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Neumark, Thomas; Brudin, Lars; Mölstad, Sigvard

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Antibiotic prescribing in primary care by international medical graduates and graduates from Swedish medical schools

Thomas Neumark[a,b] *, **Lars Brudin**[c] and **Sigvard Mölstad**[e]

[a,]*Primary Health Centre in Lindsdal, Kalmar, Sweden
[b] Planning Department& Division of Pharmacotherapy, Kalmar Count Council, Kalmar, Sweden
[c] Department of Clinical Physiology, Kalmar County Hospital, Kalmar, Sweden
[e] Department of Clinical Sciences, General Practice, Lund University, Malmö, Sweden

Running head: Antibiotic prescribing by doctors trained abroad

*Correspondence to Dr. Thomas Neumark, Planning Department, Pharmacotherapy division, Kalmar County Council, Box 601, 39126 Kalmar, Sweden; E-mail: thomas.neumark@ltkalmar.se

Abstract

Background. Studies of antibiotic prescribing related to diagnosis comparing prescribers trained abroad with those trained in Sweden, are lacking.
Objectives. To determine whether GPs and GP residents trained abroad had different prescribing patterns for antibiotics for common infections than those trained in Sweden using retrospective data from electronic patient records from primary health care in Kalmar County, Sweden.
Methods. Consultations with an infection diagnosis, both with and without the prescription of antibiotics to 67 GPs and residents trained in Western Europe outside Sweden (WE) and other countries (Non-WE), were compared with a matched control group trained in Sweden (SW).
Results. For one year, 44 101 consultations of patients with an infection diagnosis and 16 276 prescriptions of antibiotics were registered. Foreign trained physicians had 20%

more visits compared to physicians trained in Sweden. The prescription of antibiotics per visit and physician in the respective groups, and independent of diagnosis, did not significantly differ between groups, when scaled down from number of consultations to number of prescribing physicians.

Conclusion. There were minor and non-significant differences in antibiotic prescribing comparing GPs and residents trained abroad and in Sweden, most likely the result of an adaptation to Swedish conditions. Nevertheless, no group prescribed antibiotics in accordance to national guidelines. The results suggest that interventions are needed to reduce irrational antibiotic prescribing patterns, targeting all physicians working in Swedish primary healthcare

Key Words: Primary healthcare, family practice, antibiotics, antibiotic prescribing, medical education, trained abroad

Introduction

Antibiotic use is the main cause of the emergence and spread of antibiotic resistance, and has become a major threat to public health (1). During the last years, efforts have been made to reduce inappropriate antibiotic prescribing to outpatients in Sweden, to minimize the spread of resistance.

Over the past 15 years, Kalmar County has recruited physicians trained abroad both from European and non-European countries, since the supply of physicians from Swedish medical schools has been inadequate. Many of these physicians have been in countries with a high utilization of antibiotics (2, 3), and it is generally believed that physicians trained abroad have different prescribing patterns than physicians trained in Sweden. In Kalmar County data output tools from the electronic record system for antibiotic prescribing, related to diagnosis, has been developed, providing the possibility of feedback for each prescriber's individual prescription profile.

Two studies from Canada (4, 5), indicated that physicians trained outside Canada and the United States prescribed more antibiotics. In a Norwegian study from 2013, the

clinical skills of physicians in Norway were compared with those non-Norwegian , and foreign trained physicians wrote more sick leave certificates (antibiotic prescribing was not investigated) (6). Comparative studies of antibiotic prescribing patterns related to diagnosis between prescribers trained abroad and in those trained Sweden, are lacking. The aim of this study was to describe antibiotic prescribing patterns in relation to given infectious diagnoses and national guidelines, among international medical school graduates versus graduates from Swedish medical schools.

Methods

Design and study population

Kalmar County had, at the time of the study, 234 000 inhabitants and 200 general practitioners or residents in general practice (GPs). All physicians with a foreign medical education (n=67), permanently employed in primary health care in Kalmar County during 24/5 2011-25/5 2012, were included. They were divided into two groups according to the country in which they received their undergraduate medical education, Western Europe (WE) (n=19) (Denmark, Finland, Germany, Austria and Holland) and/or countries outside Western Europe (non-WE) (n=48) (Poland, Russia, Bosnia, Lithuania, Italy, Greece, Afghanistan, Brazil, Iraq, Lebanon and China) (Table 1).The two groups were compared with an equal number of randomly selected age and sex matched GPs and residents in general practice trained in Sweden (SW) (67 of a total of 123).

Diagnoses

All patients visiting primary health care (office and out of office hours) were registered in the electronic patient record system (EPRS) by their identification number. Registration

of diagnoses is mandatory using the ICD10-based classification system (7). All episodes of an infection diagnosis were identified as well as whether or not an antibiotic was prescribed.

All diagnoses were categorized as follows: respiratory tract infections (RTI), lower urinary tract infections (LUTI), skin and soft tissue infections, and other infections, as well as by diagnosis and, when appropriate, by gender. Less common diagnoses were grouped as “other infectious diagnoses” including, for example, gastro-intestinal infections, symptom diagnosis, and urological/gynecological infections. All diagnoses were linked to a given prescriber group.

Antibiotics

The EPRS has an integrated drug prescribing module where all prescriptions are automatically registered according to the Anatomical Therapeutic Classification System (ATC) (8) and sent electronically to pharmacies. Antibiotic prescriptions are presented as the total number of prescriptions or as an antibiotic subgroup (e.g. phenoxymethylpenicillin (PcV), doxycycline, amoxicillin, flucloxacillin) in relation to a given diagnosis or diagnoses summarized by group levels such as respiratory tract infections (RTI), lower urinary tract infections (LUTI) and skin infections. Antibiotics prescribed less often (amoxicillin + clavulanic acid, macrolides, lincosamides, cephalosporines) were grouped together and classified as ”Others”.

The recommended antibiotics for the treatment of LUTI in both men and women in Sweden are pivmecillinam and nitrofurantoin, and we have chosen to present prescription statistics after merging prescribing data for both drugs versus “Others”, i.e. those not recommended (quinolones, trimethoprim, trimethoprim-sulfamethoxazole, cephalosporines)

Statistics

Data is mainly descriptive with numbers and frequencies presented in tables. Statistically significant differences were assessed between the three physician groups using the Chi-square test, followed by Fisher's exact test when appropriate. This means that differences between e.g. antibiotic prescriptions for a specific diagnosis were scaled down from the number of consultations to the number of prescribing physicians. This analysis assumes that the included physicians had a reasonably similar patient selection (see strengths and limitations).

Results

A total of 134 physicians participated (Table 1)**.** During the one-year observation period 44 101 consultations with an infectious diagnosis and 16 276 prescriptions of antibiotics were registered. The foreign trained physicians carried out 20% more patient consultations compared to physicians trained in Sweden.

Respiratory tract infections (RTI) including acute media otitis (AOM): RTIs were the most frequent consultation cause in all three groups totaling 21 639 consultations (Table 2) with common cold as the most frequent diagnosis in all physician groups, totaling 1 632, 3 653 and 3 128 visits in the WE, Non-WE and SW groups, respectively, while the other respiratory tract infection diagnoses were distributed more widely between groups (Table 2). The proportion of consultations for an RTI with an antibiotic prescription was lowest (but without significant differences between the educational groups) for the WE, 33%, while the Non-WE and SW prescribed antibiotics in 39% and 38% of cases, respectively. The prescription of antibiotics for AOM and acute sinusitis was lower in WE, 73% and 66% in comparison with both Non-WE, 84% and 73% and SW 84 and 78%, respectively, while SW prescribed less for the diagnosis acute bronchitis, 35% in comparison with both WE, 38% and Non-WE, 41%, respectively (n.s.) Table 3. Antibiotics were prescribed to a

somewhat greater extent by Non-WE for the diagnosis pharyngotonsillitis (n.s.), 72% in comparison to both WE and SW, 67 and 66%, respectively (n.s.). For RTIs, PcV accounted for 58% and doxycycline for 24% of all antibiotic prescriptions with no significant differences in the choice of antibiotic for different RTI diagnoses between groups (Table 3).

Skin infections: Skin infections amounted to 9 241 visits in all three groups (Table 2). The most common diagnoses in all groups were bacterial skin infection, dermatitis and skin ulcers/wounds with 1 708, 2 353 and 1 636 visits in the WE, Non-WE and SW-group, respectively. The proportion of consultations for a skin infection with an antibiotic prescription was lower in SW, 36%, in comparison to WE and Non-WE, 42 and 43%, respectively (n.s.). Flucloxacillin (β-lactam-resistant penicillin) was the most frequently prescribed antibiotic for almost all skin diagnoses with 1582 prescriptions (43% of antibiotics prescribed), except for Lyme disease, where PcV was the preferred drug.

Lower urinary tract infections (LUTI): Consultation for LUTI in women accounted for 3 681 visits, and 2 825 antibiotic prescriptions, respectively (Table 2). The WE trained physicians had a slightly lower antibiotic prescription rate of 70% than Non-WE trained and SW, 80 and 76%, respectively (n.s.). The prescription of recommended antibiotics, nitrofurantoin and pivmecillinam was some higher in SW (87%) in comparison with both WE and Non-WE, 83 and 81% (n.s.) (Table 2). Prostatitis is included in other infections (see below).

Other infections: The “Other infectious diagnoses” comprised a heterogeneous collection of rarer diagnoses. A large proportion of these consultations had a “symptom and sign” based ICD 10 diagnosis, consisting of 3 473 consultations and 359 antibiotic prescriptions.

Discussion

Summary of main findings

During the observation period of 12 months, 44 101 consultations with an infection diagnosis and 16 276 prescriptions of antibiotics were registered. The foreign trained physicians had 20% more visits compared with physicians trained in Sweden, and prescribed slightly, but not significantly, more antibiotics per physician compared with Swedish trained physicians. RTI was the most common diagnostic group accounting for 21 693 visits and 8 076 prescriptions. For RTIs, PcV was the most commonly prescribed antibiotic accounting for 58%, and doxycycline 24%, of all antibiotics prescribed, with no significant differences in the choice of specific antibiotics between physician groups. Skin infections were the second most common reason for consultations accounting for 9 241 visits with 3 696 antibiotic prescriptions. SW prescribed somewhat lower, 36% vs. 42 and 43% for bacterial skin infections, dermatitis and skin ulcers/wounds, respectively, but this difference was not statistically significant. Lower urinary tract infections in women accounted for 3 681 visits and 2 825 antibiotic prescriptions. WE had a lower total antibiotic prescription rate of 70% vs. 80%, and 76% for females presenting with LUTI (n.s.). The proportion of prescribed recommended antibiotics pivmecillinam and nitrofurantoin was higher in SW (87% vs. 83% and 81%), although not statistically significant.

Strengths and limitations

Our results are based on data from all (> 40,000 consultations) patient consultations with an infection diagnosis, performed by participating physicians during a one-year period. All data was collected from a quality assured electronic patient record system (EPRS) with mandatory registration of the diagnosis (ICD-10 code), and automatic registration of

all prescribed drugs (ATC-code), which has been a reliable tool for the feedback of diagnosis-linked prescriptions of antibiotics to monitor antibiotic prescribing in primary care (9, 10).

There are some limitations using retrospective data from EPRS. The system cannot distinguish primary visits from follow-ups (due to routine therapeutic controls or therapeutic failures), and this will overestimate the number of acute visits such as for AOM, pneumonia and COPD-exacerbation. This bias will, consequently underestimate prescription rates but should be similar between the three physician groups. When registering two infection diagnoses at the same visit, the antibiotic prescription (if applicable) will be linked to both diagnoses, since the system cannot distinguish the diagnosis for which the antibiotic is intended, which may slightly overestimate prescription rates. Further, the criteria for diagnostic labeling of RTIs (11), used by different physicians may vary, and the decision (and desire) to prescribe an antibiotic might also influence the choice of diagnosis.

Unfortunately, we have not been able to follow three equally large groups from the time immediately following their completed medical training, since composition of the medical staffing in the county undergoes continuous changes.

In order to compare prescribing patterns between the three educational groups the number of prescriptions had to be scaled down to the number of physicians. After scaling down no statistically differences were obtained among the three groups, and the p-values shown in Table 2 are, in this respect, very convincing ($p>0.5$ in all instances). Nevertheless, the exact p-values might be underestimated (but not overestimated) due to differences in the number of consultations between physicians within a particular group. We have therefore, lumped diagnoses with few consultations in one special group, “other infections”.

General discussion and comparison with similar studies

Foreign trained physicians constitute a large and increasing proportion of physicians in Sweden, in 2000, 14% with foreign education (3823) and, 24% (8875) in 2011 (12).

Our study is, to our knowledge, the first comparing antibiotic prescribing patterns between physicians trained abroad with physicians trained in Sweden. Although not statistically significant, the study might indicate some differences in prescribing patterns, not always in favor of physicians trained in Sweden.

The foreign trained physicians did have a heavier workload (20% more visits compared to those trained in Sweden) and prescribed more antibiotics in absolute numbers. One explanation may be that the large group trained outside Western Europe (Non-WE) arrived in the last decade, and have less years of experience (Table 1), and therefore, have less administrative functions, less nursing home consultancy, fewer patients with chronic diseases on their lists, and meet emergency patients or work out-of-office more often. Contrary to our findings, other studies have suggested that a higher workload and cultural differences between countries might explain differences in antibiotic prescribing (4, 13-17). Diaz et al. found in a Norwegian study, that immigrant GPs expressed having had to work harder and be more careful to avoid complaints and gain acceptance from colleagues (18), which in itself probably may lead to increased motivation for adaptation to current guidelines. Genevieve Cadeieux et al. found that physicians with heavy case loads were more likely to prescribe antibiotics than those with lighter (4), and that the majority of the foreign-trained physicians (corresponding to our group – Non-WE) come from countries with high utilization of antibiotics (3). Reginald Deschepper et al. concluded that the culture-specific way people deal with authority is an important factor in explaining cross-national differences in the use of antibiotics (17).

Residency in general practice is usually a formal requirement for permanent employment in primary health care in Sweden today, which means an additional five years of

supervised training with continual evaluation of clinical and theoretical knowledge through the entire period of residency training. The non-significant differences in prescribing rates of antibiotics may be explained by the fact that the majority of the included physicians had completed their residency, worked for several years, and have adapted to the Swedish system. Nevertheless, the data indicates that none of the evaluated groups of physicians prescribed antibiotics strictly in line with current recommendations. The benefit of antibiotic treatment for most RTIs is limited, and with respect to the slow progression of antibiotic resistance, the Swedish guidelines for the treatment of infection recommend restrictiveness for antibiotic prescriptions. We have previously shown that in Kalmar County during the year 2005, antibiotics were prescribed to 60% of patients presenting with acute bronchitis, 79% sinusitis, 77% AOM, 57% pharyngotonsillitis and 14% common cold (9, 10). In this study from 2012, the proportion of patients with the above mentioned RTI diagnoses prescribed antibiotics has decreased from 69% to 48% mainly due to decreasing prescription rates for the diagnosis of acute bronchitis from 60 % to 37%, and common cold from 14% to 9%. The extensive use of antibiotics, particularly doxycycline in acute bronchitis or the excessive use of not as first line recommended doxycycline in pneumonia and sinusitis, is not supported by the Swedish guidelines (19, 20), but may be explained by concern for Mycoplasma. Meanwhile the proportion of positive PCR of all submitted Mycoplasma samples amounted to 11-13% during the years 2011-2012 and may be considered unfounded.

For AOM in most children aged 1-12 years guidelines recommend a “wait and see” policy for three days, but it seems that the guidelines are not adhered to (21). However, for many diagnoses, especially for AOM and tonsillitis, more information on symptom duration and signs is needed to judge if antibiotic prescribing was appropriate or not.

Conclusions

Physicians in general practice, trained abroad, had more patient consultations than physicians trained in Sweden. Our findings do not support the hypotheses that physicians trained abroad have a very different antibiotic prescribing pattern for infections in primary care compared with those trained in Sweden. However, the data suggest that all groups could improve their adherence to current guidelines, and that continuous feedback on diagnosis-linked prescribing data in comparison with recommendations, and continuous education together with behavioral change interventions is needed to reduce irrational antibiotic prescribing, and that such interventions should target all physicians in primary care.

Declaration

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Conflicts of interest: none.

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Table 1. Base line characteristics of all 134 participating physicians or residents permanently employed in primary health care during the observed 12 months, divided into three groups according to the region of obtained undergraduate medical education

Region of education	N	Men/women	Specialized (%)	Residency (%)	Mean age ±SD	Mean years from specialization
Western Europe (WE)*	19	10/9	14(74)	5(26)	47,8±12,2	15
Outside Western Europe (Non-WE)**	48	25/23	33(69)	15(31)	44,8±8,4	6
Sweden (SW)***	67	35/32	48(72)	19(28)	46,4±10,8	18
Totals	134	70/64	95(71)	39(29)	46,1±10,3	13

*** Western Europe**, trained in Denmark, Finland, Germany, Austria and Holland

****Outside Western Europe**, trained in Poland, Russia, Bosnia, Lithuania, Italy, Greece, Afghanistan, Brazil, Iraq, Lebanon and China

*****Trained in Sweden**

Table 2. Number of physician consultations and antibiotic prescription patterns for the different diagnostic groups in primary care between May 2011 and May 2012

	Western Europe (WE) (n=19)			Outside WE (Non-WE) (n=48)			Sweden (SW) (n=67)			
Diagnostic groups	Contacts	Ab	Ab (%)	Contacts	Ab	Ab (%)	Contacts	Ab	Ab (%)	P
RTI	3392	1128	33	8993	3467	39	9254	3481	38	0.830
Acute bronchitis	197	77	39	943	384	41	1500	524	35	0.724
Pharyngotonsillitis	412	277	67	1201	863	72	1160	768	66	0.842
COPD - exacerbation	319	52	16	900	129	14	1132	149	13	0.962
AOM	300	219	73	839	705	84	923	773	84	0.587
Pneumonia	351	235	67	923	663	72	842	559	66	0.842
Sinusitis	181	120	66	534	391	73	569	446	78	0.562
Common Cold	1632	148	9	3653	332	9	3128	262	8	0.961
Skin infections	1333	559	42	3725	1613	43	4183	1524	36	0.672
Lower UTI, women*	477	335 (83%)	70	1476	1182 (81%)	80	1728	1308 (87%)	76	0.649
Other infections/symptoms	1473	276	14	3600	651	13	4467	752	12	0.882
Totals	6675	2298	34	17794	6913	39	19632	7065	36	0.918

*) Percent recommended antibiotics - pivmecillinam or nitrofurantoin (column Ab). Group differences: p=0.742)

Differences between e.g. antibiotic prescriptions for a specific diagnosis are scaled down from number of consultations to number of prescribing physicians

Table 3. Relative prescription patterns of various antibiotics calculated for the most common RTIs, including consultations where an antibiotic was not prescribed (NoAb)

	Acute bronchitis	Pharyngo-tonsilitis	COPD-exacerbation	AOM	Pneumonia	Sinusitis	Common cold
Western Europé (WE)							
Contacts (n)	197	412	319	300	351	181	1632
NoAb (%)	61	33	84	27	33	34	91
Doxycycline (%)	29	0	13	1	26	18	3
PcV (%)	6	55	1	59	28	42	4
Amoxicillin (%)	3	1	3	10	4	2	1
Others (%)	2	11	0	3	9	5	1
Outside WE (Non-WE)							
Contacts (n)	943	1201	900	839	923	534	3653
NoAb (%)	59	28	86	16	28	27	91
Doxycycline (%)	28	1	11	1	28	25	2
PcV (%)	10	58	0	70	32	41	5
Amoxicillin (%)	1	1	2	8	5	4	1
Others (%)	2	12	1	5	6	3	2
Sweden (SW)							
Contacts (n)	1500	1160	1132	923	842	569	3128
NoAb (%)	65	34	87	16	34	22	92
Doxycycline (%)	22	1	9	1	23	22	3
PcV (%)	6	55	0	65	32	49	3
Amoxicillin (%)	3	1	2	12	5	4	1
Others (%)	4	10	2	6	6	3	2

Notes: *Acute visits for pneumonia and COPD cannot be distinguished from revisits, which underestimates prescription rates.