Colorado’s Statewide Antimicrobial Stewardship Collaborative

Tim Jenkins, MD
Director, Antimicrobial Stewardship Program
Denver Health
Disclosure

• Consultant for Colorado Hospital Association
Objectives

• Describe Colorado’s statewide antimicrobial stewardship collaborative

• Describe the initial intervention implemented in Colorado hospitals

• Discuss the effects of the intervention and lessons learned
In 2014,

- Impending regulatory requirement for antibiotic stewardship in hospitals
- Implementation expected to challenge Colorado’s diverse hospitals
- Colorado Hospital Association (CHA) organized collaborative for hospitals to work on a common stewardship initiative
- Initial syndrome-specific intervention
Collaborative Objectives

• To recruit Colorado hospitals to participate in a statewide antibiotic stewardship collaborative

• To facilitate implementation of syndrome-specific interventions for urinary tract infections (UTI) and skin infections

• To evaluate the effects of the interventions on antibiotic use
Resources Provided to Hospital Teams

• Evidence-based diagnosis and treatment guidelines
• Monthly educational webinars
• Statewide and regional meetings
• Optional site visits
• Access to local and national experts
• Quarterly feedback of individual hospital data with benchmarking
Evidence-based Guidelines

**UTI**
- Antibiotics only if localizing UTI symptoms
- Alternatives to fluoroquinolones as first-line therapy
- Duration: 5-7 days

**Skin infections**
- Single antibiotic targeting gram-positive pathogens
- Duration: 5-7 days
Main Outcomes and Targets

**UTI**

- Change in use of fluoroquinolones (30% decrease)
- Change in proportion of cases treated with antibiotics that met criteria for symptomatic UTI (15% increase)
- Change in median duration of therapy (20% decrease)
Main Outcomes and Targets

Skin infections

• Change in use of antibiotics with broad spectrum of gram-negative activity (30% decrease)
  o β-lactamase inhibitors, carbapenems, fluoroquinolones, 2\textsuperscript{nd}-5\textsuperscript{th} generation cephalosporins

• Change in median duration of therapy (20% decrease)
Data Collection

• Standardized ICD-10 codes to identify potential cases
  - Cellulitis, abscess, wound infection
  - Cystitis, complicated UTI, pyelonephritis, or catheter-associated UTI

• Manual case review:
  - 80 cases prior to intervention (12 months in 2014)
  - 20 cases per quarter during intervention (18 months)

• REDCap database
Hospital Characteristics

- **Hospital size**
  - >100 beds: n=11
  - <25 beds: n=9
  - 25-100 beds: n=6

- **Stewardship experience**
  - Considering ASP: n=4
  - Developing ASP: n=8
  - ASP in place: n=14

N = 26
## Characteristics of UTI Cases

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Baseline N = 1530</th>
<th>Intervention N = 2530</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, median (IQR)</td>
<td>76 (62-85)</td>
<td>74 (60-84)</td>
</tr>
<tr>
<td>Female</td>
<td>1078 (70)</td>
<td>1759 (70)</td>
</tr>
<tr>
<td>Infection type</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Complicated cystitis</td>
<td>1371 (90)</td>
<td>2119 (84)</td>
</tr>
<tr>
<td>Pyelonephritis</td>
<td>76 (5)</td>
<td>227 (8)</td>
</tr>
<tr>
<td>Uncomplicated cystitis</td>
<td>83 (5)</td>
<td>184 (7)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>400 (26)</td>
<td>749 (30)</td>
</tr>
<tr>
<td>Long term care facility resident</td>
<td>253 (17)</td>
<td>386 (15)</td>
</tr>
<tr>
<td>Fever (≥38.0°C)</td>
<td>413 (27)</td>
<td>892 (36)</td>
</tr>
<tr>
<td>Leukocytosis (≥12,000mm³)</td>
<td>863 (57)</td>
<td>1458 (58)</td>
</tr>
<tr>
<td>Characteristic</td>
<td>Baseline N = 722</td>
<td>Intervention N = 1030</td>
</tr>
<tr>
<td>--------------------------------------</td>
<td>------------------</td>
<td>-----------------------</td>
</tr>
<tr>
<td><strong>Age, median (IQR)</strong></td>
<td>60 (45-75)</td>
<td>60 (45-75)</td>
</tr>
<tr>
<td><strong>Male</strong></td>
<td>393 (54)</td>
<td>564 (55)</td>
</tr>
<tr>
<td><strong>Infection type</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Non-purulent cellulitis</td>
<td>530 (73)</td>
<td>719 (70)</td>
</tr>
<tr>
<td>Wound infection/purulent cellulitis</td>
<td>134 (19)</td>
<td>211 (20)</td>
</tr>
<tr>
<td>Abscess</td>
<td>58 (8)</td>
<td>100 (10)</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>216 (30)</td>
<td>312 (30)</td>
</tr>
<tr>
<td>Fever (≥38.0°C)</td>
<td>152 (21)</td>
<td>203 (20)</td>
</tr>
<tr>
<td>Leukocytosis (≥12,000mm$^3$)</td>
<td>409 (57)</td>
<td>509 (51)</td>
</tr>
</tbody>
</table>
# Pre-post Analyses - UTI

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Baseline (n=1530)</th>
<th>Intervention (n=2530)</th>
<th>% change</th>
<th>( P )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases treated with a fluoroquinolone, n (%)</td>
<td>745 (49%)</td>
<td>1030 (41%)</td>
<td>-16</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cases meeting IDSA definition of UTI, n (%)</td>
<td>786 (51%)</td>
<td>1367 (54%)</td>
<td>6</td>
<td>0.10</td>
</tr>
<tr>
<td>Duration of therapy, median (IQR)</td>
<td>7 (3-10)</td>
<td>7 (4-10)</td>
<td>0</td>
<td>0.99</td>
</tr>
</tbody>
</table>
Performance by Hospital – FQ Exposure
## Pre-post Analyses – Skin Infections

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Baseline (n=722)</th>
<th>Intervention (n=1030)</th>
<th>% change</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure to antibiotics with broad gram-negative activity, n (%)</td>
<td>440 (61%)</td>
<td>551 (53%)</td>
<td>-13</td>
<td>0.001</td>
</tr>
<tr>
<td>Duration of therapy, median (IQR)</td>
<td>11 (8-13)</td>
<td>10 (8-13)</td>
<td>-9</td>
<td>0.03</td>
</tr>
</tbody>
</table>
Performance by Hospital – Exposure to Broad Gram-Negative Antibiotics
Time Series Analysis - UTI

- Proportion of Cases or Median Duration
- Trend

Criteria for symptomatic UTI met
Exposure to fluoroquinolone
Total duration of therapy

<table>
<thead>
<tr>
<th>Proportion of Cases</th>
<th>Duration of Therapy (Days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jan</td>
<td>Mar</td>
</tr>
<tr>
<td>Baseline</td>
<td>Intervention</td>
</tr>
</tbody>
</table>
Time Series Analysis – Skin Infections

Exposure to antibiotic with broad gram-negative activity

Total duration of therapy

Proportion of Cases

Duration of Therapy (Days)

Baseline

Intervention

Baseline

Intervention
Impact by Hospital Size and ID Expertise

Critical access vs. non-critical access hospitals
• Critical access hospitals performed better than larger hospitals across all outcomes

ID expert vs. no ID expert on hospital team
• Presence of ID expert on hospital teams not consistently associated with better performance
Limitations

• Quality improvement project
  o Pre-post intervention, no control group
  o Variation in implementation across sites

• Data collection
  o Quality of medical record abstraction
  o Loss of one hospital in the last two quarters of intervention

• Surrogate outcome measures

• Unclear if changes sustained over longer period
Strengths

• Application of collaborative methodology to antibiotic stewardship
• Measurable performance targets
• Generalizable across diverse hospitals
• Modest cost ($150-175K per year)
• Springboard for stewardship programs
Conclusions

• Feasible approach to engage unaffiliated hospitals in a common stewardship target

• Overall performance targets partially met
  ○ Notable reductions in use of antibiotics with broad gram-negative activity

• Numerous hospitals demonstrated high degree of success

• Effective platform for future interventions
Barriers for Hospitals

- Resource limitations (personnel, time)
- Lack of local ID experts
- Staff turnover
- Buy-in
- Manual data collection
Lessons Learned

• Increase accountability of hospital teams
• Track implementation processes to identify key factors for success
• Identify and address barriers at hospital level
• Limit data collection burden
• Focus on sustainability of intervention
• Engagement and support of rural and critical access hospitals
Acknowledgments

Colorado Hospital Association
Toni Foos
John Savage
Teri Hulett
Sarah Hodgson
Nancy Griffith
Janet McIntyre

Our Participating hospitals

Our Partners:
Telligen
CDPHE
CO ACHA

Steering committee members
Wendy Bamberg
Gerry Barber
Jeff DesJardin
Gregory Gahm
John Hammer
Tim Jenkins
Bryan Knepper
Marc Meyer
Katherine Shihadeh
Stacy Volk
Heidi Wald
Question 1

Which of the following changes in prescribing were observed in hospitals participating in the UTI intervention?

A. Reduced use of vancomycin
B. Reduced use of fluoroquinolones
C. Shorter durations of therapy
D. All of the above
Question 2

Which of the following changes in prescribing were observed in hospitals participating in the skin infection intervention?

A. Reduced use of antibiotics with a broad spectrum of gram-negative activity
B. Increased use of vancomycin
C. Longer durations of therapy
D. All of the above