New York State Department of Health
Office of Health Insurance Programs

Avoidance of Antibiotic Treatment in Adults with Acute Bronchitis

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Background

Acute bronchitis is a self-limited acute respiratory illness characterized by cough with or without sputum production. Bronchitis typically lasts less than three weeks and appears to be caused mostly by viral agents.[1] Acute bronchitis is one of the most common diagnoses among emergency department and outpatient visits, and approximately 5% of adults are affected by acute bronchitis annually.[2] Meta analyses of randomized controlled trials have shown that empirical therapy with antibiotics is not appropriate for uncomplicated acute bronchitis in otherwise healthy adults.[1] The American College of Chest Physicians (ACCP) and American College of Physicians-American Society of Internal Medicine (ACP) have issued guidelines indicating that the routine treatment of uncomplicated acute bronchitis with antibiotics is not justified nor recommended.[3] Despite the evidence and guidelines, studies have shown that between 65% and 80% of adults with acute bronchitis are prescribed antibiotics.[1]

The HEDIS® measure Avoidance of Antibiotic Treatment in Adults with Acute Bronchitis (AAB) is a measure of the percentage of adults 18–64 years of age with a diagnosis of acute bronchitis who were *not* dispensed an antibiotic prescription; it is an inverted measure, and higher rates indicate better care. National Medicaid rates for this measure have been persistently low for several years, with a 2009 rate of only 25.6%.[4] New York Medicaid Managed Care (MMC) rates for this measure have also remained low over the past few years, with a 2009 statewide Medicaid rate of appropriate avoidance of antibiotics for bronchitis of only 26%.[5] An analysis of antibiotic prescribing for bronchitis in New York MMC revealed that antibiotics are prescribed both in the emergency department and office setting, and that rates varied by plan.[6]

Persistently low rates of avoidance of antibiotics in adults with acute bronchitis suggest that there may be reasons for clinician prescribing patterns that are not captured in the administrative data used to calculate the HEDIS AAB measure. It is possible that members have co-morbid conditions and competing diagnoses documented in the medical record, but not in administrative data, that should have excluded them from the measure. Including members with these conditions and diagnoses, for which antibiotics could appropriately be prescribed, in the eligible population of the AAB measure could falsely lower antibiotic avoidance rates. Guidelines indicate that the evaluation of individuals with presumed acute bronchitis should focus on clinically ruling out pneumonia, the third most common cause of acute cough illness.[3] It is possible that consideration of other diagnoses while evaluating acute cough, such as suspected pneumonia, could contribute to antibiotic prescribing.[3] Furthermore, markers of bacterial infection such as elevated procalcitonin levels could contribute to antibiotic prescribing for acute bronchitis.[7]

Because it is so common, acute bronchitis is a prime condition to target to reduce antibiotic overuse in the face of increasing antibiotic resistant bacteria. The aim of this study was to evaluate demographic and clinical factors associated with antibiotic prescribing for acute bronchitis in adults in order to better understand observed clinician prescribing patterns and inform improvement efforts.

Methodology

The eligible population for this study included New York Medicaid managed care members who were between the ages of 18 and 64 years in 2009, and met the denominator requirements for the HEDIS measure Avoidance of Antibiotic Treatment in Adults with Acute Bronchitis. These requirements include a negative history of antibiotics in the past 30 days, a negative history of certain respiratory and immunosuppressive co-morbid conditions, and absence of competing diagnoses for which antibiotics might be prescribed.[8] Members who were included in the study had an outpatient or emergency department (ED) visit with any diagnosis of acute bronchitis during 2009 identified through administrative claims.

Two groups were initially identified from the eligible population. The Antibiotic Group (ABX) included health plan members from the denominator who were dispensed a prescription for antibiotic medication (Table AAB-D in appendix A) on or up to three days after the visit date. The No Antibiotic Group (No ABX) included members who were not dispensed an antibiotic on or up to three days after the visit date.

A random sample was generated for each group for each MCO. A total of 45 records were requested from each NYS Medicaid MCO (totaling 810 records) and included 30 members per plan who had an antibiotic dispensed and 15 members who did not. Records included information from one month prior to the visit date and one month after, and any problem lists found in the chart. The DOH provided demographic data for the 810 members, including category of aid: Supplemental Security Income (SSI), Family Health Plus (FHP), Temporary Aid to Needy Families (TANF) and Safety Net (SN). DOH also provided the following variables: Clinical Risk Group (CRG), antibiotic dispensed, date antibiotic dispensed (up to seven days after the visit date), and diagnosis.

Records were abstracted by IPRO nurse reviewers using an electronic tool that included all study indicators. Inter-rater reliability testing was performed at the outset and throughout the data collection process to ensure reviewer accuracy.

During the record review, a third group was identified among the No ABX group. Though presumed to have no antibiotics prescribed, evidence in the medical records indicated that these members actually had been prescribed an antibiotic, but did not appear to have had an antibiotic dispensed, since they were omitted from the numerator in the plans' calculation of the measure. This group was removed from the No ABX group and designated as the Prescribed but Omitted from Numerator (PON) group.

Statistical Methods

Analyses were performed by aggregating data for all plans. To test for any differences in proportions, chi-square tests were employed. To test for differences in means, t-tests were performed. Simple logistic and multivariate analyses were performed to determine factors associated with antibiotic prescribing. The main analyses were conducted to determine differences between the ABX and No ABX groups, since this was the focus of the study. In addition, a small number of supplementary analyses were performed utilizing the third (Prescribed but Omitted from Numerator) group and to describe characteristics of ED and Non-ED Members by ABX status. A p value of <= 0.05 was considered statistically significant. All analyses were performed using SAS 9.2.

Results

Demographics and Clinical Characteristics

Table 1 shows the overall disposition of records. There were 45 medical records requested per MCO. 814 records were received. After 24 exclusions, the final study sample was comprised of 790 records allocated into three groups: the Antibiotic (ABX) Group (67.5%), the No-Antibiotic (No ABX) Group (17.8%), and the Prescribed but Omitted from Numerator (PON) Group (14.7%). Table 2 shows the disposition of records by MCO.

Table 1. Overall Disposition of Records

Category	N	%
Total Members Selected (45 per MCO)	810	
Total Records Received	814	
Exclusions (not meeting medical criteria*)	24	2.9%
Subtotal	790	
ABX Group (Group 1)	533	67.5%
Non-ABX Group (Group 2)	141	17.8%
PON (Group 3)**	116	14.7%
Total Records Reviewed/Final Study Sample***	790	100.0%

*Exclusions: No acute cough illness diagnosis, hospitalized members, IV antibiotic given in hospital. ** This group represents 45.1% of members presumed not to have been prescribed an antibiotic (the Prescribed but Omitted from Numerator (PON) group,
***The remaining analyses for this study will be based on these members, unless otherwise noted.

Table 2. Disposition of Records by MCO

MCOs	Records Received	Final Sample	ABX Group (1)	Non-ABX Group (2)	PON Group (3)
Affinity Health Plan	45	42	30	3	9
Americhoice	44	44	30	6	8
Amerigroup	46	43	30	7	6
CDPHP	45	43	28	11	4
Excellus	44	42	28	7	7
Fidelis Health Care NY	46	43	29	7	7
HealthFirst	45	44	30	11	3
HealthNow	45	44	29	11	4
Health Plus	46	45	30	6	9
Emblem/HIP	45	43	29	8	6
Hudson Health Plan	45	45	30	9	6
IHA-Buffalo	44	43	30	9	4
MetroPlus Health Plan	47	47	30	8	9
MVP Health Plan	44	43	30	8	5
Neighborhood Health Providers	46	45	29	9	7
Total Care	45	44	30	10	4
Univera Community Health	45	45	30	6	9
WellCare of NY	47	45	31	5	9
Total	814	790	533	141	116

Table 3 presents demographic and clinical characteristics of the ABX group plus the No ABX group. (Analyses of the Prescribed but Omitted from Numerator (PON) group are performed separately and presented later in the report.) The total population had a mean age of 41.3 years, was female (66.3%), and predominantly white (42.6%). A majority of members had major chronic illness (by CRG health status, 55.8%). A small proportion of visits were at the ED (16.8%), while the provider type was a physician for most (75.9%). Most members had duration of cough illness of less than 2 weeks (79.4%), absence of purulent sputum (63.8%), no upper respiratory infection (URI) symptoms (63.8%) and no clinical evidence of pneumonia (84.8%). A clinical impression of "rule out pneumonia" was documented for only 2.7% of members. Of members who had tobacco status documented, 50.6% were smokers. A total of 18.9% of members had a chest X-ray ordered, but spirometry was rarely ordered (3.1%). There were few abnormal chest X-ray or spirometry results documented in the records (4.8% and 0.6% respectively). There was documentation that the member was advised to delay filling the antibiotic prescription in only 5 records.

Table 3. Demographic and Clinical Characteristics: ABX Group and No ABX Group Combined

Category	Final Study Sample (N=674)	
	n	%
Age group		
18-44	405	60.1%
45-64	269	39.9%
Mean age = 41.3 (std = 12.6)		
Race/Ethnicity		
White	287	42.6%
Black	110	16.3%
Hispanic	97	14.4%
Asian/Pacific Islander	130	19.3%
Other	50	7.4%
Gender		
Female	447	66.3%
Male	227	33.7%
NYC/Rest of State (ROS)		
NYC	310	46.0%
ROS	364	54.0%
Aid Category		
SSI	112	16.6%
FHP	172	25.5%
TANF	225	33.4%
SN	164	24.3%
Other	1	0.2%
CRG Health Status		
Major Chronic	376	55.8%
No Major Chronic	298	44.2%
Visit Setting		
ED	108	16.8%
Non-ED	535	83.2%
UTD*	31	
Provider Type		
MD Physician	385	75.9%
NP Nurse Practitioner	43	8.5%
PA Physician Assistant	79	15.6%
UTD*	167	

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Table 3. Demographic and Clinical Characteristics: ABX Group and No ABX Group Combined (continued)

Category	Final Study Sample (N=674)	
	n	%
Cough Duration		
Less than 2 weeks	401	79.4%
2 weeks up to 3 weeks	68	13.5%
3 weeks or more	36	7.1%
UTD*	169	
Tobacco Use		
Yes	183	50.6%
No	179	49.4%
UTD*	312	
Chest x-ray ordered		
Yes	125	18.9%
No	537	81.1%
UTD*	12	
Chest x-ray normal		
Yes	80	95.2%
No	4	4.8%
N/A / No result in chart	590	
Spirometry		
Ordered; Abnormal	4	0.5%
Ordered; Normal	17	2.6%
Test not ordered	653	96.9%
Clinical Evidence Pneumonia		
Yes	96	15.2%
No	535	84.8%
UTD*	43	
Documented RO Pneumonia		
Yes	18	2.7%
No	640	97.3%
UTD*	16	
Purulent Sputum		
Yes	244	36.2%
No	430	63.8%
URI		
Yes	244	36.2%
No	430	63.8%
Advised to Delay Filling Prescription		
Yes	5	0.7%
No	663	99.3%
UTD *	6	

*UTD=Unable to determine

Table 4 presents a comparison of common administrative diagnoses and chart documented diagnoses in the ABX and No ABX group combined. While bronchitis was more likely to be documented in administrative data, the following diagnoses were more likely to be documented in the medical record: tobacco, asthma, URI, and diabetes**.**

Table 4. Comparison of Administrative Diagnoses and Documented Chart Diagnoses in ABX and No ABX Group Combined (n = 674)

Diagnoses*	Administrative Data		Chart Data		p value
	n	%	n	%	
Bronchitis	651	96.6%	629	93.3%	.01
Tobacco	44	6.5%	183	27.2%	<=.001
Asthma	45	6.7%	112	16.6%	<=.001
URI	41	6.1%	244	36.2%	<=.001
Hypertension	32	4.7%	22	3.3%	n.s.
Diabetes	26	3.9%	59	8.8%	<=.001
Hyperlipidemia	17	2.5%	15	2.2%	n.s.

*May be multiple responses, total may not add to 100%

Table 5 shows a list of antibiotics prescribed, by class and by drug name. The classes of antibiotics most prescribed were macrolides (72.4%), quinolones (8.4%), beta-lactamase inhibitors (6.6%) and aminopenicillin (6.2%). The specific antibiotics prescribed most often were Zithromax (66%), Augmentin (6.6%), amoxicillin (6.2%), and Avelox (6.2%).

Table 5. Antibiotics Prescribed - Group 1 ABX (N = 533)

Category	n	%
Class of Antibiotic Prescribed		
Macrolides	386	72.4%
Quinolones	45	8.4%
Beta-lactamase inhibitor	35	6.6%
Aminopenicillin	33	6.2%
Tetracycline	11	2.1%
Other	21	4.3%
Name of Antibiotic Prescribed		
Zithromax	352	66.0%
Augmentin	35	6.6%
Amoxicillin	33	6.2%
Avelox	33	6.2%
Biaxin	28	5.3%
Other	48	9.7%

Indicators for Antibiotic Prescribing – ABX vs. Non-ABX

We compared members with ABX versus members with no ABX on age, race/ethnicity, gender, NYC vs. rest of state, aid category, and CRG health status (Table 6). There were no statistically significant differences among these domains. Furthermore, members with ABX were not more likely to have a CRG health status indicating major chronic illness than members with no ABX.

Table 6. Demographic Characteristics by ABX Group vs. No ABX Group

Category	Members with ABX (N = 533)		Members without ABX (N = 141)		p value*
	n	%	n	%	
Age mean (std)	41.1 (12.7)		42.2 (12.3)		n.s.
Race/Ethnicity					
White	238	44.7%	49	34.8%	n.s.
Black	83	15.6%	27	19.1%	
Hispanic	78	14.6%	19	13.5%	
Asian/PI	99	18.6%	31	22.0%	
Other	35	6.6%	15	10.6%	
Gender = Female	354	66.4%	93	66.0%	n.s.
Region = NYC	246	46.2%	64	45.4%	n.s.
Aid Category = SSI	86	16.1%	26	18.4%	n.s.
CRG Health Status = Major Chronic	295	55.3%	81	57.4%	n.s.

*n.s. = not significant (p value>.05)

Table 7 presents the clinical characteristics of members with ABX compared to members with no ABX. Members with ABX were more likely to have non-ED visits, to have cough duration of at least 2 weeks, to have abnormal lung sounds, to have purulent sputum, and to have URI symptoms than members without ABX.

Table 7. Clinical Characteristics: ABX Group vs. No ABX Group

Category	Members with ABX (N = 533)		Members without ABX (N = 141)		p value
	n	%	n	%	
Visit Type = Non-ED	434	85.9%	101	73.2%	<=.001
Provider Type = MD	302	74.9%	83	79.8%	n.s.
Cough duration >= 2 Weeks	97	23.5%	11	11.5%	.01
Tobacco use = Yes*	153	52.9%	30	41.1%	n.s.
Evidence of pneumonia = Yes	81	16.3%	15	11.2%	n.s.
Abnormal lung sounds = Yes	25	4.7%	0	0%	.01
Heart rate > 100 = Yes	45	8.4%	14	9.9%	n.s.
Respiratory rate > 24 = Yes	5	0.9%	2	1.4%	n.s.
Oral temp > 38C (100.4F) = Yes	24	4.5%	3	2.1%	n.s.
Other clinical evidence					
Purulent sputum = Yes	220	41.3%	24	17.0%	<=.001
URI symptoms = Yes	205	38.5%	39	27.7%	.05
Patient reported fever = Yes	10	1.9%	2	1.4%	n.s.

*Percentage based on members assessed for tobacco usage; n=289 for Members with ABX group and n=73 for Members without ABX group.

Table 8 shows adjunctive diagnostic testing compared by members who received ABX versus members who did not receive ABX. Members without ABX were more likely to have a chest x-ray ordered (26%) than members who did receive ABX (17%).

Table 8. Adjunctive Diagnostic Testing: ABX Group vs. No ABX Group

Category	Members with ABX (N = 533)		Members without ABX (N = 141)		p value
	n	%	n	%	
Chest x-ray ordered = Yes	88	17.0%	37	26.0%	.05
Radiographic evidence pneumonia = Yes	0	0%	0	0%	---
Other radiographic abnormality = Yes	3	0.6%	0	0%	n.s.
Spirometry ordered = Yes	17	3.2%	4	2.8%	n.s.
Abnormal Spirometry	4	0.8%	0	0%	n.s.

Table 9A shows a comparison of clinical diagnoses, other than bronchitis, for members with ABX versus members with No ABX. Members with ABX were more likely to have URI and acute sinusitis than members without ABX.

Table 9A. Comparison of Documented Clinical Diagnoses other than Bronchitis: ABX vs. No ABX

Category	Members with ABX (N = 533)		Members without ABX (N = 141)		p value
	n	%	n	%	
URI	205	38.5%	39	27.7%	.05
Allergic Rhinitis	24	4.5%	3	2.1%	n.s.
Acute Sinusitis	8	1.5%	0	0%	.01
Viral Syndrome/Flu	7	1.3%	1	0.7%	n.s.
Acute Pharyngitis	5	0.9%	1	0.7%	n.s.
Chronic Sinusitis	3	0.6%	0	0%	n.s.
Otitis media	1	0.2%	1	0.7%	n.s.
Pneumonia	1	0.2%	0	0%	n.s.
Combined Variables					
HEDIS competing diagnoses*	24	4.5%	1	0.7%	.05

- May be multiple responses, total may not add to 100%.

* Any HEDIS exclusions-clinical competing diagnoses from Table URI-C, Appendix A

Table 9B presents a comparison of co-morbid conditions for members with ABX versus members with No ABX. There were no statistically significant differences.

Table 9B. Comparison of Documented Co-Morbid Conditions: ABX vs. No ABX

Category	Members with ABX (N = 533)		Members without ABX (N = 141)		p value
	n	%	n	%	
Co-morbid Conditions*					
Tobacco use	153	28.7%	30	21.3%	n.s.
Asthma	89	16.7%	24	17.0%	n.s.
Diabetes	46	8.6%	13	9.2%	n.s.
Hypertension	24	4.5%	5	3.5%	n.s.
Depression	21	3.9%	4	2.8%	n.s.
Hyperlipidemia	15	2.8%	7	5.0%	n.s.
Obesity	13	2.4%	3	2.1%	n.s.
Hypercholesterolemia	8	1.5%	2	1.4%	n.s.
Combined Variables					
Any HEDIS co-morbid Condition**	9	1.7%	1	0.7%	n.s.
Any non-HEDIS chronic co-morbid condition***	132	24.8%	32	22.7%	n.s.

*May be multiple responses, total may not add to 100%.
** Any HEDIS exclusions- co-morbid conditions from Table AAB- C, Appendix A
***Non-HEDIS chronic co-morbid diagnoses: asthma, CHF, sickle cell disease, diabetes mellitus

Table 10 presents a comparison of other indications/rationale for antibiotic prescribing for members with ABX versus members with No ABX. There were no statistically significant differences**.**

Table 10. Other Indication/Rationale for Antibiotic Prescribing

Category	Members with ABX (N = 533)		Members without ABX (N = 141)		p value
	n	%	n	%	
Rule out pneumonia diagnosis	15	2.9%	3	2.1%	n.s.
Clinical evidence pertussis	0	0%	0	0%	---
Pertussis contact	0	0%	0	0%	---
Exposure C. pneumonia/setting	0	0%	0	0%	---
Documentation of presumed bacterial bronchitis	1	0.2%	0	0%	n.s.

*May be multiple responses

Identification and Description of Group 3 – Prescribed but Omitted from Numerator (PON)

The following analyses describe Group 3, the Prescribed but Omitted from Numerator group, and compare Group 3 to Group 1.Table 11 provides antibiotic dispensing scenarios for Group 3, Prescribed but Omitted from Numerator. From prescription fill data obtained post study analysis, Group three included 15 prescriptions filled during the 0-3 day time period which are considered as data errors as they were omitted from the numerator while meeting the numerator requirements. Most members in Group 3 did not have antibiotics dispensed within one week of visit (69.0%).

Table 11. Antibiotic Dispensing Scenarios - Group 3 (N = 116)

Category	n	%
Prescription dispensed within 0-3 days	15	12.9%
Prescription dispensed beyond measure timeframe (>3 days post visit)	21	18.1%
Prescription not dispensed within one week of visit	80	69.0%
Member already on antibiotics / dispensed at visit site	4*	3.4%

*Three members given samples, one member given IV dose of antibiotics.

Table 12 shows the disposition of prescriptions by study group and mean time to prescription fill. In Group One, 100% of prescriptions were filled within 0-3 days and filled at a mean of 0.2 days (range 0-3 days). Group Two, the "No ABX" Group, shows two prescriptions filled during 0-3 days while Group Three, the Prescribed but Omitted from Numerator (PON) group, shows 15 prescriptions filled during 0-3 days.

Table12. Disposition of Prescription and Time to Prescription Fill by Group

Category	Group		
	(1) ABX (N = 533)	(2) No ABX (N = 141)	(3) PON (N = 116)
Percent Filled 0-3 Days	533 (100%)	2 (1.4%)*	15 (12.9%)*
Percent Filled > 3 Days but < 1 week	0 (0%)	5 (3.5%)	21 (18.1%)
Percent Not Filled within One Week	0 (0%)	134 (95.0%)	80 (69.0%)
Mean Days to Fill (Range)	0.2 (0-3)	3.7 (0-6)	3.3 (0-7)

*Two prescriptions filled in 0-3 days in No ABX group. Fifteen prescriptions filled in 0-3 days in Prescribed but Omitted from Numerator group. These members are clarified as data errors, with administrative data consistent with numerator compliance as per HEDIS AAB specifications, although they were not included in the numerator.

For the following comparison, the data errors described the Table 12 footnote (n = 15) are removed from the Prescribed but Omitted from Numerator group*. The remaining n is 101.

We compared members with ABX versus the Prescribed but Omitted from Numerator group on age, race/ethnicity, gender, NYC vs. rest of state, aid category, CRG health status, and selected clinical indicators (Table 13). There were no statistically significant findings.

Table 13. Characteristics by ABX Group (Group 1) vs. Prescribed but Omitted from Numerator (PON) Group (Group 3*)

Category	Members with ABX (N = 533)		PON Members (N = 101)*		p value
	n	%	n	%	
Age mean (std)	41.1 (12.7)		40.3 (12.4)		n.s.
Race/Ethnicity					
White	238	44.7%	36	35.6%	n.s.
Black	83	15.6%	15	14.9%	
Hispanic	78	14.6%	21	20.8%	
Asian/PI	99	18.6%	17	16.8%	
Other	35	6.6%	12	11.9%	
Gender					
Female	354	66.4%	63	64.3%	n.s.
Male	179	33.6%	35	35.7%	
NYC/Rest of State (ROS)					
NYC	246	46.2%	52	51.5%	n.s.
ROS	287	53.8%	49	48.5%	
Aid Category					
SSI	86	16.1%	16	15.8%	n.s.
Other	447	83.9%	85	84.2%	
Health Status					
Major Chronic	295	55.3%	53	52.5%	n.s.
No Major Chronic	238	44.7%	48	47.5%	
Cough duration					n.s
>= 2 weeks	94	22.9%	11	15.3%	
< 2 weeks	316	77.1%	61	84.7%	
Clinical evidence pneumonia					n.s.
Yes	81	16.3%	13	13.8%	
No	416	83.7%	81	86.2%	
Tobacco use					n.s.
Yes	153	52.9%	19	43.2%	
No	136	47.1%	25	56.8%	
ED setting					n.s.
Non-ED	434	85.9%	86	86.0%	
ED	71	14.1%	14	14.0%	
Chest X-ray ordered					n.s.
Yes	88	16.8%	16	15.8%	
No	436	83.2%	85	84.2%	

*excludes members in Group 3 noted to have an antibiotic dispensed within 3 days in administrative data

Regression Model and Subgroup Analysis

Table 14 presents multiple regression results for the dependent variable “ABX versus no ABX” for members in the ABX and No ABX groups combined. Members with Non-ED visits were statistically significantly more likely to receive antibiotics than members with ED visits (OR 2.8). Members with purulent sputum were statistically significantly more likely to receive antibiotics than members with no purulent sputum (OR 2.4). Members with cough duration greater than or equal to two weeks were statistically significantly more likely to receive antibiotics than members with cough duration less than two weeks (OR 2.5).

Table 14. Multiple Regression Results* for ABX vs. Non-ABX (n = 674)

Variable	OR	p value
Non-ED (vs. ED)	2.8	<=.001
Purulent Sputum	2.4	<=.001
Cough Duration >= 2 Weeks	2.5	.01

*Multiple regression included the following independent variables: Purulent sputum, URI, Cough Duration>= 2 Weeks, Abnormal Lung Sounds (Yes/No), Chest x-ray ordered, Evidence of pneumonia, Age group>45, NYC vs. ROS, SSI, Black vs. all other, Asian vs. all other, Non-ED vs. ED, Chronic CRG (Yes/No).

Due to the statistically significant multiple regression findings for ED visits versus Non-ED visits as shown in Table 14, subgroup analyses were performed to determine univariate differences in provider prescribing characteristics at the ED and Non-ED sites (Table 15A and 15B). Table 15A shows the demographic characteristics of ED and Non-ED members. ED members were younger, and more likely to be black, female, and reside outside of NYC (rest of state), and less likely to be Asian than members who did not go to the ED. Members seen in the ED were more likely to have clinical evidence of pneumonia and a chest X-ray ordered, and less likely to have URI symptoms.

Table 15A. Demographic Characteristics of ED vs. Non-ED Members

Variable	ED (N = 108)		Non-ED (N = 535)		p value
	n	%	n	%	
Age mean (std)	37.4 (11.6)		41.8 (12.7)		<=.001
Race/Ethnicity					
White	46	42.6%	230	43.0%	<=.001
Black	37	34.3%	68	12.7%	
Hispanic	18	16.7%	73	13.6%	
Asian/PI	2	1.9%	121	22.6%	
Other	5	4.6%	43	8.0%	
Gender					
Female	82	75.9%	344	64.3%	.01
Male	26	24.1%	191	35.7%	
NYC/Rest of State (ROS)					
NYC	28	25.9%	260	48.6%	<=.001
ROS	80	74.1%	275	51.4%	
Aid Category					
SSI	21	19.4%	87	16.3%	<=.001.
FHP	17	15.7%	142	26.5%	
TANF	47	43.5%	169	31.6%	
SN	22	20.4%	137	25.6%	
Other	1	1.0%	0	0%	
CRG Health Status					
Major Chronic	55	50.9%	306	57.2%	n.s.
No Major Chronic	53	49.1%	229	42.8%	
Clinical					
Chest x-ray ordered					
Yes	59	55.1%	63	12.0%	<=.001
No	48	44.9%	462	88.0%	
Purulent sputum					
Yes	37	34.3%	196	36.6%	n.s.
No	71	65.7%	339	63.4%	
URI					
Yes	29	26.9%	210	39.3%	.05
No	79	73.1%	325	60.7%	
Abnormal lung sounds					
Yes	5	4.6%	16	3.0%	n.s.
No	103	95.4%	519	97.0%	
Clinical evidence pneumonia					
Yes	38	35.5%	53	10.6%	<=.001
No	69	64.5%	447	89.4%	

Table 15B shows the differences in provider antibiotic prescribing behaviors at the ED and non-ED sites. While there are no demographic differences in provider prescribing behavior, there are clinical differences by site.

In the ED, chest x-rays were more likely to be ordered for the No ABX group, while purulent sputum was more likely to be identified in the ABX group. The latter finding was also detected in the Non-ED setting. In addition, the ABX group was more likely to have evidence of pneumonia, URI, and abnormal lung sounds than the No ABX group in the Non-ED setting.

Table 15B. Characteristics of ED and Non-ED Members by ABX Status

Variable	ED (N = 108)			Non-ED (N = 535)		
	ABX	No ABX	p	ABX	No ABX	p
	n (%)	n (%)	value	n (%)	n (%)	value
Demographic						
Age mean (std)	36.5 (11.2)	39.3 (12.3)	n.s.	41.5 (12.8)	43.3 (12.3)	n.s.
Gender						
Female	56 (78.9%)	26 (70.3%)	n.s.	280 (64.5%)	64 (63.4%)	n.s.
Male	15 (21.1%)	11 (29.7%)		154 (35.5%)	37 (35.6%)	
Race						
White	28 (39.4%)	18 (48.6%)	n.s.	200 (46.1%)	30 (29.7%)	n.s.
Black	24 (33.8%)	13 (35.1%)		54 (12.4%)	14 (13.9%)	
Hispanic	14 (19.7%)	4 (10.8%)		59 (13.6%)	14 (13.9%)	
Asian	2 (2.8%)	0 (0.0%)		91 (21.0%)	30 (29.7%)	
Other	3 (4.2%)	2 (5.4%)		30 (6.9%)	13 (12.9%)	
NYC vs. ROS						
NYC	21 (29.6%)	7 (18.9%)	n.s.	205 (47.2%)	55 (54.5%)	n.s.
ROS	50 (70.4%)	30 (81.1%)		229 (52.8%)	46 (45.5%)	
AID Category						
SSI	12 (16.9%)	9 (24.3%)	n.s.	70 (16.1%)	17 (16.8%)	n.s.
FHP	9 (12.7%)	8 (21.7%)		116 (26.7%)	26 (25.7%)	
TANF	37(52.1%)	10(27.0%)		144(33.2%)	25(24.8%)	
SN	12(16.9%)	10(27.0%)		104(24.0%)	33(32.7%)	
Other	1(1.4%)	0(0%)		0(0%)	0(0%)	
Chronic lllness CRG						
Yes	32 (45.1%)	23 (62.2%)	n.s.	249 (57.4%)	57 (56.4%)	n.s.
No	39 (54.9%)	14 (37.8%)		185 (42.6%)	44 (43.6%)	
Clinical						
Chest X ray ordered						
Yes	32 (45.7%)	27 (73.0%)	.01	53 (12.4%)	10 (10.1%)	n.s.
No	38 (54.3%)	10 (27.0%)		373 (87.6%)	89 (89.9%)	
Purulent Sputum						
Yes	29 (40.8%)	8 (21.6%)	.05	180 (41.5%)	16 (15.8%)	<=.001
No	42 (59.2%)	29 (78.4%)		254 (58.5%)	85 (84.2%)	
Evidence of Pneumonia						
Yes	26 (37.1%)	12 (32.4%)	n.s.	50 (12.3%)	3 (3.2%)	.01
No	44 (62.9%)	25 (67.6%)		355 (87.7%)	92 (96.8%)	
URI						
Yes	20 (28.2%)	9 (24.3%)	n.s.	180 (41.5%)	30 (29.7%)	.05
No	51 (71.8%)	28 (75.7%)		254 (58.5%)	71 (70.3%)	
Abnormal Lung Sounds						
Yes	5 (7.0%)	0 (0.0%)	n.s.	16 (3.7%)	0 (0.0%)	.05
No	66 (93.0%)	37 (100.0%)		418 (96.3%)	101 (100.0%)	

Discussion

Antibiotics have generally not been shown to alter the course of acute bronchitis in adults in clinically significant ways.[2] Despite the evidence and clinical guidelines that recommend against routine antibiotic prescribing for acute bronchitis in otherwise healthy adults, clinicians are reported to prescribe antibiotics for most adult patients who present with acute bronchitis.[3,9] This reported practice pattern is consistent with the high rate of antibiotic prescribing for adult New York Medicaid managed care members diagnosed with acute bronchitis as reflected in the HEDIS AAB measure. Our study revealed that antibiotic prescribing for acute bronchitis is even more prevalent than reflected in QARR rates. Surprisingly, medical record documentation of antibiotic prescribing was identified for 45.1% of MMC members who were presumed to have no antibiotics prescribed based on their omission from the numerator in plans' calculation of the AAB measure. For most of these members, prescriptions were prescribed but not dispensed.

Our study sought to identify factors that could have contributed to high rates of antibiotic prescribing for adults with acute bronchitis by comparing members who had been prescribed antibiotics to those who had not. Several factors associated with prescribing that were identified, as well as differences in practices between emergency department and non-emergency department settings, offered some insight into prescribing patterns of Medicaid managed care providers that allows better understanding of the high rates of antibiotic prescription and can inform future educational initiatives.

There is some evidence to suggest that there may be a subset of adult patients with acute bronchitis who could be more likely to derive modest benefit from antibiotics.[8] Published studies vary somewhat with regard to case definition, study populations and endpoints, and therefore there are no definitive data that identify which subpopulations might benefit.[8] However, limited evidence has suggested that individuals who are older, are non-smokers, have longer duration of cough illness and have no upper respiratory symptoms may derive more benefit from antibiotics in acute bronchitis than individuals without these characteristics.[8]

Some studies have shown that bronchitis patients with a short duration of illness may be the least likely to benefit from antibiotics.[8,10] In our study, members who were prescribed antibiotics were more likely to have a documented cough duration of two weeks or more. Although there is some suggestion that longer duration of illness impacts antibiotic benefit in acute bronchitis, ACCP and ACP guidelines do not recommend routine antibiotic treatment, regardless of the duration of cough illness.[1,11] Rather than prolonged duration being an indication for antibiotics, guidelines recommend that symptoms persistent for more than three weeks should trigger further evaluation such as a chest X-ray, since acute bronchitis is a self-limited condition and by definition lasts less than three weeks.[3,10] It is possible that longer symptom duration may have prompted clinicians to presumptively treat other possible etiologies, although this rationale was not commonly documented. One clinician specifically indicated that his decision to treat was based on suspicion of an atypical bacterial organism due to symptom duration of more than two weeks, and another documented a concern for pertussis, which has been identified in 10% to 20% of cases of acute cough illness lasting more than 2 to 3 weeks.[1] There is evidence to support empiric antibiotic treatment in acute bronchitis if pertussis is suspected, pending confirmation.[1]

We found that although other studies have shown that patients with upper respiratory infection (URI) symptoms such as rhinorrhea are less likely to benefit from antibiotics, members who were prescribed antibiotics in our study had higher rates of such symptoms. [8, 9] This finding may be more

reflective of completeness of documentation than a pattern of preferential prescribing for members with URI symptoms.

Many published trials exclude individuals older than 65 years, and older patients are more difficult to evaluate, since clinical signs associated with pneumonia may not be present in elderly adults.[12,3] However, at least one study has suggested that adults over the age of 55 years may be more likely to benefit from antibiotic treatment.[8] We did not find a difference in mean age between members prescribed antibiotics and those who were not, although it should be noted that members 65 years or older were not included in the study population, as consistent with HEDIS AAB specifications.

Though it has been reported elsewhere that clinicians are more likely to prescribe antibiotics for smokers with acute bronchitis than for non-smokers, we found no difference in smoking status between members who did receive antibiotics and those who did not.[10] Antibiotics are not routinely indicated for smokers with acute bronchitis if they do not have chronic obstructive pulmonary disease (COPD).[1] In fact, some studies have suggested that smokers without COPD may be even less likely to benefit from antibiotics that non-smokers.[9,13] While 50.6% of members who had smoking status documented were noted to be smokers, smoking status could not be determined for many members, and therefore our ability to evaluate antibiotic prescribing with regard to smoking status is limited.

It was not possible to ascertain the rationale for prescribing in most cases, since there were few cases in which the reason for antibiotics was documented, but there were some significant factors identified that suggest possible reasons for prescribing. There is no gold standard test for acute bronchitis, and definitions of acute bronchitis have been documented to vary among clinicians.[1, 3] Some clinicians have been reported to identify bronchitis only if cough is productive or if purulent sputum is present.[3] One of the most significant study findings was the observation that members who received antibiotics were much more likely to have documentation of purulent sputum than those who did not receive antibiotics. Although purulent sputum is a criterion for antibiotic prescribing in exacerbations of chronic obstructive pulmonary disease, purulent sputum is not predictive of bacterial infection in acute bronchitis and has a low positive predictive value for pneumonia in healthy adults.[10 ,14] Nonetheless, it has been reported that purulent sputum is associated with antibiotic prescribing even in upper respiratory infections.[15,10, 9] In nearly all records, it was not possible to determine if the documentation of purulent sputum was intended to support the diagnosis of bronchitis or justify the prescribing of antibiotics. However, the strong association of purulent sputum with antibiotic prescribing, particularly in the non-ED setting, suggests that it may have been a factor in prescribing. In at least one case, the clinician documented that a bacterial infection was presumed due to the presence of purulent sputum, and therefore antibiotics were prescribed.

Guidelines for the treatment of acute bronchitis are intended for otherwise healthy adults. ACCP guidelines specifically exclude patients with underlying lung disease, congestive heart failure and compromised immune system, since these groups are at risk for poor outcome.[1] Although individuals with certain chronic respiratory and immunosuppressive co-morbidities are excluded from the HEDIS AAB measure's eligible population, since antibiotics for cough illness in individuals with these conditions may be indicated, other chronic illnesses such as congestive heart failure are not excluded. There were only 10 cases of HEDIS-excluded co-morbidities in our study, nine of which were treated with antibiotics. However, the majority of members in our study (55.8%) had at least one major chronic illness as defined by CRG health status 5, 6 or 7, most commonly asthma and diabetes. The presence of a chronic condition as defined by CRGs or documentation of specific conditions such as asthma or diabetes was not significantly associated with antibiotic prescribing overall. It is possible that in some individual cases clinicians may have considered that

antibiotic prescribing guidelines for healthy adults did not apply to some members with chronic conditions, as at least one cited the patient's co-morbid conditions (diabetes and cardiac dysrhythmia) as a factor in prescribing antibiotics.

Patients with chronic lung disease are typically excluded from studies of antibiotics in acute bronchitis. While the HEDIS AAB measure excludes chronic lung conditions, asthma is not excluded from the eligible population unless the coded diagnosis is chronic obstructive asthma (ICD-9 493.2, asthma with chronic obstructive pulmonary disease or chronic asthmatic bronchitis). A total of 16.6% of our study population had medical record evidence of an asthma diagnosis. Acute bronchitis guidelines do not specifically address patients with asthma except to recommend ruling out acute asthma exacerbation in acute cough illness, and National Asthma Education and Prevention Program (NAEPP) asthma guidelines do not recommend routine antibiotic prescribing for exacerbations.[15] However, it has been suggested that atypical bacteria, such as Chlamydia pneumoniae and Mycoplasma pneumoniae, may be a factor in the manifestations of asthma.[1,16] It does not appear that this concern was a factor in high antibiotic prescribing rates, since a diagnosis of asthma was not significantly associated with antibiotics, and there was no documentation of this concern as a rationale for prescribing in this subgroup.

More than 90% of cases of acute bronchitis in healthy adults are presumed to be of viral etiology.[10] Influenza is the most commonly identified pathogen, though this was rarely documented in our study.[3] There are no reliable clinical criteria to distinguish bacterial from viral bronchitis, both of which are included in the ICD-9 code for acute bronchitis that determines eligibility for the HEDIS AAB measure.[10] While most acute bronchitis is presumed to be viral, Bordetella pertussis, Mycoplasma pneumoniae, and Chlamydia pneumoniae have been established as non-viral causes of acute bronchitis, and are thought to collectively be associated with 5-10% of acute bronchitis cases in adults.[3] Guidelines recommend that pertussis be ruled out as the cause of acute cough illness, since antibiotics can decrease spread of the disease, though perhaps not the clinical course. [1] There were only four cases in which clinicians documented suspicion of bacterial infection, pertussis or atypical organism as a rationale for antibiotic prescribing. Gram stain and culture have poor yield and are not useful in distinguishing a bacterial etiology in acute bronchitis, but there is limited evidence that use of procalcitonin level or other bacterial infection markers may be useful in identifying individuals who might benefit from antibiotics. [2, 7, 8] There was no adjunctive testing to distinguish bacterial from viral etiologies found in the records, and there were very few possibly bacterial competing diagnoses found that might have contributed to the high rates of prescribing.

It was evident that in some cases there was concern that the acute cough illness may be a presentation of pneumonia; in 2.9% of cases in which antibiotics were prescribed and 2.1% of cases in which no antibiotics were prescribed, "rule out pneumonia" or similar language was included among possible diagnoses. The evaluation of acute cough illness centers on the exclusion of pneumonia, which is the third most common cause of such illnesses.[1] It is critical that pneumonia be identified if present, since unlike bronchitis, it is not self-limited and causes significant morbidity and mortality if not promptly treated.[1,3] Pneumonia is typically ruled out by absence of an infiltrate on chest x ray.[3] However, studies have shown that the absence of vital sign and chest exam abnormalities, specifically fever, tachypnea, tachycardia, rales, egophany or fremitus in healthy non-elderly adults can allow clinicians to exclude pneumonia as a likely diagnosis without further diagnostic testing.[1,3,10] There were no radiographically documented cases of pneumonia among the study population, and the vast majority of members did not have any of the clinical signs suggestive of pneumonia documented to explain antibiotic prescribing. We found that every member with abnormal lung sounds consistent with pneumonia was prescribed antibiotics, although members who were prescribed antibiotics were not more likely to have any of the other clinical signs associated with pneumonia. This finding was not consistent across practice

settings, and it appears that ensuring antibiotic coverage of possible pneumonia may have been a factor for antibiotic prescribing among members with any clinical sign of pneumonia who were seen in a non-emergency setting. Members seen in an outpatient non-ED setting who were prescribed antibiotics were significantly more likely to have at least one clinical sign of pneumonia than members who did not have antibiotics prescribed. In contrast, there was no association of antibiotic prescribing and clinical signs of pneumonia among members seen in the ED, even though members seen in the ED were more likely to have clinical signs of pneumonia. This may be due to the fact that the ED setting afforded the opportunity to radiographically "rule out" pneumonia, as evidence by the fact that members seen in the ED were more likely to receive a chest X-ray, and receiving a chest X-ray in the ED was associated with avoidance of antibiotic prescribing. It should be noted that every member with a chest exam suggestive of pneumonia received antibiotics, regardless of the setting in which they were seen.

The finding that members seen in the ED were more likely to receive a chest X-ray than those seen in a non ED setting could be influenced by utilization practices as well as member characteristics. It appeared that chest X-rays were "appropriate" for a majority of members seen in the ED who had them, since 46% had clinical characteristics that precluded ruling out pneumonia without an X-ray, and another 9% had a clearly documented reason for chest X-ray, such as congestive heart failure. (data not shown). Among members for whom chest X-ray should be considered, 63% seen in the ED had an X-ray, compared to only 8% of members with these symptoms who were seen in a non ED setting, suggesting that imaging may be underutilized in the non ED setting.

The ability to definitively rule out pneumonia in the ED likely contributed to the finding that members who did not receive antibiotics were more likely to be seen in an ED setting, despite the fact that these members were more likely to have evidence of pneumonia and less likely to have symptoms of the common cold (URI). Members seen in the ED were younger, black and resided outside of New York City, but these factors were not significantly different between groups prescribed antibiotics and those who were not, regardless of visit setting. It is notable that many of the ED visits included a detailed patient information sheet that documented guideline-recommended information about acute bronchitis, such as the self-limited nature and viral etiology of the illness, and the general lack of efficacy of antibiotics for acute bronchitis.

The most striking finding of our study was the documentation of antibiotic prescriptions in 45% of the medical records of members who were presumed to have had no antibiotic prescription based on numerator compliance for the HEDIS AAB measure. For most of these members (69%), there was no evidence that an antibiotic was ever dispensed up to a week after the acute bronchitis visit, while an additional 18% had antibiotics dispensed outside of the 3-day timeframe specified in the HEDIS AAB measure specifications but within a week. In this way, the HEDIS measure may be more a reflection of member behavior than provider prescribing practice. There is some evidence that delaying or deferring antibiotics can result in fewer prescriptions being filled.[8] While it is possible that some members may have been instructed to wait before filling the antibiotic prescription, this advice was documented in only 3 of the records of members who were prescribed antibiotics but did not fill them within a week (data not shown). This advice was also documented in 5 of the records of members who were prescribed and dispensed antibiotics within 3 days (ABX group). The members who were prescribed antibiotics but were omitted from the numerator did not differ significantly from members who did fill their prescriptions demographically, clinically or with regard to health status or visit setting.

For the most part, members were prescribed antibiotics that would also cover atypical pneumonias and pertussis; a total of 72.4% of the prescriptions were for macrolides, mostly azithromycin. Our study found quinolones to be the second most common antibiotic prescribed at 8.4%. This finding

of prescribing of broad spectrum antibiotics for bronchitis is consistent with other published reports.[17]

Limitations

It was not possible to ascertain the degree to which findings reflect documentation practices rather than prescribing practices. The rationale for antibiotic prescribing was rarely documented, and documentation of instructions given to the member was also lacking. Lack of documentation of variables such as smoking status limited our ability to interpret some findings. The discovery that 45% of the members presumed to have no antibiotic prescription actually had been prescribed antibiotics resulted in a small comparison group.

Conclusion

We found that antibiotic prescribing rates for adults with acute bronchitis were even higher than presumed based on the HEDIS AAB measure and that although bronchitis guidelines are meant for otherwise healthy adults, over half of adult Medicaid managed care members presenting with acute bronchitis had a major chronic condition as defined by CRG health status. There were few clear clinical drivers of antibiotic prescribing, although prescribing was associated with purulent sputum and a longer duration of cough, which may indicate providers' concerns for non-viral etiologies. Members who did not receive antibiotics were more likely to be seen in the ED setting, where receipt of chest X-ray, presumably to rule out pneumonia, was associated with avoidance of antibiotics.

Educational efforts could focus on the lack of predictive value of purulent sputum for pneumonia, the recommendation that longer duration of cough prompt further evaluation rather than antibiotic prescribing, as well as other guidelines. Since there may be some subsets of patients who might benefit from antibiotics, further study of members with co-morbidities, older members, members with longer duration of illness and members without upper respiratory infection could be undertaken.

Recommendations

The possibility that many non-numerator compliant members in the QARR rates may also have been prescribed antibiotics should be considered when evaluating the measure.

Education for providers

- Information for providers should reflect the evidence that member satisfaction depends on the patient's interaction with the clinician more than the receipt of antibiotics.[8]
- The provision of written information to patients regarding antibiotics in acute bronchitis should also be stressed, such as the information disseminated in some emergency departments, since written information has been shown to reduce filling of delayed prescriptions.[8]
- Educational initiatives should include recommended ways to increase the acceptance of no antibiotic prescriptions, such as informing patients of the risk of resistant organism infection, identification and validation of concerns, symptomatic treatment, and contingency plans for worsening.
- Common misperceptions, such as the relationship of purulent sputum and bacterial infection in acute bronchitis, could also be stressed.
- It would be of benefit to focus on the fact that pneumonia is unlikely in otherwise healthy adults if guideline-specified clinical signs are absent.
- Directing efforts to avoidance of antibiotics in individuals with acute bronchitis with no identified comorbidities may be most effective.

Education for members

- Education of members should include the same guideline recommended elements as those provided to clinicians.
- Member education should also include the expectation that symptoms will last ten to fourteen days.

Future study

- Further study of the practice of prescribing delayed antibiotics for acute bronchitis could be undertaken, as well as further evaluation of prescribing for subpopulations of members, such as those with chronic conditions.

Next Steps

Findings from this study will be disseminated to New York Medicaid managed care plans and possibly to NCQA. Plans can access materials such as academic detailing sheets and physician information sheets on the CDC-Get Smart: know When Antibiotics Work Adult Treatment Guideline page at http://www.cdc.gov/getsmart/campaign-materials/adult-treatment.html.
"Prescription" pads indicating that antibiotics are not indicated for viral cough can be found at http://www.cdc.gov/getsmart/campaign-materials/print-materials/ViralRxPad-color.pdf.
Provider resources for judicious use of antibiotics are also available on the New York State DOH website http://www.health.state.ny.us/nysdoh/antibiotic/antibiotic.htm.

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