Objectives

- Describe the key properties of useful improvement measures, and evaluate typical project measures
- Create an improvement measurement plan with input from content experts, improvement specialists, and IT personnel
Faculty

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Why Measure?

- Performance
  - “Is this system producing excellent results? How does its performance compare with other systems?”
  - For consumer choice, pay for performance, network inclusion, etc.

- Improvement
  - “Is this system producing predictable results? Where are gaps that need to be addressed? Are our improvement efforts making a difference?”
  - For quality control and quality improvement; aligned throughout the system of care
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Session C3: Defining Moments: Making Measures Clear

Measuring Performance

Quality & Performance Measures

11/23/2015
What’s one of the first issues we hear when we try to compare performance?
Risk-adjustment of the mortality rate could enable hospitals to:

- Gauge the success of improvement initiatives over time
- Facilitate inter-hospital comparisons and inform consumers,
- Serve as a measure for pay-for-performance
- Help regulatory or governmental agencies detect hospitals with exceptionally high (or low) mortality rates

In the United Kingdom:
The Francis Report, has renewed debate about the use of risk-adjusted mortality rates as an indicator of system-level quality.
Observed & Expected Mortality

- Observed Mortality
- Expected Mortality

Standardized Morality Ratio (Observed/Expected Mortality)
No published studies have evaluated hospital-wide mortality measures against these criteria. Different models result in different conclusions.
Can we compare performance?

Variation over time?
Differences between hospitals’ risk-adjusted mortality cannot be measured with sufficient precision to develop fine rankings of individual performance

Parry et al 1998

Variation Yields Information

Within-organization Variation:
Hospital-wide mortality as an indicator of overall quality might obscure important variations in mortality rates within the hospital, with high mortality and low mortality areas canceling each other out, yielding an overall average rate.

Epstein, 2005
**What are they measuring?**

**Actionability:**
“Signal-to-noise” ratio is too low for mortality to be a reliable measure of performance.
- Only 7% of deaths in hospital are potentially avoidable, predominantly those in patients with poor life expectancy

*Hogan et al., 2012*

For 5000 admissions, 3% mortality rate:
11 potentially avoidable deaths per year

**Can we compare performance?**

**Prompts unnecessary actions:**
- Reporting the ranking of hospitals frequently results in defensive, contentious debates that distract from efforts to focus on improvements to reduce mortality

*Lilford & Pronovost, 2010*

**WARNING**

THIS MEASURE IS ONLY A DISTRACTION
Analogous to a screening test:
• Requires testing and tracking of unintended consequences.
• Need balance between protecting the public from organizations that are genuinely poor and protecting the reputation of hospitals that are not.

Mohammed 2013

Are we measuring improvement?

“The strong correlation between increase in coding and decrease in adjusted mortality suggests that changing coding practice likely played a part in the decrease in adjusted mortality.”

**Measurement Matters**

"Health care in the United States is not as safe as it should be—and can be. At least 44,000 people, and perhaps as many as 98,000 people, die in hospitals each year as a result of medical errors that could have been prevented, according to estimates from two major studies."

"... errors are caused by faulty systems, processes, and conditions that lead people to make mistakes or fail to prevent them."

*To Err is Human: Building a Safer Health System* (1999)

"Health care harms patients too frequently and routinely fails to deliver its potential benefits. Indeed, between the health care that we now have and the health care that we could have lies not just a gap, but a chasm."

*Crossing the Quality Chasm: A New Health System for the 21st Century* (2001)

**Change of any type requires:**

**Will, Ideas & Execution**

**Attributes of Performance Measures**

<table>
<thead>
<tr>
<th>Development</th>
<th>Well defined</th>
<th>Precise &amp; unambiguous specifications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Valid</td>
<td>Empirical evidence suggest they measure what they are intended to measure</td>
<td></td>
</tr>
<tr>
<td>Reliable</td>
<td>Empirical evidence suggests the measure returns the same value collected again, when nothing else has changed.</td>
<td></td>
</tr>
<tr>
<td>Feasibility</td>
<td>They are not over-burdensome to collect</td>
<td></td>
</tr>
<tr>
<td>Usability</td>
<td>Extent to which they can be used for both accountability and performance improvement.</td>
<td></td>
</tr>
<tr>
<td>Related or Competing Measures</td>
<td>Do similar measures already exist?</td>
<td></td>
</tr>
</tbody>
</table>

**Application**

<table>
<thead>
<tr>
<th>Buy in</th>
<th>When health care professionals and the public are part of the development process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment</td>
<td>Health care professionals and the public consider them valid &amp; reliable</td>
</tr>
<tr>
<td>Actionability</td>
<td>They are used to point to areas for further exploration</td>
</tr>
</tbody>
</table>
• What has been your experience of performance measures?
• How does your organization use them?

Chat to your neighbor

Measuring Improvement

Institute for Healthcare Improvement

Percent of Patients with Pressure Ulcers

Institute for Healthcare Improvement
Measurement for Improvement

AIM: What are we trying to accomplish?

MEASURES: How will we know if a change is an improvement?

CHANGE: What changes can we make that will result in improvement?

Act  Plan  Study  Do

Developing Improvement Measures

Theory of Improvement  Key Drivers  Measure Concepts  Defined Measures
Building a Theory of Improvement

- Driver diagrams
- Prioritization
- Linking drivers and measures

Theory Drives Improvement

“Without theory, there are no questions; without questions, there is no learning.”

W. Edwards Deming

The New Economics

For Industry, Government, Education

Second Edition
Theory for CAUTI Reduction

- **Outcomes**
  - Reduce catheter-associated urinary tract infections by 50% in one year

- **Primary Drivers**
  - P1 Leadership and aligned policy for catheter use
  - P2 Eliminate unnecessary catheter insertions
  - P3 Reliable compliance with catheter insertion protocol
  - P4 Reliable compliance with catheter maintenance protocol

- **Secondary Drivers**
  - S1 Clear policies for infection control
  - S2 Transparent reporting of process failures
  - S3 Staff training, with feedback on observed protocol compliance
  - S4 Insert catheters only for appropriate indications
  - S5 Consider alternative methods
  - S6 Minimize use of catheters for patients at risk for infections
  - S7 Remove when no longer required
  - S8 Insertion only by trained staff
  - S9 Standard insertion procedure
  - S10 Daily assessment of need, removal at earliest opportunity
  - S11 Standard cleaning and maintenance procedure

- **Insertion Bundle:**
  - A Hand hygiene
  - B Sterile gloves, materials
  - C Aseptic insertion
  - D Unobstructed flow

- **Maintenance Bundle:**
  - A Tamper seal intact
  - B Secured in place
  - C Hand hygiene
  - D Meatal hygiene
  - E Disposal & clean container
  - F Maintain unobstructed flow

- **High priority drivers**
  - M1
  - M2

Measures for CAUTI Reduction

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- **High priority drivers**
  - M1
  - M2
CAUTI Measure Concepts

- **Outcome: Occurrence of CAUTIs**
- **S4: Insert catheters only for appropriate indications.**
  The most effective way to eliminate the possibility of a CAUTI is to eliminate an unneeded catheter.
- **S7: Remove when no longer required.**
  Since the risk of infection is roughly proportional to the time the catheter is in place, removing catheters as soon as possible will reduce the risk.
- **S9: Standard insertion procedure.**
  If trained staff follow strict protocols for aseptic insertion of catheters, the risk of bacterial infection will be minimized.
- **S11: Standard cleaning and maintenance procedure.**
  Similarly, careful adherence to the components of the maintenance bundle will reduce risk.

Outcome: What is a ‘CAUTI’?

Patient had indwelling urinary catheter in place for > 2 calendar days, with day of device placement being Day 1, and catheter was in place when all elements of this criterion were first present together

...and...

at least 1 of the following signs or symptoms:
fever (>38°C), suprapubic tenderness*, or costovertebral angle pain or tenderness*

...and...

a positive urine culture of ≥105 colony-forming units (CFU)/ml with no more than 2 species of microorganisms.

----- OR ----- 

Patient had indwelling urinary catheter in place for > 2 calendar days and had it removed the day of or the day before all elements of this criterion were first present together

...and...

at least 1 of the following signs or symptoms: fever (>38°C), urgency*, frequency*, dysuria*, suprapubic tenderness*, or costovertebral angle pain or tenderness*

...and...

a positive urine culture of ≥ 105 colony-forming units (CFU)/ml with no more than 2 species of microorganisms.

*With no other recognized cause.

Source: Arizona Dept of Health Services
http://www.azdhs.gov/phs/oids/hai/training/documents/nhsn/day1/6-CAUTI.pdf
Attributes of Useful Improvement Measures

- **Responsive**
  - The measure is sensitive to changes in the system state. When the system improves, the measure says so.

- **Valid**
  - The measure aligns with the theory of changes (driver diagram). Improvement in the measure means improvement in the system.

- **Comprehensible**
  - The intended audience understands the meaning of the measure for system improvement.

- **Timely**
  - The data are available soon enough to inform improvement decisions (project planning, PDSA testing).

- **Feasible**
  - The data can be collected with minimum effort and cost, and in a timely fashion.

- **Relevant**
  - The measure supports problem identification and testing at the appropriate level of management.

- **Consistent**
  - The measure has a clear definition; it yields consistent results when applied in different places and at different times.

- **Ownership**
  - Someone is explicitly assigned to monitor the measure on a regular basis, detect problems, and initiate change.
### Outcome Trade-Offs?

1. Percentage of patients discharged in the past 12 months that suffered a CAUTI
2. % of patients with catheters discharged in the measurement month that suffered a CAUTI
3. Number of CAUTIs per 1000 inpatient days during the measurement month (3 mo. lag)
4. Number of CAUTIs per 1000 Foley catheter days last month
5. Count of CAUTIs in the measurement month
6. Number of catheter days since the last CAUTI event

### Process Compliance Measures

Number of opportunities for action correctly fulfilled

\[
\text{Number of opportunities for action correctly fulfilled} = \frac{\text{Number of opportunities for action correctly fulfilled}}{\text{Number of opportunities for action}}
\]

- aka ‘Percent conforming’, ‘Percent compliance’
- For assessing process reliability re protocols
Process Trade-Offs?

Concept = ‘Catheter insertion compliance’

1. Percent of catheter insertions in the measurement month with hand hygiene compliance.
2. Percent of insertions with checklist completed.
3. Percent of catheter insertions in the measurement month with all insertion bundle elements in compliance.
4. Number of catheters inserted this week within 2 hours or order?
5. Average time from catheter order to insertion in the current week.
6. Descriptive notes on 5 catheter insertions last week.

Responsiveness: Detecting Improvement

- Percent of severe sepsis patients with antibiotics administered within 30 min of ED arrival.
- Average time from ED arrival to antibiotic administration.

- Which measure better reflects protocol compliance?
- Which measure better reflects the accomplishments of the improvement team?
Average Time versus Percent Compliance*

January

April

June

August

September

*Simulated data via @Risk

Operational Definition

A procedural description of what to measure and the steps to follow to measure it consistently...

- Gives communicable meaning to a concept
- Tells what you need to count or measure, and how to do it
- Specifies measurement methods and equipment
- Provides guidance on sampling
- Identifies detailed criteria for inclusion and exclusion

... is the basis for consistent, comparable measurement
NQF: Operational Definition Brokers

National Quality Forum
- Convenes working groups to foster quality improvement in both public- and private-sectors
- Endorses consensus standards for performance measurement
- Ensures that consistent, high-quality performance information is publicly available
- Seeks real-time feedback to ensure measures are meaningful and accurate

Diabetes Care Measures (NCQA, NQF endorsed)

Denominator

Example: HbA1c Poor Control (NCQA)

**Percentage of patients 18-75 years of age with diabetes whose most recent HbA1c level during the measurement year is >9.0%**

**Denominator** (chart review method)

“Patients 18-75 years of age as of December 31 of the measurement year who had a diagnosis of diabetes (type 1 or type 2). Two methods are provided to identify patients with diabetes during the measurement year, or the year prior to the measurement year: pharmacy and claim/encounter data…

[details of qualifying Rx, codes]

…office visit claims (see list of codes) or other codified encounter data should be used to identify patients who have had at least one office visit in the prior (12) months from which a purposeful sample … can then be chosen for the denominator. In other uses of the measure, insurer level claims (pooled or single insurer) data can be used to identify the denominator.”

Example: HbA1c Poor Control (NCQA)

**Percentage of patients 18-75 years of age with diabetes whose most recent HbA1c level during the measurement year is >9.0%**

**Numerator** (chart review method)

“The most recent HbA1c level (performed during the measurement year) is >9.0% or is missing or was not done during the measurement year. The patient is not numerator compliant is the result for the most recent HbA1c test during the measurement year is <9.0%. At a minimum, documentation in the medical record must include a note indicating the date on which the HbA1c test was performed and the result. ”
• How useful is this measure for tracking improvement over time?
• How could you modify the definition to improve the measure?

Chat to your neighbor

The Devil is in the Denominator!
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Current Care Measures

Throughput...

...daily care...

...aggregated over a month...

...yields a measure of process reliability ("% conformance")...

...viewed over time.

Population Measures

Throughput = visits...

...with reliable care process...

Population: who’s health are we responsible for?

...have an incremental impact on population.

Algorithm provides criteria for process quality

Current Care Measures

Population Measures
Population ‘Look-Back’ Measures

Percent of diabetes patients with current self-management plan as of most recent visit within the past 12 months.

- Current test
- No current test

Each measurement contains mostly the same patients as the previous month. These measures are slow to show improvement, but reflect the state of care for the population!

“Current Care” Measures

Percent of diabetes patients seen last month who had self-management goals reviewed at the visit.

- Current test
- No current test

Each subgroup contains different patients & represents current work. These measures are great for tracking process changes!
Denominator “Dilution”

- Patients enter a population by birth or immigration, or because they age in.
- They exit by death, emigration, or because they age out.
- That means that different sets of patients are measured at different points in time.
- The denominator includes a mix of patients exposed to an improved process for different lengths of time.
- This is an especially severe issue when measuring outcomes in pediatric populations with narrow age limits.

The faster the turnover, the more severe the problem.

Did We Improve?

- New patients entering the population dilute the population measure with ‘unimproved’ patients.
- These patients have had no exposure to improvement interventions.
- These patients have had full exposure to our improvement interventions.
Cohorts

A cohort measures a group of patients as they move through the population. The impact of the intervention is clearer.

New Patients

HbA1c = 11.0
HbA1c = 9.0
HbA1c = 7.0

11 – Project begins
Cohort Avg = 11.0

11 + 6 months
Cohort Avg = 9.0

11 + 12 months
Cohort Avg = 7.0

Developing Operational Definitions

- Small team: key content expert(s); improvement specialist; project lead; data support
- Iterative process
  - Start with outcomes, key drivers as concepts
  - Clinical protocol is background for percent compliance indicators
  - Identify denominators: what are the OPPORTUNITIES for protocol compliance?
  - Identify numerators: what counts as successful compliance?
  - Use PDSA testing to refine the Measures
- All terms are defined (glossary)
  - Consistent terminology
  - Eliminate ambiguities
### Developing Operational Definitions

#### Formative question: “What behavior are we trying to encourage?”

<table>
<thead>
<tr>
<th>Concept</th>
<th>Measure</th>
<th>Denominator</th>
<th>Numerator</th>
</tr>
</thead>
<tbody>
<tr>
<td>Before</td>
<td>Percent of patients with risk assessed</td>
<td>Percent of 0-5 year old patients with a documented risk assessment by a dental provider</td>
<td>Count of active dental patients with visits in the measurement month. (This measure is aimed at visits for comprehensive (D0130/D0145) or periodic (D0120) exams, so treatment visits can be excluded. If you want to continue to report CRAs done at treatment visits because it is your standard care, please NOT include inclusion of treatment visits, and include counts of CRAs done at treatment visits in the numerator, and treatment visits in the denominator.)</td>
</tr>
<tr>
<td>After</td>
<td>Percent of patients with risk assessed</td>
<td>Percent of patients with dental exams or well-child visits in the measurement month who had caries risk assessed</td>
<td>Count of active dental patients with dental exams or well-child visits in the measurement month. Exclude restorative visits Stratify by dental exam v. well-child visit</td>
</tr>
</tbody>
</table>

Source: First 5 LA Quality Improvement Learning Collaborative

### Glossary of Key Terms

<table>
<thead>
<tr>
<th>Term</th>
<th>Definition</th>
<th>EDR Codes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Active patient</td>
<td>Patients 0 to 72 months (i.e. &lt;2160 days) old with at least 1 dental exam or well child visit in the past 18 months, and carried on the center’s EDR or EMR.</td>
<td></td>
</tr>
<tr>
<td>Caries risk assessment (CRA)</td>
<td>Patients are assessed for risk of caries lesions using a standard caries risk assessment form. The presence of a risk status code for a visit indicates that risk has been assessed.</td>
<td>D0603: High caries risk D0601: Moderate caries risk D0601: Low caries risk</td>
</tr>
<tr>
<td>Dental exam</td>
<td>Oral examination conducted by a dental provider</td>
<td>D01150/D01145: comprehensive exam D01120: Periodic exam</td>
</tr>
<tr>
<td>Measurement month</td>
<td>The month over which measures are calculated. For example, patient visits in the measurement month of April are summarized and reported in May.</td>
<td></td>
</tr>
<tr>
<td>(and Current visit)</td>
<td>In general a patient will have only one dental exam or other visit in a measurement month. If a patient had more than one exam (or other designated visit) in the measurement month, assess only the most recent visit.</td>
<td></td>
</tr>
<tr>
<td></td>
<td>The visit assessed for process or outcome measures during the measurement month is referred to as the “current visit”</td>
<td></td>
</tr>
<tr>
<td>Well child visit</td>
<td>Regular visit with pediatrician</td>
<td>[identify CDT codes]</td>
</tr>
</tbody>
</table>

Source: First 5 LA Quality Improvement Learning Collaborative
CAUTI Reduction Measures

- **Denominators**
  - D1 Count of patients with catheters in situ in measurement month
  - D3, N2 Sum of days with catheters in situ
  - D2 Count of catheters inserted in measurement month

- **Numerator**
  - N1 Count of patients meeting criteria for catheter insertion
  - N4 Count of catheter insertions with all insertion bundle elements in compliance

- **Measures**
  - M1 Percent of patients with appropriate catheter placements
  - M2 Average catheter duration
  - M4 CAUTIs per 1000 patient days
  - M4 (alternate) Catheter days between CAUTI events
  - M5 Percent of catheter insertions with all insertion bundle elements in compliance
  - M6 Percent of catheter insertions with all maintenance bundle elements in compliance

IHI Seminar

- **Advanced Measurement for Improvement**
  - February 4-5
  - San Diego, CA

For details, visit [www.ihi.org](http://www.ihi.org), and search for ‘advanced Measurement training’