Antibiotic Stewardship: Why it Matters in Nursing Homes & Where to Begin

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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).
Objectives

- Antibiotic resistance – the big picture
- Effects of antibiotics on individuals, facilities & communities
- Patterns of antibiotic use in nursing homes
- What is antibiotic stewardship?
- Barriers to stewardship in NHs
- Where to start
"Tell me wise ass....
why should I care again?"

The Looming Post-Antibiotic Era

- 35% of CDI cases arise in community
- 25% of CDI cases arise in SNFs

CDC. Antibiotic Resistant Threats in the United States, 2013
The Antibiotic Pipeline

Harmful Effects of Antibiotics: Individual Level

- Adverse drug events (ADEs)
- Antibiotic resistance
- *Clostridium difficile*
Adverse Events from Antibiotics

Preventable ADRs in NHs

- 20% of all ADRs

% of Total Abx ADE ED Visits

- 143,000 ED visits/year for antibiotic-associated ADEs
- 19% of drug-related ED visits


Antibiotic Treatment (Even When Appropriate) Carries Future Risk of Antibiotic Resistance for the Individual

- Inpatient UTIs caused by fluoroquinolone-resistant bacteria strongly associated with recent (1 mo.) fluoroquinolone use (OR = 15.7; 95% CI = 6.2 – 40.3)

- Outpatient UTIs caused by fluoroquinolone-resistant bacteria also associated with recent fluoroquinolone exposure (OR = 17.5; 95% CI = 6.0 – 50.7)

- Outpatient treatment of asymptomatic bacteriuria increases a woman’s risk of developing symptomatic UTI threefold (OR = 3.2; 95% CI = 2.6 – 3.9)

Costelloe et al. *BMJ* 2010; 340: c2059
Drinka et al. *JAMDA* 2013; 14(9): 707
**Clostridium difficile** in nursing homes

- **McGeer Criteria** (at least 3 of the following)
  - Temperature $\geq 38^\circ$ C
  - N/$\uparrow$ burning/frequency/urgency
  - New flank/suprapubic pain/tenderness
  - Change in character of urine
    - Blood/smell/sediment
    - Pyuria/hematuria
  - Worsening mental or functional status

- **Inappropriate therapy** (independent of decision to start)
  - Treatment initiated empirically (before culture) in only 27/96 (28%) of residents
  - Emporic antibiotic inappropriate in 56% of cases (FQ when TMP/SMX or NFT reasonable)
  - Dosage (High [21%] / Low [13%] / Cl [12%])
  - Duration (Short [3%] / Long [67%])

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Crnich et al. *Infect Control Hosp Epidemiol* 2007; 28(8): 1006-8

Campbell et al. *Infect Control Hosp Epidemiol* 2009; 30(6): 526-33
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)

Harmful Effects of Antibiotics: At the Facility Level (regulatory)

• Inappropriate antibiotic use is a common survey citation in Wisconsin.
• In November 2018, nursing homes will be required to have an antibiotic stewardship program which will likely influence the survey process.
MDROs: The Healthcare Facility STD?

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 pneumonia, a bacteria that commonly causes urinary tract infections.
Antibiotics are Commonly Prescribed in Nursing Homes

2/3rds of residents who stay in a NH for at least 6 months will be prescribed at least 1 course of antibiotics.

Many residents are prescribed multiple courses of antibiotics during their NH stay.

- 60% of all antibiotics prescribed in NHs are administered to 20% of the residents
- In one of our studies, we observed that a single resident received 14 courses of antibiotics over 12 months

Crnich et al. ID Week 2012, San Diego, CA
Inappropriate Antibiotic Use in NHs

Much of Antibiotic Use in Nursing Homes is Inappropriate

- >50% of antibiotic starts in NHs are not justified (figure)
- Even when justified, the prescribed antibiotic is often:
  - Unnecessarily broad spectrum (e.g., cipro when bactrim would work just as well)
  - Given for too long of a duration (>7 days)

Cnich et al. Society for Healthcare Epidemiology of America 2015 Spring Conference. 2015
Broad-Spectrum Antibiotic Use in NHs

- Random chart review of a sample of all ciprofloxacin orders (100 of 323)
- 72/100 orders deemed inappropriate by implicit review
  - 23/72 due to indication
  - 49/72 due to better alternative

- Treatment initiation often delayed until culture results available (69/96 starts [72%])
- 56% of starts involved an unnecessarily broad antibiotic (e.g., FQ when TMP/SMX or NFT active)
- Duration: too short [3%] / too long [67%]

Antibiotics are not All Equal: *Clostridium difficile*

**Brown et al. Antimicrob Ag Chemother 2013; 57(5): 2326-2332**
Duration of Therapy in NHs

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

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 infxn.s.

Comparing ASP in Hospitals and NHs

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

**Pre-Prescribing**
- Policy/procedure development (Core)
- Education & promotion (Core)
- Facility utilization reports (Core)
- Development of facility antibiogram (Advanced)
- Facility-specific prescribing guideline (Advanced)
- Provider feedback reports (Advanced)

**Post-prescribing**
- Audit & feedback (Advanced)

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

- Eliminate reagent strip testing of urine for the evaluation of resident change-in-condition
- Carefully assess unintended consequences of testing delegation protocols
- 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

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>
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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>
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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)

1. Either of the following:
   □ Acute dysuria or
   □ Acute pain, swelling or tenderness of testes, epididymis or prostate

2. If either FEVER* or LEUKOCYTOSES 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 in frequency

3. If neither FEVER or LEUKOCYTOSES present INCLUDE TWO or more of the ABOVE (Box #2).

Loeb Minimum Criteria

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

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
Suggestions for developing tracking workflows

• Start having conversations with facility pharmacy
  • Most pharmacy services maintain a database that details drug, dispense date and days of therapy that was dispensed
  • They will not often have data on indication or appropriateness

• Offload primary data collection to frontline staff
  • Every facility uses a 24-hour board that can potentially be adapted to capture discrete resident information
  • Can get information on antibiotic starts, duration of therapy and indication
  • Will be difficult to incorporate appropriateness (duration being an exception)

• Integrate into infection surveillance activities
  • IP is required to maintain line-list of infections in the facility
  • It is minimal effort to capture data on antibiotic use
  • Can assess appropriateness
Other suggestions

• Use cross-sectional approaches to identify problem areas

• Design prospective tracking efforts with your improvement activities in mind
  • Focus on tracking UTI treatment if your efforts are only focused on UTI
  • Make sure you have some tool for assessing diagnosis shifting (everyone who used to have UTI now has respiratory tract infection)

• Trend your data using incidence densities (e.g., events per 1,000 resident-days) rather than count data

• Be careful when comparing your data to external data
Education & Training

Effectiveness of multifaceted educational programme to reduce antibiotic dispensing in primary care: practice based randomised controlled trial

Table 3. Random Assignment and Treatment with Parenteral Antibiotics According to Guideline

<table>
<thead>
<tr>
<th></th>
<th>Multidisciplinary Training</th>
<th>Physician-Only Training</th>
</tr>
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<tbody>
<tr>
<td>Preintervention</td>
<td>50% (10/20)</td>
<td>65.5% (69/107)</td>
</tr>
<tr>
<td>Postintervention</td>
<td>81.8%* (18/22)</td>
<td>69% (29/42)</td>
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*P = .05
SNF = skilled nursing facility.


https://www.coursesites.com/webapps/Bb-sites-BBLEARN/courseHomepage.htmlx?course_id=348931_1
Resident & Family Engagement - Passive


Patient Engagement - Active

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

RRR = 32%; ARR = 9%
Antibiotic Prescribing is Process with Multiple (Potential) Decisions

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<thead>
<tr>
<th>Pre-Prescribing Decision-Making</th>
<th>Post-Prescribing Decision-Making</th>
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<td>Q1: Do I Test?</td>
<td>Q4: Can I Stop?</td>
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<td>Q5: Can I Narrow?</td>
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Antibiotic Prescribing is Process with Multiple (Potential) Decisions

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Antibiotic Prescribing is a Process with Multiple (Potential) Decisions

**Pre-Prescribing Decision-Making**
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- 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 an ID Consultative Service on Antibiotic Utilization in a NH

Pharmacist Led Post-Prescriptive Review and Feedback


Un-Structured Antibiotic Review in NHs

- **Objective**: Improve antibiotic prescribing through increased antibiotic prescribing "etiquette"
  - Documentation of findings
  - Diagnostics prior to Rx
  - Diagnosis, drug, dose, duration
  - Antibiotic review
- **Intervention**: Nurse-completed process checklist (resident antimicrobial management plan [RAMP])
- **Design**: Cluster-randomized study in 30 U.K. NHs from January 2010 to May 2011

**Post-Prescribing Process**

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

2. Assembly Pertinent Data for Review:
   - Resident condition
   - Microbiology results
   - Other laboratory test results
   - Imaging test results

3. Nurse/PCP Post-Prescribing Review

   - Can antibiotics be stopped?
   - Can antibiotic spectrum be narrowed?
   - Can antibiotic duration be shortened?

**Tools to Support Provider-Led Antibiotic Review**

- **Resident Condition**
  - Original Signs & Symptoms
    - Fever
    - Localizing symptoms (e.g., pain with urination, cough)
    - Non-localizing symptoms as p. confus, fall
  - Any New Signs & Symptoms (new antibiotic start)
    - Fever
    - Localizing symptoms (e.g., pain with urination, cough)
    - Non-localizing symptoms as p. confus, fall
  - Today's Vital Signs
    - Max Temp is in 24 hrs
    - Lower Blood Pressure
    - Higher Heart Rate
    - Higher Respiratory Rate
    - Lower Oxygen Saturation

- **Diagnostic Test Results**
  - Lab Results
    - White blood cell count
    - Creatinine level
    - Bulge
    - GFR
    - If diabetic, is the resident’s blood sugar higher than normal? Not applicable
  - Cultures
    - Is there any culture ordered? No: Yes
    - If yes, what cultures were performed?
    - Check all that apply
    - Urine culture
    - Respiratory culture
    - Wound culture
    - What resistance identified to any tested antibiotic?
    - No: Yes (attach copy of report to this form)
  - Imaging
    - Were any imaging studies done?
    - No: Yes (attach copy of report to this form)

- **Narrowing Antibiotic Therapy**
  - Consider culture susceptibility and the following guide:
    - Is the resident's WBC < 3,000? It is possible the resident is not a candidate for antibiotics?
    - Consider switching to Amoxicillin or Cephalaxin
    - Is the resident able to tolerate the drug?
    - Consider switching to Amoxicillin or Cephalaxin

- **Decision Tree**
  - There is a non-infectious explanation for the change in condition
    - No: Resident is being treated for a UTI
    - Yes: Urine culture is negative for bacteria
      - No: Culture shows resistance to current antibiotic
        - Yes: Change to effective antibiotic
        - No: Resident currently receiving a Bicillin/penicillin antibiotic
          - Yes: Change to effective antibiotic
          - No: Resident being treated for a UTI, pneumonia, sepsis, pyelonephritis, and not only administered to receive more than 7 days of antibiotic
            - Yes: Year as indicated for non-PJ2 infection
            - No: Switch to appropriate narrow spectrum antibiotic (time extension pathway)
Thank You