Antimicrobial Prescribing for Upper Respiratory Infections and Its Effect on Return Visits

John Li, MPH; Anindya De, PhD; Kathy Ketchum, RPh, MPA, HA; L.J. Fagnan, MD; Dean G. Haxby, PharmD; Ann Thomas, MD, MPH

Background and Objectives: Antibiotic resistance is a growing problem that complicates the treatment of various illnesses. This study analyzes Medicaid encounter data to (1) determine antibiotic prescribing rates for common respiratory tract infections in Oregon and (2) assess the effect of receiving an antibiotic at an index visit on whether there was a return visit within 30 days. Methods: Subjects included in this study were Medicaid patients in Oregon between 2001–2003 who were enrolled in Medicaid for a full year and were diagnosed with an upper respiratory tract infection, including bronchitis, sinusitis, acute otitis media (AOM), pharyngitis, and upper respiratory infections (URIs). Claims data were analyzed to determine receipt of an antibiotic within 3 days of the initial visit and if there was a return visit within 30 days. Results: During 2001–2003, the proportion of patients receiving antibiotics for bronchitis and sinusitis decreased, from 70% to 61%, and from 78% to 74%, respectively, while antibiotic prescribing for AOM, URI, and pharyngitis changed little. After controlling for age, gender, race/ethnicity, Medicaid plan type, and location, we determined that patients who had received antibiotics during the index visit for AOM, URI, and pharyngitis were more likely to return with a respiratory tract infection during the subsequent 30 days than patients who did not receive antibiotics. Conclusions: Antibiotic prescribing among Medicaid patients in Oregon has decreased. Receiving an antibiotic does not decrease the rate of subsequent return visits.

(Fam Med 2009;41(3):182-7)
of physician perceptions about antibiotic use among children, physicians were substantially more likely to prescribe if they believed the parent desired antibiotics. However, a 1996 study of 113 Oklahoma family physicians noted that physicians’ perceptions of patients’ desire for antibiotics were inaccurate 25% of the time, and for an additional 26%, physicians were unsure about patients’ expectations. In focus groups, physicians also noted that if they did not prescribe an antibiotic, the patient would likely return the next day, taking up even more clinic time.

The few studies that have evaluated the effect of receipt of an antibiotic prescription on rate of return visits have been equivocal. Three studies showed that children receiving an antibiotic for acute bronchitis had a slightly decreased rate of return visits, while another study showed small increases in return visits in those that were prescribed antibiotics. Due to these mixed past findings, we wished to explore this question further. Our approach expands on previous studies by looking at several types of respiratory infections. Also, we took a population-based approach in looking at this question by examining a large statewide Medicaid database, an approach that has not been taken previously.

Data indicating a decline in national prescribing rates are available from the National Ambulatory Medical Care Survey, but it is difficult to obtain local-level data from this source. Our study uses Medicaid encounter and pharmacy claims data to describe antibiotic prescribing practices in Oregon to help evaluate the effects of the statewide campaign. We also examined the influence of receiving an antibiotic on the likelihood of return visits within 30 days.

Methods
The Oregon Medicaid Program
The Oregon Medicaid program is administered by the Oregon Medical Assistance Program (OMAP). Health services are provided to patients through traditional fee-for-service providers (FFS) or through contracted managed care organizations (MCOs). Approximately 25% of the recipients of Oregon Medicaid, typically in rural areas, are enrolled in FFS. The rest are covered by an MCO. Those who remain in an FFS system either do not have an MCO available where they live, or they meet special qualifications to allow them to opt out of an MCO plan.

Encounter and prescribing data from FFS providers are available from OMAP, but the state does not typically receive such data from MCOs. Through a special data use agreement, the Department of Human Services was able to obtain encounter and prescribing data for this study from Care Oregon (CO), the largest Oregon Medicaid MCO provider, which covered an average of approximately 90,000 persons (or 20% of the total Medicaid population) during the study period and primarily serves the Portland metropolitan area.

Claims Data Algorithm
We modeled our algorithm for evaluating claims data after protocols in published studies on national prescribing rates for upper respiratory tract infection and an evaluation of a community-wide campaign to reduce inappropriate use of antibiotics in children in Tennessee. We evaluated claims data for the following five respiratory infections: otitis media (International Classification of Diseases, Ninth Edition [ICD-9] 381, ICD-9 382), acute unspecified URI and the common cold (ICD-9 465, ICD-9 460), acute and chronic sinusitis (ICD-9 461, ICD-9 473), acute pharyngitis (ICD-9 462), and acute or unspecified bronchitis (ICD-9 466, ICD-9 490). We categorized visits for the conditions as an index visit if no claims had been made for any of the conditions during the previous 30 days. We classified patients as having received an antibiotic if a pharmacy claim existed for an antibiotic within 3 days of the index visit and no underlying illness had been noted that might make the patient more likely to need an antibiotic (eg, cystic fibrosis, asthma, or other chronic pulmonary condition).

We also categorized the main diagnosis for each visit. If acute otitis media (AOM), pharyngitis, bronchitis, or sinusitis were diagnosed as the sole diagnosis or appeared with URI as the only other diagnosis, the main diagnosis was considered to be AOM, pharyngitis, bronchitis, or sinusitis, respectively. If any of these diagnoses appeared with another diagnosis other than URI, the visit was excluded from consideration. The only time URI was considered as the main diagnosis was for visits during which URI was the sole diagnosis.

After determination of the main diagnosis for each visit, we calculated the proportion of patients receiving antibiotics for each of our five conditions of interest. We also tracked claims for any of these respiratory conditions during the 30 days after the index visit to estimate the rate of return visits among patients with an index visit for any of the five conditions.

We examined the rates of the five conditions among CO and FFS patients by dividing the number of cases of each diagnosis by the total eligible Medicaid population for the study. The rates were determined for two main reasons. First, we wanted to be able to comment on the absolute number of antibiotics being administered. If the percentage of patients receiving antibiotics for a given condition decreased during our study period, but the rate of diagnosis of that condition increased, total antibiotic use would not have changed. Second, we were interested in determining if clinicians were shifting their use of ICD-9 codes in response to CDC guidelines disseminated throughout the state on the management of these infections. If the guidelines were being followed, rates of these diagnoses might decrease over time, and use of ICD-9 codes 460 and 465 (for common cold and viral URI) might increase. Another concern was that clinicians might code infections such as
bronchitis or sinusitis, rather than coding them as URI, when they are inclined to administer an antibiotic, and we wanted to be able to evaluate that practice.

Data Analysis
We only had data for the two types of plans (CO and FFS). To determine a general prescribing rate for the entire Medicaid population it was necessary to categorize the remaining plans as CO-like or FFS-like based on the demographics of their clientele. Discriminant analysis was conducted to classify each of the plans into CO or FFS types by using yearly demographic data for 2000–2003. This classification was based on data available regarding the demographic variables for each plan, including age distribution, gender, and race/ethnicity. Age information was available in categorical form for five groups (ages ≤5, 6–18, 19–39, 40–69, and ≥70 years) and was represented by four dichotomous variables. Gender was represented by one dichotomous variable, male/female. Race/ethnicity information was available for, and coded as, white, Asian, black, Hispanic, American Indian, and other. Four dichotomous variables for each group, except the reference group (whites), were used in the analysis. Multicollinearity was identified among the original set of race variables and as a remedial measure, dichotomous variables representing black, and Hispanic were excluded from the classification procedure.

After all the individual plans were classified into CO or FFS types, we summed the total number of members in each newly classified group (CO or FFS) to determine the market share for the two groups. These proportions were used as the relative weights, and statewide Medicaid prescribing rates were calculated as a weighted average of the two proportions. We assumed that CO and FFS were representative samples from their respective groups, and a finite population correction was used to estimate the standard errors because each of them constituted a substantial proportion of their group. We evaluated changes in prescribing rates for the 3-year period by comparing the rates on the basis of the z test.

We used multivariate logistic regression to examine the effect of receiving an antibiotic on return visits. Separate models were constructed for each of the five respiratory conditions. Return visit for any of the conditions within 30 days of the index visit (yes or no) was the dependent variable, and receipt of antibiotics (yes or no) was the independent variable of interest. We included in the model the variables that were identified as associated with receipt of antibiotics in the univariate analysis: race/ethnicity, age, residence, plan type, and gender. Race/ethnicity of patients was coded with white as the reference group.

We used Pearson correlation coefficients to assess potential correlation between all of the independent variables of interest and the outcome variable. All second-order interactions among the factors were tested, and appropriate subgroup analyses were conducted for factors that were identified as having statistically significant interaction terms.

All variables mentioned above were included in the first model. We retained variables that had a P value of <.1 or that appeared to be confounders. A P value of <.05 was considered significant in the final model. Because receipt of an antibiotic was our variable of interest, we kept it in all models regardless of significance. The Hosmer-Lemeshow goodness of fit test was used to test the fit of each model.

Results
The combined number of CO and FFS patients eligible for the study during the years 2001, 2002, and 2003 were 111,529, 141,620, and 123,478, respectively. Examination of the rates of diagnoses of AOM, URI, sinusitis, bronchitis, and pharyngitis demonstrates that the incidence of these infections or use of these codes did not vary substantially during our study period; for all five diagnoses, the incidence either declined or remained stable (Figure 1).

Table 1 displays the proportion of patients receiving antibiotics each year for the five conditions. During 2001–2003, the proportion of patients receiving antibiotics for bronchitis decreased significantly, from 70% to 61%, with a more modest decrease in prescribing seen for sinusitis, from 78% to 74%. For pharyngitis and URI, prescribing rates also declined, although the declines were quite small, albeit statistically significant.

Our logistic models for each of the five diagnoses indicated that not receiving an antibiotic on the index visit was not associated with a higher probability of return visits (Tables 2 and 3) after adjustment for other covariates. For three conditions—AOM, pharyngitis, and URI—receipt of an antibiotic was associated with an increased likelihood of a return visit.

In the logistic regression model for URI (but not the other four conditions), we identified an association between receipt of antibiotics at the index visit and probability of returning in 30 days that varied by age. We examined this interaction further by constructing separate models for URIs for four new age groups: 0–4, 5–9, 10–19, and ≥20 years (Table 3). The effect of having received an antibiotic on having a return visit was examined for each age group. The odds of having a return visit after receipt of an antibiotic was higher for the younger age groups (0–4 and 5–9 years), with an adjusted odds ratio of 1.39 (95% CI, 1.24–1.55) and 1.82 (95% CI, 1.42–2.34), respectively. Having received an antibiotic did not have a significant effect on the odds of a return visit for the older two age groups.
Discussion

Our findings that use of antibiotics for URIs is relatively low, ranging from 12% to 14%, compared to national estimates of 20% in 1999 (23) is reassuring, while relatively high rates of prescribing for bronchitis and sinusitis indicate educational intervention might be warranted. The fact that rates of diagnoses of the five respiratory conditions remained stable or declined during 2001–2003 demonstrates that clinicians were not shifting ICD-9 codes away from URIs to such diagnoses as AOM or sinusitis when they wanted to prescribe an antibiotic. Additionally, the decrease in rates of the conditions studied, coupled with a decrease in the proportion of patients receiving antibiotics, corresponds to a true decrease in the overall amount of antibiotics being dispensed for these conditions.

We also used these claims data to show that patients who received an antibiotic in the index visit did not have a decreased rate of return visits. In fact, for AOM, pharyngitis, and URI, patients were more likely to return if they did receive an antibiotic. This effect was particularly pronounced among children ages <10 years with a diagnosed URI, which is notable because 50% of our cases of URI occurred among this age group. We hypothesize that patients who received antibiotics might have higher expectations for rapid resolution than patients who do not receive antibiotics, particularly because patients who do not receive antibiotics might
receive more counseling from their clinicians on the natural history of a viral infection.

Limitations
This study has several limitations. First, our results can only be generalized to the Medicaid population. Patients examined in other settings might be different in terms of their likelihood of receiving antibiotics or their patterns of accessing care after an initial visit.

Second, statewide estimates were based on the assumption that all the Medicaid insurance plans in the state could be classified into either CO or FFS types, and their prescribing rates might be similar to that of CO or FFS. The number of variables available for the classification procedure was also limited.

Third, our study analyzed claims data; we did not review patients’ charts. Therefore, we could not determine if patients with AOM, URI, and pharyngitis who received antibiotics and had subsequent visits during the next 30 days had more severe symptoms than patients who did not receive antibiotics. However, multiple aspects of our study design should have minimized this possibility. We excluded patients who had underlying diagnoses (eg, immunodeficiency or underlying lung disease) that can make patients more likely to need antibiotics. For patients with diagnosed URIs in particular (acute unspecified upper respiratory infection or the common cold, ICD-9 codes 460 or 465), our algorithm excluded patients examined for any other respiratory diagnoses (eg, sinusitis or AOM). Therefore, patients having the sole diagnosis of URI and having severe symptoms is unlikely.

Conclusions
Antibiotic prescribing for common upper respiratory conditions decreased in Oregon between 2001–2003. Patients who received antibiotics in their initial visit for a respiratory tract infection were no less likely to return for follow-up visits than patients who did not receive antibiotics. This finding is helpful in dispelling an important myth about patient antibiotic-seeking behavior.

Acknowledgment: This project was funded through the CDC’s Epidemiology and Laboratory Capacity cooperative agreement.

Corresponding Author: Address correspondence to Mr Li, University of Minnesota, Room 1260 Mayo, MMC 807, 420 Delaware Street SE, Minneapolis, MN 55455. 612-229-2532. Fax: 612-626-4837. lixxx607@umn.edu.

References


