Using Data to Drive Improvement

M1
December 8, 2014

Discussion Topics

- Building a cascading system of measures
- Organizing your measures (Scorecards, Report Cards & Dashboards)
- Understanding variation conceptually
- Understanding variation statistically
- Linking measurement to improvement
Building a Cascading System of Measures

Look at your system of measures as a cascade!

Most cascades start at the top!

And, trickle downward...
A typical top-down cascade

Which way does (should) your cascade flow?
IOM Chasm Report Chain of Effect
(it all starts with the patient)

1. Patient (start here)
2. Physician
3. Clinical Unit/Microsystem
4. Clinical Service Line/Mesosystem
5. Health System/Macrosystem

Information System Design Principle: Capture data at the lowest level and aggregate up to higher levels for cascading metrics throughout the system.

Think about reversing the cascade!

Traditional Pyramids

Inverted Pyramids

Adapted from the work of Dr. Gene Nelson, Dr. Paul Batalden and Marjorie Godfrey. 

So, think about building an inverted pyramid

Start with the Little Dots

Micro Level

- Level 1
  - Micro: Patient, the provider of care

- Level 2
  - Meso: Clinical Units, Departments, and Service Lines

- Level 3
  - Macro

Macro Level

Adapted from R. Lloyd & G. Nelson, 2007

What system are you trying to improve?

The key question, however, is do you fully understand your measurement system and which aspects of the system you want to improve?

If you do start drilling down from the...

...then make sure there are ways to percolates the measures back up

Macro

Meso

Micro levels...
Jönköping's System Level Cascade

Macrosystem

Mesosystem

Microsystem

Source: G. Henriks & Bojestig, Jonkoping County Council, Sweden, 2008

A Cascading Approach to Measurement

Percent of patients recommending your care

Promptness/TLC

Medication administration

Order med + Prepare med + Dispense med + Administer med to patient
A Cascading Approach to Measurement

**Hospital Acquired Infection rates**

- Percent inpatient mortality
- Percent compliance with “bundles”
- VAP bundle
- CL bundle
- Pressure ulcer bundle
- Hand washing bundle

% of patients with appropriate catheter placements

% of catheter insertions with all insertion bundles in compliance

% of catheter placements with all daily maintenance bundle elements in compliance

CAUTI rate (#CAUTIs per 1000 catheter days)

Average catheter duration (days)
Dialogue
Building a Cascading System of Measures

Assess your organization’s cascade of dashboards and measures

— Does your organization have a cascading system of measurement? Or, are the measures unrelated and fragmented?

— How long do your dashboards stay in place? Do they have continuity or are they here one day and gone the next?

— Are your dashboards regularly reviewed by an appropriate oversight group? For example, are there dashboards that the Board or Governance (Non-Execs) regularly review?

— Do your dashboards cascade from the top down (macro level) or percolate up from the staff (micro level)?

Organizing Your Measures

Dashboard

Scorecard

For the 12 Months Ending September 30, 1999

<table>
<thead>
<tr>
<th>Hospital</th>
<th>Specialty</th>
<th>Length of Stay</th>
<th>Cost</th>
<th>Accountability</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hospital1</td>
<td>123</td>
<td>567</td>
<td>890</td>
<td>456</td>
</tr>
<tr>
<td>Hospital2</td>
<td>789</td>
<td>123</td>
<td>456</td>
<td>789</td>
</tr>
</tbody>
</table>

Managing the strategy and performance of the organization's teams and individuals.
The Goal:
Build an Information System

“An adequate information system has to include information that makes executives question their assumptions about current conditions. It must lead them to ask the right questions, not just feed them the information they expect.”

“That presupposes first that the executives know what information they need. It demands further that they obtain that information on a regular basis. It finally requires that they systematically integrate the information into their decision making.”


The Challenge:
Data versus Information

“Data refers to raw facts and figures which are collected as parts of the normal functioning of the hospital. Information, on the other hand, is defined as data which have been processed and analyzed in a formal, intelligent way, so that the results are directly useful to those involved in the operation and management of the hospital.”

Charles Austin, Information Systems for Hospital Administration
Health Administration Press, 1983
“Many managers fail to realize that traditional measures, which focus on results (or outcomes), may help them keep score on the performance of their business but do not help a multifunctional team monitor the activities or capabilities that enable it to perform a given process. Nor do such results measures tell team members what they must do to improve their performance.”

The Role of Management

Managers should:
• Create the strategic context and direction for measurement
• Set strategic goals and boundaries
• Make sure each team understands its purpose and how this purpose fits in with the strategic objectives
• Not dictate what measures a team should use
• Provide training and resources for the teams to accomplish their objectives
• Participate in team reviews
• Not micro-manage the teams through command and control tactics
Background – The Balanced Scorecard

Thanks are extended to Kevin Little, Ph.D., IHI Improvement Advisor, for sharing his ideas and materials for this section.

- Balanced Scorecard was proposed in the early 1990’s by Kaplan and Norton in the *Harvard Business Review*.
- Kaplan and Norton have continued to develop the concept since 1992, extending the initial measurement system into a strategy management system.
- A key aspect in deployment is linking the measures to strategies and actions that will drive improvement in the measures.
- Kaplan and Norton’s website at www.bscol.com

References:

The Kaplan & Norton’s Balanced Scorecard

Source: http://www.balancedscorecard.org/basics/bsc1.html
Report Cards, Instrument Panels and Dashboards: Who Needs What?

Report Card Image
Judgmental, Static, Instill Anger/Fear & Creates Rationalization

- Who gets them? Students
- Who gives them? Teachers
- Focus? Past Performance
- Who wins? The A’s
- Who loses? Everybody else
- What’s learned? I’m above average, average or below average

Instrumental Panel and Dashboard Image

**Decision making . . . Dynamic . . . Empowering**

- Who uses them? Cockpit crew (pilot, copilot, navigator)
- Who interprets? Cockpit crew
- Focus? Present and future
- Utility? Real-time monitoring, predicting the future and taking action

“The instrument panel or dashboard metaphor has an entirely different aura from that of the report card. It has vitality, timeliness, and a clear-cut utility that is absent from report card thinking. A key feature is providing critical, real-time information to the user to prompt wise decisions and, if need be, make rapid midcourse corrections.”


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**Linking Scorecards, Report Cards and Dashboards**

- **Balanced Scorecard** began as a recommended set of measures that went beyond the traditional management focus on financial measures to answer the question “What classes of measures should senior managers use?”

- **Report Cards** emerged as a variation on the Balanced Scorecard.

- **Dashboards** provide a means to synthesize key measures. They initially answered the question “What methods should senior managers use to interact with key measures?”
  - Show data in graphical displays
  - Use drill-downs to deeper levels (disaggregate, stratify)
  - Use timely data, relative to your decision-making cycle

- You can use dashboard methods (dynamic approach) to display and structure measures listed in a Balanced Scorecard or Report Card (static approach).

Appreciation is extended to Kevin Little, Ph.D., IHI Improvement Advisor, for sharing his ideas on this topic.
Linking Scorecards, Report Cards and Dashboards
Linking Scorecards, Report Cards and Dashboards

The data can be stratified by location and function.
When you click on a report card dial, up pops a plot of the data over time.

So, how do you view the Three Faces of Performance Measurement?

As... Improvement, Judgment, Research

As a... Or,
Relating the Three Faces of Performance Measurement to your work

The three faces of performance measurement should not be seen as mutually exclusive silos. This is not an either/or situation.

All three areas must be understood as a system. Individuals need to build skills in all three areas.

Organizations need translators who and be able to speak the language of each approach.

The problem is that individuals identify with one of the approaches and dismiss the value of the other two.

Using Small Multiples to Display your Dashboard

CAUTI Dashboard
Dashboard Exercise

Designing the Components of a Dashboard

- Is this a Macro, Meso or Micro level dashboard?
- Which of your strategic objectives will this dashboard address?
- What are the major dimensions captured by this dashboard?
- Does everyone (and I mean EVERYONE) understand the purpose of this dashboard (improvement, judgment, research)?
- Use the Dashboard Worksheet on the next page

Dashboard Worksheet (page 1)

Is this a Macro _____ Meso _____ or Micro _____ level dashboard?

The Dashboard is designed to measure the following dimension(s) (mark all that apply):

- Patient Satisfaction
- Work Life Quality
- Clinical Excellence
- Appropriateness
- Availability/Access
- Continuity of Care
- Effectiveness
- Efficiency
- information Technology
- Infection Control
- Quality & Safety
- Financial Viability
- Growth/Market Share
- Respect/Caring
- Reliability
- Other (specify)
### Dashboard Worksheet (page 2)

**Dashboard Name:**

<table>
<thead>
<tr>
<th>Dimension to be captured by this Dashboard</th>
<th>Potential Measures for each Dimension</th>
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### The Quality Measurement Journey

**AIM** (Why are you measuring?)
- Concept
- Measure
- Operational Definitions
- Data Collection Plan
- Data Collection
- **Analysis**

**ACTION**

You have performance data! Now, what do you do with it?

You have two options

**STATIC VIEW**
- Descriptive Statistics
- Mean, Median & Mode
- Minimum/Maximum/Range
- Standard Deviation
- Bar graphs/Pie charts

**DYNAMIC VIEW**
- Run Chart
- Control Chart (plot data over time)
- Statistical Process Control (SPC)
Static view at a single point in time leads to Judgement not Improvement!

Source: Alastair Philip, Quality improvement Scotland, 2010

Moving from data for Judgment (static) to data for Improvement (dynamic)

The idea for this example was proposed by Alastair Philip, Quality improvement Scotland, 2010

You do have a choice!

Data for Improvement

Data for Judgment
The Problem!

Aggregated data presented in tabular formats or with summary statistics, will not help you measure the impact of process improvement efforts.

Aggregated data can only lead to judgment, not to improvement.

Which leads to Thin-Slicing!

“Thin-slicing refers to the ability of our unconscious to find patterns in situations and behavior based on very narrow slices of experience.” Malcolm Gladwell, blink, page 23

When most people look at data they thin-slice it. That is, they basically use their unconscious to find patterns and trends in the data that fit their view of reality. They look for extremely high or low data points and then make conclusions about performance based on limited data. R. Lloyd
Average CABG Mortality
Before and After the Implementation of a New Protocol

WOW!
A “significant drop”
from 5% to 4%

Percent Mortality
Time 1
3.8
Time 2
5.0%
4.0%

Conclusion - The protocol was a success!
A 20% drop in the average mortality!

Average CABG Mortality
Before and After the Implementation of a New Protocol

A Second Look at the Data

Protocol implemented here

Percent Mortality
9.0
5.0
1.0

UCL = 6.0
CL = 4.0
LCL = 2.0

24 Months

Now what do you conclude about the impact of the protocol?
The average of a set of numbers can be created by many different distributions

If you don’t understand the variation that lives in your data, you will be tempted to ...

- Deny the data (It doesn’t fit my view of reality!)
- See trends where there are no trends
- Try to explain natural variation as special events
- Blame and give credit to people for things over which they have no control
- Distort the process that produced the data
- Discredit the messenger!
Deming’s Cycle of Fear

Increased Fear  Kill the Messenger
Micro-management  Filtered Information

“A phenomenon will be said to be controlled when, through the use of past experience, we can predict, at least within limits, how the phenomenon may be expected to vary in the future”

Dr. Walter A Shewhart

W. Shewhart, Economic Control of Quality of Manufactured Product, 1931
“What is the variation in one system over time?” Walter A. Shewhart - early 1920’s, Bell Laboratories

Every process displays variation:
- **Controlled variation**
  - stable, consistent pattern of variation
  - “chance”, constant causes
- **Special cause variation**
  - “assignable”
  - pattern changes over time

Types of Variation

**Random Variation**
- Is inherent in the design of the process
- Is due to regular, natural or ordinary causes
- Affects all the outcomes of a process
- Results in a “stable” process that is predictable
- Also known as random or unassignable variation

**Non-Random Variation**
- Is due to irregular or unnatural causes that are not inherent in the design of the process
- Affect some, but not necessarily all aspects of the process
- Results in an “unstable” process that is not predictable
- Also known as non-random or assignable variation
Point …Variation exists!

Random Variation does not mean “Good Variation.” It only means that the process is stable and predictable. For example, if a patient’s systolic blood pressure averaged around 165 and was usually between 160 and 170 mmHg, this might be stable and predictable but completely unacceptable.

Similarly, Non-Random variation should not be viewed as “Bad Variation.” You could have a non-random variation that represents a very good result (e.g., a low turnaround time), which you would want to emulate. Non-Random merely means that the process is unstable and unpredictable.

2 Questions …

1. Is the process **stable**? If so, then it is **predictable**.

2. Is the process capable?

*The chart will tell you if the process is stable and predictable.*

*You have to decide if the output of the process is capable of meeting the target or goal you have set!*
Attributes of a Person Who Understands Variation

They understand the different ways in which variation is viewed (static versus dynamic).

They explain changes in terms of common causes and special causes.

They use graphical methods to plot data over time, learn from data and expect others to consider variation in their decisions and actions.

They understand the concept of stable and unstable processes and the potential losses due to tampering.

They understand the capability of a process or system before changes are attempted.

Exercise
Understanding Variation

• Select several measures which your organization tracks regularly.

• Do you and the leaders of your organization evaluate these measures according the criteria for common and special causes of variation?

• If not, what criteria do you use to determine if your measures are improving or getting worse?
How do we analyze variation for quality improvement?

**Run** and **Control Charts** are the best tools to determine:

1. *The variation that lives in the process*
2. *if our improvement strategies have had the desired effect.*

1. **Make process performance visible**

![Current Process Performance: Isolated Femur Fractures](chart1)

2. **Determine if a change is an improvement**

![Process Improvement: Isolated Femur Fractures](chart2)

3. **Determine if we are holding the gains**

![Holding the Gain: Isolated Femur Fractures](chart3)
How many data points do I need?

**Ideally you should have between 10 – 15 data points before constructing a run chart**

- 10 – 15 patients
- 10 – 15 days
- 10 – 15 weeks
- 10 – 15 months
- 10 – 15 quarters...

- If you are just starting to measure, plot the dots and make a line graph
- Once you have 8-10 data points you can start to make a run chart
- Preferably 20 data points or more for a control chart

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**Elements of a Run Chart**

The centerline (CL) on a Run Chart is the Median

Four simple run rules are used to determine if special cause variation is present

- Measure
  - Pounds of Red Bag Waste
- Time
  - Point Number
There are 4 basic run chart rules that help you decide if your data reflect common or special causes of variation.

“How will I know what the Run Chart is trying to tell me?”

How do we analyze a Run Chart?

First, you need to determine the number of Runs

**What is a Run?**
- One or more consecutive data points on the same side of the Median
- Do not include data points that fall on the Median

**How do we count the number of runs?**
- Draw a circle around each run and count the number of circles you have drawn
- Count the number of times the sequence of data points crosses the Median and add “1”
Run Chart: Medical Waste
Determine the number of runs on this chart

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14 runs

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4 Basic Run Chart Rules

Rule 1: A Shift: 6 or more

Rule 2: A Trend: 5 or more

Rule 3: Too many or too few runs

Rule 4: An astronomical data point


Elements of a Shewhart Control Chart

An indication of a special cause

(Upper Control Limit)

(Lower Control Limit)

Measure

Number of Complaints

Time → Month

\( \bar{X} \) (Mean)
Types of Quantitative Data

Variables Data

Attributes Data

Defectives (occurrences plus non-occurrences)
Nonconforming Units

Defects (occurrences only)
Nonconformities

There Are 7 Basic Control Charts


Variables Charts

- $\overline{X}$ & R chart (average & range chart)
- $\overline{X}$ & S chart (average & SD chart)
- XmR chart (individuals & moving range chart)

Attributes Charts

- p-chart (proportion or percent of defectives)
- np-chart (number of defectives)
- c-chart (number of defects)
- u-chart (defect rate)
The Control Chart Decision Tree

Variables Data

- More than one observation per subgroup?
  - Yes: X̄ bar & R
  - No: X̄ bar & S

Attributes Data

- Occurrences or Non-occurrences?
  - Yes: c-chart, p-chart
  - No: np-chart

- Is there an equal area of opportunity?
  - Yes: u-chart
  - No: The number of Defective Units

- Are the subgroups of equal size?
  - Yes: The Defect Rate
  - No: The number of Defective Units

Decide on the type of data

Yes


Rules for Detecting Special Causes on Shewhart Charts

- A single point outside the control limits
- Two out of three consecutive points near a control limit (outer one-third)
- Eight or more consecutive points above or below the centerline
- Fifteen consecutive points close to the centerline (inner one-third)
- Six consecutive points increasing (trend up) or decreasing (trend down)
The Charts Don’t Tell You...

- The reasons(s) for a Special Cause.

- Whether or not a Common Cause process should be improved (is the performance of the process acceptable?)

- How the process should actually be improved or redesigned.
A Simple Improvement Plan

1. Which process do you want to improve or redesign?
2. Does the process contain common or special cause variation?
3. How do you plan on actually making improvements? What strategies do you plan to follow to make things better?
4. What effect (if any) did your plan have on the process performance?

SPC methods and tools will help you answer Questions 2 & 4. **YOU** need to figure out the answers to Questions 1 & 3.

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The Sequence of Improvement requires Measurement

- Make part of routine operations
- Test under a variety of conditions
- Testing a change
- Developing a change
- Measurement is needed throughout the sequence
- Implementing a change
- Sustaining improvements and spreading changes to other locations
Key issues in Building a Measurement System that Works

1. Decide on why you are measuring (improvement, judgment or research)

2. Identify the organizational level(s) of your measurement efforts

3. Determine if you will be taking a static or dynamic approach to performance measurement

What you call your performance measurement system is not as important as the questions you are addressing and what you plan to do with your measures!

Exercise Measurement Self-Assessment

This self-assessment is designed to help quality facilitators and improvement team members gain a better understanding of where they personally stand with respect to the milestones in the Quality Measurement Journey (QMJ). What would your reaction be if you had to explain why it is preferable to plot data over time rather than using aggregated statistics and tests of significance? Can you construct a run chart or help a team decide which measure is more appropriate for their project?

You may not be asked to do all of the things listed below today or even next week. But if you are facilitating a QI team or expect to be able to demonstrate improvement, sooner or later these questions will be posed. How will you deal with them?

The place to start is to be honest with yourself and see how much you know about concepts and methods related to the QMJ. Once you have had this period of self-reflection, you will be ready to develop a learning plan for yourself and those on your improvement team.

Exercise
Measurement Self-Assessment

Use the following Response Scale. Select the one response which best captures your opinion.

1. I consider myself an expert in this area and could teach this topic to others.
2. I have knowledge about this topic, could apply it to a project but would not want to be asked to teach it to others.
3. I am familiar with this topic but would have to study it further before applying it to a project.
4. I’m not sure I could apply this appropriately to a project.
5. I’d definitely have to call in an outside expert to explain and apply this topic.


<table>
<thead>
<tr>
<th>Measurement Topic or Skill</th>
<th>Response Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Help people in my organization determine why they are measuring (improvement, judgment or research)</td>
<td>1 2 3 4 5</td>
</tr>
<tr>
<td>Move teams from concepts to specific quantifiable measures</td>
<td></td>
</tr>
<tr>
<td>Building clear and unambiguous operational definitions for our measures</td>
<td></td>
</tr>
<tr>
<td>Develop data collection plans (including stratification and sampling strategies)</td>
<td></td>
</tr>
<tr>
<td>Explain why plotting data over time (dynamic display) is preferable to using aggregated data and summary statistics (static display)</td>
<td></td>
</tr>
<tr>
<td>Explain the differences between random and non-random variation</td>
<td></td>
</tr>
<tr>
<td>Construct run charts (including locating the median)</td>
<td></td>
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<tr>
<td>Explain the reasoning behind the run chart rules</td>
<td></td>
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<tr>
<td>Interpret run charts by applying the run chart rules</td>
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<tr>
<td>Help teams link measurement to their improvement efforts</td>
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</tbody>
</table>

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