Trends in antibiotic prescribing for acute respiratory infection in veterans with spinal cord injury and disorder

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Received 18 January 2005; returned 9 February 2005; revised 7 March 2005; accepted 11 March 2005

Objectives: Most acute respiratory infections (ARIs) are viral and do not warrant antibiotic therapy. Studies to date have not examined trends in antibiotic use in ARIs in populations with disabilities, thus we assessed antibiotic prescribing for veterans with spinal cord injury and disorder (SCI&D) with outpatient ARI visits.

Patients and methods: Retrospective study using Department of Veterans Affairs (VA) administrative and pharmacy datasets (1 October 1998–30 September 2001; fiscal years 1999–2001) to assess antibiotic prescribing for upper respiratory infection (URI), lower respiratory infection (LRI), and pneumonia in veterans with SCI&D.

Results: There were 5713 ARI visits; 50% received new antibiotic prescriptions. URI and LRI visits were 2.3 times and almost 4 times (P < 0.0001), respectively, more likely to have antibiotics prescribed than pneumonia visits. The majority of URI visits with antibiotic prescriptions had a diagnosis of the common cold or URI not otherwise specified (78%). Acute bronchitis without exacerbation was associated with 95% of LRI visits that received antibiotics. Broad-spectrum antibiotic use increased over time (1999, 46%; 2001, 62%; P < 0.0001).

Conclusions: Although rates of antibiotic prescribing remained stable, prescriptions for broad-spectrum antibiotics increased. Most prescriptions were for indications for which antibiotic use is generally not recommended. Since patients with SCI&D are susceptible to multiple complications, providers may be more concerned with ensuring that any infection is treated, rather than the potential for overuse and resistance. Future efforts should focus on defining benefits of antibiotic use for ARIs in those with disabilities, predictors of prescribing, and interventions to prevent injudicious use of antibiotics.

Keywords: upper respiratory infections, prescription rates, bronchitis, pneumonia, disabilities

Introduction

Antimicrobial resistance is a public health problem promoted by appropriate and inappropriate use of antibiotics.¹ Reductions in antibiotic use are warranted for many acute respiratory infections (ARIs) [i.e. acute bronchitis, acute sinusitis, pharyngitis, non-specific upper respiratory infections (URIs)] because most are caused by viruses.² Studies of antibiotic use for ARIs in the general adult population³–⁵ have found that most antibiotics prescribed in an ambulatory care setting are for ARIs and provide little to no benefit.³ There have been no large-scale studies assessing trends in antimicrobial use in ARIs in populations with disabilities, such as spinal cord injuries and disorders (SCI&D). Infections are common causes of morbidity and mortality in
persons with SCI&D, putting them at increased risk of frequent antibiotic prescribing and development of antibiotic-resistant organisms. The Veterans Health Administration (VA) is an excellent setting to assess antimicrobial use trends in persons with SCI&D because of the stability of the population and the availability of prescription data. This study examined trends in antibiotic prescribing for ARIs in veterans with SCI&D in the ambulatory care setting.

### Materials and methods

This was a 3 year (1 October 1998–30 September 2001; fiscal years, 1999–2001) retrospective analysis of a dynamic cohort of veterans with SCI&D receiving care at ~850 US VA ambulatory care facilities. Human studies approval was obtained from the investigators’ facility. Subjects included all SCI&D veterans in a cohort defined by utilization and diagnosis codes that had any ambulatory care (outpatient) visits for an ARI including URI, lower respiratory infection (LRI), and pneumonia during the study period.

The VA Medical Inpatient and Outpatient national administrative datasets were used to obtain patient demographics (gender, age and race) and identify outpatient diagnoses of ARI. Only ambulatory care visits that did not result in same-day hospitalization were included. All diagnosis fields (up to 10 codes) were examined for ARI since persons with SCI&D often have multiple comorbidities. The International Classification of Diseases, Ninth Revision, Clinical Modification (ICD9-CM) was used to identify diagnoses of the following: (i) URI [034, streptococcal sore throat; 460–465, acute nasopharyngitis (common cold), acute sinusitis, pharyngitis and laryngitis, acute non-specific URI; 475, peritonsillar abscess]; (ii) LRI (031.0, pulmonary diseases due to other mycobacteria; 033, whooping cough; 466, acute bronchitis/bronchiolitis; 510, empyema; 511, pleurisy; 513, lung/mediastinal abscess; 515, post-inflamatory pulmonary fibrosis); and (iii) pneumonia (481–486). Patients with multiple diagnoses were assigned the more severe condition (pneumonia > LRI > URI). Hospitalizations for pneumonia in the previous 30 days were identified for pneumonia visits to identify potential follow-up visits.

Outpatient antibiotic prescriptions were obtained from the VA Pharmacy Benefits Management (PBM) Strategic Healthcare Group database. We attributed any new antibiotic prescriptions that occurred within 5 days of an ARI visit to that visit (to account for delays in prescribing or filling prescriptions). Antibiotics were classified as: narrow-spectrum agents (penicillins, amoxicillin, first-generation cephalosporins, erythromycin, tetracyclines, clindamycin, sulfamethoxazole/trimethoprim, vancomycin, doxycycline, and metronidazole) and broad-spectrum agents (amoxicillin/clavulanate, second- and third-generation cephalosporins, azithromycin, clari-thromycin, fluoroquinolones and amikacin).45

Persons with SCI&D are often treated for multiple infections, making it difficult to attribute antibiotic prescriptions to ARIs for overlapping infections. Therefore, we excluded patients with ARIs who also had diagnoses of sepsicaemia, osteomyelitis, urinary tract infection, cystitis, or other diseases of the urinary tract system that occurred on or within 5 days of the ARI visit or if the visit for these other diagnoses occurred between the ARI visit and the prescription dates. Those missing race were also dropped. Overall, 6% of ARI visits were excluded for these reasons.

Analyses were conducted at the visit level unless otherwise indicated. $\chi^2$ analyses were used to test for differences by patient characteristics and ARI type over time. Random effect logistic regression models, accounting for the non-independence of multiple visits by the same subject, were used to assess differences in antibiotic prescribing and broad-spectrum use, by ARI type, patient demographics, and time. All analyses were conducted using SAS 8.2 and STATA SE/8.2.

### Results

Between 1999 and 2001, there were 5713 ARI visits. Patient characteristics did not differ by year. Most visits (57%) were for URIs (Table 1), and were more frequent for younger individuals, females, and non-Hispanic blacks than for either LRI or pneumonia visits.

A new antibiotic prescription was associated with 50% of ARI visits. Antibiotic prescribing remained stable over time and did not differ by ethnicity or gender (Table 1). However, 58% of the visits with antibiotic prescriptions were for URI, followed by LRI (32%) and pneumonia (10%). URI visits were over twice as likely, and LRI visits were almost four times more likely than pneumonia visits to have antibiotics prescribed. Older patients were less likely to receive antibiotics than those aged 18–49. The majority of URI visits were due to the common cold and non-specific URI (82%), accounting for 78% of URI visits with antibiotics. After excluding visits with a same day diagnosis of chronic bronchitis exacerbation, emphysema, or asthma (5% of acute bronchitis visits), acute bronchitis was associated with 95% of LRI visits with antibiotic prescriptions. Eleven percent of pneumonia visits had a pneumonia hospitalization in the previous 30 days, suggesting these were follow-up visits to a previous hospitalization where treatment was probably received. After adjusting for follow-up visits, 36% of pneumonia visits had antibiotic prescriptions.

There were 3089 antibiotic prescriptions for 2849 visits with any antibiotic prescriptions. Overall, 54% of these visits received broad-spectrum antibiotics. Prescribing patterns for broad-spectrum antibiotics did not vary by patient demographics. Subjects with URI or LRI visits were less likely to receive broad-spectrum antibiotics than those with pneumonia visits. Broad-spectrum antibiotic prescribing increased over time (46% in 1999 to 62% in 2001, Table 1), across ARI types (URI, 43% to 58%, $P < 0.0001$; LRI, 46% to 64%, $P < 0.0001$; pneumonia, 68% to 80%, $P = 0.07$) and across demographics (under age 50, 47% to 63%, $P < 0.0001$; ages 50–64, 43% to 60%, $P < 0.0001$; ages 65 and older, 51% to 64%, $P = 0.002$; whites, 46% to 63%, $P < 0.0001$; Hispanic/other group, 43% to 63%, $P = 0.007$; non-Hispanic blacks, 50% to 58%, $P = 0.08$).

The newer, broad-spectrum antibiotics, fluoroquinolones and macrolides, accounted for 40% of all prescriptions (pneumonia, 51%; LRI, 42%; URI, 36%) (Table 2). Fluoroquinolone and azithromycin/clarithromycin use increased over 3 years.

### Discussion

Contrary to general population findings,45 rates of outpatient antibiotic prescribing for ARIs in veterans with SCI&D did not change over 3 years. Yet, the majority of URI visits with antibiotic prescriptions were due to the common cold and non-specific URI, which are generally not indicated for antibiotic treatment.3 In addition, almost all LRI visits that received antibiotics had an uncomplicated diagnosis of acute bronchitis, a condition that usually does not warrant antibiotics, suggesting room for improvement in reducing inappropriate antibiotic prescribing in this population.
Table 1. Characteristics of ARI visits by type, by receipt of an antibiotic and by receipt of a broad-spectrum antibiotic: patients with SCI&D in the VHA healthcare system (1999–2001)

<table>
<thead>
<tr>
<th>Year</th>
<th>Visits with any antibiotic prescribed (total visits = 5713)</th>
<th>Visits with a broad-spectrum antibiotic prescribed* (total visits with an antibiotic prescribed = 2849)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No. of visits (%)</td>
<td>frequency (%)</td>
</tr>
<tr>
<td></td>
<td>Year</td>
<td>Visits with any antibiotic prescribed (total visits = 5713)</td>
</tr>
<tr>
<td></td>
<td>1999</td>
<td>2029</td>
</tr>
<tr>
<td></td>
<td>2000</td>
<td>1964</td>
</tr>
<tr>
<td></td>
<td>2001</td>
<td>1720</td>
</tr>
<tr>
<td>ARI</td>
<td>pneumonia</td>
<td>854 (15.0)</td>
</tr>
<tr>
<td></td>
<td>LRI</td>
<td>1615 (28.3)</td>
</tr>
<tr>
<td></td>
<td>URI</td>
<td>3244 (56.8)</td>
</tr>
</tbody>
</table>

Type of ARI visit, frequency (%)

<table>
<thead>
<tr>
<th>Age (years)</th>
<th>Visits with any antibiotic prescribed (total visits = 5713)</th>
<th>Visits with a broad-spectrum antibiotic prescribed* (total visits with an antibiotic prescribed = 2849)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18–49</td>
<td>179 (21.0)</td>
<td>312 (19.3)</td>
</tr>
<tr>
<td>50–64</td>
<td>306 (35.8)</td>
<td>627 (38.8)</td>
</tr>
<tr>
<td>65+</td>
<td>369 (43.2)</td>
<td>676 (41.9)</td>
</tr>
<tr>
<td>Gender</td>
<td>Visits with any antibiotic prescribed (total visits = 5713)</td>
<td>Visits with a broad-spectrum antibiotic prescribed* (total visits with an antibiotic prescribed = 2849)</td>
</tr>
<tr>
<td>male</td>
<td>839 (98.2)</td>
<td>1562 (96.7)</td>
</tr>
<tr>
<td>female</td>
<td>15 (1.8)</td>
<td>53 (3.3)</td>
</tr>
<tr>
<td>Race/ethnicity (e)</td>
<td>Visits with any antibiotic prescribed (total visits = 5713)</td>
<td>Visits with a broad-spectrum antibiotic prescribed* (total visits with an antibiotic prescribed = 2849)</td>
</tr>
<tr>
<td>NH white</td>
<td>598 (70.0)</td>
<td>1133 (70.1)</td>
</tr>
<tr>
<td>NH black</td>
<td>159 (18.6)</td>
<td>281 (17.4)</td>
</tr>
<tr>
<td>Hispanic/other</td>
<td>97 (11.4)</td>
<td>201 (12.5)</td>
</tr>
</tbody>
</table>

\(a\)If a visit had both a broad-spectrum and a narrow-spectrum antibiotic prescribed, then it was counted as broad-spectrum use.
\(b\)OR, 95% confidence interval and \(P\) value were estimated with a random effect included to account for clustering.
\(c\)\(\chi^2\) association \(P\) value < 0.0001.
\(d\)\(\chi^2\) association \(P\) value = 0.016.
\(e\)NH, non-Hispanic; white Hispanic, black Hispanic, Asian, and American-Indian were combined into ‘Hispanic/other’ due to small sample sizes.
\(f\)\(\chi^2\) association \(P\) value = 0.001.
Surprisingly, pneumonia visits were less likely to result in antibiotic prescribing than other ARI visits. We excluded all pneumonia cases with a same-day hospitalization, which probably excluded many of the severe and bacterial pneumonia cases from the analysis. The remaining cases were more likely to be viral as suggested by non-specific diagnoses of pneumonia and limited coding of viral pneumonia in administrative databases. In addition, we suspect that ~11% of pneumonia visits may be follow-up visits, thus antibiotics may have been prescribed at an initial visit or hospital admission.

Older subjects, as in other studies, were less likely to receive antibiotics than younger subjects. The younger groups made up a larger percentage of those with URI and LRI visits and these diagnoses were more frequently prescribed antibiotics.

Though the overall rate of antibiotic prescribing for ARIs has not increased in this population, there is concern about the greater use of broad-spectrum antibiotics. The increased use was driven by a greater number of prescriptions for fluoroquinolones and azithromycin. This may be a consequence of physician reactions to increasing \(-lactam resistance in pneumococci, to evolving guidelines for treatment of community-acquired pneumonia, as well as to the simple dosing instructions for these antibiotics. Unfortunately, broad-spectrum antibiotics provide minimal clinical advantage over narrow-spectrum agents or no antibiotic therapy in non-pneumonic ARIs.

Increased risk for poor outcomes in these patients may lower providers’ threshold for antibiotic use and broaden the spectrum of antibiotics employed. However, this decision must be weighed against the disadvantages of undue use of resources and selecting for antibiotic resistance. It is critical that antibiotic prescribing in a population that experiences frequent infections be carefully assessed and appropriately managed.

There were several limitations to this study. We documented antibiotic prescriptions but were unable to determine medication compliance. Second, this study was a retrospective analysis of administrative databases with limitations including coding errors and decreased sensitivity for specific infections due to frequent use of non-specific ARI diagnoses. However, studies of VA databases have found these administrative data to be valid. In addition, these databases allow for population-based studies and comparison studies on ARI antibiotic prescribing practices in the general population.

To our knowledge, this is the first study to assess antibiotic prescribing of ARIs in a population with disability. It provides preliminary data on trends in antibiotic prescribing and identifies the increasing use of broad-spectrum antibiotics in this population. Additional studies are needed to determine whether general population studies are applicable to persons with disabilities and chronic diseases.

Acknowledgements

We would like to thank Dale Gerding, MD and Douglas Passaro, MD, MPH for reviewing and providing valuable feedback on the manuscript. Research and funding support was provided by the VA Health Services Research and Development Service (HSR&D), Spinal Cord Injury Quality Enhancement Research Initiative (SCI QUERI) and the VA Medical Research Service, Seattle Epidemiologic Research and Information Center (ERIC) pilot funds.

References

Antibiotic prescribing in SCI&D


