Changing GPs' antibiotic prescribing: a randomised controlled trial

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Abstract

A randomised controlled trial involving 54 general practitioners (GPs) was conducted in Canberra, Australian Capital Territory from September 1997 to November 1999. In the first year of the study, 24 GPs, who constituted the active arm of the intervention group, were involved in the consideration of evidence and the development and implementation of a set of clinical guidelines for the treatment of acute respiratory infections. These guidelines were then endorsed in a meeting together with specialist colleagues. In the second year of the study the group of GPs who had been acting as controls, received a moderate intervention consisting of a brief educational event and distribution of the locally developed guidelines. We obtained data from January 1997 to December 1999 from the Health Insurance Commission on prescribing rates for 40 of the doctors in the study. The rate of prescribing was calculated as the number of antibiotic prescriptions per 100 Medicare services. The average yearly prescribing decreased significantly in the intensive intervention group and increased in the moderate intervention group, (p=0.026). A mixed effects longitudinal time series model was fitted to the data to account for seasonal variation of antibiotic prescribing and trends over time. The intensive intervention group significantly reduced their antibiotic prescribing over time compared to the moderate intervention group, (p<0.001). This study has shown that an intensive intervention in which general practitioners were actively engaged in development and consideration of the evidence base for the guidelines resulted in a significant fall in general antibiotic prescribing. *Commun Dis Intell* 2003;27 Suppl:S32–S38.

Keywords: acute respiratory infections, antibiotic prescribing, antibiotic resistance

Introduction

Acute respiratory infections (ARI) are a very significant part of the workload of general practitioners (GPs). Antibiotics are frequently used to treat these generally self-limiting infections. For different types of respiratory infections, the antibiotic prescribing rate in general practice ranges from 50 to 90 per cent.[1]

Numerous studies have demonstrated that antibiotics offer at best a modest benefit for most acute respiratory infections. Antibiotics are not indicated for simple upper respiratory tract infections.[2,3,4] However, upper respiratory tract infection is often associated with bronchitis, pharyngitis, otitis media or sinusitis. These conditions can sometimes benefit from antibiotic treatment in a subset of patients.[5,6,7,8,9,10,11,12,13] The difficulty for the clinician is to distinguish, at the time of the consultation, which subset of patients would benefit from antibiotics and which would not. The signs and symptoms of these illnesses may not clearly differentiate between these groups of patients. A watchful approach may often be justified,[14,15] but the pressures of modern practice are such that clinicians currently tend to overuse these drugs.

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In light of growing antibiotic resistance and the modesty of the clinical benefit[16] calls have been made for a more judicious use of antibiotics for the treatment of acute respiratory infections.[17] Yet the task of altering established practices of antibiotic use remains an unmet challenge.[18]

This paper reports on the effect on general prescribing practices of a randomised controlled trial that tested two different approaches to the implementation of clinical guidelines for antibiotic use in management of childhood respiratory infections.

Methods

We undertook a two year randomised controlled trial to explore the effects of a unique method of clinical practice guideline development and implementation on antibiotic use for acute respiratory infections in young children. The recruitment of participants and methods of guideline development are described fully elsewhere.[19] Briefly, 54 GPs from practices in Canberra, Australian Capital Territory (one GP per practice) were recruited into the study beginning in September 1997. GPs were randomly allocated into an intensive intervention group or a moderate intervention group. The intensive intervention consisted of a series of focus groups with parents of young children and workshops with the study GPs (beginning in the first quarter of 1998). Clinical practice guidelines for the management of childhood ARI were collaboratively developed in these focus groups and workshops. Evidence for antibiotic treatment of ARI from Cochrane reviews and other studies was explored and examined in light of the experiences and expectations of GPs and consumers in the management of these illnesses. Barriers to the judicious use of antibiotics for ARI were identified and discussed and an implementation package developed which addressed these barriers to change. This package consisted of:

- Guidelines for GPs: The guidelines were entitled *Principles of Practice* and stated the principles of management of ARI that the GPs had agreed upon during the development process. The guidelines were flexible and allowed for the realities of general practice and patient preference. They incorporated the evidence and were tailored to GP and patient concerns to allow for ownership of the guidelines.
- Information sheets on otitis media and sore throat: Copies of these sheets were given to GPs to distribute to patients. The sheets were developed by Dr Chris Del Mar, one of the authors for the Cochrane review on antibiotic treatment of otitis media[11] and sore throat[8] and kindly given to us for use in this study. The information sheets allowed for the education of patients in a time efficient manner.
- ARI management prescription pad: These prescription-like pads allowed the GP to tick a series of boxes that explained the diagnosis, recommended symptomatic treatment, and caution on the warning signs if the patient did not have any improvement. The prescription pads also contributed to the education of the patient by providing clear advice on self-management.
- Poster: We developed a colourful poster to be displayed in the GPs surgery that advocated the judicious use of antibiotics. The poster helped to market the new way of practice.

The implementation package was distributed to the intensive intervention group in the first year of the study shortly after the last workshop session (April 1998). The moderate intervention group acted as a control for the ensuing year.

In the second quarter of 1999, the moderate intervention group was provided with the locally developed guidelines and implementation package at an evening educational event. At this time the intensive intervention group received prescribing feedback and reinforcement of the guideline principles at a follow-up evening group meeting. Thus the study tested the comparative effects over time of two levels of intervention, an intensive intervention and a moderate intervention. Although not part of this analysis, the study also provided guidelines to parents and education through newsletters.

GP antibiotic prescribing was monitored using Health Insurance Commission (HIC) data obtained with GP's permission from 40 of the 49 GPs still active in the study by the end of 1999, 20 from each intervention group. The total number of antibiotic prescriptions filled for patients eligible for Pharmaceutical Benefits Scheme subsidy and total number of Medicare services provided by the GPs in the two groups were calculated by calendar quarter from 1997 through 1999 and by calendar year. The variable of interest was the number of subsidised antibiotic prescriptions per 100 Medicare services.

A mean rate of prescribing was calculated for each year of the study and the change in prescribing from the baseline year (1997) to the intervention years of 1998 and 1999 were compared using t-tests. To account for the seasonal variation in antibiotic prescribing, detail which is lost using a yearly mean rate, a mixed effects longitudinal time series model was fitted to the HIC data using Stata version 7 software.[20] The model incorporated a random effect clustered by GP and fixed effects of intervention group and sine and cosine terms to account for the seasonal variation of antibiotic prescribing. In addition, a linear term in time was added to measure trend within the intervention groups.

Results

Antibiotic prescribing followed a cyclical seasonal pattern. Prescribing was lowest in the summer months (first quarter) and highest in the winter months (third quarter). Table 1 details the number of antibiotic prescriptions per 100 Medicare services by intervention group and quarter.

Table 1. Mean number of antibiotic prescriptions per 100 Medicare services by intervention group and yearly quarter

Quarter*	Group	Mean ± SD	95% CI
Q1 – 1997	IIG	6.67 ± 2.7	5.4, 7.9
	MIG	5.68 ± 1.7	4.8, 6.5
Q2 – 1997	IIG	7.66 ± 2.6	6.4, 8.9
	MIG	7.61 ± 3.3	6.1, 9.1
Q3 – 1997	IIG	8.73 ± 2.8	7.4, 10.1
	MIG	8.39 ± 2.5	7.2, 9.6
Q4 – 1997	IIG	7.01 ± 2.4	5.9, 8.1
	MIG	6.96 ± 1.9	6.1, 7.8
Q1 – 1998	IIG	5.92 ± 2.1	4.9, 6.9
	MIG	5.82 ± 1.7	5.0, 6.6
Q2 – 1998	IIG	6.16 ± 2.3	5.1, 7.2
	MIG	7.14 ± 2.2	6.1, 8.2
Q3 – 1998	IIG	8.00 ± 3.3	6.5, 9.5
	MIG	7.92 ± 2.1	6.9, 8.9
Q4 – 1998	IIG	7.53 ± 2.8	6.2, 8.8
	MIG	7.61 ± 2.4	6.5, 8.7
Q1 – 1999	IIG	6.43 ± 2.4	5.3, 7.6
	MIG	6.33 ± 2.4	5.2, 7.4
Q2 – 1999	IIG	6.47 ± 2.3	5.4, 7.5
	MIG	7.14 ± 2.5	6.0, 8.3
Q3 – 1999	IIG	7.16 ± 3.5	5.5, 8.8
	MIG	8.60 ± 2.5	7.4, 9.8
Q4 – 1999	IIG	6.90 ± 3.1	5.5, 8.3
	MIG	8.00 ± 2.6	6.8, 9.2

* Recruitment into the study started at the end of Q3 1997. Intensive intervention began from Q1 1998 and moderate intervention began from Q2 1999.

IIG Intensive intervention group.

MIG Moderate intervention group.

Antibiotic prescribing during the baseline year of 1997 was not significantly different between the intensive and moderate intervention groups as shown in Table 2. Over the course of the study the mean rate of prescribing for the intensive intervention group decreased by –0.78 prescriptions per 100 Medicare services whereas the mean rate of prescribing increased by 0.35 prescriptions in the moderate intervention group, a difference of –1.13, 95 per cent CI (-2.1, –0.1) and p=0.026 (Table 2).

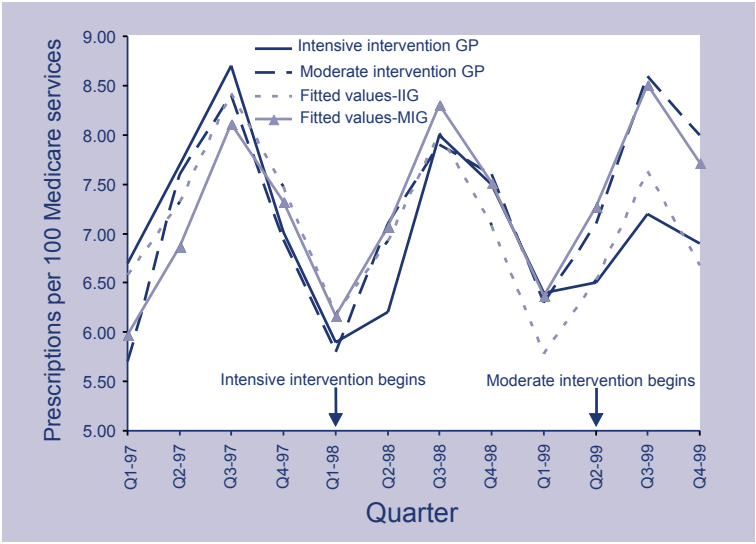
Table 2. Baseline level of antibiotic prescribing and mean yearly change

Group	Baseline prescribing in 1997 (number of prescriptions per 100 Medicare services)	Mean change* from 1997 to 1998	Mean change from 1997 to 1999
Intensive intervention group	7.52 ± 2.4	–0.62 ± 1.3	–0.78 ± 1.3
Moderate intervention group	7.16 ± 2.2	–0.04 ± 0.8	0.35 ± 1.7
p value 95% confidence interval	0.630 (–1.1, 1.8)	0.100 (–1.3, 0.1)	0.026 (–2.1, –0.1)

* Mean yearly difference ± standard deviation.

The seasonal pattern of prescribing was accounted for by a mixed effects longitudinal time series model fitted to the HIC data. There was a highly significant interaction between intervention group and time, p<0.001, whereby the intensive intervention group reduced their antibiotic prescribing over time compared to the moderate intervention group (ß coefficient = –0.15, 95% CI –0.22, –0.07). The Figure shows the fitted curve of the model with the data for mean rates of prescribing by quarter for each intervention group.

Figure. Prescriptions per 100 Medicare services in groups of GPs before and after intensive or moderate interventions to revise prescribing practices for upper respiratory tract infections, means and fitted values



Source: Data from the Health Insurance Commission

Discussion

A detailed analysis of the randomised trial that involved 54 general practitioners and 502 of their child patients has been presented elsewhere.[21] That report showed that GPs in the intensive intervention group changed their prescribing practices in relation to the study children. The analysis in the present paper was undertaken to test whether this change in prescribing behaviour, which was evident for children enrolled in the study, carried over into the overall practices of the doctors, including patients who were not enrolled in the very intense diary keeping study. This study has shown that a multi-faceted evidence-based approach to guideline development and implementation was effective in reducing general antibiotic prescribing.

The use of the Pharmaceutical Benefits Scheme and Medicare data involved some limitations but provided an objective measure of prescribing behaviour over time. The Health Insurance Commission will hold a record of a prescription only if the cost of the drug is higher than the patient contribution, approximately A$21.00 at the time of the study. However, prescriptions from pensioners and holders of concession cards is recorded. Thus the data capture for antibiotic prescriptions, which generally cost less than the patient contribution, was incomplete. This incomplete data capture, however, would have been equal for both intervention groups and not a source of bias. Furthermore, HIC data has been used previously to monitor antibiotic prescribing.[28] Only 40 of the 49 GPs active at the end of the study gave written permission to obtain their prescribing information from the HIC. Those that did not comply, however, were equally distributed between the two groups.

Clinical practice guidelines have long been seen as a way to enhance best practice in health care. The National Health and Medical Research Council has published a series of handbooks detailing the main stages of clinical practice guideline development and implementation.[22] However, observed change in studies of guideline development and implementation have often been modest.[23,24,25] Single interventions frequently resulted in little or no change in behaviour but complex interventions using several methods had a better chance of producing change.[26,27] Nevertheless, all make it clear that, as Oxman *et al* declare, 'there are no magic bullets'.[25] There is no one method that will effectively change clinical behaviour.

Grol and Grimshaw[18] provide a general framework for integration of evidence with clinical practice. They advocate an evidence-based multi-faceted approach, the careful assessment of barriers to change, and tailoring interventions to specifically address the barriers. This general framework was used to guide the approach of guideline development and implementation described in this study. We first started with the evidence for the judicious use of antibiotics for ARI. Then the barriers to incorporating the evidence into practice for GPs and consumers were assessed through the process of guideline development using focus groups and workshops. The identification of these barriers have been presented previously.[19] Discussing the evidence, identifying the barriers to incorporate the evidence into practice, openly exploring these issues with the GPs in a collaborative peer environment, and devising an implementation package to address these barriers contributed to the development of guidelines that were effective for changing practice in the intensive intervention group of GPs. Furthermore, ongoing contact was maintained with the intensive intervention group through feedback reports and reinforcement of guidelines. A moderate intervention of distribution of the locally developed guidelines and implementation package with a brief educational component was not sufficient to reduce antibiotic prescribing in the moderate intervention cohort of GPs.

Although labour intensive, the workshops, which were the main difference between the intensive and moderate interventions, were effective in changing clinical behaviour. The process of examining the evidence and discussing this with their colleagues during several sessions, with the support of academic GPs to clarify the evidence, was more influential in changing GP behaviour than distribution of the evidence-based guideline package with a brief educational event (moderate intervention).

Others have shown that passive dissemination of guidelines,[23] unsolicited feedback reports,[28] or didactic continuing medical education[28] are generally ineffective in changing clinical behaviour. This study has shown that antibiotic prescribing can be significantly reduced using methods that discuss

the evidence in a peer-supported environment. The need for effective methods to reduce antibiotic prescribing becomes more urgent in light of the results from companion research to this study that has shown antibiotic use in the community directly correlates with the level of antibiotic resistance.[29] In Australia there may be a role for the Divisions of General Practice, in conjunction with academic institutions, to organise workshop series with GPs and focus groups with consumers for the open examination of evidence, experiences, and preferences to enhance the practice of evidence-based health care.

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