Antibiotic Stewardship in Long-Term Care Facilities: Where Do We Start?

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Disclosures

Consultant Activities:
1. Zurex Pharmaceuticals (Madison, WI): provide strategic advice on development and testing of the company’s novel anti-septic platform (<$5,000).

2. Deb Group (SC Johnson Subsidiary, Charlotte, NC): provide strategic advice on evaluating the company’s automated hand hygiene monitoring technology (<$5,000).

• R18HS022465-01A1
• R18HS023779-01
• PPO 16-188 (HSR&D Pilot)
• HX001091-01 (HSR&D CREATE)
Objectives

- Why antibiotic use in NHs matters
- What is antibiotic stewardship?
- Barriers to stewardship in NHs
- Opportunities and sphere of influence
- Where to start
- Some next steps

“Don’t forget to take a handful of our complimentary antibiotics on your way out.”
Harmful Effects of Antibiotics: Individual Level

- Adverse drug events (ADEs)
  - 1 in 5 of all ADEs in NHs are the result of antibiotics
  - Risk of ADEs from antibiotics = antipsychotics

- Antibiotic resistance
  - Resistant bacteria commonly emerge following a course of antibiotics (e.g., ciprofloxacin resistance after treatment for possible UTI)
  - Resistant bacteria can persist in the body for over a year even without further antibiotic exposures
  - Makes treating the next infection harder

- *Clostridium difficile*
  - Antibiotics increase the risk of *C. difficile* infection 8-fold
  - More than half of healthcare-onset *C. difficile* cases occur in NHs

Harmful Effects of Antibiotics: Facility Level (clinical)

**Setting:**
- 607 NHs in Ontario; categorized into tertiles of antibiotic use (low, medium, high)
- 110,000 NH residents followed for 2 years.

**Study Endpoint:** Combined rate of *C. difficile*, diarrhea/gastroenteritis, infection with antibiotic-resistant bacteria and adverse drug event (ADE)

**Results:**
- ~83,000 NH residents received an antibiotic & ~27,000 residents did not receive an antibiotic
- Risk of experiencing the combined endpoint was 24% higher in high-use NHs, even if the resident never received an antibiotic (Figure)

Daneman et al. JAMA Intern Med 2015; 175(8): 1331-9
Mody & Crnich et al. JAMA Intern Med 2015; 175(8): 1339-41
Harmful Effects of Antibiotics: Community Level

- NH residents prescribed antibiotics are more likely to be colonized with antibiotic-resistant bacteria which can be spread to other.
- The high rate of transfers between NH and hospitals creates opportunities for the regional spread of resistant bacteria.

**FIGURE:** A recent study in Chicago demonstrated that NHs (green circles) played an important role in the spread (shaded areas) of a highly antibiotic-resistant bacteria* between city hospitals (orange circles).

* carbapenem-resistant Klebsiella pneumoniae, a bacteria that commonly causes urinary tract infections.

Antibiotic Use in Nursing Homes is Common & Frequently Inappropriate

**Frequency of Antibiotic Exposure Among Individuals who Reside in a Nursing Home for at least 6 Months**

- Antibiotics: 65%
- No Antibiotics: 35%

**Necessity of Antibiotic Use in Five Wisconsin Skilled Nursing Facilities**

- Facility 1: 35%
- Facility 2: 60%
- Facility 3: 40%
- Facility 4: 50%
- Facility 5: 20%

- Met Ether Criteria
- McGee Criteria
- Loeb Criteria
Potential Misuse of Abx in SNFs

Crnich et al. IDWeek 2012, San Diego, CA

Putting antibiotic stewardship into practice


**What Is Antibiotic Stewardship?**

**Benefits of Antibiotics**
- Resolution of Infection
- ↓ Psychological Stress
- ↓ Hospitalizations (?)
- Happier Families (?)

**Risks of Antibiotics**
- Adverse Drug Events
- *Clostridium difficile*
- Future abx-resistant infxns.

**Comparing ASP in Hospitals and NHs**

<table>
<thead>
<tr>
<th></th>
<th>Hospitals</th>
<th>Nursing Homes</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>External pressure for ASP</strong></td>
<td>(Increasingly) Yes</td>
<td>(Increasingly) Yes</td>
</tr>
<tr>
<td><strong>ASP cost savings accrue to facility</strong></td>
<td>Yes</td>
<td>Context-dependent</td>
</tr>
<tr>
<td><strong>Strong IT infrastructure</strong></td>
<td>(Mostly) Yes</td>
<td>No</td>
</tr>
<tr>
<td><strong>In-house pharmacy support</strong></td>
<td>Yes</td>
<td>Context-dependent</td>
</tr>
<tr>
<td><strong>Access to ID expertise</strong></td>
<td>(Usually) Yes</td>
<td>(Usually) No</td>
</tr>
<tr>
<td><strong>Prescribers directly perform the initial assessment</strong></td>
<td>Yes</td>
<td>Context-dependent</td>
</tr>
<tr>
<td><strong>Prescribers able to perform direct reassessments</strong></td>
<td>Yes</td>
<td>Context-dependent</td>
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</tbody>
</table>
Where Do We Start?

Identify an individual to be responsible for leading the ASP team
ASP is a team effort

ASP team tasks (should be detailed in facility ASP Protocol)

**Pre-Prescribing**
- Policy/procedure development (Core)
- Facility utilization and outcome reports (Core)
- Development of facility antibiogram (Advanced)
- Facility-specific prescribing guideline (Advanced)
- Provider report cards (Advanced)

**Post-prescribing**
- Prospective audit & feedback (Advanced)

**Nursing Practice**
- SBAR (Core)
- Avoiding unnecessary urine testing (Core)
- Antibiotic review (Core)
Policies for Infection Diagnosis and Treatment Etiquette

• Eliminate reagent strip testing of urine for the evaluation of resident change-in-condition

• Process & tools for assessing and communicating resident change-in-condition***

• All antibiotic orders should stipulate an indication, drug, dose, & duration***

• Eliminate test-of-cure urine cultures

• Discourage use of prophylactic antibiotics***

*** Pose high risk of survey deficiency

Measure antibiotic utilization

If You Can’t Measure It, You Can’t Improve It

(William Thomson, Lord Kelvin)
Objectives of Measurement

<table>
<thead>
<tr>
<th></th>
<th>Internal Measurement</th>
<th>External Measurement</th>
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<tbody>
<tr>
<td>Where are we?</td>
<td>+</td>
<td>+++</td>
</tr>
<tr>
<td>Where do we need to be?</td>
<td>+</td>
<td>+++</td>
</tr>
<tr>
<td>What needs to change?</td>
<td>+++</td>
<td>+</td>
</tr>
<tr>
<td>Should we change?</td>
<td>++</td>
<td>+++</td>
</tr>
<tr>
<td>Is the change working?</td>
<td>+++</td>
<td>++</td>
</tr>
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Issues Related to Measurement of Antibiotic Use in SNFs

• What should be measured?
• How do we obtain these measures?
• Do we risk adjust these measures?
Which Measures?

<table>
<thead>
<tr>
<th>Utilization</th>
<th>Appropriateness</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibiotic start (event)</td>
<td>Necessity</td>
</tr>
<tr>
<td>Days of therapy (DOT/AUR)</td>
<td>% of courses exceeding “X” days</td>
</tr>
<tr>
<td>Length of therapy (LOT)</td>
<td>Appropriateness of spectrum</td>
</tr>
<tr>
<td>Defined daily dose (DDD)</td>
<td>Appropriateness of dose</td>
</tr>
<tr>
<td>Costs (per a-day/r-day)</td>
<td></td>
</tr>
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</table>

Mylotte J. J Am Med Dir Assoc 2016; 17(7): e13-8

Antibiotic Starts

- **Pros**
  - Many facilities are already doing this (typically counts only)
  - Aligned with current 24-hour report & infection log processes
  - Relatively easy to marry with treatment indication
  - Not influenced by prophylactic therapy
  - Can be easily modified to exclude hospital-initiated antibiotics

- **Cons**
  - Current data systems dictate reliance on manual data abstraction methods
    - If automated, could be inflated by intermittent therapy (fosfomycin, vancomycin), treatment interruptions and treatment modifications
    - Suboptimal reliability of 24-hour report/infection logs
  - Does not address prophylactic antibiotics
  - Does not address dimensions of appropriateness (necessity, duration, spectrum)
Days of Therapy (DOT)

• Pros
  • Identical to the hospital AU measure
  • Does provide indirect information on length of therapy (not the case in hospitals)
  • More amenable to automation than antibiotic starts

• Cons
  • May be difficult to parse out hospital-initiate antibiotics
  • May be difficult to parse out prophylactic antibiotics
  • May be difficult to parse out relative contribution of different treatment indications
  • Only captures information on one dimension of appropriateness (duration)

Measures of Appropriateness - Necessity

Revised McGeer (Stone)

(A) Clinical (Must satisfy one of the following scenarios)
1. Either of the following:
   - Acute dysuria or
   - Acute pain, swelling or tenderness of testes, epididymis or prostate
2. If either FEVER* or LEUKOCYTBOSIS present need to include ONE or more of the following:
   - Acute costovertebral angle pain or tenderness
   - Suprapubic pain
   - Gross hematuria
   - New or marked increase in incontinence
   - New or marked increase in urgency
   - New or marked increase frequency
3. If neither FEVER or LEUKOCYTBOSIS present INCLUDE TWO or more of the ABOVE (Box #2).

(B) Lab (At least one of the following must be met)
1. Voided specimen: Positive urine culture (> 10^5 cfu/mL) no more than 2 organisms
2. Straight cath specimen: Positive urine culture (> 10^5 cfu/mL) ANY NUMBER OF ORGANISMS

Loeb Minimum Criteria

(A) Clinical (Must satisfy one of the following scenarios)
1. Acute dysuria
2. FEVER** plus ONE or more of the following:
   - New or worsening urgency
   - New or worsening frequency
   - Suprapubic pain
   - Gross hematuria
   - Costovertebral angle tenderness
   - Urinary incontinence

* Fever (Revised McGeer): single temp ≥ 100°F or repeated temp ≥ 99°F or 2°F above baseline
** Fever (LMC)x: single temp ≥ 100°F or 2.4°F above baseline

+ 55 (22%) 101 (40%)
- 85 (34%)

Either Criteria Positive = 251/504 (49.8%)
Agreement = 354/504 (70.2%)

Crnich et al. SHEA 2014
**Measures of Appropriateness - Duration**

- 50% of facility-initiated Abx treatment courses exceed 7 days
- 20% of antibiotic utilization can be eliminated by shortening treatment courses to 7 days or less

**Measures**
- DOTs
- % of facility-initiated treatment courses exceeding 7 days


**Other Measures of Appropriateness**

- % of facility-initiated treatment courses that are guideline concordant
- % of facility-initiated treatment courses in which specific classes of antibiotics utilized (e.g., fluoroquinolones)
- Spectrum Score
- Medication appropriateness index

Crnich et al. APIC Wisconsin 2015

TAKE ACTION!
Antibiotic Prescribing is Process with Multiple (Potential) Decisions

Pre-Prescribing Decision-Making
- Q1: Do I Test?
- Q2: Do I Treat?
- Q3: How Do I Treat?

Post-Prescribing Decision-Making
- Q4: Can I Stop?
- Q5: Can I Narrow?
- Q6: How Long Should I Treat?

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Dipstick → UA → Urine culture → Antibiotic Prescription

- Urine testing automated in many NHs.
- Average time from recognition of change to antibiotic = 2-3 days
- 60-90% of antibiotics prescribed for UTI started after culture results are back

Reduced Testing → Reduced Treatment

- 12 NHs in Massachusetts participated
- Intervention
  - Education (NH staff & providers)
  - Pathway (form)
  - Process and outcome measures trended & regularly reviewed by facility staff

<table>
<thead>
<tr>
<th>Measure</th>
<th>IRR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urine Culture Rate</td>
<td>0.47 (0.42 – 0.52)</td>
</tr>
<tr>
<td>UTI Rate</td>
<td>0.42 (0.35 – 0.50)</td>
</tr>
<tr>
<td>C. Difficile Rate</td>
<td>0.85 (0.45 – 1.68)</td>
</tr>
</tbody>
</table>

Doron et al., IDWeek 2014 [poster abstract]
Antibiotic Prescribing is Process with Multiple (Potential) Decisions

Pre-Prescribing Decision-Making

| Q1 | Do I Test? |
| Q2 | Do I Treat? |
| Q3 | How Do I Treat? |

Post-Prescribing Decision-Making

| Q4 | Can I Stop? |
| Q5 | Can I Narrow? |
| Q6 | How Long Should I Treat? |
Antibiotic Decision-Making

- Complexity
- Uncertainty
- Risk
- Social
- Context

Which Interaction with the Physician is More Likely to Result in an Antibiotic?

Scenario: Mrs. Sleepy, an elderly long-term stay resident with dementia, appears more lethargic than usual and refusing to come out of her room for meals. Her vital signs are stable and she has no localizing complaints.

Example A: Dr. Jones, Mrs. Sleepy is less interactive and not coming out of her room. Do you want me to send a urine culture?

Example B: Dr. Jones, Mrs. Sleepy is less interactive and not coming out of her room. She has no fevers, her other vital signs are stable and she has no other concerning exam findings. Would you be okay with me pushing fluids and monitoring her closely over the next 48 hours?

Nursing Influences on Prescriber Decision-Making

- Thoroughness of the initial assessment of resident change-in-condition
- Thoroughness of communicating findings of the assessment
- Nurse recommendations for testing and treatment
- Follow-up assessment of the resident

Communication/Decision Aid Tool

- Quasi-experimental study in 12 NHs in Texas
- Intervention focused on operationalizing Loeb study (2005) into a communication tool
- Implementation stratified by intensity
  - Control (n = 4)
  - Low-intensity (n = 4)
  - High-intensity (n = 4)

Antibiotic Prescribing is Process with Multiple (Potential) Decisions

Pre-Prescribing Decision-Making
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- Q5: Can I Narrow?
- Q6: How Long Should I Treat?

Harm of Broad-Spectrum Abx: *Clostridium difficile*

Impact of local prescribing guidelines

An Educational Intervention to Improve Antimicrobial Use in a Hospital-Based Long-Term Care Facility

David N. Schwartz, MD,*† Homer Abiad, MD,* Patricia L. DeMarais, MD,‡ Emilian Armeanu, MD,*† William E. Trick, MD,*† Yue Wang, PhD,* and Robert A. Weinstein, MD*†


Antibiotic-resistant infections (per 1,000-days) ↓ 25%

Antibiotic Prescribing is Process with Multiple (Potential) Decisions

Pre-Prescribing Decision-Making

Q1: Do I Test?
Q2: Do I Treat?
Q3: How Do I Treat?

Post-Prescribing Decision-Making

Q4: Can I Stop?
Q5: Can I Narrow?
Q6: How Long Should I Treat?
**Frequency of Opportunities to Modify Antibiotic Therapy**

- 162 antibiotic starts for UTI in 3 Wisconsin NHs were examined in detail.
- Almost 50% of the antibiotic courses initiated for UTI were amenable to change
  - **STOP OPPORTUNITY:** 4/12 (33%) of antibiotic courses initiated for a UTI indication were continued despite negative culture results.
  - **CHANGE (ESCALATE) OPPORTUNITY:** 8/25 (32%) of antibiotics were not modified despite a culture result demonstrating resistance to the empirically-initiated antibiotic regimen.
  - **CHANGE (DE-ESCALATE) OPPORTUNITY:** 36/60 (60%) of the cases treated with a fluoroquinolone (i.e., cipro) could be changed to another antibiotic with a lower risk of side effects and resistance (e.g., nitrofurantoin)
  - **SHORTEN OPPORTUNITY:** 80/162 (49%) of the cases were treated for more than 7 days even though data suggests treatment durations for UTI should rarely exceed this duration.

Crnich et al., unpublished data

**Impact of Abx Duration on Overall Utilization**

- Analyses focused on 699 providers who prescribed at least 20 antibiotic courses during 2010 in Ontario NHs.

Average Duration of Antibiotic Prescriptions among 699 Ontario NH Providers

- Estimated reduction in antibiotic utilization achievable by prescribing duration state migration:
  - Long ⇒ average: 7% reduction
  - Long & average ⇒ short: 19% reduction

Impact of an ID Consultative Service on Antibiotic Utilization in a NH


Pharmacist Led Post-Prescriptive Review and Feedback

Provider-Led Post-Prescriptive Review

Post-Prescribing Process

- Antibiotic Started by PCP?
  - Yes: Schedule Post-Prescribing Review
  - No: Notify PCP of Antibiotic Start

- Assemble Pertinent Data for Review:
  - Resident condition
  - Microbiology results
  - Other laboratory test results
  - Imaging test results

- Nurse/PCP Post-Prescribing Review
  - Can antibiotics be stopped?
  - Can antibiotic spectrum be narrowed?
  - Can antibiotic duration be shortened?

Clin Infect Dis 2015; 60(8): 1252-8
Other Beneficial Activities

Education & Training

Table 1. Random Assignment and Treatment with Parenteral Antibiotics According to Guideline

<table>
<thead>
<tr>
<th></th>
<th>Random Assignment of SNFs</th>
<th>Physician-Only Training</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Multidisciplinary Training</td>
<td>Physician-Only Training</td>
</tr>
<tr>
<td>Preintervention</td>
<td>50% (10/20)</td>
<td>64.5% (69/107)</td>
</tr>
<tr>
<td>Postintervention</td>
<td>81.8% (18/22)</td>
<td>69% (28/40)</td>
</tr>
</tbody>
</table>

*p = .06
SNF = skilled nursing facility.

https://www.coursesites.com/webapps/Bb-sites-course-creation-BBLEARN/courseHomepage.htmlx?course_id=3489
31_1

Resident & Family Engagement - Passive

Patient Engagement - Active

**Articles**

**Effects of internet-based training on antibiotic prescribing rates for acute respiratory-tract infections: a multinational, cluster, randomised, factorial, controlled trial**

Little et al. Lancet 2013; 382(9899): 1175-82

RRR = 32%; ARR = 9%

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**Make Consequences more Visible**

- 80% of cultures from a urine sample
- 85% of the antibiotic use in the 3 NHs was empiric (before cultures)
  - 54% involved a fluoroquinolone antibiotics
  - 65% of episodes associated with discordant (inappropriate) therapy
- Making antibiogram available reduced inappropriate use to 55%

Drinka et al. JAMDA 2013; 14(6): 443
Furuno et al. Infect Control Hosp Epidemiol 2014
Introducing Normative Influences

WHAT I FEEL LIKE WHEN I RUN...

WHAT I'M PRETTY SURE I ACTUALLY LOOK LIKE...

Provider Feedback

- A MRSA outbreak in a 147-bed NH in WI led to an intensive review of facility microbiology and antibiotic prescribing data
- Review of urinary antibiogram identified
  - 31/100 (27%) all isolates were *Enterococcus* sp.
  - 87% of *E. coli* resistant to ciprofloxacin
- Facility embarked on several interventions:
  - Provided staff with antibiogram results
  - Guideline-concordant prescribing tracked by facility staff
  - Medical director sent out letters to outlier providers

The Pew Charitable Trusts – A path to better antibiotic stewardship, 2016
NH ASP Resources

- Centers for Disease Control and Prevention
- Wisconsin HAI in Long-Term Care
  - https://www.dhs.wisconsin.gov/regulations/nh/hai-introduction.htm
- UNC Nursing Home Infections
  - https://nursinghomeinfections.unc.edu
- Massachusetts Coalition
- Minnesota Department of Health
  - http://www.health.state.mn.us/divs/idepc/dtopics/antibioticresistance/asp/ltc/
- Agency for Healthcare Research and Quality ASP Toolkits

Thank You