

Original Article

# Antibiotic Prescribing By Family Physicians For Upper Respiratory Tract Infections

## Impacts of feedback, non-antibiotic drug recommendations, and patient factors

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### Abstract

Feedback, non-antibiotic drug recommendations, and patient factors were examined to develop ways to reduce use of inappropriate antibiotics for Upper Respiratory Tract infections (URTIs). 3,220 encounters for URTIs over six months were reported by 45 family physicians who recorded consecutive patients and noted drugs recommended, diagnosis, and patient characteristics. After two months baseline data collection, physicians received feedback about their own and peers antibiotic prescribing, and the effect of this on their prescriptions was studied.

Patients recommended 'over the counter drugs' were less likely to be given antibiotics for acute bronchitis (OR, 0.22; 95% CI, 0.13-0.38;  $P < 0.0001$ ), pharyngitis (OR, 0.46; 95% CI, 0.29-0.75;  $P = 0.0001$ ), acute sinusitis (OR, 0.08; 95% CI, 0.03-0.22;  $P < 0.0001$ ), and acute otitis media (AOM) (OR, 0.27; 95% CI, 0.11-0.65;  $P = 0.004$ ). Prescriptions for drugs other than antibiotics were also negatively associated with antibiotics for acute bronchitis (OR, 0.49; 95% CI, 0.31-0.78;  $P = 0.003$ ) and acute sinusitis (OR, 0.29; 95% CI, 0.12-0.72;  $P = 0.007$ ). Adults (OR, 1.8; 95% CI, 1.1-3.0;  $P = 0.03$ ), males (OR, 1.6; 95% CI, 1.0-2.5;  $P = 0.05$ ), and patients with co-morbidity (OR, 2.4; 95% CI, 1.4-4.0;  $P = 0.001$ ) were more likely to be prescribed antibiotics for acute bronchitis.

After feedback antibiotic prescribing decreased from 42% to 34% of encounters ( $\chi^2 = 16$ ,  $p < 0.0001$ ) and use of the first choice antibiotics recommended in the Ontario guidelines increased from 45% to 56% ( $\chi^2 = 10$ ,  $p = 0.002$ ).

The results suggest feedback would be an effective means to improve antibiotic prescribing, and recommendations of non-antibiotic therapies would lead to decreased antibiotic use.

### Introduction

Antibiotics are often prescribed un-necessarily for upper respiratory tract infections (URTIs) both in Canada<sup>1-4</sup> and around the globe.<sup>5-13</sup> When antibiotic treatment is required first-line drugs are frequently ignored,<sup>2,6,7</sup> but feedback may improve prescribing habits.<sup>2,7</sup> We conducted a pilot study to explore whether individual and peer-based feedback would improve our family physician's antibiotic prescribing for URTIs, and also the influence of recommendations for other drugs and patient factors on prescriptions.

### Method

#### Subjects

One hundred southeastern Ontario family physicians were asked to volunteer for the study, 71 agreed and 45 reported 3,220 patient encounters for URTIs during the winter of 2001. Physicians were eligible if not involved in another study on treatment of URTIs, working in the community at least three days and seeing  $\geq 50$  patients per week. They recorded 25 consecutive patient encounters a month from December to March. Patients were included if presenting with: common colds, acute laryngitis, croup, acute bronchitis, influenza, acute sinusitis, acute otitis media (AOM), and pharyngitis.



### Methods

Physicians listed prescriptions for antibiotics and other drugs, and over-the-counter (OTC) recommendations on prescription size pads with 25 identical pages, together with the date, patient age, and sex. They recorded repeat visits within two weeks for the same illness, co-morbidity, and type of URTI on a checklist. Co-morbidity was defined as clinically evident immune suppression, active lung disease, and/or congestive heart failure. Pads were returned monthly.

### Feedback Intervention

After two months physicians were provided with a report of their own and of peers antibiotic prescribing. Their prescriptions were compared with the Ontario anti-infective guidelines<sup>14</sup> which had been disseminated free of charge in 1994 and 1997. The report included a discussion of the individual physician's and their peers prescribing for identified problem areas (Figure 1). Graphs of antibiotic prescribing and first-line antibiotic choice rates for adults and children by diagnoses were accompanied by summaries of relevant sections of the guidelines.

### Statistical Analysis

Over-the-counter drug recommendations, non-antibiotic drug prescriptions, patient sex, age, comorbidity, and repeat visits were tested for association with indication for antibiotic treatment and antibiotic choices by univariate logistic regression. Chi-square analyses were used to test the effect of feedback on antibiotic prescribing, non-antibiotic prescriptions, over-the-counter recommendations, patient age and sex, presence of co-morbidity, repeat visits, and diagnoses.

### Results

The mean age of patients was 28y (SD 24; 0.1 – 96 y), 56% were  $\geq 16$  y, and 59% were female. 13% of patients had related co-morbidity and for 10% it was a repeat visit for the same illness. The most frequent diagnoses were common cold (36%), acute bronchitis (20%), pharyngitis (19%), AOM (14%), acute sinusitis (13%), influenza (3%), laryngitis (2%) and croup (1%).

### Antibiotic Prescribing Practices

Antibiotic prescriptions were analyzed after receipt of two months baseline data. Antibiotic prescriptions by diagnosis for adults are presented in Table 1 and for children in Table 2. Only 2% of adults and children received antibiotics for common cold, influenza, croup, and laryngitis.

63% of adults and 48% of children with acute bronchitis were prescribed antibiotics although the Ontario guidelines do not recommend this. Adults with acute bronchitis and co-morbidity prescribed antibiotics received guideline recommendations (tetracycline or erythromycin) 21% of the time; but almost 50% received extended spectrum macrolides, as did 30% of children. 40% of those with pharyngitis were prescribed antibiotics. Guideline recommendations were followed for 39% of adults (penicillin V), and 81% of children (amoxicillin, penicillin, or pivampicillin).

- >85% of patients with acute sinusitis were prescribed antibiotics. Guideline recommendations were followed for 36% of adults and 53% of children.
- 90% of patients with AOM were prescribed antibiotics. Guideline recommendations were followed for 39% of adults (penicillin V) and 66% of children (amoxicillin or co-trimoxazole).

Table 1: Physician reported prescribing of antibiotics for common upper respiratory tract infections in adults prior to feedback intervention

Antibiotic Prescribed	Acute Bronchitis n=248 (%)	Pharyngitis n=176 (%)	Acute Sinusitis n=194 (%)	Acute Otitis Media n=31 (%)
Patient Prescribed Antibiotics	63	38	89	87
Amoxicillin*	13	37	31 <sup>1</sup>	56 <sup>1</sup>
Co-amoxiclav	1	2	8	4
Penicillin V	0	39 <sup>1</sup>	1	4
Cephalexin	2	2	5	4
2nd Generation Cephalosporins**	7	2	7	11
Fluoroquinolones	5	2	5	0
Erythromycin	15 <sup>1</sup>	9	2	11
Extended Spectrum Macrolides†	48	8	33	7
Tetracycline	6 <sup>1</sup>	0	1	0
Co-trimoxazole	3	2	5 <sup>1</sup>	4
Other Antibiotics	1	0	2	0

Note: \* % of antibiotic prescriptions received for indication; \*\* Cefaclor, Cefuroxime, Cefprozil;

† Clarithromycin and Azithromycin; <sup>1</sup> first line recommendation



**Other Drug Prescriptions and Recommendations**

Non-antibiotic prescriptions were made for 14% of patients; the most common were inhaled corticosteroids, inhaled bronchodilators, and cough suppressants (codeine, hydrocodone). OTC recommendations were made for 39% of patients; the most common were analgesics/antipyretics, cough remedies and oral decongestants.

**Factors Affecting Antibiotic Decisions: Indication for Antibiotic Treatment**

Baseline data were used to test the association of over-the-counter recommendations, non-antibiotic prescriptions, and patient sex, age, co-morbidity, and repeat visit with whether antibiotics were prescribed for acute bronchitis, pharyngitis, acute sinusitis, and AOM.

When patients received over-the-counter drug recommendations (OR, 0.22; 95% CI, 0.13-0.38; P<0.0001) or non-antibiotic prescriptions (OR, 0.49; 95% CI, 0.31-0.78; P=0.003) they were less likely to be prescribed antibiotics for acute bronchitis. Adults (OR, 1.8; 95% CI, 1.1-3.0; P=0.03), males (OR, 1.6; 95% CI, 1.0-2.5; P=0.05), and those with co-morbidity (OR, 2.4; 95% CI, 1.4-4.0; P=0.001) were more likely to be prescribed antibiotics for acute bronchitis.

When patients received over-the-counter drug recommendations they were less likely to be prescribed antibiotics for pharyngitis (OR, 0.46; 95% CI, 0.29-0.75; P=0.0001) and AOM (OR, 0.27; 95% CI, 0.11-0.65; P=0.004).

The following paragraph is an example of feedback related to rates of antibiotic prescribing for the URTIs of interest.

The overall rate of prescribing for pharyngitis for both children and adults was slightly over 40%. Streptococcal pharyngitis requires antibiotics but streptococcal pharyngitis is much less common than viral pharyngitis. Research indicates 80 to 90% of sore throat sufferers that consult have a viral infection. Your rate of antibiotic prescribing for pharyngitis was (physician's rate inserted here) %.

The following paragraph is an example of feedback related to the rate of use of first line antibiotics for URTIs.

An overall high rate of prescribing of clarithromycin (Biaxin) and azithromycin (Zithromax) was observed. These extended spectrum macrolides accounted for 23% of antibiotic prescriptions yet they are not first-line agents for any of the designated URTIs according to the Anti-Infective Guidelines for Community-acquired Infections 1997 Edition. Furthermore, they are considerably more expensive than most first-line agents. Treatment of acute sinusitis with clarithromycin (Biaxin) and azithromycin (Zithromax) costs 5 to 18 times more than amoxicillin or TMP/SMX, the recommended first line choices. Your prescribing of the extended spectrum macrolides: clarithromycin and azithromycin was (physician's rate inserted here) % of your total antibiotic prescribing.

Figure 1: Examples of written feedback provided to physicians

Table 2: Physician reported prescribing of antibiotics for common upper respiratory tract infections in children prior to feedback intervention

Antibiotic Prescribed	Acute Bronchitis n=71 (%)	Pharyngitis n=147 (%)	Acute Sinusitis n=23 (%)	Acute Otitis Media n=180 (%)
Patient Prescribed Antibiotics	48	40	83	89
Amoxicillin*	32	55	53 <sup>1</sup>	59 <sup>1</sup>
Co-amoxiclav	0	0	0	1
Penicillin V	0	19 <sup>1</sup>	0	0
Pivampicillin	3	7 <sup>1</sup>	0	1
Cephalexin	0	0	5	0
2nd and 3rd Generation Cephalosporins**	15	2	26	21
Fluoroquinolones	3	0	0	0
Erythromycin	9	14	0	3
Extended Spectrum Macrolides†	32	3	11	8
Co-trimoxazole	6	0	5	7 <sup>1</sup>

Note: \* % of antibiotic prescriptions received for indication; \*\* Cefaclor, Cefuroxime, Cefprozil, Cefixime; † Clarithromycin and Azithromycin; <sup>1</sup> first line recommendation



When patients received over-the-counter drug recommendations (OR, 0.08; 95% CI, 0.03-0.22;  $P < 0.0001$ ) or non-antibiotic prescriptions (OR, 0.29; 95% CI, 0.12-0.72;  $P = 0.007$ ) they were less likely to be prescribed antibiotics for acute sinusitis.

**Factors Affecting Antibiotic Decisions: Choice of Antibiotic**  
Baseline data were used to test the association of over-the-counter recommendations, non-antibiotic prescriptions, and patient sex, age, co-morbidity, and repeat visit with the prescribing of first line antibiotics for pharyngitis, acute sinusitis, and AOM.

First line antibiotic choices for were less likely to be received by:

- Adults with pharyngitis (OR, 0.15; 95% CI, 0.0.7-0.34;  $P < 0.0001$ ).
- Patients with acute sinusitis when they made a repeat visit for the same illness (OR, 0.19; 95% CI, 0.05-0.65;  $P = 0.008$ ).
- Male patients with AOM (OR, 0.47; 95% CI, 0.26-0.87;  $P = 0.02$ )
- Patients making repeat visits (OR, 0.21; 95% CI, 0.10-0.46;  $P < 0.0001$ ).

### Effects of Feedback

31 physicians recorded  $> 20$  consecutive patient encounters both pre and post feedback. An equal number of encounters pre and post feedback were studied for each physician, totalling 2,384 - a mean of 77 out of a possible 100 per physician.

Chi-square analyses indicated no significant differences between pre and post feedback periods for non-antibiotic prescriptions, over-the-counter recommendations, patient age and sex, presence of comorbidity, repeat visit, and diagnostic categories.

However the overall rate of antibiotic prescribing decreased from 42% to 34% of patient encounters ( $\chi = 16$ ,  $p < 0.0001$ ). Antibiotic prescribing rates were reduced for pharyngitis from 39% to 20% ( $\chi = 19$ ,  $p < 0.0001$ ), for acute bronchitis from 56% to 42% ( $\chi = 9$ ,  $p = 0.002$ ) and for AOM ( $\chi = 4$ ,  $p = 0.05$ ) from 89% to 81%.

Use of first-line antibiotic choices increased after feedback from 45% to 56% of prescriptions ( $\chi = 10$ ,  $p = 0.002$ ). Use of first-line antibiotics for acute sinusitis increased from 41% to 60% ( $\chi = 8$ ,  $p = 0.006$ ), and for pharyngitis from 54 to 73% ( $\chi = 4$ ,  $p = 0.04$ ). Use of extended spectrum macrolides decreased from 20% of all antibiotic prescriptions to 14% ( $\chi = 6$ ,  $p = 0.01$ ).

### Discussion

Antibiotics were prescribed more often than the guidelines suggested. Half the healthy patients with acute bronchitis received antibiotics, although this was not recommended.<sup>14</sup> Nonetheless antibiotic use was less than in Italy<sup>13</sup> and at levels similar to the United States of America<sup>8</sup> and Norway.<sup>12</sup> Prescription numbers for preschool children with acute bronchitis equalled those in Saskactewan<sup>4</sup> and were fewer than in studies in both Ontario<sup>3</sup> and internationally.<sup>10,11</sup> Antibiotics for pharyngitis were given at double the expected Group A Streptococcal rate,<sup>15</sup> although there were fewer prescriptions than in other Canadian,<sup>1,3,4</sup> American,<sup>8,10,16</sup> and European studies.<sup>11-13</sup>

When patients received OTC drug recommendations or non-antibiotic prescriptions they were less likely to be prescribed antibiotics for acute bronchitis, pharyngitis, acute sinusitis, and AOM. Recommending other drugs may have satisfied the physicians' need to give treatment, and the patients' need to receive it. The efficacy of non-antibiotic prescription drugs and OTCs as well as nondrug treatments for URTIs needs to be evaluated. Recommendations of effective non-antibiotic alternatives would lead to decreased use of antibiotics.

First-line choices were greatly underutilized. Only a third of adults with acute sinusitis received recommended antibiotics, less than in an American study.<sup>17</sup> However 40% of adults received penicillin V for pharyngitis compared with 12% of U.S. patients.<sup>16</sup> Our physicians were also more likely to prescribe first-line antibiotics for AOM than Americans<sup>18</sup> but less likely to prescribe first-line antibiotics for AOM in preschool children than in Saskatchewan where there was a restricted formulary<sup>4</sup> or in the Netherlands.<sup>19</sup> First-line antibiotics were less likely to be received by patients making repeat visits with acute sinusitis and AOM. Patients tend to receive more expensive antibiotics second time around.<sup>20</sup>

Our results suggest feedback and comprehensive, evidence-based guidelines improve antibiotic prescribing for URTIs; the overall rate of antibiotic prescribing decreased and use of first-line choices increased. The physician-linked prescription data used by the pharmaceutical industry to target market individual physicians<sup>21</sup> could be better used to provide feedback. This would be economically viable: cost savings would accrue from fewer unnecessary antibiotic prescriptions, greater use of less expensive first-line antibiotics, and decreased rates of adverse effects, drug interactions, and bacterial resistance.<sup>22</sup>

*Conflict of Interest Statement: The authors report no conflicts of interest.*



## Reference List

1. Hutchinson JM, Jelinski S, Hefferton D, Desaulniers G, Parfrey PS. Role of diagnostic labeling in antibiotic prescription. *Can Fam Physician* 2001; **47**: 1217-1224.
2. Hux JE, Melady MP, DeBoer D. Confidential prescriber feedback and education to improve antibiotic use in primary care: a controlled trial *CMAJ* 1999; **161**: 388-392.
3. Pennie RA. Prospective study of antibiotic prescribing for children. *Can Fam Physician* 1998; **44**: 1850-1856.
4. Wang EE, Einarson TR, Kellner JD, Conly JM. Antibiotic prescribing for Canadian preschool children: evidence of overprescribing for viral respiratory infections. *Clin Infect Dis* 1999; **29**: 155-160.
5. du Prey B, Ford BD, Bassili AR, Zoutman DE. Antimicrobial recommendations by healthcare providers in Kenya. *Am J Health Syst Pharm* 2004; **61**: 302-304.
6. Perez-Cuevas R, Guiscafre H, Munoz O, *et al.* Improving physician prescribing patterns to treat rhinopharyngitis. Intervention strategies in two health systems of Mexico. *Soc Sci Med* 1996; **42**: 1185-1194.
7. Zwar N, Wolk J, Gordon J, Sanson-Fisher R, Kehoe L. Influencing antibiotic prescribing in general practice: a trial of prescriber feedback and management guidelines. *Fam Pract* 1999; **16**: 495-500.
8. Gonzales R, Steiner JF, Sande MA. Antibiotic prescribing for adults with colds, upper respiratory tract infections, and bronchitis by ambulatory care physicians *JAMA* 1997; **278**: 901-904.
9. Mohan S, Dharamraj K, Dindial R, *et al.* Physician behavior for antimicrobial prescribing for paediatric upper respiratory infections: a survey in general practice in Trinidad, West Indies. *Annals of Clinical Microbiology and Antimicrobials* 2004; **3**.
10. Nyquist AC, Gonzales R, Steiner JF, Sande MA. Antibiotic prescribing for children with colds, upper respiratory tract infections, and bronchitis *JAMA* 1998; **279**: 875-877.
11. Straand J, Rokstad K, Heggedal U. Drug prescribing for children in general practice. A report from the More & Romsdal Prescription Study. *Acta Paediatr* 1998; **87**: 218-224.
12. Straand J, Rokstad KS, Sandvik H. Prescribing systemic antibiotics in general practice. A report from the More & Romsdal Prescription Study. *Scand J Prim Health Care* 1998; **16**: 121-127.
13. Vaccheri A, Castelvetti C, Esaka E, Del Favero A, Montanaro N. Pattern of antibiotic use in primary health care in Italy. *Eur J Clin Pharmacol* 2000; **56**: 417-425.
14. Ontario Anti-infective Review Panel. Anti-Infective Guidelines for Community-Acquired Infections. Toronto: Queen's Printer for Ontario; 1997.
15. Cooper RJ, Hoffman JR, Bartlett JG, *et al.* Principles of appropriate antibiotic use for acute pharyngitis in adults: background. *Ann Intern Med* 2001; **134**: 509-517.
16. Linder JA, Stafford RS. Antibiotic treatment of adults with sore throat by community primary care physicians: a national survey, 1989-1999 *JAMA* 2001; **286**: 1181-1186.
17. Piccirillo JF, Mager DE, Frisse ME, Brophy RH, Goggin A. Impact of first-line vs second-line antibiotics for the treatment of acute uncomplicated sinusitis *JAMA* 2001; **286**: 1849-1856.
18. McEwen LN, Farjo R, Foxman B. Antibiotic prescribing for otitis media: how well does it match published guidelines? *Pharmacoepidemiol* 2003; **12**: 213-219.
19. de Melker RA, Kuyvenhoven MM. Management of upper respiratory tract infections in Dutch family practice. *J Fam Pract* 1994; **38**: 353-357.
20. Hueston WJ, Mainous AG 3rd, Ornstein S, Pan Q, Jenkins R. Antibiotics for upper respiratory tract infections. Follow-up utilization and antibiotic use. *Arch Fam Med* 1999; **8**: 426-430.
21. Zoutman DE, Ford BD, Bassili AR. The confidentiality of patient and physician information in pharmacy prescription records. *CMAJ* 2004; **170**: 815-816.
22. Johnson JA, Bootman JL. Drug-related morbidity and mortality. A cost-of-illness model. *Arch Intern Med* 1995; **155**: 1949-1956.