Challenges and opportunities for rapidly advancing reporting and improving inpatient antibiotic use in the U.S.

Overview of benchmarking Antibiotic Use

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**Learning Objectives**

- To apply effective behavior change and quality improvement strategies to impact organizational culture and processes towards optimizing antimicrobial stewardship efforts.

- To interpret national regulatory changes for antimicrobial stewardship that will likely result from the President’s recent executive order to combat antibiotic resistant bacteria.
The Measurement Challenge

- You can’t improve what you can’t measure.
- You can’t measure what you can’t define.
What Do We Need to Measure?

- High level antibiotic use at the regional and national level?
- Antibiotic use at the individual facility and unit level?
- Antibiotic use at the prescriber level?
- The quality of antibiotic use at the facility and/or provider level?
What Do We Need to Measure?

- All of the above.
CDC Approach to Measurement for Stewardship

- CDC pursuing antibiotic use measurement on several fronts.
- The unifying theme is “data for action”.
  - Existing proprietary data of sample of hospitals (national)
  - Customized periodic assessments of records from a sample of hospitals (CDC’s EIP program)
  - Standard reporting by facilities (CDC’s NHSN)
Useful National Assessments

- Big picture assessment of overall antibiotic use can answer some important questions:
  - Are there regional differences in use?
  - What is the overall use of antibiotics in US hospitals?
  - What agents are being used in US hospitals?
Existing Proprietary Data

- CDC is working with MarketScan data.
- Antibiotic use (doses dispensed) from about 300 US hospitals.
About ½ of all hospitalized patients receive an antibiotic
Key Prevalence Survey Results, 2011: Antimicrobial Use

- 50% of patients were on antimicrobials at the time of the survey
- Of patients getting antimicrobials, half were getting ≥2
- Few differences in treatment given to patients in/outside of ICUs, for community and healthcare infections

Antimicrobial Drug Use Prevalence and Distribution

- 5635 patients on Antimicrobial Drugs (AD) (50%, 95% CI 49 to 51%)

Antimicrobial Treatment

Everything else (79 other drugs), 55%

Vanco, ceftriaxone, pip/tazo, levofloxacin, 45%

**What were patients with active infections being treated for?**

<table>
<thead>
<tr>
<th>Clinician-Defined Therapeutic Site*</th>
<th>Patients (N=4278) No. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lower respiratory infection</td>
<td>1480 (36)</td>
</tr>
<tr>
<td>Urinary tract infection</td>
<td>955 (22)</td>
</tr>
<tr>
<td>Skin and soft tissue infection</td>
<td>688 (16)</td>
</tr>
<tr>
<td>Gastrointestinal infection</td>
<td>537 (13)</td>
</tr>
<tr>
<td>Undetermined infection site (empiric therapy)</td>
<td>364 (9)</td>
</tr>
<tr>
<td>Bloodstream infection</td>
<td>401 (9)</td>
</tr>
<tr>
<td>Intraabdominal infection</td>
<td>178 (4)</td>
</tr>
<tr>
<td>Ears, eyes, nose, throat, mouth infection</td>
<td>183 (4)</td>
</tr>
<tr>
<td>All other sites</td>
<td>287 (7)</td>
</tr>
</tbody>
</table>

*Patients could be receiving ADs to treat more than one therapeutic site.

Preliminary data, subject to change.
Antimicrobial Use Take-Home Messages, 2011 Survey

- Lots of antimicrobials are being used in acute care hospitals—and mostly broad spectrum drugs and drugs used to treat resistant pathogens
  - Even in patients who are not in the intensive care unit and patients who do not have HAIs

- Survey data suggest high impact areas for national stewardship efforts
  - Addressing treatment for lower respiratory, urinary tract, and skin and soft tissue infections, and use of 4 specific drugs (vancomycin, pip/tazo, ceftriaxone and levofloxacin)—covers about 50% of all antimicrobial use in hospitals.
Assessing “Appropriate” Antibiotic Use

- If our ultimate goal is to improve antibiotic use, we need some way to measure that.
- It can be very hard to determine if antibiotic use is “appropriate” or not.
  - Mostly done as part of research studies where they have ID clinicians review charts.
- We want something that would be more broadly applicable.
Assessing Appropriate Antibiotic Use

- CDC developed and refined forms that could be used by any clinician to assess the appropriateness of antibiotic use
- Focused on a few conditions:
  - Community acquired pneumonia
  - Urinary tract infection
  - Use of agents for resistant gram positives
  - General antibiotic use
Assessing Appropriate Antibiotic Use

- Modified versions of these appropriate use assessment forms were used by EIP for a pilot assessment of antibiotic use in patients who were part of the 2011 prevalence survey.
Appropriate Use Assessment, EIP ABX Use and HAI Prevalence Survey, 36 Hospitals in EIP, 2011

- Of 296 reviews, 37% of the time prescribing could potentially have been improved (39.6% for UTI, 35.7% for vancomycin)
- Improvement opportunities mostly included better use of diagnostic testing
Facility Level Measurement- What’s Needed

- Data that will allow facilities to monitor their use and the impact of their interventions.
  - Unit specific data on use available in real time
- Data that would allow for risk adjusted benchmarking of antibiotic use
  - Power of comparisons
NHSN Antibiotic Use Module

- Launched Jan 2014
- Is one part of the “Antibiotic Use and Resistance” or AUR module.
- The “Antibiotic Resistance” component was launched in Jan 2015.
AU Option – Data That Facilities Report

- Monthly summary-level data—numerators and denominators—are required for all 4 of the following location categories (if applicable to facility):
  1. Critical care - All medical critical care units and surgical critical care units
  2. Ward - All medical wards and all surgical wards
  3. Specialty care area - At least one specialty care area
  4. Facility-wide – All inpatient locations

- Numerator: Antimicrobial days (days of therapy)
  - 86 antimicrobials collected – includes antibacterial, antifungal, and anti-influenza agents
    - Agents are sub-stratified by route of administration: intravenous (IV), intramuscular (IM), digestive (oral), and respiratory (inhaled)

- Denominators:
  - Days Present - number of patients present for any portion of each day of a calendar month in specific unit or in any inpatient location (facility-wide)
  - Admissions - number of patients admitted to the facility (facility-wide calculation only)
Facilities Submitting Data

- 63 facilities have submitted at least 1 month of data
  - 38 facilities submitting on a regular basis (within the last 3 months)
  - Facility types include general acute care facilities, critical access hospitals, children’s hospitals, and an oncology hospital
  - From 7 states: AZ, CA, ID, IL, MI, TX, UT
  - Using 4 vendors & ‘homegrown’ systems

- Working with additional groups to continue to grow submission during 2015
Quarterly AU Data Submissions to NHSN - Current and Projected as of February 2015
Strengths of the AU Module

- Data submission is totally electronic.
- It uses the NHSN platform, which is now used by almost every acute care hospital in the country (and almost all dialysis facilities).
Challenges with the AU Module

- Data submission is totally electronic.
  - Requires both electronic medication administration system AND integration of data from ADT systems.
  - Requires vendors process data to produce standard format (CDA)

- We’re not there yet.
Challenges with the AU Module

- Limited number of pharmacy systems are currently configured to send data to NHSN.
  - More slowly coming online

- Vendors are charging facilities to make the connection to AU.

- Connecting to AU also requires local IT support.

- Connecting to AU is generally not a high priority for facilities, so resources are not available.
Would Charge Data be Sufficient?
Current Uses of AU Module Data

- Facilities can “monitor” use in real time.
- We can begin to describe some of the variability in antibiotic use across facilities.
Preliminary Data Analysis – Location Specific
(Antibacterials from Med, Surg, Med/Surg ICUs & Wards only)
Antibiotic Use Benchmarking

- Infection rate benchmarking has proved very helpful in driving improvements.
  - No one wants to be worse than their peers
- We’d like to do the same for antibiotic use.
- NHSN AU module will allow that, but we have a lot to work on risk adjustment (and we need a lot more facilities to enroll)
Example Use of Data for a Hospital (AU Analysis Output Options): Risk-adjusted Benchmarking of Antimicrobial Use To Guide Stewardship

<table>
<thead>
<tr>
<th>Antimicrobial Class-Specific Usage Rates and Standardized Antibiotic Administration Ratios (SAARs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anti-MRSA Intravenous</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Location</th>
<th>ABX Days Observed</th>
<th>ABX Days Predicted</th>
<th>SAAR</th>
<th>Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>MICU</td>
<td>4000</td>
<td>1000</td>
<td>4.0</td>
<td>Excessive</td>
</tr>
<tr>
<td>SICU</td>
<td>2000</td>
<td>2000</td>
<td>1.0</td>
<td>Consistent</td>
</tr>
<tr>
<td>Medical Ward</td>
<td>3000</td>
<td>4000</td>
<td>0.75</td>
<td>Lower Use</td>
</tr>
<tr>
<td>Surgical Ward</td>
<td>1000</td>
<td>3000</td>
<td>0.33</td>
<td>Much Lower</td>
</tr>
<tr>
<td>Hospital</td>
<td>170,250</td>
<td>171,000</td>
<td>0.99</td>
<td>Consistent</td>
</tr>
</tbody>
</table>

Example Data Only; SAAR is a ratio of actual usage patterns compared to expected patterns given the patient population defined by the location (e.g., MICU, SICU, etc)
NHSN AU Measure Proposal – Interpreting the SAAR

- A high SAAR that achieves statistical significance may indicate excessive antibacterial use.
- A SAAR that is not statistically different from 1.0 indicates antibacterial use is equivalent to the referent population’s antibacterial use.
- A low SAAR that achieves statistical significance (i.e., different from 1.0) may indicate antibacterial under use.

Note: A SAAR alone is not a definitive measure of the appropriateness or judiciousness of antibacterial use, and any SAAR may warrant further investigation.

For example, a SAAR above 1.0 that does not achieve statistical significance may be associated with meaningful excess of antimicrobial use and further investigation may be needed. Also, a SAAR that is statistically different from 1.0 does not mean that further investigation will be productive.
Considerations for Benchmarking Use

- Data existing in NHSN for modeling
  - ICU vs. other; major teaching hospitals vs. other
  - Medical care (i.e., not surgical)
  - Location type

- Other data that could be useful
  - Proportion of admissions classified as “infectious disease” by ICD-9 or other codes
  - Medicare CMI, other CMI
Research Needed to Make Inpatient ABX Use Surveillance/Benchmarking Useful

- Identify good (somewhere between best and feasible) risk adjustment within constraints of NHSN AU
- Demonstrate that high metric = bad prescribing
- Demonstrate stewardship activity improves metrics
September 18, 2014

- White House announced a national effort to combat antibiotic resistance in bacteria.

- Three key items released on that day:
  - Report from the President’s Council of Advisors on Science at Technology (PCAST)
  - National Strategy for Combatting Antibiotic Resistant Bacteria
  - Executive Order

- Stewardship prominent in all three.
REPORT TO THE PRESIDENT ON COMBATING ANTIBIOTIC RESISTANCE

Executive Office of the President
President’s Council of Advisors on Science and Technology

September 2014
Eight high level recommendations to the president to combat antibiotic resistance:

- Ensure strong federal leadership
- Effective surveillance and response
- Fundamental research
- Clinical trials with new antibiotics
- Increase economic incentives for new antibiotics
- Improve stewardship of existing antibiotics
- Limit the use of antibiotics in animal agriculture
- Ensure effective international coordination
Executive Order -- Combating Antibiotic-Resistant Bacteria

EXECUTIVE ORDER

COMBATING ANTIBIOTIC-RESISTANT BACTERIA

By the authority vested in me as President by the Constitution and the laws of the United States of America, I hereby order as follows:

Section 1. Policy. The discovery of antibiotics in the early 20th century fundamentally transformed human and veterinary medicine. Antibiotics save millions of lives each year in the United States and around the world. The rise of antibiotic-resistant bacteria, however, represents a serious threat to public health and the economy. The Centers for Disease Control and Prevention (CDC) in the Department of Health and Human Services (HHS) estimates that annually at least two million illnesses and 23,000 deaths are caused by antibiotic-resistant bacteria in the United States alone.
Executive Order on Combating Antibiotic Resistant Bacteria

- Describes combating antibiotic resistance is a national security priority.
- Creates federal task force and Presidential advisory council to guide implementation of the national strategy.
- Addresses various areas relevant to resistance, including stewardship.
NATIONAL STRATEGY FOR COMBATING ANTIBIOTIC-RESISTANT BACTERIA

Vision: The United States will work domestically and internationally to prevent, detect, and control illness and death related to infections caused by antibiotic-resistant bacteria by implementing measures to mitigate the emergence and spread of antibiotic resistance and ensuring the continued availability of therapeutics for the treatment of bacterial infections.

September 2014
National Strategy for Combating Antibiotic Resistant Bacteria - Goals

- Slow the development of resistant bacteria and prevent transmission
- Strengthen surveillance
- Advance development of new diagnostics
- Accelerate research and development for new antibiotics, other therapeutics and vaccines
- Improve international collaboration in combating resistance.
National Strategy for Combating Antibiotic Resistant Bacteria

- Implement public health programs and reporting policies that advance antibiotic resistance prevention and foster antibiotic stewardship in healthcare settings and the community.
  - Strengthen stewardship and education
  - Develop and pilot new interventions.
National Strategy for Combating Antibiotic Resistant Bacteria

- All states will implement stewardship activities in healthcare settings.
- All federal facilities will have robust stewardship programs.
- 95% of eligible hospitals will report antibiotic use data to NHSN.
- Reduce inappropriate use for monitored conditions/agents by 20% in-patient and 50% outpatient.
- CDC and AHRQ will expand research.
Conclusions

- This is an unprecedented time for antibiotic stewardship.
- There is now a national strategy for advancing stewardship as a key part of combating resistance
  - All Hospitals should be involved/active
  - Tools for tracking are being developed
  - Use of tools should be linked to incentives (CMS)
  - FY16 Presidential Budget Initiative contains specific items to support activity