Has UK guidance affected general practitioner antibiotic prescribing for otitis media in children?

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ABSTRACT

Background Since 1997, UK guidance has advocated limiting antibiotic prescribing for otitis media. It is not known whether this has influenced general practitioner prescribing practice.

Aims and objectives To investigate the trends in diagnoses and antibiotic prescribing for otitis media in children in relation to guidance.

Methods We used the General Practice Research Database to conduct time-trend analyses of diagnoses and antibiotic prescribing for otitis media in 3 months to 15 years old, between 1990 and 2006.

Results A total of 1,210,237 otitis media episodes were identified in 464,845 children; two-thirds (68%; 818,006) received antibiotics. Twenty-two percent (267,335) were classified as acute, 85% (227,335) of which received antibiotics. Overall, antibiotic prescribing for otitis media declined by 51% between 1995 and 2000. Much of this reduction predated guidance. During this period, prescribing for otitis media coded as acute increased by 22%. Children diagnosed with acute otitis media were more likely to receive antibiotics than otitis media not coded as acute (P < 0.05). From 2000 prescribing plateaued, despite publication of further guidance. Otitis media diagnoses consistently paralleled prescribing.

Conclusions The reduction in antibiotic prescribing for otitis media predated guidance. The simultaneous decrease in prescribing for non-acute otitis media and increase for acute otitis media suggest diagnostic transfer, possibly to justify the decision to treat.

Keywords children, ear disorders, epidemiology

Introduction

Otitis media is a common childhood infection diagnosed in ~12% of all children consulting their general practitioner (GP)¹ and accounting for 14% of all antibiotic prescriptions in children.² Since 1997, a series of systematic reviews, government reports and evidence-based clinical practice guidelines have been published in the UK covering the management of otitis media.³–⁸ All reached similar conclusions that there is a limited role for antibiotics in the treatment of otitis media. Acute otitis media is a self-limiting condition with around 80% of episodes spontaneously resolving within 2 to 7 days without antibiotic treatment³ and antibiotics are rarely justified for non-acute otitis media. Since 2003, guidance has specifically advocated delayed prescribing (where an antibiotic prescription is written only for use if the patient is not improving after 48–72 h), particularly in children over 2 years of age.⁵–⁸ However, it is not known whether this guidance has had any impact upon GP antibiotic prescribing practice.

The aim of this study was to investigate the trends in diagnoses and antibiotic prescribing for otitis media in children, in relation to the UK guidance covering the treatment of otitis media. iCAP (the improving Children’s Antimicrobial Prescribing group) used routinely recorded GP consultation and antibiotic prescription data to examine these trends.

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Methods

Study design
We conducted time-trend analyses of diagnoses and antibiotic prescribing for otitis media using routinely recorded data from the General Practice Research Database (GPRD). Analyses were based on all children aged 3 months to 15 years registered with an ‘up-to-standard’ GPRD practice between 1 January 1990 and 31 December 2006.

Dataset
The GPRD is one of the world’s largest computerized databases of anonymised longitudinal general practice patient records, comprising ~6% of the UK census population. Practices contributing to the GPRD are representative of practices in the total UK and are under contract to record all diagnoses, prescriptions, immunisations, hospital referrals and test results of all active patients. Validation studies show quality and completeness of the GPRD data are high.

Identification of otitis media episodes and antibiotics prescribed for otitis media
Diagnoses in the GPRD are classified using either Oxford Medical Information Systems (OXMIS) or Read codes. We identified children with otitis media by searching the GPRD for diagnostic codes corresponding to otitis media or a related label of middle ear disease (Appendix A, available online as supplementary data). Diagnoses were reassigned to sub-groups, classified as either acute or non-acute otitis media; sign and symptom codes indicating acute infection, such as ear discharge or earache, were classified as acute otitis media. Otitis media refers to the acute plus non-acute otitis media diagnoses combined. As otitis media can recur, a 14-day screening period was set from the initial otitis media record during which time-related events were classified as the same episode; the first diagnosis after this period was once again counted as an incident episode and the cycle continued. Any antibiotic listed under the British National Formulary Section 5.1 (with the exception of anti-tuberculosis and anti-leprotic drugs) prescribed in the same consultation as otitis media was diagnosed were classified as being prescribed for otitis media.

Statistical analyses
We calculated age- and calendar year-specific incidence rates for otitis media diagnoses and for antibiotic prescribing for otitis media, per 1000 child years at risk in the GPRD. Data are given for children aged less than and greater than 2 years as some UK guidance differs for these age groups (Box 1). 95% confidence intervals (95% CIs) were generated using Poisson approximation and tests for linear trend were conducted. Data management and analyses were performed using Stata software version 9.2.

Search for UK clinical practice guidance covering the treatment of otitis media
We identified UK systematic reviews, government reports and clinical practice guidelines covering the treatment of otitis media by searching the Cochrane Central Register of Controlled Trials (CENTRAL) (www.cochrane.org), Evidence-Based Medicine for Primary Care and Internal Medicine (www.ebm.bmj.com), National Library for Health
(www.library.nhs.uk), National Library for Medicine (www.nlm.nih.gov), National Institute for Health and Clinical Excellence (NICE) (www.nice.org.uk), Turning Research Into Practice (TRIP) database (www.tripdatabase.com) and hand-searching reference lists of appropriate articles. Relevant data on the chronology and key recommendations of these documents were extracted. Individual trials were not included as it was considered unlikely that these would have had a national influence on GP prescribing practice.

Results

Between 1990 and 2006 there were a total of 2 622 348 children aged 3 months to 15 years within the GPRD, contributing 7 119 677 child years of follow-up data from 423 general practices. A total of 1 210 237 episodes of otitis media were identified in 464 845 children. Approximately, half (51%; 617 221) of the episodes occurred in boys. The mean age at otitis media diagnosis was 5.4 (SD ± 3.8) years. Incidence of otitis media peaked in children aged <1 year and just over one-fifth (21%; 258 638) of all otitis media episodes occurred in children under 2 years of age. Children had an average of 0.46 episodes of otitis media per year, decreasing with increasing age (P < 0.05).

Two-thirds of all otitis media episodes (68%; 818 006) received an antibiotic prescription. Twenty-two percent (267 335) of all otitis media episodes were classified as acute otitis media, 85% (227 335) of which received an antibiotic. A child diagnosed with acute otitis media was significantly more likely to receive an antibiotic prescription than a child with otitis media not coded as acute (85% versus 63% treated, respectively; P < 0.05). Amoxicillin accounted for 76% (622 339) of all antibiotics prescribed for otitis media, whilst erythromycin was the second most commonly prescribed antibiotic (15%; 122 701). There were no differences in the choice of antibiotic between children diagnosed with acute otitis media and those with non-acute otitis media.

Fig. 1 shows that antibiotic prescribing for otitis media in children under 2 years of age increased by 32% between 1990 and 1993 (from 350.9 (95% CI: 344.0–357.7) to 463.3 (95% CI: 457.3–469.2) prescriptions per 1000 child years; P = 0.09), while rates remained stable in the older age groups over this time period. From 1995 until 2000, antibiotic prescribing for otitis media decreased significantly in all age groups (overall decline = 51%, from 177.4 (95% CI: 176.1–178.7) to 86.7 (95% CI: 86.0–87.5) prescriptions per 1000 child years; P < 0.05) and plateaued thereafter. The proportion of otitis media episodes treated with antibiotics decreased significantly over the study period, for all otitis media diagnoses and all age groups (overall treated = 77% in 1990 versus 58% in 2006; P < 0.05; Fig. 2).

Fig. 1 Annual incidence of antibiotic prescribing for acute and non-acute otitis media in children in UK general practice (depicting events from Box 1).

SR = systematic review, GR = government report, HPC = health promotion campaign, G = guideline.
Six UK documents covering the treatment of otitis media were identified and are summarized in Box 13–8, along with other significant events likely to influence GP antibiotic prescribing nationally. Fig. 1 shows that the reduction in antibiotic prescribing for otitis media predated the first UK systematic review that reported the limited benefit of antibiotics for otitis media (Cochrane Collaboration review by Glasziou et al.); over one-third (39%) of the total decrease in antibiotic prescribing observed between 1995 and 2000 had already occurred prior to 1997. Antibiotic prescribing for otitis media plateaued from 2000 onwards in all age groups despite the publication of further national guidance advocating limiting antibiotic prescribing for otitis media.

Fig. 1 shows contrasting trends in antibiotic prescribing for acute and non-acute otitis media. Between 1995 and 2000, a 64% decrease in antibiotic prescribing for non-acute otitis media (from 149.8 (95% CI: 148.6–151.1) to 53.2 (95% CI: 52.6–53.8) prescriptions per 1000 child years; \(P < 0.05\)) coincided with a 22% increase in antibiotic prescribing for acute otitis media (from 27.5 (95% CI: 27.0–28.1) to 33.6 (95% CI: 33.1–34.1) prescriptions per 1000 child years; \(P < 0.05\)). This diagnostic transfer was most striking in children aged <2 years; 61% decrease in antibiotic prescribing for non-acute otitis media (from 391.9 (95% CI: 386.2–397.5) to 151.5 (95% CI: 148.1–155.0) prescriptions per 1000 child years; \(P < 0.05\)) accompanied by a 45% increase in antibiotic prescribing for acute otitis media (from 74.2 (95% CI: 71.2–77.2) to 107.6 (95% CI: 104.6–110.5) prescriptions per 1000 child years; \(P < 0.05\)). Otitis media diagnoses paralleled antibiotic prescribing for otitis media for all age groups throughout the study period, for both acute and non-acute diagnoses (Fig. 2. See also Table 1, available online as supplementary data).

**Discussion**

**Main findings of this study**

Antibiotic prescribing for otitis media halved between 1995 and 2000. Much of this fall predated the emergence of UK guidance advocating limiting antibiotic treatment for this condition. The overall decrease in antibiotic prescribing for otitis media coincided with an increase in prescribing for otitis media coded as acute, most marked in children aged <2 years. GPs were more likely to code otitis media episodes as acute if antibiotics were prescribed.

**What is already known on this topic**

Our findings are consistent with a previous study reporting falls in antibiotic prescribing for otitis media between 1991 and 2000, for all ages, with opposing trends for otitis media...
labelled as acute and that as glue ear (otitis media with effusion). However, it is not known whether the UK guidance advocating limiting antibiotic use for otitis media has had any impact upon GP prescribing practice.

**What this study adds**

Our study explains the trends in diagnoses and antibiotic prescribing for otitis media in relation to the UK guidance covering the treatment of this condition. Additionally, the inclusion of more recent data, until 2006, shows that incidence rates of diagnoses and antibiotic prescribing for otitis media have stabilized since the year 2000.

Antibiotic prescribing for otitis media was already in steep decline prior to the 1997 publication of the first UK systematic review reporting the limited benefit of antibiotics for otitis media and plateaued from 2000 onwards despite the publication of further UK national guidance. Evidence of poor compliance with post-2000 UK guidelines advocating limiting antibiotic use for otitis media raises the question of whether GPs have reached the lowest level of antibiotic prescribing that they find acceptable. In an attempt to assess how much lower antibiotic prescribing could go, we compared the rates of antibiotic prescribing for otitis media in the UK with the Netherlands, the country with the lowest rate of antibiotic prescribing in the world (Fig. 3). Despite the 51% reduction in UK antibiotic prescribing for otitis media between 1995 and 2000, prescribing rates in the UK are still more than twice that of the Netherlands (2003 = 164.0 versus 72.5 prescriptions per 1000 child years, respectively). This suggests that UK antibiotic prescribing for otitis media could most likely be safely reduced even further.

**Limitations of this study**

This is the largest study to date investigating the trends in diagnoses and antibiotic prescribing for otitis media in children. Strengths of our study include the large sample size, the high quality and completeness of GPRD data and the representativeness of general practices in the GPRD to those of the total UK population, where virtually all antibiotic prescribing is initiated. The national representativeness of our study is confirmed by the consistency of findings from other UK wide studies with our results. A further strength was our use of a comprehensive approach to capture all Read/OXMIS codes indicative of otitis media, in an attempt to minimize the problems associated with coding variability between GPs. By then sub-classifying the diagnoses into acute and non-acute otitis media, we revealed opposing trends in diagnoses and antibiotic prescribing in the younger age groups.

However, our study has a number of important limitations. The major weakness, common to all studies based on routinely collected clinical data, is misclassification of the reason for consultation or treatment. Our assumption that an antibiotic prescribed in the same GP consultation as otitis media was diagnosed indicated that the antibiotic was prescribed for otitis media may have been wrong. If an antibiotic was given for another ailment, this would have led to an overestimation

![Graph](https://example.com/graph.png)

**Fig. 3** Annual incidence of antibiotic prescribing for otitis media in children (aged 0 to 13 years) in the UK and the Netherlands. UK data from the GPRD and Netherlands data from the University Medical Center Utrecht Primary Care Network database.
of antibiotic prescribing for otitis media. Similarly, using GPRD data, it was not possible to test for associations between the publication of guidance and GP prescribing practice as the motives for prescribing are unknown. However, the suggested reasons for the changes in antibiotic prescribing for otitis media are supported by the existing literature in this area.27,28

Patient adherence data are not available from the GPRD. Thus, it was not possible to investigate whether GPs were practising delayed prescribing, whereby an antibiotic prescription may have been issued but the GP requested for the patient/parent not to redeem it unless symptoms persisted after 48-72 h, as recommended by the SIGN guidelines6, PRODIGY guidelines5 and the meta-analysis by Rovers et al.8

This could have led to an over-estimation of the proportion of otitis media episodes that were treated with antibiotics. Additionally, GPs contributing data to the GPRD are asked to record ‘all significant diagnoses’12 and may under-report untreated otitis media, thereby, also leading to an over-estimation of antibiotic treated otitis media. A further problem was the data did not allow assessment of severity of otitis media; it may be that antibiotic prescribing for sicker children has remained stable while inappropriate prescribing has diminished.29 GPs may also have different thresholds for prescribing, which could impact upon the results obtained, but these data serve to reflect prescribing as it stands in general practice. Finally, the findings presented in this study were derived from the population consulting their GP. Ideally, to examine otitis media trends, the incidence of otitis media in the entire population, whether consulting their GP or not, is required. However, it is effectively impossible to collect this and GP consultation data, therefore, provides the most accurate measure of otitis media incidence as is practically achievable.30

Implications

The reasons for the trends are not known. An increase in overall antibiotic prescribing from 1980 until 199531,32 followed by a reduction between 1995 and 2000 has previously been reported.2,33,34 The decline in antibiotic prescribing for otitis media is likely to reflect a true reduction in the overall occurrence of otitis media as it is associated with a decrease in GP consultations for respiratory tract infections.25,26 The decline is unlikely to be explained by changes in healthcare-seeking behaviour as overall GP consultation rates in children remained stable between 1995 and 2000.25,26

The simultaneous decrease in diagnoses and antibiotic prescribing for non-acute otitis media and increase for acute otitis media suggest diagnostic transfer, possibly to justify the decision to treat. This is further supported by the consistent parallel trends for diagnoses and prescribing and the fact that GPs were more likely to code the otitis media episode as acute if an antibiotic was prescribed. Such interpretation is plausible as disease is ultimately classified at the discretion of each GP and marked variation in the recording of otitis media between GPRD practices has previously been reported.77 As early as 1972, Howie27 proposed that the diagnosis may at times be a justification for treatment, rather than the reason for it and Mangione-Smith et al.28 reported that the perceived parental pressure to prescribe an antibiotic was associated with the diagnosis given, possibly as a means of rationalizing the treatment decision. The effects of accountability for prescribing, which may increase the need to come up with a diagnosis that justifies the treatment decision, have not yet been explored.

The reasons why GPs may not adhere to the guidance are not fully understood and cannot be determined from this study. However, it is known from previous studies27,38–42 that the decision to treat goes beyond pharmacological reasoning and is based on the interaction between the prescriber and patient with both medical and non-medical factors influencing the prescribing decision, such as fears over the development of complications29 or parental pressure for an antibiotic.28,39,43–45 Non-medical motives are especially true for young children and this may explain the marked increase in antibiotic prescribing for acute otitis media in children aged <2 years.

Qualitative research is needed to examine what motivated the changes in prescribing and to understand why, despite the evidence-based guidance, GP prescribing for otitis media has changed very little since 2000. Formal monitoring of national rates of disease incidence, antibiotic prescribing and potential complications is required to assess the impact and ensure the safety of further national healthcare guidance. In July 2008, the National Institute for Health and Clinical Excellence issued a clinical guideline entitled ‘Prescribing of antibiotics for self-limiting respiratory tract infections in adults and children in primary care’, recommending a delayed or no prescribing strategy for all upper respiratory tract infections, including otitis media.46 Will this guideline further reduce the use of antibiotics for otitis media? Our findings suggest that further guidance urging GPs to reduce antibiotic prescribing is unlikely to have a major impact unless combined with effective implementation strategies. It is essential that prescribers are made aware of their reasons for prescribing, particularly their non-medical motives, and that the barriers to implementation are more clearly identified, understood and addressed when putting future guidance into place, otherwise it seems destined to fail.


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**Author contributions**

R.G. had the original idea for the study. P.L.T. extracted the relevant data from the GPRD. P.L.T. and RG developed the analytical strategy and all authors were involved in the interpretation of the data. P.L.T. prepared the first draft of the manuscript and all authors contributed to writing subsequent and final drafts. I.C.K.W. is the paper guarantor.

**Competing interests**

P.L.T., R.G., M.S. and I.C.K.W. were members of the Department of Health’s Specialist Advisory Committee on Antimicrobial Resistance (SACAR), paediatrics sub-group. P.L.T. and S.S. have no competing interests.

**Ethics approval**

Ethics approval for this research was obtained from the Scientific and Ethical Advisory Group, application number 793R.

**Supplementary data**

Supplementary data are available at *Journal of Public Health* online.

**References**


