

# Prescribing antibiotics for respiratory tract infections by GPs: management and prescriber characteristics

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## ABSTRACT

### Background

Due to clinical and non-clinical factors, considerable variation exists in the prescribing of antibiotics for respiratory tract infections (RTIs) by GPs based in the Netherlands.

### Aim

To assess, in patients with RTIs in Dutch general practice: the prescribing rates of antibiotics; the relationship between GP characteristics and antibiotic prescribing; and the type of antibiotics prescribed.

### Design of study

Descriptive and prognostic.

### Setting

Eighty-four GPs in the middle region of the Netherlands.

### Method

All patient consultations for RTIs were registered by 84 GPs during 3 weeks in autumn and winter 2001 and 2002. In addition, all GPs completed a questionnaire related to individual and practice characteristics.

### Results

The mean proportion of consultations in which GPs prescribed antibiotics was 33% (95% CI = 29 to 35%) of all RTIs. This proportion varied from 21% for patients with upper RTIs or an exacerbation of asthma/COPD, to about 70% when patients had sinusitis-like complaints or pneumonia. Amoxycillin and doxycycline were the most frequently prescribed antibiotics, while 17% of the antibiotics prescribed were macrolides. Multiple linear regression analysis showed that the longer GPs had practised, the more frequently they prescribed antibiotics, especially in combination with relatively little knowledge about RTIs or the less time GPs felt they had available per patient. The final model, with seven factors, explained 29% of the variance of antibiotic prescribing.

### Conclusion

The prescribing behaviour of Dutch GPs might be improved with regard to choice of type and indication of antibiotics.

### Keywords

antibiotics; prescribing rates; respiratory tract infections.

## INTRODUCTION

In the Netherlands, 20% of all complaints presented to a GP are related to respiratory tract infections (RTIs).<sup>1</sup> In 34% of consultations for upper RTI<sup>2</sup> and in 30% of consultations for lower RTI<sup>3</sup> an antibiotic is prescribed, despite evidence that antibiotics do not shorten the duration of RTIs.<sup>4-6</sup> Even though antibiotic prescribing rates in the Netherlands are low in comparison with other European countries, about half of these prescriptions are estimated to be unnecessary.<sup>4</sup> Furthermore, the last 10 years has seen a shift towards costlier, broad-spectrum antibiotic usage in outpatient care.<sup>7,8</sup>

There is considerable variation in prescribing antibiotics for RTIs between GPs (FM Haaijer-Ruskamp, unpublished data, 1984).<sup>2,9-14</sup> This variation can partly be attributed to clinical reasoning,<sup>9-11</sup> but non-clinical factors, such as GP characteristics (for example: years of practice; medical knowledge about RTIs; personal attitude towards RTIs and antibiotics; list size) have also been shown to play an important role (FM Haaijer-Ruskamp, unpublished data).<sup>2,9,12-14</sup>

In order to develop feasible and successful strategies to optimise antibiotic prescribing, there is a need for more detailed and up-to-date insight in antibiotic management and associated GP characteristics. Therefore, this study aims to assess the prescribing rates of the different types of antibiotics in patients with RTIs in Dutch general practice, and to describe the relationship between GP characteristics and antibiotic prescribing.

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## METHOD

Eighty-four GPs from the middle region of the Netherlands participated in this study. These GPs registered all patient consultations for RTIs during 3 weeks in autumn or winter (2001 and 2002). GPs interpreted signs and symptoms in their usual manner, aiming to describe everyday practice, using the ICPC codes.<sup>15</sup> Additional information on patient characteristics (such as age, sex, and insurance type), symptoms and medications was gathered from the electronic patient records after the 3 weeks of registration. The consultations were grouped into upper or lower respiratory tract clinical entities and a distinction was made between symptoms and diagnoses (Table 1). Medication was classified according to the Anatomical Therapeutic Chemical (ATC) classification system.<sup>16</sup>

All GPs completed a questionnaire related to individual and practice characteristics such as sex, years of practice, list size, medical knowledge of RTIs (14 items selected from the National Test of the National Centre for Evaluation of Postgraduate Training in General Practice [SVUH] in the Netherlands, with a score ranging from 'very low' [0] to 'very well' [10]), personal attitude towards RTIs and antibiotics (12 items, with a score ranging from 'antibiotics not necessary' [1] to 'antibiotics necessary' [5]), visits of drug representatives (number in the last 4 weeks) and perceived time available per patient (ranging from 'too long' [1] to 'too short' [5]). As mentioned previously, other studies have shown these characteristics to be related to antibiotic prescribing.<sup>2,9,12-14</sup>

The mean proportion of consultations concerning respiratory tract symptoms and diagnoses in which antibiotics were prescribed was assessed per clinical entity, with 95% confidence intervals (CIs). Differences in antibiotic prescribing rates in relation to patient characteristics were analysed using one-way ANOVA.

The associations between GP characteristics and the proportion of consultations in which antibiotics were prescribed were assessed using multiple linear regression controlling for interaction. After selection of relevant factors (main factors and interaction terms) the best fitting model was assessed by means of an 'enter' model followed by a 'backward' strategy. To describe the strength of the associations, the standardised coefficients (95% CI) were presented, giving an indication of the relative importance of each independent variable. The final model was checked using multilevel analysis (MLWin) to control for practice clustering.

The types of antibiotics used were described per clinical entity. For lower respiratory tract conditions, the patients were divided into two groups: children (0–12 years) and adolescents/adults (above the age of 12 years), because indications and notable

## How this fits in

Previous research has shown considerable variation in prescribing antibiotics for respiratory tract infections, attributable to clinical and non-clinical factors. Recent antibiotic prescribing rates are lacking for the Netherlands. The variation in prescribing antibiotics for respiratory tract infections ranges from 21% for upper respiratory tract infections to 74% for sinusitis-like complaints. The proportion of antibiotics prescribed does not seem to have decreased in the last 10 years, while the proportion of macrolides prescribed increased from 4% to 17% of the antibiotics prescribed.

contraindications vary for these age groups. The data were analysed using SPSS version 10.0.

## RESULTS

The GPs had practised for a mean of 16 years (range = 0–34 years) and almost three quarters (73%) had a partnership practice. In all, they registered 2630 consultations (mean = 31; range = 4–108). The mean patient age was 32 years (range = 0–98 years) (Table 2).

**Table 1. Categories of symptoms and diagnoses per clinical entity (with International Classification of Primary Care code).**

Clinical entity	Symptoms	Diagnoses
<b>Upper respiratory tract</b>		
Ear	Earache (H01)	Acute otitis media (H71)
	Hearing complaints (H02)	Serous otitis media (H72)
	Discharge from ear (H04)	Eustachian salpingitis (H73)
	Other symptoms/complaints of ear (H29)	Chronic otitis media (H74) Perforation tympanic membrane (H77)
Upper respiratory tract	Sneezing/nasal congestion (R07)	Upper respiratory tract infection/head cold (R74)
	Other symptoms of nose (R08)	Other infections respiratory system (R83)
Sinus	Symptoms/complaints sinus (R09)	Sinusitis acute/chronic (R75)
Throat	Symptoms/complaints throat (R21)	Tonsillitis acute (R76)
	Symptoms/complaints tonsils (R22)	Acute laryngitis/tracheitis/croup (R77) Hypertrophy/chronic infection tonsils (R90)
<b>Lower respiratory tract</b>		
Pneumonia		Pneumonia (R81)
Cough/ bronchitis <sup>a</sup>	Pain attributed to respiratory system (R01)	Whooping cough (R71)
	Dyspnoea (R02)	Strep-throat/scarlet fever (R72)
	Wheezing (R03)	Acute bronchitis/bronchiolitis (R78)
	Cough (R05)	Chronic bronchitis (R79 or R91)
Abnormal sputum/phlegm (R25)		
Exacerbation asthma/COPD	Codes as stated above by cough/bronchitis in patients with asthma or COPD combined with codes COPD (R95) or asthma (R96)	

<sup>a</sup>In patients not diagnosed as having asthma or COPD.

**Table 2. GP and consultation characteristics.**

GP characteristics (n = 84)		Number (%)
Sex	Male	57 (68)
Years of practice	0–10 years	27 (32)
	11–20 years	39 (35)
	>20 years	28 (33)
Type of practice	Single	23 (27)
	Partnership practice	61 (73)
Urbanisation level	Rural	30 (36)
	Small town	38 (45)
	City	16 (19)
% patients insured by the Dutch Sickness Fund	0–60	44 (52)
	>61	31 (37)
List size (mean [SD])		2361 (504)
Consultation characteristics (n = 2630)		
Age of patient (years)	0–4	518 (20)
	5–12	378 (14)
	13–64	1360 (52)
	>65	372 (14)
Sex of patient	Male	1204 (46)
Insurance type	Dutch Sickness Fund	1749 (67)
	Private	873 (33)

SD = standard deviation.

**Table 3. Antibiotic prescribing rates according to clinical entities (n = 84 GPs).**

	Proportion antibiotics prescribed (mean per GP [95% CI])	Number of consultations
Diagnoses	47 (42 to 52)	1664
Symptoms	12 (9 to 16)	966
Ear	35 (28 to 42)	408
Upper respiratory tract	21 (15 to 27)	573
Sinus	74 (67 to 81)	272
Throat	37 (29 to 45)	255
Pneumonia	67 (54 to 80)	108
Cough/bronchitis	27 (22 to 32)	669
Exacerbation of asthma/COPD	21 (14 to 28)	345
Mean/Total	33 (29 to 35)	2630

#### Antibiotic prescribing

Overall, GPs prescribed antibiotics in one out of three consultations concerning RTIs (mean = 33%, 95% CI = 29 to 35%) (Table 3). In a consultation where a diagnosis was registered (for example, otitis media, sinusitis, bronchitis) GPs prescribed an antibiotic in almost half (47%) of the cases, compared to one in eight (12%) when the GP only registered a symptom (such as earache or cough).

Prescription rates varied considerably between clinical entities. As many as 70% of consultations with patients presenting sinusitis-like complaints or pneumonia resulted in antibiotic prescribing, against 21% of consultations with patients suffering upper RTIs or with an exacerbation of asthma/COPD. In cases of

ear and throat complaints or cough/bronchitis, an antibiotic was prescribed in one third of cases.

#### Patient characteristics and antibiotic prescribing

Children (0–12 years) received antibiotics less frequently (29%) than older patients (36%) (one-way ANOVA =  $P < 0.001$ ). Further inspection of data showed this to be the case for all clinical entities except for ear complaints: in children with ear complaints below the age of 5 years, more antibiotics were prescribed than in patients above the age of 5 years (on average 44% versus 26%, one-way ANOVA =  $P < 0.001$ ). There were no differences in antibiotic prescribing in relation to patient sex and insurance type.

#### GP characteristics and antibiotic prescribing

For RTIs, seven factors were independently correlated with antibiotic prescribing rates, explaining 29% of the variation in antibiotic prescribing (Table 4). Years of practice was shown to be a main factor, especially when in interaction with medical knowledge on RTIs and perceived time available per patient. Medical knowledge on RTIs and perceived time available per patient were also independently associated with antibiotic prescribing rates, as well as the interaction terms 'sex x list size' and 'years of practice x visits from drug representatives', but these latter associations were weaker (Table 4). Sex, list size and visits from drug representatives were not independently correlated with these prescribing rates. Other factors, such as personal attitude towards RTIs and antibiotics, were not correlated with antibiotic prescribing at all. Multilevel analysis, controlling for practice clustering, resulted in similar findings.

#### Type of antibiotics

The type of antibiotics prescribed per clinical entity is shown in Figure 1. For ear complaints amoxicillin was prescribed most frequently (in 76% of consultations in which antibiotics were prescribed). For patients with upper RTIs or sinusitis-like complaints doxycycline was most frequently prescribed (41% and 63%, respectively), as were narrow-spectrum penicillins for patients with throat complaints (43%). More specific inspection of data showed that in cases of sore throat (R21), tonsil complaints (R22) and acute tonsillitis (R76), narrow-spectrum penicillins accounted for 51% of the consultations in which antibiotics were prescribed, while broad-spectrum penicillins accounted for 27% and macrolides for 10%.

In cases of children with pneumonia or cough/bronchitis, amoxicillin was prescribed in more than half of the consultations in which antibiotics were prescribed (59% and 55% respectively). Antibiotics were rarely prescribed for children with exacerbations of asthma. None of the children in the study received

doxycycline. Adults with cough/bronchitis or exacerbation of asthma/COPD received doxycycline in almost half of the consultations in which antibiotics were prescribed (48% and 49% respectively), while macrolides and amoxicillin-clavulanate together were prescribed in about 40% of cases. In adults with pneumonia, amoxicillin, amoxicillin-clavulanate or macrolides were prescribed in about 30% of the consultations in which antibiotics were prescribed.

## DISCUSSION

The participating GPs prescribed antibiotics in one-third of consultations concerning RTIs. There was considerable variation between the clinical entities. Years of practice was the most important factor in explaining the variation in prescribing antibiotics; the longer GPs had practiced, the more antibiotics they prescribed, especially if they had relatively little knowledge about RTIs or felt they had relatively less time available per patient.

### Strengths and limitations of the study

The results were based on data from 84 GPs, with 2630 patient consultations. Our findings reliably describe antibiotic prescription rates in cases of RTIs, as the data analysed was taken from electronic patient records, which accurately reflect drug prescriptions.<sup>17</sup> Further, a previous and similar registration showed that the variety of registered consultations between GPs across time was consistent with claims data.<sup>18</sup>

GPs participated in this study by way of self-selection, as is the case with all kinds of sentinel studies. The sex of GPs, years of practice, and urbanisation level accurately reflected the whole Dutch GP population. Single-handed GPs were under-represented, but as type of practice was not associated with the frequency of antibiotic prescribing, this is unlikely to have influenced antibiotic prescribing rates. Time constraints during consultation may have influenced registration of consultations concerning RTIs. This is unlikely to have biased the registration as the antibiotic prescribing rates differed little from those found during another nationwide sentinel (AE Akkerman *et al*, unpublished data, 2004). We therefore believe that the associations between GP characteristics and antibiotic prescribing rates were unbiased.

### Comparison with the existing literature

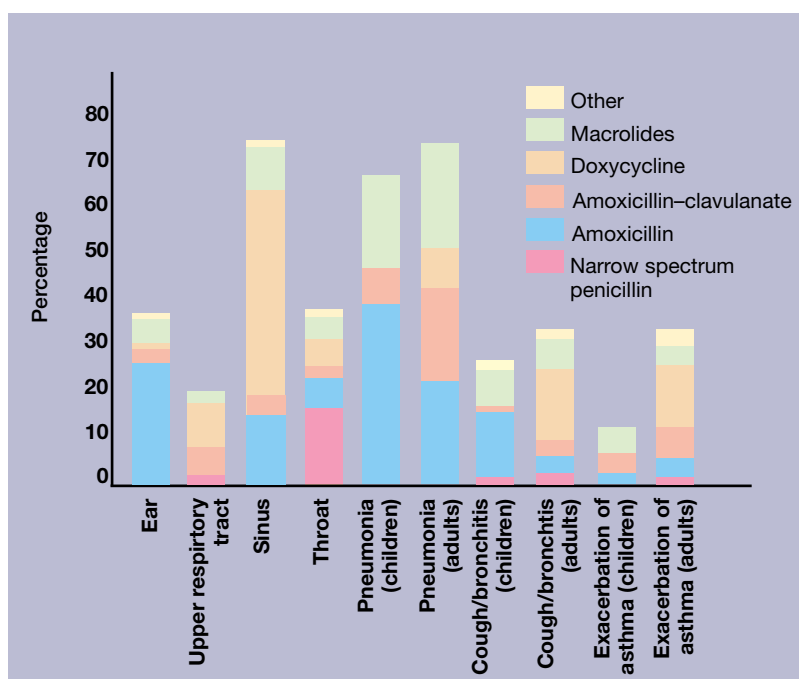
The mean prescription rates for RTIs in this study are similar to those found in the first Dutch National Survey of General Practice 10 years ago.<sup>2,3</sup>

More than three quarters of the antibiotic prescriptions for patients with ear and sinusitis-like complaints were in accordance with the first choice antibiotics advocated by the guidelines of the Dutch College of General Practitioners, that is, amoxicillin for

**Table 4. The association between GP characteristics and mean antibiotic prescribing in RTIs by means of linear regression analysis.**

GP characteristics	95% CI	
Sex	-	
Years of practice	3.60	1.20 to 6.00
List size	-	
Medical knowledge of RTIs	0.63	0.01 to 1.26
Visits from drug representatives	-	
Perceived time per patient	0.71	0.18 to 1.24
Interaction terms		
Sex x list size <sup>a</sup>	0.34	0.09 to 0.59
Years of practice x medical knowledge on RTIs <sup>b</sup>	-2.37	-4.3 to -0.42
Years of practice x visits from drug representatives <sup>c</sup>	0.25	-0.00 to 0.51
Years of practice x perceived time per patient <sup>d</sup>	-1.32	-2.48 to -0.17

Explained variance: 0.29. <sup>a</sup>Female GPs having more patients enlisted, prescribe antibiotics more frequently. <sup>b</sup>The longer the years of practice and the less a GP knows about RTIs, the more frequently a GP prescribes antibiotics. <sup>c</sup>The longer the years of practice and the more drug representatives seen by a GP, the more frequently a GP prescribes antibiotics. <sup>d</sup>The longer the years of practice and the less time perceived by the GP to be available per patient, the more frequently a GP prescribes antibiotics. RTI = respiratory tract infection.



**Figure 1. Clinical entities and type of antibiotics (n = 2630 consultations)**

ear infections and amoxicillin or doxycycline for sinusitis-like complaints. For throat complaints half of the antibiotic prescriptions were in accordance to the guidelines, that is, narrow-spectrum penicillins. Amoxicillin was most commonly prescribed in cases of lower RTIs in children, and doxycycline in adults. This was in line with the available national pharmacotherapeutic sources.<sup>19</sup> A national guideline for acute cough was lacking at the time of the study.

These results are somewhat similar to those found 10 years previously,<sup>2,3</sup> with two noteworthy exceptions. Firstly, the use of narrow-spectrum penicillins in throat infections has declined. The proportion of narrow-



spectrum penicillins among all antibiotic prescriptions for sore throat, tonsil complaints and acute tonsillitis fell from 64% 10 years ago,<sup>2</sup> to 51%. The proportion of broad-spectrum penicillins, which are not indicated in cases of throat infections, remained the same, while the proportion of macrolides, which were rarely prescribed for these cases 10 years ago, increased. Secondly, the overall use of macrolides was 17% of all consultations in which antibiotics were prescribed, mainly for lower RTIs. This percentage was less than 4% 10 years ago.<sup>2</sup> These trends are noteworthy because these types of antibiotics are not a first choice treatment in Dutch general practice and are linked to a risk of growing resistance of relevant bacterial pathogens.<sup>20</sup>

The explained variance was 29%, which is comparable to explained variances found in a previous study (FM Haaijer-Ruskamp, unpublished data).<sup>12</sup> Two studies found that years of practice are associated with higher prescribing rates.<sup>12,14</sup> This factor correlates both with the time expired after training for general practice and with developing habits over time. It is likely that GPs maintain the policy learned during their vocational training. In addition, the results show that antibiotic prescribing in RTIs does not correlate with personal attitudes, as far as measured in this study.

It can be concluded that some aspects of prescribing antibiotics by Dutch GPs could be improved, despite the relatively low rates of antibiotics prescribed compared to other European Union countries,<sup>21</sup> the US<sup>22</sup> and Canada.<sup>23</sup>

GPs who trained some time ago should be a target group for quality assurance in this field. Reduction of antibiotic prescribing for RTIs is possible, as shown by Welschen *et al* by means of a multiple intervention strategy. This consists, in part, of group education meetings, monitoring and feedback on prescribing behaviour.<sup>18</sup> However, changing clinical practice is difficult, as shown by other studies.<sup>24,25</sup> Increasing the proportion of first choice antibiotics seems to be easier than reducing the number of antibiotic prescriptions (I Welschen *et al*, unpublished data, 2004).

#### Implications for future research

There is a need for further study involving more GPs to allow for detailed subgroup analyses, as well as studies that look at both GP and patient characteristics that are a risk for unnecessary antibiotic prescriptions. We recently began a study to address these issues with 150 GPs. Findings from both types of studies are needed to develop strategies to further optimise the use of antibiotics in general practice.

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#### Ethics committee reference number

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#### Competing interests

None

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