

Determinants of prescribing of second-choice antibiotics for upper and lower respiratory tract episodes in Dutch general practice

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Objectives: The aim of this study was to assess the association between general practitioners' (GPs') characteristics and the volume of second-choice antibiotics for acute respiratory tract (RT) episodes by GPs.

Methods: Morbidity and antibiotic prescription data originated from the Second Dutch National Survey of General Practice (DNSGP-2). GPs' characteristics, including professional activities and views on RT symptoms and antibiotics, were measured by a written questionnaire. Multiple regression was carried out to assess associations between possible determinants and volume of second-choice antibiotic prescriptions.

Results: In ~39% of acute RT episodes antibiotics were prescribed, with one-quarter being second-choice antibiotics, relatively more frequently in lower than in upper RT episodes: 30 versus 19%. GPs who were more frequently consulted by patients with RT episodes ($\beta = 0.29$; 95% CI 0.13–0.41), who labelled RT episodes more as diagnoses than as symptoms ($\beta = 0.27$; 95% CI 0.15–0.42), who less frequently used national GP guidelines ($\beta = -0.17$; 95% CI -0.31 to -0.03) and who were more inclined to prescribe new drugs ($\beta = 0.26$; 95% CI 0.13–0.40), prescribed more second-choice antibiotics.

Conclusions: Given the growing number of prescriptions of second-choice antibiotics, it is important to implement professional guidelines in daily practice, while training in being reluctant to prescribe new drugs and being alert to the marketing activities of pharmaceutical companies should be started in the medical curriculum.

Keywords: respiratory tract infections, pharmaceutical representatives, national guidelines

Introduction

Over the last 10 years antibiotic prescribing rates for respiratory tract (RT) infections in Western countries have been stable or have decreased. However, there is an international trend to prescribe more co-amoxiclav and newer and more expensive antibiotics, such as new macrolides and quinolones,^{1–4} although these chemotherapeutics are 'second-choice' antibiotics, which should be reserved in case of failure of or intolerance to first-choice agents. This trend is unwanted because the growing use of antibiotics such as macrolides has been accompanied by growing resistance of important pathogens.⁵

More insight into determinants of outpatient prescribing second-choice antibiotics might be helpful in designing interventions aimed at reducing inappropriate use. Therefore, this study aimed to assess the relationship between general practitioners'

(GPs') characteristics and the volume of second-choice antibiotics prescribed for RT infections. This study was possible because of the availability of data from a nationwide study including GPs' characteristics, morbidity and prescription data.⁶

Methods

The data used in this study originate from the Second Dutch National Survey of General Practice (DNSGP-2), carried out by The Netherlands Institute for Health Services Research (NIVEL) in 2001 and including 163 GPs in 85 practices serving a mid-time population of 359 625 patients.⁶ The mean number of GPs per practice was less than two (mean 1.9), with 11 out of 85 practices having more than three GPs. The participating GPs did not differ from the total population of Dutch GPs, except for type of practice: single-handed GPs were somewhat under-represented in the study population. This study

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was believed to give a representative impression of morbidity and prescribing habits in Dutch general practice. During 12 months, data about patients' presented morbidity were extracted from routine electronic medical records using codes according to the International Classification of Primary Care, version 1 (ICPC-1), and GPs' prescriptions were registered using the Anatomical Therapeutic Chemical classification system (ATC) used by WHO (<http://www.who.int/classifications/atcddd>).

We divided RT episodes into episodes labelled by GPs as symptoms, such as earache (H01) and cough (R05), and episodes labelled as infections, such as acute otitis media (H71) and acute bronchitis (R78), for upper and lower RT. As an indication of the inclination to label episodes more as infections than as symptoms, we calculated the proportion of the number of episodes labelled as infections per GP.

Prescriptions were calculated by linking prescription data with episodes on patient level and aggregated on GP level. In 22 practices with two or more GPs, patients could not be linked with a particular GP. In these cases practice prescription rates were used to estimate GP's prescription rates.

All participating GPs completed a questionnaire containing items relating to gender, years of practice, degree of urbanization of practice location (rural, urban), full-time (no/yes), number of enlisted patients (absolute number), single-handed practice (no/yes), frequency of consulting national GP guidelines (once a week or less/more than once a week), seeing pharmaceutical representatives in the last 4 weeks (no/yes), inclination to prescribe new drugs (1 = low to 5 = high), and views on RT infections and antibiotics rated on a five-point scale (1 = strongly disagree to 5 = strongly agree).⁷

The outcome measure was the volume of second-choice antibiotics for RT episodes (the number of prescriptions of co-amoxiclav, macrolides and quinolones for RT episodes per 1000 patients per year per GP). To describe the association between GPs' characteristics and the volume of second-choice antibiotics prescribed for RT episodes, multiple linear regression analysis was carried out using SPSS 12.0.1. Independent associations were assessed using a forward stepwise strategy followed by an enter strategy with checks on interaction and collinearity.

Results

The GPs' mean age was 47 years, one-quarter of them being female (Table 1). About half of the GPs consulted national guidelines more than once a week, with the remaining half consulting them less frequently. Fifty-six percent of the GPs had seen pharmaceutical representatives in the 4 weeks preceding the questionnaire. Inclination to prescribe new drugs showed a mean score of 2.4 (95% CI 2.2–2.6). In general, GPs endorsed the self-limiting character of RT infections (mean 4.3; 95% CI 4.2–4.4), while they significantly less endorsed seriousness of RT infections (mean 2.0; 95% CI 1.9–2.2), need of antibiotics in case of RT infections (mean 1.7; 95% CI 1.6–1.8), effectiveness of antibiotics (mean 1.9; 95% CI 1.7–2.0) and the importance of side-effects of antibiotics (mean 2.3; 95% CI 2.1–2.4). GPs endorsed the need to use them in case of RT infections moderately (mean 3.5; 95% CI 3.4–3.7).

In total, 275.9 RT episodes/1000 patients were registered (Table 2). Nearly 60% of these episodes were for upper RT episodes and ~40% for lower RT episodes (150.3 versus 125.6 episodes/1000 patients), while ~70% of all RT episodes were labelled as infections. Antibiotics were prescribed in ~39% of all RT episodes. One-quarter of these prescriptions were for second-choice antibiotics (8% co-amoxiclav, 13% macrolides and 2% quinolones), relatively more frequently in lower than in

Table 1. GPs' characteristics (*n* = 163 GPs)

Characteristic	
Age, years [mean (95% CI)]	47.1 (46.1–48.1)
Gender (% female)	26.4
Years of practice [mean (95% CI)]	18.2 (16.8–19.5)
Degree of urbanization (%)	
rural	62.0
urban	38.0
Full-time (%)	30.4
Number of enlisted patients [mean (95% CI)]	2197 (2097–2296)
Single-handed practice (%)	24.5
Consulting national guidelines for GPs (%)	
once a week or less	46.0
more than once a week	54.0
Seeing pharmaceutical representatives (% yes)	56.4
Inclination to prescribe new drugs [mean (95% CI)] ^a	2.4 (2.2–2.6)

^aScale ranged as follows: 1 = low inclination to 5 = high inclination.

upper RT episodes (30 versus 19%) (Table 2). The number of prescriptions of second-choice antibiotics for episodes of the upper RT was 12.1/1000 patients, being 19% of all antibiotic prescriptions for these indications, and for episodes of the lower RT was 13.8/1000 patients, i.e. 30% of all antibiotic prescriptions for these indications.

Four factors were independently correlated with the volume of second-choice antibiotics (total explained variance 28%): GPs who were more frequently consulted by patients with RT episodes ($\beta = 0.29$; 95% CI 0.13–0.41), who labelled RT episodes more as infections ($\beta = 0.27$; 95% CI 0.15–0.42), who less frequently consulted national GP guidelines ($\beta = -0.17$; 95% CI -0.31 to -0.03) and who were more inclined to prescribe new drugs ($\beta = 0.26$; 95% CI 0.13–0.40) prescribed more second-choice antibiotics for these episodes. Neither interaction nor collinearity between determinants was found in any of the regression analyses.

Discussion

About 25% of all prescribed antibiotics were second-choice antibiotics; prescribing of second-choice antibiotics was relatively more prominent in lower RT infections than in upper RT infections. Determinants of prescribing second-choice antibiotics appeared to be a higher number of RT episodes/1000 patients, labelling RT episodes more as infections, consulting less frequently national guidelines for GPs and a higher inclination to prescribe new drugs. The data from the DNSGP-2 are thought to give a reliable and up-to-date impression of morbidity and prescription habit in Dutch general practice.⁶ We suppose the prescribing data are highly valid, because they were extracted from electronic databases of the participating practices. GPs' characteristics in the DNSGP-2 sample were comparable to those of the total population of Dutch GPs, except for an under-representation of single-handed GPs.

Some methodological remarks have to be made. First, the proportion of antibiotic prescriptions of 56 GPs was estimated with the aid of the mean number of prescriptions per 1000 patients per practice. This implies a loss of variance in outcome measurement, so associations in the regression analysis were conservatively

Table 2. Number of RT episodes per 1000 patients/GP/year, proportion of episodes labelled as infections, total and second-choice antibiotic prescriptions per 1000 patients/GP/year, and proportion of second-choice antibiotics of all antibiotic prescriptions ($n = 163$ GPs)

	Upper RT [mean (95% CI)]	Lower RT [mean (95% CI)]	Upper and lower RT [mean (95% CI)]
Respiratory tract episodes/1000 patients	150.3 (143.3–157.4)	125.6 (120.1–131.0)	275.9 (265.4–286.4)
Proportion of episodes labelled as infections of all episodes	0.80 (0.78–0.81)	0.63 (0.61–0.65)	0.72 (0.71–0.74)
Total antibiotic prescriptions/1000 patients	61.5 (57.0–66.0)	45.9 (42.4–49.4)	107.3 (100.3–114.4)
Second-choice antibiotic prescriptions/1000 patients	12.1 (10.5–13.7)	13.8 (12.3–15.3)	26.0 (23.1–28.8)
Proportion of second-choice antibiotics of all antibiotic prescriptions	0.19 (0.17–0.21)	0.30 (0.28–0.33)	0.24 (0.22–0.26)

estimated. We did not find a difference in mean antibiotic prescribing volumes between GPs with and without estimated means, so we suppose these estimations not to yield bias. Controlling results for clustering at practice level was not indicated, because the mean number of GPs per practice was less than two, with only 11 out of 85 practices having more than three GPs. Lastly, we have to consider that our study had a cross-sectional design, so we can only assume correlations and not causal relationships.

Earlier studies have shown that the more GPs are consulted for RT episodes and the more they label these episodes as infections, the more they prescribe antibiotics.^{8,9} In our study this seemed also to be the case for prescribing second-choice antibiotics, which was strongly correlated with the total number of antibiotic prescriptions/1000 patients (Pearson's $r = 0.60$; $P < 0.01$). GPs who less frequently consulted national GP guidelines prescribed more second-choice antibiotics, which supports the Dutch quality assurance policy relating to rational prescribing.

The finding that GPs who were more inclined to prescribe new drugs appeared to prescribe more second-choice antibiotics is interesting, because several studies have shown an association between the inclination to prescribe new drugs and seeing pharmaceutical representatives⁹ (in this study Pearson's $r = 0.47$; $P < 0.01$). It is probable that there is a mutual reinforcement between these factors: the inclination to prescribe new drugs influences seeing pharmaceutical representatives, and seeing them may enforce this inclination. This finding has also been corroborated by the qualitative study of Prosser and Walley.¹⁰ Moreover, it is noteworthy that after dividing RT episodes into episodes of the upper and lower tract, seeing pharmaceutical representatives was an independent factor in the volume of second-choice antibiotics prescribed for lower RT episodes ($\beta = 0.29$; 95% CI 0.14–0.41).

Given the growing number of prescriptions of second-choice antibiotics,^{1–4} it is important to implement guidelines to set a right indication to prescribe antibiotics and to reserve second-choice antibiotics in case of failure of or intolerance to first-choice

antibiotics. Furthermore, developing more critical prescribing skills, e.g. training in being reluctant to prescribe new drugs and being alert to the marketing activities of pharmaceutical companies, should be started in the medical curriculum.

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