What are Health Indicators?

Purpose

- resource for local clinical teams providing a set of robust indicators which they can use as the basis for local quality improvement [measures for improvement]
- source of indicators which can be used to benchmark and compare providers
- Some can be used as targets for performance [measures for judgement] & are often used in the public domain
Integrating the Three Faces of Performance Measurement

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.
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.

The Three Faces of Performance Measurement: Improvement, Accountability, and Research

Leif J. Solberg, MD
Gordon Mosser, MD
Sharon McDonald, RN, PhD
# The Three Faces of Performance Measurement

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Improvement</th>
<th>Accountability</th>
<th>Research</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Aim</strong></td>
<td>Improvement of care</td>
<td>Comparison, choice, reassurance, spur for change</td>
<td>New knowledge</td>
</tr>
<tr>
<td><strong>Methods:</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- Test Observability</td>
<td>Test is 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>“Just enough” data, small sequential samples</td>
<td>Obtain 100% of available, relevant data</td>
<td>“Just in case” data</td>
</tr>
<tr>
<td>- Flexibility of Hypothesis</td>
<td>Hypothesis flexible, changes as learning takes place</td>
<td>No hypothesis</td>
<td>Fixed hypothesis</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>Run charts or Shewhart control charts</td>
<td>No change focus</td>
<td>Hypothesis, statistical tests (t-test, F-test, chi square), p-values</td>
</tr>
<tr>
<td>- Confidentiality of the Data</td>
<td>Data used only by those involved with</td>
<td>Data available for public consumption and review</td>
<td>Research subjects’ identities protected</td>
</tr>
</tbody>
</table>
Data for Improvement

Using Data to understand progress toward the team’s aim

Using Data to answer the questions posed on in the plan for each PDSA cycle
Real Time Data for improvement – Process

<table>
<thead>
<tr>
<th></th>
<th>Patient 1</th>
<th>Patient 2</th>
<th>Patient 3</th>
<th>Patient 4</th>
<th>Patient 5</th>
<th>Total %</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Risk Assessment</strong></td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>x</td>
<td></td>
<td>80%</td>
</tr>
<tr>
<td><strong>Surface</strong></td>
<td></td>
<td>x</td>
<td>x</td>
<td></td>
<td></td>
<td>80%</td>
</tr>
<tr>
<td><strong>Skin Inspection</strong></td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>x</td>
<td>80%</td>
</tr>
<tr>
<td><strong>Keep Moving</strong></td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>x</td>
<td>80%</td>
</tr>
<tr>
<td><strong>Incontinence</strong></td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>√</td>
<td>x</td>
<td>80%</td>
</tr>
<tr>
<td><strong>Nutrition</strong></td>
<td>√</td>
<td>x</td>
<td>x</td>
<td></td>
<td>x</td>
<td>40%</td>
</tr>
<tr>
<td><strong>Compliance / Non-Compliance</strong></td>
<td>🎈</td>
<td>😞</td>
<td>😞</td>
<td>🎈</td>
<td>😞</td>
<td>40%</td>
</tr>
<tr>
<td><strong>Total %</strong></td>
<td>100%</td>
<td>0%</td>
<td>0%</td>
<td>100%</td>
<td>0%</td>
<td>40%</td>
</tr>
</tbody>
</table>
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)
### Assessing Quality Indicators

<table>
<thead>
<tr>
<th>Importance</th>
<th>Potential for Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scientific Acceptability</td>
<td>Reliability and Validity</td>
</tr>
<tr>
<td>Feasibility</td>
<td>Implementation and cost</td>
</tr>
<tr>
<td>Usefulness</td>
<td>Comprehensive</td>
</tr>
</tbody>
</table>

**Having Quality Quality Indicators**
# Indicators of Good Indicators

<table>
<thead>
<tr>
<th>Indicators</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measurable</td>
<td>Can you count it, time it, record it?</td>
</tr>
<tr>
<td>Achievable</td>
<td>Can you actually capture it?</td>
</tr>
<tr>
<td>Interpretable</td>
<td>When you’ve got it, what does it mean?</td>
</tr>
<tr>
<td>Actionable</td>
<td>Can you do something about it?</td>
</tr>
<tr>
<td>Timed</td>
<td>Does your set cover both the short and long term?</td>
</tr>
<tr>
<td>Engaging</td>
<td>Does your set involve all relevant personnel?</td>
</tr>
<tr>
<td>Balanced</td>
<td>Does your set cover the full cycle of events?</td>
</tr>
</tbody>
</table>
Selection of valid indicators

& applicability testing (8 centers, NL)

(feasibility, reliability, opportunity for improvement, case-mix stability)
<table>
<thead>
<tr>
<th>Disease, recommendation</th>
<th>Supporting evidence</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CAP</strong></td>
<td></td>
</tr>
<tr>
<td>No. of recommendations selected</td>
<td></td>
</tr>
<tr>
<td>1. Initiate antibiotic therapy &lt;4 h after presentation</td>
<td>B [22, 38]</td>
</tr>
<tr>
<td>2. Include coverage of <em>Legionella</em> species in empirical antibiotic therapy for severe CAP</td>
<td>B [44–49]</td>
</tr>
<tr>
<td>3. Prescribe empirical antibiotic therapy in adherence with national guidelines</td>
<td>B [27, 30, 39]</td>
</tr>
<tr>
<td>4. Adapt dose and dose interval of antibiotics to renal function</td>
<td>D</td>
</tr>
<tr>
<td>5. Switch from intravenous to oral antibiotic therapy according to existing criteria and clinical stability</td>
<td>B [40, 41]</td>
</tr>
<tr>
<td>6. Change broad-spectrum empirical therapy to pathogen-directed therapy as soon as culture results become available</td>
<td>C [3, 6]</td>
</tr>
<tr>
<td>7. Stop antibiotic therapy if no fever for 3 days</td>
<td>D</td>
</tr>
<tr>
<td>8. Change antibiotic therapy if no clinical improvement within 72 h of initiation</td>
<td>D</td>
</tr>
<tr>
<td>9. Perform Gram stain and culture of a sputum sample</td>
<td>D [3, 6]</td>
</tr>
<tr>
<td>10. Perform culture of 2 blood samples</td>
<td>B [50, 51]</td>
</tr>
<tr>
<td>11. Perform cultures &lt;24 h after presentation</td>
<td>B [22]</td>
</tr>
<tr>
<td>12. Perform blood cultures &lt;24 h after presentation</td>
<td>B [22]</td>
</tr>
<tr>
<td>13. Perform cultures before empirical therapy</td>
<td>B [22]</td>
</tr>
<tr>
<td>14. Perform 2 blood cultures before empirical therapy</td>
<td>B [22]</td>
</tr>
<tr>
<td>15. Perform Gram stain and culture of sputum sample before empirical therapy</td>
<td>D [6]</td>
</tr>
<tr>
<td>16. Perform serological tests for atypical microorganisms on clinical suspicion</td>
<td>D [3, 6]</td>
</tr>
<tr>
<td>17. Perform urine antigen testing against <em>Legionella</em> species on clinical suspicion</td>
<td>B [52]</td>
</tr>
</tbody>
</table>
CLINICAL QUALITY INDICATORS AS PERFORMANCE MEASURES

- Infection management indicators
  
  Community-acquired pneumonia (CAP)
  1. empiric therapy according to local guidelines
  2. blood cultures <24 h (ATS-IDSA’07)
  3. Legionella urinary antigen <24 h (ATS-IDSA’07)

  *S. aureus* bacteremia (SAB)
  1. echocardiography performed within 10 days (community-onset)
  2. all iv catheter removal within 10 days (device in place)
  3. ≥ 10 days appropriate therapy (β-lactams for MSSA only)

IV-PO sequential therapy
for bio-equivalent drugs
S+P=0

• S=Structure
• The environment in which health care is provided
• P=Process
• The method by which health care is provided
• O=Outcome
• The consequence of the health care provided

• Avedis Donabedian Physician
# STRUCTURE INDICATORS

## Top 5 Structure Indicators by Clinical Relevance, Generalisability and Validity

<table>
<thead>
<tr>
<th>Indicator Identifier</th>
<th>Value Ranking Score</th>
<th>Applicability Score</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clinical relevance</td>
<td>Ecological relevance</td>
</tr>
<tr>
<td><strong>Description</strong></td>
<td>0 to 5</td>
<td>0 to 5</td>
</tr>
<tr>
<td><strong>Organisation</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hospital multi-disciplinary antibiotic management team (AMT)</td>
<td>4.5</td>
<td>4.0</td>
</tr>
<tr>
<td>Antimicrobial drug formulary/ list with annual updates</td>
<td>4.3</td>
<td>4.1</td>
</tr>
<tr>
<td><strong>Guidelines</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Annual update of local clinical guidelines for empirical therapy based on review of local resistance data</td>
<td>4.5</td>
<td>4.1</td>
</tr>
<tr>
<td>Local clinical guidelines/guide for surgical antibio-prophylaxis available</td>
<td>4.7</td>
<td>4.2</td>
</tr>
<tr>
<td>guidelines for iv-oral switch available</td>
<td>4.6</td>
<td>3.9</td>
</tr>
</tbody>
</table>

GRI VAP Prevention Bundle Reliability and VAP rate per 1000 ventilator days

**Aim:** > 95% reliability by March 2009

**Ventilator Associated Pneumonia care bundle reliability (%)**

**Ventilator Associated Pneumonia rate per 1000 ventilator days**

- **Median over first 6 months**
- **AIM**

**DG sheet**
- Retesting at DG sheet
- Handling script change
- DG sheet change
- Prompts added

**Last VAP 02/01/2009**

**Annotated Run Chart, Process & Outcome**

ESCMID Online Lecture Library © by author
Do your process measures for accountability pass the “4” key criteria
NEJM 2010; 363.7; 683

1. There is a strong evidence base showing that care processed leads to improved outcomes
2. The measure accurately captures whether the evidence based care process has, in fact, been provided
3. The measure addresses a process that has few intervening care processes that must occur before the improved outcome has been realised
4. Implementing the measure has little or no chance of inducing unintended adverse consequences
What Can We Learn?

1. Test the validity and reliability of the measures and the benefits, harms, and costs of implementation.
2. Does an all-or-none threshold create undue pressure to treat, even when clinically inappropriate?
3. Key end-users must be “at the table” during development and approval of quality metrics.
4. Review the validity, reliability, impact, and costs of measures within 1 to 2 years after implementation.
European Surveillance of Antimicrobial Consumption (ESAC): quality indicators for outpatient antibiotic use in Europe

Samuel Coenen, Matus Ferech, Flora M Haafjer-Ruskamp, Chris C Butler, Robert H Vander Stichele, Theo J M Verheij, Dominique L Mogner, Paul Little, Herman Goossens, the ESAC Project Group

Antibiotic Prescribing Indicators

Process measures

Amount of antibiotic in DDD/100 bed days
- Promoted antibiotic
- Restricted antibiotics

Compliance with acute empiric guidance – documentation in notes and compliance with policy

Compliance with surgical prophylaxis - < 60 min from incision, < 24 hours and compliance with local policy

Compliance with “other bundles” – all or nothing [3 Day antibiotic review bundle, VAP, CAP bundle’s]

Outcome measures [we use trends and time series analysis]

- CDL rates
- SSI rates
- Surveillance of resistance
- Mortality [SMR’s]

Balancing measures

- Mortality
- SSI’s
- Readmissions to hospital within 30 days of discharge
- Admissions to ICU
- Rate of complications
- Treatment related toxicity - e.g aminoglycoside related toxicity
IMPACT OF POLICY CHANGE ON CID AND MORTALITY IN NHS TAYSIDE
Davey et al 2012 : Summary

• Contribution of change in hospital antibiotic policy to decrease in CDI is complex
  – Some change in use preceded change in policy
  – Reduction in 4C antibiotics in primary care from June 2009
• Pre-intervention CDI and ↓CDI greater in medicine:

<table>
<thead>
<tr>
<th></th>
<th>CDI pre-intervention</th>
<th>↓ 4C</th>
<th>↓CDI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Medicine</td>
<td>20 per 1000 admissions</td>
<td>-55%</td>
<td>-92%</td>
</tr>
<tr>
<td>Surgery</td>
<td>5 per 1000 admissions</td>
<td>-79%</td>
<td>-59%</td>
</tr>
</tbody>
</table>

• No change in overall mortality
• No increase, if anything a decrease in mortality for patients who had blood cultures taken, 60% of whom have sepsis
PROCESS MEASURES
WWW.BESTCARE.ORG.ZA

- % achieving hang time < 1 hr
- % cultures done prior to first dose
- % indications (diagnosis) shown at point of care
- % start date visible at point of care
- **Target: 95% reliability**
- – % with 4 or more antibiotics
  – % with double cover
- **Target: 30% decrease**

- - % appropriate de-escalation
- - % appropriate switch IV to PO
- - % with appropriate prophylaxis agent – % with on time (<1 hr) prophylaxis
- - % prescribers responding positively to a survey on receipt or knowledge of selected antibiotic information
- - % prescribers who can state how to secure expertise on pharmacology and antimicrobial spectrum
Discovery Health data from a group of private hospitals
IV Antibiotics < 1 hour - Acute
Royal Alexandra Hospital - Glasgow

% compliance

© by author
NHS Scotland SSP5a
IV Antibiotics within 1 hour - Acute

Average team compliance

2 teams

10 teams
### Unintended Clinical Consequences

#### Mortality

<table>
<thead>
<tr>
<th>Study</th>
<th>Target for prescribing reduction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Christ-Crain 2004</td>
<td>% patients who receive antibiotics</td>
</tr>
<tr>
<td>Christ-Crain 2006</td>
<td>% patients who receive antibiotics</td>
</tr>
<tr>
<td>de Man 2000</td>
<td>Use of target antibiotic</td>
</tr>
<tr>
<td>Fine 2003</td>
<td>Duration of IV antibiotics</td>
</tr>
<tr>
<td>Fraser 1997</td>
<td>Cost of all antibiotics</td>
</tr>
<tr>
<td>Micek 2004</td>
<td>Duration of all antibiotics</td>
</tr>
<tr>
<td>Paul 2006</td>
<td>Inappropriate empirical prescribing</td>
</tr>
<tr>
<td>Singh 2000</td>
<td>Duration of all antibiotics</td>
</tr>
<tr>
<td>Solomon 2001</td>
<td>Duration of IV antibiotics</td>
</tr>
</tbody>
</table>

Total (95% CI): 0.94 [0.82, 1.08]

**Risk ratio for mortality**

- Risk Ratio: M-H, Fixed, 95% CI

- Heterogeneity: p=0.49
- Overall effect, p=0.39
BALANCING MEASURE: AKI after policy change from co-amoxiclav to flucloxacillin + gentamicin in Tayside

ADTC Chair advice to NHS Tayside Senior Management Team
SAPG advice to Boards in NHS Scotland
• Insufficient information to assess relative risks of CDI and AKI
• Most AKI likely to be transient and not severe
• Immediate policy change premature and would damage clinical credibility
• Wait one month for full results but consult on policy change immediately
CHALLENGES IN MEASURING QUANTITY OF USE


- **10 indices of antimicrobial use:**
- Five measurements of consumption (DDD, agent days, antibiotic days, antibiotic courses, and treatment periods) each denominated by two measurements of activity [bed days and finished consultant episodes (FECs)].
- **Agent days:** the number of days that a patient received a particular agent
- **Antibiotic days:** the number of days on which a patient received any antibiotic
- **Antibiotic courses:** any period during which the same agent (regardless of dose or route) was administered to the same patient on consecutive days
- **Treatment periods:** a period of consecutive days on which any AB was administered to a patient
DEVELOPMENT OF QUALITY METRICS FOR ASP’S THROUGH A MODIFIED DELPHI TECHNIQUE
ICHE 2012; 33[3]: 500-506

• ANTIMICROBIAL CONSUMPTION MEASURES
  – Days of therapy per 1000 patient day
ANTIMICROBIAL RESISTANCE MEASURES
  - No of patients with specific drug resistant organism/total number of patients admitted to ward/unit

• PATIENT OUTCOME MEASURES
  – Mortality related to AR pathogens
  – Conservable days of therapy among CAP.SSTI,BSI & sepsis
  – Unplanned hospital readmission within 30 days after hospital discharge

ACCOUNTABILITY MEASURES/PUBLIC REPORTING

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

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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.

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Indicators for improvement and scrutiny [targets]

From intermittent antibiotic point prevalence surveys to quality improvement: experience in Scottish hospitals

William Malcolm¹, Dilip Nathwani², Peter Davey³, Tracey Cromwell⁴, Andrea Patton⁵, Jacqueline Reilly¹, Shona Cairns¹ and Marion Bennie⁴,⁶

Abstract

Background: In 2008, the Scottish Antimicrobial Prescribing Group (SAPG) was established to coordinate a national antimicrobial stewardship programme. In 2009 SAPG led participation in a European point prevalence survey (PPS) of hospital antibiotic use. We describe how SAPG used this baseline PPS as the foundation for implementation of
CDI HEAT Target
(Health, Efficiency & Access to Treatment)

• 30% reduction in CDI rate by March 2011 (target ↑ to 50%, June 2012).

• SAPG asked to develop prescribing indicators to support target.

Empirical prescribing: compliant with the local antimicrobial policy and indication recorded in case note in ≥ 95% of sampled cases

Surgical antibiotic prophylaxis: compliant with local antimicrobial prescribing policy and duration <24 hours in ≥ 95% of sampled cases

Primary Care empirical prescribing: seasonal variation in quinolone use (winter months vs. summer months) is ≤ 5%
DATA COLLECTION, REPORTING, FEEDBACK AND ACTION

• DATA COLLECTION
[principle of “collect once use frequently”]
– MINIMUM ~ 20 NOTES PER WEEK REVIEW FOR EMPIRIC USE
– ONE DAY WEEK
– PHARMACIST/DOCTOR
– Surgical prophylaxis collected by theatre team as part of surgical check list

– DATA FEEDBACK IN REAL TIME AND MONTHLY MEETING; VERBAL AND WRITTEN FEEDBACK
– DISCUSSION OF POOR COMPLIANCE AND REPORT ACTION BACK TO ACTION

– SUSTAINED IMPROVEMENT [6 or more consecutive points above 95% compliance] CAN LEAD TO LESS FREQUENT COLLECTION AND OPTION CHOOSE OTHER AREA [REWARD/INCENTIVE]
SAPG: NATIONAL HOSPITAL PRESCRIBING INDICATOR COMPLIANCE

- Median 4.3% increase in compliance (IQR 0.5% to 16%)

- **A&F is more effective when combined with**
  - Explicit targets and an action plan

- In addition,
  - the target was prescribing
  - the source was a supervisor or colleague
  - it was provided more than once
  - it was delivered in both verbal and written formats

**Courtesy of Susan Michie**

- Department of Psychology, UCL
FEEDBACK INTERVENTIONAL AND CONTROL THEORY OF BEHAVIOUR CHANGE


- Ivers N, Jamtvedt G, Flottorp S, Young JM, Odgaard-Jensen J, French
QUALITY INDICATORS SUMMARY

S+P=0

- S = Structure
- The environment in which health care is provided
- P = Process
- The method by which health care is provided
- O = Outcome
- The consequence of the health care provided

- Avedis Donabedian Physician
**Primary Drivers**
- Timely and appropriate initiation of AB
- Appropriate administration and de-escalation
- Data monitoring, transparency and stewardship infrastructure
- Availability of expertise at the point of care

**Secondary Drivers**
- Promptly identify pts who need Rx
  - Hang time < 1 hr
  - Avoid multiple Rx
  - Obtain cultures before Rx
  - Bug-drug match
  - IV to PO switch
  - Start/stop date & Dx visible
  - Monitor toxicity
  - Monitor resistance
  - Monitor AB utilisation

**Change Ideas**
- Antibiotics available
- Protocols
- Prescription form
- Monthly reports
- Family of measures
- MDT rounds
- Educational rounds
- Guidelines
- Hotline

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