Intervention with educational outreach at large scale to reduce antibiotics for respiratory tract infections: a controlled before and after study

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**Background.** A multiple intervention targeted to reduce antibiotic prescribing with an educational outreach programme had proven to be effective in a randomized controlled trial in 12 peer review groups, demonstrating 12% less prescriptions for respiratory tract infections.

**Objective.** To assess the effectiveness of a multiple intervention in primary care at a large scale.

**Methods.** A controlled before and after study in 2006 and 2007 was designed. Participants were from general practices within a geographically defined area in the middle region of The Netherlands. Participants were GPs in 141 practices in 25 peer review groups. A control group of GP practices from the same region, matched for type of practice and mean volume of antibiotic prescribing. The multiple intervention consisted of the following elements: (i) group education meeting and communication training; (ii) monitoring and feedback on prescribing behaviour; (iii) group education for GPs and pharmacists assistants and (iv) patient education material. The main outcome measures are as follows: (i) number of antibiotic prescriptions per 1000 patients per GP and (ii) number of second-choice antibiotics, obtained from claims data from the regional health insurance company. The associations between predictors and outcome measurements were assessed by means of a multiple regression analyses.

**Results.** At baseline, the number of antibiotic prescriptions per 1000 patients was slightly higher in the intervention group than in the control group (184 versus 176). In 2007, the number of prescriptions had increased to 232 and 227, respectively, and not differed between intervention and control group.

**Conclusions.** The implementation of an already proven effective multiple intervention strategy at a larger scale showed no reduction of antibiotic prescription rates. The failure might be attributed to a less tight monitoring of intervention and audit. Inserting practical tools in the intervention might be more successful and should be studied.

**Keywords.** Antibiotics, controlled study, guideline implementation, respiratory tract infections.

**Introduction**

Respiratory tract infections (RTIs) are important targets for educational strategies aimed at reducing inappropriate prescriptions of antibiotics (ABs). The strategies are particularly aimed at GPs because of the high prevalence of RTI in general practice.1–3 Eighty-five per cent of AB prescriptions for systemic use are prescribed in general practice mostly for RTIs indications, even for those illnesses that have a predominantly viral aetiology.4–10

Inappropriate use of ABs is of great public health concern, both nationally and globally, because of its association with increased AB resistance in the community.10–12 Moreover, it induces high costs, will expose patients unnecessarily to risks of side effects and will encourage re-consulting for similar problems.4,5,13,14 Although Dutch AB-prescribing rates are
relatively low compared with other European countries, even in The Netherlands about half of the AB prescriptions for RTIs lack an evidence-based indication.\textsuperscript{10,11}

The Dutch College of General Practitioners has developed evidence-based guidelines for RTIs.\textsuperscript{15–18} However, implementation of guidelines remains difficult.\textsuperscript{19} Welschen et al.\textsuperscript{20} developed a multiple intervention aiming at reducing AB prescription rates for RTIs in general practice. This multiple intervention has proven to be effective in a randomized controlled trial in 12 peer review groups. The difference in change in AB prescribing between the intervention and the control group was approximately 12\%, without increased referral rates or complications and with preservation of patients’ satisfaction. Part of the multiple active intervention to change GPs’ management was the implementation of tailoring instruments for specific practice situations.\textsuperscript{21–23} What still remained was the question whether routine use of this intervention in daily care would also produce changes in AB use. To investigate whether the earlier developed programme was adaptable, within limits of efficiency, to a regional implementation, it was carried out in a larger group of GPs.

The objective of this study was to assess the effectiveness of the intervention at a larger scale.

Methods

Design
A controlled study with before and after measurement was designed. Within self-selected peer review groups, GP practices were compared with a control group of GP practices from the same region.

Participants and controls
The existing nation-wide structure of GP peer review groups, with collaborating pharmacists, was chosen because of their common interest in promoting rational prescribing through audit and feedback. To detect a 12\% prescriptions’ reduction with a baseline AB proportion of 55\% and with an average of eight GPs per peer review group, the sample size ($\alpha = 0.05; \beta = 0.20$) was calculated at 21 groups. Of all 84 invited peer review groups in the middle region of The Netherlands, GPs in 25 groups with 141 practices agreed to participate in the intervention group. Of the remaining peer review groups, a control group of 141 practices was selected, matched for type of practice (solo or group practice) and volume of AB prescriptions (measured by means of claims data in the region). The GPs in the practices of the control group were not informed about their role in the study, but their claims data were anonymously used to compare with those of the GPs in the intervention group. The number of GPs in the practices in the intervention group ranged from two to nine, while the number in the control group ranged from two to five. The total number of GPs in the intervention group consisted of somewhat more GPs (194) compared with the control group (188).

Intervention
The tailored intervention was basically an educational outreach visit. The education material used was based on the Dutch National Guideline for RTIs and developed by experts of the University and the Institute for Proper Use of Medicine (DGV).\textsuperscript{24} Embedded in implementation methods of the DGV developed for peer review groups, it was used in the educational meetings that consisted of several components: (i) A group education meeting with a consensus procedure on indication and type of ABs for RTIs (acute otitis media, acute sinusitis, acute tonsillitis and acute cough) with academic detailing at the start of the intervention. The GPs also received a communication skills training to make better agreements with their patients about prescriptions. (ii) After 1 year, an audit and feedback was given on their prescriptions. (iii) A second group education for GPs’ and pharmacists’ assistants about Dutch GP guidelines that was followed by a skills training in patient education. (iv) Patient education material to advocate about the self-limiting character of most acute RTIs, self-medication and alarm signals to consult the GP. The group education meetings were organized by staff members of the DGV and were assisted by regional expert GPs, who were trained by expert GPs of our department.

Outcome measures
The primary outcome was the number of AB prescriptions per 1000 patients per GP practice in two measurement periods. Secondary outcome was the percentage of amoxicillin–clavulanaat (Anatomical Therapeutic Chemical classification: J01CR), macrolides (J01FA) and quinolones (J01M) prescriptions (second-choice ABs) of the total AB prescriptions per GP in the two measurement periods.

Data
Prescription data for practices were obtained from claims data of the regional health insurance company (Agis Health Database). As for economic reasons, the AB prescription data were registered per practice; prescriptions for individual GPs could not be deducted. Therefore, practices were used as the level of analyses. The data were collected in three periods: the period before the intervention (baseline; data from January to June 2005), soon after the intervention (January to June 2006) and 1 year after the intervention (January to June 2007). In the research period, the introduction of the new ‘Health Insurance Act’ in January 2006 caused a 20\% outflux of insured patients from the insurance company. An increase of mostly
young and older patients was observed and from the knowledge that these groups are large-scale consumers of ABs, prescription rates were controlled for these age groups.

**Analysis**

Practices with an incomplete registration over 3 years were excluded from analysis. The differences between the intervention and control group in the two successive periods, expressed as the number of AB prescriptions, were tested using t-tests for unpaired samples. To control for possible imbalance of baseline levels, the adjusted prescription rates of the young (0–4 years) and the older (65+ years) patients were used for the analyses.

To assess the effectiveness of the intervention, linear regression analysis was used to analyse the association between predictors and the prescription rates of intervention and control group between 2005 and 2007.25 Besides the number of prescriptions at baseline (2005) and the number of young and old patients, we sorted out other possible confounders from earlier research.26,27 In a step-backward analysis, these predictors were as follows: mean age of GPs, type of practice and urbanization level. For the analysis, we used SPSS (version 14.0).

**Results**

In both the intervention and control groups, GPs stopped practicing, causing incomplete prescription registration. These GPs were excluded for analyses leaving the remaining number of practices to 131 in the intervention group and to 127 in the control group. The remaining GPs in both groups did not differ regarding age, gender and practice characteristics and also in the number of prescriptions at baseline (Table 1).

All 25 peer review groups completed the intervention and claims data could be traced from all practices of the intervention and control group. At baseline, during the first 6 months of 2005, the number of AB prescriptions for acute RTIs per 1000 patients was higher in the intervention group than in the control group, 184 versus 176, respectively. This difference was not significant ($P = 0.23$). Data of the first 6 months of 2006 demonstrated that the number of AB prescriptions per 1000 patients had increased in the intervention group with 12% to 206, while the increase in the control group was 15% up to 202 (Fig. 1). This resulted in an also not significant difference in increase of 3%. In 2007, the number increased again with 13% to 232 in the intervention group and 12% to 227 in the control group; a negligible difference in increase of –1%.

In prescribing first- and second-choice ABs, there was no change during the study period. The percentage of second-choice ABs (amoxicillin–clavulanate, macrolides and quinolones) in the intervention group decreased in 2006 with 1% from 28% to 27%, while the control group remained stable with 27% (Fig. 1). In 2007, the percentage of these second-choice ABs changed opposite and increased to 31% of the total prescriptions of the intervention group. In the control group, it also changed to 31%.

The analysis of the outcome of the number of prescriptions in a step-backward linear regression demonstrated two significant independent variables: the number of prescriptions at baseline and the mean increase of older (>65 years) patients (Table 2).

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**Table 1** Characteristics at baseline of GPs’ age, gender, practice type and urban level

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Intervention group ($n = 131$)</th>
<th>Control group ($n = 127$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in 2005 (mean in years) [SD]</td>
<td>49 [7.5]</td>
<td>48 [7.3]</td>
</tr>
<tr>
<td>Gender (% female)</td>
<td>32</td>
<td>35</td>
</tr>
<tr>
<td>Type of practice (% single handed)</td>
<td>23</td>
<td>23</td>
</tr>
<tr>
<td>Urbanization level (% practised in city)</td>
<td>23</td>
<td>30</td>
</tr>
<tr>
<td>Prescriptions at baseline (number)</td>
<td>184</td>
<td>176</td>
</tr>
</tbody>
</table>

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**Table 2** AB prescriptions predictors in 2007 by multiple regression analysis

<table>
<thead>
<tr>
<th>Predictor</th>
<th>$B$</th>
<th>Beta</th>
<th>Significance</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention group</td>
<td>2.16</td>
<td>0.015</td>
<td>0.802</td>
<td>–14.8 to 19.1</td>
</tr>
<tr>
<td>AB prescriptions per 1000 in 2005</td>
<td>0.51</td>
<td>0.404</td>
<td>0.000</td>
<td>0.37 to 0.66</td>
</tr>
<tr>
<td>Number of patients &gt;65 years</td>
<td>29.6</td>
<td>0.121</td>
<td>0.037</td>
<td>1.79 to 57.2</td>
</tr>
</tbody>
</table>

CI, confidence interval.
most important predictor was the prescription rate in 2005 ($P = 0.000$). Other independent variables had no relation with the number of prescriptions in 2007, i.e. participation in the intervention group made no difference at all compared to the prescribing in the control group ($P = 0.8$).

Discussion

Regional implementation of a multifaceted intervention in order to reduce primary care use of ABs for respiratory infections failed to show relevant effects both in number of prescriptions and in choice of ABs. To scale up the intervention to a larger group of GPs possibly yielded components that might have counteracted the effects on prescribing.

The strengths and limitations of our approach should be taken into account since comparable projects evaluating implementation of a repeated strategy at larger scale were never published.

To explain some more reasons for failure, the theoretical model of ‘the normalisation process in practice’ of May et al. gave us certain hold. The results emphasize again the difficulties of implementation programmes to change AB prescription volumes.

A methodological strength of this study was that it encompassed a substantial number of GPs and prescriptions that will improve the precision of the results. The data from the insurance company were very reliable because of the electronic verification of the pharmacist’s records for reimbursement. As a consequence of scaling up, a limitation could be that the intervention might have been less intensive than in our previous implementation study. However, the way in which the implementation was used by the health care professionals reflected actual procedures in daily care and will ensure the external validity of our results.

The study was also limited in other ways that might have contributed to the failures of the implementation. In the design of a controlled before and after study, a randomization procedure was absent. Though practices under study were compared with practices matched at type of practice and prescription volume, still the prescription rate could have been biased. GPs who volunteered to participate might have had already low AB prescription rates for viral-indicated infections. As we matched these practices at the volume of prescriptions, a rate difference was not to be expected. Furthermore, a cluster analyses to adjust for confounders at the level of peer review groups was omitted because GPs’ practices was the level of analysis. Nevertheless, we controlled the prescription rate for gender and age, while the introduction of the new Health Insurance Act caused a departure of young adults from the insurance company.

A further potential failure might have been the contribution of regional expert GPs, who were trained to assist the educational meetings. We think that the intervention was not applied as rigorously as was done in the experimental ‘Welschen intervention’. Understandably, time and dedication of professionals working in existing organizations, who have also other routine daily tasks, is less intense than those of researchers who are focused on the research question at stake. Apparently, the intervention was not optimally suitable for use in daily routine and will not have influenced enough the GPs’ performance for an endurable implementation of a restrictive AB use. A less tight monitoring by the experts might have yielded in a failure of effectiveness.

In comparison with the Welschen study, in our study the number of AB prescriptions did not decrease but increase. National data also showed an annual increase of AB prescriptions in 2006 and 2007. Part of the increase could be explained by local temporary fluctuations or by a change in national guidelines on otitis media that expanded the indications for ABs for young infants with bilateral otitis. In our study, these guidelines were discussed in the educational meetings and may have caused some adverse effects but it is unlikely that this resulted in over-prescribing.

A second explanation was possibly hidden in the strong association between the intervention effect and the prescription rate at baseline. Information of the process evaluation illustrated that in the educational meetings was much mobility in attendance of the GPs. This may have hampered the introduction of the consensus on indications of AB prescriptions and of a wait-and-see strategy in each of the GP practices; these being important tools for disposal of old attitudes.

Conclusions

We conclude that a regional implementation of an intervention is not always as successful as the same implementation in a more experimental setting, even though we used an active approach of GPs with clear targets and feedback.

The lack of reduction in AB prescriptions can be explained from the less rigorous application of the education and audit that probably was not sufficient to the workability of changes in prescribing. A more structural monitoring of intervention and audit might be realizable when embedded in a quality control programme of accreditation, which is under study currently. Intensification of intervention and audit in large-scale programmes to improve quality of primary care might, however, be difficult from a viewpoint of scarce resources. Another approach might be the enclosure of diagnostic tools (C-reactive protein test, streptest) in the AB guideline that could convince the GP as well as the patient that a prescription is not
necessary. If this could be more persuasive than frequent education, further research that evaluate multiple interventions including a structured programme and practical tools could have better results.

Declaration

Ethical approval: None.
Conflict of interest: None.

References