

Using Quality Improvement Tools to Identify and Reduce Unwanted Variation in Healthcare Systems

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Learning Objectives

- Understand the concept of variation in healthcare systems.
- Distinguish between common cause and special cause variation to determine appropriate improvement strategies.
- Implement data-driven approaches using metrics and performance analysis to reduce unwarranted variation.
- Apply quality improvement (QI) tools to identify and analyze variation.
- Measure and monitor process changes over time to sustain improvements.

What's the Rule?

We've chosen a **rule** that some sequences of three numbers obey — and some do not.

Your job is to guess what the rule is.

1. We'll start by showing the sequence that obeys the rule.
2. Guess the next numbers in sequence that obey the rule.
3. We will check if the sequence obeys the rule.



What Are Some Takeaways

What biases did you notice in your guesses?

- Missing subtle patterns.
- Chase outliers (availability bias).
- See patterns in randomness (cognitive bias).

QI tools are necessary to investigate issues, reduce biases, and they increase learning through testing.

How does this apply to your QI efforts?

Variation in Healthcare

- In healthcare, variations are found everywhere - in processes, procedures, care environments, clinic layouts, patient symptoms and outcomes, etc.
- Much of the variation is caused by the way we organize and provide services.
- Variation is expected.



Unwanted Variation in Healthcare

Unwanted variation in healthcare leads to inefficiencies, errors, and increased costs.



Missed opportunities

Inconsistent preventive screenings for high-risk patients



Treatment delays

Variable timelines between diagnosis and antiretroviral treatment



Quality of care gaps

Differences emerge when care differs by provider, location, or patient demographics



Resource inefficiencies

Prolonged wait times, duplicate assessments, and poor care coordination

Variation In Healthcare Is An Opportunity For Improvement

The Institute for Healthcare describes variation as a common culprit behind burdens in the healthcare system.



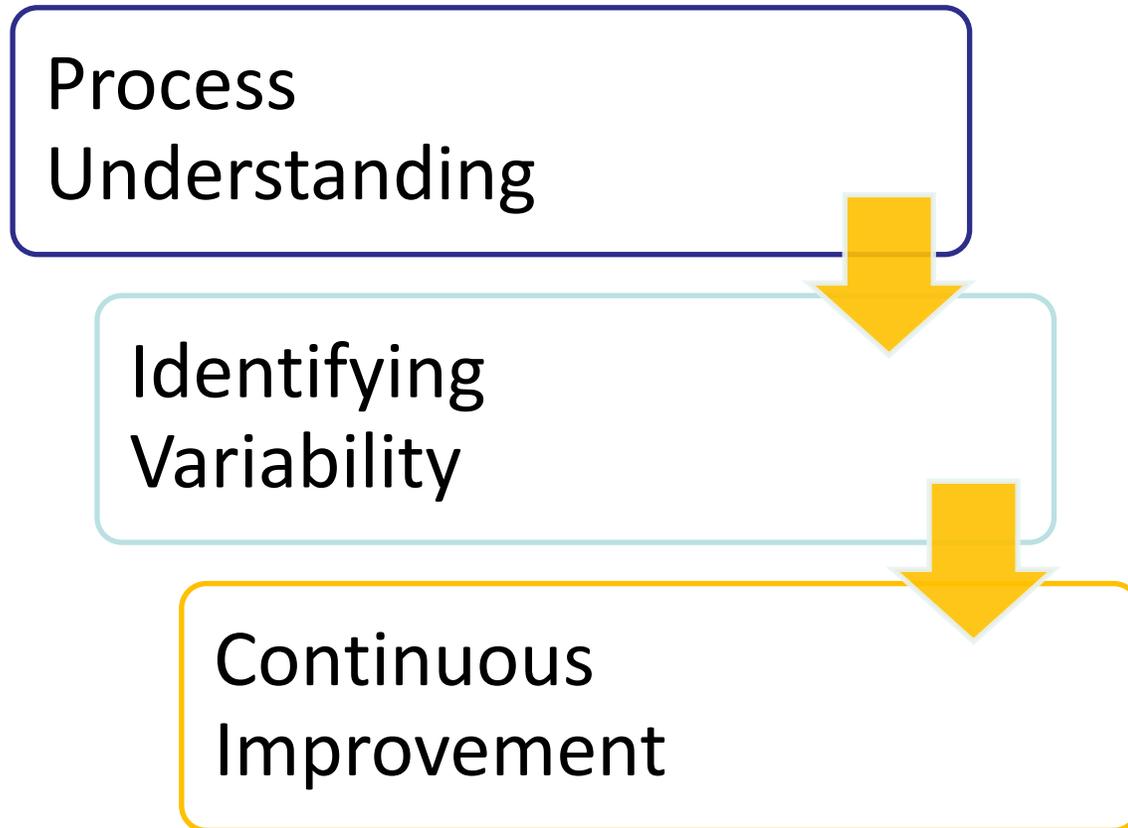
“Many quality and cost problems in a process or product are due to variation.”

“The process that produces 95 percent on-time delivery or good product is the same process that produces the other 5 percent late deliveries or bad product.”

<https://staff.ihi.org/resources/Pages/Changes/DecreaseandSmoothHVariation.aspx#>

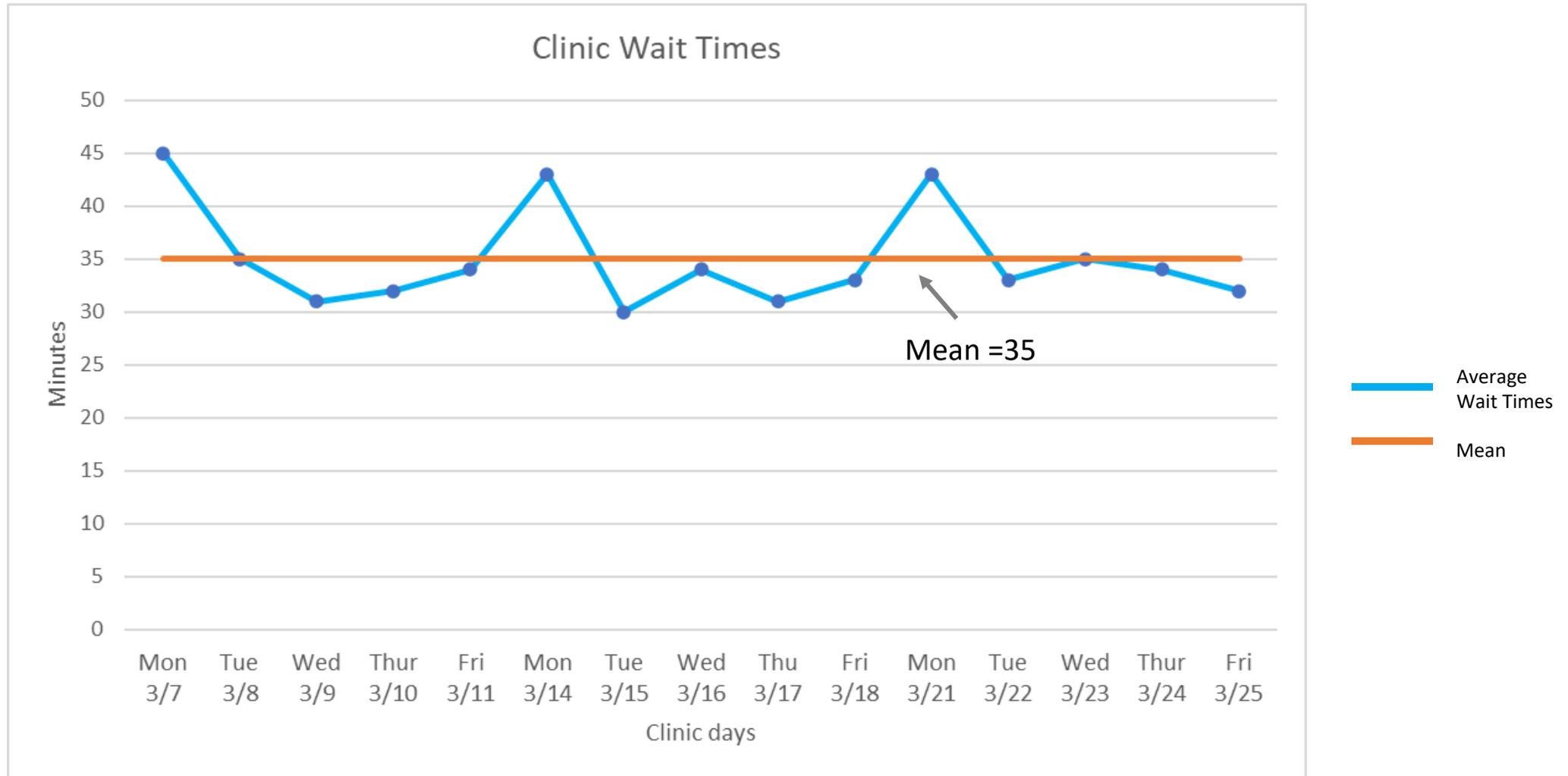
<https://www.healthcatalyst.com/learn/insights/reducing-variation-in-healthcare-to-boost-improvement>

Understanding Variation



- Understanding variation is critical to managing systems effectively.
- Understanding the source of variation is important, as this determines what we should do next.
- Each of these factors can contribute to variation in a process and should be examined for potential improvement opportunities.

Let's Examine a Process: Wait Times at Springfield Clinic



What's Going on in the Example

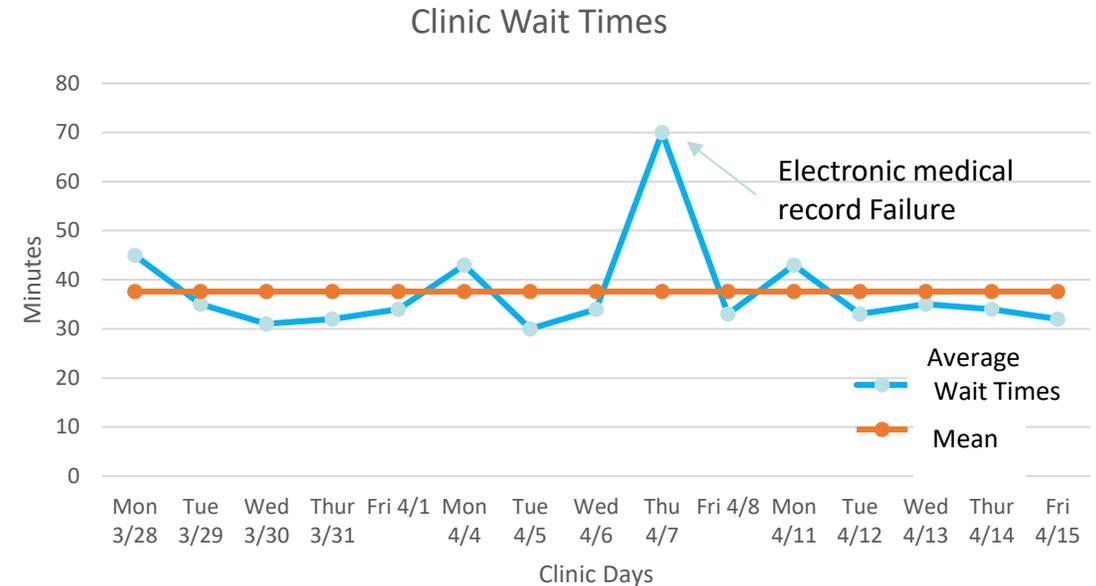
- Common cause variations represent the normal variations that occur in a system such as the staff levels, appointment scheduling (system limits amount scheduled for each hour), patient arrival patterns (in the example Monday had higher volume, possibly due to patients seeking care after the weekend).
- All those random variables create a predictable outcome of a system. In the example, the normal variation of the average clinic wait time is between 30 – 45 minutes.
- Common cause variations are the statistical noise of any system.

This noise can lead to producing undesirable results even though we say the system is stable.

Clinic Wait Times – Equipment Failure

Because of a malfunction of the electronic medical records, the clinic wait time went from 30-45 minutes to over an hour.

- The longer wait times was caused by something not part of the normal process.
- The clinic wait time is now unpredictable due to additional efforts needed to access medical records.
- The effect of an occurrence outside of the normal variation within a system was so severe that it drastically changed clinic wait time.



Stable System



Common Cause Variation (Noise)

- > The causes are inherent to the system (stable system) and affect everyone working in the process.
- > The output or outcome of a system appears seemingly random and clusters around the mean.

Unstable System



Special Cause Variation (Signal)

- > Distinct, assignable cause.
- > Outliers that are not part of the system and arise because of specific circumstances.
- > A special cause can yield favorable or unfavorable results.

“Every system is perfectly designed to get the results it gets.”

-Dr. Paul Batalden

Decrease and Smooth Variation to Improve Flow, Institute for Healthcare Improvement - <https://staff.ihp.org/resources/Pages/Changes/DecreaseandSmoothHVariation.aspx#>

Clients wait times are lower in December

Client wait times average ranges between 15 minutes to 4 hours in a year

Differences in wait times by provider

Client wait times between April and June 2020 dropped to a

There was no electricity in the clinic on Wednesday which led to a higher missed appointment rate for the reporting period

Staff Resource:70% of staff called out the day after a hurricane

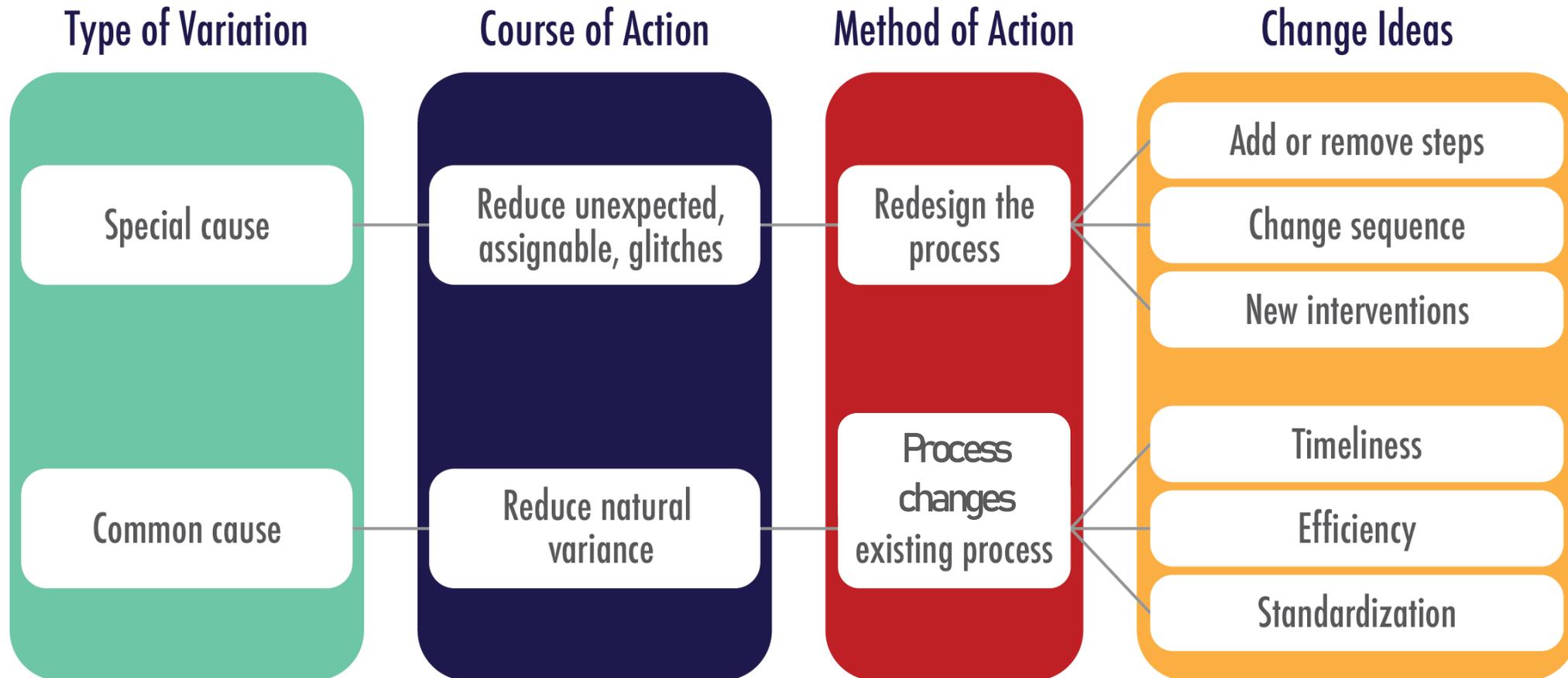
Staff turnover rate at the clinic is 35% per year

Likely Common Cause Variation

Likely Special Cause Variation

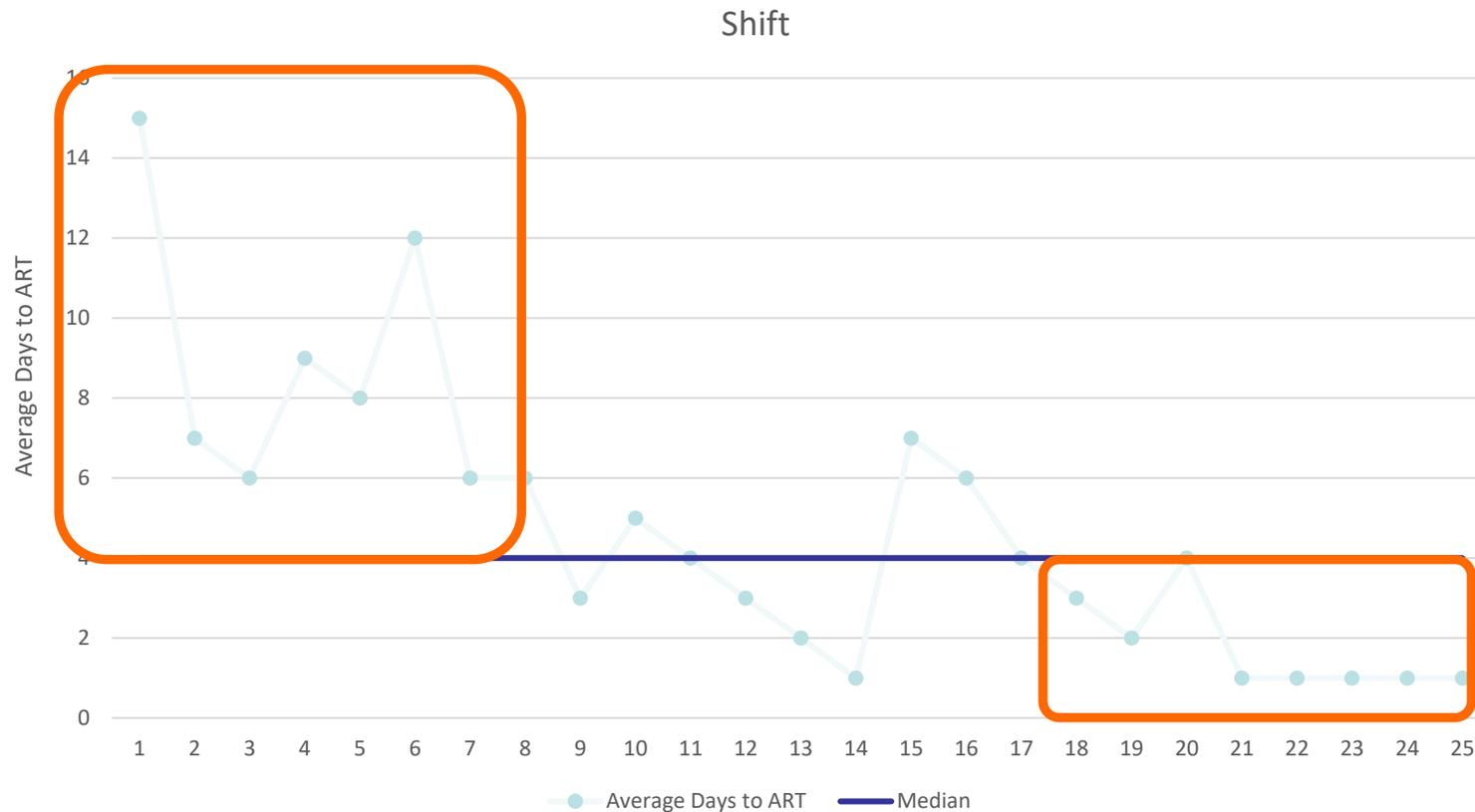


Listen then Take Action



TOOLS TO IDENTIFY VARIATION

Run Chart: Process Shift



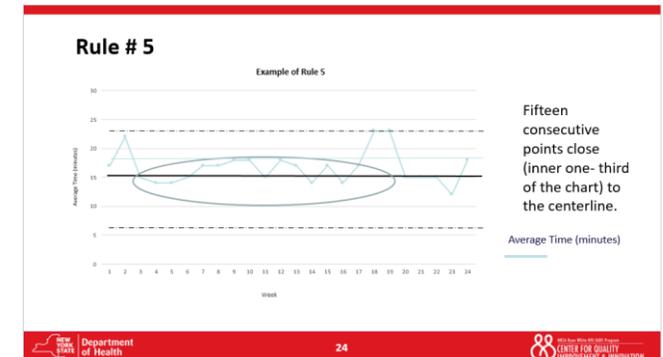
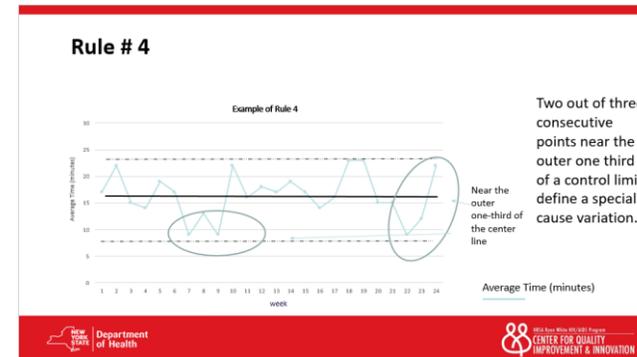
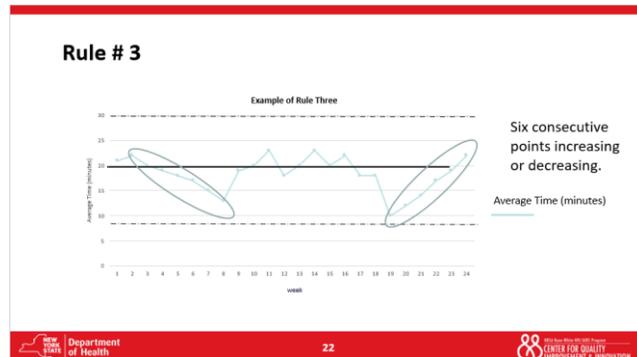
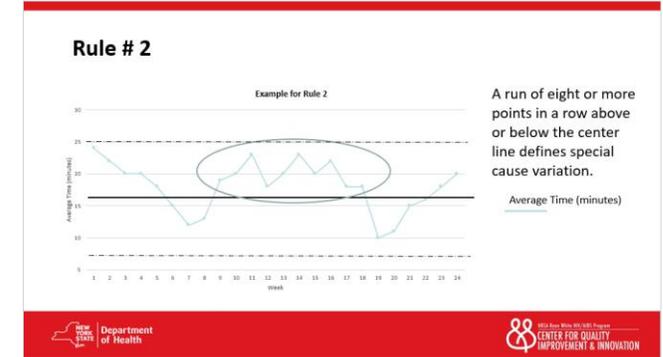
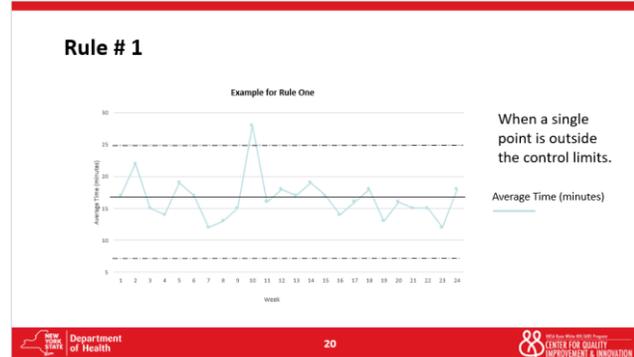
A shift is **six or more** consecutive points either all above or all below the median. **Values that fall on the median are skipped, but don't break a shift.**

Control Chart

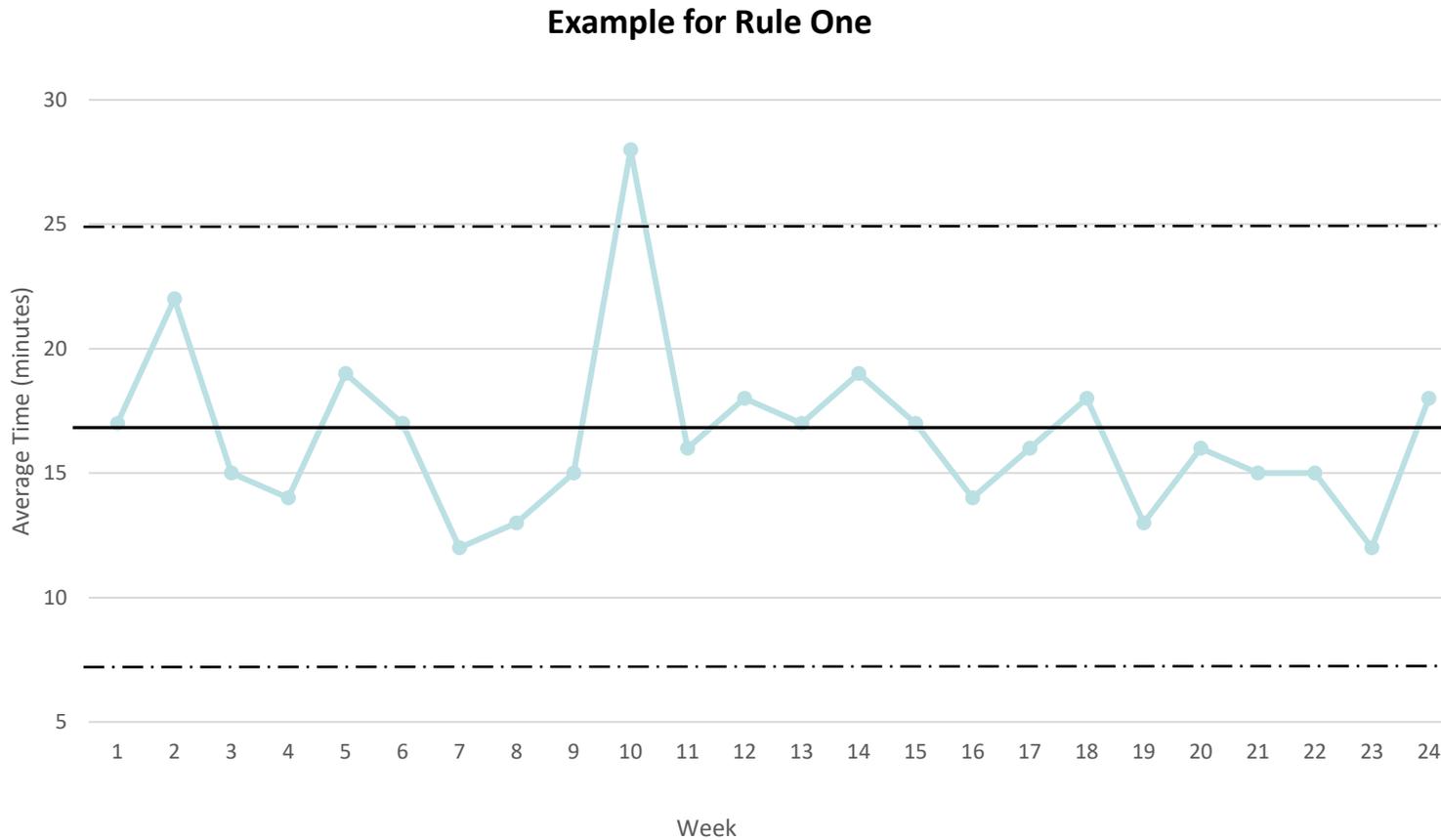
- A control chart is a statistical tool used to understand variation in a measure due to common and special causes.
- Has three lines: a center (average) line, an upper limit line, and a lower limit line.
 - An upper and lower limit (the acceptable +/- 3 standard deviations of the expected value)
 - At least 15 - 20 data points over time
- A mathematical equation is used to calculate the upper and lower limits of changes to be expected within the existing system.

Control Chart Signals

Five rules that show a special cause variation

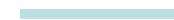


Rule # 1



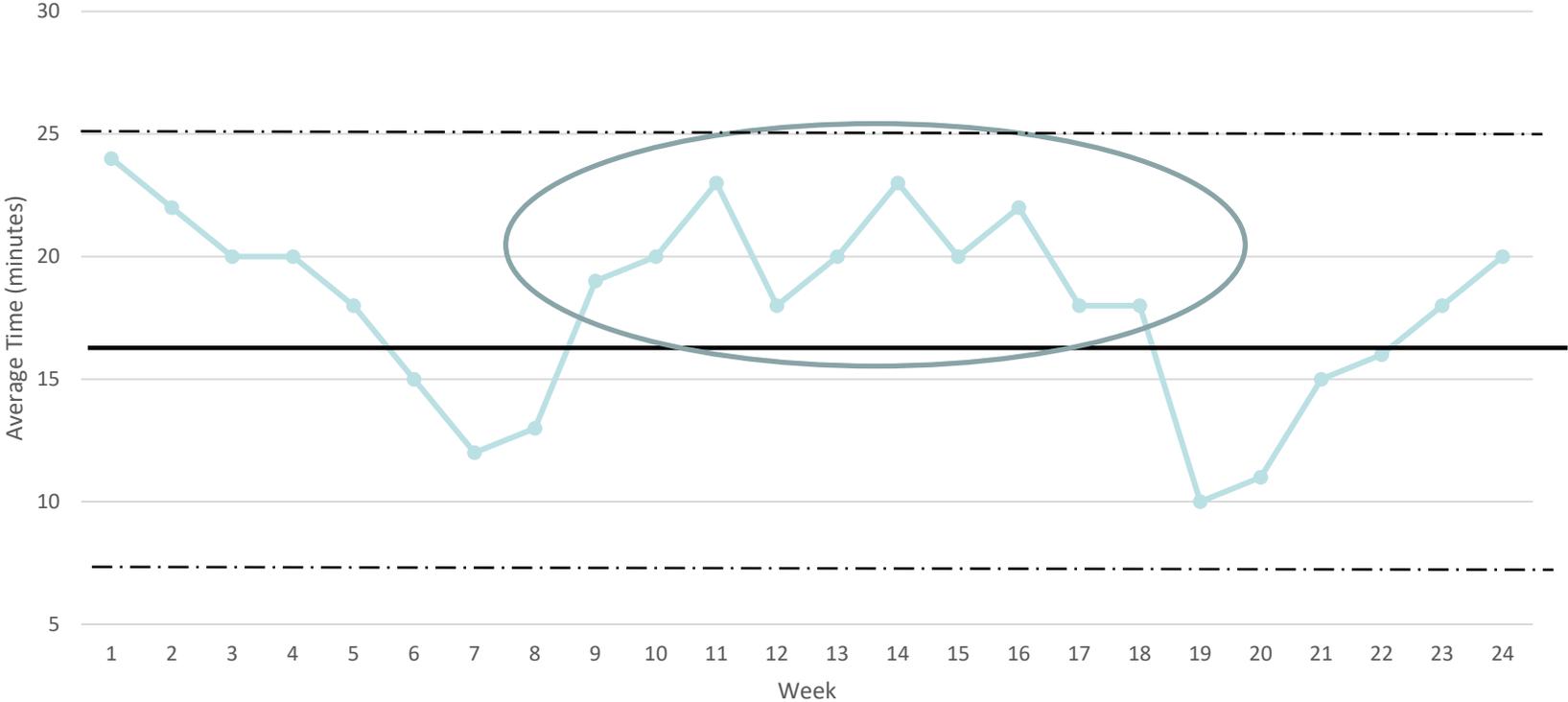
When a single point is outside the control limits.

Average Time (minutes)



Rule # 2

Example for Rule 2

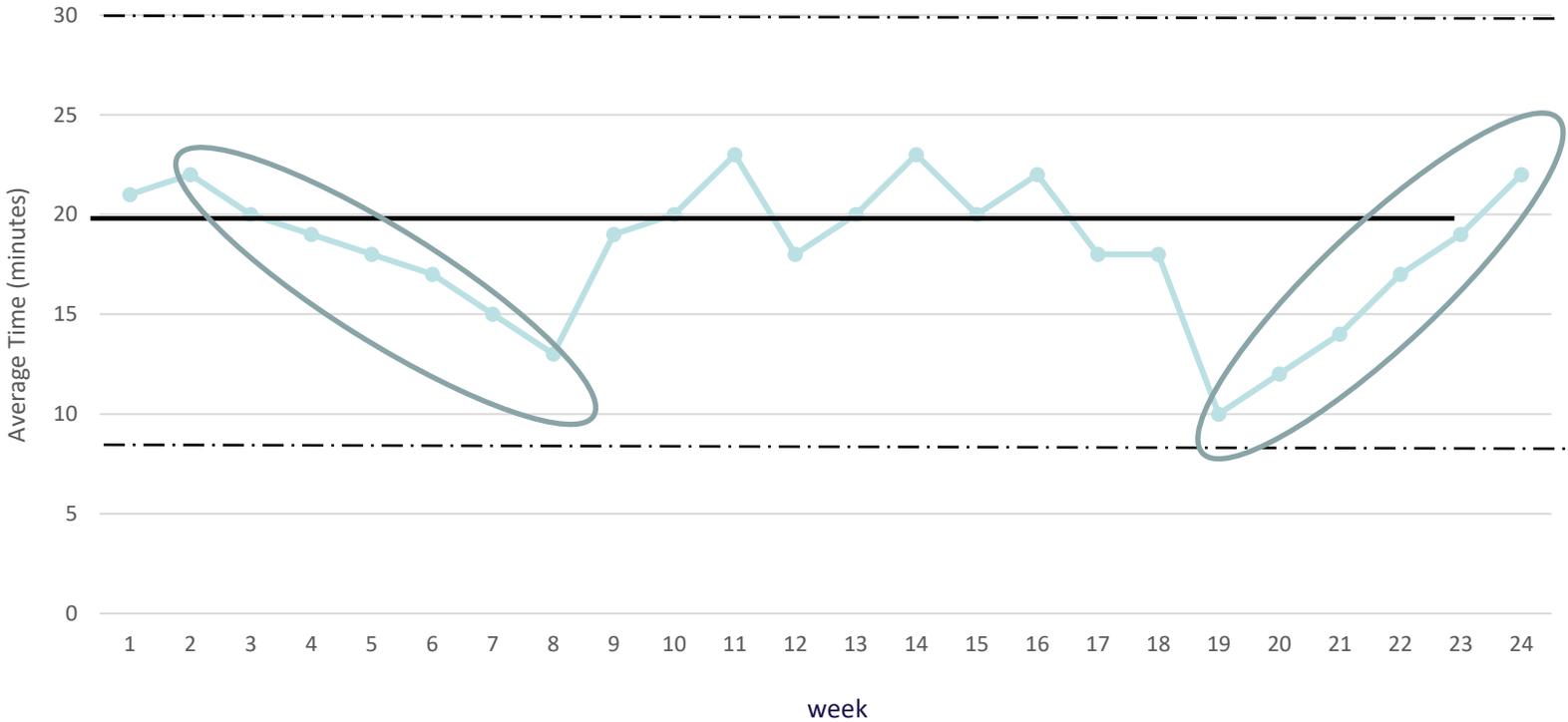


A run of eight or more points in a row above or below the center line defines special cause variation.

Average Time (minutes)

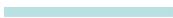
Rule # 3

Example of Rule Three



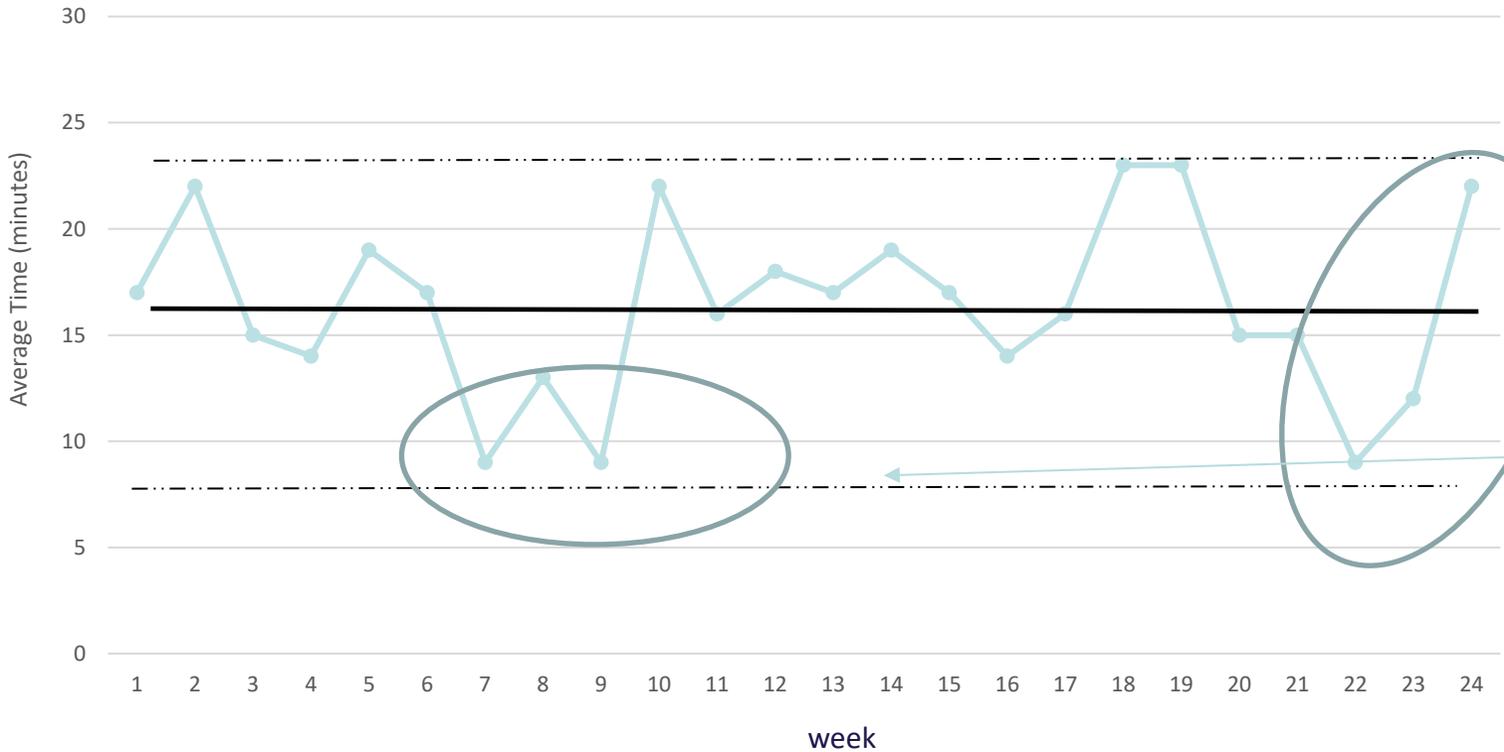
Six consecutive points increasing or decreasing.

Average Time (minutes)



Rule # 4

Example of Rule 4



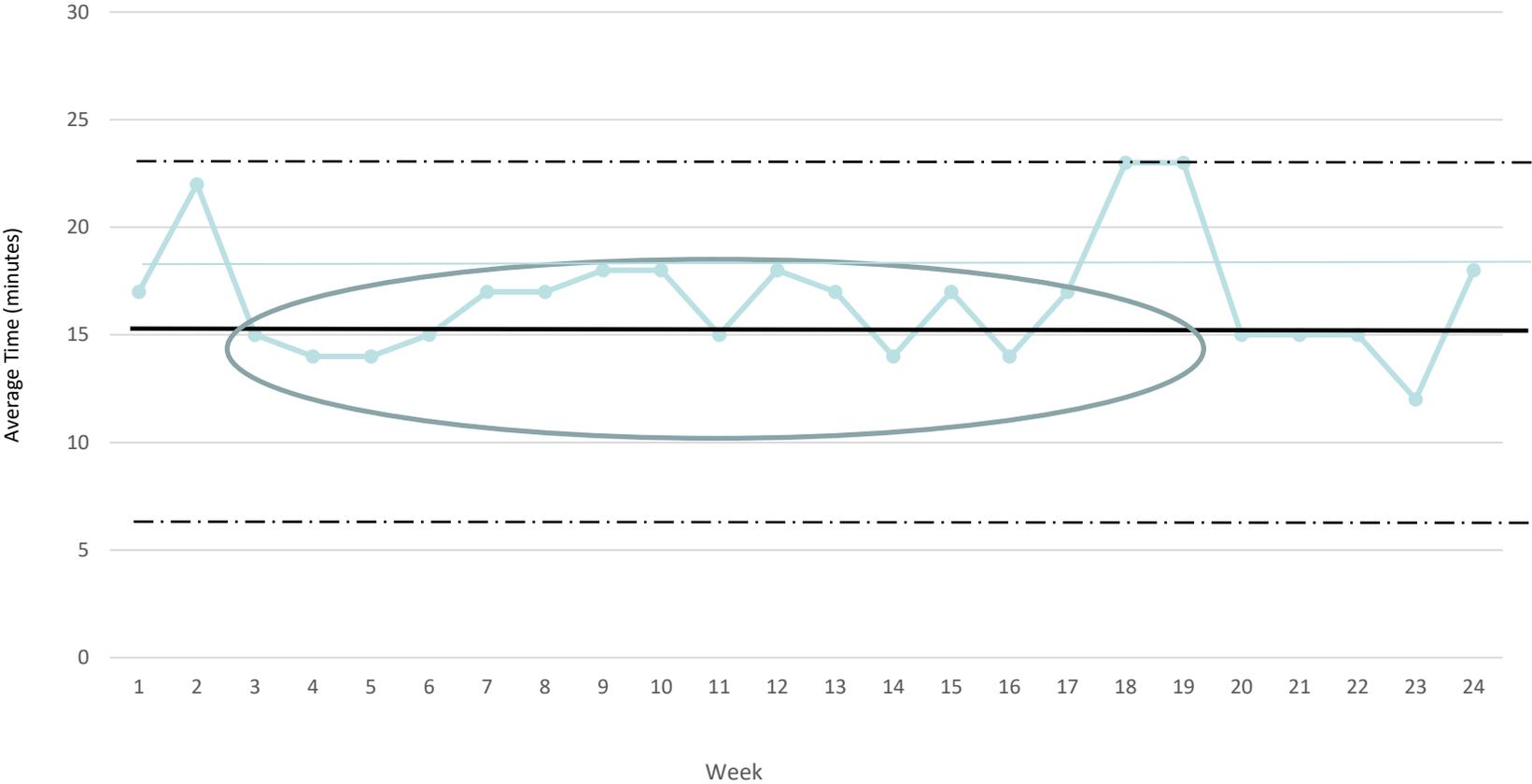
Near the outer one-third of the center line

Two out of three consecutive points near the outer one third of a control limit define a special cause variation.

Average Time (minutes)

Rule # 5

Example of Rule 5



Fifteen consecutive points close (inner one- third of the chart) to the centerline.

Average Time (minutes)



Case Study

A healthcare provider team at young adult and adolescent clinic:

- Inconsistent rates of rectal sexual transmitted infection (STI) testing for at-risk patients;
- Staff believe patients refuse rectal diagnostic tests.

The Model for Improvement

> Planning Phase

- > Aim Statement
- > Measure [Outcome & Process]
- > Develop a hypothesis for change ideas to test

> Implementation Phase

- > Test the Change

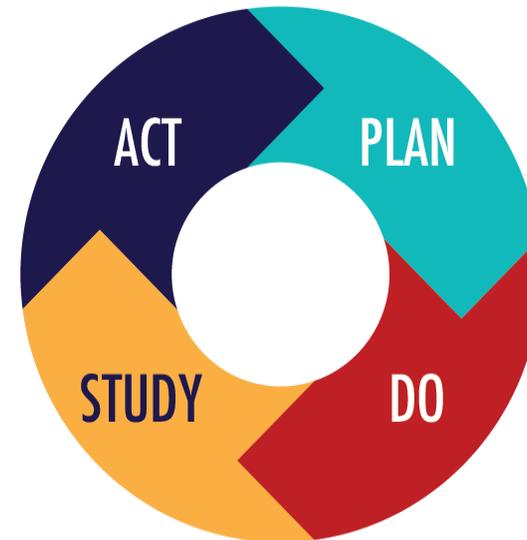
Planning Phase

What are we trying to accomplish?

How will we know that a change is an improvement?

What change can we make that will result in improvement?

Implementing Phase



Aim & Measure

Aim

- Increase rectal STI testing rates for at-risk patients from 38% to 85 % by Q4 2025.

Measure

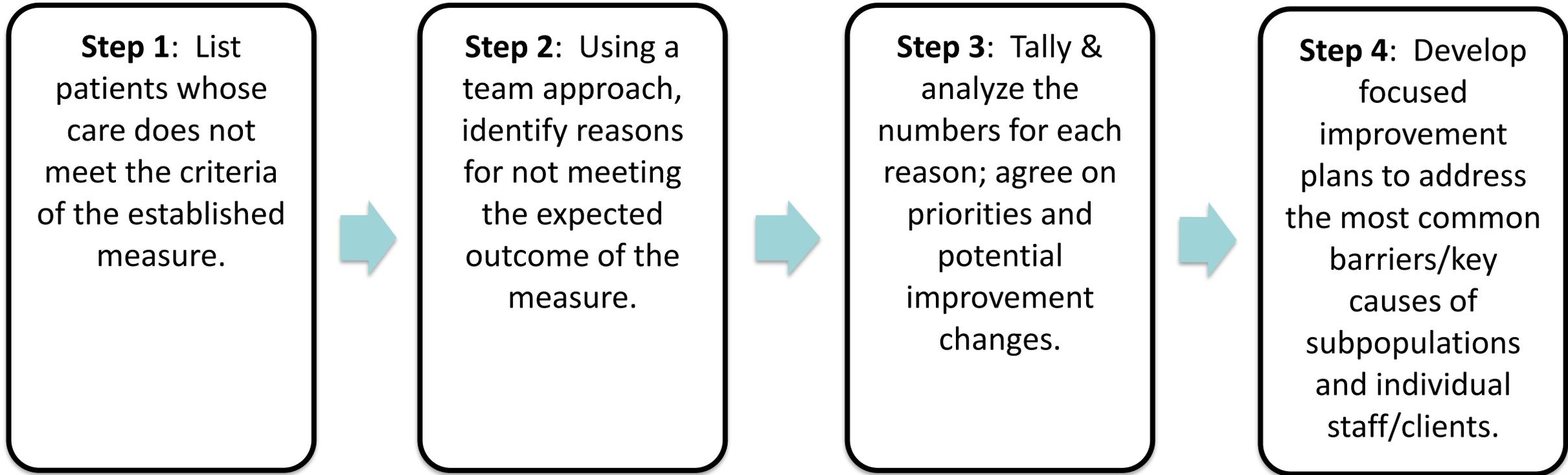
- **Percentage of at-risk patients who receive rectal STI testing during clinic visits.**

Tool: Drill Down Data to Identify Variation

Drilling down data is a process of analyzing patient care data in increasing detail to understand with which patients' desired outcomes are being achieved and which are not.



How Do You Drill Down Data?



What Variations Do You Observe?

Patient	Age	Eligible?	Test Offered?	Test Completed?	Provider
P1	24	Yes	Yes	Yes	Miller
P2	20	Yes	No	No	Smith
P3	21	Yes	Yes	No	Miller
P4	24	No	–	–	Miller
P5	19	Yes	No	No	Smith
P6	18	Yes	Yes	Yes	Miller
P7	22	Yes	No	No	Smith
P8	21	Yes	Yes	No	Miller
P9	20	Yes	No	No	Smith



Can You Identify Any Possible Sources of Variation?

Patient	Age	Eligible?	Test Offered?	Test Completed?	Provider
P1	24	Yes	Yes	Yes	Miller
P2	20	Yes	No	No	Smith
P3	21	Yes	Yes	No	Miller
P4	24	No	–	–	Miller
P5	19	Yes	No	No	Smith
P6	18	Yes	Yes	Yes	Miller
P7	22	Yes	No	No	Smith
P8	21	Yes	Yes	No	Miller
P9	20	Yes	No	Yes	Smith



Findings

Overall Testing Rates

Eligible Patients: 8/9 (P4 was ineligible)

Test Offered: 4/8 (50%)

Test Completed: 3/8 (38%)

Provider	Eligible	Offered	Completed	Offer Rate	Completion Rate
Miller	5	4	2	80%	50% (of offered)
Smith	3	0	0	0%	0%

What could be some possibilities why there is provider variation?

What could be some possibilities why the tests that were ordered, were not completed?

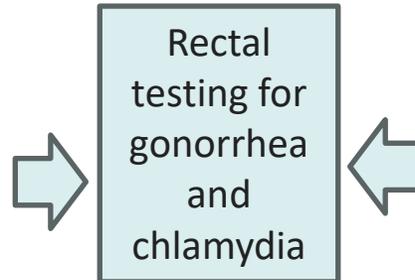
What quality improvement tools would you use to investigate the problem?

Force Field Analysis:

What are the driving and restraining forces to a change idea

Driving for Forces

- Epidemiology supports increase of rectal gonorrhea and chlamydia testing
- High level of acceptability among patients for rectal self-swabbing over traditional provider administered swab
- Provider preference of having patients perform self-swabbing versus administering rectal swab on patient
- Reliability of self-rectal swab testing methods have been validated in numerous settings
- Opt-out STI testing as a norm is easy to implement
- Testing easy to accomplish when patients come to clinic for quarterly labs



Restraining Forces

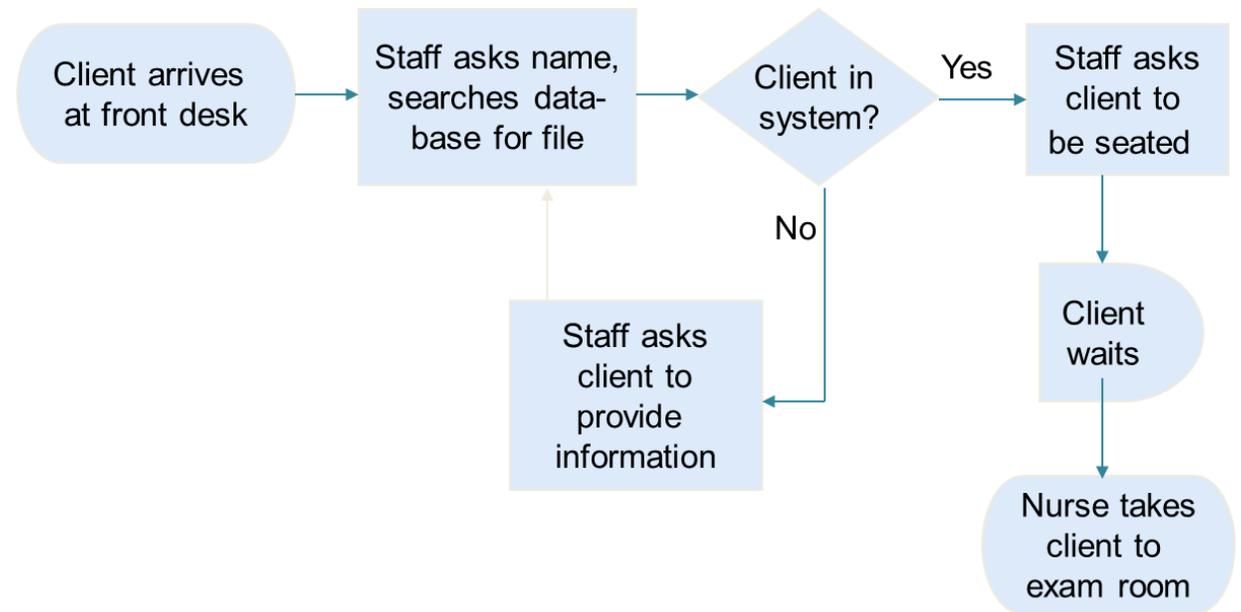
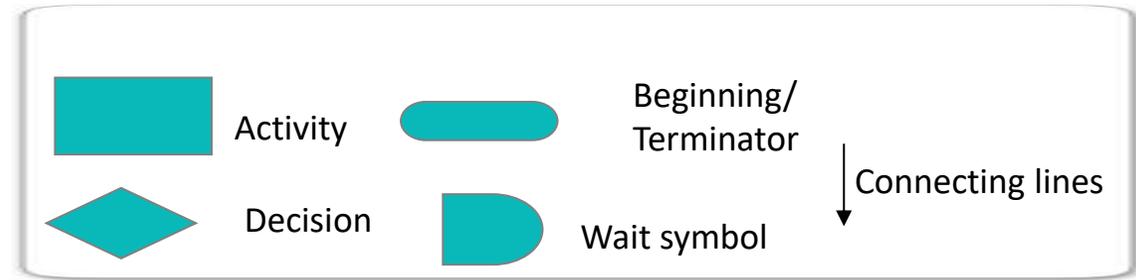
- Some providers assumed patients were not having anal sex
- Some providers are not comfortable discussing anal sex or offering rectal gonorrhea/chlamydia test
- Patient reluctance to discuss certain sexual behaviors with providers
- Provider reluctance to administer rectal self-swabbing
- Patient reluctance to have rectal swab performed by the provider

Use Flowchart to Identify Variation in Clinic Flow

Identify opportunities for improvement that exist in current systems and processes:

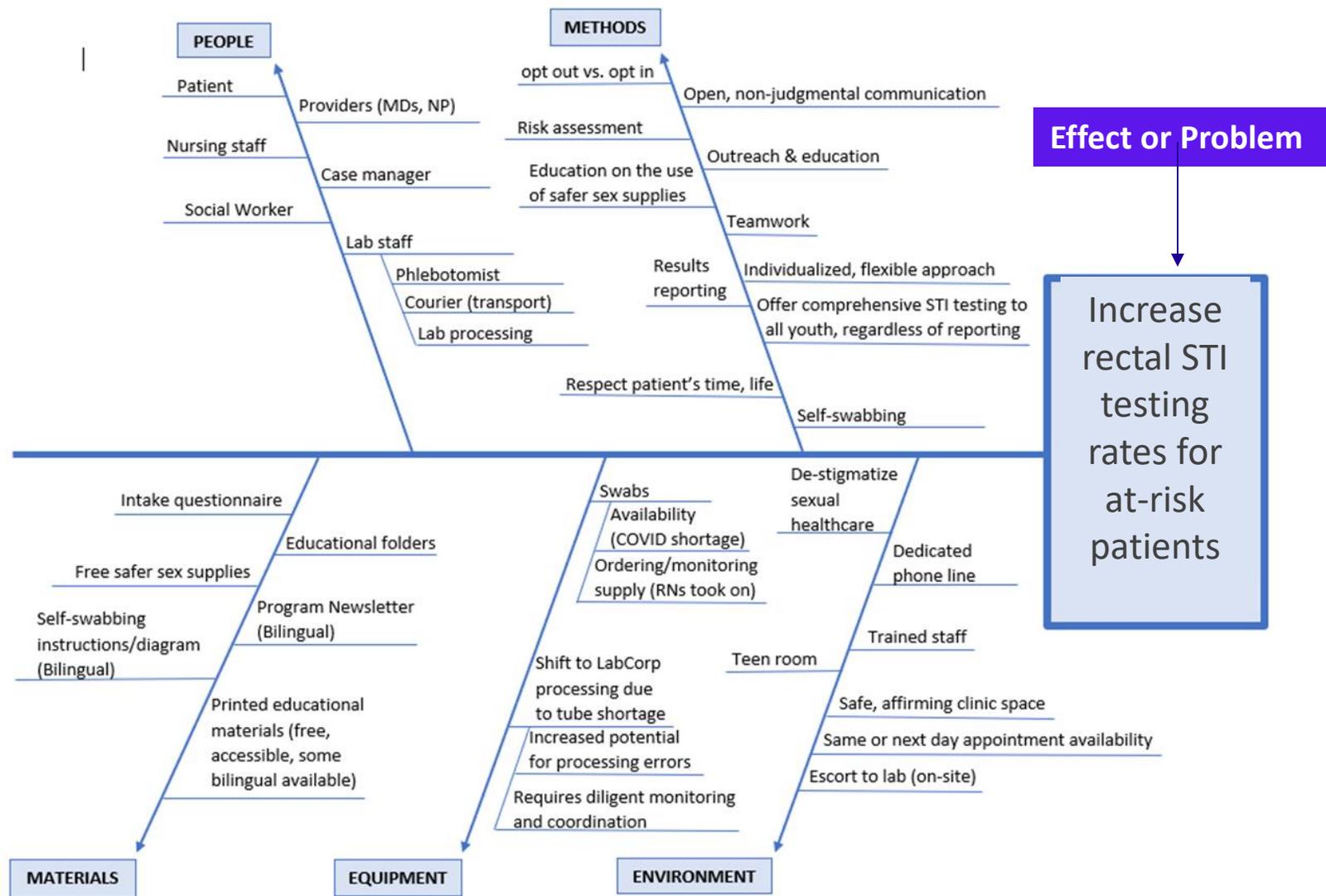
- Points where breakdowns occur
- Missed a step
- “Work-a-rounds” that have been developed
- Variation that occurs
- Duplicate or unnecessary steps

Common Flow Chart Tools



Cause and Effect and Fishbone Bone

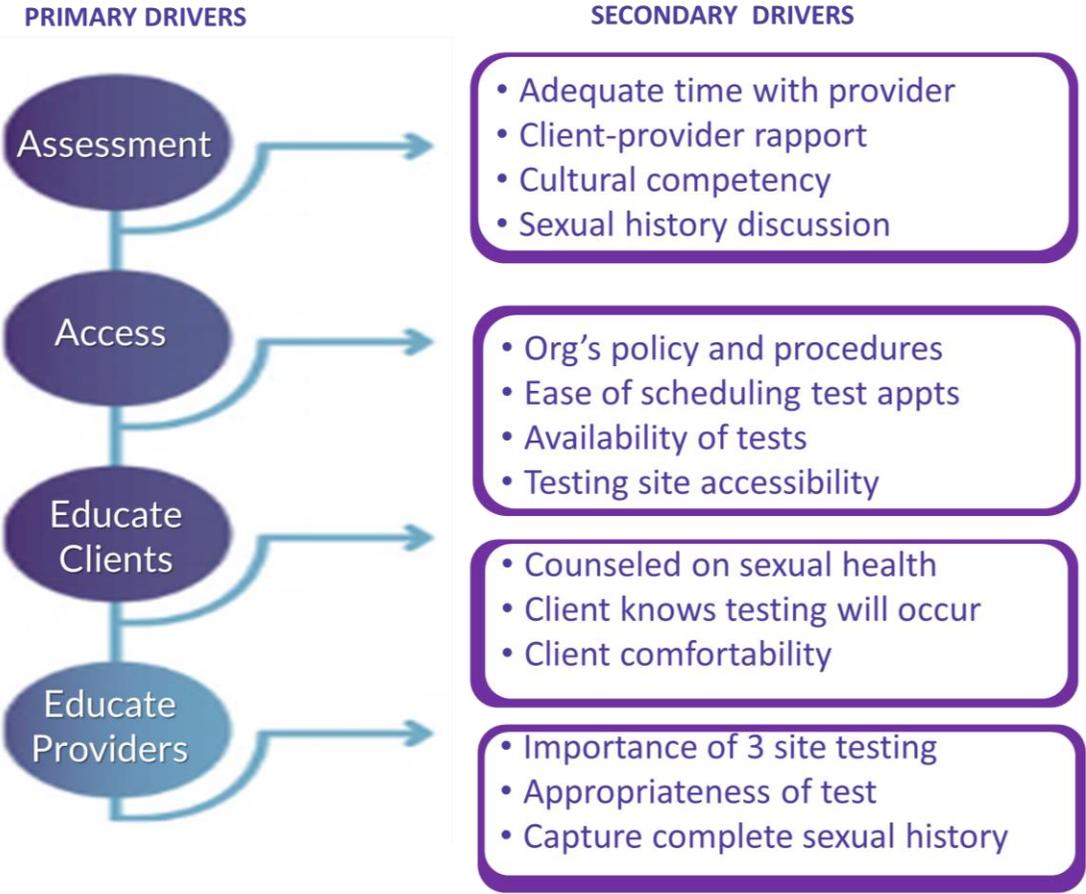
Use Fishbone/Cause and Effect Diagram with 5 Whys to brainstorm reasons why there are variations in processes or outcomes



Construct a Driver Diagram

REDUCE VARIATION
Standardization
Streamline
Capacity Building

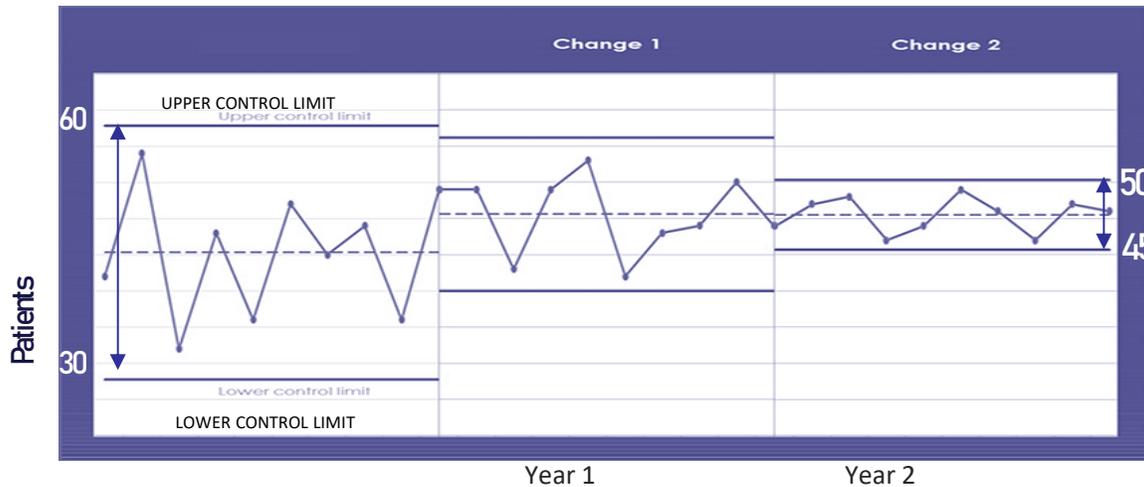
PRIMARY OUTCOME
Increase rectal STI testing rates for at-risk patients from 38% to 85 % by Q4 2025



- Change Ideas**
- Opt-out testing
 - Improve workflow: 3-site testing in electronic medical record (EMR)
 - Counsel all clients
 - Rectal Test Swab
 - Provider education to provide unbiased STI screening
 - Sex-positive environment
 - Rectal self-swab to improve comfortability for patients

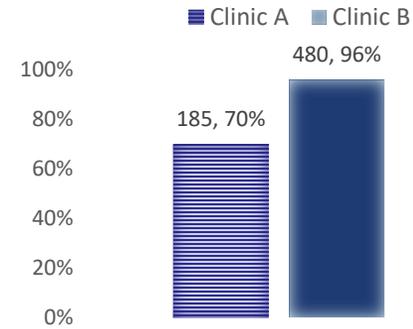
Rectal STI Testing at Clinic Example

RECTAL STI TESTING AT CLINIC

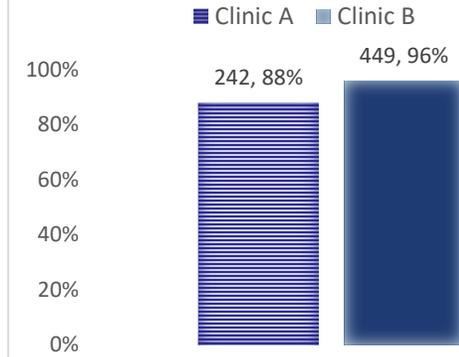


Variation reduced over time

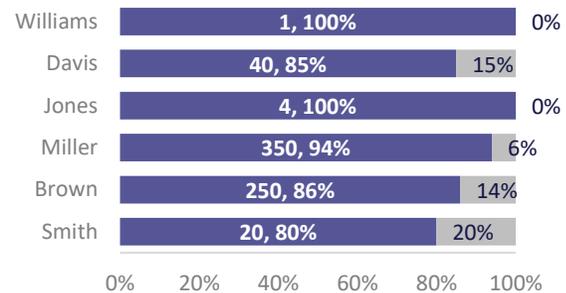
YEAR 1 RECTAL STI TESTING BY CLINIC



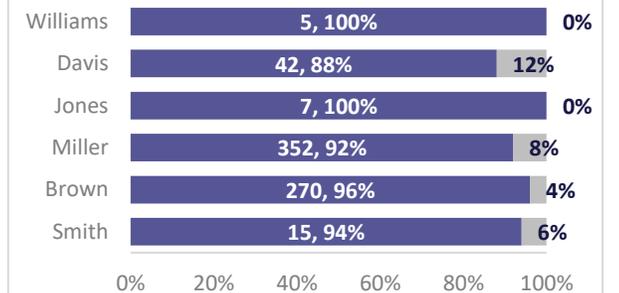
YEAR 2 RECTAL STI TESTING BY CLINIC



YEAR 1 RECTAL STI TESTING BY PROVIDER



YEAR 2 RECTAL STI TESTING BY PROVIDER

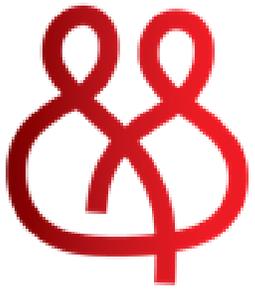


Summary

- Processes have inherent variations categorized as common cause and special cause variations.
- Variation can be either good or bad; it is important to determine the type of variation you have in your process under investigation.
- Unwanted variation provides an opportunity for improvement.
- Data analysis, Force Field Analysis, Flow charts, Cause and Effect Diagrams are useful tools to examine processes that yield unwanted variation.
- Run charts are an effective way of determining variation; for a more structured approach, the use of a control chart might be warranted.

Questions





HRSA Ryan White HIV/AIDS Program

**CENTER FOR QUALITY
IMPROVEMENT & INNOVATION**

Thank You!

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