2012 Quality Improvement Grantees Learning Congress

November 1, 2012

Four Generations of Analysis
Advanced QI Techniques

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Objectives

- By the end of this presentation, you will be able to:
  - Describe 4 generations of analysis
  - Identify and explain the difference between special cause and common cause variation
  - Analyze a run chart using 2 tests for special cause
  - Apply run charts and control charts in a public health setting
  - Explain process stability and capability
  - Define and apply Statistical Process Control

Public Health Program Analysis

- Process: a series of steps to produce an outcome

- All processes have variation

- The underlying process determines performance

- Understanding and reducing variation in process is goal

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Statistical Process Control

- A method to analyze data from ongoing processes to make decisions about the process in order to control the quality of service.

  - Involves the use of control charts to track a process over time to determine its performance.
  - A process is controlled when its variability in the future can be predicted.
  - A set of analytic methods for improvement of processes and outcomes through the analysis of process stability and capability

- Zimmerman and Icenogle, 2003

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Static and Dynamic Data Analysis
Four Generations

- Static Analysis
  - First Generation: Tables of Data, Comparison of Summary Measures

- Dynamic Analysis
  - Second Generation: Trend Line
  - Third Generation: Run Chart
  - Fourth Generation: Control Chart

## Static and Dynamic Data Analysis and Presentation

- Case Study:
  - The Smith County Health Department was concerned about the STD rate in a high risk population.
  - A program was initiated to try harder to do everything right in order to improve.
  - After 2 years, the following results were shown

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Discussion

- Looking at the following 4 slides (7-10), consider these questions:
  - How is the information different?
  - Which slide is most accurate?
  - Which is most helpful?

Smith County STD Rates
Static Comparison

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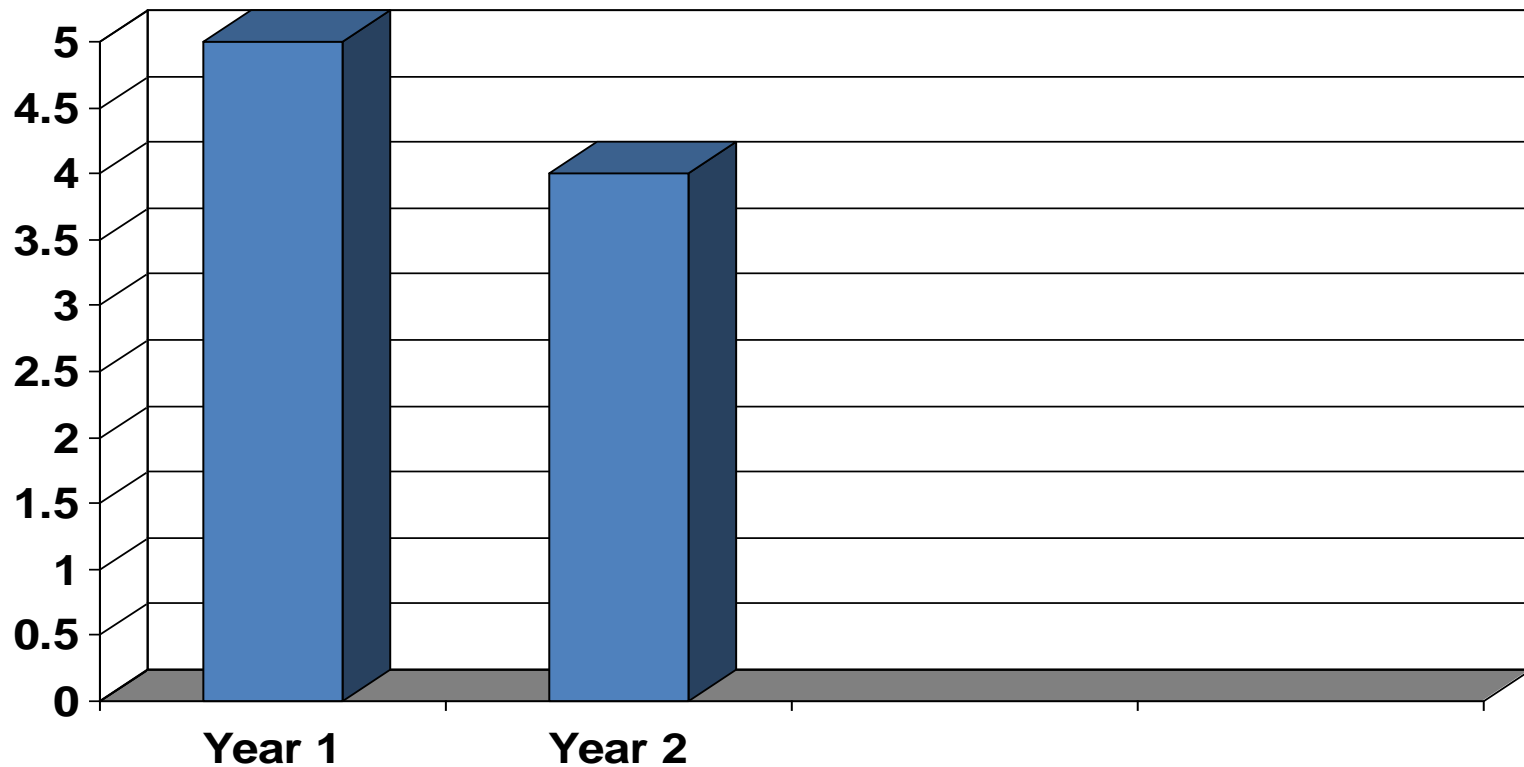
Smith STD Rate
2 year Analysis

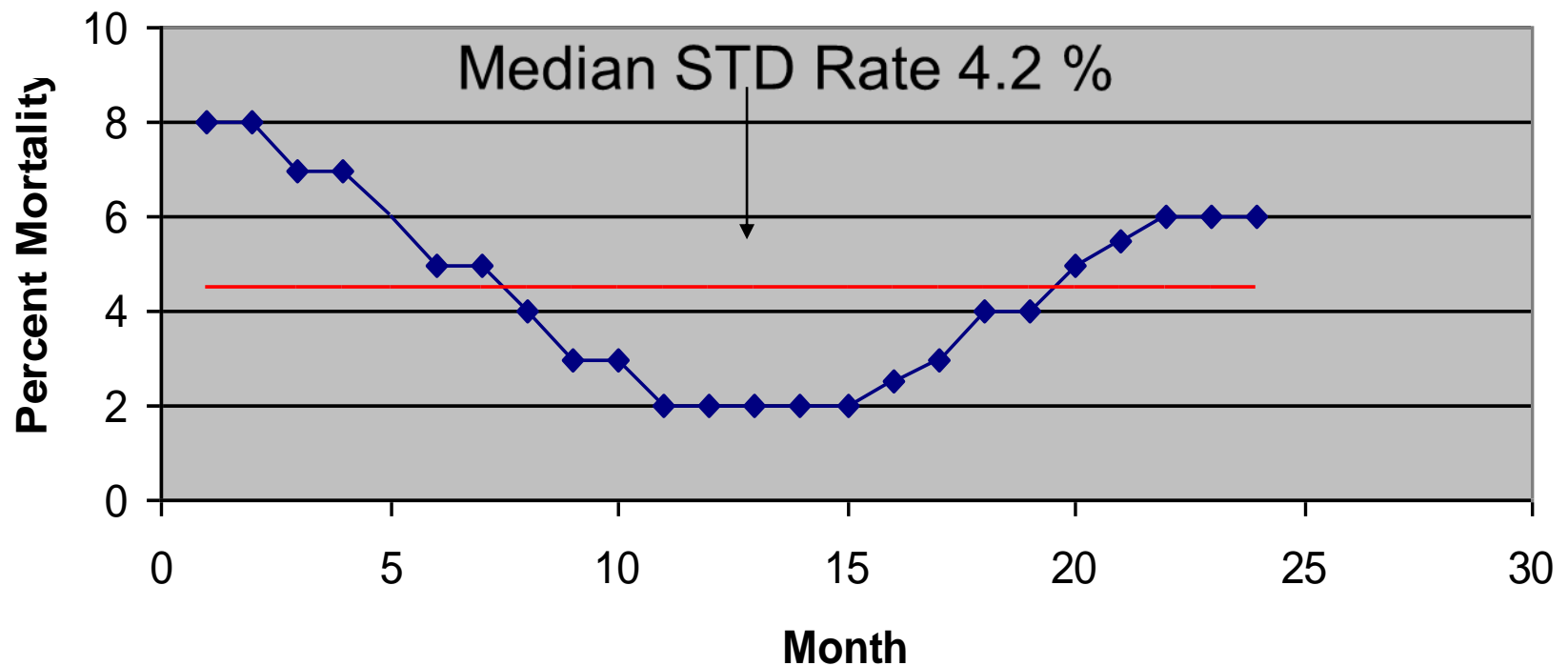|	J	F	M	A	M	J	J	A	S	O	N	D
Year 1	8	8	7	7	6	5	5	4	3	3	2	2
Year 2	2	2	2	2.5	3	4	4	5	6	6.5	6.5	6.5

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Monthly STD RATE
Trend Line

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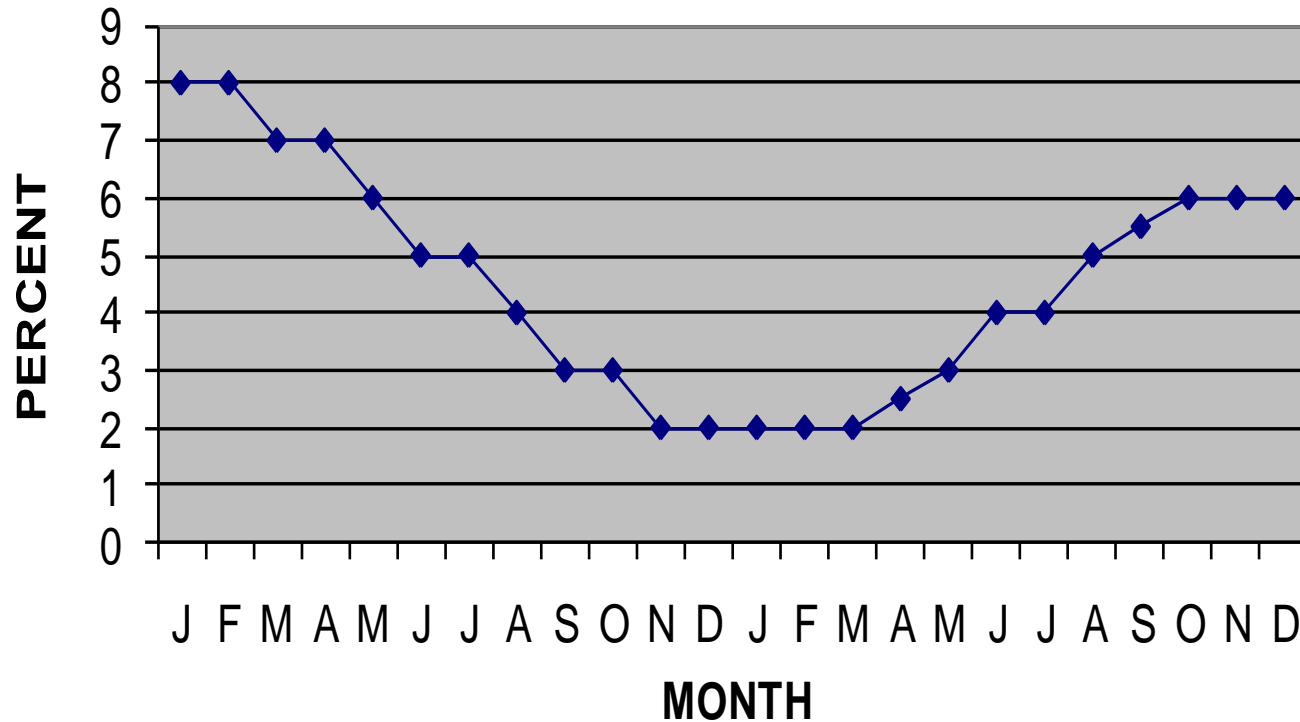
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Monthly STD Rate: Run Chart

Median STD Rate 4.2 %

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Port Gamble S'Klallam Tribe Monthly Clinic Visits: 2008-2009

Month	# Visits
June 2008	491
July	478
August	459
September	442
October	629
November	371
December	362
January 2009	525
February	568
March	874
April	742
May	722

Month	# Visits
June 2009	634
July	642
August	680
September	710
October	954
November	701
December	619
January 2010	665
February	641
March	809
April	738
May	591

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Port Gamble S'Klallam Tribe
Trend Chart: Number of Clinic Visits Per Month
June 2008 - May 2010

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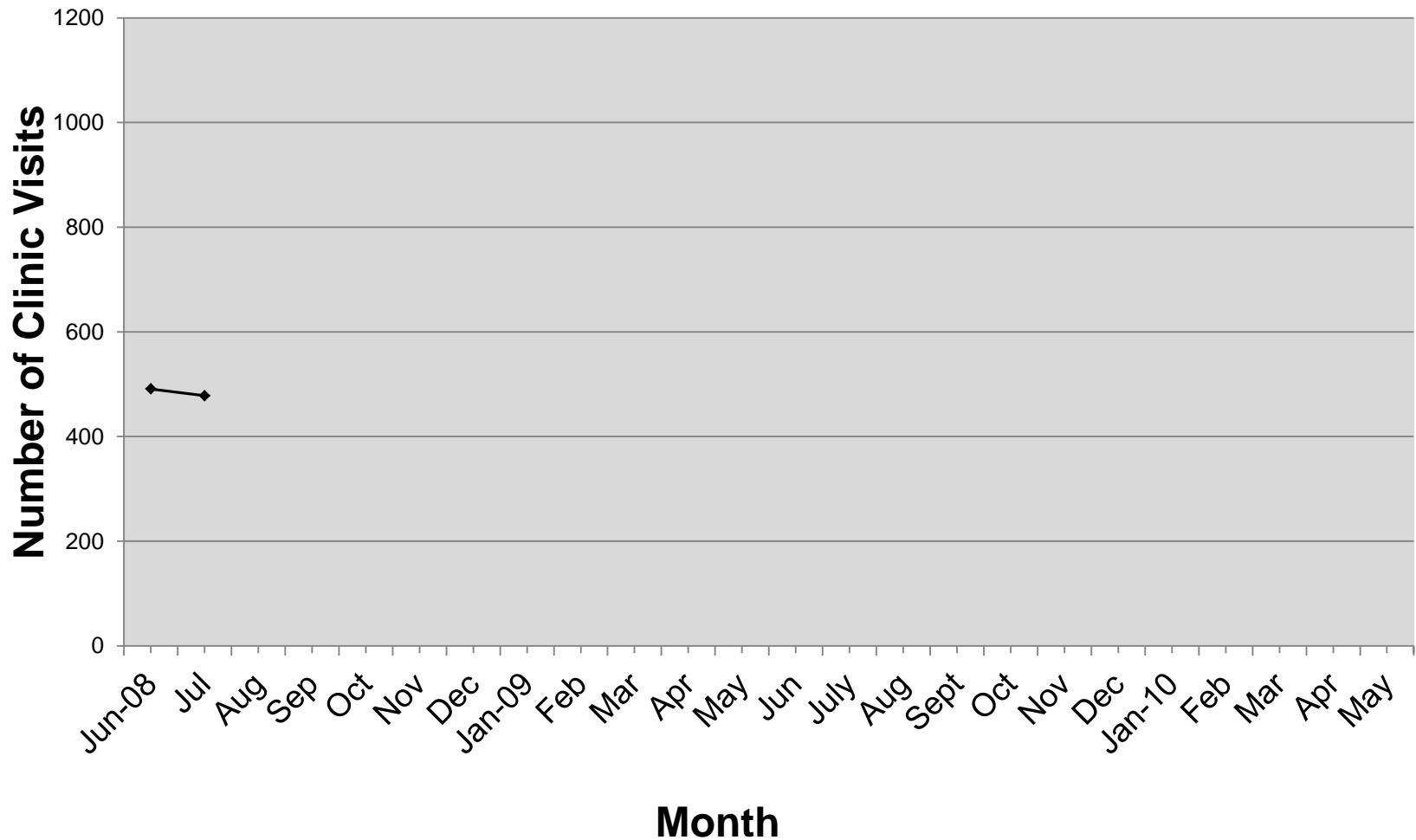
Port Gamble S'Klallam Tribe
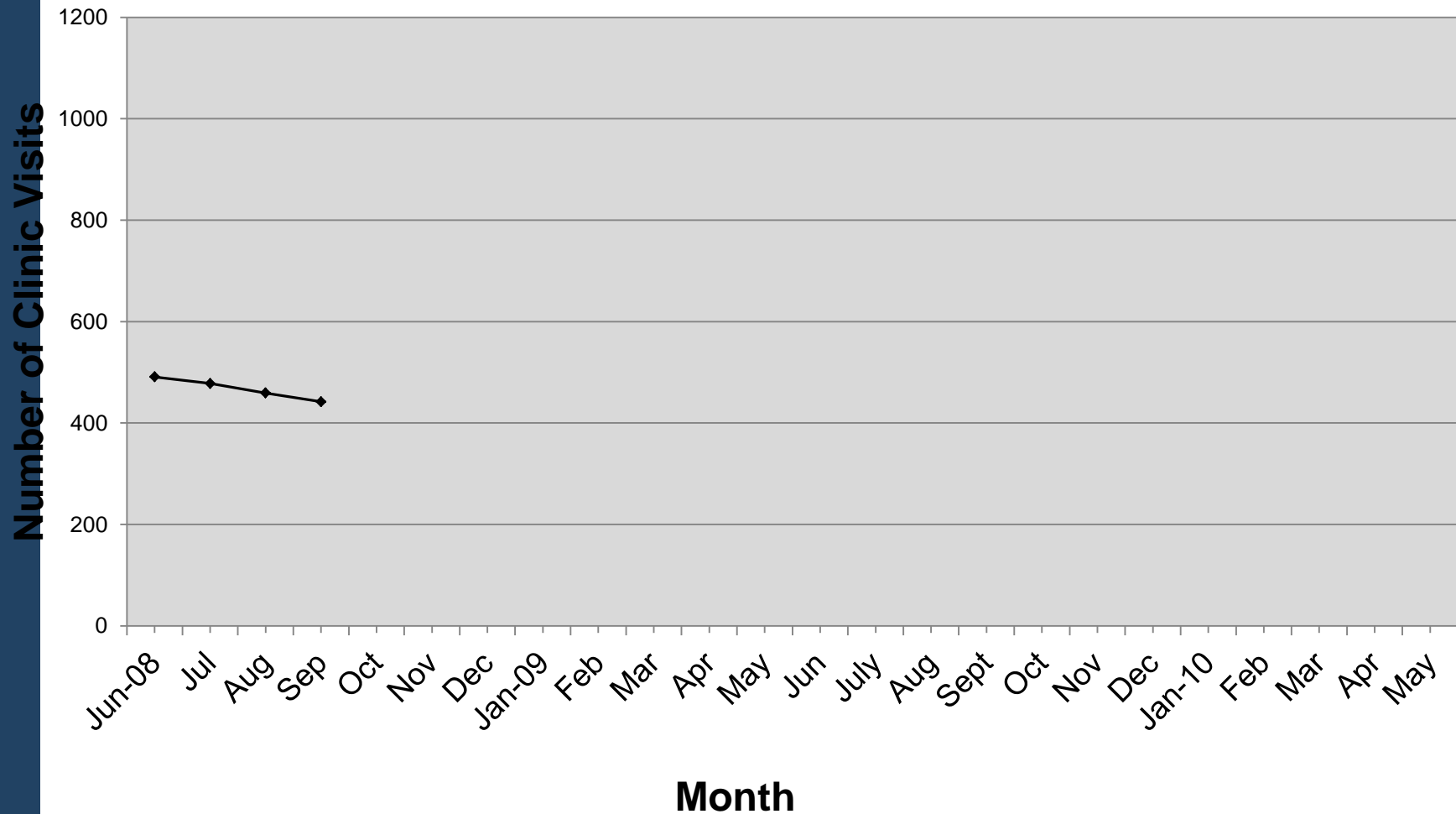# Trend Chart: Number of Clinic Visits Per Month
June 2008 - May 2010

Port Gamble S'Klallam Tribe
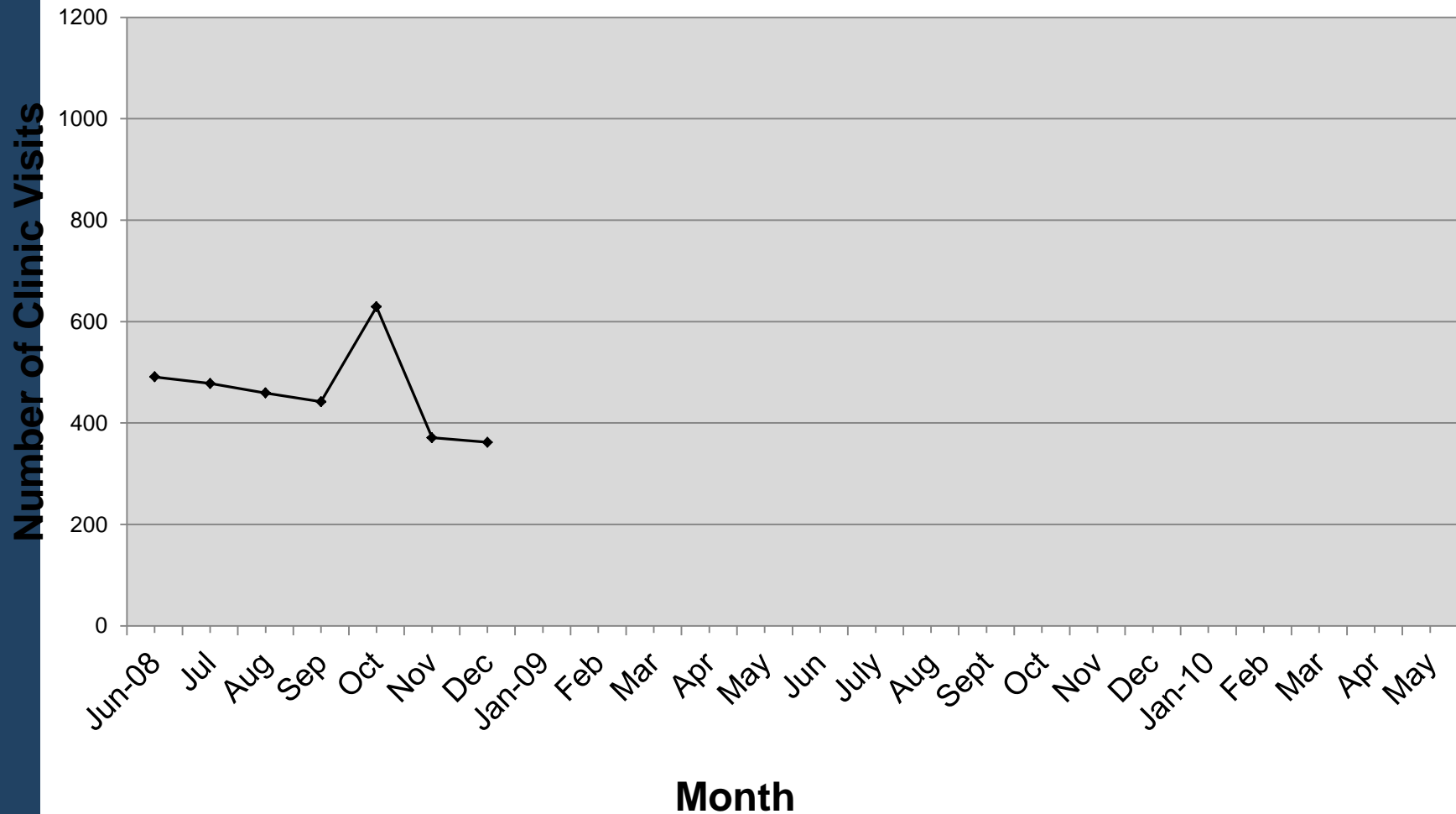# Trend Chart: Number of Clinic Visits Per Month
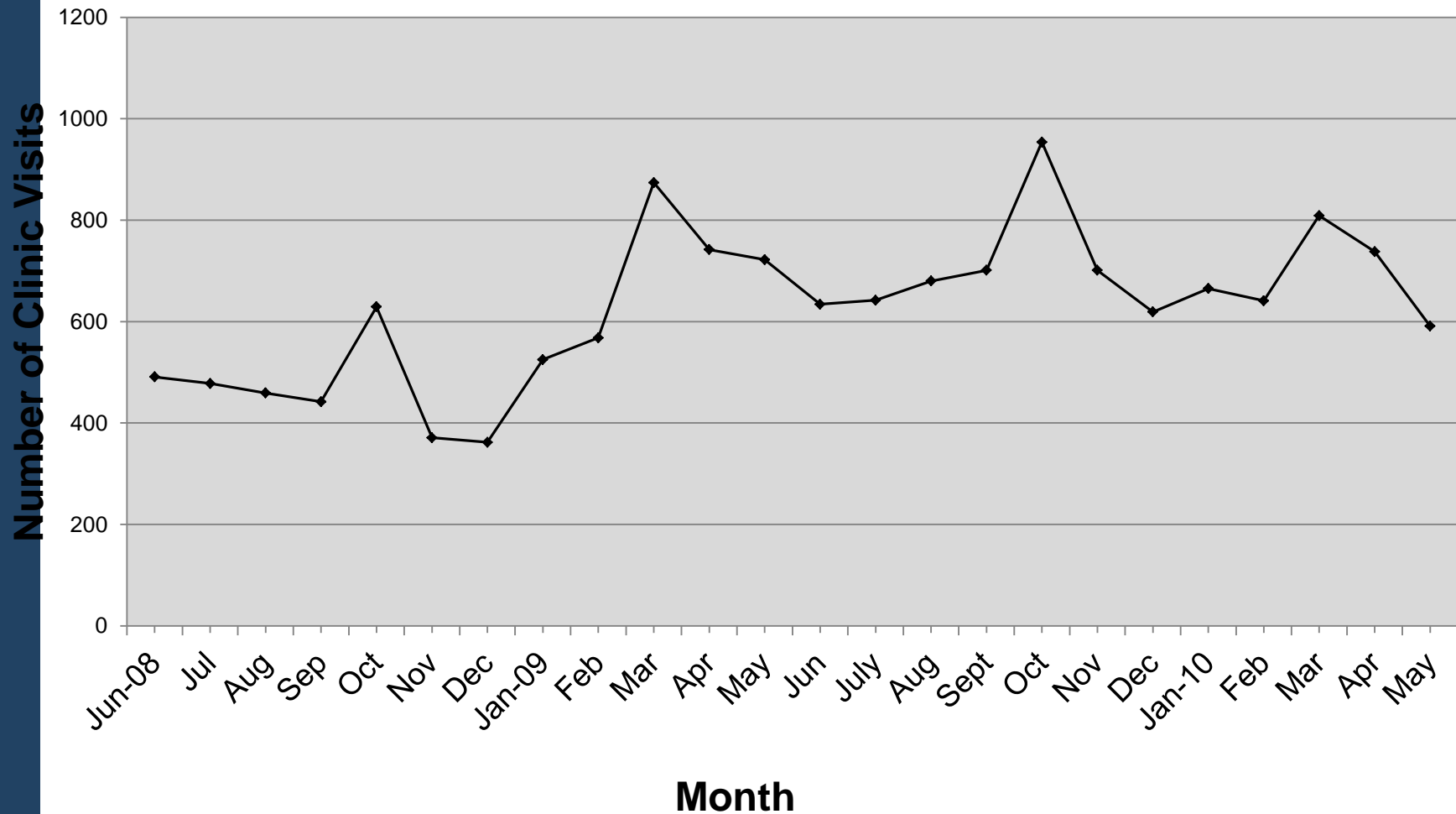# June 2008 - May 2010

Port Gamble S'Klallam Tribe
Trend Chart: Number of Clinic Visits Per Month
June 2008 - May 2010

Discussion

- All process have variation
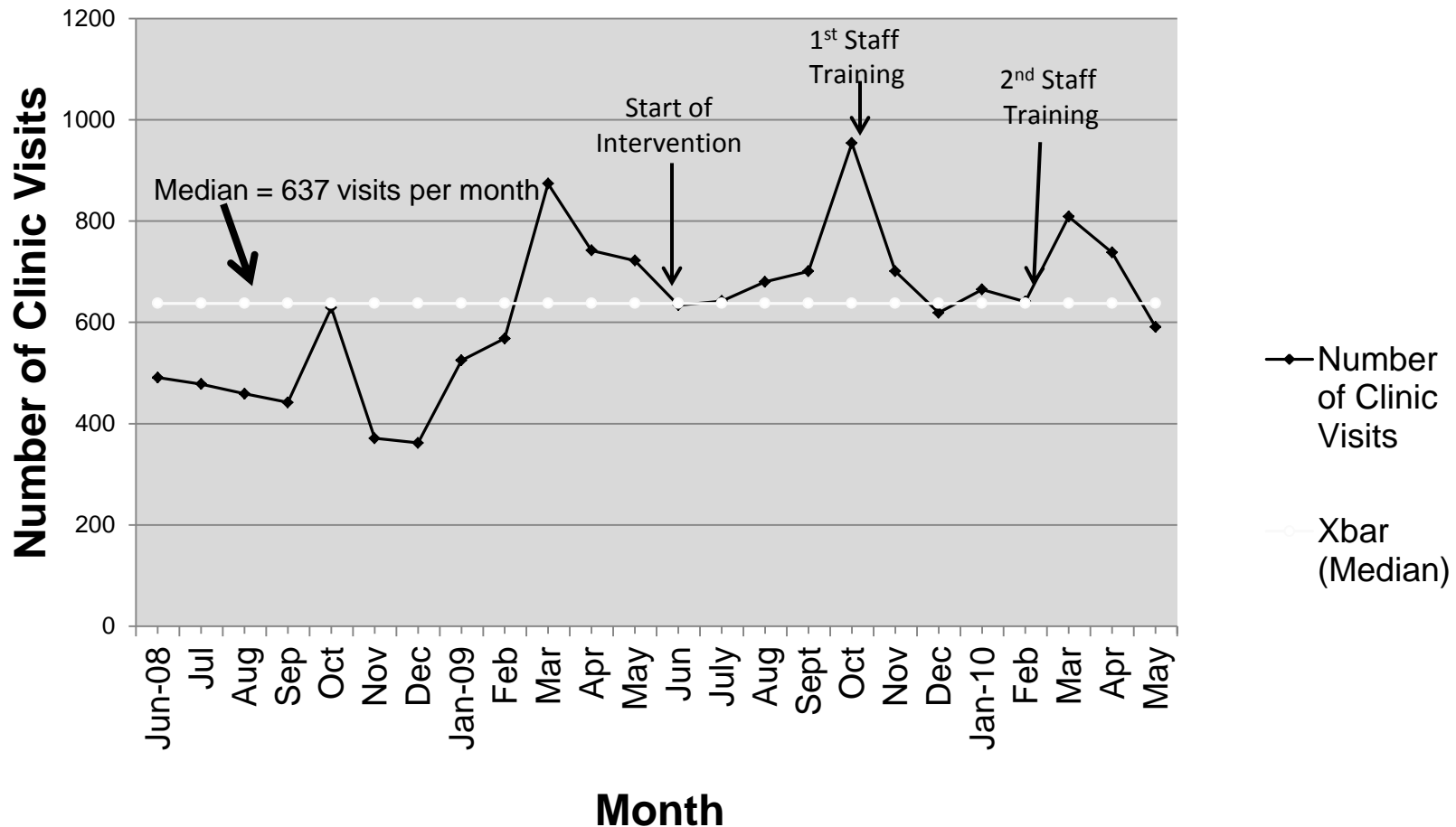- When is the change in performance meaningful?

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Run Chart

- A running record of process behavior over time.

- Easily understood by all,

- Can be used on any type of process and any type of data.

- Requires no statistical calculations, can detect some special causes.

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Port Gamble S'Klallam Tribe
Run Chart: Number of Clinic Visits Per Month
June 2008 - May 2010

Median = 637 visits per month

Start of Intervention

1st Staff Training

2nd Staff Training

Number of Clinic Visits

Xbar (Median)

Number of Clinic Visits

Month

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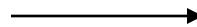
Run Charts
Determining a Run

- A run is one or more consecutive data points on the same side of the median.

- Do not count a point if it is on the centerline. (Put a box around it and ignore)

- "Useful Observations"

  – Subtract any observation that falls on median.

- Draw circle around each run, and count the number of runs.

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Run Chart
2 Tests to Identify Special Cause

- Test 1 – Long run:
  - If 7 or more in run(When less than 20 "useful observations") When 20 or more "useful observations" , then 8 or more data points needed for a run.
- Test 2 – Trend:
  - An unusually long series of consecutive increase or decrease.

Determining a Trend

Total Data Points on Chart	Number Ascending or Descending
5-8	5 or more
9-20	6 or more
21 to 100	7 or more

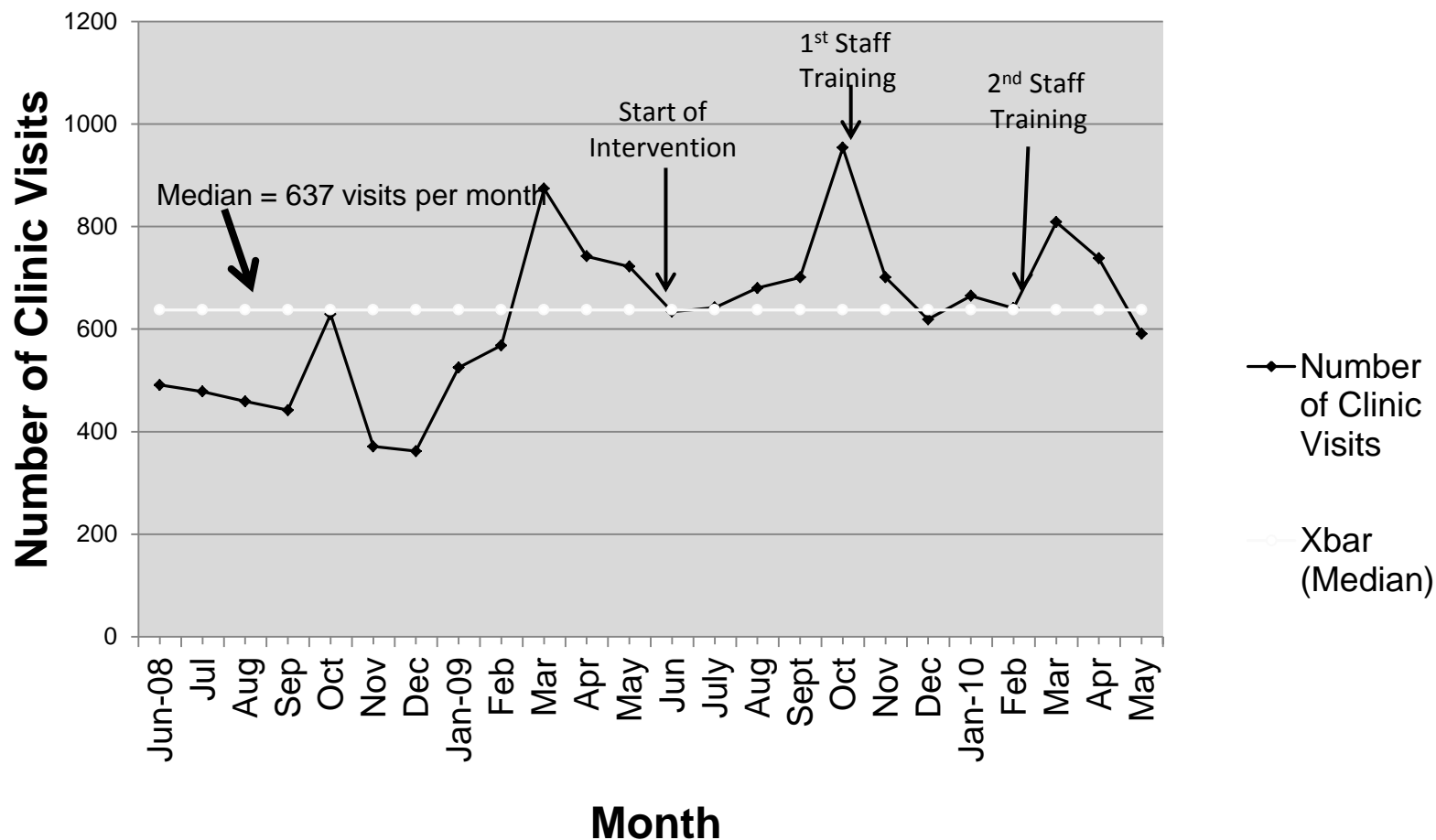*Public Health Performance Management Centers for Excellence*

Two Types of Variation

- **Common Cause**
  - Inherent in every process
  - Reflects a stable process because variation is predictable
  - Is random variation

- **Special Cause**
  - A noticeable shift or trend in data over time
  - Process is unstable or unpredictable
  - Process is out of statistical control
  - Not present in every process

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Port Gamble S'Klallam Tribe
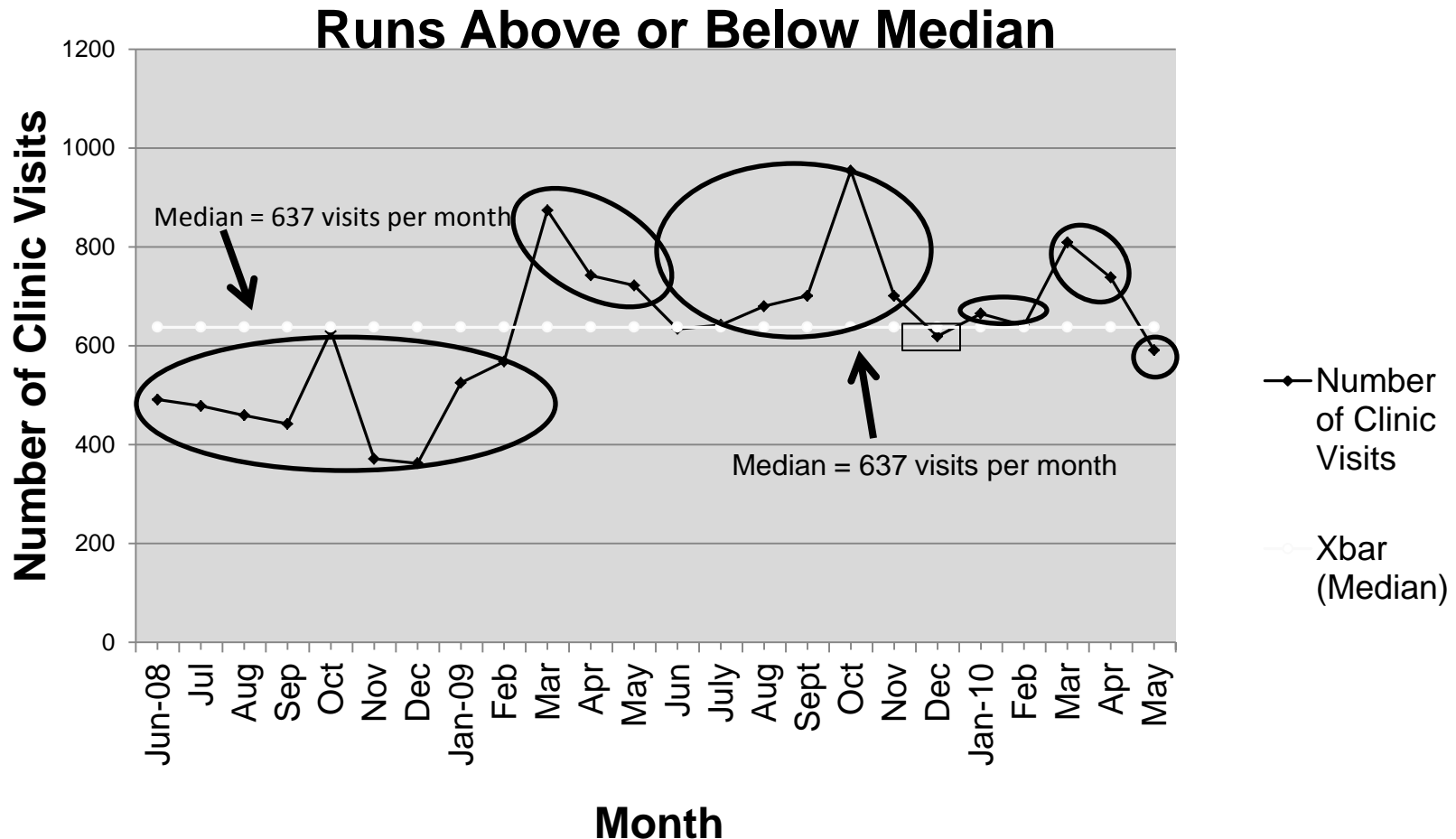## Run Chart: Number of Clinic Visits Per Month
June 2008 - May 2010

Median = 637 visits per month

Start of Intervention

1st Staff Training

2nd Staff Training

Number of Clinic Visits

Xbar (Median)

Number of Clinic Visits (y-axis)

Month (x-axis)

Port Gamble S'Klallam Tribe
Run Chart: Number of Clinic Visits Per Month
June 2008 - May 2010

Runs Above or Below Median

Median = 637 visits per month

Median = 637 visits per month

Number of Clinic Visits

Xbar (Median)

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Interpretation

- How do you interpret the run chart?

- What do you recommend?

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Run Chart and Test for Special Cause
Case Study: Waiting Time in Smith County WIC Clinic

- A key quality indicator of client satisfaction is the amount of time spent in the waiting room.

- A 7 week analysis was conducted to determine the wait time at the WIC clinic.

- The "wait time" is defined as the number of minutes from the time the client presents at the reception desk until the client is seen by the WIC specialist.

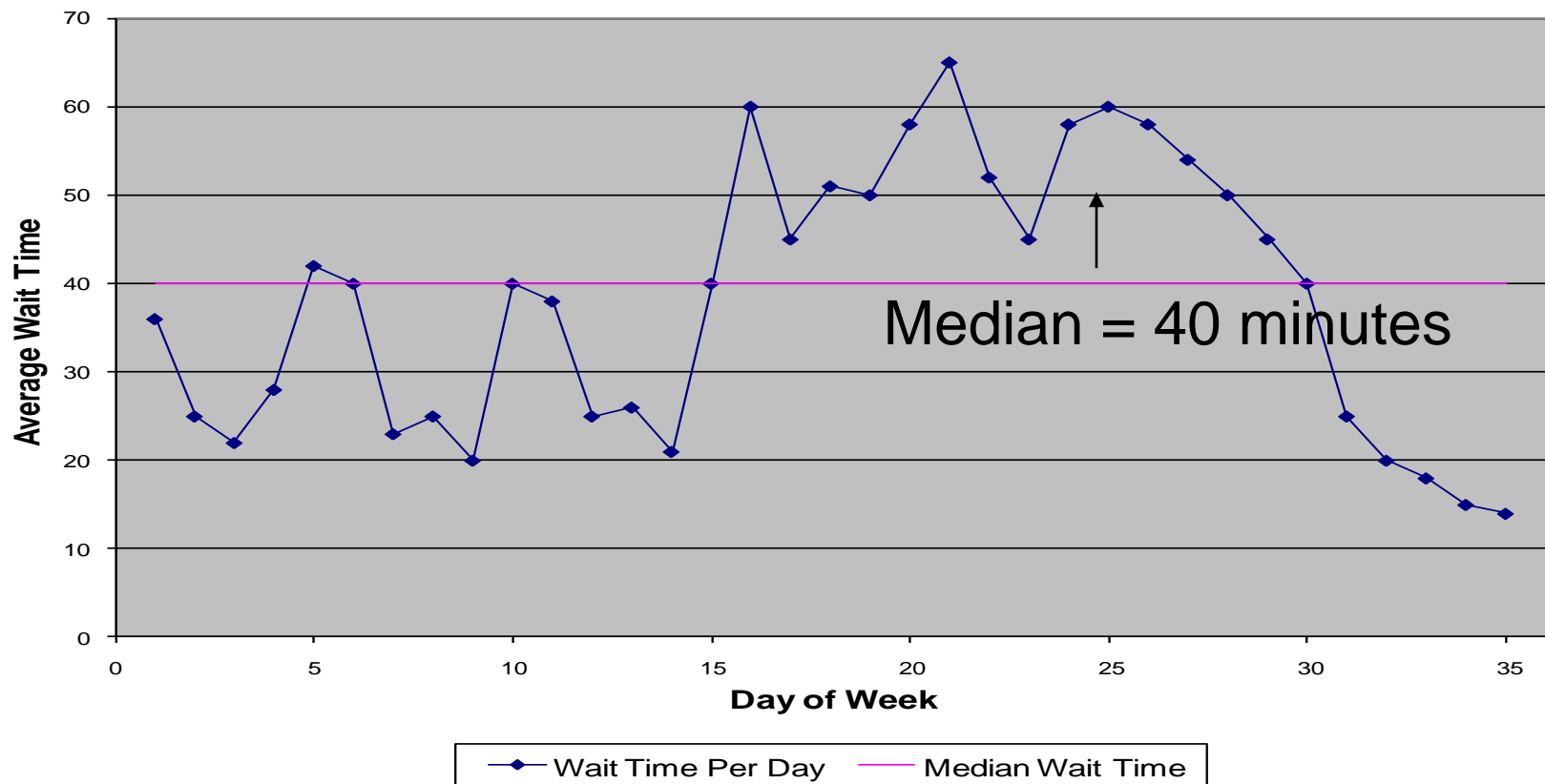- Please analyze the run chart for 2 test of Special Cause

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Another Case Study

- Please make a run chart

- How do you interpret?

- What do you recommend?

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Smith County WIC Clinic

Average Daily Wait Time

Median = 40 minutes

Legend: Wait Time Per Day — Median Wait Time

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Smith County WIC Clinic

Average Daily Wait Time

Median = 40 minutes

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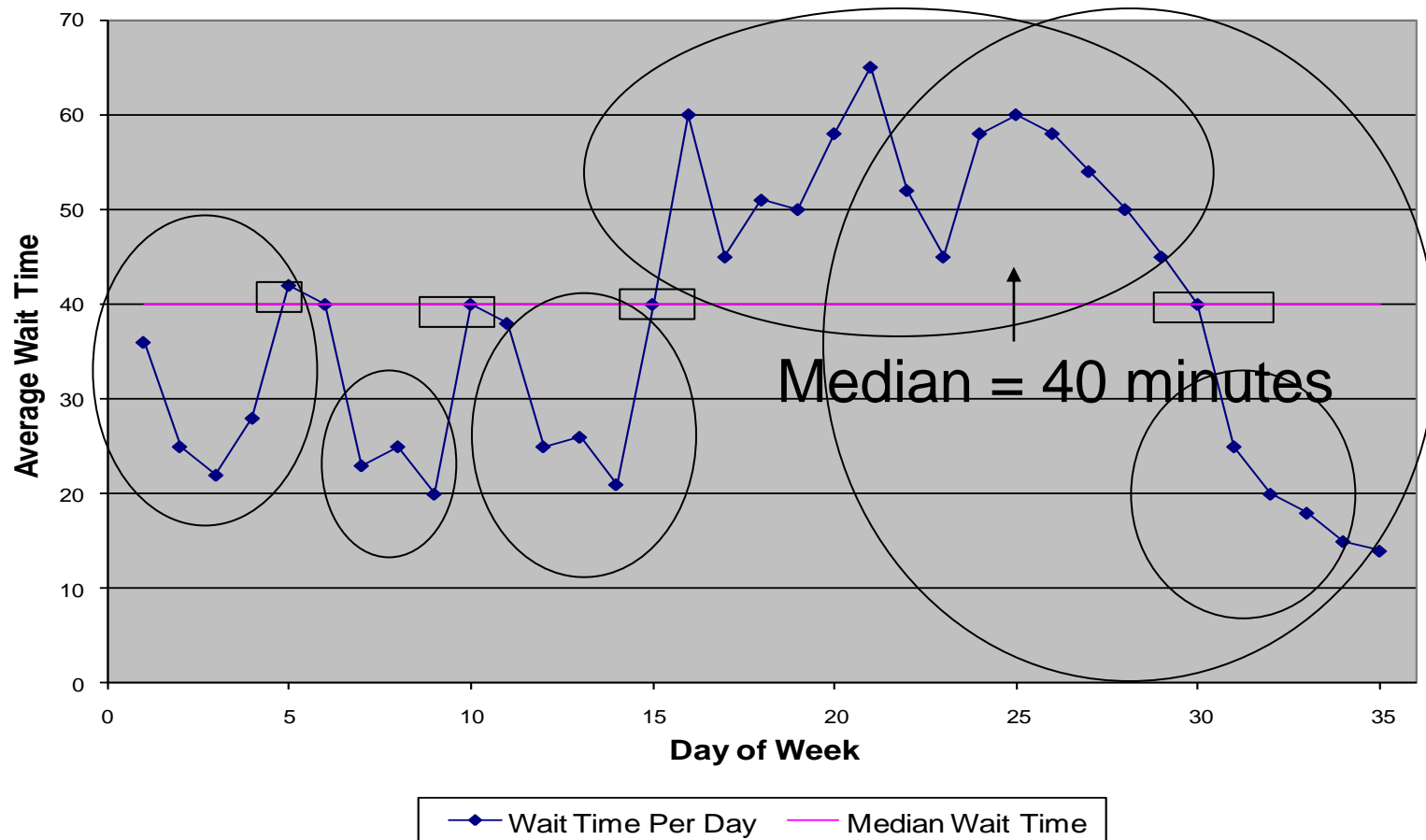
Noise and Signal

- Noise
  - Common cause variation inherent in every process.
  - Tampering: responding to common cause variation.

- Signal
  - A special cause variation that has an assignable reason.
  - A definite indication that the process has changed.

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Control Charts

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X Chart: Number of Clinic Visits Per Month
June 2008 - May 2010
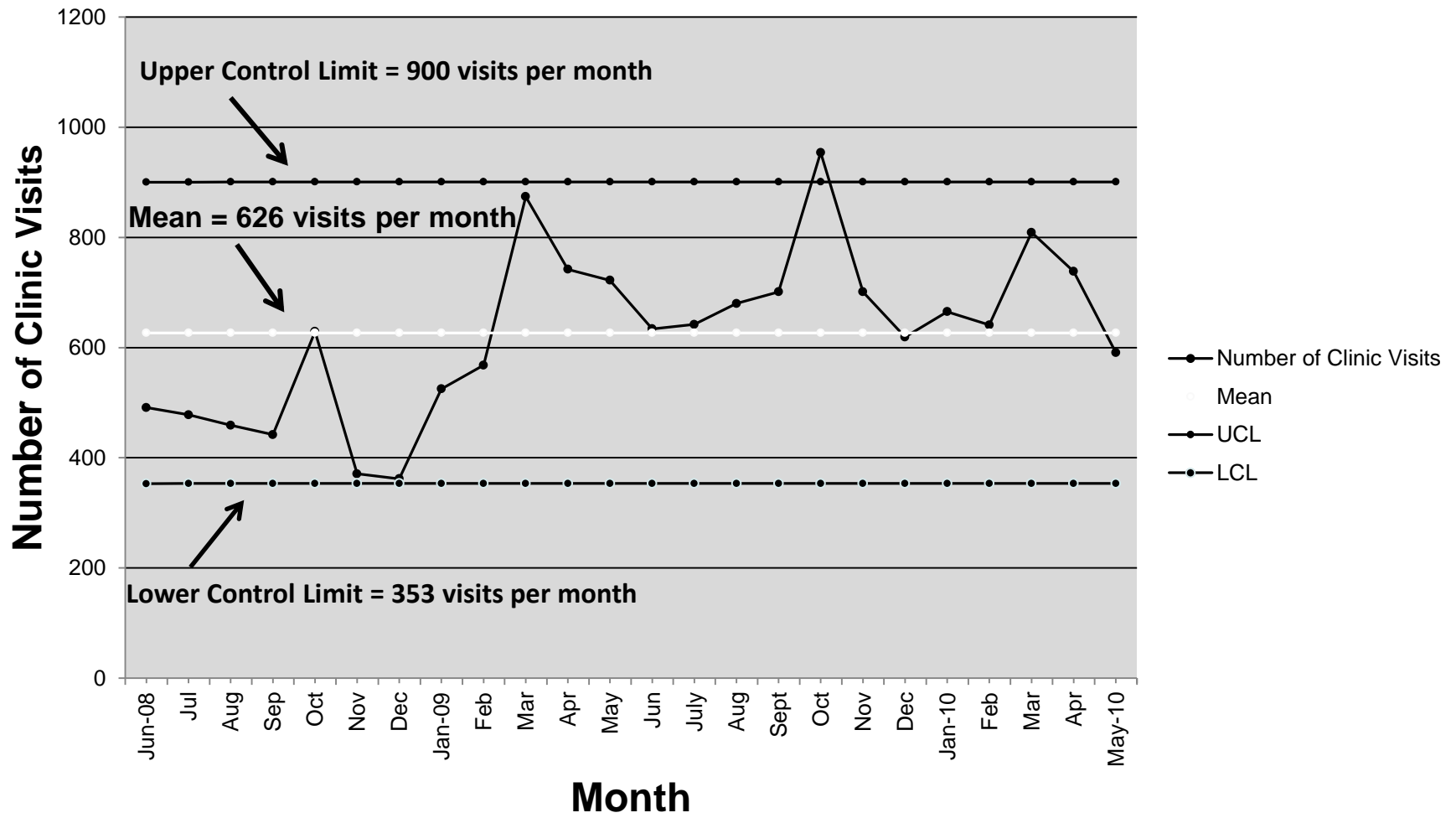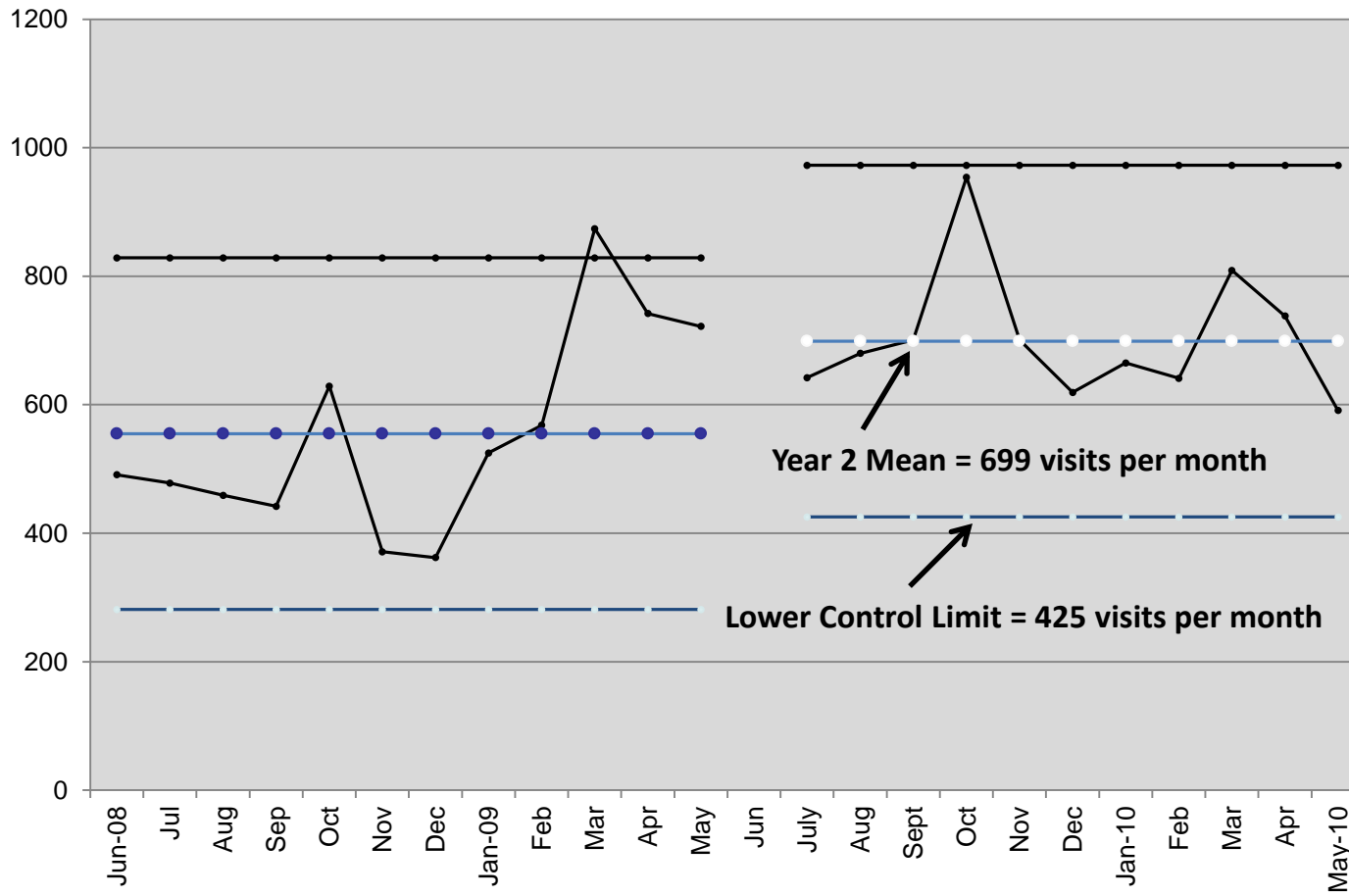
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Discussion

- Please analyze the preceding control chart

- What conclusions can you draw?

- Why would my QI team and/or management in my agency want to know how to do this?

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

Year 2 Mean = 699 visits per month

Lower Control Limit = 425 visits per month

Smith County WIC Program

X Chart of Total Service Time

UCL = 40 mins

Mean = 20.2 mins

LCL = 10.5 mins

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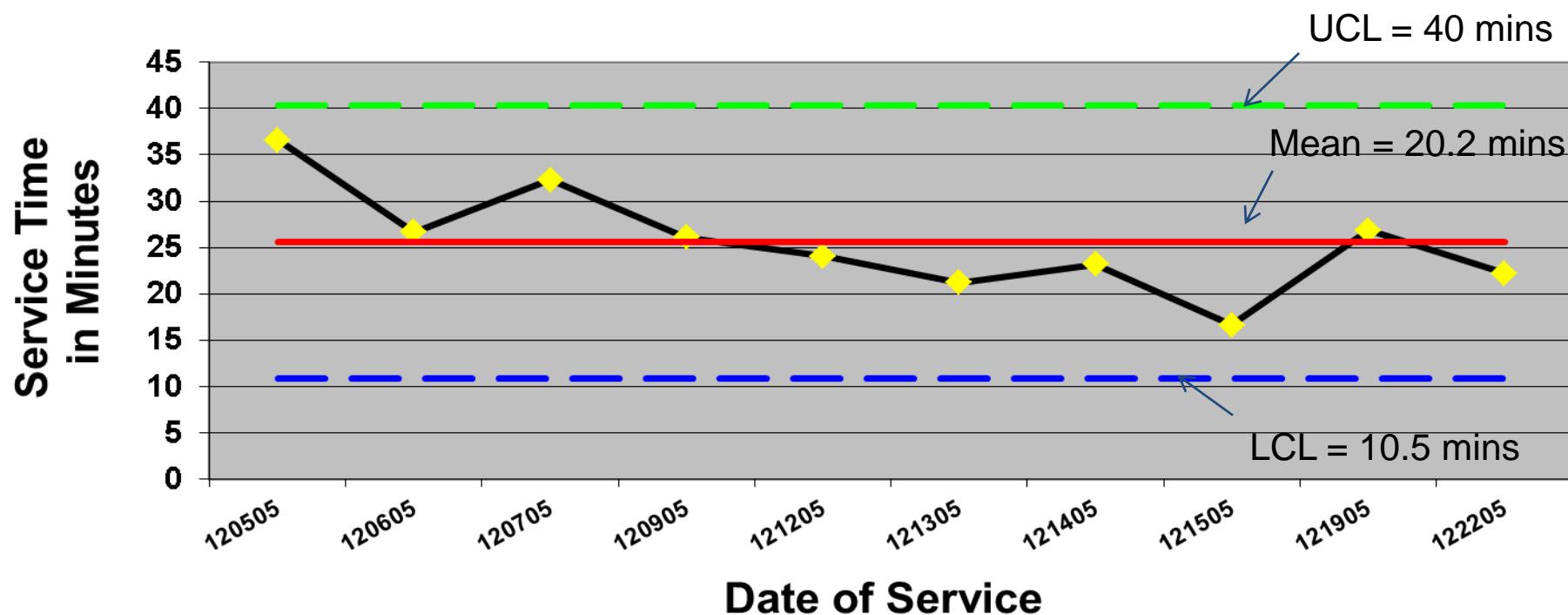
Discussion

- Please analyze the preceding control chart

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Process Capability and Stability

- Process Capability
  - The performance level of a stable process

- Process Stability
  - Whether process is in control and produces predictable results.

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Process Improvement and Process Re-engineering

- Process Improvement
  - When special cause is present
  - Process is not stable, not capable
  - Conduct root cause analysis

- Process Re-engineering
  - No special cause present, process stable
  - Process is capable, but not performing to specifications.

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