Institute for Healthcare Improvement

# Utilising Data as a Catalyst for Improvement

Tuesday, Oct 31, 2023  3:00-4:00pm

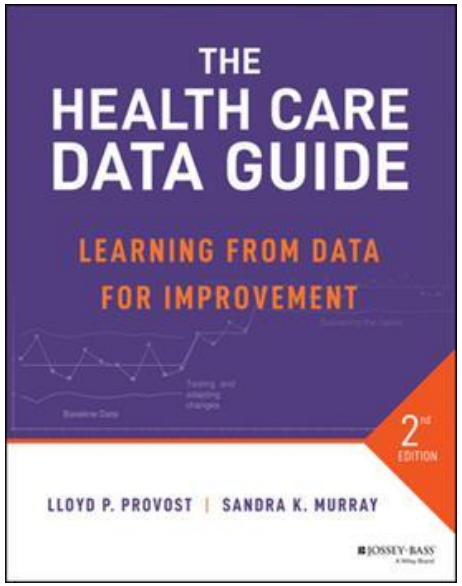
Room 213

Lloyd Provost, Institute for Healthcare Improvement and Associates in Process Improvement
Kate Bones, Institute for Healthcare Improvement

# Objectives

- Appreciate the difference in data for Improvement and data for accountability.
- Describe the ways that data informs an improvement project.
- Experience an example of an improvement project that effectively uses data to learn and communicate results.
- List the common visual methods to learn from data for improvement.

References to:



# He uses data as a drunken man uses lamp posts, for support rather than illumination

Andrew Lang, Scottish Writer

THE JOINT COMMISSION JOURNAL ON QUALITY IMPROVEMENT

MARCH 1997 VOLUME 23 NUMBER 3

LEIF I. SOLBERG, MD
GORDON MOSSER, MD
SHARON MCDONALD, RN, PHD

PERFORMANCE MEASURES AND MEASUREMENT

# The Three Faces of Performance Measurement:

## Improvement, Accountability, and Research

"We are increasingly realizing not only how critical measurement is to the quality improvement we seek but also how counterproductive it can be to mix measurement for accountability or research with measurement for improvement."

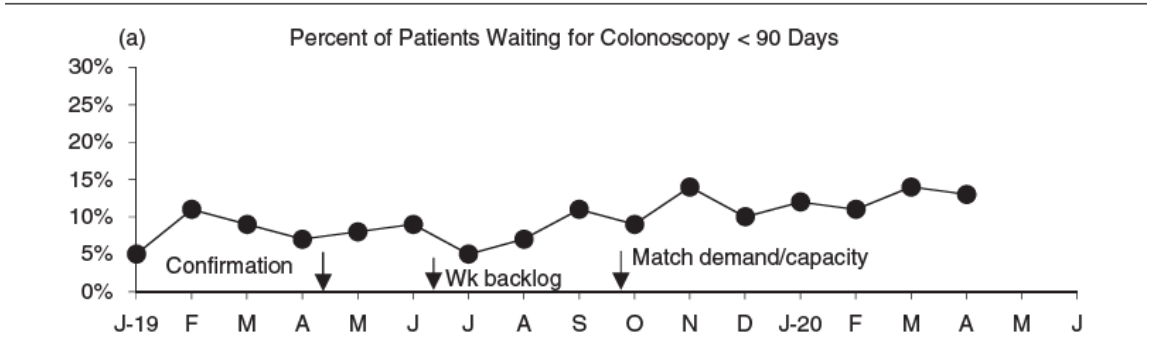
Referenced in HCDG, page 29

# Data for Improvement, Accountability and Research

| Aspect | Improvement | Accountability | Research |
|---|---|---|---|
| Aim | Improvement of care | Comparison, choice, reassurance, spur for change | New knowledge |
| Test Observability | Test observable | No test, evaluate current performance | Test blinded or controlled |
| Bias | Accept consistent bias | Measure and adjust to reduce bias | Design to eliminate bias |
| Sample Size | "Just enough" data, small sequential samples | Obtain 100% of available, relevant data | Sample to use inference methods, "Just in case" data (oversampling?) |
| Hypothesis | Hypothesis flexible, changes as learning takes place | No hypothesis | Fixed hypothesis |
| Variation | Adjust measures to reduce variation | Design to eliminate unwanted variation | Accept consistent variation |
| Testing Strategy | Sequential tests | No tests | One large test |
| Determining if change results in improvement | Run charts or Shewhart control charts | No change focus | Hypothesis, statistical tests (t-test, F-test, chi square), p-values |
| Data confidentiality | Data used only by those involved with improvement work | Data available for public review | Research subjects' identities protected |

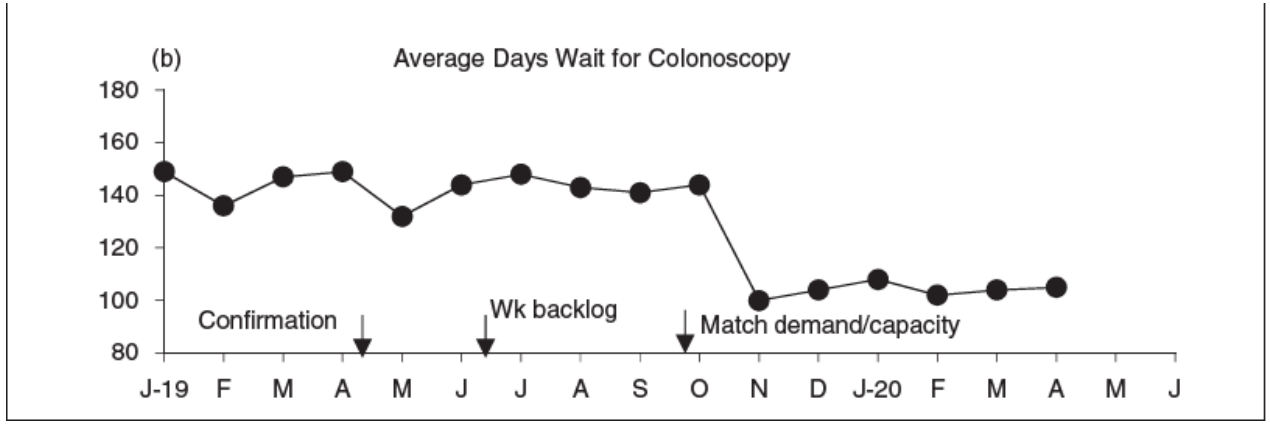
*Table 2.1, HC Data Guide, p. 29*

# Measurement for Judgment and Accountability



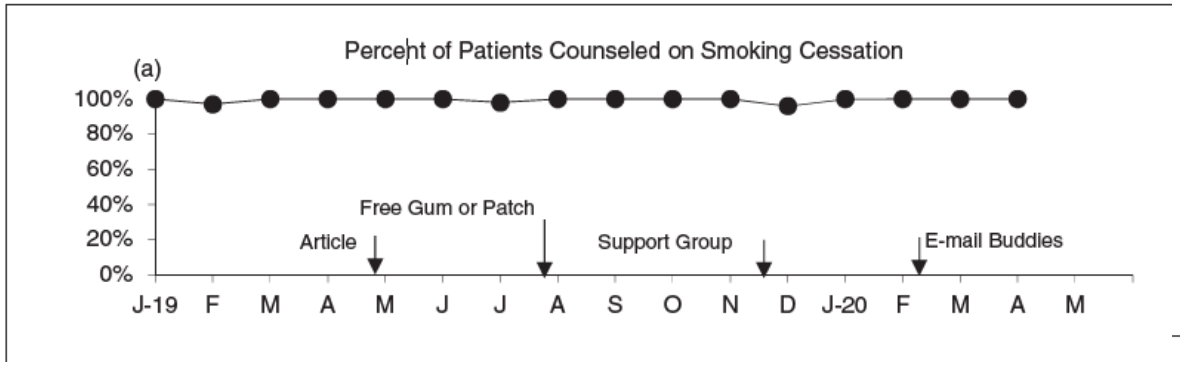

These data may not be very helpful to an improvement team testing changes to reduce waiting time.

# Measurement for Learning and Improvement




Tracking actual waiting time will be more useful than solely tracking the % that meet a waiting time standard.

# Measurement for Judgment and Accountability

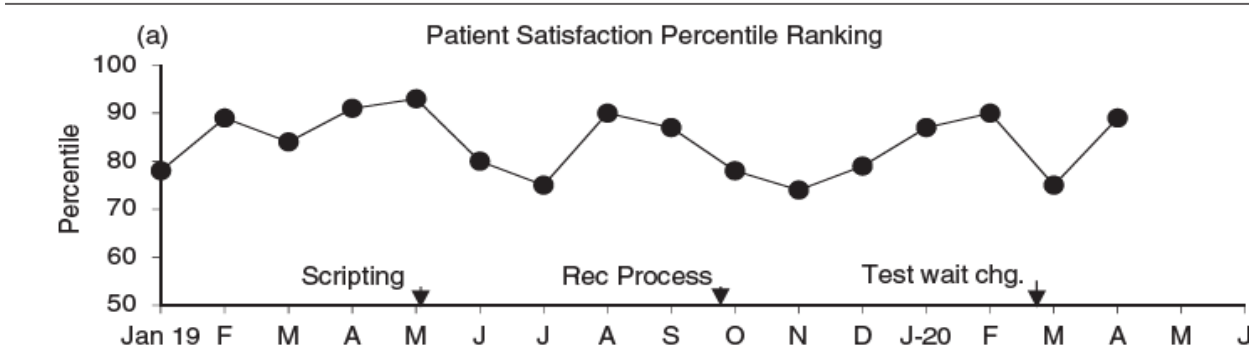



Measurement for judgment often results in data recorded as 100% or 0%, limiting opportunities for learning from the measure.

# Measurement for Learning and Improvement

Tracking the % of patients who have not smoked provides the team with a strong degree of belief that their changes yielded improvement.

# Measurement for Judgment and Accountability




Percentile rankings can create confusing situations. Did improvement occur because of the changes tested? Or because of others' poor performance in the comparison pool?

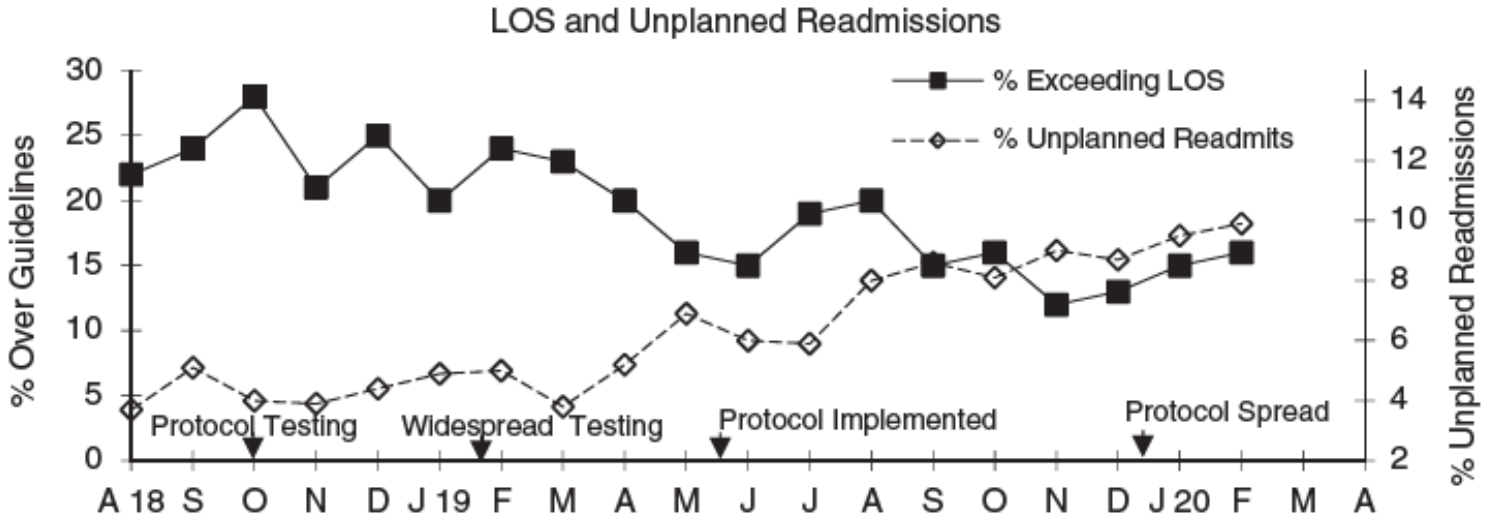
# Measurement for Learning and Improvement

Improvement teams will find it more helpful to track the actual average satisfaction scores in their organization.

# Family of Measures (FOM)

- Health care systems are complex.
- Any single measure used as the sole means of determining improvement to a particular system is inadequate.
- When working to improve a system, multiple measures are usually necessary to better evaluate the impact of our changes on the many facets of the system.
- Improvement projects typically require a family of 2-8 measures

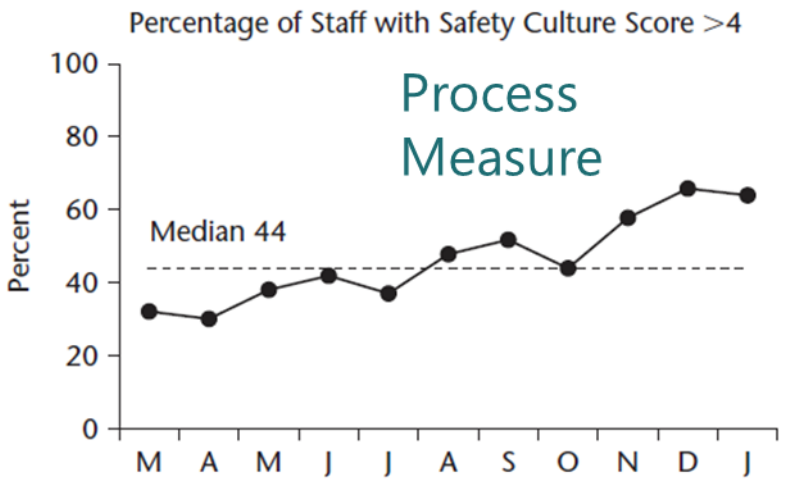
**FIGURE 2.9 Multiple Measures on a Single Graph**

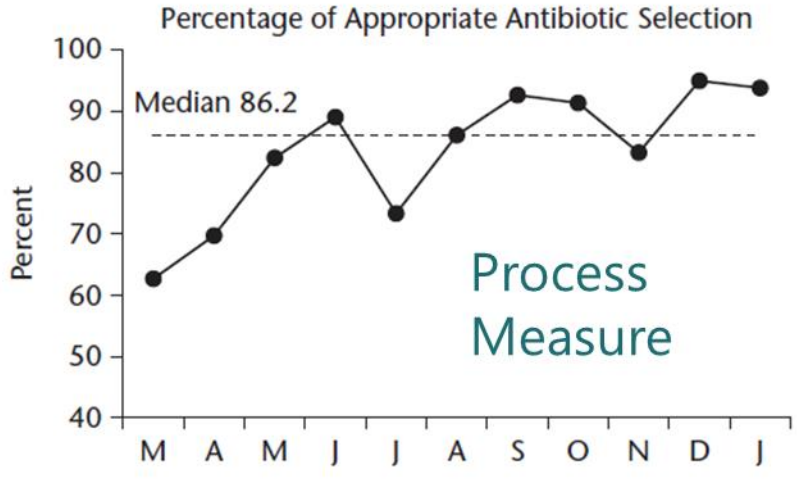


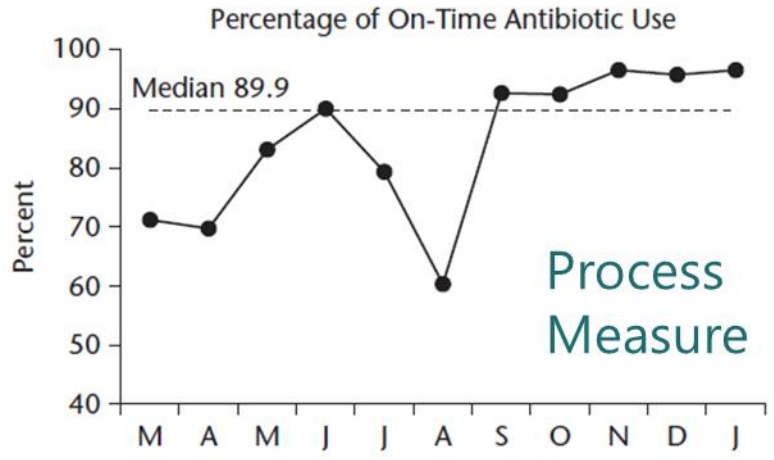

Improved LOS but readmissions are creeping up

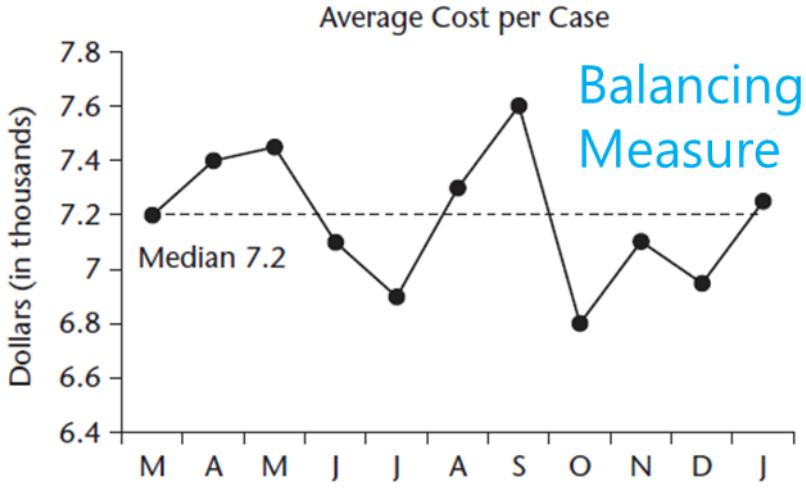
*HC Data Guide*, p. 43

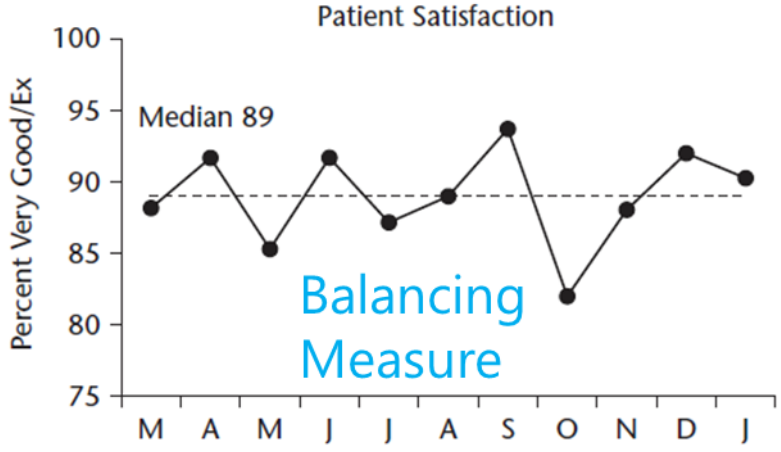
# Surgical Safety Family of Measures

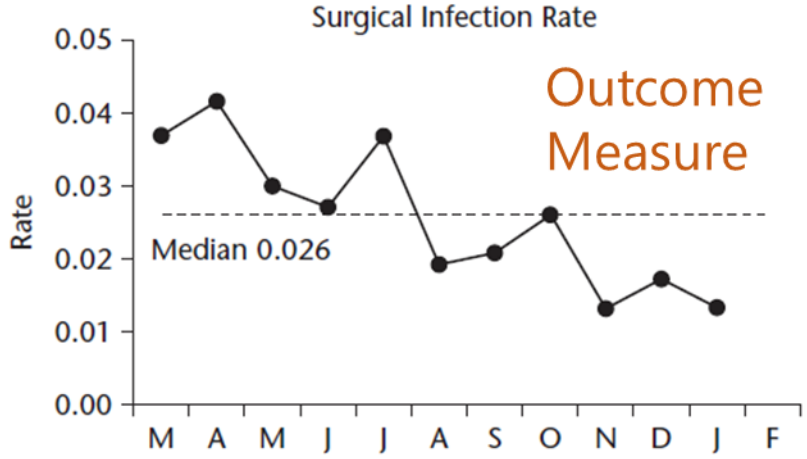



*HC Data Guide, p. 36*

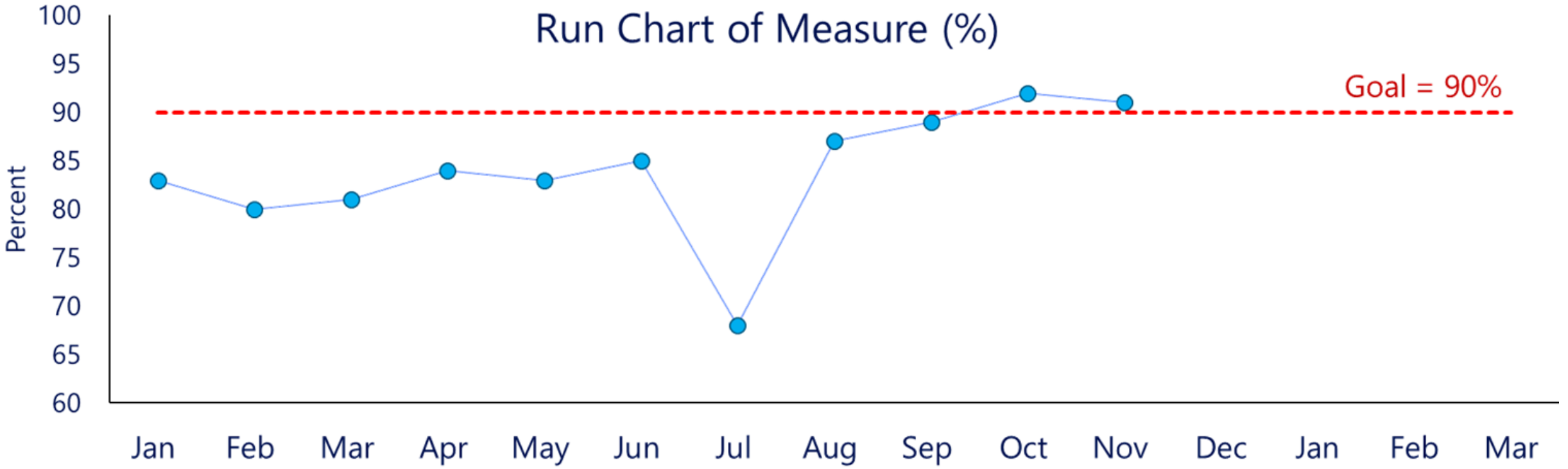
# Guidelines for Collecting Data for Improvement

- A few key measures that clarify the aim of the improvement effort and make it tangible should be regularly reported throughout the life of the project
- Be careful about over-doing process measures. A balance of outcome, process and balancing measures is important
- Plot data visually on the key measures over time
- Make use of existing databases and data already collected for developing measures.
- Whenever feasible, integrate data collection for measurement into the daily work routine.
- The second question of the MFI, "How will we know that a change is an improvement?" usually requires more than one measure. A balanced set of three to eight measures will ensure that the system is improved.

*HC Data Guide, p. 32*

# Why do we need to learn from graphs of the data?

| Month | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | Oct | Nov |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Measure (%) | 83 | 80 | 81 | 84 | 83 | 85 | 68 | 87 | 89 | 92 | 91 |






Adapted from *Health Care Data Guide*, p. 68

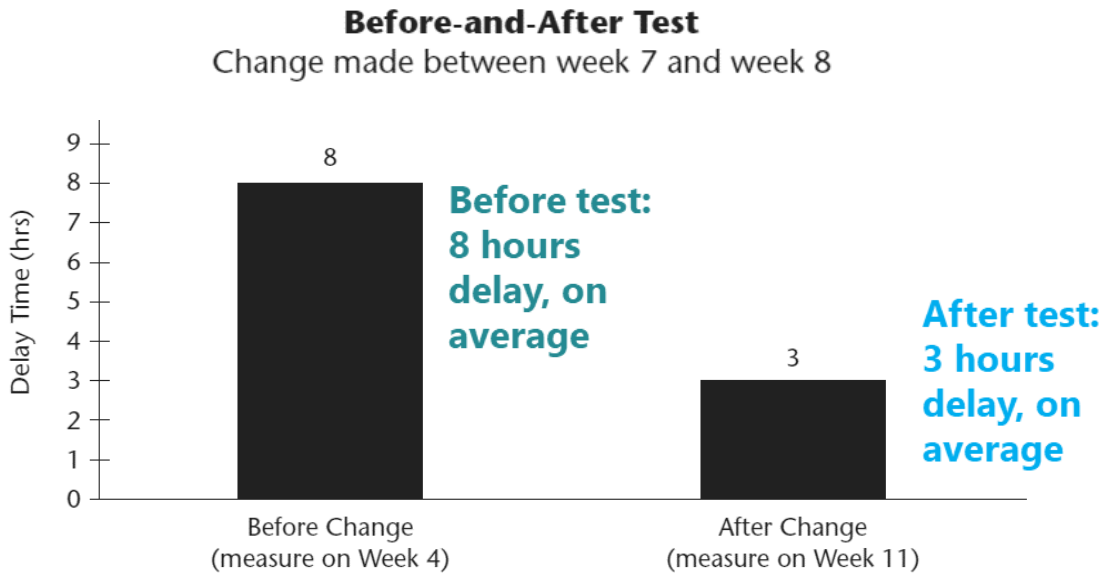
**"Plotting measurements over time turns out, in my view, to be one of the most powerful devices we have for systemic learning...** Several important things happen when you plot data over time. First, you have to ask what data to plot.

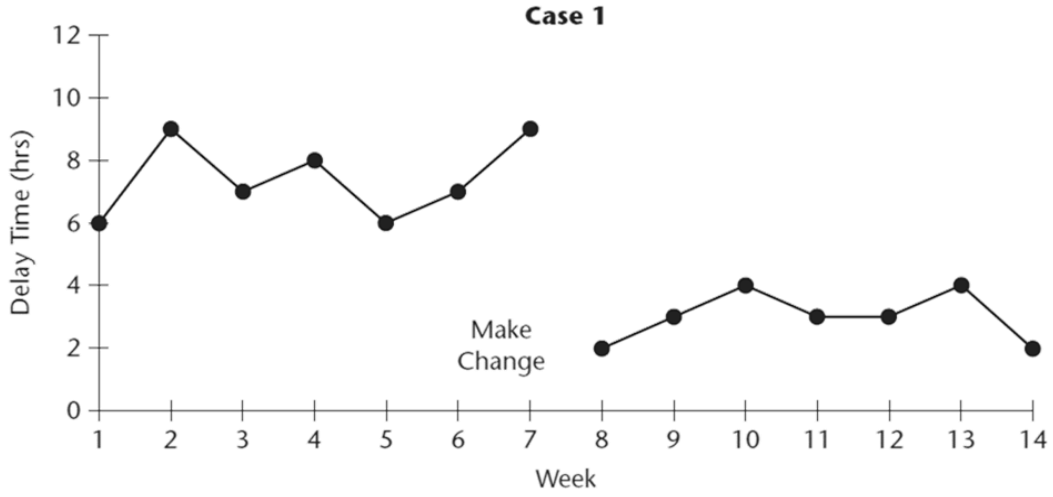
In the exploration of the answer, you begin to clarify aims, and also to see the system from a wider viewpoint. *Where are the data? What do they mean? To whom? Who should see them? Why?* These are qu
clarify aims and systems all at once...

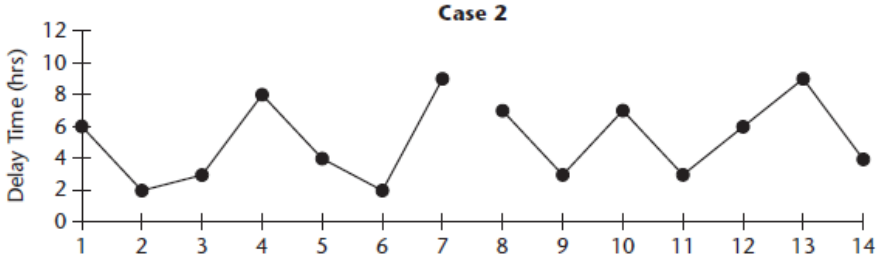
**If you follow only one piece of advice from this lecture when you get home, pick a measurement you care about and begin to plot it regularly over time. You won't be sorry."**

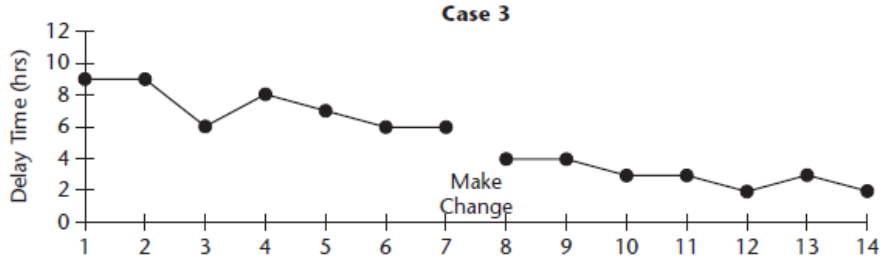
*– Donald M. Berwick MD, 1995,*
*National Forum for Quality Improvement in Health Care*

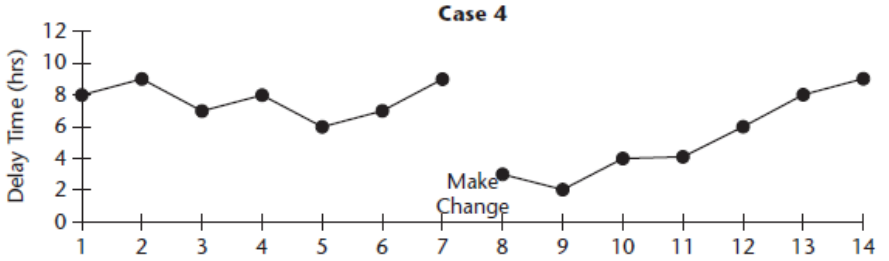
# Improvement Projects need Time Series Charts!

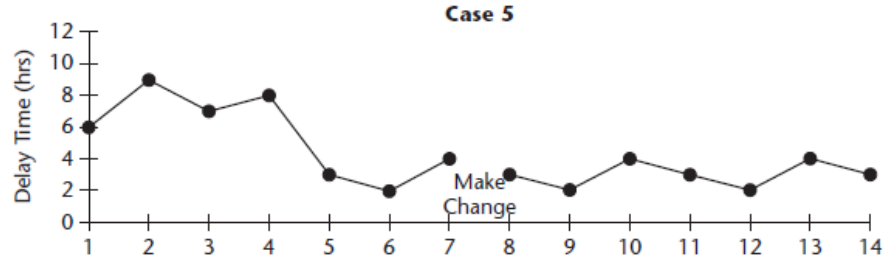


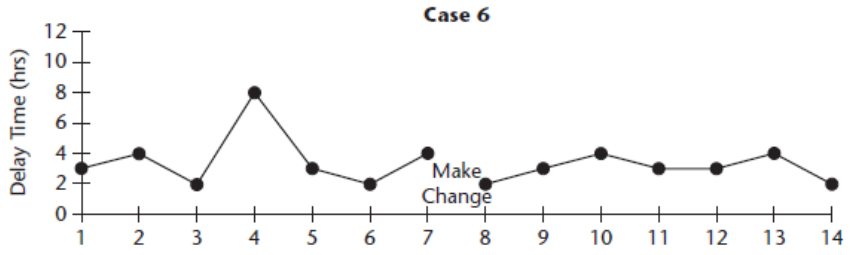



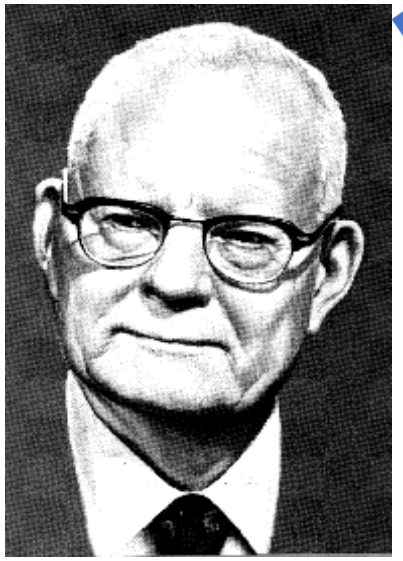



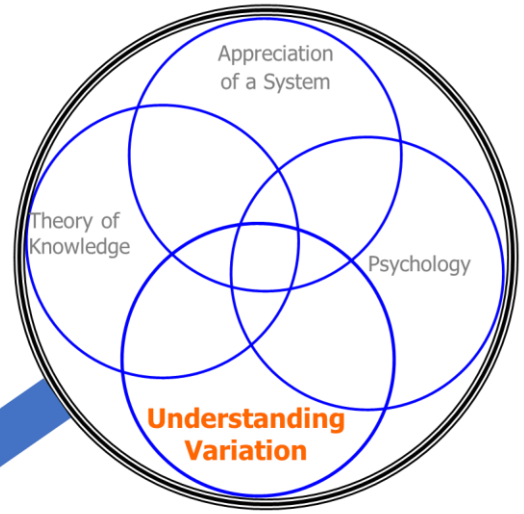



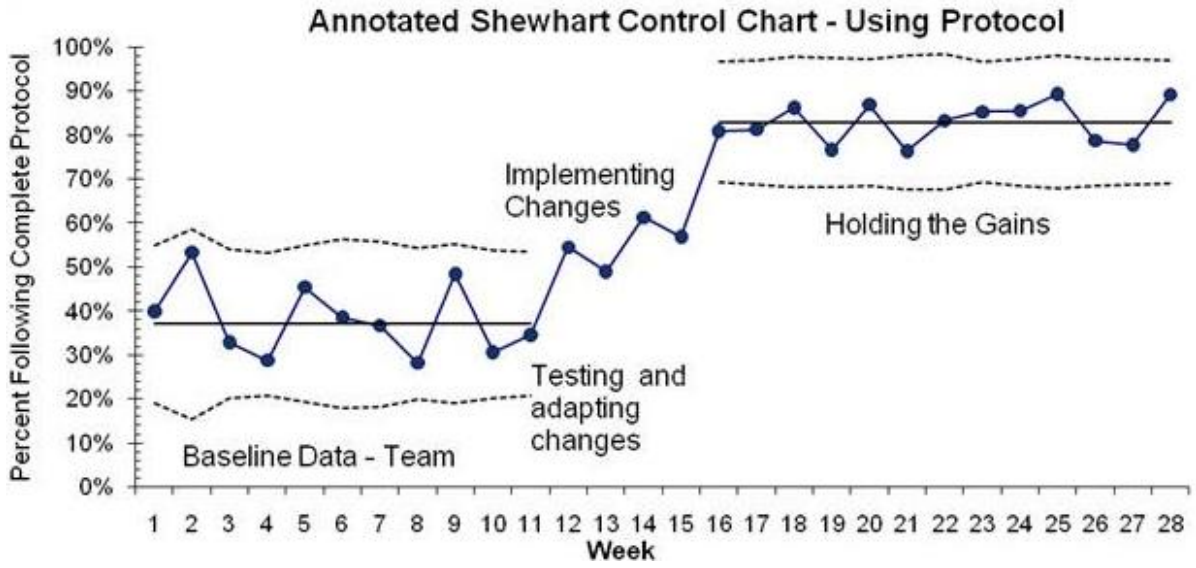
# The Pioneers of Understanding Variation and the foundation for the Science of Improvement



W. Edwards Deming
(1900 - 1993)

Science of Improvement
Understanding Variation

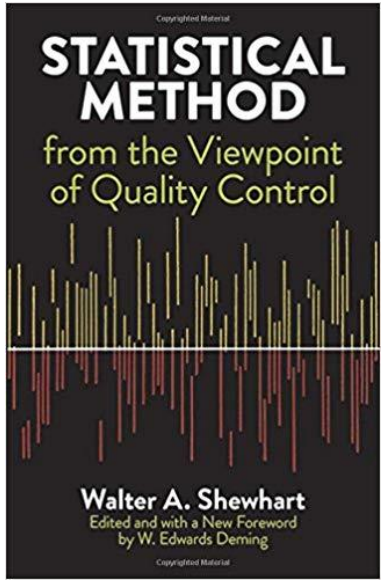


Walter Shewhart
(1891 – 1967)

# Shewhart's Theory of Variation

A fundamental concept of the science of improvement is that variation in a measure has two potential origins: common causes and special causes.



Walter A. Shewhart, Ph.D.
1891–1967

*Another half-century may pass before the full spectrum of Dr. Shewhart's contributions has been revealed in liberal education, science, and industry.*

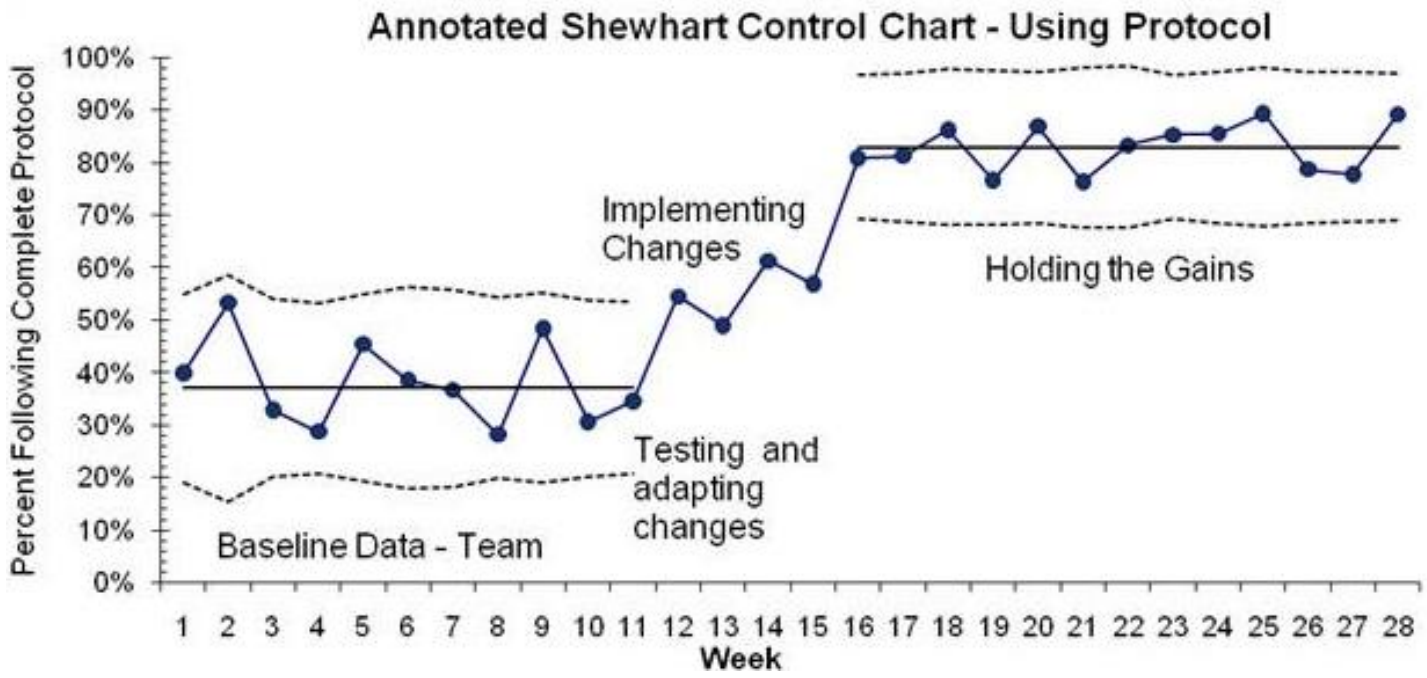
W. Edwards Deming

**Common Causes** are inherent in the system over time, affecting everyone working in the system and all system outcomes.

**Special Causes** are not part of the regular system but arise because of particular circumstances or some "special" source of variation that can be assigned to some identifiable cause

*HC Data Guide*, p. 124

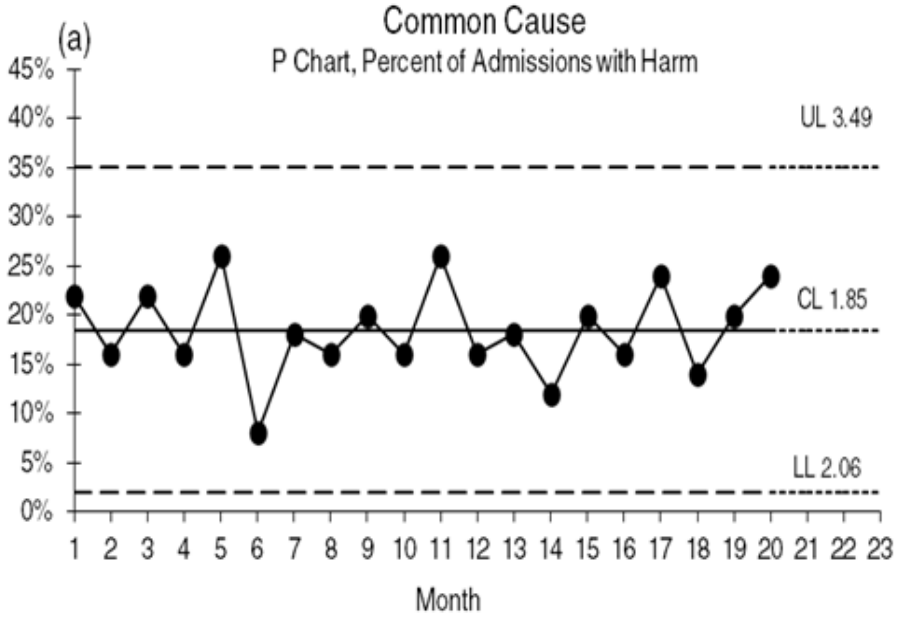
# Using the Tool……

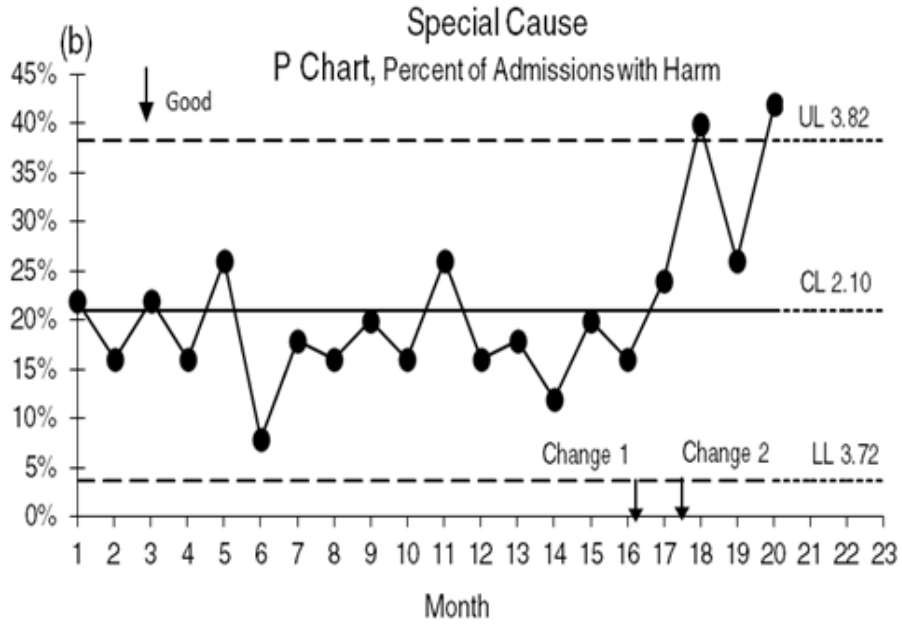


# Shewhart Charts Useful in All Parts of Model for Improvement

## What are we trying to accomplish?

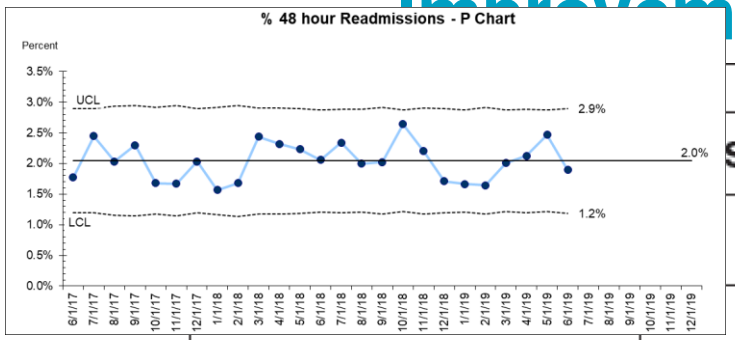
Shewhart charts for baseline project measures can be used to decide whether an improvement effort should be focused on fundamental changes or to fixing the current system or process

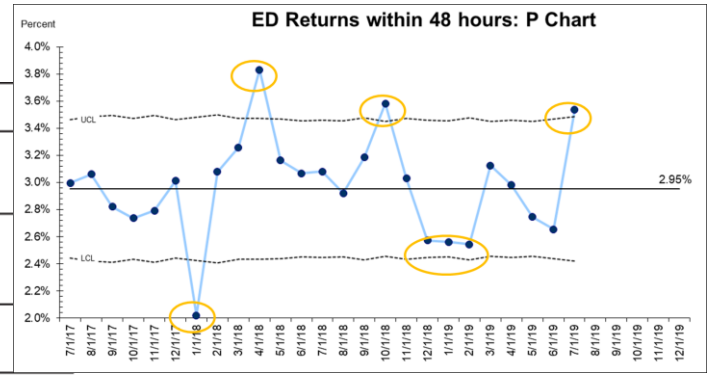


*HC Data Guide*, p. 138

# Use of Shewhart's Theory to Guide Improvement




**Select a Key Measure Related to the Aim of the Improvement Effort**

**Develop an Appropriate Shewhart Chart for the Measure**

**Is the System Stable Related to this Measure?**

**Yes**

**Identify Common Cause(s)**

**Tools/Methods:**
- -PDSA Tests of Change
- -Cause and Effect Diagram
- -Rational Subgrouping
- -Planned Experimentation

**Responsibility:***
1. Subject or technical experts
2. People working inside the healthcare process(es)
3. Patients and family

**Change the System to Remove or Reduce Common Cause(s) of Variation**

**Responsibility:***
1. Healthcare management at the appropriate level

**No**

**Identify Special Cause(s)**

**Tools/Methods:**
- -Shewhart Charts
- -Cause and Effect Diagram
- -Rational Subgrouping
- -PDSA Tests

**Responsibility:***
1. People working inside the healthcare process(es)
2. Local healthcare management
3. Subject or technical experts

**Learrn from and Act on Special Cause(s)**

**Responsibility:***
1. Local process supervisors (e.g charge nurse)
2. Subject or technical experts (e.g. infection control)
3. Healthcare managment at the appropriate level

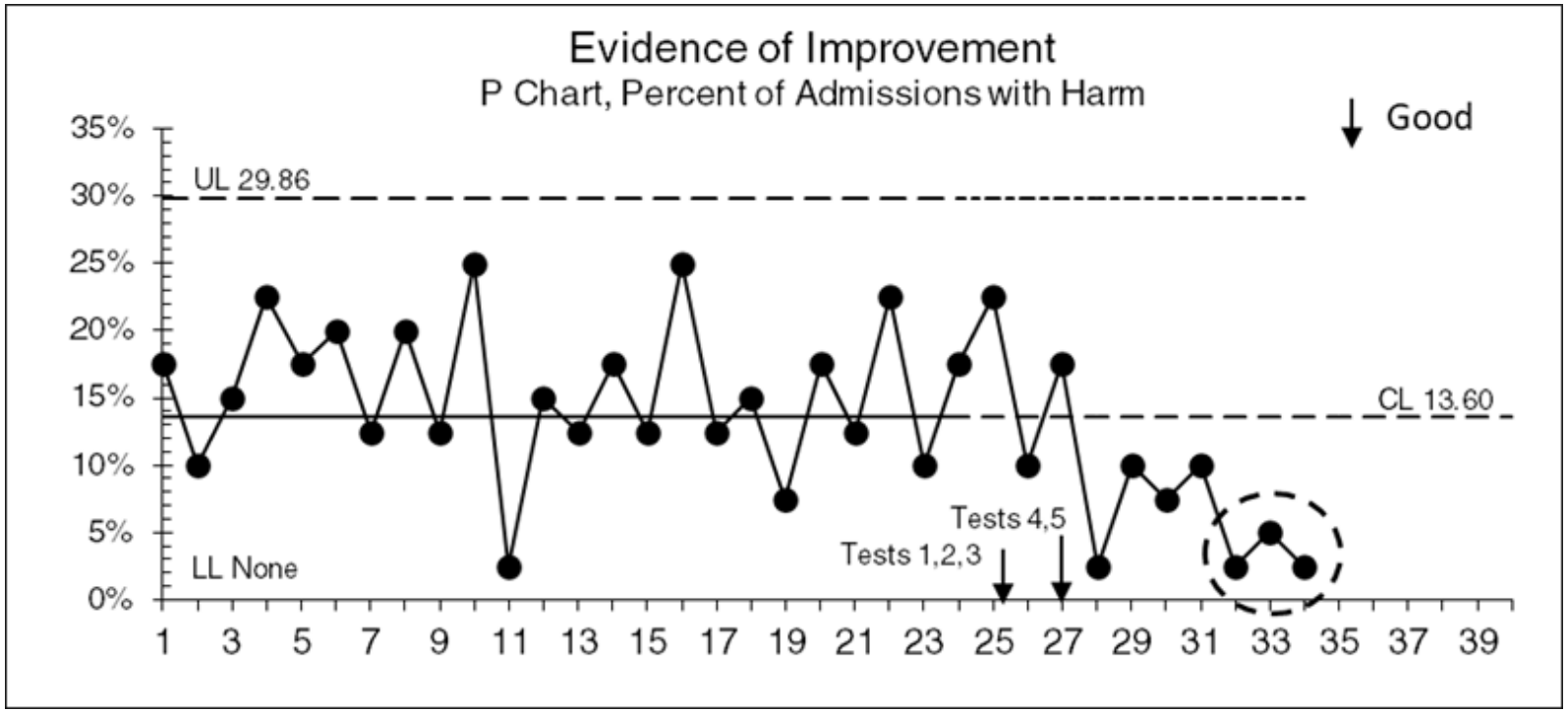
*Lists are ordered by importance

*HC Data Guide, Figure 4.1,* p. 128

# Shewhart Charts Useful in All Parts of Model for Improvement

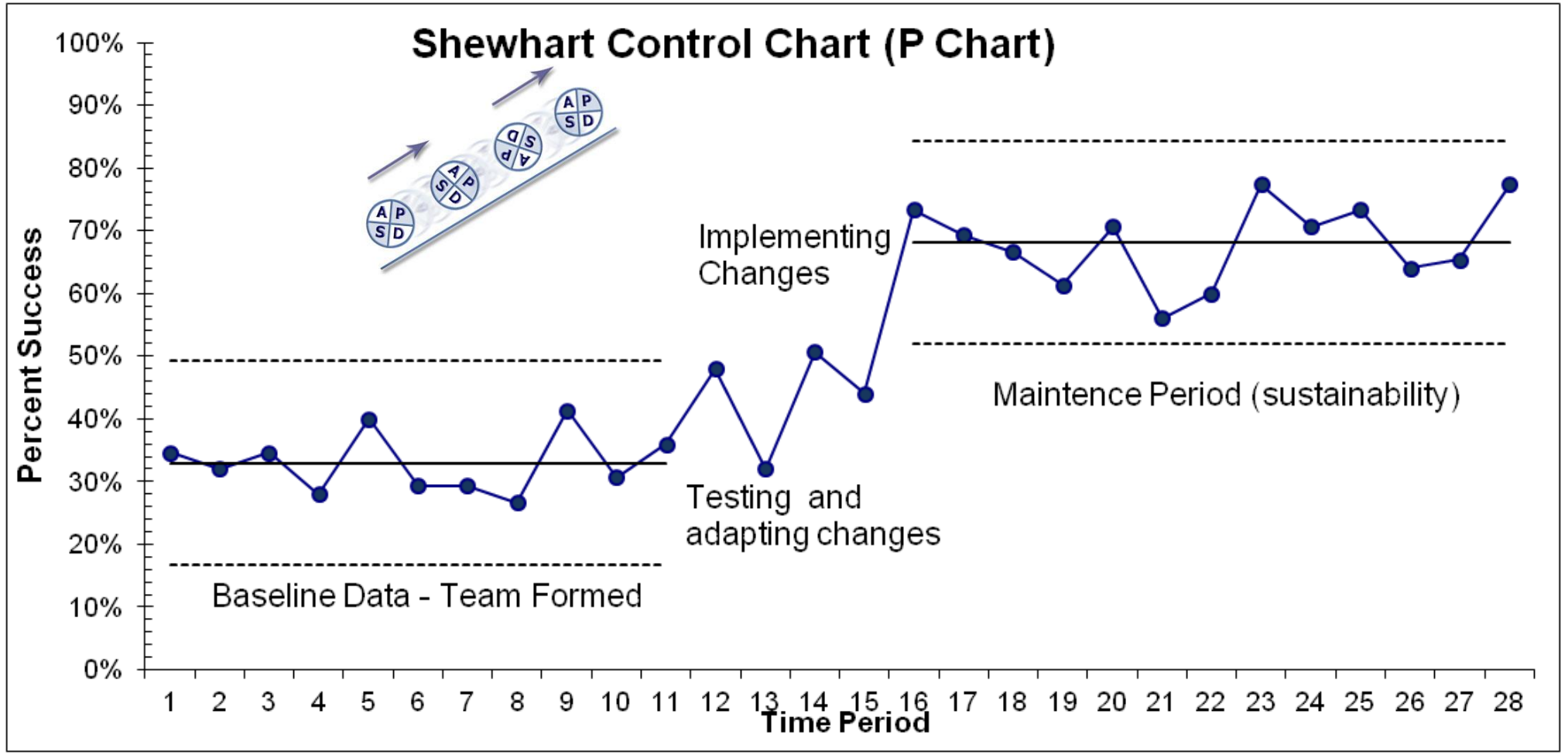
## How will we know that a change is an improvement?

The Shewhart chart method provides a formal way to decide whether observed variation in a measure of quality should be attributed to changes made or to other causes of variation in the system (Figure 4.8).



*HC Data Guide*, p. 138

# Updating a Shewhart Chart after Signals of Improvement



# Shewhart Charts Useful in All Parts of Model for Improvement

## What changes can we make that will result in improvement?

- Can help determine focus for the next PDSA cycle
  - identification, understanding, or removal of common causes (fundamental redesign of the system)
  - or focus on understanding and taking action on special causes of variation (fixing the current system).
- Used to detect causes of variation which can lead to ideas for change.
- Stratification, which includes disaggregation and rational subgrouping, is used with Shewhart charts to aid in developing ideas for change.

Depicting and Interpreting

# Detecting Variation Which Could Lead to Ideas for Change

FIGURE 4.9 Shewhart Chart Using Rational Subgrouping

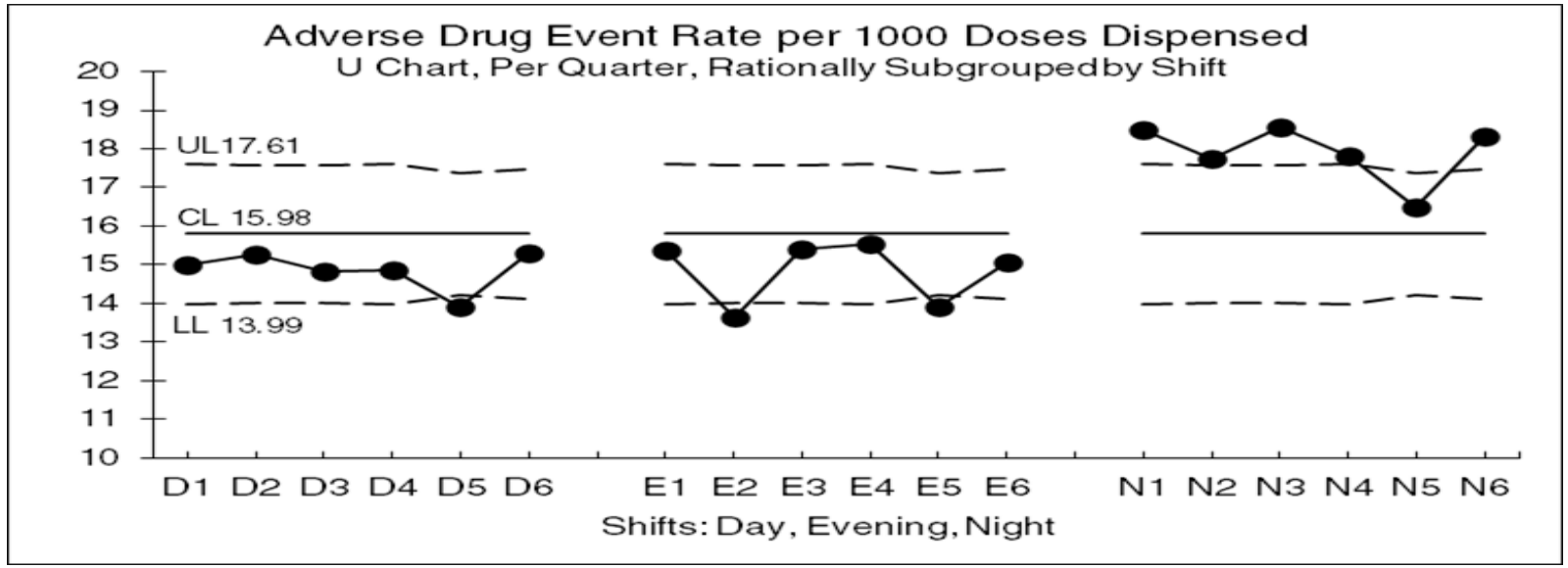
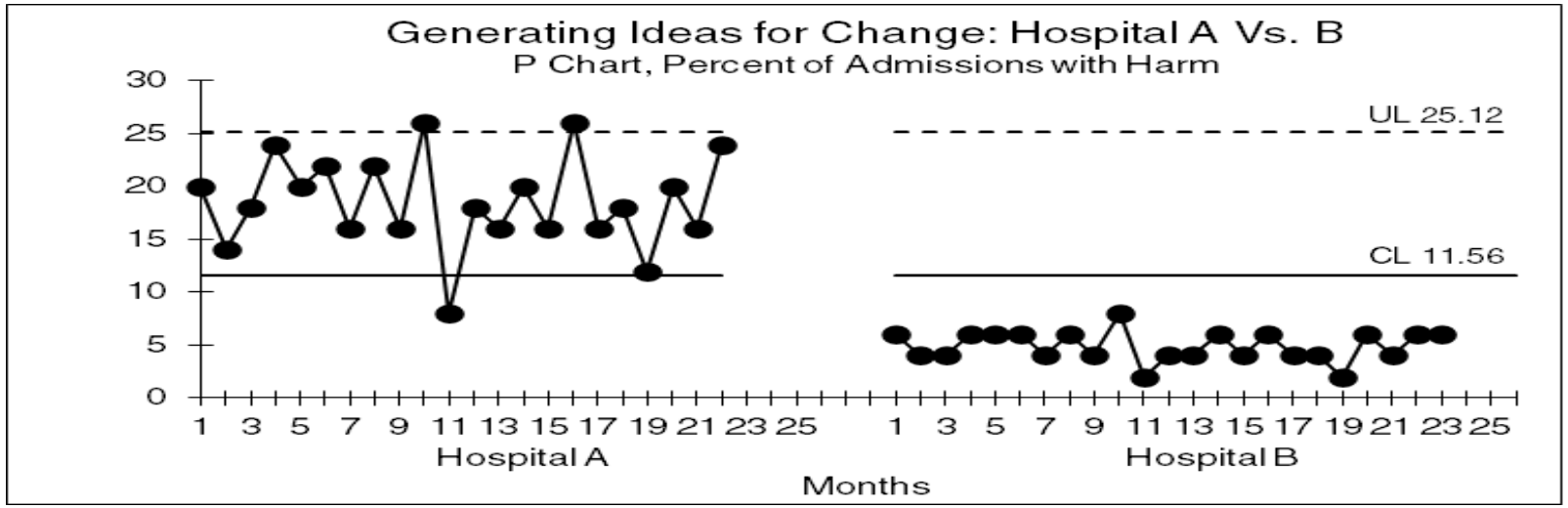
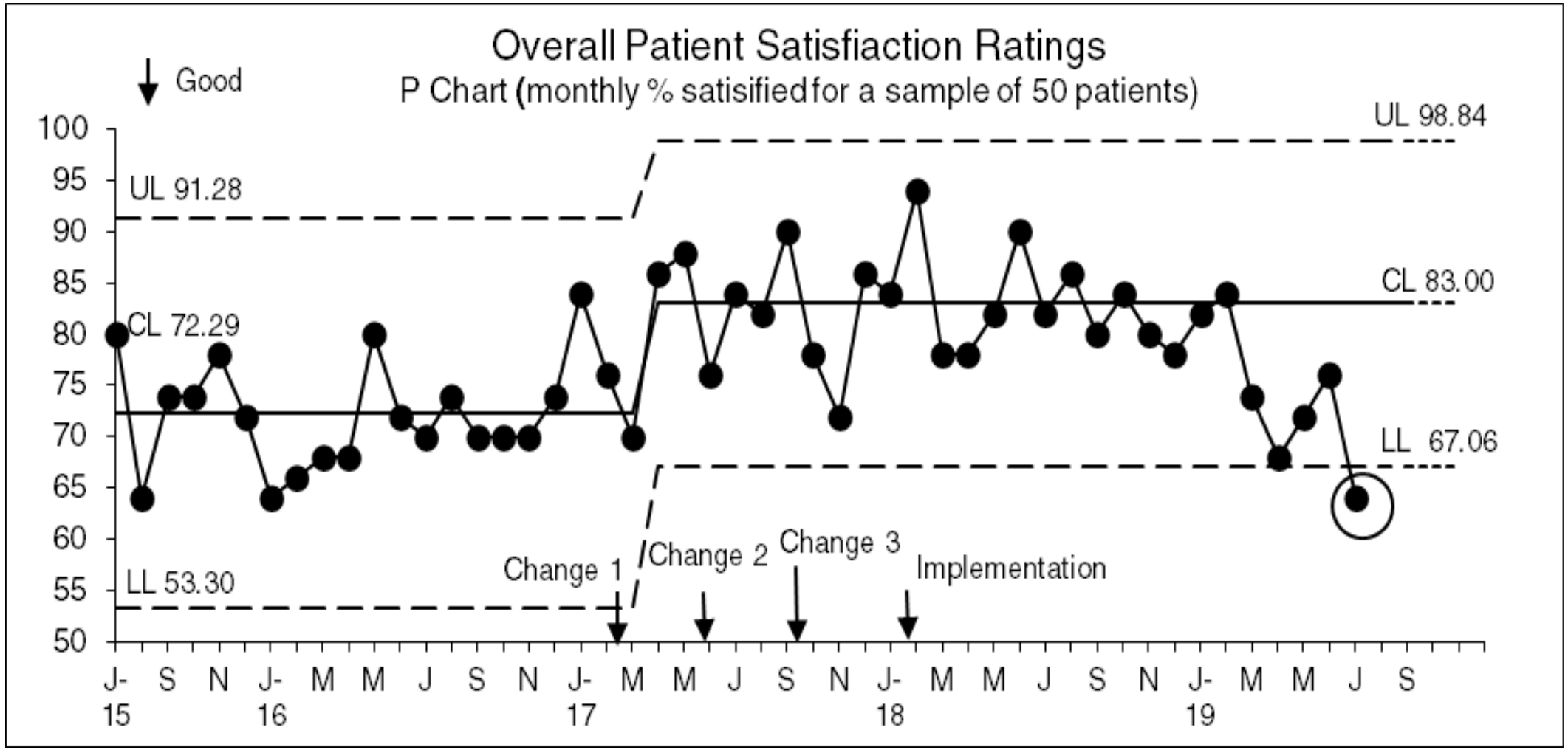



FIGURE 4.10 Shewhart Chart Using Stratification




*HC Data Guide*, p. 139

# FIGURE 4.5 Detecting "Losing the Gains" for an Improved Process

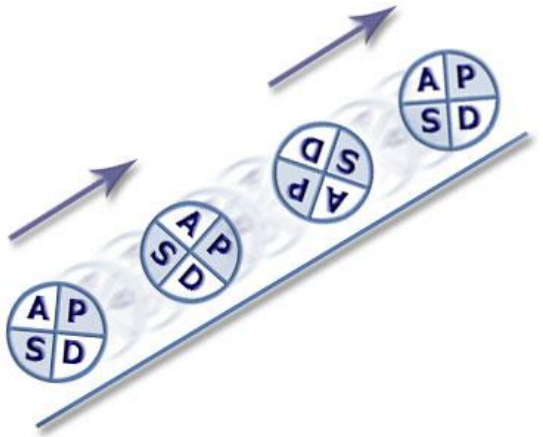



*HC Data Guide*, p. 137

# Shewhart Charts Useful in All Parts of Model for Improvement

## What are we learning while testing using PDSA Cycles?

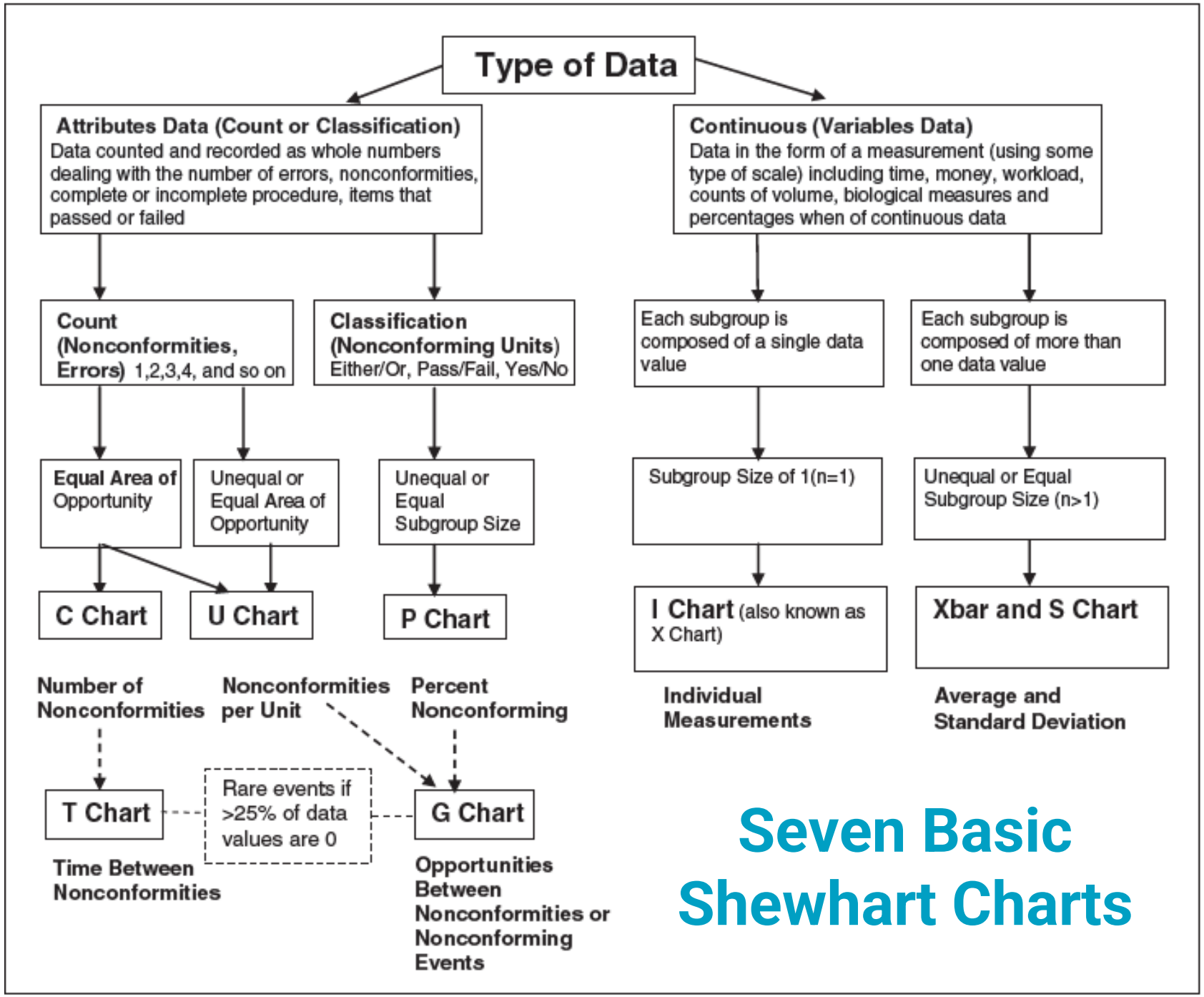
- Shewhart chart can be a key aid in learning during PDSA cycles.
- Making predictions prior to testing changes is key to good science and good learning.
- Reduces hindsight bias and focuses the study during the cycle.
- Teams should always make **predictions** about a change(s) before testing.
- Evidence always compared to prediction
- Improvement is determined using the Shewhart chart.
  - If the changes resulted in improvement the Shewhart chart would reveal evidence of favorable special cause after testing the change(s).
  - If the change tested didn't yield improvement the Shewhart chart would show no evidence of favorable special cause.



*HC Data Guide*, p. 140

## Different Shewhart Charts depending on type of data and how it is organized.

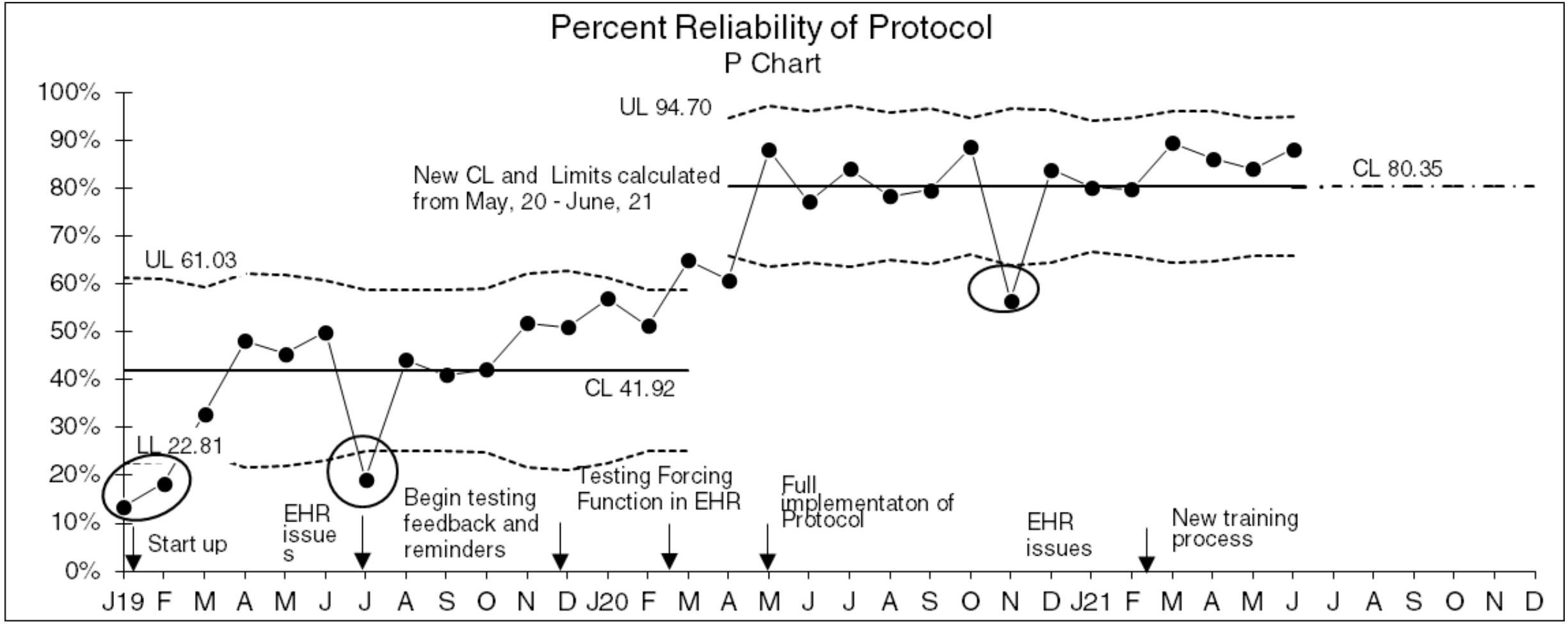
7 Basic charts and many advanced options




HCDG, Page 161

# Annotation – the key to learning with Shewhart charts

**FIGURE 7.6 Example of Shewhart Chart with Appropriate Annotations**



National Preterm Birth Prevention COLLABORATIVE

# Using Data to Support Learning

*IHI/BMJ Asia Pacific Forum*

Kate Bones
Institute for Healthcare Improvement
Improvement Advisor, National Preterm Birth Prevention Collaborative

AUSTRALIAN Preterm Birth Prevention ALLIANCE

WOMEN'S HEALTHCARE AUSTRALASIA

Institute *for* Healthcare Improvement

Safer Care Victoria

Australian Government
Department of Health and Aged Care

# Hospital sites participating in the Every Week Counts

## National Preterm Birth Prevention Collaborative

**50+** maternity hospitals working together to prevent preterm birth

### Northern Territory

Royal Darwin and Palmerston Hospital

### Western Australia

Albany Health Campus
Armadale Health Service
Broome Health Campus
Bunbury Hospital
Fiona Stanley Hospital
King Edward Memorial Hospital
Osborne Park Hospital

### South Australia

Flinders Medical Centre
Lyell McEwin Hospital
Riverland Mallee Coorong Local Health Network
Women's and Children's Hospital

### Victoria

Angliss Hospital
Box Hill Hospital
Ballarat Base Hospital
Frances Perry House
Frankston Hospital
Joan Kirner Women's & Children's Hospital
Latrobe Regional Hospital
Mercy Hospital for Women
Monash Medical Centre
Portland District Health
The Northern Hospital
The Royal Women's Hospital
University Hospital Geelong
Wangaratta District Base Hospital
Wodonga Hospital

### Queensland

Bundaberg Hospital
Darling Downs Health
Gold Coast University Hospital
Ipswich Hospital
Mater Mothers Hospital
Sunshine Coast University Hospital
The Royal Brisbane and Women's Hospital
Thursday Island Hospital
Townsville University Hospital

### New South Wales

Campbelltown Hospital
Fairfield Hospital
Griffith Base Hospital
Royal Hospital for Women
Royal Prince Alfred Hospital
Southern NSW Local Health District
St George Hospital
Sutherland Hospital
Wagga Wagga Base Hospital
Westmead Hospital
Illawarra Shoalhaven LHD

### Australian Capital Territory

Centenary Hospital for Women and Children

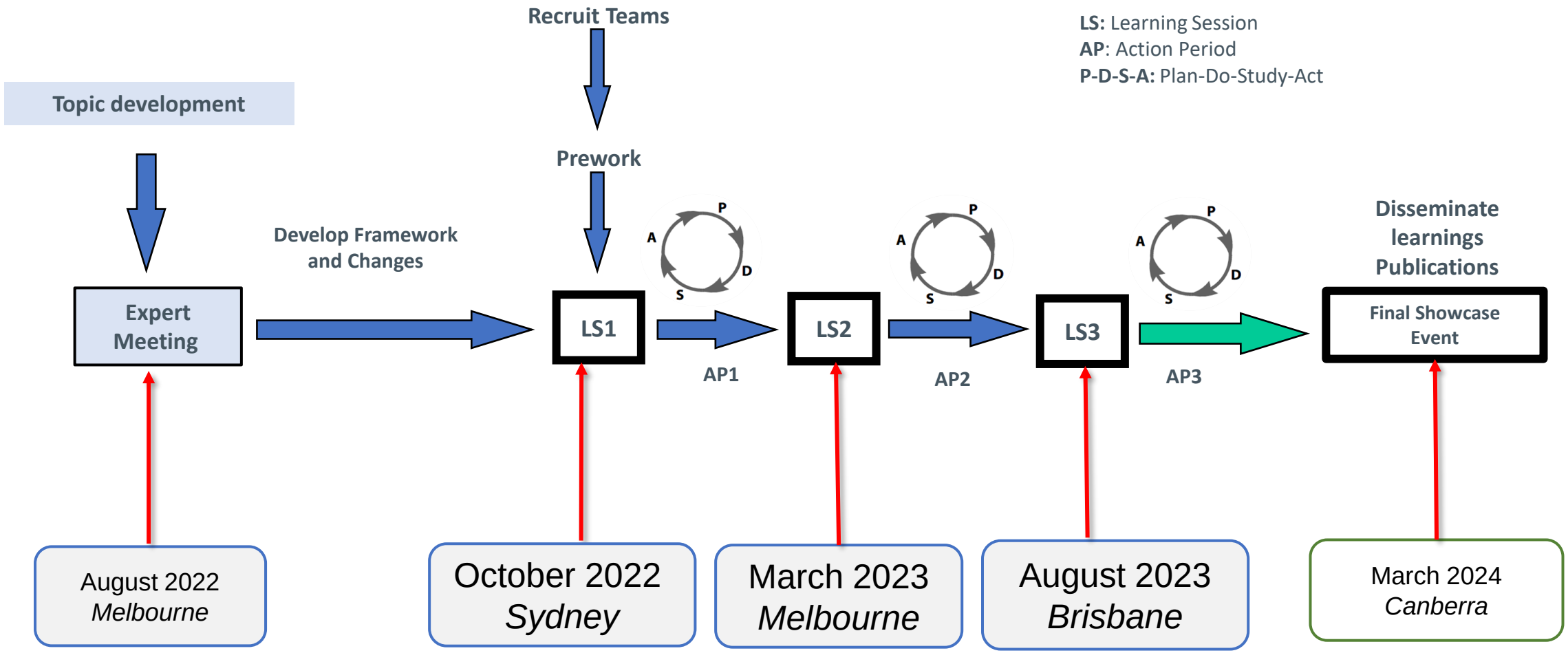
### Tasmania

Launceston General Hospital
Northwest Regional Hospital
Royal Hobart Hospital

EVERY WEEK COUNTS

Australian Government Department of Health and Aged Care
Australian Preterm Birth Prevention Alliance
Women's Healthcare Australasia
Institute for Healthcare Improvement
SCV Safer Care Victoria
Women and Babies Research Sydney
women & infants research foundation

# Every Week Counts Collaborative Timeline 2022-2024




AUSTRALIAN Preterm Birth Prevention ALLIANCE

WOMEN'S HEALTHCARE AUSTRALASIA

Institute for Healthcare Improvement

SCV Safer Care Victoria

Australian Government
Department of Health and Aged Care

# The key strategies to **prevent preterm birth**

## More than 26,000 Australian babies are born too soon each year.

New research discoveries have led to the development of key strategies to safely lower the rate of preterm birth and are continuing to make pregnancies safer for women and their babies.

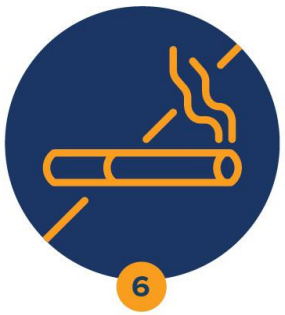
No pregnancy to be ended until at least 39 weeks unless there is obstetric or medical justification.

Measurement of the length of the cervix at all mid-pregnancy scans.

Use of natural vaginal progesterone (200mg each evening) if the length of cervix is less than 25mm.

If the length of the cervix continues to shorten despite progesterone treatment, consider surgical cerclage.

Use of vaginal progesterone if you have a prior history of spontaneous preterm birth.




Women who smoke should be identified and offered Quitline support.

To access continuity of care from a known midwife during pregnancy where possible.

AUSTRALIAN
Preterm Birth
Prevention
ALLIANCE

**These strategies have been approved and endorsed by the Australian Preterm Birth Prevention Alliance.**

# Driver Diagram

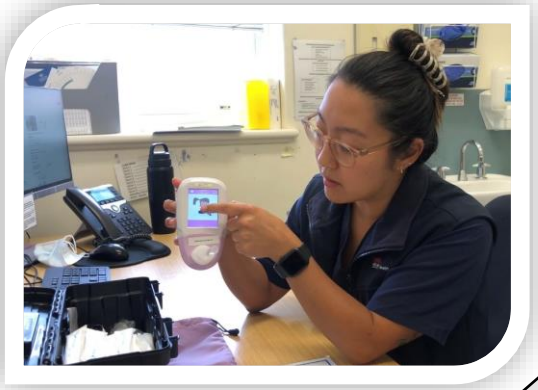
National Preterm Birth Prevention COLLABORATIVE

| AIM | PRIMARY DRIVERS | SECONDARY DRIVERS |
|---|---|---|
| To safely reduce the rate of preterm and early term birth by 20% across participating maternity services by March 2024 | **Leadership and Culture** supportive of preterm and early term birth prevention | • Build collective understanding of proven strategies and benefits of safely reducing preterm and early term birth<br>• Identify and equip clinical champions to inspire colleagues to participate in PTB and early term birth prevention<br>• Utilise data to support learning and clinical practice |
| | **Empowered Women** able to make informed decisions | • Build understanding of PTB risk factors and the need for early engagement with health care services<br>• Educate women during pregnancy on benefits of safe prolongation of pregnancy<br>• Conduct shared decision making with women to support decisions about PTB prev and timing of birth<br>• Codesign PTB prevention pathways with populations experiencing inequities in outcomes |
| | **Safe and Effective PTB Prevention** | • Offer continuity of carer for all women at risk of preterm or early term birth throughout pregnancy<br>• Identify and support women who smoke during pregnancy to quit<br>• Measure cervix length at all mid -pregnancy scans (19-20 wk anatomy scan) and refer at risk women<br>• Prescribe natural progesterone 200mg to be used each night from 16 -36 weeks gestation when cervix is <25mm and consider use where woman has history of spontaneous PTB<br>• Offer cerclage to women where medically indicated<br>• Promote strategies to safety extend pregnancy in the presence of medical/pregnancy complications |
| | **Optimal Timing of Birth** | • Confirm reliable pregnancy dating processes are operational and effective where appropriate<br>• Embed opportunities within the antenatal journey to support timing of birth discussions<br>• Develop clinical decision support processes and clinical review to support optimal timing of birth where there is no obstetric or medical indication |

Australian Preterm Birth Prevention Alliance · Women's Healthcare Australasia · Institute for Healthcare Improvement · SCV Safer Care Victoria

# Change: Use of CO monitors

Commence use of CO monitors as a motivational tool as per NSW Health PD



St George Hospital & Community Health Services

Cycle 7: Tested during busier doctors' clinic with F2F training → plan for ongoing education and compliance checks.

Cycle 6: Started using CO monitors for all women seen by midwives → further support required for medical staff.

Cycle 5: Video sent to wider group of midwives and doctors complimented with staff self-testing using the CO monitor. Tested for one day in ANC and with 1 medical officer → ongoing + feedback.

Cycle 4: Trial video with small group of midwives and completed CO monitor on 3 women → very positive feedback and staff engagement.

Cycle 3: Development of a 5 minute CO monitor video in collaboration with experienced staff. Trial with 1 clinician with no CO experience → minor amendments.

Cycle 2: Distribute Smoking in Pregnancy My Health Learning modules to staff → poor completion (as expected). Learning needs gap analysis completed by health district in collaboration with all staff.

Cycle 1: When completing PTB education with staff, inform about pending implementation of CO monitors → staff requested more information.

# National Collaborative Family of Measures

| | |
|---|---|
| Outcome Measures | 3 |
| CORE Process Measures | 5 |
| Balancing Measures | 2 |

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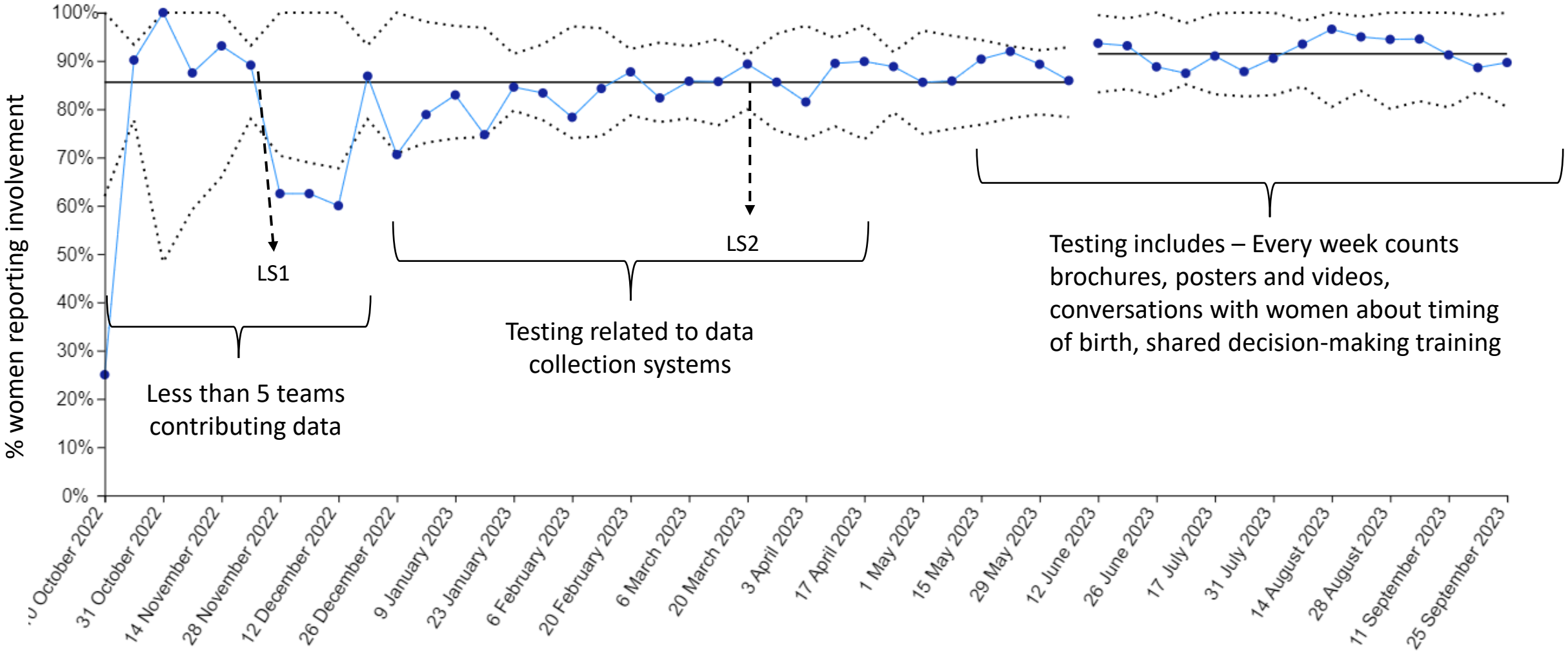
# Process 2: Women who report being involved in decision making

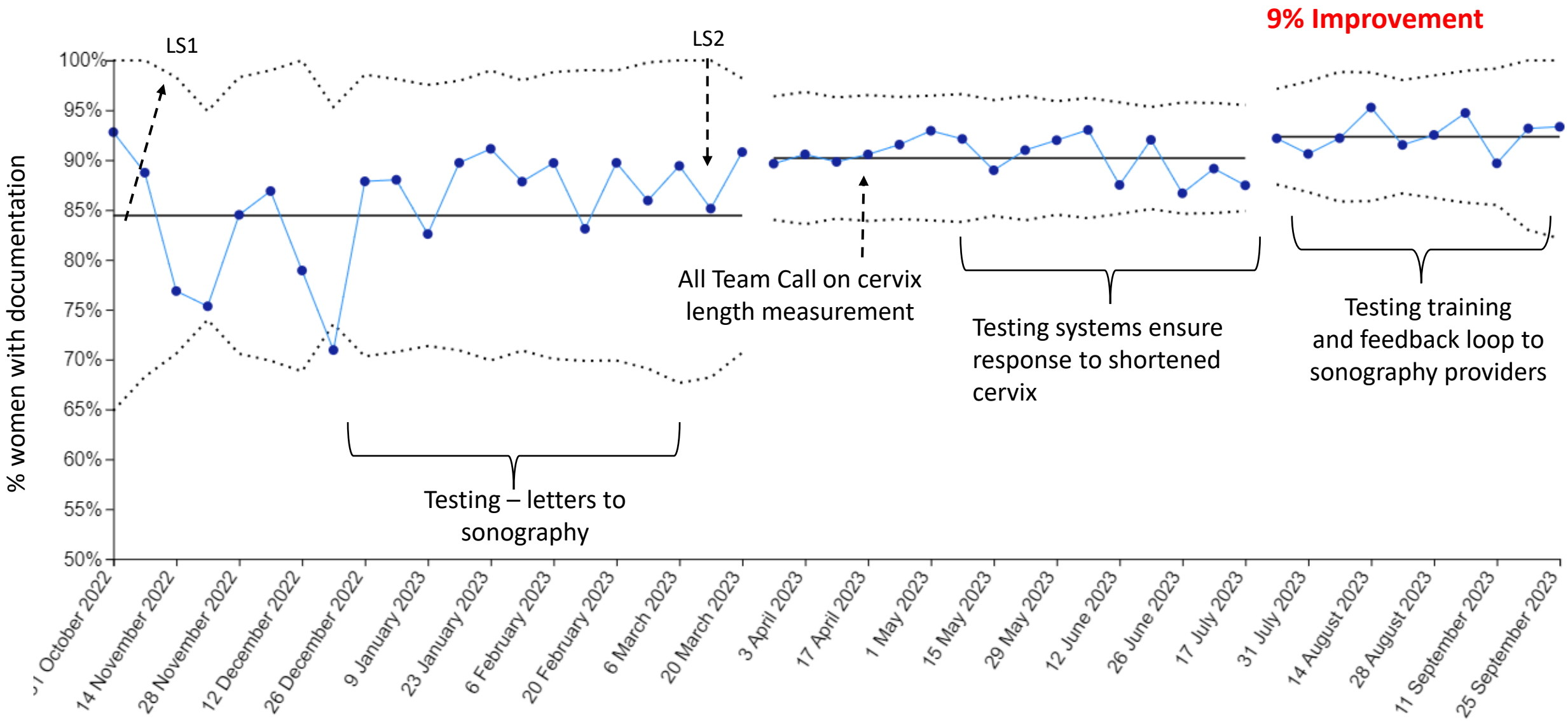
**7% Improvement**




Baseline Mean = 85.57%
Current Mean = 91.46%

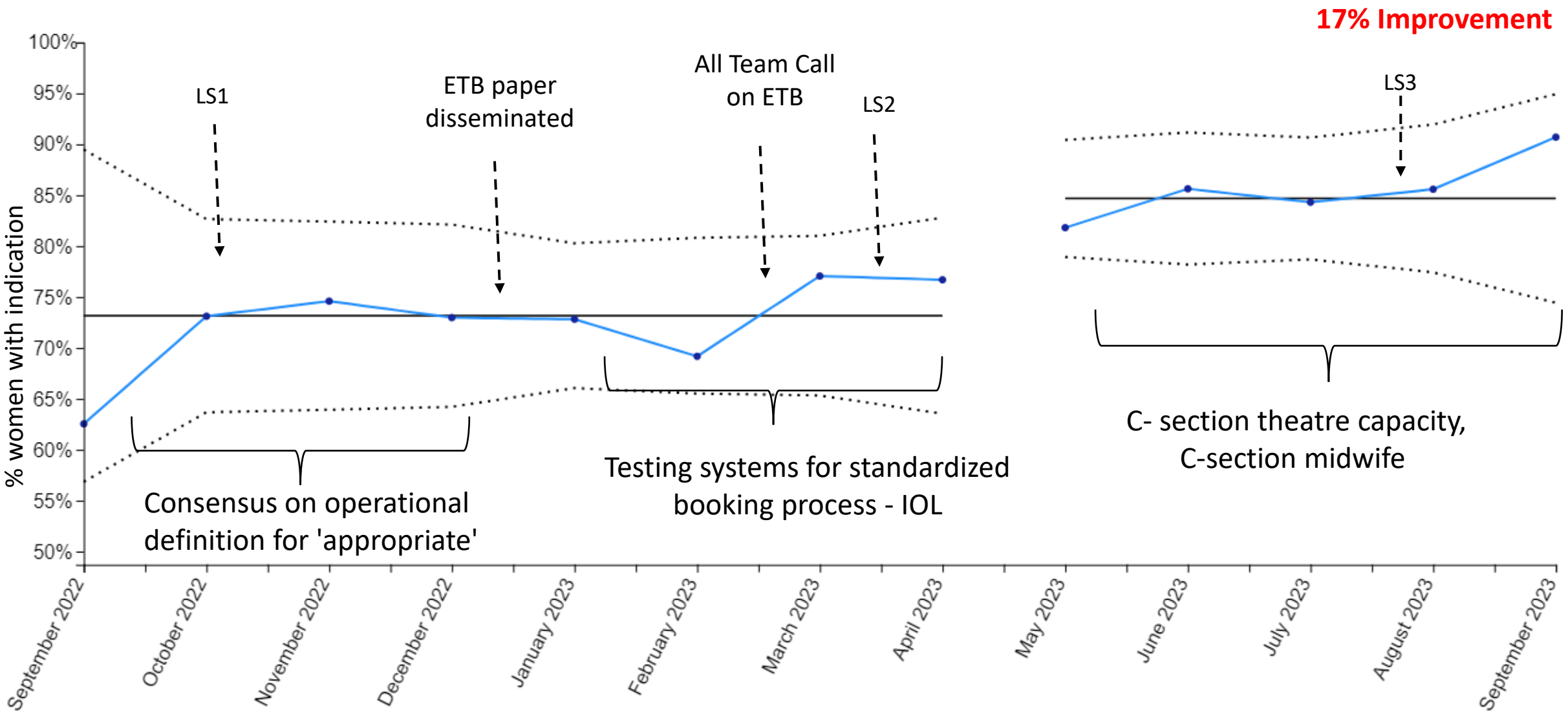
30 teams contributing (total)

# Process 3: Cervix length measurement documented




Baseline Mean = 84.43%
Current Mean = 92.33%

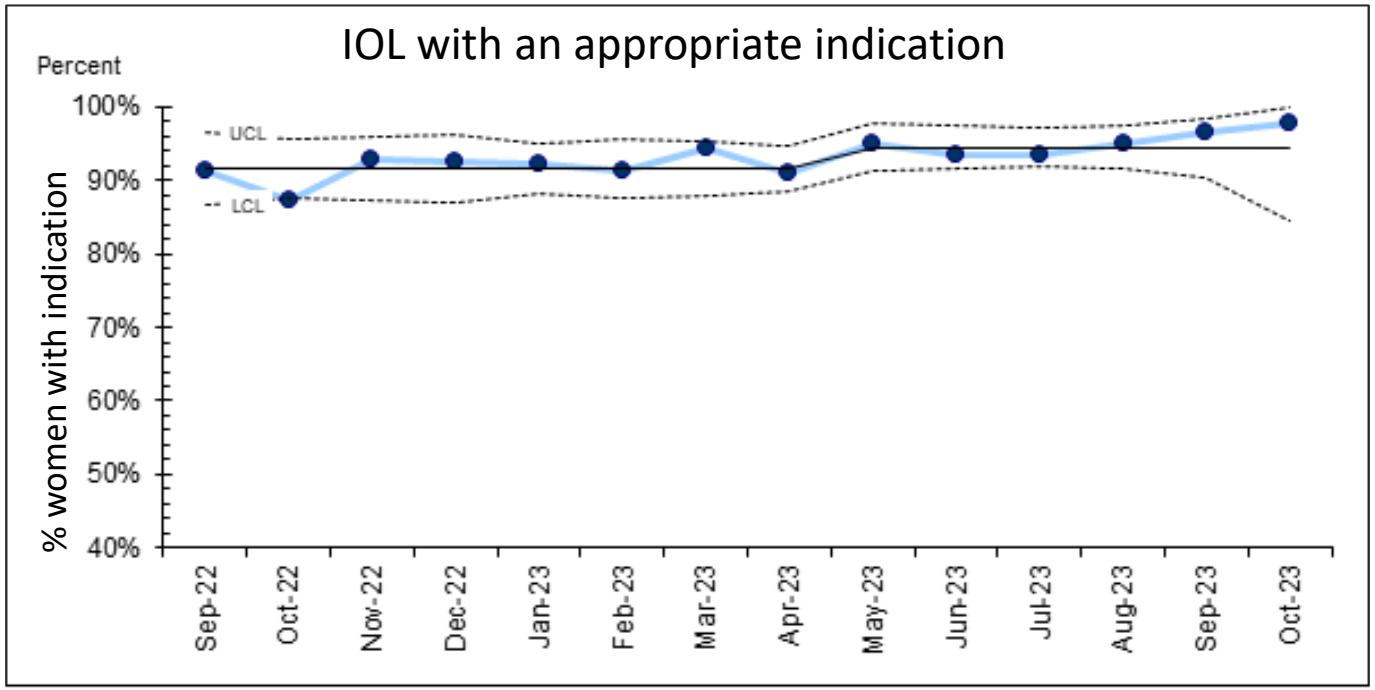
# Process 5: Planned birth (IOL and c/s) with appropriate indication




Baseline Mean = 73.16%
Current Mean = 85.68%

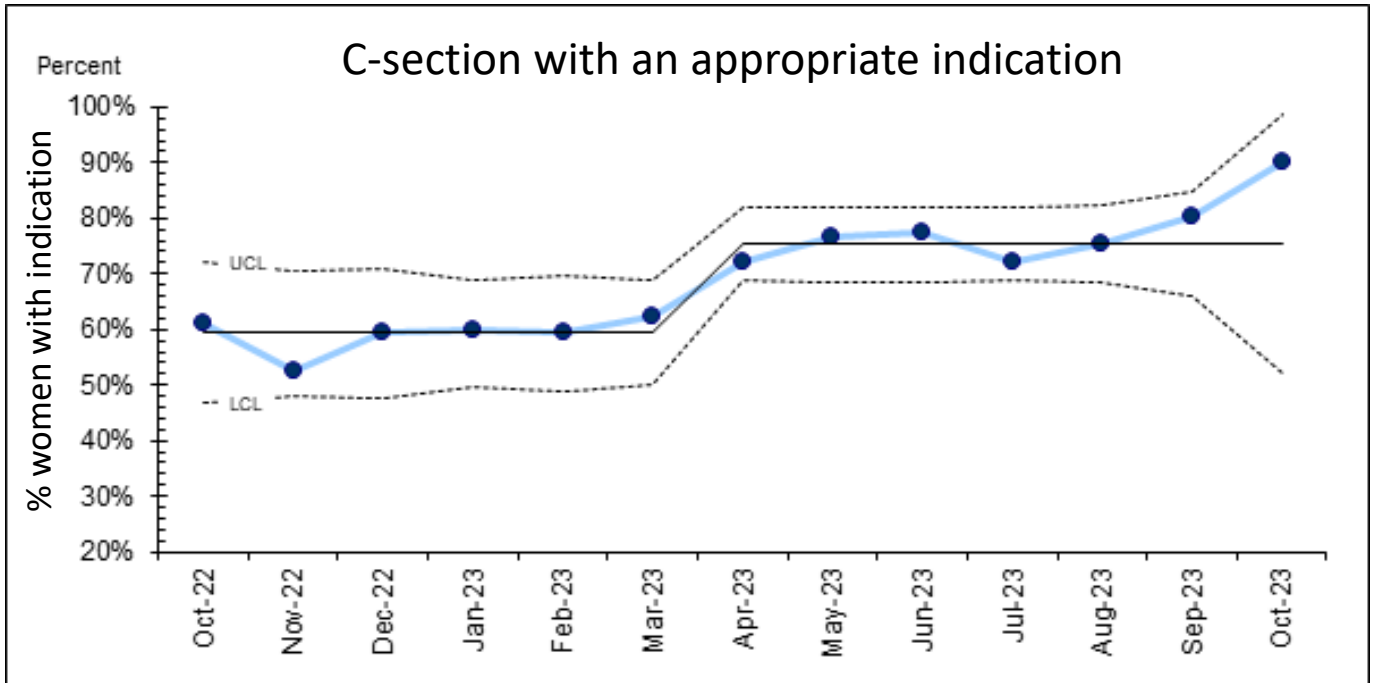
51 teams contributing (total)

# Process 5: Planned birth (37.0 – 38.6 weeks') with appropriate indication




**3% Improvement**

Baseline Mean = 91.61%
Current Mean = 94.47%



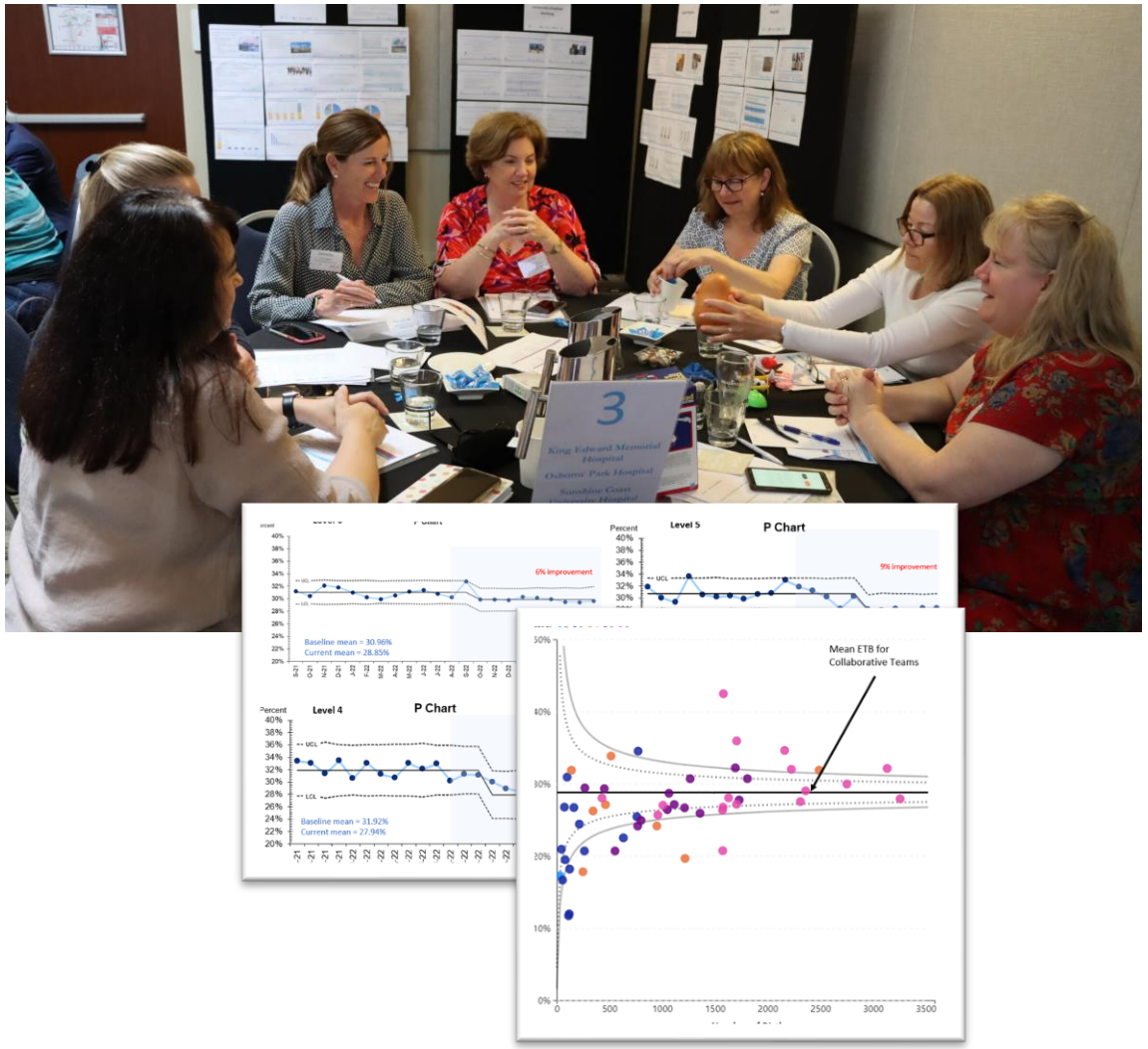

**27% Improvement**

Baseline Mean = 59.36%
Current Mean = 75.41%

- Our process measures are important! They are providing us insight into the causal pathway to results
- We are 10 months into the Collaborative and we are "watching this space" for impact on Preterm Birth
- Impacts to-date on Early Term Birth are positive and we need to keep going and focus on sustaining the progress

# Data to support on-going learning

- Aggregate outcomes using P' chart
- Small multiples by team to understand experience with process measures
- Small multiples by hospital service level and jurisdiction
- Funnel plots to identify and learn from outliers
- Scatterplots to understand relationship between process and outcome



# Using Data in the Collaborative

## Enablers

- Strong clinical leadership
- Hands-on sessions
- Jurisdiction level coaching
- Access to patient-level outcome data

## Challenges

- Using data for improvement in a data for research world
- Piloting process measures real-time…and not always getting it right

# National Preterm Birth Prevention COLLABORATIVE

## Learning Session 3, Brisbane
## 14-15 August 2023

Australian Government
Department of Health and Aged Care

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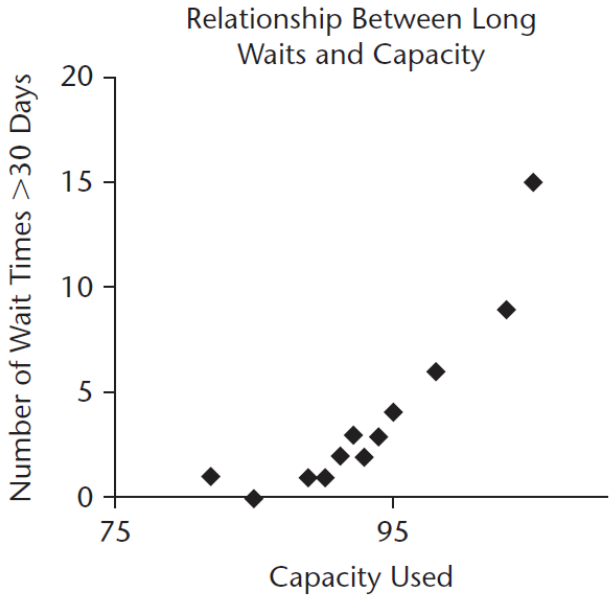
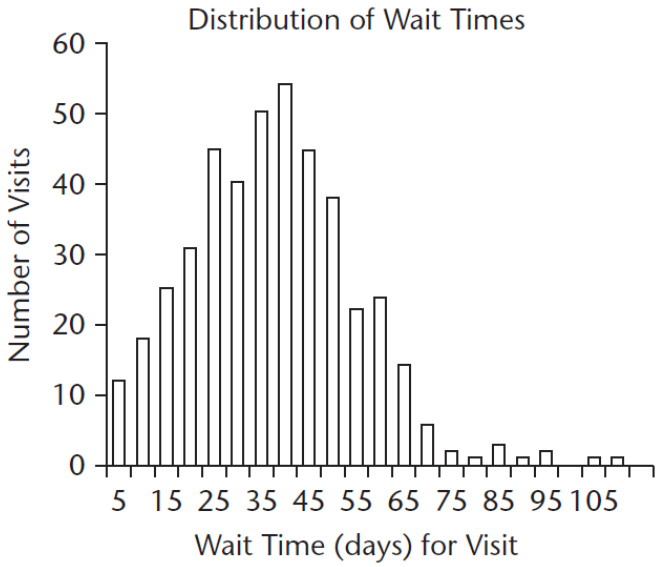
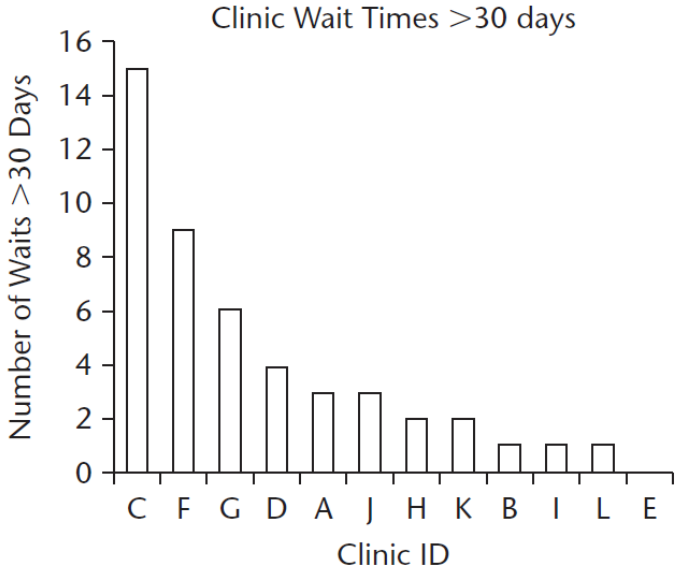
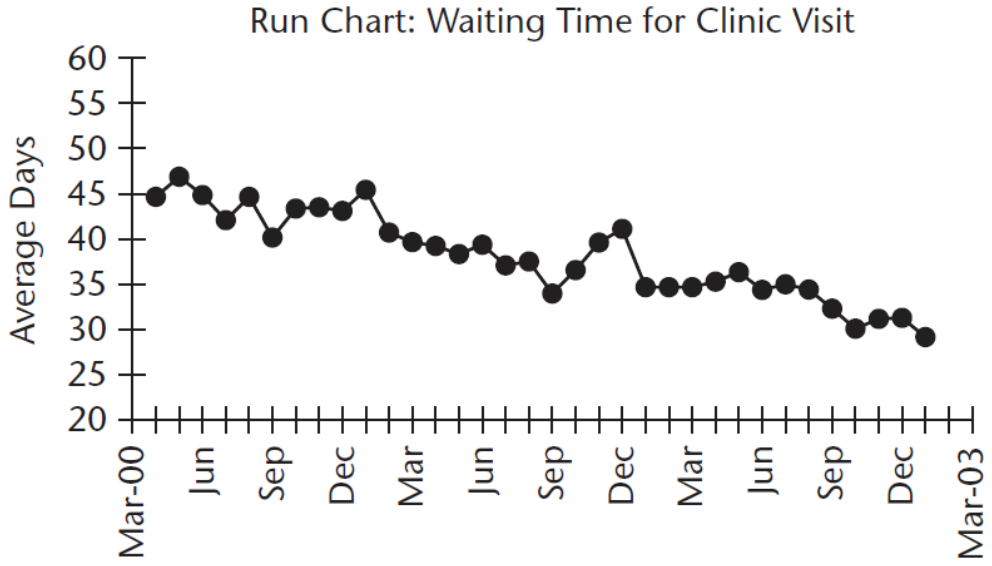
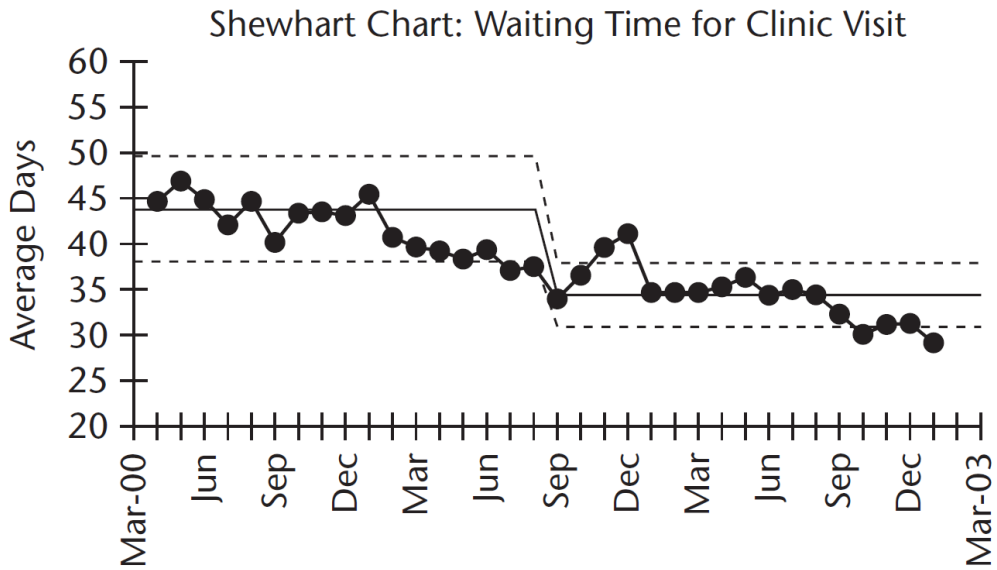
# Tools to Learn from Variation in Data



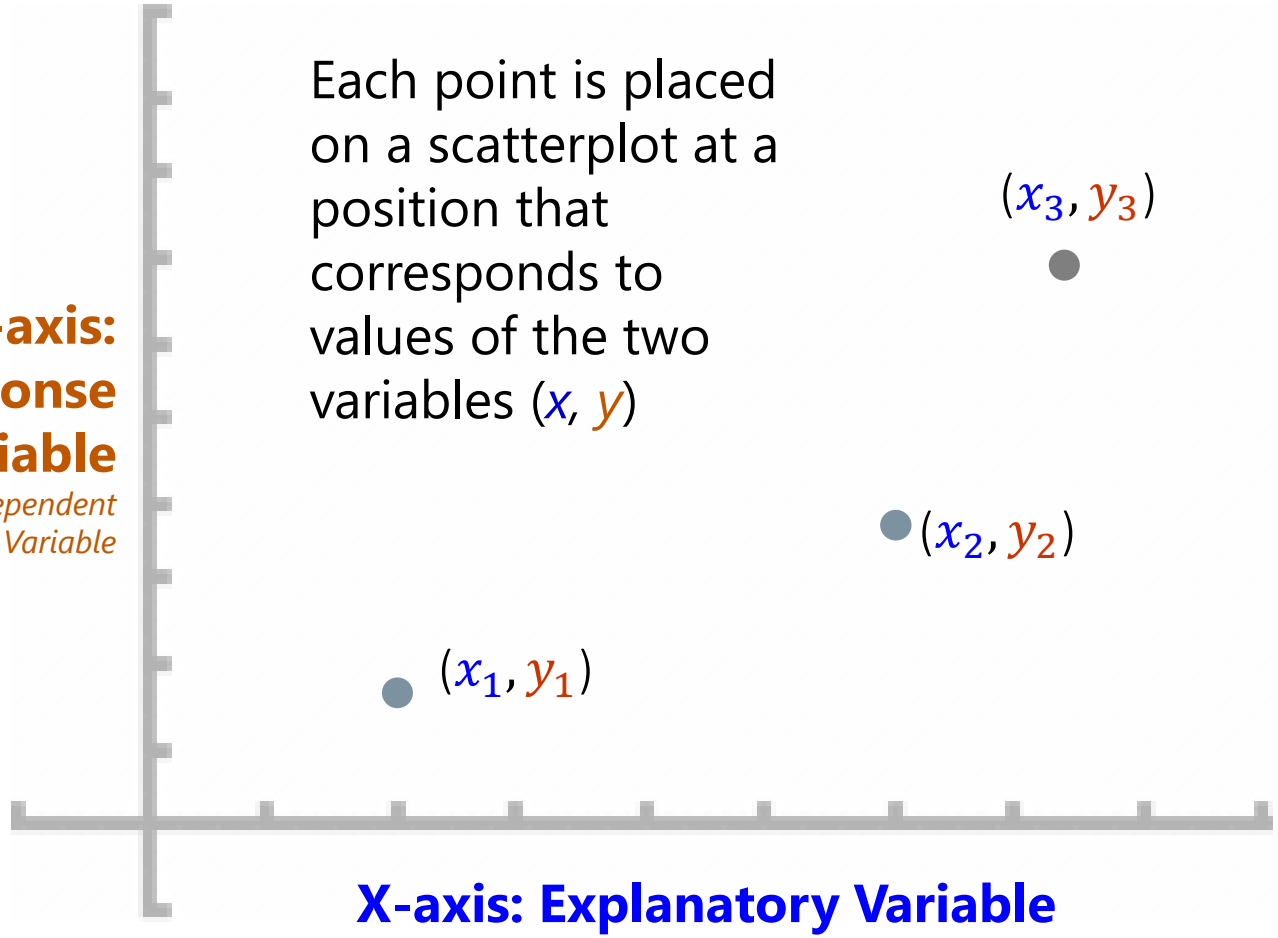



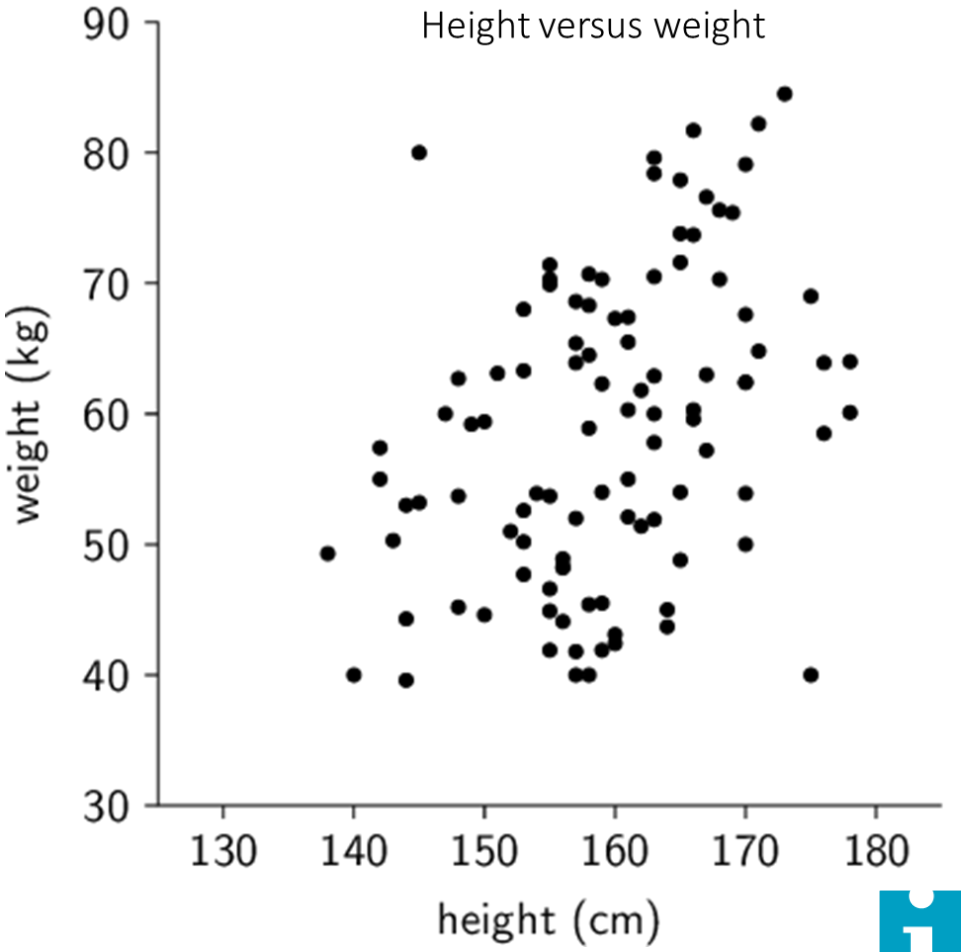



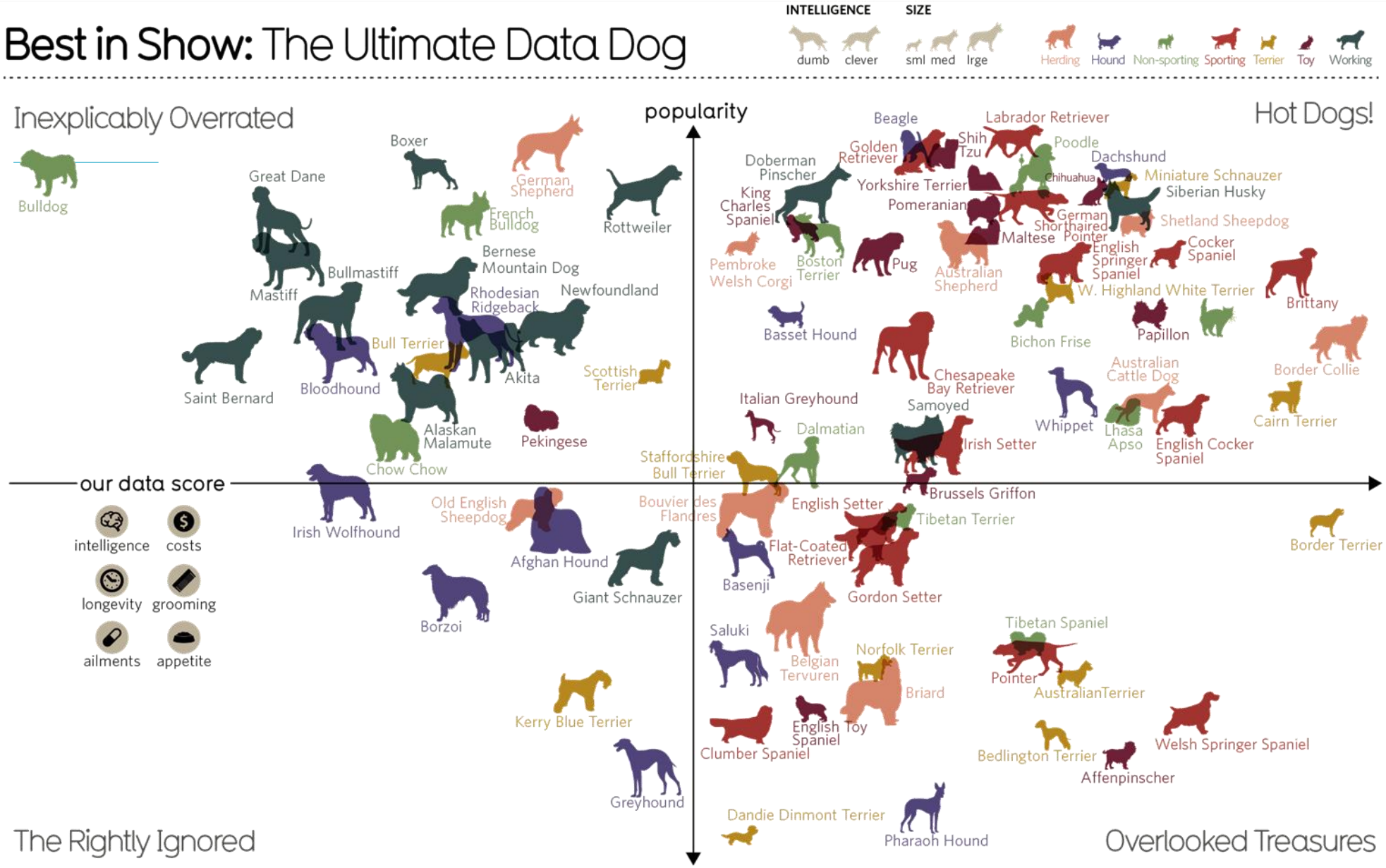

*HC Data Guide, p. 65, P. 136-146*

# Scatter Plots

- Effective display for trends, patterns, and relationship for two variables
- Useful to look at relationships between outcome and process measures
- Understand special cause signals on Shewhart Charts





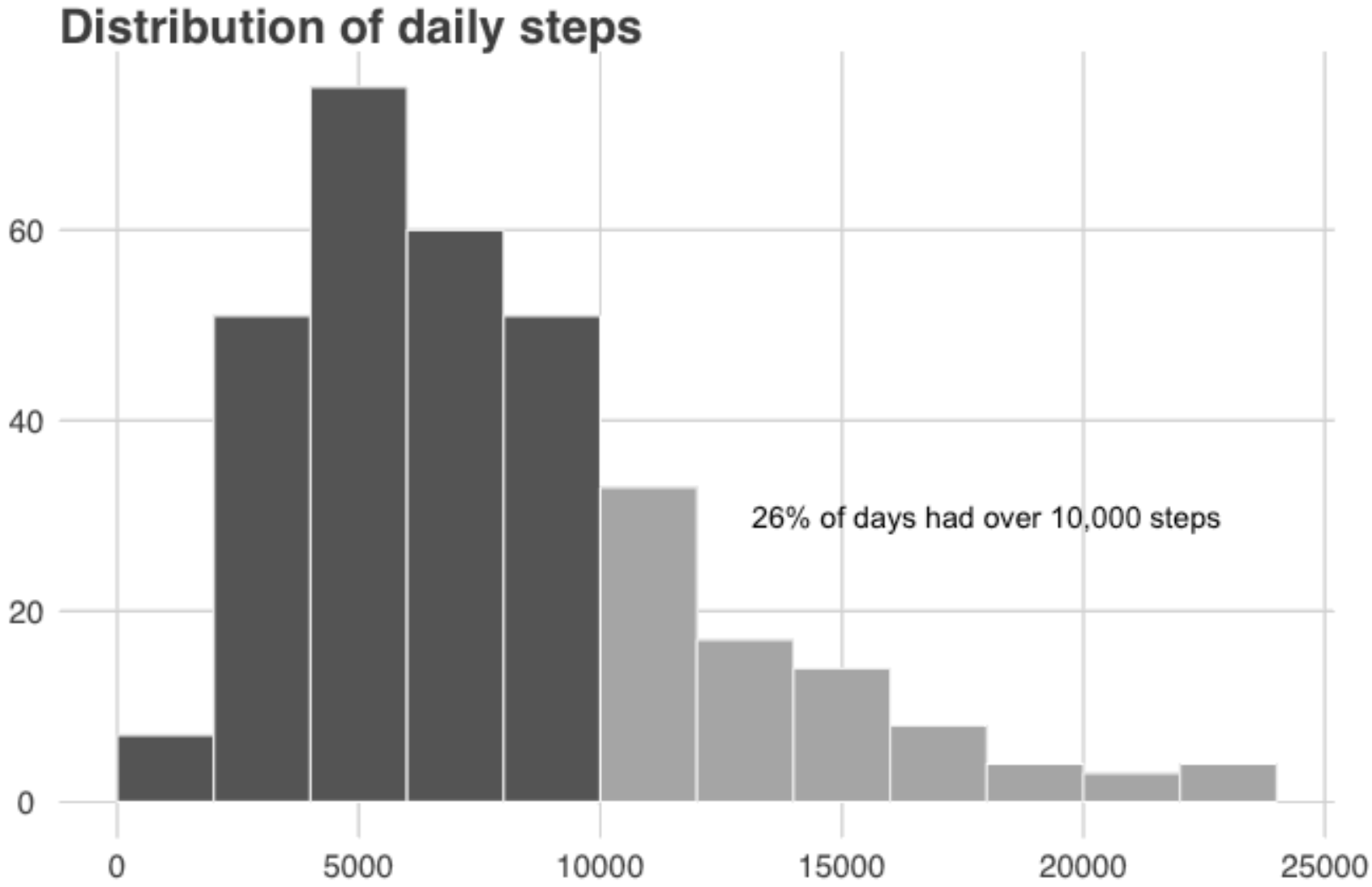

Scatter plots are also useful to define “super categories”.

The location or quadrant of different individuals or subgroups can lead to insights.

# Frequency Plot

Show all the data; good for exploratory analysis.

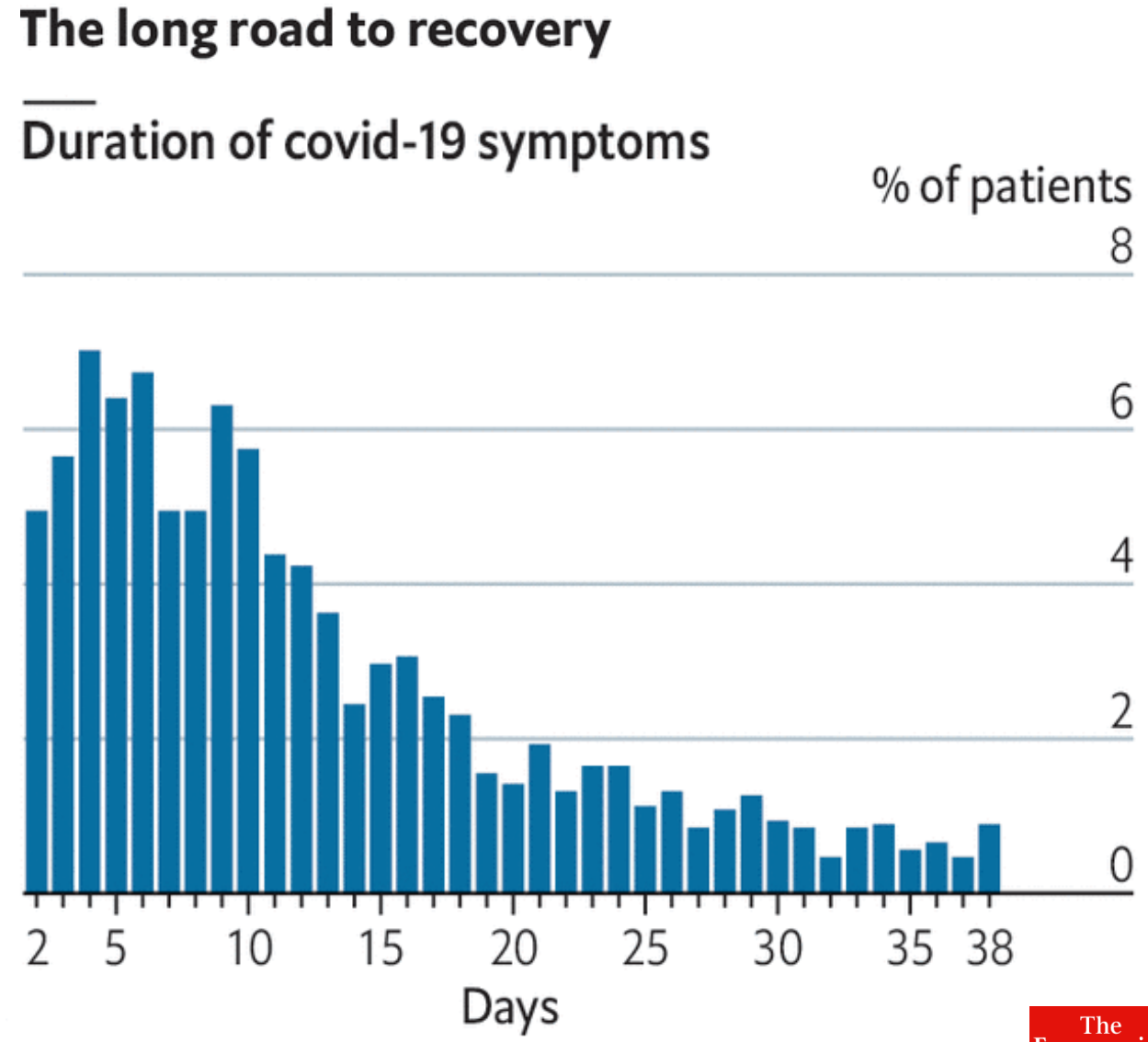
Visualize the location, the spread, modality, and symmetry for the distribution of a numerical measure.




2014: A year in review with iPhone pedometer data Geoffrey Litt

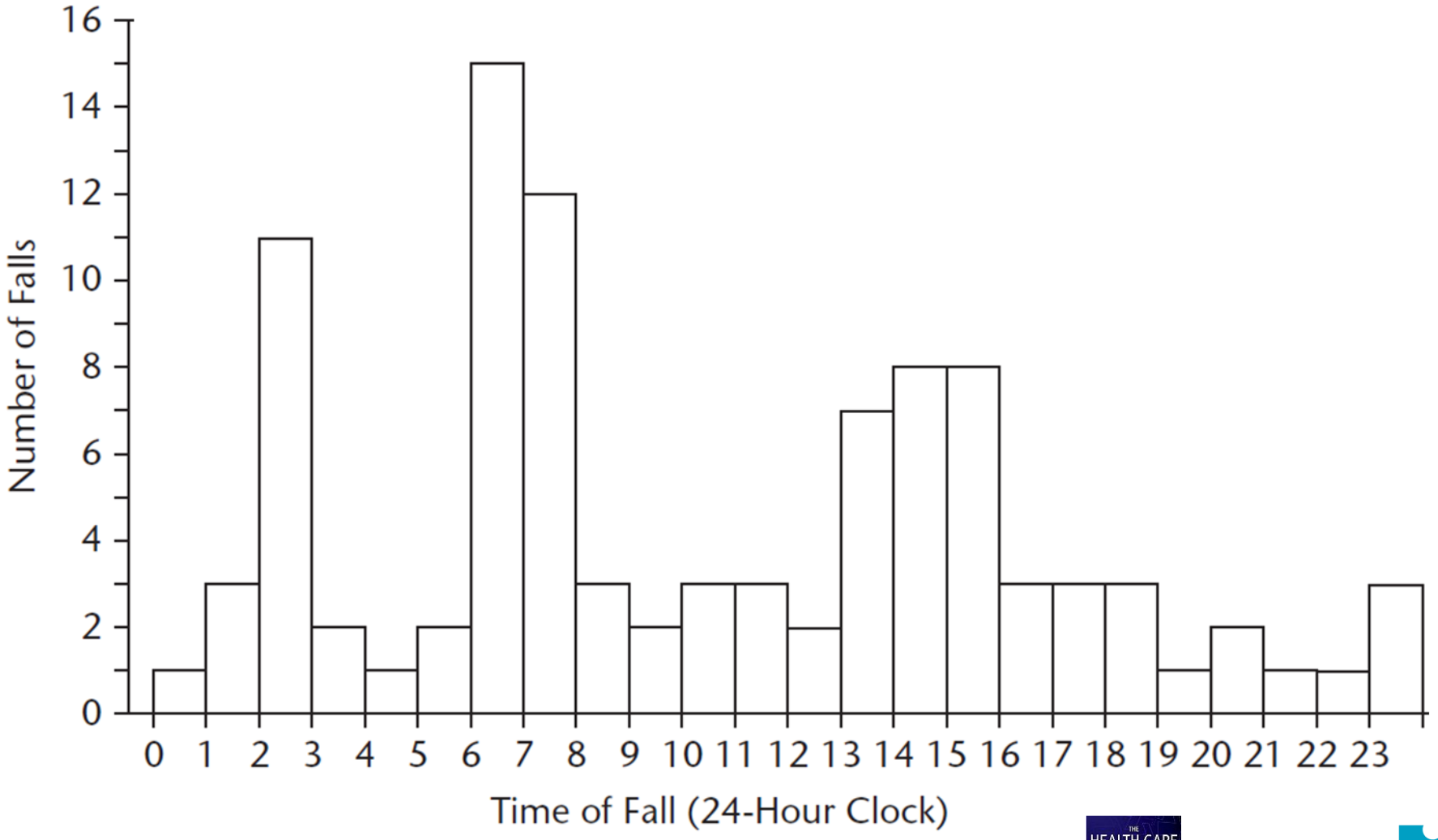
# Relative Frequency Plot

Displayed here are the *percentages* of observations that fall into each range rather than the counts.



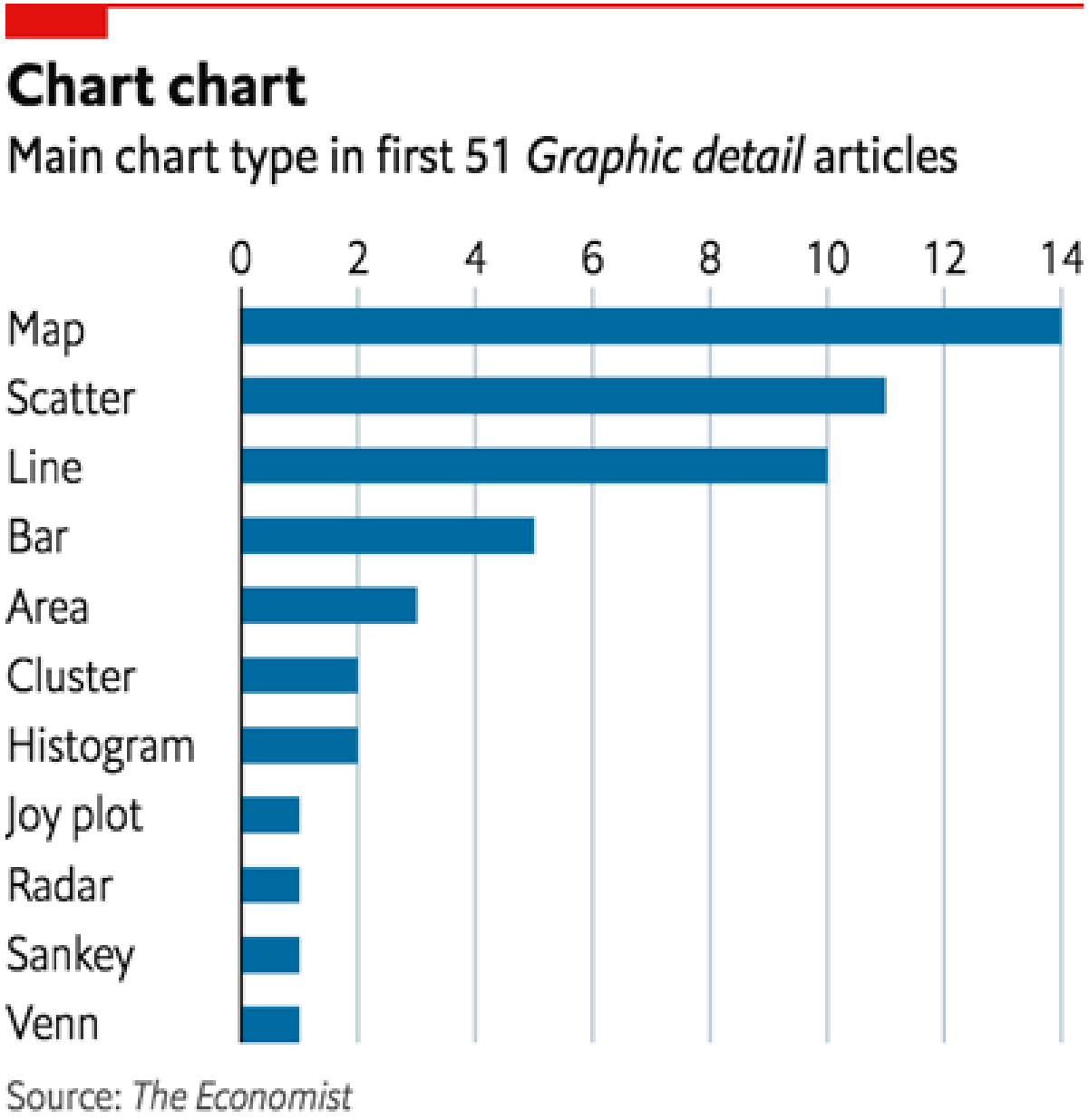
# Frequency Plot of patient falls by time of day $(n = 100)$

This display can provide ideas for testing changes that result in fewer patient falls.



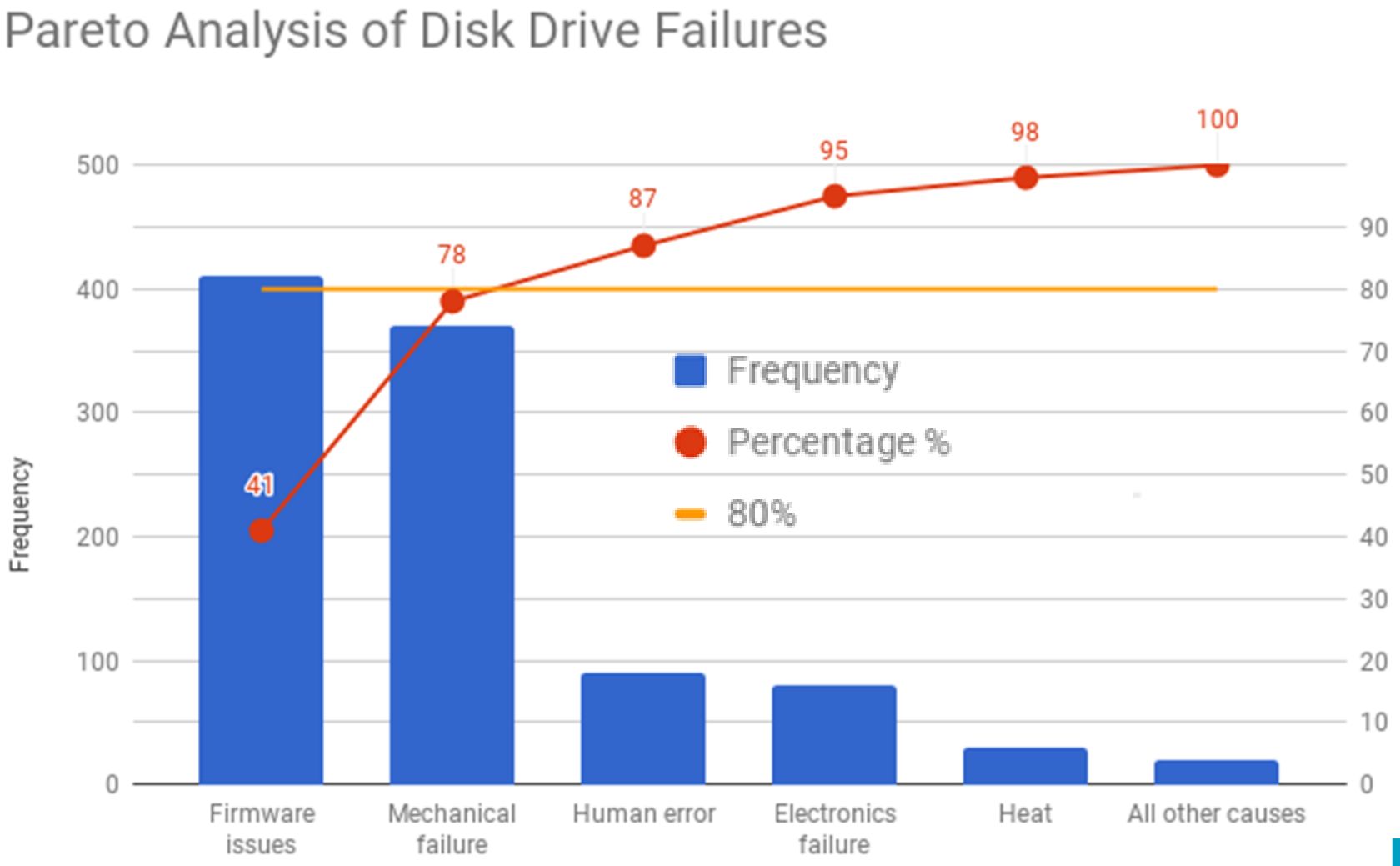
# Pareto Chart

The Pareto Chart is like a “frequency plot” for categorical data.

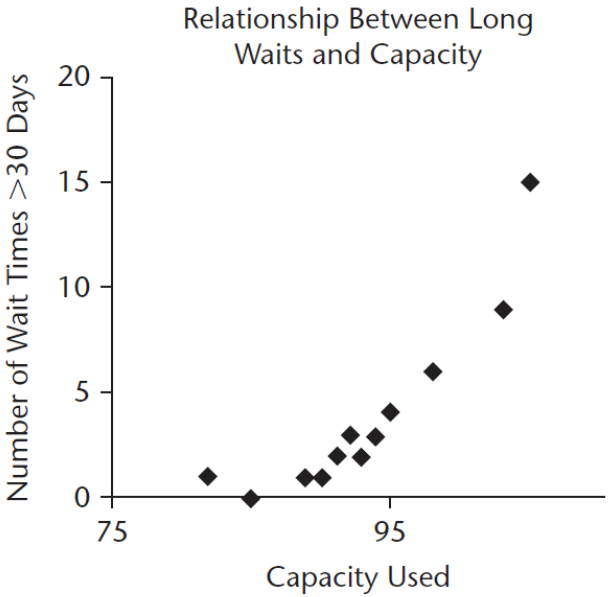


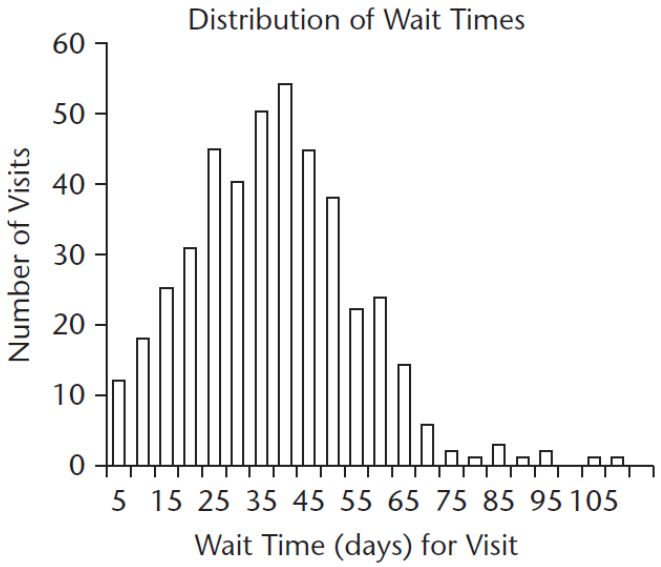
# These charts exemplify (and are named for) Vilfredo Pareto's 80/20 rule.

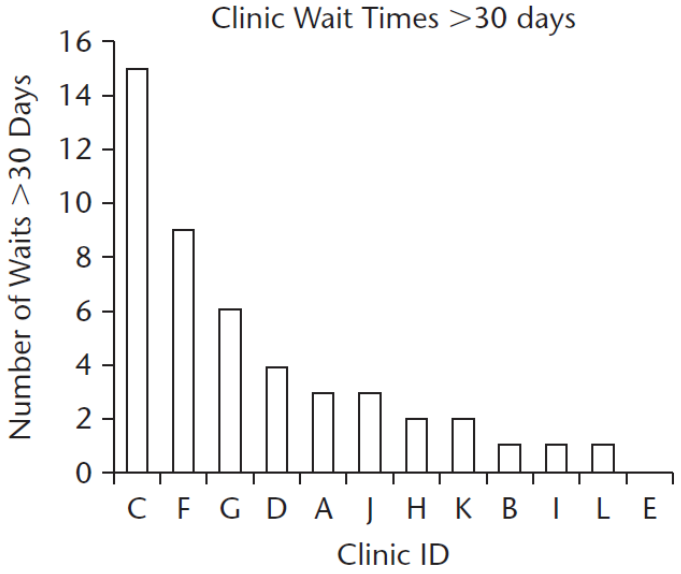
Problems, errors, defects, adverse drug events, patient complaints, and other data can often be organized into categories or classifications.

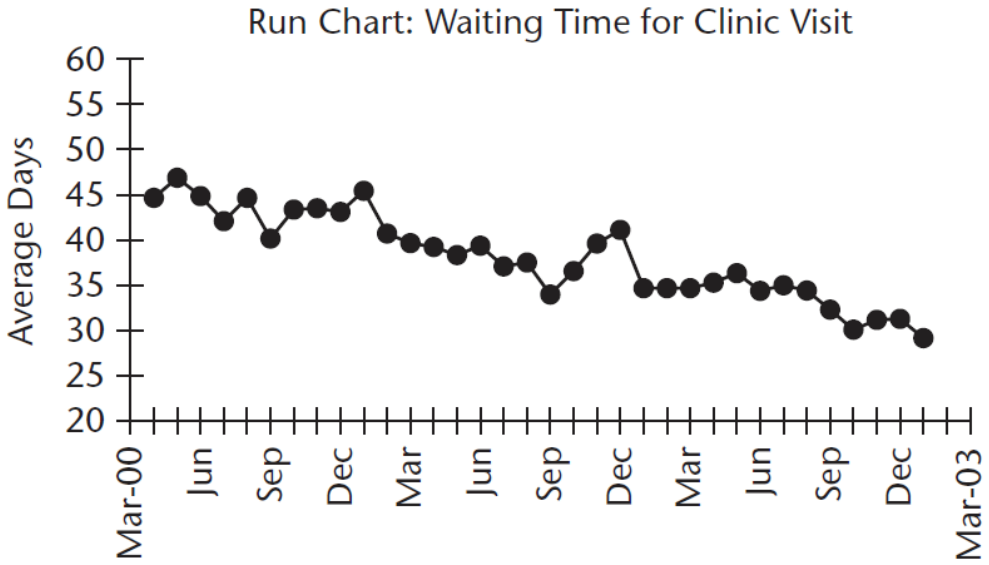


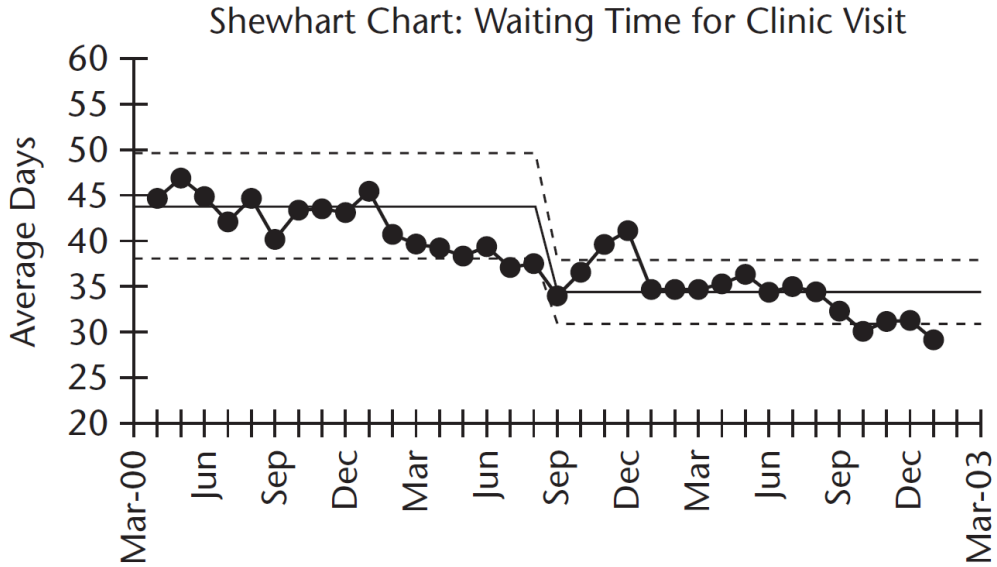
# Utilising Data as a Catalyst for Improvement: Tools to Learn from Variation in Data




*HC Data Guide, p. 65, P. 136-146*

# Thank you