Scandinavian Journal of Infectious Diseases, 2008; 40: 648–654

informa
healthcare

ORIGINAL ARTICLE

Diagnosis-prescribing surveys in 2000, 2002 and 2005 in Swedish general practice: Consultations, diagnosis, diagnostics and treatment choices

MALIN ANDRÉ[1], ÅSA VERNBY[2], INGA ODENHOLT[3], CECILIA STÅLSBY LUNDBORG[4], INGE AXELSSON[5], MARGARETA ERIKSSON[6], ARNE RUNEHAGEN[7], ÅKE SCHWAN[8] & SIGVARD MÖLSTAD[9]

From the [1]Centre for Clinical Research, Dalarna, Falun, [2]Department of Public Health Sciences, Division of International Health (IHCAR), Karolinska Institute, Stockholm, [3]Infectious Diseases Research Unit, Department of Clinical Sciences, Malmö, Lund University, [4]Department of Public Health Sciences, Division of International Health (IHCAR), Karolinska Institute, Stockholm, and Nordic School of Public Health and Apoteket AB, Göteborg, [5]Lovisenberg Deaconal University College, Oslo, [6]Department of Paediatrics, Karolinska Hospital, Stockholm, [7]Department of Infectious Disease Control, Central Hospital of Växjö, Växjö, [8]Department of Public Health and Caring Sciences/Family Medicine, Uppsala University, Uppsala, and [9]Unit of R & D in Primary Health Care, Jönköping, Sweden and Department of Medicine and Health Sciences, Linköping University, Sweden

Abstract

The aim of this study is to present diagnostic patterns, diagnostics used and antibiotic treatment in relation to guidelines in 3 repeated diagnosis-prescription studies conducted simultaneously in general practice in 5 Swedish counties, during 1 week in November 2000, 2002 and 2005. General practitioners (GPs) at the participating health centres were asked to complete a form for all patients with symptoms of an infectious disease. During the studied periods a total of 15,371 consultations was registered. Consultations with GPs diagnosed as respiratory tract infection (RTI), especially consultations for sore throat, decreased considerably between y 2000 and 2005. The percentage of patients allocated an RTI diagnosis and prescribed an antibiotic declined significantly from 54% to 49% and the decline was most pronounced among children. Penicillin V remained the dominant antibiotic prescribed throughout the study periods. For lower urinary tract infections there was a significant change in choice of prescribed antibiotics with an increase for pivmecillinam and nitrofurantoin and a decrease for trimethoprim, in accordance with recommendations. The results indicate a quite close adherence to current guidelines, with changes in the pattern of consultations as well as in the management of infectious diseases in general practice in Sweden.

Introduction

Excessive antibiotic use is a risk factor for increased development of bacterial resistance. In Sweden antibiotic outpatient use peaked in 1993 at 18.8 defined daily doses/1000 inhabitants (DID) and decreased to 14.5 DID in 2005 [1]. STRAMA, the Swedish strategic programme against antibiotic resistance, was formed in 1995. STRAMA has initiated updating of guidelines concerning acute otitis media (2000), acute pharyngotonsillitis (2001) and acute sinusitis (2005) [2–4], and given recommendations for choice of antibiotics for lower urinary tract infections [5]. Moreover, STRAMA has carried out educational activities for personnel working with children in day care and the elderly in nursing homes [1]. However, in order to design adequate support and further interventions, continuous data on management of infectious problems are needed. In Sweden, data on antibiotic sales from wholesalers has been available since 1971 and data on all prescriptions have been available since 1996. It is, however, impossible to assess the rationality of antibiotic prescribing or the adherence to treatment guidelines relying on solely antibiotic sales data.

Correspondence: M. André, Centre for Clinical Research, Nissers väg 3, SE-791 82 Falun, Sweden. E-mail: Malin.Andre@ltdalarna.se

(Received 29 June 2007; accepted 21 January 2008)

ISSN 0036-5548 print/ISSN 1651-1980 online
DOI: 10.1080/00365540801932439

Therefore, STRAMA initiated a diagnosis-prescribing survey focusing specifically on infectious diseases in general practice [6]. In Sweden approximately 90% of antibiotics are prescribed to outpatients, and 50% of these are prescribed in general practice [1]. The survey has now been conducted in 5 counties 3 times, in the y 2000, 2002 and 2005.

The aim of this study was to investigate the pattern of diagnoses regarding consultations for infectious diseases in general practice in Sweden, diagnostics used and antibiotic treatment in relation to guidelines during these y.

Material and methods

Repeated cross-sectional prospective studies were conducted simultaneously at health centres in 5 counties (Östergötland, Uppsala, Kronoberg, Dalarna, Jämtland) with a total of 1.2 million inhabitants, during 1 week in November 2000, 2002 and 2005. The week in November was chosen to minimize the risk of influenza or respiratory syncytial virus outbreaks that might influence the study. The participating counties were selected prior to the first survey in 2000 to reflect both high and low antibiotic prescribing counties in Sweden, corresponding approximately to the Swedish average in antibiotic prescribing, and to achieve geographical spread.

All health centres, approximately 160 in total, in the participating counties were contacted and most, 135, agreed to participate. All general practitioners (GPs) at the participating health centres were asked to complete a form for every patient with symptoms of an infectious disease. Nurses were not included since they do not have the right to prescribe antibiotics in Sweden. The form was to be completed irrespective of whether or not the patient was prescribed an antibiotic. The form included items on age, gender, time of visit, duration of symptoms, use of diagnostic tests, diagnosis, referrals and in cases when a systemic antibiotic was given, the type of antibiotic and duration of treatment. In most cases closed questions with pre-set alternatives were used. From 1 county, Östergötland, data from the electronic patient register regarding number of visits for respiratory tract infections (RTIs) were obtained for the y of 2000 and 2005 to validate possible changes in consultation rates. To make an overall validation, data were collected from each participating county on all dispensed antibiotics for the week of the study, and for the week before and after. This was carried out on aggregated level in 2000 and at health centre level in 2002 and 2005.

The data were entered directly into SPSS in 2000 and into a tailor-made Access application in 2002 and 2005, and then transferred into SPSS 14.0 for analysis. For each y each record was checked for entry errors by a statistician and a pharmacist and for medical inconsistencies by an experienced GP. Percentages and corresponding 95% confidence intervals are presented for most estimates. The difference in age distribution over the 3 y was tested using the non-parametric Kruskal-Wallis test, chosen because of the skewness of the age distribution.

Results

The number of registered consultations for a suspected infectious disease decreased by 39% between the y 2000 and 2005, while the number of participating health centres was approximately the same. Data from an electronic patient record register from 1 of the counties included, Östergötland, showed a decrease of 36% in the number of visits to GPs for RTIs between these y (Sven Engström, personal communication). When total prescribing in the counties was compared using registry data for the study week and the weeks preceding and following that week, only minor differences were found.

Table I shows background characteristics of the patients. The median age of the patients was significantly ($p < 0.001$) higher in 2005 (32 y), compared with the earlier y (29 y in 2000 and 2002), owing to a combined effect of relatively more patients above 80 y and relatively fewer participants under the age of 15 y. Consultations in children <15 y were evenly divided between the genders but in the older ages the proportion of males was only about one-third and no significant change was seen

Table I. Number of consultations for infectious disease, percentage of females, antibiotic prescribing and age distribution in 2000, 2002 and 2005.

Y	2000	2002	2005
Number of consultations	6207	5390	3774
Females %	59.3	59.5	59.2
(95 % CI)	(58.1–60.5)	(58.2–60.9)	(57.6–60.8)
Antibiotic prescribing %	60.1	58.2	57.3
(95 % CI)	(58.9–61.4)	(56.9–59.5)	(55.8–58.9)
Age distribution			
Age missing	1.3	1.9	2.8
(95 % CI)	(1.0–1.5)	(1.5–2.2)	(2.3–3.3)
0–7 y	22.2	23.4	21.7
(95 % CI)	(20.0–24.4)	(21.0–25.7)	(18.9–24.5)
8–14 y	11.3	10.2	8.4
(95 % CI)	(9.0–13.7)	(7.7–12.8)	(5.4–11.5)
15–64 y	51.3	51.8	51.4
(95 % CI)	(49.6–53.1)	(50.0–53.7)	(49.2–53.6)
>64 y	13.9	12.7	15.7
(95 % CI)	(11.6–16.2)	(10.3–15.2)	(12.8–15.2)

over the 3 y. Referrals constituted a small percentage of all treatments (1.3%), and no significant change in referral rate was seen over the 3 y. RTIs comprised 71% of all registered infectious episodes in 2000 (95% CI 70–72) and 2002 (95% CI 69–72) and decreased thereafter significantly to 63% in 2005 (95% CI 61–64), with the most pronounced decrease among consultations for sore throat (Table II). In children <15 y, 84% of the consultations were diagnosed with an RTI.

The percentage of all infectious episodes that resulted in an antibiotic being prescribed was significantly lower in 2005 (57%, 95% CI 56–59) than in 2000 (60%, 95% CI 59–61) (Table I). For all RTIs, there was a significant decrease in patients prescribed an antibiotic from 54% (95% CI 5–55) in 2000 to 49% (95% CI 47–51) in 2005 (Table III). The change was most evident for children <15 y (Figure 1). For patients with a throat infection, the percentage of patients prescribed an antibiotic was constant between 2000 (70%, 95% CI 67–73) and 2002 (71%, 95% CI 68–74) and then decreased significantly in 2005 (62%, 95% CI 57–66). In patients allocated the diagnosis acute otitis media (AOM) and acute sinusitis there was no significant change in the proportion of patients who were prescribed an antibiotic over the 3 y (Table III). No significant change in the proportion prescribed antibiotics was seen for patients with urinary tract infections (UTIs), or for patients with skin and soft-tissue infections (SSIs), but the relative number of SSIs increased.

Phenoximethylpencillin (penicillin V) was the most commonly prescribed antibiotic for RTIs, and there was no significant change in the choice of antibiotics for the different RTI diagnoses over the y (Table III). Table IV shows the antibiotics used for women 16 y of age or older diagnosed with lower UTI. The prescribing of pivmecillinam increased significantly from 2002 (31%, 95% CI 27–35) to 2005 (51%, 95% CI 46–55) while prescribing of trimethoprim decreased significantly, from 2002 (38%, 95% CI 34–42) to 2005 (20%, 95% CI 17–24). No significant change was noted in the use of quinolones for lower UTIs. The relative use of nitrofurantoin increased significantly from 2000 (3.5%, 95% CI 2.0–4.9) to 2002 (7.6%, 95% CI 5.2–9.9) with a further increase in 2005, which not was significant. For all patients with SSIs prescribed an antibiotic, most were prescribed isoxazolylpenicillins and no significant change was seen over the 3 y (Table III).

The use of rapid antigen detection test Strep-A for all RTI patients showed a significant steady decrease over the 3 y, from 30% of consultations (95% CI 29–31) in 2000, to 26% (95% CI 24–27) in 2002, and then to 23% (95% CI 21–24) in 2005 (Table V). For throat infections only there was a decrease from 73% in 2000 to 71% in 2002, and to 69% in 2005, but these decreases were not significant. The proportion of RTIs where near-patient C-reactive protein

Table II. Distribution of diagnoses, number, percentage of all diagnoses and percentage within diagnosis group in 2000, 2002 and 2005.

	2000			2002			2005		
Diagnosis	*n*	% of all	% within group	*n*	% of all	% within group	*n*	% of all	% within group
Respiratory tract infections (RTI)	4403	70.9	100	3817	70.8	100	2374	62.9	100
Common cold[a]	1149	18.5	26.1	1343	24.9	35.2	799	21.2	33.7
Throat infection[b]	1078	17.4	24.5	733	13.6	19.2	426	11.3	18
AOM[c]	536	8.6	12.2	510	9.5	13.4	279	7.4	11.8
Acute sinusitis	347	5.6	7.9	461	8.6	12.1	214	5.7	9
Acute bronchitis	384	6.2	8.7	272	5	7.1	249	6.6	10.5
Acute pneumonia[d]	351	5.7	8	186	3.5	4.9	204	5.4	8.6
AECOPD[e]	73	1.2	1.7	73	1.4	1.9	46	1.2	1.9
Other & unspecified RTI[f]	485	7.8	11	239	4.4	6.3	146	4.2	6.7
Urinary tract infections (UTI)	869	14	100	696	12.9	100	582	15.4	100
Lower UTI[g]	773	12.5	89	607	11.3	87.2	521	13.8	89.5
Upper UTI	47	0.8	5.4	53	1	7.6	33	0.9	5.7
Urethritis	49	0.8	5.6	36	0.7	5.2	28	0.7	4.8
Skin and soft-tissue infections	482	7.8	100	500	9.3	100	434	11.5	100
Other infections	417	6.7	100	327	6.1	100	312	8.3	100
All	6207	100	100	5390	100	100	3774	10.2	100

[a]includes otitis simplex.
[b]includes streptococcal tonsillitis, recurrent tonsillitis and pharyngitis.
[c]AOM: acute otitis media, includes recurrent AOM.
[d]includes atypical pneumonia.
[e]AECOPD: acute exacerbation of chronic obstructive pulmonary disease.
[f]includes infectious cough and influenza.
[g]includes recurrent UTI.

Table III. Percentage of cases per antibiotic and distribution over diagnosis per antibiotic for respiratory tract infections (RTI), urinary tract infections (UTI) and skin and soft-tissue infections (SSI) in 2000, 2002 and 2005.

	Antibiotic prescribed			PenicillinV J01CE02[g]			Tetracyclines J01AA[g]			Amoxicillin J01CA04[g]			Amoxicillin-clavulanic acid J01CR[g]			Cephalosporins J01DA[g]			Macrolids & Linkosamides J01FA[g] & J01FF[g]			Other antibiotic		
RTI	% of cases			% of antibiotics			% of antibiotics			% of antibiotics			% of antibiotics			% of antibiotics			% of antibiotics			% of antibiotics		
Y	00	02	05	00	02	05	00	02	05	00	02	05	00	02	05	00	02	05	00	02	05	00	02	05
Common cold[a]	6.4	8.0	6.1	56.8	61.7	59.2	20.3	14.0	22.4	9.5	11.2	6.1	1.4	0.9	6.1	2.7	3.7	4.1	8.1	6.5	2.0	1.4	1.9	4.1
Throat infection[b]	70.1	71.9	62.0	84.3	82.7	80.7	0.5	0.8	1.5	0.8	0.8	1.5	0.4	0.4	0.8	8.6	6.8	13.6	4.6	7.8	8.7	0.8	0.8	6.8
AOM[c]	91.0	92.2	93.2	75.8	77.0	78.8	0.0	0.6	0.0	8.4	8.5	11.9	7.6	7.4	3.8	3.3	1.1	3.5	2.5	3.2	2.7	2.5	2.1	2.7
Acute sinusitis	93.7	92.8	91.6	63.7	58.9	66.8	20.0	21.0	20.9	9.5	9.3	6.6	2.5	2.8	2.6	0.9	3.3	1.0	3.1	4.0	2.0	0.3	0.7	1.0
Acute bronchitis	50.3	46.7	53.0	33.2	28.3	36.4	42.0	52.8	49.2	10.9	9.4	6.1	1.0	0.8	0.0	1.0	2.4	1.5	9.8	4.7	6.1	2.1	1.6	2.3
Acute pneumonia[d]	90.9	94.6	87.7	31.3	38.1	33.5	32.0	33.5	31.8	2.8	4.0	6.1	1.6	1.7	2.2	3.1	2.3	1.7	28.5	19.3	25.1	0.6	1.1	1.1
AECOPD[e]	86.3	79.5	80.4	4.8	8.6	2.7	74.6	74.1	75.7	11.1	8.6	13.5	0.0	0.0	2.7	6.3	5.2	0.0	1.6	0.0	5.4	1.6	3.4	0.0
Other & unspecified RTI[f]	34.5	47.3	30.1	43.5	31.2	38.2	27.2	32.1	27.0	7.7	12.6	10.0	1.9	4.2	7.5	1.9	4.2	0.0	18.6	15.6	19.1	2.6	3.2	2.5
All	54.1	52.3	48.9	62.7	63.0	58.1	15.0	15.8	17.7	5.6	6.6	6.5	2.5	2.9	2.3	4.4	3.7	4.6	8.5	6.8	8.0	1.3	1.4	2.9

	Antibiotic prescribed			Pivmecillinam J01CA08[g]			Cephalosporins J01DA[g]			Trimethoprim J01EA01[g]			Quinolones J01MA[g]			Nitrofurantoin J01XE01[g]			Other antibiotic		
UTI	% of cases			% of antibiotics			% of antibiotics			% of antibiotics			% of antibiotics			% of antibiotics			% of antibiotics		
Y	00	02	05	00	02	05	00	02	05	00	02	05	00	02	05	00	02	05	00	02	05
All	88.6	91.7	93.1	28.3	26.6	42.1	2.9	5.1	5.0	33.5	34.0	17.9	27.7	24.3	23.8	3.0	6.6	8.7	4.7	3.4	7.6

	Antibiotic prescribed			PenicillinV J01CE02[g]			Isoxazolylpenicillins J01CF[g]			Cephalosporins J01DA[g]			Macrolids & Linkosamides J01FA[g] & J01FF[g]			Other antibiotic		
SSI	% of cases			% of antibiotics			% of antibiotics			% of antibiotics			% of antibiotics			% of antibiotics		
Y	00	02	05	00	02	00	00	00	05	00	02	05	00	02	05	00	02	05
All	79.2	83.7	82.7	22.8	16.7	18.1	52.9	61.7	52.5	9.9	9.4	12.0	8.1	6.8	9.0	6.3	5.3	8.4

[a]includes otitis simplex.
[b]includes streptococcal tonsillitis, recurrent tonsillitis and pharyngitis.
[c]AOM: acute otitis media, includes recurrent AOM.
[d]includes atypical pneumonia.
[e]AECOPD: acute exacerbation of chronic obstructive pulmonary disease.
[f]includes infectious cough and influenza.
[g]Classification of the drug according to ATC codes (ATC Index with DDDs 2007, The WHO Collaborating Centre for Drug Statistics Methodology).

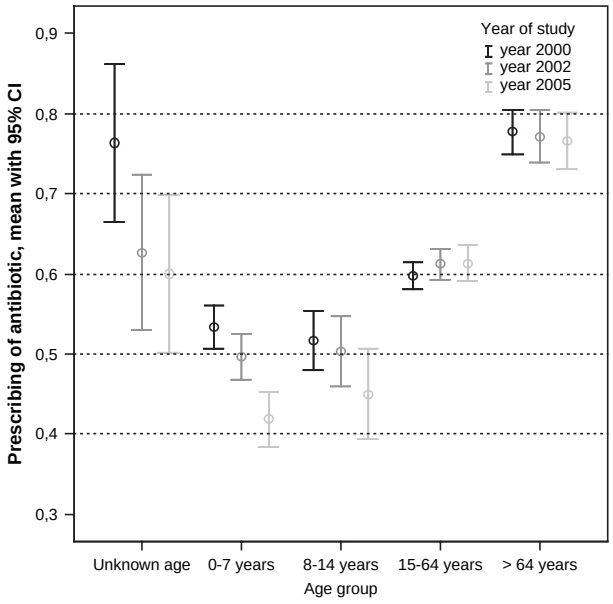

Figure 1. Proportion of patients receiving antibiotics in relation to age group.

(CRP) test was analysed was significantly higher in 2005 than in previous y, being used in 42% (95% CI 40–44) of RTI consultations that y, compared to 37% (95% CI 36–39) in 2000 and 37% (95% CI 35–38) in 2002. The proportion of throat infections where CRP was analysed increased, but not significantly, over the y, from 22% in 2000 to 26% in 2002 and then to 25% in 2005.

For all patients with UTI diagnoses, the most common diagnostic tests used were nitrite or leukocyte esterase test (Table V). A urine culture was taken in 25% (95% CI 22–28) of the UTI patients in 2000, which was significantly lower than in 2002 (95% CI 36–43) and 2005 (95% CI 32–40).

Discussion

During the last decade there has been a shift in opinion concerning management of infectious problems in general practice. This has been described as the transition from mechanistic and reductionistic to complex and organismic thinking [7]. In mechanistic thinking, bacterial infections were viewed as a causal force acting on patients in a linear fashion, where patients were regarded as passive objects. The rule of thumb could be expressed as follows: find bacteria and treat with antibiotics. The current view is, on the contrary, only to use antibiotics when there is a substantial potential gain. In line with evidence-based meta-analyses, the Swedish guidelines for acute otitis media, acute pharyngotonsillitis and acute sinusitis have been updated [2–4]. The updated guidelines advise more restrictive use of antibiotics, taking host response into account and making it possible for physicians to delay as well as to abstain from antibiotic prescribing. During this same period, antibiotic prescribing to the general population has declined in Sweden [1]. However, it is not clear to what extent this decline is a result of changed working routines in general practice care. Our repeated surveys reflect changes in clinical management as well as possible changes in the consultation habits of the general population during this period.

Our study showed that consultations for RTIs decreased substantially between 2000 and 2005, most pronounced in children younger than 15 y of age [8], which is in accordance with studies from the USA and the Netherlands from the late 1990s [9,10]. A similar reduction in consultations for RTIs between 1995 and 2000 has been reported from the UK [11,12]. Various explanations for this reduction have been discussed. Fleming el al. proposed a true decrease in acute respiratory infections owing, among other things, to influenza vaccination [12]. However, more recent studies suggest that patient expectations and illness behaviour have changed as a response to previous consultation experience, when antibiotics were not prescribed [11,13]. In Sweden almost all consultations are booked after a telephone call to a nurse and the decrease in consultations for children may be

Table IV. Percentage of prescribed antibiotics for women over 15 y of age allocated a diagnosis of lower urinary tract infection (UTI) or recurrent UTI in 2000, 2002 and 2005.

	2000 $n=633$	2002 $n=503$	2005 $n=427$
Antibiotic	percentage (95% CI)	percentage (95% CI)	percentage (95% CI)
Pivmecillinam	31.1 (28.5–34.7)	31.2 (27.2–35.3)	50.6 (45.8–55.3)
Cephalosporins	2.8 (1.5–4.1)	5.2 (3.2–7.1)	4.9 (2.9–7.0)
Trimethoprim	38.1 (34.3–41.9)	38.2 (33.9–42.4)	20.4 (16.6–24.2)
Quinolones	21.2 (18.0–24.4)	14.9 (11.8–18.0)	16.9 (13.3–20.4)
Nitrofurantoin	3.5 (2.0–4.9)	7.6 (5.2–9.9)	10.1 (7.2–12.9)
Others	2.4 (1.2–3.6)	1 (0.1–1.9)	0.2 (−0.2–0.7)

Table V. Percentage of consultations where diagnostics were used for diagnosing a respiratory tract infection or a urinary tract infection in 2000, 2002 or 2005.

Respiratory tract infections

Y	*n*	CRP (95% CI)	Strep-A (95% CI)	X-ray (95% CI)	Ultrasound (95% CI)
2000	4388	37.2 (35.7–38.6)	30.0 (28.7–31.4)	1.3 (1.0–1.7)	1.4 (1.0–1.7)
2002	3800	36.6 (35.1–38.2)	25.6 (24.2–26.9)	0.9 (0.6–1.3)	1.7 (1.3–2.2)
2005	2363	42.2 (40.2–44.2)	22.5 (20.8–24.2)	1.7 (1.2–2.2)	1.1 (0.7–1.6)

Urinary tract infections

Y	*n*	CRP (95% CI)	Nitrite or leukocyte esterase test (95% CI)	Urine culture (95% CI)
2000	869	14.3 (11.9–16.6)	84.2 (82.5–86.2)	25.3 (22.4–28.2)
2002	696	16.8 (14.0–19.6)	87.9 (86.2–83.4)	39.8 (36.2–43.4)
2005	582	14.3 (11.4–17.1)	85.4 (83.4–87.4)	35.9 (32.0–39.8)

influenced by new routines of the nurses in general practice in accordance with the new guidelines for acute otitis media and sore throat.

In Sweden penicillin V is the recommended drug for most RTIs and remained dominant without a significant decrease over the studied periods or change to other antibiotic groups. This is in contrast with trends in Canada, the Netherlands and the USA where the proportion of macrolides and broad spectrum antibiotics prescribed has increased [10,14,15]. During the studied y, a significant decrease in the proportion of prescribed antibiotics for RTI was noted. These results are in contrast with some studies from other Western countries during the same time period, where the proportion of antibiotic prescriptions after a consultation seemed unchanged, implying mainly a change in population consultation rate rather than a change in the physician prescribing patterns [9,12,13,16]. Our study did not reflect any influence of the new guidelines for acute otitis media and acute sinusitis, as antibiotic prescription rates did not decrease for these diagnoses [3,4]. However, the new guidelines for acute otitis media (to wait and see) might have contributed to fewer appointments for this diagnosis and thus fewer consultations, and so those consulting may have had more severe symptoms. Similar results have been reported from other Western countries [9,10,13,16].

Consultations that were revisits or resulted in a referral were included in the total number of consultations, which explains why some patients with acute pneumonia, for example, were not prescribed an antibiotic. However, a constantly high proportion of patients diagnosed with acute bronchitis were prescribed antibiotics, which calls for future interventions. Many GPs still consider acute bronchitis a condition for which an antibiotic is needed [17].

In our study, the most striking change in antibiotic choice was for lower UTI. Other studies have indicated that it is easier for doctors to change the class of the antibiotic than to abstain from antibiotic treatment [18]. Similar changes in the choice of antibiotics indicating adherence to local guidelines for UTI have been reported from several European countries but not from the USA [16,19,20]. A clonal spread of a fusidic acid resistant Staphylococcus aureus strain causing impetigo prompted recommendations to prescribe flucloxacillin (cefadroxil to children), which explains the dominant use of these drugs to treat skin infections [21].

Use of near-patient tests is high in Sweden compared with many other countries. In Sweden testing is free of charge for the GPs as well as for the patient. Although the benefit of CRP testing in RTIs has been questioned, its use increased during the studied periods [22]. At the same time the use of Strep-A tests decreased significantly (Table V), possibly owing to the new guideline, which stressed the importance of not testing patients with low risk of streptococcal tonsillitis [2]. In an earlier study we showed that there was room for improvement, as 44% of children tested with Strep-A in 2000 and 2002 were allocated diagnoses other than throat infection [8].

In our study the decrease in the number of patients studied was attributable to fewer patients being registered from each health centre, rather than entire health centres dropping out. The decrease was in accordance with the decrease noted in data from the electronic patient register from 1 of the included counties. The fact that there were no significant changes in distribution regarding the gender of the patients or referrals in the studies from the different y indicates that there was no systematic selection of included patients. Although it might have been possible, we did not have the resources to check all

patient records from a sample of the health centres during the studied week in order to validate the number of consultations registered. The close correspondence between our data on UTI and the changes seen in general sales data [1] indicates that our results could be more or less generalized to prescriptions issued in general practice in Sweden. From the data on total sales of antibiotics during the study week each y and during the weeks before and after, we saw no marked differences in antibiotic sales, which indicates that the study week was more or less a normal week regarding prescription of antibiotics.

In conclusion, the number of consultations and antibiotic prescriptions, mainly to children diagnosed with RTIs, decreased during the studied y. For lower UTI there was a significant change in prescribed antibiotics with an increase of prescribed pivmecillinam and nitrofurantoin and a decrease in prescribed trimethoprim, which was in accordance with guidelines. Although the results indicated changes of routines and management in general practice in Sweden in adherence to guidelines, new guidelines for lower RTI and further evaluation of the usefulness of CRP are needed.

Acknowledgements

We are grateful to all the GPs who participated in the registration and to all the nurses who assisted us in this work. The study was supported by STRAMA (Swedish Strategic Programme Against Antibiotic Resistance).

References

[1] STRAMA. Available at: http://en.strama.se/dyn//,84,2,22.html.(Accessed in June 2007)
[2] (Anonymous). Treatment of pharyngotonsillitis. Uppsala: Information from Medical Products Agency 2001;7/8:44–75.
[3] (Anonymous). Swedish Medical Research Council. Treatment for acute inflammation of the middel ear. Consensus Statement. Available at: http://1945262221/mfr/publikation er/konsensus/oronengpdf Accessed October 22, 2001.
[4] (Anonymous). Pharmacological treatment of rhinosinusitis. Uppsala: Information from Medical Products Agency; 2005.
[5] Molstad S, Burman LG, Ferry S. Okomplicerad nedre urinvagsinfektion: tre dagars behandling rekommenderas! Lakartidningen 1999;96:4212–4.
[6] Lundborg CS, Olsson E, Molstad S, Swedish Study Group on Antibiotic Usage. Antibiotic prescribing in outpatients: a 1-week diagnosis-prescribing study in 5 counties in Sweden. Scand J Infect Dis 2002;34:442–8.
[7] McWinney IR. A textbook of family medicine. 2nd edn. New York: Oxford University Press; 1997.
[8] Andre M, Eriksson M, Molstad S, Stalsby Lundborg C, Jacobsson A, Odenholt I, et al. The management of infections in children in general practice in Sweden: a repeated 1-week diagnosis-prescribing study in 5 counties in 2000 and 2002. Scand J Infect Dis 2005;37:863–9.
[9] McCaig LF, Besser RE, Hughes JM. Trends in antimicrobial prescribing rates for children and adolescents. JAMA 2002;287:3096–102.
[10] Otters HB, van der Wouden JC, Schellevis FG, van Suijlekom-Smit LW, Koes BW. Trends in prescribing antibiotics for children in Dutch general practice. J Antimicrob Chemother 2004;53:361–6.
[11] Ashworth M, Charlton J, Ballard K, Latinovic R, Gulliford M. Variations in antibiotic prescribing and consultation rates for acute respiratory infection in UK general practices 1995–2000. Br J Gen Pract 2005;55:603–8.
[12] Fleming DM, Ross AM, Cross KW, Kendall H. The reducing incidence of respiratory tract infection and its relation to antibiotic prescribing. Br J Gen Pract 2003;53:778–83.
[13] Kuyvenhoven M, van Essen G, Schellevis F, Verheij T. Management of upper respiratory tract infections in Dutch general practice: antibiotic prescribing rates and incidences in 1987 and 2001. Fam Pract 2006;23:175–9.
[14] Marra F, Patrick DM, Chong M, Bowie WR. Antibiotic use among children in British Columbia, Canada. J Antimicrob Chemother 2006;58:830–9.
[15] Steinman MA, Gonzales R, Linder JA, Landefeld CS. Changing use of antibiotics in community-based outpatient practice, 1991–1999. Ann Intern Med 2003;138:525–33.
[16] Rautakorpi UM, Huikko S, Honkanen P, Klaukka T, Makela M, Palva E, et al. The Antimicrobial Treatment Strategies (MIKSTRA) programme: a 5-y follow-up of infection-specific antibiotic use in primary health care and the effect of implementation of treatment guidelines. Clin Infect Dis 2006;42:1221–30.
[17] Coenen S, van Royen P, Vermeire E, Hermann I, Denekens J. Antibiotics for coughing in general practice: a qualitative decision analysis. Fam Pract 2000;17:380–5.
[18] Lundborg CS, Wahlstrom R, Oke T, Tomson G, Diwan VK. Influencing prescribing for urinary tract infection and asthma in primary care in Sweden: a randomized controlled trial of an interactive educational intervention. J Clin Epidemiol 1999;52:801–12.
[19] Galatti L, Sessa A, Mazzaglia G, Pecchioli S, Rossi A, Cricelli C, et al. Antibiotic prescribing for acute and recurrent cystitis in primary care: a 4-y descriptive study. J Antimicrob Chemother 2006;57:551–6.
[20] Taur Y, Smith M. Adherence to the Infectious Diseases Society of America Guidelines in the treatment of uncomplicated urinary tract infection. Clin Infect Dis 2007;44:769–74.
[21] (Anonymous). Treatment of impetigo. Uppsala: Information from Medical Products Agency 2003;2:10–3.
[22] Andre M, Schwan A, Odenholt I, Swedish Study Group on Antibiotic Usage. The use of CRP tests in patients with respiratory tract infections in primary care in Sweden can be questioned. Scand J Infect Dis 2004;36:192–7.