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ORIGINAL ARTICLE

Trends in number of consultations and antibiotic prescriptions for respiratory tract infections between 1999 and 2005 in primary healthcare in Kalmar County, Southern Sweden

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Abstract

Background. Respiratory tract infections (RTIs) comprise the most common indication for consulting a general practitioner and obtaining an antibiotic prescription. **Objective.** To study changes in the number of visits, diagnoses, and antibiotic prescriptions for RTI in primary healthcare during the period 1999–2005. **Design.** A retrospective, descriptive, population-based study of electronic patient records. **Setting.** County of Kalmar in southeastern Sweden. **Patients.** Patients visiting primary healthcare units in Kalmar County for an RTI between 1 July 1999 and 31 December 2005. **Main outcome measures.** RTI diagnoses, antibiotic prescriptions, age groups. **Results.** A total of 240 447 visits for RTI made between 1999 and 2005 were analysed. The yearly consultation rates for the diagnoses acute tonsillitis and AOM decreased by 12% and 10%, respectively ($p < 0.001$). Of all patients consulting for an RTI diagnosis, 45% received antibiotics. Of all prescribed antibiotics, 60% were for phenoxymethylpenicillin (PcV) and 18% doxycycline. Amoxicillin or amoxicillin + clavulanic acid was prescribed to a lesser extent. The proportion of patients obtaining an antibiotic prescription was almost constant over time (44–46%). The prescriptions of doxycycline showed increasing values (NS). The prescriptions of remaining antibiotics decreased significantly especially for patients up to middle age. **Conclusion.** This large population study, comprising more than six years of observations, showed the number of primary healthcare patients receiving an RTI diagnosis decreased during the period 1999–2005, but the proportion of patients receiving an antibiotic prescription remained the same. The large seasonal variations indicate a need for further interventions to decrease antibiotic use for RTIs.

Key Words: Antibiotics, electronic patient records, family practice, general practice, phenoxymethylpenicillin (PcV), primary healthcare, respiratory tract infections

Respiratory tract infections (RTIs) are the most common reason for consulting a general practitioner (GP) [1,2]. Most antibiotics are prescribed in primary care for such symptoms despite the fact that most are caused by viruses [3,4]. The benefit of antibiotic treatment for most RTIs is limited, only marginally affecting symptoms and recovery time [5].

Increasing use of antibiotics and the spread of multiresistant pneumococci in Sweden in the 1990s [6,7] incited the formation of Strama (the Swedish strategic programme for rational use of antibiotics and surveillance of resistance) in 1995. Strama played a major part in the reduction of antibiotic

use in Sweden between 1995 and 2005 [8] by an average of 22%, and for children by 50% [9]. In addition, new guidelines were developed for the treatment of acute otitis media in 2000 [10], acute sore throat in 2001 [11], and acute rhinosinusitis in 2005 [12], which may have influenced antibiotic prescription rates in outpatient care. Furthermore, diagnosis-prescribing studies performed in primary care during one week in the year 2000, 2002, and 2005 have shown that antibiotic prescribing can be further improved and has indicated that the visit rates for RTI have declined [8,13]. However, the results of such short study periods may be influenced by epidemics and can be questioned.

Antibiotics for respiratory tract infections are a cause of constant concern in this era of increasing bacterial resistance.

- The diagnoses acute tonsillitis and AOM decreased by 10%/12% per year during the study period 1999–2005.
- Independent of decreasing yearly consultation rates for RTI, the proportion of patients obtaining an antibiotic prescription was almost constant over time (44–46%).
- Antibiotic prescriptions for patients below age 45 decreased significantly for all antibiotic classes except tetracycline.
- The seasonal variation in antibiotic prescribing indicates that antibiotics are still used more than necessary.

The aim of this study was to describe changes in the number of consultations for RTI, diagnostic categories and antibiotic prescriptions in a Swedish county over a six year period.

Material and methods

Setting and population

In the middle of the study period (31 December 2002) the population of Kalmar County comprised 234 627 individuals, 118 070 women and 116 557 men [14].

Some 32 primary healthcare centres and several private healthcare providers serve the population of Kalmar County. In this study, the 21 primary healthcare centres and two private healthcare providers using the same electronic patient record (EPR) system participated from 1 January 1999 to 31 December 2005.

Material and methods

The database of the EPR system Swedestar was accessible online, allowing extraction and analysis of patient data. All patients visiting the primary healthcare centre were registered on the electronic patient data system and identified by their social security numbers. The registration of diagnoses using a primary care adapted, ICD-10 [15] based classification system, the so-called KSH 97P [16], was compulsory. The registration of diagnoses was exclusively by physicians.

When using the integrated drug-prescribing module, all drugs were automatically registered according to the Anatomical Therapeutic Chemical Classification System (ATC) [17].

All general practitioner (GP) consultations (office and out-of-office hours), receiving an RTI diagnosis according to the current classification KSH 97P were included. Rare diagnoses or combined diagnoses with a consultation frequency lower than 1000 of the 240 447 included consultations were classified as “others”. For selected analyses, common cold, pharyngitis, tonsillitis, acute otitis media, sinusitis, and laryngitis were grouped together as “upper respiratory tract infections” (URTIs) and influenza, acute bronchitis, and pneumonia as “lower respiratory tract infections” (LRTIs). Similarly, rare antibiotics and less common combinations were lumped together.

The following data were extracted from electronic patient records: date of consultation, age, gender, diagnosis, and prescribed antibiotics (ATC code). Data were extracted quarterly from July 1999 to December 2005 and further presented from July to June to avoid the influence of viral epidemics.

The study was approved by the regional ethical review board in Linköping. (Dnr M40-07)

Statistics

Most data were descriptive and units are described in figure legends and tables. Trends were analysed by linear regression analysis using logarithmic data on counts (number of visits) as the dependent variable, and quarter of years (from third quarter 1999 to last quarter 2005; $n=26$) as the independent. This allows the change to be expressed in per cent per year ($\% \Delta/\text{yr}$) by multiplying the regression coefficient by 400 (quarter to year and absolute values to percent).

Results

The 23 participating healthcare centres had a total list comprising 146 454 individuals.

During the observation period, 1 July 1999 to 31 December 2005, a total of 240 447 consultations for an RTI diagnosis were registered corresponding to 257 consultations/1000 inhabitants per 12-month period. The gender distribution was 43% males and 57% females and the median age was 27 years.

The most common RTI diagnoses are illustrated in Table I. Consultations for acute tonsillitis, AOM, pharyngitis, and laryngitis decreased significantly ($p < 0.008$). There were large seasonal fluctuations of consultations with peaks during the periods December to May (Figure 1). Similar fluctuations were observed for the prescribing of antibiotics (Figure 2). The proportion of patients receiving an antibiotic prescription related to number of visits was almost constant over the quartiles (44–46%).

Table I. Number of physician consultations for the most common diagnoses during the studied six complete infectious seasons between January 2000 and December 2005.

	2000	2001	2002	2003	2004	2005	Total	%Δ/yr	r	p-value
Common cold	11 813	14 816	13 448	11 695	10 418	11 525	73 715	−3.7%	−0.26	0.192
Tonsillitis	6144	6018	4698	4751	4255	3044	28 910	−11.7%	−0.81	0.000
AOM	4962	5673	5480	4076	3422	3464	27 077	−10.0%	−0.65	0.000
Acute bronchitis	3605	4073	3788	3350	3289	4055	22 160	−0.6%	−0.05	0.801
Sinusitis	3069	3299	3195	2774	2788	3048	18 173	−2.5%	−0.17	0.405
Pneumonia	2486	2461	2198	2007	1944	2629	13 725	−1.1%	−0.09	0.653
Pharyngitis	2181	2335	2080	2034	2033	1831	12 494	−3.5%	−0.51	0.007
Influenza	543	493	363	152	159	402	2112	−14.5%	−0.20	0.337
Laryngitis	189	201	195	198	146	171	1100	−6.4%	−0.51	0.008
Others	3683	3853	3723	3333	3515	3981	22 088	—		
Total	38675	43222	39168	34370	31969	34150	221554			

Notes: Correlations shown in bold are significant at $p < 0.05$. %Δ/yr = relative yearly change (%) during the observation period 1999–2005. r is the correlation coefficient.

The proportion of consultations for an URTI that resulted in an antibiotic prescription was 50% in 2000 and 42% in 2005 and for a LRTI 55% in 2000 and 57% in 2005.

A total of 107 990 antibiotic prescriptions were registered (Table II). Antibiotics were prescribed most frequently to patients aged 18–44. Phenoxy-methylpenicillin (PcV) was the most prescribed antibiotic and accounted for 60% of all antibiotics prescriptions.

The percentage of PcV was higher in the age groups 0–6 (69%), 7–17 (77%), and 18–44 (65%) and lower in the age groups 45–64 (43%), 65–74 (35%), and ≥ 75 (34%) (see Table II). Doxycycline was the second most prescribed antibiotic with 19 556 prescriptions (18%). The percentage of prescriptions increased after 45 years of age and doxycycline dominated all antibiotic prescriptions after age 65. Amoxicillin or amoxicillin combined with clavulanic acid were most often used in the age group 0–6 (4% and 2%, respectively). Erythromycin

(90% of all macrolides) and cephalosporins were prescribed less frequently for all age groups (see Table II).

During the study period, the use of all antibiotic classes except doxycycline decreased significantly particularly in patients under 44 (Table III, and see Figure 2).

Discussion

Summary of main findings

The overall consultation rate and diagnoses of acute tonsillitis, AOM, pharyngitis, and laryngitis decreased significantly but remained unchanged for common cold, acute sinusitis, pneumonia, acute bronchitis, and influenza between 1999 and 2005.

The average number of consultations for an RTI per 1000 inhabitants was 257 and 45% of patients received an antibiotic prescription. PcV accounted for 60% of all prescribed antibiotics followed by doxycycline (18%). Antibiotic prescriptions for patients

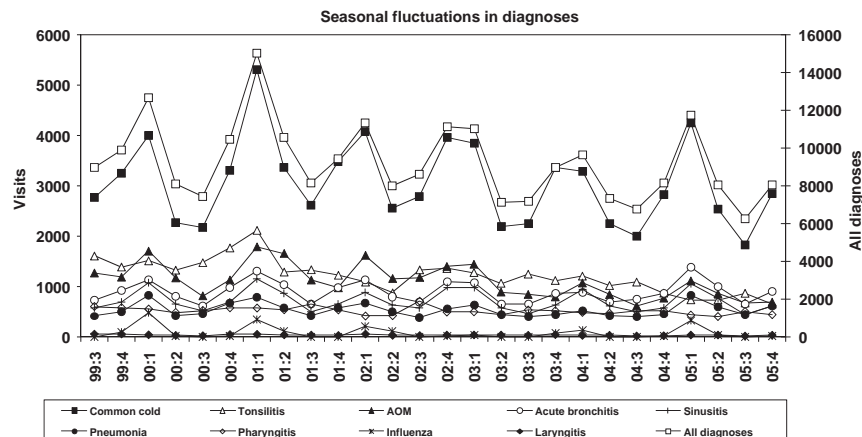


Figure 1. Trends from July 1999 to December 2005 of number of physician visits calculated for the most common respiratory tract infections from July 1999 to December 2005. Note: The sum of all diagnoses is shown on the right-hand scale, individual diagnoses on the left.

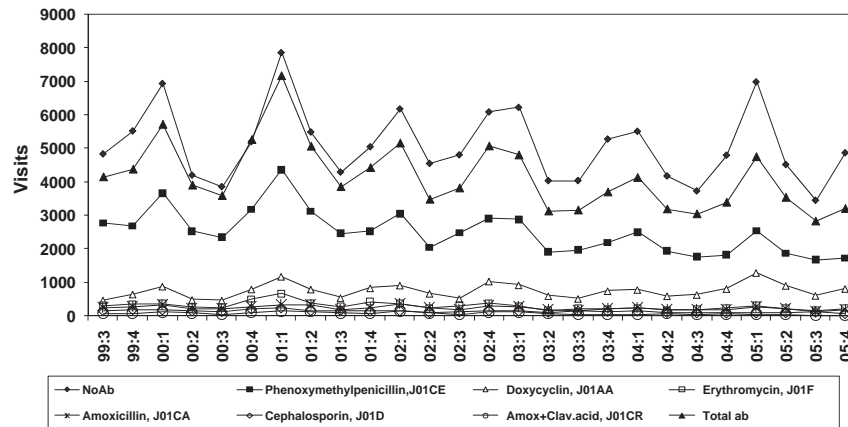


Figure 2. Trends from July 1999 to December 2005 of number of physician visits calculated for the most commonly used antibiotics from July 1999 to December 2005. Note: No antibiotics represents consultations where no antibiotic was prescribed.

below age 45 decreased significantly for all antibiotic classes except tetracycline.

Strengths and limitations

The EPR system is well implemented in the daily routines and registration of the diagnosis (KSH 97Pcode [16]) and prescriptions is mandatory. EPRs have been suitable for describing consultation rates, diagnoses, and antibiotic prescribing in primary care [18,19]. There are some limitations using retrospective data from EPRs. Control visits cannot be distinguished from acute visits which may overestimate the number of cases of acute otitis media and pneumonia. In addition, the criteria for diagnostic labelling used by different physicians have been shown to be variable and antibiotic treatment may also influence the choice of diagnosis.

The strength of this study was in following an entire population for six years, including all consultations for RTI ($n=240\ 447$). The included

population in Kalmar County did not change significantly from 1999 to 2005 for gender, age distribution, or size ($235\ 391 \rightarrow 233\ 944$). The list sizes of analysed units remained constant, with only small fluctuations. We chose to present estimations based on single diagnoses. The remaining 10% of unusual diagnoses/diagnosis combinations and 3.6% of unusual antibiotics/antibiotic combinations, which statistically only slightly influenced the prescription and diagnosis changes over time, are presented in Table I and II as “others”.

Comparisons with similar studies

Our study showed that consultations for RTI decreased by 23% between 1999/2000 and 2004/2005. This finding was in accordance with studies from England [20–22], the USA [23], and the Netherlands [3,24]. However, these studies reported data prior to 2001 while we found no studies reporting data after 2001.

Table II. Relative antibiotic prescription pattern calculated for each age group, including consultations where an antibiotic was not prescribed (no antibiotics).

	Age 0–6	Age 7–17	Age 18–44	Age 45–64	Age 65–74	Age >74	Total (%)	Total (abs)
No antibiotics	59%	54%	52%	54%	55%	59%	55%	132457
Phenoxyethylpenicillin (J01CE)	29%	35%	30%	20%	16%	14%	27%	64864
Doxycycline (J01AA)	0%	1%	8%	17%	21%	19%	8%	19556
Erythromycin (J01F)	3%	4%	4%	3%	2%	1%	3%	7763
Amoxicillin (J01CA)	4%	2%	2%	3%	3%	3%	3%	6475
Cephalosporin (J01D)	1%	2%	2%	1%	1%	2%	2%	3633
Amoxicillin and clavulanic acid (J01CR)	2%	1%	0%	0%	0%	0%	1%	2053
Others	1%	2%	1%	1%	2%	2%	2%	3646
Total	100%	100%	100%	100%	100%	100%	100%	
Visits total (abs)	54804	42575	69163	43496	14504	15905	240447	
Antibiotics total (abs)	22655	19538	33002	19791	6528	6476	107990	

Note: (abs) = absolute values.

Table III. Changes over time in number of prescriptions of antibiotics in the various age groups.

Treatment	Age 0-6			Age 7-17			Age 18-44			Age 45-64			Age 65-74			Age >74		
	%Δ/yr	r	p	%Δ/yr	r	p	%Δ/yr	r	p	%Δ/yr	r	p	%Δ/yr	r	p	%Δ/yr	r	p
No antibiotics	-4.5	-0.27	0.181	-7.8	-0.51	0.008	-3.6	-0.40	0.043	1.4	0.12	0.547	2.4	0.19	0.364	2.9	0.22	0.271
Phenoxymethylpenicillin	-9.4	-0.53	0.005	-12.6	-0.75	0.000	-8.8	-0.77	0.000	-4.7	-0.46	0.019	-4.1	-0.30	0.134	-1.9	-0.15	0.477
Doxycycline	—	—	—	6.8	0.21	0.305	2.1	0.13	0.538	4.5	0.27	0.181	4.1	0.28	0.162	4.7	0.32	0.112
Erythromycin	-12.5	-0.47	0.016	-12.0	-0.48	0.013	-11.6	-0.72	0.000	-6.2	-0.44	0.025	-0.4	-0.02	0.929	-7.4	-0.33	0.100
Amoxicillin	-10.7	-0.47	0.015	-14.5	-0.70	0.000	-8.0	-0.51	0.007	1.4	0.16	0.429	1.5	0.08	0.686	-0.4	-0.02	0.925
Cephalosporin	-22.5	-0.79	0.000	-11.7	-0.66	0.000	-15.2	-0.80	0.000	-6.6	-0.48	0.013	5.6	0.18	0.369	-0.4	-0.02	0.922
Amox + Clavulanic acid	-19.2	-0.64	0.000	-13.4	-0.53	0.006	-10.9	-0.41	0.039	5.3	0.13	0.526	2.2	0.07	0.757	5.6	0.21	0.398

Note: "No antibiotics" represents consultations where an antibiotic was not prescribed. Correlations shown in bold are significant at $p < 0.05$. %Δ/yr = Relative yearly change (%) during the observation period 1999-2005. r is the correlation coefficient. All the statistically significant trends are de facto decreasing (negative %Δ/yr values (slopes)). Doxycycline is not used in age group 0-6.

The number of consultations for RTI per 1000 inhabitants and year averaged 257 in our study, nearly identical to the findings of 273 for the year 2000 in an English study [22]. There, the proportion of consultations for RTI prescribing an antibiotic was 67%, which is in contrast to an average of 45% in our study. Analysing our data from 2005, antibiotics were prescribed to 42% of upper RTIs and 57% of lower RTIs, in comparison with approximately 65% of upper RTIs and 85% of lower RTIs in the study by Ashworth in 2000 [22]. Thus, it appears as if both populations have similar consulting behaviour, but the GPs have different prescribing habits.

The total antibiotic use in outpatient care in Sweden, measured by defined daily doses, was 13.3/1000 inhabitants and day in 2002 and 13.1 in Kalmar County, and by number of prescriptions/1000 inhabitants per year 473 in 2000, and 426 in 2005 in Sweden, and 440 and 406, respectively, in Kalmar County. We consider our results to be representative of Sweden due to the size of our study population and the similarity regarding antibiotic use between Sweden and Kalmar County. In addition, the pattern of results was similar to results from Östergötland County [18] where antibiotics were prescribed in 47% of all cases of which 61% received PcV and 18% doxycycline. Decreasing consultation trends and prescribing antibiotics have also been reported in three Swedish diagnosis and prescription surveys. In these studies 56 (2000), 54 (2002), and 49% (2005) of patients consulting GPs for RTI obtained a prescription for antibiotics [13,25,26].

Common cold was the most common diagnosis for all years (see Table I, Figure 1). The decrease in yearly consultation rates was most evident for acute tonsillitis and AOM. This decline was probably due to the new guidelines for AOM in 2000 [10] and sore throat in 2001 [11]. In the new guidelines for AOM, it was possible to refrain from antibiotic treatment during the first three symptomatic days in children > 2 years of age. However, the new guidelines do not appear to have been implemented in the year 2000 in Kalmar County, since a decline in frequency was first noted only for the season 2003-2004 (see Table I). Instead, the decline coincided with a randomized study on AOM in the county [27] including information to all GPs and the media.

The decrease in frequency of acute tonsillitis, however, coincided with the introduction of the new guidelines for the treatment of sore throat, in Sweden equivalent to the diagnoses acute tonsillitis and acute pharyngitis in ICD 10P [11].

In this guideline, it was stressed that patients with any other viral symptoms should be diagnosed as viral infections, i.e. common cold or pharyngitis. Antibiotics should only be considered for patients with >2 Centor criteria [28] and a rapid test indicating presence of Group A streptococci.

PcV is the drug of choice in Sweden in most RTIs and our study confirmed a high use of PcV especially for younger patients. In most other countries, amoxicillin or amoxicillin in combination with clavulanic acid and macrolides form the first-line antibiotics for RTIs, although dosage and treatment length may vary substantially [29,30]. The observed high use of tetracycline is not supported by Swedish guidelines, but has been noted in prior studies [8,18,26,31].

Low seasonal variation in antibiotic use is regarded as a quality indicator of rational antibiotic use [32]. The high seasonal variation in antibiotic prescribing in our study indicates that antibiotics are still used more than necessary for RTIs. A national study on weekly antibiotic use and incidence of influenza between 1998 and 2002 indicated similar seasonal variations in antibiotic use and a coincidental relationship between the peaks of diagnosed influenza and antibiotic utilization in 2003 [31]. In our study, diagnosed influenza cases were few but could, of course, have caused some bacterial complications in the lower respiratory tract.

Conclusions

In this six-year, population-based study, antibiotic prescriptions for RTIs decreased, as did consultation rates. The large seasonal variation indicates further possibilities to decrease antibiotic prescription. Knowledge of indications for antibiotics and changes over time is a prerequisite for interventions targeting the expectations of the population and prescribing habits of physicians.

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There were no conflicts of interest.

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