Antibiotic Prescribing for Children With Colds, Upper Respiratory Tract Infections, and Bronchitis

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Context.—The spread of antibiotic-resistant bacteria is associated with antibiotic use. Children receive a significant proportion of the antibiotics prescribed each year and represent an important target group for efforts aimed at reducing unnecessary antibiotic use.

Objective.—To evaluate antibiotic-prescribing practices for children younger than 18 years who had received a diagnosis of cold, upper respiratory tract infection (URI), or bronchitis in the United States.

Design.—Representative national survey of practicing physicians participating in the National Ambulatory Medical Care Survey conducted in 1992 with a response rate of 73%.

Setting.—Office-based physician practices.

Participants.—Physicians completing patient record forms for patients younger than 18 years.

Main Outcome Measures.—Principal diagnoses and antibiotic prescriptions.

Results.—A total of 531 pediatric office visits were recorded that included a principal diagnosis of cold, URI, or bronchitis. Antibiotics were prescribed to 44% of patients with common colds, 46% with URIs, and 75% with bronchitis. Extrapolating to the United States, 6.5 million prescriptions (12% of all prescriptions for children) were written for children diagnosed as having a URI or nasopharyngitis (common cold), and 4.7 million (9% of all prescriptions for children) were written for children diagnosed as having bronchitis. After controlling for confounding factors, antibiotics were prescribed more often for children aged 5 to 11 years than for younger children (odds ratio [OR], 1.94; 95% confidence interval [CI], 1.13-3.33) and rates were lower for pediatricians than for nonpediatricians (OR, 0.57; 95% CI, 0.35-0.92). Children aged 0 to 4 years received 53% of all antibiotic prescriptions, and otitis media was the most frequent diagnosis for which antibiotics were prescribed (30% of all prescriptions).

Conclusions.—Antibiotic prescribing for children diagnosed as having colds, URIs, and bronchitis, conditions that typically do not benefit from antibiotics, represents a substantial proportion of total antibiotic prescriptions to children in the United States each year.

Increasing rates of antibiotic resistance in community pathogens have focused the attention of researchers and clinicians on this public health problem.¹ Prior to 1980, more than 99% of all Strep-

tococcus pneumoniae cases were susceptible to penicillin. In the past decade, however, up to 40% of clinical isolates have demonstrated intermediate- and high-level resistance to penicillins and cephalosporins in children.²

The frequency and duration of prior antibiotic exposure are strongly associated with the spread of drug-resistant S pneumoniae, and children receive a significant proportion of the total antibiotics prescribed each year.²³

For editorial comment see p 881.

Reducing unnecessary antibiotic use in children requires identification of conditions for which antibiotics are overprescribed. McCaig and Hughes⁷ reported that upper respiratory tract infections (URIs) and bronchitis ranked second and third among conditions associated with antibiotic prescriptions by US ambulatory physicians in 1992. Further characterization of this antibiotic-prescribing practice in pediatric populations is needed. The goals of this study were to identify the conditions for which clinicians prescribe antibiotics most frequently in children and to characterize the antibiotic-prescribing practices for conditions that do not typically benefit from antibiotics (colds, URIs, and bronchitis).⁸¹⁰

Methods

The National Ambulatory Medical Care Survey (NAMCS), conducted annually by the National Center for Health Statistics, provides national estimates of reasons people seek medical attention and the diagnoses and prescriptions they receive from a representative sample of US ambulatory care physicians.¹¹ An analysis of antibiotic prescribing for adults has been previously reported by our group.¹²

For the current study, we evaluated antibiotic prescriptions from the 1992 survey for patients younger than 18 years with the principal diagnoses of acute nasopharyngitis (common cold, International Classification of Diseases, Ninth Revision, Clinical Modification¹³ [ICD-9-CM code 460], acute URIs [ICD-9-CM code 465] of multiple or unspecified sites, acute bronchitis or bronchiolitis [ICD-9-CM code 466], and bronchitis, not otherwise specified [ICD-9-CM code 490]). Office visits were...
sampled equally throughout the year. We excluded patients with underlying lung diseases such as asthma (ICD-9 code 493) and chronic bronchitis (ICD-9 code 491) to eliminate subsets of patients for whom antibiotic therapy might be justified. We aggregated colds, URIs, and bronchitis to identify common factors associated with antibiotic use for these conditions. Antibiotic prescriptions for each visit were counted only if entered as the primary medication related to the office visit on the patient record form. The final study group (n = 531) represented 9% of pediatric office visits in the 1992 NAMCS and comprised 62% pediatricians, 20% family practitioners, 11% general practitioners, 4% internists, and 3% other (mostly specialists).

Our statistical analysis of the NAMCS 1992 database was previously described. χ² Tests were used to measure the unadjusted association between predictor variables (age, race, ethnicity, method of payment, practice location, physician specialty) and antibiotic prescriptions for colds, URIs, and bronchitis in children. Multivariate logistic regression analysis further tested the independence of associations using a model that included all predictor variables. Results are presented as odds ratios (ORs) with 95% confidence intervals (CIs).

**Results**

The leading ambulatory care diagnoses accounting for antibiotic prescriptions in children younger than 18 years are presented in Table 1. Otitis media was the leading condition, accounting for 30% of the total antibiotic prescriptions to children in ambulatory practice in 1992. Diagnoses of URI (including the common cold), pharyngitis, and bronchitis accounted for 12%, 10%, and 9% of total antibiotic prescriptions, respectively.

Antibiotics were prescribed in 44% of cases diagnosed as the common cold, 46% of URIs, 72% of acute bronchitis, and 76% of bronchitis, not otherwise specified (total for bronchitis overall, 75%). Antibiotic prescription rates were significantly lower for URIs than for bronchitis (χ² test, P < .001) (Figure).

Antibiotic prescription rates for colds, URIs, and bronchitis, as a group, were stratified by patient-specific factors (age, group, gender, race, ethnicity), practice demographics (geographic region, US Census standard metropolitan statistical area), method of payment, and physician specialty (Table 2). Factors significantly associated with greater antibiotic prescription rates in the bivariate analyses (unadjusted ORs) included patients aged 5 to 11 years (OR, 2.24; 95% CI, 1.34-3.73) and patients aged 12 to 17 years (OR, 2.17; 95% CI, 1.15-4.08). Pediatricians had lower antibiotic prescription rates (OR, 0.51; 95% CI, 0.33-0.77) than physicians in other specialties.

After controlling for variations due to gender, race, payment source, physician specialty, and practice location, significant independent associations persisted for children aged 5 to 11 years (compared with those aged 0 to 4 years) and pediatricians (compared with nonpediatricians). Children aged 5 to 11 years were 1.94 times as likely to receive an antibiotic prescription at an office visit related to colds, URIs, and bronchitis as children aged 0 to 4 years. Pediatricians were 0.57 times less likely to prescribe antibiotics for these conditions than nonpediatricians. These associations persisted within disease categories and were not affected by excluding office visits for which secondary diagnoses of otitis media, sinusitis, and pharyngitis were reported (present in 12% of the study sample) (data not shown).

Table 2 also displays the percentage of antibiotic use in each group. Despite a lower antibiotic prescription rate, children aged 0 to 4 years received 53% of all antibiotic prescriptions to pediatric populations. Pediatricians, while prescribing less frequently than nonpediatricians, accounted for approximately half of all prescriptions.

**Comment**

Colds, URIs, and bronchitis accounted for over 20% of all antibiotic prescriptions provided by US ambulatory physicians to children (~18 years) in 1992, despite the lack of evidence that antibiotics improve outcomes in these patients.14-15 Our finding that antibiotics were prescribed for the common cold in 44% of visits and for URIs in 46% of visits corroborates other smaller studies of antibiotic-prescribing practices in children.14,15

Controlling for all other factors, we found that patient age (age 5 to 11 years) and physician specialty were independent predictors of antibiotic use for these respiratory illnesses. There was also suggestive evidence that antibiotic prescribing was more common in visits for children aged 12 to 17 years and by physicians practicing in the South (90% CIs excluded 1.0).

Physicians who provide care for children and are not trained as pediatricians were more likely to prescribe antibiotics for colds, URIs, and bronchitis than pediatricians. This finding could be due to differential distribution among physician specialties of a number of factors that have been reported to influence the treatment of children with acute respiratory illnesses, including parental pressure, patient volume, and the physician’s desire to act or to validate the office visit.16-20 For example, parents whose children are seen by pediatricians may have different expectations regarding antibiotic prescribing. It is also possible that pediatricians use different clinical criteria for deciding when to prescribe antibiotic therapy.

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**Table 1.** Leading Ambulatory Care Diagnoses Accounting for Antibiotic Prescriptions to Children and Adolescents in the United States

<table>
<thead>
<tr>
<th>Diagnosis (ICD-9-CM Codes)</th>
<th>Office Visits, in Thousands</th>
<th>Antibiotic Prescriptions, in Thousands</th>
<th>Percentage of Total Antibiotic Prescriptions, in Thousands</th>
</tr>
</thead>
<tbody>
<tr>
<td>Otitis media (381.0, 381.3, 381.4, 382.0, 382.9)</td>
<td>20 600</td>
<td>16 150</td>
<td>30</td>
</tr>
<tr>
<td>Upper respiratory tract infection (460, 465)</td>
<td>14 068</td>
<td>6 509</td>
<td>12</td>
</tr>
<tr>
<td>Pharyngitis (462)</td>
<td>7435</td>
<td>5246</td>
<td>10</td>
</tr>
<tr>
<td>Bronchitis (466, 490)</td>
<td>6418</td>
<td>4664</td>
<td>9</td>
</tr>
<tr>
<td>Sinusitis (461, 473)</td>
<td>3254</td>
<td>2356</td>
<td>4</td>
</tr>
</tbody>
</table>

"Data are from the 1992 National Ambulatory Medical Care Survey (NAMCS). Diagnosis classified by the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) code. Nasopharyngitis (ICD-9-CM code 460) is included with upper respiratory tract infection (ICD-9-CM code 465), and acute bronchitis (ICD-9-CM code 466.0), acute bronchiolitis (ICD-9-CM code 466.10), and bronchitis, not otherwise specified (ICD-9-CM code 490.3) are summarized under bronchitis."
Table 2.—Factors Associated With Pediatric Antibiotic Prescription for Colds, Upper Respiratory Tract Infections, and Bronchitis*

<table>
<thead>
<tr>
<th>Factor</th>
<th>Percentage of Sample (n=251)</th>
<th>Percentage of Total Antibiotics</th>
<th>Unadjusted Odds Ratio (95% CI)</th>
<th>Adjusted Odds Ratio (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, y</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-4</td>
<td>64</td>
<td>53</td>
<td>Referent</td>
<td>Referent</td>
</tr>
<tr>
<td>5-11</td>
<td>23</td>
<td>29</td>
<td>2.24 (1.34-3.73)</td>
<td>1.94 (1.13-3.33)</td>
</tr>
<tr>
<td>12-17</td>
<td>13</td>
<td>18</td>
<td>2.17 (1.15-4.08)</td>
<td>1.88 (0.92-3.85)</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>49</td>
<td>46</td>
<td>Referent</td>
<td>Referent</td>
</tr>
<tr>
<td>Female</td>
<td>51</td>
<td>54</td>
<td>1.08 (0.72-1.61)</td>
<td>1.10 (0.71-1.67)</td>
</tr>
<tr>
<td>Race</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>White</td>
<td>75</td>
<td>77</td>
<td>Referent</td>
<td>Referent</td>
</tr>
<tr>
<td>Black</td>
<td>17</td>
<td>13</td>
<td>0.72 (0.42-1.24)</td>
<td>0.89 (0.47-1.68)</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>10</td>
<td>1.20 (0.56-2.54)</td>
<td>1.36 (0.56-3.32)</td>
</tr>
<tr>
<td>Ethnicity</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Hispanic</td>
<td>16</td>
<td>16</td>
<td>1.32 (0.76-2.29)</td>
<td>1.60 (0.84-3.02)</td>
</tr>
<tr>
<td>Geographic region</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Northeast</td>
<td>18</td>
<td>16</td>
<td>Referent</td>
<td>Referent</td>
</tr>
<tr>
<td>Midwest</td>
<td>22</td>
<td>23</td>
<td>1.09 (0.57-2.06)</td>
<td>1.25 (0.62-2.51)</td>
</tr>
<tr>
<td>South</td>
<td>37</td>
<td>38</td>
<td>1.54 (0.86-2.74)</td>
<td>1.87 (0.98-3.55)</td>
</tr>
<tr>
<td>West</td>
<td>23</td>
<td>23</td>
<td>1.22 (0.65-2.29)</td>
<td>1.10 (0.54-2.27)</td>
</tr>
<tr>
<td>Practice location</td>
<td></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>SMSA</td>
<td>70</td>
<td>67</td>
<td>Referent</td>
<td>Referent</td>
</tr>
<tr>
<td>Non-SMSA</td>
<td>30</td>
<td>33</td>
<td>1.06 (0.68-1.64)</td>
<td>1.02 (0.62-1.68)</td>
</tr>
<tr>
<td>Insurance type</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Commercial</td>
<td>25</td>
<td>29</td>
<td>Referent</td>
<td>Referent</td>
</tr>
<tr>
<td>HMO</td>
<td>16</td>
<td>12</td>
<td>0.65 (0.37-1.14)</td>
<td>0.62 (0.30-1.28)</td>
</tr>
<tr>
<td>Medicaid</td>
<td>30</td>
<td>27</td>
<td>0.82 (0.52-1.29)</td>
<td>0.65 (0.34-1.23)</td>
</tr>
<tr>
<td>Self-pay</td>
<td>17</td>
<td>23</td>
<td>1.41 (0.82-2.51)</td>
<td>1.23 (0.61-2.51)</td>
</tr>
<tr>
<td>Other</td>
<td>13</td>
<td>10</td>
<td>0.67 (0.37-1.22)</td>
<td>0.67 (0.31-1.41)</td>
</tr>
<tr>
<td>Physician specialty</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nonpediatrics</td>
<td>38</td>
<td>47</td>
<td>Referent</td>
<td>Referent</td>
</tr>
<tr>
<td>Pediatrics</td>
<td>62</td>
<td>53</td>
<td>0.51 (0.33-0.77)</td>
<td>0.57 (0.35-0.92)</td>
</tr>
</tbody>
</table>

*Data are from the 1992 National Ambulatory Medical Care Survey (NAMCS). CI indicates confidence interval; SMSA, standardized metropolitan statistical area (defined by the US Census Bureau as an area with total population of 75 000 to 100 000, having a large population nucleus and being well integrated with adjacent communities); and HMO, health maintenance organization.

an antibiotic for children with URIs. For example, they may place less weight on the purulence of secretions than nonpediatricians, a factor that seems to increase the likelihood for antibiotic treatment of URIs.21

Office visits for school-aged children were more likely to result in an antibiotic prescription than visits for younger children (although younger children, aged 0 to 4 years, still account for 53% of the total antibiotic burden in pediatric populations). This finding could also reflect differences in parental pressure. Since parents of school-aged children often do not have mechanisms in place to care for their child at home, they may perceive antibiotic treatment as reassurance that “everything possible is being done” and feel more comfortable returning the child with a respiratory illness back to school.

The NAMCS provides important information about antibiotic-prescribing practices in the United States because of its representativeness, standardized data collection methods, and the ability to avoid ascertainment bias related to study hypotheses. Despite this, our study was limited because physicians may have reported diagnoses in a biased manner to justify antibiotic treatment. However, this occurrence would likely lead to an underestimation of antibiotic prescribing for colds, URIs, and bronchitis. To decrease the potential for misclassification, we included only those office visits in the study in which cold, URI, or bronchitis were listed as the principal diagnosis and an antibiotic was listed as the principal drug therapy.

Antibiotics are frequently prescribed for children with colds, URIs, and bronchitis, despite recommendations to the contrary. This study confirms that the overuse of antibiotics for these conditions is widespread, prevalent in all medical specialties, and not dramatically influenced by patient demographics or methods of payment. Understanding why physicians prescribe antibiotics for conditions not helped by antibiotics will require broadly based studies of physician decision making and patient health-seeking behavior. Efforts to improve antibiotic-prescribing practices should target all physicians and parents who care for children and teenagers.

This study was supported in part by a National Research Service Award (grant No. 5 F32-FP100096-04) (Drs Nyquist and Gonzales). We thank the staff at the National Center for Health Statistics, Hyattsville, Md, for their guidance and statistical support using the NAMCS 1992 database.

References

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plant material. The name has been used in marketing this product to growers since that time. It was only in 1997 that Glaxo Wellcome filed trademark papers to use the name “Zyban” for smoking cessation pharmaceuticals.

Second, the labeling for Zyban WSB states clear warnings, in both Spanish and English, that include, among other warning language and precautionary statements, that it is for professional use only, and is harmful if swallowed or inhaled.

Third, this product is not available to the consumer through retail channels, but rather is sold only through professional distributors who sell to the horticulture industry. Also, the product’s packaging does not lend itself to consumer use, as the product is packaged in a durable plastic pouch, with four 8-oz water-soluble bags enclosed, filled with wettable powder, and instructions for horticultural application.

Last, we disagree with Dr Bubb’s assertion that agricultural workers would be familiar with classification names of chemical compounds such as benzimidazoles, and would be likely to formulate a mental connection between a veterinary product and a fungicide for use on ornamental plant material.

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Macular Edema Associated With Nicotinic Acid (Niacin)

To the Editor.—Oral nicotinic acid (niacin) lowers serum cholesterol levels when taken in high doses. Although nicotinic acid has not achieved widespread use, its low cost makes it attractive in today’s cost-conscious medical environment and its use may be increasing. In this report, we describe 3 patients who developed visual loss while taking nicotinic acid for hypercholesterolemia.

Report of Cases.—A 51-year-old man gradually increased his dose of nicotinic acid from 1 g to 4.5 g. Within 4 weeks, he noted blurred vision in both eyes. Visual acuity was 20/60 OD and 20/70 OS. Both fovea had a cystic appearance but no leakage was demonstrated on fluorescein angiography. The patient discontinued the nicotinic acid and reported significant improvement 1 month later, with measured visual acuity of 20/25.

A 53-year-old man gradually increased his dose of oral nicotinic acid from 1 g/d to 3 g/d over 1 year. He had been taking 3 g/d for 6 months when he noted gradual onset of darkening of the vision (“someone turned down the rheostat”). Visual acuity was 20/60 OD and 20/50 OS and there was typical cystoid macular edema without leakage on angiography. Use of the nicotinic acid was discontinued and within 3 days the visual symptoms had resolved; visual acuity was 20/20 OD and 20/15 OS. The macula demonstrated normal appearance with resolution of the cystoid macular edema in both eyes (Figure, C).

Comment.—Nicotinic acid maculopathy is an uncommon occurrence and, therefore, not widely appreciated. Gass first reported loss of vision associated with high doses of nicotinic acid for the treatment of hypercholesterolemia. To our knowledge, there is only 1 other report of confirmed nicotinic acid maculopathy in the literature. The usual symptom is blurring of vision and the time to development of symptoms varies. The clinical findings include cystoid macular edema on biomicroscopy and absence of leakage on fluorescein angiogram. Fortunately, the adverse effect appears reversible with lowering the dose or discontinuing the use of nicotinic acid. Clinicians should be aware of this potential complication in patients who take nicotinic acid.

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CORRECTIONS

Unit of Measure Omitted.—In the Brief Report entitled “Antibiotic Prescribing for Children With Colds, Upper Respiratory Tract Infections, and Bronchitis” published in the March 18, 1998, issue of THE JOURNAL (1998;279:875–877), the unit of measure was omitted in the Figure and in Table 1. On page 876, in the Figure, the vertical axis label that reads “Office Visits” should have read “Office Visits, in Thousands.” Also, on page 876, in Table 1, the column headings that read “Office Visits,” “Antibiotic Prescriptions,” and “Percentage of Total Antibiotic Prescriptions” should have read “Office Visits, in Thousands,” “Antibiotic Prescriptions, in Thousands,” and “Percentage of Total Antibiotic Prescriptions.”