HRSA Ryan White HIV/AIDS Program
CENTER FOR QUALITY IMPROVEMENT & INNOVATION

Using Graphs to Analyze and Share Performance Data

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Christina Clarke, BSc MHA
cclarke@ideategroup.ca

Learning objectives

1. Define performance measurement
2. Describe the purpose of performance measurement for quality improvement (QI)
3. List steps in the process of performance measurement
4. Recognize and describe six core graphical tools to analyze improvement data including the run chart, control chart, histogram, Pareto chart, scatter plot, and two-way table

What is Performance Measurement?

The HRSA HIV/AIDS Bureau defines performance measurement as

- "…the regular collection of data to assess whether the correct processes are being performed and desired results are being achieved."[1]

[1] http://www.hrsa.gov/quality/toolbox/methodology/performancemanagement/index.html

“…if I keep no record of what I do, I can always assume I’ve succeeded.”

– Stephen Colbert

What is the purpose of performance measurement?

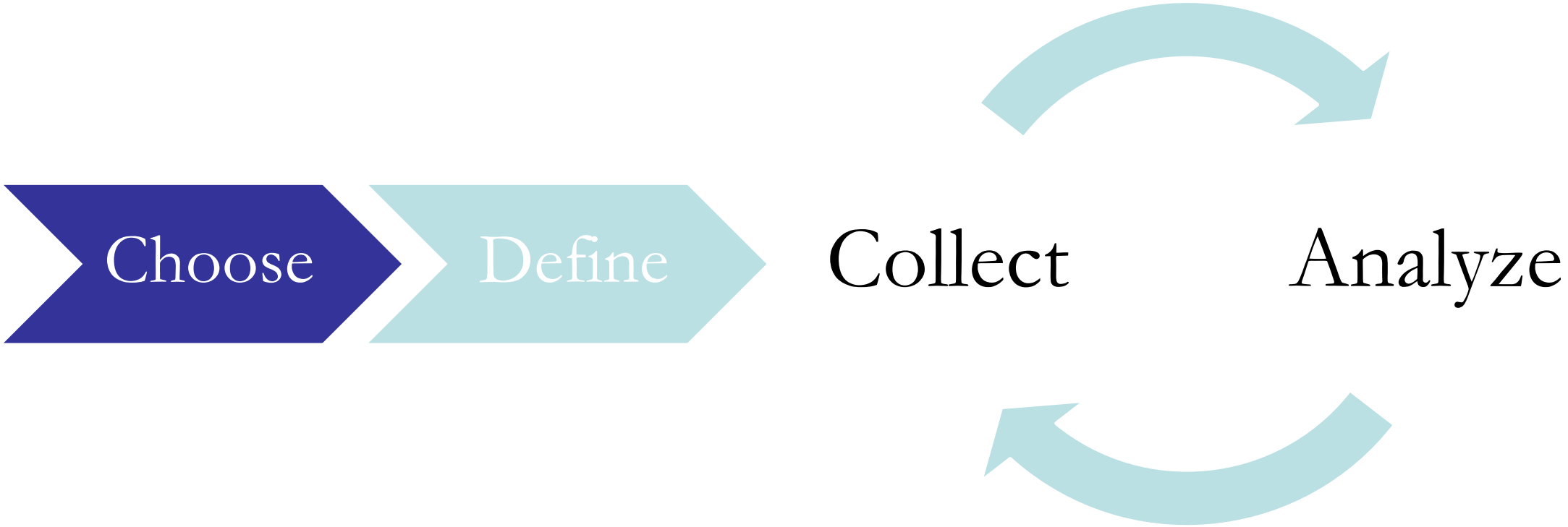
Characteristic	Quality Improvement	Research	Accountability
Purpose	Improve systems, learn	Create new knowledge	Comparison, choice, assurance, spur change
Examples	• Improve client satisfaction • Improve timely access to care • Improve viral load suppression	• Determine treatment efficacy • Determine improvement program impact on outcomes • Compare cost-effectiveness of treatment program	• Understand overall satisfaction levels • Understand demand for service and system capacity • Determine program level viral suppression rates across populations

Adapted from Solberg, LI et al. (1997). The three faces of performance measurement: Improvement, accountability and research. The Joint Commission Journal on Quality Improvement. 23(3): 135-147.

Performance measurement for QI

Evaluate & understand current process performance	• What is the rate of missed appointments? • What proportion of clients are not on treatment?
Search for improvement ideas	• What are the reasons that people are missing appointments? • What barriers did people encounter among those that didn't pick up their medication?
Tell if our changes show evidence of improvement	• Did our call reminders help reduce the rate of missed appointments? • Did our peer navigator call help clients pick up their treatment in a timely way?
Track implementation efforts to assure sustainability of improvement	• Have we sustained our lower levels of missed appointments? • Have we been able to sustain higher levels of timely medication pickups?
Share and compare our results with peers for learning	• Who has relatively low levels of missed appointments and what can we learn? • Where can we find ideas to support clients with timely medication pick-ups?

A note about the measurement process

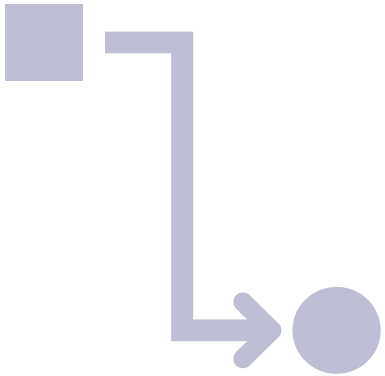


- Aligned with improvement aim
- Measures that are useful to drive learning (useful, not perfect; just enough, good enough data)
- Between 4-8 measures
  - Outcome
  - Process
  - Balancing

Measures Proposed by the HRSA HIV/AIDS Bureau

- The HIV/AIDS Bureau has developed a portfolio of measures in HIV care
  - https://hab.hrsa.gov/clinical-quality-management/performance-measure-portfolio
- It covers a variety of domains, including All Ages, Adolescent/Adult, Children, Medical Case Management, Oral Health, ADAP
- Each measures includes a description with definitions for Description, Numerator, Denominator, Patient Exclusions, Data Elements
- A *Frequently Asked Questions* document provides further details
- HIV/AIDS Bureau encourages the utilization of those measures and look at the National HIV/AIDS Strategy indicators

Guidance for choosing measures: Choose at least one of the three measure types to create a balanced family of measures



Process

Steps in a process

Balancing

A window to other parts of the system

Outcome

The end points of processes

Process

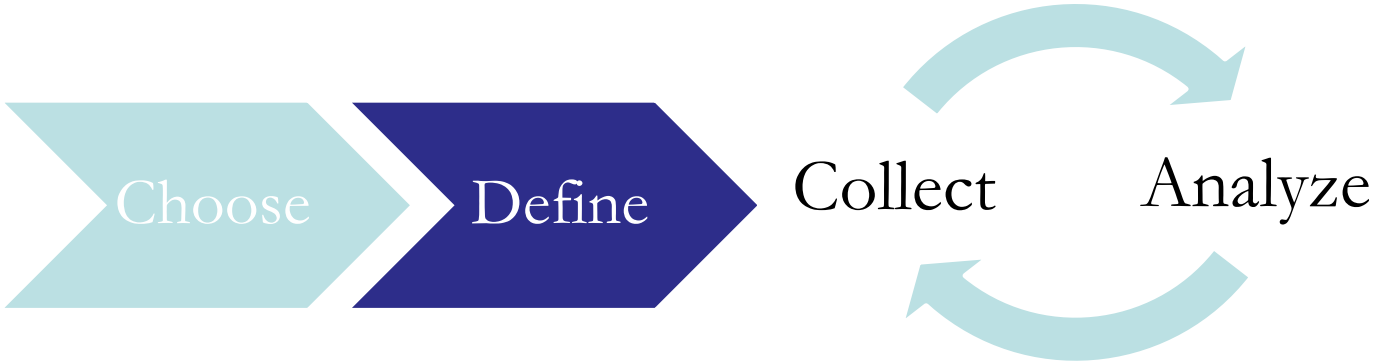
- Preventive cancer screening
- Plasma viral load testing
- Medication adherence
- Missed appointments
- Documented self management plans documented

Balancing

- Time to perform service
- Cost of service
- Patient and/or provider satisfaction

Outcome

- Viral suppression
- PROMs (depression, pain, patient activation, etc.)



- Who, what, where, when, why
- Don't need to re-invent the wheel (e.g., HRSA HIV/AIDS Bureau measures)
- If you can't get exactly what you want, use something close enough (proxy measure)

HRSA HIV/AIDS Bureau measure definition for: HIV Viral Load Suppression

- Description:
  - Percentage of patients, regardless of age, with a diagnosis of HIV with a HIV viral load less than 200 copies/ml at last viral load test during the measurement year
- Numerator:
  - Number of patients in the denominator with a HIV viral load less than 200 copies/ml at last HIV viral load test during the measurement year
- Denominator:
  - Number of patients, regardless of age, with a diagnosis of HIV with at least one medical visit in the measurement year
- Patient Exclusions: None
- Data Elements:
  - Does the patient, regardless of age, have a diagnosis of HIV? (Y/N)
  - If yes, did the patient have at least one medical visit during the measurement year? (Y/N)
  - If yes, did the patient have a HIV viral load test with a result <200 copies/mL at the last test? (Y/N)

Additional elements to include in your definition

In addition to elements like the measure name, description, numerator, denominator, population inclusion/exclusion criteria, you might also include:

- Why is this important?
- Who owns this measure?
- What data do you need/where in your information systems will you find it?
- What type of measure is this?
- How is your measure calculated?
- How will the data be displayed?
- Is there is a numeric goal?

Example

Measure setup

Measure name: Viral load suppression		
Measure definition	What is the numerator?	
	What is the dominator?	
	What is the calculation?	
	What is the population of focus?	
Goal Setting	What is your numerical goal?	
	Who is responsible for setting this?	
	When will it be achieved by?	

Example continued

Measurement process

Collect	Is the data available?	
	Who is responsible for data collection?	
	What is the process of collection?	
Analysis	What is the process/tool for presenting results?	
	Who is responsible for the analysis?	
	How often is the analysis completed?	
Review	Where will decisions be made based on results?	
	Who is responsible for taking action?	

- Follow the data definitions to collect, calculate, and present the data reliably

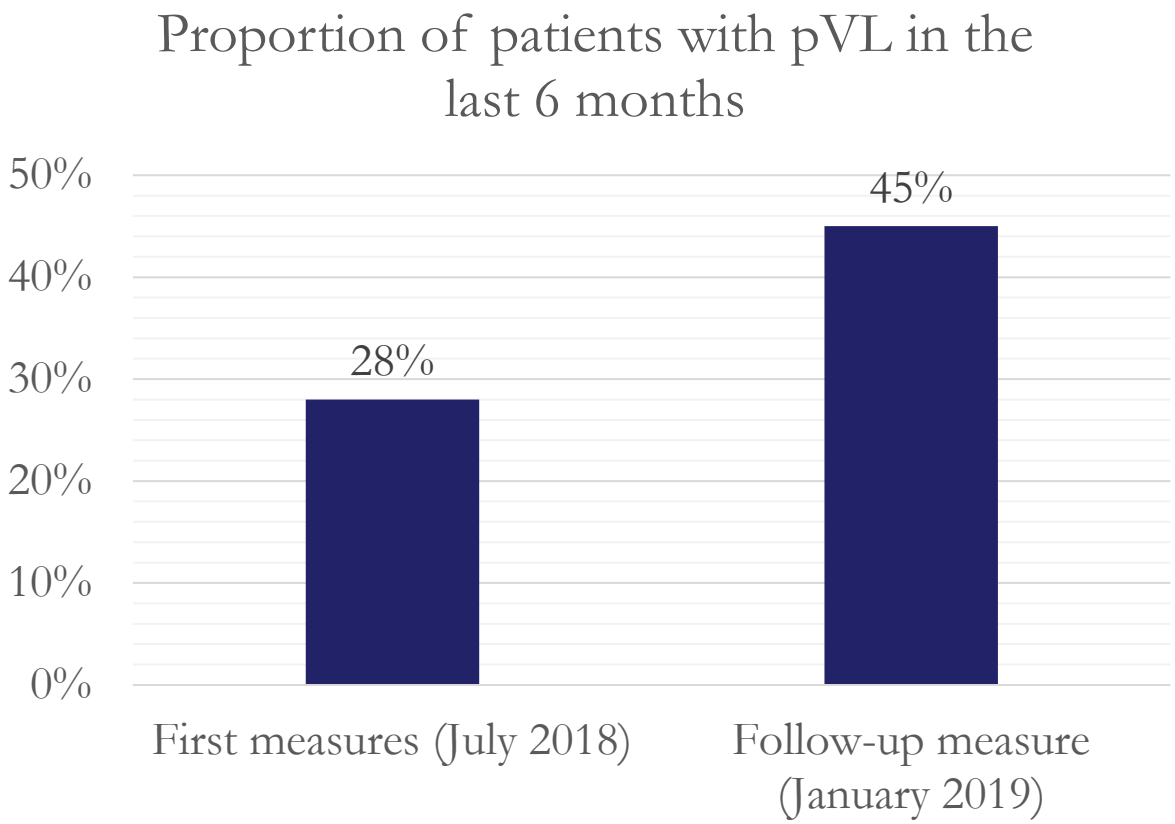
Graphical tools for performance data analysis

A note about choosing the right tool for the job

Essential graphical tools for QI performance data analysis

Tools	Purpose
Run charts (time series chart) Shewhart control chart (time-series chart)	Study variation in data over time, understand the impact of changes on measures Distinguish between special cause and common cause variation, understand the impact of changes on measures
Frequency plots Pareto charts	Understand location, spread, shape, and patterns of data Identify and focus on that areas of improvement that may have the greatest impact.
Scatter plots Two-way table	Analyze the associations or relationships between two variables; test for possible cause and effect Understand cause and effect for qualitative variables

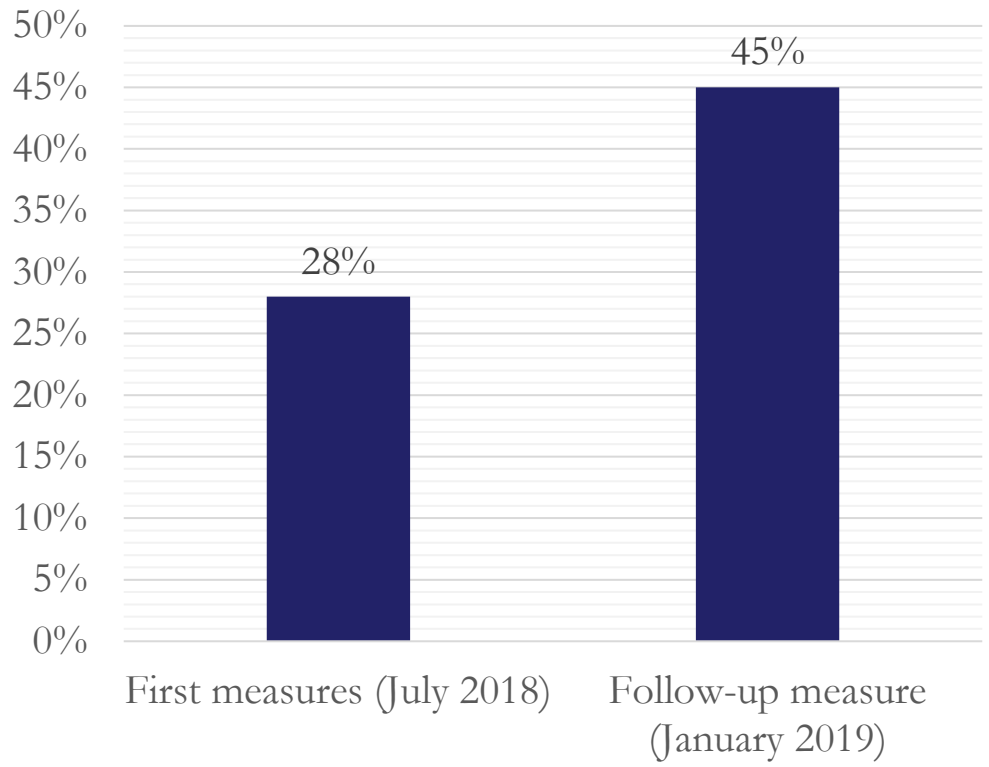
Plasma viral load testing, last 6 moths

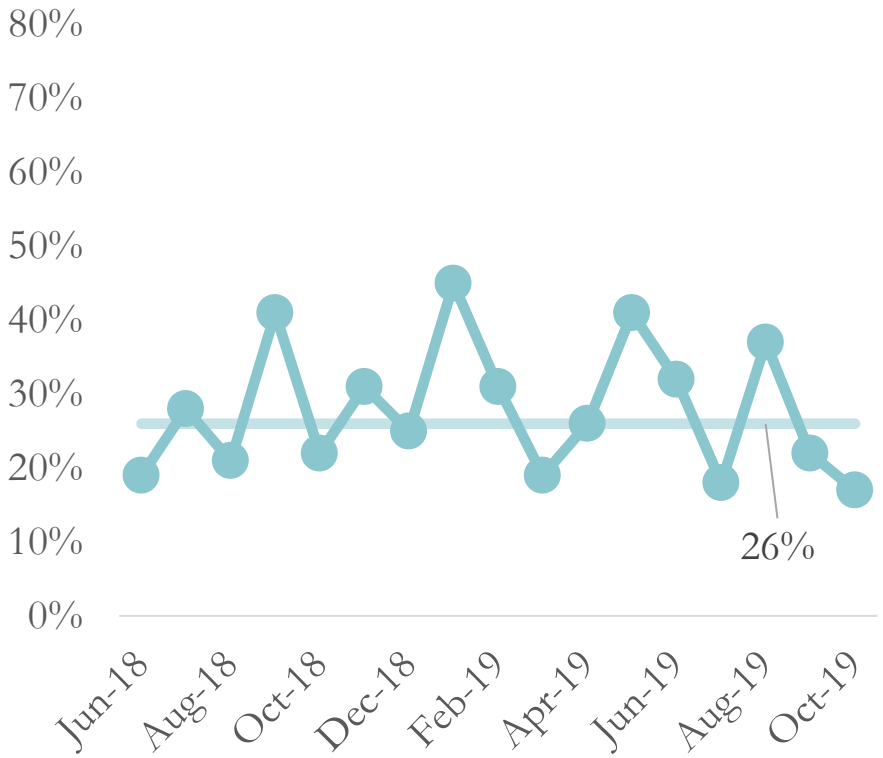


Did they improve care?

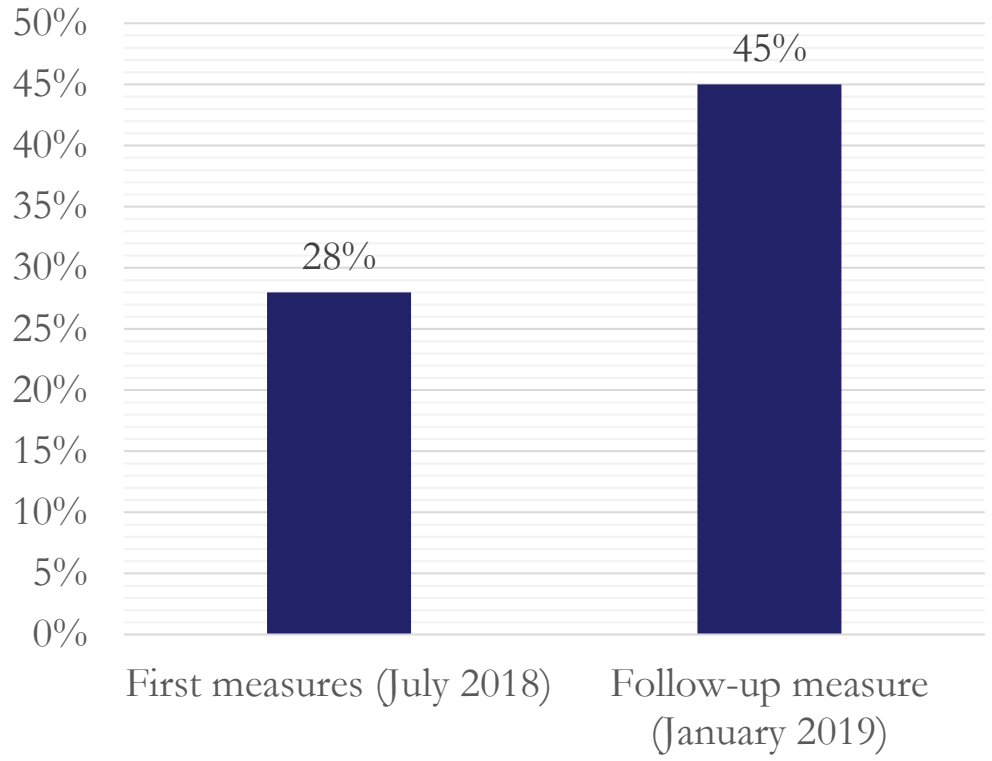
What thoughts would you offer to the improvement team?

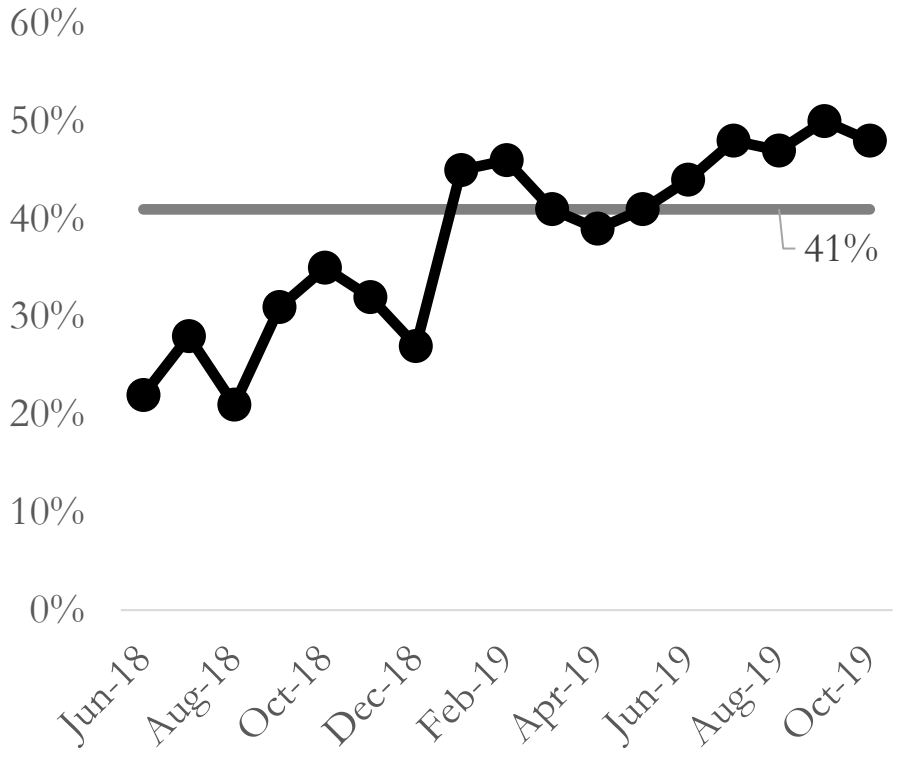
Scenario 1: No improvement, lots of variation



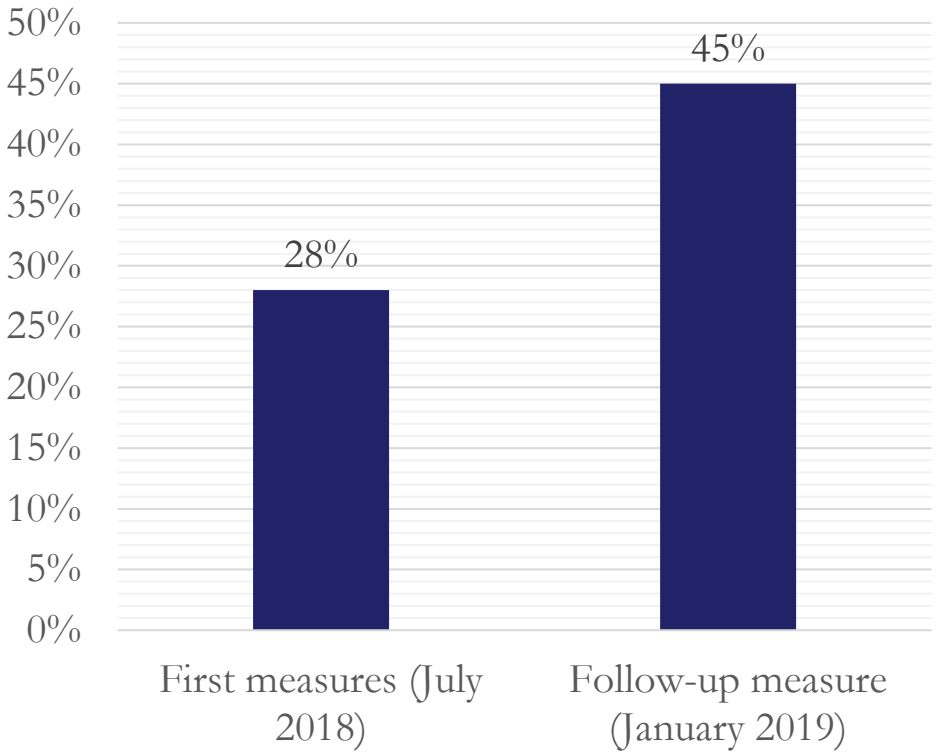


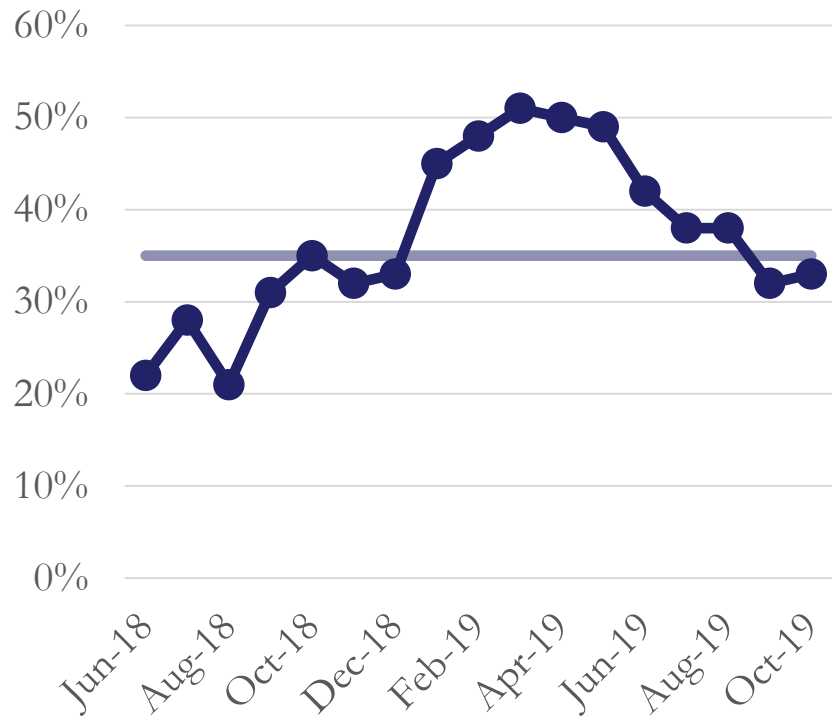
Scenario 2: Possible improvement





Scenario 3:Possible improvement, not sustained





> People will often over- or under-react to a single or most recent data point (and begin tampering, possibly making things worse).

Perla RJ et al. *BMJ Qual Saf* 2011;**20**:46–51.

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Run chart (time series)

- A plot of data over time
- Median (middle value) calculated and plotted
- Easy to construct and interpret
- Can be annotated with changes were tested and implemented
- Primary way to assess the effect of changes on the measures and system (are changes leading to improvement? Are gains sustained?)

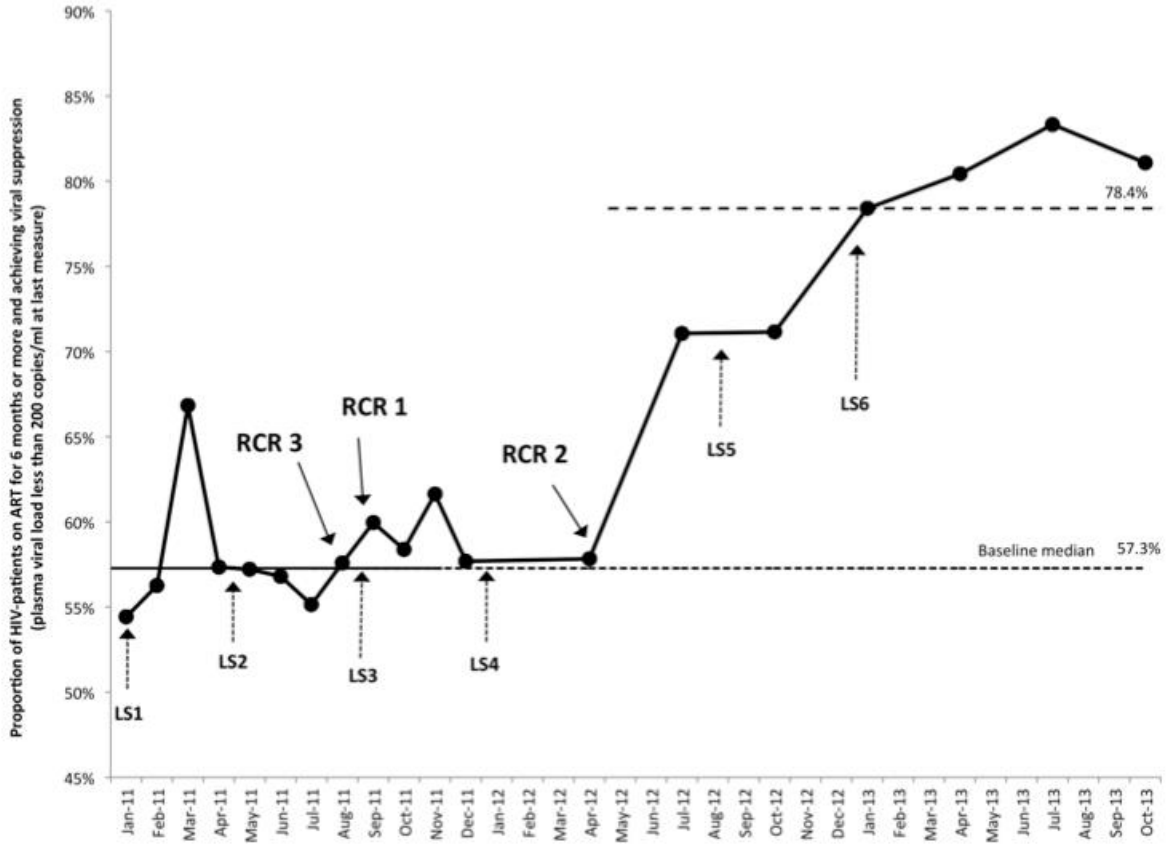


Figure 5 Antiretroviral therapy (ART) uptake for ≥6 months and achieving viral suppression. LS, learning session; RCR, run chart rule.

Clarke et al (20015). BMJ Qual Safety

Run Chart Analysis Through Run Chart Rules

- Need at least 10 data points (observations) to apply rules
- Probability-based rules
- Use to identify *signals of non-random patterns* in the data

A **non-random pattern** is a pattern that is not likely to occur by chance*.

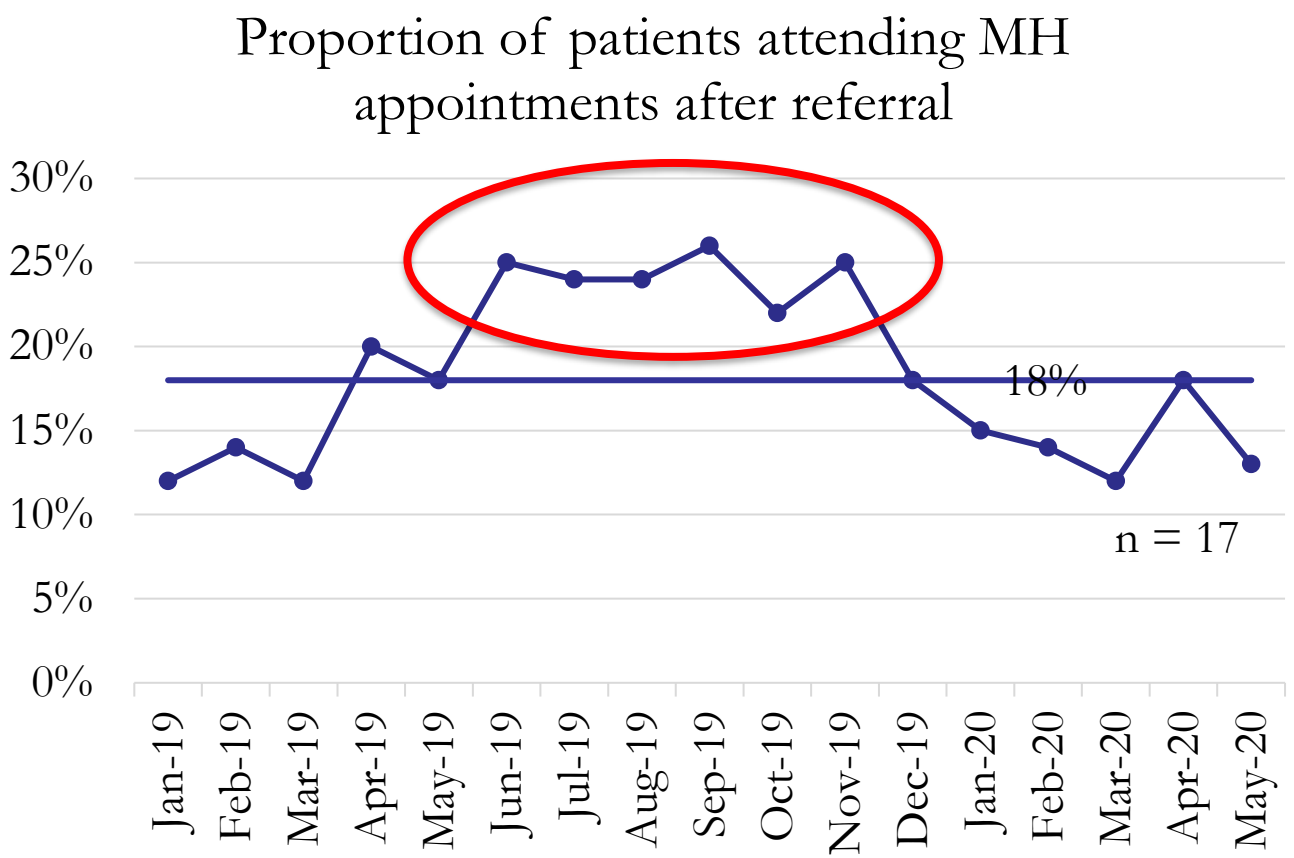
The non-random pattern is a **signal**. The signal could be good (improvement), bad (worsening system performance), or something else. The key is to learn about the signal.

* Run chart rules describe non-random patterns that are unlikely to occur by chance 95% of the time (i.e., there is an alpha error of 0.05 or there is a 5% chance of falsely inferring the existence of a non-random pattern using these rules). Think false positives.

Run Chart Rules

Rule 1: Shift	6 or more consecutive points *either* all above or all below the median
Rule 2: Trend	Five (5) or more consecutive points all going up or down
Rule 3: Runs	Too few or too many runs crossing the median (see table)
Rule 4: Astronomical point	Used to detect an unusually large or small number. This rule is not probability based, though may be useful for learning

Rule 1: Shift

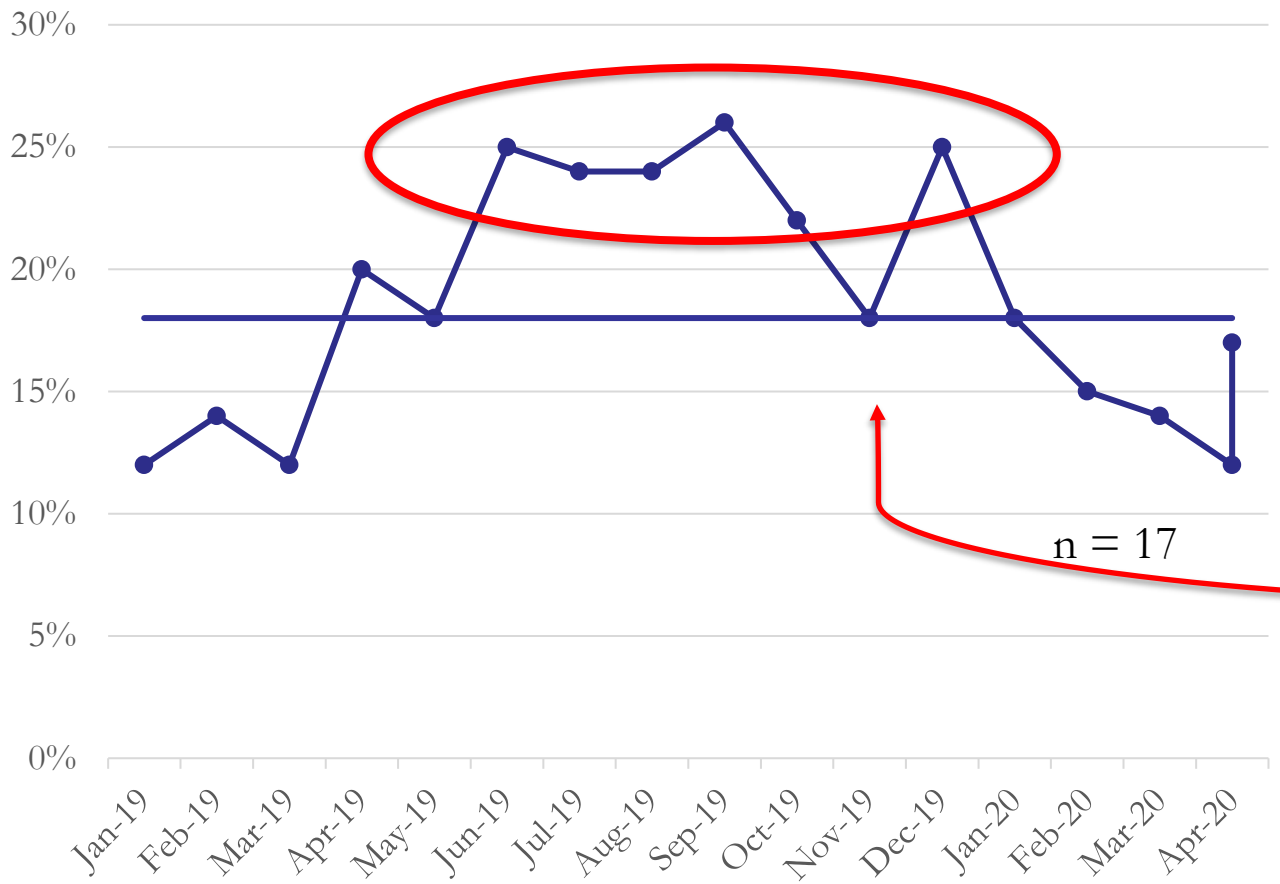


Six or more consecutive points either all above or all below the median.

Values that fall on the median do not add to, nor break a shift. Skip all values that fall on the median and continue counting.

Provost, L.P., & Murray, S.K. The Health Care Data Guide. San Fransisco, CA: Jossey Bass, 2011.

Rule 1: Shift



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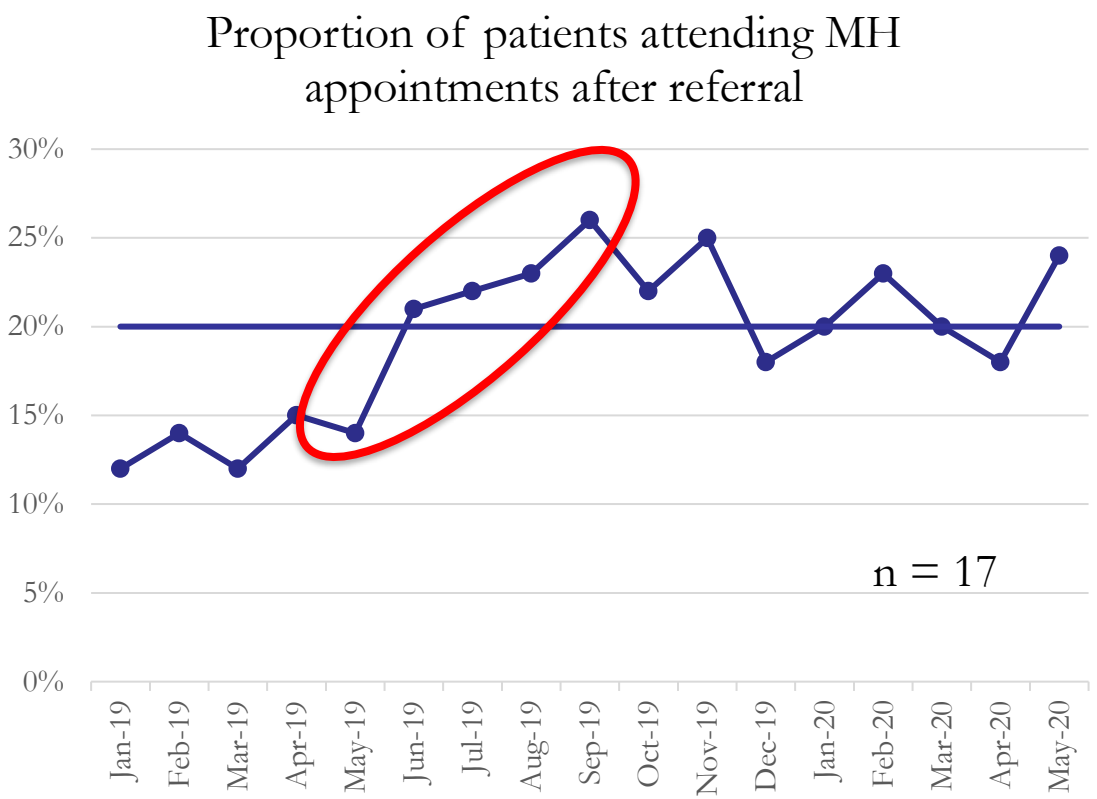
Rule 2: Trend

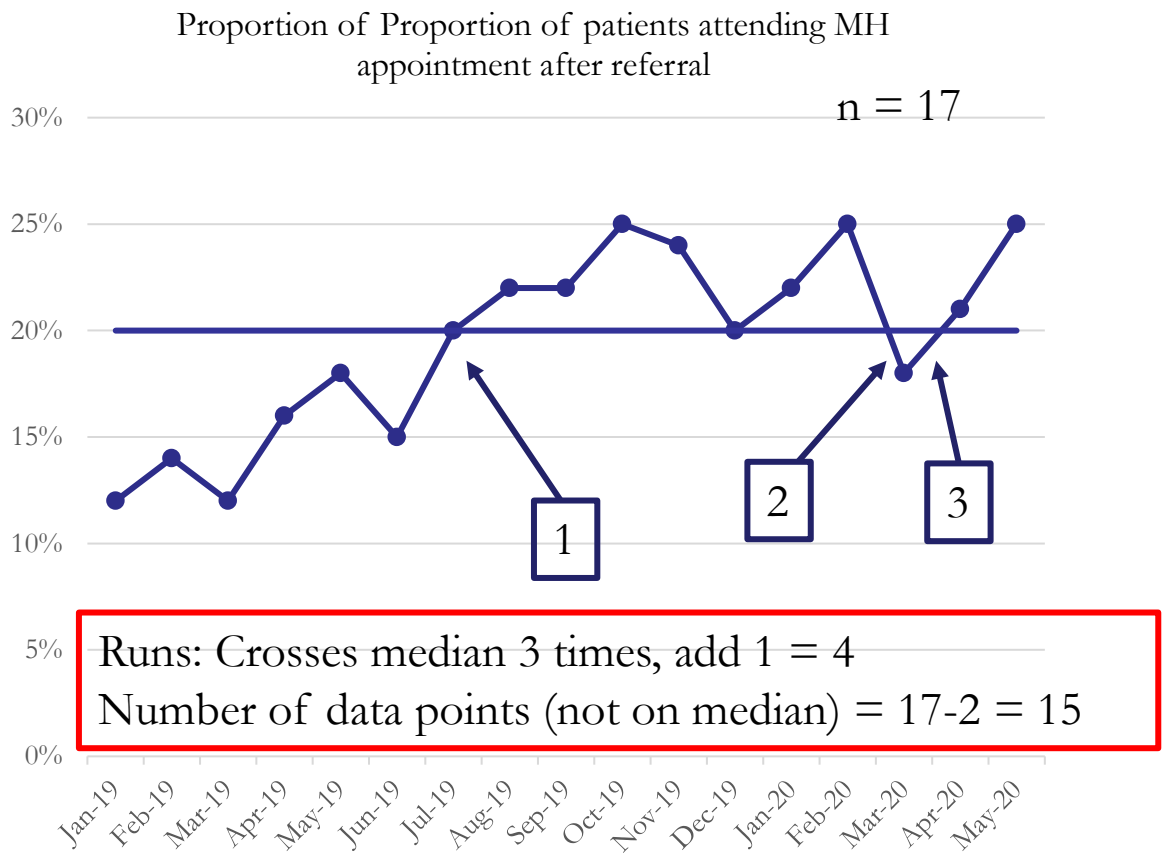


Five or more consecutive points all going up or all going down.

If the value of two or more consecutive points is the same, only count the first point and ignore the repeating values (same values do not make or break a trend).

Provost, L.P., & Murray, S.K. The Health Care Data Guide. San Fransisco, CA: Jossey Bass, 2011.

Rule 3: Runs



A run is a series of points that fall on one side of the median.

1. **Count the runs: Count the number of times the line connecting data points crosses the median and add one (note: if a data point falls on the median but does not cross the line, it does not count as a run).**

2. **Count all the data points. Subtract all those that fall on the median.**

Tabled critical values (table 1) are used to determine if too many or too few runs exist.

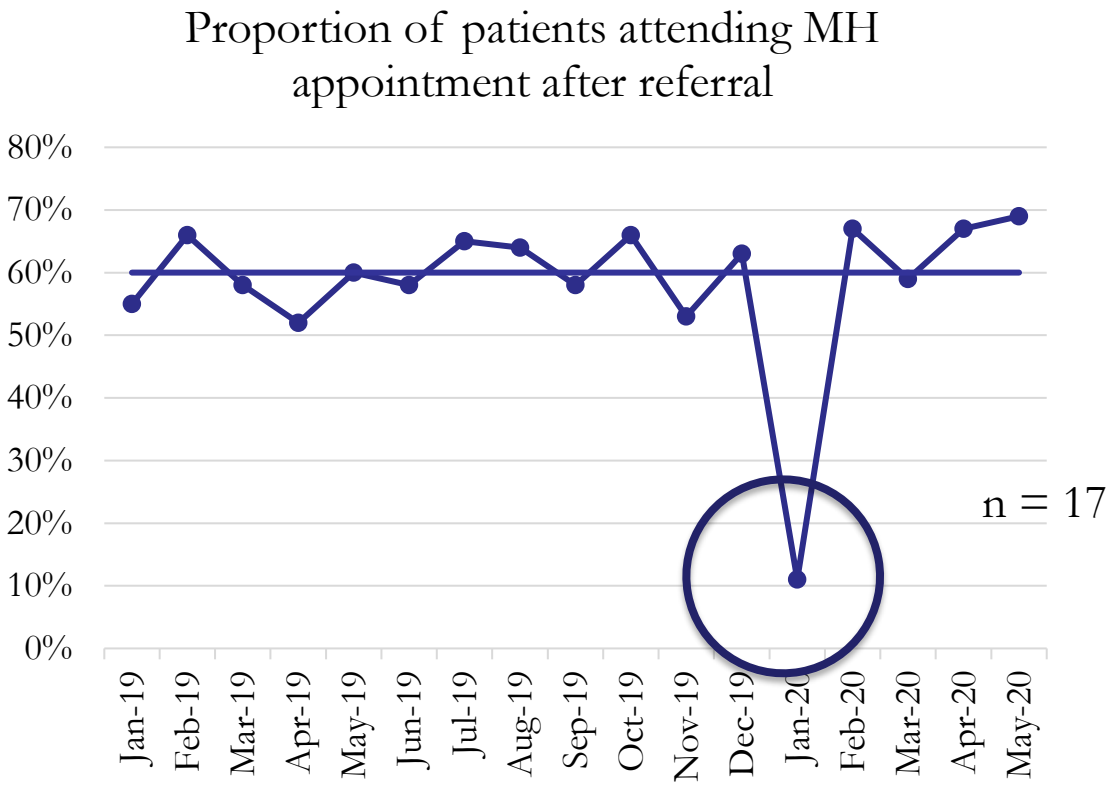
Provost, L.P., & Murray, S.K. The Health Care Data Guide. San Fransisco, CA: Jossey Bass, 2011.

Runs = 4
Data points not on median = 15

Total number of data points on run chart not falling on median	Lower limit for number of runs (<than this is "too few")	Upper limit for number of runs (>than this 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

Provost, L.P., & Murray, S.K. The Health Care Data Guide. San Fransisco, CA: Jossey Bass, 2011.

Rule 4: Astronomical Point



A judgement call. Any result that is blatantly different.

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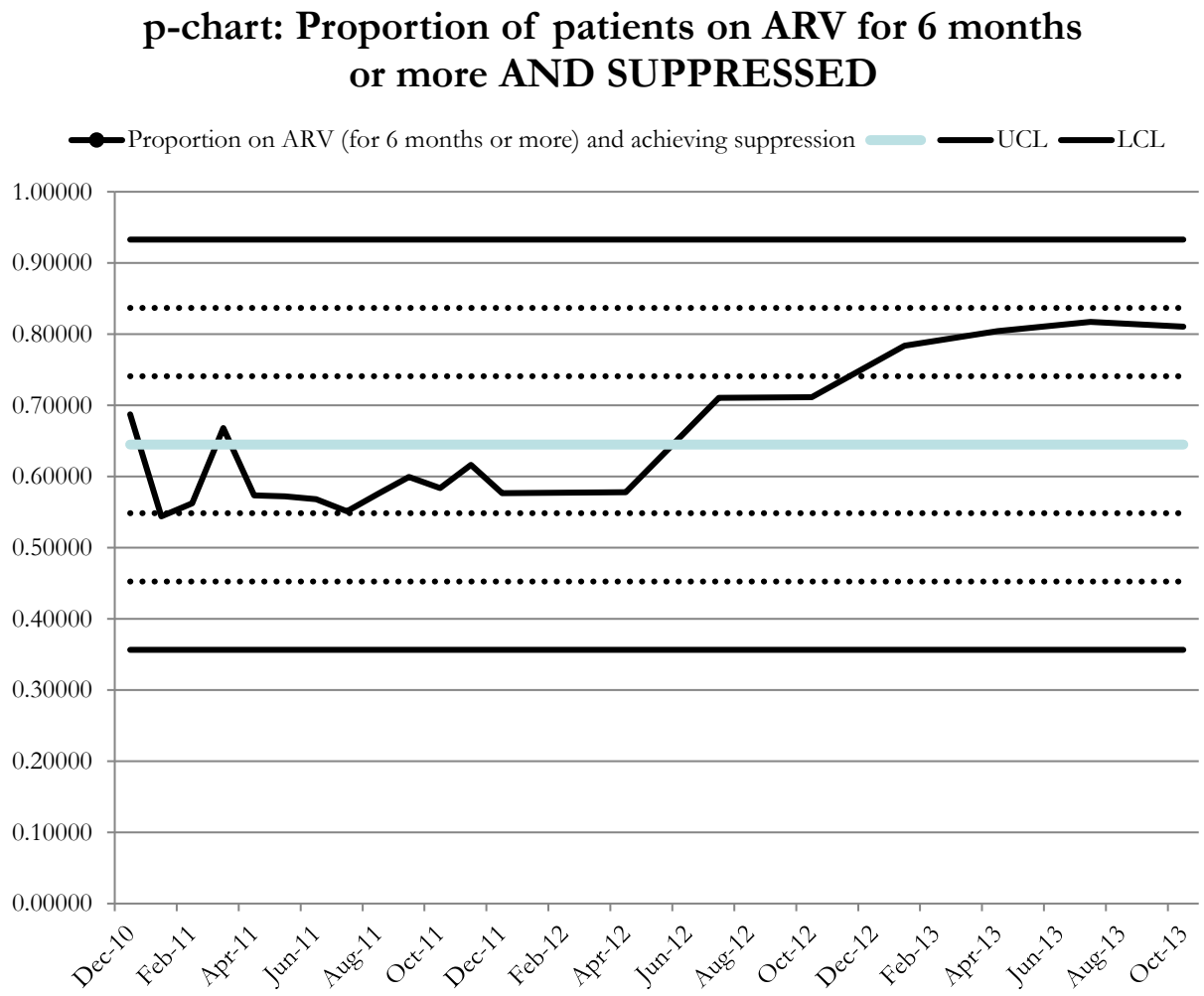
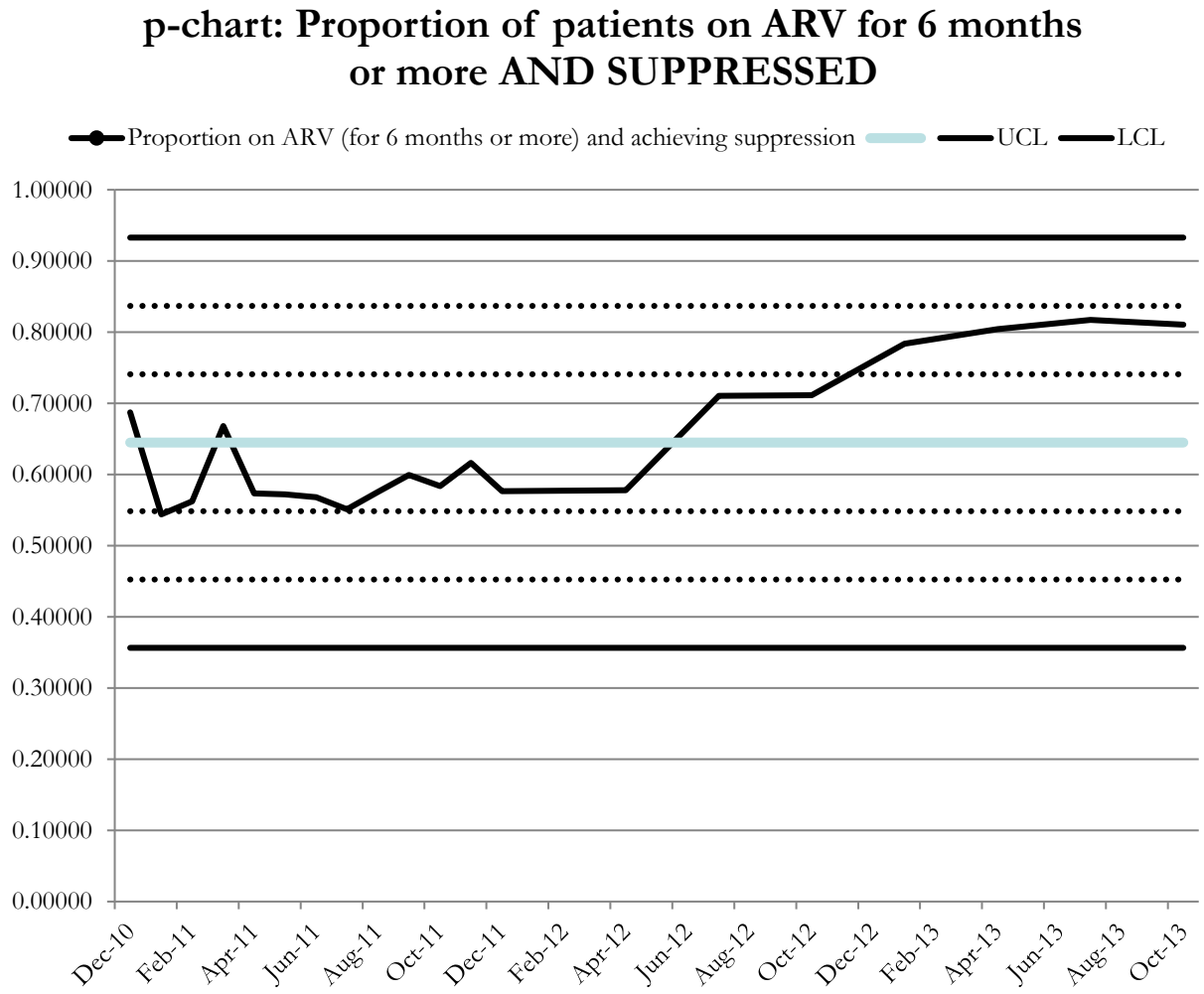
Shewhart Control chart

- Used to learn about variation (common cause and special cause variation) and evaluate the impact of changes
- Used to understand process stability, process capability, and to select appropriate improvement strategy
- Includes center line (average) and upper/lower control charts
- Control chart rules aid in the detection of special cause variation
- Absence of special cause variation indicates a stable system
- A stable system is not a value judgement (can be great performance or in need of improvement)



Shewhart Control chart rules for determining special cause

1. Single point outside the control limits
2. A run of 8 or more points in a row above (or below) the centerline
3. Six consecutive points increasing (trend up) or decreasing (trend down)
4. Two out of 3 consecutive points near the (outer third) a control limit
5. 15 consecutive point close (inner one third of the chart) to the centerline



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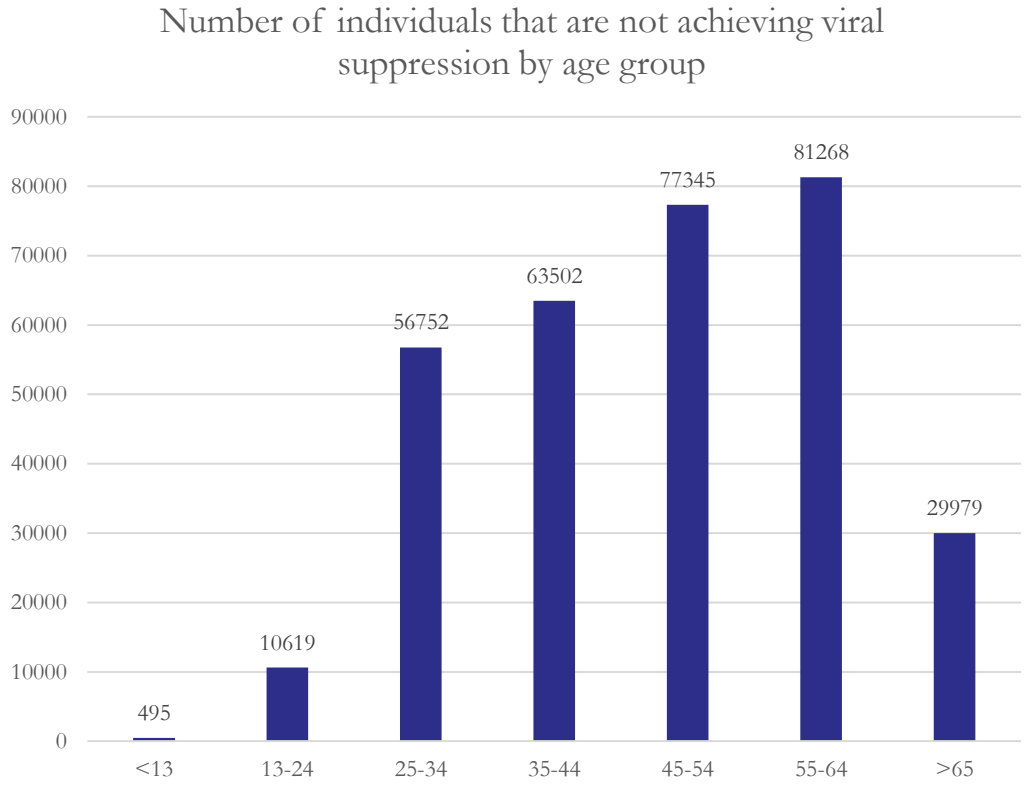
Frequency plots and Pareto Charts

- Graphical tools best used as an accompaniment to a run chart and/or control chart
- Tools to understand why health of groups of patients and/or processes in care system are not optimal using objective data (avoid assumptions)

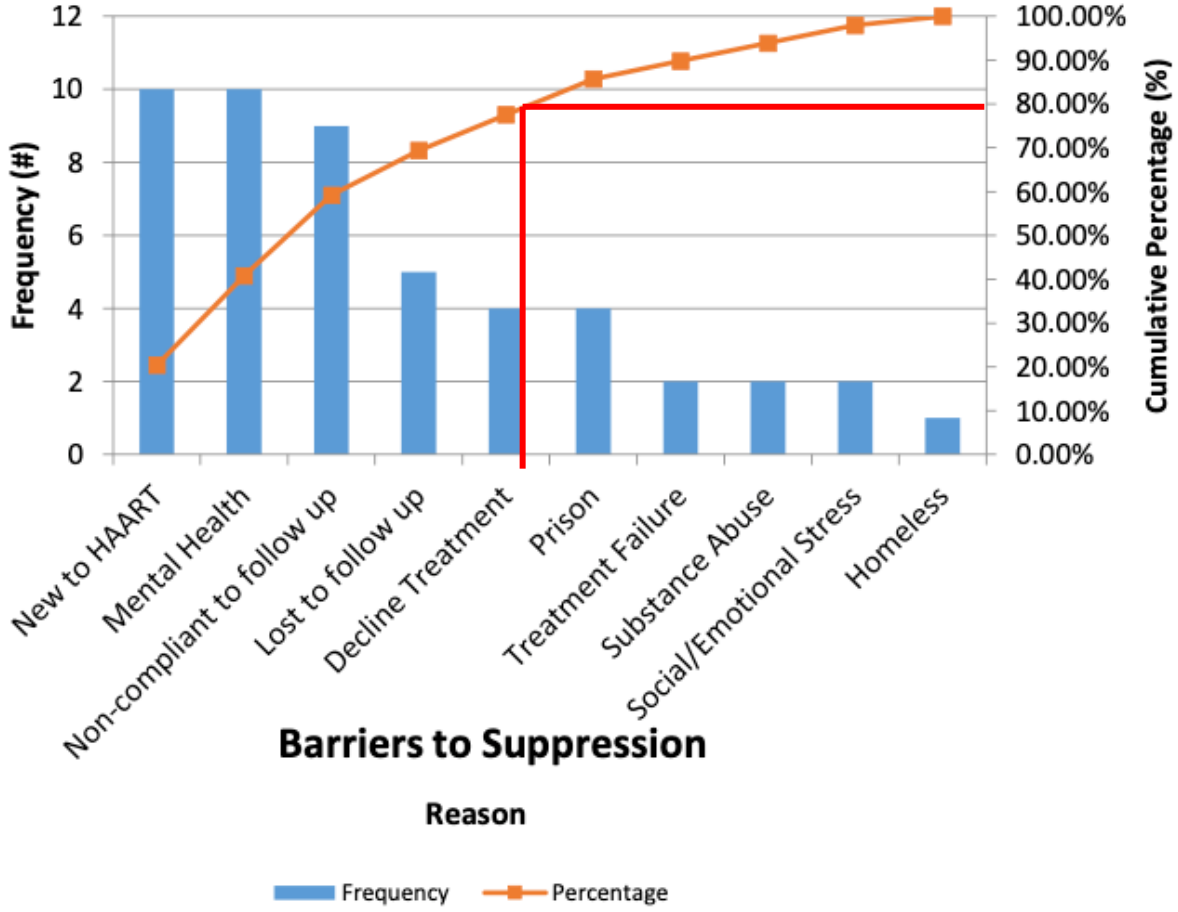
Frequency chart

- For continuous data (e.g., wait time, age, etc.)
- Most useful after a run chart or control chart
- Know if your system is stable or unstable when using
- Useful for finding patterns in the data (e.g., PREP use lower in an age group)



Pareto chart

- For attribute data (e.g. problems, errors, adverse events, complaints, etc.)
- Manifestation of 80/20 rule (80% of the problems are related to 20% of the causes/categories)
- Helps to focus improvement efforts, prioritize root causes



Example from Brown et al. Impacting the Cascade: Drilling Down Data to Improve Patient Care. Presentation

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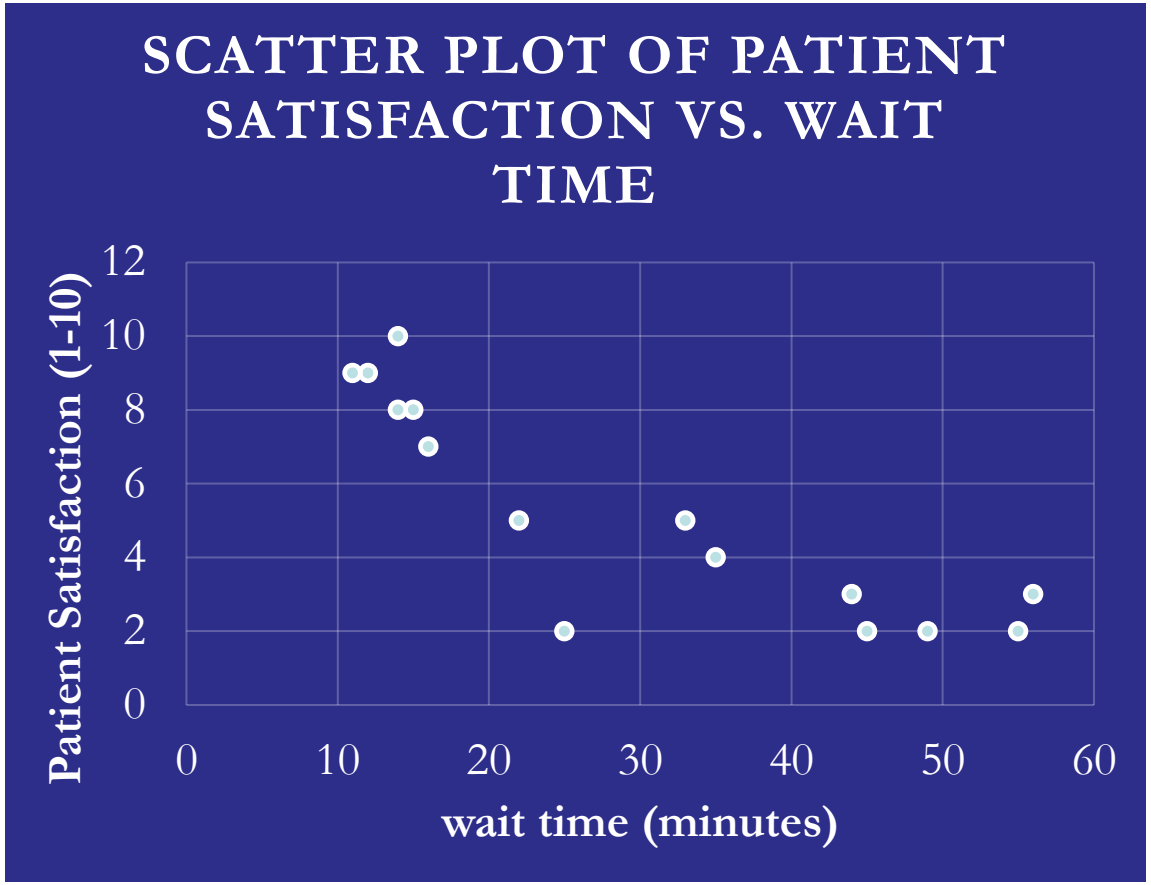
Scatter plot

- Graphical tool to look for associations between two variables
- Helps us learn about relationships (to what extent does one variable predict the other?)
- Linear regression common for analysis

PT. ID	Satisfaction	Wait time
1	11	9
2	25	5
3	55	2



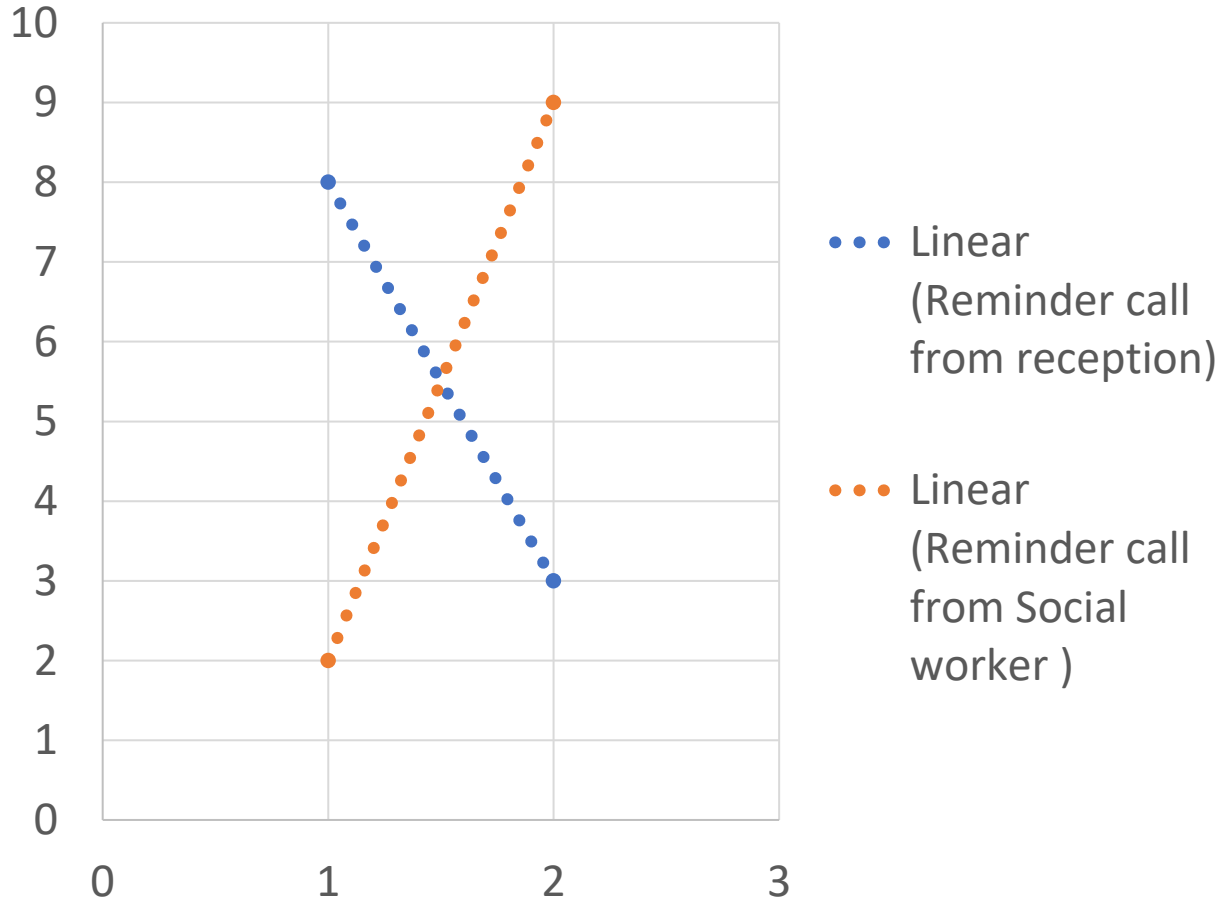
r = -0.87

Strong negative relationship

Two-way table

- Tabular representation of the relationship between pairs of variables
- Helps to understand the important causes of variation in process and the effect of different changes
- Multiple factors that can be tested in a single PDSA
- Helps understand interactions

	Appointment missed	Attended appointment
Reminder call from reception	8	3
Reminder call from Social worker	2	9



	Appointment missed	Attended appointment
Reminder call from reception	8	3
Reminder call from Social worker	2	9

Summary

- Performance measurement is essential to improvement projects but is not the purpose of improvement projects
- It is helpful to view the process of performance measurement to be able to select the right measures and identify the best tools to display and analyze them
- A number of important graphical tools can be used to help us to:
  - Understand our systems using objective data which helps us make better decisions
  - Identify if the changes we are making are leading to improvement


What questions
do you have?

Contact Information

Christina Clarke, BSc MHA cclarke@ideategroup.ca

Learn More

212-417-4730 (phone)
212-417-4684 (fax)
Info@CQII.org

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