Effect of Antibiotic Stewardship Intensity and Outpatient Antibiotic Prescribing Rates on the Variability in Prevalence of Antibiotic-Resistant Phenotypes between U.S. States

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INTRODUCTION

- According to the CDC, antibiotic-resistant bacteria cause over 2 million illnesses and 23,000 deaths in the U.S. per year
- Antibiotic resistance prevalence varies between U.S. states, despite there being national recommendations in place to combat antibiotic resistance

PURPOSE: Determine whether the variability in prevalence of three antibiotic-resistant phenotypes between U.S. states can be explained by differences in:
- Antibiotic stewardship intensity
- Outpatient antibiotic prescribing rates

METHODS

STUDY DESIGN

- Ecological secondary analysis
- Sources of data:
  - CDC’s Antibiotic Patient Safety Atlas
  - Pathogen and Resistance Prevalence
  - Antibiotic Stewardship
  - Outpatient Antibiotic Prescribing
  - Centers for Medicaid and Medicare Services
  - U.S. Census Bureau

PREDICTORS

- % hospitals that incorporate all 7 of CDC’S Core Elements of Antibiotic Stewardship
- Outpatient antibiotic prescribing rates

OUTCOMES

- Prevalence of three antibiotic-resistant phenotypes
  - MDR P. aeruginosa
  - ESC-R E. coli
  - MRSA

STATISTICAL ANALYSIS

- Multivariate logistic regression with event/trials
- Pearson’s partial correlation coefficient (R²)
- Wilcoxon ranked-sum test

RESULTS

Table 2. Pearson’s Partial Correlation Coefficients (R²) for Intensity of Antibiotic Stewardship and Outpatient Prescription Rates on Prevalence of MRSA, ESC-R E.coli, and MDR P. aeruginosa

<table>
<thead>
<tr>
<th>Predictor</th>
<th>MRSA*</th>
<th>ESC-R E.coli</th>
<th>MDR P. aeruginosa*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antibiotic Stewardship</td>
<td>0.1104</td>
<td>-0.0297</td>
<td>0.0003</td>
</tr>
<tr>
<td>Fluoroquinolones</td>
<td>-</td>
<td>0.4417**</td>
<td>0.2876</td>
</tr>
<tr>
<td>High African-American</td>
<td>0.3499</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Low African-American</td>
<td>0.3333*</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Cephalosporins</td>
<td>0.1268</td>
<td>0.966***</td>
<td>-0.089</td>
</tr>
<tr>
<td>Penicillins</td>
<td>-0.162</td>
<td>0.1813</td>
<td>0.1705</td>
</tr>
<tr>
<td>Macrolides</td>
<td>0.0381</td>
<td>-0.07</td>
<td>-0.153</td>
</tr>
</tbody>
</table>

* Adjusted for number of SNF bed-days, percent of the population African-American, validation, and mandate
** Adjusted for percent of the population African-American, total population, and percent of the population ≥ 65 years of age
*** Adjusted for percent of the population ≥ 65 years of age, number of LTACFs, and validation

CONCLUSIONS

- Intensity of antibiotic stewardship DID NOT explain the variability in any of the antibiotic-resistant phenotype prevalence between U.S. states
  - Poor accuracy in assessment of effective stewardship
  - Lack of time-series component of antibiotic stewardship assessment
  - Lack of infection control assessment

- Fluoroquinolone prescribing DID explain the variability of MRSA; this was further elevated in states with a higher population of African-Americans
  - African-American children have higher rates of MRSA colonization
  - African-Americans more likely to develop illnesses requiring antibiotic use

- Fluoroquinolone and cephalosporin prescribing DID explain the variability of ESC-R E. coli
  - May be indicative of other general behaviors that influence resistant E. coli (i.e. promotion or alteration of the gastrointestinal tract flora)

- States with validation standards DID NOT differ in antibiotic resistance prevalence to states without
  - States with validation focus on correct reporting of HAI data regardless of resistance status

- States with NHSN mandate DID NOT differ in antibiotic resistance prevalence to states without
  - Infections included in CMS federal quality reporting programs, acted only additional reporting mandate
  - Almost all hospitals in all states are reporting these data to NHSN

CONTACT INFORMATION

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