

## Determinants of antibiotic overprescribing in respiratory tract infections in general practice

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**Objectives:** To assess determinants of antibiotic overprescribing in patients with sinusitis, tonsillitis and bronchitis in Dutch general practice.

**Patients and methods:** A total of 146 general practitioners (GPs) from the Netherlands included all patients with sinusitis, tonsillitis and bronchitis during a 4 week period in the winter of 2002/2003, and recorded patient characteristics, clinical presentation and management. Overprescribing of antibiotics was assessed using the recommendations of the Dutch national guidelines as a benchmark.

**Results:** In almost 50% of all 1469 respiratory tract infection (RTI) consultations (694/1469), the antibiotic prescribing decisions were in accordance with the recommendations of the Dutch national guidelines. Overprescribing was highest in tonsillitis and bronchitis [71% (168/238) and 63% (415/656), respectively], while in sinusitis this was only 22% (128/575). Underprescribing was seen in 1% (3/238), 3% (17/656) and 8% (44/575), respectively. Patients who received an antibiotic prescription that was not in accordance with the guidelines had more inflammation signs such as fever (ORs 2.08, 2.18 and 3.04, for sinusitis, tonsillitis and bronchitis, respectively), were more severely ill according to their GP (ORs 2.37, 1.87 and 1.42, respectively), and their GP assumed more often that they expected an antibiotic (ORs 1.95, 1.70 and 2.11, respectively), compared with those who did not receive an antibiotic prescription.

**Conclusions:** GPs overestimate symptoms and probably patients' expectations when indicating antibiotic therapy in RTI cases in daily practice. Correct interpretation of combinations of symptoms for antibiotic treatment should be emphasized, combined with adopting more patient-centred consulting skills to rationalize the prescribing of antibiotics.

Keywords: respiratory diagnoses, appropriateness, primary care, The Netherlands

### Introduction

Respiratory tract infections (RTIs) are a common reason to consult a general practitioner (GP).<sup>1</sup> Every year in the Netherlands, about 500 new cases of upper RTIs and 80 new cases of lower RTIs are presented in an average general practice.<sup>2</sup> Treatment frequently involves the use of antibiotics,<sup>3</sup> in spite of their questionable effectiveness in the majority of RTIs.<sup>4–7</sup> About two-thirds of antibiotic prescriptions in Dutch general practice are for RTIs.<sup>8</sup> Internationally, there has been much concern that antibiotics may be overused.<sup>9</sup> Several studies have investigated determinants of antibiotic use in general practice,<sup>3,10–17</sup> and found that patient age,<sup>3</sup>

inflammation signs (such as fever and purulent sputum<sup>10–12</sup>), medical knowledge of RTIs,<sup>17</sup> diagnostic labelling<sup>18</sup> and patient expectations<sup>13,19–21</sup> play an important role in antibiotic prescribing decisions. However, determinants of inappropriate prescribing of antibiotics are not well investigated, even though strategies to change prescribing routines will only be successful when based on a proper understanding of why GPs prescribe antibiotics when not indicated.

Therefore, this study aimed to assess determinants of overprescribing of antibiotics in patients with sinusitis, tonsillitis and bronchitis in Dutch general practice.

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### Patients and methods

#### Setting; GPs and patients; data collection

This study was part of a research project of which the methods were described previously.<sup>22</sup> The 146 participating GPs included all consultations with complaints related to sinusitis, tonsillitis and bronchitis (complaints persisting up to 31 days) during a 4 week period between November 2002 and May 2003. For each consultation, GPs recorded patient characteristics, clinical presentation, their perception of the severity of illness and whether patients expected an antibiotic (Table 1). At the end of the consultation, the final diagnosis and management were recorded. Because we aimed to describe everyday practice, GPs interpreted the signs and symptoms of their patients in their usual way. Only consultations with the diagnosis codes R75 'Sinusitis', R76 'Tonsillitis' and R78 'Bronchitis', classified according to the International Classification of Primary Care (ICPC) coding,<sup>23</sup> were included. Bronchitis in combination with asthma or chronic obstructive pulmonary disease (COPD) was excluded. Medication prescribed for these RTIs was classified according to the Anatomical Therapeutic Chemical (ATC) classification system.<sup>24</sup> All records were checked after the 4 weeks of recording and additional information was retrieved from the patient's electronic records.

#### Antibiotic prescribing according to Dutch national guidelines: benchmark for appropriate use

To assess the appropriateness of prescribing antibiotics, the recommendations concerning antibiotic prescribing from the current guidelines for 'Sinusitis', 'Acute sore throat' and 'Acute cough' of the Dutch College of General Practitioners<sup>25-27</sup> were used. The recommendations were converted into criteria and an algorithm for data analysis by three GPs with special expertise on RTIs. These criteria were used as a benchmark for appropriate use of antibiotics in sinusitis, tonsillitis and bronchitis in order to categorize the consultations with regard to antibiotic indication and antibiotic prescribing (Table 2). The categories were: antibiotics indicated and prescribed (category A), antibiotics not indicated, but prescribed (overprescribing; B), antibiotics indicated, but not prescribed (underprescribing; C), antibiotics not indicated and not prescribed (D).

#### Analysis

After description of the management of sinusitis, tonsillitis and bronchitis, the algorithm for appropriate prescribing of antibiotics was applied to all consultations (excluding those in which patients were referred to secondary care), using SPSS version 12.0. After checking for interactions between age and clinical determinants, we assessed the

**Table 1.** Determinants as recorded and used in the analyses

Determinants	Categories	Classification	Used in analysis		
			R75	R76	R78
<b>Patient characteristics</b>					
age	continuous	in years	X	X	X
gender	dichotomous	male (1), female (2)	X	X	X
type of insurance	dichotomous	nat. health insurance (1), private insurance (2)	X	X	X
smoking	dichotomous	absent (0), present (1)	X	X	X
comorbidity <sup>a</sup>	dichotomous	absent (0), present (1)	X	X	X
acute rheumatic fever in history	dichotomous	absent (0), present (1)		X	
<b>Clinical presentation</b>					
duration of symptoms prior to consultation	continuous	in days	X	X	X
worsening clinical syndrome since previous contact in same episode	dichotomous	no worsening or no prev. contact (0), yes (1)	X	X	X
cold in previous month	dichotomous	absent (0), present (1)	X		
peritonsillar infiltration	dichotomous	absent (0), present (1)		X	
cough	dichotomous	absent (0), present (1)	X	X	X
wheezing, dys- or tachypnoea, chest pain	dichotomous	absent (0), present (1)			X
suspicion for pneumonia	dichotomous	absent (0), present (1)			X
signs of inflammation sinus <sup>b</sup>	continuous	number of signs (1-2)	X		
signs of inflammation throat <sup>b</sup>	continuous	number of signs (1-3)		X	
signs of inflammation lower RT <sup>b</sup>	continuous	number of signs (1-3)			X
pain complaints sinus <sup>c</sup>	continuous	number of compl. (1-3)	X		
pain complaints throat <sup>c</sup>	continuous	number of compl. (1-2)		X	
<b>GP's perception of</b>					
severity of illness	4	light (1)—severe (4)	X	X	X
whether the patient expected an antibiotic	5	definitely not (1)—sure (5)	X	X	X

R75, sinusitis; R76, tonsillitis; R78, bronchitis.

<sup>a</sup>Included: chronic respiratory illness, cardiovascular diseases, diabetes mellitus, atopy and malformations of ear, nose or throat.

<sup>b</sup>Inflammation signs sinus: fever or purulent nasal discharge. Inflammation signs throat: fever, inflamed pharynx or tonsillar exudate. Inflammation signs lower RT: fever, purulent sputum or auscultation abnormalities with left-right difference.

<sup>c</sup>Pain sinus: maxillary pain, pain when bending or tooth pain. Pain throat: throat ache or pain while swallowing.

**Table 2.** Criteria for antibiotic prescribing according to recommendations of the guidelines ‘Sinusitis’, ‘Acute sore throat’ and ‘Acute cough’ of the Dutch College of General Practitioners

	Sinusitis	Acute sore throat	Acute cough
Duration of symptoms	>5 days	<14 days	>3 days
Presented symptoms	three of the following six symptoms: cold in previous month, purulent nasal discharge, maxillary pain, pain when bending, tooth pain, severe illness	tonsillar exudate with pain while swallowing <i>or</i> inflamed pharynx	sputum production <i>or</i> auscultation abnormalities with left-right difference
Patients at risk for complications		presence of peritonsillar infiltration, severe illness, acute rheumatic fever in history <i>or</i> relevant comorbidity	age <6 months or >75 years with fever, heart failure <i>or</i> suspicion for pneumonia

independent association (univariate and multivariate) between patient characteristics, clinical presentation and GPs’ perception of severity of illness, and whether the patient expected an antibiotic on the one hand (see Table 1 for the exact determinants for analysis), and overprescribing on the other. The analyses of determinants of overprescribing addressed consultations without an indication for antibiotic treatment (categories B and D), with category B ‘antibiotics not indicated, but prescribed’ (overprescribing) being the outcome measure. Associations were assessed by odds ratios (ORs) with 95% confidence intervals (95% CI) using logistic regression (backward stepwise analysis) with Generalised Estimating Equation estimations<sup>28</sup> in SAS version 8.02, to control for clustering at the level of GPs.

## Results

### *Consultations, patients and management*

The 146 GPs included 1490 consultations for sinusitis ( $n = 581$ ), tonsillitis ( $n = 245$ ) and bronchitis ( $n = 664$ ) (median: eight consultations per GP; range: 1–32 consultations). Mean age of the patients was 37 years (range: 0–98 years) and 41% were male (Table 3). Patients with a diagnosis of sinusitis were less severely ill compared with patients with tonsillitis and bronchitis. Almost half of the patients with sinusitis (47%) had symptoms for >2 weeks prior to the consultation. Two-thirds of patients with tonsillitis had fever (65%) and one-third had symptoms lasting <4 days (39%). One-third of patients with bronchitis had comorbidity (37%) and one-third had symptoms lasting >2 weeks prior to the consultation (35%).

Antibiotics were prescribed in 80% (1184/1490) of the consultations with very few differences between sinusitis (80%; 467/581), tonsillitis (81%; 199/245) and bronchitis (78%; 518/664) (Table 3). In 1% of consultations (21/1490), patients were referred to secondary care.

### *Appropriateness of antibiotic prescribing*

In almost half of the consultations about sinusitis, tonsillitis and bronchitis the antibiotic prescribing decisions were in accordance with the recommendations of the Dutch national guidelines

(A+D = 48%) (Figure 1). In the remainder of the consultations, the antibiotic prescribing decisions were not in accordance with the guidelines (B+C); in 48% antibiotics were not indicated but prescribed (B: overprescribing), and in only 4% antibiotics were indicated but not prescribed (C: underprescribing).

These percentages varied according to the type of infection; in 70% of sinusitis consultations the antibiotic prescribing decisions were according to the recommendations, whereas in tonsillitis and bronchitis the recommendations were followed in 28 and 34% of consultations, respectively. Overprescribing was highest in tonsillitis and bronchitis (in 71 and 63% of all consultations, respectively), as opposed to 22% for sinusitis; underprescribing was highest in sinusitis (in 8% of all consultations), as opposed to 1% for tonsillitis and 3% for bronchitis (Figure 1). Thus, underprescribing was not frequent in these RTIs, and therefore not analysed.

### *Determinants associated with antibiotic overprescribing*

Overall, patients who received an antibiotic prescription that was not in accordance with the recommendations of the Dutch national guidelines, had more inflammation signs such as fever, were more severely ill according to the GP and their GP more often assumed they expected an antibiotic, compared with those who rightly did not receive an antibiotic (Tables 4 and 5). In sinusitis cases, patients with National Health insurance and patients with cough were more likely to receive an antibiotic prescription that was not in accordance with the guideline. In bronchitis consultations, older patients and patients who were not wheezing were more likely to receive an antibiotic prescription that was not in accordance with the guideline (Tables 4 and 5). Regarding overprescribing of antibiotics, no interactions were found between age and determinants.

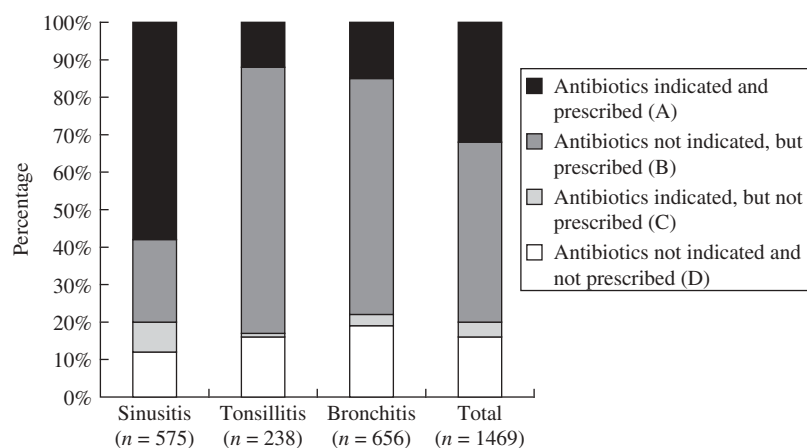
## Discussion

In half of the consultations for sinusitis, tonsillitis and bronchitis, antibiotic prescribing decisions were in accordance with the recommendations of the Dutch national guidelines. Differences between the RTIs were considerable. Overprescribing was highest in

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**Table 3.** Patient characteristics and management ( $n = 1490$ ) in percentages

Patient characteristics	Respiratory tract infections			
	sinusitis ( $n = 581$ ) %	tonsillitis ( $n = 245$ ) %	bronchitis ( $n = 664$ ) %	Total ( $n = 1490$ ) %
Age				
0–12 years	2	30	29	19
Gender				
male	36	41	46	41
Comorbidity				
present	19	13	37	26
Fever				
present	25	65	38	37
Previous contact in same episode				
present	23	18	28	24
GP perception of severity of illness				
marked/severe	19	37	30	27
Duration of symptoms prior to consultation				
0–3 days	7	39	14	15
4–5 days	13	30	19	19
6–13 days	33	22	32	30
14+ days	47	9	35	36
Management				
antibiotic prescription	80%	81%	78%	80%



**Figure 1.** Appropriateness of antibiotic prescribing for respiratory tract infections ( $n = 1469$ ).

tonsillitis and bronchitis (in 71 and in 63% of the consultations, respectively), whereas in sinusitis this was 22%. Patients who received an antibiotic prescription that was not in accordance with the Dutch national guidelines, had more inflammation signs such as fever, were more severely ill according to their GP and their GP more often assumed that they expected an antibiotic, compared with those who rightly did not receive an antibiotic prescription.

### *Strengths and weaknesses of the study*

This is a large study and characteristics of participating GPs did not differ from the average Dutch GP.<sup>29</sup> However, all participating GPs

were volunteers, which might indicate that these GPs adhere more strongly to guidelines than non-participating GPs. In that case, our results would underestimate the inappropriateness of antibiotic prescribing. It is, however, highly unlikely that a possible underestimation of inappropriate antibiotic prescribing would also affect the associations studied.

While our data can be considered complete for antibiotic prescriptions, misclassification of clinical determinants is always possible. Such misclassification because of missing data might result in inaccurate estimates of appropriateness of antibiotic prescribing. However, bias would only occur if misclassification is limited to a specific subgroup of patients; we think this is highly unlikely.

**Table 4.** Determinants of overprescribing of antibiotics for respiratory tract infections; univariate odds ratios (ORs) with 95% confidence intervals (95% CI)

	Sinusitis ( <i>n</i> = 181) OR (95% CI)	Tonsillitis ( <i>n</i> = 206) OR (95% CI)	Bronchitis ( <i>n</i> = 526) OR (95% CI)
Patient characteristics			
age	–	–	1.01 (1.00–1.02)
type of insurance	0.70 (0.38–1.29)	–	–
Clinical presentation			
cough	3.09 (1.30–7.35)	–	–
wheezing	NA	NA	0.60 (0.42–0.86)
signs of inflammation (number)	3.08 (1.81–5.22)	3.01 (1.88–4.83)	3.47 (2.55–4.74)
GP perception of			
severity of illness	3.05 (1.87–4.99)	3.23 (1.81–5.77)	1.68 (1.34–2.12)
whether patient expected an antibiotic	1.94 (1.43–2.62)	2.02 (1.29–3.19)	2.46 (1.96–3.09)

Odds ratio <1: negative association [the lower the value of the variable (see Table 1), the more overprescribing]. Odds ratio >1: positive association (the higher the value of the variable, the more overprescribing).

–, Not in final model.

NA, not applicable.

**Table 5.** Determinants of overprescribing of antibiotics for respiratory tract infections; multivariate odds ratios (ORs) with 95% confidence intervals (95% CI)

	Sinusitis ( <i>n</i> = 181) OR (95% CI)	Tonsillitis ( <i>n</i> = 206) OR (95% CI)	Bronchitis ( <i>n</i> = 526) OR (95% CI)
Patient characteristics			
age	–	–	1.01 (1.00–1.02)
type of insurance	0.43 (0.21–0.89)	–	–
Clinical presentation			
cough	3.44 (1.36–8.70)	–	–
wheezing	NA	NA	0.62 (0.42–0.91)
signs of inflammation (number)	2.08 (1.18–3.66)	2.18 (1.37–3.47)	3.04 (2.17–4.26)
GP perception of			
severity of illness	2.37 (1.45–3.88)	1.87 (1.08–3.23)	1.42 (1.09–1.86)
whether patient expected an antibiotic	1.95 (1.36–2.78)	1.70 (1.13–2.56)	2.11 (1.71–2.60)

Odds ratio <1: negative association [the lower the value of the variable (see Table 1), the more overprescribing]. Odds ratio >1: positive association (the higher the value of the variable, the more overprescribing).

–, Not in final model.

NA, not applicable.

Guidelines are partly evidence-based, partly based on expert opinion, and should be regarded as the best indication at a given moment on how patients should be treated. In individual patients GPs can, of course, have good reasons to diverge from guidelines. However, taking into account the large number of patients in our study, we think non-compliance with the current guidelines is the best estimation of inappropriate antibiotic prescribing in the total group of patients under study.

#### Comparison with the literature

In about half of the consultations antibiotics were prescribed, while not indicated. In this respect our results support the impression of de Melker<sup>30</sup> that about half of the antibiotic prescriptions for RTIs in Dutch general practice are unnecessary.<sup>30</sup>

In another study on acute otitis media,<sup>22</sup> we found the same determinants of antibiotic overprescribing. Apparently these determinants (severity of illness and signs of inflammation,

which are in fact mentioned in the guidelines as criteria for antibiotic treatment), were recognized by participating GPs as important items irrespective of the type of RTI, but given too much weight, which is in accordance with other studies.<sup>10–12</sup> GPs prescribed antibiotics in the presence of one or two criteria, whereas according to the guidelines more criteria (e.g. certain duration of symptoms, inflammation signs and a risk for complications) should be present. It seems that although GPs realize which clinical signs and symptoms are relevant indications for antibiotic use, they still find it difficult to refrain from prescribing antibiotics in large subgroups of patients. For instance, the results show that in sinusitis cases patients with cough, and in bronchitis cases older patients and patients not wheezing, were more likely to receive an antibiotic prescription even though this was not in accordance with the guidelines. There are no reports that these latter patients have a higher risk of complications. Overprescribing also occurred in patients with National Health insurance.

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In addition, we found that GPs' perceptions of patients' expectations play an important role in prescribing antibiotics when they are not indicated. This confirms the results of other studies reporting that GPs tend to overestimate patients' expectations on this subject.<sup>13,19–21</sup> It is worthwhile exploring whether a patient with an RTI really expects an antibiotic, or merely desires any effective treatment<sup>21</sup> or reassurance that nothing is seriously wrong.<sup>31</sup>

Apparently it is difficult for GPs to apply clinical criteria as described in the Dutch national guidelines in daily practice. More appropriate use of the guidelines in this field should be targeted to prevent over- and underprescribing of antibiotics. In particular, correct interpretation of combinations of signs and symptoms as indications for antibiotic therapy should be emphasized. Adopting more patient-centred consulting skills might be a tool to rationalize prescribing antibiotics<sup>32</sup> and enhance patients' self-management, which might also decrease consultation rates for these complaints in the longer term. In order to reach these targets, a multiple educational intervention (including indications setting and communication skills training) has proven to be effective in the Netherlands.<sup>33</sup>

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