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RESEARCH ARTICLE

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Peer academic detailing on use of antibiotics in acute respiratory tract infections. A controlled study in an urban Norwegian out-of-hours service

Roar Dyrkorn[a], Svein Gjelstad[b], Ketil Arne Espnes[a] and Morten Lindbæk[b]

[a]Department of Clinical Pharmacology, St. Olavs Hospital, Trondheim, Norway; [b]Department of General Practice, Antibiotic centre for primary care, Institute for health and society, University of Oslo, Oslo, Norway

ABSTRACT

Objective: To analyse if peer academic detailing by experienced general practitioners (GPs) could be a useful way to change Medical Doctors (MDs) prescription of antibiotics for acute respiratory tract infections (ARTIs) in out-of-hours service. ***Method:*** An educational Intervention study based on prescription data among MDs working in an out-of-hours service from June 2006 through October 2008. Specially trained GPs lectured a peer educational program (3×45 minutes) about use of antibiotics for ARTIs according to national recommendations. ***Outcome measures:*** The type and frequency of antibiotics prescribed for different ARTIs before and after intervention comparing the intervention group with the control group. ***Subjects:*** 22 MDs in the intervention group and 31 MDs in the control group. ***Results:*** The intervention group showed an overall statistically significantly absolute increase in the use of penicillin V (Penicillin V) of 9.8% (95% CI: 2.3%–17.4% $p < 0.05$), and similarly an statistically significantly absolute decrease in the use of macrolides and lincosamides of 8.8% (95% CI: 2.6%14.9.2% $p < 0.05$) for all diagnoses. For subgroups of ARTIs we found a significant increase in the use of Penicillin V for acute otitis media, sinusitis, pneumonia and upper ARTIs. There was no significant changes in total prescription rates in the two groups. 41% of all consultations with respiratory tract infections resulted in antibiotic prescription. ***Conclusions:*** Using trained GPs to give peer academic detailing to colleagues in combination with open discussion on prescription, showed a significant change in prescription of antibiotics towards national guidelines.

KEY POINTS

- Phenoxymethylpenicillin is the first choice for the most of respiratory tract infections when indicated.
- Despite the guidelines for the choice of antibiotics in Norway, general practitioners' choice often differs from these.
- We showed that a session of three times 45 min of peer academic detailing changed significantly the choice of antibiotics towards the National Guidelines in an urban Norwegian out-of-hours service.

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Introduction

The emerging worldwide threat of bacterial antibiotic resistance as a result of overuse of antibiotics [1] demands an increased effort to identify determinants and patterns of antibiotic prescribing in order to improve clinical practice. In Norway, more than 85% of all antibiotic prescriptions are issued by general practitioners (GPs), and about 60% of these prescriptions are issued as treatment for common acute respiratory tract infections (ARTIs). Generally, the number of antibiotic prescriptions has risen by more than 30% in Norway during the last two decades. During the last decade Norwegian GPs' use of macrolides has increased from 1.5 DDD/1000 inhabitants/day in 1998 to 2.3 DDD/1000 inhabitants/day in 2007.[2]. The increase in multiresistant *Streptococcus pneumoniae* (MRSP) is of clinical concern as well as of public health interest. In Finland Seppala et al. [3] showed that after nationwide reductions in the use of macrolide antibiotics for outpatient therapy, there was a significant decline in the frequency of erythromycin resistance among group A

CONTACT Roar Dyrkorn roar.dyrkorn@stolav.no Clinical Pharmacologist and GP, Department of Clinical Pharmacology, St. Olavs Hospital, Trondheim, Norway

streptococci isolated from throat swabs and pus samples.

Arnold and Straus found conflicting results as to the effect of various interventions to reduce antibiotic use in primary care in a Cochrane Collaboration systematic review in 2005.[4] Their conclusion was that only multifaceted interventions have the potential to reduce antibiotic prescribing to a degree that may reduce antibiotic resistance.

Earlier Norwegian studies showed that the use of antibiotics for treatment of acute otitis media were higher than national recommendations, 64% in daytime practice and 91.5% in an out-of-hours (OOH) service, respectively.[5] A few studies on antibiotic prescription in Norwegian OOH service [6–8] have been performed. These have also shown that educational intervention gives significant results.

The large Rx PAD study was performed in Norway and gave significant changes in total prescribing of antibiotics in ARTIs in Norwegian general practice, as well as an increased proportion of narrow spectrum penicillin prescriptions. This study was based on the experiences from Rx PAD study [9].

The objectives of this study were to investigate the effect of a peer academic detailing programme on the prescribing habits of antibiotics towards national guidelines for the treatment of ARTIs and to analyse changes in proportion of Penicillin V prescription in subgroups of ARTIs.

Materials and methods

The OOH service in the city of Trondheim serves about 170,000 inhabitants and 30,000 students and staffs about 60 medical doctors (MDs), mostly GPs. At least two MDs are on duty at all times. We made an extraction from the electronic journal system of all ARTI consultation–diagnosis listed below and any prescriptions following these consultations between 1 June 2006 and 31 May 2007 (baseline). Out of 32,601 consultations, 5295 (16.2%) were ARTIs. We invited all 60 GPs to participate in a peer educational program (3×45 min) about use of antibiotics for ARTIs according to national recommendations, which were held in September and October 2007. In addition we produced an A4-notice with a short version of the national guidelines [10] for treatment of ARTIs which was placed in three offices used by the MDs on duty and which also could be seen and potentially used by both the intervention and the control group's GPs.

Thirty-four MDs participated in the peer educational programme by invitation and 30 of them were interested in a personal evaluation of their prescribing habits before and after the intervention. The intervention data were collected in the period from 1 November 2007 until 31 October 2008. In this period there were 33,267 consultations, of which 5427 (16.3%) were ARTIs. We made an equal extraction of all ARTI consultation–diagnosis and any prescriptions made during consultations in the OOH service for this last period. The 30 MDs who were in the intervention group were given a personal report of their prescribing before and after the peer educational program. They also received continuing medical education (CME) points for participating. All the MDs working in the out-of-hours service have allowed the local authority to use medical data for statistics and research; hence we were able to use the 31 MDs who did not participate in the intervention as our control group. We thus had the data from all 60 MDs working in the OOH service one year before and one year after the intervention. Only doctors who had issued more than 10 prescriptions and delivered data from both periods were included in the study. Thus, our intervention group consisted of 22 MDs where eight were GP specialists. In the control group there were 31 MDs where 12 were GP specialists. In Norway you have to complete a five year structured educational programme to specialise in general practice, and revalidation is required every fifth year. There were no significant differences between the two groups with respect to doctor's gender, age or whether they were GP specialists or not (Table 1).

The Norwegian national guidelines recommend penicillin V as the drug of choice when an antibiotic is needed for ARTIs.[10] Macrolides are recommended as second-line alternatives in the treatment of ARTIs,

Table 1. Characteristics of 53 doctors working in out-of-hours health service divided by whether they received peer academic detailing on use of antibiotics in acute respiratory tract infections in out-of-hours service (Trondheim 2006–2008).

Description	Intervention arm (22 GPs)	Control arm (31 GPs)
GP specialists	8	12
Male GPs (%)	68	83
Mean (95% CI) age in years	39.7 (35.8–43.7)	40.7 (31.1–44.4)
Mean (95% CI) consultation rate at baseline	757 (384–1129)	514 (320–708)
Mean (95% CI) consultation rate intervention year	698 (364–1031)	577 (358–796)
Mean (95% CI) prescription rate at baseline	39.4 (34.5–44.3)	43.4 (38.6–48.2)
Mean (95% CI) prescription rate intervention year	41.3 (35.1–47.5)	41.5 (35.5–47.4)

Table 2. Proportions and absolute changes in proportions (%) in antibiotic prescriptions from 53 doctors.

Outcome	Intervention group (22 GPs)	Control group (31 GPs)
Proportion of ARTI episodes with antibiotic prescription	Mean (95% CI)	Mean (95% CI)
Before intervention	39.4 (34.5 to 44.3)	43.4 (38.6 to 48.2)
After intervention	41.3 (35.1 to 47.5)	41.5 (35.5 to 47.4)
Change	1.9	− 1.9
Proportion of penicillin V		
Before intervention	65.5 (58.2 to 72.8)	68.8 (62.0 to 75.5)
After intervention	75.3 (69.4 to 81.2)	69.2 (62.9 to 75.5)
Change	9.8* (2.3 to 17.4)	0.4 (−5.2 to 6.1)
Proportion of penicillin with extended spectrum		
Before intervention	7.2 (2.7 to 11.7)	4.3 (1.7 to 6.8)
After intervention	6.7 (2.5 to 10.8)	6.6 (2.7 to 10.5)
Change	−0.5 (−4.3 to 3.1)	2.3 (−1.3 to 6.0)
Proportion of macrolides and lincosamides		
Before intervention	21.3 (15.6 to 26.9)	22.7 (17.3 to 28.0)
After intervention	12.5 (8.1 to 16.9)	18.8 (12.6 to 24.9)
Change	−8.8* (−14.9 to −2.6)	−3.9 (−9.6 to 1.9)
Proportion of tetracyclines		
Before intervention	4.4 (2.7 to 6.1)	2.9 (1.3 to 4.5)
After intervention	2.2 (0.7 to 3.8)	3.7 (1.4 to 6.0)
Change	−2.2 (−4.3 to 0.01)	0.8 (−1.4 to 3.1)
Proportion of all other antibiotics in ATC J01 group		
Before intervention	0.6 (−0.07 to 1.3)	0.4 (−0.1 to 0.9)
After intervention	1.0 (−0.6 to 2.6)	0.6 (−0.2 to 1.4)
Change	0.4 (−1.4 to 2.2)	0.2 (−0.7 to 1.1)

*Statistical significance at $p = 0.05$ level.
Note: Values are based on means for each group, analysed by paired sample *t*-test.
The intervention group received peer academic detailing on prescription of antibiotics in acute respiratory tract infections in out-of-hours service (Trondheim 2006–2008).

because the prevalence of non-penicillin-susceptible *S. pneumoniae* was below 3% in Norway.

The study protocol was approved by the Regional Committee for Medical and Health Research Ethics (13 April 2007).

STATA 13.1 [11] was used for the statistical analyses and we used paired *t*-tests to find differences between the groups before and after intervention. The total sample size was limited by the number of doctors on the OOH service and a time frame of one year. We used multilevel logistic regression analyses to find the effect on Penicillin V prescriptions in the different infection groups. During data analyses, we grouped some diagnostic ICPC-2 codes reflecting similar illnesses: ear infections (H01, 71, 72, and 74). Other included acute respiratory tract infections diagnoses were acute tonsillitis (R72 and 76), acute sinusitis (R75), acute bronchitis (R78), and pneumonia (R81), upper respiratory tract infections (URTIs) and respiratory symptoms (R01-05, 07-29, 74, and 80) and other respiratory tract infections (R71, 77, 82, and 83). We used the statistical significance level $p < 0.05$.

We always analysed macrolides and lincosamides as one antibiotic group, due to the similarities in microbiological effects and resistance mechanisms. Macrolides account for about 97% of this group.

We grouped the antibiotics used in the same way as in the Rx PAD Study; penicillin V, broad spectrum penicillins, macrolides and lincosamides, tetracycline, and all others (ATC J01) (Table 2).

Results

During the two years the intervention and the control group had an average number of consultations with an RTI diagnosis of 757 and 514 at baseline, respectively, and 698 and 514 in the intervention year (Table 1).

In the intervention group we found that the intervention gave an overall significant rise in the use of penicillin V of 9.8% (95% class interval (CI): 2.3%–17.4%; $p < 0.05$) for ARTIs and a similar significant fall in the use of macrolides and lincosamides of 8.8% (95% CI: 2.6%–14.9.2%; $p < 0.05$).which was the main goal of the intervention (Table 2).

In the control group there was no overall significant rise in the use of Penicillin V or significant fall in use of macrolides and lincosamides (Table 2). The total prescription rates were 41% when the groups were merged after intervention. There were no significant differences between the intervention and control groups in total prescription rates neither at baseline or in the intervention period. The intervention group showed a better adherence to national guidelines after the intervention (Table 1).

From the multilevel regression analyses (Table 3), an increase in the use of penicillin V was seen (OR = 1.60;

Table 3. Multilevel logistic regression analyses where the effect of the intervention on prescribing penicillin V versus other antibiotics for specific conditions.

Diagnose	Observations	OR (95% CI)	*p* Value
All diagnoses	4550	1.60 (1.22–2.10)	<0.01
URTI	1443	1.66 (1.00–2.74)	0.05
Tonsillitis	751	1.06 (0.41–2.73)	0.91
Sinusitis	441	5.52 (1.84–16.6)	<0.01
Acute bronchitis	398	2.53 (0.93–6.87)	0.07
Pneumonia	335	3.22 (1.13–9.22)	0.03
Acute otitis media	1050	2.41 (1.16–5.03)	0.02
Other RTIs	132	1.65 (0.29–9.39)	0.57

Note: Estimates are based on an interaction variable of time and intervention. The highest OR represents the strongest effect of the intervention. The data are adjusted for patients' age and gender, with doctors as clusters.

95% CI: 1.22–2.10; $p < 0.01$) and a subsequent decrease in more broad spectrum antibiotics. For acute otitis media, sinusitis and pneumonia, and upper ARTIs (Table 3) there was a significant increase in the use of penicillin V in the intervention group. Examining the change in use of penicillin V in the intervention group (2431 observations) and the control group (2119 observations) after, versus before the intervention, the ORs were 1.87 ($p < 0.01$) and 1.17 ($p = 0.12$), respectively.

Discussion

We observed an overall statistical significant rise in the use of narrow spectrum antibiotics and a corresponding absolute reduction in the use of macrolides in the intervention group.

Earlier studies have shown conflicting results as to whether interventions can have an impact on MDs' prescribing habits.[4,9,12–14]. The form of intervention that was used in the Rx PAD Study,[9] using specially trained GPs to give lectures to and discuss with colleagues, and which was copied in our study, shows that this kind of intervention gives clinically relevant results both for individuals and to reduce the development of bacterial resistance. As in several other studies [9,13–15] we found that our intervention made MDs in the intervention group more aware of and adherent to national guidelines for the treatment of ARTIs. This gave an increased use of Penicillin V by 9.8% and a reduction in the use of macrolides by 8.8% (Table 2).

We analysed the subgroups and found significant and clinical relevant increase in the use of penicillin V for acute otitis media, sinusitis, pneumonia, and upper ARTIs which were four of seven subgroups (Table 3). The OR for acute bronchitis and other RTIs also increased, but did not show statistical significance. The acute tonsillitis group is a well-known group A Streptococcus infection where the use of Penicillin V seems to be a well implemented practice when needed and did not show any change (Table 3).

When we observe results for acute otitis media with earlier Norwegian studies; the Moere and Romsdal Study which was a cross-sectional observational study, in 1998 [5] and the Rx Pad Study, (a cluster-randomised educational intervention in general practice; prescription peer academic detailing (Rx PAD) study) in 2013,[9] both in daytime general practices, we can observe that the prescription rate for daytime general practice was 64% and 39%, respectively. From OOH services as in the Tromsoe Study, in 1999 [8] and our study in 2007, we can observe the prescription rate 91.5% in the Tromsoe Study and 55.6% before and 65.4% after intervention in our study. These findings indicate a reduction over time in the use of antibiotics for acute otitis media both in daytime general practice and in an OOH service, which is a desired development.

Due to there being a limited amount of studies on treatment for ARTIs in OOH services in Norway there seems to be a common opinion among colleagues that MDs working in OOH services prescribe a lot more antibiotics to ARTIs than GPs in well-organised general practices. There was a difference in total prescription rate between our study (41%) and the Rx PAD study (33.6%) of 7.4%.[9] Admission to the OOH service, strictly speaking, demands a medical problem that cannot wait until the next day, and if this is practiced the difference may not seem higher than anticipated. However the OOH service is also used by patients that just are unable to get an appointment with their regular GP during daytime. A higher prescription rate in OOH services can probably be due to the fact that patients assess their symptoms as so serious that they do not want to wait to see their regular GP the following day. As we know that just a few of the ARTIs need antibiotics, some of the patients who got antibiotics in the OOH service may not have received it if they consulted their regular GP during daytime as the prescription rate was lower in the Rx PAD study. Better accessibility to GPs during daytime could possible result in fewer antibiotic prescriptions. The regular GPs also have better opportunity to follow-up the patients.

Butler et al. [14] in 2012 also showed that a similar kind of intervention reduced the overall antibiotic dispensing in primary care, as did Welschen et al. in 2004.[13]

The Norwegian surveillance program for antimicrobial resistance (NORM), which was established in 1999, has reported an increase in macrolide resistance in *S. pneumoniae* (MRSP) in blood culture isolates from 2.4% in 2000, to 9.7% in 2004 and to 12.4% in 2006.[2]

The development of macrolide resistance in these bacteria also seems to be sensitive to a rise in

consumption of macrolides and this demands a constant effort among GPs to use antibiotics according to national guidelines to avoid further development of MRSP even if some of the increase could have been due to a clonal burst.

Strengths and limitations of the study

This is a pragmatic study from an everyday practice in an urban OOH service. All the data were collected from the electronic medical record system at the OOH service which made the study feasible for the participating MDs. As the baseline data were collected retrospectively, the participants were not able to influence the results. The fact that the two GPs that carried out the intervention had experience as colleague consultants from the Rx Pad Study and were looked upon as peers was probably important.

It is a small study compared with the Rx Pad Study and other studies which have studied different interventions in general practice [9,13–15] but gives the opportunity to compare Norwegian daytime general practice with an urban OOH service.

The fact that this study did not randomise the participants is a limitation, even if the baseline data did not show significant differences.

The subgroup analysis was hampered by the small size of the study. We found significant differences in four subgroups, but in the other three subgroups we did not have enough power to conclude on equality between control and intervention.

Implications for practice

Our findings may be an important contribution in reducing the development of macrolide resistance locally, and similar interventions can probably give similar results in other areas. The high use of Penicillin V in the Nordic countries is important, but may limit the external validity when compared with other European countries where the use of narrow spectrum antibiotics is much lower.[16] However, the main goal of this study was to see whether peer academic detailing is a suitable method to change practice in a desirable direction.

Conclusion

We found that a short intervention (3×45 min) where we presented national guidelines for the use of antibiotics for ARTIs gave an overall increase in the use of penicillin V for ARTIs and a corresponding decreased prescription of macrolides and lincosamides. Peer academic detailing could be used in a multifaceted and systematic manner in clinical fields where there is an evidence-based need for change.

Disclosure statement

All authors declare no conflict of interest.

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