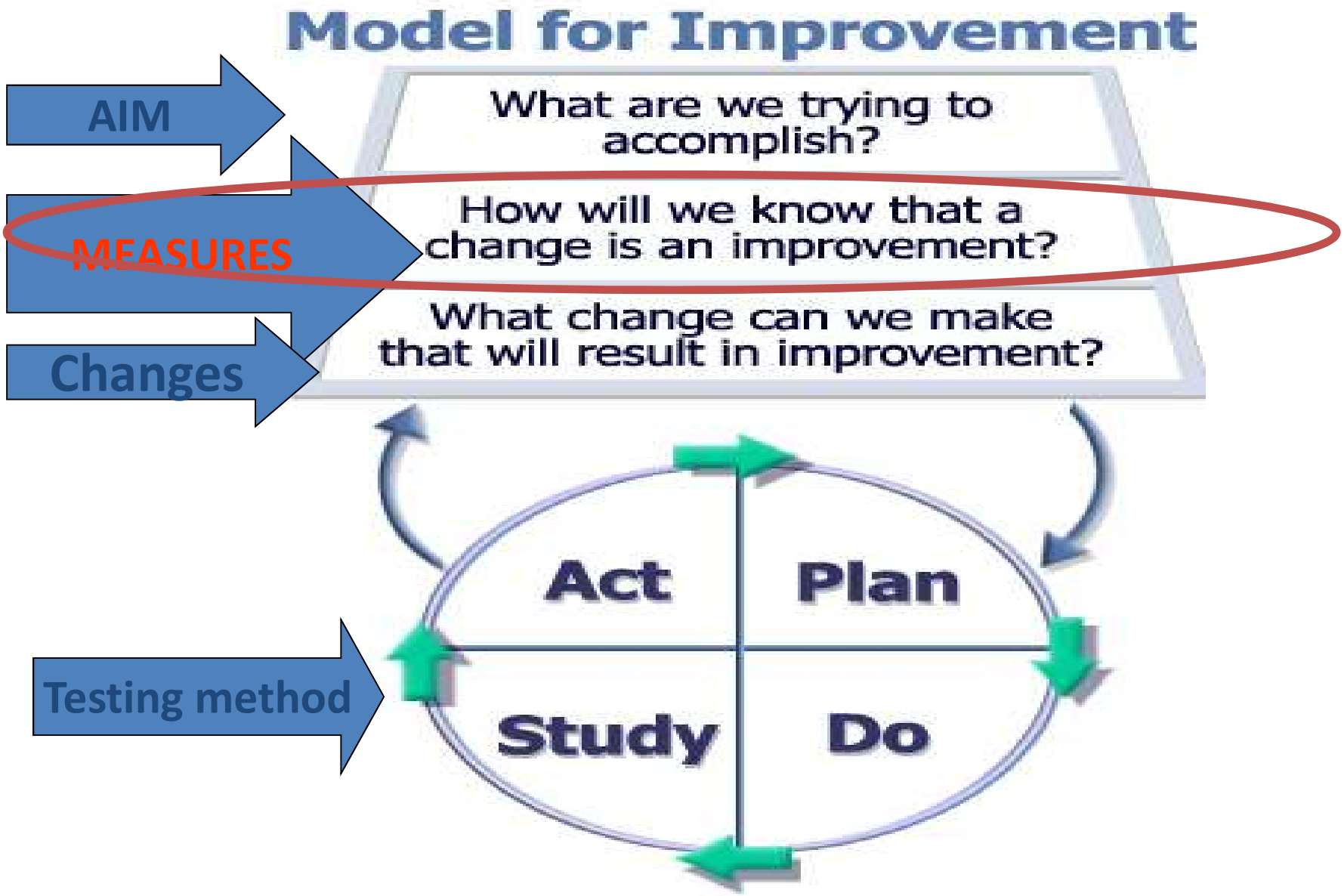
# Measurement Matters

Pat O’Connor

# Seek Usefulness
# Not Perfection

# Measuring Results

- Measurement MATTERS
- Generate light not heat!
- Measures for improvement
- Dash board of measures
- Run and control charts
- Info graphics


Model for Improvement
AIM
What are we trying to accomplish?
MEASURES
How will we know that a change is an improvement?
Changes
What change can we make that will result in improvement?
Testing method
Act
Plan
Study
Do

# The Three Faces of Performance Measurement

| Aspect | Improvement | Accountability | Research |
|---|---|---|---|
| **Aim** | Improvement of care (efficiency & effectiveness) | Comparison, choice, reassurance, motivation for change | New knowledge (efficacy) |
| **Methods:**<br>• 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 | "Just in case" data |
| • Flexibility of Hypothesis | Flexible hypotheses, changes as learning takes place | No hypothesis | Fixed hypothesis (null hypothesis) |
| • Testing Strategy | Sequential tests | No tests | One large test |
| • Determining if a change is an improvement | Run charts or Shewhart control charts (statistical process control) | No change focus (maybe compute a percent change or rank order the results) | Hypothesis, statistical tests (t-test, F-test, chi square), p-values |
| • Confidentiality of the data | Data used only by those involved with improvement | Data available for public consumption and review | Research subjects' identities protected |

# What might you measure?

- Patient Experience
- Staff experience
- Patient safety
- Clinical Outcomes
  - compliance
  - Effectiveness
  - Improvement

# Data

- Static (bar charts, pie, charts  red amber and green) they single moments in time
- Monitoring how the system is doing overtime run and control charts

# The weekly view of progress

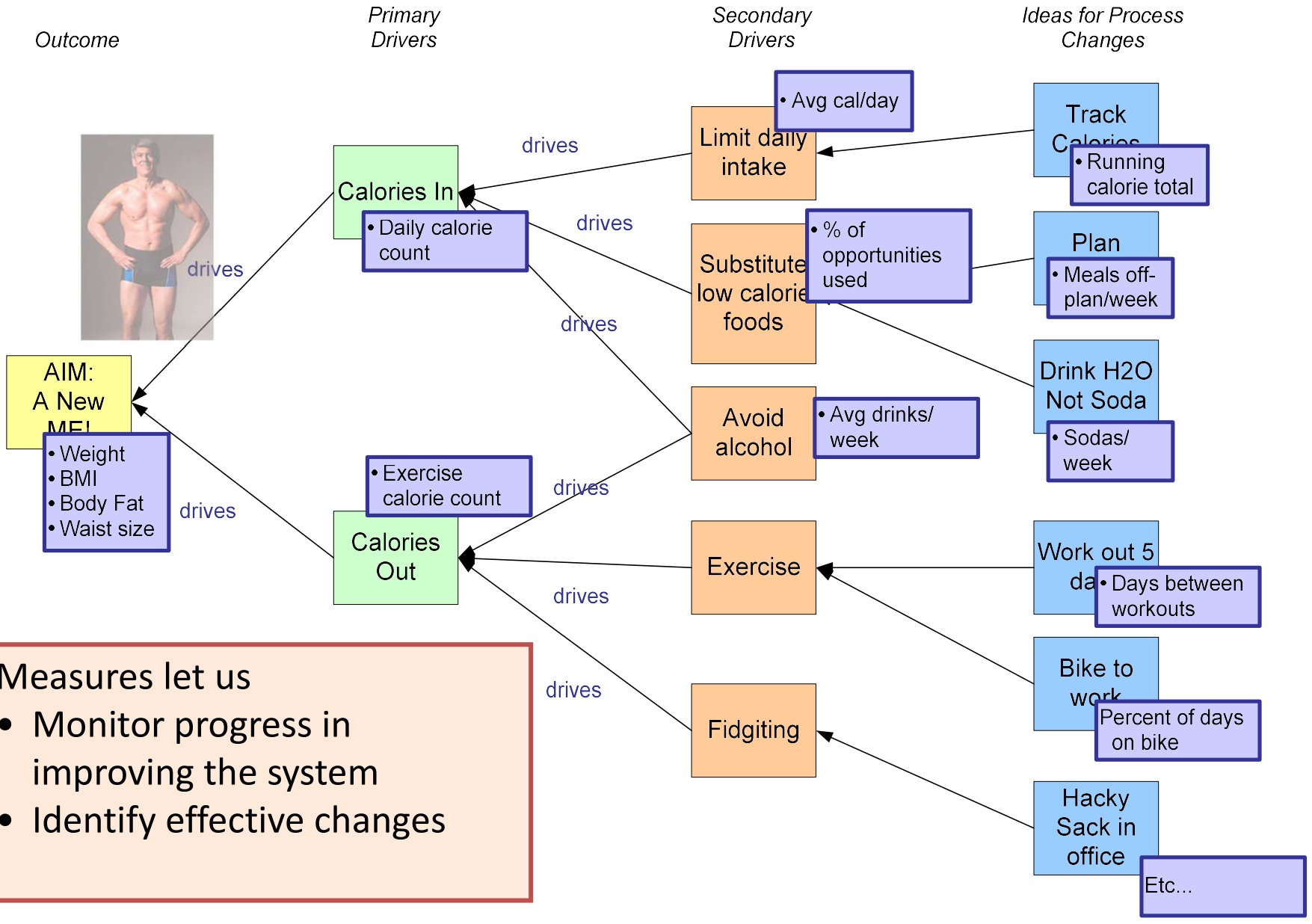
PROTECT - For Scottish Ambulance Service Use Only

Time Period: 01/04/2016 to 06/11/2016

| Access & Referral | Last Year | Measure | YTD | Monthly Performance: Apr | May | Jun | Jul | Aug | Sep | Oct | Nov | Dec | Jan | Feb | Mar | Quarterly Performance: Q1 | Q2 | Q3 | Q4 | Demand: YTD | Last YTD | % Change |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Unscheduled** | | | | | | | | | | | | | | | | | | | | | | |
| AR01: Cat A Performance | 62.3% | 75% | 61.3% | 64.9% | 63.4% | 62.6% | 59.4% | 61.7% | 57.6% | 60.7% | 57.4% | | | | | 63.6% | 59.5% | | | 26,731 | 25,555 | 4.6% |
| AR02: Cat A Cardiac Arrest Performance | 73.9% | 80% | 74.4% | 75.8% | 74.2% | 80.8% | 70.9% | 70.4% | 74.8% | 76.0% | 67.7% | | | | | 76.9% | 71.9% | | | 845 | 711 | 18.8% |
| AR16: ILTs Responded to Within 8 minutes | 75.5% | 75% | 77.4% | 77.3% | 76.7% | 83.3% | 73.3% | 75.7% | 80.0% | 79.4% | 64.0% | | | | | 79.1% | 76.1% | | | 680 | 628 | 8.3% |
| AR03: Cat B Performance | 78.3% | 95% | 76.2% | 80.0% | 75.0% | 77.8% | 74.1% | 75.5% | 74.1% | 77.1% | 74.3% | | | | | 77.5% | 74.6% | | | 58,533 | 54,505 | 7.4% |
| AR05: 1Hr Urgent In Performance | 79.9% | 91% | 70.3% | 77.4% | 69.2% | 67.5% | 63.1% | 71.8% | 64.3% | 76.4% | 73.8% | | | | | 71.5% | 66.7% | | | 5,154 | 4,616 | 11.7% |
| AR06: Conveying Resource on Scene within 19 mins | 87.1% | 95% | 87.1% | 88.4% | 87.5% | 88.2% | 86.2% | 87.1% | 86.3% | 86.0% | 89.0% | | | | | 88.0% | 86.5% | | | 26,071 | 24,856 | 4.9% |
| AR07: 999 Call Pick Up within 10 seconds | This Indicator is Reported at Scotland Level | | | | | | | | | | | | | | | | | | | | | |
| AR17: ALL Urgent In Performance | 75.9% | 91% | 73.2% | 82.2% | 72.7% | 73.5% | 65.0% | 74.8% | 64.1% | 77.1% | 75.8% | | | | | 76.3% | 68.3% | | | 13,035 | 13,366 | -2.5% |
| **Scheduled** | | | | | | | | | | | | | | | | | | | | | | |
| AR08: PTS Punctuality for Appointment | 71.7% | 75% | 74.0% | 76.8% | 74.3% | 73.4% | 75.5% | 73.1% | 72.9% | 72.7% | 69.9% | | | | | 74.8% | 73.8% | | | 48,050 | 61,202 | -21.5% |
| AR09: PTS Punctuality for Pickup after Appointment | 87.7% | 80% | 89.1% | 91.0% | 89.7% | 87.6% | 89.3% | 89.0% | 88.6% | 88.6% | 89.4% | | | | | 89.4% | 89.0% | | | 51,924 | 63,190 | -17.8% |
| AR14: PTS SAS Cancelled No Resource | 2.9% | <= 0.5% | 1.8% | 1.2% | 1.8% | 2.2% | 1.4% | 2.1% | 3.2% | 1.4% | 0.2% | | | | | 1.7% | 2.3% | | | 171,815 | 192,874 | -10.9% |
| AR15: PTS SAS Cancelled At Booking | 2.0% | <= 0.2% | 1.5% | 1.8% | 1.6% | 1.2% | 1.4% | 1.5% | 1.3% | 1.4% | 2.0% | | | | | 1.5% | 1.4% | | | 171,815 | 192,874 | -10.9% |
| AR13: PTS Call Pick Up within 60 seconds | This Indicator is Reported at Scotland Level | | | | | | | | | | | | | | | | | | | | | |
| **Air Ambulance** | | | | | | | | | | | | | | | | | | | | | | |
| AR11: Time from Take Off to Land on Scene < 60 mins | This Indicator is Reported at Scotland Level | | | | | | | | | | | | | | | | | | | | | |
| AR12: Non-Emerg Transfers within Agreed Timescales | This Indicator is Reported at Scotland Level | | | | | | | | | | | | | | | | | | | | | |
| **Clinical Excellence** | **Last Year** | **Measure** | **YTD** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Q1** | **Q2** | **Q3** | **Q4** | **YTD** | **Last YTD** | **% Change** |
| CE01a: ROSC | 18.4% | 12% | 17.2% | 8.0% | 10.4% | 14.7% | 23.4% | 20.2% | 18.0% | 24.4% | | | | | | 10.9% | 20.7% | | | 518 | 467 | 10.9% |
| CE01b: VF/VT ROSC | 34.8% | 30% | 42.6% | 23.1% | 15.0% | 31.6% | 66.7% | 64.7% | 41.7% | 60.0% | | | | | | 23.1% | 57.9% | | | 115 | 126 | -8.7% |
| CE02: Hyper Acute Stroke to Hospital < 60 mins | 81.9% | 80% | 77.9% | 80.0% | 78.4% | 76.2% | 65.8% | 78.8% | 83.9% | 83.8% | 80.0% | | | | | 78.0% | 76.0% | | | 267 | 410 | -34.9% |
| CE03: SEWS Scores >= 4 Taken to Hospital | 97.3% | 95% | 97.3% | 99.9% | 100% | 99.9% | 97.0% | 95.6% | 95.4% | 95.6% | 95.1% | | | | | 99.9% | 96.0% | | | 14,591 | 1,737 | 740.0% |
| CE04: Appropriate Incidents with Paramedic on Scene | 92.2% | 99% | 92.5% | 91.5% | 94.2% | 92.9% | 93.4% | 93.0% | 91.1% | 91.8% | 91.5% | | | | | 92.9% | 92.5% | | | 14,278 | 13,886 | 2.8% |
| CE05: Treatment of Asthma | 82.1% | 75% | 68.5% | 72.2% | 66.3% | 70.9% | 62.7% | 67.1% | 67.6% | 72.5% | 72.7% | | | | | 69.5% | 65.6% | | | 528 | 500 | 5.6% |
| CE06: Glycaemic Emergencies Given Glucose etc. | 75.2% | 75% | 75.4% | 72.1% | 81.8% | 100% | | | | | | | | | | 75.4% | | | | 57 | 651 | -91.2% |
| CE07: Treatment of STEMI Patients | 88.5% | 75% | 53.8% | 57.1% | 50.0% | | | | | | | | | | | | | | | 13 | 254 | -94.9% |
| CE08: Percentage of PVC bundle use | 77.2% | 75% | 80.3% | 78.9% | 81.5% | 80.0% | 78.1% | 80.5% | 80.2% | 82.2% | 83.3% | | | | | 80.2% | 79.6% | | | 5,097 | 6,146 | -17.1% |
| CE09: Cardiac Arrests with 3 or more crew on scene | 65.9% | 70% | 65.8% | 66.5% | 61.9% | 65.7% | 57.7% | 74.5% | 65.0% | 68.9% | 63.0% | | | | | 64.7% | 66.3% | | | 1,298 | 1,106 | 17.4% |
| **Engaging with Partners** | **Last Year** | **Measure** | **YTD** | **Apr** | **May** | **Jun** | **Jul** | **Aug** | **Sep** | **Oct** | **Nov** | **Dec** | **Jan** | **Feb** | **Mar** | **Q1** | **Q2** | **Q3** | **Q4** | **YTD** | **Last YTD** | **% Change** |
| EP01: Category C Calls transferred to NHS24 | 47.5% | 25% | 52.9% | 48.6% | 52.6% | 52.7% | 54.9% | 51.5% | 53.2% | 56.0% | 55.2% | | | | | 51.3% | 53.2% | | | 7,602 | 8,785 | -13.5% |
| EP02: Conveyance to Hospital | 78.6% | <= 72% | 77.4% | 77.3% | 76.6% | 77.3% | 77.6% | 77.6% | 77.9% | 77.7% | 77.7% | | | | | 77.0% | 77.7% | | | 86,865 | 83,496 | 4.0% |
| EP03a: PTS Aborts | 8.5% | <= 6% | 8.4% | 8.4% | 8.5% | 8.2% | 8.8% | 8.7% | 9.5% | 9.1% | 3.9% | | | | | 8.4% | 9.0% | | | 123,012 | 155,290 | -20.8% |
| EP03b: PTS Cancels | 10.6% | <= 8% | 9.7% | 8.8% | 10.0% | 10.4% | 9.8% | 10.2% | 11.7% | 9.4% | 4.6% | | | | | 9.7% | 10.6% | | | 175,834 | 197,273 | -10.9% |
| EP04: NHS24 Referrals with CHI Recorded | 84.2% | 95% | 94.9% | 93.2% | 94.0% | 94.3% | 95.2% | 96.3% | 95.3% | 96.0% | 96.8% | | | | | 93.8% | 95.6% | | | 12,333 | 12,815 | -3.8% |
| EP06: Emergency Incidents Treated at Scene | | | | | | | | | | | | | | | | | | | | | | |

# How Will We Know We Are Improving?

## Understanding the System for Weight Loss with Measures

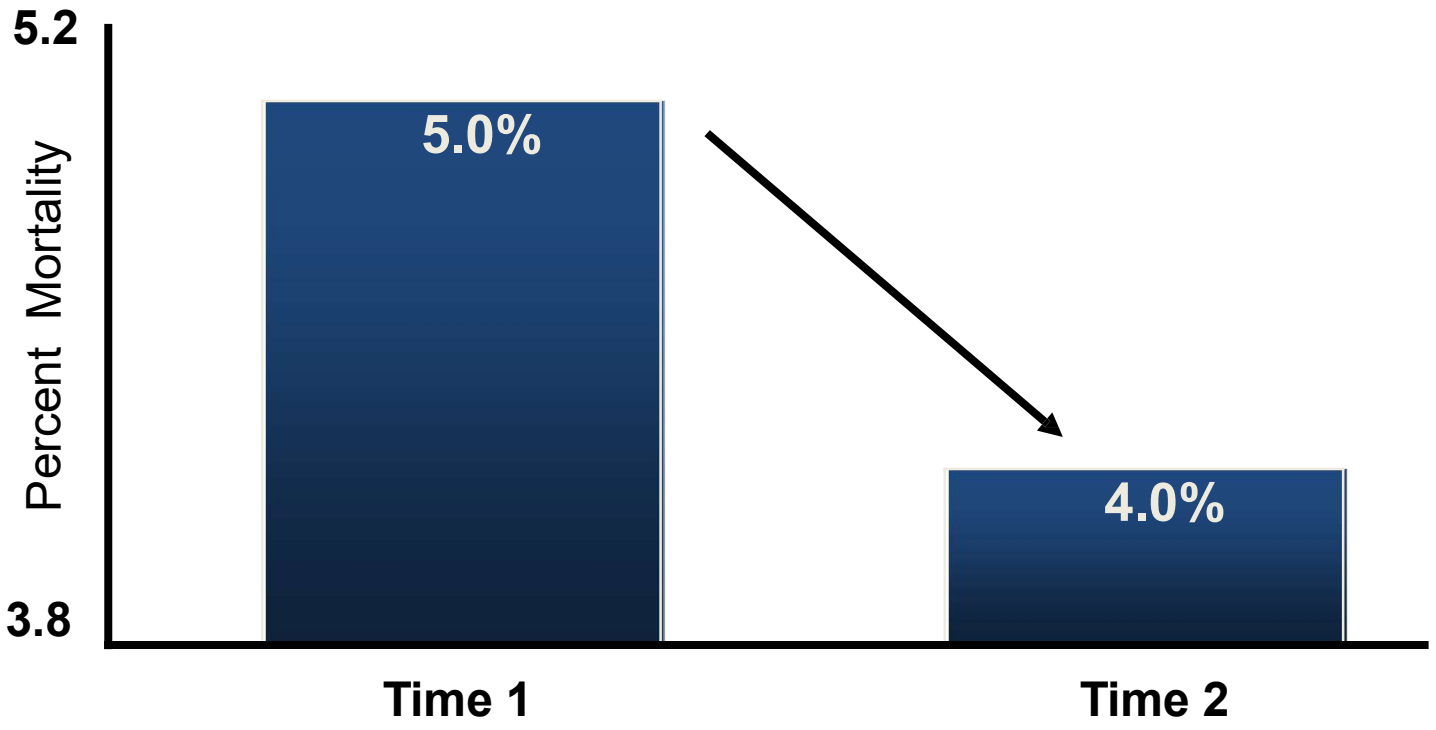



Measures let us

- Monitor progress in improving the system
- Identify effective changes

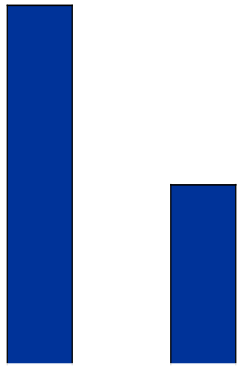
# Standard measurement

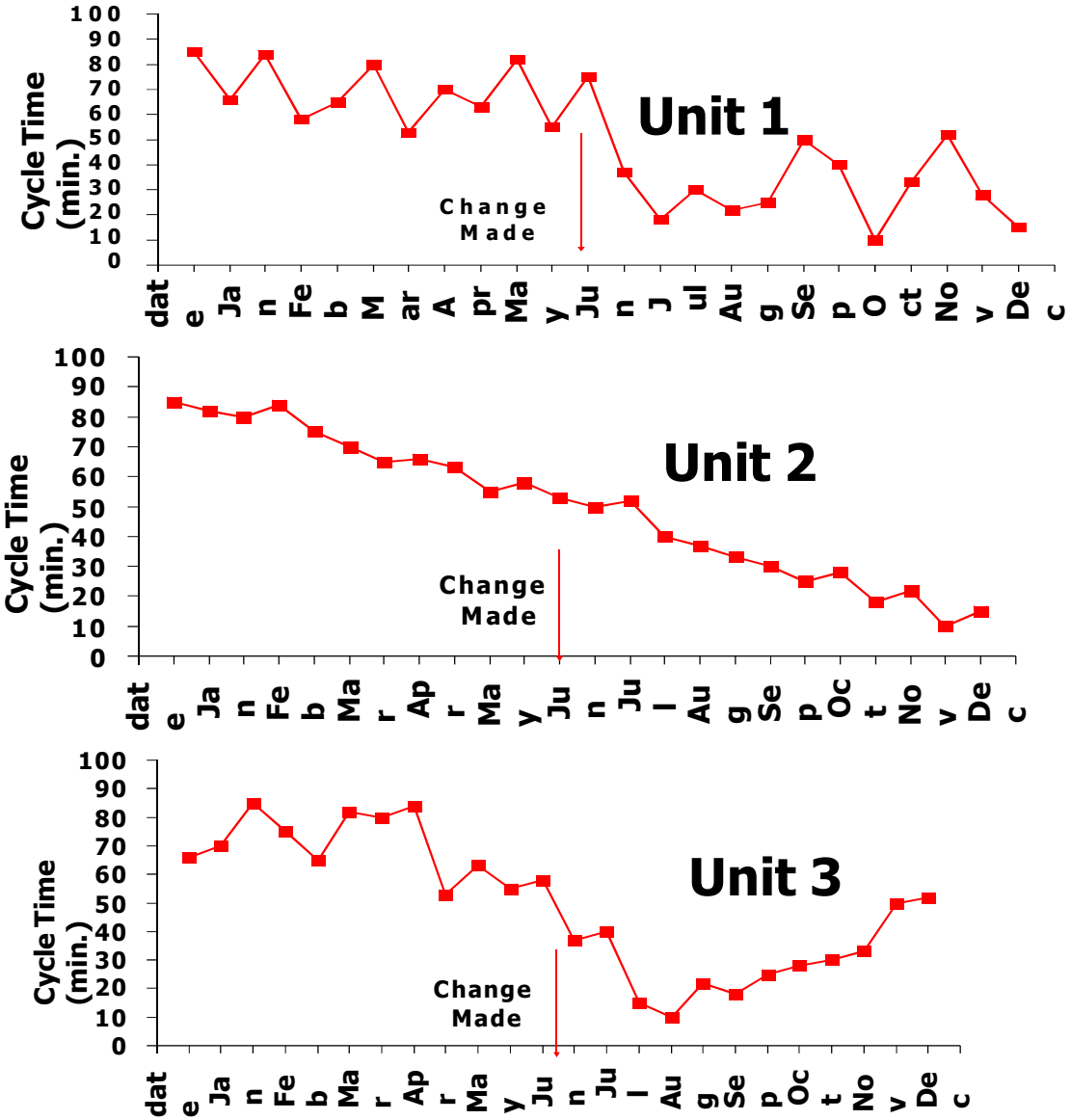
## Before and After the Implementation of a New Protocol



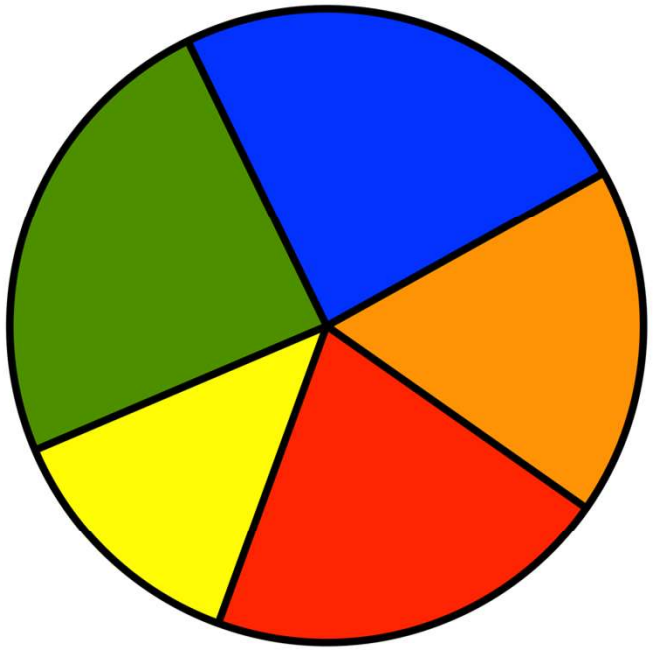
# Who is improving?

**Cycle time results for units 1, 2 and 3**

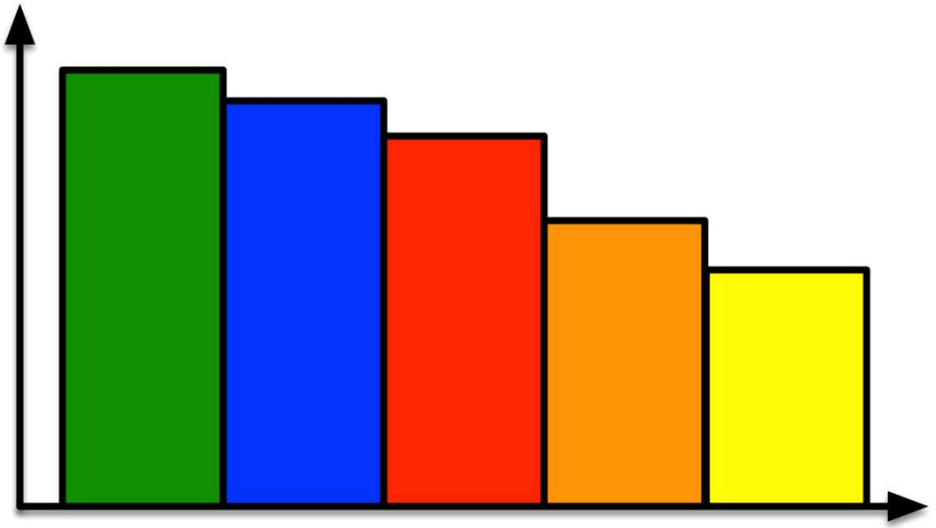




# Pie Charts



**Pie Chart**



**Pareto Chart**

# The only useful Pie Chart

# Reactions to Measurement!

- The data are wrong!
- The data are right, but it is not a real problem!
- The data are right, it's a real problem but it's not my problem!
- The data are right, it's a real problem AND it's my problem!
- The data are right, it's a real problem AND it's my problem BUT… I'm not sure what to do about it!

**Adapted from Jarman & Berwick, 2005**

## What Non-Executives Directors need to ask about measurement:

- What is the data for?
- Is it up to date?
- What does it say?
- Do I know how to look at this presentation of data?
- Do I understand it?
- Do I need to have a short session with someone who can interpret this?
- Do I know how this presentation differs from other data presented in Board papers?

# Fundamental Questions for Measurement

1. How can we monitor the real-time behaviour of the system of care, steer it to avoid crashes, and maintain it's operational reliability?
2. Over time, where are the gaps in performance that indicate a need for system change (i.e. improvement)?
3. In our efforts to improve, what's working? What changes are improvements? Are we on track to meet our aims?

# Two charts you can start with

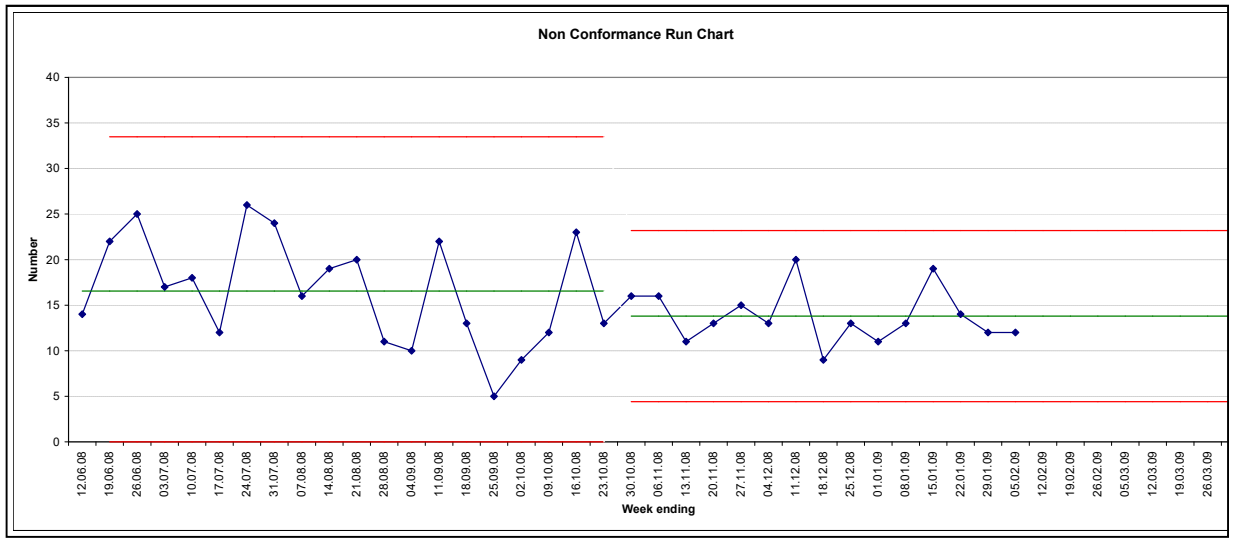
How are we doing?

Run chart

Where are our problems ?

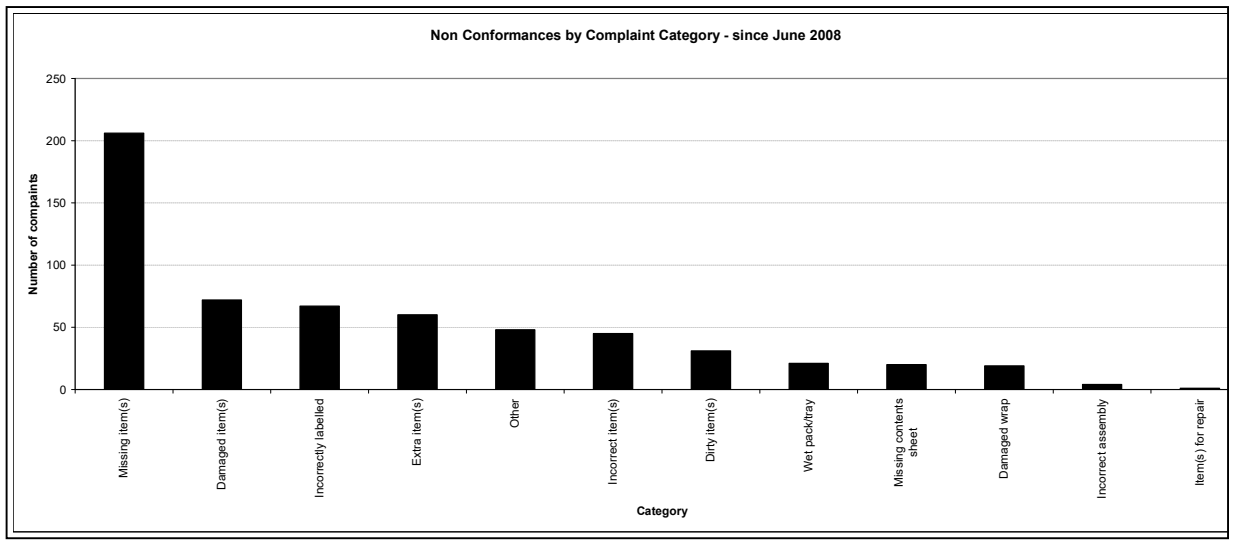
Pareto

# We will use these two charts 99% of the time




**Run chart to answer the Question:**

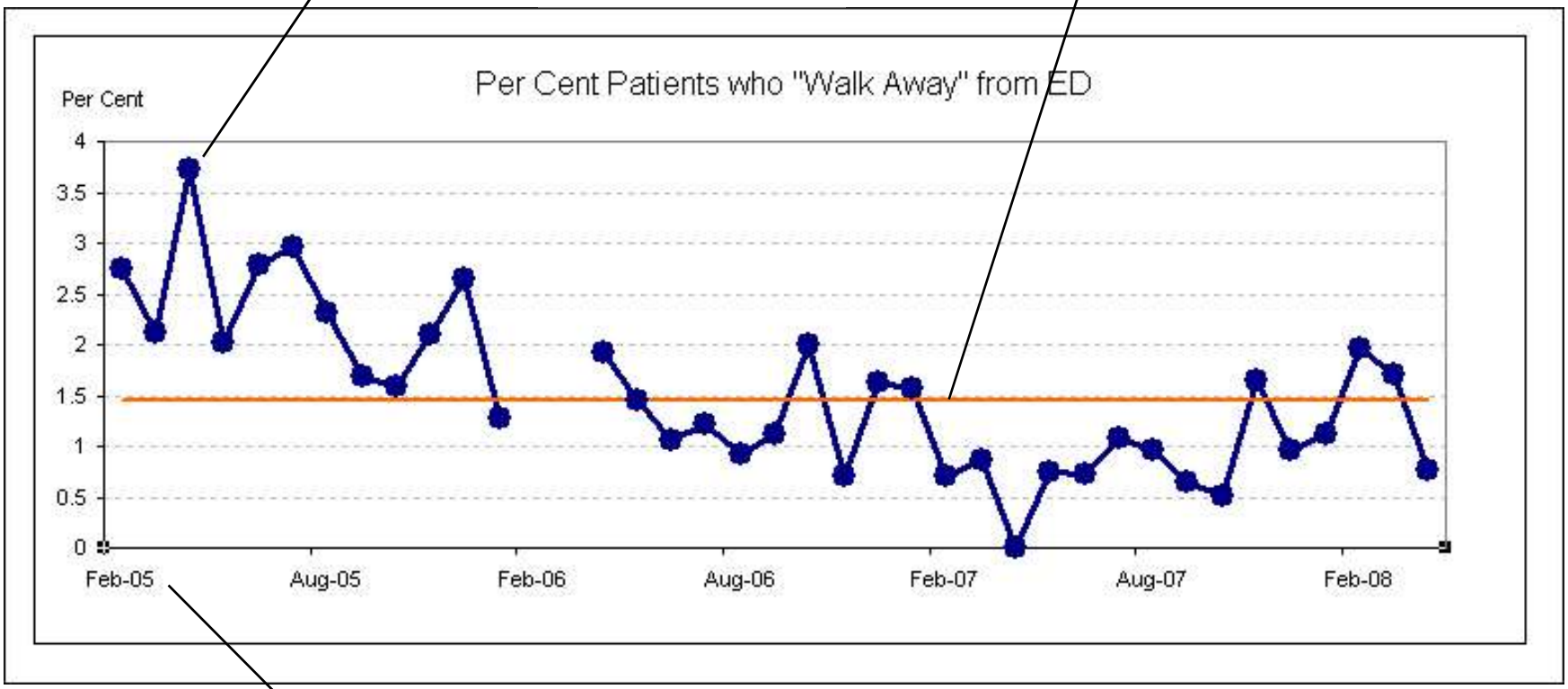
**How are we doing?**



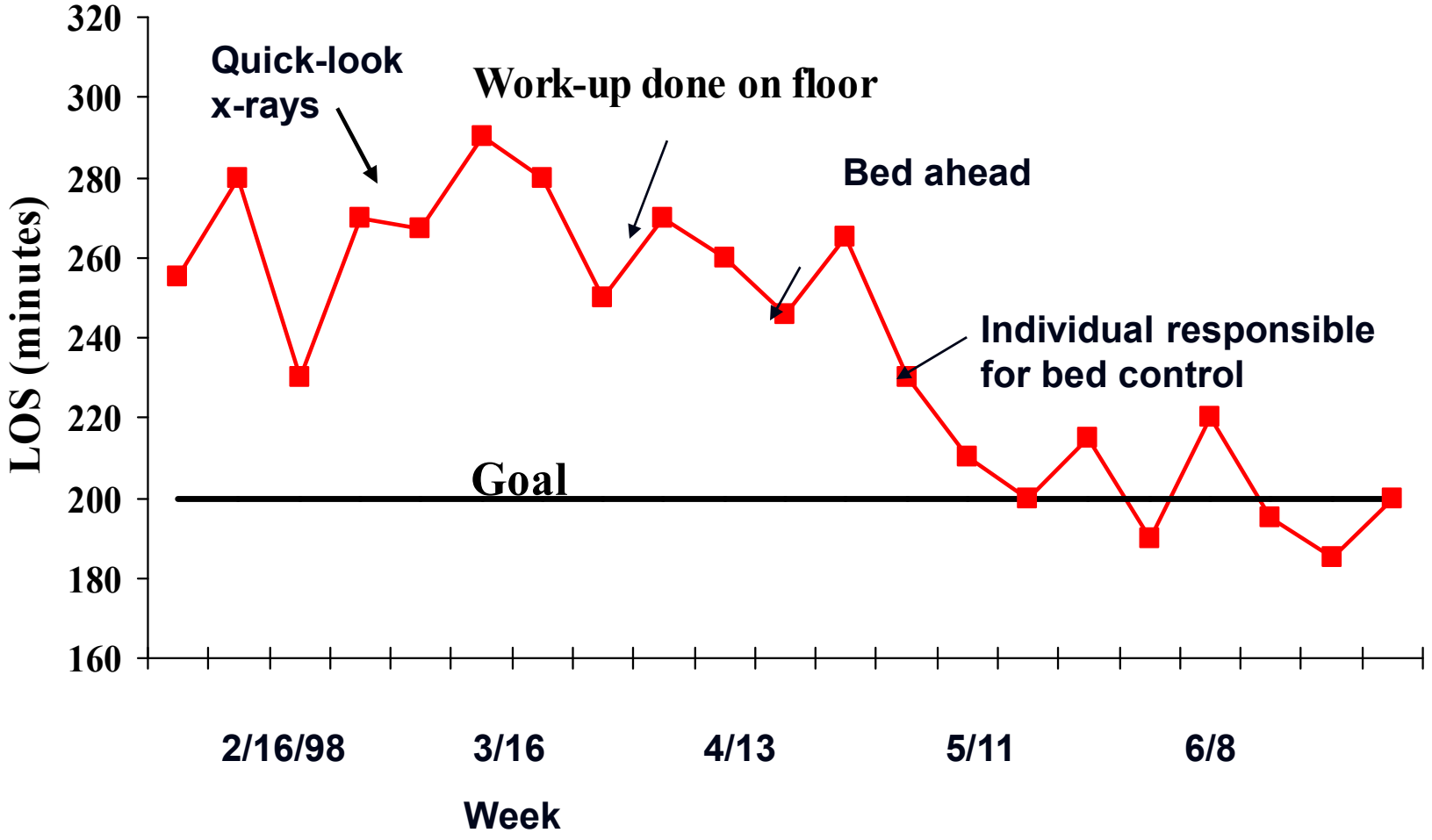

**Pareto chart or ranked Bar chart to answer the question:**

**Where is the problem?**

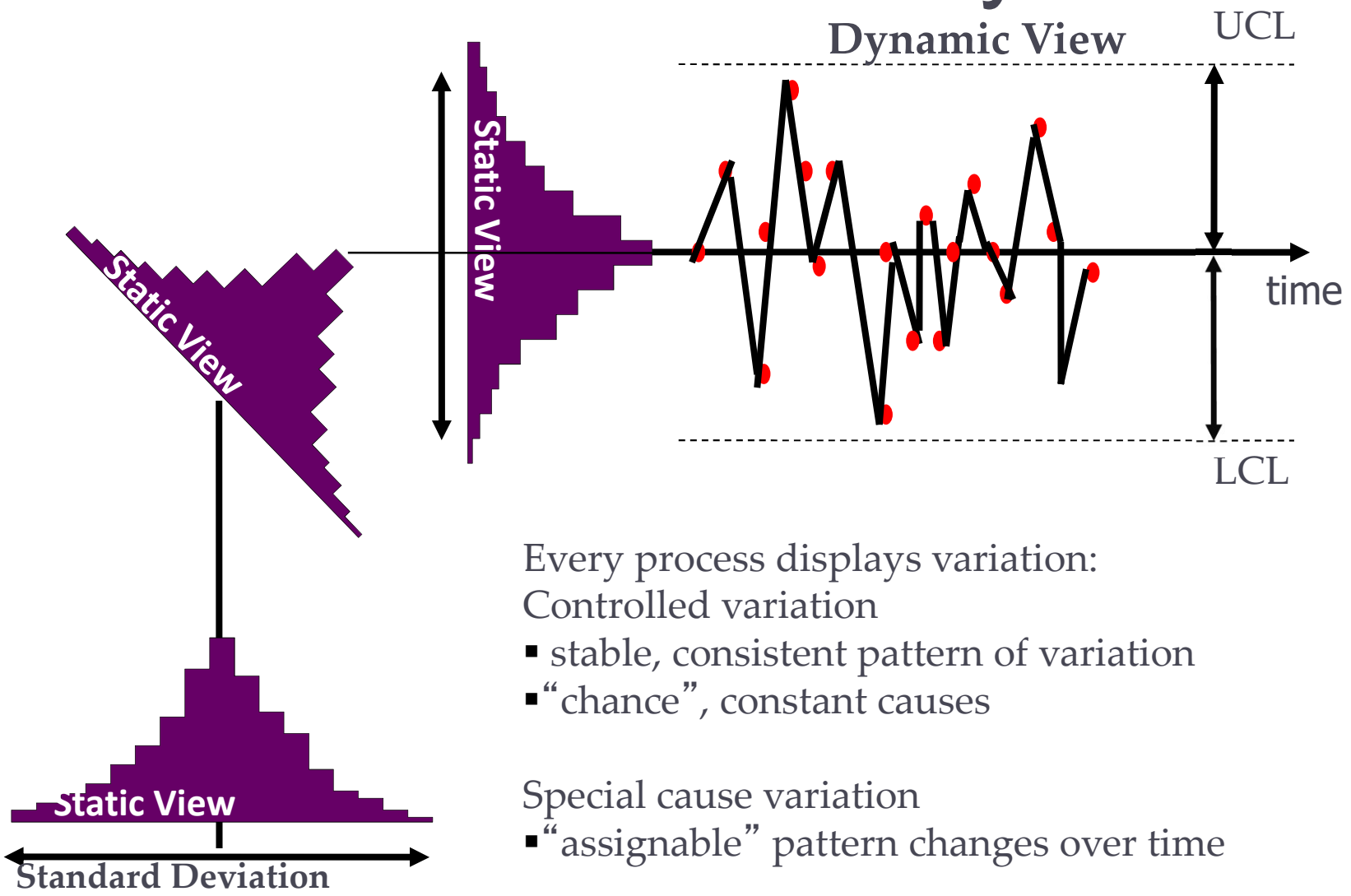
# Run Chart Anatomy



# Minimum Standard for Reporting Data in a QI Project: Annotated Time Series



# Measure Differently




Every process displays variation:
Controlled variation
- stable, consistent pattern of variation
- "chance", constant causes

Special cause variation
- "assignable" pattern changes over time

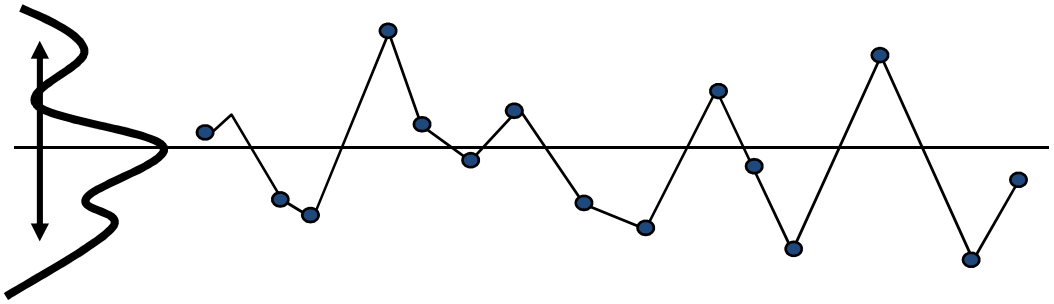
Reference R Lloyd, Institute for Healthcare Improvement

# Our improvement plans

- Which processes do we want to improve?
- Does the process show common or special cause variation?
- How are we going to improve by what methods?
- What effect have our changes had on the performance?

Run and Control charts will help us to answer questions 2 and 4, we need to figure out the answers to questions 1 and 3

# Predicting the Future




- *Centre*: What's my best guess for the future?
- *Spread*: How far off am I likely to be?
- *Shape*: What are other likely values? Is this a single, coherent process?
- *Sequence*: Are things getting better? Worse? Is the process predictable?

Source: Bob Lloyd ihi.org

# Three Types of Measures

- Outcome Measures: **Voice of the customer or patient. How is the system performing? What is the result?**

- Process Measures: **Voice of the workings of the system. Are the parts/steps in the system performing as planned?**

- Balancing Measures: **Looking at a system from different directions/dimensions. What happened to the system as we improved the outcome and process measures? (e.g. unanticipated consequences, other factors influencing outcome)**

Source: Bob Lloyd ihi.org

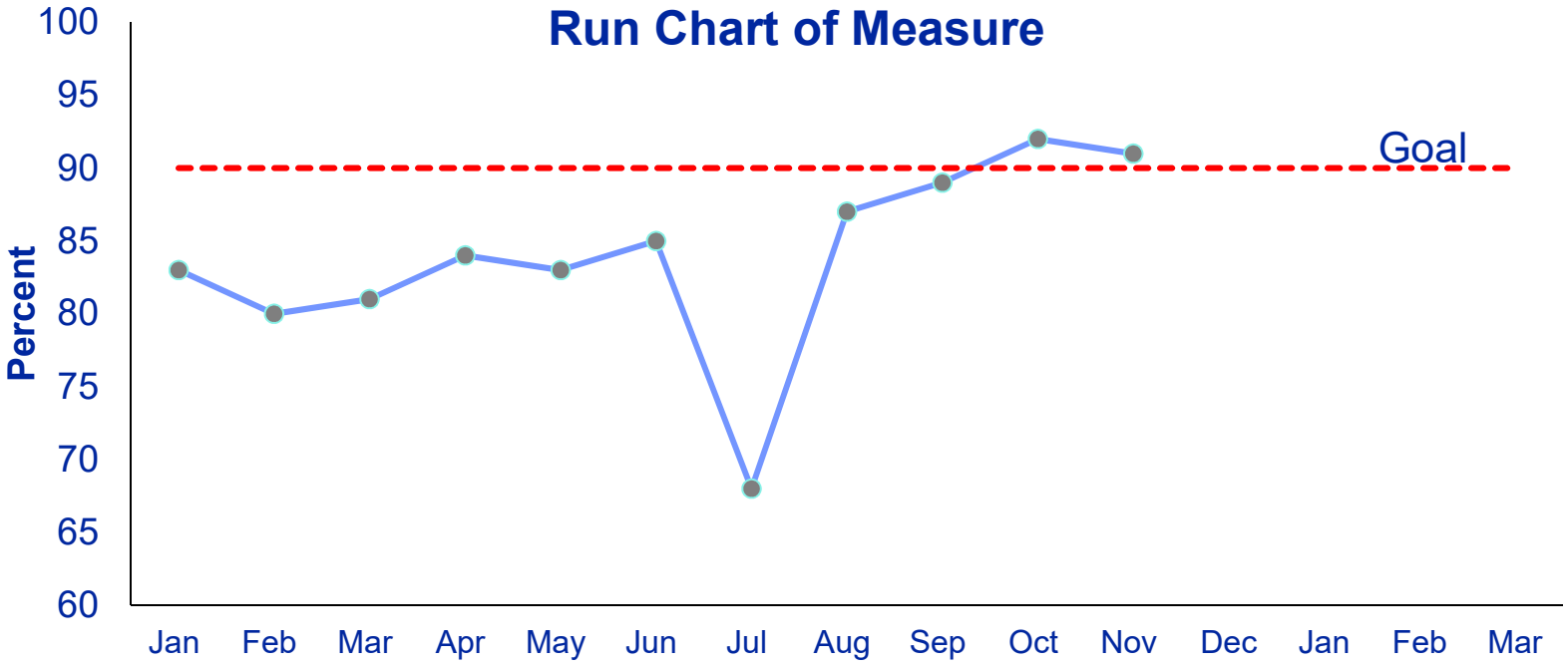
# Balancing Measures: Looking at the System from Different Dimensions

- Outcome (quality, time)
- Transaction (volume, no. of patients)
- Productivity (cycle time, efficiency, utilisation, flow, capacity, demand)
- Financial (charges, staff hours, materials)
- Appropriateness (validity, usefulness)
- Patient satisfaction (surveys, customer complaints)
- Staff satisfaction

Source: Bob Lloyd ihi.org

# *Why charts and graphs? Why not just a table?*

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




## Monthly Measure – Goal = 90%

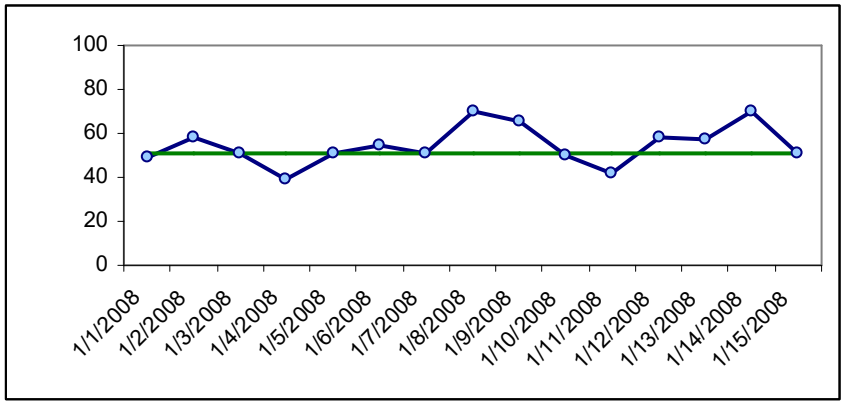
*HC Data Guide*, p 68

# Why Time Is Important for Measurement

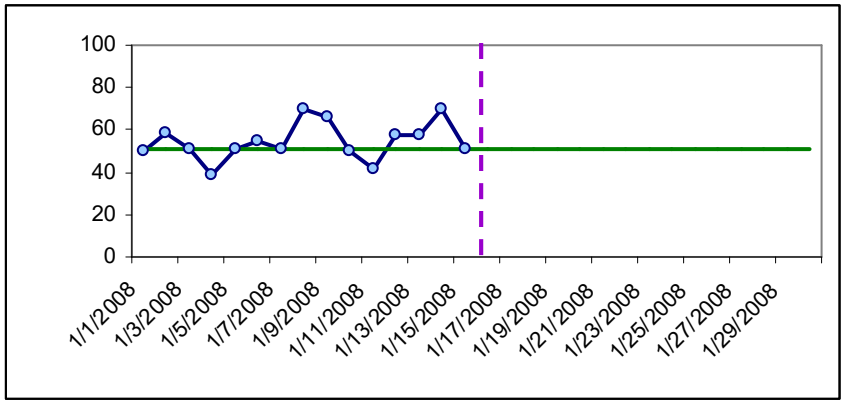
- Aggregate measures alone do not lead to predictions about future performance or insights to explain past variations
- Displaying data over time (using run charts or control charts) allows us to make informed predictions, and thus make changes to create different results

# Testing a Change with Run or Control Charts

1. Plot the baseline

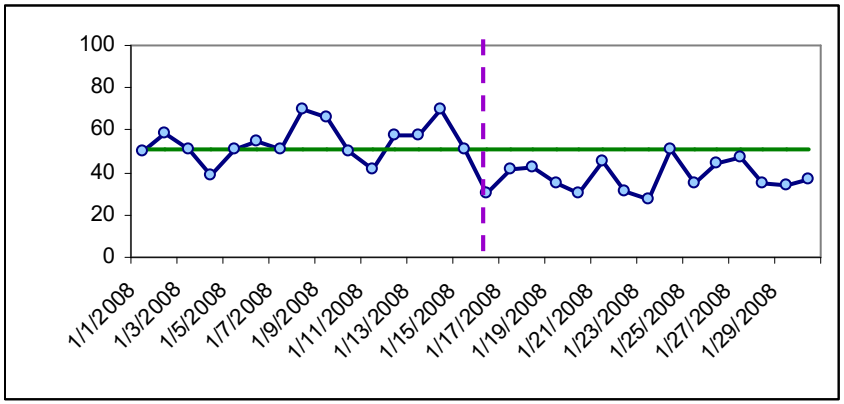



2. Extend the median & begin the test



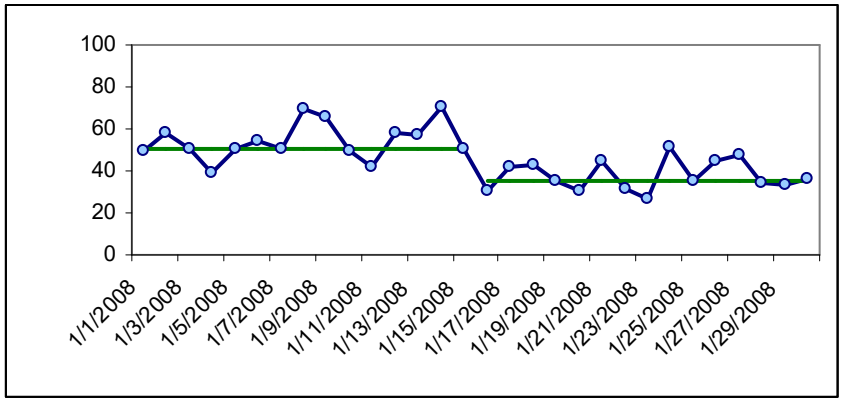
# Testing a Change

3. Continue to plot data as test change(s)




4. Apply the rules

5. If there was a signal, re-plot with new median



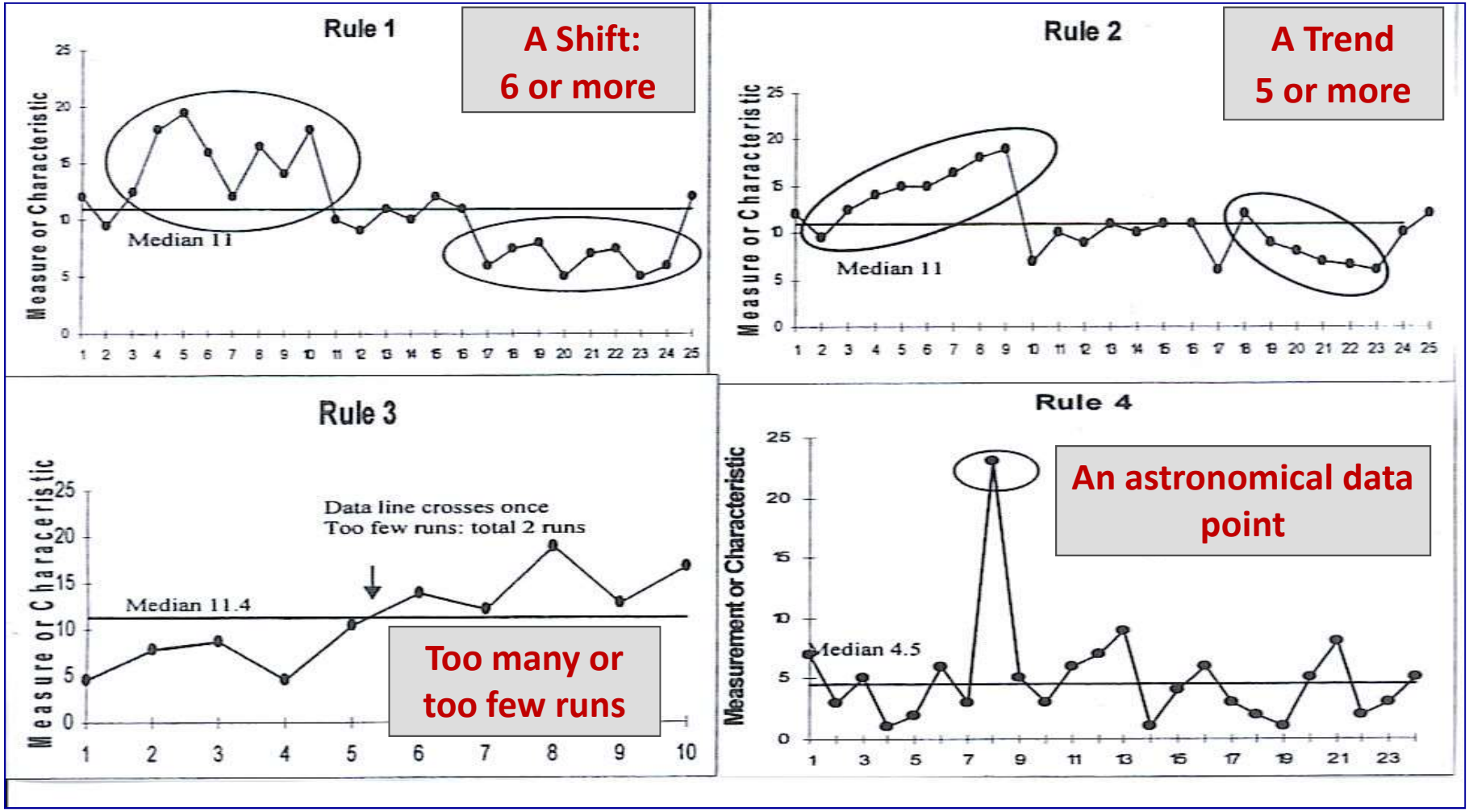
# How will we know that change is an improvement?

1. **By *understanding* the variation that lives within our data**

2. **By making good management *decisions* on this variation (i.e., not overreacting to a special cause and making assumptions that random movement of our data up and down is a signal of improvement).**

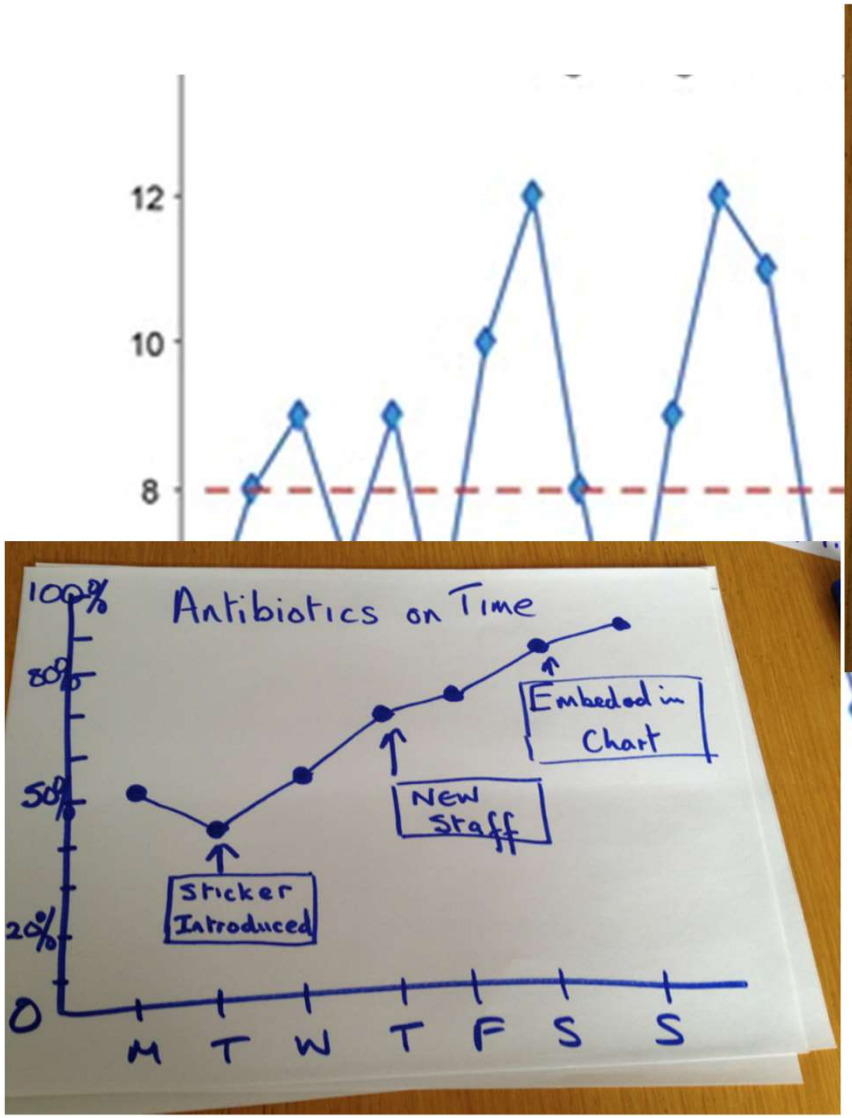
Repeated measures on a run chart tell a story over time including interventions

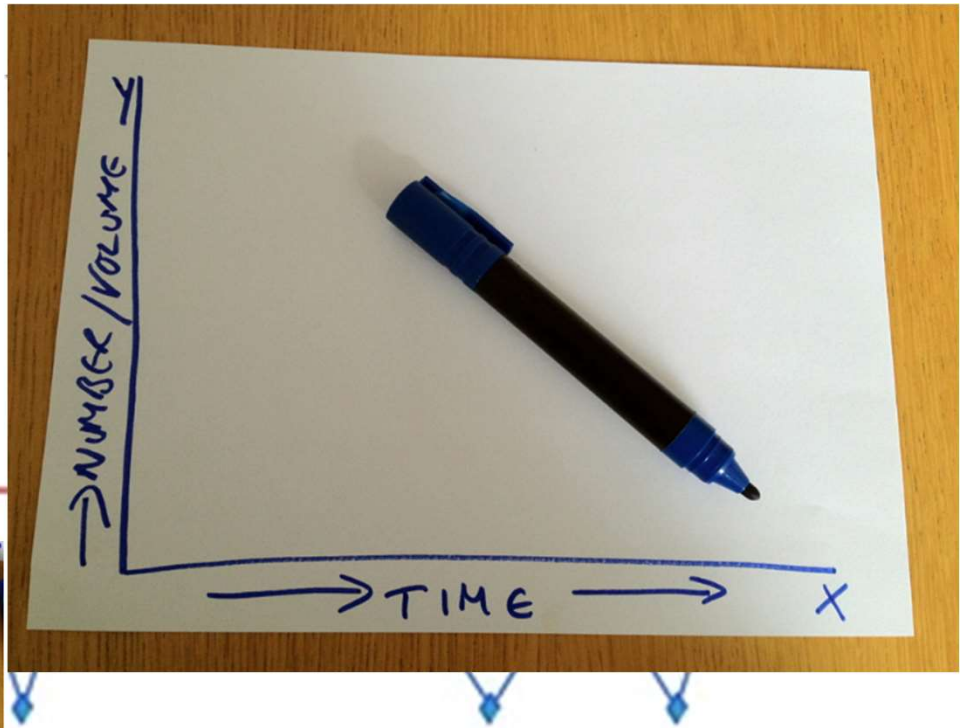
# Non-Random Rules for Run Charts




Source: The Data Guide by L. Provost and S. Murray, Austin, Texas, February, 2007: p3-10.

# MEASURING RESULTS



# Your journey to work

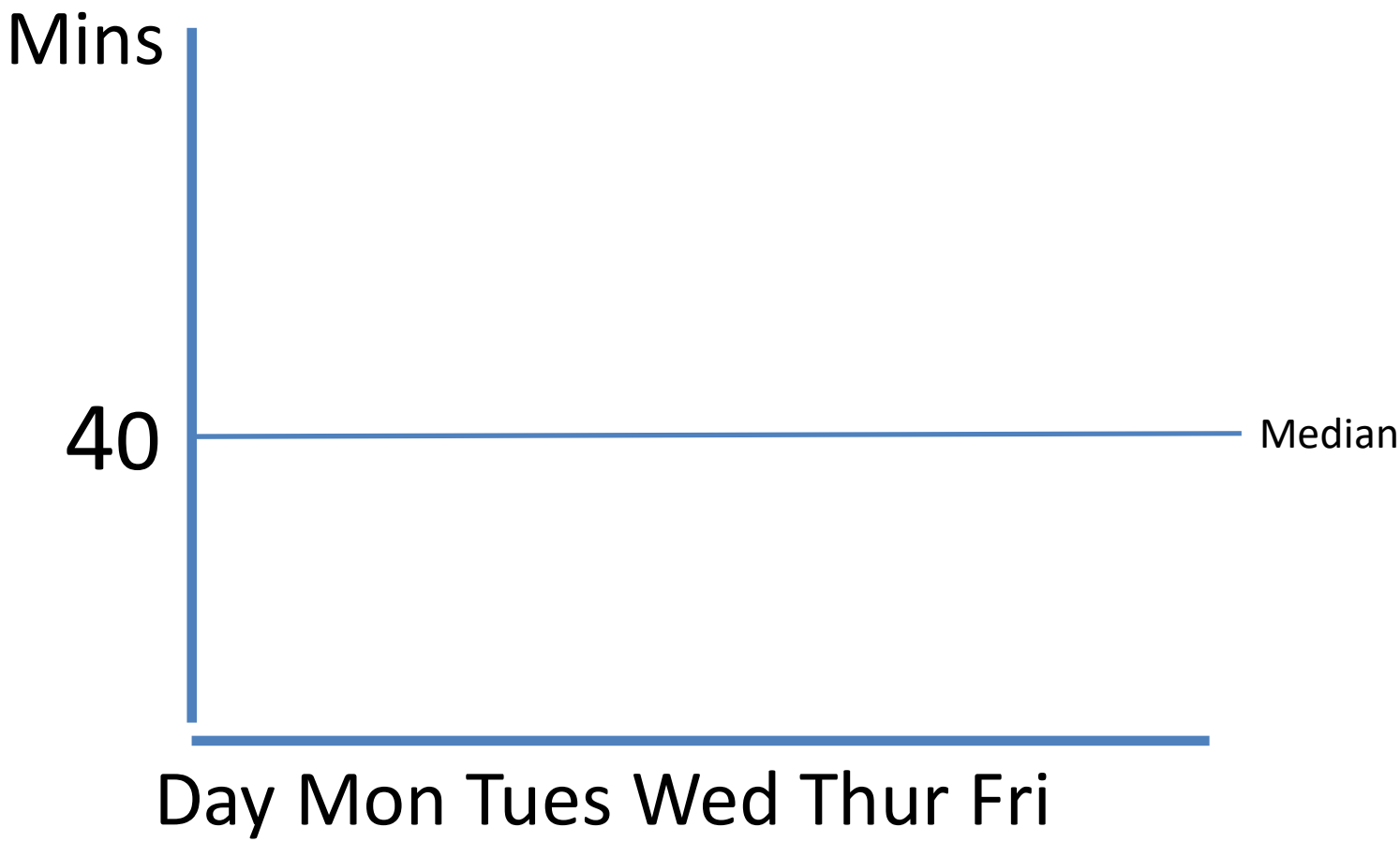
- Monday  55mins
- Tuesday  30 mins
- Wednesday 22 mins
- Thursday 40 mins
- Friday 50 mins

Put the numbers in order to find the mid point

22,  30,  40,  50,  55

Make a chart

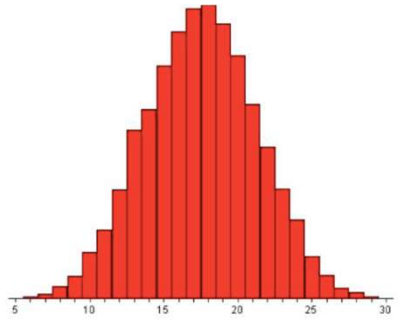
# Your Chart

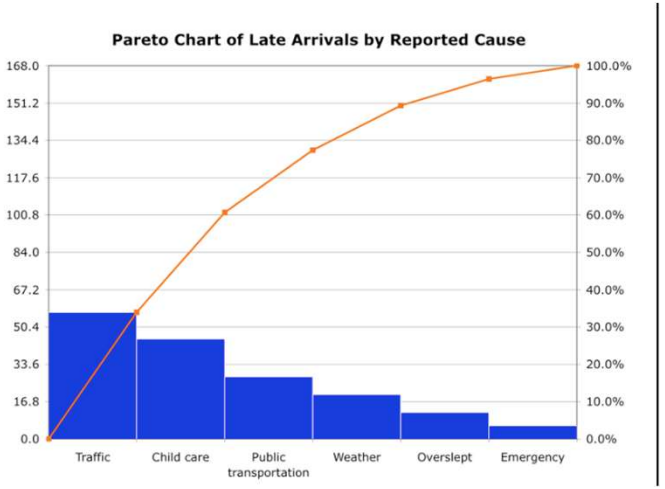


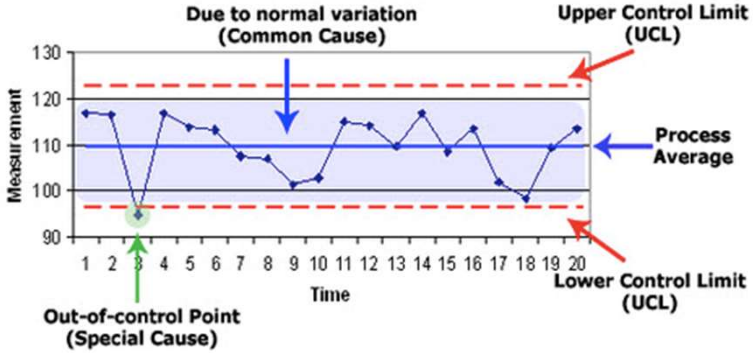
# Summary

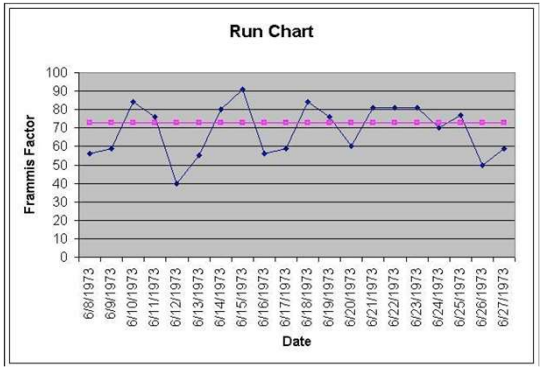
Four main kinds for data presentation

- Histograms looking at distribution
- Pareto 80 20 rule
- Run charts
- Control charts

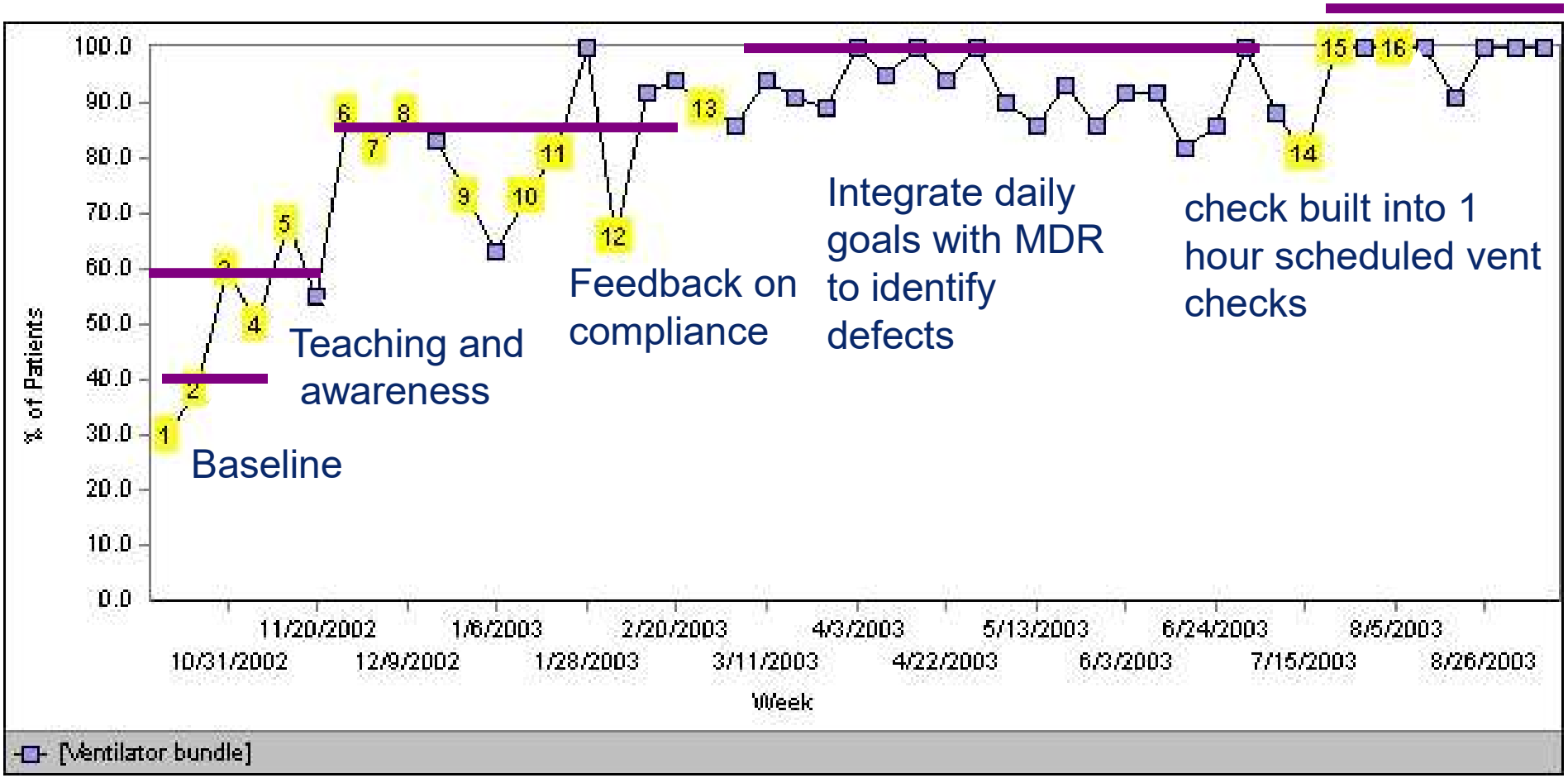


# Example of 3 Step Design in Implementing the Ventilator Bundle




Example of using 80% and 95% change concepts to initially reach a reliability of 80% then additionally using a robust change concept (redundancy) to reach 95% reliability in the 4 elements of the ventilator bundle (Baptist Memorial, Memphis)


Patient Safety Update
SNAP-CAP Compliance in
SEPT
67%
Target = 95%
Patient Safety Update
Antibiotic Prescribing Compliance in
SEPT
73%
Target = 95%
Patient Safety Update
Medicines Reconciliation Compliance in
SEPT
75%
Target = 95%
Patient Safety Update
Oxygen Prescribing Compliance in
SEPT
75%
Target = 95%
Patient Safety Update
Blood Culture Contamination in
Octo - 4-8%
5%
Target = < 3%
Antibiotic prescribing
Hand hygiene
Blood culture contam-ination
Patient Safety Update
Thromboprophylaxis Prescribing Compliance in
SEPT
70%
Target = 95%
Missed doses
Patient Safety Update
SEWS Compliance in
SEPT
95%
Target = 95%
Patient Safety Update
PVC Bundle Compliance in
SEPT
100%
Target = 95%
Patient Safety Update
Hand Hygiene Compliance in
OCT
75%
Target = 95%

# Measurement for Improvement - 2017