Using an Algorithm to Decrease Fluoroquinolone Use and Effects on Escherichia coli Resistance

Denver Health, an urban, integrated public health care system, saw resistance to trimethoprim-sulfamethoxazole (TMP-SMX) among urinary E. coli isolates reach 24% in 1999.

In response, an algorithm was developed recommending fluoroquinolones first-line for the treatment of outpatient acute cystitis. This resulted in an increase in outpatient fluoroquinolone use, accompanied by a rapid increase in fluoroquinolone-resistant E. coli isolates, from 1% in 1999 to 9.4% in 2005.

In response to the increasing resistance, the algorithm was revised in November 2007 recommending nitrofurantoin first line for uncomplicated cystitis, reserving levofloxacin for complicated cases.

Background

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Objective

• To evaluate changes in fluoroquinolone and nitrofurantoin prescriptions following the revised algorithm
• To assess the impact on antimicrobial resistance in E. coli

Methods

Study design: single center, retrospective, pre-post intervention study

<table>
<thead>
<tr>
<th>Pre-Intervention</th>
<th>Post-Intervention</th>
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<tbody>
<tr>
<td>Fluoroquinolones (FQ) recommended first-line</td>
<td>Nitrofurantoin (NF) recommended first-line</td>
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Included: patients seen in the emergency department, urgent care clinic, or primary care clinic with an ICD-9 diagnosis code for acute cystitis (595.00, 599.00) who filled an antibiotic within 3 days

Excluded: pregnant women, prisoners, patients <19 yrs or >89 yrs

All E. coli urine cultures were collected during the study period.

Prescription and microbiological data was aggregated by quarter and evaluated over time via interrupted time series analysis. Mean changes were compared pre- and post-intervention using a Wilcoxon non-parametric rank-sum test.

Results

N = 5717 prescriptions

<table>
<thead>
<tr>
<th>FQ</th>
<th>Pre-Intervention</th>
<th>Post-Intervention</th>
<th>P-value</th>
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<tbody>
<tr>
<td></td>
<td>66.1%</td>
<td>34.7%</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>NF</td>
<td>16.3%</td>
<td>28.3%</td>
<td>&lt; 0.001</td>
</tr>
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• A detailed time series analysis revealed the intervention was associated with an immediate 15% decrease in FQ use and 13% increase in NF use.

N = 11,367 urinary E. coli isolates with susceptibilities

Figure 1: Fluoroquinolone and nitrofurantoin prescriptions

**Figure 2: E. coli fluoroquinolone and nitrofurantoin resistance**

• Detailed time series analysis of FQ resistance rates in the post-intervention period showed a slight but significant 0.3% decrease in resistant organisms per quarter (P = 0.02)
• There was no change in NF resistance during the study

Conclusion

• The halt and decline of a growing population of FQ-resistant E. coli found in the community quickly followed a marked reduction in FQ use for UTI management
• These findings suggest that antimicrobial stewardship interventions such as treatment algorithms can impact prescribing practices and the emergence of antimicrobial resistance in the community

References:


Disclosure: Authors of this presentation have nothing to disclose concerning possible financial or personal relationships with commercial entities that may have a direct or indirect interest in the subject matter of this presentation.

This research has been approved by the Colorado Institutional Review Board.

Questions should be directed to: Rebecca Seymour
rebecca.seymour@dhha.org

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Denver Health Medical Center, Denver, CO
Rebecca Seymour, PharmD; Kati Shihadeh, PharmD; Bryan Knepper, MPH, MSc; Mike Doody, PharmD; Michelle Haas, MD; Timothy Jenkins, MD