Variations in antibiotic prescribing and consultation rates for acute respiratory infection in UK general practices 1995–2000

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ABSTRACT

Background
Antibiotic prescribing by GPs in the UK has declined since 1995.

Aim
We investigated whether general practices that issue fewer antibiotic prescriptions to patients presenting with acute respiratory infections had lower consultation rates for these conditions.

Design of study
Retrospective data analysis.

Setting
UK general practice.

Method
We analysed data from the General Practice Research Database, including all registered patients from 108 practices between 1995 and 2000. For each practice, numbers of consultations for acute respiratory tract infections and the proportion of consultations resulting in an antibiotic prescription were obtained. An age- and sex-standardised consultation ratio (SCR) and standardised prescription ratio (SPR) were calculated for each practice. We evaluated whether SPR and SCR values were associated.

Results
For the mid-year data (1997), the crude consultation rate for all acute respiratory infections ranged from 125–1110 per 1000 registered patients at different practices; the proportion of consultations with antibiotics prescribed ranged from 45–98%. After standardising for varying age and sex structure of practice populations, practices with lower SPR values had lower SCR values (r = 0.41; P<0.001). This association was observed in each study year. Moreover, practices that demonstrated reductions in SPR between 1995 and 2000 also showed reductions in SCR (r = 0.27; P = 0.005).

Conclusion
Practices that prescribe antibiotics to a smaller proportion of patients presenting with acute respiratory infections have lower consultation rates for these conditions. Practices that succeed, over time, in reducing antibiotic prescribing also experience reductions in consultation rates for these conditions. Although our methodology cannot prove that these two findings are causally related, they imply that patients alter their illness behaviour and that this may be a response to previous consultation experience. In consequence, respiratory illness in the community may be undergoing a process of de-medicalisation.

Keywords
antibiotics; de-medicalisation; illness behaviour; prescriptions, drug; referral and consultation.

INTRODUCTION

The annual GP consultation rate in England and Wales currently stands at about four consultations per patient per year,[1] with respiratory diseases being the most common reason for visiting the GP.[2] Indeed, about a quarter of the population will visit their GP for a respiratory infection each year.[3,4] Many of these consultations result in the prescription of antibiotics,[5] but recent studies suggest that patterns of prescribing may be changing. Antibiotic prescribing for common respiratory infections has been declining since 1995 and there has also been a decline in consultations for these conditions.[3,4] Prescribing patterns often vary widely between different general practices, but it is not known whether variations in antibiotic prescribing at the level of the individual general practice are associated with variations in consultation rates for respiratory infections.

In this study, we analysed data from the General Practice Research Database (GPRD).[6] We aimed to quantify variations between general practices in the proportion of consultations in which antibiotics were prescribed and to determine whether these variations were associated with practice-specific consultation rates for acute respiratory infections. We also aimed to determine whether changes in

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How this fits in

We already know that national antibiotic prescribing volumes have been declining since 1995 and that consultations for acute respiratory infections have also declined over the same period. This study offers the first evidence that these phenomena are linked at practice level. Practices that were more successful at reducing the proportion of patients given an antibiotic were found to have the steepest falls in consultations for acute respiratory infections.

practices' antibiotic prescribing over time were associated with changes in consultation rates for respiratory infections.

METHOD

Practices and patients

The GPRD is a primary care database recording clinical data from 1986 onwards. It is derived from 755 general practices covering a registered population of over 9 million patients in the UK. We derived data from 108 practices that continuously provided 'up-to-standard' data to the GPRD from 1994 to 2000. For this analysis we selected 1995 as the initial year because antibiotic prescribing peaked in this year,[4] and we wished to examine the effect of declining levels of antibiotic prescribing. The mean number of patients registered at these practices over the study period was 643 626. There were 641 936 patients registered in 1995 and 646 336 in 2000. Summary data for trends in overall consultation and antibiotic prescribing have been published elsewhere,[4] but practice level information from this dataset has not been previously reported.

Diagnostic codes

We first identified consultations for acute respiratory infections using appropriate medical codes as described previously.[4] Acute respiratory infections were divided into categories (Table 1). The category 'all respiratory infections' comprised all codes included in the 10 subdivisions of acute respiratory infection, excluding duplicated codes, but including codes that could not be allocated into any one type of respiratory infection (such as the code for 'respiratory tract infection'). In order to investigate possible changes in use of specific codes over time, we also evaluated non-specific infections (using codes such as 'viral infection'), symptoms (including specific symptoms such as 'earache' or non-specific symptoms such as 'fever'), pathological agents (such as 'adenovirus' or 'streptococcal infection') and other respiratory system diseases (such as 'ear disease' and 'respiratory tract disease'). Full details of the codes used are available from the authors.

We estimated the proportion of consultations for each respiratory infection for which an antibiotic prescription was issued on the same date as the consultation. All antibiotics listed in the *British National Formulary* (*BNF*) section 5.1 were included with the exception of antituberculous and antilepromatous drugs.[7] We initially extracted prescriptions for penicillin and non-penicillin antibiotics separately and then combined them. Co-prescription of the two groups of antibiotics only occurred in 539 (0.26%) of all consultations.

Analysis

General practices vary in the age and sex distribution of registered populations, while consultation rates and antibiotic prescribing rates also vary according to age and sex. We therefore used the method of indirect standardisation to calculate an age- and sex-standardised measure of consultation and prescription frequency for each practice. We used the data for the whole sample in 1997 for reference. We estimated the number of consultations expected for each practice by applying the age- and sex-specific consultation rates for the whole sample in 1997 to the practice's population. The standardised consultation ratio (SCR) was then calculated as the total consultations observed divided by the number expected if the practice experienced the same age- and sex-specific consultations rates as for the whole sample in 1997. Similarly, age- and sex-standardised prescription ratios (SPRs) were calculated for each practice by comparing the observed number of prescriptions with the number expected, based on the proportion of consultations resulting in an antibiotic prescription in the whole sample in 1997. The resultant SCRs and SPRs for each individual practice, and for each category of respiratory infection, were expressed as percentages and can be compared with a reference value of 100 for the whole sample in 1997. The value for the median practice deviated from the value of 100 when the distribution of consultations or prescriptions was markedly skewed. We estimated correlations between SCRs and SPRs in order to evaluate associations between consultations for respiratory infections and the proportion of consultations at which antibiotics were prescribed.

RESULTS

Table 1 shows the distribution of practice-specific values for crude consultations rates and proportion (per cent) of consultations with antibiotics prescribed for the different classes of respiratory illness. For all acute respiratory infections in 1997, the median practice had a consultation rate of 388 per 1000 patients per annum and the median

Table 1. Practice-specific antibiotic and consultation data: crude and standardised values for 108 general practices in 1997.

		Distribution of practice specific values						
		Lowest practice	25th centile	Median practice	75th centile	Highest practice	Correlation coefficient[a]	*P*-value
All respiratory infections	Prescriptions per 100 consultations (*n*)	45	72	78	86	98		
	Consultations per 1000 registered patients (*n*)	125	319	388	517	1110	0.414	<0.001
	Standardised prescribing ratio (%)	58	93	102	110	126		
	Standardised consultation ratio (%)	31	80	95	127	261		
Ear infection	Prescriptions per 100 consultations (*n*)	46	80	87	93	100		
	Consultations per 1000 registered patients (*n*)	1	23	33	51	100	0.418	<0.001
	Standardised prescribing ratio (%)	55	93	100	107	115		
	Standardised consultation ratio (%)	4	63	87	130	238		
Sinus infection	Prescriptions per 100 consultations (*n*)	46	89	92	95	100		
	Consultations per 1000 registered patients (*n*)	0	13	22	32	51	0.165	0.090
	Standardised prescribing ratio (%)	52	96	100	104	109		
	Standardised consultation ratio (%)	0	54	89	133	323		
Sore throat	Prescriptions per 100 consultations (*n*)	15	62	76	85	99		
	Consultations per 1000 registered patients (*n*)	4	36	56	78	331	0.386	<0.001
	Standardised prescribing ratio (%)	20	81	100	111	131		
	Standardised consultation ratio (%)	6	62	90	125	556		
Tonsillitis	Prescriptions per 100 consultations (*n*)	31	86	91	94	100		
	Consultations per 1000 registered patients (*n*)	1	19	27	39	114	0.264	0.006
	Standardised prescribing ratio (%)	35	96	101	105	111		
	Standardised consultation ratio (%)	2	62	84	127	307		
Upper respiratory tract infection — site not specified	Prescriptions per 100 consultations (*n*)	2	44	65	86	100		
	Consultations per 1000 registered patients (*n*)	4	52	90	157	931	0.444	<0.001
	Standardised prescribing ratio (%)	3	67	97	127	157		
	Standardised consultation ratio (%)	3	46	81	140	687		
Common cold	Prescriptions per 100 consultations (*n*)	0	7	13	25	84		
	Consultations per 1000 registered patients (*n*)	0	4	8	16	106	0.339	<0.001
	Standardised prescribing ratio (%)	0	33	55	117	378		
	Standardised consultation ratio (%)	0	39	72	132	869		
Influenza	Prescriptions per 100 consultations (*n*)	0	14	33	61	97		
	Consultations per 1000 registered patients (*n*)	0	4	10	15	457	0.221	0.022
	Standardised prescribing ratio (%)	0	31	67	126	210		
	Standardised consultation ratio (%)	0	32	72	110	3383		
Laryngitis	Prescriptions per 100 consultations (*n*)	6	50	67	82	100		
	Consultations per 1000 registered patients (*n*)	0	3	5	7	19	0.073	0.467
	Standardised prescribing ratio[b] (%)	12	80	109	127	199		
	Standardised consultation ratio (%)	0	50	88	133	378		
Tracheitis/ bronchitis	Prescriptions per 100 consultations (*n*)	52	78	88	93	100[c]		
	Consultations per 1000 registered patients (*n*)	0	9	17	35	237	0.267	0.006
	Standardised prescribing ratio[c] (%)	58	88	99	105	145		
	Standardised consultation ratio (%)	0	31	61	125	904		
Chest infection	Prescriptions per 100 consultations (*n*)	32	81	88	92	100[d]		
	Consultations per 1000 registered patients (*n*)	1	18	44	79	528	0.340	<0.001
	Standardised prescribing ratio (%)	36	92	99	103	133		
	Standardised consultation ratio (%)	2	31	74	125	951		

[a]Correlation coefficient for association of SCR with SPR. [b]Based on 102 practices with non-zero consultations. [c]Based on 107 practices with non-zero consultations. [d]Figure capped at 100%; actual figures appear to exceed 100% because of double counting when both a penicillin and non-penicillin antibiotic were prescribed. SCR = sex-standardised consultation ratio. SPR = standardised prescription ratio.

practice issued an antibiotic prescription at 78% of consultations for these conditions. Table 1 also shows the distribution of SPR and SCR values. For 1997, the SCR for 'all respiratory infections' ranged from 31–261% at different practices. Wide variation in the SCR persisted when different acute respiratory infections were considered separately. Some respiratory infections, such as sinus infection, were not recorded at all by some practices over the course of the year, whereas at the other extreme, one practice recorded a sinus infection SCR of 323%. When patients consulted with an acute respiratory infection, the proportion who were prescribed antibiotics varied more than two-fold (SPR range = 58–126%). For some types of respiratory infection, there was little variation in the SPR; for example, the interquartile range for sinusitis was 8. At the other extreme, the SPR interquartile range for influenza was 95.

Inspection of the correlation coefficients (Pearson's *r*) shows that practices with lower SPR values had lower SCR values for 'all respiratory infections' ($r = 0.41$; $P<0.001$). This association held for each of the individual conditions but not for laryngitis (which was infrequently recorded) or sinus infection (Table 1). Analyses for each of the other study years showed that this association held in each year although the association weakened over time ($r = 0.40$, $P<0.001$ in 1995; $r = 0.44$, $P<0.001$ in 1996; $r = 0.37$, $P<0.001$ in 1998; $r = 0.22$, $P = 0.025$ in 1999; $r = 0.19$, $P = 0.055$ in 2000).

Over the course of the study period (1995–2000) the standardised antibiotic prescribing rate for acute respiratory infections fell by 51% and the standardised consultation rate fell by 43%.[4] Additional data were obtained for consultations recorded in the dataset as 'non-specific infections', 'respiratory tract symptoms', 'organisms causing respiratory diseases' and 'other respiratory diseases' that could be indicative of an acute respiratory infection. Compared to the data obtained for 'all acute respiratory infections' in 1997, these categories increased the number of consultations by a further 8.5% and the antibiotic prescriptions by 3.6%. Both consultations and the antibiotic prescribing frequency for these conditions fell over the study period (by 46% and 50%, respectively). Further details are available from the authors.

Trends in mean SPRs and SCRs over the 5 years of the study are displayed in Table 2. Reductions in SPRs between 1995 and 2000 were found to be associated with reductions in SCRs. For 'all respiratory infections', practices with greater reductions in SCRs also had greater reductions in SPRs ($r = 0.27$; $P = 0.005$). Details of trends over time for different types of respiratory infection are also available from the authors.

DISCUSSION

Summary of the main findings

Antibiotic prescribing and, to a greater extent, patient consultation rates for acute respiratory infections varied widely between practices and over time. Practices with lower proportions of consultations resulting in an antibiotic prescription also had lower consultation rates for acute respiratory infections. Moreover, those practices that succeeded in reducing their antibiotic prescribing over time also experienced reductions in consultation rates. Although an observational study cannot prove that the relationship is causal, our results are consistent with the hypothesis that reduced antibiotic prescribing discourages GP re-attendance. The reverse explanation, that a falling consultation rate discourages antibiotic prescription, does not have a plausible underlying explanation. Indeed, it is possible that patients in practices with particularly low consultation rates for respiratory infection only attend with more severe symptoms and there may then be a stronger indication to prescribe, although our data showed no evidence of this trend.

These data were gathered over a period of 6 years, during which antibiotic prescribing and consultations for respiratory infections declined steadily. Since we analysed antibiotic prescription rates per consultation rather than the total volume of antibiotic prescriptions, observed reductions in prescribing did not occur simply because fewer people consulted with a respiratory infection. We consider the most likely explanation of our findings to be that patient expectations and illness behaviour have changed.[8]

Table 2. Changes in the proportion of consultations for acute respiratory infections resulting in a prescription (mean SPR) and changes in consultation rate (mean SCR) between 1995 and 2000.

	1995	1996	1997	1998	1999	2000	Annual change in SPR or SCR (95% CI)	Correlation of SCR change with SPR change	*P*-value
All respiratory infections									
SPR	101	102	100	95	89	89	-3.0 (-3.6 to -2.3)	0.266	0.005
SCR	116	106	105	95	80	68	-9.5 (-11.3 to -7.8)		

SCR = sex-standardised consultation ratio. SPR = standardised prescription ratio.

Based on the concept of the 'iceberg of illness', which suggests that most patients do not consult with self-limiting illnesses, just small changes in help-seeking behaviour are likely to result in large changes in consultation behaviour. Others have suggested that a secular change in the incidence of a wide variety of acute respiratory infections might have occurred, accounting for the reductions in GP consultations for these illnesses.[3] However, the true community incidence of respiratory infections remains unknown and cannot be estimated by extrapolating from the GP consultation rate.

Strengths and limitations of the study

Our dataset did not allow us to measure any confounding effects of consultation duration. It is possible, therefore, that reduced consultation rates might be more closely related to longer consultations than to reduced antibiotic prescribing.[9] We had no first-hand qualitative data from patients, using methods such as symptom diaries, which could have demonstrated whether consultations for respiratory infections not resulting in an antibiotic prescription changed the consultation behaviour for similar illnesses on subsequent occasions. Such information would have strengthened the hypothesis that there was a causal relationship between these two factors.

The data were generally consistent across the grouped condition, 'all respiratory infections' and individual types of acute respiratory tract infections. Two individual categories of respiratory infection, laryngitis and sinusitis, did not reflect the more general pattern of lower antibiotic prescribing associated with lower consultation rates in the 1997 dataset. Similarly, reductions in antibiotics over 6 years were not associated with reductions in consultation rates for some individual categories of respiratory infection, although the correlation was significant for 'all respiratory infections'.

Reductions in the recording of respiratory infections could have been an artefact, occurring because of changing recording patterns by GPs. We consider this unlikely since other possible consultation codes for respiratory diseases, symptoms, infective agents or non-specific infections showed no concomitant increases. Data that corroborates our findings have recently been published. Other researchers exploring the GPRD, but using a different methodology, have reported similar reductions in consultations for certain respiratory infections and in the proportion of consultations resulting in an antibiotic prescription.[10]

This study is the first to demonstrate a link between declining antibiotic prescribing and consultations for acute respiratory infections at practice level. The GPRD practices selected for this study covered just over 1% of the national population.

Implications for future research

Acute respiratory infections form a major component of GP workload.[2] The GP's own behaviour, in terms of prescribing antibiotics, may have a bearing on long-term consultation rates for these infections. It has been suggested that increases in antibiotic prescribing by GPs in the early 1990s resulted in the medicalisation of self-limiting acute upper respiratory tract infections.[11] Since 1995, the prescribing pattern has changed, antibiotic prescribing for upper respiratory tract infections has declined and our results suggest that the opposite process, de-medicalisation, might be taking place.

Medicalisation is defined as a process whereby aspects of everyday life come under medical dominion, influence and supervision.[12] This phenomenon may occur at a broad conceptual level when there is a general perception within society that a condition is medical; or, it may occur at a more individual level, in the presence of the doctor, when a condition is diagnosed, awarded a medical label and treatment is administered.[13]

If we were observing the consequences of de-medicalisation, then this process would most likely be acting at an individual level, resulting in changes to the illness behaviour of patients with respiratory infections. Patients attending practices in which an antibiotic prescription for such infections was no longer an automatic outcome of their visit to the GP may consider alternatives to a GP consultation when suffering their next respiratory infection. Thus, the GP's action in prescribing fewer antibiotics may contribute to the process of de-medicalisation or may even initiate this process. Patient awareness about self-treatment options and the ineffectiveness of antibiotics in most acute respiratory infections would also contribute to the belief that these symptoms are not within the medical realm.

On the other hand, the twin processes of reduced antibiotic prescribing and reduced consultation for acute respiratory infection may not have been causally linked. For some years, GPs have come under pressure to curtail antibiotic prescribing. Similarly, patients have been advised through various health education campaigns to avoid bringing 'coughs and colds' to the doctor. Certain health authorities or primary care trusts may have been more vigorous in deterring patients from consulting with minor illnesses and discouraging GPs from antibiotic prescribing, possibly seeing both approaches as a means of achieving improved antibiotic prescribing indicators within the locality. Under these circumstances, patients might simply have transferred the object of their help-seeking behaviour away from GPs and towards other primary care professionals such as community pharmacists.

Further research, using a more qualitative approach, would be helpful to explore the processes involved in determining whether or not patients with respiratory infections choose to consult a GP. If unwell patients are choosing not to consult their GP, then we need to know about patients' experiences of, and satisfaction ratings for, subsequent self-care. There was no evidence from our data that low antibiotic prescribing resulted in more respiratory complications, such as pneumonia, but we need to know more about whether patients are aware of possible danger signs when they are ill but choose not to consult.

While the data presented reveal a continuing downward trend in GP consultations for respiratory infections, these reductions are much more evident in some GP practices than others. Our findings support the hypothesis that reduced antibiotic prescribing for acute respiratory infections reduces the likelihood of GP re-attendance. This consequence may be explained by the process of de-medicalisation, in which patients and doctors increasingly perceive some of these infections as being outside the domain of medical care. Whether these twin phenomena really are causally related can only be determined by qualitative, community-based studies that capture the views of patients deciding whether or not their respiratory symptoms merit an appointment with the GP and their attitudes based on the experience of previous antibiotic prescribing decisions.

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Ethics committee

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Competing interests

None

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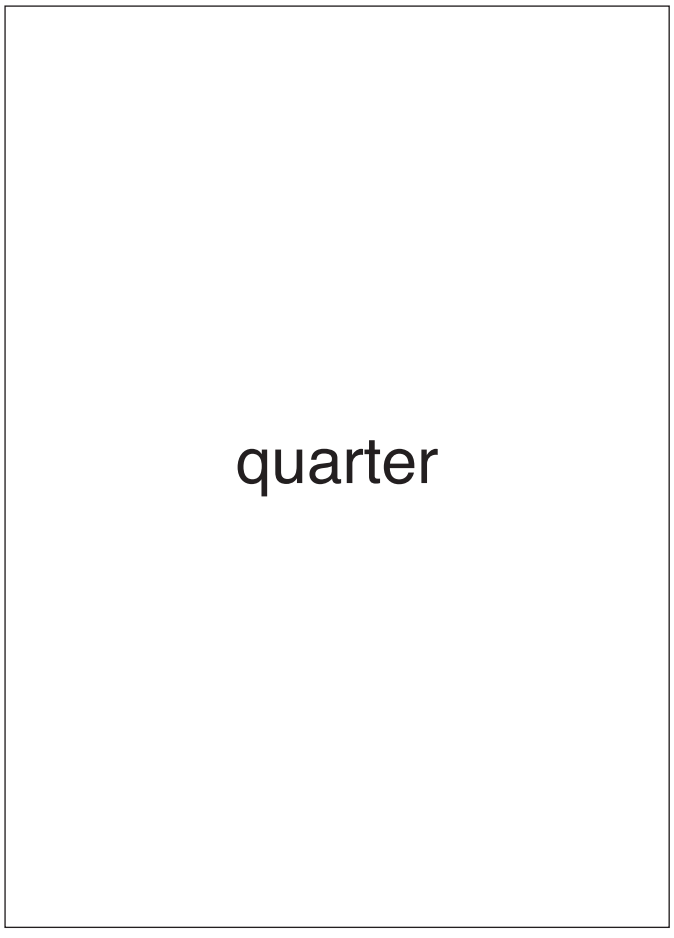

REFERENCES

1. Bajekal M. Use of health services and prescribed medicines. In: *Health Survey for England.* 1998. London, Stationery Office, 1999. http://www.archive.official-documents.co.uk/document/doh/survey98/hset7-1.htm (accessed 27 Jun 2004).
2. Royal College of General Practitioners, Office of Population Censuses and Surveys, Department of Health. *Morbidity statistics from general practice. Fourth national study 1991–1992.* London: HMSO, 1995.
3. Fleming DM, Ross AM, Cross KW, Kendall H. The reducing incidence of respiratory tract infection and its relation to antibiotic prescribing. *Br J Gen Pract* 2003; **53:** 778–783.
4. Ashworth M, Latinovic R, Charlton J, *et al.* Why has antibiotic prescribing for respiratory illness declined in primary care? A longitudinal study using the General Practice Research Database. *J Public Health (Oxf)* 2004; **26:** 268–274.
5. Little P, Williamson I, Warner G, *et al.* Open randomised trial of prescribing strategies in managing sore throat. *BMJ* 1997; **314:** 722–727.
6. Hollowell J. The General Practice Research Database: quality of morbidity data. *Popul Trends* 1997; **87:** 36–40.
7. Mehta DK (ed). *British national formulary. 44.* London: Pharmaceutical Press, 2002: 500.
8. Mechanic D, Volkart EH. Illness behaviour and medical diagnosis. *J Health Hum Behav* 1960; **1:** 86–94.
9. Lundkvist J, Akerlind I, Borgquist L, Molstad S. The more time spent on listening, the less time spent on prescribing antibiotics in general practice. *Fam Pract* 2002; **19:** 638–640.
10. Smith GE, Smith S, Heatlie H, *et al.* What has happened to antimicrobial usage in primary care in the United Kingdom since the SMAC report? Description of trends in antimicrobial usage using the General Practice Research Database. *J Public Health (Oxf)* 2004; **26:** 359–364.
11. Little P, Gould C, Williamson I, *et al.* Reattendance and complications in a randomised trial of prescribing strategies for sore throat: the medicalising effect of prescribing antibiotics. *BMJ* 1997; **315:** 350–352.
12. Zola IK. Medicine as an institution of social control. *Sociol Rev* 1972; **20:** 487–504.
13. Conrad P, Schneider JW. Looking at levels of medicalisation: A comment on Strong's critique of the thesis of medical imperialism. *Soc Sci Med* 1980; **14A:** 75–79.