An Introduction to Healthcare Quality Improvement

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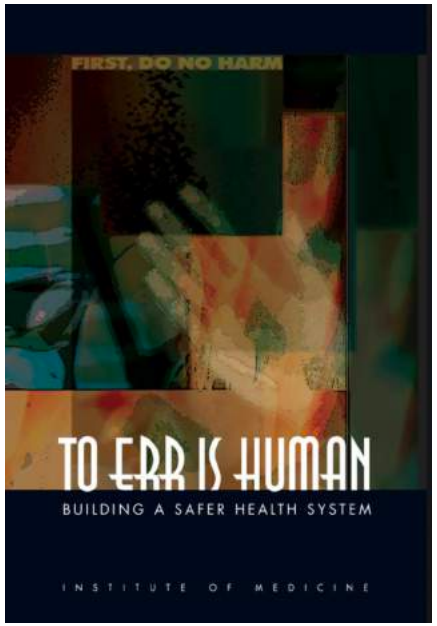
Outline

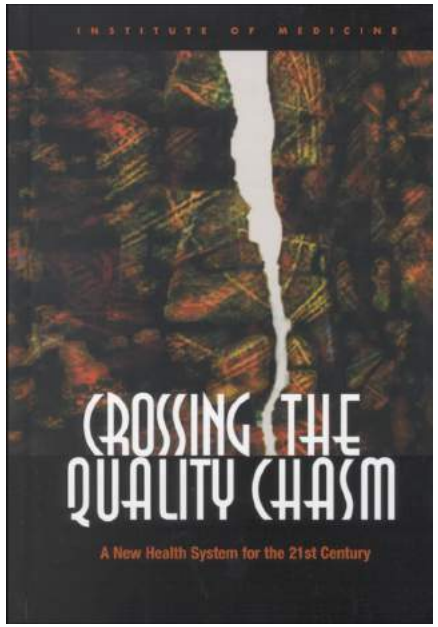
- Background
  - What is Quality
- Quality Improvement Paradigm
  - Problem Identification
  - Team formation
  - Aim Statement
  - Family of Measures
  - Project Charter
  - Data Collection
  - Stakeholder Analysis
  - Root Cause Analysis
- Quality Improvement Interventions
  - Intervention Hierarchy
  - Variation in Healthcare
  - PDSA
- Quality Improvement Results
  - Run Charts
  - SPC Charts

Disclaimer

No conflict of interest

What is Healthcare Quality?





AHRQ
Agency for Healthcare Research and Quality
Advancing Excellence in Health Care www.ahrq.gov

Table 1: Defining elements of quality care

Element	Patient meaning	Provider meaning
Safe	I will not be harmed by the health system – physically, emotionally or otherwise.	The care my patient receives does not cause the patient to be harmed.
Effective	I receive the right treatment for my condition, and it contributes to improving my health.	The care I provide is based on best evidence and produces the desired outcome.
Patient-centred	My goals and preferences are respected. My family and I are treated with respect and dignity.	Decisions about my patient's care reflect the goals and preferences of the patient and his or her family or caregivers.
Efficient	The care I receive from all practitioners is well coordinated and efforts are not duplicated. The value of my time is respected.	I deliver care to my patients using available human, physical, and financial resources efficiently, with no waste to the system.
Timely	I know how long I have to wait to see a doctor or for tests or treatments I need and why. I am confident this wait time is safe and appropriate.	My patient can receive care within an acceptable time after the need is identified.
Equitable	No matter who I am or where I live, I can access services that benefit me. I am fairly treated by the health care system.	Every individual receives high quality care that is fair and appropriate to them, no matter where they live, what they have, or who they are.

What is Healthcare Quality?

Canadian Adverse Events Study
2004

- 7.5% of all hospital admissions were subject to an adverse event
- 37% were preventable ie approximately 70,000 events in Canada every year

"A high quality health care system is one that is **accessible,** appropriate, effective, efficient, equitable, integrated, patient centred, population health focussed, and safe".

The preamble of the Excellent Care for All Act, enacted in 2010

Health Quality Ontario. Quality matters: Realizing excellent care for all. Retrieved from the Health Quality Ontario (HQO) website: http://www. hqontario. ca/Portals/0/documents/health-quality/realizing-excellent-care-for-allen. pdf. 2015.

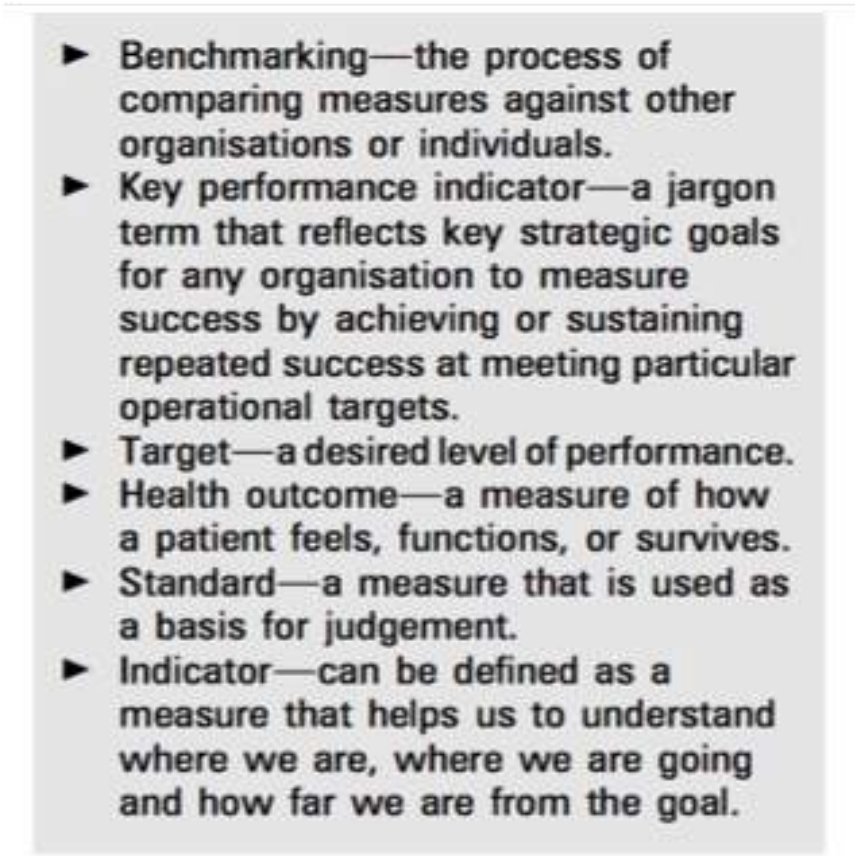
Healthcare Quality - Terminology

Quality Assurance (QA)

- An audit or review, that is, a process to assess compliance with an established standard.
- It aims to bring up the care provided *up to* a known standard.
- Usually top-down

Quality Improvement (QI)

- A philosophy towards improving the quality of healthcare in a systematic, analytic, pragmatic and sustainable way
- Holistic



- Benchmarking—the process of comparing measures against other organisations or individuals.
- Key performance indicator—a jargon term that reflects key strategic goals for any organisation to measure success by achieving or sustaining repeated success at meeting particular operational targets.
- Target—a desired level of performance.
- Health outcome—a measure of how a patient feels, functions, or survives.
- Standard—a measure that is used as a basis for judgement.
- Indicator—can be defined as a measure that helps us to understand where we are, where we are going and how far we are from the goal.

Cameron P, Schull M, Cooke M. A framework for measuring quality in the emergency department. *Emerg Med J*. 2011;28(9):735-740.

QUALITY IMPROVEMENT PARADIGM

PROBLEM IDENTIFICATION

- Is the initiative **important** with implications for patient care?
- Does the initiative occur **frequently** enough to measure and intervene?
- Does the initiative have **evidence** supporting an optimal benchmark or accepted practice?
- Is the initiative within the **scope** of the QI?

Where do I start???

Chartier LB, Cheng AHY, Stang AS, Vaillancourt S. Quality improvement primer part 1:
Preparing for a quality improvement project in the emergency department. *C*. 2017;20(01):104-111.

QUALITY IMPROVEMENT TEAM

- Have we included a representative from each **discipline** that touches the work?
- Have we included a representative who will provide **systems expertise** or management support?
- Have we considered including **non-registered staff** who also support the work?
- Have we identified a **team leader?**
- Are there **local champions** on the team?
- Should we include a **constructive skeptic** on our team? (i.e. someone who will question the status quo and enable a deeper dive into our change ideas).
- Do we have someone with **QI skills** to facilitate our progress?
- Should we consider a **patient** or patient representative?
- Should we consider an **external stakeholder?**

Quality Improvement Guide. Health Quality Ontario. http://www.hqontario.ca/portals/0/Documents/qi/qi-quality-improve-guide-2012-en.pdf. Published 2012. Accessed August 15, 2018.

BUILDING A *SMART* AIM STATEMENT

Specific – focused and well-delineated aims, such as ordering to test completion improvement from 120 minutes to 90 minutes.

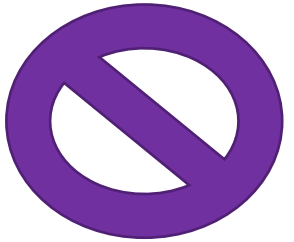
Measurable – has aspects that are amenable to measurement before and after improvement interventions such as timestamps, number of patients, etc.

Actionable – within your core team's scope of influence.

Realistic – achievable, which may exclude ideas like purchasing three more ED CTs or hiring more techs!

Time-defined – with a specific timeline in mind for the completion of the project.

Improving the CT scan process



Decreasing the time from CT order to CT completion for CTAS 1-3 patients in the ED by 25% in 6 months (i.e. date XYZ).

FAMILY OF MEASURES

Framework for Quality Improvement Measures		
Measures	**Definition**	**Examples**
Structural Measures	The capacity of the system	Number of ED beds; number of nurses, porters, or physicians on shift.
Process Measures	What is done along the continuum of care	Time to be seen by ED physician; percentage of patients receiving meal trays; length of time until consultant calls back.
Outcome Measures	The impact of the care or intervention	Patient reported outcomes; number of unscheduled return visits.
Balancing Measures	Unintended consequences	Cost changes with intervention; impact on other patients; impact on other services.

MEASURES

1. **Structural measure:** number beds in the ED, number of CT scanners
2. **Outcome measures:** end result of the intervention
   - number of CT scans ordered
3. **Process measures:** measures specific steps in the process of ordering CT scans
   - percent of unnecessary CT scans ordered after intervention implementation
   - number of physicians that receive the educational content
4. **Balancing measures**: determine whether the intervention had unintended consequences
   - percent of patients that required repeat imaging or with incidental findings

PROJECT CHARTER

Project name:
Date:

University Health Network
Emergency Department

QUALITY IMPROVEMENT
PROJECT CHARTER

PROBLEM AND BACKGROUND
What is the core quality issue that you are trying to improve, and what are the factors involved?

RATIONALE AND BENEFITS
Why is this an important problem to tackle, and what are the expected benefits?

AIM STATEMENT AND DELIVERABLES
What are the goal and objectives of this project?

SCOPE
What are the things (people, tasks, processes) that this project WILL and WILL NOT touch on?

MEASURES
What are the outcome, process and balancing measures that you are planning on looking at?

CHANGE IDEAS
What are you going to be attempting or changing, if already known?

PROJECT LEADER, TEAM MEMBERS AND RESPONSIBILITIES
Who is the point person accountable for the project's progression, who are the other members, who will do what?

RESOURCES
What resources will you require – human, financial, equipment, authorizations and permissions, etc?

TIMELINES AND MILESTONES
When do you anticipate STARTING to work on this project, IMPLEMENTING this project, and COMPLETING it?

Questions? Email: lucas.chartier@uhn.ca

RESEARCH & QUALITY IMPROVEMENT

CHARACTERISTICS OF RESEARCH AND QUALITY IMPROVEMENT:

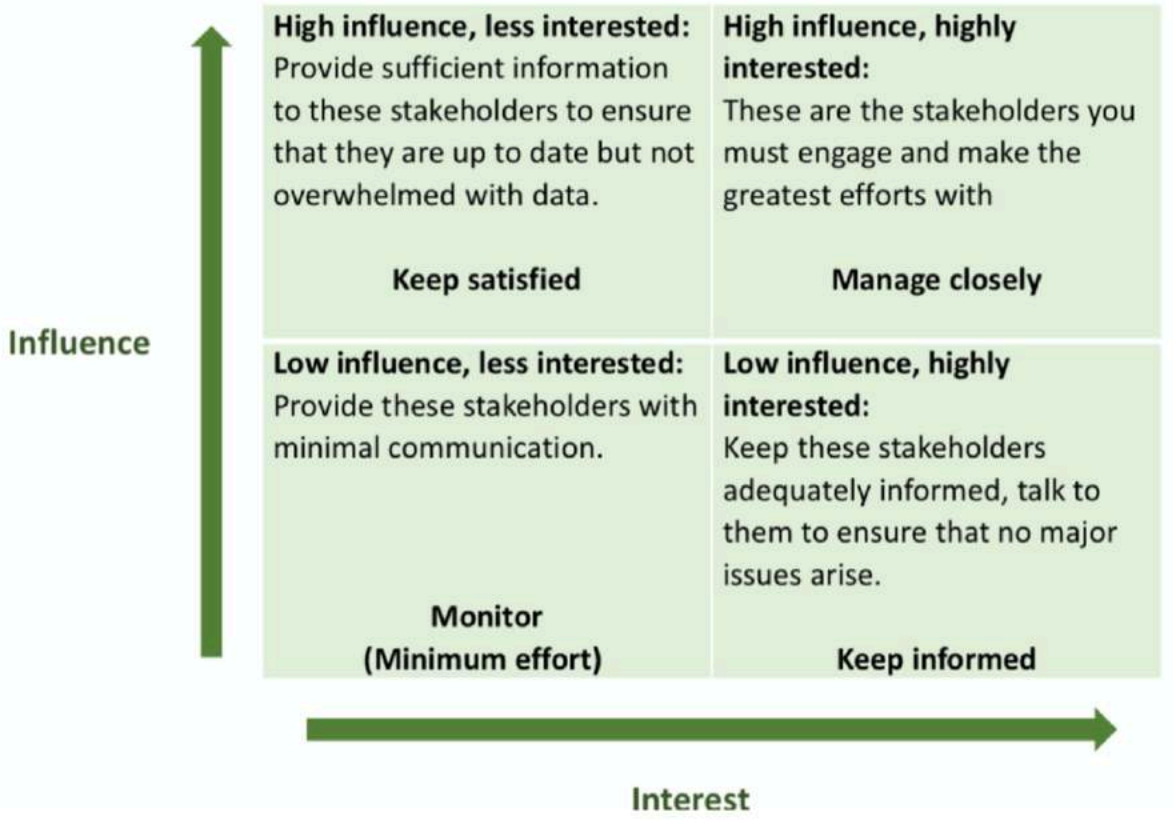
	Research	Quality Improvement
Purpose	Any systematic investigation to establish facts, principles or generalizable knowledge which involves human participants (including patient data), biological materials, as well as human embryos, fetuses, fetal tissue, reproductive materials and stem cells (from living and deceased individuals).	Quality Improvement is "an activity where the primary purpose is to monitor, evaluate or improve the quality of health care delivered by a health care provider (an individual, a service or an organization)." [1]
Starting Point	To answer a question or test a hypothesis with the intention of contributing to generalizable knowledge.	To answer a question or test a hypothesis with the intention of measuring or improving performance.
Design/ Methods	Follows a research design (e.g. control groups, random selection of subjects, statistical tests, sample design, etc.) that will lead to scientifically valid findings.	Uses established quality improvement methods (e.g. IHI model for improvement, PDSA cycles) aimed at producing change within the hospital.
Risks/ Burdens	May put participants at risk (including privacy risk) and added burden.	Does not increase risk to participants.
Benefits	Knowledge sought will likely not benefit current participants.	Knowledge sought directly benefits a process/ program/ service at SJHC, and may or may not directly benefit patients
Data Collection	Involves systematic data collection.	Involves systematic data collection
Testing/ Analysis	Statistically prove or disprove hypothesis	Uses details of qualitative and quantitative (statistical) methods used to draw inferences from the data.
End Point	Answer a research question and/or invite critical appraisal of that conclusion by peers through presentation.	Improve a program, process, or service; implement, monitor and sustain program improvement.

[1] National Health & Medical Research Council, *When does quality assurance in health care require independent ethical review?* Endorsed 20 February 2003, Australia.

Other

- Sample size: just enough vs *apriori* calculations
- Blinding
- Generalizability
- Statistics
- Ethics

STAKEHOLDER ANALYSIS



Stakeholder Management. Imperial College London. https://www.imperial.ac.uk/media/imperial-college/administration-and-support-services/staff-development/public/impex/Stakeholder-management-21jun17.pdf . Published June 2017. Accessed August 9, 2018.

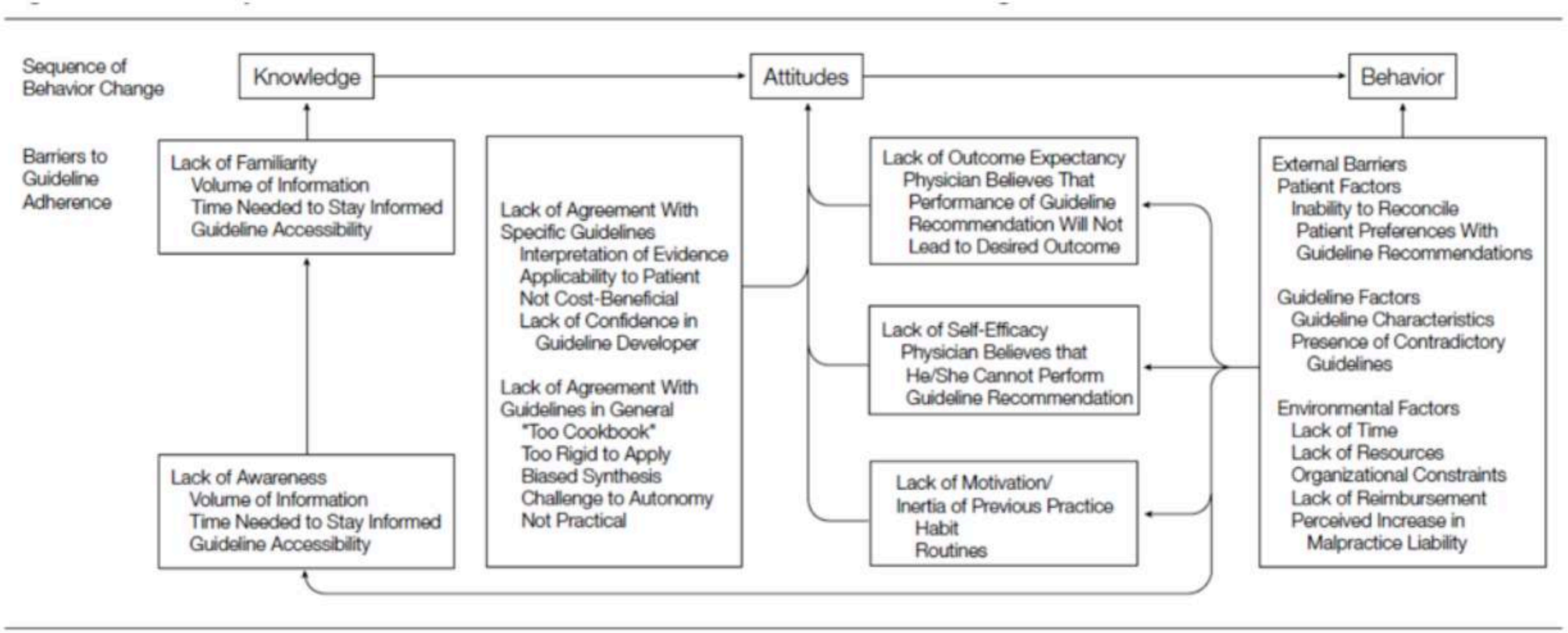
STAKEHOLDER ANALYSIS

Characteristics	Details
Provider Characteristics	Personal traits of health care providers, such as their attitudes toward guidelines in general. These include self-efficacy, outcome expectancy, motivation, and subjective norms.
Guideline, Intervention, & Innovation Characteristics	Aspects of the guideline or innovation itself that affect uptake, for example how complex the guidelines are. These include relative advantages, compatibility with clinicians' values, complexity, trialability.
System Characteristics	Structural features of the healthcare organization, rules, culture, and peer pressure. These include task factors, present tools and technology, physical environment factors, and organizational factors such as leadership and culture.
Implementation Characteristics	Aspects to when and how a guideline or innovation is implemented, including change processes and promotion strategies. These include the tension for change, change agent characteristics, the presence of opinion leaders, and the presence of behavioural competition.

Cabana M, Rand C, Powe N, et al. Why don't physicians follow clinical practice guidelines? A framework for improvement. *JAMA*. 1999;282(15):1458-1465.

Gurses A, Marsteller J, Ozok A, Xiao Y, Owens S, Pronovost P. Using an interdisciplinary approach to identify factors that affect clinicians' compliance with evidence-based guidelines. *Crit Care Med*. 2010;38(8 Suppl):S282-91.

STAKEHOLDER ANALYSIS



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ROOT CAUSE ANALYSIS

- A root cause analysis is a structured approach to identify how or why an incident occurs and to better understand a process
  - 5 Whys
  - Fishbone or Ishikawa Diagram
  - Process Mapping
  - Driver Diagram

Peerally M, Carr S, Waring J, Dixon-Woods M. The problem with root cause analysis. *BMJ Qual Saf* . 2017;26(5):417-422. https

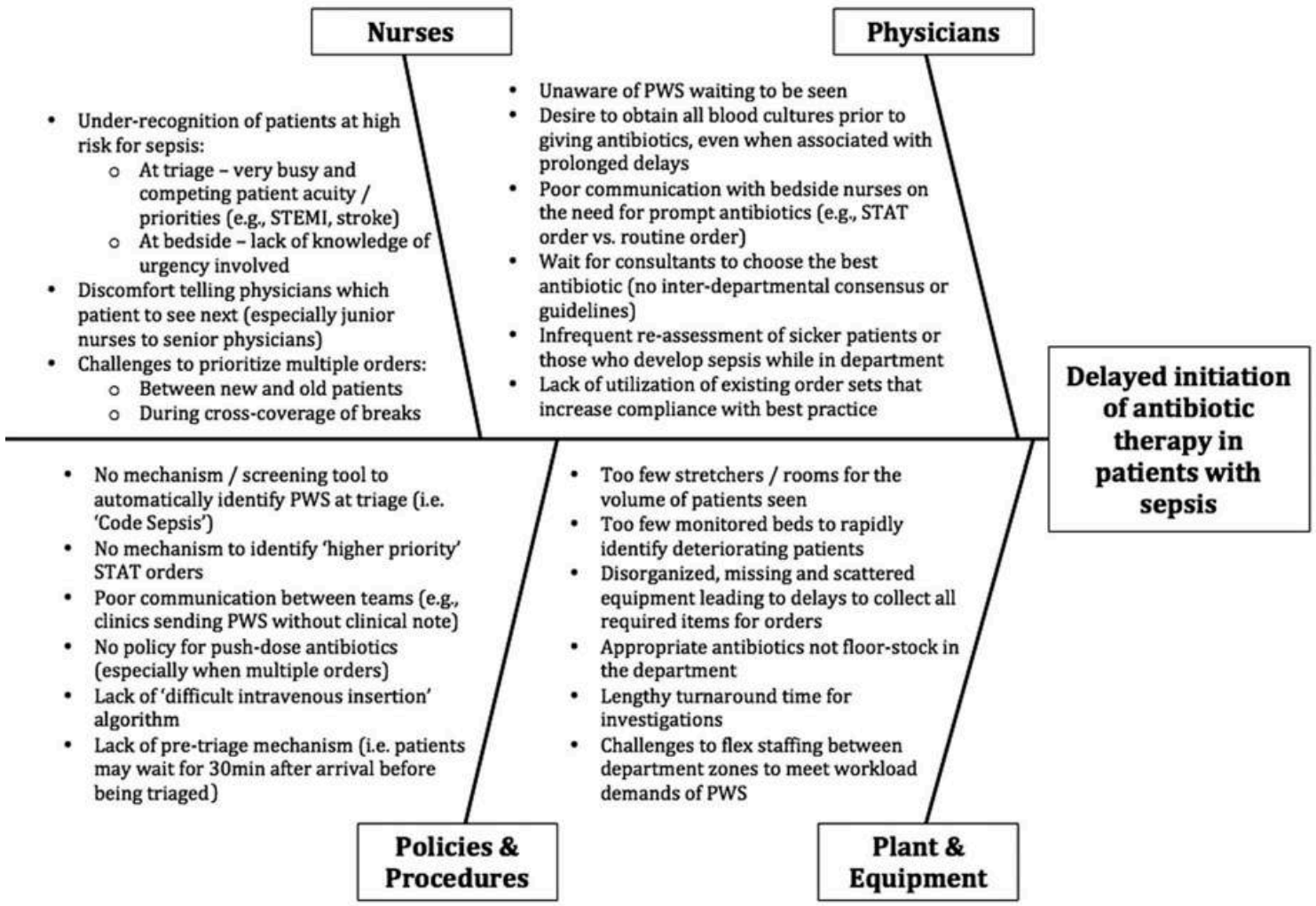
https://images.app.goo.gl/hKSVZM3Hkd4JBrKy6

ROOT CAUSE ANALYSIS – 5 WHYS

- Why is there a delay in administering pRBCs to patients in the ED?
  - Because the pRBCs are delayed in arriving to the ED…
- Why are pRBCs delayed in arriving to the ED?
  - There is a delay in pRBCs release from the hematology lab…
- Why is there a delay in pRBCs release from the hematology lab?
  - There is a delay in matching the blood product with the requisition in the lab…
- Why is there a delay in matching the blood product with the requisition in the lab?
  - The pRBC requisition forms coming from the ED are often missing important information and/or are not legible.

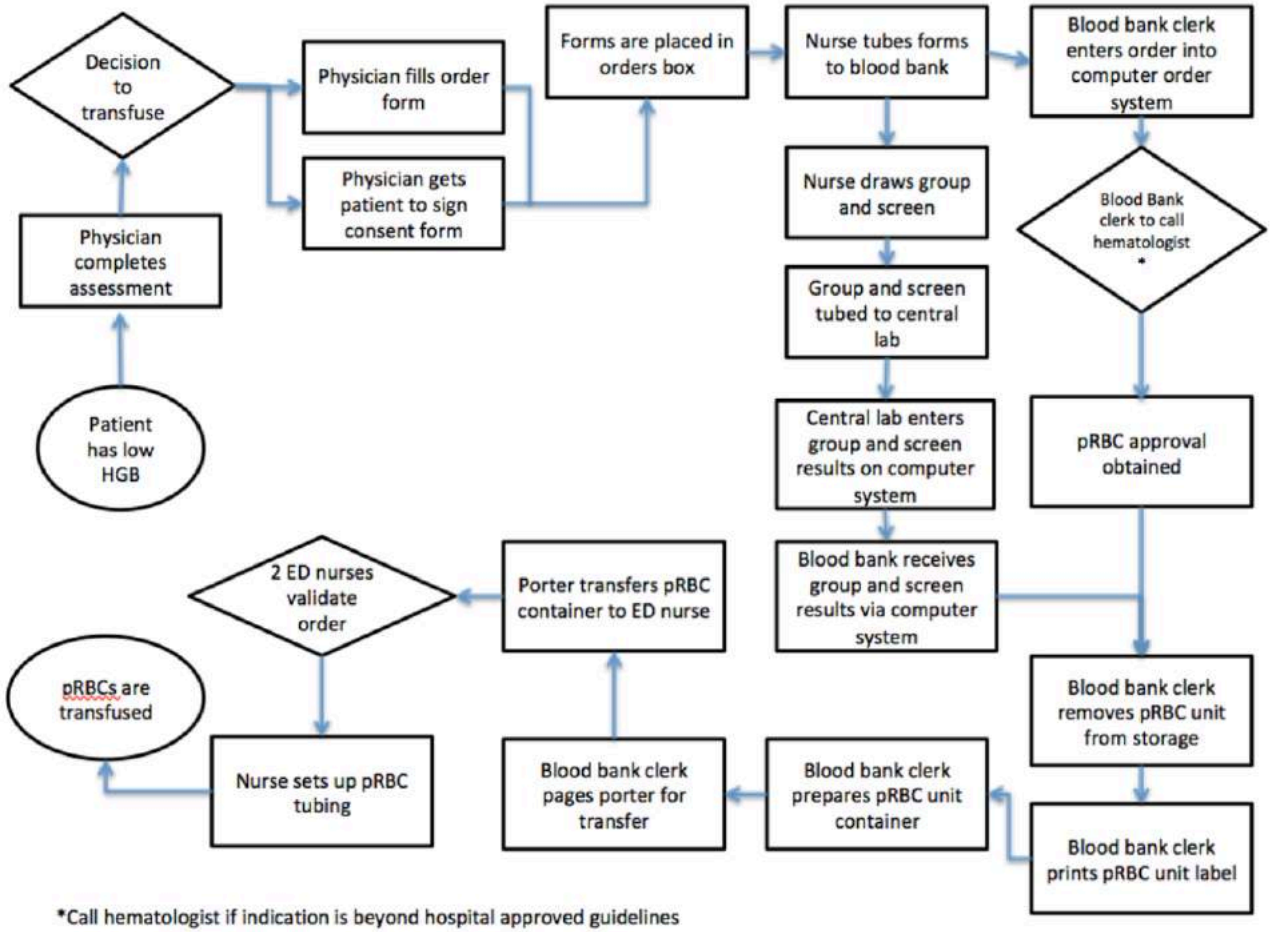
Williams P. Techniques for root cause analysis. *Proc (Bayl Univ Med Cent)*. 2001;14(2):154-157.

ROOT CAUSE ANALYSIS – FISHBONE DIAGRAM



Chartier L, Cheng A, Stang A, Vaillancourt S. Quality improvement primer part 1: Preparing for a quality I mprovement project in the emergency department. *CJEM*. 2018;20(1):104-111.

ROOT CAUSE ANALYSIS – PROCESS MAP



Symbol	Part of the process that is represented by the symbol
⬭	Ovals represent beginnings and ending
▭	Boxes represent steps or activities
◇	Diamonds represent questions or decision points
→	Arrows represent sequence and chronology

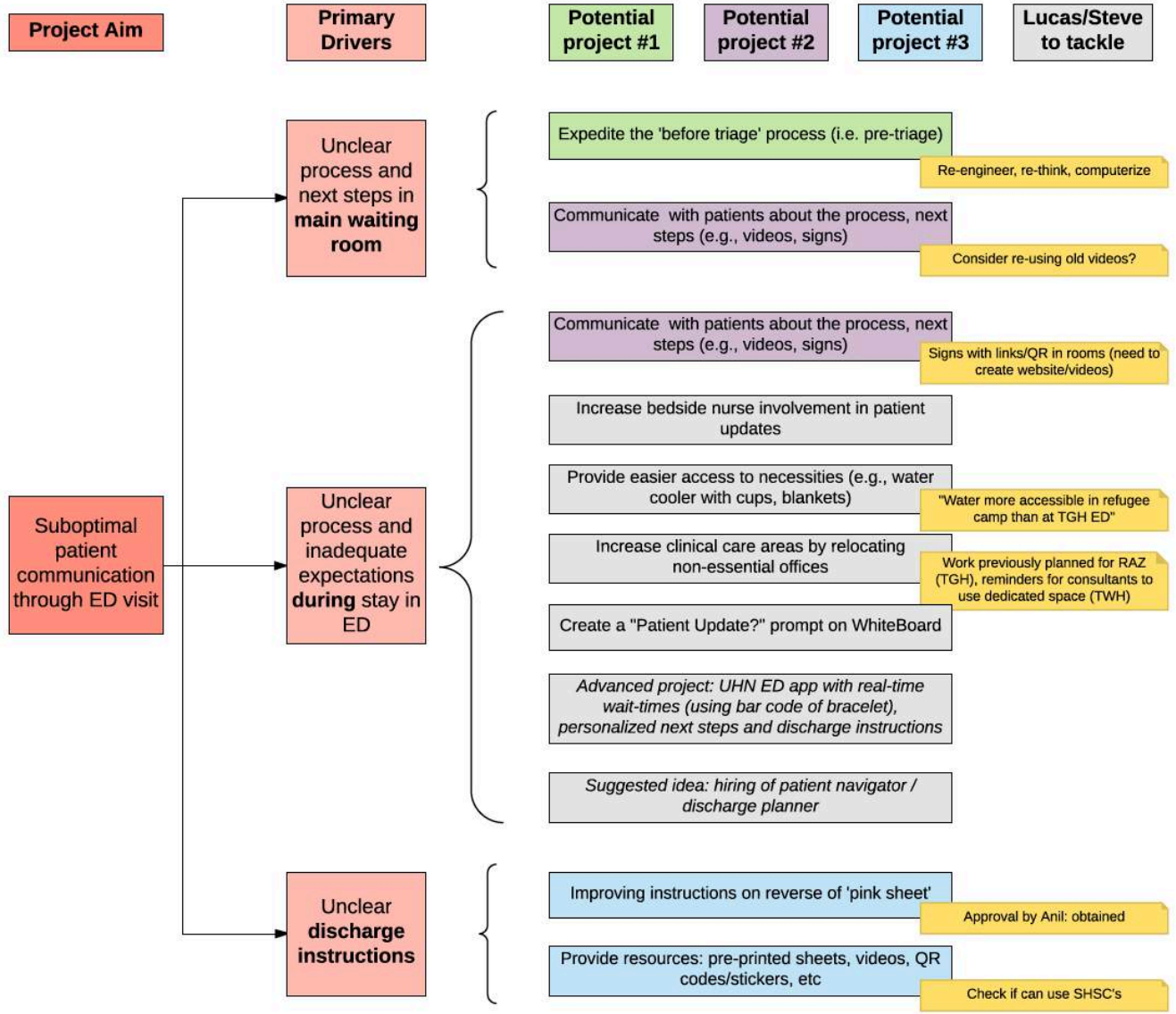
Barach P, Johnson J. Understanding the complexity of redesigning care around the clinical microsystem. *Qual Saf Health Care*. 2006;15 Suppl 1:i10-6.

ROOT CAUSE ANALYSIS – DRIVER DIAGRAM

What changes will lead to an improvement?

Drivers can be thought of as the actions needed to tackle the root causes of the quality problem.

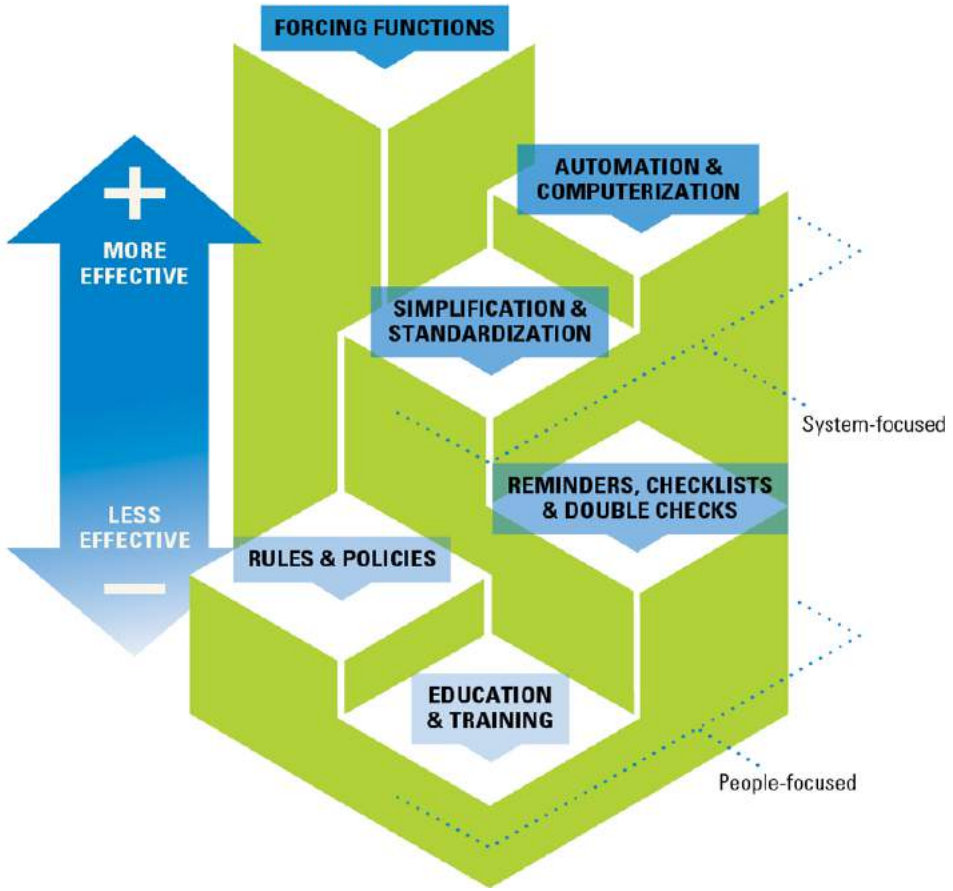
- Primary drivers directly influence the aim
- Secondary drivers are required for primary drivers to be successful.



QUALITY IMPROVEMENT INTERVENTION

INTERVENTION HIERARCHY

FIGURE 2.
The Hierarchy of Intervention Effectiveness



Hierarchy Levels	Example
Education and Training	Deliver a training PowerPoint at rounds reminding providers to properly tag lab samples
Rules and policies	Change the protocol of who picks up the blood samples after labeling
Reminders, Checklists, & Double Checks	Create a checklist beside the blood drawing areas
Simplification and Standardization	Remove redundant steps in lab processing
Automation & Computerization	Use printing labels
Forcing Functions	Use an order form that only has two specified options for pRBC delivery

Institute for Safe Medication Practices, 1999

QUALITY IMPROVEMENT & VARIATION

- **Common Cause Variation**: This type of variation is produced by random variation, inherent to the process itself.
  - For example, your daily commute time will vary by 10 minutes based on the weather conditions, traffic that day or the number of red lights you encountered.
  - This type of variation is said to be **'stable'** and has a spread that can be anticipated.

- **Special Cause Variation:** This type of variation is seen due to identifiable causes that are outside the core work processes.
  - For example, if there was a big accident on your route to work, or your bike had a flat and you needed to take the bus.
  - A process with special cause variation is said to be an **'unstable process'.**

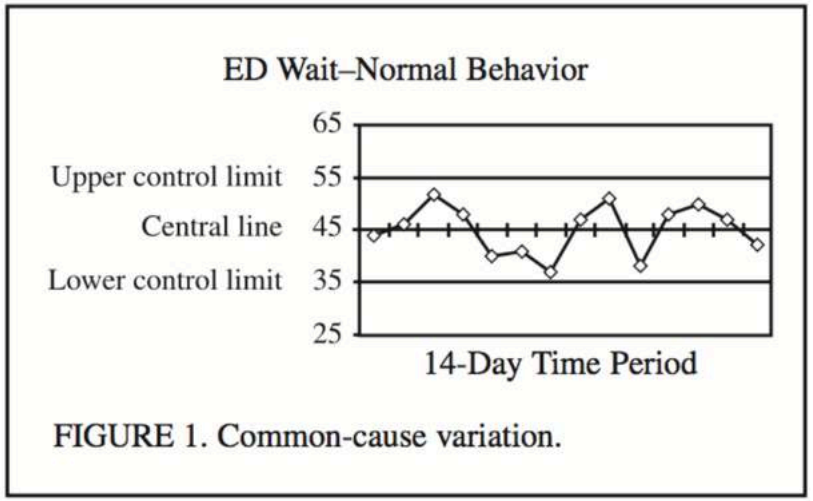


FIGURE 1. Common-cause variation.

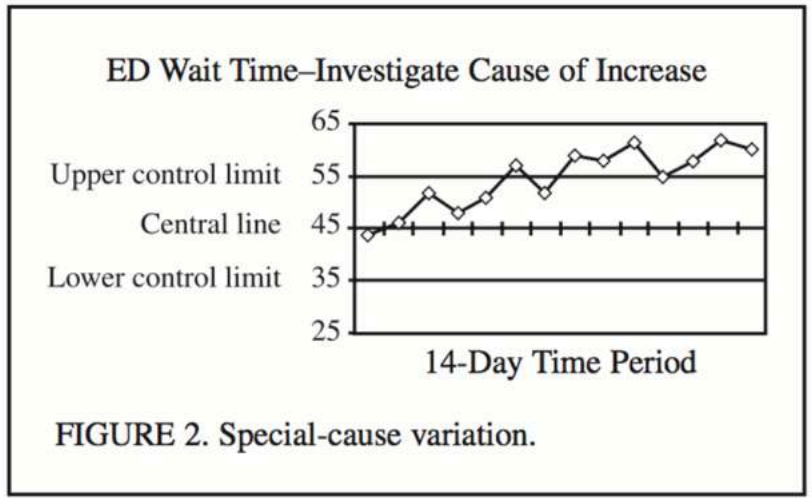


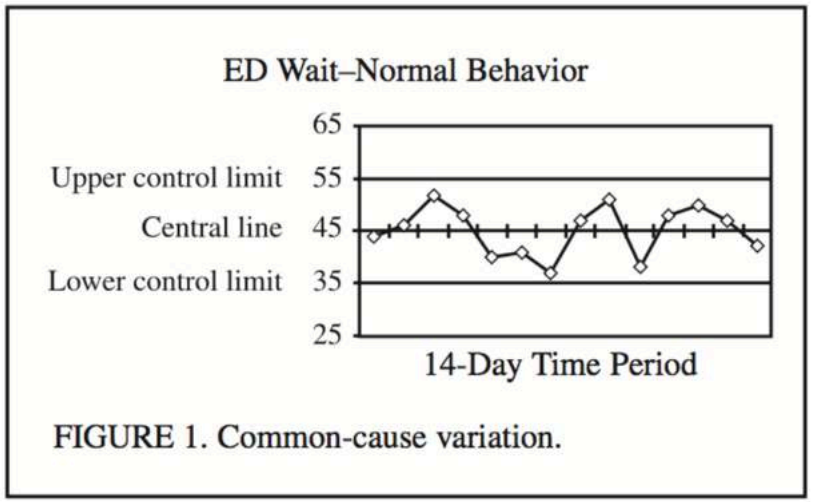
FIGURE 2. Special-cause variation.

James C. Manufacturing's prescription for improving healthcare quality. *Hosp Top*. 2005;83(1):2-8. https://www.ncbi.nlm.nih.gov/pubmed/16092632.

QUALITY IMPROVEMENT & VARIATION

- **Stable Process**
  - The process is stable but suboptimal, then the process (system) itself needs to be adapted or changed.

- **Unstable Process**
  - There is something happened that is making the process different in a good or bad way, then this needs to be investigated to determine the appropriate response through QI methodology



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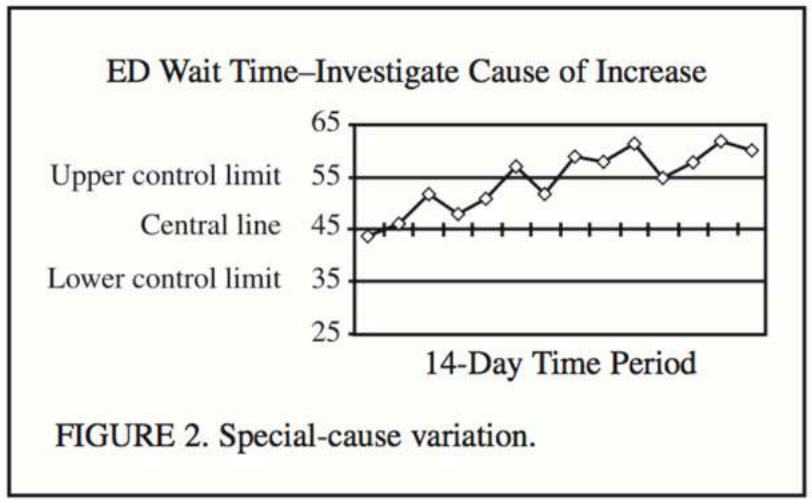
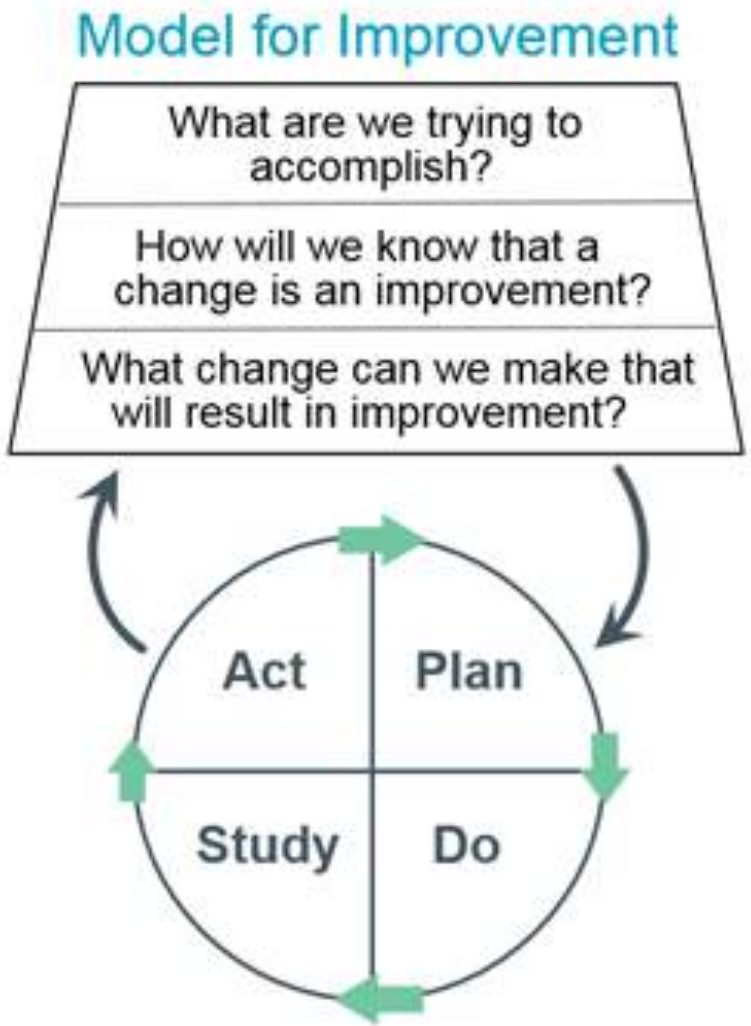


FIGURE 2. Special-cause variation.

James C. Manufacturing's prescription for improving healthcare quality. *Hosp Top*. 2005;83(1):2-8. https://www.ncbi.nlm.nih.gov/pubmed/16092632.

PDSA METHEDOLOGY



Identify Problem & Aim

Measurement of collected data

Using QI diagnostic tools

Continuous quality improvement

Langley GL, et al. The Improvement Guide: A Practical Approach to Enhancing Organizational Performance (2nd edition). San Francisco: Jossey-Bass Publishers; 2009.

PDSA METHEDOLOGY

Table 2.11 Deciding the Scale of a Test[20]

Appropriate Scope for a PDSA Cycle				
Current Situation		Staff/Physician Readiness to Make Change		
		No Commitment	Some Commitment	Strong Commitment
Low Belief that change idea will lead to Improvement	**Cost of failure large**	Very Small-Scale Test	Very Small-Scale Test	Very Small-Scale Test
	Cost of failure small	Very Small-Scale Test	Very Small-Scale Test	Small-Scale Test
High Belief that change idea will lead to Improvement	**Cost of failure large**	Very Small-Scale Test	Small-Scale Test	Large-Scale Test
	Cost of failure small	Small-Scale Test	Large-Scale Test	**Implement**

Source: Adapted from Langley, et al., 2009.

[20]Langley et al., *The Improvement Guide*, 146.

Langley GL, et al. The Improvement Guide: A Practical Approach to Enhancing Organizational Performance (2nd edition). San Francisco: Jossey-Bass Publishers; 2009.

QUALITY IMPROVEMENT RESULTS

RUN CHARTS

Purpose

- To visualize data on process performance
- To determine if the changes tested resulted in an improvement in the process
- To determine if the gains made by the improvement are sustained
- To allow for better data analysis

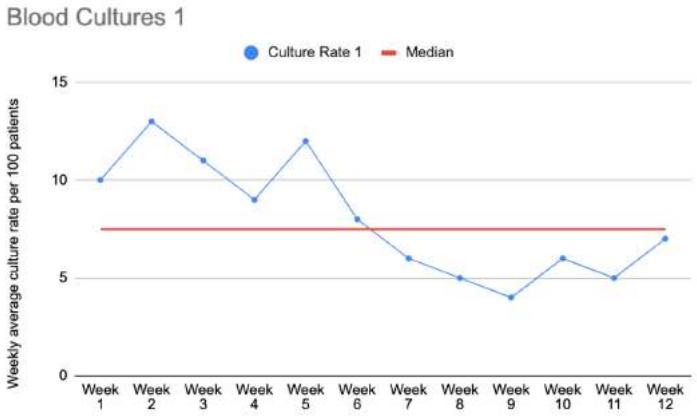


Figure 2. The intervention seems to have made a difference

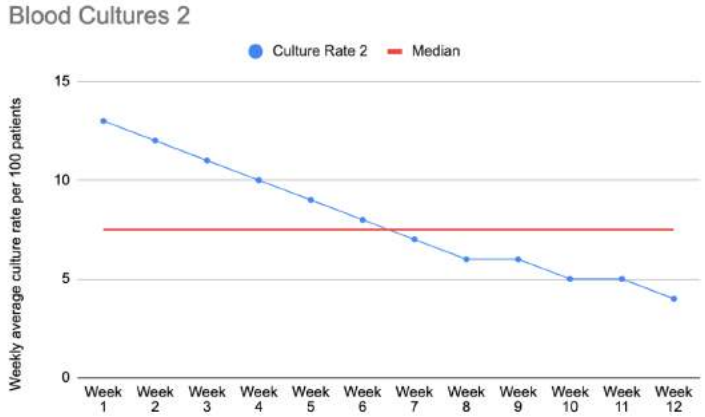


Figure 3. An overall downward trend.

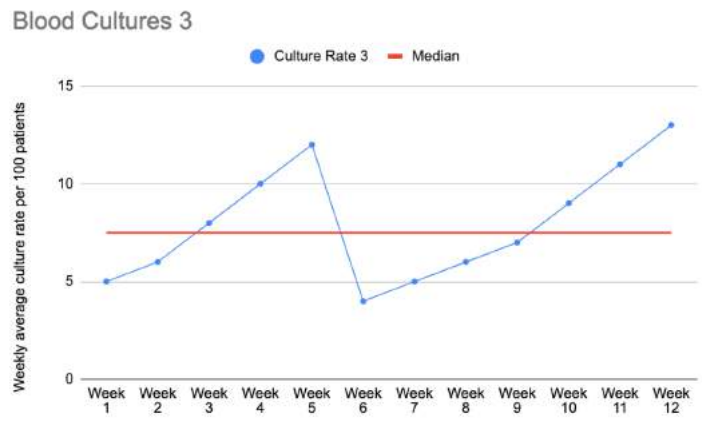


Figure 4. A sudden change then a return to a trend

Provost L, Murray S. *The Health Care Data Guide: Learning from Data for Improvement* . San Francisco: Jossey-Bass; 2011.

RUN CHARTS

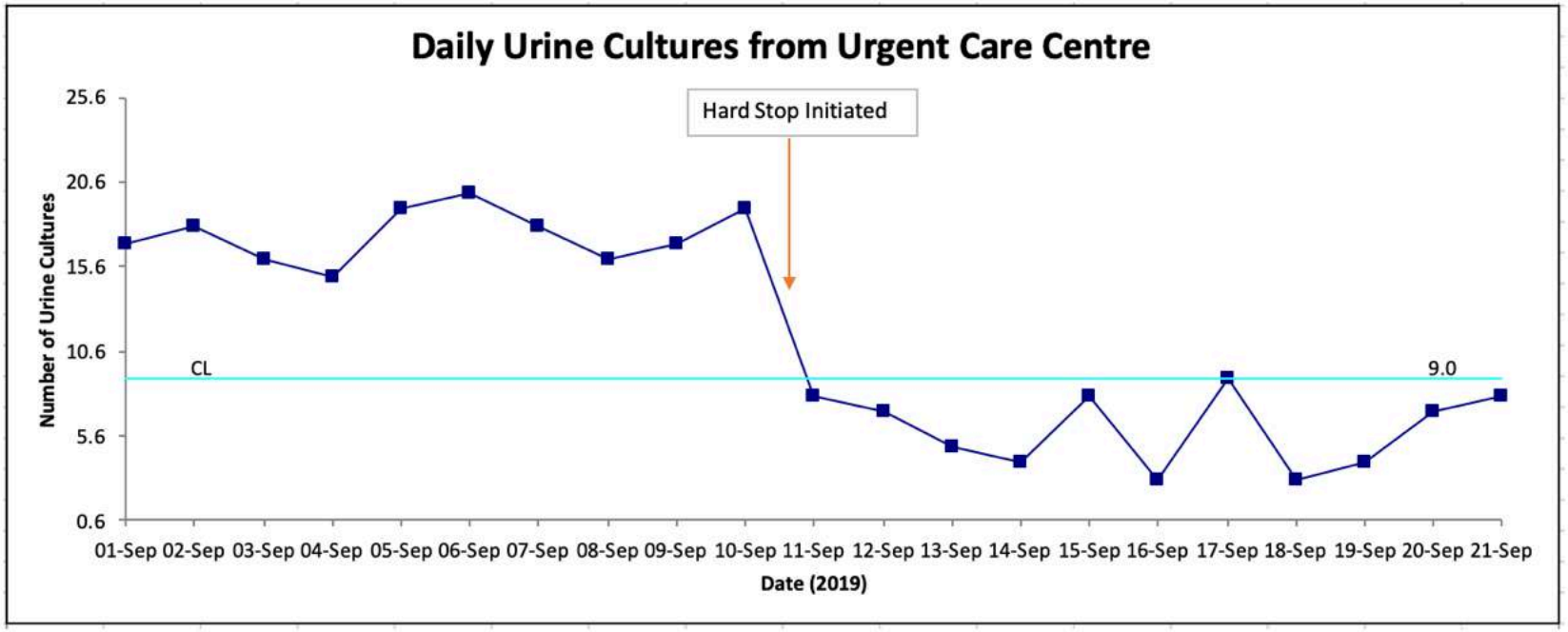


Figure 1. Run Chart for Daily Urine Cultures from the Urgent Care Centre

RUN CHARTS – PROBABILITY BASED RULES

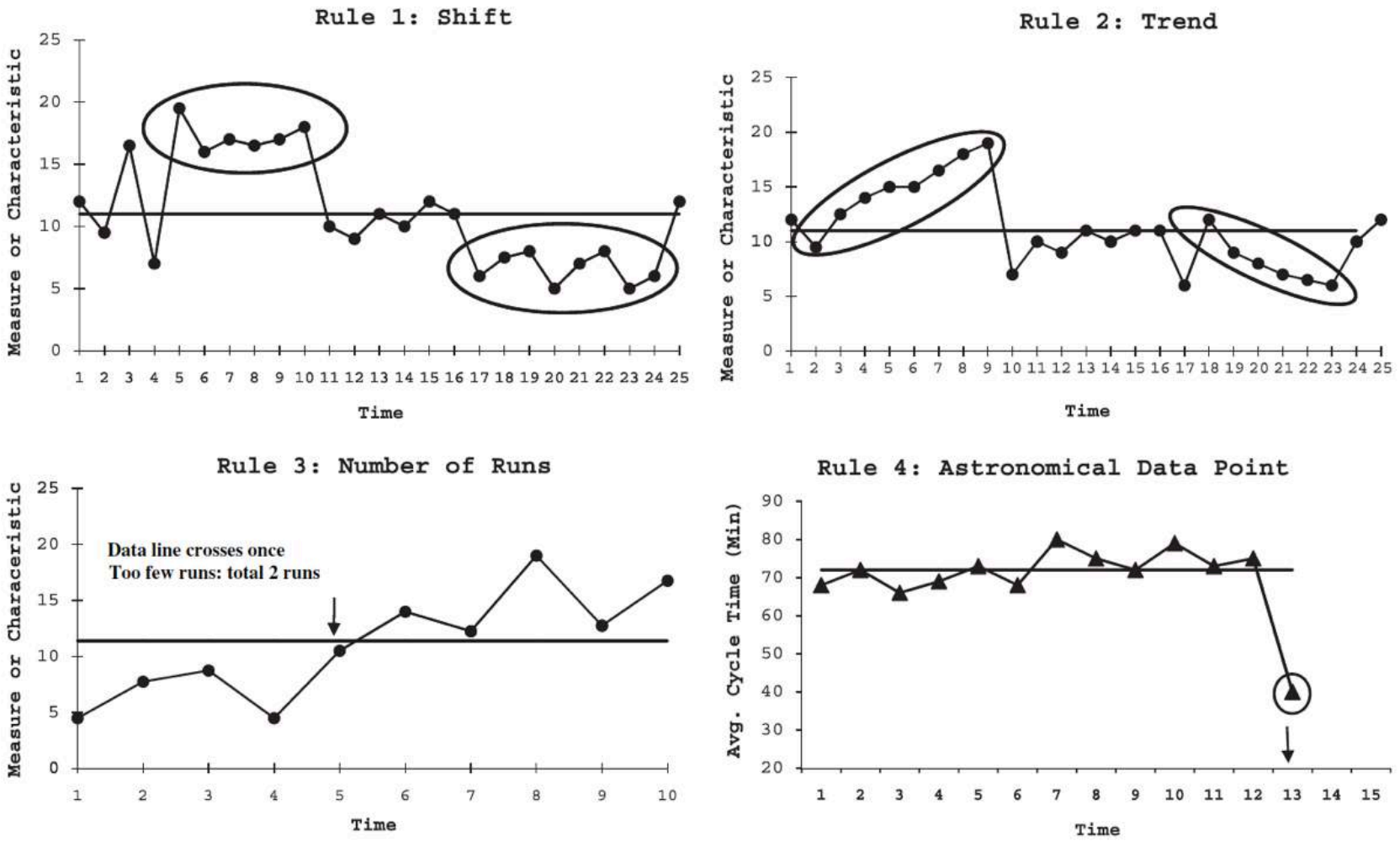


Figure 5: Probability based rules in Run Charts Adapted from Perla et al. 2011

An adaption of this is as follows:

Table 1. The upper and lower limits of runs that is expected with random variation in a run chart.

Total number of data points on the run chart that do not fall on the median	Lower limit for the number of run (<than this number runs is "too few")	Upper limit for the number of runs (>than this number runs is "too many")
10	3	9
11	3	10
12	3	11
13	4	11

Provost L, Murray S. *The Health Care Data Guide: Learning from Data for Improvement* . San Francisco: Jossey-Bass; 2011.

Perla R, Provost L, Murray S. The run chart: a simple analytical tool for learning from variation in healthcare processes. *BMJ Qual Saf*. 2011;20(1):46-51. https://www.ncbi.nlm.nih.gov/pubmed/21228075.

RUN CHARTS – CONSIDERATIONS

Sample Size

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

Baseline

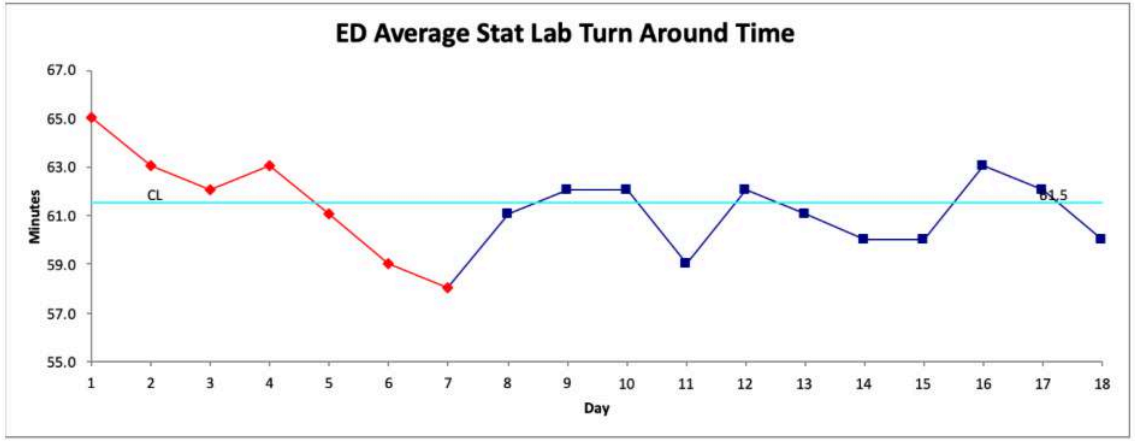
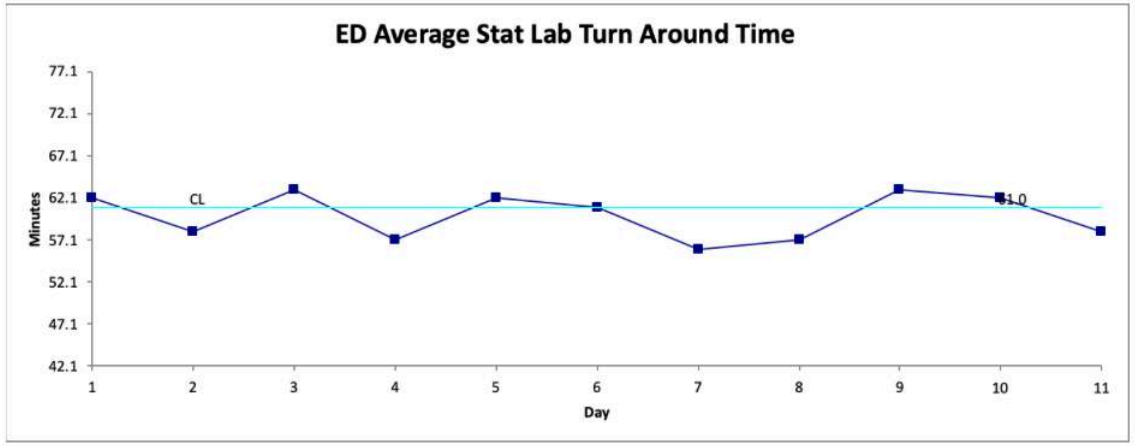


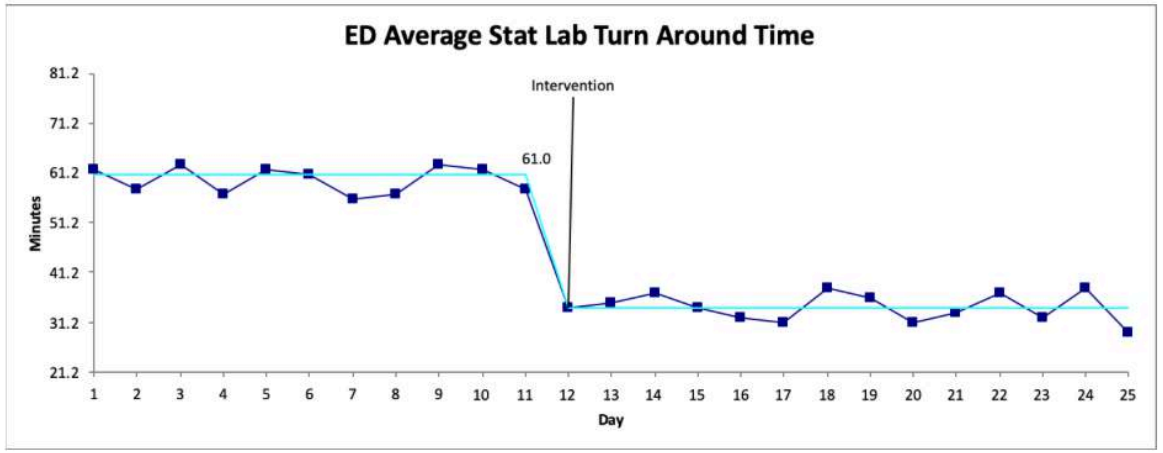
Figure 2. ED Average STAT Lab Turnaround time. Illustration of baseline with change.



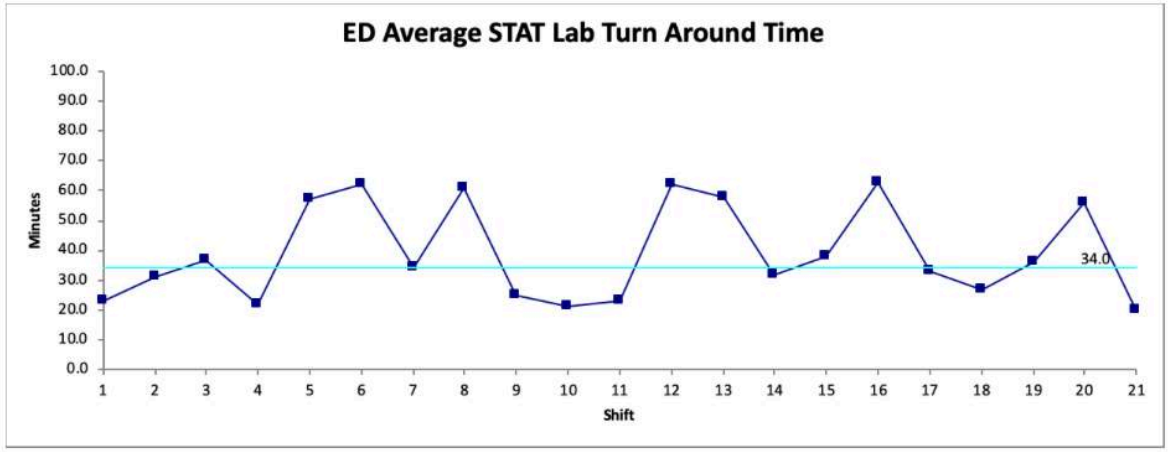
Perla RJ, Provost LP, Murray SK. Sampling considerations for health care improvement. Quality Management in Healthcare. 2014 Oct 1;23(4):268-79.

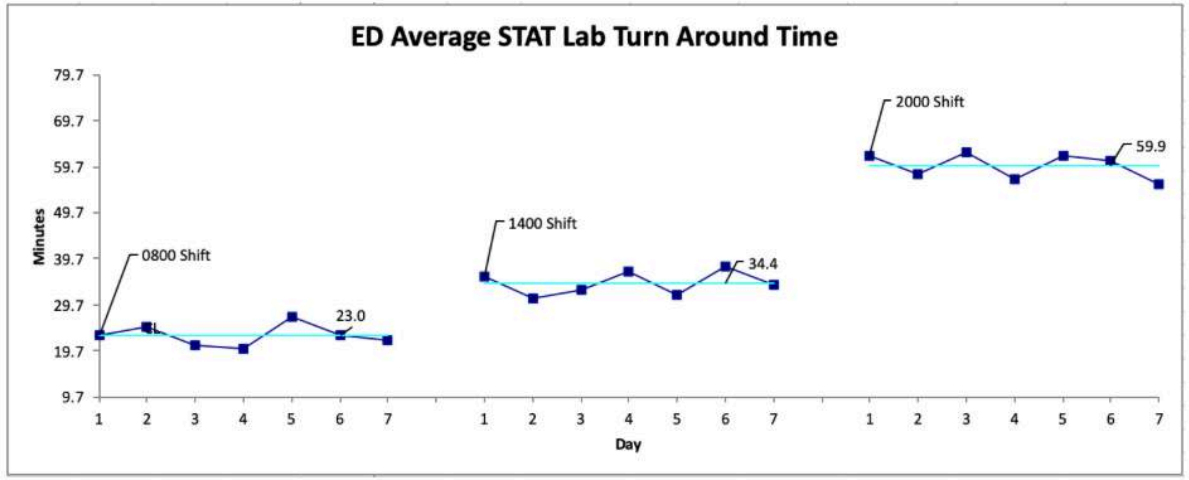
RUN CHARTS – CONSIDERATIONS

Median Recalculation



Stratification





SPC (SHEWHART) CHARTS

How to Select the Chart :

- Selection of a measure and a statistic to be plotted
- A method of data collection: observation, measurement, and sampling procedures
- A strategy for determining subgroups of measurements (including subgroup size and frequency)
- Selection of the appropriate Shewhart chart
- Criteria for identifying a signal of a special cause

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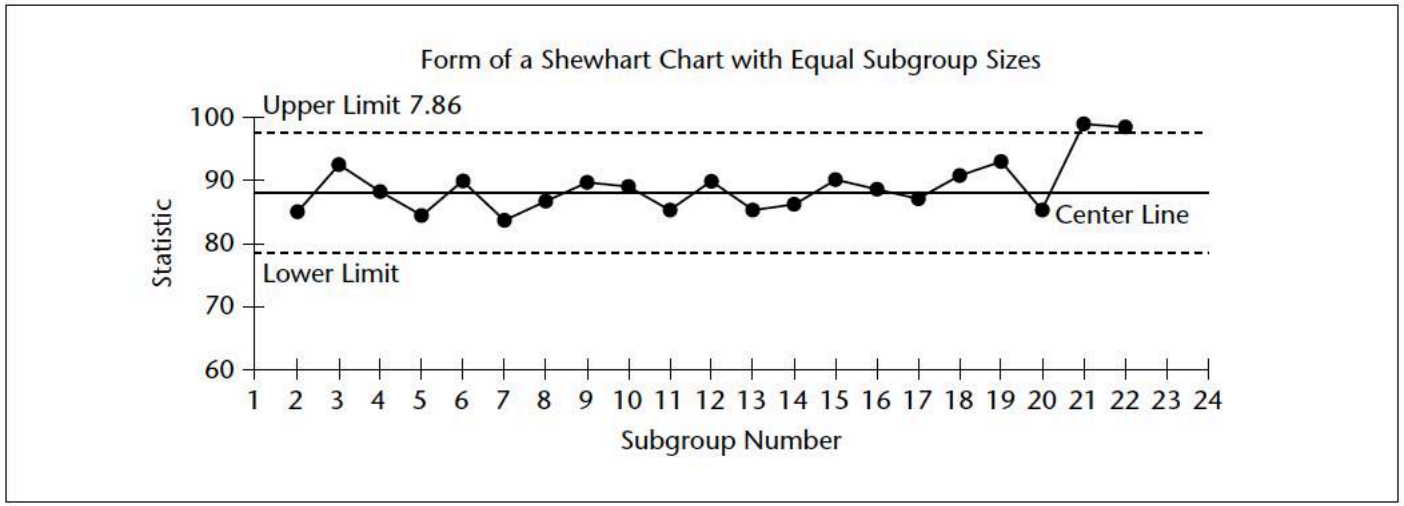
SPC (SHEWHART) CHARTS

FIGURE 4.3 Example of Shewhart Chart for Equal Subgroup Size



the center line: $CL = \mu_s$
the upper limit: $UL = \mu_s + 3 * \sigma_s$
the lower limit: $LL = \mu_s - 3 * \sigma_s$

Type 1 error < 5% approximately

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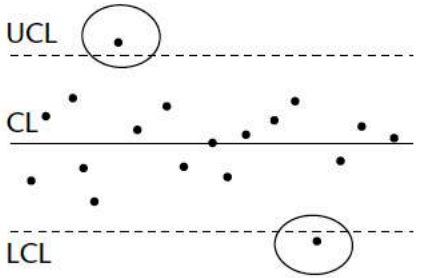
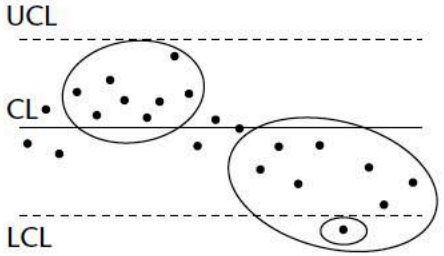
SPC (SHEWHART) CHARTS

FIGURE 4.5 Rules for Determining a Special Cause

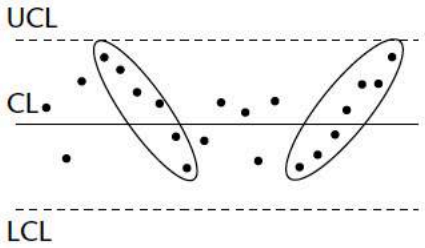
1. A single point outside the control limits.



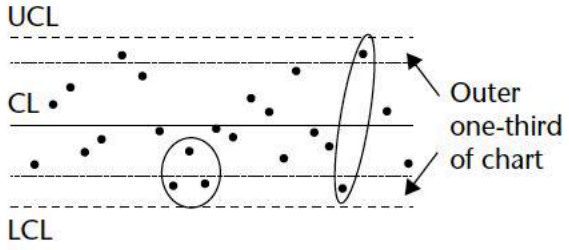
2. A run of eight or more points in a row above (or below) the centerline.



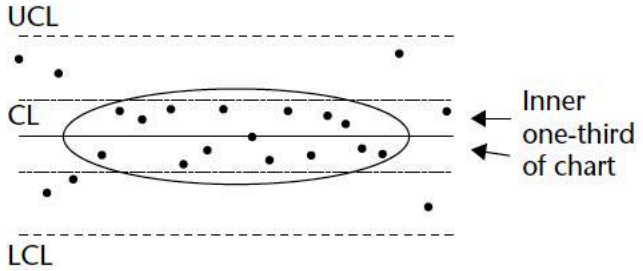
3. Six consecutive points increasing (trend up) or decreasing (trend down).



4. Two out of three consecutive points near (outer one-third) a control limit.



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



- Montgomery (Default) Rules
- Juran Rules
- AIAG Rules
- Westgard Rules
- Western Electric Rules
- Healthcare-IHI Rules
- Custom Rules

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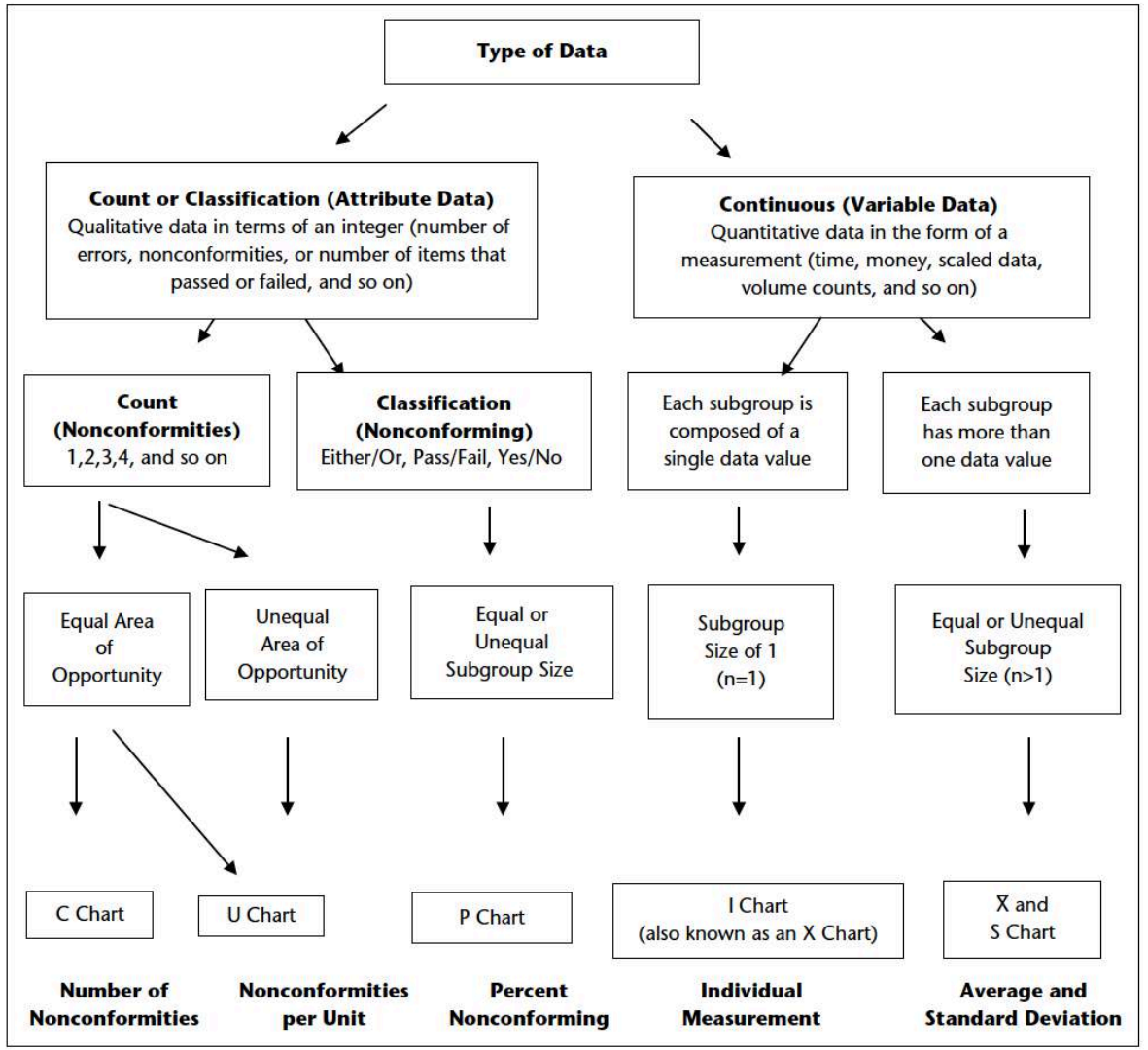
SPC (SHEWHART) CHARTS

Types of Data

- Classification data (attribute data)
- Count data (attribute data)
- Continuous data (variable data)



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SPC (SHEWHART) CHARTS

FIGURE 5.2 I Chart with Initial Limits for Volume of Infectious Waste

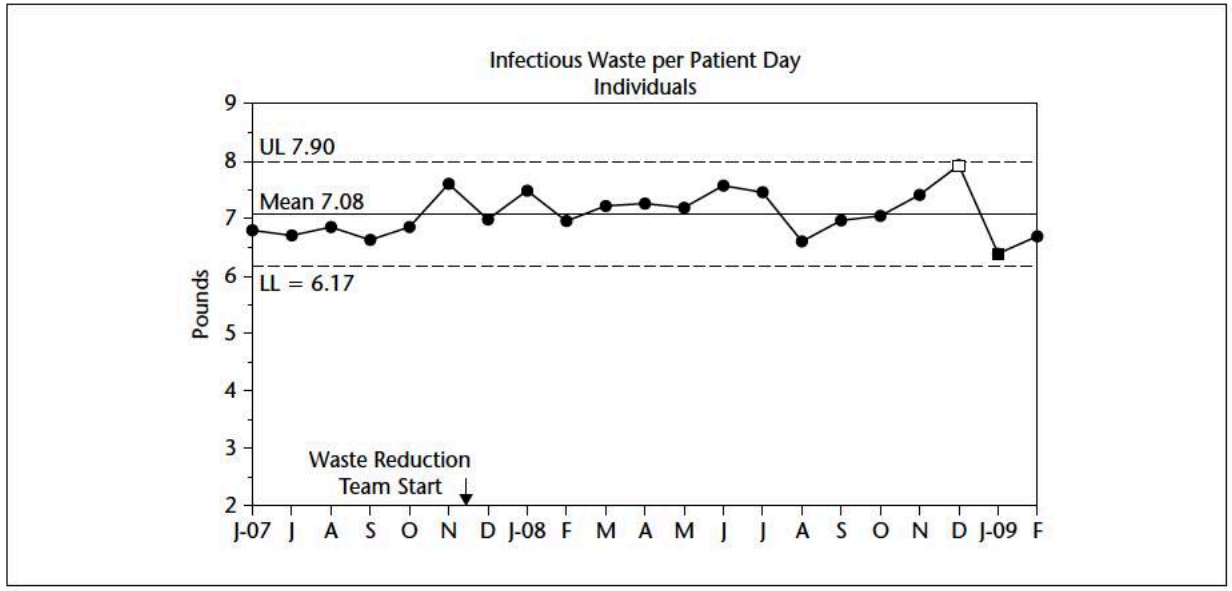

Table 5.2 Data and Calculations for Infectious Waste I Chart

Month	Infectious Waste (#) per Patient Day (I)	Moving Range (MR)
J-07	6.8	*XXX*
J	6.7	0.10
A	6.86	0.16
S	6.63	0.23
O	6.86	0.23
Total	148.62	8.01
Average	7.077	0.40

1. Calculate the k − 1 moving ranges.
2. Calculate the average of the moving ranges (MR_{bar})

$$MR_{bar} = \frac{\sum MR}{k-1} = \frac{8.01}{(21-1)} = \frac{8.01}{20} = 0.40$$

3. Calculate the $UL_{MR} = 3.27 * MR_{bar}$. $UL_{MR} = 3.27 \times 0.40 = \underline{1.308}$
4. Remove any moving range bigger than the UL_{MR} and recalculate the average moving range (MR_{bar}). [Note: This recalculation should be done only once.] *In this example one moving range (J-07) exceeded the upper limit of the moving range chart. The new average moving range is*:

$$\frac{(8.01-1.53)}{19} = \frac{6.48}{19} = 0.34$$

5. Calculate the average of the individual data (I_{bar}). This is the center line (CL) on the I chart.

$$CL\ (I_{bar}) = \frac{\sum I}{k} = \frac{148.62}{21} = 7.077$$

6. Calculate limits:

$UL = I_{bar} + (2.66 * MR_{bar})$
$UL = 7.077 + (2.66 * 0.34)$
$UL = 7.077 + .904$
$UL = \mathbf{7.98}$

$LL = I_{bar} - (2.66 * MR_{bar})$
$LL = 7.077 - (2.66 * 0.34)$
$LL = 7.077 - .904$
$LL = \mathbf{6.17}$

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SPC (SHEWHART) CHARTS

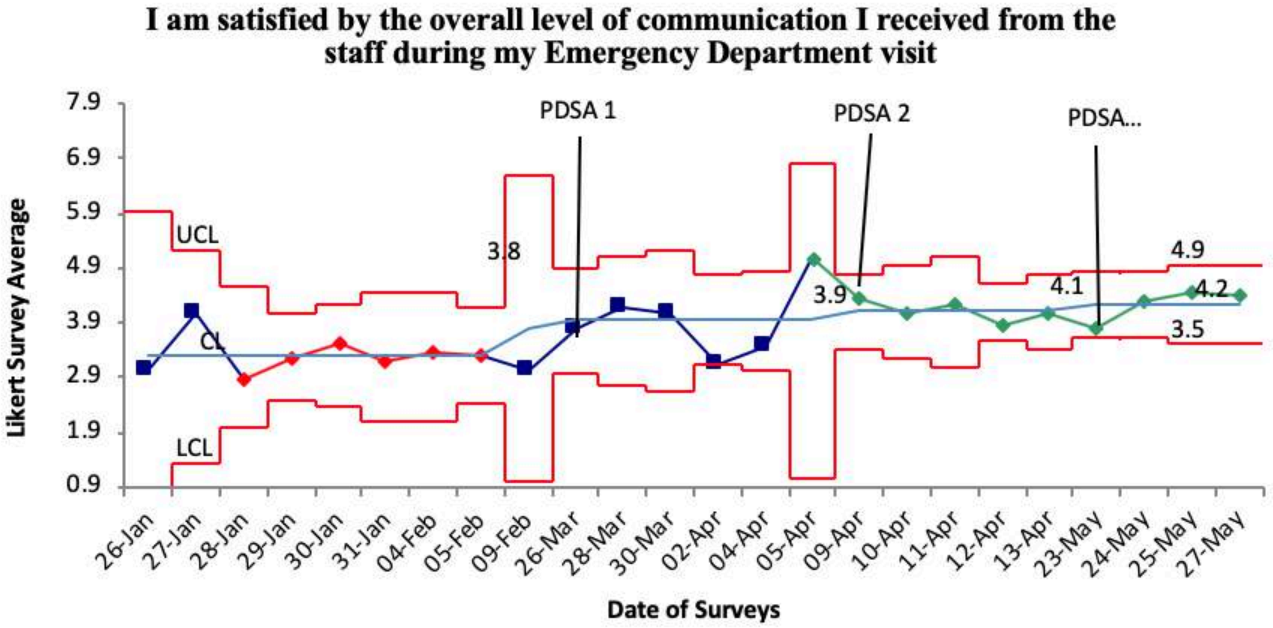

Figure 2.a Patient Likert Scale Survey Item (2) Statistical Process Control (Xbar) Chart
UCL – Upper Control Limit, CL – Control Limit, LCL – Lower Control Limit. The means are displayed adjacent to the CL line. The 3 Standard Deviation Confidence Intervals are displayed at the UCL and LCL lines.
*Red data points – special cause variation during the baseline assessment period. **Greed data points – special cause variation during the intervention period.

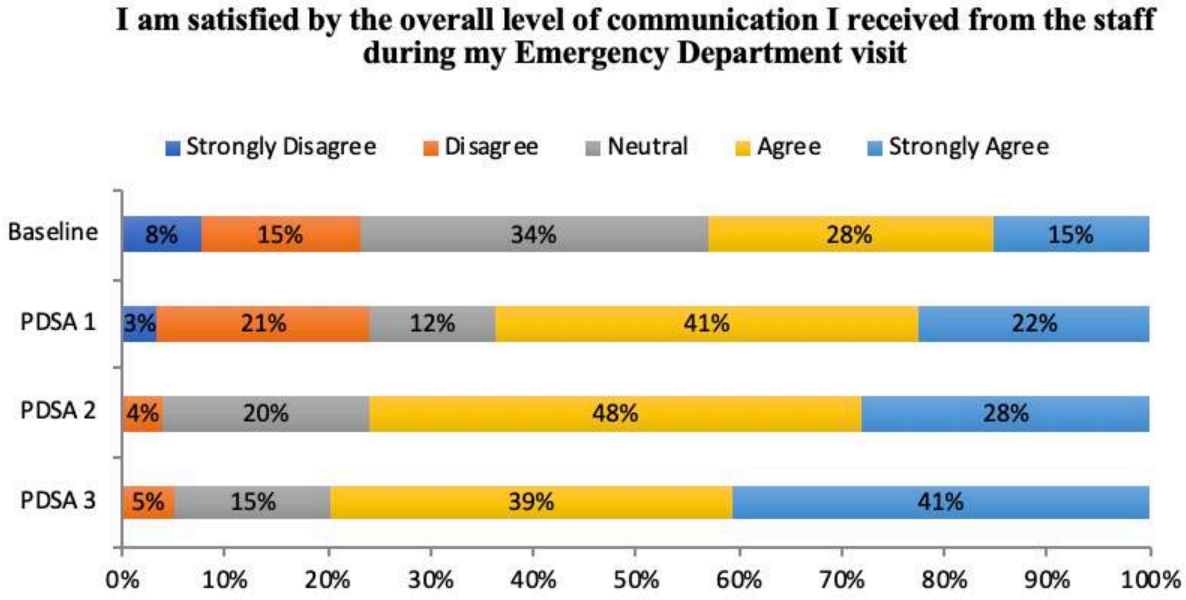

Figure 2.b Patient Likert Scale Survey Item (2) Bar Graph
Number of Patients who selected each category.

Recap

- Background
  - What is Quality
  - Terminology
- Quality Improvement Paradigm
  - Problem Identification
  - Team formation
  - Aim Statement
  - Family of Measures
  - Project Charter
  - Data Collection
  - Stakeholder Analysis
  - Root Cause Analysis
- Quality Improvement Interventions
  - Intervention Hierarchy
  - Variation in Healthcare
  - Lean
  - Six Sigma
  - PDSA
- Quality Improvement Results
  - Run Charts
  - Pareto Charts
  - SPC Charts

Questions