

Role of diagnostic labeling in antibiotic prescription

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abstract

OBJECTIVE To evaluate the association between diagnostic labeling of respiratory tract infections (RTIs) and antibiotic prescription rates in family practice.

DESIGN Descriptive analysis of outpatient chart review supplemented by interviews with physicians. Charts of patients attending 73 general practitioners were reviewed between October 1997 and February 1998. Two days of practice were evaluated per physician.

SETTING Urban family practices in greater St John's, Nfld.

PARTICIPANTS Of 96 family physicians contacted, 73 (76%) agreed to participate.

MAIN OUTCOME MEASURES Rates of diagnoses and antibiotic prescriptions for acute infections. Physicians were divided into "low prescribers" and "high prescribers" based on overall rates of prescription to patients with infections. Low prescribers were compared with high prescribers with respect to physician characteristics, patient characteristics, and diagnoses assigned.

RESULTS Of all patients seen, 22% were seen for acute infections; RTIs accounted for 76% of diagnoses. Low prescribers and high prescribers were of similar ages and saw similar numbers of patients of similar ages with very similar presenting complaints. Both groups diagnosed urinary tract and skin and soft-tissue infections at similar rates, but differed markedly in their rates of diagnoses of RTIs. High prescribers diagnosed bacterial RTIs in 65.4% (147/225) of their patients; low prescribers diagnosed bacterial RTIs in 31.0% (66/213) ($P < .001$).

CONCLUSION Family doctors frequently prescribe antibiotics. The difference in rates of prescription between high prescribers and low prescribers is largely explained by assignment of diagnoses of RTIs.

résumé

OBJECTIF Évaluer le lien entre l'établissement d'un diagnostic d'infections des voies respiratoires (IVR) et le taux de prescription d'antibiotiques dans la pratique familiale.

CONCEPTION Une analyse descriptive des dossiers de patients externes à laquelle s'ajoutaient des entrevues avec les médecins. Les dossiers de patients ayant consulté 73 omnipraticiens entre octobre 1997 et février 1998 ont fait l'objet d'un examen. Deux jours de pratique étaient évalués par médecin.

CONTEXTE Des pratiques familiales en milieu urbain, à St. John's et sa banlieue, à Terre-Neuve.

PARTICIPANTS Parmi les 96 médecins de famille sollicités, 73 (76%) ont accepté de participer.

PRINCIPALES MESURES DES RÉSULTATS Les taux de diagnostic et de prescription d'antibiotiques pour les infections aiguës. Les médecins ont été classés en deux groupes, les « grands prescripteurs » et « les faibles prescripteurs » selon le taux global de prescriptions faites aux patients souffrant d'une infection. Les deux groupes ont fait l'objet d'une comparaison en fonction des caractéristiques des médecins, des caractéristiques des patients et des diagnostics prononcés.

RÉSULTATS Dans l'ensemble des patients venus en consultation, 22% souffraient d'une infection aiguë; les IVR représentaient 76% des infections diagnostiquées. Les grands prescripteurs et les faibles prescripteurs étaient semblables au chapitre de l'âge et du nombre de patients vus, et de l'âge de ces derniers, et très similaires quant aux problèmes présentés par les patients. Les deux groupes ont diagnostiqué dans une même proportion les infections des voies urinaires, de la peau et des tissus mous, mais se distinguaient considérablement dans leur taux de diagnostic des IVR. Les grands prescripteurs ont diagnostiqué une IVR bactérienne chez 65,4% (147/225) de leurs patients; les faibles prescripteurs ont diagnostiqué une IVR bactérienne chez 31,0% (66/213) ($p < 0,001$).

CONCLUSION Les médecins de famille prescrivent souvent des antibiotiques. La différence dans la proportion de prescription chez les grands prescripteurs et les faibles prescripteurs se situe largement dans l'établissement d'un diagnostic d'IVR.

This article has been peer reviewed.

Cet article a fait l'objet d'une évaluation externe.

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Antibiotic resistance is an urgent and growing worldwide public health problem. Many studies have demonstrated a causal relationship between antibiotic use and development of antibiotic resistance, and it is clear that any use of antibiotics will result in some level of antibiotic resistance in a population.^{1,5} If all use of antibiotics is properly indicated after careful and judicious clinical consideration, the resistance that results must be accepted as an inevitable consequence that is, we hope, far outweighed by the treatment benefits for those with serious bacterial infections.

Much antibiotic use in Canada, however, is neither judicious nor careful. Antibiotics are very liberally prescribed; 25.4 million prescriptions for oral antibiotics for outpatients alone were filled between September 1997 and August 1998, according to IMS Health, a provider of sales management and market research information to pharmaceutical companies (personal communication 1999 April). This is more than double the number of prescriptions per capita in Holland or Denmark, countries envied for their prudent antibiotic use and relatively low resistance rates.^{6,7}

There is little published quantitative information about Canadian physicians' antibiotic prescribing habits. Pennie⁸ described primary care physicians' care of 4344 children in eastern Ontario in 1997 and found antibiotics had been prescribed very liberally. Only 30% of the 2467 patients with acute respiratory tract infections (RTIs) were diagnosed with viral colds; 62% were diagnosed with otitis media, pharyngitis, or bronchitis, and most of them received prescriptions for antibiotics. These three diagnoses, in fact, accounted for 82% of all antibiotic prescriptions.⁸ A linked database study described liberal and inappropriate prescription decisions in Saskatchewan,⁹ and many studies describe similar decisions in other jurisdictions.¹⁰⁻¹⁶ Factors such as patient demand, diagnostic uncertainty, inadequate initial and continuing medical education, medicolegal concerns, pharmaceutical industry efforts, and physician remuneration issues¹⁷ have all been implicated in inappropriate antibiotic prescription.

A general problem that hinders the study of appropriateness of antibiotic prescription is diagnostic labeling. Very few community-acquired infections,

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most notably RTIs, have diagnoses confirmed microbiologically or radiologically. Symptoms and signs of viral colds overlap with bacterial pharyngitis, sinusitis, bronchitis, and otitis media. It is impossible for investigators using chart or administrative database review or prospective form collection to determine diagnostic accuracy. If appropriateness of therapy is based on the assumption that diagnosis is correct, even physicians who diagnose all their patients with respiratory complaints with bacterial RTIs can be deemed good prescribers. It is frightening that several studies have shown that, even when the assigned diagnosis is viral cold, antibiotics are often prescribed.^{9,10,15,16,18}

Only one study has systematically evaluated diagnostic labeling in family practice. Five physicians in one group health centre in Teleborg district, Sweden, had information collated on all of their patients with RTIs during January and February, 1990 to 1993.¹⁹ It was assumed that similar patients attended each physician because they were randomly assigned by nature of the clinic. Antibiotic prescription varied from 21% to 76%; the proportion of diagnoses varied nearly identically. Low prescribers diagnosed more patients with colds, and high prescribers diagnosed more patients with bacterial RTIs. The authors concluded that the diagnosis was assigned to justify the prescription decision.

Our study was designed to expand, in a quantitative fashion, understanding of management of community-acquired infections and use of antibiotics in family practice in Canada. A second objective was to evaluate diagnostic labeling by comparing physicians stratified by their prescribing rates.

METHODS

All family practitioners in the greater St John's area (St John's, Mount Pearl, Torbay, and the northern portion of Conception Bay South), identified through the Newfoundland Medical Association, were invited to participate in the project. All were contacted initially by mail and subsequently by telephone by one of the authors (J.M.H.) in August and September, 1997. Ethics approval was obtained from Memorial University's Human Investigations Committee.

Participants were informed that a research assistant would visit their offices without prior notice. The visits occurred between October 1, 1997, and January 30, 1998. During the office visit, all charts from the preceding 2 days of regular practice were reviewed and counted, and patients

with infection-related illnesses were identified. Data obtained included patient demographics (age, sex, address), presenting complaints, clinical diagnoses, and types of antibiotics prescribed.

To complete data collection, physicians were interviewed (usually within 2 days of chart review). The charts of their patients with infections were available for perusal during the interviews. Physicians were asked to rate the influence of four factors on each decision to prescribe antibiotics using a 5-point Likert scale (1—not at all to 5—very much). The following questions were asked.

- How certain were you that antibiotics were medically indicated?
- Did patient or parent demand influence your decision to prescribe?
- Did time constraints influence your decision to prescribe?
- Did your sense that your patient would attend another physician if you did not prescribe antibiotics influence your decision to prescribe?

Follow-up information was obtained on all patients with infections from the Medical Care Plan (MCP), Newfoundland's Medicare agency. Identification numbers were used; no patients' names were collected from physicians' offices nor reported from the MCP. The follow-up information consisted of numbers of office visits to physicians in the 30 days following the captured doctor-patient encounter.

For the purposes of further analysis, patients were identified as having acute infections that might or might not have required systemic antibacterial antibiotic therapy. This excluded patients seen for follow up of previously prescribed-for infections and those prescribed topical antibacterial, antifungal, or antiviral agents.

Physicians were compared as to their rate of prescribing. They were divided into "low prescribers" and "high prescribers" on the basis of their rates of prescriptions to patients with acute infections. Physicians with rates in the lowest quartile were designated low prescribers; those in the highest quartile were designated high prescribers.

Categorical variables were compared using Pearson's χ^2 and continuous variables with one-way analysis of variance (ANOVA). All analyses were conducted in SPSS for Windows, version 8. Estimates of proportions of patients seen by family physicians for infections and estimated prescription rates indicated that 2 days of practice of 75% to 80% of the physicians would be sufficient to show that a 10% change in overall prescription rates was statistically significant.

RESULTS

Physicians and patients

Seventy-three of the 96 family physicians contacted (76%) agreed to participate and provided written consent. Of the 4218 patients seen by study physicians, 27% (1158) had infections. Of these, 949 had newly acquired acute infections for which systemic antibacterial antibiotics might or might not have been indicated. Two cases, however, did not have a clear diagnosis. Age and sex of patients with acute infections are shown in **Figure 1**. Until age 20, the sexes were reasonably equally represented in the study sample. After age 20, female patients outnumbered male patients by approximately 2:1.

Presenting complaints

Respiratory complaints predominated, most notably cough, sore throat, and cold symptoms. Symptoms referable to RTIs were the presenting complaint of more than 76% of patients (79% of male patients and 75% of female patients). Urinary symptoms accounted for 8.9% of women's complaints and 3.1% of men's complaints.

Diagnoses

Respiratory tract infections were diagnosed in 727 of 949 cases (77%); most (451/727, 62%) were assigned a diagnosis with a potential bacterial cause (pharyngitis, otitis media, acute bronchitis, pneumonia, and sinusitis) (**Table 1**). Only 7.2% of infections were urinary tract infections.

Antibiotic prescriptions

Prescriptions for oral antibiotics were given to 604 (64%) of the 949 patients with acute infections. This was 14.3% (604/4218) of all patients attending the sample physicians for any reason. Not surprisingly, more than 70% of the prescriptions were written for treatment of RTIs (**Table 1**). Note that 15% of those diagnosed with RTIs (physicians' designation for the common cold) were prescribed antibiotics. Most (88%) of those diagnosed with a potential bacterial respiratory infection received antibiotics. Pharyngitis, otitis media, and lower RTIs were the three most common diagnoses for which antibiotics were prescribed, accounting for 23%, 16%, and 15%, respectively, of all antibiotics prescribed.

Patient outcomes

Outcome data on return visits to physicians within 1 month of the initial visit were obtained for all

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Figure 1. Patients' age and sex

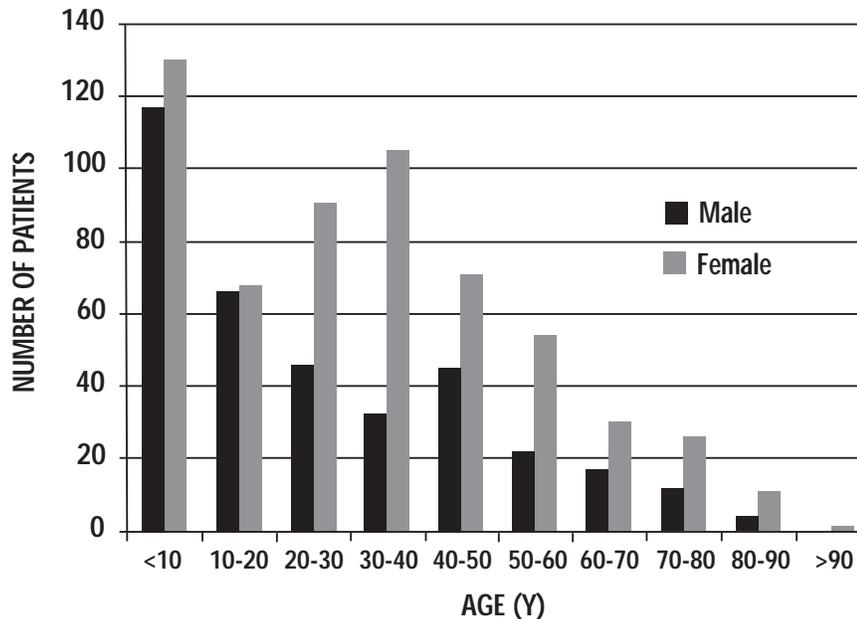


Table 1. Diagnoses and antibiotic prescriptions for 947 clearly diagnosed cases of newly acquired infection: For two of the 949 cases, physicians did not clearly state diagnosis.

DIAGNOSIS	PATIENTS WITH INFECTION NO. (% OF TOTAL)	PATIENTS GIVEN PRESCRIPTIONS NO. (% OF DIAGNOSTIC GROUP)
Upper respiratory tract infection ("cold")	276 (29)	42 (15)
Pharyngitis	163 (17)	137 (84)
Otitis media	101 (11)	98 (97)
Lower respiratory tract infection	107 (11)	91 (85)
Sinusitis	80 (8)	71 (89)
Urinary tract infection	68 (7)	54 (79)
Skin or soft tissue infection	51 (5)	47 (92)
Other	101 (11)	63 (62)

cases of newly acquired infection: 44% did not return, 25% returned once, and the remaining 31% returned more than once. Rates of return visits were similar for those prescribed antibiotics and those not (57% vs 52%, $P = .15$).

Factors influencing prescription

We evaluated 596 prescriptions. Time constraints and the sense that patients would attend other physicians were not identified by prescribers as influencing their

decisions; 90% indicated the lowest level (1—not at all); mean score was 1.14. Physicians indicated that patient demand had at least some influence on 39% of prescriptions (mean score 1.73) and that medical indication was not completely clear for 54% of patients who received prescriptions (mean score 4.18).

Prescribing rates

Seventy of the 73 participating physicians saw at least one patient with acute infection. Their mean

Table 2. Characteristics of high prescribers and low prescribers of antibiotics and their patients

CHARACTERISTICS OF PHYSICIANS AND PATIENTS	HIGH PRESCRIBERS (N=17) MEAN ± SD	LOW PRESCRIBERS (N=17) MEAN ± SD	P VALUE
PHYSICIANS' CHARACTERISTICS			
Age	44.1 ± 8.7	43.6 ± 8.4	.86 (NS)
Number of patients seen	56.3 ± 34.3	62.4 ± 35.1	.62 (NS)
Number of patients with infections	13.2 ± 9.6	13.1 ± 10.1	.98 (NS)
Patients' age	30.5 ± 20.9	29.0 ± 21.3	.44 (NS)

SD—standard deviation, NS—not significant.

Table 3. Characteristics of high prescribers and low prescribers of antibiotics and their patients

CHARACTERISTICS OF PHYSICIANS AND PATIENTS	HIGH PRESCRIBERS (N=17) N (%)	LOW PRESCRIBERS (N=17) N (%)	P VALUE
Number of women physicians	6 (35)	9 (53)	.30 (NS)
Number of patients' presenting complaints			
• Respiratory	168 (80.4)	165 (78.2)	.58 (NS)
• Urinary	14 (6.7)	16 (7.6)	.72 (NS)
• Skin	13 (6.2)	16 (7.6)	.58 (NS)
• Gastrointestinal	2 (1.0)	3 (1.4)	.66 (NS)
• Other	12 (5.3)	11 (5.2)	.81 (NS)
Doctors' diagnoses			
• Cold	34 (15.1)	109 (48.9)	.001
• Pharyngitis	53 (23.6)	21 (9.4)	<.001
• Otitis media	35 (15.6)	14 (6.3)	.002
• Lower respiratory tract infection	34 (15.1)	17 (7.6)	.01
• Sinusitis	25 (11.1)	14 (6.3)	.07 (NS)
• Urinary tract infection	15 (6.7)	18 (8.1)	.57 (NS)
• Skin or soft tissue infection	12 (5.3)	12 (5.4)	.98 (NS)

SD—standard deviation, NS—not significant.

prescription rate was 64%; by quartile, rates were < 48%, 48% to 63%, 64% to 79%, and >79%. The 17 physicians and their patients in the lowest quartile (low prescribers) were compared with the 17 physicians in the highest quartile (high prescribers) (**Tables 2 and 3**). Overall, the two groups were very similar. Mean age of physicians was 44 years for both groups and the sexes were similarly represented. They attended to similar

mean numbers of patients overall and of patients with acute infection. Mean age and proportion of presenting complaints of patients were similar in both groups. The two groups diagnosed urinary tract infections and skin and soft tissue infections at comparable rates.

The one aspect in which the groups differed markedly was in diagnosis of RTIs. High prescribers diagnosed pharyngitis, otitis media, lower RTIs, and

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sinusitis much more frequently (65%) than low prescribers (30%) ($P < .001$). Low prescribers diagnosed colds more than three times as often as high prescribers (49% vs 15%) ($P < .001$).

If we consider only patients diagnosed with upper or lower RTIs, sinusitis, pharyngitis, and otitis media ($n = 359$), low prescribers gave antibiotics to 28% of their patients and high prescribers to 86% (48/171 vs 156/181, $P < .001$). Among low prescribers, only one doctor prescribed antibiotics to a patient in whom cold was diagnosed; among high prescribers, 47% prescribed antibiotics to patients with colds. High and low prescribers' diagnoses of patients with RTIs are shown in **Figure 2**.

Perhaps low prescribers were missing some serious bacterial infections that would need subsequent attention. This did not appear to be the case. Mean number of visits to physicians in the 1-month follow-up period was actually lower (1.1) for patients of low prescribers than for patients of high prescribers (1.3).

DISCUSSION

This study confirms that antibiotics are liberally prescribed by family practitioners in St John's. More than 14% of all patients presenting to family practitioners received antibiotics, usually as a result of a single phenomenon—liberal prescription to patients with

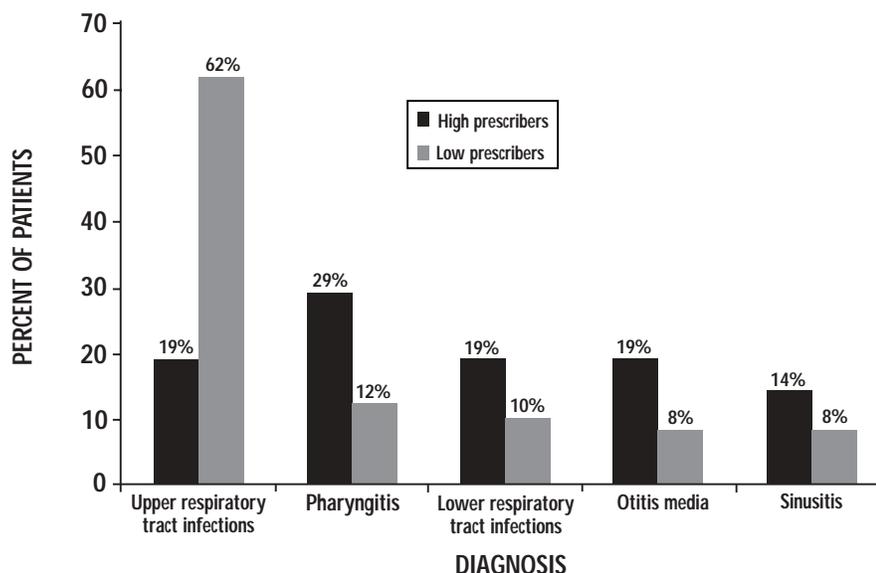
acute RTIs. Two types of evidence suggest that many patients with common colds receive antibiotics: first, several physicians overtly admit to prescribing antibiotics for colds; and second, the difference in prescribing rates between high and low prescribers of antibiotics are almost completely explained by differences in diagnostic labeling of patients with respiratory tract complaints.

The overall state of antibiotic prescribing and the epidemiology of RTIs in Canada shed light on these observations. Canadian physicians prescribed antibiotics at about one prescription per person per year from 1992 to 1996, according to IMS Health (personal communication 1997 April 24). About 75% of prescriptions were for RTIs, implying a rate of diagnosed bacterial respiratory illness of approximately 750 per 1000 patient-years in Canada. This cannot, in any way, be explained by rates of community-acquired pneumonia, sinusitis, group A streptococcal pharyngitis, and otitis media, the four main RTIs.

Conservative approach to therapy

Ample evidence also indicates that even well-diagnosed bacterial RTIs often do not require antibiotic therapy. Since the early 1980s, evidence supporting a conservative approach to antibiotic therapy of otitis media has been accumulating. A recent case series from Newfoundland reported on one rural physician's experience with 100 consecutive

Figure 2. Diagnoses of patients with respiratory tract infections by high prescribers (171 patients) and low prescribers (181 patients): $P < .001$.



patients presenting with earache.²⁰ He adopted a “watchful waiting” approach for all patients not fulfilling specific diagnostic criteria. Only four of the 100 patients received antibiotic therapy; no serious outcomes were reported in any patient. Worrall’s²⁰ approach contrasts with our findings and those of Pennie,⁸ where large numbers of patients were assigned a diagnosis of otitis media and most received antibiotics. Another interesting finding in Worrall’s paper²⁰ was that 87% of patients presented after less than 24 hours of earache, implying that patients perceive otitis media as an urgent condition, perhaps as a result of years of liberal prescription. Conservative approaches to diagnosis and therapy of pharyngitis, bronchitis, and sinusitis are also well supported by available literature.²¹⁻²⁵

What happens to patients who do not get prescriptions for antibiotics they think they need? Physicians often say that, if they do not give patients prescriptions, patients will go to someone else who will. They rationalize that the health care system will be spared the extra expense of a second physician evaluation. We found that patients who did not receive prescriptions did not attend physicians more often than those who did in the month following their initial visits. This is the first time this question has been systematically evaluated. Our findings should help dispel the myth that liberal prescribing of antibiotics saves Medicare dollars.

What can be done to convince prescribers to adopt a conservative, careful approach to prescription of antibiotics? If most physicians would change from being liberal in their diagnosis of bacterial RTIs to being conservative, there would be a huge reduction in overall consumption of antibiotics. This reduction might well slow or even reverse the progression of resistance as has been the case elsewhere.²⁶ Considerable economic benefits and reductions in often-serious side effects of antibiotic use would accrue from this. Although such change seems logical and in everyone’s best interest, it has proven difficult to influence physicians’ prescribing behaviour. Education for physicians and patients and profiling prescribing and feedback approaches have all had little success. Inappropriate prescribing for colds has been identified as the primary problem in many studies.^{19,27,28}

We hope that publication of our findings will heighten awareness among prescribers, the public, and anyone responsible for health care administration of the magnitude of our misuse of antibiotics and the importance of improving our overall approach to antibiotic use. We must be considerably more conservative and careful.

Editor’s key points

- Antibiotics were prescribed for 64% of patients presenting with acute infections; respiratory tract infections (RTIs) accounted for 76% of the diagnoses.
- “High prescribers” diagnosed bacterial RTIs much more frequently than “low prescribers”; low prescribers diagnosed the common cold much more frequently.
- The difference between high and low prescribers is largely explained by assignment of diagnoses of acute RTIs.

Points de repère du rédacteur

- Des antibiotiques étaient prescrits à 64% des patients présentant une infection aiguë; les infections des voies respiratoires (IVR) représentaient 76% des diagnostics.
- Les «grands prescripteurs» diagnostiquaient une IVR bactérienne beaucoup plus fréquemment que les «faibles prescripteurs»; les faibles prescripteurs diagnostiquaient beaucoup plus souvent un simple rhume.
- La différence entre les grands et les faibles prescripteurs est surtout attribuable à l’établissement d’un diagnostic d’IVR aiguë.

It is a complex problem and will need complex solutions. The issue must be emphasized on national and provincial political agendas if we are to monitor consumption and resistance accurately and to develop concerted strategies for change. Because our sample of physicians perceived a pressure of patient demand for antibiotics, we must involve both the public and prescribers in adopting conservative attitudes and actions.

Conclusion

Primary care physicians write more than 80% of the oral antibiotic prescriptions filled.²⁹ Oral antibiotics account for approximately 90% of the antibiotics consumed. More than 70% of prescriptions are for acute RTIs. Diagnostic labeling is a large factor; we must make changes in this area if we are to reduce use of antibiotics. ❀

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Contributors

Dr Hutchison was actively involved in design of the study, data analysis, and most of the writing of the article. **Ms Jelinski** was involved in data analysis and wrote a substantial portion of the paper. **Ms Hefferton** and **Ms Desaulniers** were involved in study design and design of the data collection form, were an integral part of recruitment and data collection, and participated in data analysis. **Mr Parfrey** was involved in concept and design of the study, data analysis, and writing the article, including critical appraisal of drafts.

Competing interests

None declared

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