Treatment of acute rhinosinusitis: discrepancy between guideline recommendations and clinical practice

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Background. A revised primary care guideline on acute rhinosinusitis (ARS) has been introduced in the Netherlands in 2005, which advocates a more judicious use of antibiotics.

Objective. To investigate whether consultation and prescription rates for ARS in adults changed over recent years in order to provide information on family physicians’ behaviour before and after introduction of the revised guideline.

Methods. Retrospective cohort study. All adult patients within the computerized database of Utrecht Primary Care Research Network over the years 2000–09 were included. Clinical diagnoses of ARS were recorded according to the International Classification of Primary Care codes (R75 and/or R09) and drug prescriptions according to the Anatomical Therapeutic Chemical Classification System.

Results. ARS consultation rates revealed a stable pattern, with an average consultation rate of 29 episodes per 1000 person-years. From 2000 to 2005, the antibiotic prescription rate increased from 56 to 62 prescriptions per 100 episodes (P value for time trend <0.05). From 2005 onwards, the antibiotic prescription rate decreased to 56 per 100 episodes in 2009 [rate difference (RD): −6, 95% confidence interval (CI): −10 to −1; P value for difference between 2000–05 and 2005–09 <0.05]. From 2005 to 2009, intranasal corticosteroid (INCS) prescription rate increased from 20 to 31 prescriptions per 100 episodes (RD: 11, 95% CI: 7 to 15; P value for difference between 2000–05 and 2005–09 <0.01). Oral corticosteroid prescription and referral rates remained low.

Conclusions. Despite strong guideline recommendations to restrict the use of antibiotics and INCS, we found only a modest decrease in antibiotic prescription rates, whereas INCS prescription rates even increased.

Keywords. Primary care, upper respiratory infections, antibiotics, epidemiology, cohort study.

Introduction

Acute rhinosinusitis (ARS) is an important reason of consultations and antibiotic prescriptions in primary care and is accompanied with high financial burden on society.\textsuperscript{1–3} Whereas ARS also occurs in children, the vast majority of patients who visits their family physician with this condition are adults.\textsuperscript{4,5} Previous studies reported a decline in consultation rates for ARS in primary care, which is in agreement with incidence patterns of other upper respiratory tract infections.\textsuperscript{1,6,7} However, recent data on consultation rates in adults are lacking since these studies reported consultation rates of both children and adults combined over the period 1987–2001.

Symptoms consistent with ARS are self-limiting in the majority of patients within 2–4 weeks.\textsuperscript{8} Nevertheless, ARS is the fifth most common condition for which an antibiotic is prescribed in the USA,\textsuperscript{4} while antibiotic prescription rates in Europe ranged from 70% in the Netherlands (2001) to 92% in the UK (1997).\textsuperscript{1,2,9} Previous studies revealed that overprescription of antibiotics might be caused by patients’ misconceptions on the efficacy of antibiotics in viral infections\textsuperscript{10} and family physicians’ overestimation of patients’ expectations towards antibiotics.\textsuperscript{11,12} In addition, the lack of specific
knowledge about respiratory tract infections has been identified as an important reason. To increase disease-specific knowledge and improve health care decisions, the Dutch College of Family Physicians developed an evidence-based guideline for management of ARS in 1993. As numerous placebo-controlled trials have failed to demonstrate a clinical beneficial effect of antibiotics in clinically diagnosed ARS in the past decade, an even more restricted use of antibiotics was justified and, therefore, a revised guideline was issued in 2005. This revised guideline advocates a more judicious use of antibiotics and emphasizes that antibiotic prescriptions may only be considered in patients with (i) severe illness, (ii) fever that recurs after a fever-free period within one ARS episode, (iii) symptoms that last for more than three episodes in previous year) or (v) immunodeficiency. Doxycycline and amoxicillin are considered to be the first-choice antibiotics. Besides, the guideline recommends to restrict the use of intranasal corticosteroids (INCS) to patients in which previous treatment options have failed.

Almost all family physicians in the Netherlands had full access to this revised guideline by its publication on the open access website of the Dutch College of Family Physicians and publication in the College National Journal, i.e. Huisarts en Wetenschap (over 90% of Dutch family physicians are member). In addition, family physicians received an abstract of the guidelines’ most important revisions and recommendations for clinical practice to further enhance implementation. Furthermore, Dutch family physicians have to follow postgraduate courses including medical educational sessions in which the guidelines are discussed in order to obtain re-registration.

It is unknown whether a change in daily clinical practice could be observed after the introduction of the revised guideline in 2005. Our aim, therefore, was to investigate whether consultation and prescription rates for ARS in adults changed over recent years in order to provide information on family physicians’ prescribing and referral patterns before and after the introduction of a revised guideline in daily practice.

Methods

Design

We used the medical database of the University Medical Centre Utrecht Primary Care Research Network (HNU) to analyze the consultation rates, therapy and management of ARS in adults between 2000 and 2009. This database comprises well-documented information of all patients enlisted in the participating family practices, which resemble a population of ~40,000 patients over the years 2000-09. The family physicians uniformly and systematically recorded patient demographics (including date of birth and gender), medical conditions and disease episodes according to the International Classification of Primary Care (ICPC), drug prescriptions according to the Anatomical Therapeutic Chemical (ATC) Classification System and hospital referrals.

Study population

All patients aged ≥18 years enlisted in the participating family practices between 2000 and 2009 were included in the study. The size of this dynamic cohort did not change significantly over time.

Outcome measures

The main outcome was clinical diagnosis of ARS defined as ICPC code R75 (sinusitis) and/or ICPC code R09 (symptoms/complaints sinuses). Episodes of chronic rhinosinusitis (ICPC code R75.2) were excluded. A new episode of ARS was documented after a rhinosinusitis-free interval of at least 28 days. Secondary outcomes were the proportion of antibiotic (ATC code J01) and steroidal anti-inflammatory drug (INCS: ATC code R01 and oral corticosteroid: ATC code H02AB) prescriptions and referrals to an otorhinolaryngologist per 100 ARS episodes. In the HNU database, a direct link between a disease episode and drug prescription or referral is missing. Drug prescriptions and referrals were therefore collected from 7 days before the start of an episode until 7 days after the end of an episode.

Statistical analysis

Annual consultation rates per 1000 person-years were calculated by dividing the number of ARS episodes by the total number of person-years in a specific year. An average consultation rate was calculated for all the years combined. We performed subgroup analysis for age (18-40 and ≥40 years) and gender in order to compare consultation rates across these subgroups. We have dichotomized age to 18-40 and ≥40 years because atopic constitution (e.g. allergic rhinitis, asthma) is known to affect younger patients more commonly. Consequently, prescribing patterns of family physicians (i.e. prescription of antibiotics or corticosteroids) may be different between these age categories.

Antibiotic and steroidal anti-inflammatory drug prescriptions and referral rates were calculated as the number of prescriptions and referrals per 100 ARS episodes recorded by the family physician. In addition, we stratified prescription rates according to age, gender and atopic constitution (defined as ICPC code R97: allergic rhinitis and/or R96: asthma and/or S87: atopic dermatitis/eczema). Trend analysis over the years 2005-09 was performed by calculating rate differences (RDs) and the corresponding 95% confidence intervals (CIs). Moreover, we performed interrupted time series (ITS) analyses with segmented regression. These analyses provide information on the trend over time prior to the introduction of the revised guideline (i.e. P value for the slope over the years 2000-05), the
change in level immediately after the introduction of the revised guideline (i.e. $P$ value for the immediate effect of guidelines’ introduction in 2005) and the change in the slope of the time period before and the slope of the time period after the introduction of the revised guideline (i.e. $P$ value for the difference in slope between the years 2000–05 and 2005–09). Important assumption of this regression analysis is the fact that the error terms associated with each observation are uncorrelated. Plotting the residuals over time for both antibiotic and INCS prescription rates revealed random patterns indicating the absence of autocorrelation. Moreover, the Durbin–Watson statistic ($D–W$) appeared to be between 1.5 and 2.5 ($D–W$ for antibiotic prescription rate: 1.8 and $D–W$ for INCS prescription rate: 2.1). For the statistical analyses, SPSS version 17 (SPSS Inc., Chicago, IL) and Rothman’s EpiSheet version 11 June 2008 (http://www.daguepi.info/links/downloads/episheet.xls) was used.

Results

Study population

The total size of the cohort varied from 31,938 patients in 2000 to 35,803 in 2009, with an average number of 33,352 patients. Gender and age distribution did not change substantially over time: 53% of the patients were female and 71% were aged ≥40 years.

Clinical diagnosis of ARS

Between 2000 and 2009, a total of 5,839 patients had at least one episode of ARS; median age at the first episode was 47 years (interquartile range: 36–57) and ~63% were female. The total number of ARS episodes within the study period was 9631.

Consultation rates

The overall consultation rates of ARS revealed a stable pattern over time, with an average consultation rate of 28.9 episodes per 1000 person-years (95% CI: 28.4 to 29.5) (Fig. 1). ITS analysis revealed no significant effect of the introduction of the revised guideline.

The consultation rate for patients aged between 18 and 40 years demonstrated a significant decline (RD: -9.5, 95% CI: -14.0 to -4.9). The average ARS consultation rate was almost two times higher in females (36.3 episodes per 100 person-years, 95% CI: 35.4 to 37.2) compared to males (20.8 episodes per 100 person-years, 95% CI: 20.1 to 21.5).

Antibiotic prescriptions

Before the introduction of the revised guideline, the antibiotic prescription rate revealed a statistical significant increase: from 56 prescriptions per 100 ARS episodes (95% CI: 53 to 59) in 2000 to 62 per 100 episodes (95% CI: 59 to 65) in 2005 (RD: 6, 95% CI: 1 to 10, $P$ value for slope in ITS analysis <0.05) (Fig. 1). From 2005 onwards, the antibiotic prescription rate decreased

![Figure 1](https://academic.oup.com/fampra/article-abstract/29/6/706/452557/2380/7044052557)
to 56 per 100 episodes (95% CI: 53 to 59) in 2009 (RD: –6; 95% CI: –1 to –10). The slope between the years 2000–05 and 2005–09 revealed a statistical significant difference ($P < 0.05$).

The largest decrease was seen in the subgroup of atopic patients (Table 1). The type of antibiotic prescribed did not change substantially over time. Doxycycline was prescribed most frequently (±70% of the episodes in which antibiotics were prescribed), followed by amoxicillin and macrolides (±10%).

**Steroidal anti-inflammatory drug prescriptions**

From 2000 to 2005, the INCS prescription rate demonstrated a non-statistical significant increase: from 16 prescriptions per 100 ARS episodes (95% CI: 14 to 19) to 20 per 100 episodes (95% CI: 18 to 23) (RD: 4; 95% CI: 1 to 7, $P$ value for slope in ITS analysis = 0.11). After the introduction of the revised guideline, the INCS prescription rate increased significantly to 31 per 100 episodes (95% CI: 28 to 34) in 2009 (RD: 11, 95% CI: 7 to 15). The slope between the years 2000–05 and 2005–09 demonstrated a statistical significant difference ($P < 0.01$).

Subgroup analysis revealed similar trends (Table 1). Atopic patients received INCS more frequently compared to non-atopic patients. Over time, fluticasone was prescribed most frequently (60%–70% of the episodes in which INCS were prescribed), followed by beclometasone and mometasone (±10% to 20%).

The oral steroid prescription rates were low and demonstrated a minor increase over time (RD: 1, 95% CI: 0 to 2) (Table 1). The prescription rates were similar across the different subgroups.

**Referral rates**

The referral rates to otorhinolaryngologists for ARS revealed a stable pattern over time with an average referral rate of 2 per 100 episodes (95% CI: 1 to 2) (Table 1). ITS analysis demonstrated no significant effect of the introduction of the revised guideline. No differences were found across the different subgroups.

**Discussion**

**Summary of main findings**

From 2000 to 2009, ARS consultation rates for adults in primary care revealed a stable pattern, with an average consultation rate of ~29 episodes per 1000 person-years. Consultation rates were almost two times higher in females compared to males. From 2005 onwards, we found only a modest decrease in antibiotic prescription rates, whereas INCS prescription rates even increased over this time period.

**Strengths**

In primary care, ARS is based on clinical signs and symptoms, which includes nasal discharge, nasal congestion, reduction/loss of smell and facial pain/pressure lasting for a maximum of 12 weeks. Additional diagnostic tools such as laboratory, microbiological and imaging tests are not routinely performed in this setting prior to treatment decision. The clinical definition of ARS used in our main analysis [ICPC code R09 (symptoms/complaints sinuses) and R75 (sinusitis)] is in agreement with daily practice. A previous study, however, defined ARS as ICPC code R75 (sinusitis).1

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Table 1  Consultation and prescription rates for ARS in primary care*

<table>
<thead>
<tr>
<th>Rate in 2000 (95% CI)</th>
<th>Rate in 2005 (95% CI)</th>
<th>Rate in 2009 (95% CI)</th>
<th>Difference 2005–09 (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Consultation rate</td>
<td>30.8 (28.9 to 29.7)</td>
<td>30.1 (28.3 to 32.0)</td>
<td>28.2 (26.5 to 30.0)</td>
</tr>
<tr>
<td>Age 18–40 years</td>
<td>35.1 (31.5 to 38.9)</td>
<td>30.9 (27.5 to 34.6)</td>
<td>21.4 (18.8 to 24.4)</td>
</tr>
<tr>
<td>Age &gt;40 years</td>
<td>28.1 (26.7 to 31.2)</td>
<td>29.8 (27.6 to 32.1)</td>
<td>30.9 (28.8 to 33.2)</td>
</tr>
<tr>
<td>Male</td>
<td>21.9 (19.6 to 24.3)</td>
<td>20.4 (18.3 to 22.7)</td>
<td>18.7 (16.7 to 20.8)</td>
</tr>
<tr>
<td>Female</td>
<td>38.8 (35.9 to 41.8)</td>
<td>38.9 (36.0 to 41.9)</td>
<td>36.8 (34.1 to 39.6)</td>
</tr>
<tr>
<td>Antibiotic prescription rate</td>
<td>56 (53 to 59)</td>
<td>62 (59 to 65)</td>
<td>56 (53 to 59)</td>
</tr>
<tr>
<td>Age 18–40 years</td>
<td>61 (56 to 66)</td>
<td>67 (62 to 72)</td>
<td>58 (52 to 65)</td>
</tr>
<tr>
<td>Age &gt;40 years</td>
<td>53 (50 to 57)</td>
<td>59 (56 to 63)</td>
<td>56 (52 to 59)</td>
</tr>
<tr>
<td>Male</td>
<td>57 (51 to 62)</td>
<td>59 (53 to 64)</td>
<td>56 (51 to 62)</td>
</tr>
<tr>
<td>Female</td>
<td>56 (52 to 60)</td>
<td>63 (59 to 67)</td>
<td>56 (52 to 60)</td>
</tr>
<tr>
<td>Atopic</td>
<td>55 (47 to 62)</td>
<td>61 (55 to 67)</td>
<td>49 (44 to 54)</td>
</tr>
<tr>
<td>Non-atopic</td>
<td>56 (52 to 60)</td>
<td>63 (59 to 67)</td>
<td>56 (52 to 60)</td>
</tr>
<tr>
<td>INCS prescription rate</td>
<td>16 (14 to 19)</td>
<td>20 (18 to 23)</td>
<td>31 (28 to 34)</td>
</tr>
<tr>
<td>Age 18–40 years</td>
<td>16 (12 to 20)</td>
<td>18 (14 to 23)</td>
<td>17 (13 to 23)</td>
</tr>
<tr>
<td>Age &gt;40 years</td>
<td>17 (14 to 20)</td>
<td>21 (18 to 24)</td>
<td>35 (32 to 38)</td>
</tr>
<tr>
<td>Male</td>
<td>14 (11 to 18)</td>
<td>19 (15 to 24)</td>
<td>32 (27 to 37)</td>
</tr>
<tr>
<td>Female</td>
<td>17 (15 to 20)</td>
<td>21 (18 to 24)</td>
<td>31 (27 to 34)</td>
</tr>
<tr>
<td>Atopic</td>
<td>20 (15 to 26)</td>
<td>22 (18 to 22)</td>
<td>38 (33 to 43)</td>
</tr>
<tr>
<td>Non-atopic</td>
<td>16 (13 to 18)</td>
<td>19 (17 to 22)</td>
<td>27 (24 to 30)</td>
</tr>
<tr>
<td>Oral steroid prescription rate</td>
<td>1 (1 to 2)</td>
<td>2 (1 to 3)</td>
<td>3 (2 to 3)</td>
</tr>
<tr>
<td>Referral rate</td>
<td>2 (1 to 3)</td>
<td>2 (2 to 3)</td>
<td>2 (2 to 3)</td>
</tr>
</tbody>
</table>

*Consultation rate per 1000 person-years and prescription rate per 100 episodes.
To enhance comparability, we performed sensitivity analysis in which we restricted our outcome definition to ICPC code R75. The observed consultation rates did not change substantially over time, which were in agreement with the findings in our main analysis (ICPC code R75 and/or R09). Furthermore, the antibiotic prescription rates in this additional analysis resembled the prescription rates of our main analysis [i.e. 60 prescriptions per 100 episodes (95% CI: 59 to 61) with a slight decrease over recent years].

Other major strengths of our study are the size of the cohort and the quality of the data. The medical database of the University Medical Centre Utrecht Primary Care Research Network (HNU) comprises well-documented information of enlisted patients over the years 2000–2009. Characteristics of these patients did not differ from the overall Dutch population and main characteristics of the family physicians were comparable with total Dutch family physicians with respect to age, gender, part-time and full-time workers and practice in both urban and rural areas. In addition, all participating family physicians received continuing education regarding the correct coding of diagnostic information according to the ICPC coding system and >90% of the contacts did receive an ICPC code.

**Limitations**
Next to strengths also some potential limitations should be discussed before drawing conclusions from our findings. Firstly, the main limitation of using a medical database for research purposes is the fact that no additional information is available on the specific clinical features of patients with an episode of ARS such as duration of symptoms prior to consultation and (the absence of) fever. As a consequence, we were not able to determine to what extent the observed antibiotic prescriptions from 2005 onwards were justified according to the revised guideline or not. However, an earlier study of Akkerman et al. revealed that >20% of the antibiotic prescriptions for ARS over the years 2002 and 2003 were not in agreement with the previous ARS guideline. Given the stable consultation rates reported in our study and the strong recommendation in the revised guideline to limit the use of antibiotics in ARS, a firm decline in antibiotic prescription rates over recent years was expected when family physicians would apply its recommendations into daily practice.

Secondly, other determinants than the introduction of the revised guideline in 2005 may have modified the prescription rates over time such as access to point-of-care C-reactive protein (CRP) tests, pharmaceutical pressure to prescribe INCS and a change in patients’ expectations, knowledge and consultation behaviour. It is, however, unlikely that these determinants have had a major influence on our results. Point-of-care CRP testing is not used by family physicians in the Netherlands. Additionally, the influence of pharmaceutical pressure is likely to be limited as participating family practices did not receive pharmaceutical sales representatives. Furthermore, no public campaigns to increase patients’ knowledge on the efficacy of antibiotics in ARS were held during the study period and consultation rates remained stable over time.

Thirdly, the fact that episodes and prescriptions had to be linked to each other could be criticized. However, this procedure is inherent to database research. Moreover, we excluded prescriptions clearly prescribed for other indications (i.e. antibiotics clearly prescribed for urinary tract infections) to increase accuracy of the results.

Fourthly, misclassification due to missing data and differences in classification between the years and family physicians cannot be ruled out, and this may have resulted in either an overestimation or underestimation of the true consultation rates. It is, however, unlikely that misclassification has affected the results substantially because over 90% of the patient contacts were coded and all participating family physicians received training regarding the correct coding.

**Comparison with existing literature and clinical implications**
A previous study on consultation and prescription rates for upper respiratory tract infections in primary care revealed a significant decline in consultation rates and total antibiotic prescriptions for ARS after the introduction of the primary guideline on ARS in 1993. Nevertheless, overprescription of antibiotics remained substantial. Results of our study suggest that dissemination of a revised guideline as added to medical education regarding guidelines’ recommendations for a more judicious use of antibiotics did not lead to a further decline in overall consultation and antibiotic prescription rates for ARS. In patients aged <40 years, the consultation rate for ARS declined substantially over time. This might be explained by family physicians’ response to the guidelines to consider alternative diagnoses such as (non)allergic rhinitis in younger patients with symptoms of ARS. Subsequently, family physicians may find it hard to refrain from prescribing antibiotics once ARS is diagnosed in these patients.

Our main findings are in agreement with data on total antibiotic use in the Netherlands over the past decade (http://app.esac.ua.ac.be/public) and may reflect the fact that it is difficult for family physicians to go under the current level of antibiotic prescription rates in the Netherlands, even though that rate still represents a substantial overuse. It could well be that the current Dutch level of antibiotic use for a troublesome infection like ARS is difficult to improve further due to pressure of patients and the inclination of physicians to do something, even when this is not evidence-based.

A previous trial on antibiotics demonstrated beneficial effects in ARS patients in which the diagnosis is...
confirmed by the presence of air-fluid level or total opacification on computed tomography scanning. As a consequence, there may be a subgroup among clinically diagnosed ARS patients who do benefit from antibiotics. Unfortunately, such subgroups could not be identified by a recent meta-analysis of individual patient data. Until such subgroups have been identified, antibiotics should only be considered in patients with a complicated course of ARS.

To further rationalize antibiotic use, additional tools are perhaps needed to help family physicians and their patients. Cals et al. recently demonstrated that the use of a near patient test and specific communication training could reduce antibiotic use for lower respiratory tract infections still substantially, even in a low prescribing country like the Netherlands. In addition, current evidence reveals that also local circumstances, like organization of health care and patients’ expectations, play a pivotal role when trying to rationalize the use of medical treatment. Nowadays, it is, however, unknown which combination of interventions lead to the highest and sustainable reduction of antibiotic prescriptions in daily practice. Currently, therefore, our research group is collaborating in both national and international research projects to determine and evaluate the most effective strategy in different settings.

Next to increasing family physicians’ awareness on a more appropriate prescribing behaviour, public beliefs towards antibiotics may also be an important target for intervention in order to reduce unnecessary prescriptions. Increasing patients’ knowledge on the ineffectiveness of antibiotics in clinically diagnosed ARS by patient educational materials and public campaigns might reduce consultation rates and, subsequently, antibiotic prescriptions in daily clinical practice.

Conclusions

This study reports a stable pattern of consultation rates for ARS over the period 2000–09. Moreover, we found only a modest decrease in antibiotic prescription rates over recent years, whereas INCS prescription rates even increased. This daily practice is not in agreement with recommendations of the revised ARS guideline to restrict the use of antibiotics and INCS in this condition.

Acknowledgements

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Declaration

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Ethical approval: not applicable.

Conflict of interest: none.

References