Effect of educational intervention on antibiotic prescription practices for upper respiratory infections in children: a multicentre study

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Objectives: To evaluate the impact of an educational intervention on judicious antibiotic prescription for upper respiratory diseases in children.

Methods: A multicentre before-and-after study was conducted in five major community child health centres in Israel. Antibiotic prescription data were collected for all visits of patients aged 3 months to 18 years with a diagnosis of acute otitis media, tonsillitis/pharyngitis, sinusitis or upper respiratory tract infection from November 1999 through February 2000 (pre-intervention period) and from November 2000 through February 2001 (post-intervention period). The intervention consisted of a 1-day seminar on the diagnosis and judicious treatment of respiratory tract infections in children according to the recommendations of the Centers of Disease Control and Prevention. The patient files were reviewed for patient characteristics, specific respiratory disease, and specific antibiotics prescribed. The main outcome measures were the rates and appropriateness of antibiotic prescribing for the different respiratory diseases before and after an educational intervention for practising paediatricians.

Results: A total of 4580 clinic visits were eligible for analysis in the pre-intervention period and 4364 in the post-intervention period. From the pre- to the post-intervention period, the odds ratio for appropriate antibiotic treatment was 1.8 for acute otitis media (95% CI 1.52–2.11, P < 0.01) and 1.35 for pharyngitis (95% CI 1.13–1.61, P < 0.01). Overall, use of antibiotics for acute otitis media decreased from 93% to 87.4% (P < 0.05), and for upper respiratory tract infection, from 13.8% to 11.5% (P < 0.05). There were no significant changes in these factors for sinusitis.

Conclusions: A targeted educational intervention can improve antibiotic prescription practices for respiratory infections in children and decrease unnecessary antibiotic use. Such studies can also pinpoint areas that require further attention.

Keywords: antibiotics, respiratory tract infections, education, treatment, community

Introduction

Respiratory infections are the leading reason for antibiotic prescriptions in the paediatric population. According to the 1992 National Ambulatory Medical Care Survey (NAMCS) in the United States, acute otitis media (AOM) was the most common diagnosis for which antibiotics were prescribed (30%), followed by upper respiratory tract infection (URTI), pharyngitis and bronchitis (12%, 10% and 9%, respectively). In a study by Nyquist et al. 44% of children diagnosed with the common cold and 46% of children diagnosed with URTI received antibiotics. A recently published Dutch study showed high (46%) rates of antibiotic prescribing for patients with respiratory diagnosis, especially in children 0–5 years old. Inappropriate prescription of antibiotics can lead to the evolution of bacterial resistance, mainly by selective pressure, an increase in adverse drug effects and an increased financial burden.

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To counter this problem, the Centers for Disease Control and Prevention (CDC) established principles for the use of antimicrobial agents in children, which were later endorsed by the American Academy of Pediatrics. Several studies have suggested interventions to improve the implementation of these recommendations, such as physician education by written guidelines, parental education, point-of-care evidence, and use of public media. However, most of these studies evaluated the effect of the intervention on quantitative rates of antibiotic prescribing in general or for a specific disease entity.

The aim of this study was to evaluate the impact of a targeted physician educational intervention on the quality, appropriateness, and rates of antibiotic prescribing for different respiratory disease entities in children.

At the time of this study, there were no written guidelines by the national paediatric organization so there was no conflict between the CDC and other local guidelines.

Patients and methods

Primary paediatric healthcare in Israel is provided mostly by certified paediatricians in solo practices, group practices, or part of community healthcare centres, which provide acute care, but not immunization or preventive care, to a large number of children (5000–7000 per centre).

In this study, the antibiotic prescription practices of community paediatricians in Israel were examined before and after an educational intervention, held in September and October 2000. The study covered two winter seasons when respiratory morbidity is maximal: pre-intervention, from 1 November 1999 to 28 February 2000, and post-intervention, from 1 November 2000 to 28 February 2001. The study was conducted in five major child healthcare centres in Israel employing 27 physicians and caring for a total of 30 000 patients. The physicians included board-certified paediatricians (n = 14, 52%) and general practitioners who practiced paediatric medicine (n = 13, 48%). The educational intervention consisted of a 1 day seminar on the diagnosis and treatment of paediatric respiratory tract infections based on the principles of the CDC, including viral respiratory tract infections, AOM, acute tonsillopharyngitis, and acute sinusitis. The lecture was given by an expert in paediatric infectious diseases (I. L.), and a written summary of the recommendations was distributed to the participants. Special emphasis was placed on the diagnostic criteria, because overdiagnosis is known to be an important cause of overuse of antibiotics. All physicians in all five healthcentres, without exception, participated in the seminar. The physicians were not aware that they were taking part in a research study, but rather in a project to improve judicious use of antibiotics.

Antibiotic prescription data were collected from the computerized records of the child healthcare centres for all visits by patients aged 3 months to 18 years who were diagnosed with AOM, tonsillopharyngitis, sinusitis or URTI during the study period. Visits of patients with chronic illnesses, immunodeficiency or penicillin allergy were excluded, as were repeated visits within 28 days of the same child with the same diagnosis (possible recurrence) or visits of children who had received antibiotic treatment within the previous 28 days (possible indication for a second-line antibiotic).

Definitions

We defined appropriate antibiotic treatment as the first-line antimicrobial agent stipulated by the Principles ofJudicious Use of Antimicrobial Agents for paediatric respiratory tract infections, as follows: for AOM—amoxicillin or observation without treatment, for tonsillopharyngitis—penicillin or observation until throat culture results were available, for sinusitis—amoxicillin, and for URTI—no antibiotics. We did not examine the criteria for establishing the diagnoses, because our outcome measure was the antibiotic prescription for a specific diagnosis, after it was made by the physician.

Data retrieval

All healthcare centres in the study used the same computerized medical record system (CLICKS by Rosh Tov Ltd, Beer Sheva, Israel). Data for every visit made during the pre- and post-intervention periods that met the inclusion criteria were retrieved by a query specially designed for this study by Rosh Tov Ltd and categorized into three text files: (i) background data—visit code, patient age and sex, and attending physician; (ii) diagnosis—visit code, diagnosis (if there was more than one diagnosis at a single visit, a separate record was compiled for each, with the same visit code); (iii) treatment—visit code, antibiotic prescribed (if more than one antibiotic was prescribed at a visit, a separate record was compiled for each, with the same visit code).

Data protection was assured by the IT directors.

Data and statistical analysis

We compared the appropriateness of antibiotic use for AOM, tonsillopharyngitis and sinusitis before and after the educational intervention (percentage of visits with an appropriate treatment from the total number of visits, with a specific diagnosis) and the rates of antibiotic prescription for any of these diagnoses and for URTI (percentage of visits with antibiotic treatment of any kind from the total number of visits with a specific diagnosis).

Changes in the appropriateness of antibiotic use were analysed by calculating the odds ratio (OR) for appropriate use during the pre- and post-intervention periods for each diagnosis, using the chi-square test corrected for continuity and Fisher’s exact 95% confidence intervals. A similar method was used to examine changes in the proportion of visits in which antibiotics were prescribed, in total and by type. A P value of <0.05 was considered statistically significant.

Results

Of the 12 415 visits for respiratory infections by patients aged 3 months to 18 years during the pre-intervention period, 4580 were eligible for analysis according to the study criteria, as outlined in the Patients and methods section. Of the 13 052 visits for respiratory infections in the post-intervention period, 4364 were eligible for analysis. The remainders were either repeated visits for the same illness or visits of children for whom antibiotics had been prescribed within the previous 28 days. The distribution of diagnoses is shown in Table 1. The most common diagnosis before and after intervention was AOM (46% and 40%, respectively); and

Table 1. Diagnoses of the children who attended the clinics in the two study periods

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Post-intervention</th>
<th>Pre-intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Otitis media</td>
<td>2114</td>
<td>1727</td>
</tr>
<tr>
<td>Pharyngitis/tonsillitis</td>
<td>1434</td>
<td>1610</td>
</tr>
<tr>
<td>Sinusitis</td>
<td>186</td>
<td>166</td>
</tr>
<tr>
<td>URTI</td>
<td>846</td>
<td>861</td>
</tr>
</tbody>
</table>

URTI, upper respiratory tract infection.
the rates of URTI were similar in the two periods (18.5% and 19.7%).

Changes in appropriate antibiotic use and rates of antibiotic prescription (Table 2)

Appropriate antibiotic treatment was prescribed for AOM in 74.7% of all visits for AOM in the pre-intervention period, and increased to 84.4% in the post-intervention period (OR = 1.8, 95% CI 1.52–2.11, P < 0.01). Likewise, appropriate treatment of tonsillopharyngitis was prescribed in 40.6% of the visits before the intervention and 49.6% after (OR = 1.35; 95% CI 1.13–1.61, P < 0.01). Antibiotic use of any type for AOM decreased from 93% before the intervention to 87.4% after (P < 0.05). For URTI, the prescription rate decreased significantly, from 13.8% to 11.5% (P < 0.05).

Types of antimicrobial agents prescribed

Otitis media. Among the pre-intervention visits for AOM in which antibiotics were prescribed, the specific drugs prescribed were amoxicillin in 73%, amoxicillin/clavulanate in 13% and cefaclor in 6%. After the intervention, 83% of the prescriptions were for amoxicillin (P < 0.001), 10% for amoxicillin/clavulanate (P < 0.001) and only 1% for cefaclor (P < 0.001).

Tonsillopharyngitis. Penicillin was prescribed in 30% of cases before the intervention compared with 41% after (P < 0.001), whereas amoxicillin prescription decreased from 61% to 50% (P < 0.001). There was no significant change in the prescription of other types of antibiotics for tonsillopharyngitis between the two periods: amoxicillin/clavulanate, 3% and 1%; cefaclor 1% for both periods; cefuroxime axetil, 1% for both; and erythromycin, 4% for both.

Sinusitis. No significant changes were found in the types of antibiotics prescribed for sinusitis before and after the intervention. Amoxicillin was prescribed in 50% of visits, amoxicillin/clavulanate in 22% and cefuroxime axetil in 25%.

Discussion

This study provided us with a true picture of antibiotic prescription for URTI among paediatricians in Israel. After the educational intervention, there was a significant reduction in antibiotic prescribing for AOM and URTI, and an increase in appropriate antibiotic use for AOM and tonsillopharyngitis.

Several research teams have attempted to reduce antibiotic prescribing for respiratory tract infections by an educational intervention.8–15,18–20 Most assessed overall antibiotic use for respiratory tract infections in general, and reported a drop in prescription rates.12,19,21 However, only a few studies assessed the changes with regard to specific diagnoses, as was done in this study. Smabrekke et al.12 noted a reduction in antibiotic prescriptions for AOM, from 90% to 74%, and also a reduction in broad-spectrum antibiotic use, after an educational intervention addressing physicians and parents. Melander et al.13 studied the effect of a medical audit on antibiotic prescribing for respiratory tract infection in children and adults (50% of the study population was above 18 years of age). Antibiotic use for AOM dropped from 93% to 88%, and for URTI, from 13% to 8%. These rates of antibiotic prescribing and reduction were similar to those in our study. Analysis by type of antibiotic yielded an improvement in the treatment of AOM in our study owing to the increase in amoxicillin prescription and the reduction in use of amoxicillin/clavulanate. Other studies showed that close observation without treatment of a first episode of AOM with no risk factors is a safe and cost-effective strategy.14 This issue was also stressed in our intervention and could be the reason for the increase in watchful observation without treatment in our study. For tonsillitis, however, the prescription rate in the study of Melander et al.11 decreased from 94% to 77%, whereas in our study, the pre-intervention rate was lower (83%), and there was no reduction after. At the same time, there was an 11% increase in the use of penicillin for tonsillopharyngitis in our series that could have been due to the emphasis in our intervention on the universal susceptibility of B-haemolytic Streptococcus group A to penicillin.

By assessing changes in antibiotic prescribing for specific diseases and antibiotics, we were also better able to pinpoint areas where further intervention might be needed. We did not demonstrate any change in the antibiotic prescription pattern for sinusitis after the intervention. Cefuroxime axetil and amoxicillin/clavulanate, which are second-line antibiotics for sinusitis,7 still accounted for half the prescriptions. In addition, the rate of inappropriate antibiotic use for tonsillopharyngitis is still high, and there is still an excess of antibiotic use for URTI.

The main limitation of our study is the lack of a control group without intervention. Therefore, the reduction in antibiotic prescribing cannot be attributed solely to our intervention. Recent publications in the medical literature and in the public media have alerted physicians to the dangers of antibiotic overuse and have led to a worldwide decline in prescription for antibiotics in the paediatric population.15 Indeed, some studies of the effect of education showed a reduction in antibiotic use also in the control group which did not undergo the intervention.10,11 Doyne et al.16 recently reported that antibiotic use decreased with no adverse effects, after an academic detailing compared with a minimal intervention (handing out written guidelines).
Finally, our intervention was for physicians only. Other studies showed the importance of parental attitudes and parental demands for antibiotic treatment,17 and trials that included educational interventions for both parents and physicians had promising results.9,10,20–22 An additional intervention for parents in our study might have further improved antibiotic prescription practices.

In conclusion, educational intervention may be effective in improving antibiotic prescription patterns for upper respiratory tract infections in children. The optimal method of education is still unclear, but it should probably include ongoing campaigns for both physicians and parents at local and nationwide levels. Further investigation is needed to identify areas that require more attention, such as sinusitis in our study, and to determine the long-term effect of such interventions.

References


