Metrics in antibiotic stewardship: structure, process and outcomes

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IQ Healthcare, Radboudumc
Importance of metrics?

• Quality assurance; monitor the effect of an (Antibiotic Stewardship) intervention

• Continual improvement in clinical care (PDSA)

• Comparisons
  – Intrahospital (units, services)
  – Interhospital (benchmarking)

• Justify cost of antimicrobial stewardship programs (ASPs)
Quality of antibiotic use

What defines ‘appropriate antibiotic use’? and how can you measure it?
Is Quality measurable?
Quality is measurable!
Quality of hospital care: measurable?
What do I want to measure?

Definition Quality Indicator:

A measurable element of practice performance for which there is evidence or consensus that it can be used to assess the quality, and hence change the quality of care provided ...

Lawrence, 1997
What do I want to measure?

• Different types of indicators
  – process
  – outcome
  – structure

• Use is dependent on stakeholder: doctors, Health Care Insurance and Inspectorate, patient organisations etc (QI project, performance, control, ...)

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What do I want to measure?

• 1. Validity
  – Scientific evidence
  – Consensus
  – Systematic procedure

• 2. Validity not enough: indicator should be applicable in practice
  – Feasibility
  – Reliability
  – Opportunity for improvement
  – Case-mix stability

How to develop QI’s?
How to develop QI’s?

What do I want to measure?

Preselection of possible Quality indicators

- Existing (inter)national guidelines

- Existing (inter)national QI/Accreditation organisations (JCAHO; AHRO; IHI)

- Literature (systematic approach)
What do I want to measure?

• Evidence based medicine: QI with very strong relation between process and outcome should be selected (Grade A)

• Determine what relevant outcome is relevant for you?
  – Patient health benefit (e.g. mortality, morbidity)
  – Cost-effectiveness
  – Reducing antimicrobial resistance
  – Improving patient satisfaction...
What do I want to measure?

- Expert consensus procedure
  - no GOBSAT!
  - RAND Delphi procedure, etc.

- General recommendations:
  - include all stakeholders, patient group if possible
  - adding indicators is possible
  - use max. two validation rounds
  - use consensus meeting with min. 8-12 experts
  - prioritize through a “top 10”
Development of QI in CAP

1. National Guidelines for CAP and AECB
   - 4 reviewers
   - Select key recommendations from national guidelines

2. International Guidelines (IDSA, ATS, ERS, ETS)
   - Select indicators recommended in guidelines and the literature
   - 11 CAP (6) AECB (5)

3. Literature Review (see Box 1)
   - 4 CAP (4)

- Potential Indicators CAP (10) AECB (5)

4. Evidence Base?
   - Grade A
   - Grade B, C or D
   - Expert Consensus procedure

5. Indicator excluded
   - Contradictory evidence

6. Basic set CAP (12) AECB (7)
   - Indicators (0)

Schouten, *Clin Infect Dis*, 2005
Development of “Quality Indicators”: determining validity

First round
- 9 point Likert scale
- accepted if > 70% agreement on one of the relevant criteria (patient outcome, antimicrobial resistance, cost)
- rejected if > 70% disagreement on all three relevant criteria

Consensus discussion

Second round
- accepted if > 70% agreement on one of the relevant outcomes
- prioritize in top 10
Table 1. Rating and adding procedure for the development of quality indicators for antibiotic use in lower respiratory tract infection.

<table>
<thead>
<tr>
<th>Disease, recommendation</th>
<th>Supporting evidence</th>
<th>Selection round</th>
<th>First round</th>
<th>Second round</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of recommendations selected</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Initiate antibiotic therapy &lt;4 h after presentation</td>
<td>B [22, 38]</td>
<td>Selected</td>
<td>4</td>
<td></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>
<td>Selected</td>
<td>8</td>
<td>Rejected</td>
</tr>
<tr>
<td>3. Prescribe empirical antibiotic therapy in adherence with national guidelines</td>
<td>B [27, 30, 39]</td>
<td>Selected</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>4. Adapt dose and dose interval of antibiotics to renal function</td>
<td>D</td>
<td>Added</td>
<td>8</td>
<td>Selected</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>
<td>No decision</td>
<td>4</td>
<td>Selected</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>
<td>Selected</td>
<td>8</td>
<td></td>
</tr>
<tr>
<td>7. Stop antibiotic therapy if no fever for 3 days</td>
<td>D</td>
<td>Added</td>
<td>4</td>
<td>Selected</td>
</tr>
<tr>
<td>8. Change antibiotic therapy if no clinical improvement within 72 h of initiation</td>
<td>D</td>
<td>Added</td>
<td>8</td>
<td>Selected</td>
</tr>
<tr>
<td>9. Perform Gram stain and culture of a sputum sample</td>
<td>D [3, 6]</td>
<td>Selected</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>10. Perform culture of 2 blood samples</td>
<td>B [50, 51]</td>
<td>No decision</td>
<td>8</td>
<td>Selected</td>
</tr>
<tr>
<td>11. Perform cultures &lt;24 h after presentation</td>
<td>B [22]</td>
<td>Modified from rec. 12</td>
<td>8</td>
<td>Rejected</td>
</tr>
<tr>
<td>12. Perform blood cultures &lt;24 h after presentation</td>
<td>B [22]</td>
<td>Modified from recs. 14 and 15</td>
<td>8</td>
<td>Rejected</td>
</tr>
<tr>
<td>13. Perform cultures before empirical therapy</td>
<td>B [22]</td>
<td>Changed to recs. 14 and 15</td>
<td>8</td>
<td>Selected</td>
</tr>
<tr>
<td>14. Perform 2 blood cultures before empirical therapy</td>
<td>B [22]</td>
<td>Modified from rec. 13</td>
<td>8</td>
<td>Selected</td>
</tr>
<tr>
<td>16. Perform serological tests for atypical microorganisms on clinical suspicion</td>
<td>D [3, 6]</td>
<td>No decision</td>
<td>8</td>
<td>Rejected</td>
</tr>
<tr>
<td>17. Perform urine antigen testing against <em>Legionella</em> species on clinical suspicion</td>
<td>B [52]</td>
<td>Added</td>
<td>8</td>
<td>Selected</td>
</tr>
</tbody>
</table>
Development of QI in CAP

• Validity is not enough

• QI’s should also be applicable in practice
  – feasibility
  – opportunity for improvement
  – reliability
  – case-mix stability

• Needs practice test
Development of QI in CAP

• Feasibility
  – Percentage of missing values per indicator (max. 25%)

• Potential room for Quality Improvement
  – Percentage > 85% with little variation
Development of QI in CAP

- Reliability
  - Percentage of agreement between two reviewers (kappa)

- Case-mix stability
  - Distribution of indicator outcome according to age, severity of illness (e.g. Pneumonia Severity Index)

- Factor analysis
<table>
<thead>
<tr>
<th>Indicator</th>
<th>Feasibility, % of patients with missing values</th>
<th>Opportunity for improvement (% range)</th>
<th>Inter-observer reliability, $\kappa$</th>
<th>Case-mix correction</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescribe empirical therapy adherent to national guidelines</td>
<td>0.7</td>
<td>45 (5-59)</td>
<td>0.7</td>
<td>No</td>
</tr>
<tr>
<td>Initiate antibiotic therapy within 4 hours after presentation</td>
<td>21$^b$</td>
<td>68 (35-87)</td>
<td>0.5</td>
<td>No</td>
</tr>
<tr>
<td>Adapt dose and dosing interval of antibiotics to renal function</td>
<td>17$^a$</td>
<td>77 (40-100)</td>
<td>1</td>
<td>Yes$^c$</td>
</tr>
<tr>
<td>Switch from intravenous to oral antibiotic therapy according to existing criteria and clinical stability</td>
<td>5</td>
<td>81 (35-93)</td>
<td>0.7</td>
<td>No</td>
</tr>
<tr>
<td>Change broad-spectrum empirical to pathogen-directed therapy as soon as culture results become available</td>
<td>8</td>
<td>80 (50-100)</td>
<td>0.7</td>
<td>No</td>
</tr>
<tr>
<td>Change antibiotic therapy if no clinical improvement occurs within 72 hours after initiation</td>
<td>100$^b$</td>
<td>NA$^d$</td>
<td>NA$^d$</td>
<td>NA$^d$</td>
</tr>
<tr>
<td>Stop antibiotic therapy three days after defervescence</td>
<td>18$^b$</td>
<td>11 (2-32)</td>
<td>1</td>
<td>No</td>
</tr>
<tr>
<td>Perform Gram stain and culture of a sputum sample</td>
<td>0</td>
<td>54 (20-63)</td>
<td>1</td>
<td>Yes$^e$</td>
</tr>
<tr>
<td>Performance culture of 2 blood samples</td>
<td>0</td>
<td>57 (48-67)</td>
<td>0.6</td>
<td>Yes$^c$</td>
</tr>
<tr>
<td>Perform Gram stain and culture of a sputum sample before empirical therapy</td>
<td>75$^b$</td>
<td>24 (0-100)</td>
<td>0.8</td>
<td>NA</td>
</tr>
<tr>
<td>Perform culture of 2 blood samples before empirical therapy</td>
<td>55$^b$</td>
<td>85 (70-100)</td>
<td>0.8</td>
<td>NA</td>
</tr>
<tr>
<td>Perform a urine antigen test against Legionella species on clinical suspicion</td>
<td>0</td>
<td>84 (67-100)</td>
<td>ND$^e$</td>
<td>No</td>
</tr>
</tbody>
</table>
Indicators (0) → Basic set CAP (12) AECB (7) → Use for QI project

- Indicator excluded CAP (3)
  - Indicator excluded AECB (1)
  - Feasibility
    - Yes
  - Reliability (kappa)
    - Yes
    - Room for Improvement
      - Yes
      - Factor analysis
        - Yes
        - Final set for QI Project
          - CAP (9) AECB (6)

America;
Development of QI

- Use a systematic procedure: invest time and effort
- Include all potential stakeholders
- Include a practice test before implementation
- Measurability can be induced!
- Watch out for “adverse effects” of the use of indicators:
  - focus reduced to QI performance only
  - top charts and data mongering
Table 1. Performance levels of quality indicators for antibiotic use in CAP

<table>
<thead>
<tr>
<th>Quality indicator</th>
<th>Adherence (median, %)</th>
<th>Range (eight hospitals, %)</th>
<th>Supporting evidence^b</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Timely initiation of antibiotic therapy (within 4 h after presentation)</td>
<td>68</td>
<td>36–87</td>
<td>B</td>
</tr>
<tr>
<td>2. Empirical antibiotic regimen according to national guidelines</td>
<td>45</td>
<td>5–59</td>
<td>B</td>
</tr>
<tr>
<td>3. Adapting dose and dose interval of antibiotics to renal function</td>
<td>74</td>
<td>40–100</td>
<td>D</td>
</tr>
<tr>
<td>4. Switching from iv to oral therapy, according to existing criteria and when clinically stable</td>
<td>81</td>
<td>35–93</td>
<td>B</td>
</tr>
<tr>
<td>5. Changing broad-spectrum empirical into pathogen-directed therapy (streamlining therapy)</td>
<td>30</td>
<td>50–100</td>
<td>C</td>
</tr>
<tr>
<td>6. Stopping antibiotic therapy after three consecutive days of defervesence^a</td>
<td>11</td>
<td>2–32</td>
<td>D</td>
</tr>
<tr>
<td>7. Taking two sets of blood samples for culture</td>
<td>57</td>
<td>48–67</td>
<td>B</td>
</tr>
<tr>
<td>8. Obtaining sputum samples for Gram stain and culture</td>
<td>54</td>
<td>24–100</td>
<td>D</td>
</tr>
<tr>
<td>9. Urine antigen testing against <em>Legionella</em> spp. upon clinical suspicion</td>
<td>84</td>
<td>67–100</td>
<td>B</td>
</tr>
</tbody>
</table>

^a Three days of defervesence is considered to be seven days without fever.

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### Process Indicators for antibiotic use in UTI’s

<table>
<thead>
<tr>
<th>Quality indicator (scores at department level)</th>
<th>Median % (percentiles 10-90)</th>
<th>Range (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Perform a urine culture</td>
<td>77 (52 - 87)</td>
<td>28 – 93</td>
</tr>
<tr>
<td>Prescribe empirical therapy conform the national guideline</td>
<td>68 (56 – 84)</td>
<td>38 – 87</td>
</tr>
<tr>
<td>Prescribe empirical therapy conform the local guideline</td>
<td>51 (11 – 83)</td>
<td>3 – 87</td>
</tr>
<tr>
<td>Switch from intravenous to oral therapy after 48-72 h on the basis of the clinical condition</td>
<td>52 (22 – 85)</td>
<td>15 – 86</td>
</tr>
<tr>
<td>Change empirical therapy to pathogen-directed therapy when culture results become available</td>
<td>77 (63 – 91)</td>
<td>35 – 100</td>
</tr>
<tr>
<td>Duration of antibiotic therapy should be at least 10 days (conform the national guideline)</td>
<td>52 (30 – 76)</td>
<td>14 – 87</td>
</tr>
<tr>
<td>Duration of antibiotic therapy should be conform the local guideline</td>
<td>41 (22 – 80)</td>
<td>15 – 90</td>
</tr>
<tr>
<td>Treat UTI in men as complicated UTI (conform the national guideline)</td>
<td>26 (12 – 46)</td>
<td>5 – 51</td>
</tr>
<tr>
<td>Treat UTI in men in accordance with the local guideline</td>
<td>31 (9 – 57)</td>
<td>2 – 71</td>
</tr>
</tbody>
</table>
Generic process indicators for antibiotic use in hospitals

1. Perform 2 blood cultures before starting AB treatment
2. Perform cultures from suspected sites of infection
3. Prescribe empirical therapy according to the local guideline
4. Adapt antibiotic dosage to renal function
5. Document antibiotic plan in case notes
6. Tailor antibiotic treatment on the basis of culture result
7. Switch from intravenous to oral treatment < 72 hours
8. Therapeutic drug monitoring (aminoglycosides and vancomycin)
9. De-escalation of antibiotic therapy
10. Current antibiotic booklet must be present in every hospital
11. Local guideline should correspond to the national guideline

Van den Bosch, *abstract IDSA, 2013*
<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt;</td>
<td>the clinical rational for antibiotic start should be documented in the medical chart at the start of therapy</td>
</tr>
<tr>
<td></td>
<td>appropriate microbiological culture according to local and/or international guidelines should be collected</td>
</tr>
<tr>
<td></td>
<td>the choice of empirical antibiotic therapy should be performed according to local guidelines</td>
</tr>
<tr>
<td>2&lt;sup&gt;nd&lt;/sup&gt;</td>
<td>review of the diagnosis based on newly acquired microbiological cultures</td>
</tr>
<tr>
<td></td>
<td>de-escalation therapy (the narrowest spectrum as possible) according to available microbiological results</td>
</tr>
<tr>
<td>3&lt;sup&gt;rd&lt;/sup&gt;-5&lt;sup&gt;th&lt;/sup&gt;</td>
<td>review of the diagnosis based on newly acquired microbiological cultures</td>
</tr>
<tr>
<td></td>
<td>de-escalation therapy (the narrowest spectrum as possible) according to available microbiological results</td>
</tr>
<tr>
<td></td>
<td>interruption of treatment should be considered according to local and/or international guidelines</td>
</tr>
</tbody>
</table>
Flowchart for appropriate antibiotic use
Process indicators for stewardship

• Pro’s
  – measured close to the patient: often no case mix problems
  – relevant insights for quality improvement

• Cons
  – difficult / expensive /time consuming to measure
  – improvement of the process does not always lead to better outcome

• Proxy’s may be a solution (e.g. i.v. to oral switch)
Process indicators for stewardship

Sprong, abstract ECCMID, 2012
Process indicators for stewardship

% infection specialist consultation

- 2007
- 2011

Sprong, abstract *ECCMID*, 2012
My optimal strategy for metrics in a local project

- Perform a Point Prevalence Study once a year

- Perform day to day automated proxy process measurements based on electronic prescribing (e.g. % empirical antibiotic therapy > 5 days or % restricted antibiotics) in an antibiotic vigilance system

- Only “dive deep” in problem area’s (e.g. Gyssens flowchart, process indicators, audit)

- Use outcome indicators (DDD’s; resistance patterns, etc.) for feedback on regular base e.g. once per (half) year
Over to Dilip!
“In God we trust. All others bring data.”

W. E. Deming
QUALITY INDICATORS
FOCUS ON STRUCTURE, OUTCOMES AND IMPLEMENTATION

Dilip Nathwani
Ninewells Hospital and Medical School
Dundee, UK
VISION, GOALS, DRIVERS  ...............COUNTRY WIDE ROAD-SHOW

AIM

- Timely and appropriate antimicrobial use in all health and care settings
- Improved clinical outcomes for patients with infections
- Decreased incidence of antimicrobial-related adverse drug events (ADEs)
- Decreased prevalence of antimicrobial resistant healthcare-associated pathogens
- Decreased incidence of healthcare-associated Clostridium difficile infection (CDI)
- Improved cost-effective use of antimicrobials

PRIMARY DRIVERS

- Timely and appropriate initiation of antimicrobial treatment
- Appropriate administration and de-escalation
- Stewardship infrastructure, data monitoring and staff education
- Availability of expertise at the point of care

SECONDARY DRIVERS

- Promptly identify patients who require antibiotics and in patients with sepsis syndrome start treatment within one hour
- Obtain cultures prior to starting antibiotics
- Do not give antibiotics with overlapping activity or combinations not supported by evidence or guideline
- Determine and verify antibiotic allergies and tailor therapy accordingly
- Consider local antibiotic susceptibility patterns in selecting therapy
- Start treatment promptly following local guidelines
- Specify expected duration of therapy based on evidence and national and local guidelines
- Make antibiotics patient is receiving and start dates visible at point of care
- Give antibiotics at the right dose and interval
- Stop or de-escalate therapy promptly based on culture and sensitivity results; consider role of biomarker
- Ensure therapeutic drug monitoring and dosage adjustment is carried out reliably
- Reconcile and adjust antibiotics at all transitions and changes in patient’s condition
- Consider need for use of IV route throughout the patient’s episode of treatment; consider IVOST
- Monitor for toxicity reliably and adjust agent and/or dose promptly when required
- Establish stewardship as an organisational priority and identify accountability
- Ensure local structures for antimicrobial stewardship and links to management, infection prevention and control and patient safety are in place
- Monitor, feedback, and make visible data regarding antibiotic utilisation, antibiotic resistance, ADEs, CIs and cost, and adherence to the organisation’s recommended microbiology and prescribing practices
- Ensure national and local education programmes on antimicrobial stewardship meet the training needs of health and care staff and promote patient and public awareness about use of antimicrobials
- Develop and make available multi-professional expertise in antimicrobial use
- Ensure expertise is available at the point of care across all health and care settings

Based on the CDC/IHI Antimicrobial stewardship Driver Diagram [http://www.cdc.gov/getsman/healthcare/pdfs/Antibiotic_Stewardship_Driver_Diagram_10_30_12.pdf]
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.

Performance Measures and Measurement

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

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

**Aspect** | **Improvement** | **Accountability** | **Research**
--- | --- | --- | ---
**Aim** | Improvement of care | Comparison, choice, reassurance, spur for change | New knowledge

**Methods:**

- **Test Observability**
  - Test is observable

- **Bias**
  - Accept consistent bias

- **Sample Size**
  - “Just enough” data, small sequential samples

- **Flexibility of Hypothesis**
  - Hypothesis flexible, changes as learning takes place

- **Testing Strategy**
  - Sequential tests

- **Determining if a Change is an Improvement**
  - Run charts or Shewhart control charts

- **Confidentiality of the Data**
  - Data used only by those involved with improvement

- **New knowledge**
  - No hypothesis
  - One large test
  - Hypothesis, statistical tests (t-test, F-test, chi square), p-values
  - Research subjects’ identities protected

---

*"The Three Faces of Performance Measurement: Improvement, Accountability and Research"*  
Lief Solberg, Gordon Mosser and Sharon McDonald  
*Journal on Quality Improvement* vol. 23, no. 3, (March 1997), 135-147.
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.
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
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

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>AB committee ≥ 3 meetings/year</td>
<td>+136%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Prescription</td>
<td></td>
<td>+175%</td>
<td></td>
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<tr>
<td>Pharmaceutical analysis</td>
<td></td>
<td></td>
<td>+112%</td>
<td></td>
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<tr>
<td>AB advisor</td>
<td></td>
<td></td>
<td></td>
<td>+141%</td>
<td></td>
</tr>
<tr>
<td>AB multidisciplinary team</td>
<td></td>
<td></td>
<td>+190%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ability to quantify AB advisor time</td>
<td></td>
<td></td>
<td></td>
<td>+19%</td>
<td></td>
</tr>
<tr>
<td>Ability to quantify pharmacist time</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+19%</td>
</tr>
<tr>
<td>Prescription with stop-order</td>
<td></td>
<td></td>
<td></td>
<td>+23%</td>
<td></td>
</tr>
<tr>
<td>Approval by AB advisor</td>
<td></td>
<td></td>
<td></td>
<td>+250%</td>
<td></td>
</tr>
<tr>
<td>Guidelines for first-line treatment</td>
<td></td>
<td></td>
<td></td>
<td>+57%</td>
<td></td>
</tr>
<tr>
<td>Educative/persuasive actions</td>
<td></td>
<td></td>
<td></td>
<td>+69%</td>
<td></td>
</tr>
<tr>
<td>Practice audits</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+14%</td>
</tr>
<tr>
<td>Audit with feedback to prescribers</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>+123%</td>
</tr>
<tr>
<td>Education in the two previous years</td>
<td></td>
<td></td>
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</table>


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Consultation Draft: Clinical Care Standard for Antimicrobial Stewardship

December 2013
Clinical Care Standard for Antimicrobial Stewardship

1. A patient requiring urgent treatment for a life-threatening condition due to a suspected bacterial infection receives antibiotic treatment without waiting for the results of microbiology tests.

2. A patient has samples taken for microbiology testing when clinically indicated and before starting antibiotic treatment whenever possible.

3. A patient with a suspected bacterial infection, and/or their carer, receives information on their condition and treatment options, which may or may not include antibiotic therapy.

4. When a patient is prescribed antibiotics, this is done in accordance with the current version of *Therapeutic Guidelines: Antibiotic* or guidelines based on local bacterial susceptibility patterns, taking into consideration a patient’s allergies and other clinical factors.

5. If antibiotics are prescribed, information about when, how and for how long to take them, as well as potential side effects and a review plan, is discussed with a patient and/or their carer.

6. When a patient is prescribed antibiotics, the clinical reason, drug name, dose, route of administration, intended duration and review plan is documented in their medical record.

7. A patient who is treated with a broad-spectrum antibiotic is reviewed and, where indicated, switched to treatment with a narrow-spectrum antibiotic as indicated by microbiology test results.

8. If microbiology tests are conducted to identify a suspected bacterial infection, the responsible clinician reviews these results in a timely manner (usually within 48–72 hours) and the patient’s antibiotic therapy is modified accordingly.

9. A patient receives surgical prophylactic antibiotics in accordance with the latest version of *Therapeutic Guidelines: Antibiotic* or guidelines based on local bacterial susceptibility patterns.

Appendix 2 – Suggested indicators

Health services need to be aware of how well the treatment they provide matches the Clinical Standards. Monitoring of the performance of the clinical services provided by an organisation is part of the National Safety and Quality Health Service (NSQHS) Standards, particularly Standards 5-9 on Governance for Safety and Quality.

Organisations are likely to already have mechanisms in place that monitor the care provided. However, if additional measures are needed, then following indicators are suggested.

The detailed specifications for these indicators are provided in *Indicator Specification: Consult and Draft Clinical Care Standard for Antimicrobial Stewardship*. This supporting documentation can be accessed at [http://www.safetyandquality.gov.au](http://www.safetyandquality.gov.au).

**Quality statement 1 – Life-threatening conditions**

- CCS.AMS.1a: Median time from triage in emergency department to the first dose of antibiotic for patients with suspected bacterial meningitis, or for patients requiring admission to an intensive care unit (ICU) for suspected sepsis.

**Quality statement 2 – Microbiological testing**

- No suggested indicators for this quality statement have been identified.

**Quality statement 3 – Information on treatment options**

- No suggested indicators for this quality statement have been identified. However, patient experience surveys in many cases address the issue of informed consent, and may be used as measures towards this statement.

**Quality statement 4 – Use of guidelines**

- CCS.AMS.4a: Proportion of antibiotic prescriptions that are in accordance with guidelines.
- CCS.AMS.4b: Rate of antibiotic allergy mismatch in prescribing.

**Quality statement 5 – Taking antibiotics as prescribed**

- No indicators were identified for this quality statement. However, patient experience surveys in many cases include questions on whether patients felt that their care was adequately explained and discussed.

**Quality statement 6 – Documentation**

- CCS.AMS.6a: Rate of documentation of clinical reason (or indication) for prescribing an antibiotic.

**Quality statement 7 – Use of broad-spectrum antibiotics**

- CCS.AMS.7/8a: Proportion of patient prescriptions of broad-spectrum antibiotics for which a medical review is documented within 48–72 hours from first prescription.

**Quality statement 8 – Review of treatment**

- As for quality statement 7.
Structure indicators for stewardship

<table>
<thead>
<tr>
<th>Governance and management</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Does your facility have a formally defined antimicrobial stewardship programme for assuring appropriate antimicrobial use?</td>
</tr>
<tr>
<td>2. Does your facility have a formal reporting structure responsible for antimicrobial stewardship (e.g. a multidisciplinary committee focused on appropriate antimicrobial use, pharmacy committee, patient safety committee or other relevant structure)?</td>
</tr>
<tr>
<td>3. Does your facility have a named senior executive officer with accountability for antimicrobial leadership?</td>
</tr>
<tr>
<td>4. Has an annual report focused on antimicrobial stewardship (summary antimicrobial use and/or practices improvement initiatives) been produced for your facility in the past year?</td>
</tr>
<tr>
<td>5. Is there any budgeted financial support for antimicrobial stewardship activities at your facility (e.g., support for salary, training, or IT support)?</td>
</tr>
</tbody>
</table>
### Outcome indicators for stewardship

<table>
<thead>
<tr>
<th>Domain</th>
<th>Metric</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consumption</strong></td>
<td>Expenditures</td>
<td>Dollars spent from purchased, dispensed or administered data</td>
</tr>
<tr>
<td></td>
<td>Grams</td>
<td>Grams used from purchased, dispensed or administered data</td>
</tr>
<tr>
<td></td>
<td>Defined Daily Doses (DDD)</td>
<td>Grams used (as above) divided by WHO** approved DDD values</td>
</tr>
<tr>
<td></td>
<td>Days Of Therapy (DOT)</td>
<td>Number of days that patient receives at least one dose of an antibiotic summed for each antibiotic</td>
</tr>
<tr>
<td></td>
<td>Length of Therapy (LOT)</td>
<td>Number of days that patient receives therapy regardless of number of different drugs or doses</td>
</tr>
</tbody>
</table>
| **Patient Outcomes**  | Health care associated infections | -% of patients with infection  
- ASP intervention/acceptance rates |
| **Resistance**        | Antibiotic resistant organisms | -% of patients with resistant organism(s)  
- Antibiogram |

* Collected for defined population, over specified time, standardized to 100 or 1000 patient-days
** World Health Organization (see references)
Outcome indicators for stewardship

• Quantity of antibiotic use (DDD’s or DOT’s): total vs different classes

• Cost-effectiveness

• Measures of antimicrobial resistance (e.g. C. difficile)

• Patient outcome (mortality, clinical cure, length of stay)

• Side effects, toxicity [unintended consequence]
Appropriate antibiotic use for patients with urinary tract infections reduces length of hospital stay

Veroniek Spoorenb erg1,*, Marlies E.J.L. Hulscher2, Reinier P. Akkermans3, Jan M. Prins1 and Suzanne E. Geerlings1

Table 3. Associations between quality indicators and ICU admission* and in-hospital mortality

<table>
<thead>
<tr>
<th>Quality Indicator</th>
<th>ICU Admission*</th>
<th>P-value</th>
<th>In-hospital Mortality</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urine culture</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=1,247</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urine culture</td>
<td>34 (3.4)</td>
<td>0.06</td>
<td>23 (2.5)</td>
<td>0.77</td>
</tr>
<tr>
<td>No urine culture</td>
<td>2 (0.8)</td>
<td></td>
<td>7 (2.8)</td>
<td></td>
</tr>
<tr>
<td>Guideline adherence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=1,164</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Guideline adherence</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Local</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=980</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Early iv-oral switch</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N=343</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Fulfilling criteria of safe switch and iv-oral switch &lt; 72 h (n=293)</td>
<td>1 (0.5)</td>
<td>0.06</td>
<td>2 (0.7)</td>
<td>0.93</td>
</tr>
<tr>
<td>Fulfilling criteria of safe switch and no iv-oral switch &lt; 72 h (n=245)</td>
<td>7 (2.8)</td>
<td>2 (0.8)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tailored antibiotic treatment</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=831</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final treatment culture-guided and as tailored as possible (n=610)</td>
<td>22 (3.6)</td>
<td>0.59</td>
<td>16 (1.6)</td>
<td>0.98</td>
</tr>
<tr>
<td>Final treatment not culture-guided and as tailored as possible (n=241)</td>
<td>7 (2.9)</td>
<td></td>
<td>5 (2.1)</td>
<td></td>
</tr>
</tbody>
</table>

*ICU admission after initial admission to Internal Medicine or Urology ward
**missing data on ICU admission and in-hospital mortality in 3 patients
Data adjusted for age, urological comorbidity, other comorbidity and febrile UTI

Table 2. Associations between quality indicators and LOS

<table>
<thead>
<tr>
<th>Quality Indicator</th>
<th>Length of hospital stay (LOS), days mean (SD)</th>
<th>P-value</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urine culture</td>
<td>Urine culture (n=1,001)</td>
<td>8.1 (8.2)</td>
<td>0.23</td>
</tr>
<tr>
<td>n=1,248</td>
<td>No urine culture (n=247)</td>
<td>7.4 (7.9)</td>
<td></td>
</tr>
<tr>
<td>Guideline adherence</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>National</td>
<td>Empirical therapy in accordance with national guideline (n=763)</td>
<td>7.6 (7.3)</td>
<td>0.13</td>
</tr>
<tr>
<td>n=1,165</td>
<td>Empirical therapy not according to national guideline (n=402)</td>
<td>8.5 (9.7)</td>
<td></td>
</tr>
<tr>
<td>Local</td>
<td>Empirical therapy in accordance with local guideline (n=455)</td>
<td>7.3 (5.9)</td>
<td>0.004</td>
</tr>
<tr>
<td>n=982</td>
<td>Empirical therapy not according to local guideline (n=527)</td>
<td>8.7 (9.6)</td>
<td></td>
</tr>
<tr>
<td>Early iv-oral switch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>N=547</td>
<td>Fulfilling criteria of safe switch and iv-oral switch &lt; 72 h (n=294)</td>
<td>4.8 (2.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Fulfilling criteria of safe switch and no iv-oral switch &lt; 72 h (n=248)</td>
<td>9.1 (7.7)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tailored antibiotic treatment</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>n=830</td>
<td>Final treatment culture-guided and as tailored as possible (n=609)</td>
<td>8.7 (9.1)</td>
<td>0.60</td>
</tr>
<tr>
<td>Final treatment not culture-guided and as tailored as possible (n=241)</td>
<td>9.0 (9.4)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Variables in bold are associated with shorter LOS

a Data not adjusted for possible confounding variables
b Data adjusted for age, gender, urological comorbidity, other comorbidity, febrile UTI and ICU admission-24h
BALANCING MEASURES: UNINTENDED HARM
TAYSIDE 30DAY MEDICAL AND SURGICAL MORTALITY

MEDICAL ADMISSION
Ninewells AMAU Admissions

Surgery
Policy change

30D FROM ADMISSION

Ninewells AMAU Death Rate (%)

© by author

ESCMID Online Lecture Library
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
### Outcome indicators for stewardship

<table>
<thead>
<tr>
<th>Consumption Metrics</th>
<th>Key Advantages</th>
<th>Key Disadvantages</th>
</tr>
</thead>
</table>
| **Expenditures**    | - Purchase data easy to obtain  
                      - Easily understood by administrators | - Purchase data least accurate  
                      - Affected by changes in costs, formulary |
| **Grams**           | - Purchase data easy to obtain  
                      - Not affected by price changes  
                      - Can be used to calculate DDD | - Purchase data least accurate |
| **Defined Daily Doses (DDD)** | - Easy to obtain  
                      - Benchmark between hospitals, regions, countries | - DDD values (WHO defined*) may not reflect typical doses and may change over time  
                      - Affected by formulary composition  
                      - Accuracy in pediatric, renal populations |
| **Days Of Therapy (DOT)** | - More accurate than DDD  
                      - Recommended by CDC**, NHSN** and Canadian Delphi Panel*** | - Difficult to obtain  
                      - Favours those who use broad spectrum monotherapy  
                      - Accuracy in renal population |
| **Length of Therapy (LOT)** | - Most reflective of treatment duration  
                      - DOT/LOT proxy for combination versus monotherapy | - Cannot be used to compare use of specific drugs |

* World Health Organization (see references)  
** Centers for Disease Control and Prevention, US National Healthcare Safety Network  
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
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 are 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.
Every man dies, not every man really lives.
NATIONAL CDI HEAT Target
(Health, Efficiency & Access to Treatment)

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

Now revised to: 0.39 cases or less per 1,000 total occupied bed days. SAPG prescribing indicators to support target.

Empirical prescribing: compliant with the local antimicrobial policy and indication recorded in case note in ≥ 95% of sampled cases
  • April 2011 revised to providing information and action about non-compliance

Surgical antibiotic prophylaxis: compliant with local antimicrobial prescribing policy and duration <24 hours in ≥ 95% of sampled cases
  • April 2011 - colorectal surgery

Primary Care empirical prescribing: seasonal variation in quinolone use (winter months vs. summer months) is ≤ 5%: to remain
  • Potential additional “Stand Alone Target” of “best in class” reduction in items of antibiotic prescriptions
# Quality indicators for antibiotic consumption in the community (primary care sector) in Europe 2011

<table>
<thead>
<tr>
<th>Country</th>
<th>Consumption</th>
<th>Relative consumption</th>
<th>Broad/narrow</th>
<th>Seasonal variation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>J01*</td>
<td>J01C</td>
<td>J01D</td>
<td>J01F</td>
</tr>
<tr>
<td>Austria</td>
<td>14.47</td>
<td>6.50</td>
<td>1.65</td>
<td>3.38</td>
</tr>
<tr>
<td>Belgium</td>
<td>29.03</td>
<td>16.55</td>
<td>1.52</td>
<td>3.18</td>
</tr>
<tr>
<td>Bulgaria</td>
<td>19.47</td>
<td>8.42</td>
<td>2.56</td>
<td>3.27</td>
</tr>
<tr>
<td>Croatia</td>
<td>31.99</td>
<td>15.41</td>
<td>6.07</td>
<td>3.11</td>
</tr>
<tr>
<td>Cyprus**</td>
<td>18.50</td>
<td>8.11</td>
<td>1.51</td>
<td>3.64</td>
</tr>
<tr>
<td>Czech Republic</td>
<td>17.44</td>
<td>10.88</td>
<td>0.05</td>
<td>2.66</td>
</tr>
<tr>
<td>Denmark</td>
<td>12.07</td>
<td>4.57</td>
<td>0.98</td>
<td>2.47</td>
</tr>
<tr>
<td>Estonia</td>
<td>20.06</td>
<td>6.63</td>
<td>2.36</td>
<td>1.82</td>
</tr>
<tr>
<td>Finland</td>
<td>28.72</td>
<td>15.53</td>
<td>2.55</td>
<td>3.84</td>
</tr>
<tr>
<td>France</td>
<td>14.14</td>
<td>3.91</td>
<td>2.72</td>
<td>2.29</td>
</tr>
<tr>
<td>Germany</td>
<td>35.14</td>
<td>12.20</td>
<td>7.60</td>
<td>9.38</td>
</tr>
<tr>
<td>Greece**</td>
<td>14.75</td>
<td>6.74</td>
<td>1.95</td>
<td>2.65</td>
</tr>
<tr>
<td>Hungary</td>
<td>22.27</td>
<td>12.10</td>
<td>0.63</td>
<td>1.58</td>
</tr>
<tr>
<td>Iceland**</td>
<td>22.65</td>
<td>12.22</td>
<td>1.21</td>
<td>4.17</td>
</tr>
<tr>
<td>Ireland</td>
<td>28.21</td>
<td>15.60</td>
<td>2.53</td>
<td>4.98</td>
</tr>
</tbody>
</table>

* J01*: Total consumption of antibiotics
* J01C*: Consumption of oral antibiotics
* J01D*: Consumption of intramuscular antibiotics
* J01F*: Consumption of intravenous antibiotics
* J01M*: Consumption of parenteral antibiotics

**Note:** The above table represents the quality indicators for antibiotic consumption in the community (primary care sector) in Europe 2011. The indicators include consumption, relative consumption, broad/narrow spectrum, and seasonal variation.
Seasonal variation in quinolones
2008/9, 2009/10, 2010/11 [-4/10 to 3/12]
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]
- CDI 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
SECONDARY CARE 4C ANTIBIOTIC USE

Antibacterials Dispensed in Secondary Care (Four C Groups)

Antibacterials Dispensed in Secondary Care (Four C's)
Impact of NHS Tayside’s 2009 Primary Care Antibiotic Policy Change on Prescribing of 4C Antibiotics by Age
Davey P et al 2012
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
National reduction in “4C” antibacterials in primary care

Target antibacterials:
1. Cephalosporins
2. Ciprofloxacin
3. Clindamycin
4. Co-amoxiclav

Data from Scottish Antimicrobial Prescribing Group Primary Care Prescribing Indicators reports, 2010 and 2012-13
Continuing fall in the incidence of CDI
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.
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 checklist

- 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]
DATA COMMUNICATION
FEEDBACK & ACTION
2012 theory-based Cochrane review of Audit & Feedback

Ivers et al 2012 Courtesy of Susan Michie UCL

- 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
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
The measurement of time to first antibiotic dose for pneumonia in the emergency department: A white paper and position statement prepared for the American Academy of Emergency Medicine

Jesse M. Pines, MD, MBA, MScE.†‡ Joshua A. Isserman, MS,* and Patrick B. Hinfey, MD§

*Department of Emergency Medicine and †Center for Clinical Epidemiology and Biostatistics, University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania; ‡Leonard Davis Institute for Health Economics, University of Pennsylvania, Philadelphia, Pennsylvania, and §Beth Israel Medical Center, Newark, New Jersey
Reprint Address: Jesse M. Pines, MD, MBA, MScE, Department of Emergency Medicine, University of Pennsylvania School of Medicine, 3400 Spruce Street, Ground Floor, Philadelphia, PA 19104

In the absence of convincing data that suggest that the measurement of TFAD has a positive effect on patients with pneumonia, and with an increasing number of reports suggesting that the measurement of TFAD is associated with antibiotic overuse, it is difficult to support the continued measurement of TFAD in the ED as a quality measure. The 2007 American Thoracic Society/Infectious Disease Society of America guidelines have withdrawn their support for TFAD measurement in favor of the recommendation to give antibiotics in the ED once a diagnosis of pneumonia is established (17).
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.
Well Known but Often Ignored

(1) tunnel vision;
(2) suboptimization;
(3) myopia;
(4) measure fixation;
(5) misrepresentation;
(6) misinterpretation;
(7) gaming;
(8) ossification.

ON THE UNINTENDED CONSEQUENCES OF PUBLISHING PERFORMANCE DATA IN THE PUBLIC SECTOR

Peter Smith
Department of Economics and Related Studies
University of York
Unintended consequences

Serum Creatinine

Orthopaedic Surgery

Local Hospital Medicines Database

SCI STORE

SMR01

Local Prescribing

Post-operative Kidney Acute Injury, all patients, unadjusted analysis - pre vs. last post-operative creatinine measurement (NHS Tayside, Peter Davey)
CONCLUSIONS

- Measurement of antibiotic prescribing quality are key to measuring change ["so what"]
- PPS can be national or local and can be adapted to give a "point in time" landscape of prescribing quality
- PPS can inform the need for indicators to address specific problems
- Process and outcomes indicators can be a powerful measures for antimicrobial stewardship organisations
- They can be used for scrutiny [performance targets] but importantly can be used for improvement locally
- Balancing measures are crucial for reassurance and clinical engagement