Repeat consultations after antibiotic prescribing for respiratory infection: a study in one general practice

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SUMMARY

Background. *Several new antibacterial drugs have been introduced in the last 10 years with the aim of improved treatment of respiratory tract infection.*

Aim. *The study set out to use repeat consultations as a measure of the outcome of antibiotic treatment for respiratory tract infection, and to develop a simple model for discussion of the cost effectiveness of alternative antibiotic treatments.*

Method. *All consultations to one practice during a single winter were reviewed by one general practitioner.*

Results. *A total of 1140 patients had acute symptoms suggestive of respiratory infection. Of these, 899 patients (79%) were prescribed antibiotics at the first consultation and 160 of the 899 patients (18%) returned for one or more repeat consultations; only nine repeat consultations were due to adverse effects of the antibiotics prescribed. Only two patients were admitted to hospital for respiratory symptoms following initial antibiotic therapy and both patients had additional reasons for their admission. Using the highest estimates, the cost of a repeat consultation was found to be £28.54. These data were used to calculate how much more might be spent on more effective antibiotics at the first consultation. It would be difficult to justify increasing the cost of antibiotic treatment by more than £5 per patient, even if the new treatment were 100% effective and all repeat consultations were due to treatment failure (£5 is equal to £28.54 x 0.18, which is the maximum cost of a repeat consultation multiplied by the proportion of patients prescribed antibiotics who make repeat consultations).*

Conclusion. *From these results and a review of the literature it can be concluded that new antibacterial drugs will have to be carefully targeted if they are to prove cost effective in practice. Other methods for reducing repeat consultation merit investigation.*

Keywords: respiratory tract infections; antibiotics; consultation frequency; consultation costs; outcome.

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Introduction

ACUTE respiratory symptoms are among the commonest indications for consultation with a general practitioner[1] and several new cephalosporins, macrolides and quinolones have been introduced with the aim of improved treatment of respiratory tract infection.[2]

As a first step in considering the need for these new drugs, repeat consultations have been used as a measure of the outcome of antibiotic treatment for respiratory tract infection in a single practice and a simple model developed for discussion of the cost effectiveness of alternative antibiotic treatments.

Method

All consultations for acute problems which were made to one practice in St Andrews, Scotland between 1 October 1989 and 31 March 1990, inclusive, were reviewed retrospectively from the practice notes by D R starting in June 1990. Regular return consultations by patients, and consultations arising from provision of student health services to the University of St Andrews were excluded. The total practice population in 1989 (excluding students) was 7442 people. The consultations were with one of five partners (four full time and one part time).

From all consultations for acute problems patients with new acute respiratory symptoms likely to be due to infection were identified. The clinical detail about infection in the practice records was not standardized and varied in quantity. When the records specifically identified the site of infection as throat or lower respiratory tract, this diagnosis was accepted for the purposes of the analysis, as was otitis media. All other symptoms were grouped as non-specific upper respiratory symptoms. The patients' records were scanned for any further consultations for acute respiratory symptoms in the two months following the initial consultation. Details of antibiotic therapy prescribed at the first or subsequent consultation were recorded, including the drug, dose, frequency and duration of treatment to allow calculation of the cost of drugs prescribed.

The cost of repeat consultations and home visits was estimated from several sources. A published study estimated costs of £4.30 to £7.56 per consultation depending on the marginal use of resources including general practitioner's time, administration time, and the need to increase or decrease buildings and furniture available as a result of a change in practice.[3] In contrast, the British Medical Association's 1993 estimate of the market rate for general practitioner's time was £93.00 per hour (Ford JC, personal communication). This would equate to £15.50 for a 10 minute consultation which is slightly above the fee of £14.00 per medical attendance for non-National Health Service patients.[4] Detailed analysis of the accounts for the practice for the period April–September 1990 resulted in an estimate of £7.26 per 10 minute consultation[5] which is close to the figure of £44.84 per hour (£7.47 per 10 minutes) calculated in 1989 by Croft-Jeffreys and Wilkinson.[6] For the purposes of the present study low and high costs of £4.30 and £15.50 per 10 minutes of general practitioner time have been used.

A controversial area of health economics is the inclusion of indirect costs.[7] Indirect costs are those which do not fall on the

health service. Indirect costs were estimated by including the following potential costs to the patient: prescription charges, transport costs and cost of time in travelling to and from the surgery and/or pharmacy together with the time spent at these places. Prescription charges were £2.80 at the time of the study. Patient travel costs were estimated at £0.37 per journey, which was the flat rate fare for a single journey by public transport in St Andrews at the time of the study. A monetary value for patients' time was taken from the Department of Transport estimate of the value of leisure time, which was £1.53 per hour in 1987.[8] The time taken for a return journey to the practice or pharmacy was estimated to be 40 minutes. Estimates for the time spent at the practice or pharmacy were 25 minutes and 10 minutes, respectively.

Potential cost effectiveness of alternative treatments was assessed using a single formula for calculation of points of indifference.[9] Briefly, this approach assumes that if drug A is both more expensive and more effective than drug B, we are indifferent between the two drugs at the point at which:

Difference in drug costs (A–B) = difference in success rate (A–B) x cost of failure

For any given difference in drug cost, the points of indifference can be calculated over a range of costs of failure of treatment.

Data were entered onto *DBASE IV*. Statistical analysis was performed with *MINITAB*, version 7.0. Proportions were compared using the chi square test and a corrected McNemar test was used for two by two tables.

Results

Of 17 600 consultations in the practice during the period of observation 8800 were for acute problems and 1479 of these (16.8%) were for respiratory infection. The total number of patients seen was 1140. Of the 280 patients who had one or more repeat consultations for acute respiratory symptoms, 227 returned within two months of the original consultation, and these patients are the subjects for this analysis.

Repeat visit rates varied from 11.0% (10/91) of patients aged 20–29 years to 27.1% (90/332) of patients aged 0–9 years. An overall χ^2 test comparing the patients making single and repeat visits in each age band gave a χ^2 value of 20.1 (8 degrees of freedom, $P<0.05$). The discrepancy between the number of observed and expected repeat visits was highest in the 0–9 years age band (90 observed versus 66.1 expected).

Of the 227 patients who had a second consultation 48 (21.1%) returned for up to four further consultations for respiratory symptoms. This analysis was restricted to comparison of the first and second consultations. Overall 48.0% of the 227 second consultations occurred within 15 days of the first consultation.

Drugs prescribed

Of the 227 patients 160 (70.5%) were prescribed an antibacterial drug at the first consultation compared with 136 (59.9%) at the second consultation (corrected McNemar test, $\chi^2 = 5.1$, $P<0.05$). The percentage of all 1140 patients prescribed an antibacterial drug at the first consultation, by type of respiratory diagnosis is shown in Table 1. Aminopencillins (amoxycillin, pivampicillin, ampicillin) accounted for 455 of all 899 antibiotics prescribed at first consultation (50.6%). Penicillin V was prescribed almost exclusively for throat infections, but only accounted for 55 of 252 prescriptions issued for throat infections (21.8%). The proportion of patients who did not receive a prescription was significantly higher in the patients with unspecified upper respiratory symptoms or a throat infection than in patients with otitis media or lower respiratory tract infection (Table 1; $\chi^2 = 35.1$, 3 df, $P<0.001$). The highest repeat visit rate occurred in patients who received a prescription for lower respiratory tract infection (16/57, 28.1%).

Table 1. Percentage of patients prescribed drugs at first consultation, by type of respiratory diagnosis.

Drug prescribed	% of patients				
	Throat infection (*n*=310)	Upper respiratory symptoms (*n*=654)	Otitis media (*n*=114)	Lower respiratory tract infection (*n*=62)	Total (*n*=1140)
None	*18.7*	*26.3*	*5.3*	*8.1*	*21.1*
Penicillins					
Amino-penicillins[a]	*41.0*	*33.0*	*72.8*	*46.8*	*39.9*
Co-amoxiclav	*2.3*	*2.6*	*6.1*	*4.8*	*3.0*
Penicillin V	*17.7*	*0.9*	*0*	*1.6*	*5.4*
Cephalosporins					
Cephalexin or cefadroxil	*8.4*	*20.8*	*4.4*	*21.0*	*15.8*
Cefaclor	*1.9*	*4.9*	*4.4*	*6.5*	*4.1*
Other antibacterial drugs					
Erythromycins	*4.2*	*3.5*	*4.4*	*4.8*	*3.9*
Ciprofloxacin	*0.3*	*0.5*	*0.9*	*4.8*	*0.7*
Co-trimoxazole	*0*	*0.3*	*0*	*0*	*0.2*
Tetracyclines	*5.5*	*7.2*	*1.8*	*1.6*	*5.9*

n = total number of patients in group. [a] Amoxycillin, pivampicillin, ampicillin.

Adverse events and admissions to hospital

Only nine of the 227 second consultations were recorded as possibly being due to adverse reactions to antibacterial drugs — three were with children (0–16 years) and six were with adults. Overall five patients were admitted to hospital as an emergency within two months of a consultation for acute respiratory infection — one with melaena and the remaining four because of respiratory symptoms. Of the latter four, the two longest admissions occurred in patients with other associated diseases (systemic lupus erythematosus and senile dementia) while the remaining two appeared to be due only to the acute respiratory infection but were brief (two and six days) and neither of these patients had received a prescription for an antibacterial drug before their admission to hospital.

Estimated costs of repeat consultations

The 227 patients who made second consultations fell into four groups with regard to antibacterial prescribing: 27 patients (11.9%) received no prescription at either consultation, 64 (28.2%) received a prescription at the first consultation only, 40 (17.6%) received a prescription at the second consultation only and 96 (42.3%) received a prescription at both consultations. Therefore, a maximum of 160 repeat consultations can be considered to be related to failure of antibacterial drugs prescribed at the first consultation, and for the 899 patients prescribed an antibacterial drug at the first consultation the maximum failure rate is 17.8%.

The potential costs of repeat consultations owing to failure of antibacterial therapy can be calculated (Table 2). Using the highest estimates the cost includes the cost of antibacterial drugs pre-

Table 2. Estimated costs of the 160 repeat consultations using lowest and highest estimates.

	Estimated costs (£)	
	Lowest estimates	Highest estimates
To the practice		
Practice visits (*n*=125)	537.50 (4.30 each)	1937.50 (15.50 each)
Home visits (*n*=35)	361.35 (10.32 each)	1672.50 (46.50 each)
Drugs (*n*=96)	496.32	496.32
To the patient		
Travel (*n*=125)	–	46.25 (0.37 each)
Travelling time (*n*=125)	–	191.25 (1.53 each)
Prescription charges (*n*=96)	–	268.80 (2.80 each)
Total	1395.17	4567.62
Mean for 160 consultations	8.72	28.54

n = number of repeat consultations.

scribed at the second consultation plus the general practitioner's time priced according to the British Medical Association rates and indirect costs to the patient including the assumption that all patients paid prescription charges. Using the lowest estimates the only costs allowed are those which fall on the practice budget and the cost of a general practitioner's time is taken as the lowest estimate. This gives costs per treatment failure of £8.72 using the lowest estimates and £28.54 using the highest.

Cost effectiveness of more expensive drugs

The mean cost of the course of antibiotics prescribed at first consultation was £2.98. The additional cost of some recently introduced drugs for respiratory infection is dependent on dose but, even assuming a maximum of five days of treatment, ranges from £2.08 for co-amoxiclav 375 mg three times a day to £19.52 for ciprofloxacin 750 mg twice a day.

Supposing that co-amoxiclav is more effective than current treatment, under what circumstances might it be more cost effective? In the unlikely event that co-amoxiclav is 100% effective, resulting in no repeat consultations, the maximum difference in efficacy between co-amoxiclav and current treatment would be 18%. Therefore the prescriber would have to believe that the value of avoiding one repeat consultation is at least £11.56 (additional drug cost divided by the difference in efficacy, that is £2.08 divided by 0.18) to justify spending an additional £2.08 per patient by prescribing co-amoxiclav at the first consultation. A further worked example is given in Appendix 1.

Discussion

The observation that acute respiratory illness is a common reason for a consultation with a general practitioner for an acute problem is consistent with the results of an earlier study[1] as is the preponderance of patients with an acute respiratory illness in the first decade of life[10,12] and the high frequency of repeat visits within two months in this group.[10,12] Writing in 1971, Howie and colleagues stated that uncertainty about the use of antibiotics posed real difficulties for the family doctor which could only be resolved with 'time and many good-quality prospective clinical trials'.[1] Prescribing rates among Scottish general practitioners for coryza (which can be taken as undefined upper respiratory symptoms) averaged 18% (range 0–85%), whereas prescribing rates for defined tonsillitis averaged 90% (range 33–100%).[1] Howie and colleagues concluded that high prescribers for coryza should justify their decision and that the results suggested a consensus in favour of restricted use of antibiotics for coryza. Other papers from general practitioners in the United Kingdom in the 1970s also advocated limited prescribing of antibiotics for generalized upper respiratory symptoms without an obvious primary focus of infection.[10,12] Despite these recommendations, there are limited data about antibiotic prescribing rates in general practice or about the outcome of prescribing.

The possibility that antibiotic therapy for respiratory tract infection has both beneficial and harmful effects has been raised by a recent placebo-controlled trial of penicillin therapy for streptococcal pharyngitis in which overall recurrence rates were statistically significantly higher among patients who received penicillin (22/59, 37%) than among patients who received placebo (9/55, 16%).[13] The most likely mechanism is that antibiotic treatment eliminates the normal flora from the throat and predisposes to colonization by pathogenic bacteria, and therefore to recurrent infection.[14-17] If this is true, then it seems equally plausible that treatment of patients who do not have bacterial infection merely gives them these harmful effects of antibiotic therapy with no benefit. In support of this hypothesis, repeat visit rates for throat infection among general practitioners who are low prescribers have been found to be similar to[1] or lower[18] than repeat visit rates to high prescribers.

Some prospective trials report high incidences of discontinuation of antibiotic treatment because of adverse events, for example six out of 83 children (7%) discontinued ampicillin treatment for otitis media because of diarrhoea.[19] However, in the present study only nine out of 899 patients (1%) had a possible adverse event from antibacterial treatment. In common with earlier studies from UK general practice[10,20] it was found that serious sequelae from respiratory infection were rare, with only two patients being admitted to hospital primarily for respiratory infection. Stott also found no evidence of suppurative complications (quinsy, chronic discharging otitis media and so on) among children with upper respiratory symptoms.[10] Fry reviewed over 3000 attacks of acute tonsillitis in the context of 30 years experience in general practice and found no associated cases of nephritis (there were six cases of nephritis in the practice during that time but none was preceded by a sore throat), no cases of rheumatic fever, 20 cases of quinsy, three cases of cervical adenitis which required surgery and no other serious complications.[20] Both rheumatic fever and invasive, bacteraemic infection associated with pharyngitis have increased recently in the United States of America,[21,22] but as yet, no such increase has been noted in the UK.

The major adverse outcome of treatment in the present study was repeat visits to the general practitioner because of persistent or recurrent symptoms. The cost of a repeat consultation is therefore a key element in any cost effectiveness analysis. The cost to the practice is the biggest single component and there is currently no consensus about an appropriate value for this. The value, or opportunity cost to the general practitioner of a potentially avoidable additional consultation is complex and should include debate about increasing the quality of care (through longer consultations) as well as the quantity of care (more consultation time available for other patients). Ultimately it will be up to individual practices to decide on the value of their time. Similarly, the indirect costs to the patient are approximate and likely to be highly variable. Many patients will not incur prescription charges but the purpose of the results presented here was to establish the likely extremes of the cost of repeat consultations. These extremes can then be used to examine the cost effectiveness of alternative antibiotic treatments for acute respiratory symptoms.

The data from this study suggest that universal use of more expensive antibiotics will not be cost effective, even if they are

100% effective. It is possible that a cost effectiveness argument could be developed for some patients. For example, of the patients in the present study with a diagnosis of lower respiratory tract infection 92% (57/62) received a prescription at the first consultation and of these 28% (16/57) returned for one or more additional consultations. This is similar to the repeat consultation rate of 26% (81/315) observed in a larger study of lower respiratory tract infection in general practice.[23] It is also possible that the new antimicrobial drugs will prove cost effective as second line therapy for patients with relapsing infection. For example, Brook found a relapse rate of 58% (11/19) for children with relapsing streptococcal pharyngitis treated with penicillin, whereas only 11% children (2/18) treated with co-amoxiclav had further relapses.[24]

The present study has confirmed that repeat consultations for acute respiratory symptoms are common.[10] Failure of antibacterial therapy may account for some repeat visits but other important potential causes include social and environmental factors,[25-30] as well as new infections resulting from the damage which previous infections have done to the respiratory epithelium or immune system.[31,32] General practitioners are under considerable pressure to prescribe a wide variety of new antibacterial drugs as a potential solution to this problem. These treatments will have to be much more effective than current therapy in order to be cost effective and there is little evidence that they are clinically superior to penicillins in the majority of patients. The reasons for prescribing antibacterial drugs in general practice are complex. The context of the consultation should have as much, if not more importance than the objective symptoms and signs of infection.[1,33] Nonetheless, the possibility that the antibacterial drug may have harmful effects for the patient in the form of an increased risk of recurrent symptoms[13] deserves wider recognition and debate by doctors and public. There is no doubt that some worrying trends in bacterial resistance may be directly linked to escalating antibiotic prescribing.[34-36]

In conclusion, acute respiratory symptoms are a common reason for consultations with the general practitioner and 18% of patients prescribed an antibacterial drug return for one or more repeat consultations. Practitioners should be encouraged to examine their own prescribing and to compare the cost effectiveness of alternative policies using repeat consultation rates as an outcome measure. Among the alternative policies to be considered should be reduced overall prescribing of antibacterial drugs.

Appendix 1. Worked example of calculation of critical values for repeat consultations.

If it is assumed that only half of the 160 repeat consultations were actually due to failure of antibiotic treatment, then the failure rate for current treatment would be 9% (80/899). If the treatment which cost an extra £2.08 per patient treated reduced this failure rate to 3%, that is the difference in efficacy was 6%, the prescriber must believe that the value of preventing one treatment failure is at least £34.67 (2.08 divided by 0.06).

Table 3 could be used to answer the same problem by reading across from the difference in efficacy (6%). The difference in cost (£2.08) lies between £2.00 and £2.50, and therefore the critical value is between £33 and £42. Alternatively, prescribers may prefer to agree on the maximum value of preventing one repeat consultation and then use Table 3 to read off combinations of increased cost and efficacy which are compatible with that value.

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Table 3. Critical values of avoiding one repeat consultation by using more expensive, more effective treatment.

Difference in efficacy[a] (%)	Critical value of avoiding repeat consultation (£) by difference in drug cost[b]												
	£2.00	£2.50	£3.00	£3.50	£4.00	£4.50	£5.00	£7.50	£10.00	£12.50	£15.00	£17.50	£20.00
2	100	125	150	175	200	225	250	375	500	625	750	875	1000
4	50	63	75	88	100	113	125	188	250	313	375	438	500
6	33	42	50	58	67	75	83	125	167	208	250	292	333
8	25	31	38	44	50	56	63	94	125	156	188	219	250
10	20	25	30	35	40	45	50	75	100	125	150	175	200
12	17	21	25	29	33	38	42	63	83	104	125	146	167
14	14	18	21	25	29	32	36	54	71	89	107	125	143
16	13	16	19	22	25	28	31	47	63	78	94	109	125
18	11	14	17	19	22	25	28	42	56	69	83	97	111
20	10	13	15	18	20	23	25	38	50	63	75	88	100
22	9	11	14	16	18	20	23	34	45	57	68	80	91
24	8	10	13	15	17	19	21	31	42	52	63	73	83
26	8	10	12	13	15	17	19	29	38	48	58	67	77
28	7	9	11	13	14	16	18	27	36	45	54	63	71
30	7	8	10	12	13	15	17	25	33	42	50	58	67

[a]Difference in efficacy between more expensive drug and current treatment. [b]Difference in cost between more expensive drug and current treatment.

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