*J Antimicrob Chemother* 2011; **66**: 2872–2879
doi:10.1093/jac/dkr387 Advance Access publication 29 September 2011

Journal of Antimicrobial Chemotherapy

# Impact of the French campaign to reduce inappropriate ambulatory antibiotic use on the prescription and consultation rates for respiratory tract infections

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*Received 12 May 2011; returned 1 June 2011; revised 14 July 2011; accepted 23 August 2011*

**Objectives:** To assess long-term trends in the volume of ambulatory antibiotic prescriptions and prescription and consultation rates for respiratory tract infections (RTIs) in France in relation to the yearly public antibiotic campaign since 2002.

**Methods:** Data collected on representative cohorts of office-based physicians and pharmacies in France participating in IMS Health panels between 1980 and 2009 were analysed retrospectively. Main outcome measures were antibiotic prescriptions per 1000 inhabitants per year (PIY), consultations per 1000 inhabitants per year and proportion of consultations resulting in antibiotic prescriptions.

**Results:** The peak in ambulatory antibiotic prescriptions occurred in 1997 (1468 PIY). Although prescriptions had decreased by 6% until 2001, prescriptions fell sharply (−22%) between 2001 and 2004, followed by stable prescription rates until 2009. The 2001–09 decrease in antibiotic prescriptions was driven by a sharp decline in office-based antibiotic prescriptions (−33%), exclusively achieved through a decrease in prescriptions for RTIs. Consultations for RTIs steadily declined between 2001 and 2009 (−23%), with the proportion of consultations resulting in antibiotic prescriptions decreasing from 58% to 46%. Not all types of RTIs were equally affected. The largest decrease in prescriptions was observed for nasopharyngitis and influenza. Rates for bronchitis, sinusitis, otitis media and tonsillitis remained persistently high.

**Conclusions:** During its first 3 years, the French public campaign accelerated a pre-existing decrease in ambulatory antibiotic prescriptions. The decrease in consultation rates suggests that altered illness behaviour of patients may have contributed to the observed decline. The persistently high prescribing rates for certain RTIs show that further effort is needed to improve antibiotic prescribing in France.

**Keywords:** public campaign, antimicrobial agents, RTIs, drug prescribing, outpatient visits

## Introduction

France is known for its high outpatient antibiotic consumption.[1] In order to change this worrisome situation a yearly mass media campaign has been conducted by the French National Health Insurance each winter since autumn 2002. The aim of this national campaign is to inform the public about appropriate ambulatory antibiotic use, with a special focus on respiratory tract infections (RTIs).[2] The public campaign was complemented by interventions targeting prescribers, such as academic detailing, individual prescribing feedback and promotion of rapid streptococcal antigen tests.[2]

In a recently published study, Sabuncu *et al.*[2] analysed the impact of the campaign using electronic data on individual prescriptions provided by the French National Health Insurance, covering >90% of the population. They found a 26.5% decrease in the total number of antibiotic prescriptions per 100 inhabitants between 2000–02 and 2006–07.[2] Little is known about the impact of the campaign on prescribing and consultation rates for specific indications, a common shortfall of campaigns to improve antibiotic use, because these data are not easily available.[3] This information seems, however, essential in order to identify the most effective interventions and to adequately plan future campaigns.[4]

With this study we aimed to fill some of the gaps in the literature using validated databases provided by IMS Health to assess trends in ambulatory antibiotic use in France over three decades, including a detailed assessment of the evolution of prescription and consultation rates for specific RTIs.

## Methods

We compiled annual data regarding ambulatory antibiotic prescriptions and related infectious diseases since 1980 in France, excluding its overseas departments, from IMS Health (Puteaux, France), including representative panels of retail pharmacies [*Le Marché Pharmaceutique* (LMP), compiled until 2001, and *Suivi de la Dispensation Médicale* (SDM), compiled since 1999] and office-based physicians [*Enquête Permanente sur la Prescription Médicale* (EPPM)]. IMS Health is an international company which provides data on sales and medical activities mostly to the pharmaceutical industry, but whose data are also exploited for research purposes.[5–8]

### *Data from retail pharmacies*

IMS Health France has been collecting sales data from retail pharmacies for >35 years. Until 1999, sales data (LMP data) were exclusively obtained from a representative panel of 450 retail pharmacies among the 22 500 pharmacies in metropolitan France whose reported drug purchases (in packages) were extrapolated to the entire cohort of pharmacies. Packages were transformed into prescriptions by using EPPM data regarding the number of packs per prescription (calculated for each drug/package from physicians' detailed information about the prescribed drugs).

Since 1999, IMS Health has electronically collected daily prescriptions and sales data from a much wider sample of retail pharmacies, the number of which has increased continuously to >13 500, now covering ~60% of pharmaceutical sales in France (SDM data). The data are then extrapolated to all 22 500 pharmacies in France. The collected data contain information about the prescribing physician, the prescribed and dispensed drugs and dosages, and the patient.

Data derived from the EPPM and SDM panels are not expected to be equivalent since physicians selected in the EPPM panel are exclusively self-employed physicians without hospital or clinic activity.

### *Data from office-based physicians*

The EPPM survey has been collecting data from a representative sample of self-employed, office-based physicians (without hospital or clinic activity) throughout France, on a quarterly basis for almost 40 years. In each quarter, data are collected from a representative sample of 835 physicians (400 general practitioners and 435 specialists), selected according to specialty, region, size of the urban setting and physician age and gender, and annual consultation activity. A proportion of the sample (115 doctors) is replaced in each quarter. Data are then extrapolated to the entire population of physicians.

Data are collected during a period of 7 consecutive days, including a copy of each prescription. Moreover, physicians fill out a survey form for each patient containing information about socio-demographic characteristics, the drugs prescribed (formulation, strength, daily dosage, duration of therapy) and related presumed or confirmed diagnoses (labelled by physicians with their own words), which are then compiled and classified by IMS using ICD-9 (International Statistical Classification of Diseases and Related Health Problems) and ICD-10 diagnostic codes (from 1998 onwards). Because of some discrepancies between ICD-9 and ICD-10 diagnostic coding, we continued to use ICD-9 codes for a few indications.

### *Reporting methods*

Extrapolated data from all panels were normalized per 1000 inhabitants. LMP and SDM data cover all ambulatory dispensed antibiotic prescriptions, while EPPM provides data about antibiotic prescriptions, specific diagnoses and consultation rates for office-based physicians only, excluding other categories of physicians (e.g. physicians based in public hospitals).

For the purpose of this study, all prescriptions of antibiotics belonging to Anatomical Therapeutic Chemical Classification (ATC) group J01 (systemic antibiotics; ATC version 2010) were included. We used descriptive statistics and graphical displays to analyse trends in antibiotic prescriptions and in consultation rates for specific diagnoses. Prescription patterns and changes over time were monitored by calculating the percentage of consultations for a specific diagnosis resulting in antibiotic prescriptions. Data were aggregated for entire years. For the purpose of validation, we compared the French IMS (SDM) data with European Surveillance of Antibiotic Consumption (ESAC) data for the campaign implementation period (2001–08). Because of the explorative nature of this study, we did not perform hypothesis testing for statistical significance.

## Results

### *General analysis of trends*

Figure 1 shows the evolution of antibiotic prescription rates in France [prescriptions per 1000 inhabitants per year (PIY)] between 1980 and 2009, stratified by total ambulatory prescription rates (LMP and SDM data from retail pharmacies) and prescription rates by self-employed office-based physicians only (EPPM data).

### *Data from retail pharmacies*

The data (Figure 1) show a steady increase in total ambulatory antibiotic prescriptions from 1980 onwards, with a peak in 1997 (1468 PIY). Between 1997 and 2001 antibiotic prescription rates declined by 5.9% (or on average 1.5% per year), preceding a sharper decline between 2001 and 2004 (−21.9% or −7.9% per year), which coincided with the initial years of the antibiotic campaign. After 2004, however, overall prescription rates remained stable (+2.0% between 2004 and 2009). Examining 3 year average prescription rates (hence smoothing variable seasonal effects), the results were similar: −3.2% between 1996–98 and 1999–2001; −21.6% between 1999–2001 and 2004–06; and +0.4% between 2004–06 and 2007–09. Similar trends were observed when comparing data from IMS Health with ESAC data, expressed as defined daily doses per 1000 inhabitants per day (Figure 2).

### *Data from office-based physicians*

Antibiotic prescription rates by self-employed office-based physicians similarly increased until their peak in 1997 (Figure 1). From 1998 onwards they decreased continuously at a faster rate than total ambulatory prescription rates: by 12.9% (−3.4% per year) between 1997 and 2001 (the year preceding the implementation of the public campaign); by 26.0% (−9.5% per year) between 2001 and 2004 (the initial years following its implementation); and by 9.7% (−2.0% per year) between 2004 and 2009.

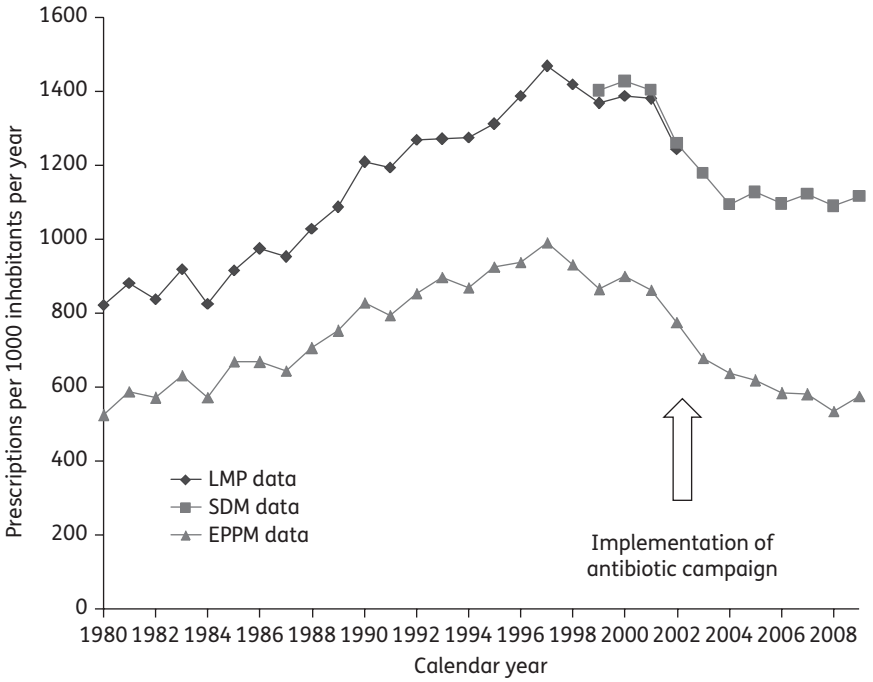


**Figure 1.** Changes in ambulatory antibiotic prescriptions per 1000 inhabitants per year in France between 1980 and 2009 according to the different IMS data sources. LMP, data extrapolated from a representative panel of 450 retail pharmacies reporting their drug purchases; SDM, data extrapolated from a panel of 13 500 retail pharmacies reporting prescriptions dispensed to patients; EPPM, data extrapolated from a representative panel of 835 office-based doctors without hospital activity reporting detailed information about patients' consultations, prescriptions and diagnoses.

### *Analysis of trends in prescriptions according to type of prescriber and infection*

Between 2001 and 2009 prescription rates by office-based doctors (physician-based EPPM data) fell by 33.1% to 577 PIY, while overall ambulatory prescription rates (pharmacy-based SDM data) were down 20.4% to 1118 PIY (Table 1). SDM data confirmed that the 2001–09 decrease in antibiotic prescriptions was limited to self-employed physicians (either office-based or practising in private clinics), as ambulatory prescriptions issued by physicians practising in public hospitals (+13.6%) and dentists (+13.3%) increased slightly over that period. The decrease in antibiotic prescription rates by office-based physicians between 2001 and 2009 was exclusively attributable to a decrease in prescriptions for RTIs (−39.9%), while prescriptions for other types of infections (e.g. infections of the urinary and female genital tract) remained almost stable (+4.6%; Table 1).

### *Analysis of trends in antibiotic prescriptions according to age groups*

Not all age groups were equally affected by the decrease in prescriptions issued by office-based physicians (Figure 3). The decrease was most marked for children aged <15 years and continued over the whole study period, because prescriptions per 1000 children per year decreased by 32.1% from 2001 to 2004 and by a further 15.8% from 2004 to 2009. The overall 2001–09 decrease was similar in all three young age groups: <2.5 years (−42.6%); 2.5–7 years (−43.3%); and 8–14 years (−44.4%). Antibiotic PIY for adolescents and adults (15–64 years) declined by 31.1% between 2001 and 2009, while in contrast prescriptions for the elderly (>65 years) decreased only moderately (−10.7%).

### *Analysis of trends in consultation and prescription rates for RTIs*

After excluding flu (for which annual consultation rates vary considerably due to seasonal effects), antibiotic prescription rates for RTIs (expressed as PIY) between 2001 and 2004 decreased to a greater extent (by −32.3%) than the drop (−11.4%) in patient consultation rates for those RTIs, expressed as consultations per 1000 inhabitants (Figure 4). The proportion of consultations for RTIs resulting in antibiotic prescriptions overall fell from 58% in 2001 to 44% in 2004 (Figure 4). Of note, the decrease in prescriptions for RTIs between 2001 and 2004 mostly resulted from a steep decline in the proportion of consultations resulting in antibiotic prescriptions for RTIs for which prescribing levels were already relatively low, such as nasopharyngitis, pharyngitis and flu (Figure 5). Prescribing levels decreased only modestly for tonsillitis (from 93% to 87%), otitis media (from 80% to 74%), acute bronchitis (from 80% to 73%) and sinusitis (from 84% to 83%; Figure 5).

Importantly, the decrease in antibiotic prescription rates for RTIs after 2004 was mostly attributable to a decrease in consultation rates (Figure 4). Antibiotic prescription rates for RTIs (other than flu) decreased by 10.8% between 2004 and 2009. This was mostly a consequence of a decrease in consultation rate (−13.4%), because the proportion of consultations for RTIs

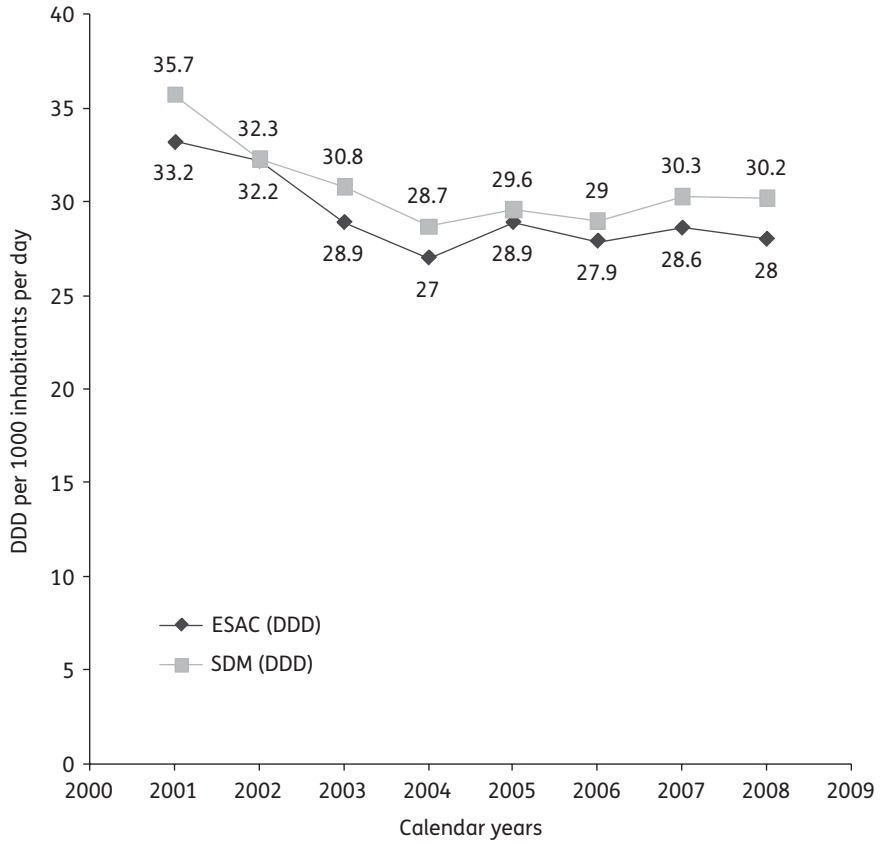


**Figure 2.** Ambulatory antibiotic use in France expressed as defined daily doses (DDD) per 1000 inhabitants per day, 2001–08. Comparison between data reported by the ESAC project and IMS pharmacy data obtained by converting dispensed packages into DDD (using the 2008 version of the WHO ATC/DDD classification).

**Table 1.** Changes in number of ambulatory antibiotic prescriptions per 1000 inhabitants per year (PIY) in France between 2001 and 2009, stratified by data source, category of prescribing physician and infection type

| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | Percentage change 2001/09 |
|---|---|---|---|---|---|---|---|---|---|---|
| Pharmacy-based data (in PIY) | | | | | | | | | | |
| total ambulatory antibiotic prescriptions | 1404 | 1260 | 1180 | 1096 | 1127 | 1096 | 1124 | 1090 | 1118 | −20.4 |
| prescribed by dentists | 80 | 89 | 89 | 89 | 88 | 90 | 91 | 91 | 91 | +13.3 |
| prescribed by public hospital-based physicians | 73 | 75 | 73 | 72 | 74 | 77 | 80 | 81 | 83 | +13.6 |
| prescribed by self-employed physicians[a] | 1251 | 1096 | 1018 | 935 | 965 | 929 | 953 | 918 | 944 | −24.5 |
| Physician-based data (in PIY) | | | | | | | | | | |
| total antibiotic prescriptions by office-based physicians[b] | 863 | 777 | 680 | 639 | 619 | 584 | 580 | 536 | 577 | −33.1 |
| for RTIs[c] | 689 | 598 | 512 | 466 | 443 | 411 | 410 | 377 | 414 | −39.9 |
| for infections of the urinary and female genital tract[c] | 58 | 60 | 57 | 60 | 59 | 63 | 61 | 59 | 61 | +4.6 |

[a]Self-employed doctors either based in retail offices or practising in private clinics.
[b]Office-based doctors with no hospital/clinic activity.
[c]When diagnosis explicitly specified by doctors (i.e. in ∼95% of total prescriptions).

leading to antibiotic prescriptions increased slightly from 44% in 2004 to 46% in 2009 (Figure 4). After 2004, antibiotic prescription rates remained more or less constant for all major RTIs, and even bounced back for pharyngitis (from 17% in 2004 to 25% in 2008) and acute bronchitis (from 73% to 82%).

## Discussion

This study assessed temporal trends in ambulatory antibiotic usage in France from 1980 to 2009, and provides the following important findings:

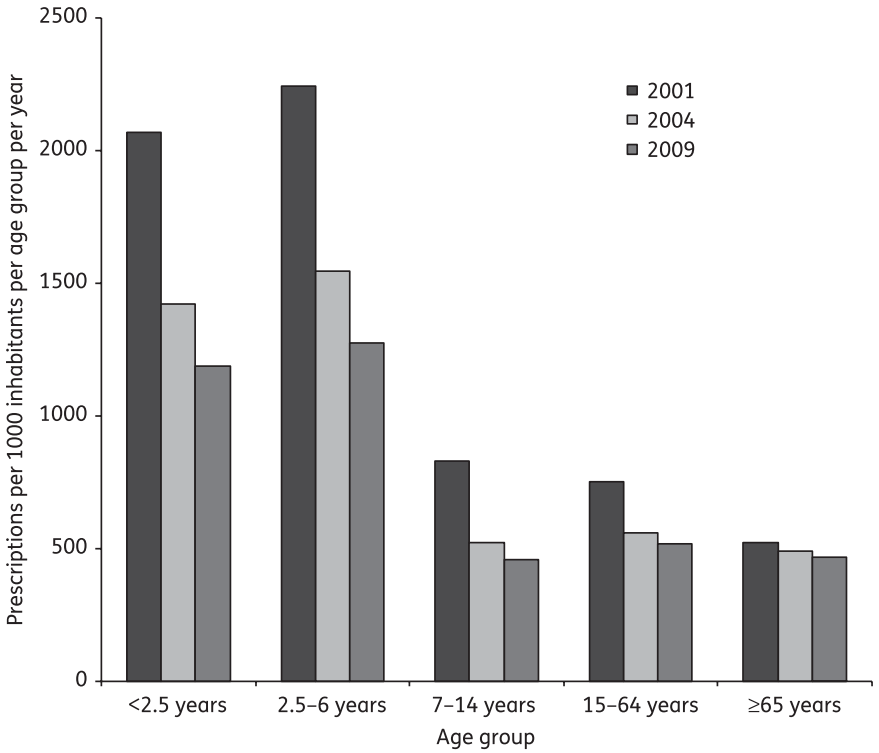


**Figure 3.** Antibiotic prescriptions per 1000 inhabitants per year by office-based doctors (EPPM panel) in France, stratified by age groups for the years 2001, 2004 and 2009.

(i) During its first 3 years, the French public campaign accelerated a pre-existing decrease in ambulatory antibiotic prescriptions after their peak in 1997.
(ii) After 2004, the impact of the campaign was limited.
(iii) Declining consultation rates for RTIs and the drop in antibiotic prescription rates for those infections contributed equally to the overall decrease in antibiotic prescriptions by office-based physicians between 2001 and 2009.
(iv) Decreased consultation rates for RTIs suggest altered illness behaviour by patients.
(v) The decrease in antibiotic prescription rates by office-based physicians for RTIs indicates that they also altered their behaviour, yet they continue to frequently treat certain RTIs with antibiotics unnecessarily.

These IMS Health data confirm those from the ESAC network (Figure 2) and the French National Health Insurance published by Sabuncu *et al.*[2] and show an important reduction in antibiotic use in France between 2001 and 2004, which correlates partially with the French public campaign. Sabuncu *et al.*[2] used the winter seasons 2001 and 2002 to determine baseline prescribing rates, thus limiting their ability to detect any secular trends existing before the intervention. It is unclear what caused the modest decrease in antibiotic use before implementation of the antibiotic campaign (between 1997 and 2001). Recommendations to reduce antibiotic prescribing in the primary care setting in France had already been issued in the mid-1990s. In addition, the particularly high antibiotic use in France compared with some of its European neighbours and the problems associated with antibiotic misuse became a frequent topic in the non-medical press by the change of millennium, following the publication of an Official Report to the Ministry of Health in May 1998. It is possible that these factors already contributed to the observed pre-campaign decrease. Most of the campaign effect occurred during the period up to 2004, followed by a plateau with relatively stable antibiotic prescription rates. The French National Health Insurance even noted a recent increasing trend in antibiotic use, which led to the announcement of a modified campaign in 2010 with a special focus on the risks of antimicrobial resistance.[9] The decrease in antibiotic prescriptions after implementation of the campaign was more marked in children, which is consistent with a campaign focusing on RTIs that are particularly common in the paediatric population and specifically targeting parents of young children. The staggered introduction of the conjugate pneumococcal vaccine in 2003 in France may only have played a very minor role in the reduction in prescriptions in this age group.

The physician-based EPPM data offer a unique perspective on the quality of antibiotic prescribing not provided by other data sources and show that the decline in antibiotic prescriptions did not concern all RTIs equally. The decrease was most marked for nasopharyngitis and influenza, for which prescribing rates were already relatively low and even decreasing before the campaign. This indicates that physicians might more easily abandon unnecessary prescribing for infectious conditions that are relatively easily recognizable as of viral origin, with a low diagnostic uncertainty compared with acute bronchitis, which continues to be a common cause of antibiotic prescribing despite its frequent viral origin.[10–12]

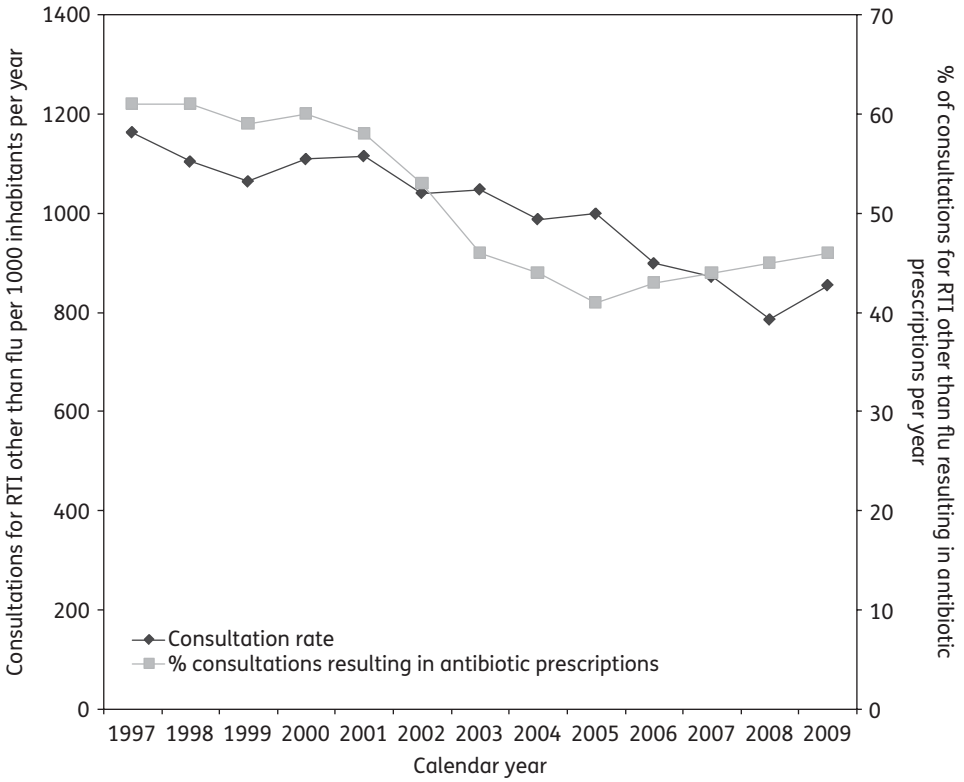


**Figure 4.** Consultations per 1000 inhabitants per year and proportion of consultations resulting in antibiotic prescriptions by office-based doctors (EPPM) for RTIs other than flu in France, 1997–2009.

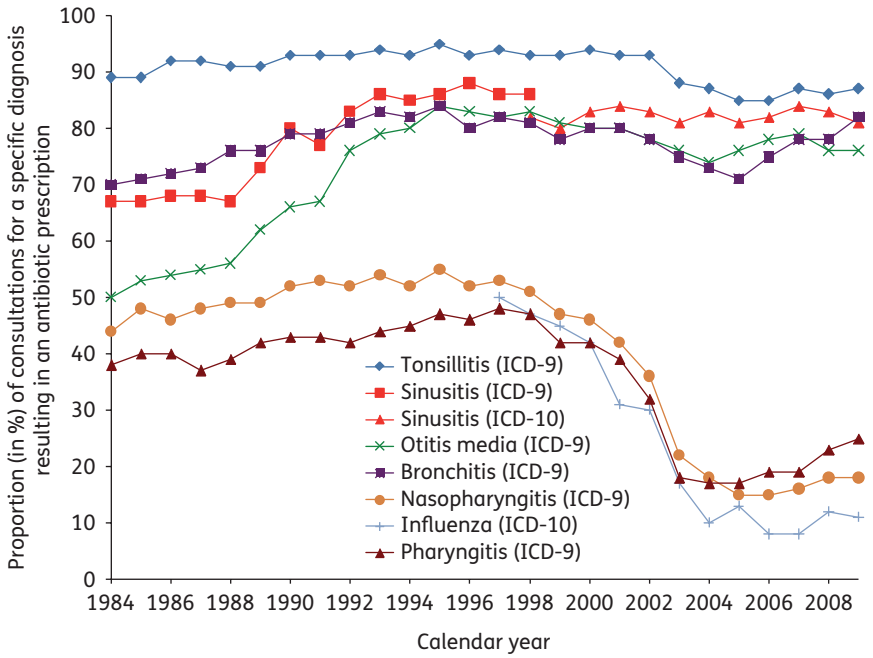


**Figure 5.** Proportion of consultations by office-based doctors (EPPM data) for a specific diagnosis resulting in antibiotic prescriptions in France, 1984–2009.

Prescribing for acute tonsillitis was only marginally affected by the decrease in antibiotic prescriptions (a shift from the diagnosis of tonsillitis towards pharyngitis is unlikely since there was no change in the relative frequency of the diagnoses pharyngitis and tonsillitis). By contrast, the declines in consultation rates for both tonsillitis and pharyngitis were greatest among all

RTIs. These data suggest that the part of the campaign targeting the public may have been effective in persuading patients with a sore throat not to seek medical attention, while physicians only slightly improved their prescribing habit for this indication. This is surprising since a considerable amount of money was spent to distribute the rapid streptococcal antigen test and train physicians in its use. A recently published study among general practitioners in the Paris region confirms this assumption, showing that the use of the rapid test was inconsistent and decreased between 2005 and 2007.[13] The reason for the failure of many physicians to integrate this point-of-care test into their clinical decision making is unclear, but diagnostic automatisms probably play a role.

Importantly, consultation rates for RTIs were remarkably high in France[14,15] and decreased markedly over the period 2001–09, explaining about one-half of the decrease in overall antibiotic use by office-based physicians. This decrease was mostly attributable to a three-quarter drop in the number of home visits by office-based doctors for RTIs between 2001 and 2009 (data not shown), with a 50% decrease over the 2001–04 period only. The observed drop is in line with the published decrease in total home visits in France by 30% between 2001 and 2003 and is most likely an effect of the change in the reimbursement of home visits by the French National Health Insurance introduced in 2002, limiting the reimbursement to certain pre-defined indications and excluding minor illnesses.[16] We assume that a small proportion of these consultations have shifted to emergency rooms, partly explaining the increase in outpatient antibiotic prescriptions issued by hospitals. However, the magnitude of the decline in consultations with office-based doctors suggests a successful effect of the campaign that educated patients about the self-limited nature of most RTIs (amplified by financial disincentives) and implies that the altered illness behaviour of patients might have contributed to the reduction in antibiotic use.

This analysis has limitations. EPPM data are derived from a sample of office-based physicians and do not necessarily represent the prescribing behaviour of all physicians. The criteria for physician selection into the panel remained constant over time, hence possibly altering the relative weight of the represented population in overall medical activity. In addition, the data are collected only for 1 week per trimester per physician, limiting the degree to which the data can be extrapolated. Diagnostic uncertainty may have biased the classification of RTIs, since reported diagnoses reflect physicians' own perceptions and labelling of diseases. Unfortunately, we were not able to assess the specific impact of each individual intervention of the multifaceted antibiotic campaign. Finally, we did not adjust our analyses for seasonal variations in the incidence of influenza-like illness, as done by others.[2,17] However, when analysing trends over extended time periods, this adjustment would probably have changed the overall trends only slightly.

Despite these limitations, it should be noted that sales data obtained from IMS Health have been used in previous studies to evaluate antibiotic prescriptions in different countries.[5–8] It also has to be emphasized that the EPPM data together with the SDM data on antibiotic prescriptions are mostly consistent with the data from ESAC and the French National Health Insurance, while having some additional strengths such as covering an extended time period with physician-based data that are not available otherwise.

What are the policy implications of these findings for France and other countries? First, even though there seems to have been a secular trend towards decreased antibiotic use even before 2001, the public campaign was successful, since it was associated with a rapid and marked reduction in antibiotic use, at least in the initial years. There are, however, some caveats. Even after the reduction in antibiotic use, France remains a country with comparatively high antibiotic consumption; unfortunately, the encouraging trend seems to have been reversed in recent years.[18] The potential reasons for this are most likely complex and beyond the scope of this article.[19] The data also show that RTIs of frequent viral origin, such as bronchitis and sinusitis, are still predominantly treated with antibiotics, leaving ample room for improvement. Overall, our data show that detailed evaluation of campaigns is necessary in order to identify areas of success and failure and to guide future interventions.

## Acknowledgements

We thank GSK France and IMS Health France for providing data, and Valérie Machuron-Thué and Jean-Baptiste Angeloglou from IMS for their valuable advice.

## Funding

B. H. was supported in part by the 6th Framework Programme of the European Community in the context of the project '*Changing behaviour of Health care professionals And the general public towards a More Prudent use of anti-microbial agents*' (acronym CHAMP, network contract SP5A-CT-2007-044317) and a research fellowship grant from the University of Geneva Hospitals. In addition, this study was supported by internal funding.

## Transparency declarations

Pierre Chahwakilian was a paid employee of Glaxo-SmithKline until August 2010. All other authors: none to declare.

### *Author contributions*

Analysis and interpretation of data, P. C., B. H. and S. H.; drafting the article, P. C., B. H. and S. H.; revising the manuscript critically for important intellectual content, B. S.; final approval of the version to be published, P. C., B. H., B. S. and S. H.; and guarantor, P.C.

## References

**1** Goossens H, Ferech M, Vander Stichele R *et al*. Outpatient antibiotic use in Europe and association with resistance: a cross-national database study. *Lancet* 2005; **365**: 579–87.

**2** Sabuncu E, David J, Bernede-Bauduin C *et al*. Significant reduction of antibiotic use in the community after a nationwide campaign in France, 2002–2007. *PLoS Med* 2009; **6**: e1000084.

**3** Huttner B, Goossens H, Verheij T *et al*. Characteristics and outcomes of public campaigns aimed at improving the use of antibiotics in outpatients in high-income countries. *Lancet Infect Dis* 2010; **10**: 17–31.

**4** Huttner B, Harbarth S "Antibiotics are not automatic anymore"—the French national campaign to cut antibiotic overuse. *PLoS Med* 2009; **6**: e1000080.

**5** Belongia EA, Knobloch MJ, Kieke BA *et al*. Impact of statewide program to promote appropriate antimicrobial drug use. *Emerg Infect Dis* 2005; **11**: 912–20.

**6** Cars O, Molstad S, Melander A. Variation in antibiotic use in the European Union. *Lancet* 2001; **357**: 1851–3.

**7** Goossens H, Ferech M, Coenen S *et al*. Comparison of outpatient systemic antibacterial use in 2004 in the United States and 27 European countries. *Clin Infect Dis* 2007; **44**: 1091–5.

**8** Hicks L, Suda K, Roberts R *et al*. Antimicrobial prescription data reveal wide geographic variability in antimicrobial use in the United States, 2009. In: *Abstracts of the Forty-eighth Annual Meeting of the Infectious Diseases Society of America, Vancouver, British Columbia, 2010*. Abstract 339. Infectious Diseases Society of America, Arlington, VA, USA.

**9** Azanowsky JM. *Bilan du plan pour préserver l'efficacité des antibiotiques 2007–2010 (Assessment of the plan to preserve the efficacy of antibiotics 2007–2010)*. Paris: Direction générale de la Santé, Sous direction prévention des risques infectieux, Bureau des infections et autres Risques liés aux soins, 2010.

**10** Aspinall SL, Good CB, Metlay JP *et al*. Antibiotic prescribing for presumed nonbacterial acute respiratory tract infections. *Am J Emerg Med* 2009; **27**: 544–51.

**11** Faure H, Mahy S, Soudry A *et al*. [Factors influencing the prescription or non-prescription of antibiotics by general practitioners]. *Med Mal Infect* 2009; **39**: 714–21.

**12** Butler CC, Hood K, Verheij T *et al*. Variation in antibiotic prescribing and its impact on recovery in patients with acute cough in primary care: prospective study in 13 countries. *BMJ* 2009; **338**: b2242.

**13** Cornaglia C, Robinet J, Partouche H. [Use of Rapid Antigen Detection Test (RADT) among general practitioner teachers at the Paris Descartes University: 2005–2007]. *Med Mal Infect* 2009; **39**: 375–81.

**14** Bouvenot G. [French National Institute for observation of prescriptions and consumption of medicines. Prescription and consumption of antibiotics in ambulatory care]. *Bull Acad Natl Med* 1999; **183**: 601–9; discussion 9–13.

**15** Harbarth S, Albrich W, Brun-Buisson C. Outpatient antibiotic use and prevalence of antibiotic-resistant pneumococci in France and Germany: a sociocultural perspective. *Emerg Infect Dis* 2002; **8**: 1460–7.

**16** Union Régionale des Médecins Libéraux d'Ile de France. La visite à domicile est-elle justifiée—Enquête visite à domicile 2005 (Are home visits justified—survey of home visits 2005). 2006.

**17** Bauraind I, Lopez-Lozano JM, Beyaert A *et al*. Association between antibiotic sales and public campaigns for their appropriate use. *JAMA* 2004; **292**: 2468–70.

**18** ESAC Yearbook 2008. http://www.esac.ua.ac.be/main.aspx?c=*ESAC2&n=50036 (14 September 2011, date last accessed).

**19** Humphreys G Are antibiotics still "automatic" in France? *Bull World Health Organ* 2011; **89**: 8–9.