

Selective decrease in consultations and antibiotic prescribing for acute respiratory tract infections in UK primary care up to 2006

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ABSTRACT

Background The aim of this study was to estimate trends in primary care consultations and antibiotic prescribing for acute respiratory tract infections (RTIs) in the UK from 1997 to 2006.

Methods Data were analysed for 100 000 subjects registered with 78 family practices in the UK General Practice Research Database; the numbers of consultations for RTI and associated antibiotic prescriptions were enumerated.

Results The consultation rate for RTI declined in females from 442.2 per 1000 registered patients in 1997 to 330.9 in 2006, and in males from 318.5 to 249.0. The rate of consultations for colds, rhinitis and upper respiratory tract infection (URTI) declined by 4.2 (95% CI 2.3–6.1) per 1000 per year in females and by 3.6 (2.3–4.8) in males. The rate of antibiotic prescribing for RTI was higher in females and declined by 8.5 (2.0–15.1) per 1000 in females and 6.7 (2.7–10.8) in males. For colds, rhinitis and URTI, the proportion of consultations with antibiotics was prescribed declined by 1.7% per year in females and 1.8% in males.

Conclusions Decreasing frequency of consultation and antibiotic prescription for colds, rhinitis and 'URTI' continues to drive a reduction in the rate of antibiotic utilization for RTIs.

Keywords antibacterial agents, drug prescription, drug resistance, family practice, microbial, respiratory tract infections

Introduction

The problem of resistance to antimicrobial drugs is growing and appropriate prescribing of antimicrobial drugs is of great public health importance.¹ Antibiotic prescribing in the UK declined after reaching a peak in 1995. This decline has been substantial, amounting to a reduction of nearly a quarter in antibiotics prescribed in the community between 1996 and 2002.² However, since 2000, overall national antibiotic prescribing volumes appear to have remained constant in England (NHS Information Centre, personal communication to M. A., 3 November 2008). Concerns therefore remain that the current levels of antibiotic prescribing are

too high, incurring unnecessary costs to the health service, exposing individuals to the risks of unnecessary drug therapy and contributing to the growing problem of antibiotic resistance.^{3,4}

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Respiratory tract infections (RTIs) are common. RTIs account for some 300–400 general practice consultations annually per 1000 registered patients⁵ and RTIs represent one of the most frequent indications for antibiotic drug prescription.¹ Prescribing antibiotics to patients with RTIs appears to be driven by a concern to meet patient expectations.⁶ However, antibiotics do not provide clinical benefit in a majority of RTIs.^{1,7–10} These illnesses are usually brief and self-limiting, and complications are unusual even without antibiotics.^{1,11} Reducing antibiotic prescribing for RTIs is therefore both clinically justified and feasible.¹²

In a previous report, we described trends in antibiotic prescribing for RTI in the General Practice Research Database (GPRD) between 1994 and 2000.⁵ During this period, we noted decreases in rates of consultation for RTI with more modest reductions in the proportion of consultations with antibiotics prescribed. Given the current relative stability of prescribing, this study aimed to determine whether consultation rates for RTIs, and use of antibiotics in patients consulting with RTIs, are continuing to decrease.

Methods

Practice and patient selection

Data were obtained from the GPRD.¹³ The GPRD is a large database comprising the electronic patient records of ~5% of UK general practices. Practices were selected for the present study if they contributed up-to-standard data continuously from 1 January 1997 to 31 December 2006 and provided exclusively Read-coded data. There were 78 practices included. From the population of all registered subjects, a sample was compiled by taking an independent random sample of 10 000 subjects for each year of study. Eligible subjects were registered with the practice continuously between 1 January and 31 December in the year of study, had records of an 'acceptable' standard and were aged 100 years or less. Subjects were sampled with replacement and 94 470 subjects provided 100 000 person years of study.

Analysis

We searched the medical records of subjects for consultations for acute respiratory infections that took place in the index year of study. Sets of medical codes were used to identify consultations for respiratory infections. These included: colds, rhinitis and unspecified upper respiratory tract infections (URTI); sore throats and pharyngitis; tonsillitis; acute sinusitis; otitis media and earache; influenza; laryngitis and tracheitis, including epiglottitis and croup; and acute bronchitis, pneumonia, chest infection and lower RTI.

Details of codes used are available from the authors. Selection of codes was informed by the structure of the Read code classification¹⁴ and the International Classification for Primary Care.¹⁵

For each consultation, we evaluated whether a prescription for an antimicrobial drug was issued on the same day. We included all drugs listed in Section 5.1 of the *British National Formulary*¹⁶ except for anti-tuberculous and anti-leprotic drugs. Age- and sex-specific consultation rates were estimated and these were used to calculate age-standardized rates using the European Standard Population for reference. Age-standardized rates for antibiotic prescription in RTI per 1000 registered patients and for proportion of RTI consultations with antibiotics prescribed were also estimated. Linear regression models were fitted to estimate the linear association of year with age-standardized consultation and prescribing rates.

Results

Data were analysed for 10 000 subjects in each year. The number of RTI consultations and antibiotic prescriptions associated with RTI consultations declined during the period of study (Table 1). Figure 1a shows the age-standardized rates for RTI consultations for males and females between 1997 and 2006. Consultation rates were about one-third higher for females than males. There was an overall decrease in consultation rates during the period of study that was similar for males and females. The linear decrease in consultation rate for RTI was 8.7 (2.2–15.2) per 1000 in females and 6.9 (3.3–10.6) in males. However, the trend was not entirely consistent from year to year. Figure 1b shows the age-standardized rate of antibiotic prescriptions for RTI per 1000 registered patients. The linear decrease in antibiotic prescribing for RTI was 8.5 (2.0–15.1) per 1000 registered patients in females and 6.7 (2.7–10.8) per 1000 in males (Table 1). Figure 1c shows the trend in the proportion of RTI consultations with antibiotics prescribed. The linear decrease was estimated to be 0.8% per year in males and females (Table 1). However, much of the decrease appeared to be between 1997 and 1999 with estimates remaining more or less constant after this date. In contrast to the large differences in consultation rates, there were no gender differences in the proportion of consultations with antibiotics prescribed. There was no overall decrease in total antibiotic utilization for all indications during the period (Fig. 1d and Table 1).

Table 2 shows the rates of consultation for different groups of RTI. The highest rates of consultation were for 'colds, rhinitis and other URTIs'. Consultations for these

Table 1 Consultations and antibiotic (AB) prescriptions for acute RTIs by gender and year

		1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Annual change (95% CI)	P-value
Subjects	Total	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000	10 000		
	Female	5038	5084	5025	5213	5096	5048	5093	5117	5080	5104		
	Male	4962	4916	4975	4787	4904	4952	4907	4883	4920	4896		
RTI consultations	Female	1996	1736	1639	1563	1578	1668	1626	1447	1523	1496		
	Male	1399	1299	1190	1082	1161	1161	1137	1018	987	1086		
AB prescriptions for RTI	Female	1426	1163	1037	974	1010	1131	1022	940	925	939		
	Male	1008	886	716	693	743	756	685	662	610	686		
RTI consultation rate (per 1000) ^a	Female	442.2	374.3	356.6	330.5	346.7	360.0	355.2	313.6	330.4	330.9	-8.7 (-15.2 to -2.2)	0.015
	Male	318.5	292.9	269.8	255.2	279.3	264.3	268.3	239.7	236.6	249.0	-6.9 (-10.6 to -3.3)	0.002
AB prescription rate for RTI (per 1000) ^a	Female	309.9	244.6	217.6	197.0	213.8	236.1	212.6	195.2	192.0	199.1	-8.5 (-15.1 to -2.0)	0.017
	Male	224.6	195.7	157.1	159.9	172.6	164.3	154.9	147.9	139.6	152.3	-6.7 (-10.8 to -2.7)	0.005
Proportion of RTI consultations with AB prescribed (%) ^a	Female	70.1	65.3	61.0	59.6	61.7	65.6	59.9	62.2	58.1	60.2	-0.8 (-10.5 to -0.1)	0.040
	Male	70.5	66.8	58.2	62.6	61.8	62.1	57.7	61.7	59.0	61.2	-0.8 (-1.6 to 0.0)	0.048
AB prescriptions for any indication (per 1000) ^a	Female	763.2	666.1	629.0	632.0	630.7	668.4	646.0	644.7	648.4	683.9	-4.1 (-14.4 to 6.2)	0.382
	Male	527.0	480.3	438.2	427.7	463.6	474.5	454.5	467.0	462.5	467.4	-2.6 (-9.4 to 4.3)	0.411

Figures are frequencies except where stated.

^aStandardized to European standard population for reference.

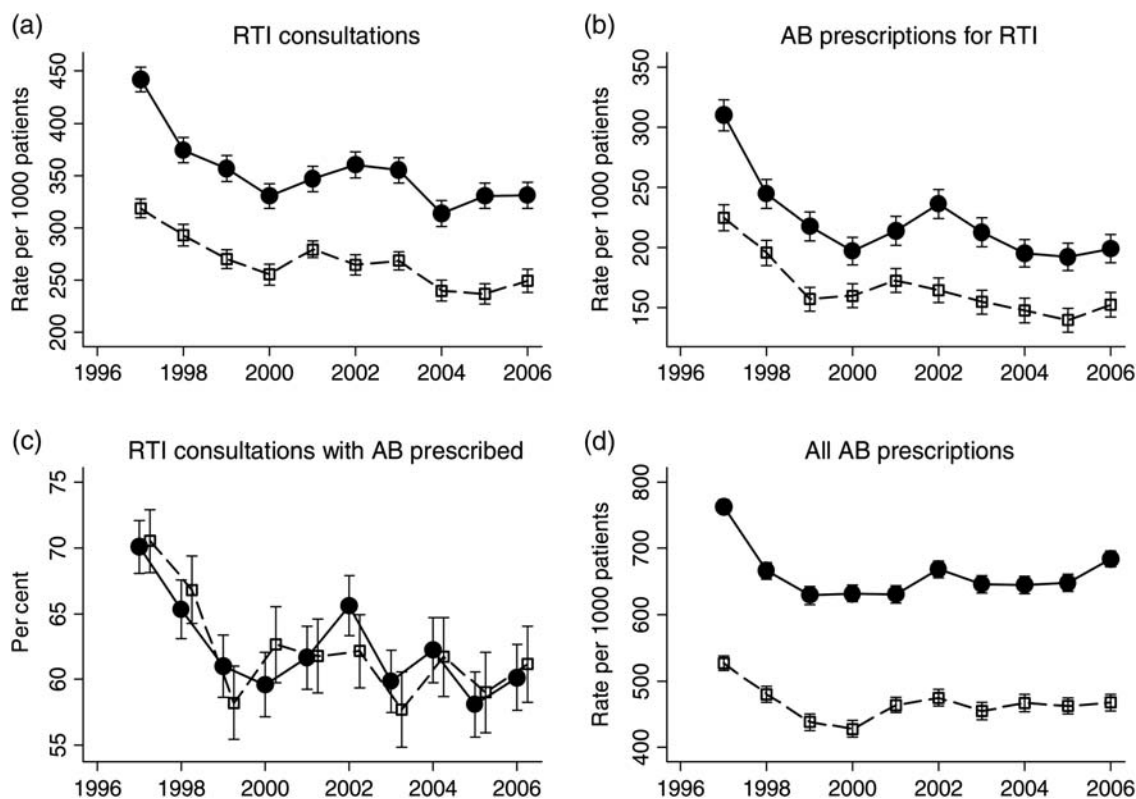


Fig. 1 (a) General practice consultation rates for RTIs per 1000 registered patients per year. (b) Antibiotic prescriptions rate for RTI per 1000 registered patients per year. (c) Per cent of RTI consultations with antibiotic prescribed. (d) All antibiotic prescriptions per 1000 registered patients per year. Filled circles, females; open squares, males. Bars represent 95% CIs. Data were standardized to European Standard Population for reference.

diagnoses declined during the period, with an annual decrease of ~ 4 per 1000 registered patients in both males and females. Consultation rates also declined for influenza and laryngitis but the estimated declines were considerably smaller than for colds, rhinitis and URTI. Consultations for acute sinusitis declined in females and for otitis media in males. There were no consistent changes in consultations for sore throat, tonsillitis, nor chest infection and pneumonia.

Table 3 shows trends in the proportion of RTI consultations with antibiotics prescribed. There was a decrease in the proportion of consultations for colds, rhinitis and URTI at which antibiotics were prescribed. This amounted to an annual decrease of just under 2% per year in both males and females. There was also some evidence for a decrease in antibiotic prescribing for influenza and sore throat in females and otitis media in males. However, there was no consistent change in antibiotic prescribing for laryngitis, sinusitis or acute bronchitis, chest infection or pneumonia. Note that the estimates for influenza show several large fluctuations between years owing to the small number of events resulting from the low recorded consultation rates for these conditions.

Discussion

Main findings of this study

These data reveal a striking decline in the rate of primary care consultations for RTI between 1996 and 2006. The decrease amounts to a 25% decline in females and a 22% decline in males. A reduction in consultations for colds, rhinitis and 'URTIs' is the main contributor to this decrease. Overall antibiotic prescribing for RTI declined over the 10-year study period up to 2006 by $\sim 36\%$ in females and 32% in males. However, the proportion of consultations with antibiotics prescribed declined by a much smaller amount, 14% in females and 13% in males, showing that the decline in consultations rates was an important driver of the decline in antibiotic prescribing. The decline in antibiotic prescribing was most rapid in the early years of our study, consistent with our previous report,⁵ but the overall decline in prescribing volumes continued through to 2006. The decline in the earlier years of the period may have been in response to the 1998 publication of the Standing Medical Advisory Committee Report, 'The Path of Least Resistance'¹⁷ as well as primary research studies⁸ and reviews,⁷ which received widespread publicity in the medical and lay media.

Table 2 Consultation rate for different groups of RTI

Condition	Gender	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Annual change per 1000 (95% CI)	P-value
Colds, rhinitis and 'URTI'	Female	141.4	134.3	124.4	111.8	116.2	102.8	118.0	97.8	106.9	99.7	-4.2 (-6.1 to -2.3)	0.001
	Male	111.9	105.8	105.4	88.3	96.6	87.4	96.6	81.0	83.1	76.6	-3.6 (-4.8 to -2.3)	<0.001
Influenza	Female	12.5	10.6	10.3	8.2	8.2	6.6	10.5	5.2	6.7	4.9	-0.7 (-1.1 to -0.3)	0.003
	Male	8.5	8.1	10.4	6.0	6.8	4.2	6.5	3.0	6.9	4.2	-0.5 (-1.0 to -0.1)	0.025
Sore throat and pharyngitis	Female	71.0	57.5	53.7	52.0	55.7	68.9	62.7	63.0	63.7	64.0	0.4 (-1.2 to 2.1)	0.564
	Male	41.6	33.6	31.3	30.2	36.5	37.7	38.2	39.0	33.9	46.5	0.7 (-0.5 to 1.9)	0.238
Tonsillitis	Female	41.1	28.9	36.2	31.3	37.9	36.1	37.3	30.2	32.6	33.3	-0.4 (-1.3 to 0.6)	0.439
	Male	35.0	22.2	22.1	21.0	27.3	26.3	28.1	27.3	23.0	31.1	0.1 (-1.1 to 1.3)	0.852
Laryngitis/tracheitis	Female	13.2	13.4	9.3	6.5	7.4	8.5	8.9	8.1	9.1	5.5	-0.6 (-1.1 to -0.1)	0.025
	Male	7.3	8.6	5.1	4.7	8.6	4.8	4.7	3.7	4.0	4.0	-0.4 (-0.8 to -0.1)	0.021
Otitis media and earache	Female	57.6	45.7	39.0	40.6	39.9	48.4	41.2	37.2	35.7	48.2	-0.9 (-2.5 to 0.7)	0.225
	Male	47.7	45.1	43.8	43.6	37.6	34.2	36.6	35.1	31.2	36.8	-1.6 (-2.3 to -0.9)	0.001
Acute sinusitis	Female	31.6	25.6	27.0	26.3	23.6	23.0	22.2	25.7	20.5	23.4	-0.8 (-1.3 to -0.2)	0.010
	Male	12.1	8.6	8.3	11.1	13.6	14.3	7.4	8.7	6.7	9.7	-0.3 (-0.9 to 0.4)	0.388
Acute bronchitis, 'chest infection' and pneumonia	Female	78.4	64.7	61.9	59.9	62.9	74.7	64.6	52.4	62.1	61.0	-1.2 (-2.9 to 0.5)	0.153
	Male	59.8	63.6	47.3	54.6	56.8	60.6	57.2	46.2	51.8	44.9	-1.3 (-2.7 to 0.1)	0.071

Figures are rates per 1000 registered patients per year, standardized to European Standard Population.

This study is one of the first to report on gender differences in antibiotic prescribing volumes for RTIs. Throughout the duration of the study, females were prescribed 30–50% more antibiotics for RTIs than males. This was explained by a higher consultation rate for females while the proportion of consultations with antibiotics prescribed was similar in men and women.

We explored the consultation and prescribing pattern for several components of RTIs. The largest and most consistent reductions in consultation rates were observed for consultations coded as 'colds, rhinitis and URTI'. Although the overall proportion of patients prescribed antibiotics did not decline to the same extent, 'colds, rhinitis and URTI' together with 'influenza' were the conditions associated with the largest reductions in antibiotic prescribing frequency. There was less consistent or no evidence of a decrease in consultation or prescribing for sore throat, tonsillitis, otitis media or sinusitis. Concern had been expressed that overall reductions in antibiotic prescribing could contribute to rising hospital admissions, and possibly increased mortality, from pneumonia.^{2,18,19} However, we found no decrease in the proportion of patients who had a recorded diagnosis of 'acute bronchitis' or 'chest infection, pneumonia' and were prescribed antibiotics. Thus, the decrease in antibiotic

utilization for RTIs has been selective and mostly confined to certain types of upper respiratory infection.

What is already known on this topic

The present results show that the favourable trend, reported from the GPRD^{5,20} and the Royal College of General Practitioner's surveillance system,²¹ up to 2000 has continued. Decreasing rates of consultation for RTIs (including common cold, pharyngitis, tonsillitis, acute otitis media, laryngitis, influenza, acute bronchitis, pneumonia and lower respiratory infections) have also been reported from Sweden up to 2005.^{22,23} In the Swedish studies, there was also evidence of decreasing overall antibiotic utilization with little change in the proportion of consultations with antibiotics prescribed.²³ In a study from the Netherlands, Kuyvenhoven *et al.*²⁴ compared data for 1987 with 2001. There were substantial decreases in consultation rates for acute otitis media (decrease of 10.4 per 1000), common cold (71.9 per 1000), sinusitis (12.7 per 1000) and acute tonsillitis (14.1 per 1000), leading to reduced antibiotic prescribing volumes. However, antibiotic prescribing per consultation increased over the period for acute otitis media and common cold while remaining constant for sinusitis

Table 3 Proportion of consultations with antibiotics prescribed

Condition	Gender	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	Annual % change (95% CI)	P-value
Colds, rhinitis and 'URTI'	Female	58.6	51.0	38.3	40.4	37.7	41.8	37.7	41.2	37.7	36.6	-1.7 (-3.0 to -0.4)	0.018
	Male	55.8	50.2	37.1	36.6	40.6	36.1	32.2	38.4	34.3	36.3	-1.8 (-3.2 to -0.4)	0.016
Influenza	Female	38.5	27.5	25.7	16.5	17.3	12.8	21.3	22.9	19.5	3.9	-2.3 (-3.9 to -0.6)	0.015
	Male	36.9	16.3	24.4	25.5	10.4	19.9	21.5	6.8	12.9	32.2	-0.9 (-3.4 to 1.5)	0.397
Sore throat and pharyngitis	Female	64.3	52.4	52.7	44.6	47.6	53.2	49.5	49.8	44.0	40.9	-1.6 (-2.8 to -0.4)	0.014
	Male	68.9	61.0	44.1	52.7	48.4	54.2	48.8	52.8	55.1	51.0	-1.0 (-2.7 to 0.7)	0.213
Tonsillitis	Female	86.6	91.7	83.1	81.1	93.0	91.6	88.5	90.4	84.8	92.6	0.4 (-0.7 to 1.5)	0.452
	Male	85.5	90.7	92.4	92.6	87.7	83.1	86.2	88.6	84.2	91.6	-0.2 (-1.1 to 0.7)	0.633
Laryngitis and tracheitis	Female	46.2	43.4	52.4	51.4	53.1	65.1	51.2	50.8	33.4	52.6	-0.1 (-2.2 to 2.1)	0.952
	Male	63.3	44.4	36.2	67.4	24.2	45.4	40.5	51.7	46.7	31.2	-1.5 (-4.9 to 1.8)	0.323
Otitis media and earache	Female	78.6	84.0	78.1	70.4	76.0	81.9	69.3	77.0	73.6	74.9	-0.7 (-1.8 to 0.5)	0.210
	Male	81.7	86.2	81.3	85.4	86.6	84.5	70.3	75.5	80.7	69.1	-1.4 (-2.7 to -0.1)	0.040
Acute sinusitis	Female	93.5	86.6	90.3	89.5	94.0	94.0	92.7	93.2	91.9	87.7	0.1 (-0.7 to 0.8)	0.872
	Male	85.8	95.2	86.7	86.4	83.5	90.4	73.9	93.4	93.7	90.1	0.2 (-1.5 to 1.9)	0.805
Acute bronchitis, 'chest infection' and pneumonia	Female	82.4	86.0	85.9	84.8	87.3	85.6	87.8	82.1	85.9	86.4	0.1 (-0.3 to 0.6)	0.513
	Male	84.9	82.5	83.5	81.3	86.6	83.0	88.8	84.4	82.7	89.1	0.4 (-0.3 to 1.0)	0.214

Figures are per cents and were standardized to the European Standard Population.

and acute tonsillitis.²⁴ In a study from the USA, McCaig *et al.*²⁵ found that in children aged <15 years, the consultation rate for respiratory infections declined 34% between 1989–90 and 1999–2000. This decrease was mainly accounted for by reduced rates of consultation for otitis media, pharyngitis and bronchitis. Over the 12-year period, there was a 29% decline in antibiotic prescribing per consultation. There were declines in antibiotic prescribing per consultation for pharyngitis and URTI but not for otitis media, sinusitis or bronchitis.²⁵

Previous studies have observed higher antibiotic prescription volumes for females but considered that this was probably attributable to treatment for urinary tract infections.²⁶ Gender differences in consultation rates with RTIs are consistent with previous reports. In the Fourth National Study of Morbidity in General Practice (MSGP4), consultation rates for RTIs were ~1.67 time greater in women than men between the ages of 15 and 65 years, with smaller or no gender differences in the young and old.²⁷ This was confirmed in a comparison of consultation rates estimated from GPRD with MSGP4 data.²⁸ The consistently higher levels of antibiotic prescribing reflect the greater consultation rates for women but once women attend their GP, there is little

differential between men and women in the proportion prescribed antibiotics.

What this study adds

Antibiotic prescribing for RTIs has continued to decline in the UK throughout the decade 1997–2006.^{5,21} This decrease has been most evident for colds, rhinitis and 'other upper respiratory infections'. These results show that further work is needed to explore effective interventions to reduce high antibiotic prescribing rates for RTIs which are most commonly viral in aetiology. Attempts to reduce antibiotic prescribing generally either concentrate on national campaigns targeting potential patients, with some evidence of success,³ or on interventions aimed at practitioners. For example, Sabuncu *et al.*²⁹ reported that there was a 26% reduction in antibiotic prescriptions per 100 population from 2002 to 2007 following the introduction of a national campaign ('Antibiotics are not automatic'). Attempts to influence practitioner prescribing behaviour generally have more limited impact in rigorous evaluations.³⁰ However, the consequences of population and practitioner approaches may interact in the context of consultations. It may be difficult to confidently ascribe the observed changes to either

patient or professional behaviour. There may have been changes in the case-mix of consulting patients during this period but the potential impact of case-mix on GP prescribing has not been measured. There may have been increased use of 'delayed prescribing' during the period³¹ and not all prescriptions issued may have resulted in a course of treatment. Rapid diagnostic tests for respiratory illness are becoming available,³² and may be of value,³³ but were not in widespread use in the UK primary care during this period. Changing professional behaviour, including communicating messages to patients that antibiotics are not required, may have contributed to changing individual and societal perceptions that some RTIs are amenable to self-treatment rather than a visit to the GP or an antibiotic prescription.

The proportion of consultations resulting in an antibiotic prescription as recently as 2006 is not consistent with current recommendations for good practice in the management of RTIs.³⁴ There seems little justification for prescribing antibiotics in ~90% of sinusitis cases, 70% of cases of otitis media and 40% of cases of laryngitis and tracheitis.³⁴ Continuing high antibiotic prescribing rates for conditions that are mostly viral in aetiology suggests that further work is needed to influence both consultation and prescribing thresholds. Recent NICE guidance on antibiotic prescribing for RTIs may influence practitioners' prescribing behaviour but its release post-dated our study.³⁴

Limitations of this study

The study had the strength of a large sample of family practices that was not confined to one geographical locality but drawn from across the UK. The GPRD population shows a similar age and sex distribution to the UK population.³⁵ However, we acknowledge that findings might differ in areas that have different characteristics in terms of deprivation category or proportion of ethnic minorities. The same practices were included each year, thus reducing potential bias arising from inter-practice variation. Nevertheless, the practices themselves are likely to have changed over time with potential modification of appointment systems, out-of-hours arrangements and access for acute self-limiting conditions that may have contributed to reductions in consultation rates for RTIs. The total sample was 100 000 overall, and 10 000 in any year of study. However, for the less frequent conditions, there were relatively small numbers of consultations and some of the estimates fluctuated between years of study. The data were collected in clinical practice and standard case definitions were not used leading to difficulties in distinguishing categories such as 'chest infection',

'pneumonia' or 'acute bronchitis'. The boundaries between diagnostic categories may have been indistinct in clinical practice but the overall pattern of change is consistent, even if there might have been a degree of diagnostic drift between categories over the course of ten years.

We analysed the numbers of antibiotic prescriptions and did not standardize the volume of antibiotics prescribed. However, national data demonstrate that reductions in the number of prescriptions parallel reductions in the standardized volume of prescribing.² Our study could only determine prescription rates and not whether these were intended for immediate use. If there was increased use of deferred antibiotic prescribing strategies during the period, in response to publications that endorsed this strategy,^{36,37} then the number of courses of antibiotics used may have been lower than the apparent prescribing rate for each condition. There may be repeat consultations during a single illness episode that may inflate the apparent consultation rate. However, when we analysed only the first consultation in any calendar month, the consultation rate was ~8% lower and prescribing rate was ~5% lower, but the proportion of consultations with antibiotics prescribed was negligibly different from those reported. The results are therefore likely to be relatively insensitive to repeat consultations in an episode.

Although the present findings are generally consistent with our earlier report,⁵ a number of methodological differences should be noted. The data for this study were derived from a more recent version of GPRD. The practices included in this report represent a different sample from those studied previously and may have included practices and practitioners whose prescribing habits differed from those in the earlier sample. The code lists and diagnostic grouping for this study were updated and aligned, to the extent possible, with other diagnostic groupings. Thus, although we emphasize the overall consistency of the two reports, there are methodological differences that may account for differences of detail.

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