Measuring for Improvement

Presented by: Brandon Bennett

In Collaboration with
Hamad Medical Corporation
Institute for Healthcare Improvement

Agenda

- The Three Faces of performance measurement
- Articulating Theory
- Linking Theory with Measures
- Use of the Run Chart

Aspect	Improvement	Accountability	Research
Aim	Improvement of care	Comparison, choice, reassurance, spur for change	New knowledge
Methods: • Test Observability	Test observable	No test, evaluate current performance	Test blinded or controlled
• Bias	Accept consistent bias	Measure and adjust to reduce bias	Design to eliminate bias
• Sample Size	"Just enough" data, small sequential samples	Obtain 100% of available, relevant data	"Just in case" data
• Flexibility of Hypothesis	Hypothesis flexible, changes as learning takes place	No hypothesis	Fixed hypothesis
• Testing Strategy	Sequential tests	No tests	One large test
• Determining if a change is an improvement	Run charts or Shewhart control charts	No change focus	Hypothesis, statistical tests (t-test, F-test, chi square), p-values
• Confidentiality of the data	Data used only by those involved with improvement	Data available for public consumption and review	Research subjects' identities protected

Lief Solberg, Gordon Mosser and Sharon McDonald *Journal on Quality Improvement* vol. 23, no. 3, (March 1997), 135-147.

Improvement Science

- Understanding Variation
- Psychology of Change
- Systems Thinking
- Theory of Knowledge

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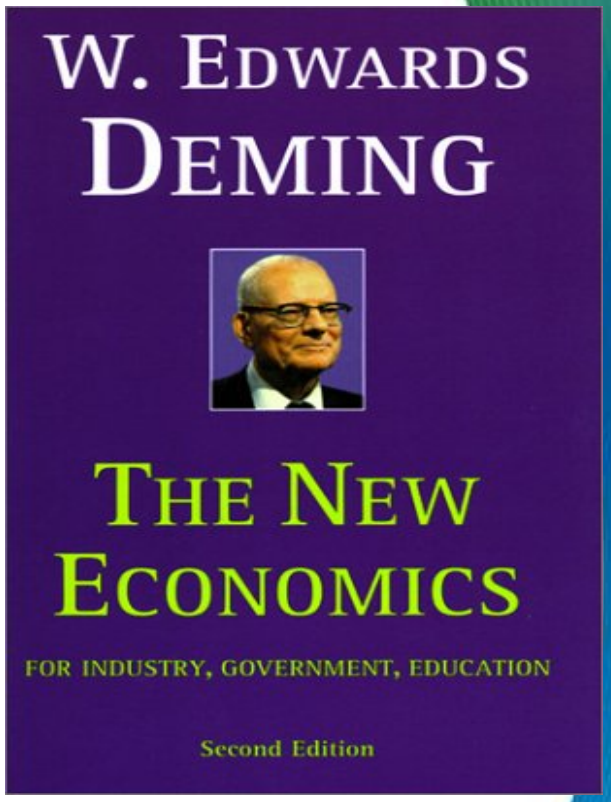
- Subject Matter Expertise



First articulated as Profound Knowledge by W. Edwards Deming

What is a Theory?

- A description of our best understanding about why things are the way they are

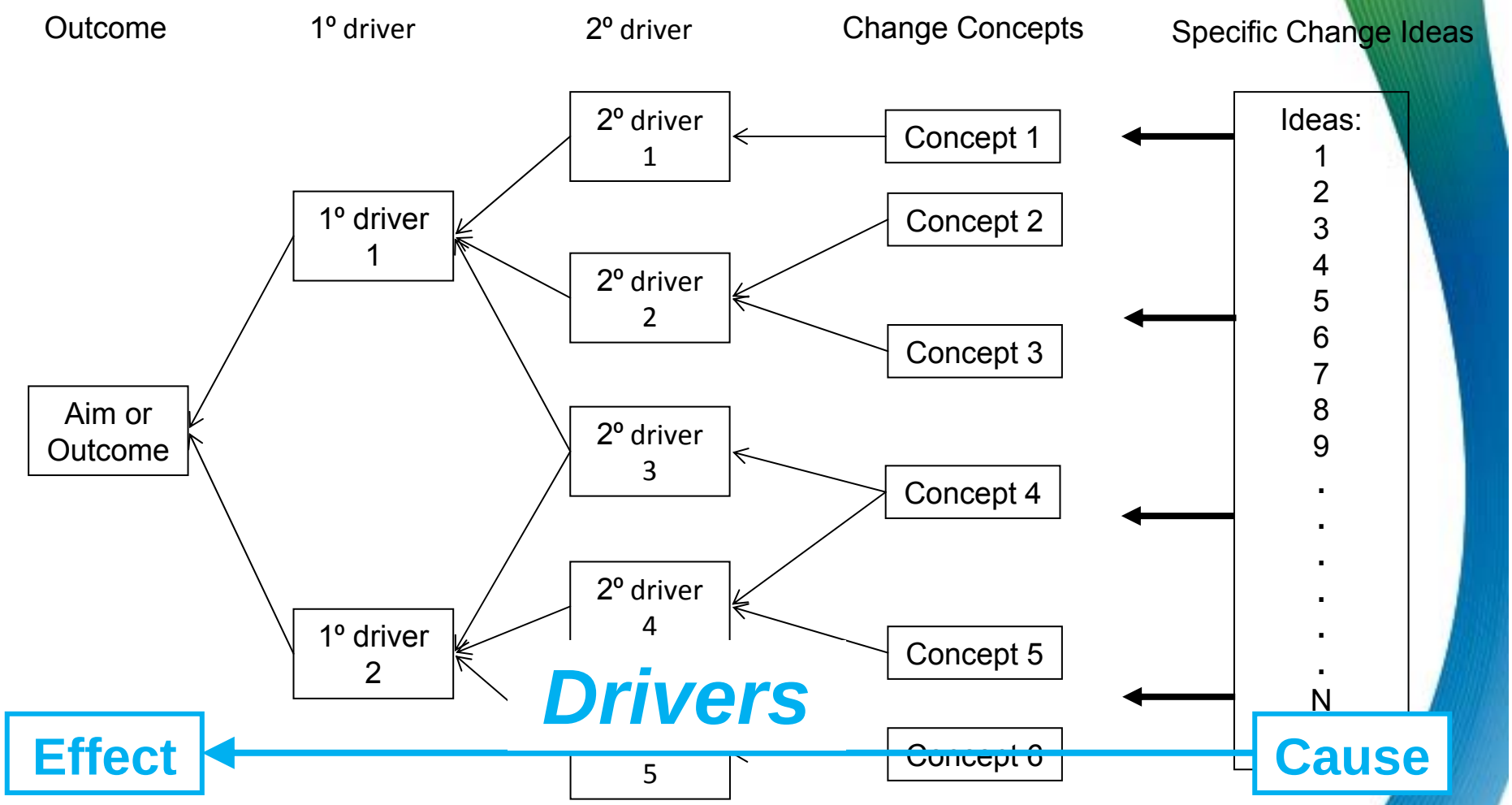
- What are some theories/beliefs?
  - Economics – Keynesian Theory, Value Theory, etc.
  - Biology – Theory of Evolution
  - Physics – String Theory
  - Meteorology – Chaos Theory

How is a Theory useful?

- A theory, in the scientific sense, can be tested
- Theories are used to predict outcomes of future events

- In essence, a theory is the starting place for generating new knowledge

Conceptual Driver Diagram



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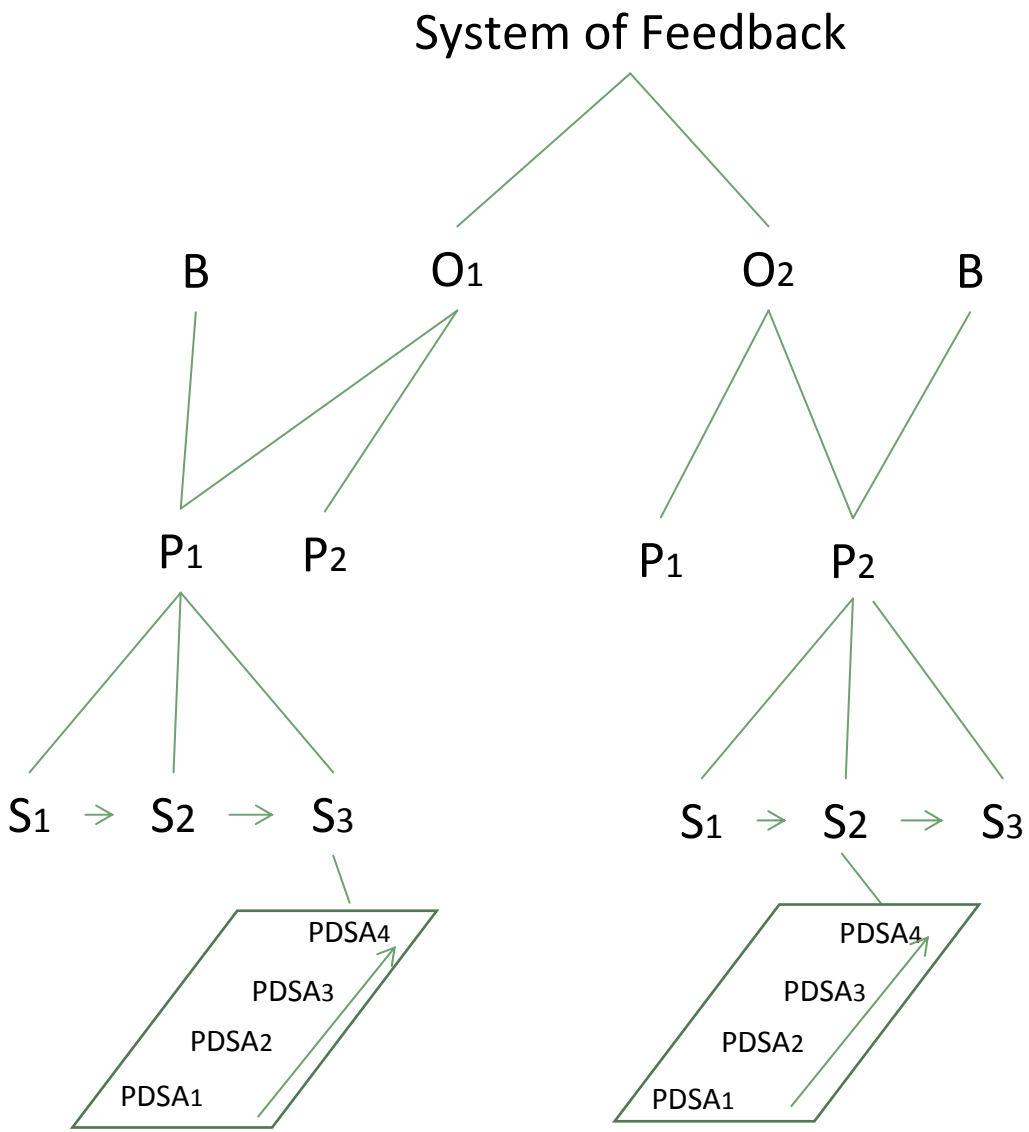


Measure Types

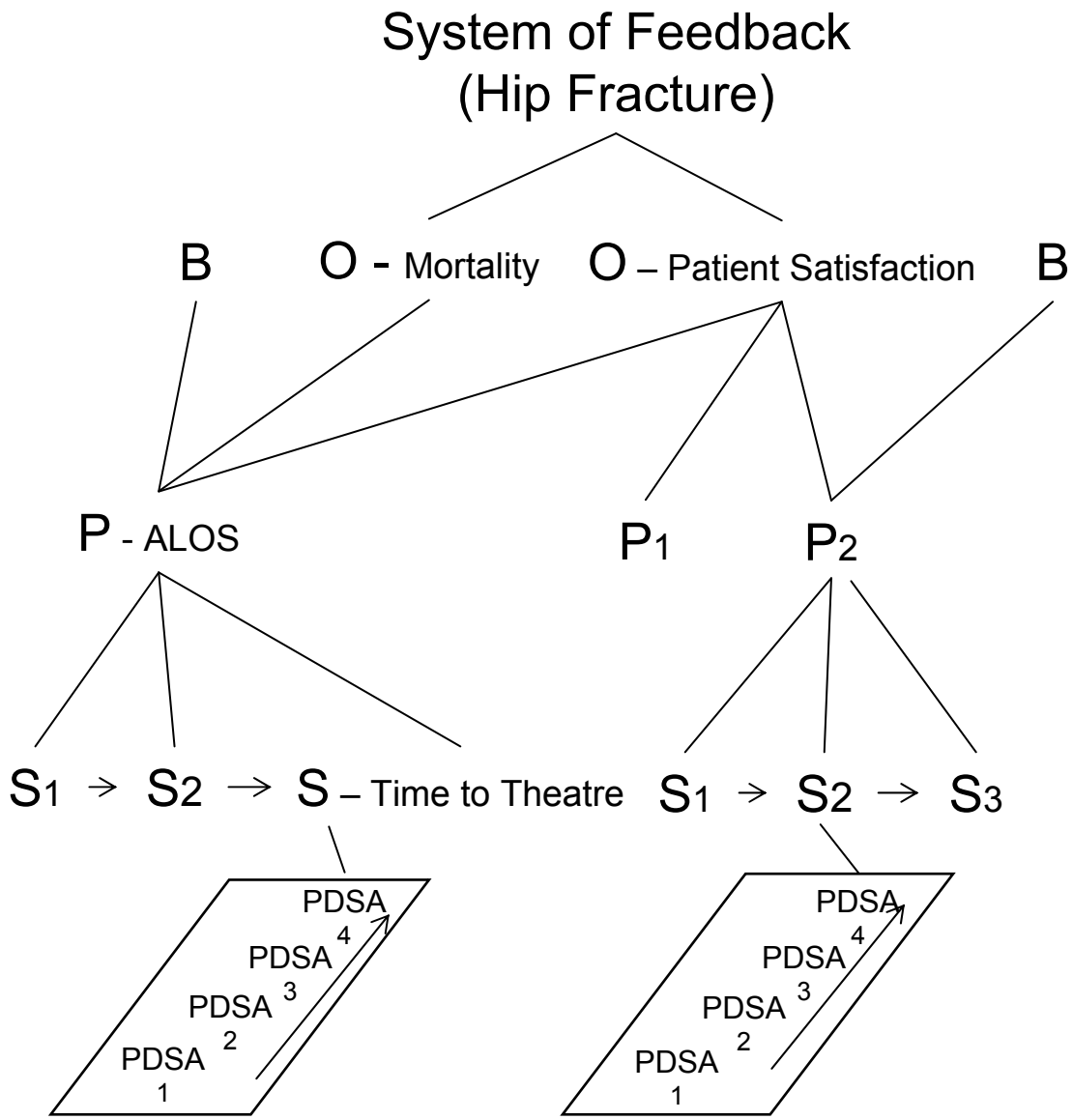
O = Outcome Measure

P = Process Measure

B = Balance Measure

S = Process Step Measure

PDSA = Learning Cycle Measure



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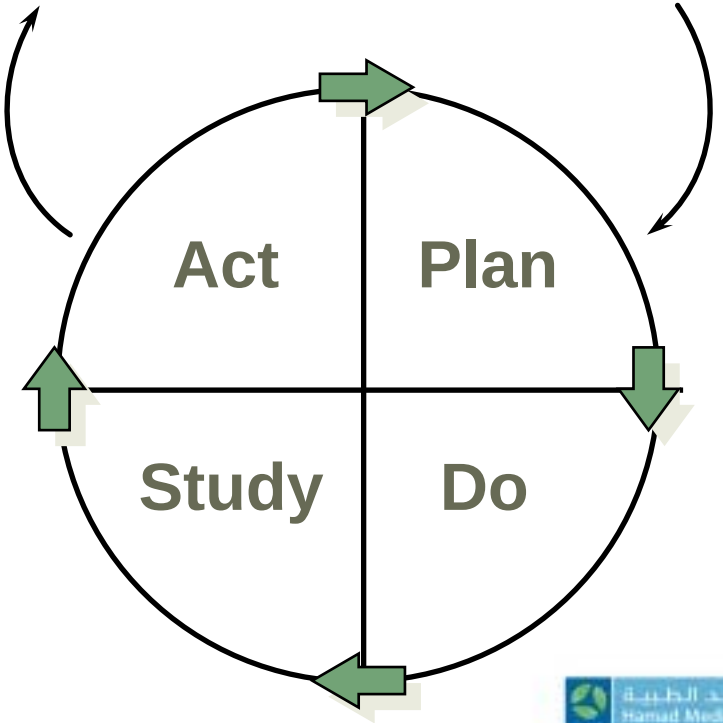
Model for Improvement

What are we trying to accomplish?

What change can we make that will result in improvement?

How will we know that a change is an improvement?



Langley, et al.

As the scale of the test increases we move from qualitative to quantitative evidence

Sequence of learning and change

Evidence primarily Qualitative

Evidence primarily Quantitative with noticeable impact on process measures

Very small scale test of a change idea

Large scale test of change idea or Implementation of a change idea

Distinguishing Characteristics of a Run Chart

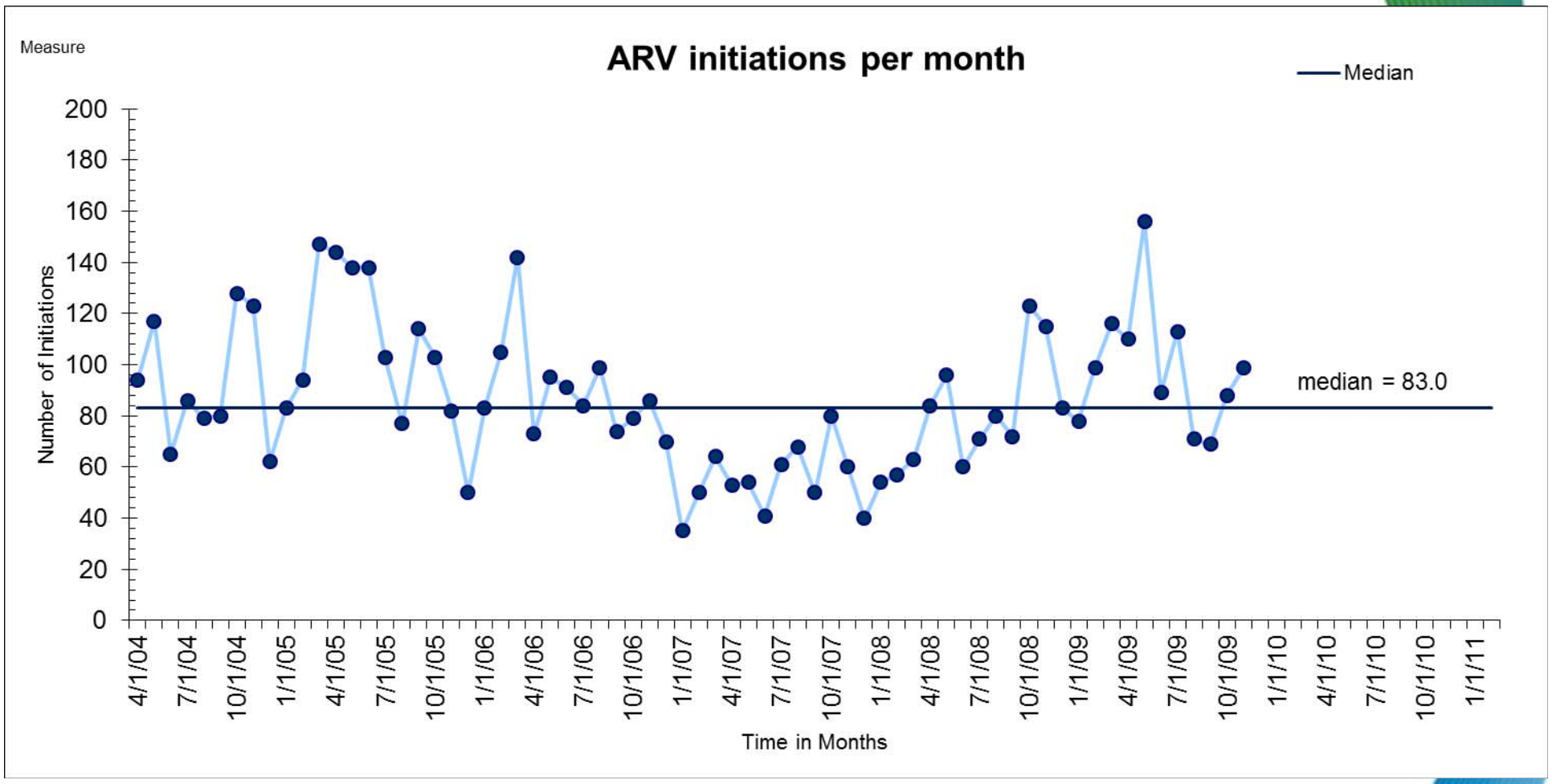
- Contains at least 10 data points
- Those data points are described using a median center line

How to Make a Run Chart

1. Identify the question you would like to answer using a Run Chart
2. Develop the horizontal scale (x-axis)
3. Develop the vertical scale (y-axis)
4. Plot the data points
5. Label the graph
6. Calculate and place a median center line on the chart
7. Add any additional information which will communicate a more complete picture to the intended audience (including annotations on change efforts)

Note: Be sure you have gone out and collected the relevant data before trying to construct your chart

Murray and Provost, Pg 3-4



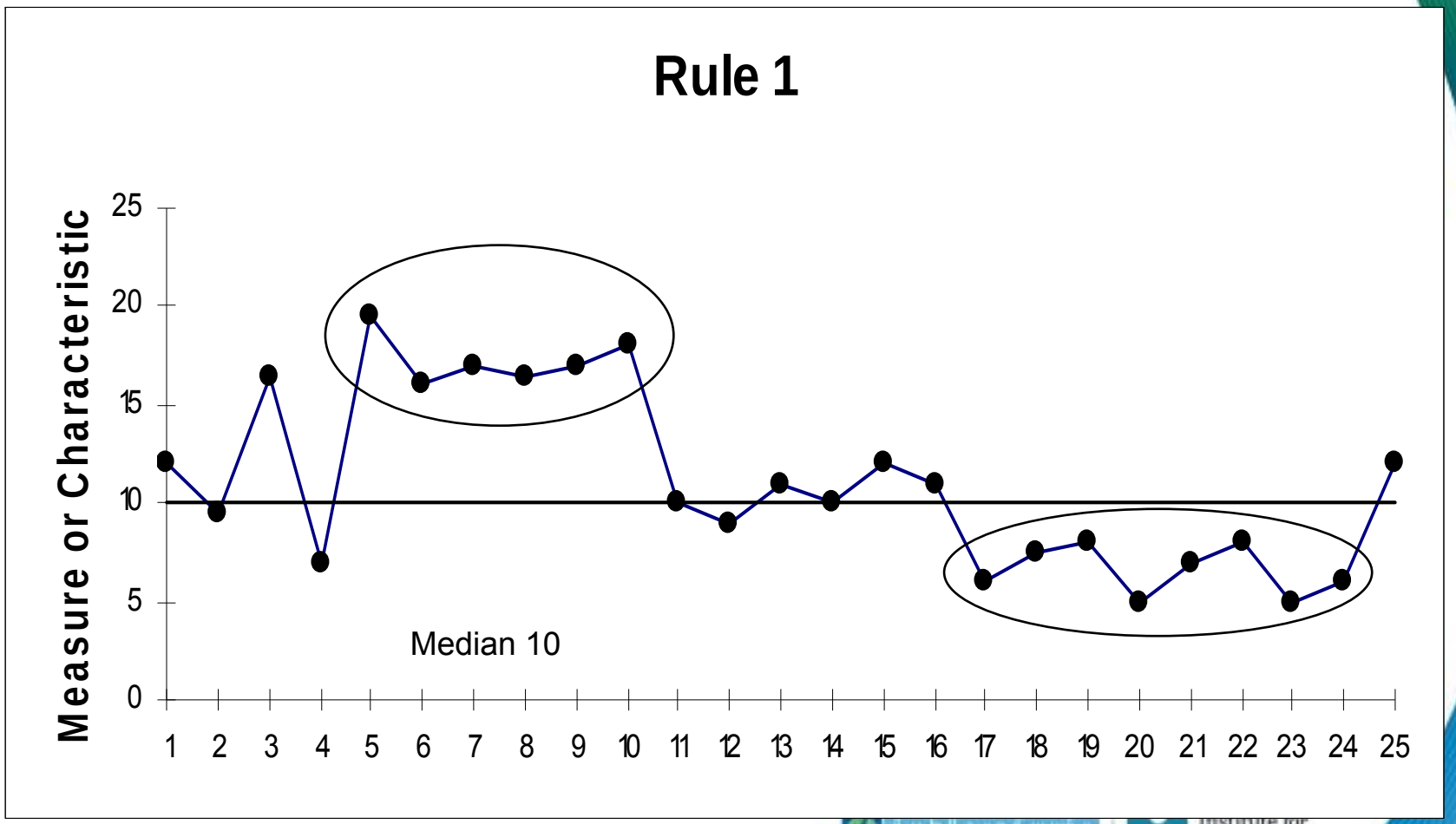
4 Rules indicating non-random signals that change in performance is occurring

1. Shift
2. Trend
3. Too many or too few Runs
4. Astronomical Data Point

Murray and Provost

Rules For Determining Probability Based Signals of Change

Rule 1 (Shift) : Six or more consecutive POINTS either all above or all below the median. Skip values on the median and continue counting points. Values on the median DO NOT make or break a shift.



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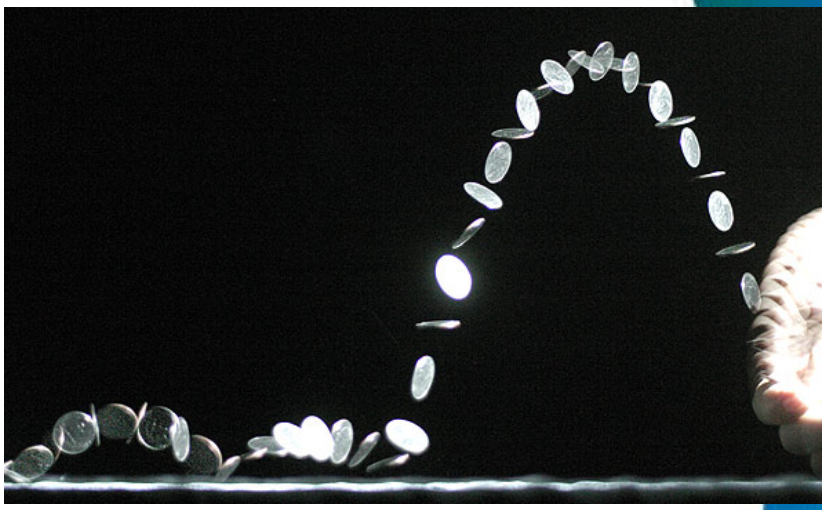
Why do we need 6 points?

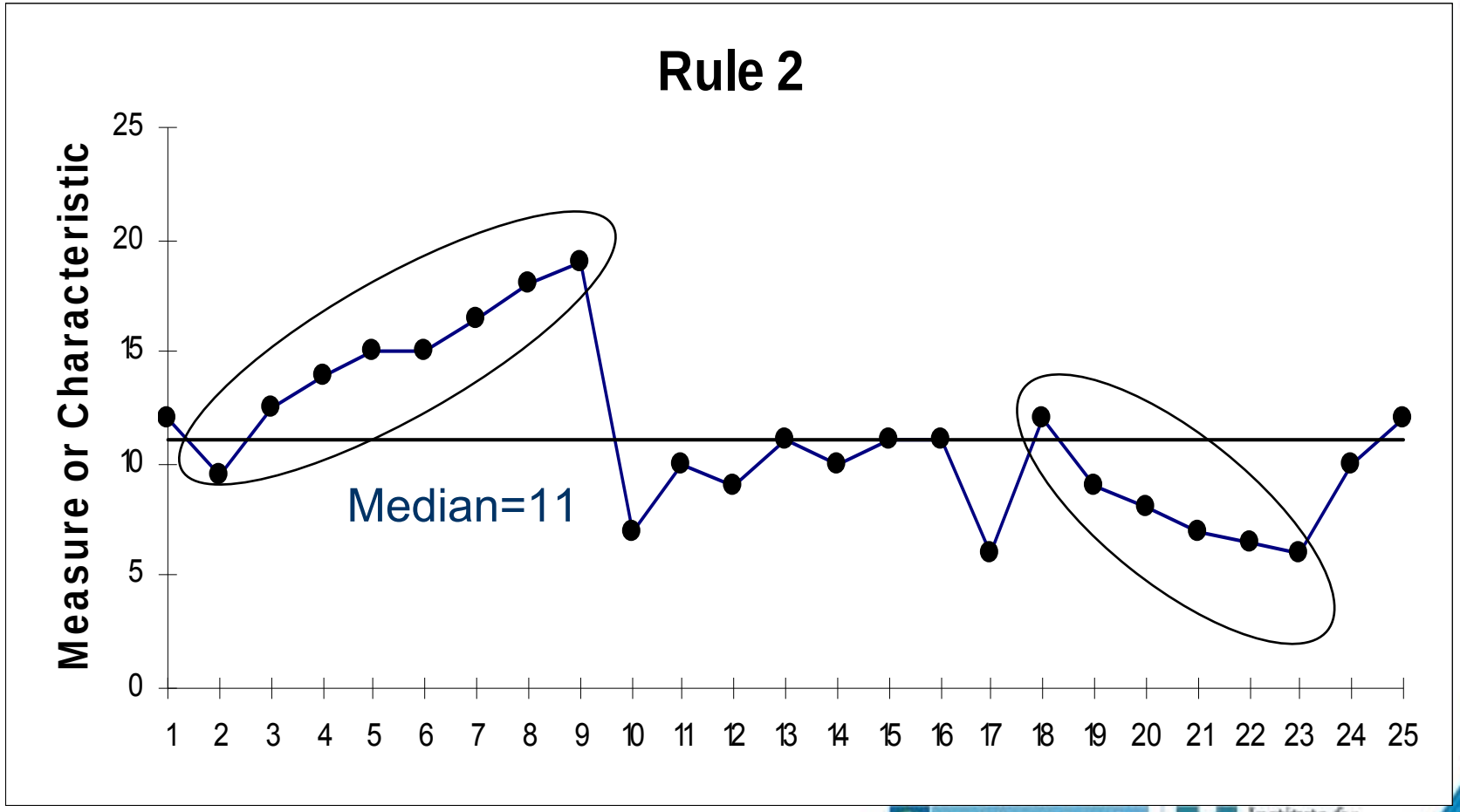
- What is the probability of a coin landing heads or tails?



- .5
- .5 x .5 = .25
- .5 x .5 x .5 = .125
- .5 x .5 x .5 x .5 = .0625
- .5 x .5 x .5 x .5 x .5 = .03125
- .5 x .5 x .5 x .5 x .5 x .5 = .015625

Rules For Determining Probability Based Signals of Change

Rule 2 (Trend): Five points all going up or all going down. If the value of <u>two or more successive points is the same</u>, ignore one of the points when counting; like values do not make or break a trend.



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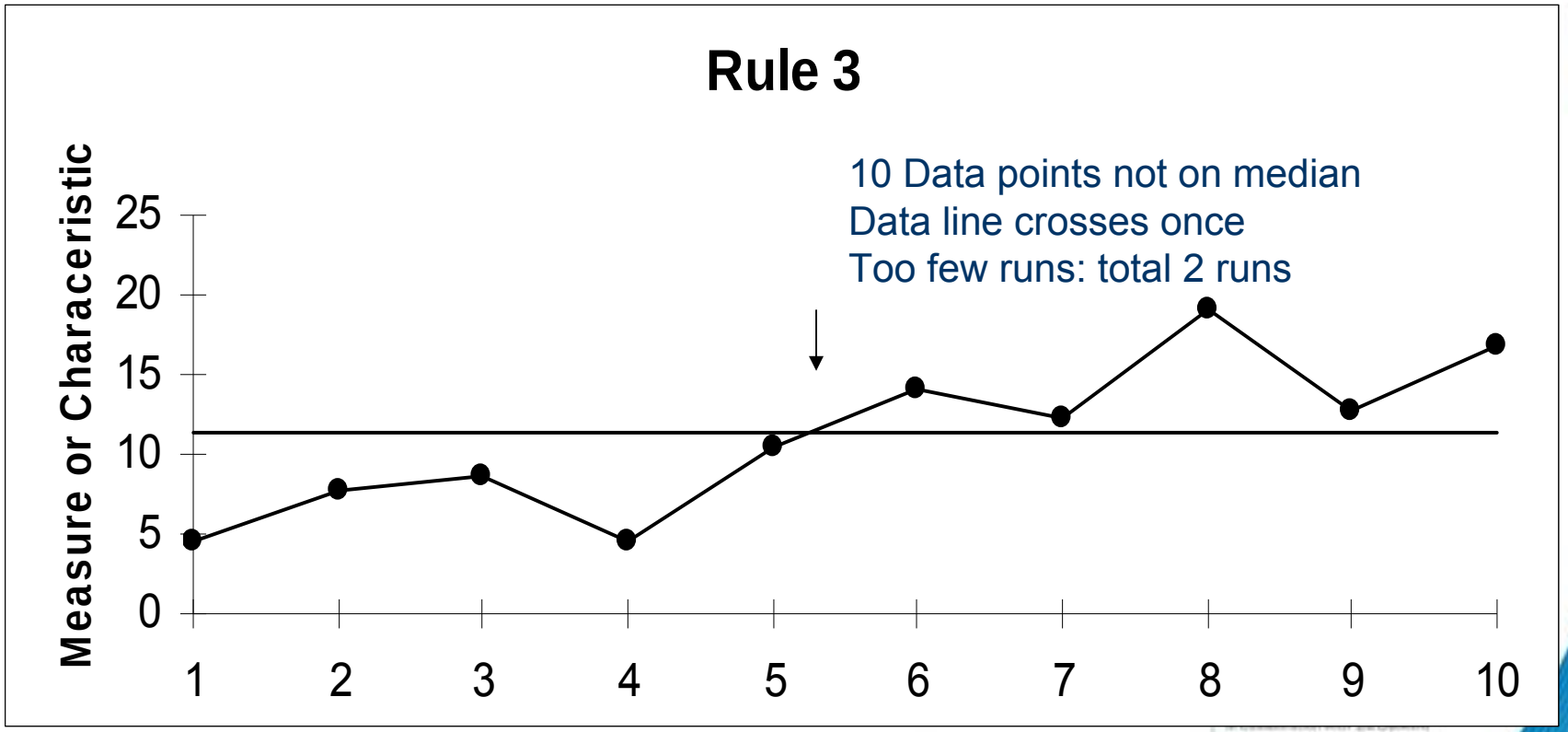
Rules For Determining Probability Based Signals of Change

Rule 3 (Too many or too few runs) To Determine The Number of Runs Above and Below the Median:

A run is a series of points in a row on one side of the median. Some points fall right on the median, which makes it hard to decide which run these points belong to.
So, an easy way to determine the number of runs is to count the number of times the data line crosses the median and add one.
Statistically significant change signaled by too few or too many runs.



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Rule 3: # of Runs

Table for Checking for Too Many or Too Few Runs on a Run Chart

Total number of data points on the run chart *that do not fall on the median*	Lower limit for the number of runs (< than this number of runs is "too few")	Upper limit for the number of runs (> than this number of runs is "too many")
10	3	9
11	3	10
12	3	11
13	4	11
14	4	12
15	5	12
16	5	13
17	5	13
18	6	14
19	6	15
20	6	16
21	7	16
22	7	17
23	7	17
24	8	18
25	8	18

Table is based on about a 5% risk of failing the run test for random patterns of data.

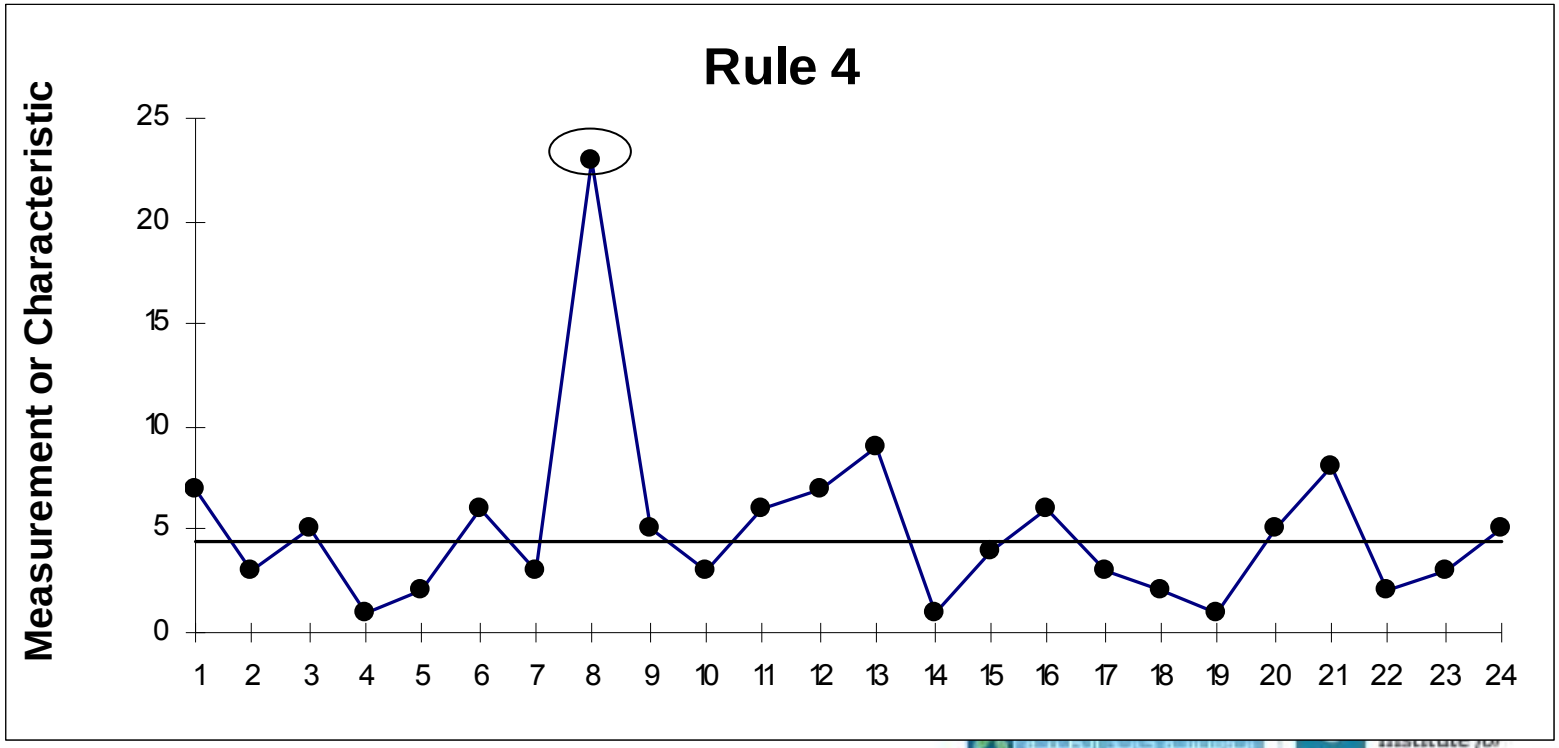
Adapted from Swed, Feda S. and Eisenhart, C. (1943). "Tables for Testing Randomness of Grouping in a Sequence of Alternatives. Annals of Mathematical Statistics. Vol. XIV, pp.66 and 87, Tables II and III.

Rules For Determining Probability Based Signals of Change

RULE 4:Astronomical
For detecting unusually large or small numbers:

Data that is Blatantly Obvious different value
Everyone studying the chart agrees that it is unusual
Remember:

Every data set will have a high and a low - this does not mean the high or low are astronomical



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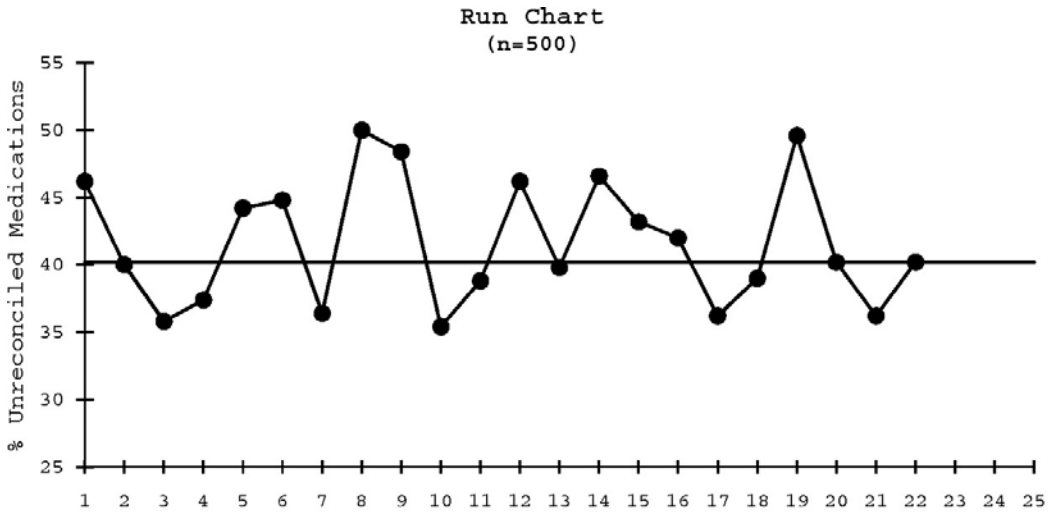
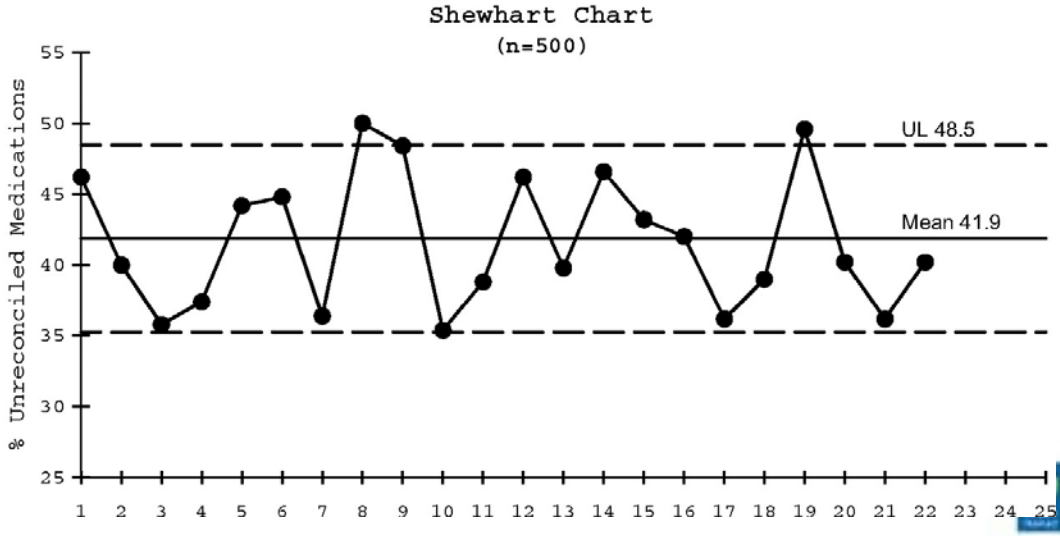
When should we transition from using a Run Chart to using a Shewhart Control Chart?





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Summary of Key Points

- Always be clear in communicating the purpose you have in mind when analyzing and presenting data
- Measurement for improvement is purposeful and should reflect our understanding of the system and our theory of change
- Measuring across the different levels of our system is a must for understanding change
- Measures can be qualitative and quantitative
- The Run Chart is a statistical tool that can help us to understand random and non-random variation – whether intentional or unintentional

Thank you

- Questions?

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