indicate expected range of random variation (aka common cause)
- Can indicate patterns of unexpected and attributable variation (aka special cause)

Key Points for Analyzing Data

- The average by itself is not a good summary of data; use a variety of numerical summaries
- Measures of center include:
 - Average/Mean: the total data values divided by the total number of observations
 - Median: the middle value in the data set, half of the data value lie above, half lie below the median
 - Mode: the most frequently occurring values in the set of data
- Use histograms to look at overall variation patterns
- Use line graphs to look at patterns over time

Random and Expected: # Times Heads in 10 chance Trial



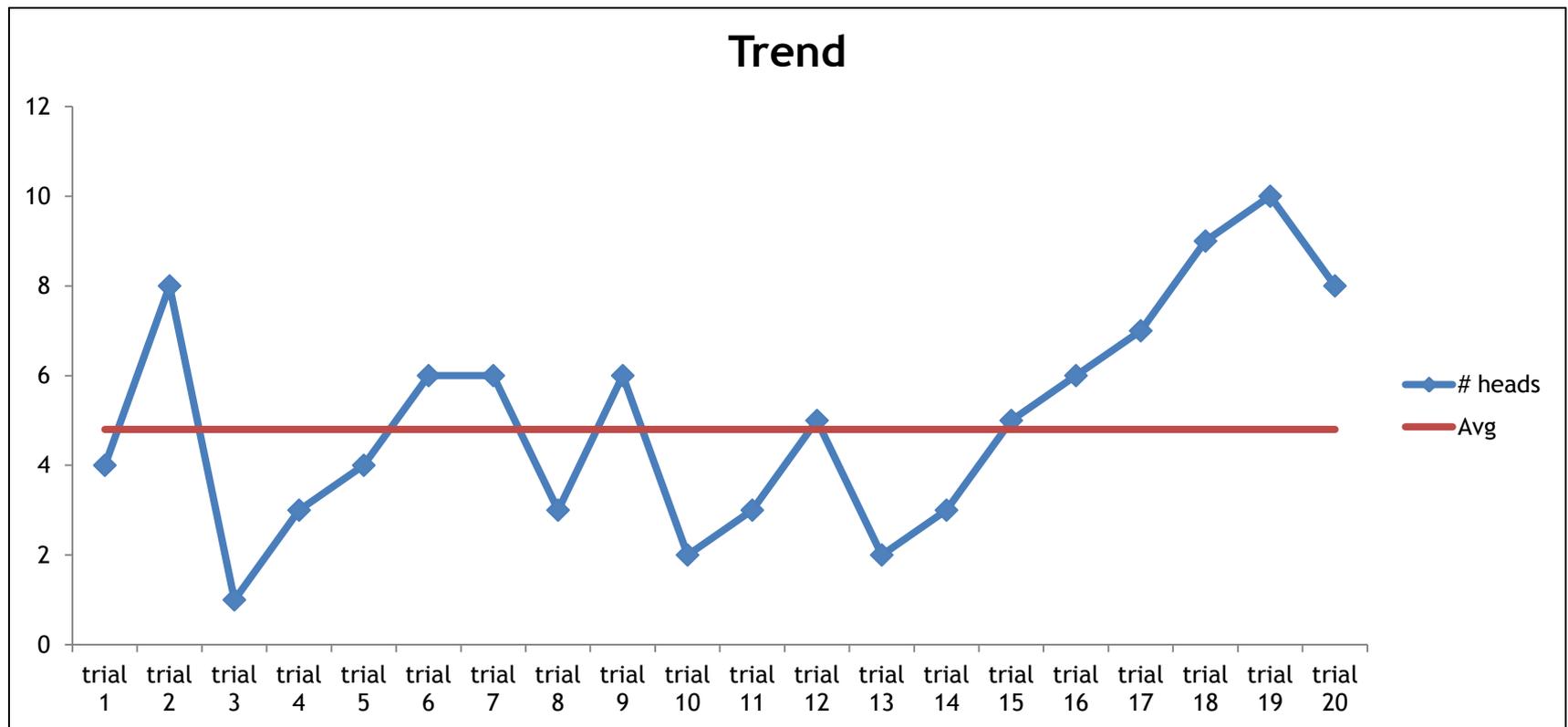
Line Chart Indicators of Unexpected/Attributable Variation

- Trends (7 points in a row in same direction)
- Shifts (7 continuous points above/below the mean)
- Data Collection Problems/Manipulation (5 identical points in a row)
- Personal variation (alternating pattern)

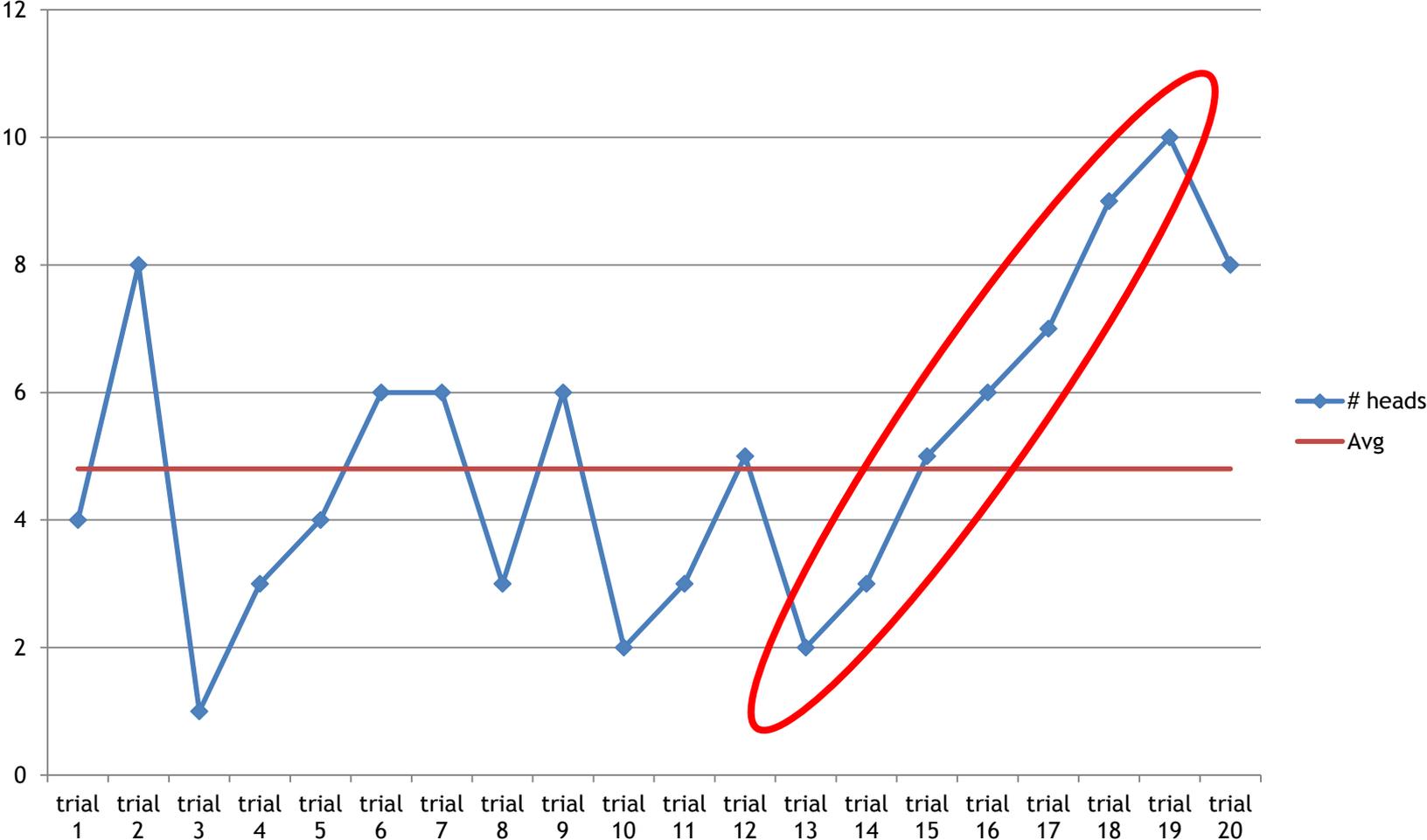
POLL

At what trial number does the trend start?

A. Trial 3 B. Trial 10 C. Trial 13



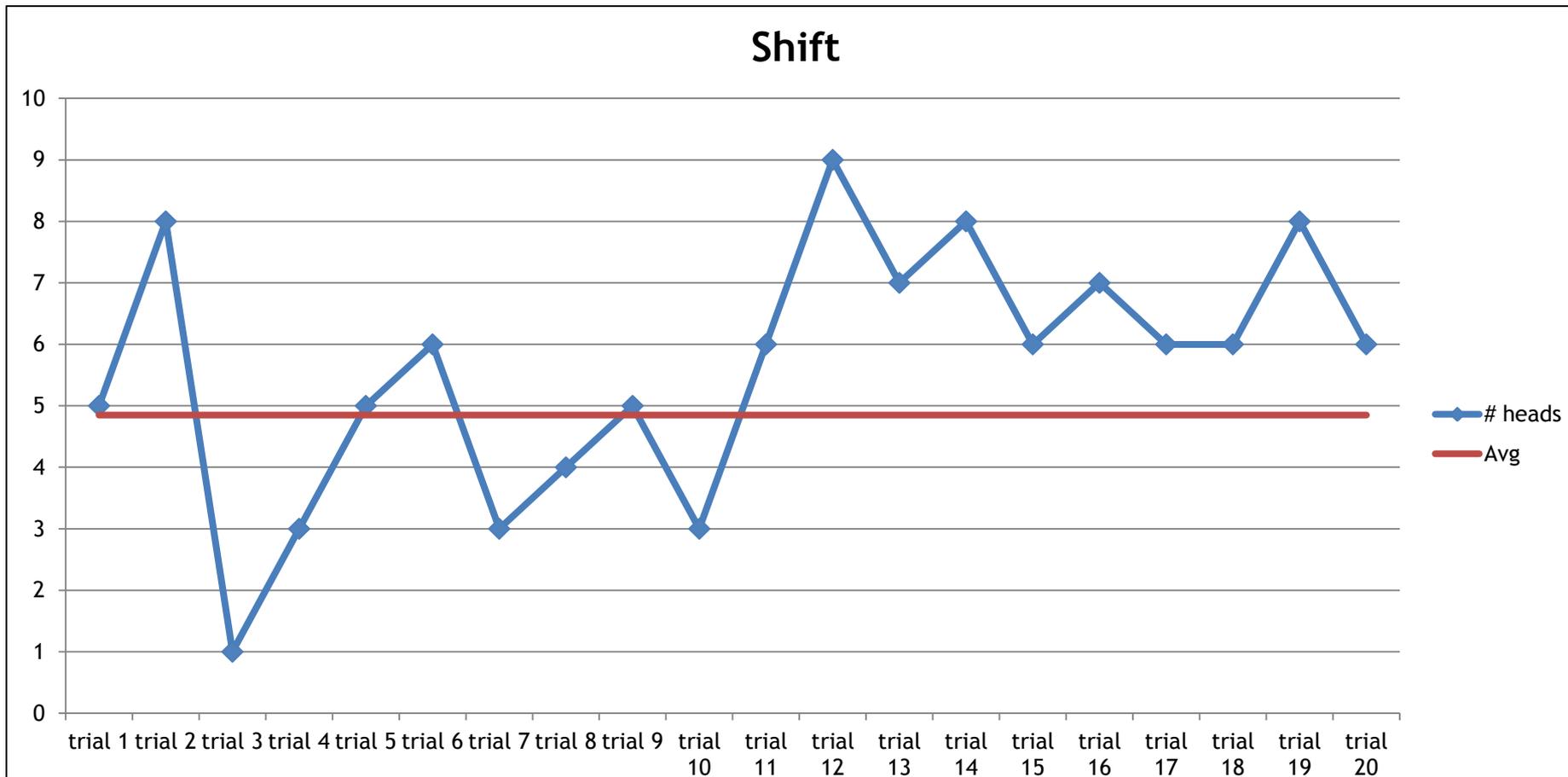
Trend



POLL:

What trial number does the shift start?

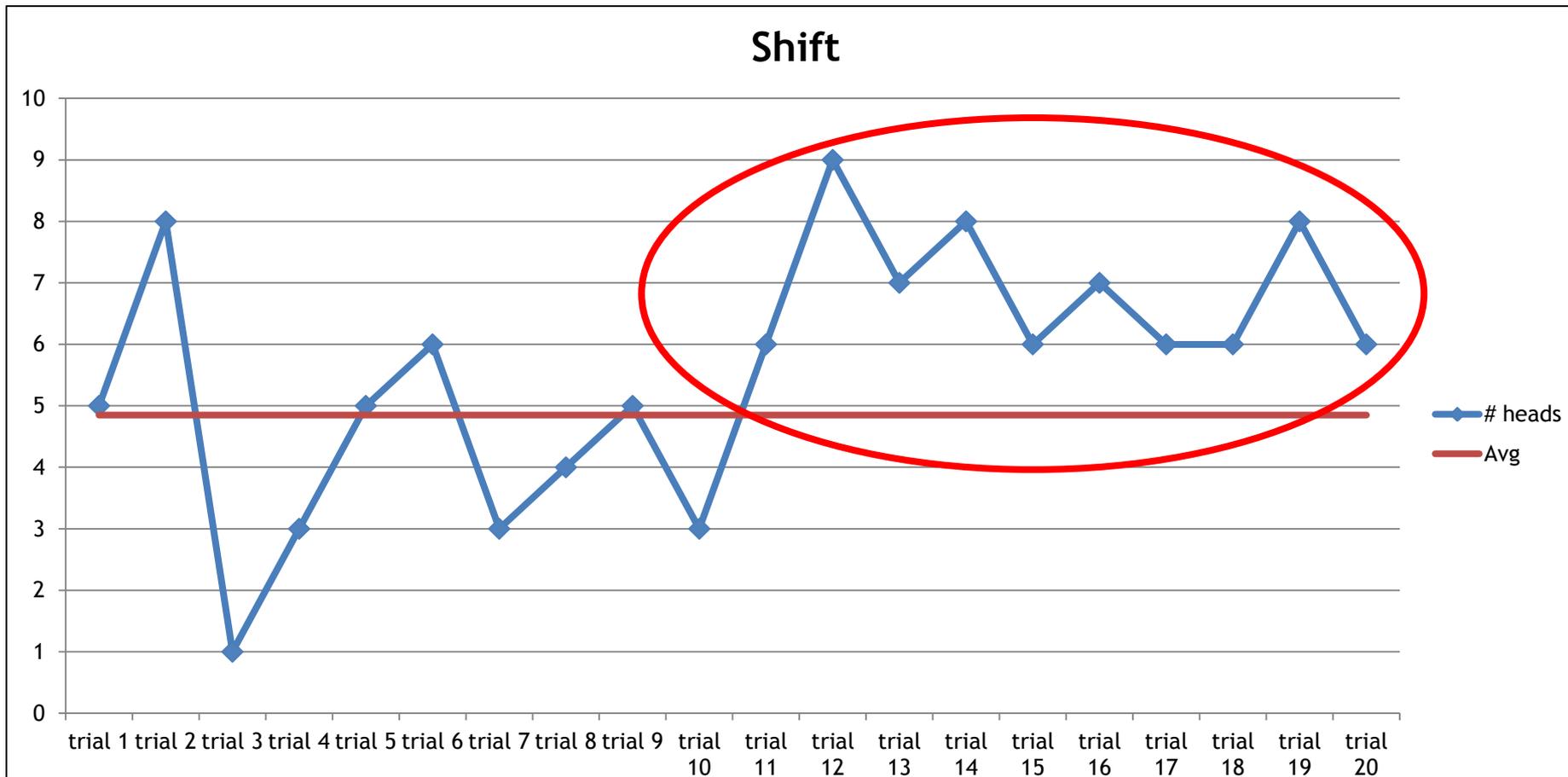
A. Trial 3 B. Trial 11



POLL:

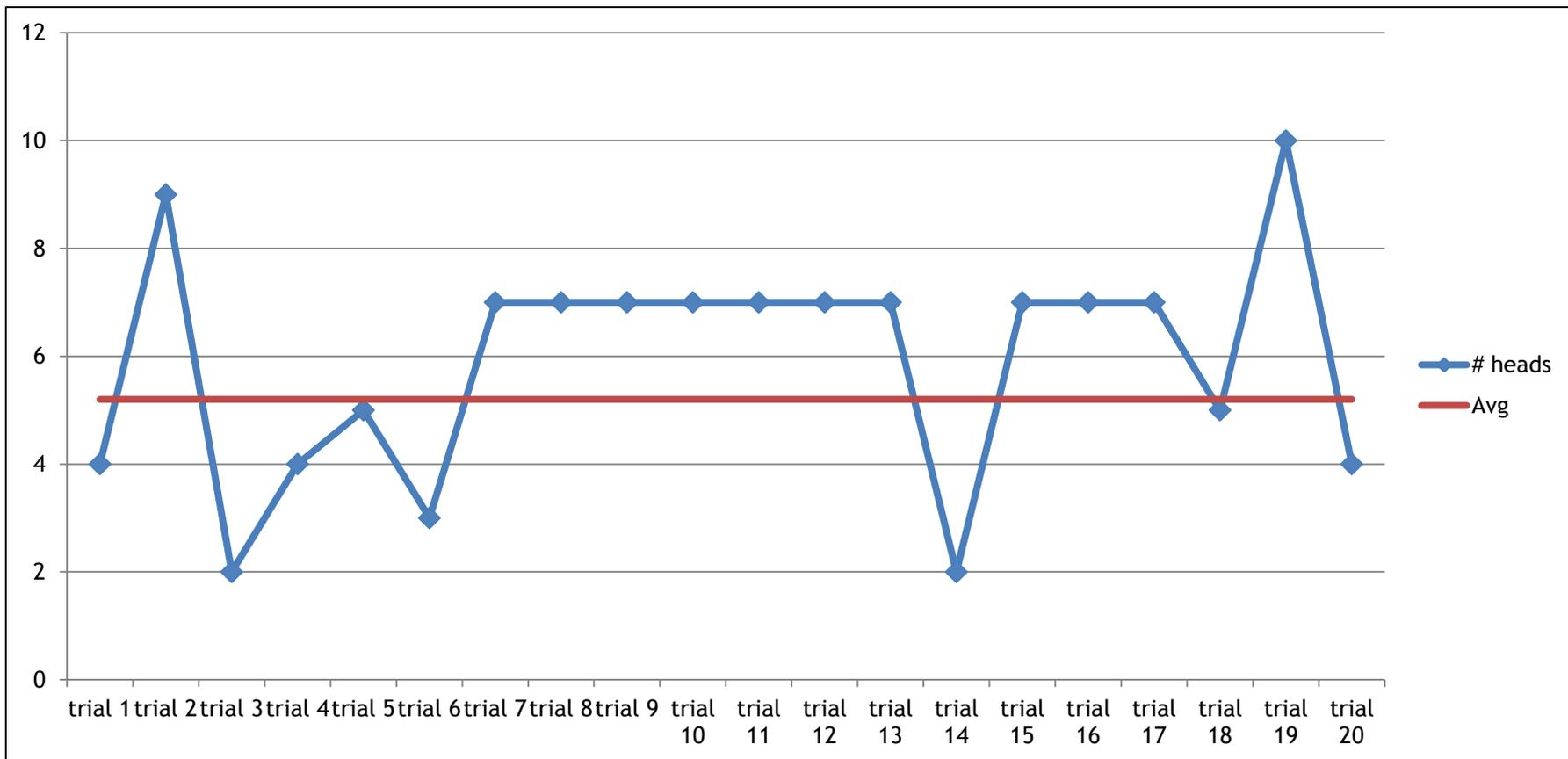
What trial number does the shift start?

A. Trial 3 B. Trial 11

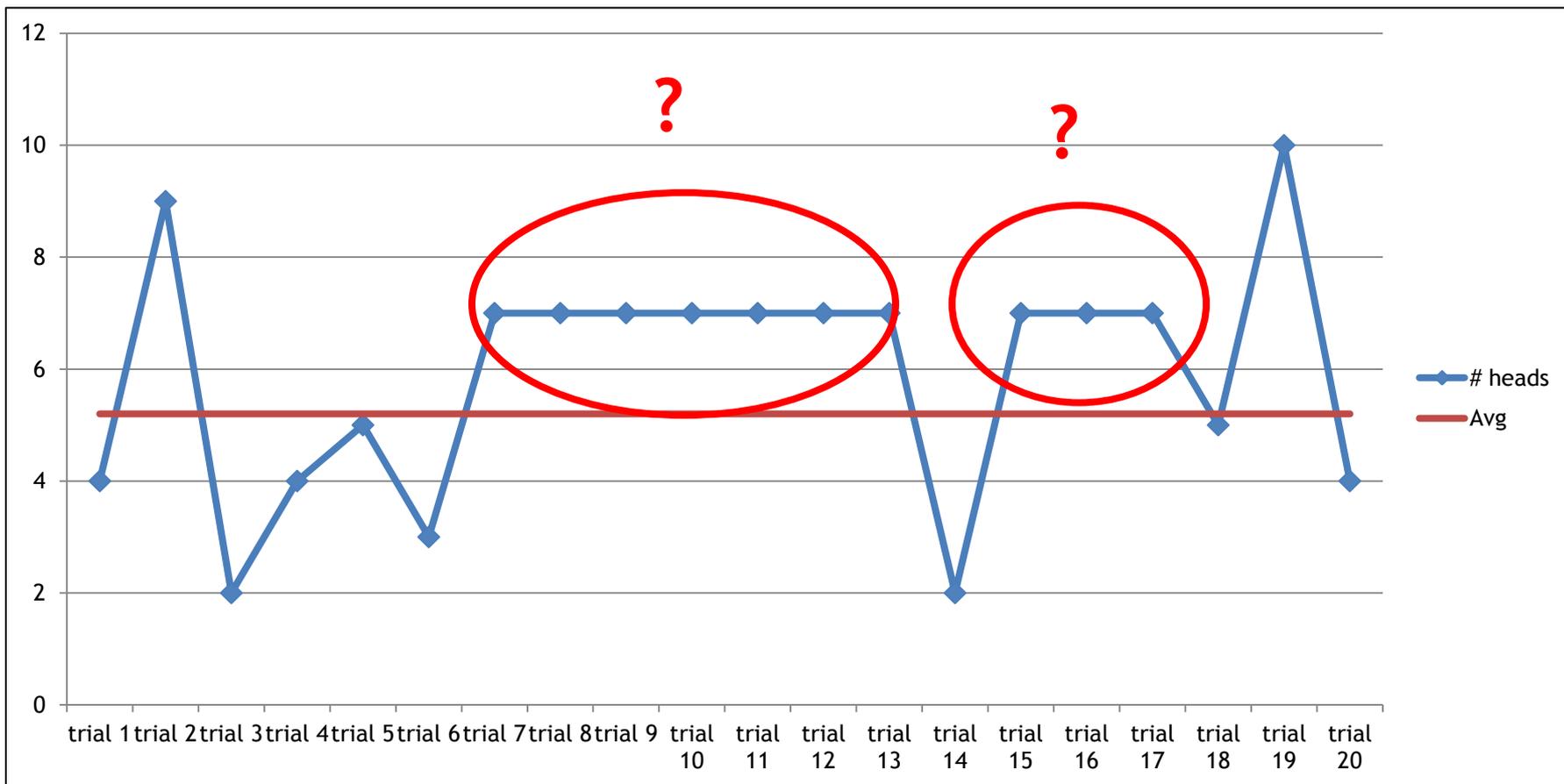


CHAT BOX:

What conclusions might you draw from this data?

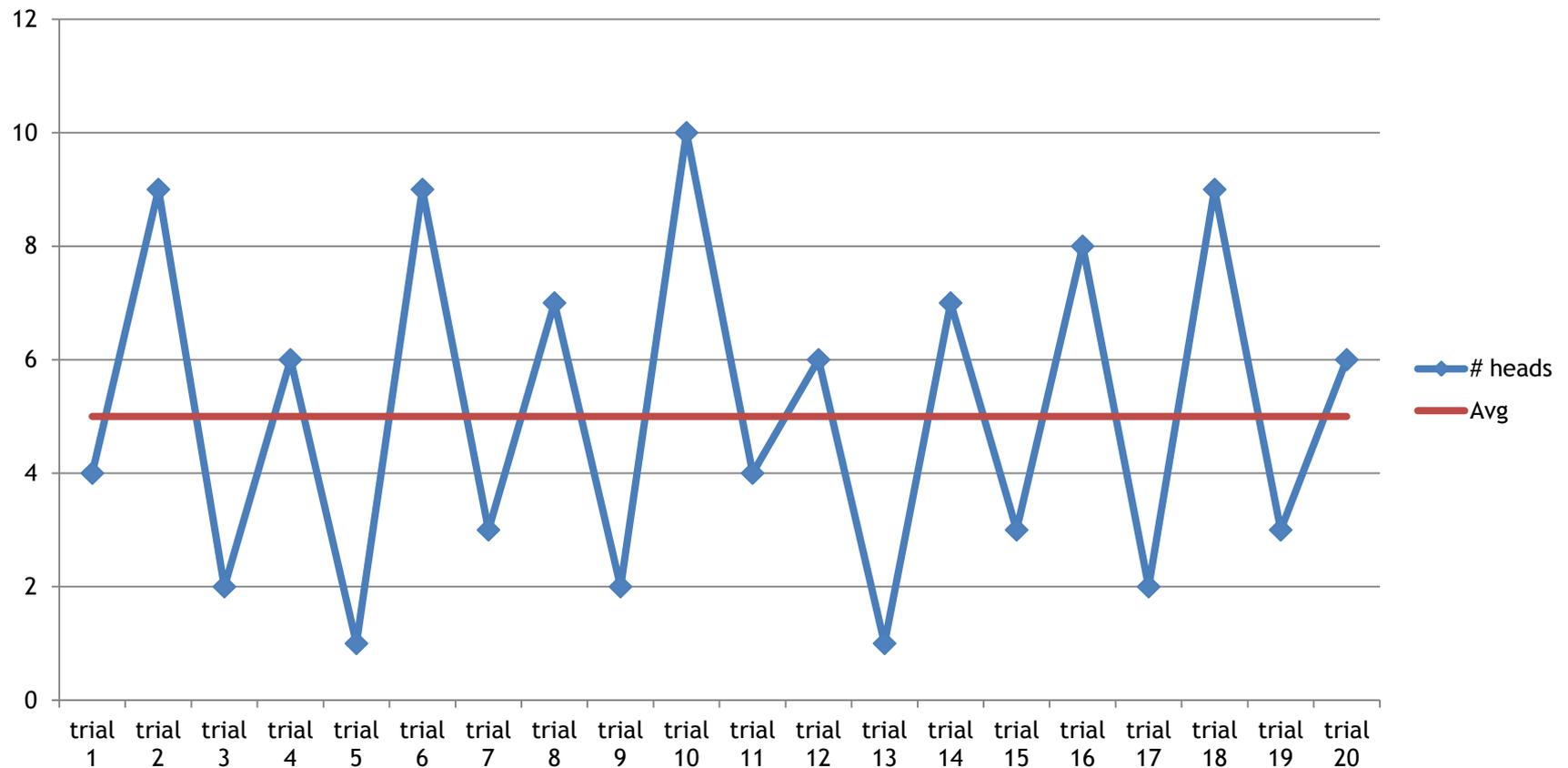


Data Collection Problems - repeat results (data fudged?)

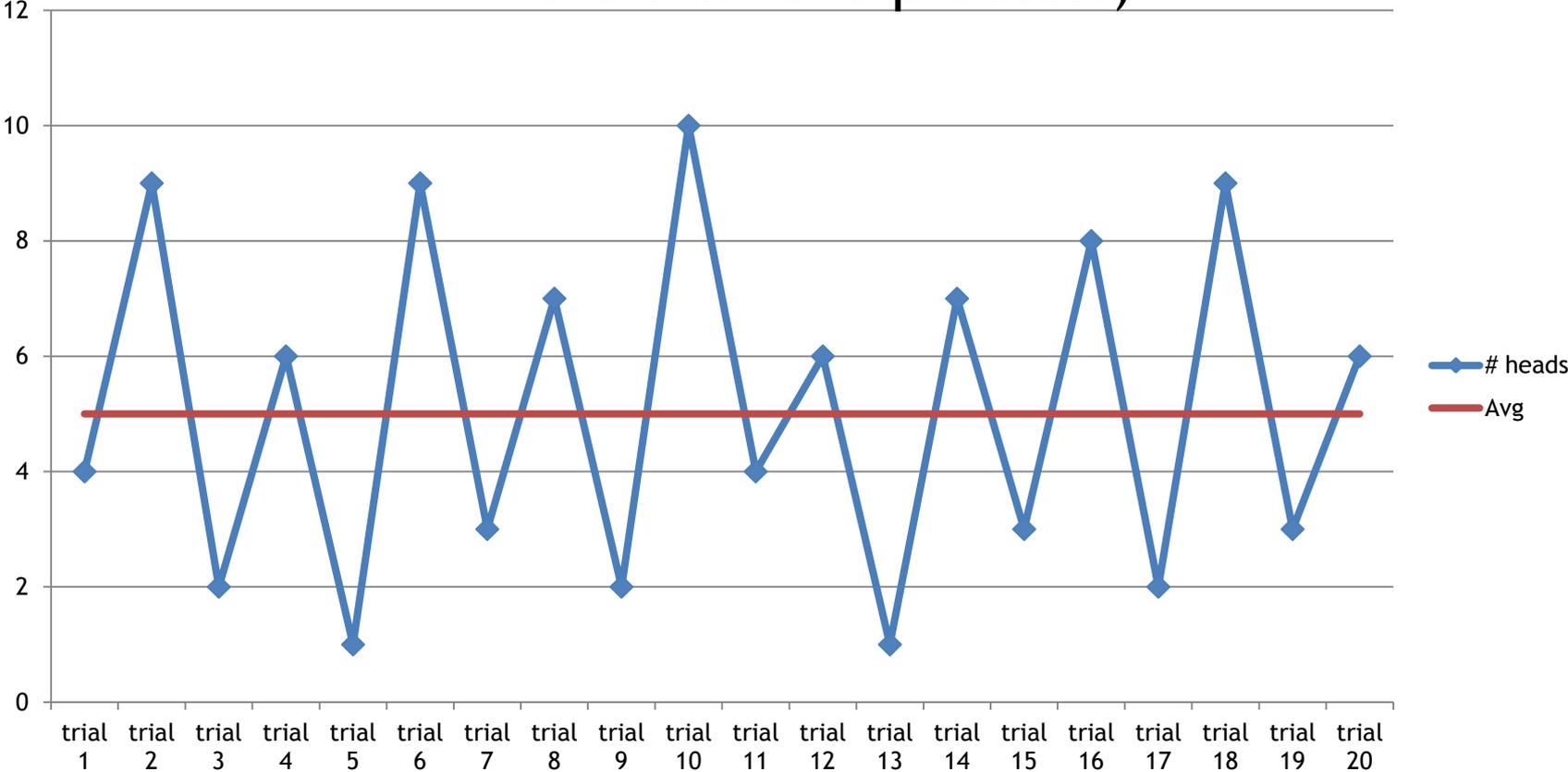


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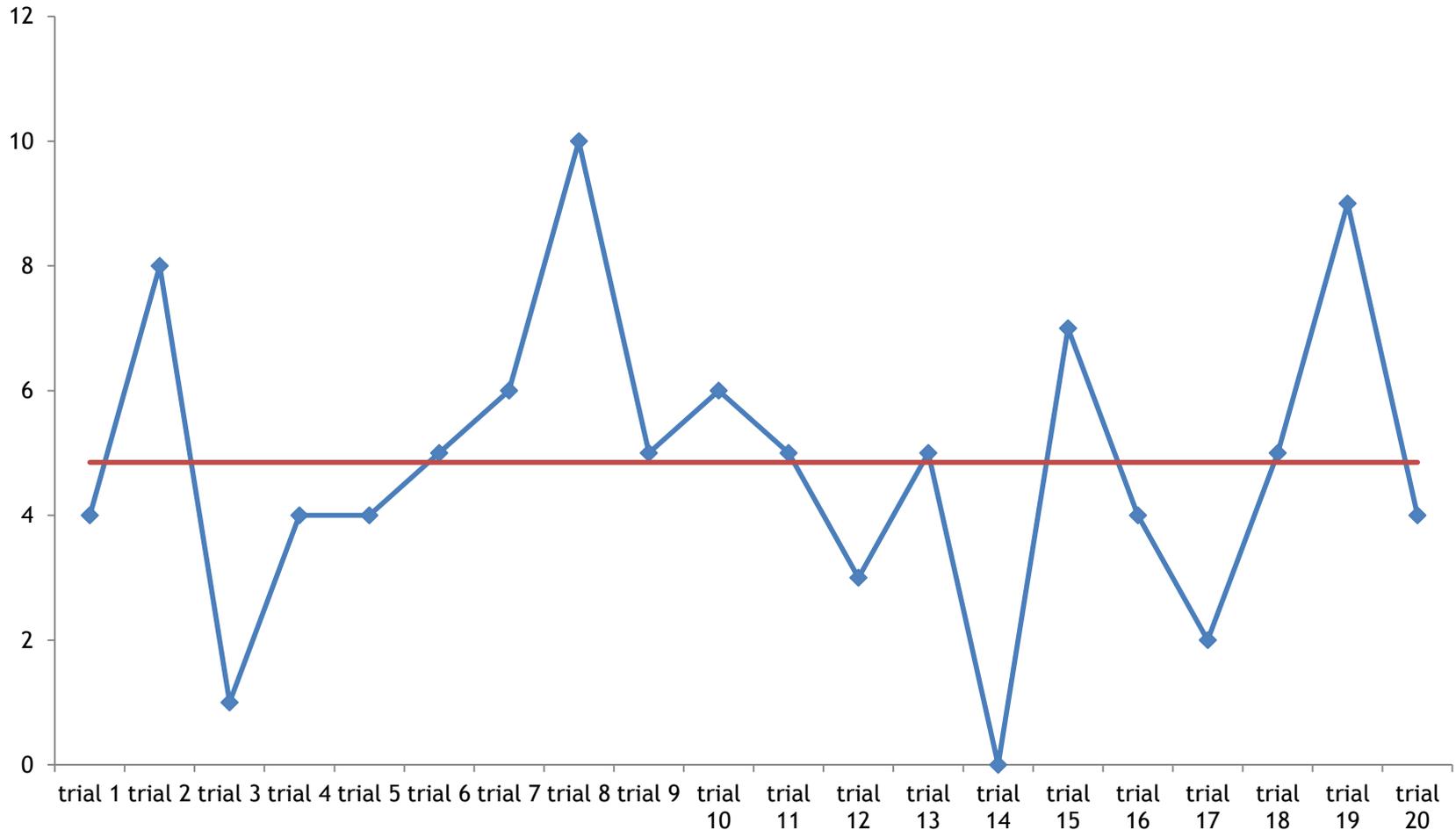


Data Collection/Sampling Problems - Alternating Pattern (Differences between staff? between shifts? More than one process?)



A Good QI Project Candidate

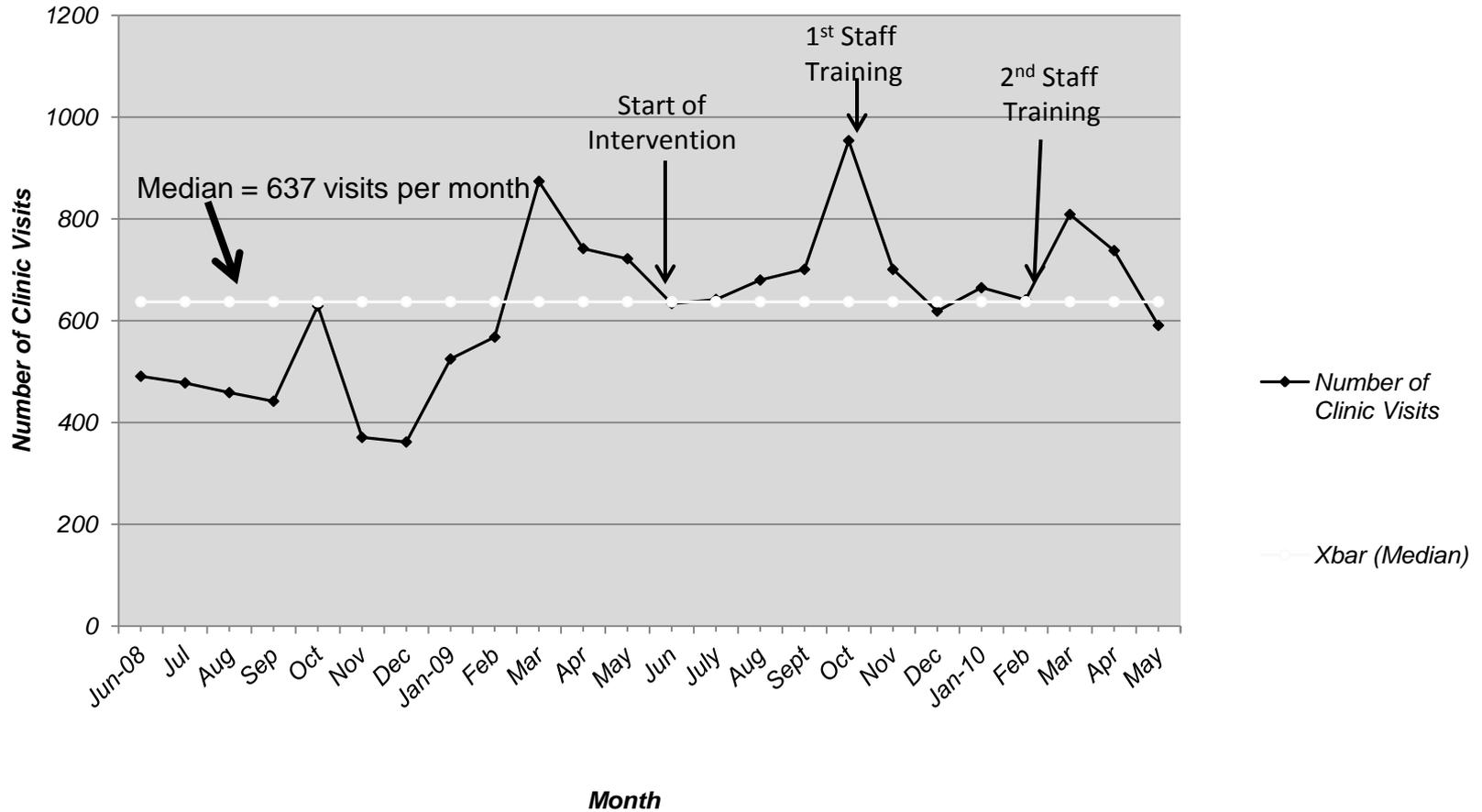
Capable, Random and Expected:
Days to Complete an Environmental Health Permit



Port Gamble S'Klallam Tribe

Run Chart: Number of Clinic Visits Per Month

June 2008 - May 2010

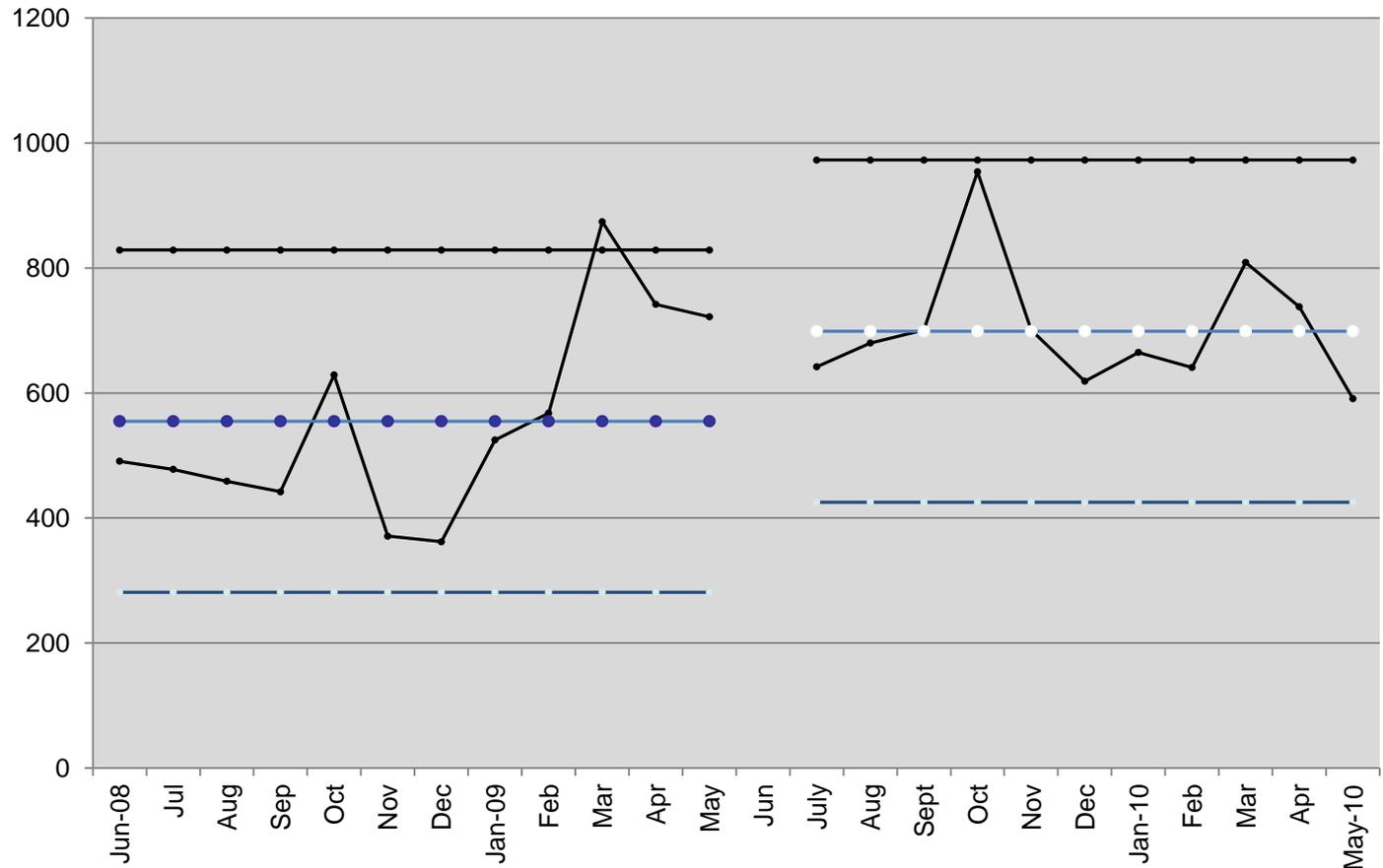


Port Gamble S'Klallam Tribe Control Chart with Process Shift Number of Clinic Visits Per Month June 2008 - May 2010

POLL:

Did the Port Gamble S'Klallam intervention aimed at increasing visits work?

- A. Yes
- B. No



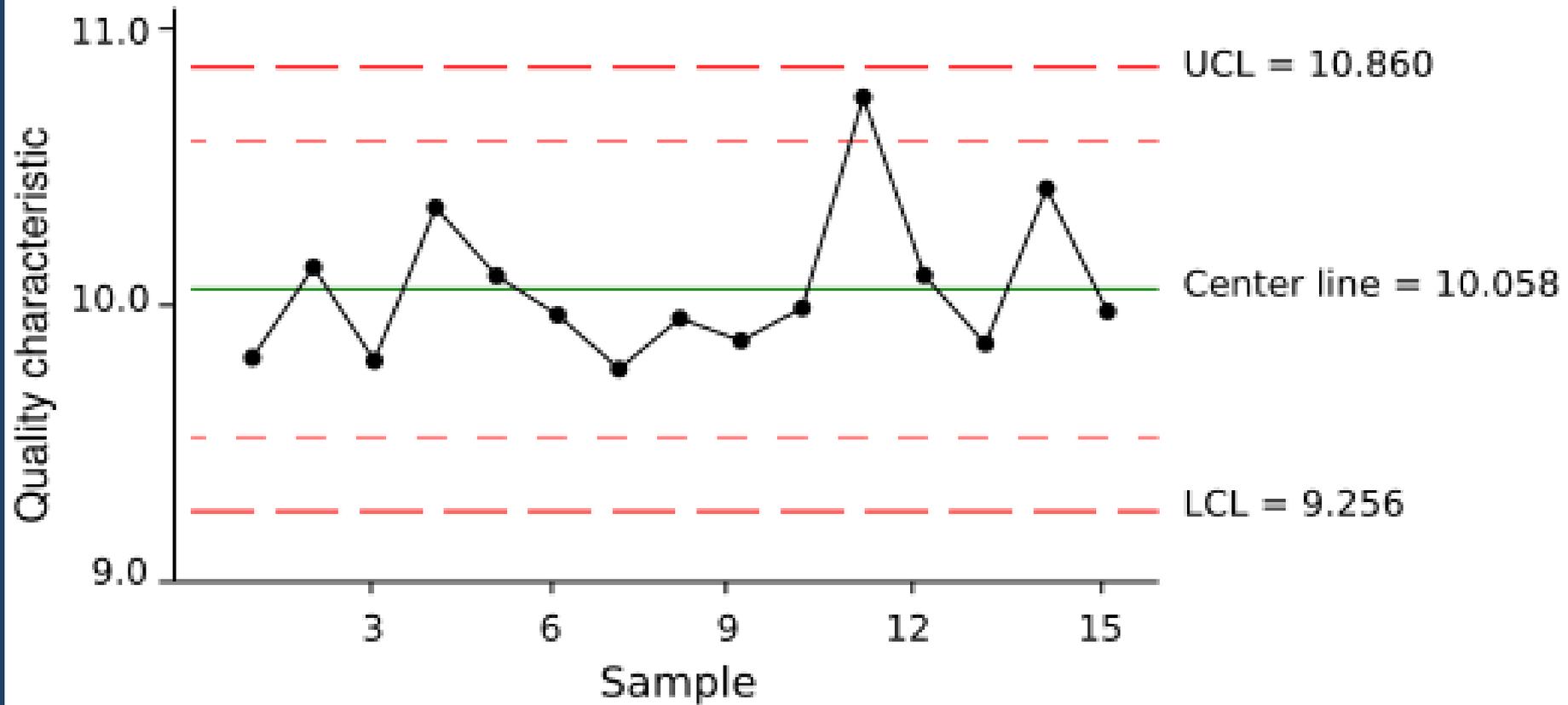
Control Charts

Same elements as a run chart plus:

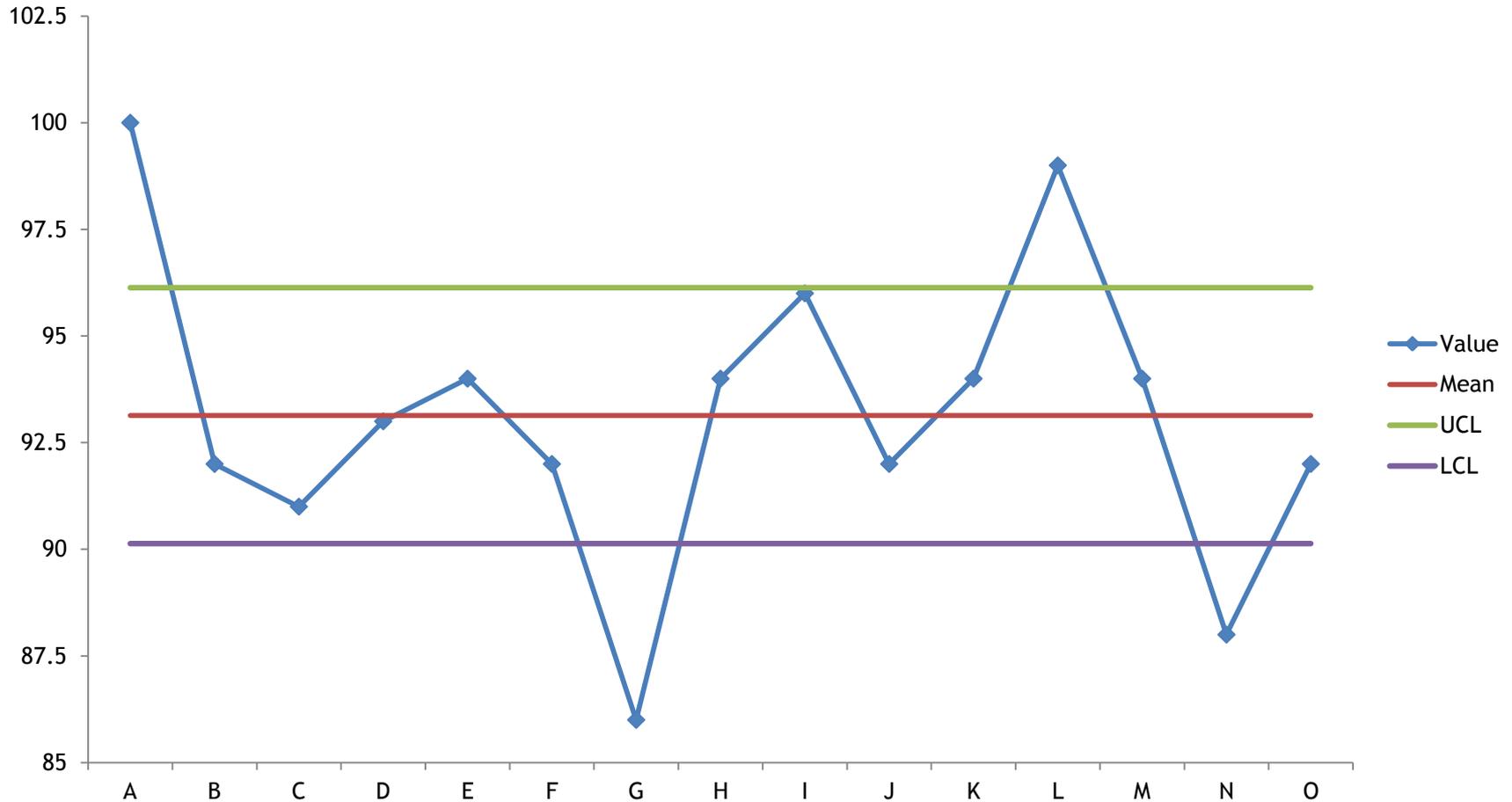
- Upper/lower control limits placed a certain number of standard deviations (or practical equivalent) from the mean
- Like the mean, limits are based on initial series of samples
- Typical choice is 3 standard deviations (captures 99% of the variation from a normally distributed population)

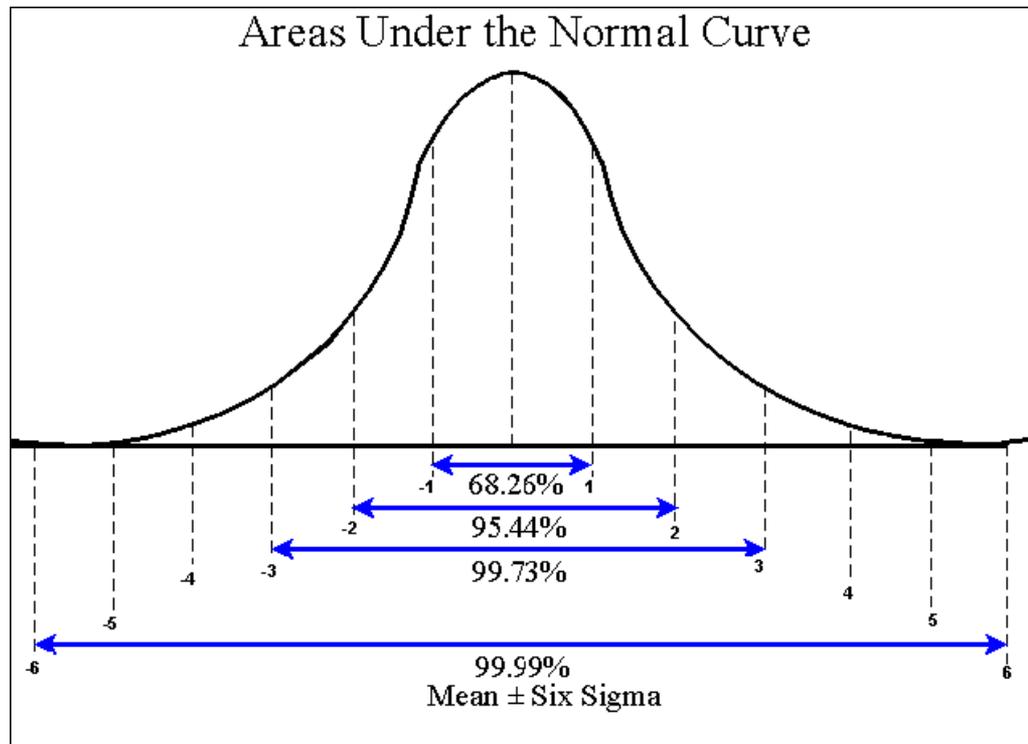
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Control Chart



Data point outside control limits





The six sigma level is where the performance at each function, process or operation is nearly perfect, generating a defect rate of .000034% or only 3.4 defects per million opportunities. For comparison, a three sigma level of performance generates 66,807 defects per million opportunities.

Standard Deviation

- Represented by the lowercase form of the Greek letter sigma, is a statistic that tells you how tightly the data points are clustered around the mean for a given process.
- This tells you how much variation exists.
 - When data points are tightly clustered around the mean and the bell-shaped curve is steep, the standard deviation and the range of variation is small.
 - When the data points are spread apart and the bell-shaped curve is flat, the standard deviation and range of the variation is great.

Standard Deviation

- Analysts generally talk about the number of standard deviations from the mean.
- One standard deviation in either direction of the mean accounts for 68 percent of the data in the group.
- Two standard deviations account for 95 percent of it.
- Three standard deviations account for 99 percent of the data.

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Control Chart Construction

Options:

- Follow Public Health Memory Jogger II instructions, pages 36 to 51.
- Write formulas and build templates in Excel
- Buy Excel data pack add-ons (Green Belt XL, etc.)
- Download Excel templates from internet (usually free)
- Mini-tab or other stats program
- Incorporate control limits into Crystal and SQL query reports

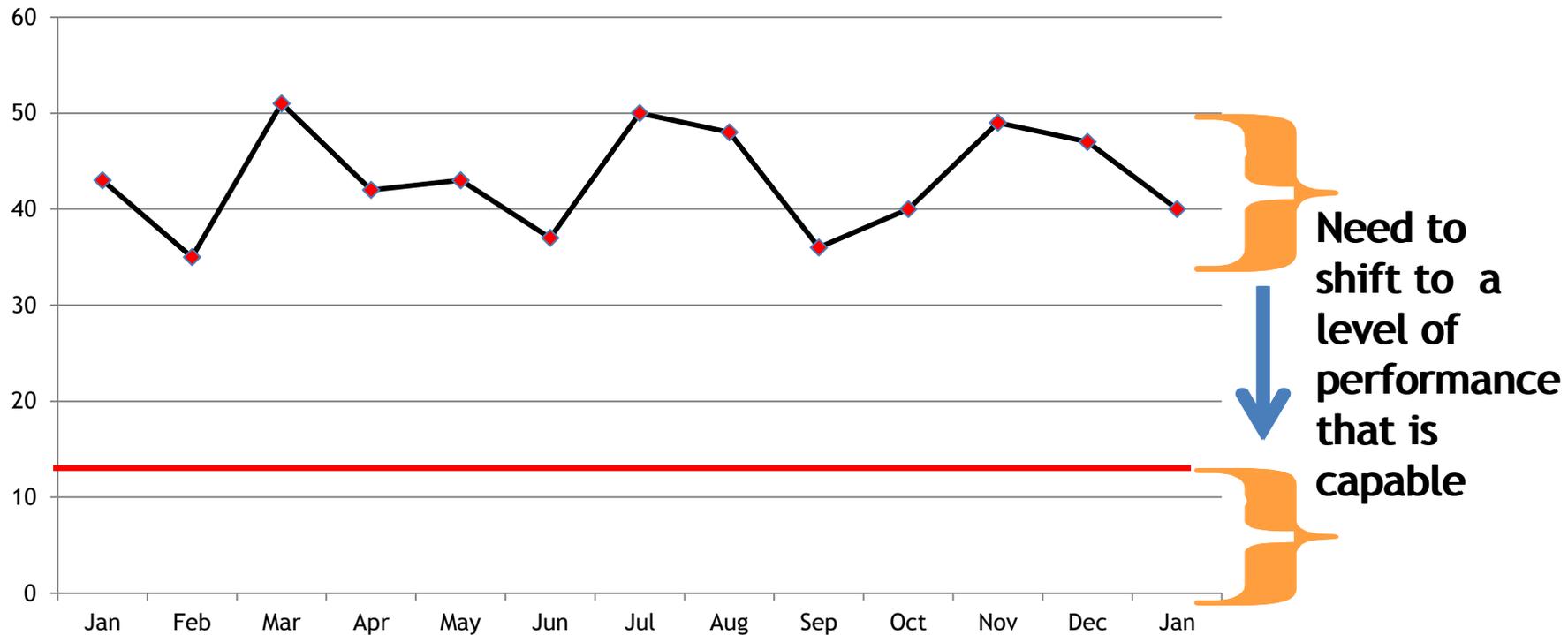
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Specifications and Control Limits

- **Don't confuse them!!!**
 - A specification tells you how well you need the process to perform
 - A control limit is a statistical reference that helps you distinguish between expected results and unexpected results
 - A process can be “in control” but not quality
 - A process can be meeting the specification but be “out of control”

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Days to Complete Request



Control Charts

- Pitfalls
 - Non-normal distribution such as data collection problems, shift in data, or alternating pattern in run chart
 - Not adjusting control limits periodically
 - Over Rounding
 - Sampling variation

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Discussion

- What are situations where control charts might be helpful in public health?
 - Why?
 - What would be concerns?

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In Summary

- Understanding variation is crucial to selecting appropriate work processes for QI projects
- Responding correctly to the type of variation, and not tampering, makes our management and QI efforts more effective

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Review Learning Objectives

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 - Identify examples of each chart type
 - Analyze data displayed in each chart type

Additional Resources

- Performance Management Centers for Excellence Web site: www.doh.wa.gov/PHIP/perfmgmtcenters
- Public Health Memory Jogger, GOAL/QPC, 2007, www.goalqpc.com, pages 36 through 51
- Creating Control Charts in Excel instructions: http://www.ehow.com/how_5928553_create-control-charts-excel.html
- Bialek R, Duffy DL, Moran JW. The Public Health Quality Improvement Handbook. Milwaukee, WI: ASQ Quality Press; 2009
- The Improvement Guide, Langley et al. Jossey-Bass, 1996.
- Juran, J.; Juran on Leadership for Quality, Free Press, 1989
- Juran, J.; Juran on Planning for Quality, Free Press, 1988
- Mason M, Moran J, Understanding and Controlling Variation in Public Health. *Journal of Public Health Management and Practice*. Jan/Feb 2012; 18(1), 74-78

THANKS FOR YOUR PARTICIPATION!

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**Join us Next Time:
July 17, 2013
“Quality Tools Training”**

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What questions do
you have?

