Antimicrobial Stewardship
Metrics and Evaluation
Introduction

• “In order to improve antimicrobial use we must be able to measure it”

• Identify the measurables that can be used to evaluate outcomes of antimicrobial stewardship

Berrington A. J Antimicrob Chemother 2010;65:163
Importance of Metrics

• Quality assurance
  • Continual improvement in clinical care

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

• Justify cost of antimicrobial stewardship programs (ASPs)
Challenges of Measurement

- Establishing a baseline to enable trending over time
- Establishing uniform definitions, data collection methods, information systems to enable meaningful comparisons

Examples:
- Antibiotics vs. antifungals vs. antivirals
- Treatment and/or surgical prophylaxis
- Adults and/or pediatrics
- Purchased vs. dispensed vs. administered data
Challenges of Measurement

- Varying patient volumes, severity of illness, formularies, resource availability
  - Common denominator, such as 100 or 1000 patient-days, is necessary to control for differences in census
- Unknown which metric is “best” and/or linked to antibiotic associated risks such as resistance or *C. difficile*
Selecting Your Metrics

• Know your audience and their focus
  • Administrators (financial)
  • Medical staff (patient outcomes)

• Know your goals
  • Short and long term: antimicrobial consumption, patient outcomes
  • Long term: resistance

• Know your information systems, databases and resources
Metrics Options

• No single best metric
  • Select more than one metric

• Choose from 3 domains
  • Antimicrobial consumption measures
  • Patient outcome measures
  • Antimicrobial resistance measures

• Whichever you choose, measure them reliably and consistently over time
# Metrics Options

<table>
<thead>
<tr>
<th>Domain</th>
<th>Metric</th>
<th>Description*</th>
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</thead>
<tbody>
<tr>
<td>Consumption</td>
<td>Expenditures</td>
<td>-Dollars spent from purchased, dispensed or administered data</td>
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<tr>
<td></td>
<td>Grams</td>
<td>-Grams used from purchased, dispensed or administered data</td>
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<tr>
<td></td>
<td>Defined Daily Doses (DDD)</td>
<td>-Grams used (as above) divided by WHO** approved DDD values</td>
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<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>
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<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>
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<tr>
<td>Patient Outcomes</td>
<td>Health care associated infections</td>
<td>-rate of infections (e.g. <em>C. difficile</em> infection, MRSA and VRE bacteremia)</td>
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<td></td>
<td></td>
<td>-ASP intervention/acceptance rates</td>
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<td>Resistance</td>
<td>Antibiotic resistant organisms</td>
<td>-% of patients with resistant organism(s)</td>
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<td></td>
<td>-Antibiogram</td>
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</tbody>
</table>

* Collected for defined population, over specified time, standardized to 100 or 1000 patient-days

** World Health Organization (see references)

www.oahpp.ca
# Metrics Options

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

* World Health Organization (see references)
** Centers for Disease Control and Prevention, US National Healthcare Safety Network
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Example Calculations

• DDD

Rx: levofloxacin 750mg po daily X 7 days
= (0.75g dose / 0.5g DDD*) X 7 days
= 1.5 DDD X 7 days
= 10.5 DDD

Example Calculations

• DOT

Rx: ciprofloxacin 500mg po q12h +
    vancomycin 1g IV q12h +
    metronidazole 500mg po q8h X 7 days

= 1 DOT for each drug X 3 drugs X 7 days
= 3 DOT X 7 days
= 21 DOT
Example Calculations

• LOT

Rx: ciprofloxacin 500mg po q12h +
    vancomycin 1g IV q12h +
    metronidazole 500mg po q8h X 7 days

= 1 LOT for all 3 drugs X 7 days
= 1 LOT X 7 days
= 7 LOT

• DOT/LOT

21 DOT / 7 LOT = 3
(ratio > 1 usually identifies combination therapy)
• More detailed information on metrics is available in the “Metrics and Evaluation Table”

• For general information on developing and implementing an antimicrobial stewardship program visit the PHO Antimicrobial stewardship webpage
References