Measurement: Using Data for Improvement

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How will we know that a change is an improvement?

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

2. By *making good management decisions* on this variation (i.e., don’t overreact to a special cause and don’t think that random movement of your data up and down is a signal of improvement).
The Quality Pioneers

W. Edwards Deming
(1900 - 1993)

Walter Shewhart
(1891 – 1967)

Joseph Juran
(1904 - 2008)
“These statistics will enable us to ascertain what diseases and ages press most heavily on the resources of particular hospitals.”

“They will show subscribers how their money is being spent, what amount of good is really being done with it, or whether the money is doing mischief rather than good.”

“To understand God's thoughts we must study statistics, for these are the measure of His purpose.”

Florence Nightingale (1820-1910)
Defining Quality: Old Way, New Way

Old Way (Quality Assurance)
- Requirement, Specification or Threshold
- No action taken here
- Reject defectives

New Way (Quality Improvement)
- Action taken on all occurrences

Source: Robert Lloyd, Ph.D.
“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.”
<table>
<thead>
<tr>
<th>Aspect</th>
<th>Improvement</th>
<th>Accountability (Judgment)</th>
<th>Research</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aim</strong></td>
<td>Improvement of care Process, system, and outcomes <em>(efficiency &amp; effectiveness)</em></td>
<td>judgment, choice, reassurance, spur for change</td>
<td>New generalizable knowledge <em>(efficacy)</em></td>
</tr>
<tr>
<td><strong>Methods:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Test Observability</td>
<td>Test observable</td>
<td>No test, evaluate current performance</td>
<td>Test blinded or controlled</td>
</tr>
<tr>
<td>- Bias</td>
<td>Accept consistent bias</td>
<td>Measure and adjust to reduce bias</td>
<td>Design to eliminate bias</td>
</tr>
<tr>
<td>- Sample Size</td>
<td><em>Just enough</em> data, small sequential samples</td>
<td>Obtain 100% of available, relevant data</td>
<td><em>Just in case</em> data</td>
</tr>
<tr>
<td>- Flexibility of Hypothesis</td>
<td>Flexible hypotheses, changes as learning takes place</td>
<td>No hypothesis</td>
<td>Fixed hypothesis <em>(null hypothesis)</em></td>
</tr>
<tr>
<td>- Testing Strategy</td>
<td>Sequential tests</td>
<td>No tests</td>
<td>One large test</td>
</tr>
<tr>
<td>- Determining if a change is an improvement</td>
<td>Analytic Statistics <em>(statistical process control)</em> Run &amp; Control charts</td>
<td>No change focus <em>(maybe compute a percent change or rank order the results)</em></td>
<td>Enumerative Statistics <em>(t-test, F-test, chi square, p-values)</em></td>
</tr>
<tr>
<td>- Confidentiality of the data</td>
<td>Data used only by those involved with improvement</td>
<td>Data available for public consumption and review</td>
<td>Research subjects’ identities protected</td>
</tr>
</tbody>
</table>

A Story…
Example of Data for Judgement

<table>
<thead>
<tr>
<th>FY 2009 Hospital System-Level Measures</th>
</tr>
</thead>
<tbody>
<tr>
<td>Goals</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Patient Perspective</td>
</tr>
<tr>
<td>1. Overall Satisfaction Rating: Percent Who Would Recommend (Includes inpatient, outpatient, ED, and Home Health)</td>
</tr>
<tr>
<td>2. Wait for 3rd Next Available Appointment: Percent of Areas with appointment available in less than or equal to 7 business days (n=43)</td>
</tr>
<tr>
<td>Patient Safety</td>
</tr>
<tr>
<td>3. Safety Events per 10,000 Adjusted Patient Days</td>
</tr>
<tr>
<td>4. Percent Mortality</td>
</tr>
<tr>
<td>5. Total Infections per 1000 Patient Days</td>
</tr>
<tr>
<td>Clinical</td>
</tr>
<tr>
<td>6. Percent Unplanned Readmissions</td>
</tr>
<tr>
<td>7. Percent of Eligible Patients Receiving Perfect Care--Evidence Based Care (Inpatient and ED)</td>
</tr>
<tr>
<td>Employee Perspective</td>
</tr>
<tr>
<td>8. Percent Voluntary Employee Turnover</td>
</tr>
<tr>
<td>9. Employee Satisfaction: Average Rating Using 1-5 Scale (5 Best Possible)</td>
</tr>
<tr>
<td>Operational Performance</td>
</tr>
<tr>
<td>10. Percent Occupancy</td>
</tr>
<tr>
<td>11. Average Length of Stay</td>
</tr>
<tr>
<td>12. Physician Satisfaction: Average Rating Using 1-5 Scale (5 Best Possible)</td>
</tr>
<tr>
<td>Community Perspective</td>
</tr>
<tr>
<td>13. Percent of Budget Allocated to Non-recompensed Care</td>
</tr>
<tr>
<td>14. Percent of Budget Spent on Community Health Promotion Programs</td>
</tr>
<tr>
<td>Financial Perspective</td>
</tr>
<tr>
<td>15. Operating Margin-Percent</td>
</tr>
<tr>
<td>16. Monthly Revenue (Million)-change so shows red--but sp cause good related to occupancy</td>
</tr>
</tbody>
</table>

Source: Provost, Murray & Britto (2010)
How is Perfect Care Doing?

Source: Provost, Murray & Britto (2010)
How to use measurement for improvement?

Focus on the question: How will we know a change is an Improvement?

Three Key issues:
- Family of measures
- Operational definitions
- Visual display of data over time
A Family 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)?
### A Family of Measures: Surgical Safety

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Process</th>
<th>Balancing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgical Site Infection Rate</td>
<td>% of appropriate antibiotic selection</td>
<td>Cost per case</td>
</tr>
<tr>
<td>(infections/cases)</td>
<td>% on time administration</td>
<td></td>
</tr>
<tr>
<td></td>
<td>% cases where surgical checklist is used</td>
<td></td>
</tr>
</tbody>
</table>
Exercise: Developing a Set of Measures

• Background: A friend has come to you and asked you to help develop measures for a group she is working with. The aim of the group’s improvement project is for participants to lose weight.

• Develop a family of 4 to 6 measures that could be reported each week for the project:
  – Outcome Measures – 1-2 measures
  – Process Measures – 2 measures
  – Balancing Measures – 1 or 2 measures
### Project Aim: Lose Weight

<table>
<thead>
<tr>
<th>Type</th>
<th>Name of Measure</th>
<th>Definition, how to collect data</th>
<th>Weekly summary statistic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Outcome Measure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Process Measure</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Balancing Measure</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Balancing Measures: Looking at the System from Different Dimensions

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

Balancing Measures help you capture Unintended Consequences
An Operational Definition...

... is a description, in quantifiable terms, of what to measure and the steps to follow to measure it consistently.

- It gives communicable meaning to a concept
- Is clear and unambiguous
- Specifies measurement methods and equipment
- Identifies criteria

Components of Operational Definition

Developing an operational definition requires agreement on two things:

1. A method of measurement
   - Which device? (clock, wristwatch, stopwatch?)
   - To what degree of precision (nearest hour, 5 minutes, minute, second?)
   - For time based measurements, what are the start and end points

2. A set of criteria for judgment
   - What is “late”, “error”, “a fall”?
   - What counts as an adverse event, like a CLABSI?
How do you define these concepts?

- A “fair tax”
- A “tax loophole”
- A “good vacation”
- A “great movie”
- Rural, Urban or Suburban
- The “rich”
- The “poor”
- The “middle class”
- “Jump start” the economy
- “Global Warming”
What does it mean to “go wireless”?
NASA lost a $125 million Mars orbiter because one engineering team used metric units (newton-seconds) to guide the spacecraft while the builder (Lockheed Martin) used pounds-second to calibrate the maneuvering operations of the craft.

Information failed to transfer between the Mars Climate Orbiter spacecraft team at Lockheed Martin in Colorado and the mission navigation team in California. The confusion caused the orbiter to encounter Mars on a trajectory that brought it too close to the planet, causing it to pass through the upper atmosphere and disintegrate.
Traditionally we had…

…the 9 planet operational definition of the solar system.
But, in 2006 the 8 planet operational definition emerged!

NOTE: On February 18, 1930 Mr. Clyde Tombaugh of Streator, Illinois discovered the planet Pluto. In 2006 however, the International Astronomical Union reclassified Pluto as a “dwarf planet.”
The **Operational Definition of a Planet** includes three criteria:

1. **It must orbit the sun,**
2. **It must be more or less round,**
3. **It must "clear the neighborhood" around its orbit.**

Pluto meets the first two, but falls short of the third, crossing the orbit of Neptune and those of other objects in the Kuiper belt where Pluto is located.

**July 14, 2015**

New Horizons spacecraft, which has traveled more than 9 years and 3+ billion miles, took this photo of Pluto at the moment of its closest approach at 0749 EDT. It is the most detailed image of Pluto ever sent to Earth.

Percival Lowell and Clyde Tombaugh would be very proud even though the revised operational definition demoted Pluto to a dwarf planet.
How do you define the following healthcare concepts?

- Medication error
- Co-morbid conditions
- Teenage pregnancy
- Cancer waiting times
- Health inequalities
- Asthma admissions
- Childhood obesity
- Patient education
- Health and wellbeing
- Adding life to years and years to life
- Children's palliative care
- Safe services
- Smoking cessation
- Urgent care
- Complete history & physical

- Delayed discharges
- End of life care
- Falls (with/without injuries)
- Childhood immunizations
- Complete maternity service
- Patient engagement
- Moving services closer to home
- Successful breastfeeding
- Ambulatory care
- Access to health in deprived areas
- Diagnostics in the community
- Productive community services
- Vascular inequalities
- Breakthrough priorities
- Surgery start time
Example
Medication Error Operational Definition

**Measure Name:** Percent of medication errors

**Numerator:** Number of outpatient medication orders with one or more errors. *An error is defined as:* wrong med, wrong dose, wrong route or wrong patient.

**Denominator:** Number of outpatient medication orders received by the family practice clinic pharmacy.

**Data Collection:**
- This measure applies to all patients seen at the clinic
- The data will be stratified by type of order (new versus refill) and patient age
- The data will be tracked daily and grouped by week
- The data will be pulled from the pharmacy computer and the CPOE systems
- Initially all medication orders will be reviewed. A stratified proportional random sample will be considered once the variation in the process is fully understood and the volume of orders is analyzed.
Exercise: Operational Definitions


2. Measure your banana using the definition, and write down the result and keep it secret!

3. Pass your definition and banana to another table. They will use your definition to measure.

4. Compare results.