ORIGINAL ARTICLE

Modifying Antibiotic Prescribing: The Effectiveness of Academic Detailing Plus Information Leaflet in a Malaysian Primary Care Setting

C L Teng, MMed*, F I Achike, MD*, K L Phua, PhD*, M I Nurjahan, FAFPM*, I Mastura, MMed, H Nor Asiah, MMed**, A M Mariam, MMed**, S Narayanan, MMed**, A Norsiah, MMed**, I Sabariah, MMed**, I Shariah, MMed**, K Siti Rokiah, MMed**, M A Siti Zubaidah, MMed**, C N Koh, M OccMed***, I Rosnah, MPH*****

*International Medical University, **Family Medicine Specialist, Klinik Kesihatan in Negeri Sembilan, ***Head, Klinik Kesihatan Seremban, Negeri Sembilan, ****Director, State Health Department, Negeri Sembilan

Summary

We assessed the effectiveness of an educational intervention in reducing antibiotic prescribing in public primary care clinics in Malaysia. Twenty-nine medical officers in nine clinics received an educational intervention consisting of academic detailing from the resident Family Medicine Specialist, as well as an information leaflet. The antibiotic prescribing rates were assessed for six months - three months before and three months after the intervention. A total of 28,562 prescriptions were analyzed. Among participating doctors, general antibiotic prescribing rates for pre- and post-intervention phases were 14.3% and 11.0% (post-intervention vs pre-intervention RR 0.77, 95%CI 0.72 to 0.83). The URTI-specific antibiotic prescribing rates for pre- and post-intervention phases were 27.7% and 16.6%, respectively (post-intervention vs pre-intervention RR 0.60, 95%CI 0.54 to 0.66). No significant change in antibiotic prescribing rates was observed among primary care practitioners who did not participate in the study. This low cost educational intervention using both active and passive strategies focusing on URTI produced a statistically significant (and clinically important) reduction in antibiotic prescribing.

Key Words: Prescribing, Primary care, Upper respiratory tract infection, Academic detailing, Information leaflet

Background

Upper respiratory tract infections (URTI) constitute about one-third of the cases seen in Malaysian primary care setting[1,2]. A multitude of pathogens can give rise to URTI, the most common being viruses. Even in acute pharyngitis where the URTI manifestation is primarily a sore throat, Group A beta-hemolytic streptococcus can be isolated in no more than 20-30% of cases[3]. Three case series from Malaysia and Singapore reported Group A streptococcus isolation rates between 10.2 to 15.7% in URTI[4-6]. Notwithstanding the above, we have reported that the antibiotic prescribing rate for URTI was about 30% in public primary care clinics[7,8] and up to 68% in private general practice clinics[9].

Various factors act in concert to maintain the high antibiotic prescribing rates in URTI. These include patients/parents expectations, prescribers' uncertainty and erroneous clinical decision making, and marketing by the pharmaceutical industry[10]. While antibiotics are

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Corresponding Author: Teng Cheong Lieng, International Medical University, Jalan Rasah, 70300 Seremban, Negeri Sembilan Darul Khusus, Malaysia

life-saving in serious infections, their indiscriminate use in relatively trivial infections, such as URTI, is an important factor in the emergence of antibiotic resistance[11]. This problem is worldwide and various regulatory bodies/researchers periodically determine the antibiotic prescription rates within their areas of practice as an index of antibiotic abuse and also as an important database for the designing and execution of corrective intervention. Antibiotic prescribing in the Malaysian primary care is done by three categories of healthcare workers - the specialist primary care physician (Family Medicine Specialist - FMS), the medical officer (MO) and the medical assistant (MA). A typical primary care clinic is run by one or two MOs with a few MAs who depend on the MOs for leadership and guidance. A few clinics have FMS who invariably head such units and serve as role models for the MOs. The current follow up study was designed with a view to exploring the possibility of reducing antibiotic prescription rates in the Malaysian primary care setting. To enhance sample homogeneity and thus minimize confounding factors, this intervention study was targeted at the MOs who do most of the antibiotic prescribing and have a great potential to influence the MAs.

Several workers have revealed a lack of effectiveness of passive strategies (e.g. printed educational materials[12]) in changing physician's prescription behavior, while relatively more active strategies (e.g. academic detailing[13], opinion leader[14], and audit with feedback[15]) have shown greater promise. Academic detailing or educational outreach, a one-to-one encounter between the detailer and the prescriber with the aim of transferring unbiased information,[16] has been shown to be effective in modifying physicians' prescribing behaviors[17,18]. To date, this approach has been used largely in Western countries[19-21]. In this study, we have combined academic detailing with a passive strategy (information leaflet) in exploring the possibility of changing the antibiotic prescribing for URTI in Malaysian public primary care clinics - specifically those in the state of Negeri Sembilan.

Materials and Methods

Subjects and setting

At the time of the study, the state of Negeri Sembilan had 39 public primary care clinics. Nine of the larger clinics with resident FMS were selected for the study. Forty medical officers and ten medical assistants served in these nine clinics but only 29 medical officers participated in this study, the remaining eleven being unavailable for intervention for various reasons, including annual leave and out-station relief duties or were newly recruited and thus had no pre-intervention data. The non-participating primary care practitioners constituted the inadvertent non-intervention control group (see discussion).

Study design

We have chosen an interrupted time series design for this intervention. The scheme of the study is as shown in Figure 1. Antibiotic prescribing rate was measured for six months in these clinics. The first three months (January to March) was considered the pre-intervention phase and the last three months (April to June) were considered the post-intervention phase. Educational interventions consisted of academic detailing and the dissemination of an educational leaflet.

Intervention

The educational intervention consisted of several components:

(1) A one-page evidence-based summary on the management of URTI (Appendix 1). This summary which emphasized the clinical predictors of bacterial URTI and appropriate antibiotic choice was adapted from standard guidelines[22-24] and developed by consensus between the investigators and the FMS.

(2) Academic detailing of the information contained in the evidence-based summary was conducted by the FMS who were generally regarded as opinion leaders by the medical officers. The FMS delivered the detailing to the participating medical officers in their respective primary care clinics. The session consisted of a 20-minute one-to-one meeting between the FMS and the medical officer and this occurred in the first two weeks of April 2004. A copy of this information leaflet was given to the medical officers at the time of the academic detailing and another (laminated) copy in bright yellow color was pasted on the wall of the clinic room of each medical officer.

Measurement of antibiotic prescription rate

All prescription slips for the months January to June 2004 were collected from the pharmacy of the nine participating clinics. In view of the huge number of prescription slips, a systematic sampling (1 in 3) of the prescription slips was done. The following information from the prescriptions was recorded: patient's registration number, month of visit, patient's age, name of antibiotic prescribed, URTI surrogate marker (see below), and initials of the prescribing medical officer.

We classified antibiotics according to the recommendation of the WHO Action Programme on Essential Drugs and the International Network for the Rational Use of Drugs[25]. This classification included topical antibacterials, but excluded antifungal, antihelminthic, antiprotozoal, antiviral and antituberculous agents. Topical antibiotics were not included in our study.

A preliminary assessment of the prescription slips revealed that the doctors usually did not write the patient's diagnosis. As in our earlier study[8], we used four drug items commonly prescribed for URTI as surrogate markers for the diagnosis of URTI; they are cough mixtures (syrup diphenhydramine, syrup promethazine, mist expectorant) and thymol gargle. Our preliminary evaluation of the case records revealed that these surrogate markers have acceptable accuracy in suggesting the diagnosis of URTI (the sensitivity, specificity and positive predictive value were 82.7%, 97.6% and 89.6%, respectively)[8]. Antibiotic prescription rates per clinic and per MO were assessed pre-intervention and post-intervention to evaluate the effectiveness of academic detailing.

This study received ethical approval from the Research & Ethics Committee of the International Medical University. All participating doctors gave informed written consent.

Statistical analysis

We entered the prescription data into an Excel computer program spreadsheet and later converted and analyzed them with the aid of the SPSS version 11.5 computer software. The overall antibiotic prescription rates per clinic and for each MO were determined and the prescription rates for URTI and non-URTI cases were also evaluated. The rates before and after intervention were compared by generating the relative risk (with 95% confidence intervals) using Confidence Interval Analysis[26]. The data before and after intervention were compared at the clinic level using the Wilcoxon Signed Rank Test. Statistical significance was set at $p<0.05$.

Results

Prescriptions

Data were retrieved from 28,562 prescriptions; 23,180 prescriptions were written by the 29 participating MOs in the nine clinics, while another 5,382 came from MOs and MAs not participating in the study. Unless otherwise specified, all analyses were based on the prescriptions from the participating doctors only.

Demographic and clinical data of patients

The mean age of the patients was 38.9 years (range 1-97 years, SD=21.9 years). Of the 23,180 prescriptions by doctors in the study, 11,725 (50.6%) and 11,455 (49.4%) were from patients seen in the pre-intervention and post-intervention phases respectively. As shown in Table I, URTI cases constituted 28.6% of all the patients seen.

Profile of participating doctors

Of the twenty-nine MOs who participated in the study, 26 (89.7%) were females. Medical officers who provided only maternal and child health care as well as medical assistants did not participate in this study. The age range of participating MOs was 28 to 55 years (median 33 years). They had worked as doctors for 3-30 years (median seven years).

Impact of educational intervention on the antibiotic prescribing rates

The antibiotic prescribing rates for pre-intervention and post-intervention phases are shown in Table II. The general antibiotic prescribing rate was 14.3% in the pre-intervention phase and dropped to 11.0% in the post-intervention phase, a relative risk reduction of 23% (RR=0.77). A contributory factor is the relative risk reduction of up to 40% (RR=0.60) in the URTI-specific antibiotic prescribing. The antibiotic prescribing for MOs and MAs not participating in the intervention did not show statistical significant change (General antibiotic prescribing rates, before 14.1%, after 13.9%; URTI-specific antibiotic prescribing rates, before 26.0%, after 28.5%).

Figure 2 shows the trend of antibiotic prescribing rates for the six months of the study. A change in antibiotic prescribing rate occurred by March 2004, even before the educational intervention which started in April 2004. The antibiotic prescription rates showed a significant downward trend for URTI cases (chi-square for trend, $p<0.001$) but not for the non-URTI cases (chi-square for trend, $p=0.942$).

Antibiotic prescribing rates of individual clinics

Table III compares the antibiotic prescribing rates of individual clinics before and after the educational intervention (data shown are for seven clinics; the doctors from two clinics left before the completion of the interventional phase). There was considerable variability in the antibiotic prescribing rates for these

clinics. Six out of these seven clinics had a reduction in the general and URTI-specific antibiotic prescribing rates (Wilcoxon signed rank test, p=0.028). The only clinic that did not show a reduction in antibiotic prescribing (Clinic 4) already had relative low prescribing rate before the intervention. In Clinic 3, no antibiotic was prescribed for URTI based on the sampled prescriptions.

Antibiotic choice

An overall total of 2934 antibiotics prescriptions were recorded out of which 1674 and 1260 were recorded pre- and post-intervention, respectively. Total antibiotic prescriptions for URTI cases (1476) constituted 50.3% of the overall total. Erythromycin and amoxycillin were the most commonly prescribed antibiotics in URTI (Table IV). Penicillin V was uncommonly prescribed for URTI in all clinics. A small increase of cloxacillin prescriptions in URTI was noted.

Discussion

This study demonstrated that the educational intervention consisting of academic detailing and information leaflet is a feasible approach to alter the antibiotic prescribing pattern in Malaysian public primary care clinics. The absolute reduction in antibiotic prescribing rate in the nine participating clinics was 3.3% (relative risk reduction 23%); and for URTI the antibiotic prescribing rate reduced by 11.1% (relative risk reduction 40%).

The absolute reduction in antibiotic prescribing may be small; however, if the reduction is extrapolated to the 500,000 outpatient visits in these nine clinics for the year 2004, there is a potential reduction of 16,500 doses of antibiotics. This would translate to a significant immediate financial savings not to mention the much bigger long term benefit of reduced antibiotic abuse, if the new attitude is sustained. Academic detailing is often regarded as an effective but expensive method of changing professional behaviour[27]. Thus, instead of using a one-to-one approach, interactive group sessions conducted by a key opinion leader also have been shown to be effective [28]. In this study, we managed to keep the cost down by using resident specialist in the clinic (FMS), thus the academic detailing took only an average of one hour per FMS (nine FMS detailing 29 medical officers at 20 minutes per doctor). The other cost was group meetings to develop the information leaflet and centralised training for the delivery of academic detailing.

Our study outcome is broadly in keeping with evidence from systematic reviews[13,17,18] and with the outcome of recently completed randomized control trials[19-21] which modified antibiotic prescribing for URTI using academic detailing as the main strategy. The offer of the information leaflets in addition to academic detailing possibly reinforced the information conveyed during the academic detailing. The prominent display of the leaflet in the clinic room served as a constant reminder for the doctors as they saw their patients. The leaflets also served as a quick reference material.

The use of time series design (rather than randomised control trial) is a pragmatic approach we have adopted in this study; the presence of multiple data points in this study allows a realistic evaluation of the educational intervention even in the absence of a control group[29]. However, we cannot discount the presence of co-intervention as a possible confounder. In view of the lack of reduction in antibiotic prescribing among primary care practitioners who did not participate in this study, the prescribing behavioral changes observed could be largely attributed to the educational intervention. On the other hand, the role of the Hawthorne effect[30] on the antibiotic prescribing behavior of the doctors must be considered. This possibility is suggested by the reduction in antibiotic prescribing rate occurring even before the initiation of the intervention (Figure 2) - possibly due to the doctors' awareness of the study at the time of signing of consent form which took place in March 2004. However, we are inclined to believe that the observed reduction in antibiotic prescription is primarily due to the educational intervention as we did not observe a significant reduction in antibiotic prescribing for non-URTI cases.

Among the participating clinics, slight variations were observed in the effectiveness of the educational intervention (Table III). This could be due to a variety of reasons, among which are differences in the baseline antibiotic prescribing rates, unequal number of patient encounters (including URTI cases), differences in the academic detailing provided (despite two standardization training sessions provided to the FMS). Due to the small number of clinics and variable number of medical officers per clinic (range 1-10), we had not factored in possible clustering effect in our analysis[31].

The antibiotic choice of the participating doctors was limited by the formulary (essential drug list) of the Malaysian Ministry of Health. This explains the

Table I: Number of patients (URTI and non-URTI)

	Intervention phase		Total
	Pre-intervention	Post-intervention	
Non-URTI	8302 (70.8%)	8260 (72.1%)	16562 (71.4%)
URTI	3423 (29.2%)	3195 (27.9%)	6618 (28.6%)
Total	11725	11455	23180

All percentages (%) refer to the column descriptor.

Table II: Antibiotic prescribing rates before and after intervention

	Intervention phase		Relative risk (95%CI)
	Pre-intervention	Post-intervention	
Non-URTI	8.8%	8.8%	1.01 (0.92 to 1.11)
URTI	27.7%	16.6%	0.60 (0.54 to 0.66)
Total	**14.3%**	**11.0%**	**0.77 (0.72 to 0.83)**

Table III: General and URTI-specific antibiotic prescribing rates for participating clinics before and after intervention

Clinic	General prescribing rate (%)		Change %, 95%CI)	URTI-specific prescribing rate (%)		Change (%, 95%CI)
	Before	After		Before	After	
1	13.7	11.2	2.5 (1.2 to 3.9)	30.7	15.1	15.6 (12.2 to 18.9)
2	13.5	8.3	5.2 (2.8 to 7.7)	25.6	14.9	10.7 (4.9 to 16.5)
3	17.3	4.2	13.1 (4.8 to 21.4)	23.1	0*	23.1 (6.9 to 39.3)
4	11.8	12.0	-0.2 (-1.9 to 1.5)	17.4	19.4	-2.0 (-6.2 to 2.3)
5	17.4	15.3	2.1 (-0.8 to 5.0)	40.7	35.7	5.0 (-2.2 to 12.1)
6	19.4	12.3	7.2 (3.1 to 11.3)	20.7	12.4	8.3 (3.6 to 13.0)
7	15.3	8.9	6.5 (3.0 to 9.9)	28.2	10.2	18.0 (8.8 to 27.2)

* see text for explanation of this

Table IV: Number and type of antibiotics prescribed

Antibiotic	All antibiotics		Antibiotics for URTI	
	Pre-intervention (n=1674)	Post-intervention (n=1260)	Pre-intervention (n=947)	Post-intervention (n=529)
Erythromycin	550	360	445	245
Amoxycillin	404	228	292	125
Cloxacillin	334	372	23	48
Cephalexin	135	73	75	24
Ampicillin*	141	106	94	77
Other antibiotics**	98	111	13	5
Penicillin V	12	10	5	5

* include bacampicillin

** 'Other antibiotics' include co-trimoxazole, tetracycline, doxycycline

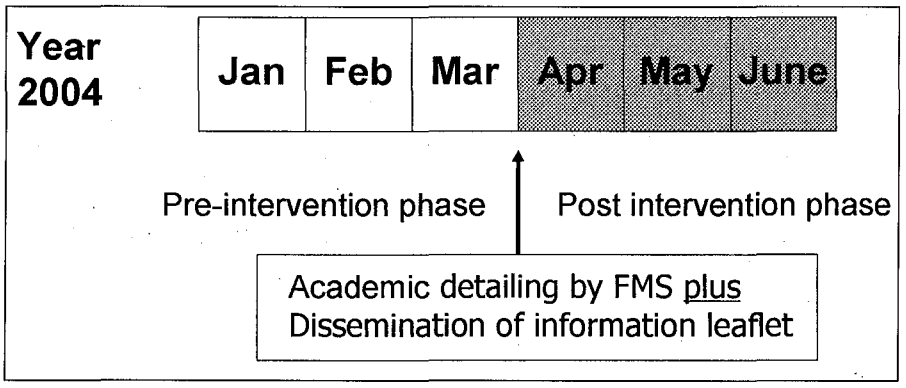

Fig. 1: Study design

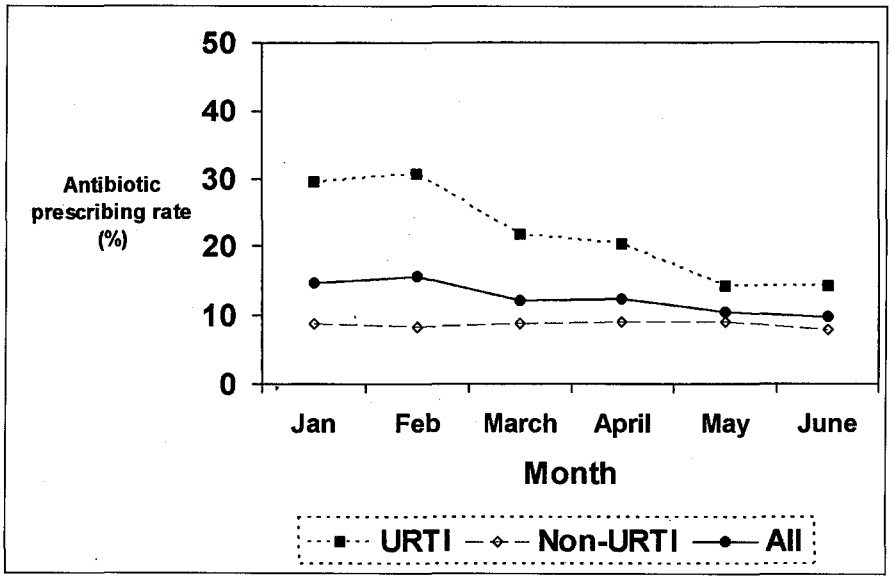

Fig. 2: Trend of antibiotic prescribing rates for URTI and non-URTI

absence of the quinolones and the newer generation cephalosporins. The antibiotic choice of these doctors did not appear to be influenced by the educational intervention; in particular, we did not observe a switch from the broad-spectrum antibiotics (erythromycin and amoxycillin) to the narrow-spectrum penicillin V in the management of URTI. The small increase in cloxacillin prescriptions for URTI is an unexpected finding.

Several logistic problems encountered during this study will need further deliberation in the planning of future interventional study. They include:

1. The huge number of outpatient visits and the lack of electronic medical records. We overcame this by doing systematic sampling of the prescriptions (1:3). We are aware that the number of prescription slips may not be an accurate reflection of the number of patients seen in the clinic given that some patients may be managed without prescriptions. Electronic data recording would have obviated this possibility.
2. The diagnosis of URTI was based on "URTI surrogates" - presence of drug items on the prescriptions that were suggestive of the diagnosis of URTI. This method could miss out URTI cases in which cough mixtures and thymol gargle were not prescribed.
3. As our entire study lasted only six months, we do not know whether the impact of our intervention is sustainable. Further data collection is needed to determine the long-term effect of this intervention. We noted that about 30% of the medical officers were transferred out of the primary care clinics within one year. This may reduce the effect of academic detailing in the long-term and this factor would have to be communicated to the policy makers if the potential long term benefits of intervention are to be attained.
4. Illegibility of doctors' handwriting posed some difficulty in data transcription in a small proportion of prescriptions. We could not verify the captured data with clinic records due to poor recording of patients' identifying data. Age was missing in 11.5% of included prescriptions. Some selected prescriptions were excluded due to missing dates.

In conclusion, notwithstanding the logistic problems encountered, we feel that educational intervention using strategies that have been verified in systematic reviews or randomized control trials should continue to be explored in the Malaysian health care system. The combination of both active and passive strategies may be synergistic and worth pursuing for other prescribing issues in primary care.

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APPENDIX 1

EMB Summary - URTI

Introduction

Upper respiratory tract infection (URTI) is the commonest self-limiting illness in primary care. Majority of these infections are viral in origin. A small proportion (20-30%) of these infections is due to bacteria, the most important of which is the Group A β-hemolytic streptococcus. In susceptible individuals, untreated streptococcal pharyngo-tonsillitis may result in rare complications such as rheumatic fever and peritonsillar abscess.

Diagnosis

Distinguishing bacterial from viral causes can be difficult. However, several clinical features have been shown to increase the likelihood of correctly diagnosing streptococcal pharyngo-tonsillitis. They are

- absence of cough
- fever
- cervical lymphadenopathy
- tonsillar exudates

Patients with 1 or none of the above features are very unlikely to have streptococcal pharyngo-tonsillitis (probability is < 5%). Patients with all 4 features have 50% chance of having streptococcal pharyngo-tonsillitis. Clinical features that are not useful in the diagnosis are: color of the phlegm, severity of sore throat, red throat and duration of illness.

Management

In most cases, symptomatic treatment is all that is needed. In patients with streptococcal pharyngo-tonsillitis, antibiotic shortens the illness and prevents serious complications. Antibiotic is not useful in viral URTI. Penicillin V for 10 days is the recommended treatment in bacterial URTI. Erythromycin is an appropriate alternative in patients with penicillin allergy.

Patient's expectation for antibiotic treatment for their viral URTI is common. This results from prior experience of "recovery" after antibiotic therapy and the misconception that antibiotic is a panacea for all infections. Such patients or the parents of children need health education about the benign nature of most URTI and the possible harm of indiscriminate usage of antibiotics – the emergency of antibiotic resistance and risk of side effects and allergy.