

Antibiotic Prescriptions Associated with Outpatient Visits for Acute Upper Respiratory Tract Infections among Adult Medicaid Recipients in North Carolina

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Abstract

Background: North Carolina and the southeastern United States have the highest antimicrobial resistance rates for common respiratory tract pathogens in the nation. The excessive use of antibiotics for common outpatient infections is a major contributing factor in the emergence of antibiotic resistant bacteria.

Objective: To estimate the prevalence of oral antibiotic treatment for acute, nonbacterial respiratory tract infections among adult Medicaid recipients in North Carolina, and to describe a pilot project aimed at reducing the prevalence of oral antibiotic treatment among this population.

Methods: Using administrative claims data, we identified 24,137 Medicaid recipients, aged 18 to 64 years, who made at least one outpatient physician visit for acute nasopharyngitis (ICD-9, 460.x), acute pharyngitis (462.x), acute upper respiratory infection (465.9), acute bronchitis (466.0), or influenza (487.1) between October 1, 2000, and March 29, 2001. We excluded adults with chronic bronchitis (ICD-9, 491.x), emphysema (492.x), asthma (493.x), or chronic obstructive pulmonary disease (496.x). Pharmacy claims data were used to identify oral antibiotic treatment that occurred within 5 days of the outpatient visit.

Results: Overall, 63% (n=15,189) of Medicaid recipients who made at least one outpatient visit during the observation period for one of the study conditions had a prescription filled for an oral antibiotic within 5 days. Residence in a rural county (64% vs. urban, 61%, $p<0.01$) and in the eastern region of the state (65% vs. western region, 59%, $p<0.01$) was associated with receipt of an antibiotic. Compared with the other principal study diagnoses, patients with acute bronchitis (44% of all outpatient visits) were 2.88 (95% CI=2.72, 3.05) times more likely to receive oral antibiotic treatment after multivariate adjustment.

Summary: The prevalence of oral antibiotic treatment among adult Medicaid beneficiaries diagnosed with nonspecific upper respiratory infections, colds, pharyngitis, bronchitis, and influenza is high and varies significantly across patient demographics and geography. Interventions to reduce antibiotic prescribing are needed to reduce the progression of antimicrobial resistance.

ANTIMICROBIAL RESISTANCE among common bacterial pathogens is increasing at an alarming rate, both in hospitals and in the community. *S. pneumoniae*, or pneumococcus, is the leading cause of community-acquired pneumonia, bacterial sinusitis, meningitis, and otitis media in the United States.¹ Through 1980, virtually 100% of pneumococci in the United States were fully susceptible to penicillin. During the five-year period from 1994–1995 to 1999–2000, penicillin susceptibility decreased from 76% to 66%, and erythromycin susceptibility decreased from 90% to 74%.²

The southeastern United States has demonstrated the lowest susceptibility of all regions of the nation. While the overall proportion of penicillin nonsusceptible pneumococci within a seven-region, population-based, active surveillance

program across the United States in 1997 was 25%, nonsusceptibility ranged from a low of 15% in Maryland to a high of 38% in Tennessee.³ In another pneumococcal resistance tracking program, from 2000–2001 high level penicillin resistance was found in 9.7% of isolates from the northwest, 13.1% from the northeast, and 22.2% from the southeast.⁴ Similarly, azithromycin resistance was found in 24% of isolates from the northwest, 20.1% from the northeast, and 32% from the southeast. Among pneumococci tested at North Carolina hospitals during 2000, 32% were fully resistant to penicillin and 39% were resistant to erythromycin.⁵ Pneumococci resistant to erythromycin are also resistant to azithromycin and clarithromycin.⁶

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Excessive use of antibiotics in the outpatient setting has contributed to the increase in antimicrobial resistance.⁷⁻¹⁰ Infectious diseases account for approximately 19% of visits to physicians, or an average of 129 million visits per year nationally.¹¹ Projections from a study of the National Ambulatory Medical Care Survey estimate 76 million primary care office visits for acute respiratory tract infections resulting in 41 million prescriptions in a one year period.¹² In 1992, 21% of all antibiotic prescriptions among adults resulted from office visits for colds, upper respiratory tract infections, and bronchitis.¹³ Antibiotics were prescribed for 51% of patients diagnosed with colds, 52% with upper respiratory tract infections, and 66% with bronchitis after exclusion of patients with underlying lung disease.¹³

Numerous studies have demonstrated little or no benefit from antibiotics for many common upper respiratory tract infections. The American College of Physicians-American Society for Internal Medicine, American Academy of Family Physicians, Infectious Diseases Society of America, and Centers for Disease Control and Prevention have endorsed a campaign to promote appropriate antibiotic use for the treatment of acute respiratory tract infections in adults, and Clinical Practice Guidelines providing evidence-based recommendations have been published.¹⁴ These provide practical strategies for limiting antibiotic use to the patients who are most likely to benefit, and they do not apply to immunocompromised individuals or those with significant cardiac or pulmonary disease.

Reductions in antibiotic usage can result in improvements in antibiotic resistance trends. In Finland, nationwide reductions in the use of macrolides resulted in a significant decline in the frequency of erythromycin resistance among Group A streptococci.¹⁵ Kristinsson reported an aggressive campaign in Iceland that resulted in a decline of pneumococcal penicillin resistance from 20% in 1993 to 16.9% in 1994.^{16,17}

This analysis describes the prevalence of oral antibiotic treatment for acute upper respiratory tract infections among adult Medicaid recipients in North Carolina.

Methods

Data and Study Population: The study population of interest was all adult North Carolina Medicaid recipients. The study sample included Medicaid recipients aged 18 to 64 years as of January 1, 2001, who participated in the following systems of care within the North Carolina Medicaid program: fee-for-service, Carolina ACCESS, ACCESS II & III, and Healthcare Connection. Carolina ACCESS is a program designed to provide more efficient and effective healthcare delivery to Medicaid recipients by linking each eligible recipient with a primary care provider.¹⁸ The ACCESS II & III program further builds on the Carolina ACCESS program by working with local providers and networks to provide better management of the Medicaid population with

processes that affect both the quality and cost of healthcare. Healthcare Connection operates in Mecklenburg County, NC, and requires enrollment in a health maintenance organization.

We obtained Medicaid outpatient and pharmacy claims data from the North Carolina Division of Medical Assistance, the state agency that administers North Carolina's Medicaid program. Data were obtained for the period April 1, 2000, through March 31, 2001. Using *Current Procedural Terminology (CPT)* and *International Classification of Disease, 9th Revision, Clinical Modification (ICD-9-CM)* codes, we identified visits to physicians' offices (*CPT codes 99201-99205, 99211-99215, 99241-99245*) and emergency departments (ED) (*99281-99285*) for which the principal diagnosis was acute nasopharyngitis (*ICD-9, 460.x*), acute pharyngitis (*462.x*), acute upper respiratory infection (*465.9*), acute bronchitis (*466.0*), or influenza (*487.1*). Outpatient visits were further restricted to those where the physician was located in North Carolina and where the physician-designated specialty was family practice, general practice, or internal medicine (for office or ED visits), or full-time ED physician or multi-specialty (for ED visits).

The analysis is focused on outpatient visits that occurred between October 1, 2000, and March 29, 2001. We excluded persons who were not aged 18 to 64 years ($n=188$) as of January 1, 2001, as well as those with chronic pulmonary diseases. Chronic conditions were identified by examining outpatient claims data 90 days prior to the first visit for each recipient; they were defined by two or more office visit claims at least six days apart for which the principal diagnosis on each claim was chronic bronchitis (*ICD-9, 491.x*), emphysema (*492.x*), asthma (*493.x*), or chronic obstructive pulmonary disease (*496.x*). Antibiotics were identified by one of the authors (MK) using the *Physician's Desk Reference* and the *National Drug Code Directory*. For each of the antibiotics listed in Appendix B, National Drug Code (NDC) numbers were obtained from the Multum Lexicon™ database (Multum Information Services, Inc., Denver, CO, 2001) and used to identify oral antibiotic prescriptions in the Medicaid pharmacy claims database. We retained only those medications that were associated with oral administration. Using the dates of service from the outpatient and pharmacy claims, we calculated the number of days between each outpatient visit claim and each prescription claim to determine whether a prescription was filled within five days of the outpatient visit. We repeated analyses using three-, seven-, and ten-day periods.

Analysis: The primary outcome of interest was the prevalence of oral antibiotic treatment received within five days of a outpatient physician visit for one of the acute upper respiratory tract infections listed above among persons making at least one outpatient visit. Persons with more than one outpatient visit followed by oral antibiotic treatment within five days are counted only once in the numerator of the prevalence calculation.

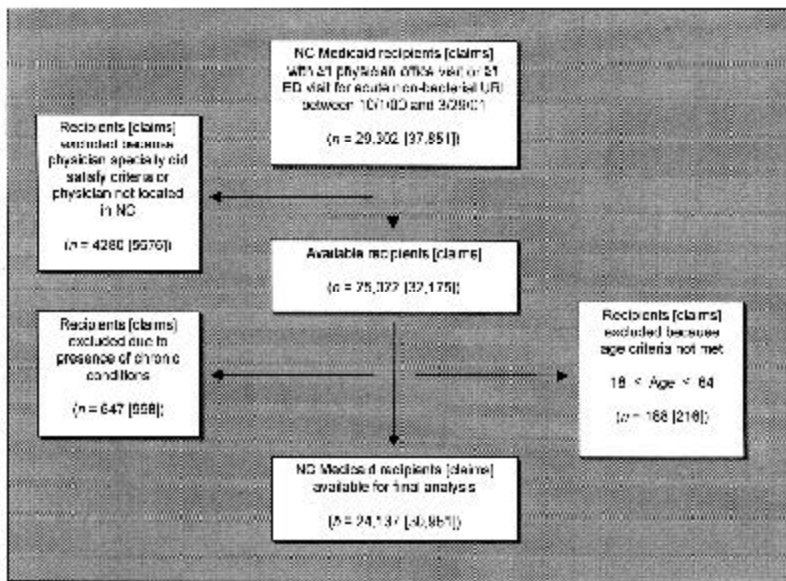


Figure 1. Flow of Medicaid recipients and claims meeting study inclusion and exclusion criteria (n = number of Medicaid recipients/claims).

The prevalence of oral antibiotic treatment is described by Medicaid recipient characteristics including age, gender, race/ethnicity, and residence area (urban vs. rural; regional). The Medicaid data maintains six racial/ethnic categories (White, Black, Hispanic, Asian/Pacific Islander, Native American/Alaska Native, and Other). Because of the small numbers, we collapsed the six categories into white, black, and other. Urban areas are defined as counties that include a standard metropolitan statistical area as defined by the US Bureau of the Census in 1990 with a population density greater than 190 residents per square mile, and rural areas are defined as those with fewer than 190 residents per square mile. Urban counties are highlighted in Appendix A. We also present region-specific prevalence of antibiotic treatment for the nine regions comprised in the North Carolina Area Health Education Centers (AHEC) Program. The aim of the North Carolina AHEC Program, in part, is to enhance the quality of care and improve the health outcomes of the state's residents, particularly in underserved communities and populations. The individual counties used to define the North Carolina AHEC regions are listed in Appendix A. The Medicaid recipient's county of residence is the basis for these assignments.

All statistical analyses were performed using SAS v8.2 statistical software (SAS Institute, Inc., Cary, NC). Statistical comparisons of categorical variables across groups were performed using Pearson's chi-square statistic. Prevalence estimates adjusted for the number of outpatient visits was obtained using direct standardization and the outpatient visit distribution of the total sample as the standard. Logistic regression was used to obtain prevalence odds ratios. Multivariable adjusted models controlled for age, gender, race/ethnicity, and rural/urban residence area unless noted otherwise. Model parameter estimates were computed by maximum likelihood techniques and 95% confidence intervals

(95% CIs) were based on the standard error of the model coefficients.

Results

Population Description: After exclusion of 647 adult Medicaid recipients with underlying chronic lung disease, a total of 24,137 made 30,961 outpatient visits for acute, nonbacterial respiratory tract infections between October 1, 2000, and March 29, 2001 (Figure 1). This six-month "respiratory season" reflected 67% of the visits for the study diagnoses for the year. Nearly 25% of visits were to the emergency department (n=7478), and 55% of outpatient visits were to a general practice or family practice physician (n=16,943). More than 50% of the Medicaid recipients were less than 40 years of age, more than 75% were women, and 44% were non-white. Sixty-

nine percent of these patients resided in a rural area, at a time when 59% of NC Medicaid recipients did so. Further demographic data are available in Table 1. Among the Medicaid recipients making at least one physician outpatient visit for an acute, nonbacterial respiratory infection, the mean number of visits was slightly more than one (mean=1.3; standard deviation=0.7; range=1-9). Fifteen percent (n=4979) of recipients made more than one outpatient visit. A total of 6645 recipients made at least one visit to the emergency department for an acute, nonbacterial respiratory infection (range=0-7).

We categorized Medicaid recipients with a claim for one of the study conditions into one of three groups based on the number of physician outpatient visits during the six-month period. Nearly 80% (n=19,158) made one visit, 15.3% (n=3700) made two visits, and 5.3% (n=1279) made three or more visits. Making more than one physician outpatient visit for one of the study URIs was associated with being older, female, white, and with residence in a rural area.

Antibiotic usage: Sixty-three percent of Medicaid recipients who made at least one outpatient visit during the observation period for acute URI filled a prescription for an antibiotic within five days of their URI diagnosis. The prevalence of treatment was 59% among recipients who made only one visit, 77% among those who made two outpatient visits, and 86% among those who made three or more outpatient visits (Cochrane-Armitage test of trend, p<0.001) (Table 2). Older Medicaid recipients were slightly more likely to be treated with an oral antibiotic compared to younger recipients (p<0.01), as were men compared to women (p=0.03), and rural residents compared to urban residents (p<0.01). The prevalence of antibiotic treatment was slightly lower among whites and blacks compared to persons of other racial/ethnic groups (p<0.01). These associations remained

Table 1. Characteristics of 24,137 North Carolina Medicaid recipients with at least one physician outpatient visit between October 1, 2000 and March 29, 2001 for a principal diagnosis of acute nasopharyngitis (common cold), acute upper respiratory infection, acute pharyngitis, acute bronchitis, or influenza by number of visits

Characteristic	Number of visits			TOTAL n (%)
	1 (N = 19,158) n (%)	2 (N = 3700) n (%)	= 3 (N = 1279) n (%)	
Age (years)*				
18–29	6488 (33.9)	1086 (29.3)	305 (23.9)	7879 (32.6)
30–39	4616 (24.1)	955 (25.8)	316 (24.7)	5887 (24.4)
40–49	3621 (18.9)	757 (20.5)	284 (22.2)	4662 (19.3)
50–59	3102 (16.2)	624 (16.9)	253 (19.8)	3979 (16.5)
60–64	1331 (6.9)	278 (7.5)	121 (9.5)	1730 (7.2)
mean (std dev)	37.6 (13.4)	38.6 (13.1)	40.6 (13.2)	37.9 (13.3)
Women*	14,902 (77.8)	2941 (79.5)	1028 (80.4)	18,871 (78.2)
Race/ethnicity*				
White	10,426 (54.4)	2149 (58.1)	819 (64.0)	13,394 (55.5)
Black	6778 (35.4)	1144 (30.9)	315 (24.6)	8237 (34.1)
Other	1954 (10.2)	407 (11.0)	145 (11.3)	2506 (10.4)
Rural*	13,110 (68.4)	2600 (70.3)	922 (72.1)	16,632 (68.9)
NC–AHEC Region				
Mountain	2032 (10.6)	359 (9.7)	117 (9.1)	2508 (10.4)
Northwest	3476 (18.1)	688 (18.6)	238 (18.6)	4402 (18.2)
Charlotte	2181 (11.4)	437 (11.8)	151 (11.8)	2769 (11.5)
Greensboro	1871 (9.8)	373 (10.1)	133 (10.4)	2377 (9.9)
Southern	2688 (14.0)	527 (14.2)	204 (15.9)	3419 (14.2)
Wake	1741 (9.1)	336 (9.1)	97 (7.6)	2174 (9.0)
Area L	893 (4.7)	149 (4.0)	49 (3.8)	1091 (4.5)
Coastal	1109 (5.8)	214 (5.8)	72 (5.6)	1395 (5.8)
Eastern	3167 (16.5)	617 (16.7)	218 (17.0)	4002 (16.6)

* Statistically significant difference across visit groups, $p < 0.05$.

after multivariable adjustment and were independent of the number of outpatient visits.

Acute bronchitis (*ICD-9-CM 466.0*) and acute upper respiratory tract infection (*ICD-9-CM 465.9*) were the most common of the study conditions, accounting for 44% ($n=13,739$) and 32% ($n=9812$), respectively, of outpatient visits (Figure 2). The prevalence of oral antibiotic treatment varied substantially across study principal diagnoses (Table 3). Compared with the other principal study diagnoses, recipients whose principal diagnosis was acute nasopharyngitis were significantly less likely to receive oral antibiotic treatment (OR=0.44; 95% CI=0.42, 0.47) independent of age,

race/ethnicity, gender, residence area, and number of outpatient visits. In contrast, Medicaid recipients whose principal diagnosis was acute bronchitis were 2.88 (95% CI=2.72, 3.05) times more likely to receive an oral antibiotic compared to those with other principal study diagnoses after multivariable adjustment.

The prevalence of oral antibiotic treatment also varied significantly by geographic area. Independent of age, gender, race/ethnicity, and the number of outpatient visits, residents of rural areas were 1.13 times more likely to be treated with an oral antibiotic than their urban counterparts (95% CI=1.06, 1.19). Across North Carolina AHEC regions, the

Table 2. Prevalence of oral antibiotic treatment among North Carolina Medicaid recipients with at least one physician outpatient visit between October 1, 2000 and March 29, 2001 for a principal diagnosis of acute nasopharyngitis (common cold), acute upper respiratory infection, acute pharyngitis, acute bronchitis, or influenza by number of visits and recipient characteristics

Characteristic	Number of visits					
	1 (N = 19,158)		2 (N = 3700)		= 3 (N = 1279)	
	n (%) [*]	OR (95% CI) [†]	n (%)	OR (95% CI)	n (%)	OR (95% CI)
Age (years)						
18–29	3676 (56.7)	0.84 (0.74, 0.94)	830	76.4 0.84 (0.61, 1.17)	272	89.21.80 (0.99, 3.28)
30–39	2747 (59.5)	0.94 (0.83, 1.06)	727	76.1 0.83 (0.60, 1.15)	279	88.31.64 (0.91, 2.95)
40–49	2091 (57.7)	0.86 (0.75, 0.98)	576	76.1 0.82 (0.59, 1.15)	247	87.01.39 (0.78, 2.50)
50–59	1895 (61.1)	0.98 (0.86, 1.12)	500	80.1 1.03 (0.73, 1.47)	207	81.80.95 (0.54, 1.69)
60–64	821 (61.2)	1.00	221	79.5	100	82.6
Gender						
Women	8669 (58.2)	0.94 (0.87, 1.00)	2256	76.7 0.90 (0.74, 1.10)	886	86.20.87 (0.57, 1.32)
Men	2561 (60.2)	1.00	598	78.8	219	87.3
Race/ethnicity						
White	6154 (59.0)	0.91 (0.83, 1.01)	1664	(77.4) 1.02 (0.79, 1.33)	705	86.10.74 (0.43, 1.29)
Black	3872 (57.1)	0.85 (0.76, 0.95)	874	(76.4) 0.97 (0.74, 1.27)	272	86.30.79 (0.43, 1.44)
Other	1204 (61.6)	1.00	316	(77.6)	128	88.3
Residence						
Rural	7811 (59.6)	1.13 (1.06, 1.20)	2023	(77.8) 1.13 (0.96, 1.34)	798	86.51.05 (0.73, 1.50)
Urban	3419 (56.5)	1.00	831	(75.5)	307	86.0
Total	11,230 (58.6)		2854 (77.1)		1105 (86.4)	

* Number and percent receiving oral antibiotic treatment within 5 days of the physician outpatient visit.

† Odds ratios (ORs) and 95% confidence intervals (CIs) adjusted for all variables in the table.

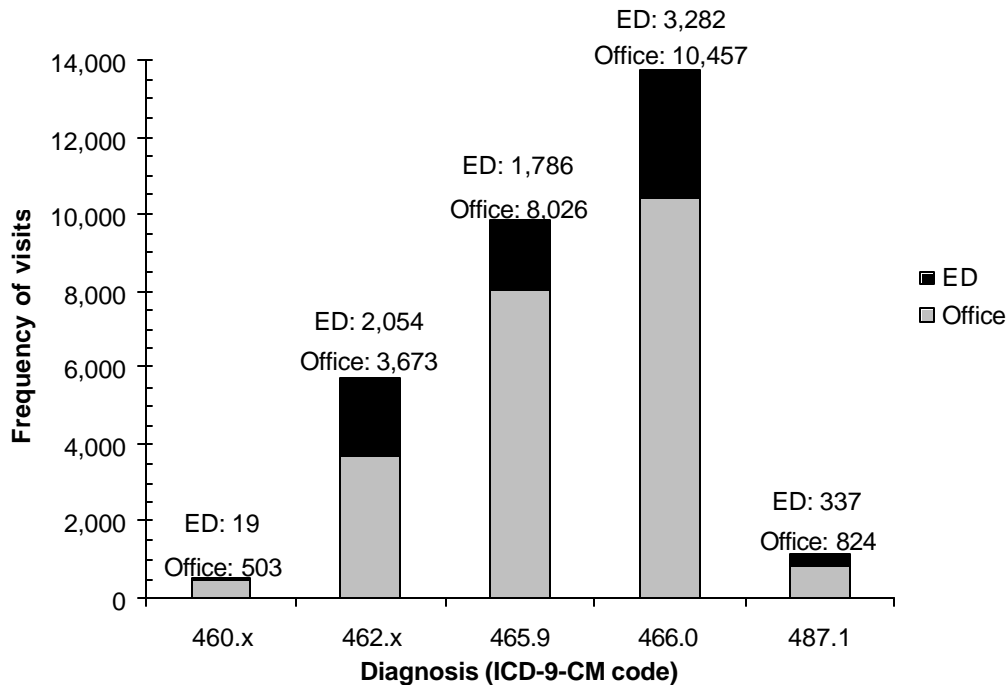


Figure 2. Frequency of outpatient claims by diagnosis and visit setting

Table 3. Prevalence of oral antibiotic treatment among North Carolina Medicaid recipients with at least one outpatient visit between October 1, 2000, and March 29, 2001, for a principal diagnosis of acute nasopharyngitis (common cold), acute upper respiratory infection, acute pharyngitis, acute bronchitis, or influenza by number of visits and principal diagnosis

Condition	n (%) [*]	1 (N = 19,158)		2 (N = 3700)		= 3 (N = 1279)	
		OR (95% CI) [†]	n (%)	OR (95% CI)	n (%)	OR (95% CI)	
Acute nasopharyngitis	106 (31.5)	0.32 (0.25, 0.40)	60 (60.6)	0.45 (0.30, 0.68)	29 (80.6)	0.69 (0.29, 1.61)	
Acute pharyngitis	2309 (60.8)	1.18 (1.10, 1.27)	758 (79.8)	1.32 (1.09, 1.59)	344 (91.5)	1.91 (1.27, 2.89)	
Acute URI	2807 (44.5)	0.42 (0.39, 0.44)	1111 (71.3)	0.56 (0.48, 0.66)	511 (84.2)	0.65 (0.47, 0.91)	
Acute bronchitis	5784 (73.0)	2.92 (2.74, 3.11)	1833 (84.4)	2.75 (2.34, 3.24)	838 (89.1)	2.55 (1.80, 3.63)	
Influenza	224 (28.4)	0.27 (0.23, 0.31)	143 (66.5)	0.58 (0.43, 0.78)	63 (73.3)	0.35 (0.21, 0.59)	

* Number and percent receiving oral antibiotic treatment within 5 days of an office visit.

† Prevalence odds ratio (OR) and 95% confidence interval (CI) adjusted for age, race/ethnicity, gender, rural/urban residence. Referent group for each principal diagnosis is all other principal diagnosis groups.

prevalence ranged from 55% in the Mountain region to 67% in the Southern Regional area (Figure 3).

Sensitivity: We assessed the sensitivity of our prevalence measure to the amount of time allowed between an outpatient visit claim and a pharmacy claim. When the time frame was reduced from five days to three days, a total of 14,871 (62%) Medicaid recipients were treated with an oral antibiotic medication. Similarly, when the time frame was expanded from five days to seven and ten days, respectively, the prevalence of treatment was 64% and 65%.

Between October 1, 2000, and April 5, 2001, a total of 258,693 prescriptions for the oral antibiotics listed in Appendix A were identified in the Medicaid pharmacy claims database. Of these, 33,061 (12.8%) were associated with a visit for one of the study URIs, and 43,709 (17 %) were filled by recipients making at least one physician outpatient visit for acute, nonbacterial respiratory infection. Among the 19,699 Medicaid recipients who filled at least one oral antibiotic prescription, the median number of prescriptions filled was 2 (interquartile range=2.0). Approximately 35% (n=8471) filled one oral antibiotic prescription; 22% (n=5258) filled two prescriptions; 12% (n=2823) filled three; and 13% (n=3147) filled four or more oral antibiotic prescriptions. The most common medications prescribed were azithromycin and amoxicillin (Table 4).

Cost Description: The total amount paid by Medicaid for the 30,961 physician outpatient visits during respiratory season 2000-2001 for the acute upper respiratory tract infections included in the study was \$1,346,577. The average amount paid per recipient was \$56 (standard deviation=\$44.79) and the median amount paid per recipient was \$46. The total amount paid for 7478 emergency department visits, which accounted for 24% of the outpatient visits during the period, was \$378,663, or 28% of the total amount paid for the outpatient visits for acute, nonbacterial respiratory tract infections.

For each of the oral antibiotics shown in Table 2, we identified the most common quantity of pills dispensed (i.e., the mode of the distribution) and the median price per pill. These values, in addition to the number of prescriptions or claims, were multiplied together to obtain an estimate of the total cost for each medication. The total cost of the 33,061 oral antibiotic prescriptions filled within five days of a physician outpatient visit for a study condition was more than \$1.5 million during the six-month period of study.

Discussion

Our results demonstrate that 63% of North Carolina Medicaid recipients without documented chronic lung disease who made at least one outpatient physician visit during the respiratory season 2000-2001 for acute, nonbacterial respiratory tract infection had a prescription filled for an oral antibiotic within five days of the visit. Forty-one percent of those with acute nasopharyngitis received an antibiotic. A study in Kentucky using Medicaid data for 1993-1994 reported an antibiotic prescription rate of 60% for common cold.¹⁹ While this may reflect better current rates in NC than were observed in Kentucky in 1993-1994, the Kentucky study did not exclude patients with underlying lung diseases. The rate among a truly comparative population would likely be lower than the 60% observed. Among recipients with bronchitis in our study, 76% received an antibiotic, compared with 75% in a 1993-1994 Kentucky Medicaid study that reported those without underlying lung disease.²⁰

A 1992 national survey of ambulatory visits reported antibiotic use for 52% of patients with upper respiratory tract infection (URI), and 66% with bronchitis after exclusion of patients with underlying lung disease.¹³ In our current study 52% with URI and 76% with bronchitis received an antibiotic. There are several possible explanations for this appar-

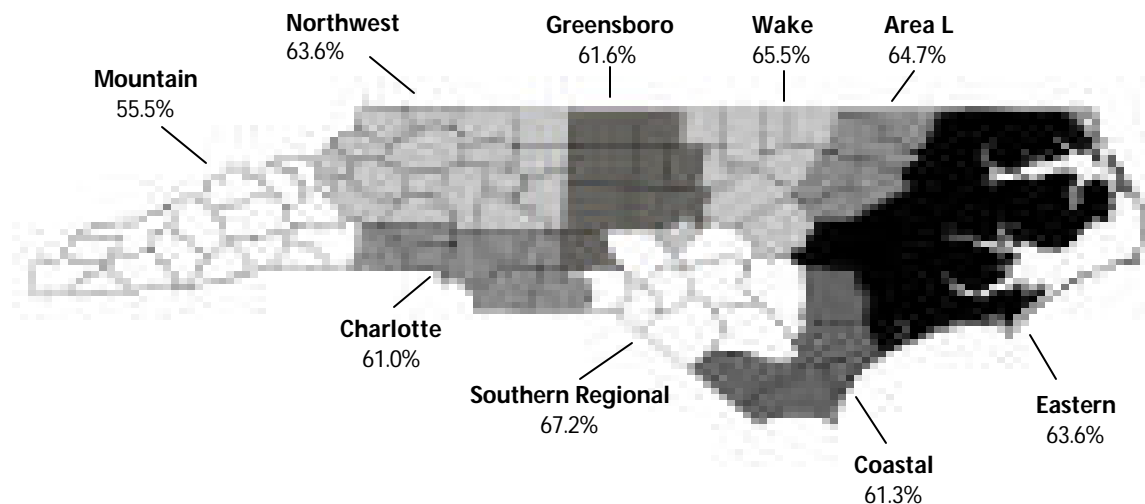


Figure 3. Prevalence of oral antibiotic treatment between October 1, 200, and March 29, 2001, among North Carolina Medicaid recipients with at least one outpatient visit for a principal diagnosis of acute nasopharyngitis (common cold), acute upper respiratory infection, acute pharyngitis, acute bronchitis, or influenza, by Area Health Education Center (AHEC) region.*

*Prevalence estimates have been adjusted for the number of outpatient visits.

ent lack of improvement: (1) There has been little improvement over the eight-year period in prescribing patterns. (2) Antibiotic prescribing rates have improved in the general population, but remain higher for Medicaid recipients. (3) Prescribing patterns in NC are and have been consistently higher than in the nation as a whole.

We observed geographic variation in the prevalence of oral antibiotic treatment. Antibiotic prescribing rates are higher in rural areas compared to urban areas and are slightly higher in the eastern counties of the state compared with those in the central region (64.8% vs. 63.7%, $p=0.01$) and the western region (64.8% vs. 59.0%, $p<0.01$). The higher antibiotic treatment rate in eastern North Carolina correlates with lower susceptibility, or higher resistance, identified by Stein and colleagues, who observed the percent of pneumococci susceptible to penicillin during 2000 was 45.3% in eastern counties of North Carolina, 55.5% in central counties, and 51.9% in western counties.⁵

We recognize that antibiotics may be warranted for some patients with URIs, and that using claims data to assess the need for therapy in individual cases is not appropriate. Given that we excluded patients with underlying lung disease, a 63% prescription rate is probably excessive.

The results of this study are subject to several limitations. First, we were not able to link a prescription directly to an outpatient visit or health care episode. It is certainly possible for a patient to receive one of the oral antibiotics listed in Appendix B for reasons other than treatment of acute, nonbacterial respiratory infections. We excluded persons with syndromes that are more likely to warrant antibiotic treatment, such as streptococcal pharyngitis and sinusitis, and we limited our analysis to those pharmacy claims

that occurred within five days of the URI visit. Thus, we believe we have captured antibiotic treatment for the study conditions rather than other conditions. Second, it is possible that some Medicaid recipients treated for an acute, nonbacterial respiratory tract infection may have been given office samples or received a prescription for oral antibiotics without making an office visit. Because we used administrative pharmacy claims data to identify prescriptions, we will not capture these instances of oral antibiotic prescription. The results of this study may not be generalizable to the North Carolina population at large for several reasons. The Medicaid population (1.2 million in State Fiscal Year 2000) represents approximately one sixth of the total (7 million) population in North Carolina. Many factors associated with this group, including the presence of a drug benefit, may influence provider behavior. However, if prescribing patterns are similar among the general population, then approximately \$9,000,000 is spent each respiratory season in NC for antibiotic therapy for the study conditions. Reducing rates of antibiotic usage for common, non-life-threatening upper respiratory tract infections has important implications not only for antimicrobial resistance problems but for healthcare costs as well.

Pilot Study Description: In many cases it is difficult for a physician to avoid prescribing an antibiotic because of perceived patient expectation as well as time constraints (it takes longer to explain why an antibiotic is not warranted than to write a prescription for one). However, many patients have expressed a willingness to avoid antibiotic use if their clinician does not believe it is warranted.

To assist physicians in their efforts to decrease antibiotic

Table 4. Frequency of Medicaid pharmacy claims (overall and within five days of an outpatient visit), the number of pills dispensed per prescription, the price per pill, and prescription costs for oral antibiotics prescriptions filled within five days of an outpatient visit among North Carolina Medicaid recipients making at least one physician outpatient visits for acute, nonbacterial respiratory tract infections

Drug Name	Overall		Prescription within 5 days of outpatient visit				
	n	(%)	n	(%)†	Pills dispensed‡	Price per pill§	Total cost¶
Penicillins	11,212	(25.7)	8430	(25.5)	–	–	276,486
Amoxicillin	6210	(14.2)	4765	(14.4)	30	\$0.13	\$18,155
Amoxicillin-clavulanate	3224	(7.4)	2444	(7.4)	20	\$5.19	\$253,687
Ampicillin	132	(0.3)	91	(0.3)	40	\$0.11	\$406
Dicloxacillin	42	(0.1)	23	(0.1)	40	\$0.76	\$696
Penicillin	1604	(3.7)	1107	(3.4)	40	\$0.08	\$3,542
Erythromycins/ Lincosamides/Macrolides	14,161	(32.4)	11,565	(35.0)	–	–	\$524,639
Azithromycin	9472	(21.7)	7850	(23.7)	6	\$6.97	\$328,424
Clarithromycin	2630	(6.0)	2154	(6.5)	20	\$3.95	\$170,140
Clindamycin	524	(1.2)	314	(1.0)	28	\$0.92	\$8,115
Dirithromycin	226	(0.5)	191	(0.6)	10	\$3.26	\$6,220
Erythromycin	1309	(3.0)	1056	(3.2)	30	\$0.37	\$11,741
Cephalosporins	5914	(13.5)	4176	(12.6)	–	–	\$201,175
Cefaclor	632	(1.5)	505	(1.5)	20	\$4.41	\$44,588
Cefadroxil	241	(0.6)	146	(0.4)	20	\$3.05	\$8,906
Cefdinir	139	(0.3)	114	(0.3)	20	\$3.93	\$8,957
Cefixime	76	(0.2)	56	(0.2)	10	\$8.01	\$4,485
Cefpodoxime	135	(0.3)	91	(0.3)	20	\$4.20	\$7,644
Cefprozil	591	(1.4)	472	(1.4)	20	\$3.57	\$33,683
Ceftibuten	113	(0.3)	89	(0.3)	10	\$7.89	\$7,019
Cefuroxime	1048	(2.4)	806	(2.4)	20	\$4.20	\$67,704
Cephalexin	2866	(6.6)	1842	(5.6)	30	\$0.22	\$11,881
Cephradine	3	(0.0)	2	(0.0)	24	\$0.99	\$47
Loracarbef	70	(0.2)	53	(0.2)	20	\$5.91	\$6,261
Quinolones	7602	(17.4)	5563	(16.8)	–	–	\$444,279
Ciprofloxacin	2189	(5.0)	1303	(3.9)	20	\$4.51	\$117,632
Gatifloxacin	1515	(3.5)	1261	(3.8)	7	\$7.78	\$68,664
Levofloxacin	3085	(7.1)	2357	(7.1)	10	\$8.53	\$201,146
Moxifloxacin	670	(1.5)	566	(1.7)	10	\$8.71	\$49,313
Nalidixic acid	2	(0.0)	1	(0.0)	120	\$1.66	\$199
Norfloxacin	22	(0.1)	14	(0.0)	20	\$3.81	\$1,066
Ofloxacin	117	(0.3)	59	(0.2)	20	\$5.19	\$6,124
Sparfloxacin	2	(0.0)	2	(0.0)	10	\$6.69	\$134
Tetracyclines	2129	(4.9)	1566	(4.7)	–	–	\$76,037
Demeclocycline	7	(0.0)	6	(0.0)	48	\$9.30	\$2,678
Doxycycline	1787	(4.1)	1352	(4.1)	20	\$2.40	\$64,896
Minocycline	105	(0.2)	65	(0.2)	60	\$1.95	\$7,605
Tetracycline	230	(0.5)	143	(0.4)	60	\$0.10	\$858
Sulfonamides and Trimethoprim	2690	(6.2)	1760	(5.3)	–	–	\$7,286
Sulfamethoxazole- trimethoprim	2690	(6.2)	1760	(5.3)	20	\$0.21	\$7,286
Oxazolidone	1	(0.0)	1	(0.0)	–	–	\$2,231
Linezolid	1	(0.0)	1	(0.0)	42	\$53.13	\$2,231
Total	43,709		33,061		–	–	\$1,532,134

* Percentage given is based on the total number of oral antibiotic claims (n=43,709) between October 1, 2000 and April 5, 2001 for 24,137 adult Medicaid recipients with at least one outpatient visit for acute, nonbacterial respiratory tract infections

† Percentage given is based on the total number of oral antibiotic claims within 5 days of an outpatient visit (n=33,061)

‡ Number of pills dispensed per prescription for each drug based on the mode of the distribution

§ Price per pill obtained from the North Carolina Division of Medical Assistance and reflects the effective price for the period April 4, 2000 through March 31, 2001

¶ Total cost = (# of claims within five days) x (Modal # of pills dispensed per claim) x (Price per pill)

prescribing for common URIs, we have developed a "Self-Care Kit" which contains symptom relieving items as well as a CDC pamphlet reviewing the concerns of antimicrobial resistance. We gathered a focus group of primary care physicians to determine the package items. The total cost of each packet is approximately \$6.00. We began a pilot project to assess physician and patient response to these packets in four North Carolina practices and to assess the impact on prescribing practices. Our hope is that, if improvement is demonstrated with patient and physician satisfaction, similar kits may be distributed both by Medicaid and other third party payors to aid in the resistance effort and to lower costs.

Summary

Antibiotic prescribing for common acute, nonbacterial respiratory tract infections in North Carolina is at higher than desirable levels and correlates with antimicrobial resistance. Ongoing efforts will be required to assist physicians in making it easier to avoid prescribing antibiotics, and to monitor the effects of these interventions on resistance. Providing therapeutic alternatives such as symptom relievers is one approach, but it is very likely that combating this problem will require multifaceted efforts. We welcome suggestions from providers, patients and third-party payors on furthering our efforts.

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