

Increasing prevalence of asthma in UK primary care during the 1990s

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SUMMARY

OBJECTIVE: To estimate recent prevalence trends of physician-diagnosed asthma in primary care in the UK, and to test the hypothesis that the asthma epidemic in the UK peaked in the mid-1990s and is currently declining.

METHODS: A retrospective cohort of asthma patients was obtained from the General Practice Research Database (GPRD). From January 1990 to February 1999, asthmatics were followed up to death, censoring or mention of chronic obstructive pulmonary disease (COPD) in their clinical record. Prevalence rates of ever and managed asthma were obtained by sex, age and calendar year.

RESULTS AND CONCLUSION: From 1990 to 1998, annual prevalence rates of managed physician-diagnosed

asthma in women rose from 3.01% (95%CI 2.99–3.03) to 5.14% (95%CI 5.10–5.18), and in men from 3.44% (95%CI 3.41–3.46) to 5.06% (95%CI 5.02–5.10) (P for trend <0.01 in both). In 1998, prevalence rates of managed asthma in children aged 5–14 affected 7.86% (95%CI 7.71–8.00) of girls and 10.30% (95%CI 10.15–10.47) of boys. Increasing prevalence rates in adult asthma (maximum 4.11% in 1998, 95%CI 4.03–4.19) and elderly asthma (maximum 3.37% in 1998, 95%CI 3.29–3.46) were observed as well in 1998. The study shows that the burden of asthma in UK primary care during the 1990s was still increasing.

KEY WORDS: asthma; epidemiology; GPRD; prevalence; UK

ASTHMA IS THE MOST common chronic disease in children and one of the most common diseases worldwide. The World Health Organization (WHO) estimates that there are 155 million asthma sufferers,¹ affecting all ages, in both high- and low-income countries.² The current public health burden of asthma, in terms of morbidity, mortality and health care costs, is high. Multiple sources and authors indicate that asthma is on the rise; the increase appears to have started in the early 1970s, and data up to 1994 show a continuing increase.³ However, the increase in asthma almost certainly started even earlier than the 1970s, with indirect evidence as early as in the 1950s and 1960s. Between 1957 and 1985 there was a 5–10-fold increase in hospital discharge rates for asthma in children aged under 15 years in England.⁴ This phenomenon has been particularly well documented in Finland, where asthma prevalence has been reported to be on the increase in adolescents,⁵ and adults.⁶ Elsewhere, there is less evidence of asthma increase in adults, and indeed the causes for the increase of asthma in children and adults may differ. The increase in asthma prevalence has been accompanied by an increase in the

severity of asthma in Denmark.⁷ A recent report from a monitoring system of primary care in the UK indicated a plateau in the incidence of asthma episodes presented to general practitioners (GPs) since 1993, with the hypothesis that the epidemic of asthma in the UK peaked in the mid-1990s and is currently declining.⁸

The UK General Practice Research Database (GPRD) has been used previously to obtain epidemiological trends of chronic obstructive pulmonary disease (COPD).^{9,10} The largest population-based medical database in the world, it is potentially a unique source of information to investigate asthma in general, and our research question in particular. We aimed to determine the recent prevalence and severity trends of physician-diagnosed asthma in primary care in the UK, and to test the hypothesis that asthma prevalence and severity increased from 1990 to 1998.

METHODS

The database

The GPRD has been described in detail elsewhere.¹¹ Briefly, it was set up in May 1987, with the aim of

recruiting sufficient practices to build up a database containing continuing information on patients in the UK. As of 1998, a group of 472 practices throughout the UK, with a total of 3.4 million patients, had provided a sample of approximately 5.7% of the population. Continuous information has been collected from most of these practices for 6 years or more, giving a database of more than 30 million patient-years of observation.¹² Several studies have demonstrated that the base is a representative sample of the general UK population, with a sex and age structure almost identical to that provided by the Office of National Statistics. Each participating GP enters all significant morbidity events for each patient in the computer record, irrespective of whether the event occurred in the surgery, at a visit, or was reported over the phone. All diagnoses and procedures communicated to the GP as a result of a hospital or other specialist visit (in-patient, out-patient, or accident and emergency [A&E] unit) are recorded, and diagnoses, symptoms, procedures or investigations, referrals and their outcome are entered into the relevant sections of the medical record. The coding system follows the OXMIS system, whose codes are derived from the ICD-8 coding system: the first three digits of the OXMIS number correspond, in most cases, to the first three digits of the ICD-8 codes.¹¹ In 1998, GPs started to use the READ coding system.¹²

The current protocol was approved by the Scientific and Ethical Advisory Group of the GPRD.

Identification of asthma cases

Physician-diagnosed asthma was defined as any individual labelled with one or more of the diagnostic codes compatible with asthma.* Validation studies of the GPRD documented that the recording of medical data in GPs' computers was nearly complete, and demonstrated good agreement between the recorded diagnosis and the diagnosis of the written clinical records.¹³ A recent paper comparing the GPRD with the 4th Morbidity Survey in General Practice reported overall agreement in age- and sex-specific population rates of 11 respiratory conditions, including asthma and COPD.⁹

Entry time was considered as the date at which a first diagnosis of asthma was given. Duration was defined as the period between entry and the end of follow-up in the database, assessed in person-years by calendar time. End of follow-up was defined as the date until which a practice provided data to the database (up to February 1999), or earlier if a patient was diagnosed with COPD,¹⁰ left the practice or died. Death was identified by the specific OXMIS code for death in the registration status file of the GPRD plus

an extended set of 10 OXMIS codes from the medical file including the terms 'death', 'died' or 'dead'.

Two increasingly stringent definitions of asthma, 'ever' and 'managed' asthma, were used in this population. 'Ever asthma' was individuals who had ever had a diagnosis of asthma in their GPRD record and were alive in a given year, while 'managed asthma' was asthmatics, as described above, who also had an asthma-related medical code or a respiratory drug prescription recorded in a given year. This latter definition mirrors that used by Hansell et al. as inhaler therapy plus asthma diagnosis.⁹

Definition of other variables of interest

Asthma medication refers to any prescription of respiratory drugs, including inhaled corticosteroids, short- and long-acting β_2 agonists, other adrenergic stimulants, oral acting β_2 agonists, xanthines, anticholinergics, or combined bronchodilator products. Hospitalisations refer to in- and out-patient hospital visits related to asthma. Co-morbidities were obtained by a modified Charlson co-morbidity index.¹⁴

Statistical analyses

Prevalence rates of asthma were estimated by sex, year and age group (infants 0–4, children 5–14, young adults 15–44, older adults 45–64 and the elderly 65+ years) using standard techniques.^{15,16} A prevalence rate at a given period was determined as the number of asthmatics divided by the number of GPRD active participants alive at the beginning of that period. Individuals identified retrospectively

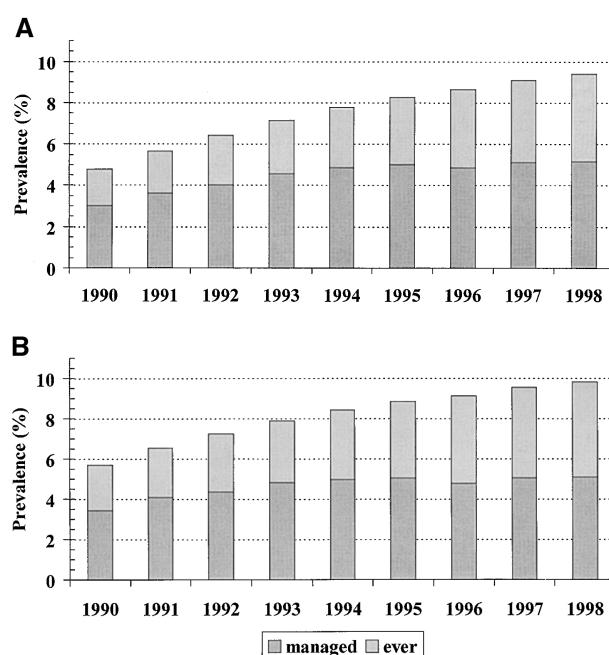


Figure 1 Prevalence (%) of ever and managed asthma in the UK GPRD from 1990 to 1998, in females and males. A: Females; B: Males. GPRD = General Practice Research Database.

* The full list of asthma and COPD compatible codes can be obtained from the authors.

as asthmatics before 1987, or prospectively from 1 January 1987 to 31 December 1989, were considered prevalent asthmatics.

Prevalence rates of ever and managed asthma are presented on a yearly basis. In addition, trends were calculated in the GP surgeries that contributed data to the GPRD during the entire study period, to take into account potential biases in the distribution of new surgeries incorporated into or removed from the GPRD.

Rates adjusted for age and sex by the indirect method, using the GPRD population in 1990 as standard, were found to be similar to the corresponding crude rates. Because there was no change in the age and sex distribution during the 9 years of follow-up, it was not considered necessary to conduct age standardisation over time, and all results are presented as crude rates without standardisation.

χ^2 and *t*-test statistics were used to test for statistical significance for qualitative and quantitative variables respectively, both at the 0.05 level of significance. Probabilities for trends were estimated with all available point estimates.

RESULTS

From 1990 to 1998, the annual prevalence rates of managed physician-diagnosed asthma rose continuously in women, from 3.01% (95% confidence interval [CI] 2.99–3.03) to 5.14% (95%CI 5.10–5.18), and in men from 3.44% (95%CI 3.41–3.46) to 5.06% (95%CI 5.02–5.10) (*P* for trend <0.01 in both). Prevalence rates of managed asthma in children aged 5–14 affected 7.86% (95%CI 7.71–8.00) of girls and 10.30% (95%CI 10.15–10.47) of boys. Increasing asthma prevalence rates in adults (maximum 4.11% in 1998, 95%CI 4.03–4.19) and the elderly (maximum 3.37% in 1998, 95%CI 3.29–3.46) were also observed (Figure 2). In relative terms, the increase was higher in women than men (70.8% vs. 47.1%), and the highest increase was observed in young adult females (97.3%). The results of asthma prevalence trends in the subset of 256 (52.4%) GP surgeries that contributed patients to the GPRD during the entire study period were identical to those of the entire sample of surgeries (data not shown).

Comparing the subsample of newly-diagnosed asthmatics in 1997, the age and sex structure was fairly identical to that of newly-diagnosed asthmatics in 1990 (Table 1). The use of asthma medication within a year after diagnosis showed an increase in the use of inhaled corticosteroids and short- and long-acting β_2 agonists. However, in 1997 compared to 1990, decreases were observed in the use of other adrenergic stimulants, oral β_2 agonists, xanthines, anticholinergics, and combined bronchodilator products (all *P* < 0.05). A proxy for asthma severity changes in 1990 and 1997 is presented in Table 2. In

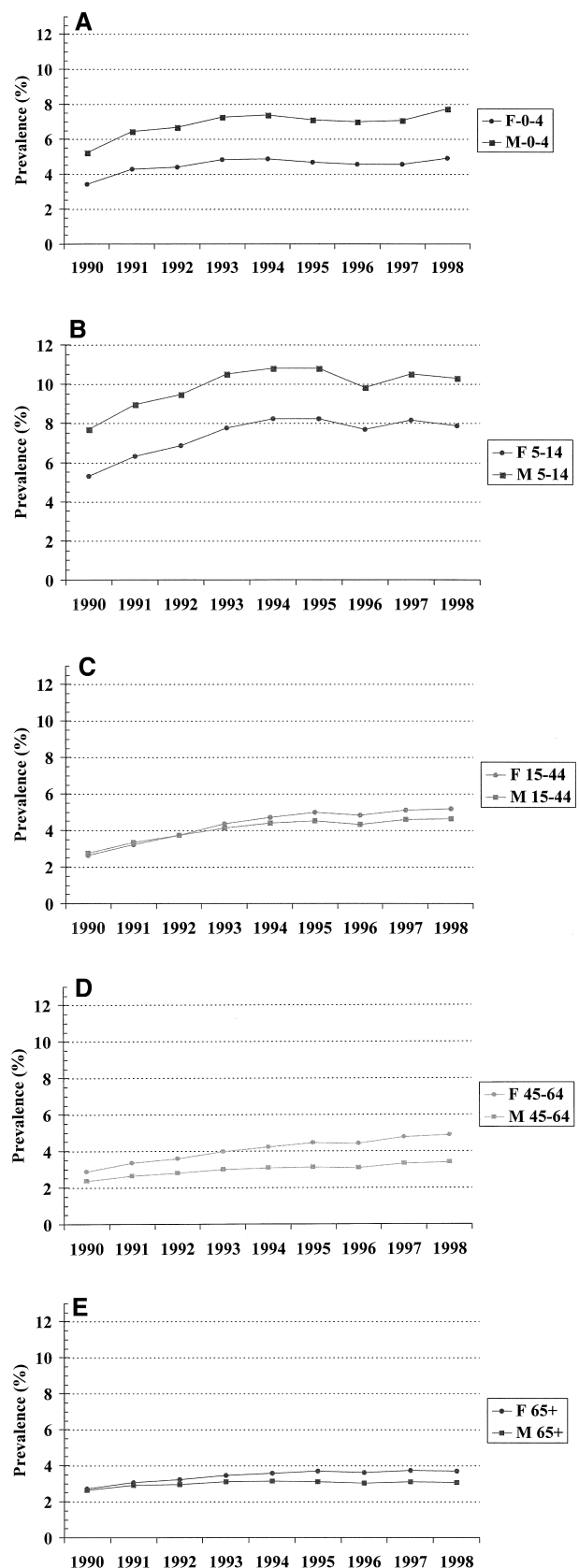


Figure 2 Prevalence (%) of managed asthma in the UK GPRD from 1990 to 1998, in females and males, by age. GPRD = General Practice Research Database. A: Infants 0–4 years; B: Children 5–14 years; C: Young adults 15–44 years; D: Adults 45–64 years; E: Elderly 65 years+.

Table 1 Descriptive characteristics of asthmatics newly diagnosed in 1990 and in 1997

	1990	1997	P value
Total, <i>n</i>	18 818	15 751	
Female, %	50.9*	53.4	0.0017
Mean age, years (SD)	24.4 (21.6)*	25.4 (22.2)	0.0012
Treatment within a year after diagnosis			
Inhaled corticosteroids, %	32.0*	60.1	0.0000
Inhaled β_2 agonists, %	55.5*	71.6	0.0000
SABA, %	52.0*	69.7	0.0000
LABA, %	0.9*	4.2	0.0000
Other adrenergic stimulants, %	6.1*	3.7	0.0000
Oral β_2 agonists, %	23.0*	5.0	0.0000
Xanthines, %	7.2*	1.2	0.0000
Anticholinergics, %	8.5*	4.8	0.0000
Combined bronchodilator products, %	0.9*	0.4	0.0000

* $P < 0.05$ comparing 1990 and 1997.SABA = short-acting β_2 agonists; LABA = long-acting β_2 agonists.

newly-diagnosed asthmatics in 1997, use of health services within a year of diagnosis was similar to that of patients diagnosed in 1990. The observation of a decreased rate in asthma-related hospitalisations was accompanied by an increase in asthma-related accident and emergency (A&E) room visits. The increased number of co-morbidities per patient, and the increased use of oral corticosteroids, home oxygen or nebulised treatment, suggest that there was no decline in asthma severity in asthmatics detected by the UK primary care system during the 1990s.

Finally, the age- and sex-specific incidence rates of managed asthma are presented in Figure 3. Incidence rates were constant from 1990 to 1998, except for in school-age children. There was a significant decrease in asthma incidence rates from 1990 to 1998, in boys from 3.16% (95%CI 3.09–3.24) to 1.63% (95%CI 1.56–1.70) and in girls from 2.43% (95%CI 2.36–2.50) to 1.42% (95%CI 1.36–1.49). As per the prev-

alence figures, Figure 3 elegantly presents the switch in the male-to-female ratio of asthma after adolescence. Incidence rates of asthma are higher in male than female infants (M:F ratio 1.49:1) and schoolchildren (1.30:1) ($P < 0.05$); in young adults, asthma incidence decreases more in men relative to women (1:1.20); and the male-to-female ratio is inverted in older adults (1:1.36) and in the elderly (1:1.04), as asthma incidence rates are higher in women than men ($P < 0.05$). No changes in the male-to-female ratio of asthma incidence are observed between 1990 and 1998.

DISCUSSION

In a retrospective cohort of individuals from the UK general population, we observed an increase in the burden of asthma during the 1990s using two definitions of the disease. These results are of concern, as the asthma epidemic seems to be still on the rise.

Table 2 Severity of asthmatics newly diagnosed in 1990 and in 1997, within a year after diagnosis

	1990	1997	P value
Asthmatics, <i>n</i>	18 818	15 751	
Use of health services			
GP visits, %	99.4	99.5	0.8949
Hospitalisations, in- & out-patient, %	33.9*	38.6	0.0000
A&E room visits, %	5.0*	9.5	0.0000
Asthma-related GP visits, %	97.6	97.3	0.8025
Asthma-related hospitalisations, in- & out-patient, %	7.5*	6.7	0.0132
Asthma-related A&E room visits, %	0.5*	1.1	0.0000
History of comorbidities†			
Presence of comorbidities, %	3.1*	4.6	0.0000
Mean (SD) number of comorbidities	0.03 (0.20)*	0.06 (0.28)	0.0000
Medication for severe asthma			
Oral corticosteroids, %	14.8*	17.1	0.0000
Oxygen treatment, %	0.1*	0.2	0.0498
Nebulised treatment, %	0.5	0.6	0.1474
Severe asthma,‡ %	0.6*	0.8	0.0441

* $P < 0.05$ comparing 1990 and 1997.

† Comorbidities as in Ref. 6

‡ Severe asthma defined as users of home oxygen or nebulised therapy within that year, as in Ref. 10.

GP = general practitioner; A&E = accident and emergency.

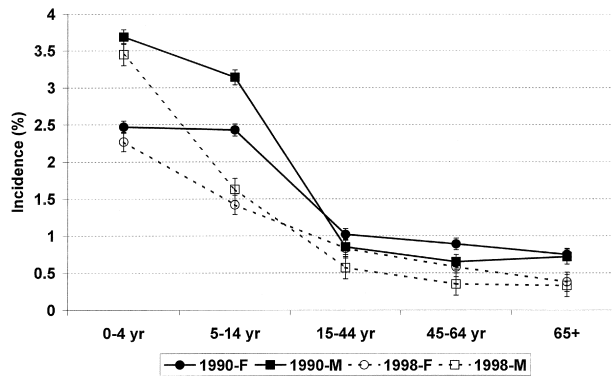


Figure 3 Incidence rates (%) and 95% confidence intervals of managed asthma by age in the UK in 1990 and 1998, in females (F) and males (M).

Recent reports from certain areas of Australia and New Zealand, where a third of school-age children had asthma symptoms and up to half were using inhaled medication,^{17,18} may still be observed in the UK in the future.

Our findings appear to challenge those of Fleming et al. that the asthma epidemic plateaued in the UK during the 1990s.⁸ Apart from some methodological aspects underlined in the correspondence of that paper,¹⁹ our conclusion of an increase in current asthma prevalence is not incompatible with their results. Asthma is a chronic-episodic disease, and by means of correct medical management, or merely due to the natural history of asthma, many patients obtain total symptom control and absence of exacerbations. A decrease in the incidence of asthma episodes presented to GPs is not incompatible with an increase in the population asthma burden. While measurement of disease incidence is particularly relevant for the causation of disease, prevalence is a more important estimator in terms of public health, and a better descriptor of population burden. Because the causes of changes in disease incidence and prevalence might be different,²⁰ our focus was on prevalence rather than on incidence rates. Similarly to Huovinen et al.,²¹ we observed no changes in incidence rates, while the asthma prevalence rates increased substantially.

Before discussing the significance of our findings, some limitations in the data sources and study design must be considered. A general shortcoming of using the GPRD for studies of the natural history of respiratory disease is the lack of valid information on respiratory function and tobacco consumption.²² Offsetting these is the very large sample size and the extensive information on medical events and treatments among patients from practices throughout the UK. Using a cohort from the GPRD was deemed the most appropriate design to study recent trends of asthma in the UK. The use of retrospective patient data may have led to some misclassification of disease status. The

technique used to identify asthma could suffer from the common disadvantage of screening tools for chronic diseases over time, namely that methods with good sensitivity and with reasonable specificity might detect increases in prevalence with decreases in incidence, as exemplified in cancer studies.²³ This apparent decrease in asthma incidence is probably a screening artefact. We re-analysed our data in the subgroup of 256 (52.4%) surgeries that contributed information during the entire period, observing that prevalence rates of asthma by age, sex and calendar year were virtually identical to when estimated in all surgeries.

Other factors, such as publicity and awareness campaigns on asthma in the lay and medical arenas, and diagnostic bias, might play a role in the reported increase in asthma prevalence. We tried to overcome diagnostic bias by using a combination of diagnostic codes other than asthma only. It is possible that previously undiagnosed or untreated patients were more likely to seek medical care, which indeed will increase the burden of the disease for the health system. However, the rates of ever and managed asthma presented here are the lowest estimates of the population burden of asthma in the UK. Less severe asthma is commonly not diagnosed, and thus is not identified by the GPRD system. Physician-diagnosed asthma is only the tip of the iceberg of individuals with asthma symptoms.

Epidemiological studies may give clues as to the etiology of asthma, identify modifiable risk factors, and eventually reduce the disease burden.²⁴ Recent international surveys in children²⁵ and young adults²⁶ quantified the prevalence of asthma during the 1990s. Repeated cross-sectional surveys, performed by the same investigators in samples of children and adults from the same geographical areas, identified that there has been a 2–4% annual increase in asthma prevalence rates in most European countries over the past 15 years.²⁷ Other epidemiological studies and follow-up studies have further and elegantly estimated an increase in the asthma burden.²⁸

Discussion on the patterns of asthma severity deserves consideration. While few authors challenge the increase of asthma since the 1970s, the changes in patterns of asthma severity are more controversial.^{7,29,30} We tried to quantify asthma severity trends by looking at the use of health services, drug treatment and comorbidities, as recommended recently by the US Centers for Disease Control and Prevention.³¹ Our findings indicate that several proxies of asthma severity were at least maintained during this 8-year follow-up. When comparing newly-diagnosed asthmatics within a year after diagnosis, the severity of the disease was at least the same, if not worse, in 1997 compared with 1990.

Interestingly, the pattern of asthma trends described here is completely different to that observed in COPD. We recently reported that COPD prevalence rates in the UK achieved a plateau among men during

the 1990s, while it continued to increase among women.¹⁰ Our decision to exclude individuals with COPD has to be briefly discussed. We consider obstructive lung disease as a continuum. In the so-called 'Dutch' hypothesis, an individual with asthma who over the years develops obstructive lung disease should be labelled as COPD, as per current guidelines.³² This decision certainly reduced the prevalence of adult and elderly asthma reported in our study, but it is robust and should have minimum or no effect on the trends described during the 1990s.

Asthma is still an important public health issue, and the burden and severity of disease were maintained or increased during the 1990s, as seen in primary care. We conclude that the burden of asthma in UK primary care was still increasing during the 1990s.

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R É S U M É

OBJECTIF : Estimer les tendances récentes de prévalence des asthmes diagnostiqués par le médecin dans les soins de santé primaires au Royaume-Uni et de tester l'hypothèse que l'épidémie d'asthme a connu un pic au milieu des années 1990 et est actuellement en décroissance.

MÉTHODES : Une cohorte rétrospective des patients asthmatiques a été obtenue à partir de la Base de données de Recherche des Praticiens généralistes (GPRD). Entre janvier 1990 et février 1999, on a suivi les asthmatiques jusqu'au décès, l'écartement ou la mention de BOC dans leur dossier clinique. Les taux de prévalence des asthmes traités ou non traités ont été obtenus par sexe, âge et années de calendrier.

RÉSULTATS ET CONCLUSION : Entre 1990 et 1998, les taux annuels de prévalence des asthmes diagnostiqués

par les médecins et traités ont augmenté chez les femmes de 3,01% (IC95% 2,99–3,03) à 5,14% (IC95% 5,10–5,18) et chez les hommes de 3,44% (IC95% 3,41–3,46) à 5,06% (IC95% 5,02–5,10) (*P* pour la tendance <0,01 dans les deux cas). Les taux de prévalence des asthmes traités chez les enfants âgés de 5 à 14 ans s'élèvent à 7,86% (IC95% 7,71–8,00) chez les filles et à 10,30% (IC95% 10,15–10,47) chez les garçons. Une augmentation des taux de prévalence de l'asthme chez les adultes (maximum 4,11% en 1998, IC95% 4,03–4,19) et chez des personnes âgées (maximum 3,37% en 1998, IC95% 3,29–3,46) a été également observée. La charge de l'asthme dans les soins primaires au Royaume Uni au cours des années 1990 a toujours continué à augmenter.

R E S U M E N

OBJETIVO : Estimar las tendencias recientes de la prevalencia del asma diagnosticada por médicos en la atención primaria de salud en el Reino Unido y probar la hipótesis que la epidemia de asma en el Reino Unido experimentó un aumento a mediados de la década de 1990 y actualmente está en descenso.

MÉTODOS : Se obtuvo retrospectivamente una cohorte de pacientes asmáticos a partir de la base de datos de investigación de atención primaria (GPRD). Desde enero de 1990 a febrero de 1999 se practicó un seguimiento de los asmáticos hasta el momento de la muerte, censura o mención de EPOC en la historia clínica. Se obtuvo la tasa de prevalencia de asma tratada o no tratada, por sexo, edad y año de calendario.

RESULTADOS Y CONCLUSIONES : Desde 1990 a 1998,

la tasa anual de prevalencia del asma diagnosticada y tratada por los médicos aumentó de 3,01% (IC95% 2,99–3,03) a 5,14% (IC95% 5,10–5,18) en las mujeres y de 3,44% (IC95% 3,41–3,46) a 5,06% (IC95% 5,02–5,10) en los hombres (*P* para la tendencia <0,01 en ambos sexos). La tasa de prevalencia del asma tratada en los niños de 5 a 14 años fue de 7,86% (IC95% 7,71–8,00) en las niñas y de 10,30% (IC95% 10,15–10,47) en los niños. Se observó igualmente un aumento de la tasa de prevalencia del asma en los adultos (máximo 4,11% en 1998, IC95% 4,03–4,19) y en las personas de edad avanzada (máximo 3,37% en 1998, IC95% 3,29–3,46). La carga del asma en el sistema de atención primaria de la salud del Reino Unido durante la década de 1990 estaba todavía en aumento.