

# Trends in primary care consultations for asthma in Switzerland, 1989–2002

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Accepted 5 April 2005

**Background** There is widespread debate about trends in the occurrence of asthma in industrialized countries. This study was conducted to investigate time trends in consultations for asthma in primary care in Switzerland.

**Methods** Prospective observational study from 1989 to 2002 within the Swiss Sentinel Surveillance Network; a primary care surveillance system. We used time series analysis and non-parametric smoothing methods to investigate long-term and short-term trends in rates of asthma episodes per 1000 consultations. From 1994 to 2002 we compared rates of first episodes with all subsequent consultations for asthma.

**Results** Overall consultation rates for asthma per 1000 primary care consultations increased from 1989 to 1994 then stabilized and have declined since 2000. Long-term trends showed a small decline in first consultations for asthma from an average of 0.78 (95% credibility intervals (CI) 0.74–0.81) in 1999 to 0.62 (95% CI 0.55–0.69) per 1000 consultations in 2002. Subsequent consultations for asthma have been declining since at least 1994, from an average of 1.5 (95% CI 1.40–1.61) per 1000 consultations in 1994 to 0.93 (95% CI 0.82–1.04) in 2002. In addition, the ratio of subsequent to first episodes of asthma fell in all age groups.

**Conclusions** In Switzerland, primary care consultations for asthma, subsequent to the initial diagnosis, have been declining since 1994. This is more likely to be owing to an increase in the use of home medication than to a shift in care to hospital settings. The incidence of diagnosed asthma might also be decreasing.

**Keywords** Asthma, primary health care, family practice, incidence, prevalence

There is widespread debate about trends in the occurrence of asthma in industrialized countries. Although the methodological quality of many studies has been criticized,<sup>1</sup> an increase in the prevalence of childhood asthma up to the mid-1990s has been consistently reported.<sup>2–5</sup> Reports of stabilizing or declining prevalence in both high-income and middle-income countries,<sup>6</sup> and a fall in the incidence of diagnosed asthma in primary care in England,<sup>7</sup> now raise the question as to whether the

‘epidemic’ of asthma has ended.<sup>6</sup> However, trends in the prevalence of risk factors for asthma reported from different countries are less clear, and there is no consensus about the reasons for such changes.<sup>8,9</sup> A long-standing concern is that, in the absence of an accepted objectively determined definition of asthma, these trends might have been influenced by changes in diagnostic labelling practices among doctors<sup>10</sup> or in symptom awareness by patients.<sup>11</sup>

In Switzerland primary health care is delivered principally by general practitioners, general internists, and paediatricians. The Swiss Sentinel Surveillance Network (SSSN) has been collecting information about primary care consultations with physicians from these groups since 1986. We have previously used the SSSN to study long-term epidemiological characteristics and seasonal patterns of asthma in different age groups.<sup>12,13</sup> This study was conducted to investigate time trends in all consultations for episodic asthma, in first consultations, and the relationship between first and subsequent consultations.

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## Methods

The SSSN has been described in detail elsewhere.<sup>13,14</sup> Briefly, from 1989 to 2002 the SSSN has consistently included ~3% of all physicians reporting a similar proportion of all annual consultations in Switzerland (Table 1). Of the participants ~70% are general practitioners, 15–20% general physicians, and 10–15% paediatricians. For this study, we included data from sentinel physicians who reported for  $\geq 75\%$  of the time ( $>90\%$  of participants) to ensure consistency.

The definition of asthma in the SSSN, which did not change during the study period, includes exertional, allergic, and infectious causes: bronchial obstruction or hyper-responsiveness diagnosed by the presence of wheezing, dyspnoea or cough on or after physical exertion, or on contact with pollen, dust, or animal dander; and cough at night without an acute respiratory infection, or for  $>2$  weeks after an acute respiratory infection. Age and gender were available for each reported asthma episode. From 1994 onwards, the first recorded episode of asthma was reported separately. In this paper we refer to first recorded consultations as first asthma episodes and to all remaining consultations as subsequent episodes.

### Statistical analysis

We calculated 4 weekly rates of all reported asthma episodes per 100 consultations from 1989 to 2002. From 1994 to 2002 we examined the first recorded consultation and all other subsequent consultations separately. We then used standard time series analysis methods to explore trends. A time series of rates consists of a trend, a seasonal component, and random error. We estimated the seasonal component<sup>15–17</sup> and then examined long-term and short-term trends on deseasonalized data, using 'loess', a robust non-parametric smoothing method implemented in the statistical package S-plus (6.1, Insightful, US). The algorithm used by loess is as follows: a window is placed about time  $t$  and the data points that lie inside it are weighted so that nearby points get more weight.<sup>15</sup> Then, a robust weighted regression is used to predict the value of  $y_t$ . The parameter  $f$  controls the window size and is the proportion of data (total 9 years) that are included in estimation. By increasing  $f$  we obtain smoother functions over a longer time period. We used the default S-plus value for  $f$  of two-thirds of the data to define the longer term (6 years). For shorter trends, we chose  $f$  of about one-third of the data (3 years). We estimated 95% credibility intervals (CI) for these data using a generalized additive model with loess smoother to calculate pointwise twice-standard-error curves around estimated trends.<sup>15,18</sup> To examine changes in consultation patterns over time we calculated a yearly ratio of subsequent to first consultations for asthma from 1994 to 2002 in age groups 0–4, 5–16, 17–45, 46–65 and  $>65$  years and examined these over time using chi-square tests for trend.

## Results

Of 13 050 014 consultations recorded in the SSSN from 1989 to 2002, 24 871 were for acute asthma. Total yearly asthma episodes increased from 1.47 (95% CI 1.39–1.56) per 1000 consultations in 1989 to 2.23 (95% CI 2.14–2.33) in 1994. They fluctuated around this level until 2000 and fell to 1.65 in 2002

(95% CI 1.57–1.73) (Table 1 and Figure 1). First ever episodes accounted for an increasing proportion of all asthma episodes over time, from 28% (95% CI 26–30, 578/2073) in 1994 to 41% (95% CI 39–44, 671/1632) in 2002 ( $P$  for trend  $< 0.001$ ). Of 18 440 asthma consultations from 1994 onwards 26% were in children  $<5$  years, 29% in 5- to 16-year olds, 22% in 17- to 45-year olds, and 23% in adults  $>45$  years. The  $<16$  years age group accounted for 61% of first asthma episodes compared with 16% in the  $>45$  years age group.

Figure 2 shows loess long-term and short-term trends with upper and lower 95% CIs for first and subsequent asthma episodes from 1994. Long-term trends show that consultations for first asthma episodes increased to an estimated average of 0.78 (95% CI 0.74–0.81) per 1000 consultations in 1999 and then fell to 0.62 (95% CI 0.55–0.69) in 2002, although the short-term trend suggests another upturn in 2001. Consultations for subsequent asthma episodes have fallen by 38.0% since 1994, from an estimated average of 1.50 (95% CI 1.40–1.61) per 1000 consultations to 0.93 (95% CI 0.82–1.04) in 2002. Short-term trends indicate a plateau from 1997 to 2000 before a steep decline. Figure 3 shows that yearly ratios of subsequent to first episodes declined over time in all age groups ( $P$  for trend in all age groups  $<0.001$ ), demonstrating that subsequent episodes represented a decreasing proportion of all episodes. These ratios were highest in the two oldest age groups in which the decrease was also greatest. In 5- to 16-year olds the ratio increased from 1998 to 2001 but the overall trend was downwards.

## Discussion

Time trend analysis from the SSSN shows that primary care consultation rates for first episodes of asthma in Switzerland began to fall in 2000. Rates of subsequent episodes have been falling since at least 1994. The yearly ratio of subsequent to first episodes has declined since 1994 in all age groups.

### Methodological issues

The main advantage of the SSSN is that it is a national system with centralized collation, analysis, and dissemination of data. Sentinel practices are stratified by geographic area, socio-demographic characteristics and physician speciality<sup>19</sup> and coverage exceeds that of other similar systems.<sup>20,21</sup> Participation is voluntary, which may lead to some selection but improves the consistency of reporting. Another strength of this study was the use of a robust non-parametric method to estimate the non-linear trends in our data. This was more appropriate than using parametric methods such as quadratic polynomials<sup>7</sup> for exploring non-linear trends because they do not specify a particular form for the trend. They also allow for shorter or longer trend detection by changing the smoothing parameters and both contribute to our understanding of the data.

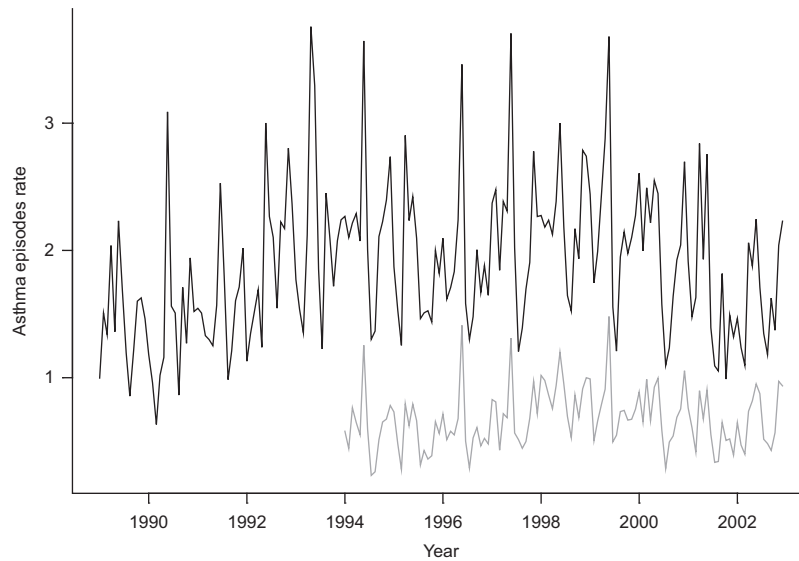
There are some limitations in using primary care surveillance data, which need to be taken into consideration in interpreting our results. First, we calculated rates per 1000 consultations rather than population-based rates because practices do not serve defined populations. The use of different denominators in primary care epidemiology has been discussed<sup>23,24</sup> and practice consultations are acknowledged to be an appropriate substitute when population denominators are not available.<sup>24</sup> We believe that the time trends observed here are a reflection of the

**Table 1** Participants and consultations for asthma in the Swiss Sentinel Surveillance Network (SSSN), 1989–2002

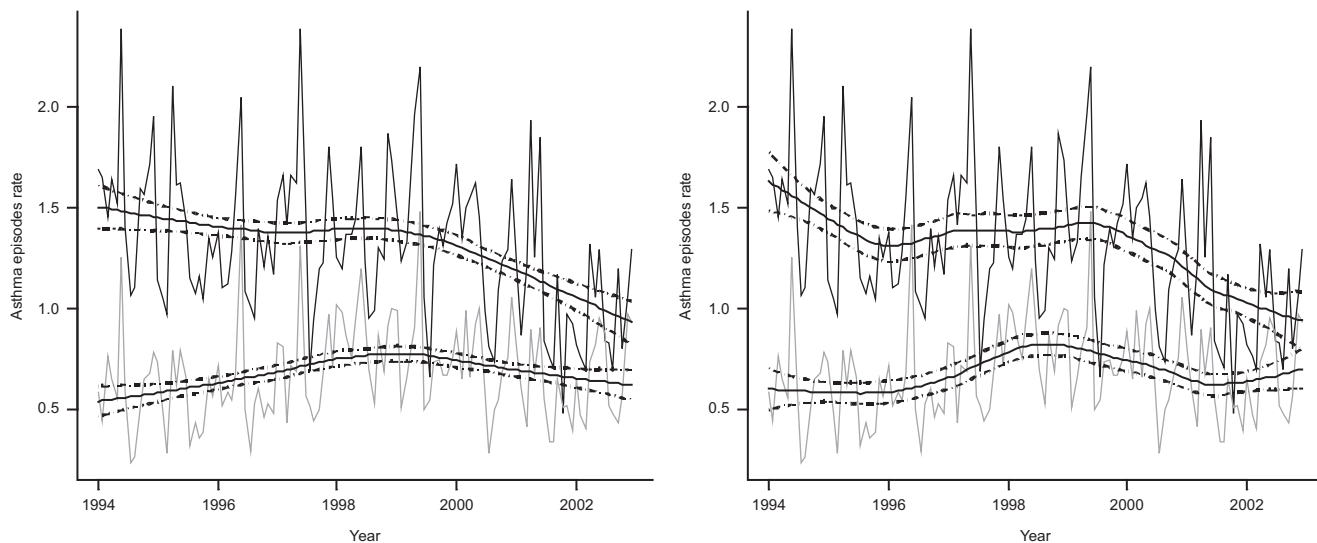
	1989	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Total SSSN participants <sup>a</sup> ( <i>n</i> )	179	181	173	184	163	177	190	220	221	216	231	240	224	223
% of all private physicians in Switzerland	na	na	na	na	na	3.5	3.4	3.7	3.6	3.1	3.0	3.1	3.0	3.4
General practitioners ( <i>n</i> )	114	125	127	129	114	117	128	151	146	139	130	139	134	132
%	63.7	69.1	73.4	70.1	69.9	66.1	67.4	68.6	66.1	64.4	56.3	57.9	59.8	59.2
General internists ( <i>n</i> )	36	39	30	33	30	42	44	52	52	56	66	62	60	60
%	20.1	21.5	17.3	17.9	18.4	23.7	23.2	23.6	23.5	25.9	28.6	25.8	26.8	26.9
Paediatricians ( <i>n</i> )	29	17	16	22	19	18	18	17	23	21	35	39	30	31
%	16.2	9.4	9.2	12.0	11.7	10.2	9.5	7.7	10.4	9.7	15.2	16.3	13.4	13.9
Total SSSN consultations ( <i>n</i> )	774 761	773 195	726 928	724 636	761 464	928 329	971 592	1 015 614	1 042 493	997 107	1 060 644	1 129 277	1 022 771	986 958
% of all consultations in Switzerland	na	na	na	na	na	3.0	3.1	3.3	3.5	3.3	3.5	3.6	3.4	3.3
Consultations for acute asthma ( <i>n</i> )	1141	1083	1130	1427	1617	2073	1803	1934	2304	2253	2336	2346	1720	1632
Rate per 1000 consultations	1.47	1.40	1.55	1.97	2.12	2.23	1.86	1.90	2.21	2.26	2.20	2.08	1.68	1.65
Consultations for first asthma episodes ( <i>n</i> )	na	na	na	na	na	578	533	623	742	879	818	845	601	671
Rate per 1000 consultations	na	na	na	na	na	0.62	0.55	0.61	0.71	0.88	0.77	0.75	0.59	0.68

na, not available.

<sup>a</sup> Eligible for evaluation, i.e. reporting for at least 39 weeks per year.



**Figure 1** Consultation rates for all asthmatic episodes since 1989 and first episodes since 1994. Four-weekly rates of all episodes per 1000 consultations (black) and first episodes (grey)



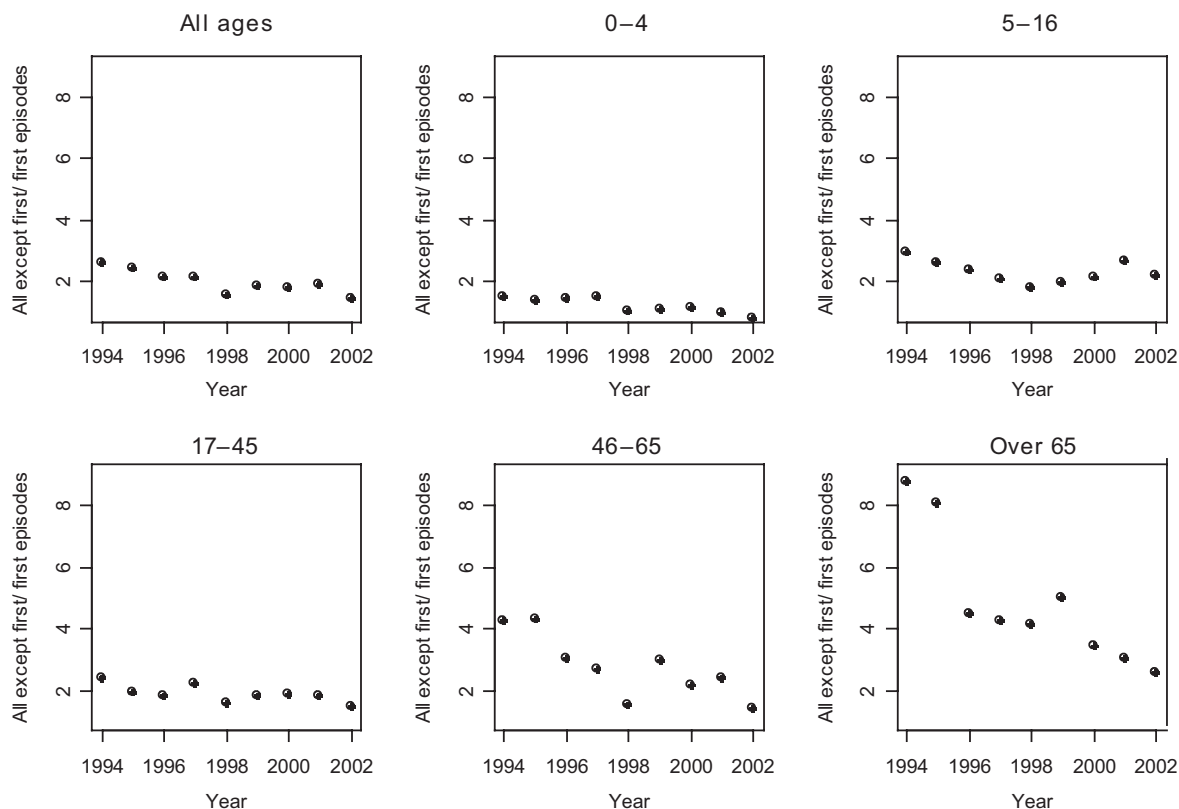
**Figure 2** Long-term and short-term trends in first and subsequent episodes of asthma, 1994–2002. Four-weekly rates of first episodes per 1000 consultations (grey) and subsequent episodes (black). Left panel: Long term trend estimates with loess smoother (solid line) and the corresponding upper and lower pointwise twice-standard-error curves (dashed lines);  $f = 2/3$ . Right panel: Short term trend estimates with loess smoother (solid line) and the corresponding upper and lower pointwise twice-standard-error curves (dashed lines);  $f = 3/10$

national situation because the numbers of physicians and consultations in the SSSN as a proportion of the respective totals in Switzerland remained stable over time, as did the number of consultations per physician. Second, consultation rates for asthma are sensitive to the number of paediatricians in the system. The proportion of paediatricians was reasonably stable and the age distribution of the population consulting for asthma remained constant over time. Third, although the definition of asthma was in accordance with the international paediatric asthma consensus group statement<sup>22</sup> and remained unchanged throughout the study period it relied on clinical diagnosis, which might have differed between physicians and over time.

However, the problem of subjectivity applies to all similar studies, including those using self-reported symptoms because there are no objective diagnostic tests for asthma. Fourth, consultations were recorded anonymously so we could not relate subsequent consultations to first episodes of asthma on an individual basis. We therefore focused on trends in the ratio of subsequent to first consultations rather than absolute figures.

#### The end of the asthma epidemic?

Our results are consistent with findings from a primary care surveillance system in England, in which new diagnoses of asthma fell from ~50 per 100 000 population in 1993 to



**Figure 3** Annual rates of subsequent consultations per first asthma episode, 1994–2002, by age group

~30 per 100 000 in 1998.<sup>7</sup> This was not explained by changes in patterns of health care use or diagnostic preference of doctors. First recorded consultations approximate the incidence of asthma diagnosis although absolute rates may be overestimated because of differences in the interpretation of a first episode. Taken together, these two studies provide some evidence that the incidence of asthma diagnosis in western Europe might be decreasing.

Studies that have investigated both reported symptoms in the past 12 months and lifetime diagnosis of asthma have found a decreasing or stable prevalence of reported symptoms in children<sup>25</sup> and adults<sup>11</sup> but an increase in reported prevalence of diagnosed asthma. This apparent discrepancy is interpreted as being attributable to a change in diagnostic labelling, with milder symptoms being labelled as asthma,<sup>11,25,26</sup> but could also indicate a true decline in underlying prevalence.<sup>25</sup> A recent fall in newly diagnosed cases of asthma, as reported here, might also reflect this trend, and is not incompatible with rising lifetime prevalence, particularly, for chronic conditions with low mortality such as asthma.

We also observed a fall in the proportion of asthma patients who had hay fever (data not shown), so a fall in atopic asthma might explain this trend and is consistent with other reports from Switzerland.<sup>27,28</sup> The prevalence of asthma and hay fever fell in children of Swiss farmers whose respiratory health and sensitization to common allergens were measured regularly from 1983 to 1999.<sup>27</sup> The Swiss Study on Childhood Allergy and Respiratory Symptoms, which assessed symptom prevalence

using the International Study on Asthma and Allergy in Children core questions and specific IgE levels in serum, observed a levelling in trends between 1992 and 1998.<sup>28</sup> Decreases in the prevalence of eczema and hay fever have also been reported from the British Isles,<sup>25</sup> although a survey in Australia has reported an increase in the prevalence of eczema and hay fever, despite a fall in asthma prevalence.<sup>29</sup> We did not distinguish between different asthma phenotypes (transient wheezing, non-atopic wheezing, and atopy-associated asthma)<sup>9</sup> so we cannot comment on the relative contribution of these to the observed trends.

### Changes in asthma management or health service utilization?

Decreasing morbidity and mortality from asthma in New Zealand in the 1990s<sup>30</sup> and declining mortality in the United States of America<sup>31</sup> have been attributed to improved management, with a shift in focus towards an increase in home medication with inhaled steroids and beta-agonists and a reduction in unscheduled primary care visits. The European Community Respiratory Health Survey found a large increase in the reported use of medications for asthma over the past decade.<sup>11</sup> Our findings of a fall in subsequent asthma consultations are compatible with the hypothesis that management of asthma has changed, although formal self-management plans with regular physician review are not widely implemented in Switzerland, even amongst well-motivated patients.<sup>32</sup> In our study, subsequent consultation rates increased in 5- to 16-year olds from 1998 to 2001,

consistent with the finding that the highest rates of emergency visits to general practitioners for asthma are in children.<sup>32</sup>

A fall in consultation rates in primary care could also reflect changes in patterns of health care utilization. In Switzerland, patients have direct access to primary care, specialist physicians, and emergency departments.<sup>33</sup> A rise in health insurance premiums in Switzerland since the introduction of a new scheme<sup>34</sup> might have reduced use of primary care services, and the use of emergency departments in Swiss hospitals for chronic conditions including asthma has increased. We do not believe that this explains our observations. First, increasing attendances at emergency departments are thought to be owing to demographic changes in adults.<sup>33</sup> Second, hospital referral rates for asthmatic patients in the SSSN from 1994 onwards were consistently low, ranging between 2.4 and 3.7%. Although we cannot exclude an increase in emergency room attendances without referral by a doctor, overall hospital admissions for asthma in children in Switzerland have also decreased by 20% from 1995 to 2002. Future studies on the incidence and prevalence of clinically diagnosed asthma should cover primary, secondary, and tertiary health care settings to facilitate the

interpretation of secular trends. Studies should also begin to examine explanations for observed changes. Differentiation of the different phenotypes of asthma would provide insights into the relative contributions of allergic and other triggers of bronchoconstrictive disorders.

In conclusion, primary care consultations for asthma, subsequent to the initial diagnosis, have been declining in Switzerland since 1994. This is more likely to be owing to an increase in the use of home medication than to a shift in care to hospital settings. The incidence of diagnosed asthma might also be decreasing.

## Acknowledgments

We particularly thank the primary health care physicians participating in the SSSN for their incessant efforts to collect these data and Urban Wirz, president of the SSSN, for his support and encouragement. We thank Douglas Fleming, Birmingham Research Unit, UK, and Claudia Kuehni, Institute of Social and Preventive Medicine, Bern, Switzerland for constructive comments on previous versions of this manuscript.

### KEY MESSAGES

- There is an ongoing international debate about trends in asthma.
- In Switzerland, primary care consultations for asthma have fallen, particularly for episodes subsequent to the first presentation.
- A small fall in first asthma presentations suggests that asthma incidence in Switzerland is falling.

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Published by Oxford University Press on behalf of the International Epidemiological Association  
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*International Journal of Epidemiology* 2005;**34**:1018–1019  
doi:10.1093/ije/dy1115

## Commentary: Asthma time trends—mission accomplished?

Neil Pearce<sup>1,2\*</sup> and Jeroen Douwes<sup>1</sup>

Until recently most studies had reported that asthma prevalence has increased in recent decades and that the magnitude of the increase had, in some cases, been substantial.<sup>1</sup> The best indication of what is now happening globally will be provided by the forthcoming findings of Phase III of the ISAAC study. However, some individual ISAAC centres in Western countries, as well as several studies in adults, have already reported either no increase, or even a decrease in asthma prevalence over the last ten years.<sup>2</sup> Furthermore, Phase II of the European Respiratory Health Survey (ECRHS) found no increase in current or severe asthma symptoms, but a significant increase in diagnosed asthma.<sup>3</sup> The most likely explanation for these patterns is that asthma prevalence has peaked or even begun to decline, whereas the observed increases in diagnosed asthma reflect changes in diagnostic labelling and/or medical treatment for mild and/or moderate asthma.<sup>2</sup>

In this context, the findings reported by Bollag *et al.*<sup>4</sup> in this issue of the journal are of considerable interest. They examined time trends in consultations for asthma in primary care in Switzerland. Overall consultation rates for asthma increased

from 1989 to 1994, then stabilised and have declined since 2000. There was also a small decline in first consultations for asthma since 1999, but subsequent consultations for asthma have been falling at least since 1994. The ratio of subsequent to first episodes of asthma fell in all age groups.

However, while it is tempting to agree with Bollag *et al.*<sup>4</sup> that these patterns are due to improvements in asthma management, and to declare ‘mission accomplished’ in the fight for asthma control, such a declaration would be premature.

In particular, we need to distinguish between three different aspects of asthma occurrence: incidence, prevalence and severity.<sup>5</sup> In parallel with these three measures of asthma occurrence, we have corresponding measures of contact with asthma health services. Incident cases may (or may not) be diagnosed, prevalent cases may (or may not) have a primary health care consultation during a specified period, and severe cases may (or may not) have frequent consultations. Thus, there are three important reservations that should be born in mind before we conclude that the observed patterns are due to improved asthma management.

First, an improvement in management cannot explain the decrease in first consultations for asthma that appears to have occurred since 1999.

Second, although an improvement in management could plausibly explain the decrease in severity of diagnosed asthma

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