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QI 101: Jumpstart Your Scholarly Improvement Project

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Disclosures / COI

We have no disclosures to report

Who Are You?

Experience you've had with QI & Patient Safety

Dreyfus Level	Description
None	Vague awareness of general QI terms & relevance.
Novice	Incomplete understanding, approaches QI mechanistically, needs supervision to complete.
Advanced Beginner	Working understanding of QI concepts, sees actions as a series of steps, can complete simpler tasks without supervision.
Competent	Good working and background understanding of QI, sees actions in system context, able to complete QI work independently.
Proficient	Deep understanding of QI, sees actions holistically, can achieve a high standard routinely.
Expert	Authoritative/deep holistic understanding of QI, deals with routine matters intuitively, goes beyond existing interpretations, achieves excellence with ease.

Objectives

1. Participants will be able to devise their own SMARTIE AIM statement for their QI project

2. Participants will be able to develop outcome, process and balancing measures for their QI project

3. Participants will be able to utilize Key Driver Diagrams, Fishbone Diagrams, Process Maps, and Pareto Charts for their projects

	LENGTH	START	TOPIC or ACTIVITY
Part 1 ~90 min	10 m	9:25 am	Basic Concepts & Aims
	15 m	9:35 am	Exercise 1: Aims
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		12:35 pm	**Lunch**

BASIC QI CONCEPTS

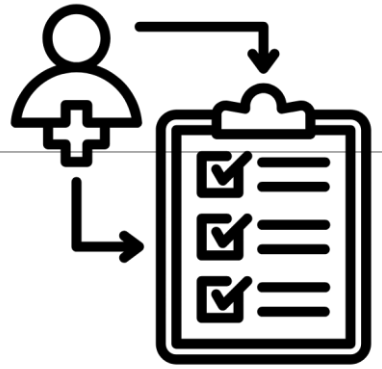
What Is Quality Improvement?

What comes to your mind
when you hear the words
“quality improvement”?

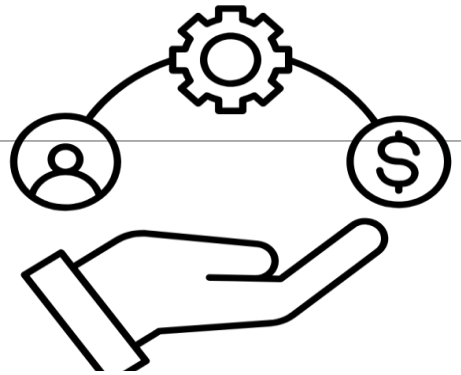
Quality Improvement vs Research vs Quality Assurance

QI is a logical, systematic & data guided approach to continuous improvement that helps to standardize processes & structures to reduce variations, achieve predictable results & improve outcomes for patients, healthcare systems & organizations.

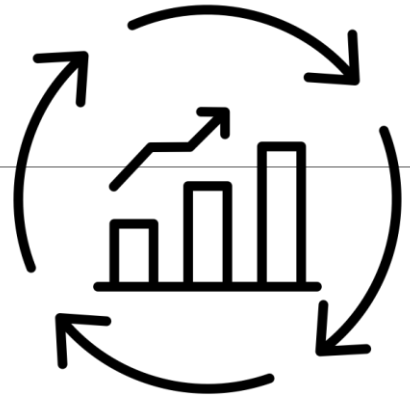
Importance of QI



Improved patient outcomes



Optimal resource utilization



Continuous improvement

Enhanced patient experience

Staff empowerment

Institutional reputation

Why is quality improvement important to you?

YOU CAN MAKE AN ACADEMIC CAREER OUT OF QI

Diagnostic Errors in Primary Care Pediatrics: Project RedDE

Michael L. Rinke, MD, PhD; Hardeep Singh, MD, MPH; Moonseong Heo, PhD; Jason S. Adelman, MS, MD; Heather C. O'Donnell, MS, MD; Steven J. Choi, MD; Amanda Norton, MSW; Ruth E. K. Stein, MD; Tammy M. Brady, MD, PhD; Christoph U. Lehmann, MD; Steven W. Kairys, MD; Elizabeth Rice-Conboy, MS; Keri Thiessen, MEd; David G. Bundy, MD, MPH

Improving Care and Outcomes for Pediatric Musculoskeletal Infections

Gabrielle Z. Hester, MD, MS,[a] Amanda J. Nickel, MPH,[b] David Watson, PhD,[b] Gloria Swanson, MD,[c] Jennifer C. Laine, MD,[d,e] Kelly R. Bergmann, DO, MS[f]

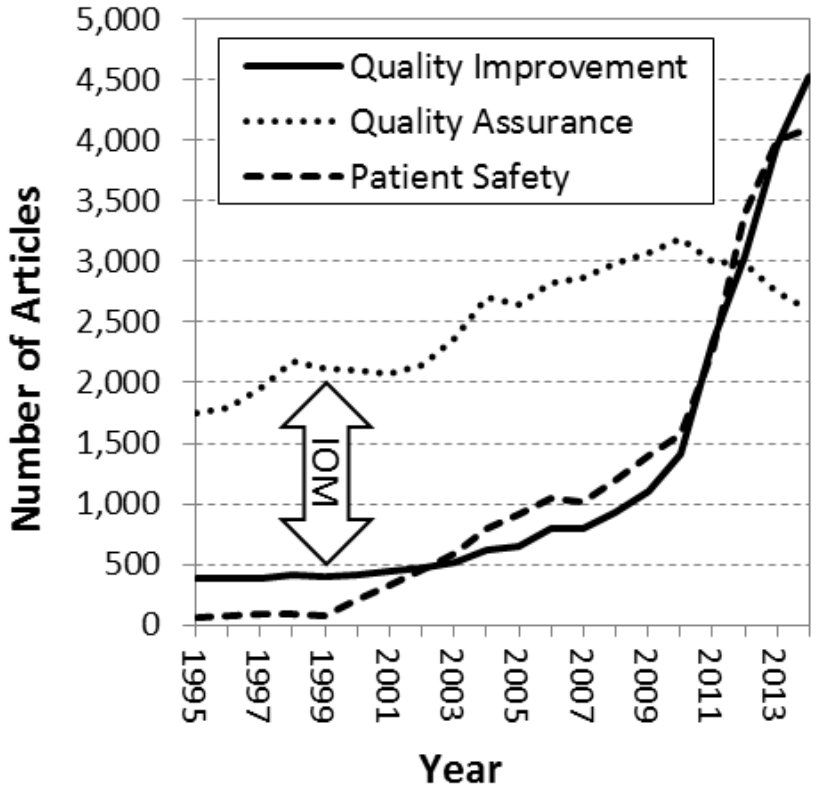
Using web-based technology to improve depression screening in primary care settings

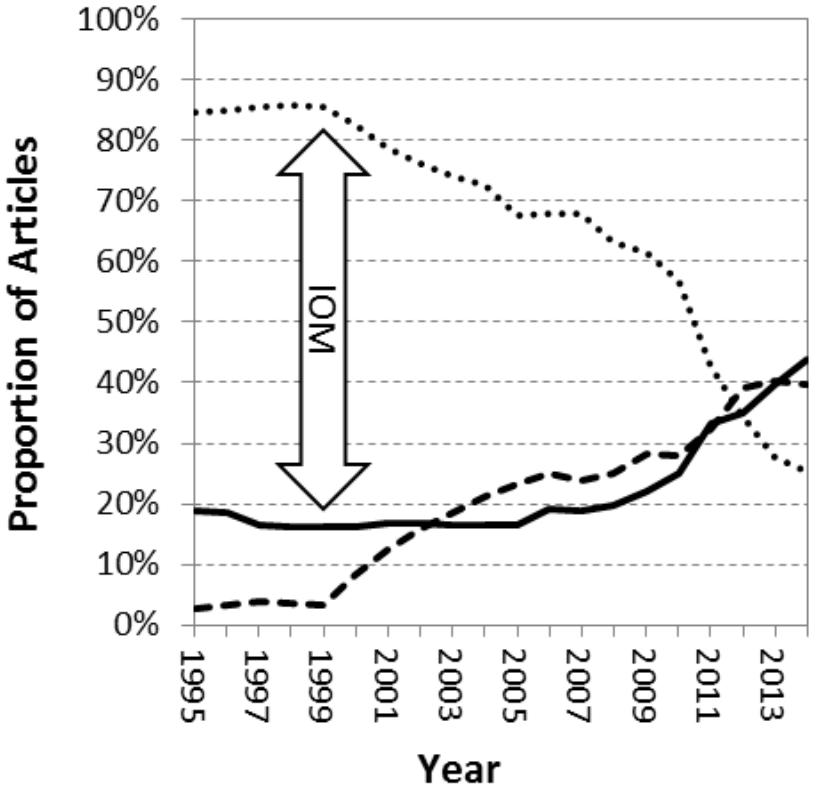
Jessica Jeffrey,[1] Minh-Chau T Do,[1] Nastassia Hajal,[1] Yu-Hsiang Lin,[2] Rachel Linonis,[1] Mark S Grossman,[2] Patricia E Lester[1]

A Quality Improvement Initiative to Improve Postdischarge Antimicrobial Adherence

Sheena Gupta, MD, MBA,[a,b] Britanny Winckler, MD, MBA,[a,b] Michelle A. Lopez, MD, MPH,[a,b] Marco Costilla, BSN, RN, CPN,[b] Jennifer McCarthy, RPh,[b] Jeffrey Wagner, PharmD, MPH, RPh, BCPS,[b] Amanda Broderick, MD,[a] Katherine French, MD,[a] Brittany Le, BSA,[a] Huay-ying Lo, MD[a,b]

QI/PS: It is scholarly, it is a science



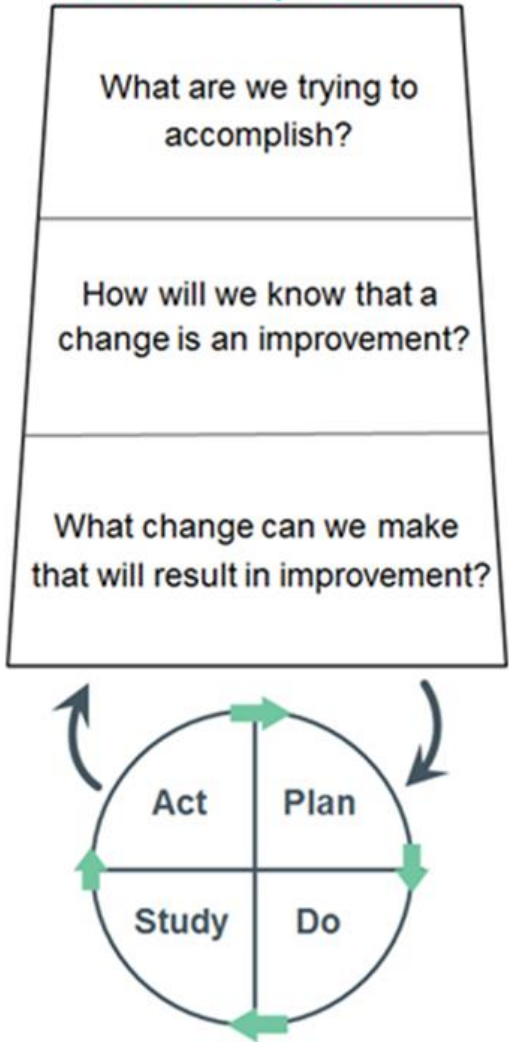


QI Projects can meet Fellowship Scholarly Activity requirements

QI Projects and Publications can meet MOC-4 for Certification

QI Methods

Model for Improvement



Six Sigma (DMAIC)

LEAN

The Model for Improvement – Key Ingredients:

The Right Questions

What Aim? What Measure? What test(s) of change?

Plan-Do-Study-Act (PDSA) Cycles

To test/implement changes in real work settings

Find optimal balance between ideal and practical

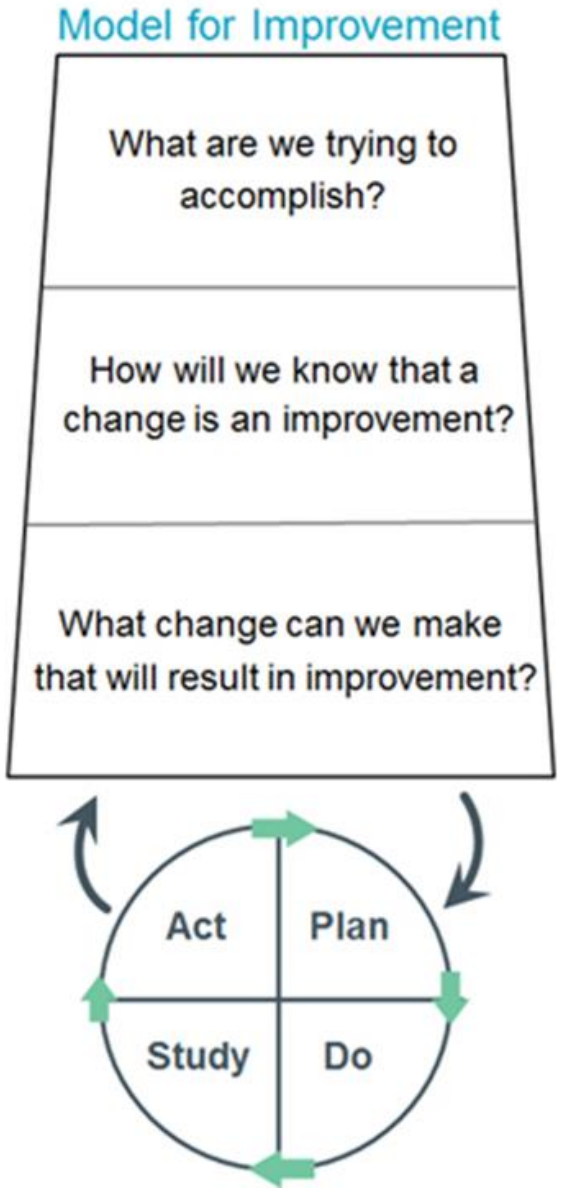
Right People engaged with improvement team

Team leadership, front-line wisdom

Senior leadership & stakeholder support

Highly variable team structures, very local issues

MODEL FOR IMPROVEMENT



Aims

Measures

Ideas

Improvement aims cannot be vague

“Soon is not a time, some is not a number.”

– Don Berwick, MD

“What gets measured, gets managed.”

- Peter Drucker

A written aim is…

- A statement of the accomplishments expected from a team's improvement effort
- A communication tool within a group and between the group & larger system
- A tension-creating reminder to aid in garnering buy in for the project
- Targeted to an Audience (C-suite vs Bedside) and Timeframe (near vs long)

Building your aim statement

S	**Specific** (who?)
M	**Measurable** (what?)
A	**Attainable** (how?)
R	**Relevant** (why?)
T	**Time-bound** (when?)
I	**Inclusion**
E	**Equity**

Style:

- **Succinct:**
  1-3 sentences
  (not paragraphs)
- **Clearly answers:**
  "What are we trying to accomplish?"

Structure of an AIM statement

What?	
For whom?	
By when?	
How much?	
Full statement	

Example AIM statement

What?	Create sustainable strategies to improve asthma prevention across our community
For whom?	10 public elementary schools within the local county
By when?	June 30, 2016
How much?	30 percent of public schools will have staff trained in asthma prevention; 40 percent of public schools will have at least one professional who is trained to provide education to students with asthma and their families; 40 percent of public schools will have programs to outreach to parents to increase awareness of the impact of second-hand smoke.
Full statement	By June 30, 2016, we will create sustainable strategies to improve asthma prevention across our community. Within our target of 10 public elementary schools in the local county, 30 percent will have staff trained in asthma prevention, 40 percent will have at least one professional who is trained to provide education to students with asthma and their families, and 40 percent will have programs to outreach to parents to increase awareness of the impact of second-hand smoke.

More examples

- Increase the number of surgical cases between cases with a surgical site infection by 50 percent within 1 year.

- Achieve > 95 percent compliance with on-time prophylactic antibiotic administration within 1 year.

- Reduce waiting time to see a urologist by 50 percent within 9 months.
- Offer all patients same-day access to their primary care physician within 9 months.

- Reduce ICU mortality by 20 percent within 9 months.

- Reduce incidence of ventilator-associated pneumonia by 25 percent.

Global vs Specific AIM

Global AIM *Overall systems level change you are hoping to create*	To prevent HPV-related disease
Specific AIM(s) *Smaller changes that will contribute to global aim, but focused on a piece within the system*	To increase the percentage of 13-year-old patients with 2 HPV vaccines from 64% to 70% by August 2025

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Exercise 1: Aims

Working in pairs (or triads), write a concise Aim Statement:

Challenge 1: Pediatric clinic underserved urban asthma population

Challenge 2: Pediatric emergency department

If time, e*ach of you write an Aims Statement directed at a Quality/Safety Project of interest to you at your facility.*

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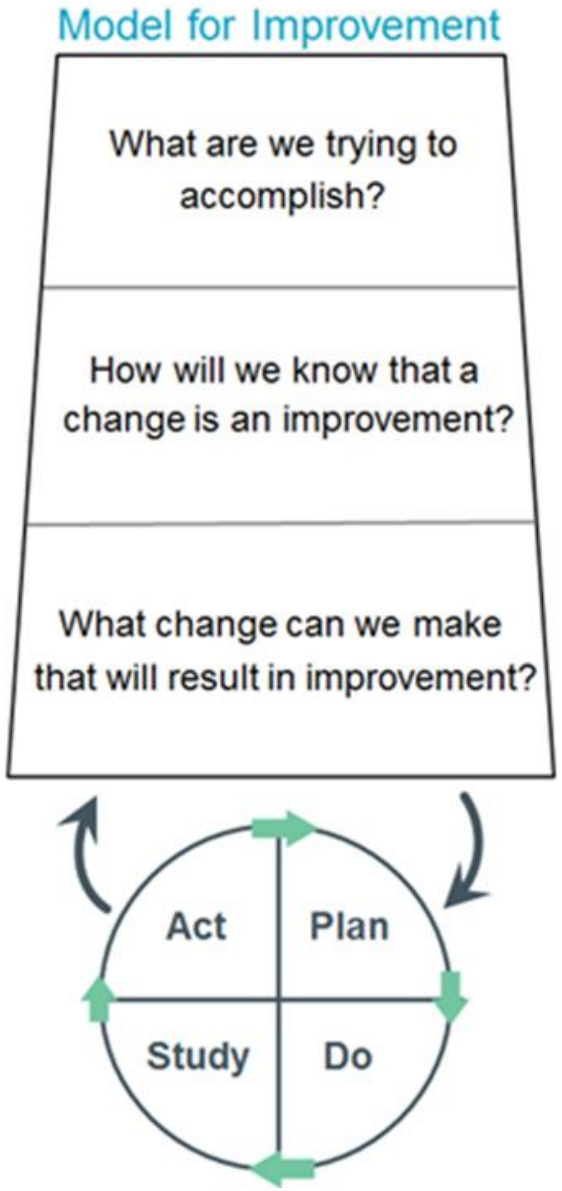
Measuring tape
Steel rule
Calipe
Spirit level
Micrometer
Protract
Mechworlz
Combination swar
Bevel protractor
Ruler
Tape measure
Dial indicator
Carpenter's
Tape measure
Height gauge

QI MEASURES

MODEL FOR IMPROVEMENT



Aims

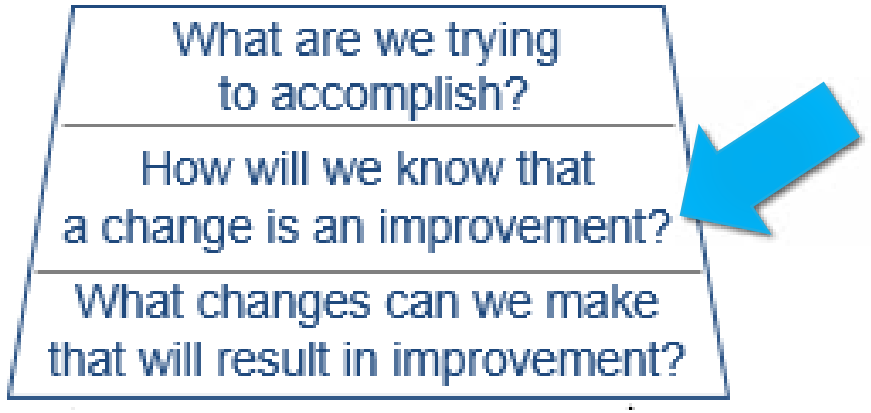
Measures

Ideas

Q2: How will we know if a change is an improvement?

"All improvement is change,

but not all change is an improvement"



Importance of Measurement

- Measures are an indicator of how the system is working at any given time – important feedback
- It shows whether and how changes are working
- All measures have limitations, but the limitations do not negate their value
- The purpose of measurement in improvement work is for ***learning*** not judgment

Purposeful measure selection

Commonly requires a balanced set of 3 to 6 measures

Purposeful measure selection

Commonly requires a balanced set of 3 to 6 measures

Just in case v/s Just enough

Types of Measures

Measure type	Use this to track…	Question answered	Example: (reduce hospital acquired infections)
Outcome measure	Progress toward your aim	How is the system ultimately performing?	Rate of hospital-acquired infections
Process measure	Steps you are taking to achieve the goal	Are the parts/steps in the system performing as planned?	Percentage of time clinicians wash hands before patient encounters
Balancing measure	How your changes may be impacting other parts of the system (unintended consequences)	Are the changes designed to improve one part of the system introducing problems elsewhere?	Cost of materials for handwashing

Measure	What type of measure?
% of PICU patients diagnosed with delirium during their ICU stay	
% of PICU patients screened for delirium	

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% of initial prenatal visits that have maternal country of birth documented	
% of pregnant women who meet defined criteria who undergo prenatal serologic Chagas screening	

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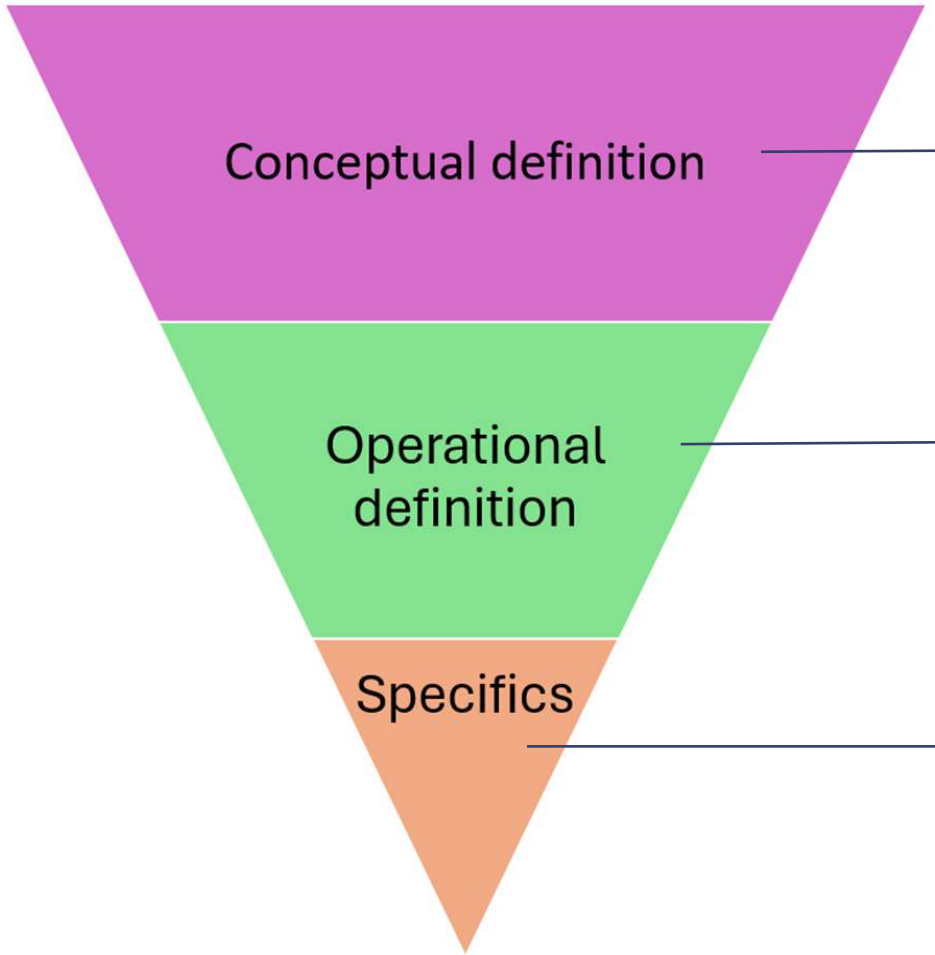
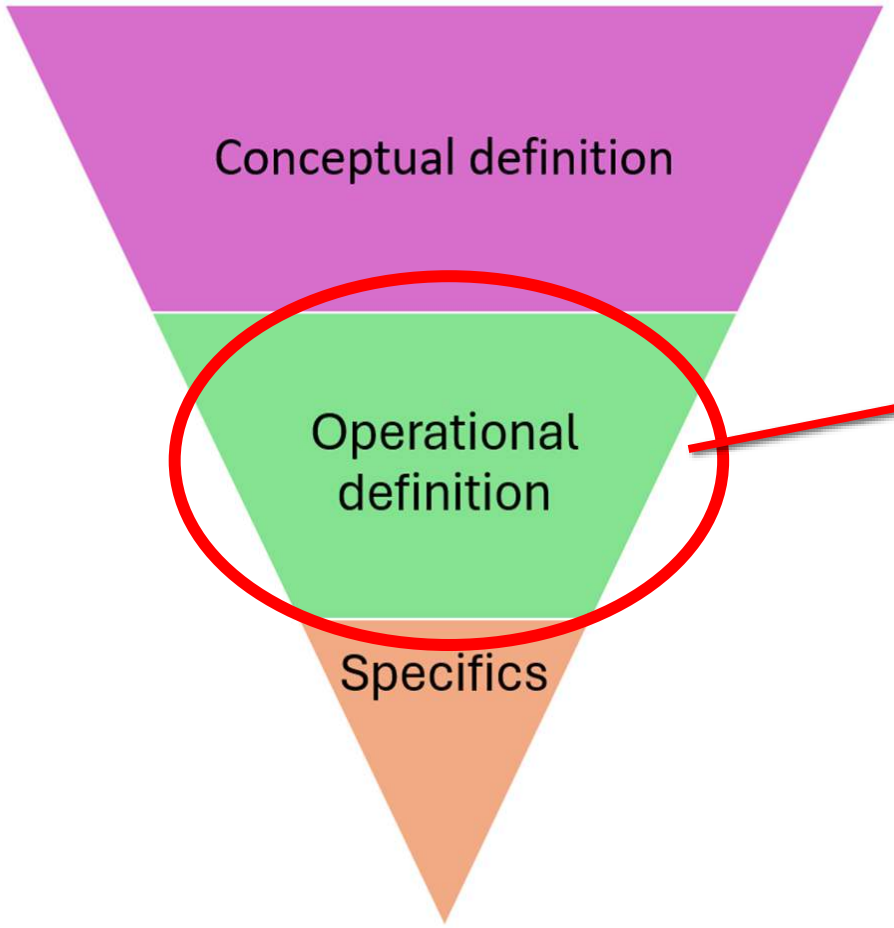
What goes into making of a “Measure”?



What you want to measure?

How will you measure it ?

Who, What, When, Where and How?



Clarity and specificity:

Define Improvement population

Define total population

Measures need a specific numerator and denominator

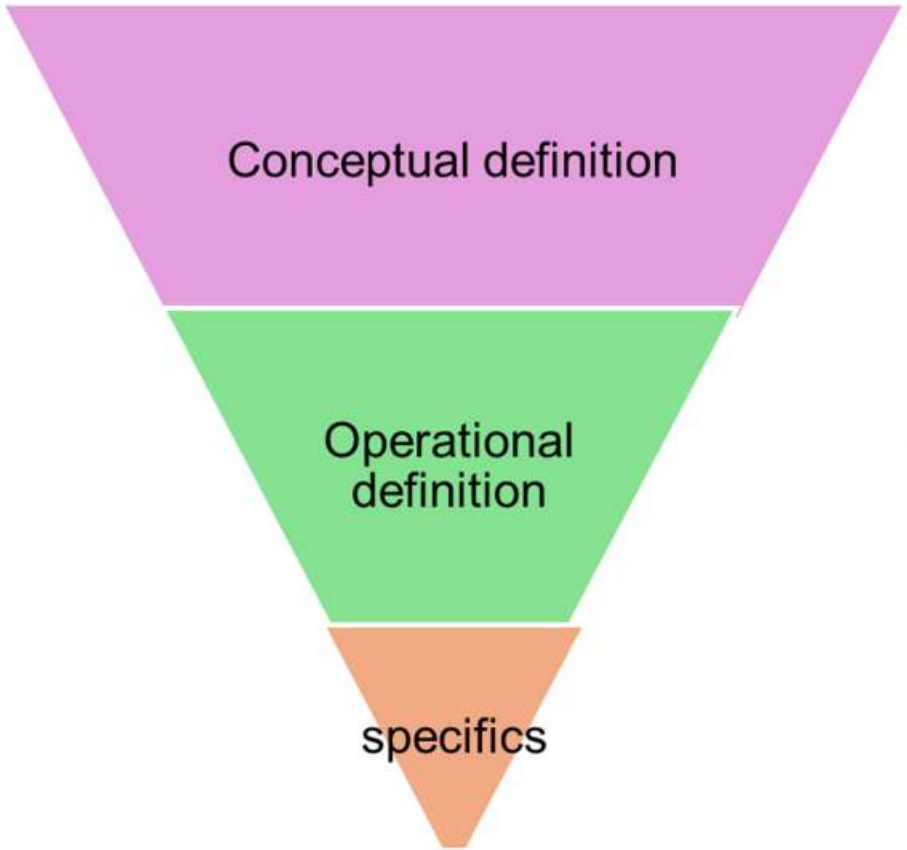
A ‘concept’ is not the same as a ‘measure’.

- Example: % of patients with delayed discharge

What is the problem with the following measures?

- Number of medication errors on our floor per month
- % of 2 year-olds up to date on their vaccines

Defining Measures



Reduced antibiotic duration to 5 days for treating acute cystitis

The number of patients ≥ 3y with acute cystitis discharged from the ED, with 5 day of antibiotics

Total number of patients ≥ 3y with acute cystitis discharged from the ED with antibiotic prescriptions

ED Attending, PEM Fellow, Pediatric ED, EHR, biweekly data collection, Excel sheet

Proportions (percentages) vs Rates

Time to antibiotics in suspected sepsis - percentage

Numerator: Patients with suspected sepsis who receive IV antibiotics within 60 minutes of arrival or recognition in the ED.

Denominator: Total number of patients presenting to the ED with suspected sepsis who received antibiotics

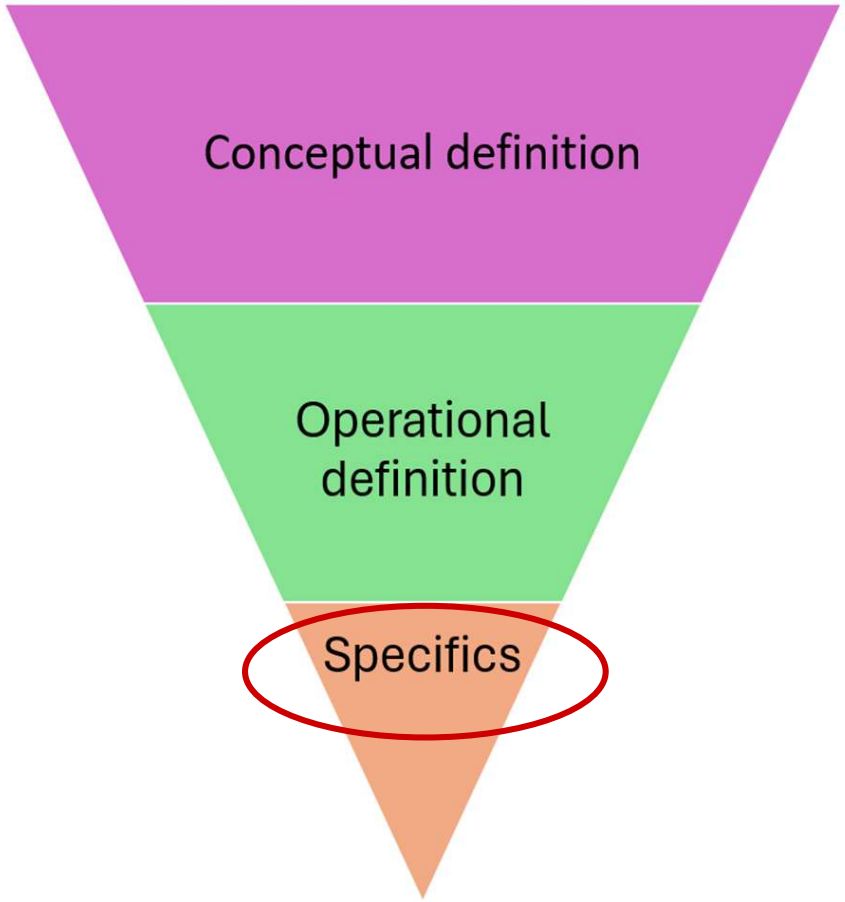
Rate of Central Line associated blood steam infection rate (CLABSI)

Numerator: Number of CLABSI related events

Denominator: Total number of central line associated catheter days

Carefully choose specifics

- Who will collect the data?
- How will the data be tracked?
- What frequency will the data be collected?
- How much data will be collected?
- Data security
- Pilot testing data collection
- Sampling may speed up learning and improvement



Measure Detail	Description	Technical Specifications
Measure Definition	**Numerator**: **Denominator:** **Exclusion criteria –**	**Numerator:** *Please list codes to define numerator. Ex: count of specific antibiotic prescriptions in –– field.* **Denominator:** *All admissions in specified time period (ex: 1/1/2014-12/31/204) ICD codes for PN (primary only or primary and secondary)* **Inclusion criteria:** *ICD codes for PN (primary only or primary and secondary)* **Exclusion criteria:** *All admissions with ICD diagnoses codes for CF*
Stratifiers/Risk Adjustment	How would you like your data grouped. *Ex: stratify all admissions by following age groups* *<5 years old, between 5-10, >5 years old*	Age definition: *Ex: Date of discharge – DOB or Date of admission – DOB?*
Data Collection & Sampling Method		*If chart review, how many sampled? Method used?*
Data Analysis		*How often should data be analyzed. Please specify if results reported by overall BCH, practice, MD*

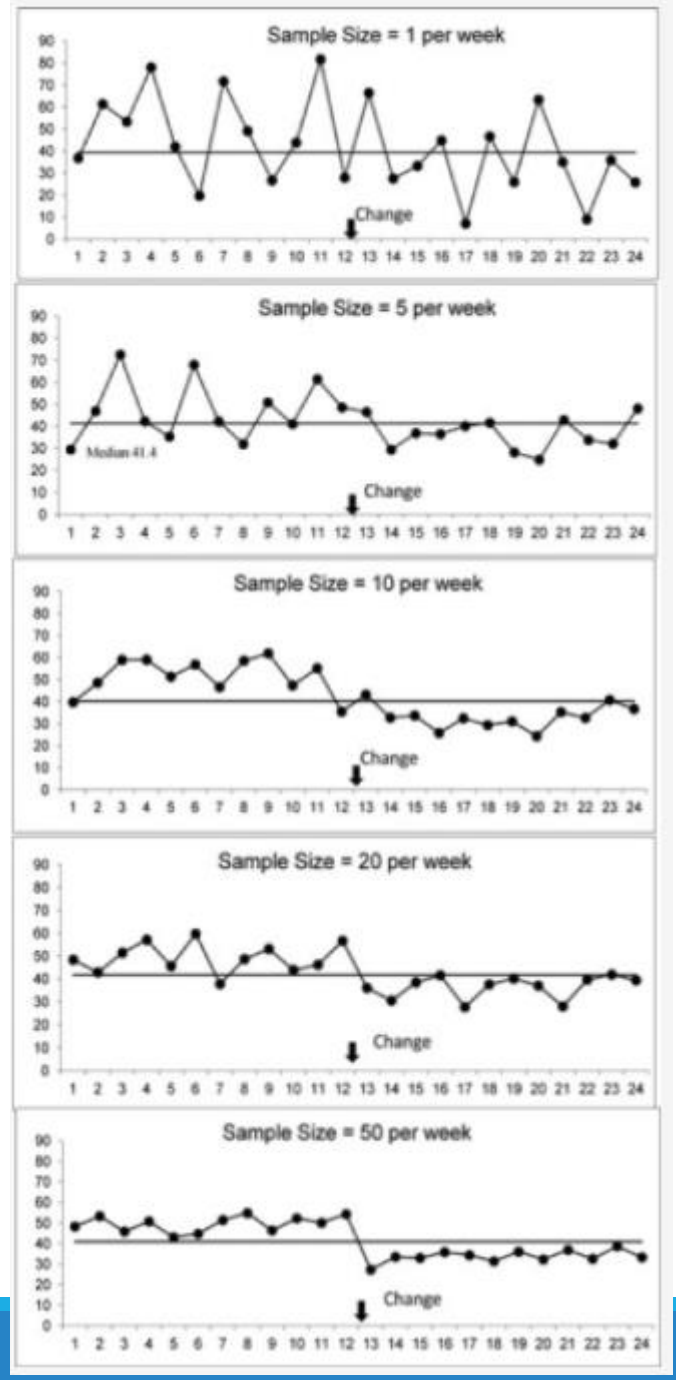
Enough data to make a sensible judgement

(Perla, Provost, Murray, Quality Management in Health Care, 2013)

MINIMUM NUMBER OF DATA POINTS FOR AN EFFECTIVE RUN CHART[a]

Situation	Data Points Required
Expensive tests, complex prototypes, or long periods between available data points, large effects anticipated	<10
Desire to discern patterns indicating improvements that are moderate or large	11-30
The effect of the change is expected to be small relative to the variation in the system	31-100

[a]Adapted from Provost and Murray.[11]



QUALITY IMPROVEMENT REPORT

Improving rates of ferrous sulfate prescription for suspected iron deficiency anaemia in infants

Corinna J Rea,[1,2] Clement Bottino,[1,2] Jenny Chan Yuen,[1] Kathleen Conroy,[1,2] Joanne Cox,[1,2] Alexandra Epee-Bounya,[1,2] Radhika Kamalia,[1] Patricia Meleedy-Rey,[1] Kalpana Pethe,[3,4] Ronald Samuels,[1,2] Pamela Schubert,[1] Amy J Starmer[1,2]

Abstract

Background Iron deficiency anaemia (IDA) in infancy is prevalent and associated with impaired neurodevelopment; however, studies suggest that treatment and follow-up rates are poor.

Objectives To improve the rate of ferrous sulfate prescription for suspected IDA among infants aged 8–13 months to 75% or greater within 24 months.

Methods We implemented a multidisciplinary process improvement effort aimed at standardising treatment for suspected IDA at two academic paediatric primary care clinics. We developed a clinical pathway with screening and treatment recommendations, followed by multiple plan-do-study-act cycles including provider education, targeted reminders when ferrous sulfate was not prescribed and development of standardised procedures for responding to abnormal lab values. We tracked prescription and screening rates using statistical process control charts. In post hoc analyses, we examined rates of haemoglobin (Hgb) recheck and normalisation for the preintervention versus postintervention groups.

Results The prescription rate for suspected IDA increased from 41% to 78% following implementation of the intervention. Common reasons for treatment failure included prescription of a multivitamin instead of ferrous sulfate, and Hgb not flagged as low by the electronic medical record. Screening rates remained stable at 89%. Forty-one per cent of patients with anaemia in the preintervention group had their Hgb rechecked within 6 months, compared with 56% in the postintervention group ($p<0.001$). Furthermore, 30% of patients with anaemia in the postintervention group had normalised their Hgb by 6 months, compared with 20% in the preintervention group ($p<0.05$).

Conclusions A multipronged interdisciplinary quality improvement intervention enabled: (1) development of standardised practices for treating suspected IDA among infants aged 8–13 months, (2) improvement of prescription rates and (3) maintenance of high screening rates. Rates of Hgb recheck and normalisation also increased in the intervention period.

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You've got a good measure when…

- Is related to the aim and linked to key changes
- Is easy to collect
  - Fits into clinical flow (e.g. the billing sheet)
  - Already being collected or available electronically
- Is simple and easy to understand
- Shows improvement quickly (e.g. not a pediatric code)
- **Can be collected regularly (weekly, monthly)**

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Exercise 2: Measures

Working in pairs, identify 2-3 metrics that would help your QI team keep track of and communicate improvement.

Challenge 1: Pediatric asthma clinic

Challenge 2: Pediatric emergency department

If time allows, *identify 2-3 metrics for a problem of interest to you at your facility.*

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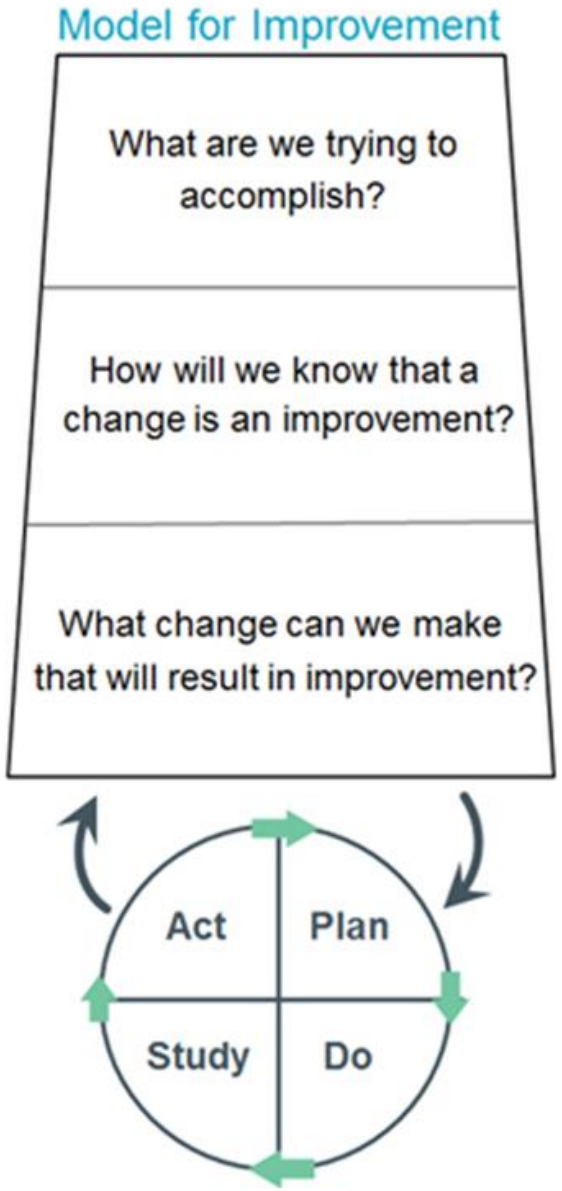
QI DISCOVERY TOOLS

MODEL FOR IMPROVEMENT



Aims

Measures

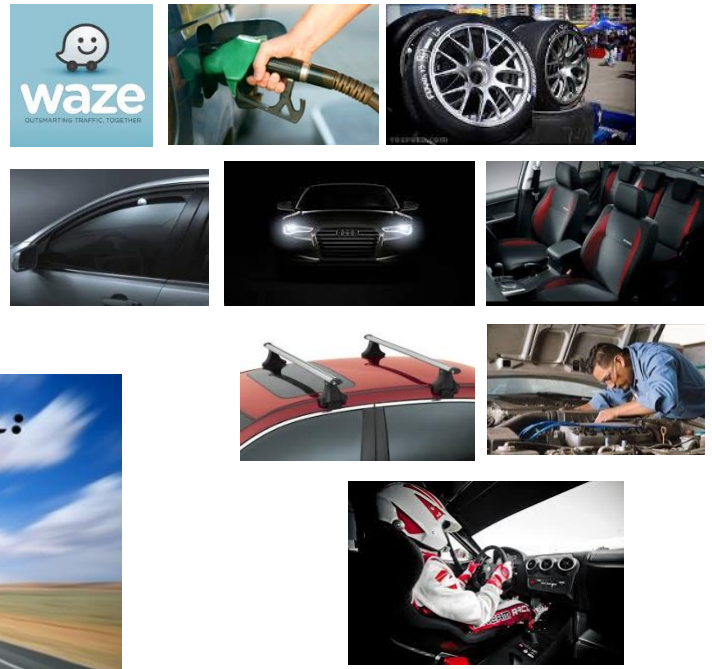
Ideas

Understanding the Big Picture

Improvement Initiative

Gemba walk
KDD
Fishbone diagram
Process map
Spaghetti diagram
Pareto charts
Impact/Effort matrix
5 why's
8 wastes
FMEA
Value stream mapping
5S

Tools



PDSA

5 Discovery Tools:

Key Driver Diagrams
Fishbone Diagrams
5 Whys
Process Mapping
Pareto Charts

5 Discovery Tools:

Key Driver Diagrams

Fishbone Diagrams

5 Whys

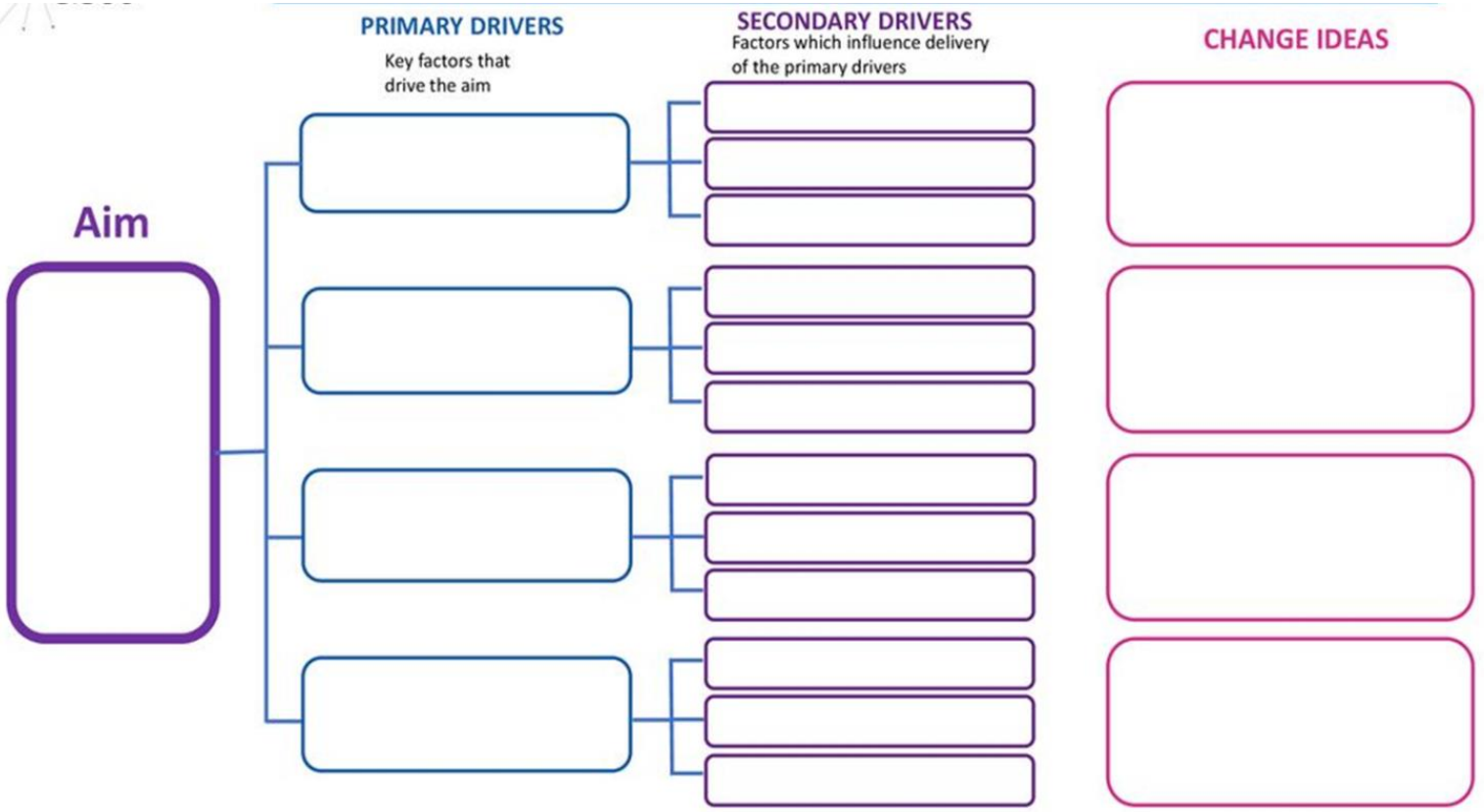
Process Mapping

Pareto Charts

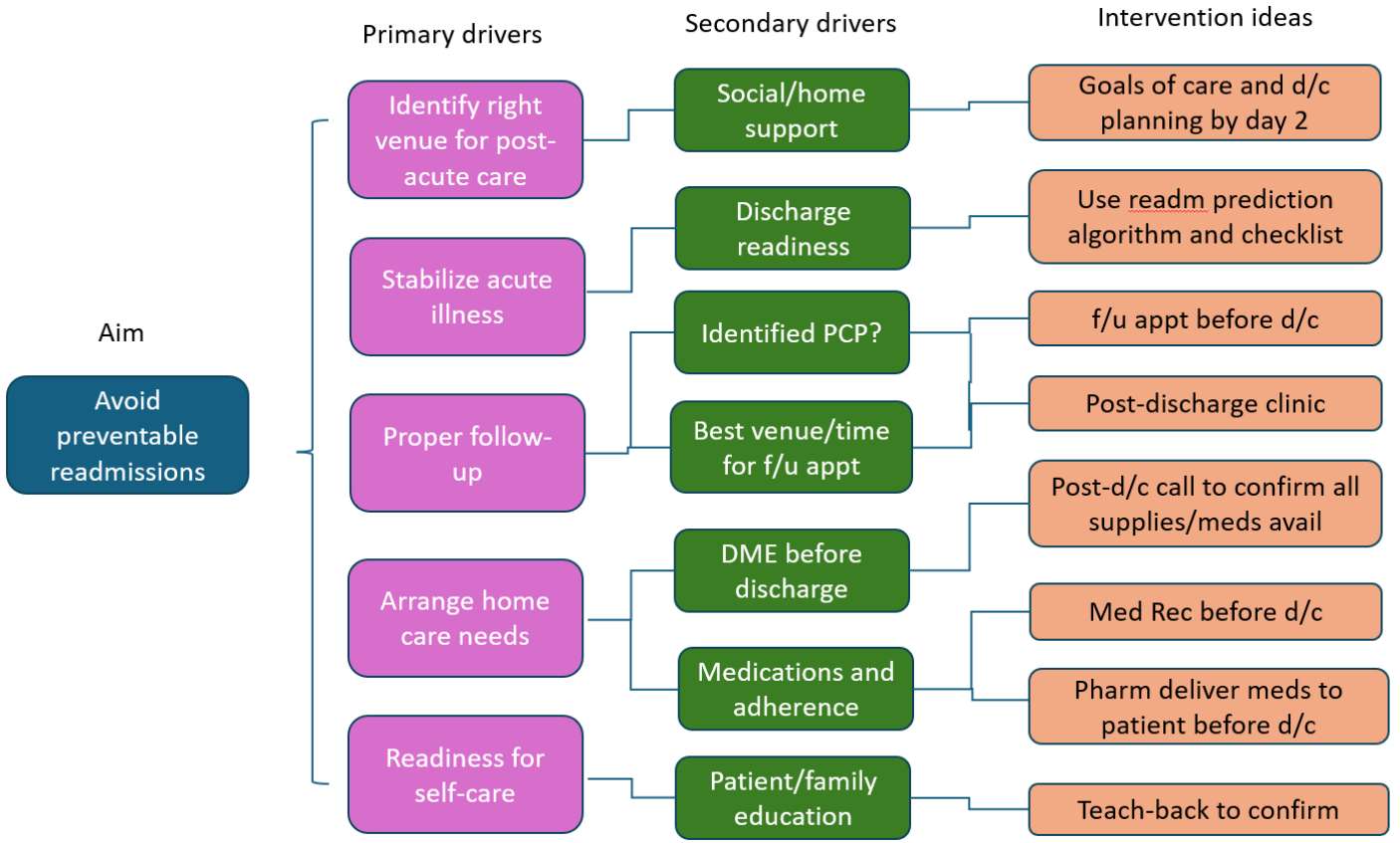
Key Driver Diagrams

- Organizes the Model for Improvement for a specific aim
- Key Drivers: all the factors that contribute to desired outcome
- Identifying key drivers helps focus the selection of changes to be tested
- Frequently used in publishing to describe the approach

Key Driver Diagram



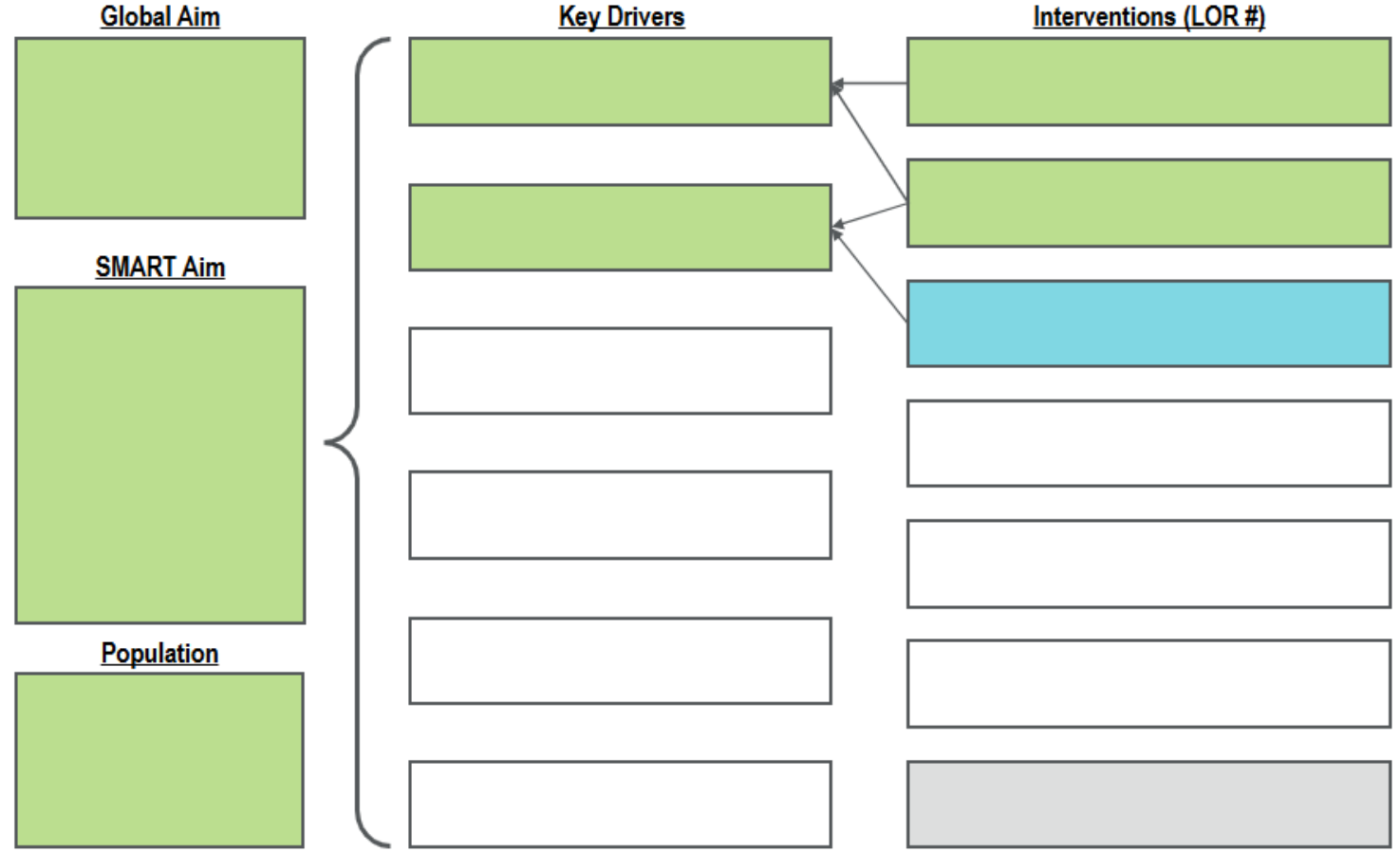
Key Driver Diagram



<Insert Project Name> Key Driver Diagram (KDD)

Revision Date: mm/dd/yyyy (v#)

Project Leader(s):



 Note: *LOR # = Level of Reliability Number, e.g., (LOR 1)*

5 Discovery Tools:

Key Driver Diagrams

Fishbone Diagrams

5 Whys

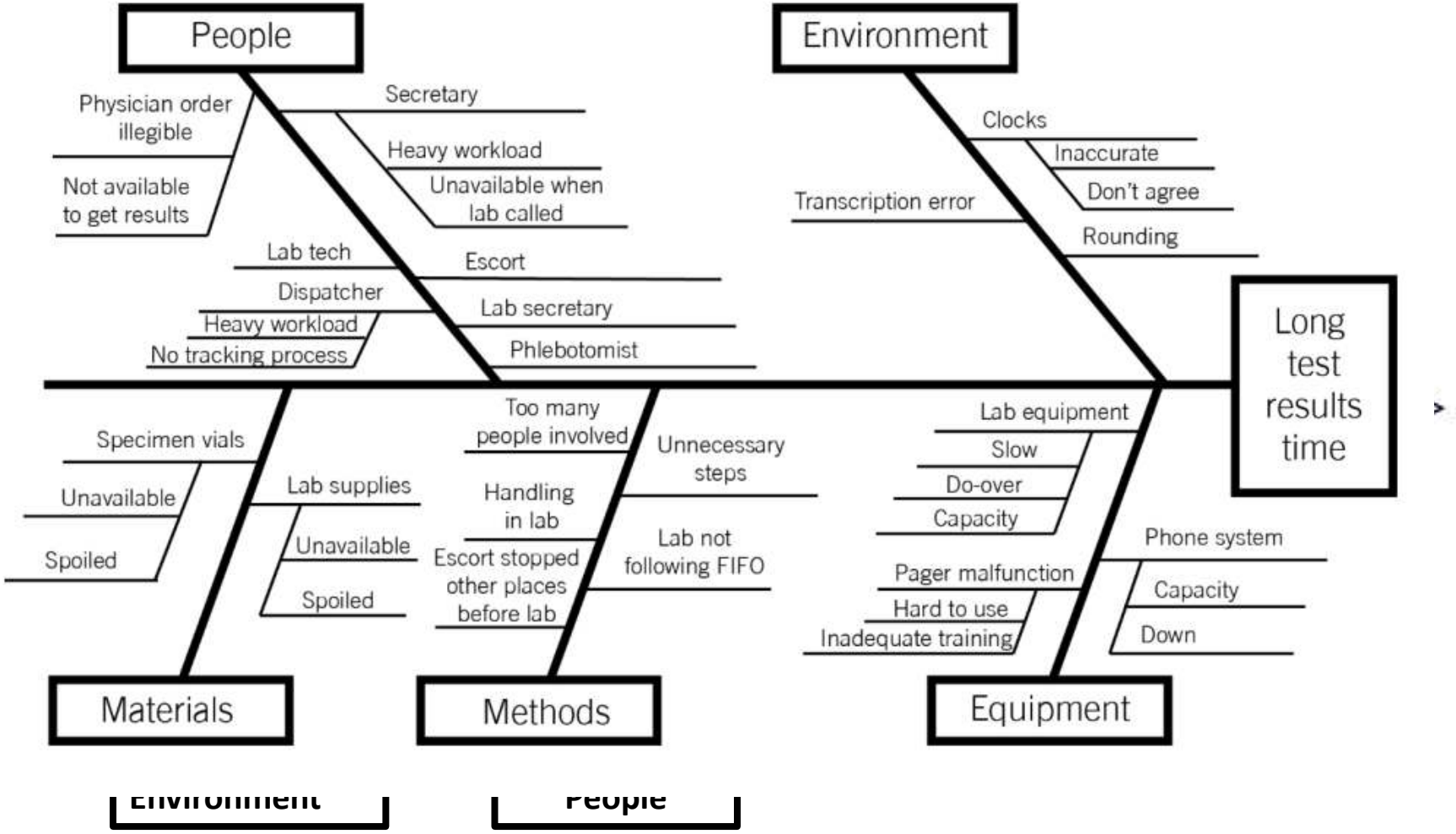
Process Mapping

Pareto Charts

Ishikawa Diagram

- Structured guide for brainstorming
- Organizes cause(s) to a problem into categories
- Helps identify possible causes that may otherwise not be readily noticed
- Allows for drill down to possible solutions
- Avoids tendency to believe all cause-and-effect relationship are simply linear (i.e. 1 dimensional)
- Provides VISUAL context to improvement team
- Use the **6M**'s as a start

The FISHBONE Diagram (*see the 6M categories*)
AKA: Ishikawa Diagram or Cause and Effect Diagram



5 Discovery Tools:

Key Driver Diagrams

Fishbone Diagrams

5 Whys

Process Mapping

Pareto Charts

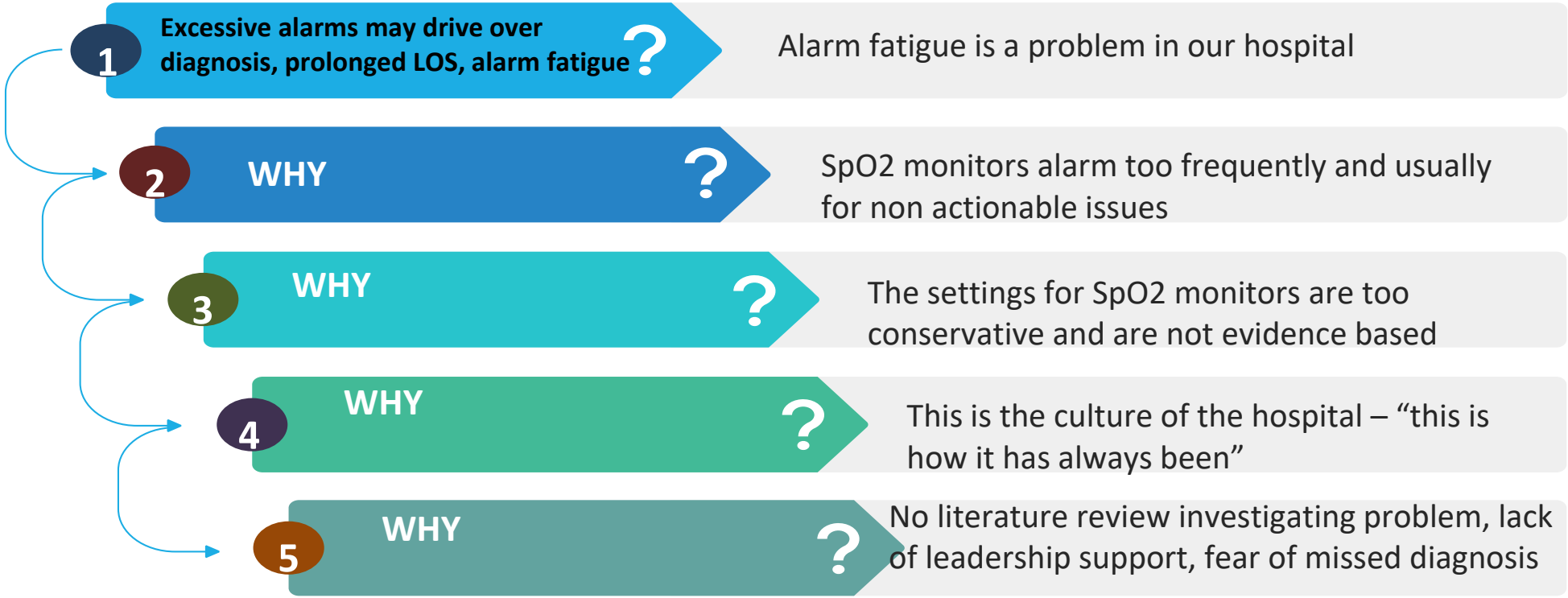
The 5 Whys

- Goal: Determine the root cause of a defect or problem.
- Process: Ask "Why" at least 5 times

Defect	Reasons
Why-1: Why did THE DEFECT occur?	
Why-2: Why did THAT occur?	
Why-3: Why did THAT occur?	
Why-4: Why did THAT occur?	
Why-5: Why did THAT occur?	
Why-6: Why did THAT occur?	

Investigating: 5 Whys

Problem: Excessive continuous pulse oximetry alarms on a general hospitalist floor



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Process maps

Flow chart that shows an entire process

Standard symbols used for different types of actions

Very helpful to map out systems

- Find “hidden” processes
- Make sure everyone is on the same page (and all the right people included)
- Find inefficiencies

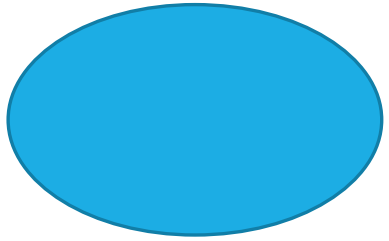
Start by interviewing experts or have everyone in room!

Use post it notes! Then convert to electronic

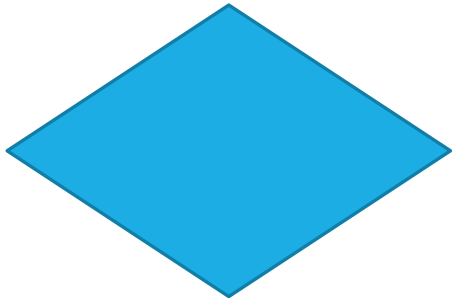
- But can do via video…

Observe process then double check with experts

Process maps: key



Start and end of process

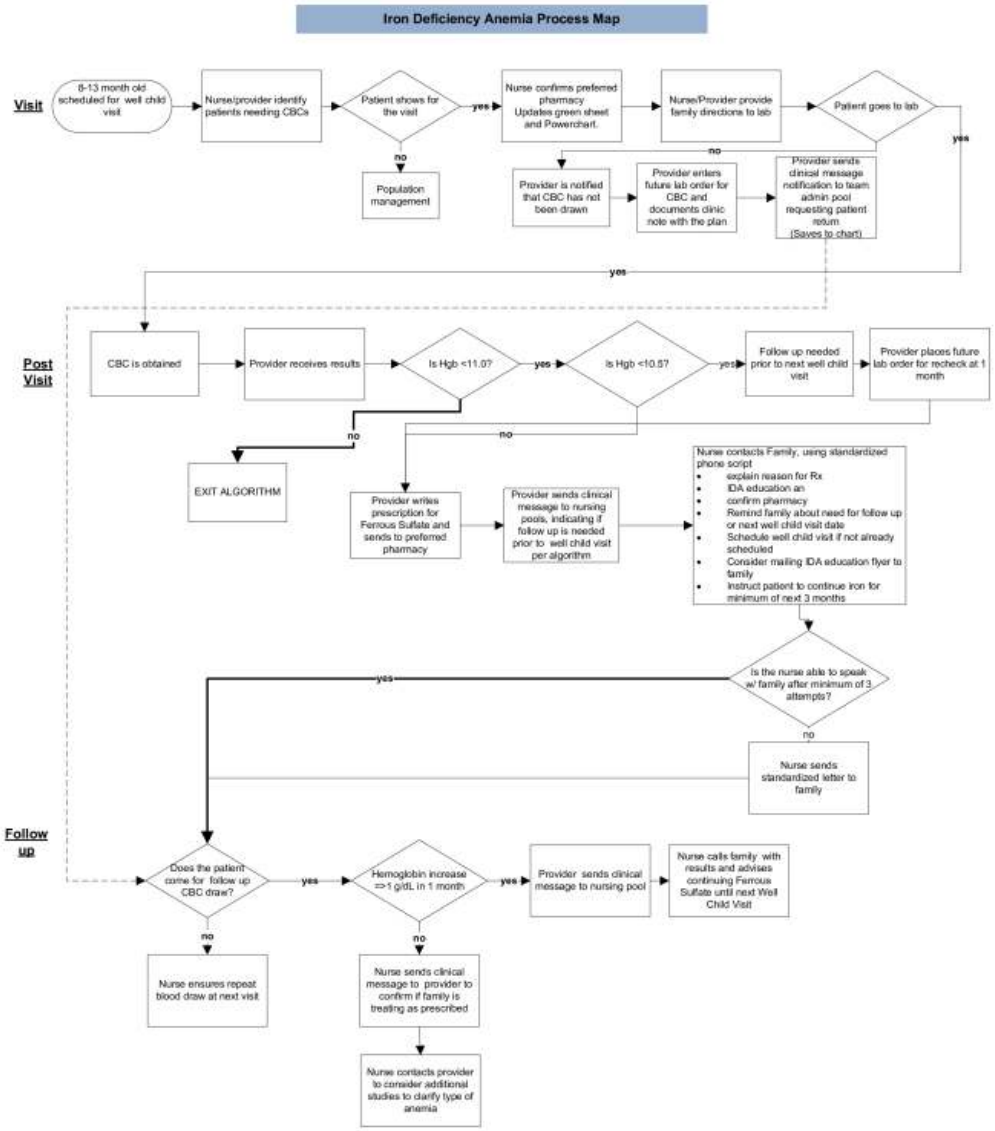


Decision point (yes/no)

Activity or task

Flow line

You may see variations on this framework

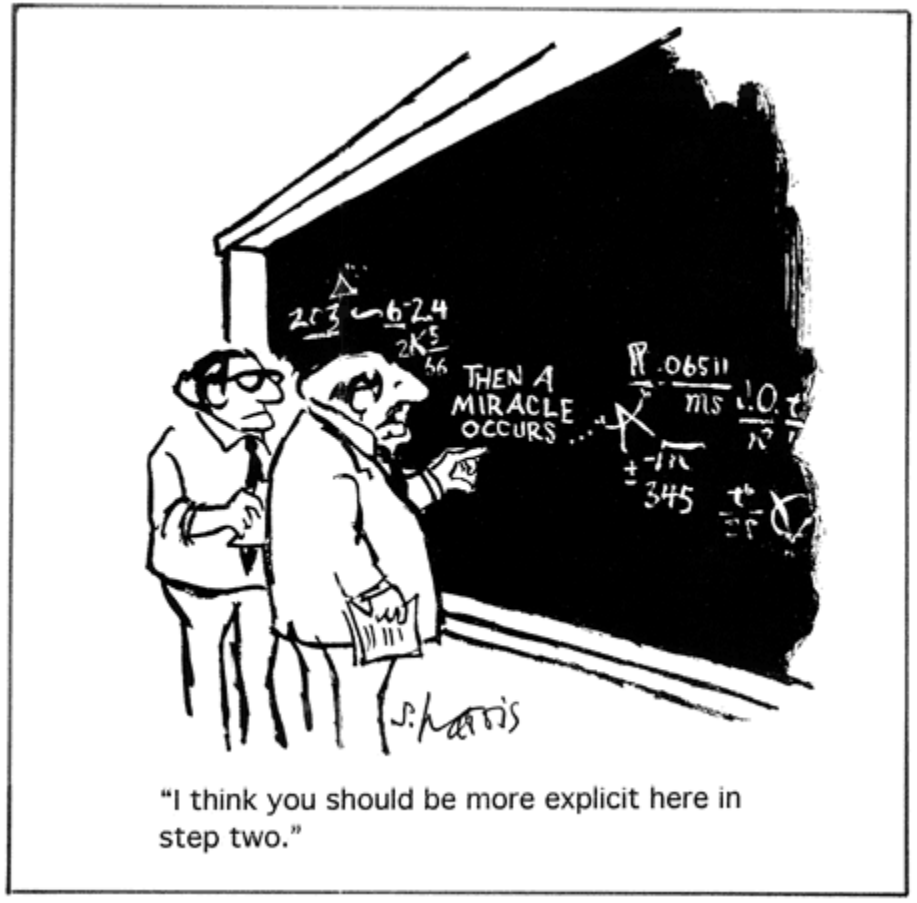

Iron Deficiency Anemia Process Map
Visit
8-13 month old scheduled for well child visit
Nurse/provider identify patients needing CBCs
Patient shows for the visit
yes
no
Population management
Nurse confirms preferred pharmacy Updates green sheet and Powerchart.
Nurse/Provider provide family directions to lab
Patient goes to lab
yes
no
Provider is notified that CBC has not been drawn
Provider enters future lab order for CBC and documents clinic note with the plan
Provider sends clinical message notification to team admin pool requesting patient return (Saves to chart)
yes
Post Visit
CBC is obtained
Provider receives results
Is Hgb <11.0?
yes
Is Hgb <10.5?
yes
Follow up needed prior to next well child visit
Provider places future lab order for recheck at 1 month
no
no
EXIT ALGORITHM
Provider writes prescription for Ferrous Sulfate and sends to preferred pharmacy
Provider sends clinical message to nursing pools, indicating if follow up is needed prior to well child visit per algorithm
Nurse contacts Family, using standardized phone script
explain reason for Rx
IDA education an
confirm pharmacy
Remind family about need for follow up or next well child visit date
Schedule well child visit if not already scheduled
Consider mailing IDA education flyer to family
Instruct patient to continue iron for minimum of next 3 months
Is the nurse able to speak w/ family after minimum of 3 attempts?
yes
no
Nurse sends standardized letter to family
Follow up
Does the patient come for follow up CBC draw?
yes
Hemoglobin increase =>1 g/dL in 1 month
yes
Provider sends clinical message to nursing pool
Nurse calls family with results and advises continuing Ferrous Sulfate until next Well Child Visit
no
Nurse ensures repeat blood draw at next visit
no
Nurse sends clinical message to provider to confirm if family is treating as prescribed
Nurse contacts provider to consider additional studies to clarify type of anemia


MATERIALS

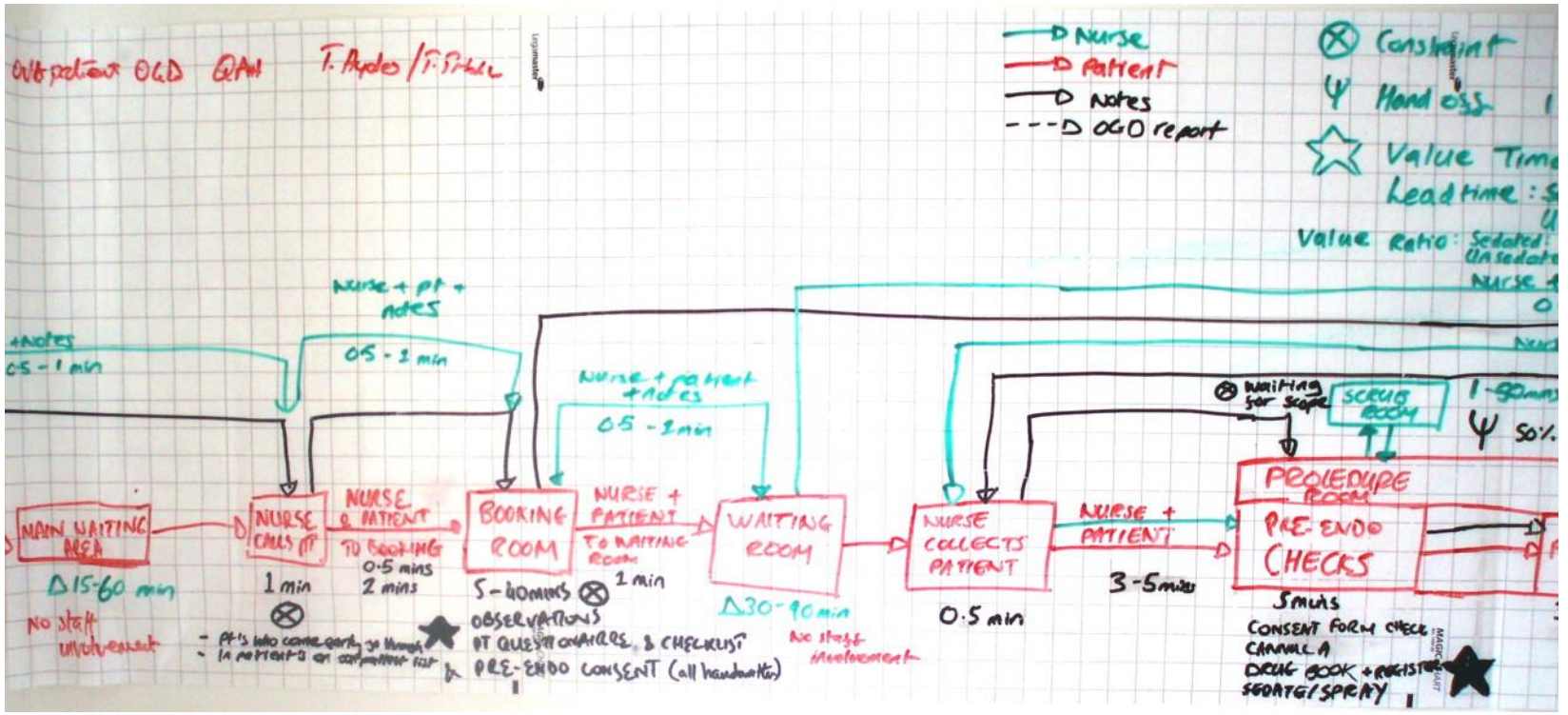
Process mapping can occur at multiple levels

- 10,000 feet: what is our process for admitting a patient from clinic?
- 100 feet: what is our process for identifying patients who need to be admitted?
- 10 feet: what is our process for seeing patients?
- 1 foot: what is our process for entering a room when a patient is waiting?

What we're trying to avoid…

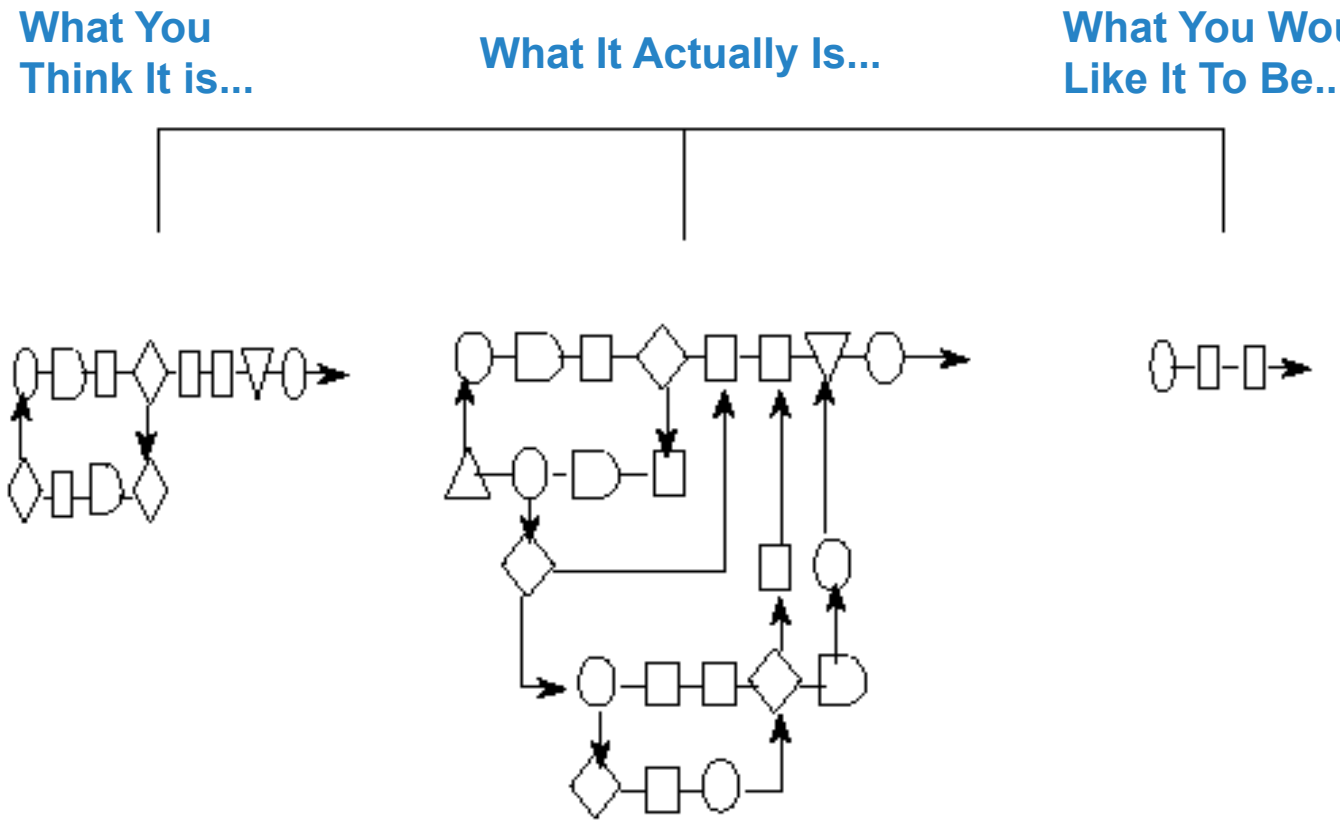


"I think you should be more explicit here in step two."

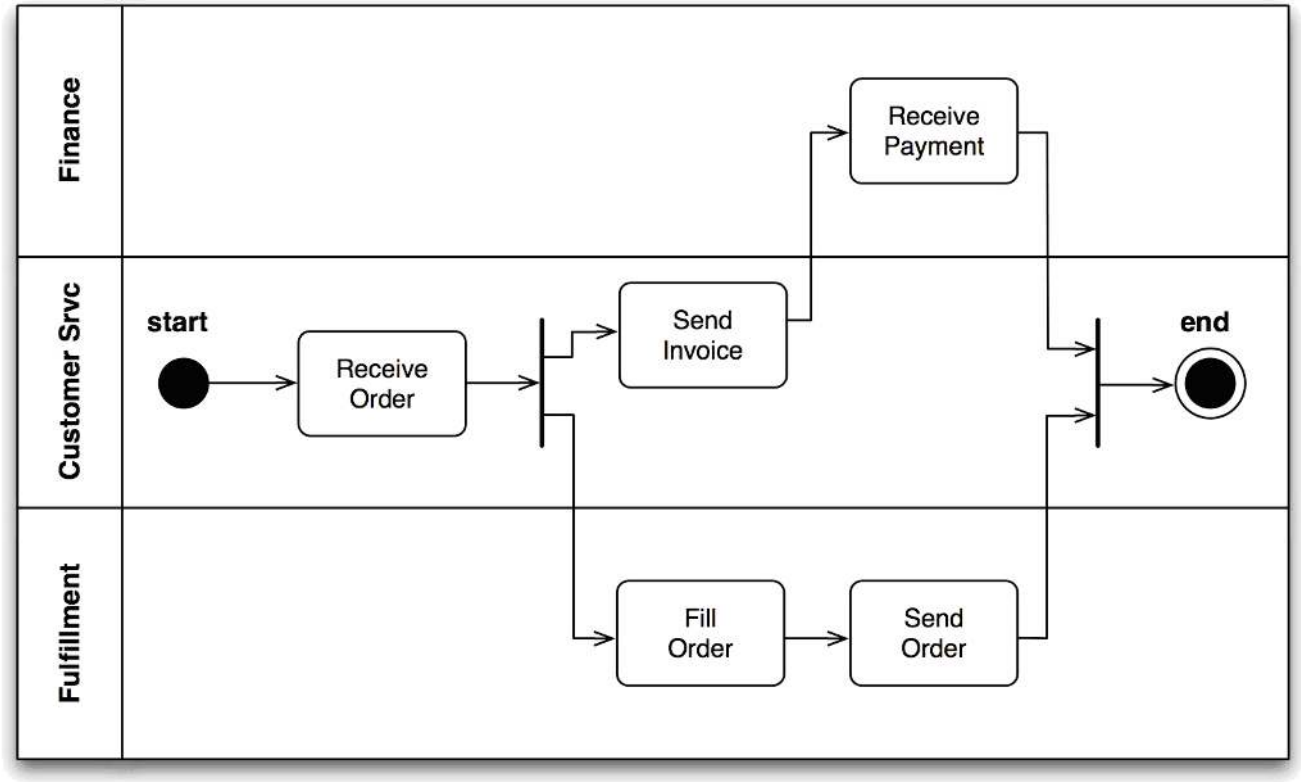


"The first step in any organization is to draw a flow diagram to show how each component depends on others. Then everyone may understand what his job is. If people do not see the process they cannot improve it." W. Edwards Deming

A Process Map Has At Least 3 Versions



Swim lane diagram



5 Discovery Tools:

Key Driver Diagrams

Fishbone Diagrams

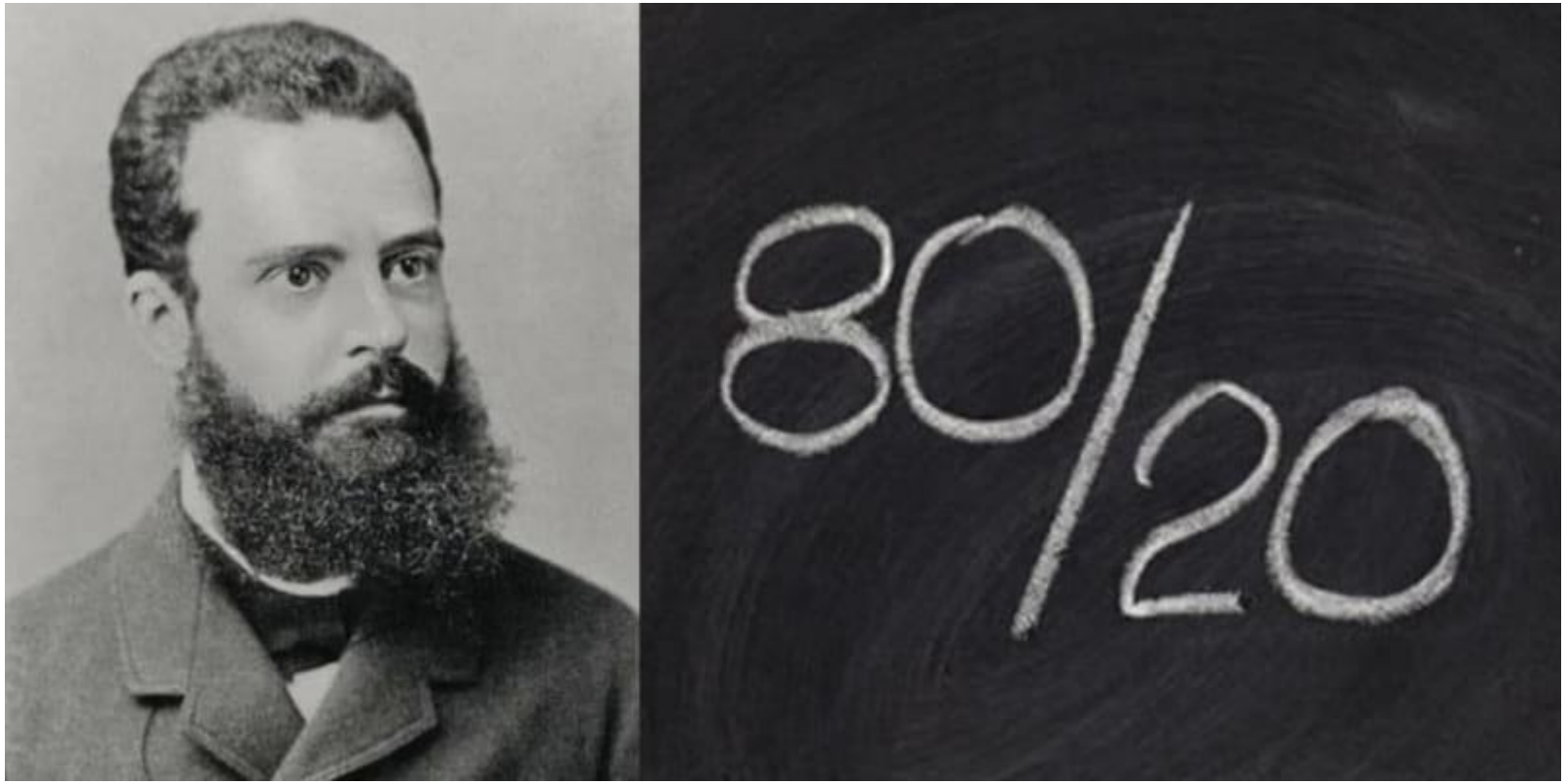
5 Whys

Process Mapping

Pareto Charts

Vilfredo Pareto (1848-1923)

80% of the wealth in Italy belonged to about 20% of the population.



“The vital few and the trivial many”

Pareto chart

A Pareto chart is a bar graph

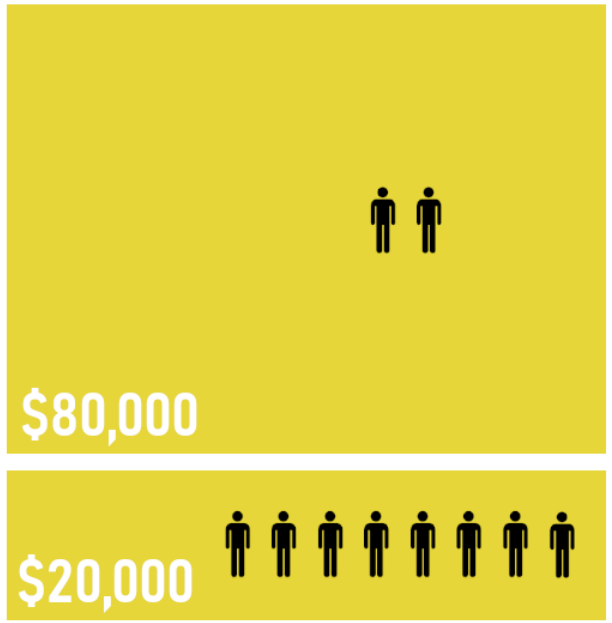
Lengths of the bars represent frequency or cost (time or money), and are arranged with longest bars on the left and shortest to the right

Visually depi

According to the “Pareto principle” — also known as the “80/20 rule” — in any group of factors that contribute to an overall effect, roughly 80% of the effect comes from 20% of the causes.

Pareto Principle

- 80% of a problem is caused by 20% of the causes
  - Uses a tally sheet to make a Pareto chart
  - Helps prioritization -- best return on your time & effort
  - In a crunch, helps focus on 20% (the vital few) of the causes that really matter most
    - These are often the hardest…teamwork, communication

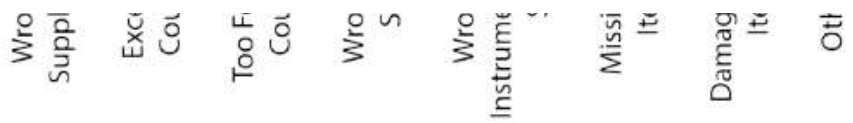


Pareto chart

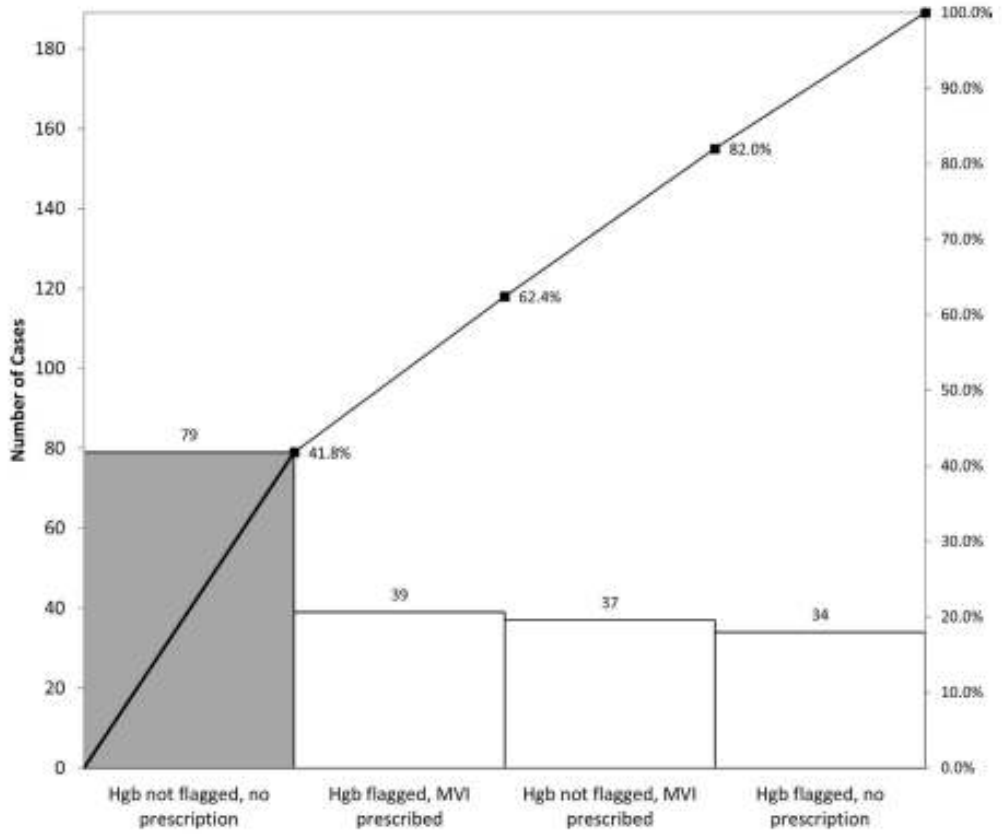
Pareto Chart: Types of Errors Discovered During Surgical Set-up

Data Table: Types of Errors Discovered During Surgical Set-up

Error Type	Frequency	Percent	Cumulative %
Wrong Supplier	67	46.5	46.5
Excess Count	24	16.7	63.2
Too Few Count	17	11.8	75
Wrong Size	10	6.9	81.9
Wrong Sterile Instrument Set	10	6.9	88.8
Missing Item	8	5.6	94.4
Damaged Item	6	4.2	98.6
Other	2	1.4	100
TOTAL	**144**	**100**	



Pareto chart: example from our clinic



- We categorized problem scenarios for the iron deficiency anemia project
- Hgb not being flagged in EMR AND no RX (for either ferrous sulfate OR MVI) was most common problem

What to do next?

Vilfredo Pareto (1848-1923)

- Analyze data to determine the frequency of problems or causes in a process
- Create a tally sheet and a Pareto chart
- Brainstorm based on your Pareto analysis and develop targeted **change concepts (interventions)** to improve your performance
- Plan your PDSA cycle
- Repeat your Pareto analysis over the course of the project to show shifts in key causes over time (…a Pareto of the Pareto)

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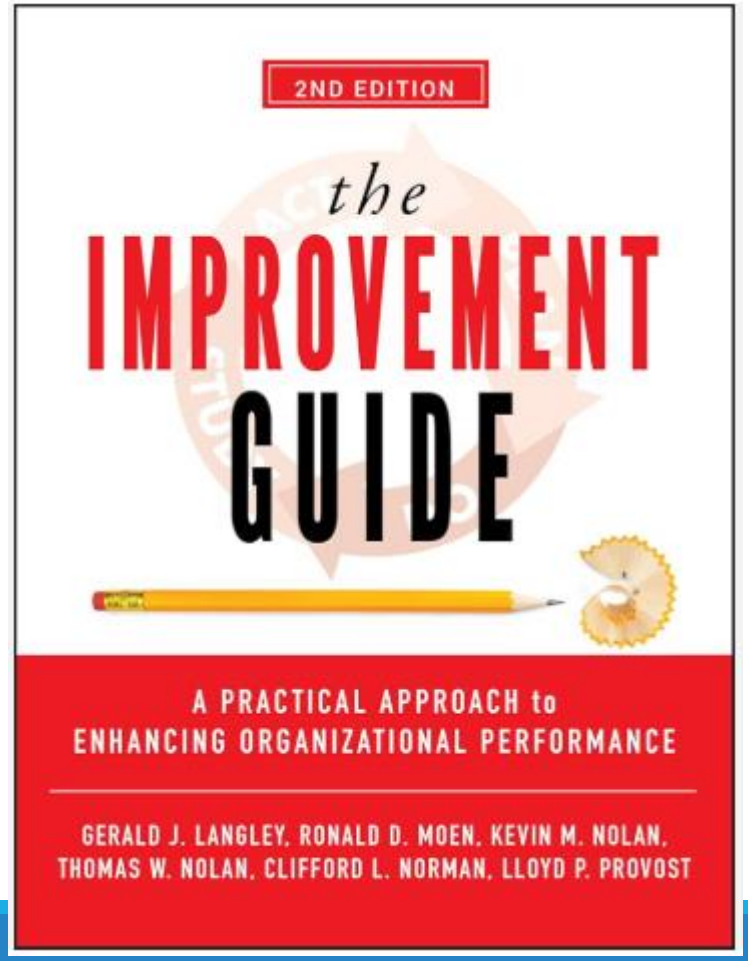
		12:35 pm	**Lunch**

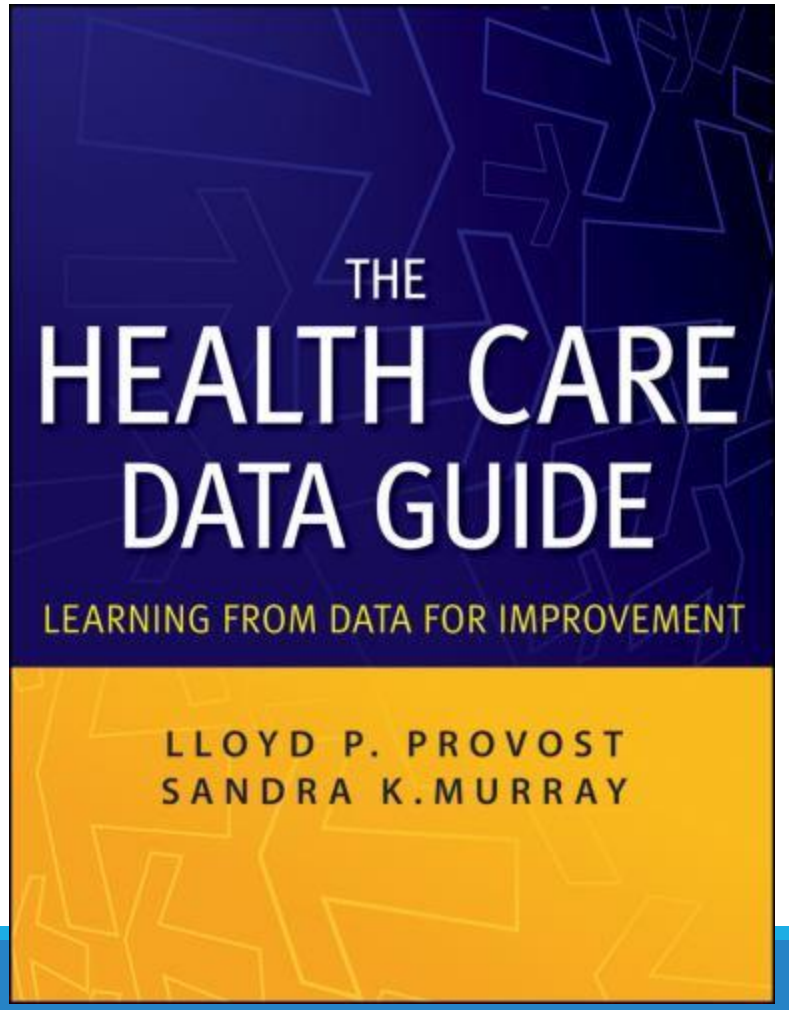
QI Discovery Tools Exercise

Working in pairs : Complete a Fishbone or Key Driver Diagram Related to your Project Aim

QI Resources

Institute *for* Healthcare Improvement





QI 101: Jumpstart Your Scholarly Improvement Project, 2026

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Gagandeep Kooner: gagandeep.kooner@emory.edu

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Academic partners advancing pediatric research

QI 102: A Data-Driven Approach to Your Scholarly Improvement Project

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Clinical Co-Chief, Children's Hospital Primary Care Center, Director of Quality for Primary Care, Director of General Academic Pediatric Fellowship

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Associate Director of Quality & Safety for Hospital Medicine

Instructor of Pediatrics

Pediatric Hospitalist at Boston Children's Hospital

QI 102: A Data-Driven Approach to Your Scholarly Improvement Project (Part 2)

Disclosures / COI

We have no disclosures to report

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	10 m	12:20 pm	Closing & Discussion (end 12:35p)
		12:35 pm	**Lunch**

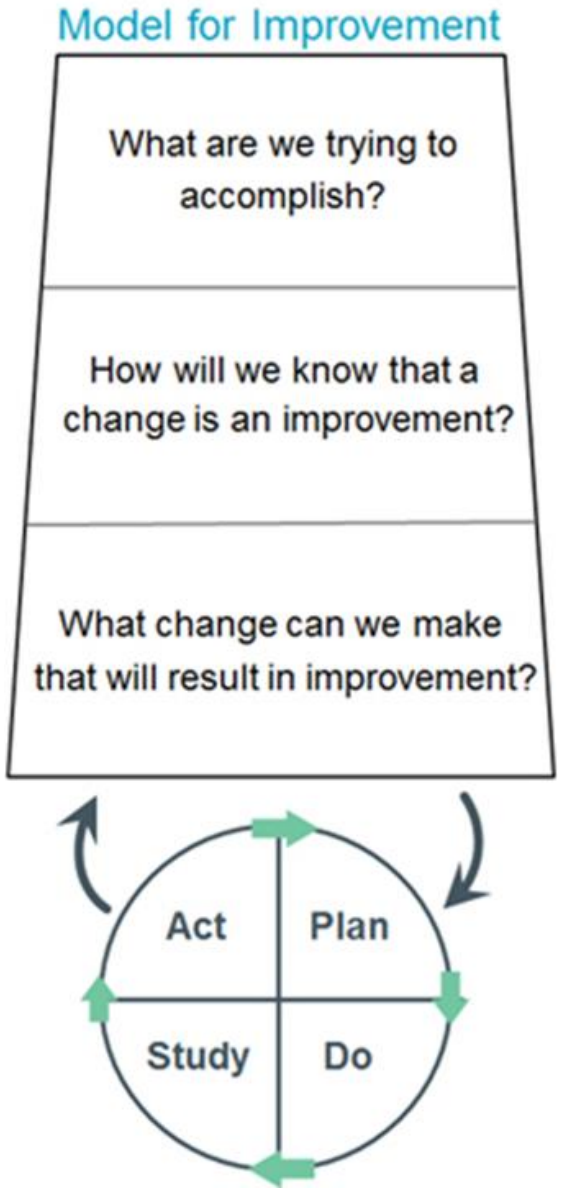
Objectives

By the end of this presentation participants will be able to:

- Design a PDSA cycle for their QI project.
- Create and interpret a run chart for their QI project.
- Decide when to use a run chart vs. a control chart.

PDSA CYCLES

MODEL FOR IMPROVEMENT

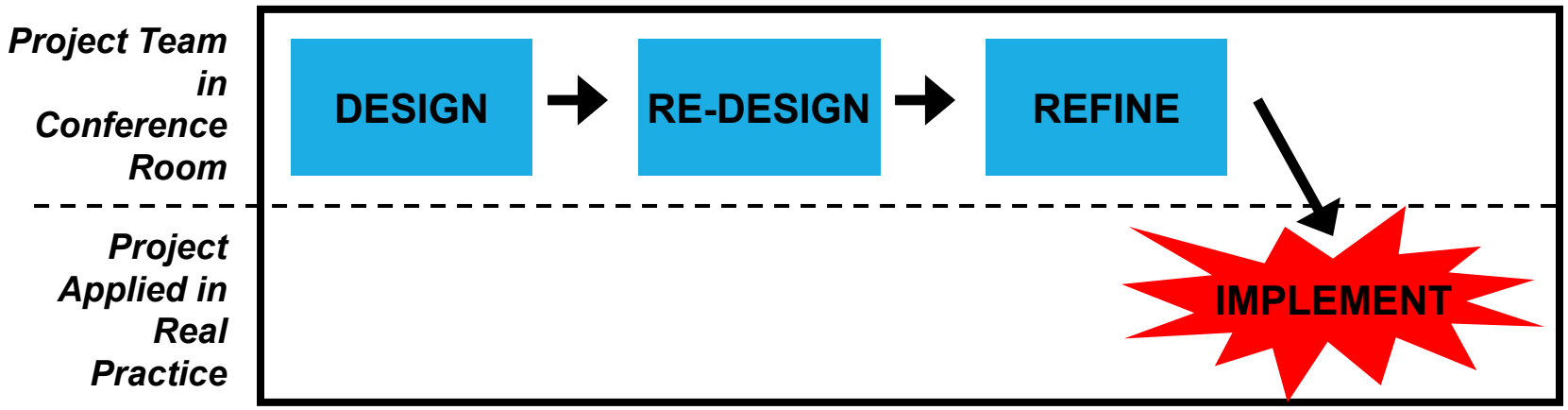


Aims

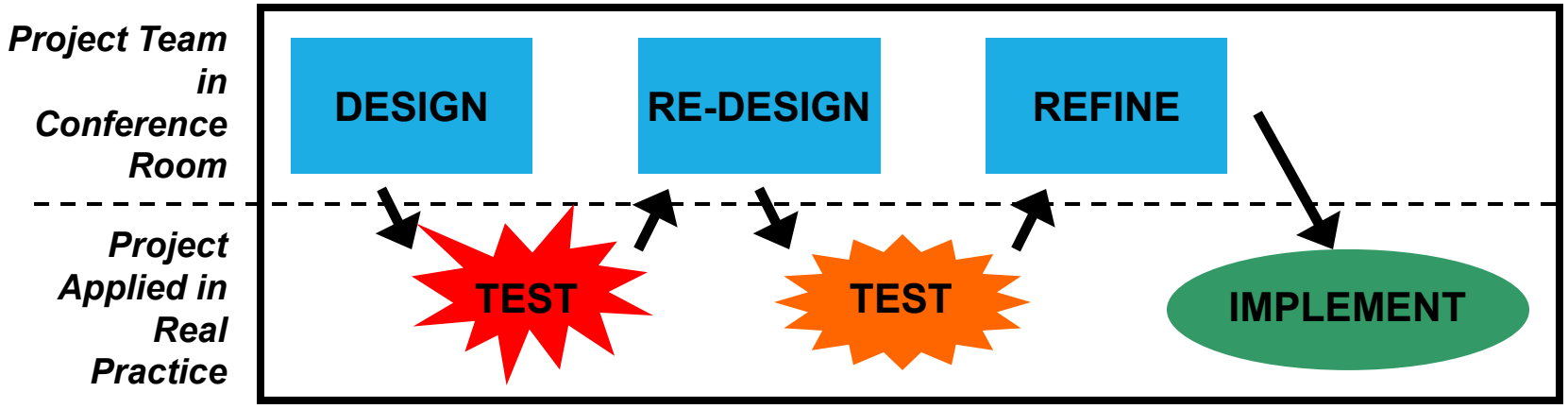
Measures

Ideas

Typical Approach to QI:



More Efficient Approach:



PSDA Cycle

P – Plan
D – Do
S – Study
A – Act

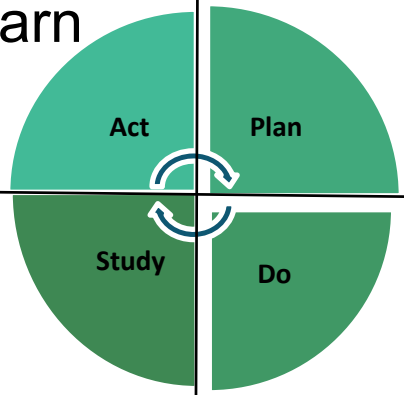
PDSA Cycles

PDSA - Act

- Adapt: Make revisions & test again
- Adopt: Change was executed successfully & results are positive
- Abandon: Test did not go as expected, but you were able to learn

PDSA - Plan

- What is the objective of test?
- Questions & predictions
- Plan to carry out the test (who, what, where & when)



PDSA - Study

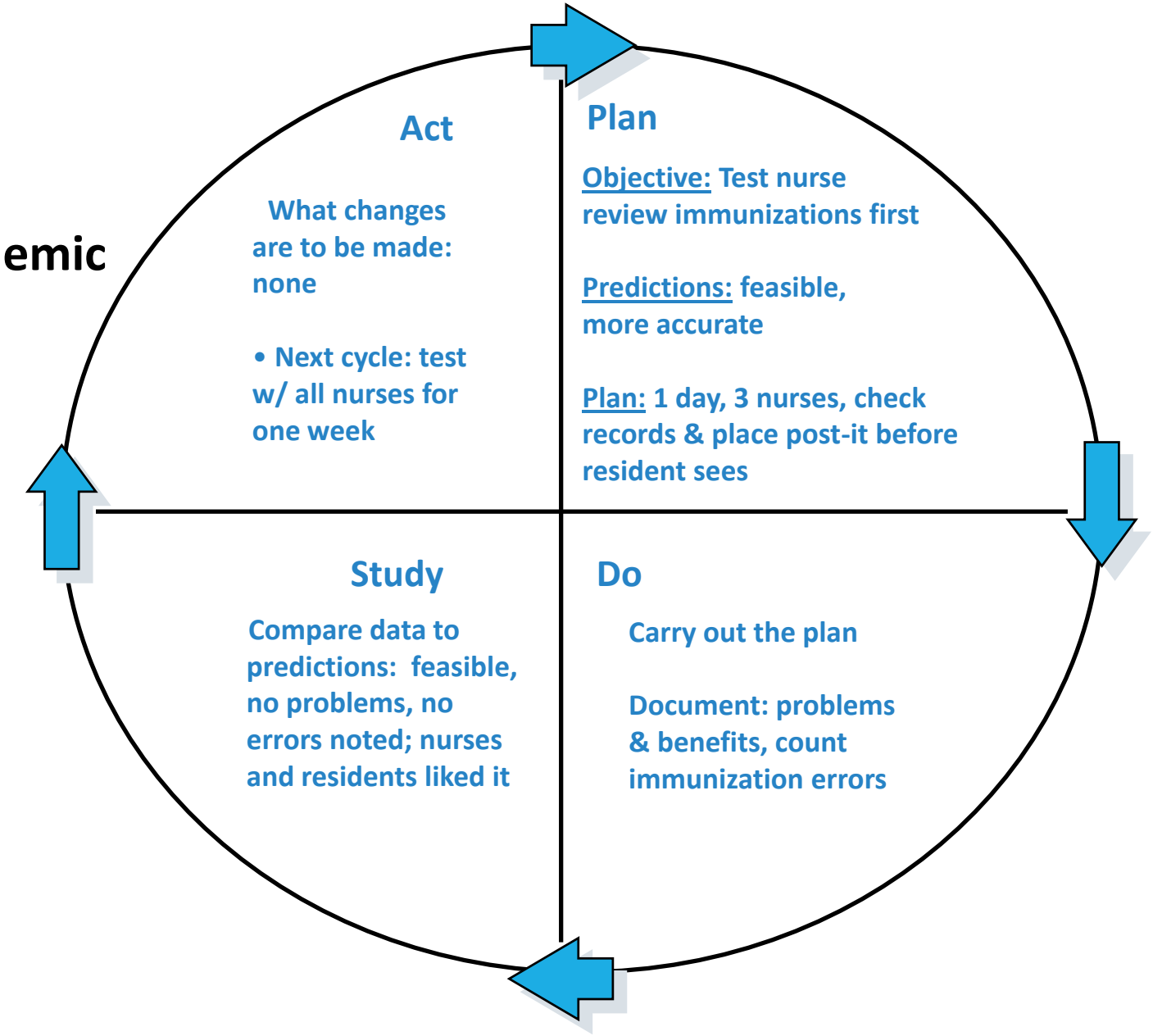
- Complete analysis of data
- Compare data to prediction
- Summarize what was learned

PDSA - Do

- Carry out the plan
- Document problem
- Was the cycle carried out as planned?

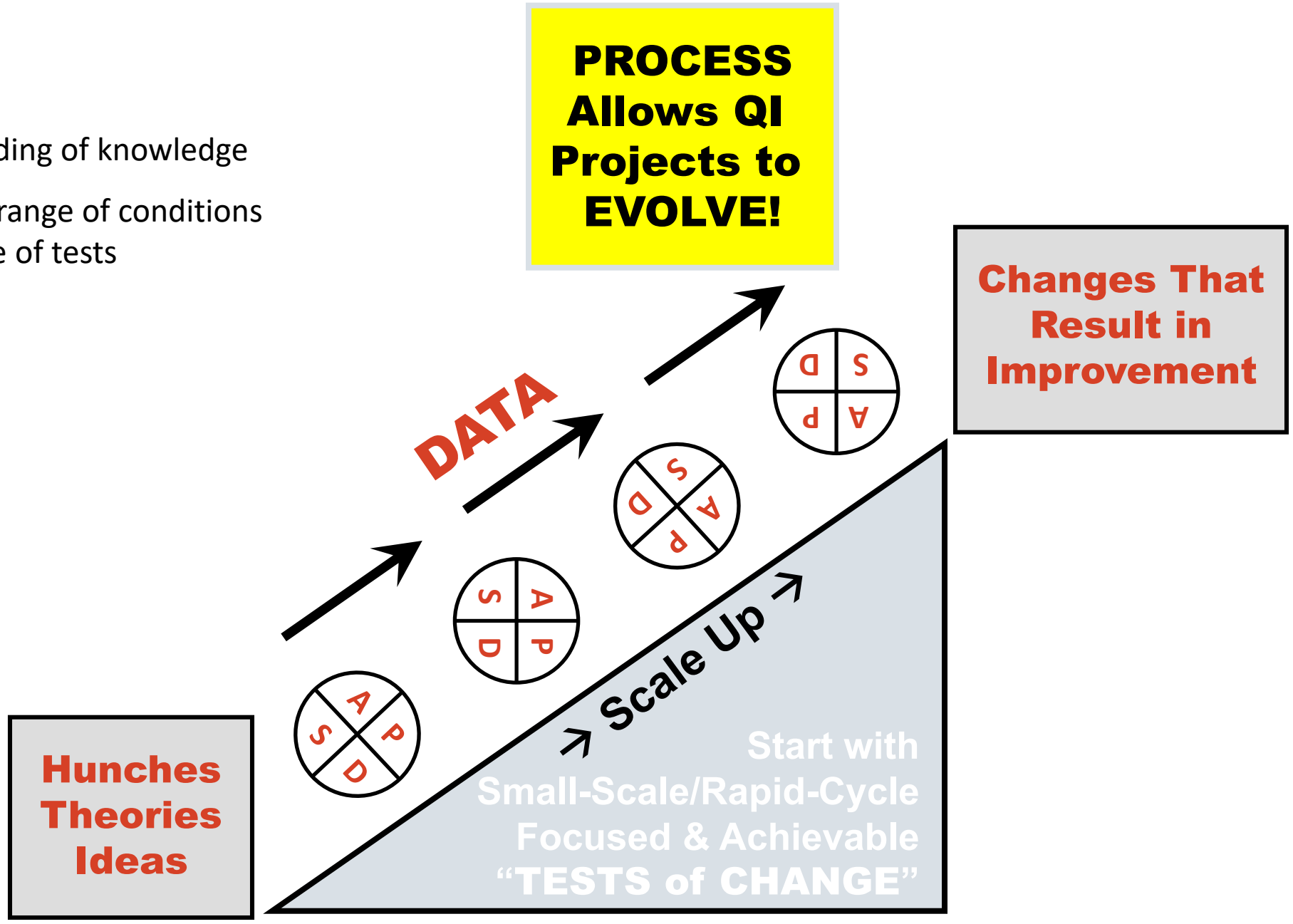
Example:

QI initiative to decrease immunization errors in academic primary care pediatric clinic

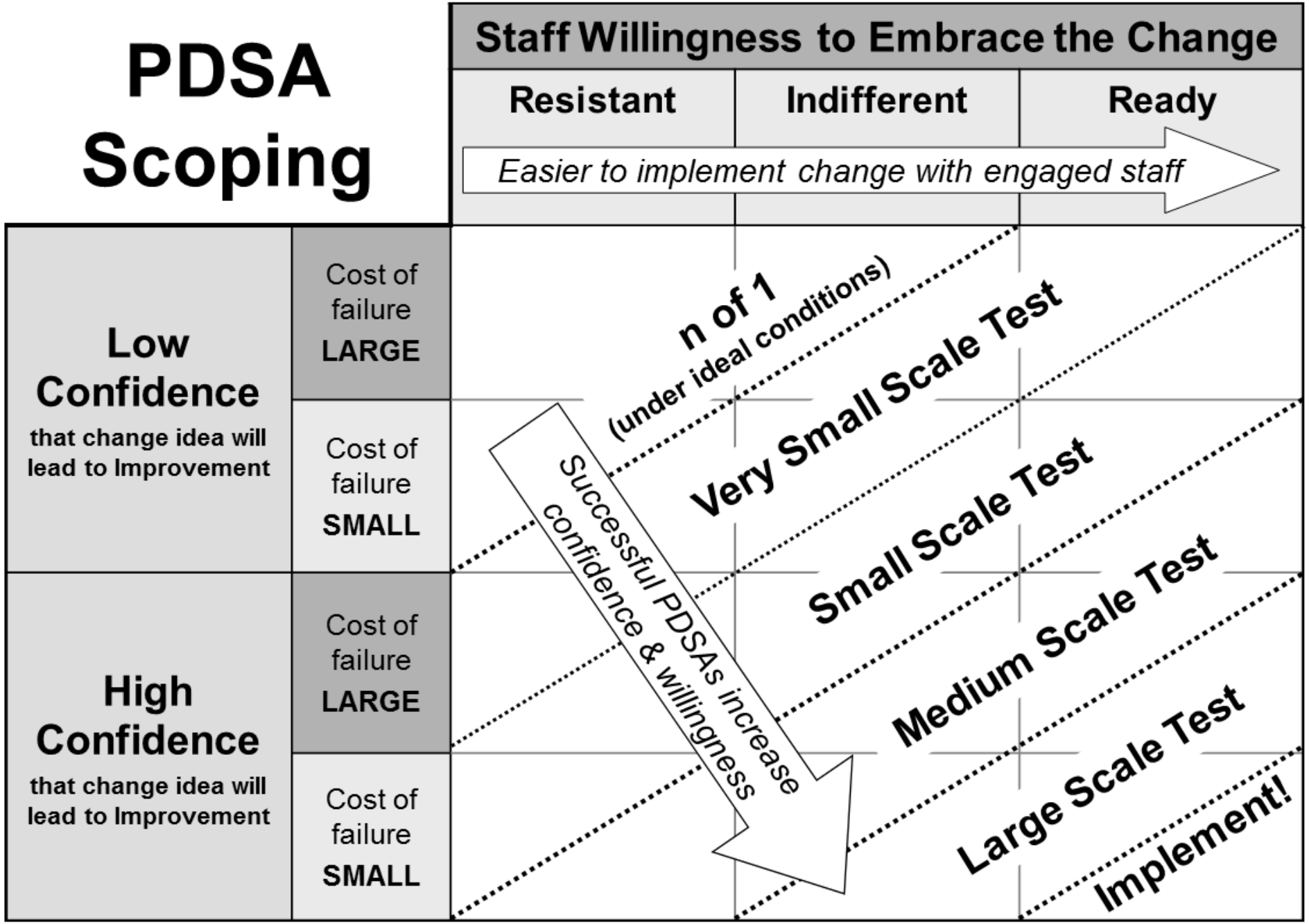


Sequential building of knowledge

Include a wide range of conditions in the sequence of tests



PDSA Scoping



Before filling out the template, first save the file on your computer. Then open and use that version of the tool. Otherwise, your changes will not be saved.

Template: PDSA Worksheet

Objective:

1. Plan: Plan the test, including a plan for collecting data.

Questions and predictions:

-
-

Who, what, where, when:

Plan for collecting data:

2. Do: Run the test on a small scale.

Describe what happened. What data did you collect? What observations did you make?

3. Study: Analyze the results and compare them to your predictions.

Summarize and reflect on what you learned:

4. Act: Based on what you learned from the test, make a plan for your next step.

Determine what modifications you should make — adapt, adopt, or abandon:

What a PDSA Cycle is NOT

- Data collection
- Implementing a solution
- A project plan OR an action plan
- Rolling out an educational program
- Getting a form/policy/procedure approved by official committees

Key Points for PDSA Cycles

Do initial cycles on smallest scale possible

- **Think baby steps…a "cycle of one" usually best**
- **"Failed" cycles are good learning opportunities when small (i.e., don't just learn from successes!)**

Quantitative results are important, but qualitative results are often more valuable in early PDSA

- **PDSA Cycles help teams adapt good ideas to their specific situation**

Keep track of dates PDSA cycles were implemented and outcomes

- **Will annotate run chart with interventions to demonstrate efficacy**

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Exercise 3:PDSA

Working in pairs (or triads), choose an intervention related to your AIM and create a PDSA cycle

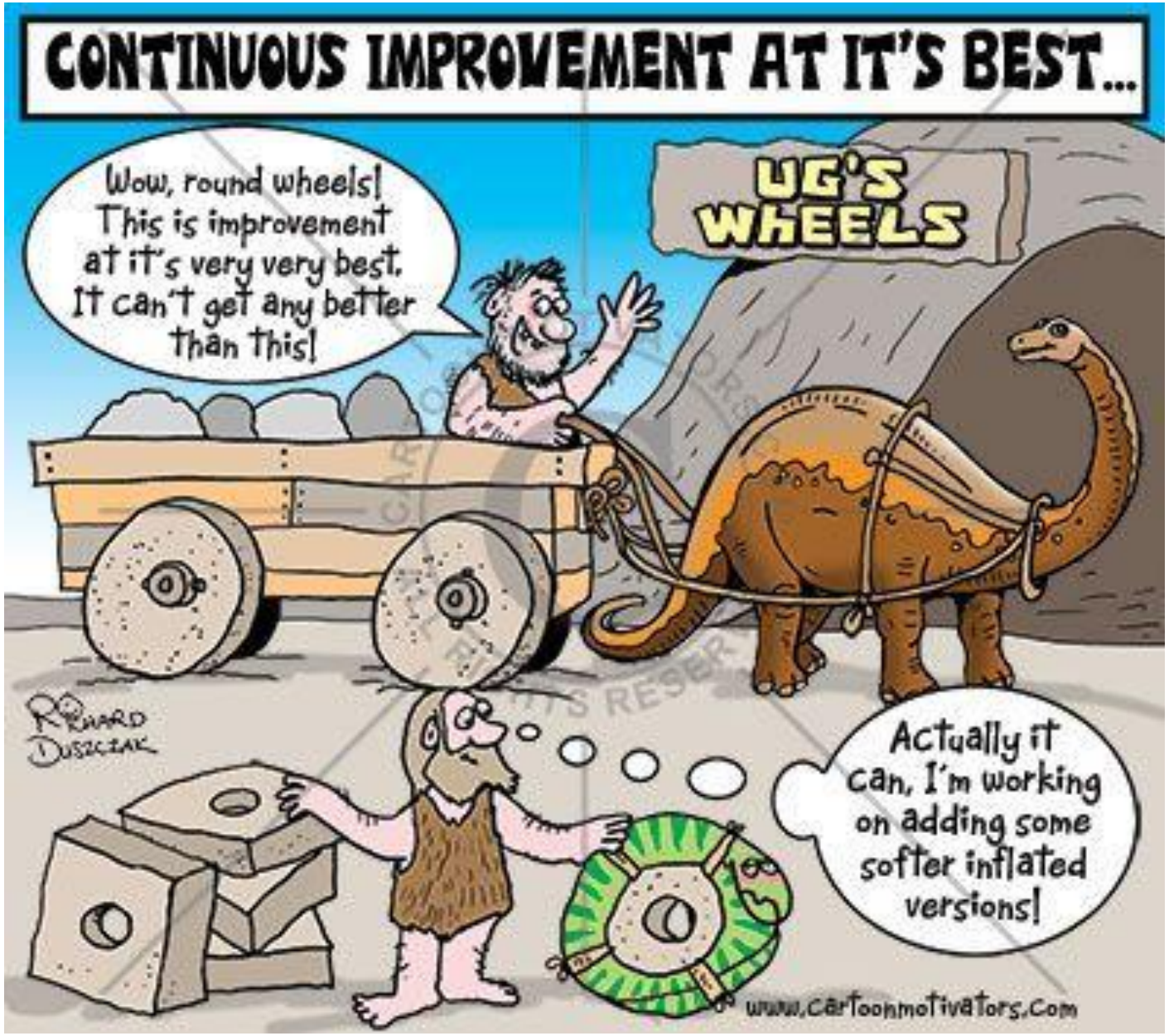
Challenge 1: Pediatric clinic

Underserved urban asthma population

Challenge 2: Pediatric emergency department

Topic of choice

If time, you can think of a PDSA cycle that you might use to affect your own project metrics and achieve aims.


CONTINUOUS IMPROVEMENT AT IT'S BEST...
Wow, round wheels! This is improvement at it's very very best. It can't get any better than this!
UG'S WHEELS
Actually it can, I'm working on adding some softer inflated versions!
RICHARD DUSZCIAK
www.cartoonmotivators.com

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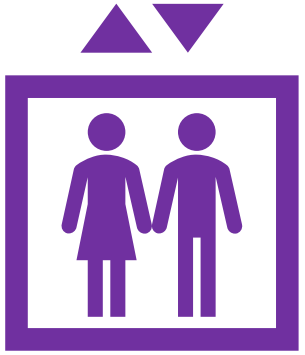
CHANGE OVER TIME: RUN & STATISTICAL PROCESS CONTROL (SPC) CHARTS

"Misunderstanding variation is the root cause of knee-jerk reactions, over control, and micromanagement."

What is variation?

What makes variation meaningful?

Types of Variation



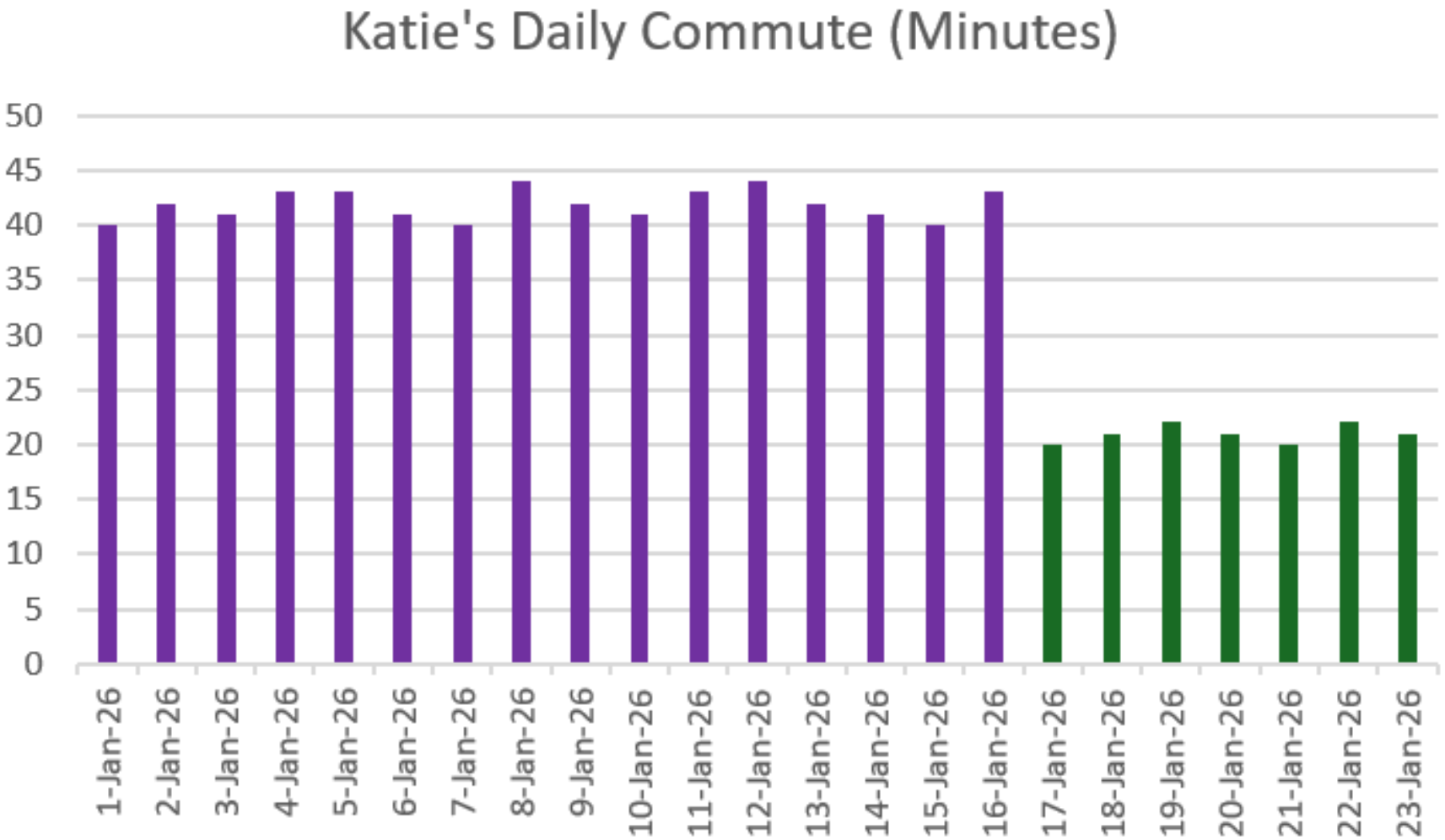
Common Cause Variation (CCV)

- Natural and/or random variation, “noise”
- Inherent in all systems
- Expected variability within a process that remains stable and predictable over time

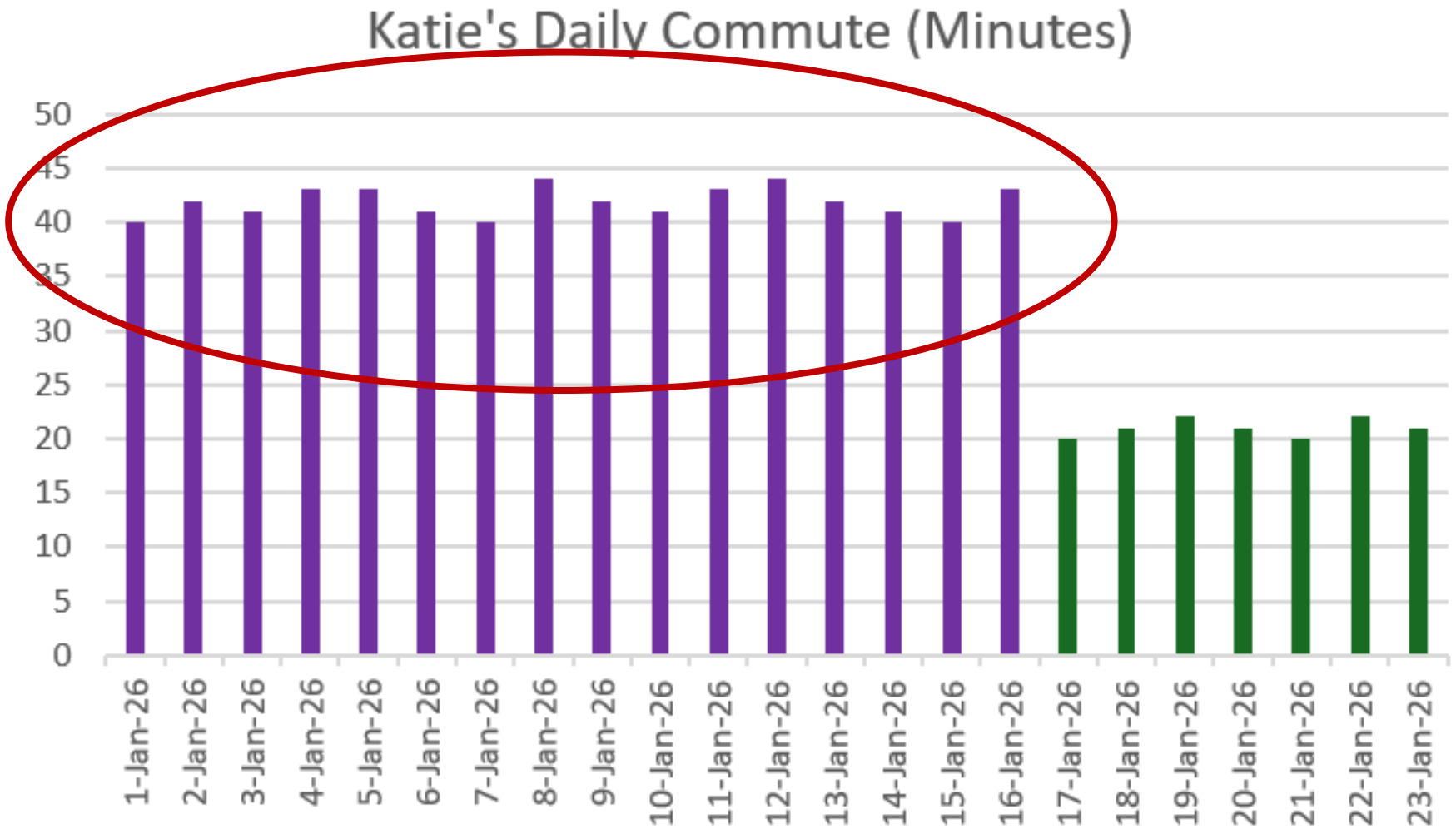
Special Cause Variation (SCV)

- Unnatural and/or un-random variation, “signal”
- May be unplanned (e.g., COVID pandemic) or planned (e.g., QI initiative)
- Detected by a set of statistically informed rules

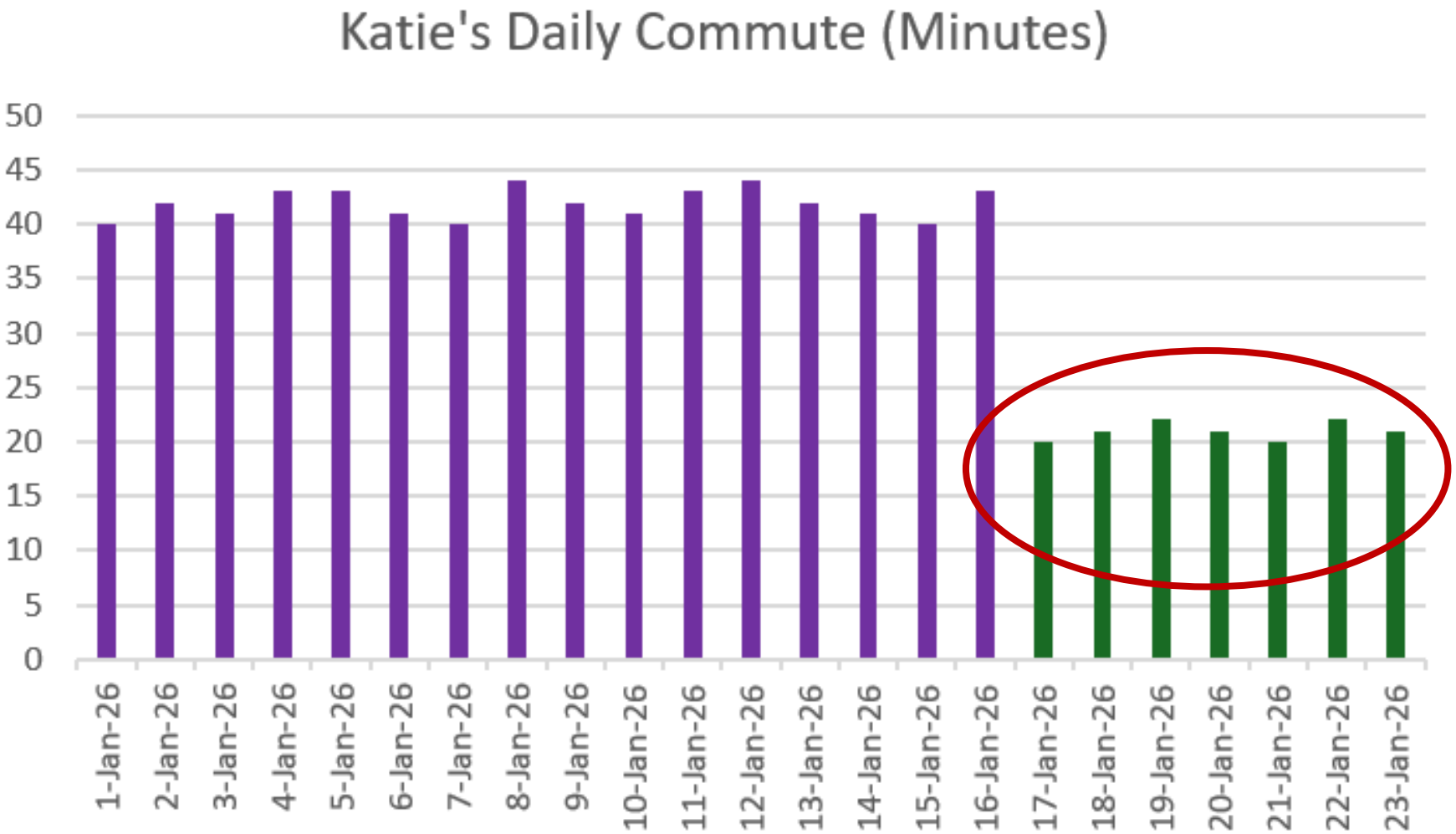
Types of Variation



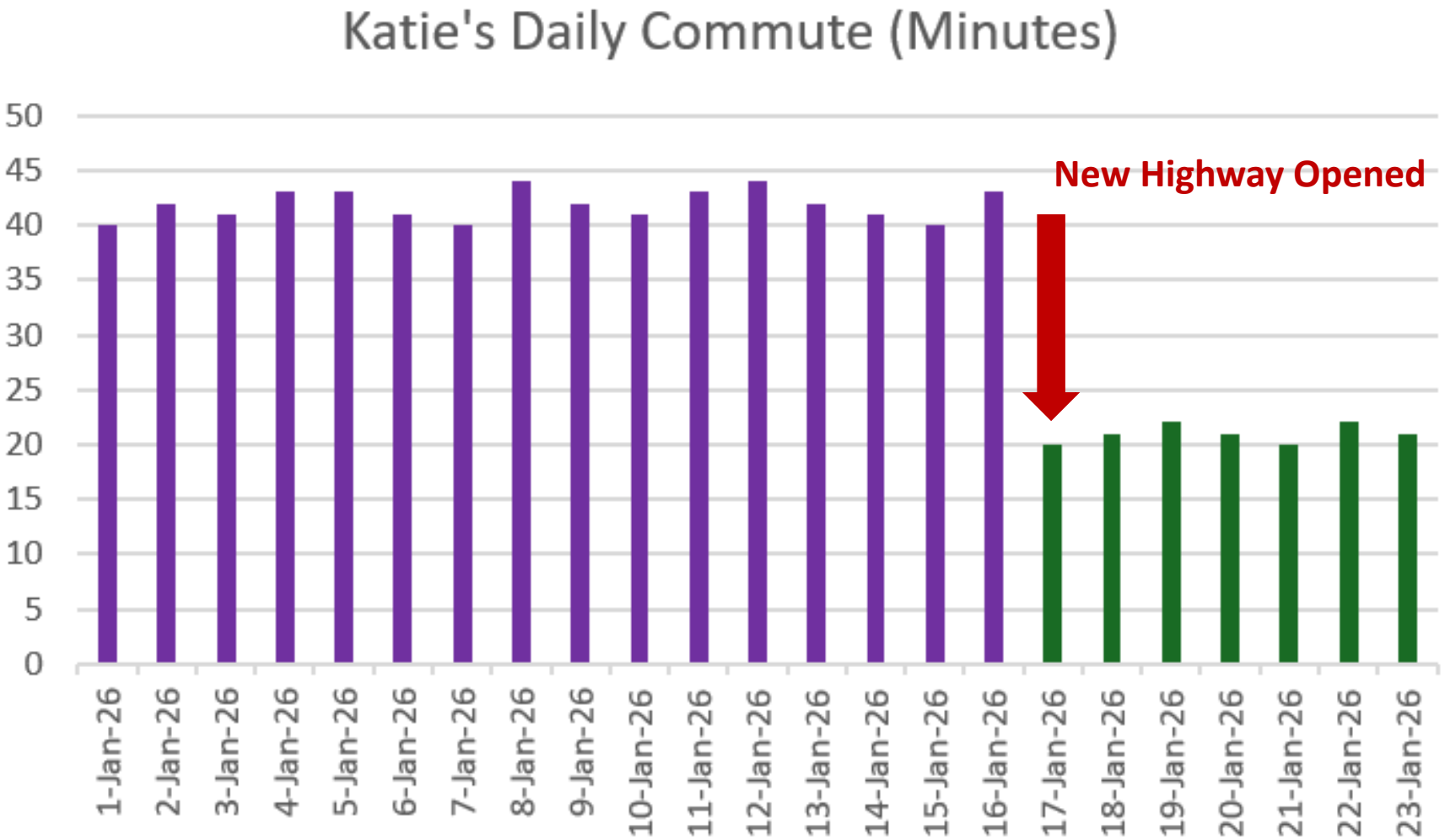
Types of Variation



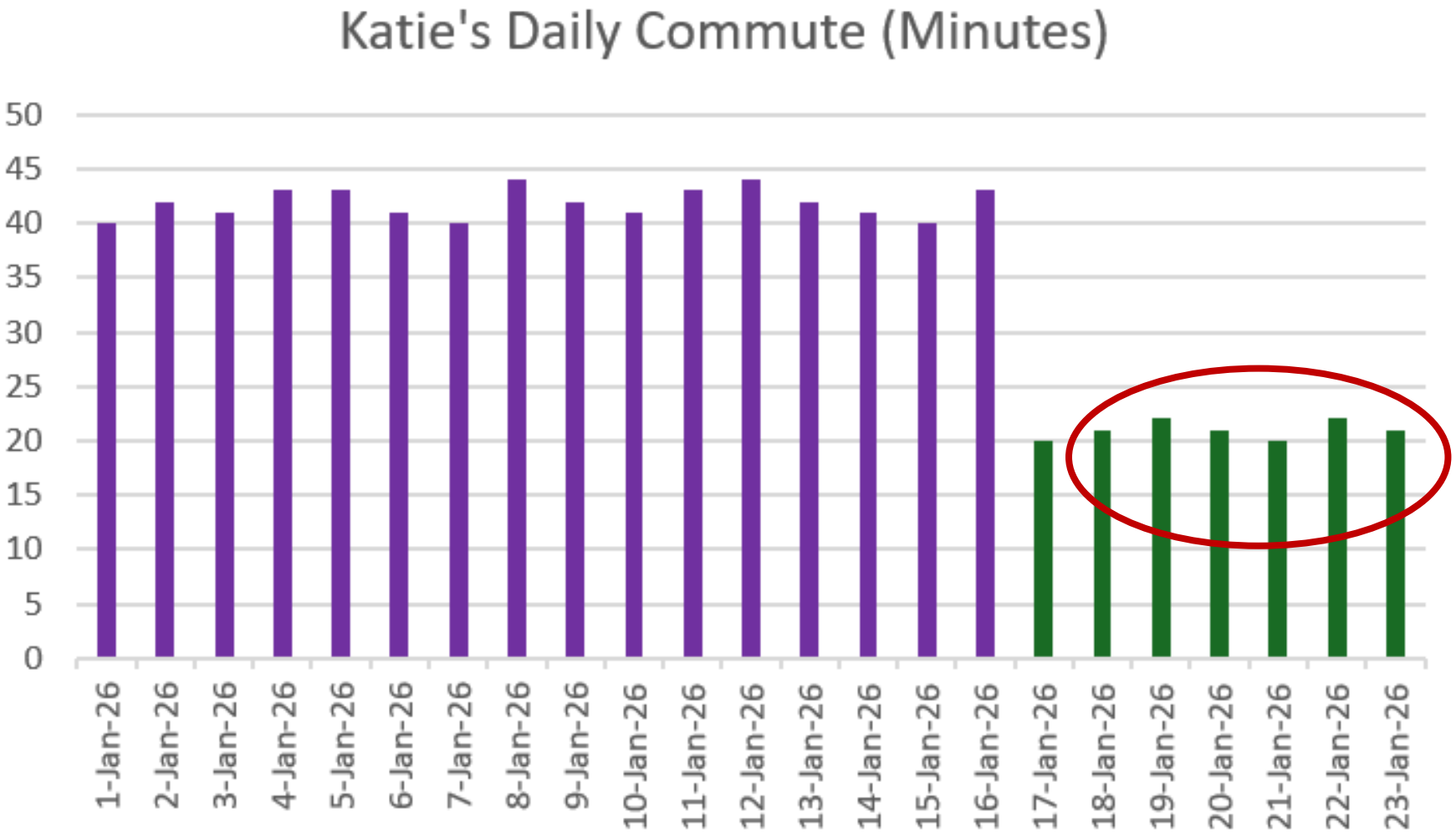
Types of Variation



Types of Variation

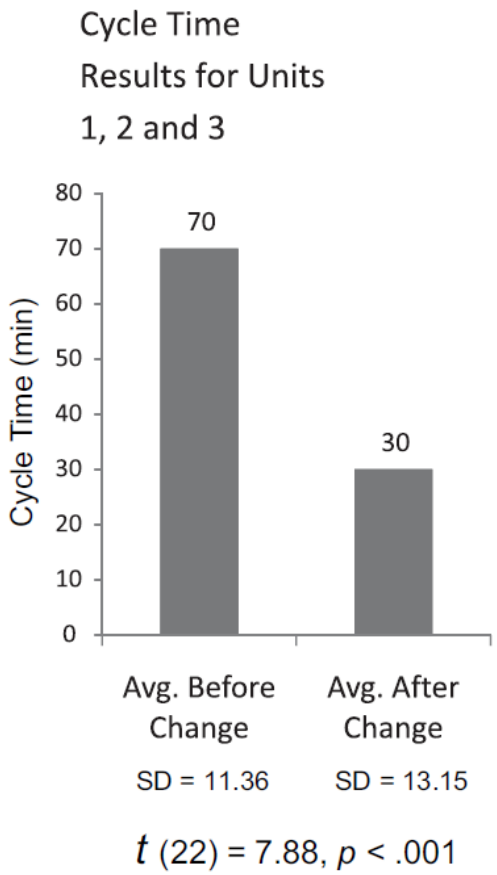


Types of Variation

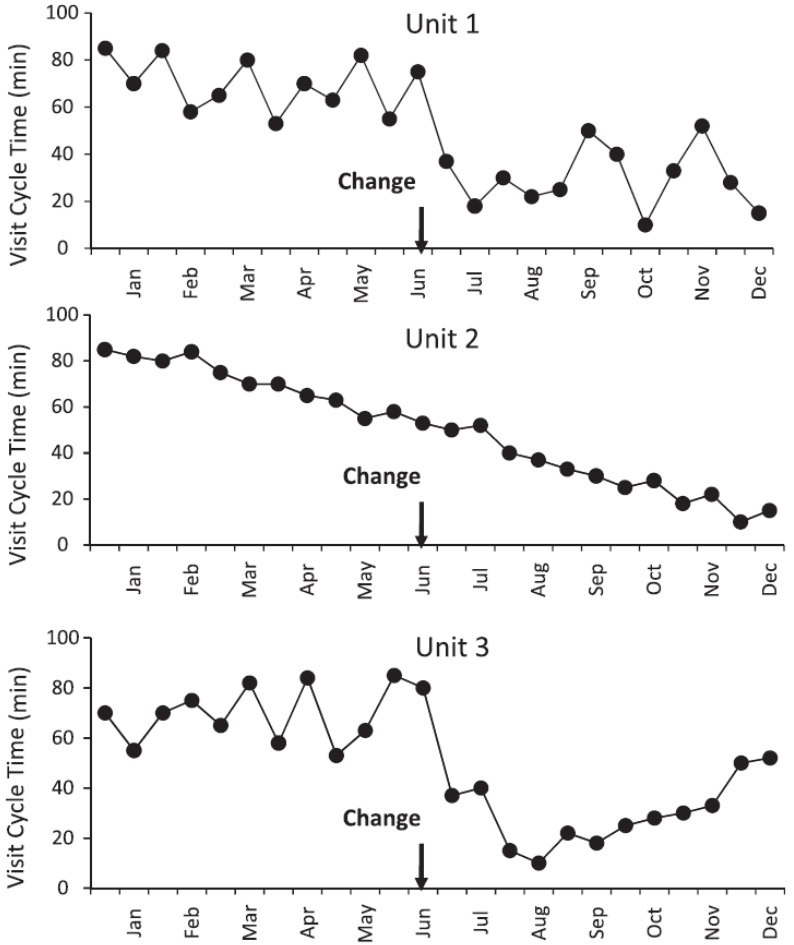


Variation: For QI, It's All About Time

Pretest-Posttest Study Design



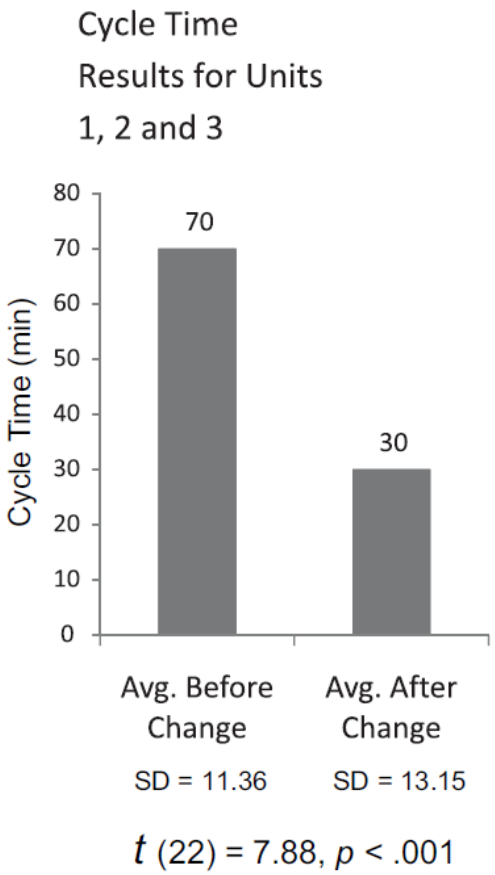
Quality Improvement Project Design



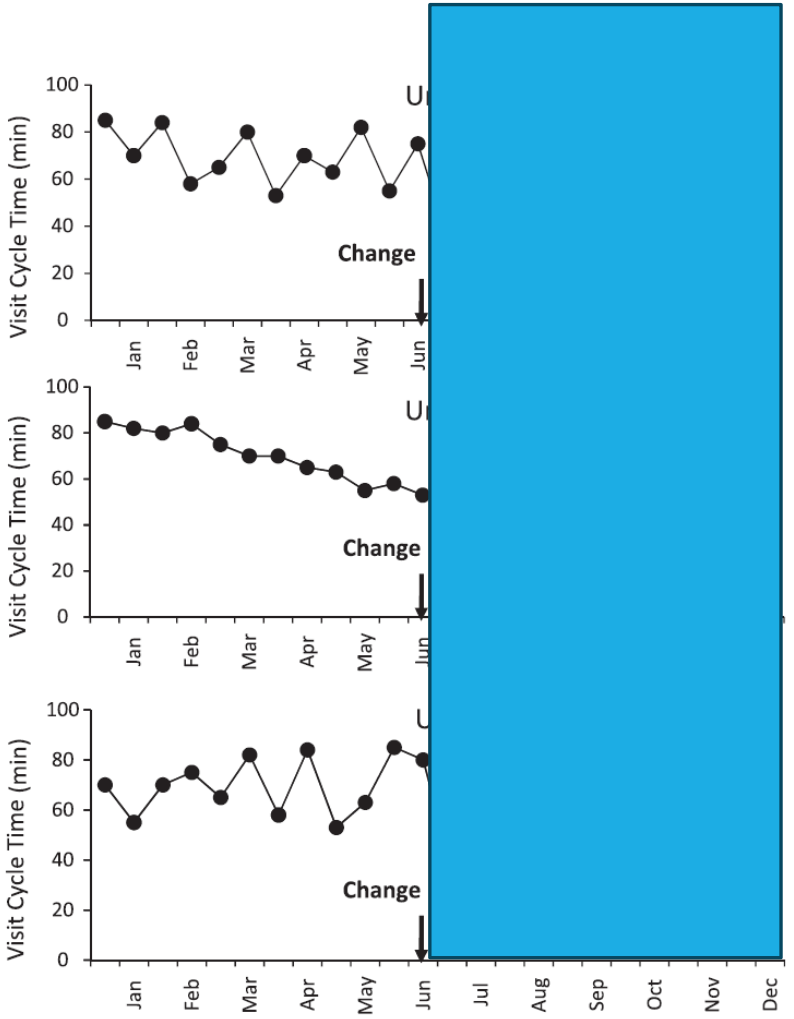
Rocco et al. BMJ Q&S. 2011

Variation: For QI, It's All About Time

Pretest-Posttest Study Design



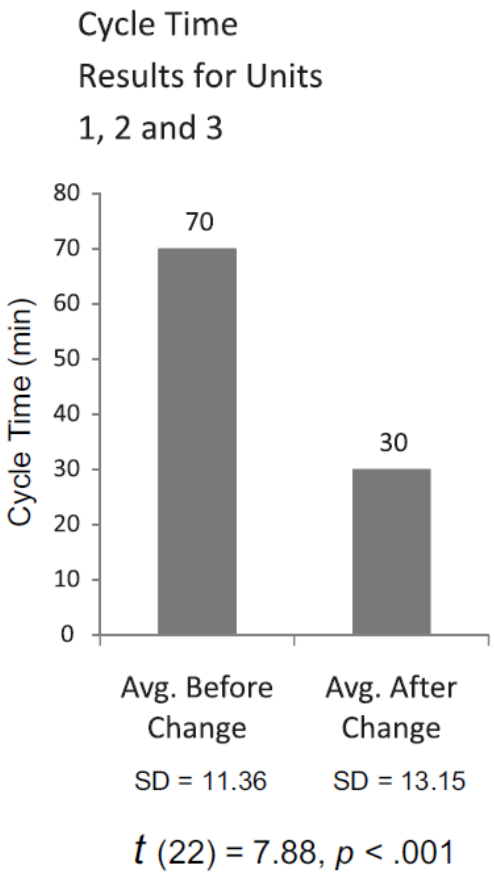
Quality Improvement Project Design



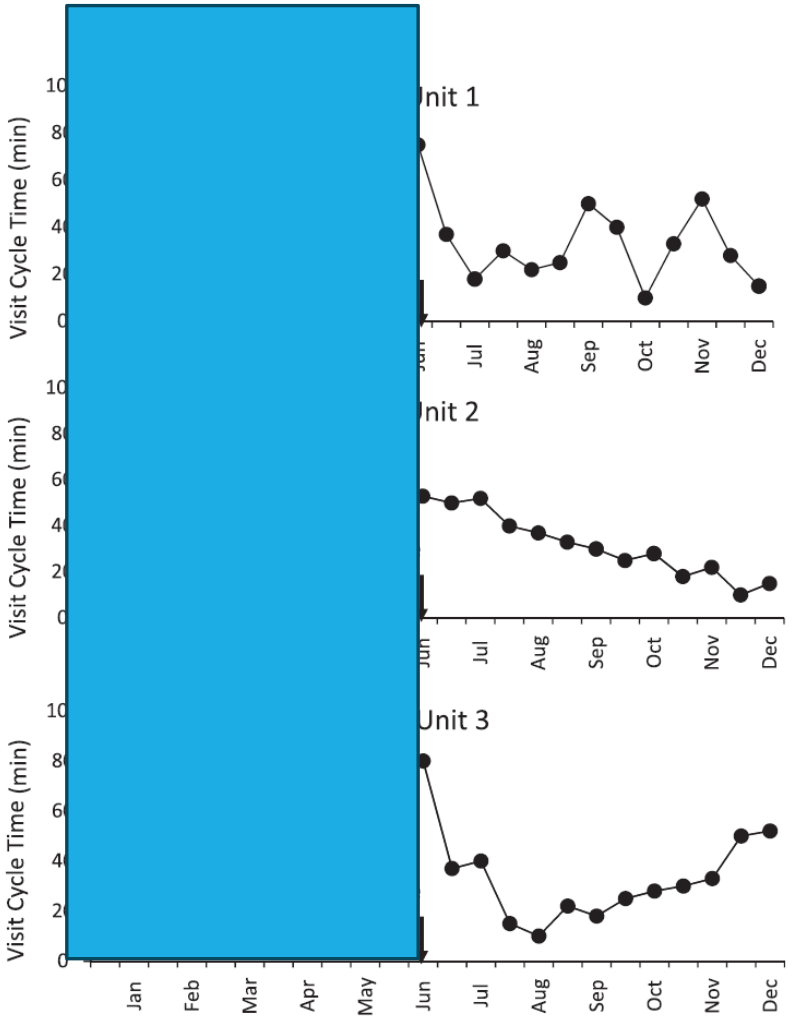
Rocco et al. BMJ Q&S. 2011

Variation: For QI, It's All About Time

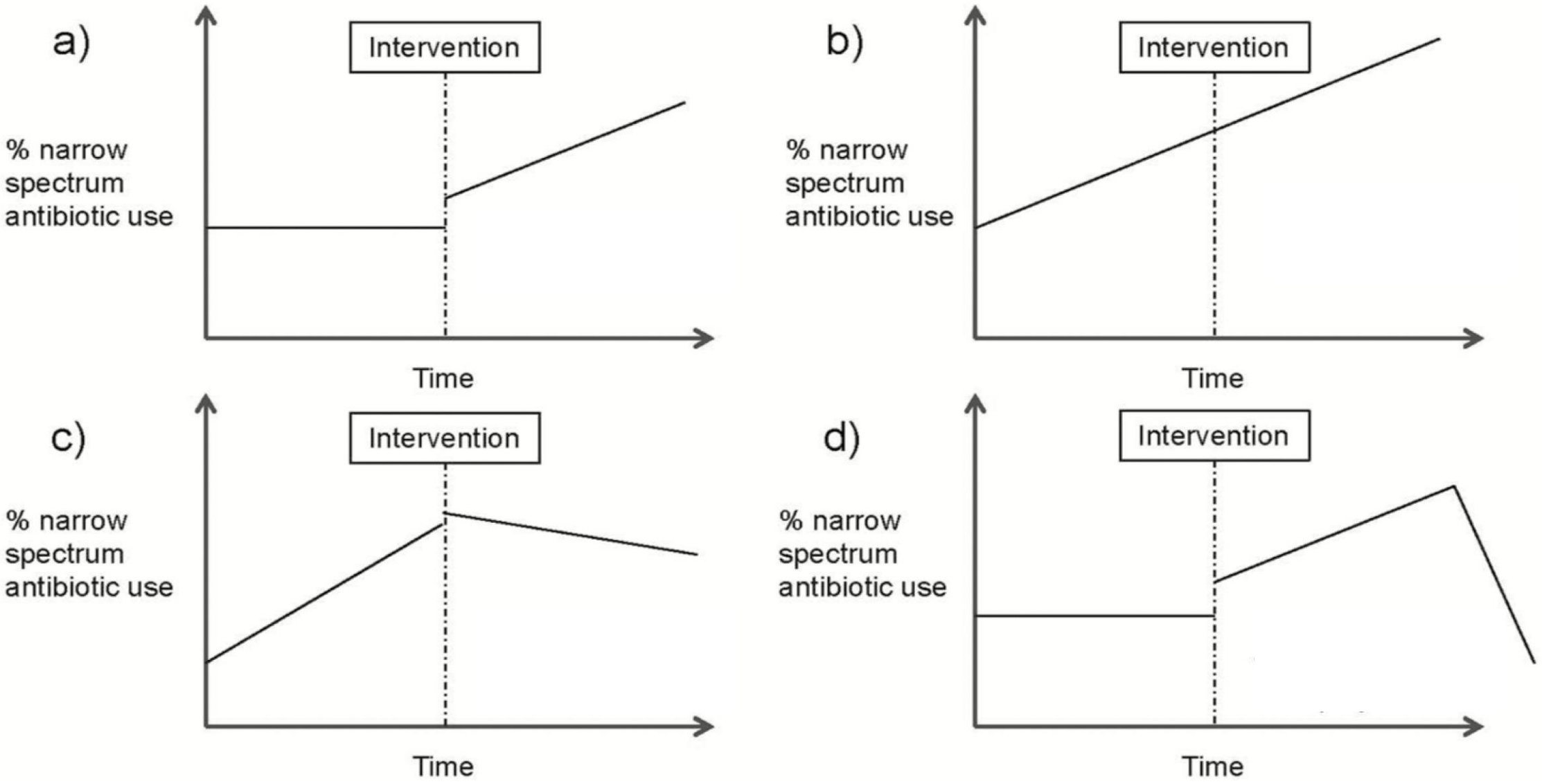
Pretest-Posttest Study Design

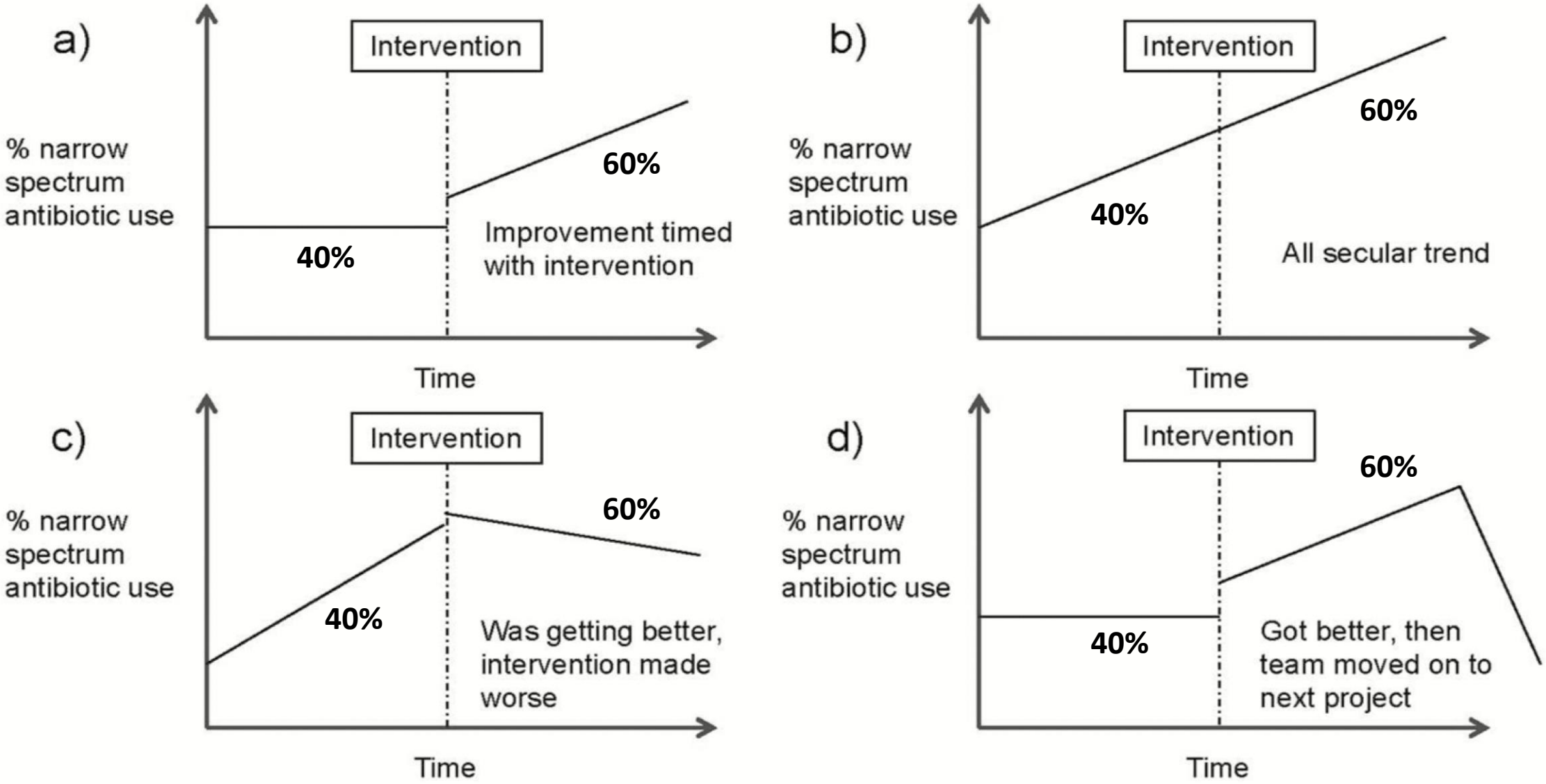


Quality Improvement Project Design



Rocco et al. BMJ Q&S. 2011


a)
Intervention
% narrow spectrum antibiotic use
Time
b)
Intervention
% narrow spectrum antibiotic use
Time
c)
Intervention
% narrow spectrum antibiotic use
Time
d)
Intervention
% narrow spectrum antibiotic use
Time


a)
Intervention
% narrow spectrum antibiotic use
60%
40%
Improvement timed with intervention
Time
b)
Intervention
% narrow spectrum antibiotic use
60%
40%
All secular trend
Time
c)
Intervention
% narrow spectrum antibiotic use
60%
40%
Was getting better, intervention made worse
Time
d)
Intervention
% narrow spectrum antibiotic use
60%
40%
Got better, then team moved on to next project
Time

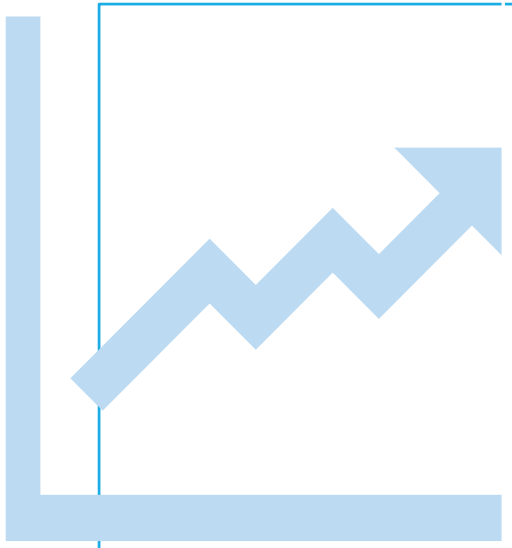
Variation

QI: Goal to understand the variation within our system and the subsequent impact of your intervention via PDSA cycles

vs

How do we display and analyze variation in quality improvement?

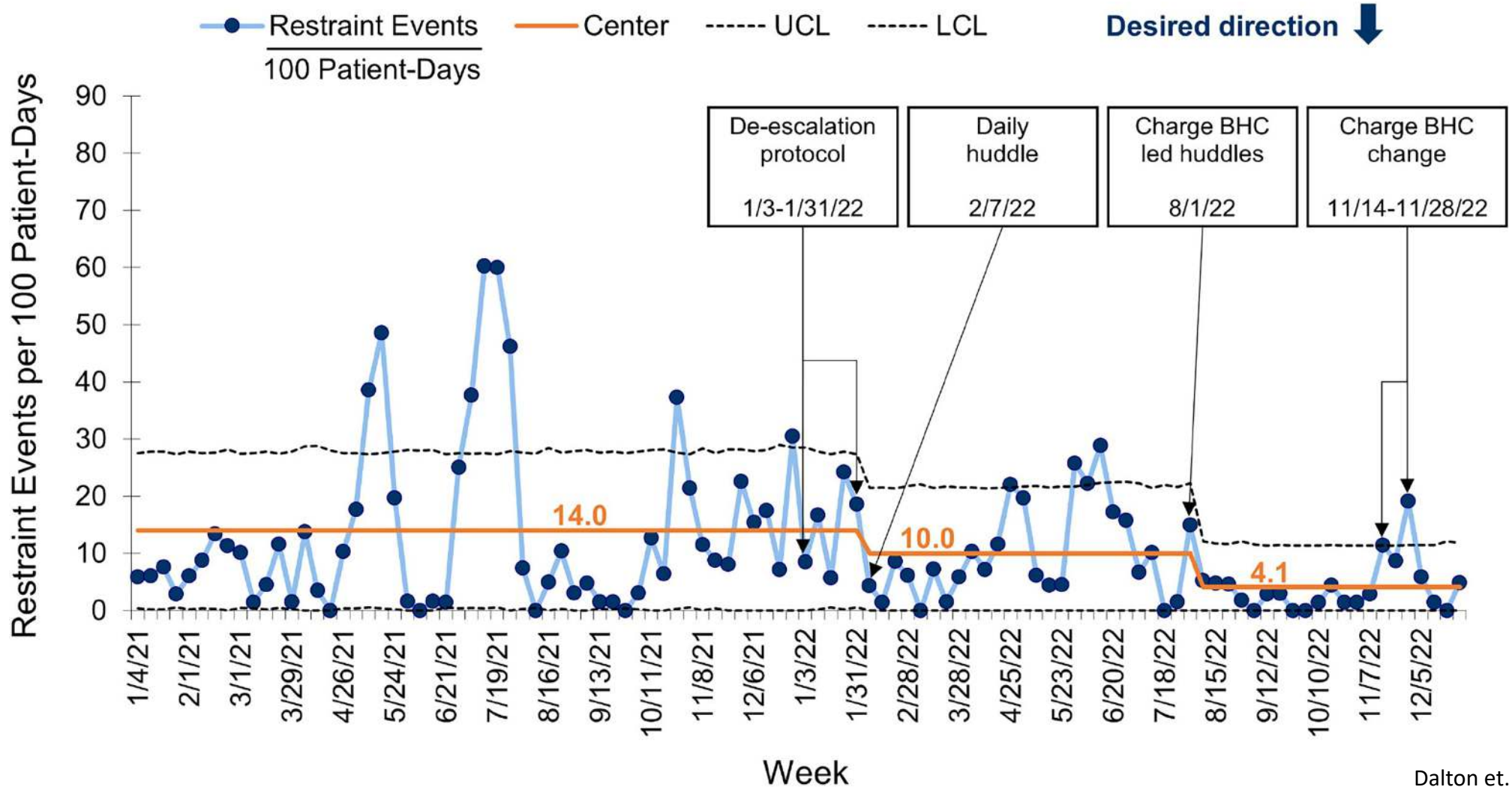
QI Charts



Before you create your QI chart

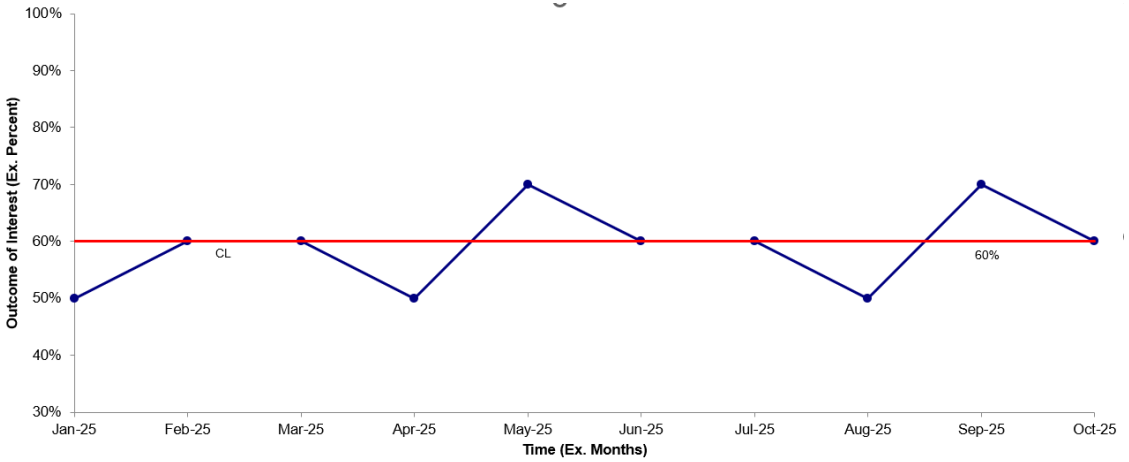
- Create an operational definition of your measure (including numerator & denominator)
- Create an aim/goal for your measure
- Identify inclusion & exclusion criteria for data collection
- Keep track of all activities that may impact the “system” or local context

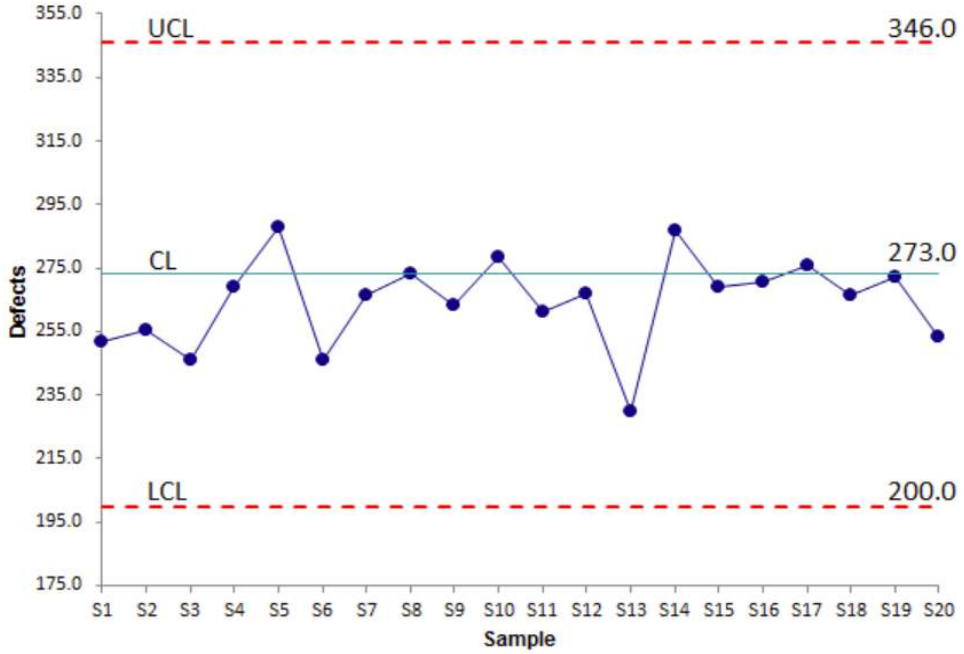
QI Charts = Storytelling + (Change/Time)



Dalton et. al. Pediatrics. 2024.

Types of Charts in QI





Run Chart

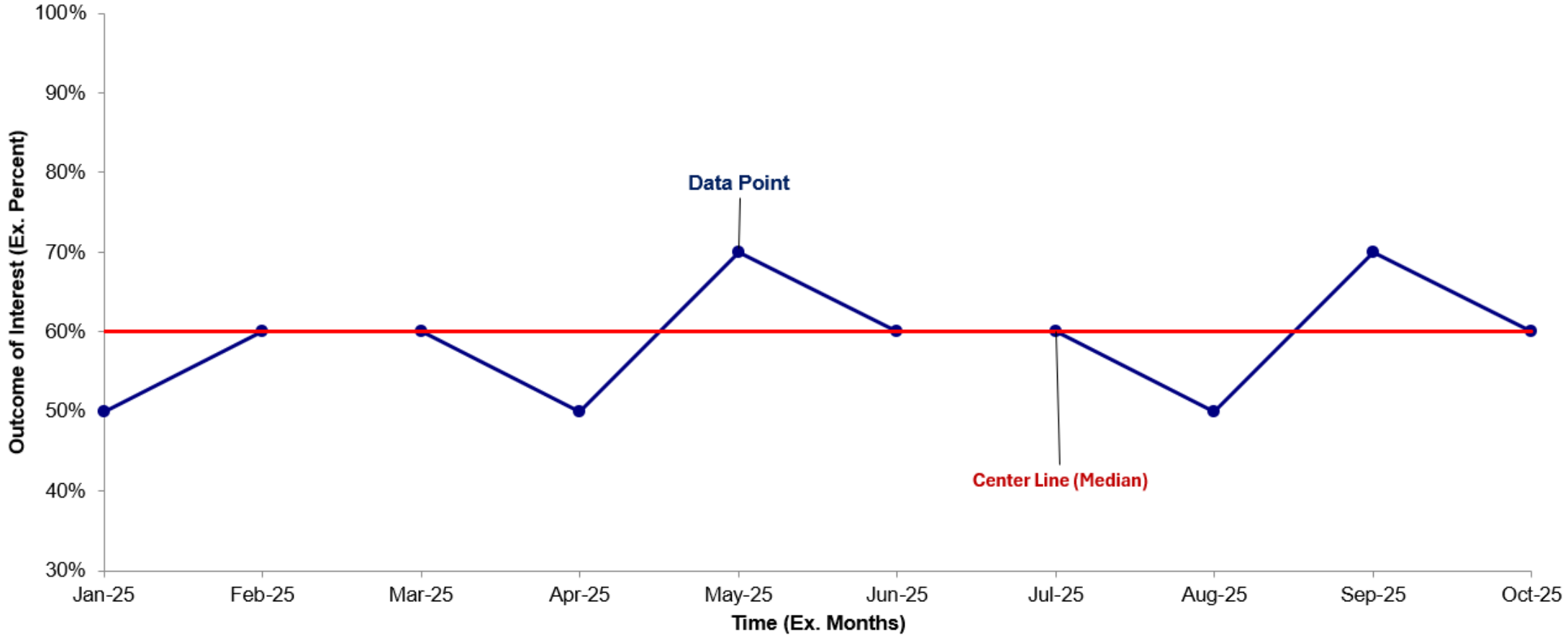
Statistical Process Control (SPC) Chart

Run Charts

Visually depicts how a process is performing

Run charts have <12-20 data points; therefore, median is the center line

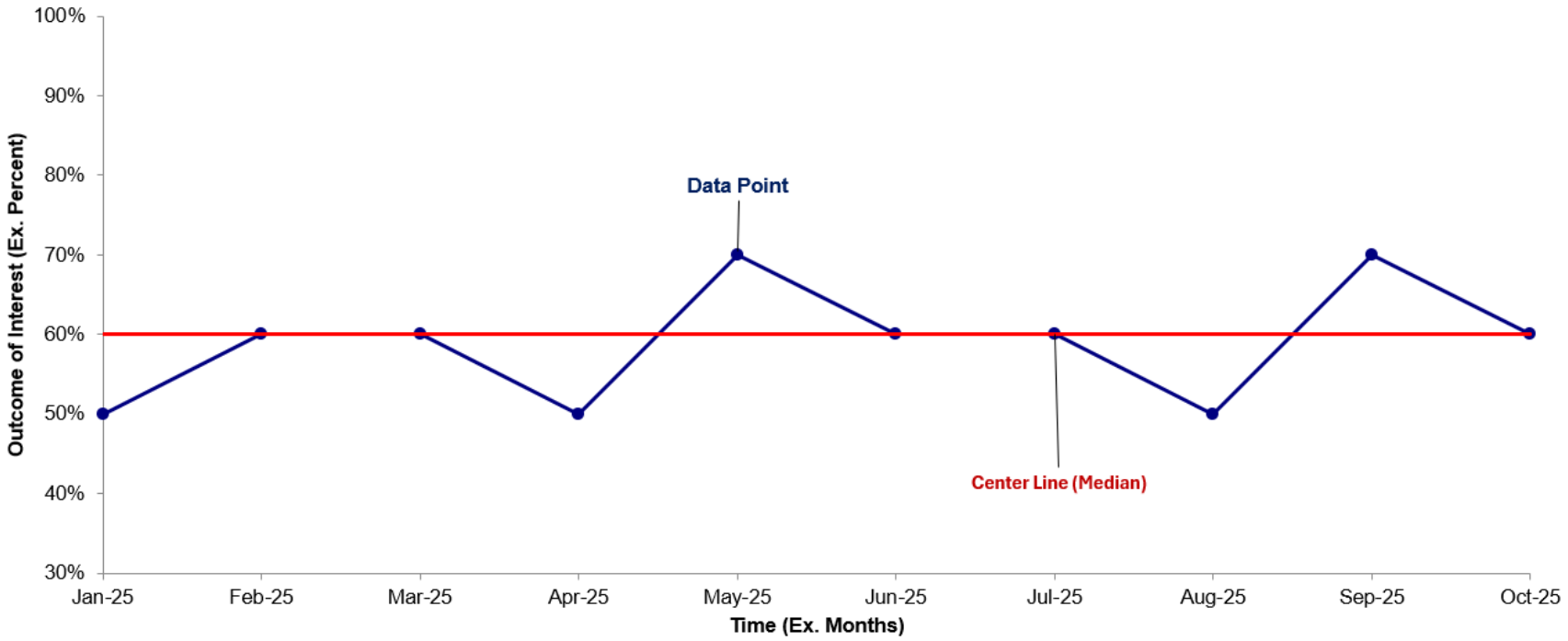
Y-axis, Measure of interest (example, percent)



X-axis, Time (example, months)

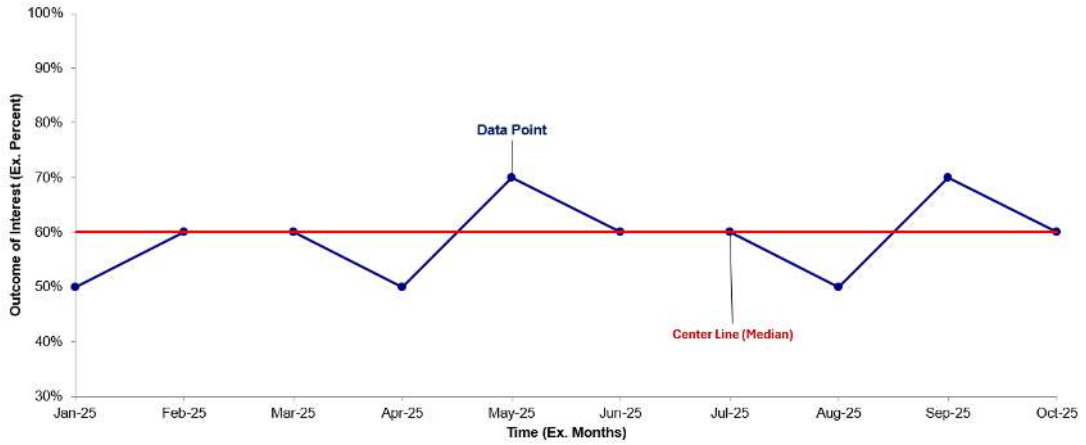
Run Charts

Which is easier to interpret?

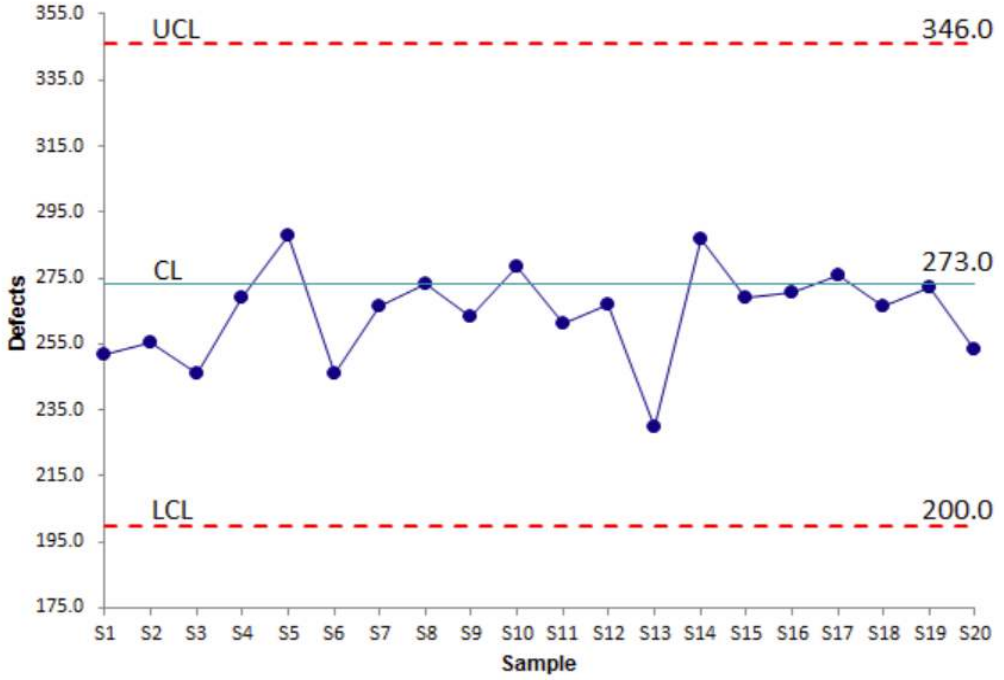


Time	Measure of Interest
Jan 25	50%
Feb 25	60%
March 25	60%
April 25	50%
May 25	70%
June 25	60%
July 25	60%
August 25	50%
September 25	70%
October 25	60%

Statistical Process Control (SPC) Chart

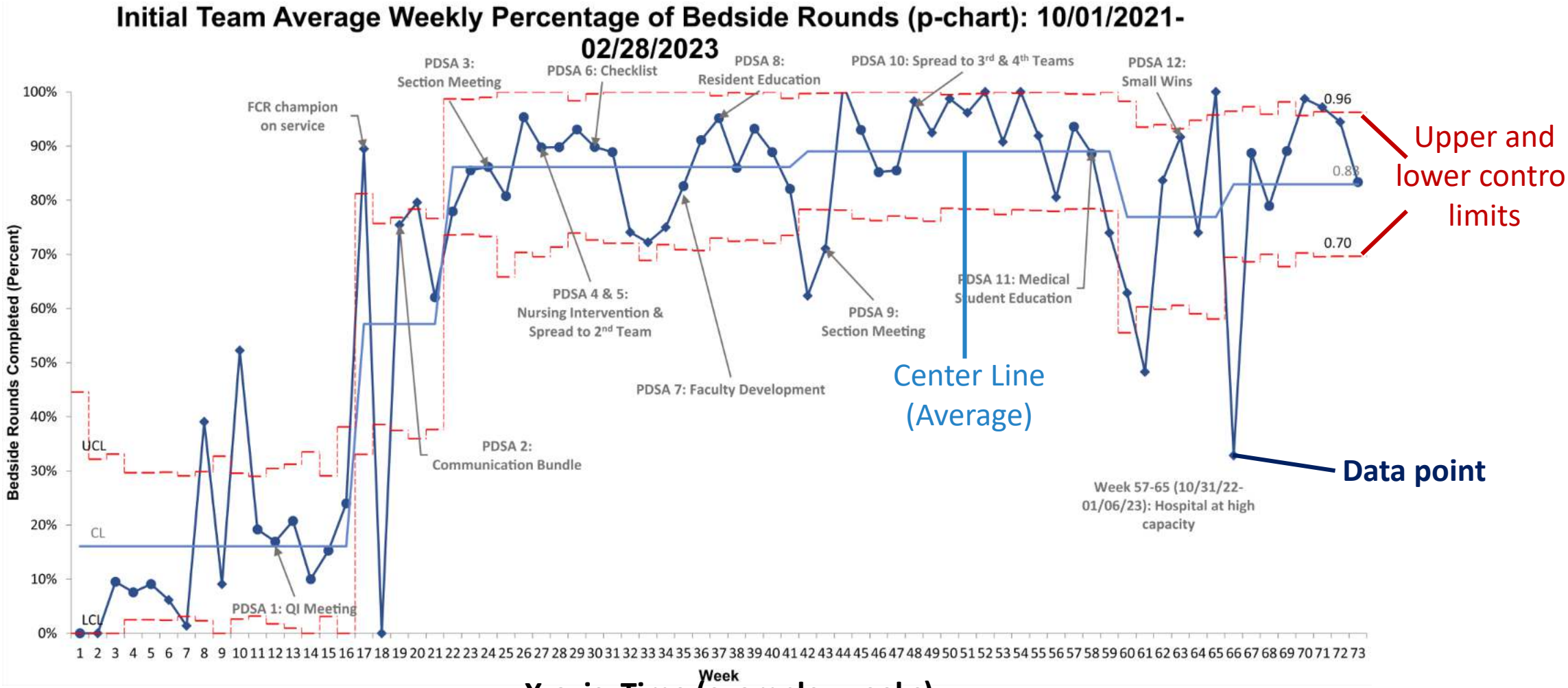


Run Chart



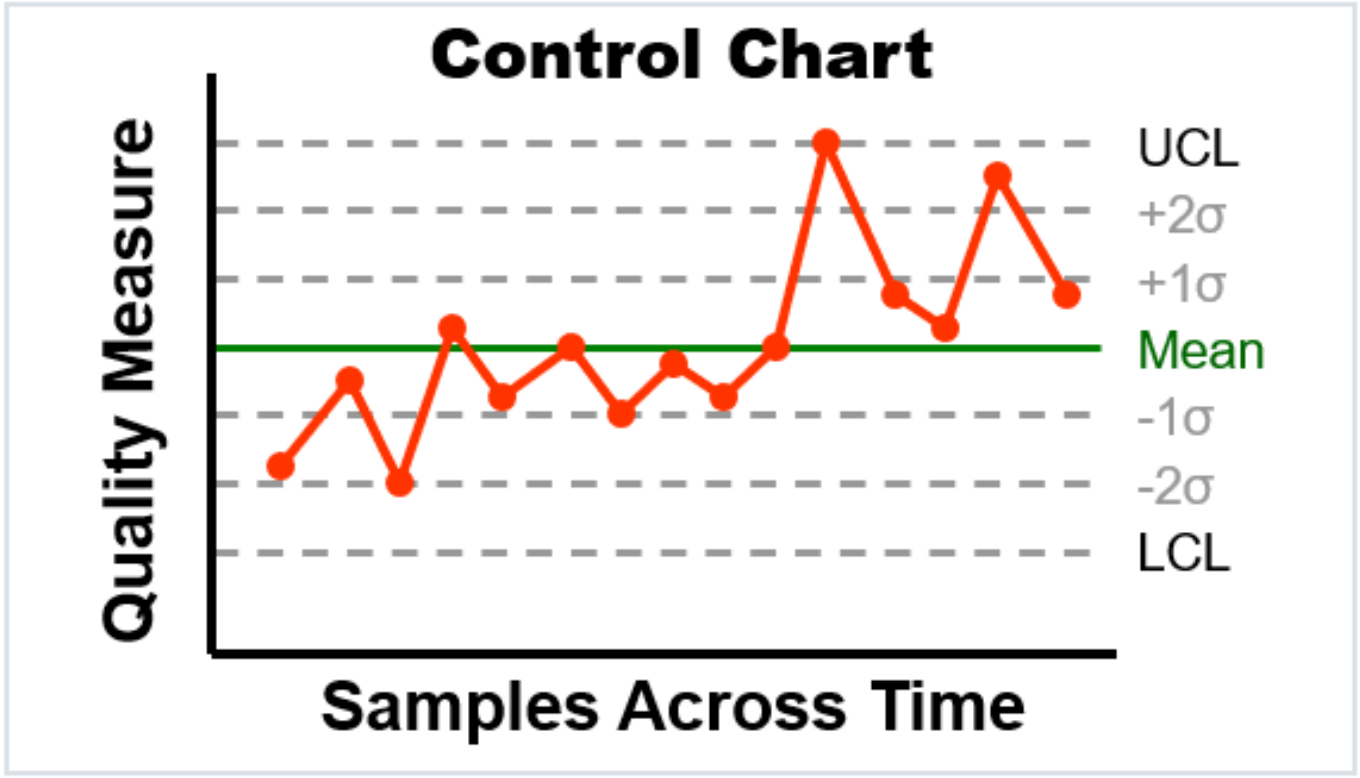
SPC Chart

SPC Chart

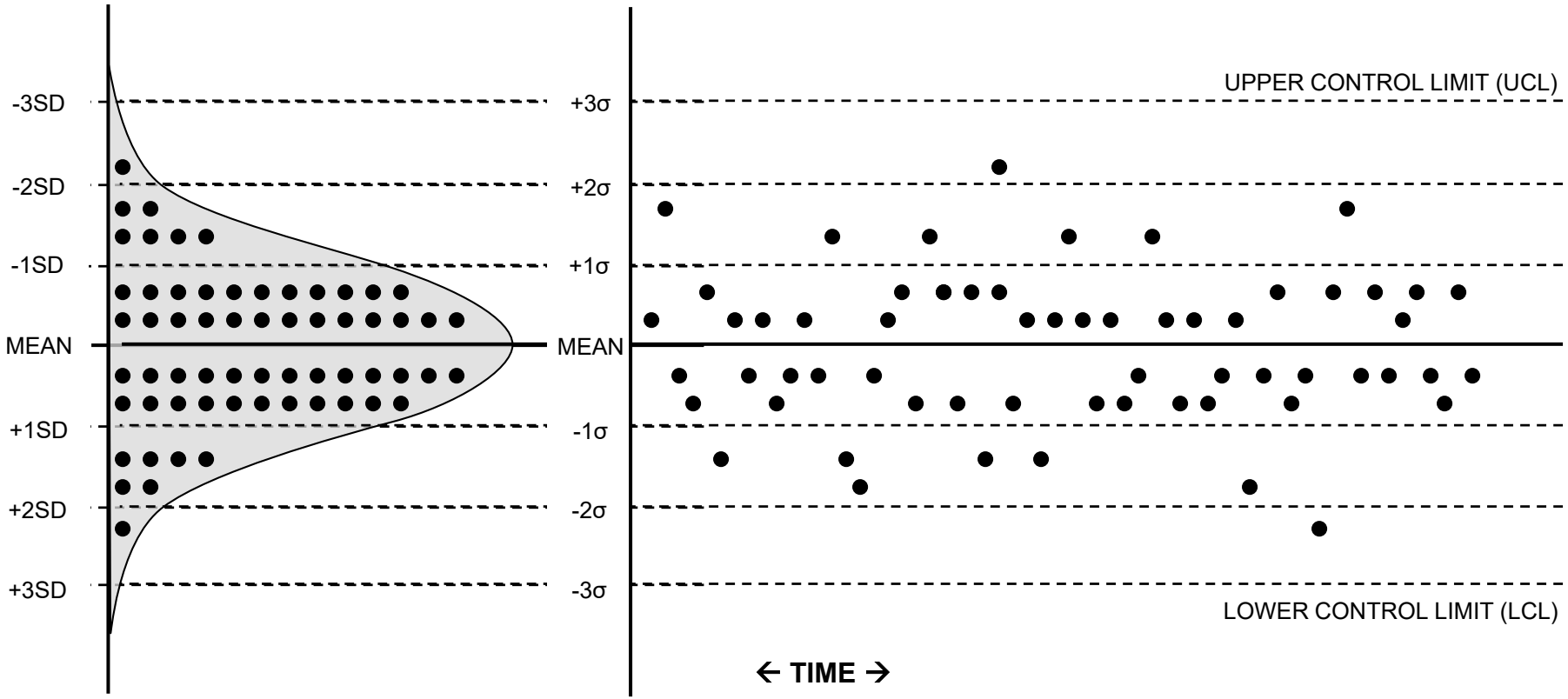

Initial Team Average Weekly Percentage of Bedside Rounds (p-chart): 10/01/2021-02/28/2023
Bedside Rounds Completed (Percent)
Week
PDSA 1: QI Meeting
PDSA 2: Communication Bundle
PDSA 3: Section Meeting
PDSA 4 & 5: Nursing Intervention & Spread to 2nd Team
PDSA 6: Checklist
PDSA 7: Faculty Development
PDSA 8: Resident Education
PDSA 9: Section Meeting
PDSA 10: Spread to 3rd & 4th Teams
PDSA 11: Medical Student Education
PDSA 12: Small Wins
FCR champion on service
Week 57-65 (10/31/22-01/06/23): Hospital at high capacity
UCL
CL
LCL
0.96
0.83
0.70
Upper and lower control limits
Center Line (Average)
Data point
Y-axis, Measure of interest (example, percent)
X-axis, Time (example, weeks)

SPC Chart: UCL & LCL

Upper/Lower Control Limits based on ±3 standard deviations from the mean



SPC Chart: UCL & LCLC



There are other numerous other criteria/rules and sources for identifying special cause variation

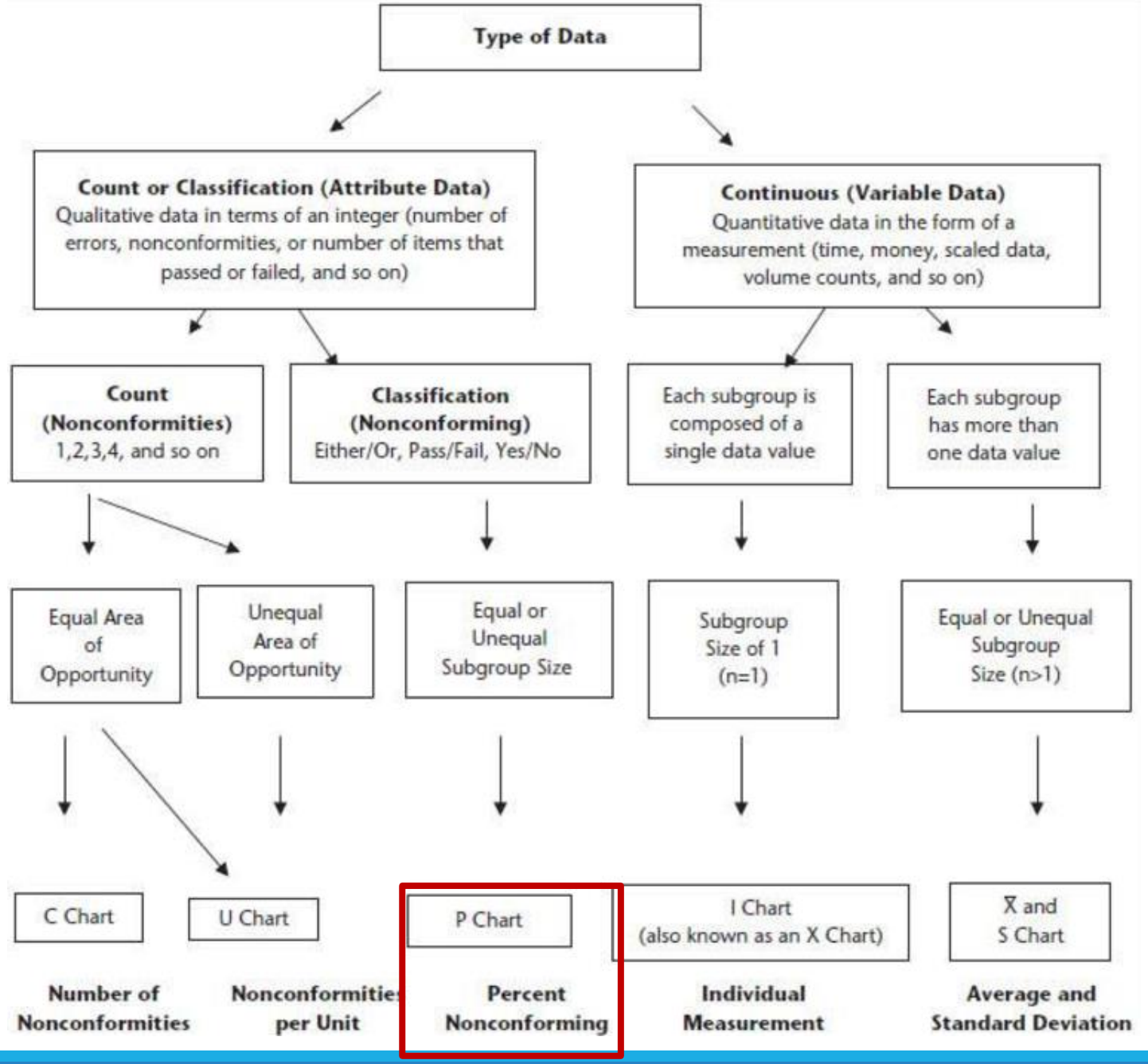
SPC Chart

Just like in classical statistics, different data types use different statistics that are based on assumptions.

Each chart assumes a different distribution.

These assumptions are used to calculate sigma (UCL, LCL)

Pick the SPC chart type that aligns with the operational definition of your measure



The Healthcare Data Guide, Chapter 5, page 151

SPC Chart

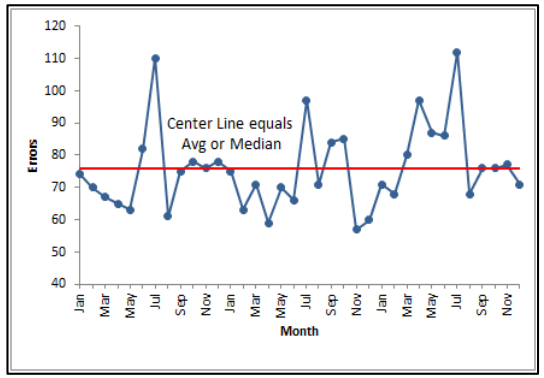
Hardest Things About SPC:

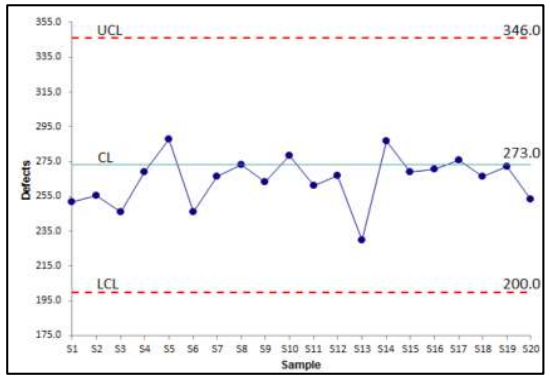
- Obtaining the data…
- Picking the right chart
- Deciding if/when to reset the center line

Best Things About SPC:

- You don't have to be a statistician to add statistical rigor to your data
  - *Understanding how to analyze your data will help you design better QI projects*
  - *There is power in understanding the clinical context within data analysis*
- You can collect, interpret, and confidently act on data simultaneously

SPC vs Run Chart





Run Chart

- Visually depicts how a process is performing overall
- Simple (can be made via Excel)
- 12 or fewer data points

SPC Chart

- Distinguishes reliably between common cause & special cause variation
- Requires software (ex. QI Macros)
- 12 (*vs 20*) or more data points

SPC vs Run Chart

Similarities

- X-axis is time
- Y-axis is measure of interest
- Visually depict how a process is performing
- Highlight change over time
- Annotated with PDSA cycles (or other notable events)

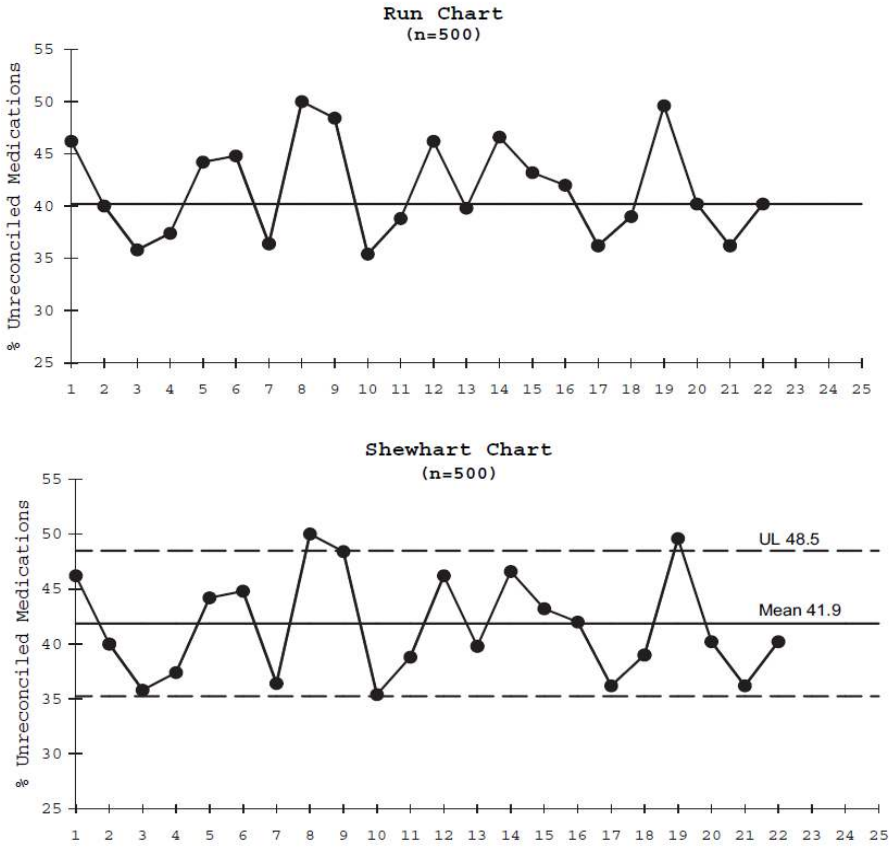
Differences

Run chart center line (CL) represents the median

SPC chart CL represents the mean

SPC charts are more robust, utilizing statistical limits to distinguish between common and special cause variation

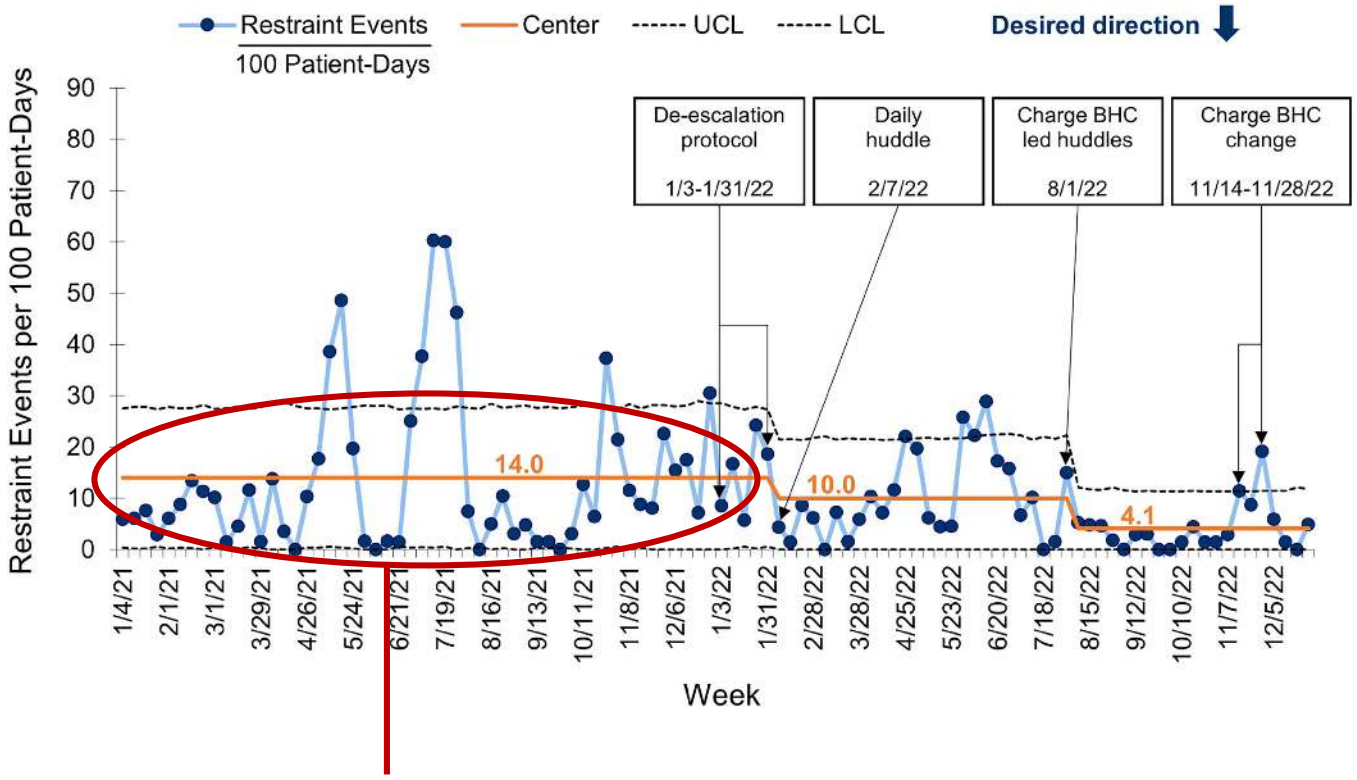
SPC charts require more data



SPC vs Run Chart: Baseline Data

How many data points are required to inform baseline data?

- Minimum 10
- Optimal 12-20
- Depends on total sample size & context



13 data points informed the baseline

You have visually displayed a process, how do we identify common cause vs special cause variation?

Special Cause Variation

#	Control Chart Rule	West-gard	Nelson-Juran	AIAG	Mont-gomery	Western Electric	IHI

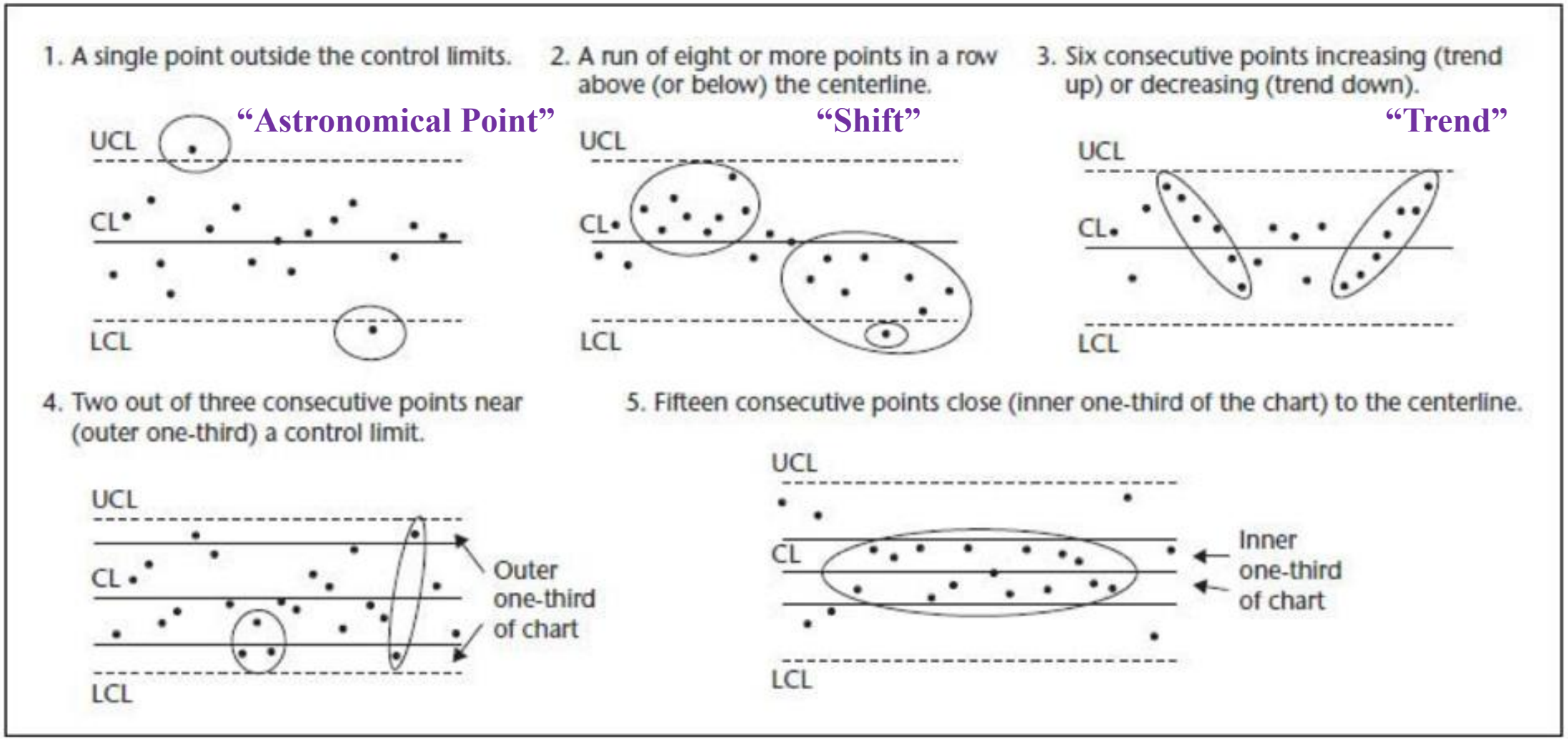
Special Cause Variation → Unnatural and/or un-random variation → Detected by a set of statistically informed rules

There are other numerous other criteria/rules and sources for identifying special cause variation

Special Cause Variation

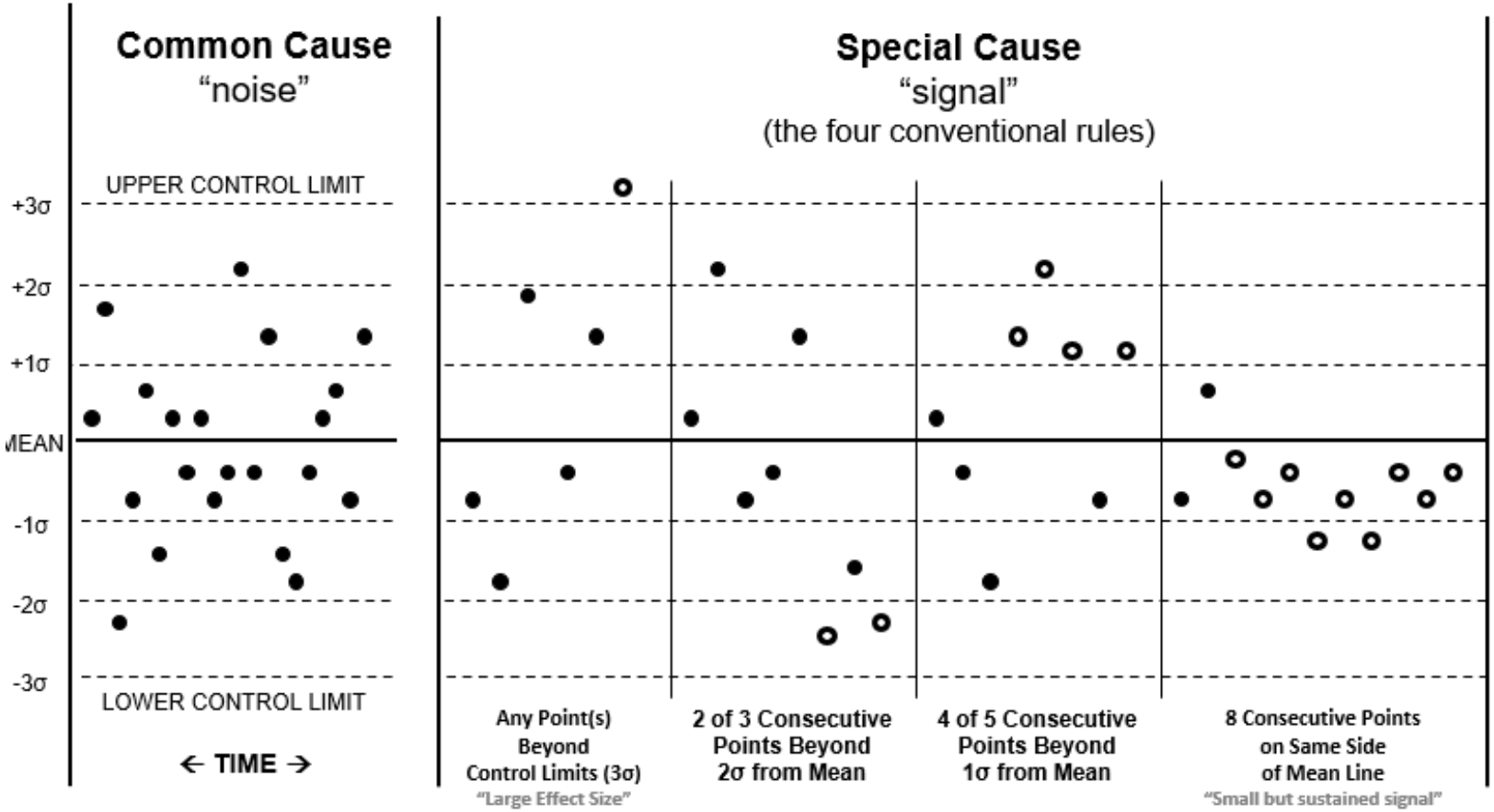
Your job:

1. Identify special cause variation
2. Interpret variation within the local context



There are other numerous other criteria/rules and sources for identifying special cause variation

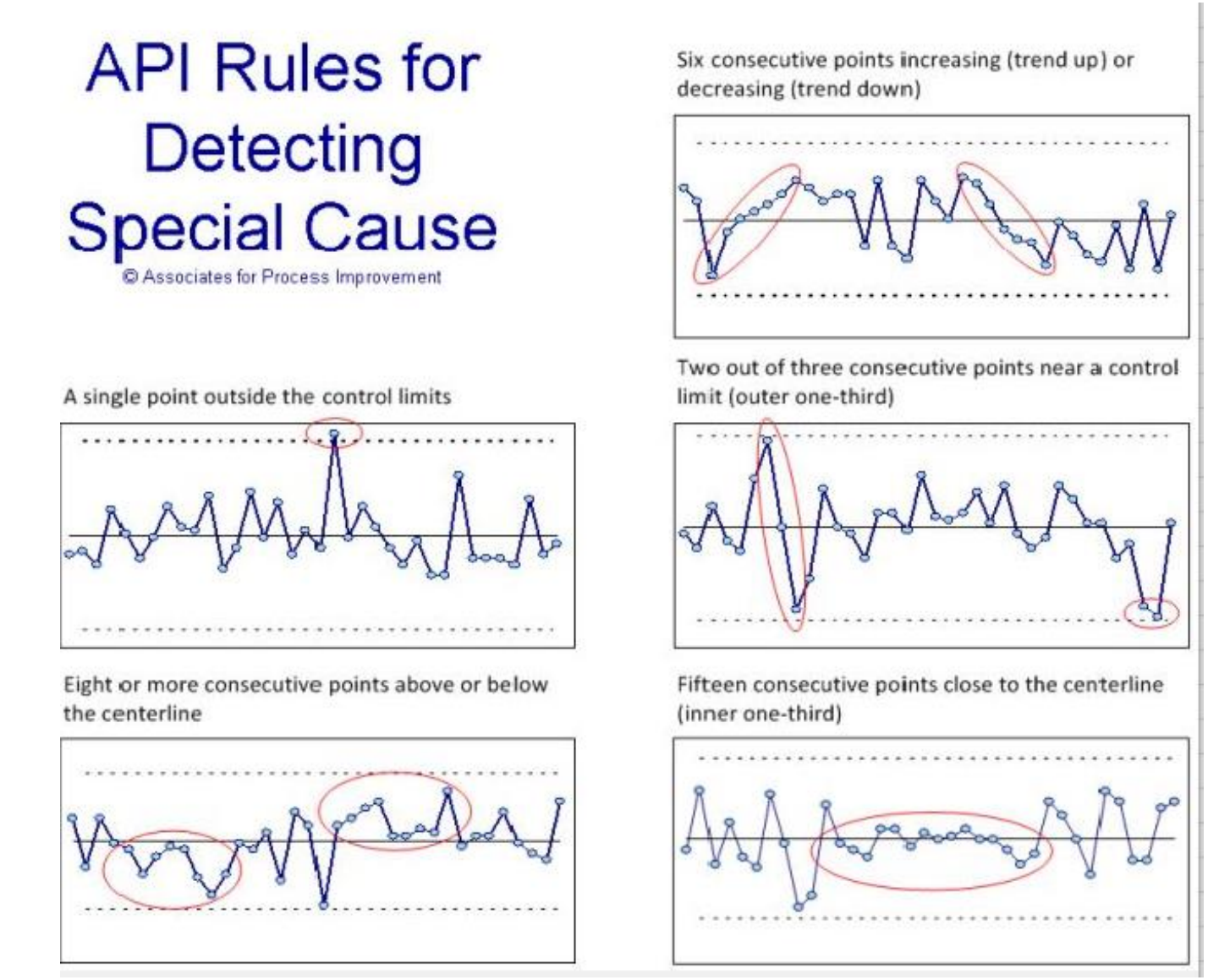
Special Cause Variation



There are other numerous other criteria/rules and sources for identifying special cause variation

Slide c/o Matt Niedner

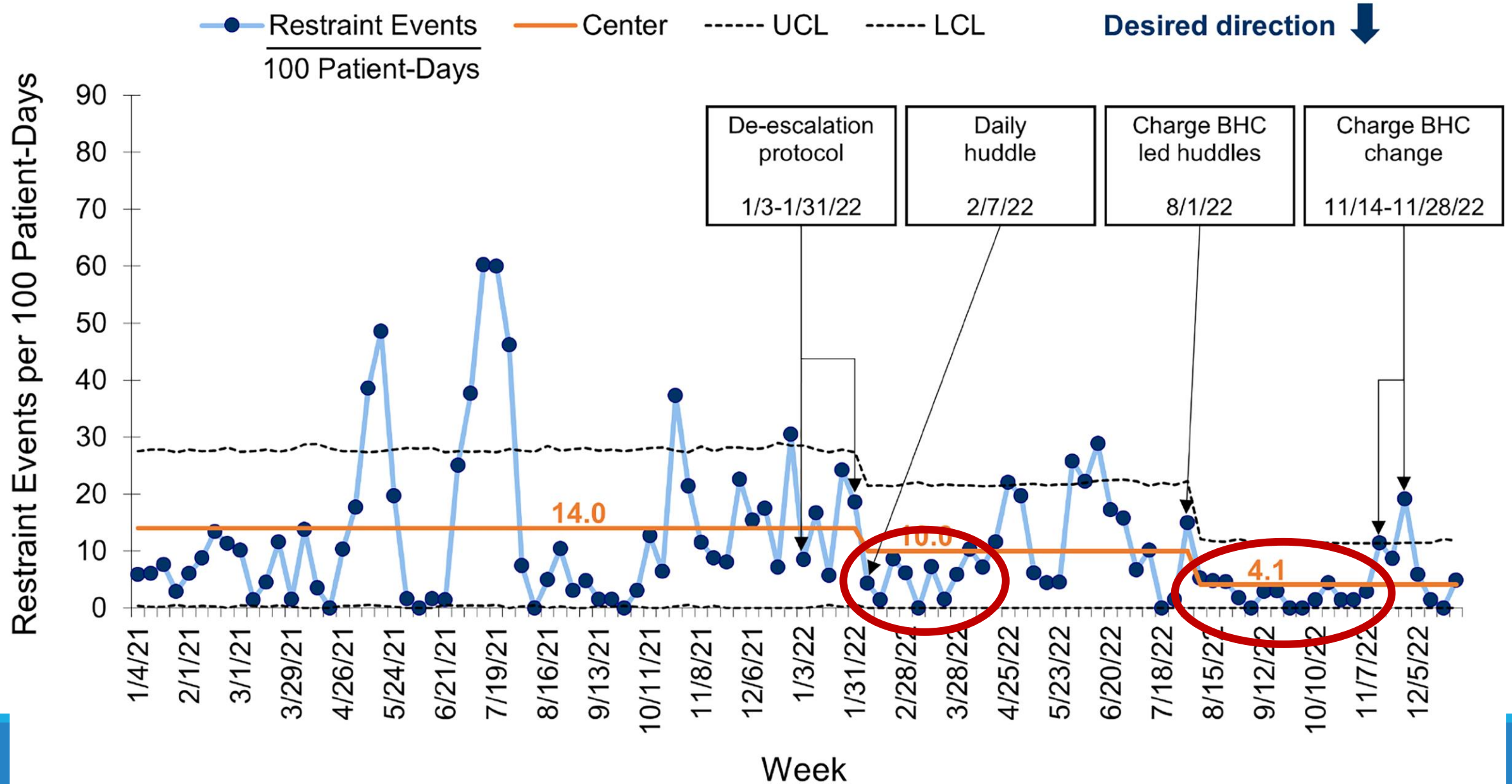
Special Cause Variation



There are other numerous other criteria/rules and sources for identifying special cause variation

Special Cause Variation: Identify the shift & trend

Special Cause Variation



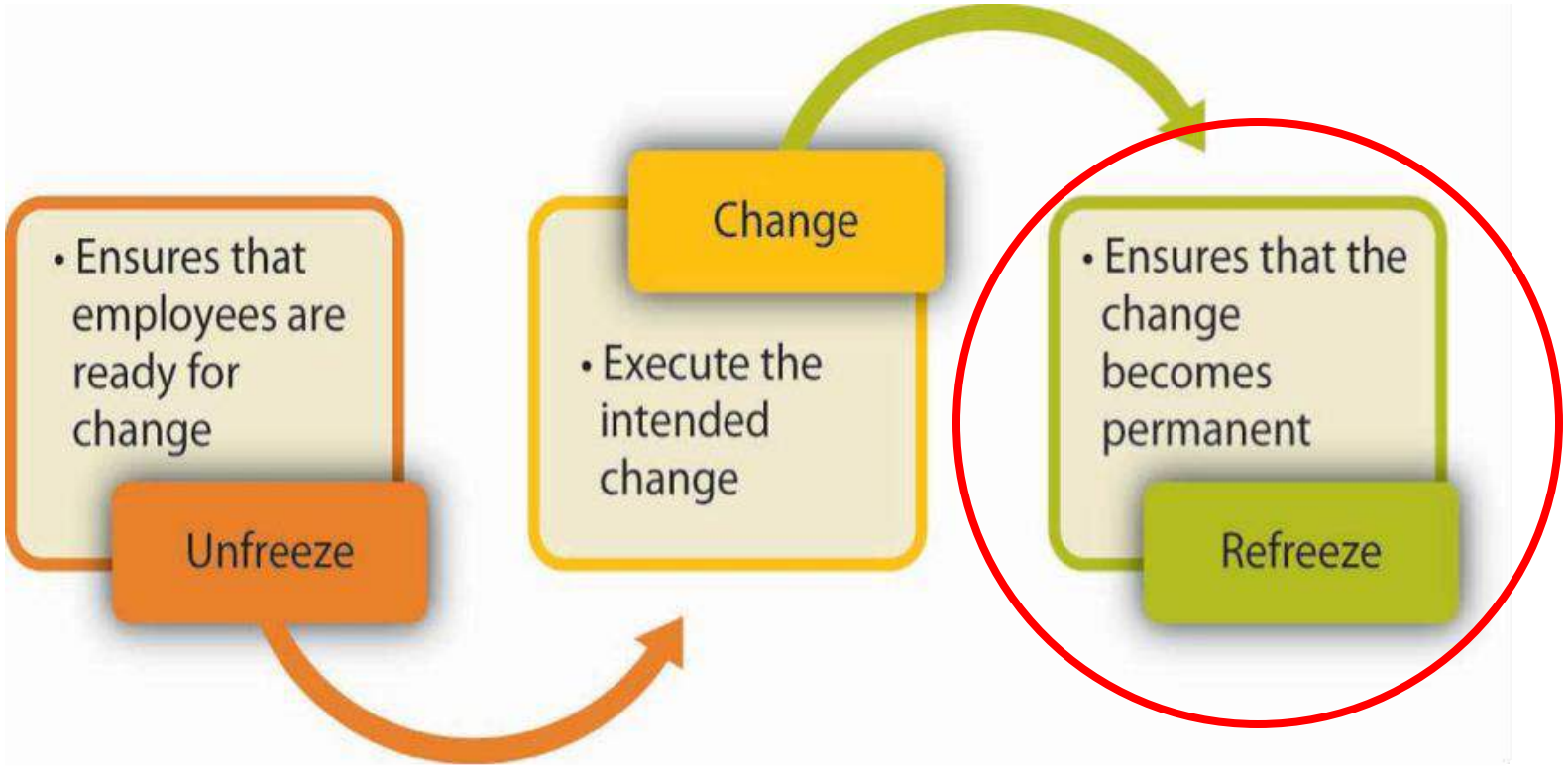
	LENGTH	START	TOPIC or ACTIVITY
Part 1 ~90 min	10 m	9:25 am	Basic Concepts & Aims
	15 m	9:35 am	Exercise 1: Aims
	15 m	9:50 am	Measures
	15 m	10:05 am	Exercise 2: Measures
	15 m	10:20 am	QI Discovery Tools
	15 m	10:35 am	Exercise 3: QI Discovery Tools (end 10:55a)
	10 m	**10:55 am**	**Break**
Part 2 ~90 min	15 m	11:05 am	QI Methods & PDSA
	15 m	11:20 pm	Exercise 4: QI Methods & PDSA
	30 m	11:35 pm	Run Charts and Control Charts
	15 m	12:05 pm	Exercise 5: Run/Control Chart Activities
	10 m	12:20 pm	Closing & Discussion (end 12:35p)
		12:35 pm	**Lunch**

Exercise 4: Run and Statistical Process Control (SPC) Charts

	LENGTH	START	TOPIC or ACTIVITY
Part 1 ~90 min	10 m	9:25 am	Basic Concepts & Aims
	15 m	9:35 am	Exercise 1: Aims
	15 m	9:50 am	Measures
	15 m	10:05 am	Exercise 2: Measures
	15 m	10:20 am	QI Discovery Tools
	15 m	10:35 am	Exercise 3: QI Discovery Tools (end 10:55a)
	10 m	**10:55 am**	**Break**
Part 2 ~90 min	15 m	11:05 am	QI Methods & PDSA
	15 m	11:20 pm	Exercise 4: QI Methods & PDSA
	30 m	11:35 pm	Run Charts and Control Charts
	15 m	12:05 pm	Exercise 5: Run/Control Chart Activities
	10 m	12:20 pm	Closing & Discussion (end 12:35p)
		12:35 pm	**Lunch**

Sustaining Gains

Lewin's Model for Change



Control Plans

Measure	Goal	Documentation	Monitoring	Prevention	Process Owner	Reaction Plan

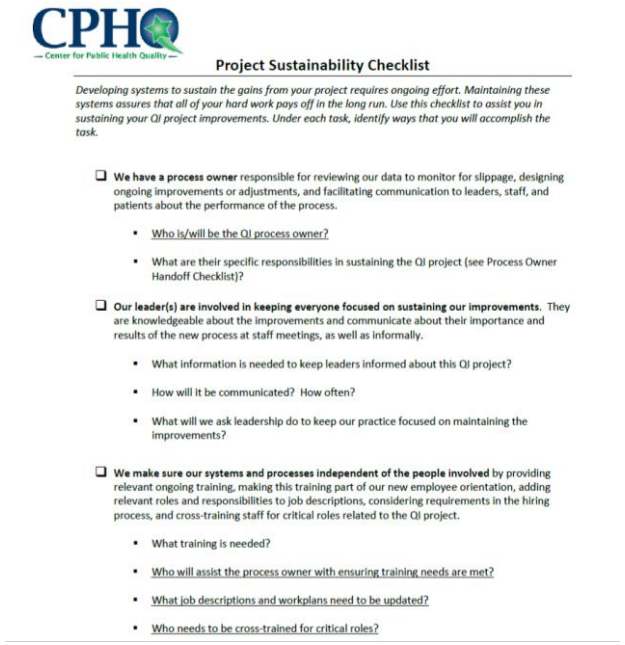
Effective Control System

Control Plans

Measure	Goal	Documentation	Monitoring	Prevention	Process Owner	Reaction Plan
PHQ9M given to all patients 11 or greater at health supervision visits	90%	1. Policy #23, last updated 6/2/2013; 2. OMS for front desk staff family history taking	Quarterly audits of 5 charts for all physicians by Marie RN	Patient portal sends automatic email to parents before visit	Notify Dr. Thomas if < 90%	Put up data, re-educate front desk staff, audit weekly for 1 month, discuss at staff meeting

Center for Public Health Quality Checklist

1. Leadership and organizational support
2. Integration into workflow
3. Staff engagement and ownership
4. Ongoing measurement and feedback
5. Training and knowledge transfer
6. Adaptability



CPHQ
Center for Public Health Quality

Project Sustainability Checklist

Developing systems to sustain the gains from your project requires ongoing effort. Maintaining these systems assures that all of your hard work pays off in the long run. Use this checklist to assist you in sustaining your QI project improvements. Under each task, identify ways that you will accomplish the task.

❑ **We have a process owner** responsible for reviewing our data to monitor for slippage, designing ongoing improvements or adjustments, and facilitating communication to leaders, staff, and patients about the performance of the process.

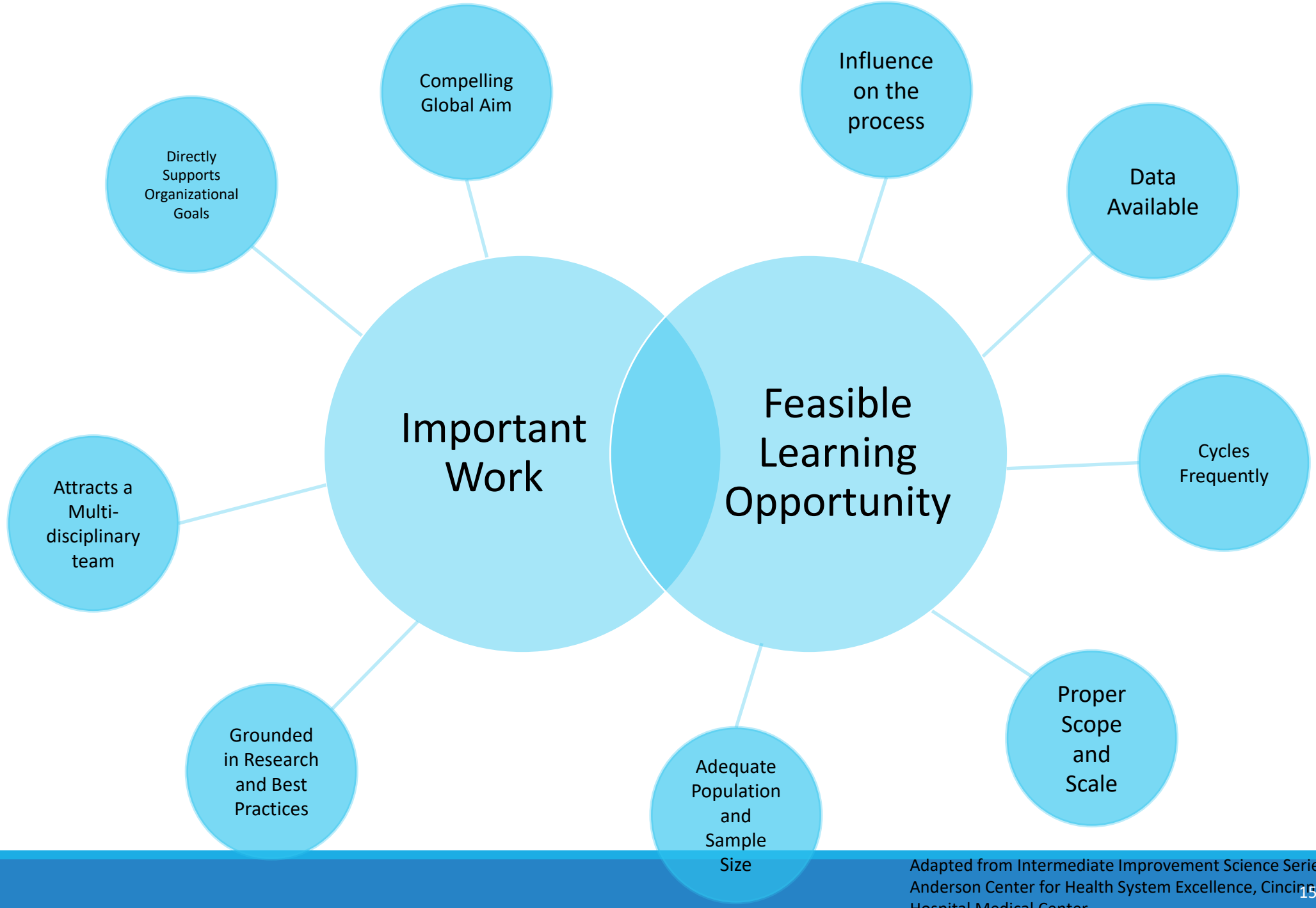
- Who is/will be the QI process owner?
- What are their specific responsibilities in sustaining the QI project (see Process Owner Handoff Checklist)?

❑ **Our leader(s) are involved in keeping everyone focused on sustaining our improvements.** They are knowledgeable about the improvements and communicate about their importance and results of the new process at staff meetings, as well as informally.

- What information is needed to keep leaders informed about this QI project?
- How will it be communicated? How often?
- What will we ask leadership do to keep our practice focused on maintaining the improvements?

❑ **We make sure our systems and processes independent of the people involved** by providing relevant ongoing training, making this training part of our new employee orientation, adding relevant roles and responsibilities to job descriptions, considering requirements in the hiring process, and cross-training staff for critical roles related to the QI project.

- What training is needed?
- Who will assist the process owner with ensuring training needs are met?
- What job descriptions and workplans need to be updated?
- Who needs to be cross-trained for critical roles?

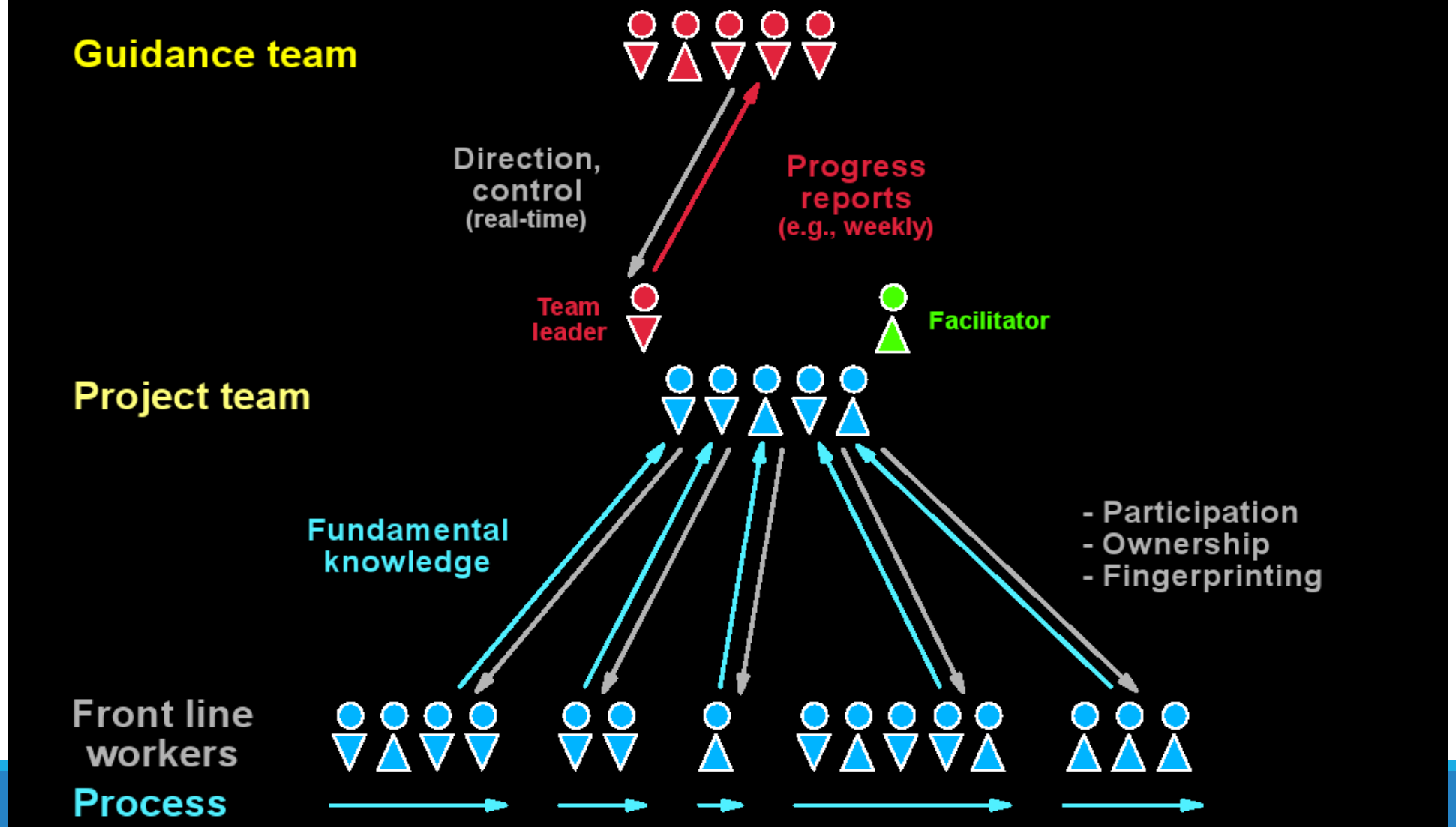


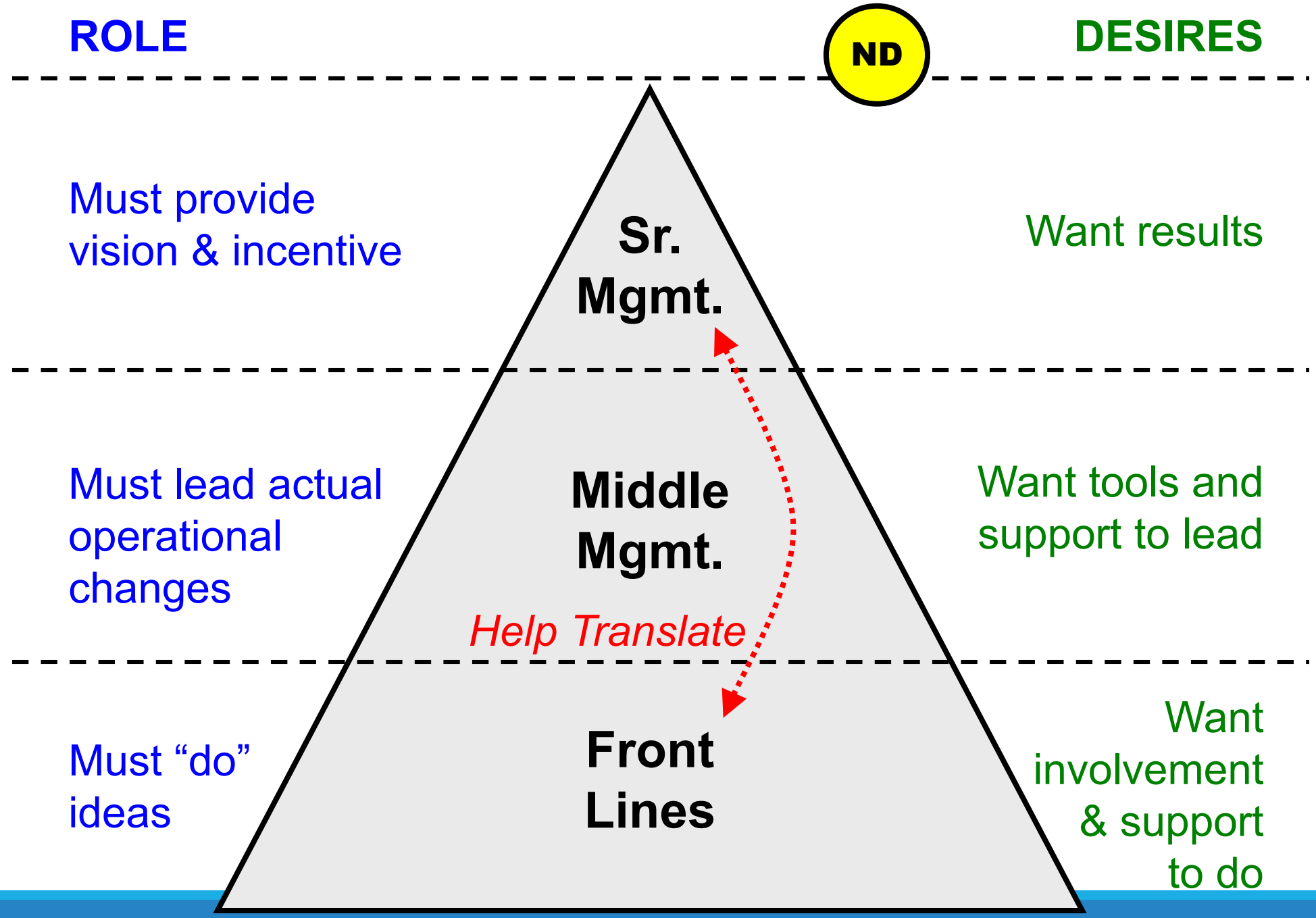
Adapted from Intermediate Improvement Science Series, James M. Anderson Center for Health System Excellence, Cincinnati Children's Hospital Medical Center

LEADING QI

"What if, and I know this sounds kooky, we communicated with the employees."

Basic QI team structure





Adapted from John Shook, 2006

QI Leadership Pearls

Create multidisciplinary teams and ensure everyone has a voice
- Facilitate equality and turn taking

Help set the proper scope/frequency of testing
- Usually smaller, more often, more variety of tests

Be a part of the testing
- First hand experience, be wary of over-delegation

Distinguish bad ideas vs poor implementation
- Don’t let good ideas fail because of poor execution

Allow operations to evolve
- Question habits/assumptions, prevent ruts/stagnation

QI Leadership Pearls

Engage higher order improvement strategies

- Think sustainability & reliability (not brute force)

Good leaders don't hoard information

- Create situational awareness for teams/frontline/staff

Be transparent, share data, network

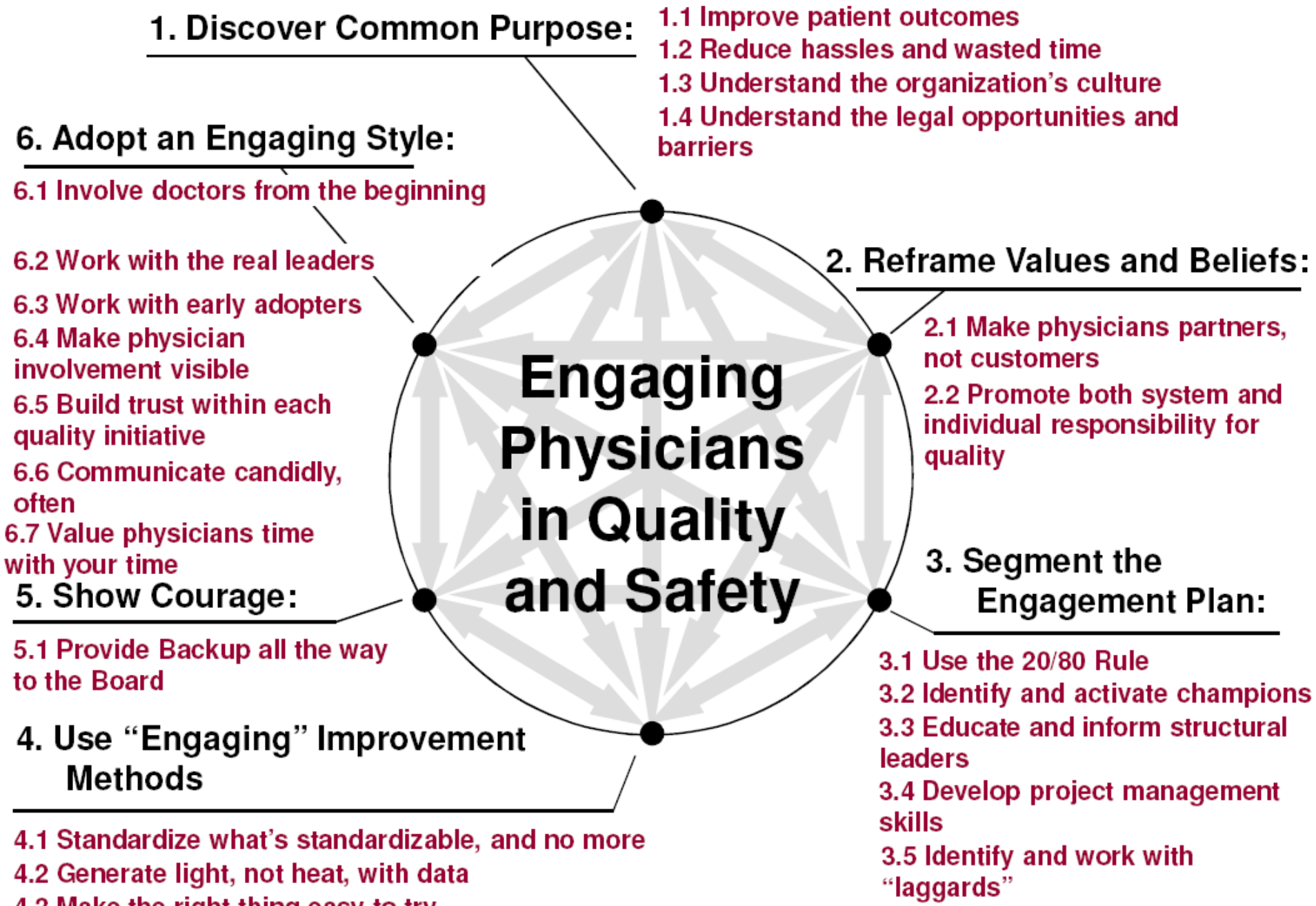
- Never ask frontline for info that you don't feed back

Strive engage content experts in the QI processes

- Use "QI coaches" to acquire QI skills, not substitute for

Don't wait until you're "ready"

- Get QI teams meeting regularly, "do" the work

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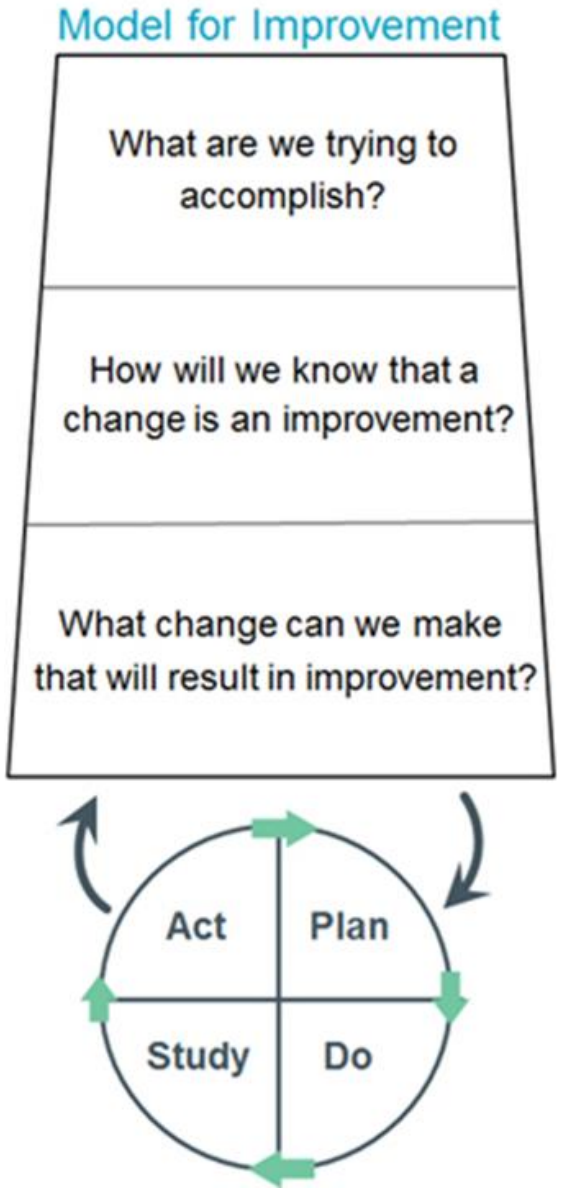
Key Takeaways

MODEL FOR IMPROVEMENT

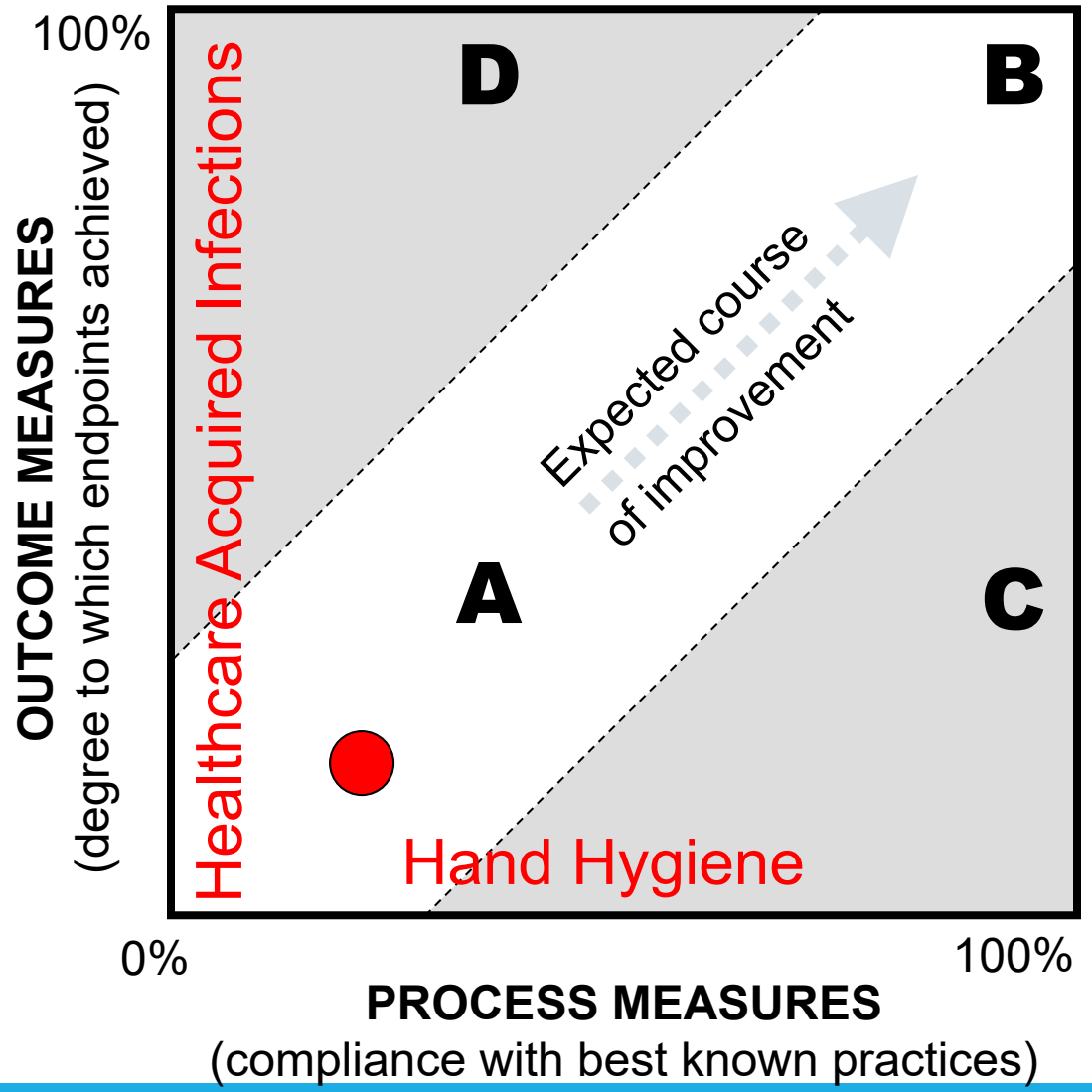


Aims

Measures

Ideas

Use of Discrepant Process & Outcome Measures to Stimulate Identification of Erroneous Metrics & Contextual Influencers



A – Common Starting Point

- Undesirable performance but informed for improvement

B – Common Goal Point

- High performance and informed for emerging defects in process

C – Outcome Discordance

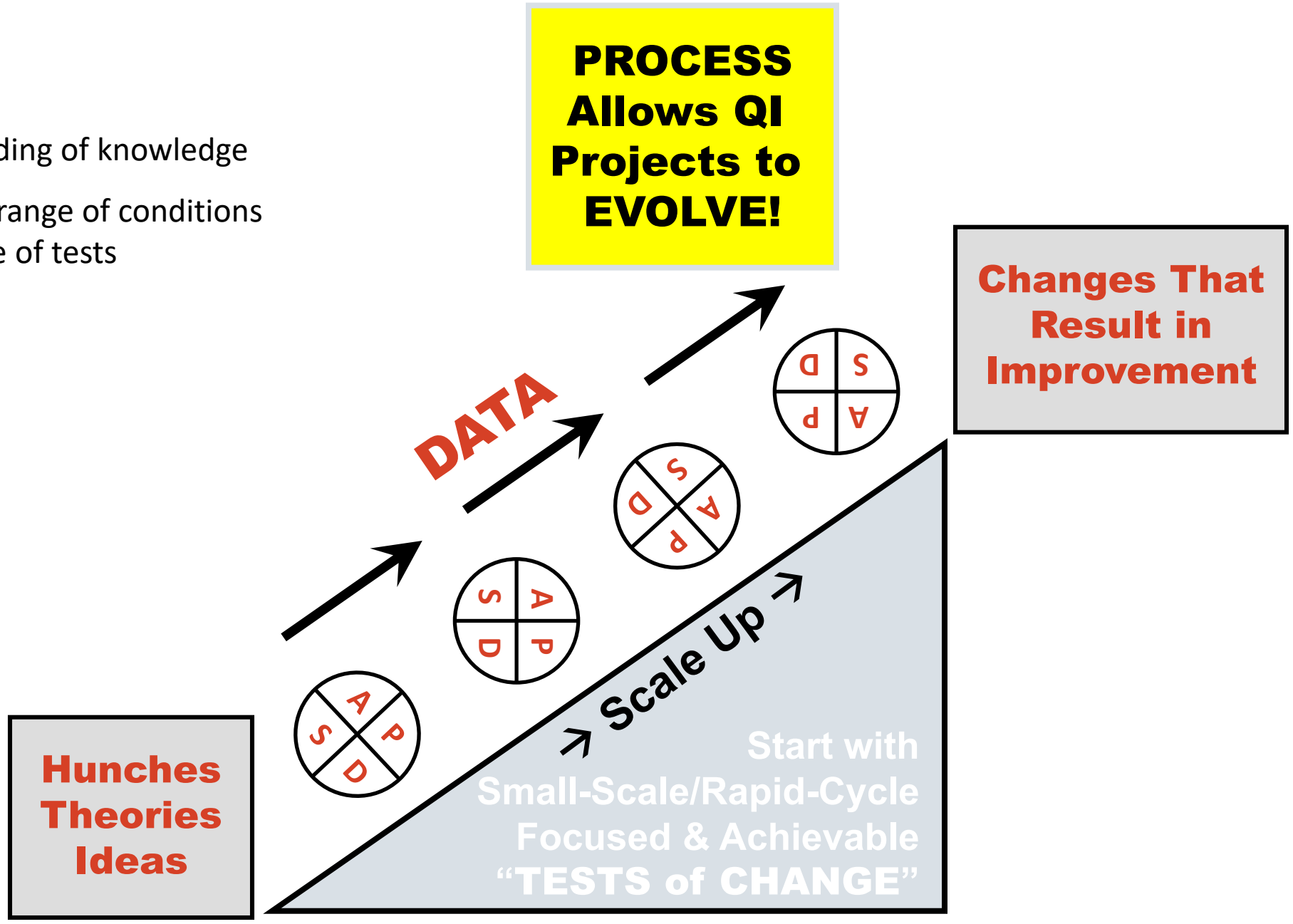
- Low performing and uninformed for improvement; preventable adverse outcomes are the learning events
- Question validity of measures (process over-estimated, outcome under-estimated)
- Query presence of contextual factors confounding performance and/or measurement

D – Process Discordance

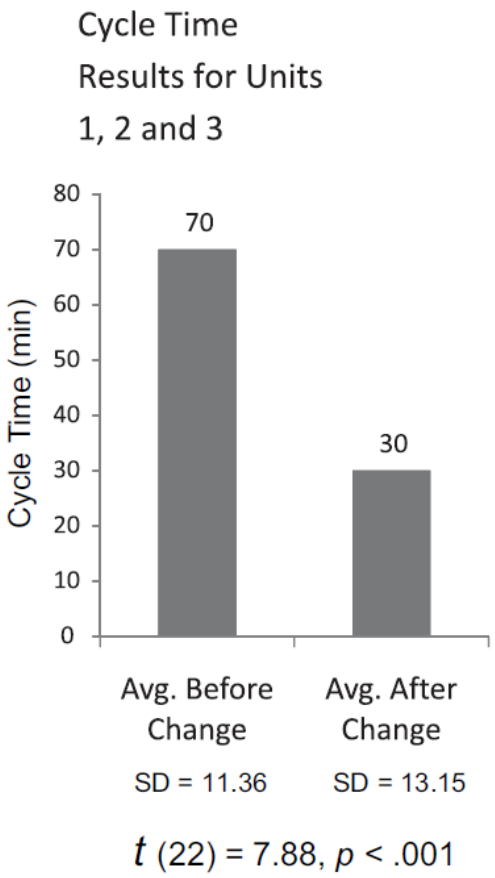
- High performing and informed for prevention, process simplification, de-bundling, etc.
- Question validity of measures (process under-estimated, outcome over-estimated)
- Query presence of contextual factors that protect performance or affect measurement

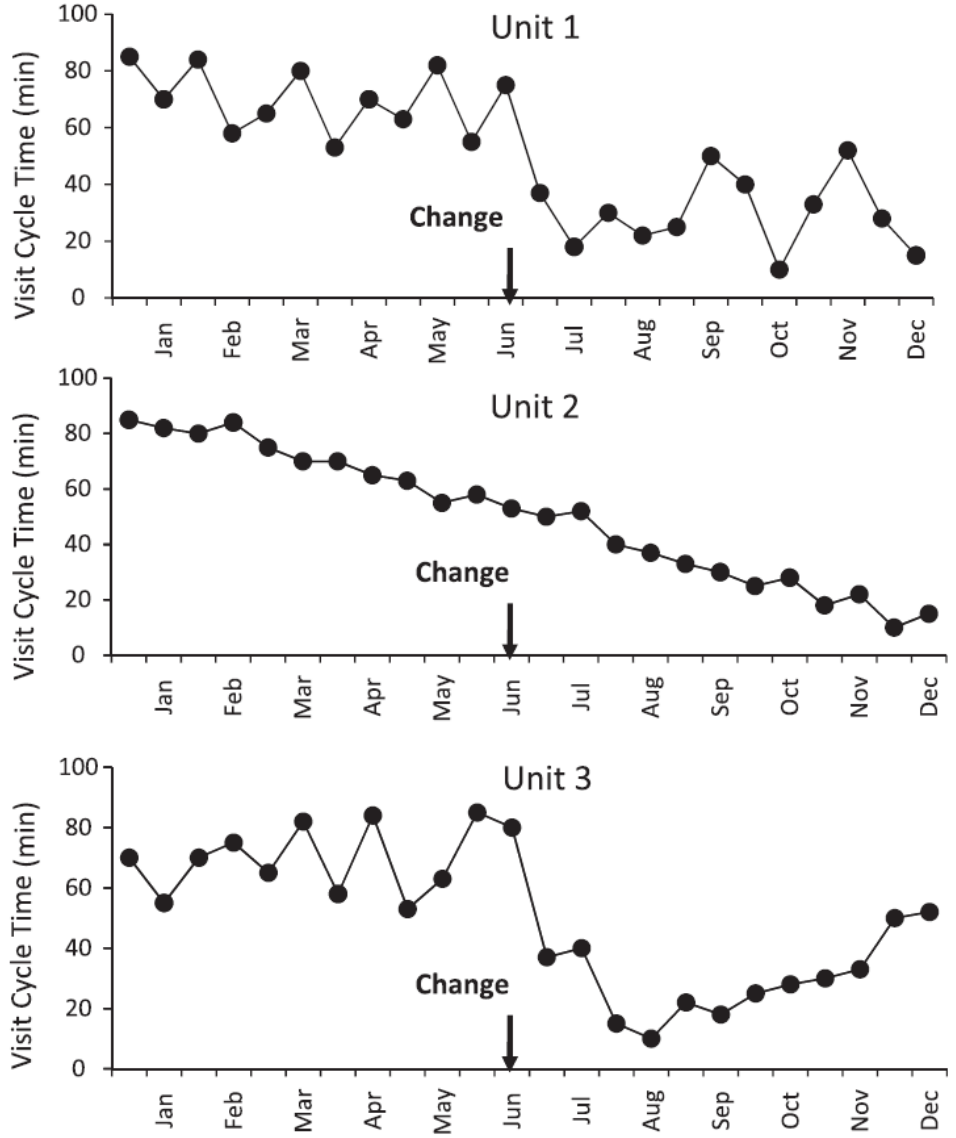
Sequential building of knowledge

Include a wide range of conditions in the sequence of tests



Pre-Post analysis vs Longitudinal Data Over Time





Types of Variation

Common Cause Variation (CCV)

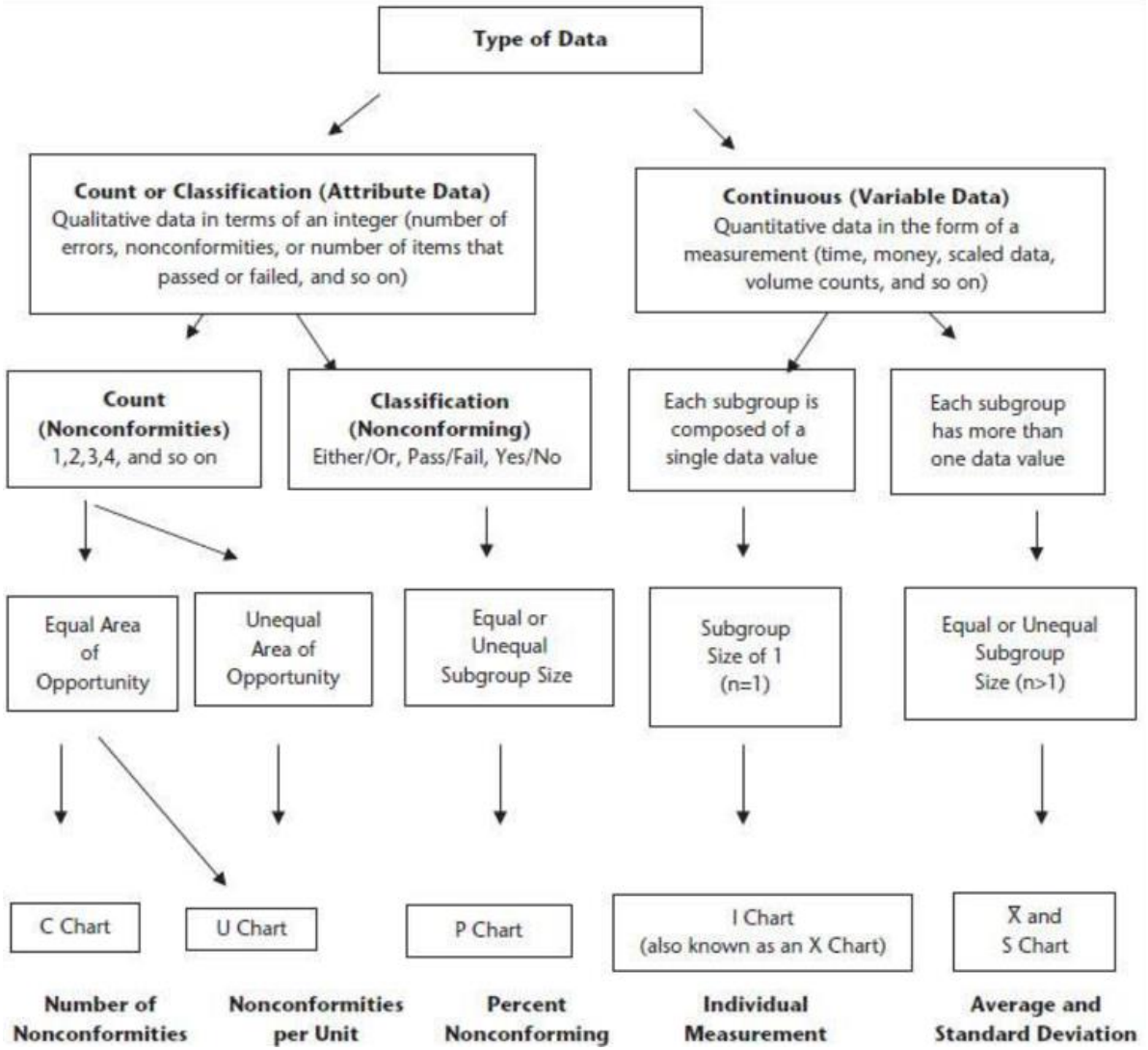
- Natural variation, “noise”
- Inherent in all systems

Special Cause Variation (SCV)

- Unnatural variation, “signal”
- May be
  - unplanned (e.g., H1N1 pandemic)
  - planned (e.g., QI initiative)

Ultimate Goal of QI: Turn good SCV into sustainable CCV!

How to Select a Control Chart



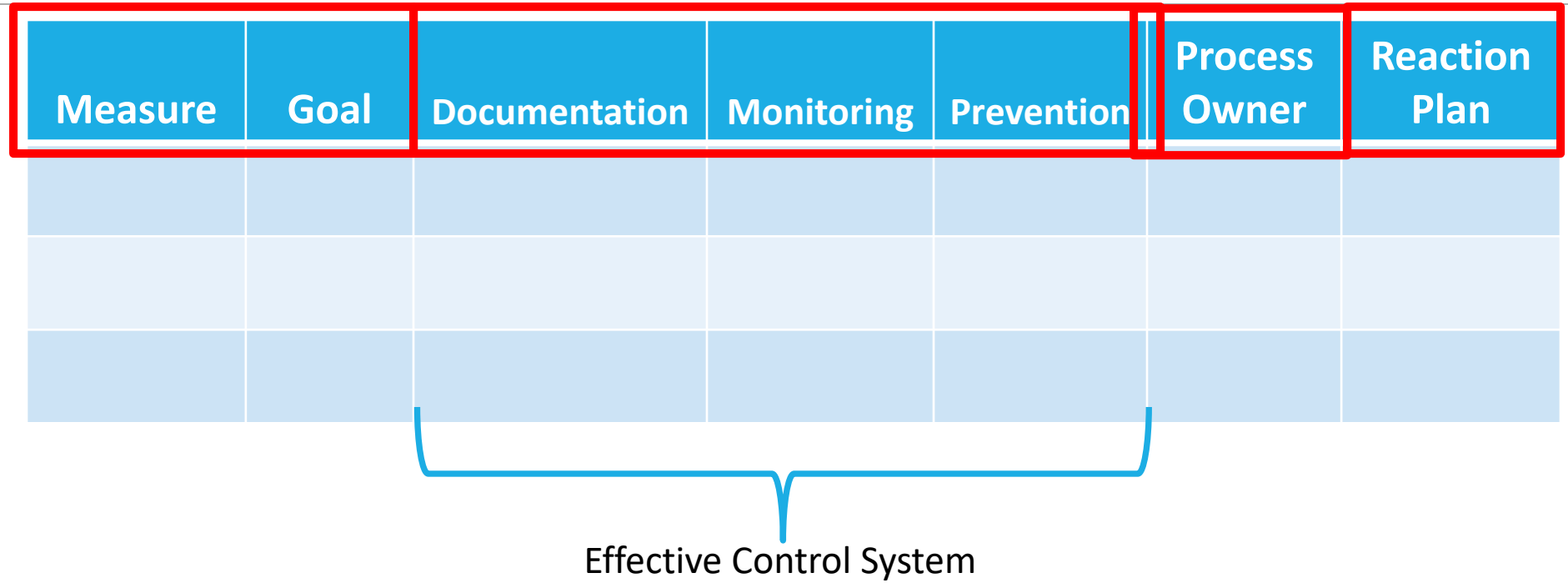
Just like in classical statistics, different data types use different statistics that are based on assumptions.

Each chart assumes a different distribution.

These assumptions are used to calculate sigma (UCL, LCL)

The Healthcare Data Guide, Chapter 5, page 151

Control Plans

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Want to learn more?

Sunday, April 26, 2026

11:30am - 1:00pm ET

Control Charts for Quality Improvement: A Hands-On Introduction

Location: Convention Center: 254 A East

Leader: Munish Gupta, MD, MMSc – Beth Israel Deaconess Medical Center

Co-Leader: Michelle-Marie Peña, MD MSHP (she/her/hers) – Emory University and Children's Healthcare of Atlanta

Co-Leader: Alan Picarillo, MD – The Barbara Bush Children's Hospital at Maine Medical Center

Co-Leader: Heather C. Kaplan, MD, MSCE (she/her/hers) – Cincinnati Children's Hospital Medical Center

Co-Leader: Michael Posencheg, MD (he/him/his) – Children's Hospital of Philadelphia

Academic and Research Skills | Career Development | Core Curriculum for Fellows | Leadership and Business Training | Quality Improvement/Patient Safety | Trainee

CME Hours 1.5

QI 102: A Data-Driven Approach to Your Scholarly Improvement Project, 2026

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