Antibiotics for lower respiratory tract infections

Still too frequently prescribed?

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ABSTRACT

OBJECTIVE To examine how Canadian family physicians currently prescribe for lower respiratory tract infections (LRTIs).

DESIGN Prospective assessment of adults with symptoms of LRTIs.

SETTING Offices of 120 community-based members of the College of Family Physicians of Canada.

PARTICIPANTS Four hundred seven adults (16 years and older).

MAIN OUTCOME MEASURES Clinical findings, diagnoses, tests ordered, and prescriptions for antibiotics were documented on a standardized form.

RESULTS Antibiotics were prescribed to 58.4% of patients presenting with symptoms of LRTIs. Prescribing was higher (77.9%) for those diagnosed with acute bronchitis, which accounted for 70.3% of prescriptions. Physicians were often uncertain about the need for antibiotics, were concerned that patients could become sicker, and felt pressured by patients to prescribe antibiotics. Macrolides were most frequently prescribed; no tests were ordered in 85.0% of encounters.

CONCLUSION The number of antibiotic prescriptions for adults with LRTIs remains high in Canada. Rates of prescribing are increased by diagnosis of acute bronchitis, clinical uncertainty, pressure from patients to receive antibiotics, and concern that patients will deteriorate if left untreated.

RÉSUMÉ

OBJECTIF Vérifier comment les médecins de famille canadiens traitent les infections des voies respiratoires inférieures (IVRI).

TYPE D'ÉTUDE Évaluation prospective d'adultes présentant des symptômes d'IVRI.

CONTEXTE Cabinets de 120 membres du Collège des médecins de famille du Canada pratiquant dans la communauté.

PARTICIPANTS Quatre cent sept adultes de 16 ans ou plus.

PRINCIPAUX PARAMÈTRES ÉTUDIÉS Les données cliniques, diagnostics et prescriptions d'examens et d'antibiotiques ont été consignés à l'aide d'un formulaire standard.

RÉSULTATS Dans 58,4% des cas, les patients présentant des symptômes d'IVRI ont reçu des antibiotiques. Le taux de prescription était plus élevé en cas de bronchite aiguë (77,9%), ce qui représentait 70,3% de toutes les prescriptions. Souvent, les médecins craignaient une aggravation de la maladie, n'étaient pas certains que les antibiotiques étaient nécessaires ou sentaient que le patient souhaitaient en recevoir. Les antibiotiques les plus utilisés étaient les macrolides; dans 85,0% des cas, aucun test n'était demandé.

CONCLUSION Le nombre de prescriptions d'antibiotiques à des adultes souffrant d'IVRI demeure élevé au Canada. Les facteurs responsables sont un diagnostic de bronchite aiguë, l'incertitude clinique, les pressions des patients et la crainte d'une aggravation de la maladie en l'absence de traitement.

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Acute bronchitis is one of the most frequent reasons for prescribing antibiotics to adults.[1,2] Acute bronchitis is distinct from acute exacerbation of chronic bronchitis in that patients who present with cough and symptoms of acute lower respiratory tract infections (LRTIs) usually do not have underlying chronic lung disease.[3,4] Prescribing rates for adults with acute bronchitis have been reported to range from 66% to 81%[2,5-9] even though experts recommend that antibiotics not be prescribed routinely for acute bronchitis (studies have found they have either limited or no benefit).[10-13]

Common lower respiratory tract pathogens have become more resistant to antibiotics.[14] Penicillin-resistant and multidrug-resistant *Streptococcus pneumoniae* are increasingly common.[15,16] Case reports have described treatment failures related to quinolone resistance.[17,18] Other pathogens, such as *Haemophilus influenzae* and *Moraxella catarrhalis* are frequently resistant to common antibiotics such as ampicillin.[19]

Whether family physicians have reduced their use of antibiotics for acute bronchitis in light of concerns about resistance is unclear. A 1997 chart audit of family physicians in Newfoundland found 85% of patients with LRTIs received antibiotics.[20] Other studies have relied on self-reported prescribing, chart audits, or data from case vignettes of hypothetical patients.[21-23] Some studies have reported actual prescribing,[24,25] but one study was limited to children and others studied only physicians in Saskatchewan and Ontario.[23,24] The purpose of this study was to determine prospectively rates of antibiotic prescribing for adults with LRTIs presenting to a national sample of community-based family physicians.

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METHODS

The study was conducted in collaboration with the College of Family Physicians of Canada (CFPC). The College maintains a national register, known as NaReS (National Research System), of community-based family physicians engaged in full-time clinical practice who have participated in research projects.[26] In March 1999, English-speaking NaReS members were invited to participate in a study of adults with acute cough.

Physicians agreeing to participate were mailed a consent form and four clinical encounter sheets with accompanying patient consent forms and diaries. Any patients 16 years or older who presented with a new cough and the possibility of chest infection, such as acute bronchitis, were eligible and could be chosen by physicians for the study. Patients already taking antibiotics, immunocompromised, with chronic obstructive lung disease, or unable to complete the diary in English were ineligible. After the visit, patients were invited to read information about the diary portion of the study. Those expressing interest were given a package containing a diary and consent form that, when completed, were to be returned directly to the study centre.

A one-page form was used to record patients' demographic characteristics, duration of illness, presenting symptoms and signs, diagnoses, tests ordered, and whether antibiotics were prescribed. Physicians were also asked how certain they felt that antibiotics were either indicated or not indicated, how concerned they were that patients might become sicker in the next week (using a scale from 0 to 100%), and whether they felt pressure to prescribe antibiotics (none, some, a lot, patient verbally requested antibiotics). The form was pretested on a convenience sample of family physicians.

There were approximately 700 English-speaking family physicians participating in NaReS in 1999. The study sought to enrol 300 physicians, based on a 50% response rate in a previous study.[27] Cluster sampling was used: each physician was asked to complete four clinical assessments. Frequencies were used for categorical variables and means or medians for continuous variables; 95% confidence

intervals were determined and adjusted for clustering of patients using estimation procedures for complex survey data.[28] The study was approved by the University of Toronto's Research Ethics Board.

RESULTS

Of 600 family physicians contacted, 270 agreed to participate, and 120 (44%) completed the study. Compared with all CFPC members,[29] study physicians were younger (42.7 vs 46.6 years), more likely to be male (68.3% vs 65.0%), and had practised for fewer years (16.2 vs 18.5 years). Proportion of urban physicians was similar (85.0% vs 84.1%). Most family physicians were from Ontario (63.7%); followed by British Columbia (15.9%); Alberta (6.7%); Saskatchewan and Manitoba (7.0%); Quebec (3.0%); and Nova Scotia, Newfoundland, and Yukon Territories (3.7%). In all, 408 clinical encounters were completed, a median of two per physician (range one to four). One patient younger than 16 years was excluded. Little information on individual items on the form was missing (0.5% to 4.1%).

Patient characteristics and clinical findings

Median age was 44.0 years (range 16 to 86), and 62.5% were women. Sixty-eight people (17.1%) were 65 years or older, and 114 (28.4%) had major comorbid conditions. Two thirds (63.8%) were seen within 7 days of onset of symptoms. Almost all reported frequent cough, two thirds had coloured sputum (**Table 1**), more than half reported wheezing or a tight chest, and 28.4% reported fever (>38°C). Most had concurrent upper respiratory tract symptoms, such as runny or stuffy nose and sore throat.

Physicians could record physical findings as present, absent, or not assessed; all were asked to record respiratory rate. Temperature was taken in 48.2% of cases, more often if fever was reported (55.8%, $P = .05$). Heart rate was recorded for 59.5% and respiratory rate for 79.6% of patients. Auscultation indicated that 57.1% of patients had clear chests.

Table 1. Clinical features of adults presenting with symptoms of chest infection and cough: *Patients' mean temperature was 36.9°C (range 34.9°C to 39.4°C) (n = 196); mean heart rate was 79.0 (range 56 to 150) (n = 242).*

CLINICAL FINDINGS*	N	%
HISTORY†		
Frequent cough	390	96.3
Sputum	317	78.7
Runny or stuffy nose	288	72.4
Cough disturbs sleep	289	72.1
Coloured sputum	249	64.8
Sore throat	254	64.1
Wheezy or tight chest	229	56.7
General aches	196	49.3
Chest pain with coughing	172	42.3
History of temperature >38°C	113	28.4
History of pneumonia	85	21.4
Recently exposed	69	17.4
Pleuritic chest pain	47	11.6
PHYSICAL FINDINGS†		
Any chest finding	173	42.9
Sounds clear after cough (n = 282)‡	96	34.1
Wheezes	117	29.2
Patient looks unwell	103	27.5
Crackles	79	19.7
Decreased breath sounds	54	13.5
Tactile or vocal fremitus (n = 241)‡	8	3.3
Percussion dullness (n = 272)‡	5	1.8

**Missing information in items varies; denominator can be determined using frequencies.*
†In order of frequency.
‡Proportion of cases where findings were assessed.

Most common findings were wheezes, followed by crackles and decreased breath sounds. Other clinical findings were rare.

Diagnoses, tests, and prescriptions for antibiotics

Diagnoses. Physicians used 35 separate diagnostic labels. These were grouped into common categories of variations of the same term (**Table 2**). The most common diagnosis was acute bronchitis or some variation (viral bronchitis, bacterial bronchitis, asthmatic bronchitis, sinubronchitis,

Table 2. Diagnoses, tests ordered, and antibiotics prescribed by family physicians to patients presenting with symptoms of chest infection and cough

DIAGNOSIS, TESTS, PRESCRIPTIONS	N (%)
DIAGNOSIS	
Bronchitis*	214 (52.6)
None recorded	95 (23.3)
Viral illness†	63 (15.5)
Pneumonia, bronchopneumonia	17 (4.2)
Asthma, asthmalike illness‡	10 (2.5)
Sinusitis, pharyngitis	8 (2.0)
TESTS ORDERED§	
None	345 (85.0)
Chest x-ray examination	38 (9.3)
Throat swab	12 (3.0)
Sputum for culture	11 (2.7)
Blood test	5 (1.2)
Other	7 (1.7)
ANTIBIOTIC PRESCRIPTIONS	
None	168 (41.6)
Immediate	230 (56.9)
Delayed	6 (1.5)

*Viral bronchitis, bacterial bronchitis, asthmatic bronchitis, sinubronchitis, tracheobronchitis.
†Upper respiratory infection, viral lower respiratory tract infection, viral illness, postinfectious cough, influenza, tracheitis, laryngitis, cough, chest cold, bronchial cough.
‡Reactive airways, asthmatic cough, bronchospasm.
§Some patients had more than one test.

tracheobronchitis). Pneumonia was diagnosed in 4.2% of patients. A nonspecific label (cough, chest cold) or viral etiology (viral LRTI, viral illness) was used in one in six cases.

Tests. Tests were rarely ordered; the most common test requested was chest x-ray examination. Antibiotics were prescribed in 86.5% of instances where chest x-ray was ordered and in 57.4% of instances where no x-ray was requested ($P < .001$).

Prescriptions. Prescribing data were available for 404 encounters (99.3%). Antibiotics were prescribed at 58.4% of visits (95% confidence interval [CI] 52.2 to 64.6); six of these (2.5%) were delayed prescriptions to be filled if patients did not improve. Median duration of prescriptions was 10 days (interquartile range 7 to 10 days). Viral conditions, asthmalike presentations, and cases with no diagnoses were combined into one category because prescribing rates were similar (**Table 3**).

Table 3. Rates of antibiotic prescribing by diagnosis

DIAGNOSIS	NO. DIAGNOSED	NO. GIVEN PRESCRIPTIONS (%)
Acute bronchitis	213	166 (77.9)
Pneumonia	17	17 (100.0)
Sinusitis, pharyngitis	8	5 (62.5)
Viral asthma, no diagnosis	166	48 (28.9)
TOTAL	404*	236 (58.4)

*Cases with complete prescribing information.

Antibiotics were prescribed in 77.9% of encounters (95% CI 70.4% to 84.0%) where the diagnosis was acute bronchitis and in 28.9% where the diagnosis was viral, asthma related, or no diagnosis (95% CI 21.4% to 37.9%). Acute bronchitis accounted for 70.3% of antibiotic prescriptions (95% CI 62.8% to 76.9%).

Information about choice of antibiotic (**Table 4**) was available for 233 of 236 prescriptions (98.7%). Macrolides were most commonly prescribed (59.2%) (95% CI 51.3% to 66.7%); 64.5% of these prescriptions were for either clarithromycin or azithromycin. Aminopenicillins were the next most commonly prescribed antibiotics; amoxicillin accounted for 84.8% of these. Cephalosporins were prescribed in 9.0% of cases (95% CI 5.6% to 14.2%). Quinolones were prescribed less often (6.4%) (95% CI 3.5% to 11.7%).

Clinical uncertainty and patient pressure

Physicians expressed uncertainty about the need for antibiotics in 281 of 404 encounters (69.6%). Antibiotics were thought to be definitely indicated or definitely not indicated in 123 encounters (30.5%), probably indicated in 154 (38.1%), and probably not indicated in 127 (31.4%). Prescribing rate was 96.6% when antibiotics were definitely indicated, 98.0% when probably indicated, 24.0% when probably not indicated, and 0 when definitely not indicated. For 76.3% of their prescriptions (95% CI 68.7% to 82.5%), physicians expressed at least some uncertainty about the need for antibiotics.

Table 4. Antibiotics chosen for treating lower respiratory tract infections: *N = 233.*

ANTIBIOTICS*	NO. GIVEN PRESCRIPTIONS (%)
Macrolides	138 (59.2)
• Clarithromycin	56
• Azithromycin	33
• Erythromycin	49
Aminopenicillins	47 (19.7)
• Amoxicillin	39
• Amoxicillin-clavulanate	5
• Pivampicillin	2
• Ampicillin	1
Cephalosporins	21 (9.0)
• Cefuroxime	13
• Cephalexin	3
• Cefaclor	2
• Cefprozil	3
Quinolones	15 (6.4)
• Levofloxacin	8
• Ciprofloxacin	5
• Trovafloxacin	1
• Grepafloxacin	1
• Other†	12 (5.2)

**Complete information available for 233/236 (98.7%) prescriptions.*
†Doxycycline, tetracycline, trimethoprim-sulfamethoxazole.

Physicians reported feeling no pressure from patients to prescribe antibiotics in 272 of 405 encounters (67.2%). When they felt at least some pressure from patients, the prescribing rate was 82.7% (95% CI 75.3% to 88.3%) compared with 46.5% when no pressure was felt (95% CI 39.3% to 53.8%). In 145 of 402 encounters (36.1%), physicians were somewhat concerned that patients could become sicker in the next week. The prescribing rate was 82.6% in these encounters, but only 44.3% in visits where physicians thought deterioration unlikely.

DISCUSSION

More than half the adults who present to Canadian family physicians with cough and symptoms suggesting LRTI are prescribed antibiotics. The rate of prescribing is higher when acute bronchitis is diagnosed. The 78% rate for acute bronchitis in this study is similar to the 89% rate in a 1990 Australian study,[5] the 75% rate in an American study of Medicaid claims from 1993 to 1994,[6] and the 75% rate in a 1997 British study of more than 1000 adults.[7] From 1980 to 1994 in the United States, the prescribing rate for acute bronchitis remained at 81% overall.[9] Two other studies reported lower rates: 67% and 68%.[2,8] This suggests that prescribing for acute bronchitis in Canada has remained as high as in other English-speaking countries during the last 20 years and has not changed appreciably.

Whether acute bronchitis should be considered a distinct diagnosis has been questioned.[30] A consensus report on management of cough did not include acute bronchitis in the absence of underlying chronic lung disease as a cause of acute cough.[31] Instead, common cold and postnasal drip syndromes were listed as the most common causes of cough and sputum of less than 3 weeks' duration.[31] Considerable variation in the criteria family physicians use in making this diagnosis has also been found.[3]

The contribution of diagnostic labels to the problem of antibiotic overuse has been described by Hutchison et al,[20] who found the main difference between high and low prescribers of antibiotics was their use of diagnostic labels suggesting bacterial etiology, such as bronchitis or otitis media. An alternative term suggested is "chest cold," which is consistent with the usually viral etiology of acute bronchitis. A randomized trial that encouraged physicians to use this term instead of acute bronchitis reduced antibiotic use from 74% to 48%.[32]

Patient pressure and clinical uncertainty played a role in high rates of antibiotic use.[33] Patient pressure was a factor in only one third of visits; physicians' uncertainty about the need for antibiotics was a factor in three quarters of visits. Use of patient information leaflets on the uncertain benefit of antibiotics for acute bronchitis together with delayed prescriptions reduced antibiotic prescriptions by 24% in one study.[34] Canadian family physicians appear to use delayed prescriptions infrequently.

Some of the uncertainty arose from concern that patients might become sicker during the following week. This could reflect physicians' preference to err on the side of caution to avoid missing early cases of pneumonia. Although no combination of findings is specific for pneumonia,[35] physicians relied primarily on clinical examination and ordered chest x-ray examinations for fewer than one in 10 cases. Normal vital signs and a clear chest on auscultation reduce the likelihood of pneumonia, but a chest x-ray examination can allow greater diagnostic certainty when chest findings are present.[35] About 40% of patients had chest findings, which would necessitate a substantial increase in the number of x-ray examinations over current practice, and might be impractical in many communities.

The most commonly prescribed antibiotics were macrolides. Between 1995 and 1998, *S pneumoniae's* resistance to macrolides increased from 11% to 15% in the United States.[16] Macrolide-resistant group A streptococci also appear more frequently,[36] a problem that has been linked with the volume of macrolides used in outpatient settings.[37] Quinolones are now being prescribed to manage cough in the community. Fluoroquinolone use increased throughout the 1990s in Canada while *S pneumoniae* susceptibility declined.[17] The patterns of antibiotic use observed in this study suggest that multidrug-resistant *S pneumoniae* and macrolide-resistant group A streptococcus might continue to be a problem.

Limitations

Physicians in this study were volunteers and did not necessarily assess consecutive cases of LRTIs. This could have biased results toward more optimal prescribing. The observed prescribing rate of 78%, however, is similar to rates reported in other studies.[5-7,9] Antibiotic use might have declined since this study was completed, but a recent American study found no decrease in visit-based prescribing for bronchitis among children and adolescents.[38]

EDITOR'S KEY POINTS

- Despite concerns about growing resistance, use of antibiotics for lower respiratory tract infections remains high. This study reports antibiotic prescribing in a national sample of family physicians.
- More than half (58%) the patients with acute symptoms of cough (excluding exacerbations of chronic obstructive lung disease) were prescribed antibiotics; 2.5% received delayed prescriptions to be filled if symptoms worsened.
- Physicians expressed uncertainty about diagnosis 70% of the time. Antibiotics were prescribed more often when physicians felt pressured by patients or when they were worried patients might deteriorate.
- Unnecessary antibiotic use could be reduced by clarifying whether lower respiratory tract infections are viral or bacterial in origin, by using the diagnostic label "chest cold" when viral etiology is suspected, by educating patients through information sheets, and by using delayed prescriptions.

POINTS DE REPÈRE DU RÉDACTEUR

- Malgré le spectre d'une augmentation de résistance, le taux d'utilisation d'antibiotiques dans les infections des voies respiratoires inférieures (IVRI) demeure élevé. Cette étude décrit le mode de prescription d'antibiotiques chez un échantillon de médecins de famille canadiens.
- Plus de la moitié des patients (58%) présentant de la toux (excluant les exacerbations d'une maladie pulmonaire obstructive chronique) ont reçu des antibiotiques; dans 2,5% des cas, il s'agissait de prescriptions «retard» à utiliser en cas d'aggravation.
- Les médecins se disaient incertains du diagnostic dans 70% des cas. Ils avaient tendance à prescrire plus volontiers des antibiotiques s'ils s'y sentaient pressés par les patients ou craignaient une aggravation de la maladie.
- On pourrait réduire l'utilisation futile d'antibiotiques en précisant la nature virale ou bactérienne des IVRI, en utilisant le terme «rhume de poitrine» quand on pense à une origine virale, en remettant des feuillets informatifs aux patients et en utilisant des prescriptions retard.

Conclusion

Acute bronchitis remains a common diagnosis in adults presenting with symptoms of LRTIs and accounts for 70% of antibiotic prescriptions for managing cough. Specific strategies to help family physicians reduce antibiotic prescribing are needed and could include using the term "chest cold" instead of "acute bronchitis," writing delayed prescriptions, and disseminating patient information leaflets. Addressing clinical uncertainty is also important if physicians are to have confidence in advising their patients that antibiotics are not needed.

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Contributors

Dr McIsaac *and* **Dr To** *designed the study, analyzed and interpreted the data, and prepared the paper for publication.*

Competing interests

None declared

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