Quality Indicators for Antibiotic Prescribing

Dilip Nathwani
What are Health Indicators? (1)

With the goal of good health in mind, think of an indicator as

“...a measure that helps quantify the achievement of a goal.”

-Mark Friedman
INFECTION QUALITY INDICATORS AS PERFORMANCE MEASURES

• Prescribing indicators
  - ESAC [Outpatient]
  - SAPG [Hospital-Compliance ans Surgical Prophylaxis]
  - JCHAO [Hospital]
  - MEDICARE
  - Australian Stewardship Programme
    - patients undergoing specified surgical procedures that receive an appropriate prophylactic antibiotic regimen
    - prescriptions for restricted antibiotics that are concordant with drug and therapeutics committee approved criteria
    - patients with a toxic or subtherapeutic aminoglycoside concentration whose dosage has been adjusted or reviewed prior to the next aminoglycoside dose
    - patients presenting with community acquired pneumonia that are prescribed guideline concordant antimicrobial therapy

• 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
Strategies for Improving Antimicrobial Use and the Role of Antimicrobial Stewardship Programs

Table 2: National Performance Trends From the Medicare National Pneumonia Project [2]

<table>
<thead>
<tr>
<th>Measure</th>
<th>1998</th>
<th>2005</th>
<th>2009 (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patients</td>
<td>24,920</td>
<td>71,424</td>
<td></td>
</tr>
<tr>
<td>Antimicrobial treatment within 4 hours</td>
<td>56.9%</td>
<td>99.8%</td>
<td>94.1% (6 h)</td>
</tr>
<tr>
<td>Antimicrobial selection</td>
<td>--</td>
<td>--</td>
<td>91.4%</td>
</tr>
<tr>
<td>Blood culture</td>
<td>61.2%</td>
<td>78.6%</td>
<td>94.2%</td>
</tr>
<tr>
<td>G2 assessment</td>
<td>90.1%</td>
<td>90.9%</td>
<td>Refined</td>
</tr>
<tr>
<td>Pneumonia vaccination</td>
<td>7.7%</td>
<td>51.3%</td>
<td>91.4%</td>
</tr>
<tr>
<td>Influenza vaccination</td>
<td>9.7%</td>
<td>41.2%</td>
<td>93.4%</td>
</tr>
</tbody>
</table>

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 Haaijer-Ruskamp, Chris C Butler, Robert H Vander Stichele, Theo J M Verheij, Dominique L Monnet, Paul Little, Herman Goossens, the ESAC Project Group

Antibiotic 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
Policies and Guidance

- Surveillance of antimicrobial use and resistance Guidance for AMTs June 2010
- SAPG Antimicrobial Supporting Indicators Report Final National Report May 2010
- ESAC report final 060510
- Microsoft Word - Guidance to Optimise Antimicrobial use and Reduce Clostridium difficile Associated disease in Scottish Hospitals
- Clinical Governance Symposium Poster
- Procedure for development and governance of new projects
- Gentamicin Calculator 110210
- Vancomycin Calculator 080110
- Scottish Antimicrobial Prescribing Group – Year 1 Annual Report
- Chief Executive Letter to Boards regarding roles and responsibilities related to HAI, including infection control policies, procedures and antimicrobial prescribing
- The Scottish Management of Antimicrobial Resistance action Plan 2008
- Antimicrobial Prescribing Policy and Practice in Scotland: Recommendations for Good Antimicrobial Practice in Acute Hospitals 2005
- Minimum Requirements for Antimicrobial Prescribing
- SAPG Guidance on Surgical Prophylaxis
- Summary of Guidance on Antibiotics for the treatment of infection in the diabetic foot
- Use of Antibiotics in people with diabetic foot disease - Consensus Statement
- BTS Guideline for the Management of Community Acquired Pneumonia in Adults - Update 2009
- SAPG Guidance on gentamicin and vancomycin policies revised
- Good Practice Guidance on Ratification of Antimicrobial Policies
- Prudent Antimicrobial use - respiratory
Public Awareness: Problems in the UK in 2005

Lethal bug is costing NHS £160m a year - and is spreading at a phenomenal rate

Tories demand inquiry into fatal bug outbreak

The Independent 8th-10th June 2005
Where were we: hospital Prescribing

National Point Prevalence Study 2009 (ESAC-3)

Scottish data

- 31 hospitals (8732 patients-76% of all acute beds)
- 27.8% patients on antimicrobials
- 50.5% given intravenously
- 76.1% reason recorded in case notes
- 57.9% compliant with local guidelines
- 30.3% surgical prophylaxis more than one day

• some room for improvement
Indication in the Notes

- Intensive care
- Medicine
- Surgery
- Other
Compliant with Antibiotic Policy

- Intensive care
- Medicine
- Surgery
- Other

Legend:
- Compliant
- No information available
- Not assessable
- Not compliant
Antimicrobials Prescribed

![Graph showing proportion of total antimicrobials prescribed by different countries and regions.](image-url)
Duration of Surgical Prophylaxis

![Bar chart showing the percentage of different surgical procedures requiring prophylaxis for more than 1 day, 1 day, or a single dose.](chart.png)
AMBITION: TO MOVE FROM MEDIOCRITY TO SUCCESS
WHAT MADE A DIFFERENCE:

5 CRITICAL HIGH IMPACT INTERVENTIONS

• NATIONAL AWARENESS & PROFILE [PUBLIC AND POLITICIANS & MEDIA]
• FUNDING FOR ANTIMICROBIAL PHARMACISTS TO SUPPORT ANTIMICROBIAL MANAGEMENT TEAMS
• MANDATORY EDUCATIONAL REQUIREMENTS
• SYSTEM TO MEASURE CONSUMPTION AND LINK TO UNIFORM SURVEILLANCE SYSTEM
• PERFORMANCE and IMPROVEMENT MEASURES [INDICATORS] WITH SENIOR CLINICAL LEADERSHIP ACCOUNTABILITY AND ENGAGEMENT – AN ORGANISATIONAL PRIORITY
CHANGE STRATEGIES

• How to break the balance between Drivers and Resisting forces?

• 2 Basic approaches:
  – **PUSH** = increase reasons to change; restrictive policy, external scrutiny [Inspection], performance accountability [Targets],
  – **PULL** = decrease reasons to resist [guidance, engagement of AMTs and clinical teams, education, measures for improvement with feedback, organisational and clinical leadership, systems changes]
NHS Tayside Antibiotic Man
for Hospital Inpatients,
October 2008

**Promoted:**
- Amoxicillin
- Co-trimoxazole
- Doxycycline
- Flucloxacillin
- Gentamicin

**Restricted**
- Cephalosporins
- Ciprofloxacin
- Clarithromycin
- Co-amoxiclav
- Moxifloxacin

---

**GENTAMICIN**

<table>
<thead>
<tr>
<th>Normal Duration of Gentamicin Therapy Should Not Exceed 2-3 Days</th>
</tr>
</thead>
</table>
| See separate guidance for information on calculating dose and monitoring levels.
| Monitor renal function daily. |

**VANCOCIN**

| See separate guidance for information on calculating dose and monitoring levels. |

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**CNS:**

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dosage</th>
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<td>Amoxicillin</td>
<td>2g bd</td>
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**ENT:**

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We are increasingly realising 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

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<th>Research</th>
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<td>New knowledge</td>
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<td>No test, evaluate current performance</td>
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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

• DATA COLLECTION
  [principle of “collect once use frequently”]
  – MINIMUM ~ 20 NOTES PER WEEK REVIEW FOR EMPIRIC USE
  – ONE DAY WEEK
  – PHARMACIST/DOCTOR
  – DATA FEEDBACK IN REAL TIME AND MONTHLY MEETING
  – DISCUSSION OF POOR COMPLIANCE AND REPORT ACTION BACK TO ACTION

• DATA REPORTING
  – REPORTING ON WARD RUN CHART
  – LOCAL AMG
  – NATIONAL SAPG THROUGH EXTRA-NET
  – M&M meetingd
  – Conference/web-ex calls
National Compliance: Empiric Treatment

**National Data: Indication Documented**

- Median % Compliance
- X-axis: Apr-11 to Dec-11
- Y-axis: 80 to 100
- Lines for Medical Admissions, Surgical Admissions, and Target

**National Data: Antibiotic Choice Compliant with Policy**

- Median % Compliance
- X-axis: Apr-11 to Dec-11
- Y-axis: 80 to 100
- Lines for Medical Admissions, Surgical Admissions, and Target
Results – Surgical prophylaxis

- Clinical engagement challenging
- Data collected in 10/15 NHS boards covering 7 surgical specialties
- Compliance with policy and duration <24 hours 90%
- In 2011, plan to focus on colorectal surgery
A Surgical Safety Checklist to Reduce Morbidity and Mortality in a Global Population

PATIENT SAFETY CHECKLIST (PERI-OPERATIVE)

Date: Site: SRI Consultant: WARD

Please attach Patient Addressograph Label here:

Reception section

Theatre No.

GLYCEMIC CONTROL Is patient DIABETIC?
If yes, document HbA1c in SAA/Ward/DSU prior to theatre

If yes, document BM before Knife to Skin

NORMOTHERMIA
Document patients temperature on admission to department/reception

BETA BLOCKER USE Please check sticker & ask anaesthetist to confirm
(a) Is patient on Beta Blockers
(b) Did pt have Beta Blocker pre-operative?

Does patient require TEDS? If so, are they insitu?

OPERATIVE PROCEDURE

Surgical Briefing undertaken prior to commencement of theatre list?

Surgical Pause undertaken using FV WHO Checklist?

Knife To Skin Time: 24hrs

NORMOTHERMIA
Please circle if used intra-operatively: Full Bairhugger Torso Upperbody Fluid Warmer

ANTIBIOTIC PROPHYLAXIS
(a) Does Patient require ANTIBIOTIC prophylaxis
(b) Time Administered: 24hrs
(c) Name of Antibiotic given:

(d) Is this type of antibiotic as per guideline?
(e) Was there a clinical reason the guideline was not adhered to?
National Compliance: colorectal surgical Prophylaxis

Graph 1: National Data (Elective Colorectal) Single Dose

Graph 2: National Data (Elective Colorectal) Antibiotic Choice Compliant with Policy

© by author
NHS Scotland: use of high risk antibacterials in secondary care* DDD/1000/day 2008-2010.

*10 boards, covering 58% Scottish population

4C antibacterials in 2010
30.7% lower than 2008
Cephalosporins ↓ 54%
Co-amoxiclav ↓ 27%
Fluoroquinolones ↓ 26%
Clindamycin ↓ 13%
Seasonal variation in quinolones
2008/9, 2009/10, 2010/11 [-4/10 to 3/12]

Quinolone DDDs per 1000 Patients Seasonal Variation

ESCMID Online Lecture Library © by author
## NHS Scotland: key national primary care prescribing indicators 2008 - 2010

<table>
<thead>
<tr>
<th></th>
<th>Items/1000/day</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2008</td>
</tr>
<tr>
<td>Antibacterials associated with a higher risk of CDI (co-amoxiclav, fluoroquinolones, cephalosporins, clindamycin)</td>
<td>0.41</td>
</tr>
<tr>
<td>SAPG recommended antibacterials (amoxicillin, clarithromycin, doxycycline, erythromycin, flucloxacillin, phenoxymethylpenicillin, nitrofurantoin, trimethoprim)</td>
<td>1.45</td>
</tr>
</tbody>
</table>
Use of antibacterials in primary care in UK countries from 2008-2010, items/1000/day, % change previous year

**BENCHMARKING**

<table>
<thead>
<tr>
<th></th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2008-2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scotland</td>
<td>2.18</td>
<td>2.13 (-1.6%)</td>
<td>2.09 (-1.9%)</td>
<td>-0.07 (-3.4%)</td>
</tr>
<tr>
<td>England</td>
<td>1.85</td>
<td>1.85 (-1.2%)</td>
<td>1.90 (3.1%)</td>
<td>0.03 (1.8%)</td>
</tr>
<tr>
<td>Northern Ireland</td>
<td>2.92</td>
<td>2.74 (-6.1%)</td>
<td>2.84 (3.7%)</td>
<td>-0.08 (-2.7%)</td>
</tr>
<tr>
<td>Wales</td>
<td>2.25</td>
<td>2.22 (-0.9%)</td>
<td>2.30 (3.3%)</td>
<td>0.05 (2.4%)</td>
</tr>
</tbody>
</table>
# The Three Faces of Performance Measurement

“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.

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Impact of Antimicrobial Stewardship –

“Measurement for improvement is not focused on judging whether data meet a compliance threshold or target but rather is a means of determining whether the changes we make to improve are effective and to what degree.”

The Model for Improvement

‘This model is not magic, but it is probably the most useful single framework I have encountered in twenty years of my own work on quality improvement’

Dr Donald M. Berwick
Former Administrator of the Centres for Medicare & Medicaid Services
Professor of Paediatrics and Health Care Policy at the Harvard Medical School
Run chart

Graph of data over time
Track performance
Display & identify variation
Continued enthusiasm and innovation of the frontline teams.
RESULTS

Vascular Surgery (Ward 12)

NHS Tayside
GWO5 - Days between a C. difficile associated disease occurrence 1 - Ward 12, Ninewells Hospital

207 days since last event (today 11/1/2010)
Time Series Analysis, NHS Tayside

- Identify high risk antibiotics
- Change Antibiotic Policy

Cases of C difficile infection

- Red: C difficile cases
- Green: Model

2006 - 2009
International Forum on Quality & Safety, April 5th 2011

- Strong relationship between variation in antibiotic use and variation in *C difficile* infections

- Strong support for antibiotic policies that minimise the use of broad spectrum penicillins (co-amoxiclav, cephalosporins and fluoroquinolones)

FIGURE 6. Overall quarterly CDI rates for Scotland (per 1000 total OCBDs) for sixteen quarters of mandatory surveillance covering the period October 2006-September 2010.
The Original Hippocratic Oath

- “I will prescribe regimens for the good of my patients according to my ability and my judgment and never do harm to anyone”

A 12th-century Byzantine manuscript of the Oath.
UNINTENDED CONSEQUENCES OF STEWARDSHIP INTERVENTIONS: the need for balancing measures

- RESISTANCE DUE TO NARROW “PROTOCOL” DRIVEN SELECTION PRESSURE
- INCREASED AMINOGLYCOSIDE TOXICITY [TREATMENT AND FROM PROPHYLAXIS]
- INCREASED SURGICAL SITE INFECTION [SSI]
- WORSENING CLINICAL OUTCOMES [COMPLICATIONS, ICU referrals, READMISSIONS]
- MORTALITY
MORTALITY, SSI, RESISTANCE

<table>
<thead>
<tr>
<th></th>
<th>Number of Joints</th>
<th>Superficial Infection %</th>
<th>Deep Infection %</th>
<th>All Infections %</th>
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</thead>
<tbody>
<tr>
<td>Oct 07-Jun 09</td>
<td>1252</td>
<td>1.29</td>
<td>1.05</td>
<td>2.34</td>
</tr>
<tr>
<td>Jul 09 – Mar 11</td>
<td>1219</td>
<td>1.61</td>
<td>0.52</td>
<td>2.13</td>
</tr>
<tr>
<td>P value</td>
<td></td>
<td>0.69</td>
<td>0.049</td>
<td>0.56</td>
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</tr>
<tr>
<td>Jul 09 – Mar 11</td>
<td>0.92</td>
<td>0.25</td>
<td>1.17</td>
</tr>
<tr>
<td>P value</td>
<td>0.17</td>
<td>0.029</td>
<td></td>
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</table>
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 JUDGEMENT] BUT IMPORTANTLY CAN BE USED FOR IMPROVEMENT
- BALANCING MEASURES ARE CRUCIAL