# How to use our data

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| Aspect | Improvement | Accountability | Research |
|---|---|---|---|
| **Aim** | Improvement of care | Comparison, choice, reassurance, spur for change | New knowledge |
| **Methods:**<br>• 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.

# Run Charts

- Distinguishing Characteristics of an effective Run Chart
- How to make a Run Chart
- Rules for Interpretation
- How different from a control chart

# Distinguishing Characteristics of a Run Chart

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

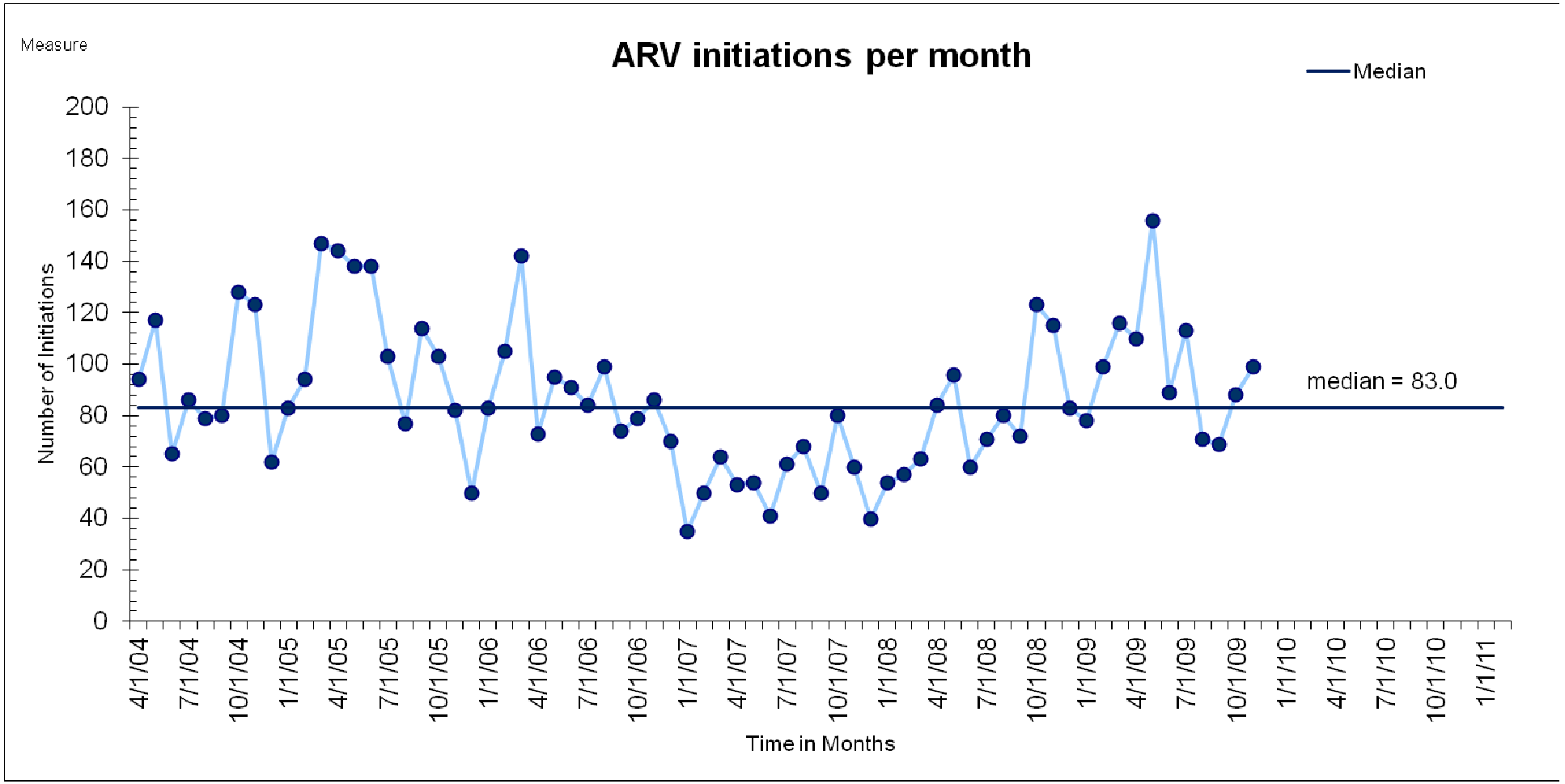
# Calculating a Median – 3 ways

1. In MS Excel – use the median function
   - In a cell write: =median(number 1, number 2, number n)
   - This will return the median value for a set of data selected between the parentheses
2. By Hand – Reorder the data from highest number to lowest. Then count down the data to find the middle number, if you have an odd number of data points in your data set. If your data set contains an even number of data points, find the average of the two data point numbers at the middle of your data set
3. Several statistical software packages will do this for you (QI Charts, Chart Runner, STATA, SPSS, Minitab, etc.)

# 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

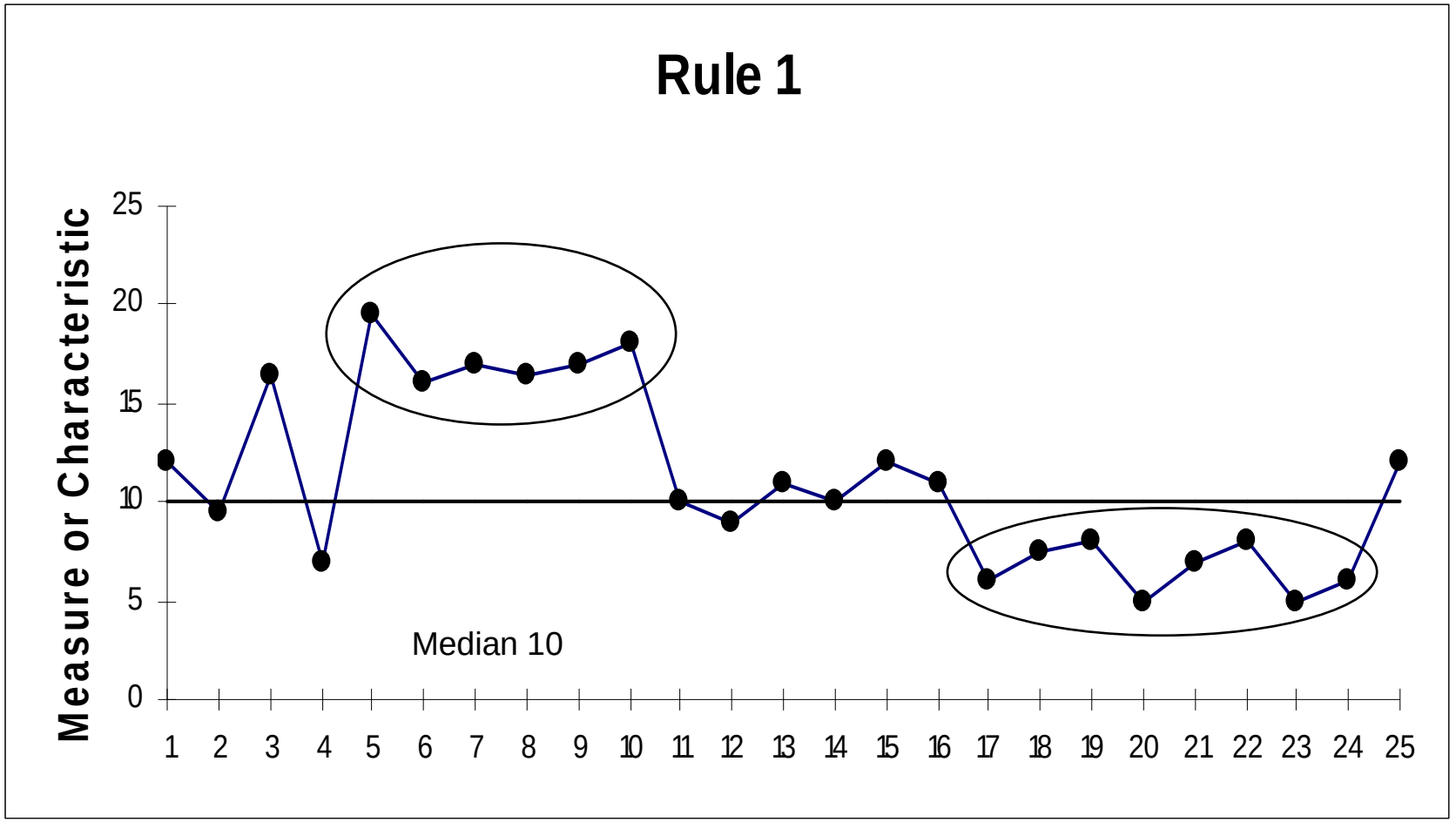

Measure
ARV initiations per month
Median
median = 83.0
Number of Initiations
200
180
160
140
120
100
80
60
40
20
0
4/1/04
7/1/04
10/1/04
1/1/05
4/1/05
7/1/05
10/1/05
1/1/06
4/1/06
7/1/06
10/1/06
1/1/07
4/1/07
7/1/07
10/1/07
1/1/08
4/1/08
7/1/08
10/1/08
1/1/09
4/1/09
7/1/09
10/1/09
1/1/10
4/1/10
7/1/10
10/1/10
1/1/11
Time in Months

# 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

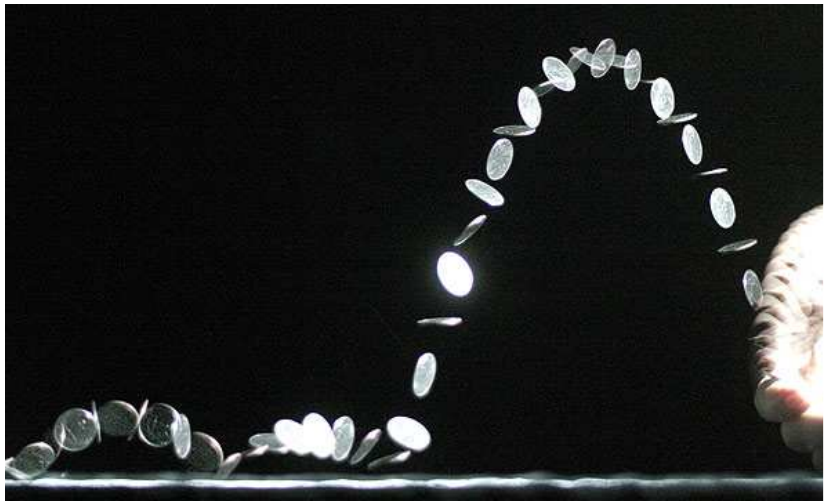
# Rules For Determining Probability Based Signals of Change

**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.**



# Why do we need 6 points?

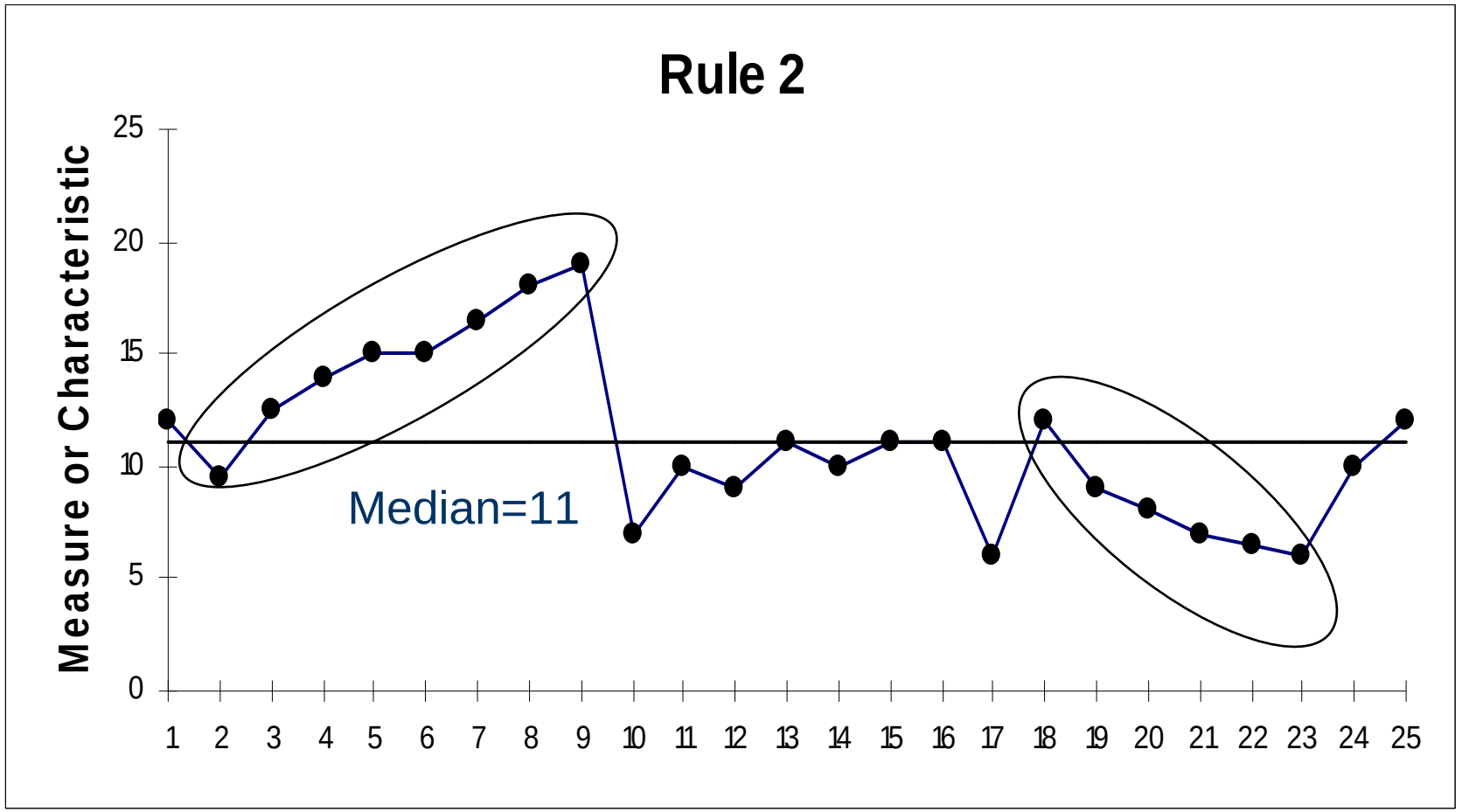
- What is the probability of a coin landing heads or tails?



- .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

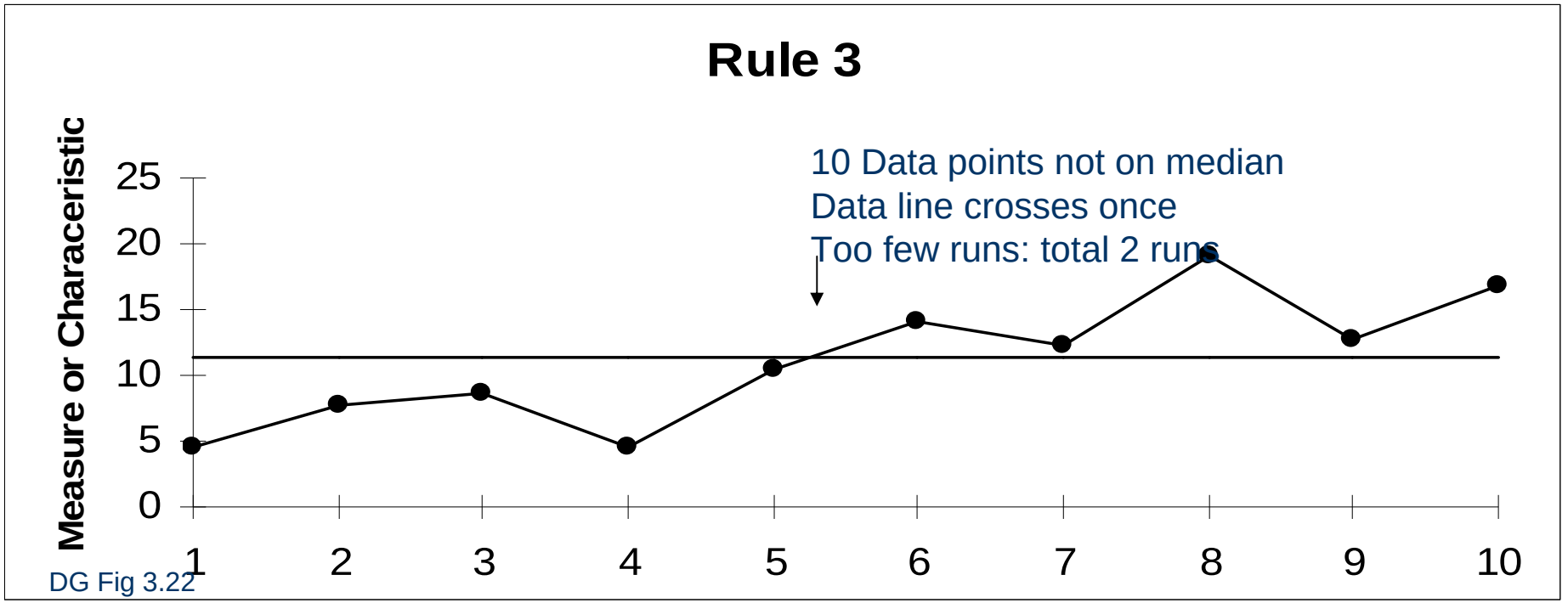
**Rule 2 (Trend): Five points all going up or all going down. If the value of <u>two or more successive points is the same</u>, ignore one of the points when counting; like values do not make or break a trend.**



# 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.



DG Fig 3.22

# 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.

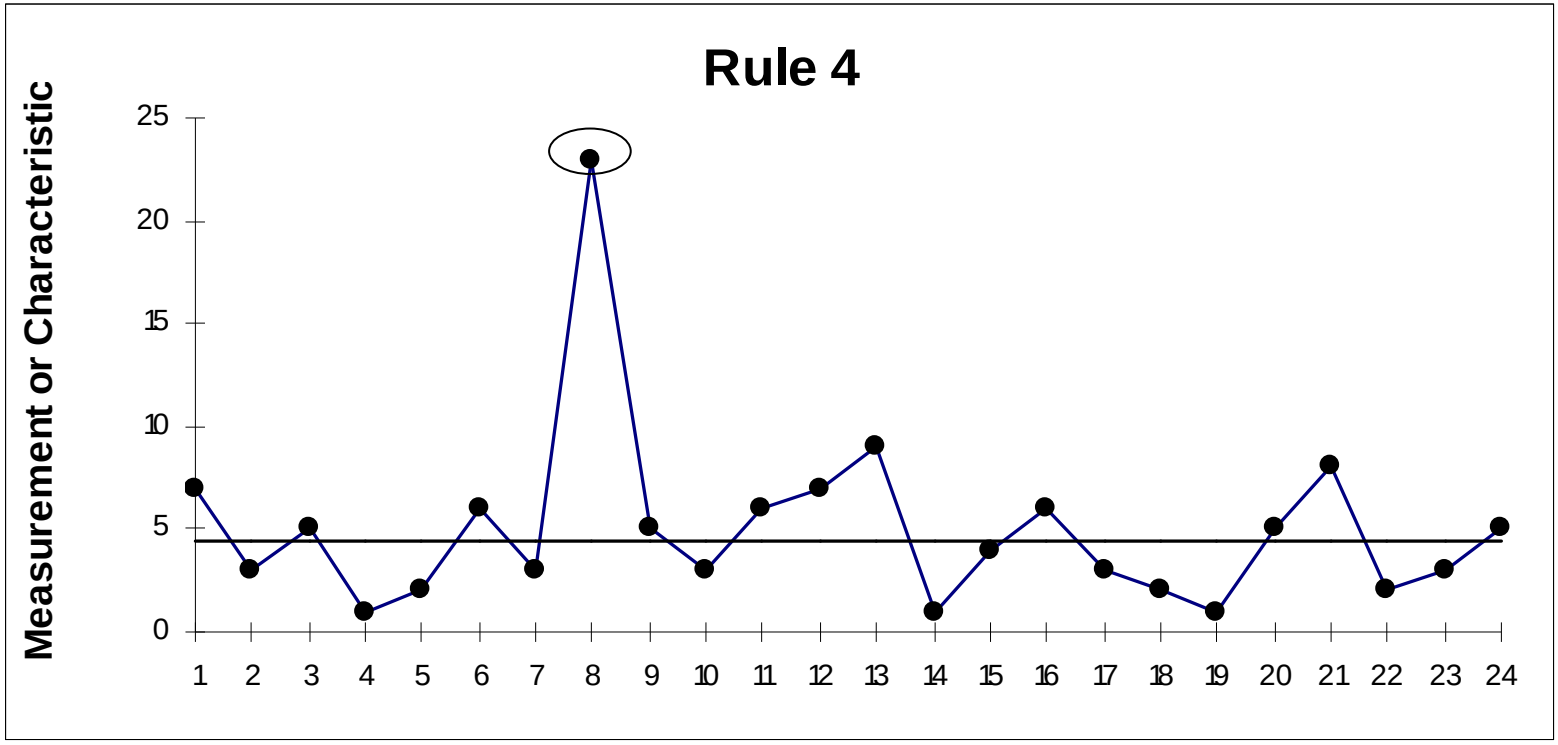
Adapted from Swed, Feda S. and Eisenhart, C. (1943). "Tables for Testing Randomness of Grouping in a Sequence of Alternatives. Annals of Mathematical Statistics. Vol. XIV, pp.66 and 87, Tables II and III.

## Rules For Determining Probability Based Signals of Change

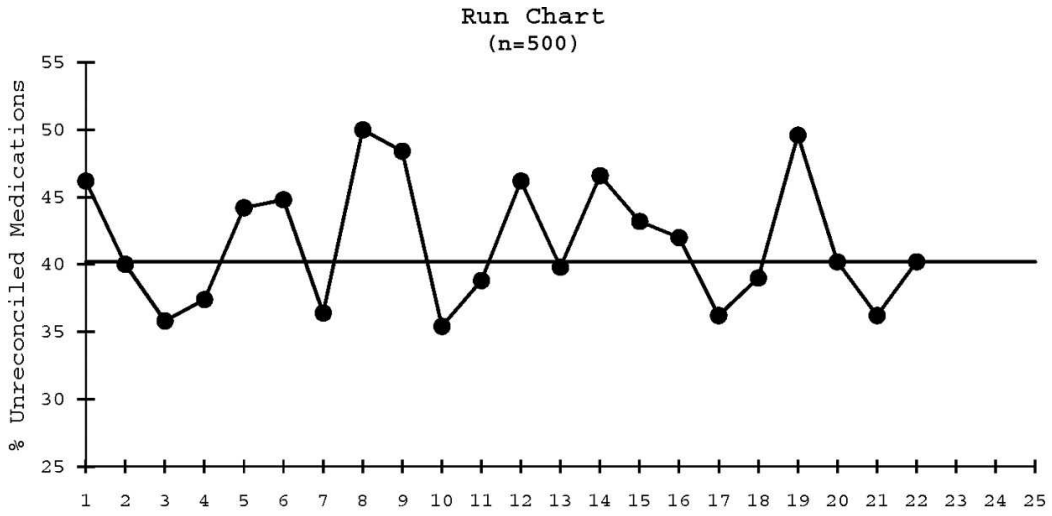
RULE 4:Astronomical
For detecting unusually large or small numbers:

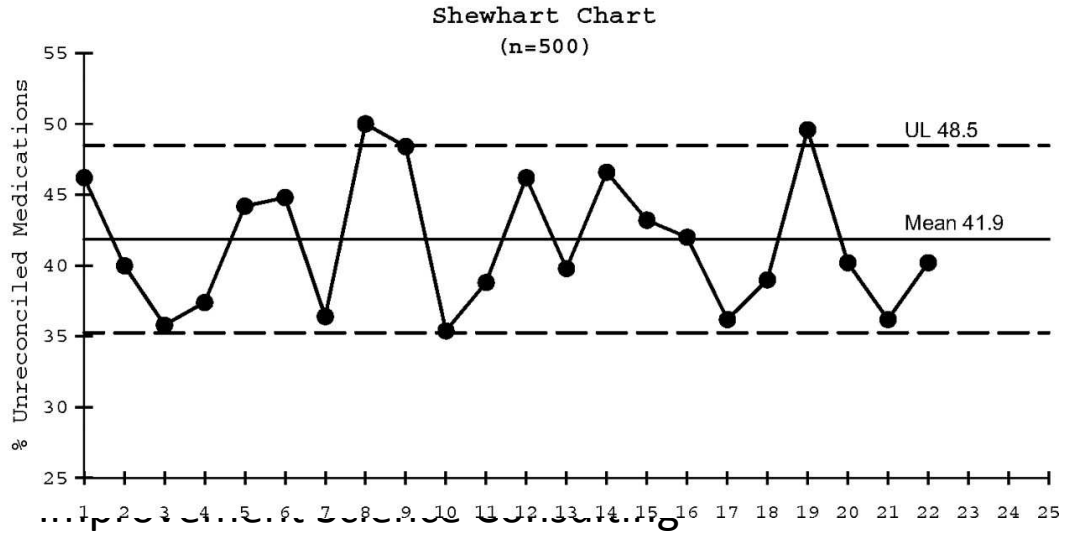
Data that is Blatantly Obvious different value
Everyone studying the chart agrees that it is unusual
Remember:

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



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

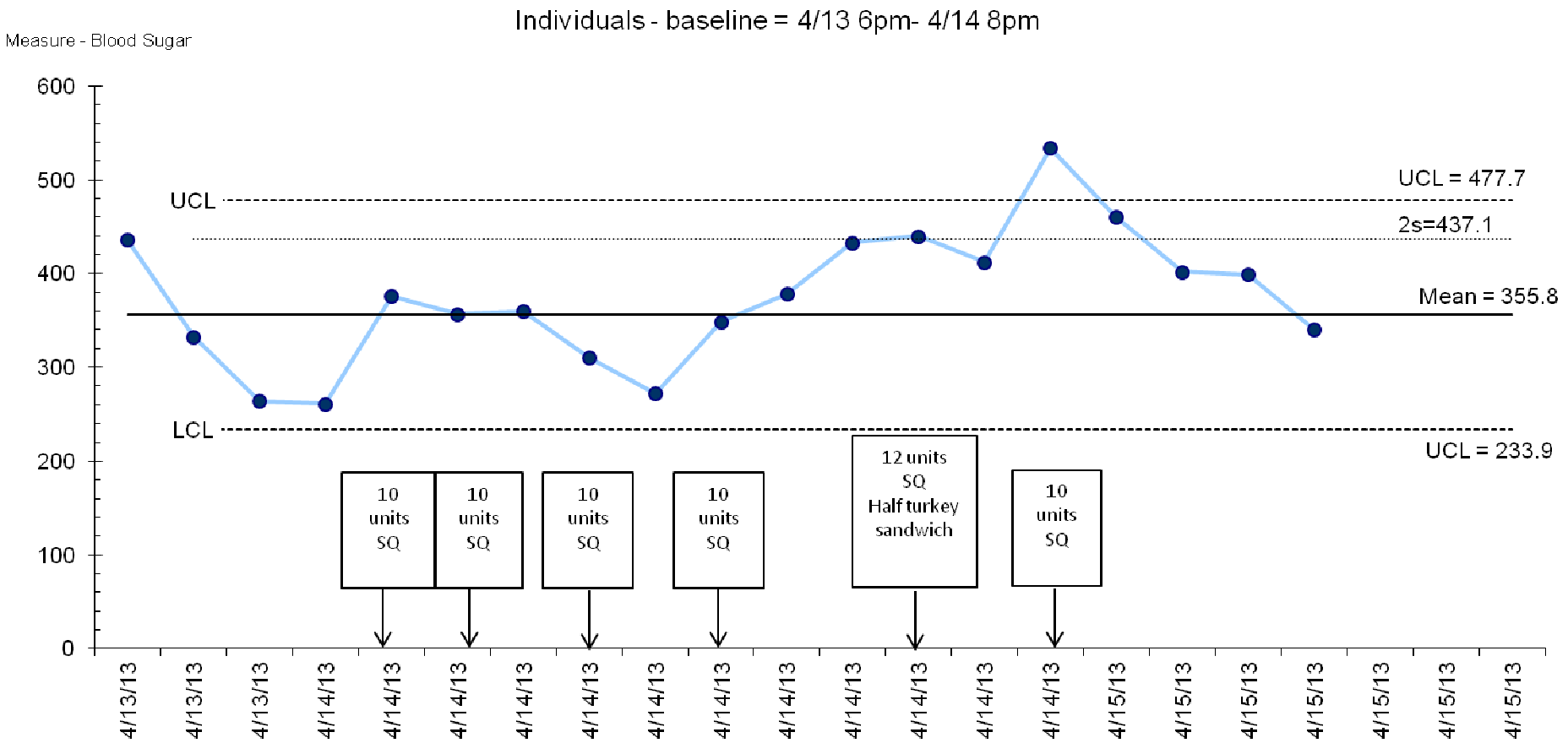



...Improve...Reduce Documentation...

Perla et al

# Some examples


Individuals - baseline = 4/13 6pm- 4/14 8pm
Measure - Blood Sugar
600
500
400
300
200
100
0
UCL
LCL
UCL = 477.7
2s=437.1
Mean = 355.8
UCL = 233.9
10 units SQ
10 units SQ
10 units SQ
10 units SQ
12 units SQ Half turkey sandwich
10 units SQ
4/13/13
4/13/13
4/13/13
4/14/13
4/14/13
4/14/13
4/14/13
4/14/13
4/14/13
4/14/13
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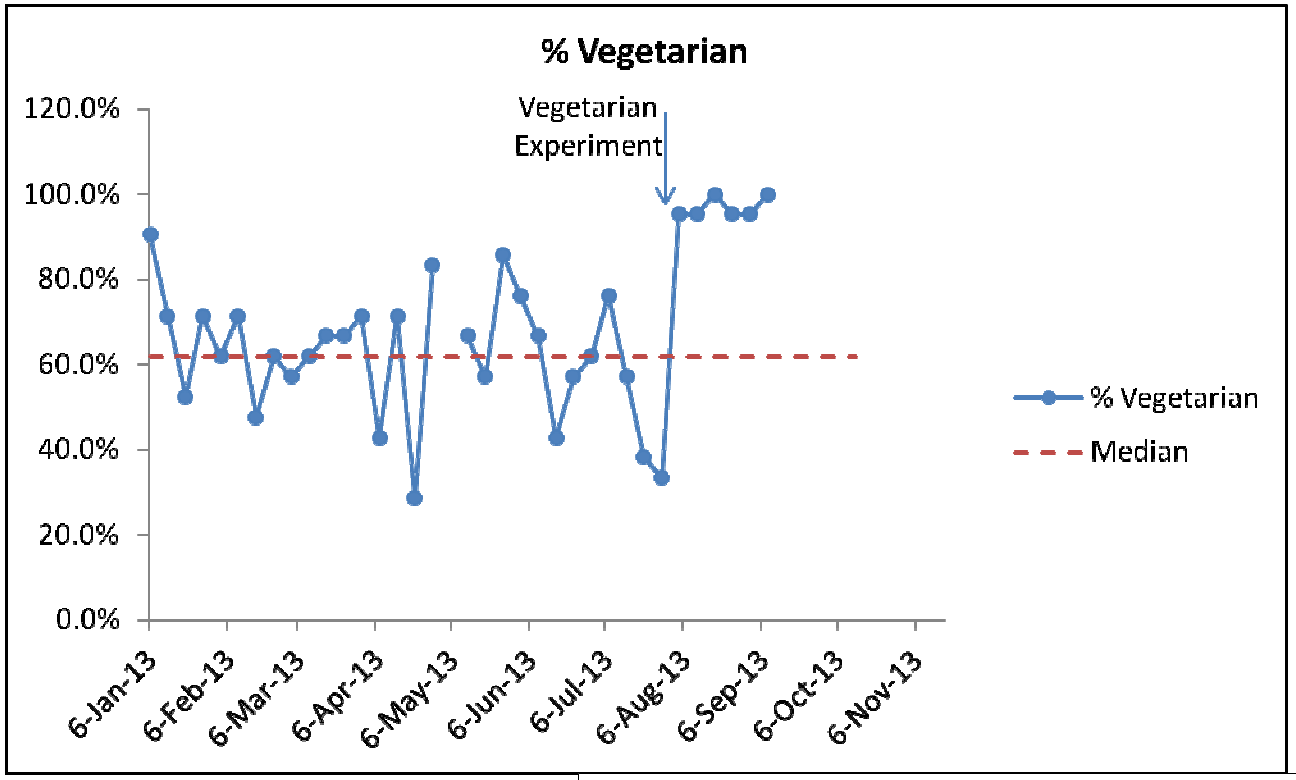
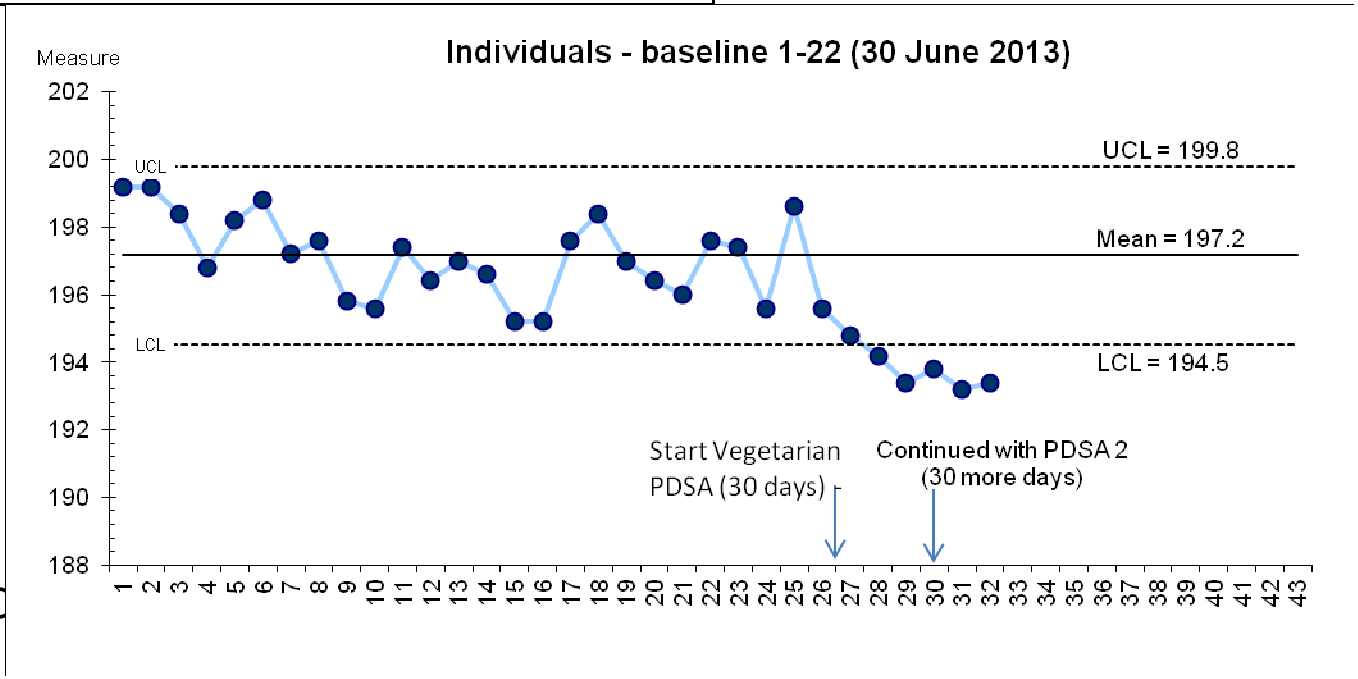
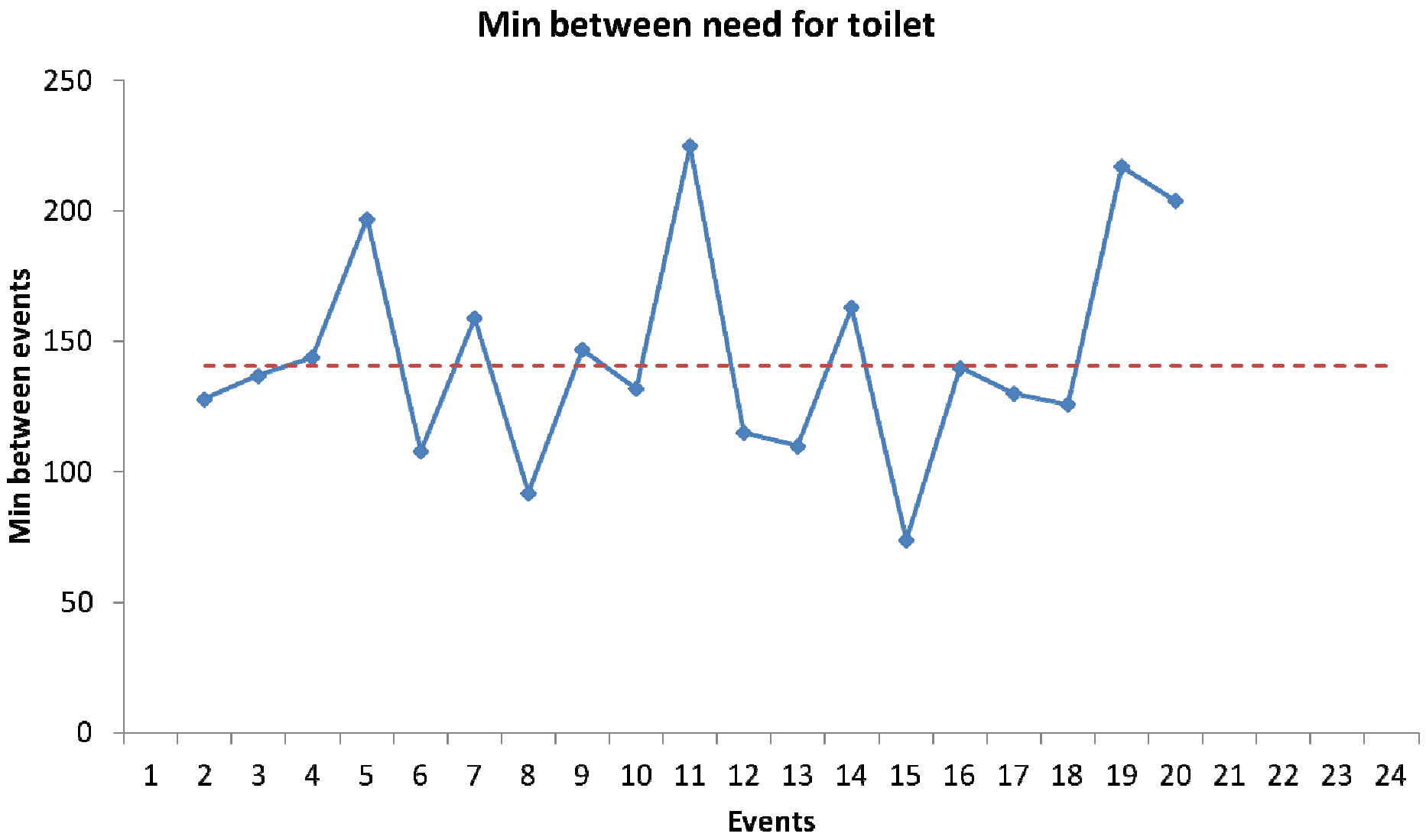
4/15/13


% Vegetarian
Vegetarian Experiment
120.0%
100.0%
80.0%
60.0%
40.0%
20.0%
0.0%
6-Jan-13
6-Feb-13
6-Mar-13
6-Apr-13
6-May-13
6-Jun-13
6-Jul-13
6-Aug-13
6-Sep-13
6-Oct-13
6-Nov-13
% Vegetarian
Median


Individuals - baseline 1-22 (30 June 2013)
Measure
202
200
198
196
194
192
190
188
UCL
LCL
UCL = 199.8
Mean = 197.2
LCL = 194.5
Start Vegetarian PDSA (30 days)
Continued with PDSA 2 (30 more days)
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43

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