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Antibiotic Prescribing in Outpatients: a 1-Week Diagnosis–Prescribing Study in 5 Counties in Sweden

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A diagnosis–antibiotic prescribing study initiated by the Swedish Strategic Programme for the Rational Use of Antimicrobial Agents and Surveillance of Resistance was performed in 5 counties in Sweden (total 1,290,000 inhabitants) during 1 week in November 2000. The aims of the study were to analyse diagnoses and antibiotics prescribed for outpatients and to appraise the feasibility of the data collection method. Physicians in primary care and departments of ENT, paediatrics and infectious diseases completed a questionnaire for each patient with an infectious disease complaint, including information about age, sex, diagnosis, diagnostic methods used and treatment. When an antibiotic was prescribed, the type and duration of treatment were noted. A total of 7,071 forms were returned, of which 7,029 included information on diagnosis; infections of the respiratory tract, urinary tract and the skin or soft tissues were responsible for 70%, 14% and 10% of the visits, respectively. Antibiotics were prescribed in 59% of all cases and phenoxymethylpenicillin was the most commonly prescribed antibiotic. Of the forms returned, 94% emanated from primary care centres. In conclusion, this study provides information on the treatment pattern associated with various diagnoses and the pattern of use of various antibiotics. Such a study is relatively simple to perform and entails only a small extra workload for the participants.

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INTRODUCTION

Antibiotic resistance is increasing worldwide and intensified measures are called for globally as well as in individual countries in order to curb this trend (1–3). There is a concern that the irrational use of antibiotics can contribute to this increase in resistance (1).

The Swedish Strategic Programme for the Rational Use of Antimicrobial Agents and Surveillance of Resistance (STRAMA) was initiated in 1994 as a national network in Sweden (4, 5) in order to give these issues national prominence. An increasing trend in the sale of antibiotics for systemic use was seen in Sweden at the end of the 1980s, from 14.1 defined daily doses (DDD)/1,000 inhabitants and days (TID) in 1986 to a peak in 1993 of 19.4 DDD/TID. Subsequently a decrease has occurred to a total of 15.8 DDD/TID in 1999 (6), of which 14.4 DDD/TID were dispensed for outpatients, a low figure from a European perspective, whereas a range between 8.9 and 36.5 DDD/TID was seen in 1997 (7).

In order to obtain detailed information concerning how various diseases are treated and for which diseases specific drugs are used, the Swedish Diagnosis Prescription Study (DPS) was initiated in 1978. Owing to a decreasing participation rate, in particular for general practitioners (GPs), its validity has been questioned and the study, in its present form, will be ended in 2002. It is important to create a valid and comparable picture of the proportion of patients with infectious symptoms who are prescribed antibiotics, for which diagnoses antibiotics are prescribed and the relations between different types of antibiotics for each diagnosis. Such information is essential in the development of both clinical practice guidelines and contextualized educational materials. The National Board of Health and Welfare in Sweden has proposed the development of a system (known as SPAR) for continuous follow-up of antibiotic prescribing and the reasons for prescribing, in hospitals as well as in outpatient care (8). However, the present study was conducted awaiting the implementation of this system. Recent statistics shows that $>90\%$ of antibiotics are prescribed for

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outpatients whereas ≈50% of both DDDs and prescriptions emanate from the primary care sector (6).

The main aim of this study was to present diagnosis and antibiotic-prescribing information for outpatients with infectious disease complaints in 5 counties in Sweden who sought treatment during a 1-week period. A further aim was to appraise the feasibility of this kind of survey and to see whether it could be recommended for possible use in the future.

MATERIALS AND METHODS

A prospective study was conducted simultaneously in 5 counties in Sweden during 1 week in November 2000. There are usually a high number of patients with infectious symptoms in November but winter epidemics of influenza and respiratory syncytial virus usually occur after this time. The participating counties were selected so as both to achieve a geographical spread and incorporate low-, medium and high-prescribing counties. The participating counties were Uppsala (16.5 DDD/TID), Östergötland (13.8 DDD/TID), Kronoberg (16.4 DDD/TID), Dalarna (12.9 DDD/TID) and Jämtland (12.7 DDD/TID), the figures in parentheses showing the sales of antibacterials for systemic use in 1999 (ATC code J01, version 1999; not including nitrofurantoin and fosfomycin) (6).

In each county, 1 or 2 persons were responsible for informing and communicating with participating doctors. These individuals were typically involved in local STRAMA groups working towards the rational use of antibiotics and were well known among their colleagues. In order to ensure anonymity, the participating doctors were usually recruited as part of teams in primary care centres or hospital departments. Both public and private surgeries, where available, were included. In total, 155 primary care centres (≈600 doctors), 24 hospital departments or specialized surgeries (ENT, infectious diseases and paediatrics) and 20 individual private practitioners agreed to participate. A number of measures were taken to ensure a high participation rate:

1. Written information regarding the study was in most cases provided twice to all potential participants;
2. Oral information was provided to key persons in each county; and
3. In some cases, information meetings were conducted for larger groups of doctors.

The study began at 08.00 on Monday 20 November, 2000 and ended at 08.00 on Monday 27 November, 2000. The physicians were asked to complete a form for all patients with a respiratory tract infection (RTI), a urinary tract infection (UTI), a skin/soft tissue infection or another type of infection. The forms were to be completed irrespective of whether the patient was prescribed an antibiotic or not. Only 1 diagnosis per form was to be given and only antibiotics for oral systemic use were included (ATC code J01, version 2001; includes nitrofurantoin and fosfomycin). Disorders normally treated with topical antibiotics, such as conjunctivitis, were excluded. The questionnaire form was a slightly modified version of 1 used previously in Finland (9, 10). The number of items was reduced in order to minimize the effort required from the participating doctors. The included items were discussed by members of the Swedish Study Group on Antibiotic Use following consultations with other practitioners. The final version of the form was piloted in a small group of GPs and found to be acceptable. The main topics of the questionnaire form are listed in Table I. For each item, the doctor was asked to choose between pre-formulated response alternatives but could use a written alternative when these were not considered suitable. The choice of antibiotic (generic or trade name) and the duration of treatment had to be written by hand. Dosage was not included. Detailed information for the doctor was printed on the reverse of each form. A full version of the questionnaire (in Swedish) is available from the corresponding author.

Table I. *Main topics included in the questionnaire*

1. Sex and year of birth
2. Visit: new, i.e. "first", visit or return visit. If return visit, was the patient already receiving antibiotic treatment?
3. Time of visit: working hours or emergency hours
4. Duration of symptoms (d)
5. Main diagnosis
6. Diagnostic techniques used
7. Treatment with antibiotics (yes/no), referral or both
8. Type of antibiotic and treatment duration
9. Factors influencing the choice of treatment

Each participating doctor collected the completed forms anonymously in envelopes. For each envelope, the county, physician category and type of surgery were recorded. The envelopes were sent to the Department of Public Health Sciences, Karolinska Institutet, Stockholm, where the data were entered into a computer and descriptively analysed using SPSS version 10.0. For this overall analysis it was decided not to separate the results into primary care and other outpatient care facilities, but to treat the data as a whole.

To validate the data, additional data were collected from Apoteket AB (National Corporation of Swedish Pharmacies). These data included data from each participating county concerning dispensed antibiotics for the week of the study, the week before and the week after. Furthermore, data were collected regarding the proportion of antibiotics prescribed by different physician categories in November 2000 from 2 counties (Dalarna and Uppsala). We calculated the number of completed forms per 1,000 inhabitants per county and the number of forms with prescribed antibiotic per dispensed antibiotic in each county during the study week. For all counties the percentage of forms emanating from primary care centres was calculated. In addition, for Uppsala and Dalarna, the proportion of dispensed antibiotic prescriptions emanating from primary care centres as a percentage of all the included types of department was analysed for the entire month of November 2000. These comparative data were analysed for face validity.

RESULTS

A total of 7,071 forms were returned and the forms were generally completed according to instructions. In a few cases (<20), >1 of the included diagnoses had been marked despite a clear instruction that only 1 diagnosis should be given. In those cases, by examining the diagnosis and the prescribed drug, the most relevant diagnosis was recorded. In some cases the form had also been completed for non-infectious symptoms or for drugs not belonging to ATC code J01. These forms were excluded from the analysis.

In the analysis, 7,029 patient cases were included. The remaining forms lacked diagnosis information. Of these 7,029 forms, 6,738 included information on the type of surgery, which in 92% of cases was primary care centres. There were 133 forms from ENT, 334 from paediatric and 100 from infectious disease departments. In 6,900 forms

both the sex (58% female, 42% male) and age of the patient was given. The age group for which the highest number of forms had been completed was children aged 0–7 y (25%; $n = 1718$) (Fig. 1).

In 84% of cases the visit was a first visit and 68% of the visits were made on weekdays between 08.00 and 17.00. The duration of symptoms before consultation was 1–7 d in 56% of cases but 17% of patients had had their symptoms for > 14 d.

A total of 70% of visits were for a RTI, 14% for a UTI, 10% for a skin/soft tissue infection and 6% for other infections. Overall, an antibiotic was prescribed in 59% of cases. The group of diagnoses with the highest rate of antibiotic prescriptions was UTIs (87%), followed by skin/soft tissue infections (74%) and RTIs (54%) (Table II). Detailed information on cases already receiving treatment and on referral/hospitalization is also presented per diagnosis.

On the form throat infections were divided into streptococcal tonsillitis and pharyngitis. In 779 cases the throat infection was classified as streptococcal tonsillitis. Of these, 98% were treated with an antibiotic. For the diagnosis pharyngitis, 10% were treated with antibiotics. Of the pneumonia cases $\approx 30\%$ were classified as atypical.

In 60% ($n = 4,248$) of cases with a given diagnosis some kind of diagnostic technique, as specified in the form, was used. The most common was the CRP test, which was used in 36% of RTIs, 15% of UTIs, 11% of skin/soft tissue infections and 42% of other infections. A diagnostic technique was used in 62% ($n = 2,586$) of the cases where an antibiotic was prescribed. The CRP test was also the most commonly used in this setting, being used in 44% of cases. For RTIs, a rapid streptococcal test was used in 27% of cases where an antibiotic was prescribed.

For RTIs, phenoxymethyl penicillin (PcV) was the most commonly prescribed antibiotic, being prescribed in 62% of cases, and tetracylines were the next commonest, being prescribed in 14% of cases (Table III). In UTIs, trimethoprim, extended-spectrum penicillins (almost exclusively pivmecillinam) and quinolones were prescribed in $\approx 30\%$ of cases each. Cotrimoxazole, fosfomycin and nitrofurantoin all had limited use. Of the skin/soft tissue infections treated with antibiotics, isoxazolyl penicillins (mainly flucloxacillin) were used in 51% of cases, PcV in 23% and cephalosporins in 12%.

The duration of treatment was provided in 4,082 cases. The overall duration of treatment varied from 1 to 360 d. For tonsillitis it was 10 d in 96% of cases. For uncomplicated UTI, a 7-day treatment duration was recommended in 77% of cases.

The choice of treatment was reported to be influenced by various specified factors (1 or more choices were possible) in 1,112 cases, the most common being that the patient was difficult to judge ($n = 340$). Therapeutic failure was mentioned in 194 cases, previous skin reactions or vomiting for penicillin in 97 cases, previous urticaria, etc. for penicillin in 83 cases, other diseases, such as diabetes, chronic obstructive pulmonary disease or other chronic diseases, in 292 cases and special requests by the patient in 188 cases.

The number of completed forms per 1,000 inhabitants ranged from 3.73 to 7.68 for the 5 counties, with a mean of 5.48. During the study week, a total of 9,820 prescriptions for oral antibiotics were dispensed in the 5 counties, with approximately the same numbers for the weeks before and after the study. The approximate proportion of antibiotics dispensed in the counties as revealed from the forms was 41% (range 33–48%). The physician specialities included in our study were responsible for $\approx 70\%$ of dispensed antibiotic prescriptions in Dalarna and Östergötland, where the prescriber category was examined for all prescriptions. When examining the primary care share of forms and dispensed prescriptions in those counties, the figures were almost identical at 93.3% and 93.5% for Dalarna and 91.1% and 91.0% for Östergötland, respectively.

DISCUSSION

This is the first large-scale study in Sweden to have collected information on physicians' treatments and choices of antibiotics for outpatients consulting for infectious symp-

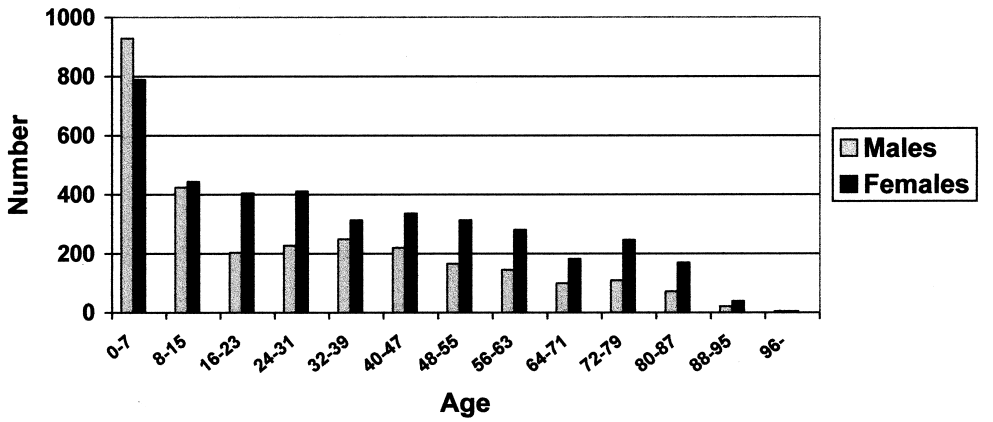

Fig. 1. The age and sex distributions of the included patients.

toms. The data make it possible to study the treatment patterns for various diagnoses as well as the patterns of use for various antibiotics.

The results confirm that RTIs are the most common infections encountered in outpatient care. They also show that Swedish physicians prescribe PcV to a high degree compared to physicians in other countries. In this study, PcV constituted 44% of all prescribed antibiotics, compared to a study in Norway in which the proportion was 32% (11) and studies in Finland in which the proportions were 17% (9) and 13% (10). The proportion of RTIs was almost the same in our study as in the Finnish studies, which were conducted in a similar way to ours. In the Norwegian study, the proportion of RTIs was somewhat lower.

For most diagnoses, the antibiotic prescribing pattern seemed to be in relatively good accordance with Swedish recommendations. PcV was prescribed in most cases of acute otitis media and acute pharyngotonsillitis, especially if cases of therapeutic failure or relapse were excluded. However, it was noted that $>90\%$ of children with acute otitis media were prescribed an antibiotic, despite the recently issued, and more restrictive, treatment recommendations for otitis media in children aged >2 y (12). Cases with the diagnosis pharyngitis were treated with antibiotics in only 10% of cases, compared to 21% in a Finnish study (9), which may reflect differences in treatment or diagnostic traditions. However, it is also possible that the high use of rapid streptococcal tests in this study influenced the pattern of diagnosis and that the diagnosis pharyngitis was used in this study when diagnostic tests were negative and the diagnosis tonsillitis when they were positive. According to Swedish tradition, isoxazolylpenicillins are often used for skin and soft tissue infections. This was also evident in this study, where $\approx 50\%$ of skin and soft tissue infections was treated with isoxazolylpenicillins whereas cephalosporins were only used in 12% of cases, as opposed to the situation in Finland where cephalosporins were used in 82% of cases (10). According to Swedish recommendations macrolides are not recommended as first-choice drugs in most situations and the dominance of erythromycin is probably due to therapeutic tradition, as other macrolides are also available.

Some potential deviations from guidelines could be discerned. It is, however, difficult to judge the appropriateness

Table II. *Diagnosis and cases with information regarding treatment*

Diagnosis	Total no. of cases ($n = 7{,}029$); *n* (%)	Cases with information on treatment ($n = 6{,}977$[a])		
		On treatment, no change ($n = 115$); *n*	Referral/ hospitalization ($n = 131$); *n*	Treatment with antibiotics ($n = 4{,}170$); % treated per diagnosis
Throat infection	1,193 (17)	10	7	70
URTI	1,276 (18)	11	5	7
Pneumonia	403 (6)	9	21	89
Influenza	20 (0.3)			10
Unspecified lower RTI	515 (7)	10	6	33
Otitis media	657 (9)	14	8	91
Sinusitis	393 (6)	10	1	94
Bronchitis, acute	411 (6)	9	2	50
Bronchitis, exacerbation of chronic bronchitis	75 (1)		1	87
RTI, all	4,943 (70)	73	54	54
Lower UTI	683 (10)	3		93
Recurrent UTI	136 (2)	3		89
Upper UTI	59 (0.8)	3	9	78
Urethritis	74 (1.1)	1		40
UTI, all	952 (14)	10	9	87
Erysipelas	83 (1.2)	2	7	82
Leg ulceration	52 (0.7)	6	2	67
Boil, abcess, ulcer, impetigo	369 (5)	9	7	78
Other	175 (2.5)	5	5	65
Skin/soft tissue infections, all	679 (10)	22	21	74
Other	455 (6)	10	50	32
All infections	7,029 (100)	115	131	59

[a] In total, 2,561 cases were given no treatment. The discrepancies in numbers are due to missing values.
URTI = upper respiratory tract infection; RTI = respiratory tract infection; UTI = urinary tract infection.

Table III. *Numbers of cases per antibiotic and per diagnosis*

Diagnosis	Penicillin V; J01CE02 ($n = 1,836$)	Amoxicillin, pivmecillinam, etc.; J01CA ($n = 422$)[a]	Flucloxacillin, etc. J01CF ($n = 268$)	Amoxicillin and clavulanic acid ($n = 74$)	Tetra-cyclines; J01A ($n = 461$)	Cephalosporins; J01DA ($n = 216$)[b]	Trimetho-prim; J01EA01 ($n = 274$)	Cotrimoxazole; J01EE01 ($n = 35$)	Macrolides; J01FA ($n = 286$[c])	Quinolones; J01MA ($n = 265$)	Other[d] ($n = 73$)	Total number of antibiotics per type of infection ($n = 4,173$[e])
Throat infection	700	10	–	3	2	71	–	2	27	–	11	832
URTI	48	8	–	2	15	2	–		18	–		93
Pneumonia	113	15	–	6	108	11	–	3	103	–	–	359
Influenza	1	–	–	–	1	–	–	–	–	–	–	2
Unspecified lower RTI	69	14	–	3	43	6	–	–	32	–	–	170
Otitis media	439	63	–	46	–	22	1	9	19	–	–	599
Sinusitis	228	34	–	9	75	8		1	21	–	1	377
Acute bronchitis	67	23	–	2	85	2	–	2		2	–	183
Exacerbation of chronic bronchitis	3	8	–		48	4	–	–	1	1	–	66
RTI, all	1,668	175	0	72	379	126	1	20	225	3	12	2,681
Lower UTI	–	198	1	–	5	16	236	4	1	149	27	637
Recurrent UTI	1	36	–	–	–	5	35	3	–	38	3	121
Upper UTI	–	1	–	–	–	1	1	6	–	37	–	46
Urethritis	1	1	1	–	19	–	–	–	1	9	1	33
UTI, all	2	236	2	0	24	22	272	13	2	233	31	837
Erysipelas	31	1	25	–	–	6	–	–	–	–	7	70
Leg ulceration, infected	2	–	27	–	1	3	–	–	–	3	2	38
Boil, abcess, ulcer, impetigo	51	6	164	–	1	33	–	1	11	5	18	290
Other skin infections	32	1	46	–	13	18	–	–	2	2	1	115
Skin/soft tissue infections, all	116	8	262	0	15	60	0	1	13	10	28	513
Other infections	50	4	4	2	43	8	1	1	8	19	2	142

[a] J01CA01, ampicillin 11, J01CA02, pivampicillin 1, J01CA04, amoxicillin 177, and J01CA08, pivmecillinam 233.
[b] 167 are for J01DA09 lorakarbef.
[c] 229 are for J01FA01 erythromycin.
[d] Clindamycin, 38 (11 tonsillitis, 1 sinusitis, 7 erysipelas, 2 infected leg ulcer, 16 boil, abscess, ulcer and impetigo, 1 other), fusidinic acid, 3 (2 impetigo, 1 other skin infections), phosphomycin, 7 (cystitis), nitrofurantoin, 24 (20 cystitis, 3 recurrent UTI, 1 urethritis) and vancomycin 1 (other infection).
[e] Differences compared to Table II are due to missing values and 17 cases of prescribing of 2 different antibiotics for the same patient.
URTI = upper respiratory tract infection; RTI = respiratory tract infection; UTI = urinary tract infection.

of prescribing in individual cases without a detailed examination of patient records or at the very least an analysis of the diagnostics measures taken.

A total of 33% of cases classified as unspecified lower RTI, which includes cough, were treated with an antibiotic, as well as 50% of cases of acute bronchitis. In addition, there was a relatively high proportion of tetracyclines prescribed for those infections, as well as for pneumonia and exacerbation of chronic bronchitis (Table III). It is, however, difficult to devise guidelines for unspecific diagnoses. The proportion of cases of acute bronchitis that were treated with an antibiotic was however lower compared to 1 of the Finnish studies (10), in which 71% of cases were treated.

The surprisingly high number of diagnostic tests made for RTIs, especially of CRP, requires further analysis.

Another example of a potential deviation from guidelines was that quinolones were used in 21% of females with a lower UTI, a non-recommended treatment (13). This level of non-recommended use was lower than figures reported in the DPS for 2000 (6) and in an earlier study (14). This may reflect a shift towards recommended drugs or may be because the DPS does not distinguish between complicated and uncomplicated UTIs. It may also be a sign of socially desirable responses.

To estimate the face validity of the data we made a number of comparisons, from which we drew the conclusion that the data could be regarded as a relatively good estimate of antibiotic prescribing in these counties during the study week. The inter-county variation in the number of forms returned per 1,000 inhabitants was 2-fold. This may depend on differences in physician availability but calls for a somewhat cautious interpretation of the data. When the number of forms with an antibiotic prescribed was divided by the total number of antibiotic prescriptions dispensed during the study week, the figures varied to a smaller degree. Finally, for the 2 counties where we compared the proportion of forms emanating from primary care centres during the study week to the proportion of dispensed prescriptions for the entire month of November in the same 2 counties emanating from primary care centres, the figures were amazingly similar. This is likely to indicate a more or less random inclusion of cases, and that the forms seem to correspond relatively well to reality for the included prescriber categories.

The actual response rate for the included prescriber categories is difficult to establish. Unpublished statistics from the county of Östergötland have previously shown that 43% of all antibiotic prescribing emanates from primary care centres. This corresponds well to our data. Theoretically, there are 2 main categories of low response rate:

1. Elected responses, where only physicians already complying with recommendations participate, or each participating physician fills in the forms only for some of his/her patients, those for whom the physician feels that the treatment was really justified, or shifting of diagnosis to a more "justified" diagnosis (15); and
2. Random responses, where the physician either participates or not and when s/he participates s/he fills in the form for most of the patients, without further analysis.

The consequences of these different response problems are somewhat different. In this study, the participating physicians remained anonymous, which should reduce the problems of elected responses, but such an influence could not be completely disregarded. Random responses are less problematic as long as the response rate is relatively high.

As the included prescriber categories only represent $\approx$ 70–75% of all prescriptions during the month when the study was done, it would be useful to include all prescriber categories for humans in future studies. It might be the case that the prescriber categories included here, due to extensive experience of antibiotic prescribing, have patterns that coincide relatively well with recommendations and that other prescriber categories less exposed to discussions regarding antibiotic use and resistance patterns might present a different prescribing pattern.

In conclusion, the method used in this study is simple and entails only a small extra workload for participants. It was found feasible to perform this type of study for a 1-week period. The results gave more detailed information regarding individual diagnosis compared to the regular DPS. Also, additional information, such as duration of symptoms before consultation and use of diagnostic techniques, was acquired for further analysis. The intention is to repeat the study using the same questionnaire form, for example every other year, in order to closely follow changes in diagnostic and treatment patterns for outpatients in Sweden.

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