An Update on National Antibiotic Stewardship Activities

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Objectives and Disclosure

Objectives

- Describe current efforts to monitor antibiotic use in US hospitals
- List important improvement opportunities for improving antibiotic use in US hospitals

Disclosure

- None
It’s a Matter of Patient Safety—it is more than just about antibiotic resistance

- What if something bad happens without an antibiotic? What is the number needed to treat?
  - Complications to common respiratory infections are very rare
  - Over 4400 patients with colds need to be treated to prevent 1 case of pneumonia

- What if something bad happens with an antibiotic? What is the number needed to harm?
  - Antibiotic adverse events can be severe
    - Life-threatening allergic reactions (e.g., anaphylaxis)
    - Antibiotic-associated diarrhea (e.g., *C. difficile* infection)
    - 1 in 1000 antibiotic prescriptions leads to an ER visit for an adverse event (~200,000 estimated ER visits/year in U.S.)
  - Antibiotic adverse events have long-term consequences for chronic disease: disruption of microbiota and microbiome linked to chronic disease

Adverse Events from Hospital Antibiotics

• In a review of 1488 hospitalized patients given antibiotics.
• 20% of patients experienced at least 1 antibiotic-associated adverse event.
  – 4% of all patients got *C. difficile*, 6% got an MDRO infection
• 20% of non-indicated antibiotic regiments were associated with an adverse event, including 7 cases of *C. difficile*.
• Every 10 days of antibiotics was associated with a 3% increased risk of an adverse event.
• Most common in 1st 30 days:
  – GI (diarrhea, nausea, vomiting): 42%
  – Renal (>1.5 times rise in creatinine): 24%
  – Hematologic (anemia, leukopenia, thrombocytopenia): 15%

Tamma et al. JAMA Intern Med, 2017
Adverse Events from Hospital Antibiotics

- 97% of antibiotic adverse events resulted in additional testing and/or additional medical care (prolonged or new hospitalization or clinic and/or ED visit).
Increased Risk of Sepsis After Antibiotic Exposure

- Disruption of the gut microbiome increases the risk of sepsis in animal models.
- Retrospective study of ~9 million patients discharged without sepsis in 473 US hospitals.
- 0.6% were readmitted with sepsis in 90 days.
- Exposure to broad spectrum antibiotics during hospitalization was independently associated with risk of sepsis:
  - OR=1.50 95% CI:1.47-1.53

Major Policy Developments for Antibiotic Stewardship: No Longer “Whether” but “How”

- CMS issued a final rule requiring nursing homes to have antibiotic stewardship programs.
- CMS issued a proposed rule requiring hospitals to have antibiotic stewardship programs.
- The Joint Commission issued a standard requiring all accredited hospitals to have stewardship programs – Enforcement began in January of 2017.
- The Federal Office of Rural Health Policy added a requirement for stewardship programs for critical access hospitals to receive FLEX funding in 2018.
Major Policy Developments for Antibiotic Stewardship: No Longer “Whether” but “How”

- Outpatient stewardship is part of the new payment program for outpatient providers, the Merit Based Incentive Payment System (MIPS).
- Providers have to earn “points” in 4 domains to maximize reimbursement.
- Stewardship is in 2 of the 4.
- Quality- providers can report on one or more of several antibiotic prescribing quality measures (e.g. avoiding antibiotics in adults with sinusitis, using amox or amox/clav to treat adult sinusitis).
- Improvement- providers can show they are implementing outpatient stewardship programs and can take the CDC on-line stewardship course.
Antibiotic Prescribing and Use in Doctor’s Offices

Continuing Education and Informational Resources

Several organizations, including the Centers for Disease Control and Prevention, provide continuing education (CE) opportunities related to antibiotic resistance and appropriate antibiotic prescribing practices.

Healthcare Professionals

Below are continuing education opportunities for healthcare professionals regarding judicious antibiotic prescribing and antibiotic resistance.

CDC Training on Antibiotic Stewardship

This online training course offers participants up to eight hours of free continuing education (CE). It is accessible in multiple modules offered in four sections. The first section is available now, with additional content releasing later this year. Create an account on CDC Train to register for the course.

Course objectives include:

- optimizing antibiotic prescribing and use to protect patients and combat the threat of antibiotic resistance,
- informing healthcare professionals about appropriate antibiotic prescribing and
- encouraging open discussions among physicians and patients.

While this particular course is primarily for clinicians who prescribe antibiotics, CDC recognizes that everyone plays an important role in improving antibiotic use. Physicians, nurse practitioners, physician assistants, certified health education specialists, nurses, pharmacists, and public health practitioners with a master's degree in public health are all eligible to receive up to eight hours of free CE.

This course fulfills Improvement Activities (IA) Patient Safety and Practice Assessment (PSPA)_23 and PSPA_24 under the Centers for Medicare & Medicaid Services (CMS) Merit-Based Incentive Programs, or MIPS.

Accreditation Statements and Disclosure [PDF - 20 KB]
Update on Core Element Uptake:
2016 NHSN Annual Hospital Survey
### Number of facilities responding to NHSN Annual Hospital Surveys 2014-2016:
Number and percentage meeting all 7 Core Elements

<table>
<thead>
<tr>
<th>Year</th>
<th>Meeting all 7</th>
<th>Not meeting all 7</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>40.9%</td>
<td>59.1%</td>
<td>4,184</td>
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<tr>
<td>2015</td>
<td>48.1%</td>
<td>51.9%</td>
<td>4,569</td>
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<tr>
<td>2016</td>
<td>64.1%</td>
<td>35.9%</td>
<td>4,781</td>
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Percentage of Facilities in Each State Meeting all 7 Core Elements, 2016

[Map showing the percentage of facilities meeting all 7 core elements in each state, with different shades indicating the percentage range.]
Percentage of U.S. acute care hospitals reporting uptake of all 7 CDC Core Elements, by facility demographic, National Healthcare Safety Network, 2016 (N=4,781)

<table>
<thead>
<tr>
<th>Facility Type</th>
<th>Bed Size</th>
<th>Teaching Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical access hospital</td>
<td>≤50 beds</td>
<td>Non-teaching</td>
</tr>
<tr>
<td>Surgical hospital</td>
<td>51 - 200 beds</td>
<td>Major teaching</td>
</tr>
<tr>
<td>General acute care hospital</td>
<td>&gt;200 beds</td>
<td></td>
</tr>
<tr>
<td>Children's hospital</td>
<td></td>
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</tr>
</tbody>
</table>

- 43.0% Critical access hospital
- 58.1% Surgical hospital
- 69.5% General acute care hospital
- 73.9% Children's hospital
- 46.0% ≤50 beds
- 69.0% 51 - 200 beds
- 81.5% >200 beds
- 58.5% Non-teaching
- 76.3% Major teaching
Critical Access Hospitals Use Antibiotics About As Much As Larger Hospitals

Mean Rates of Total Antibiotic Use

Mean rates (DOT/1,000 days present)

- ≤25 beds: 627.6
- 26-50 beds: 713.6
- >50 beds: 595.4
Implementing Core Elements in CAHs

- Input from CAHs in several states (in green below)

https://www.cdc.gov/getsmart/healthcare/implement/implementation/core-elements-small-critical.html
Incentivizing Stewardship Implementation in Critical Access Hospitals

- Medicare Beneficiary Quality Improvement Program (MBQIP) is seeking to expand stewardship programs in CAHs.
  - 99% of CAHs participate in MBQIP
  - Hospitals are supported by state Flex grantees
- Implementation of the CDC Core Elements is now a Core/Required Element of MBQIP (2018-2021).
Measuring Antibiotic Use
Data For Action- CDC’s Measurement Framework for Hospital Stewardship

- Broad (ideally national) assessments of aggregate use.
- Facility, practice and provider specific assessments of antibiotic administration data
- Assessments of appropriate antibiotic use.
National Healthcare Safety Network Antibiotic Use Option

- Captures electronic data on antibiotics administered, along with admission/discharge/transfer data.

- Calculates rates of administration for use:
  - By facilities to monitor interventions on single units or facility wide
  - To collect aggregate information on antibiotic use at a regional and national level
  - To create antibiotic use benchmarks.
Yearly Submission into the AU Option*

*As of April 1, 2018

No. of Facilities Reporting or that have Reported AU Data

[Graph showing the increase in facilities reporting AU data from 2012 to 2018]
Submission Metrics*

- 776 facilities submitted at least one month of data
  - From 49 states (+AE & DC)
  - Bed size
    - Average = 217
    - Median = 171
    - Min/Max = 6, 1455
  - Teaching status
    - Teaching: 65%
      - (of all Teaching) Major teaching: 47%

*As of April 1, 2018
Standardized Antibiotic Administration Ratio (SAAR)

- CDC’s 1st attempt at developing a risk-adjusted benchmarking measure for hospital antibiotic use.
- SAAR expresses observed antibiotic use compared to predicted use.
  - Predicted use is calculated with risk adjusted models
- CDC worked with many partners to develop the SAAR measure to try and make it most useful for stewardship.
- Endorsed by The National Quality Forum in 2016 for performance improvement.
Standardized Antibiotic Administration Ratio (SAAR) Categories- 2016-2018

- Broad spectrum agents predominantly used for hospital-onset/multi-drug resistant bacteria.
- Broad spectrum agents predominantly used for community-acquired infection.
- Anti-MRSA agents.
- Agents predominantly used for surgical site infection prophylaxis.
- All antibacterial agents.
- SAAR categories are calculated separately for different patient care locations
  - ICU and Ward
  - Pediatrics and Adult
Revisions to the SAAR Categories

- Now that many more facilities are reporting, CDC is re-doing the SAAR values to produce measures of expected use that are based on more data.
- It also gave us the opportunity to talk with experts who are using the NHSN Antibiotic Use option to get their thoughts on changes we should make.
- We have enough data to produce SAAR values for some new location types:
  - Step-down units
  - General oncology units
- Goal is to have the new SAARs in the January 2019 release of NHSN.
Some Suggestions About the SAAR

- Pull out “last resort” agents (like colistin) into a different category.
- Change the “surgical prophylaxis” category to a “narrow spectrum beta-lactam” category.
- Add a SAAR with agents that pose the highest risks for *C. difficile*.
- Add a SAAR for anti-fungals to focus on agents to treat candiemia.
- Add an azithromycin only SAAR for pediatrics.
- Develop SAARs for NICUs, distinct from pediatrics.
  - Developmental work underway in partnership with The Vermont Oxford Network.
Key Questions About the SAAR

- Does the SAAR help point to locations and/or agents where there are meaningful opportunities to improve antibiotic use?
- How would additional data for risk-adjustment impact the SAAR?
- Will the SAAR values change if antibiotic use is improved?
Using NHSN AU Data to Focus Stewardship Efforts

Courtesy of Eddie Stenehjem
SAAR Values Before And After A Stewardship Intervention

Assessing the SAAR Risk Adjustment: Facility Level vs. Patient Level Data

- Collaboration with Kaiser of Southern California looking at risk adjusted benchmarks using a variety of patient level data (DRG, case-mix, diagnosis codes, WBC, Charlson etc) in addition to facility level data.
  - NHSN AU currently only gets facility level data.
- Comparing these benchmark values (KP ratio) to SAARs.
  - Slides courtesy of Kalvin Yu, Jason Jones, Liz Moisan
Comparing Facility Level and Patient Level Risk Adjustment

- Using DRG and post-discharge infectious disease diagnoses (ICD codes)
- Agreement defined as both above or below 1.0
- They agreed:
  - 86% of the time for all antibiotics
  - 72% for agents predominantly used for community-acquired infection.
  - 86% for hospital-onset/multi-drug resistant bacteria agents
  - 92% for surgical site infection prophylaxis agents
- There were differences in magnitude in some instances.
Next Steps for the SAAR Measure

- More work on exploring and refining risk adjustment.
- More work on assessing application of the SAAR for stewardship.
  - Duke Antimicrobial Stewardship Outreach Network working on a project to
    - Enroll a group of hospitals in NHSN AU
    - Implement or expand stewardship core elements
    - Assess the impact on SAAR measures
What About Measuring Prescribing Quality in Hospitals?

- Simply looking at discharge diagnoses does not usually help assess if antibiotic use was appropriate.
  - Which antibiotics are for which diagnoses?
- Most inappropriate use in hospitals occurs in patients who are either misdiagnosed with an infection or who have an infection, but are treated incorrectly.

Hecker MT et al. *Arch Intern Med.* 2003;163:972-978
Measuring Prescribing Quality in Hospitals

- When this has been done, it has involved detailed chart reviews.
  - Expert clinicians - often infectious disease, often a panel
  - Non-clinician applying an algorithm
- Both are (very) labor intensive.
- The former has the advantage of being able to assess use in all cases, the latter has the advantage of being more standardized and reproducible.
- In the US, we are taking the latter approach to attempt a national assessment of appropriate use.
United States Point Prevalence Survey of Hospital Prescribing Quality

- In 2015, CDC conducted a point prevalence survey of healthcare associated infections and antibiotic use in about 180 hospitals in 10 states.
  - Follow up from a 2011 survey, similar methods to EU surveys
- The 2015 survey also abstracted data to look at quality prescribing for:
  - Vancomycin
  - Quinolones
  - Urinary tract infections
  - Community acquired pneumonia
- Algorithms will be used to assess prescribing quality.
Pilot-Vancomycin Prescribing Quality in 36 Hospitals

Patients treated with intravenous vancomycin 185 —

No diagnostic culture obtained around antibiotic initiation, although standard practice with most infections 17 (9.2)

Diagnostic culture showed no Gram-positive bacterial growth, but patient still treated for long duration (>3 days) (excludes presumed SSTI, which often can be culture negative) 40 (21.6)

Diagnostic culture grew only oxacillin-susceptible Staphylococcus aureus, but patient still treated for long duration (>3 days) (likely missed opportunity to switch antibiotic based on culture result) 9 (4.9)

No. of patients with potential for improvement in prescribing 66 (35.7)
Advancing Assessments of Appropriate Use in Hospitals

- Exploring ways to use electronic health information to assess appropriate antibiotic use.
- Outpatient/community measures are already extracted electronically in many instances.
  - How can we make that data available in real time?
- Some hospital assessments of prescribing quality also seem amenable to electronic surveillance.
  - Vancomycin use
  - Unnecessary duplicate antibiotic therapy
  - Bug-drug mismatch
Opportunities for Hospital Stewardship
Engaging Beside Nurses in Antibiotic Stewardship

- What roles can bedside nurses play in improving antibiotic use in hospitals?
  - Preliminary allergy assessments?
  - Prompting time out reviews?
  - Leading IV-PO switch?
- On-going collaborations with American Nurses Association and some work at Columbia University.
- What more could we do here?
Improving Stewardship at Transitions of Care

- Average duration of therapy for community acquired pneumonia is 3-5 days longer than guidelines recommend.
- Data from studies of community acquired pneumonia show that more than half of the days of therapy occur after discharge.
- How can we improve prescribing at time of discharge to make durations of therapy for community acquired pneumonia more guideline concordant?
How Can We Best Evaluate Stewardship Programs?

- The Joint Commission has an accreditation standard for antibiotic stewardship.
- What should surveyors be looking for and asking about to try and assess the effectiveness of a hospital stewardship program?
  - What processes?
  - What outcomes?
- How can we use the survey process to try and inform improvements in stewardship programs?
Antibiotic Stewardship in Outpatients and Nursing Homes
Percent of U.S. Nursing Homes Reporting Implementation of All CDC Core Elements on 2016 Annual NHSN Survey*

*Preliminary results courtesy of Danielle Palms, adapted from presentation at SHEA Spring Conference 2017; St. Louis, MO. Abstract 9026

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Clinicians Face Unique Challenges Related to Antibiotic Prescribing in Nursing Homes.¹

- Older adults may not express the classic signs and symptoms of infection
- Availability of diagnostic tests
- The decision to initiate antibiotics is frequently made offsite and influenced by family preferences and nursing staff communication
  - Many antibiotic prescriptions (66% in one study²) are started by telephone orders without a physician examination
- Documentation of the assessment and the decision making process is sometimes limited
  - Key prescribing information was not documented for 38% of antibiotic courses administered³


- Asymptomatic bacteriuria is common in NH residents.$^{1,2}$
  - Urine cultures are positive for bacteria in 25-50% of women and 15-35% of men in NHs.$^{3}$
- Up to $1/2$ of antibiotics prescribed to treat UTI in older adults are unnecessary or inappropriate.$^{4-7}$
  - Foul-smelling or cloudy urine frequently leads to unnecessary urine testing and treatment.$^{6}$
- Overtesting leads to overdiagnosis of UTI, treatment of asymptomatic bacteriuria, risk for adverse drug events (ADE) and delays in diagnosis.$^{8}$


- Implementing protocols for appropriate urine testing can help avoid diagnosing and treating asymptomatic bacteriuria
  - 17 MA LTC facilities implemented tools promoting urine testing based on specific evaluation and indications
    - Urine cultures decreased by $\frac{1}{4}$, UTI diagnosis decreased by $\frac{1}{3}$ and CDI decreased by $\sim\frac{1}{2}$

- Treating residents with clear signs and symptoms of a UTI
  - Multifaceted intervention focused on a diagnostic and treatment algorithm for UTI implemented in 12 NH in Canada led to fewer courses of antibiotics for UTI without increase in mortality or hospital admission
    - $1.17 \text{ v } 1.59$ courses; weighted mean difference -$0.49$, 95% confidence intervals -$0.93$ to -$0.06$

2. Loeb et al, BMJ 2005;331(7518):669
Action: Implementing Practices that Improve Communication: Communicating with Offsite Providers.

- Assess residents for any infection using standardized tools and criteria
  - Standardized assessment and communication tools will ensure that important clinical information is:
    - Collected when there is a change in the resident’s clinical condition or when an infection is suspected
    - Documented in the medical chart
    - Communicated with the offsite provider
  - One example is the SBAR (Situation, Background, Assessment input and Request)\(^1\)
    - A quasi-experimental trial assessing a quality improvement program that included tools to improve nurse-provider communication was conducted.
      - The number of antibiotic prescriptions decreased significantly (adjusted incidence rate ratio = 0.86, 95% confidence interval = 0.79-0.95).\(^2\)

1. [https://www.ahrq.gov/sites/default/files/wysiwyg/nhguide/4_TK1_T1-SBAR_UTI_Final.pdf](https://www.ahrq.gov/sites/default/files/wysiwyg/nhguide/4_TK1_T1-SBAR_UTI_Final.pdf)
Action: Implementing Practices that Improve Communication: Communicating with Emergency Departments and Acute Care Hospitals.

- There are critical gaps in communication between nursing homes, emergency departments\(^1\), and acute care hospitals
  - Antibiotic stewardship at hospital discharge is important

- Standardized transfer forms can improve the communication of important information related to resident care when residents are transferred to other healthcare settings.\(^2\)-\(^4\)

4. [https://www.cdc.gov/hai/pdfs/toolkits/InfectionControlTransferFormExample1.pdf](https://www.cdc.gov/hai/pdfs/toolkits/InfectionControlTransferFormExample1.pdf)
Outpatient Prescribing Quality in the United States

“Prescribing of first-line antibiotics ranged from a low of 37% (95% CI, 32%-43%) for adult patients with sinusitis and pharyngitis to a high of 67% (95% CI, 63%-71%) for pediatric patients with otitis media. For all 3 conditions overall, use of first-line agents was 52% (95% CI, 49%-55%).”

For adults with sinusitis:“The median duration of therapy was 10.0 days (interquartile range, 7.0-10.0 days), and 69.6% (95% CI, 63.7%-75.4%) of therapies were prescribed for 10 days or longer.” JAMA Intern Med. Published online March 26, 2018
Have We Made Progress in Reducing Inappropriate Antibiotic Use?

- Outpatient antibiotic prescribing rates to children decreased by 13%
- Outpatient antibiotic prescribing rates to adults have been stable
Outpatient Stewardship Implementation

- CMS Quality Innovation Network and Quality Improvement Organizations (QIN-QIOs) helping outpatient facilities to implement CDC’s Core Elements.
  - ~7000 outpatient practices are participating
  - CDC hosting educational webinars to support effective implementation.

- CDC funding University of Utah to implement and evaluate CDC’s Core Elements of Outpatient Antibiotic Stewardship
Public commitment posters: inappropriate prescribing for acute respiratory infections

Adjusted absolute reduction: -20% compared to controls, p=0.02

Peer Comparison to Top Performers

- **“You are a Top Performer:”**
  You are in the top 10% of clinicians. You wrote 0 prescriptions out of 21 acute respiratory infection cases that did not warrant antibiotics.

- **“You are not a Top Performer:”**
  Your inappropriate antibiotic prescribing rate is 15%. Top performers' rate is 0%. You wrote 3 prescriptions out of 20 acute respiratory infection cases that did not warrant antibiotics.

- Mean antibiotic prescribing for antibiotic-inappropriate diagnoses decreased from 19.9% to 3.7% (-16.3%)
  - Statistically significant versus controls

Be Antibiotics Aware

A new educational effort to improve antibiotic prescribing and use.


We’ve designed a variety of *Be Antibiotics Aware* resources that appeal to patients, parents and the public:

- Web buttons and badges; animated videos and GIF images
- “The Right Tool” public service announcements in print, video and radio
- Brochures, fact sheets, infographics and posters
- Content for social media, newsletters and press releases
- To view the online toolkit and download materials, visit [https://spark.adobe.com/page/pd0u80TFAsq6G](https://spark.adobe.com/page/pd0u80TFAsq6G).

*Be Antibiotics Aware* is an ongoing educational effort – so stay tuned for new and exciting additions throughout 2018!
There is a misperception that efforts to improve sepsis care and stewardship are in conflict.

They should be complimentary.

Getting patients with suspected sepsis on the right antibiotic quickly is good stewardship.

Working with the stewardship team to determine how to optimize early identification of potentially septic patients and what the best antibiotics are is good sepsis care.
Conclusions

- The question now is not “if stewardship”, but “how stewardship”.
- There is a lot going on here in Nebraska, which we are about to learn more about.
- More important- how to do most efficiently and effectively?
  - Speed is of the essence
- We count on you to find the answers to those questions.
- What can we do to help?