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# Physician-diagnosed asthma and allergic rhinitis in Manitoba: 1985–1998

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**Background:** A worldwide increase has been noted in the prevalence of asthma, but the data for other allergic disorders are less consistent.

**Objective:** To study 14-year trends in utilization of physician resources for asthma and compare them to trends for allergic rhinitis.

**Methods:** We studied visits to physicians by Manitoba residents for asthma (*International Classification of Diseases, Ninth Revision, Clinical Modification* [ICD-9-CM] code 493) and allergic rhinitis (ICD-9 code 477) between 1985 and 1998. Prevalence and incidence of physician resources utilization were calculated annually for the total population and by age groups. Aggregate statistics and frequency of physician resources utilization were also analyzed.

**Results:** The prevalence and incidence of physician resources utilization for asthma increased more than for allergic rhinitis; differences were most striking in the youngest age groups. In adults, the differences were smaller and changed little with time. Most of the increase in asthma care occurred in children and in people without allergic rhinitis. Overall, 17% of Manitobans were diagnosed as having asthma, and the average asthmatic patient made 6 visits. Approximately 14% had an allergic rhinitis diagnosis, each person being seen twice on average. Coexistence of asthma and allergic rhinitis led to increased physician resources utilization for each of the conditions.

**Conclusions:** Trends in utilization of physician resources for allergic rhinitis differed strikingly from trends for asthma, particularly in the youngest age group. Asthma and allergic rhinitis affected comparable proportions of the population, but a diagnosis of asthma resulted in much higher utilization of physician resources. The relationship of physician-diagnosed asthma and atopy, as indicated by the diagnosis of allergic rhinitis, appears to have weakened with time in children but not in adults.

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## INTRODUCTION

Allergic disorders are a global concern of increasing magnitude, but accurate evaluation of time trends in populations is difficult because of ambiguity of clinical definitions. The prevalence of asthma diagnoses and asthma-like symptoms, especially among children, has apparently increased.<sup>1–3</sup> Allergic rhinitis is a less serious disease than asthma, and partly because of this fewer data are available regarding its epidemiology and trends in populations.<sup>4</sup> However, some evidence indicates that allergic rhinitis is becoming more common.<sup>3,5,6</sup> The term *atopy* defines the common allergic nature of asthma, allergic rhinitis, and atopic dermatitis, implying underlying IgE-mediated mechanisms. Our knowledge about the relationship of these diagnoses and their changes with time is limited. Despite the lack of a standard clinical identification of atopy, asthma has been often categorized as atopic and nonatopic. Analyses of multiple studies have shown that overall less than half of all asthma in western countries could be attributed to atopy,<sup>7,8</sup> and several recent studies suggested that nonatopic asthma may be increasing

more than atopic asthma.<sup>3,9</sup> Since allergic rhinitis and atopic dermatitis are believed to be more strongly and consistently associated with IgE-mediated mechanisms than asthma, a number of epidemiologic studies have used these diagnoses as surrogates for atopy in the study of asthma trends.<sup>1,3,10</sup> We studied changes in visits to physicians for asthma and allergic rhinitis treatment in Manitoba during the last 2 decades, comparing trends in the prevalence and incidence of physician resources utilization for the 2 diagnoses for the total population and 6 separate age groups.

## METHODS

### *Study Population*

The province of Manitoba in Canada has a relatively stable population, with approximately 1.1 million people of diverse ethnic composition. Approximately 60% of the population lives in the provincial capital of Winnipeg, whereas the rest reside in rural communities and small towns. A provincial population registry is available for research purposes and is updated annually. It contains information such as age, sex, and start and end of health coverage for all residents. All physician visits and hospitalizations are paid for by the province on submission of claims by physicians that include the diagnosis. Physicians are reimbursed on a fee-for-service basis, ensuring claims submission. Medical claims can be linked to the population registry using scrambled personal

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identifiers. The reliability and validity of the database have been established.<sup>11,12</sup>

### Outcome Measures

We studied utilization of physicians' visits for asthma (*International Classification of Diseases, Ninth Revision, Clinical Modification* [ICD-9-CM] code 493) and allergic rhinitis (ICD-9-CM code 477). Prevalence of physician resources utilization was defined as the number of people with at least one physician visit for asthma or allergic rhinitis in a year. Because prescription data were not available for 1985 to 1996, definitions of asthma and allergic rhinitis did not include people taking asthma or allergic rhinitis medications who did not see a physician for these diseases in a given year.

Incidence of physician resources utilization was defined as the number of people with a new diagnosis of asthma or allergic rhinitis. The diagnosis was considered new if a person had no claims for that diagnosis in the previous 5 years. The 5-year cutoff was chosen because a shorter interval would have biased comparisons between asthma and allergic rhinitis due to different utilization frequencies: intervals between visits for allergic rhinitis treatment were generally longer than for asthma treatment. Using the 5-year cutoff overestimated the incidence of physician resources utilization by including people who had a diagnosis more than 5 years previously, but this overestimation was small. Compared with a 13-year cutoff, the 5-year cutoff measure overestimated the incidence by less than 2 cases per 1,000 for both asthma and allergic rhinitis.

Prevalence was calculated annually for 1985 to 1998, and incidence was calculated annually for 1990 to 1998. Both prevalence and incidence rates of physician resources utilization were calculated for the total province and separately for 6 age groups: 0 to 4 years, 5 to 9 years, 10 to 14 years, 15 to 19 years, 20 to 54 years, and 55 years or older. All rates were based on the relevant population (all living residents of Manitoba) in each of the age groups in each of the years.

To aid in the interpretation of utilization trends, we also identified the total number of people diagnosed as having asthma or allergic rhinitis at least once during the 14 years (1985–1998) and in 3 periods (1985 to 1988, 1989 to 1993, and 1994 to 1998). We divided them into 3 mutually exclusive groups. "Asthma only" designated people had never been diagnosed as having allergic rhinitis, "allergic rhinitis only" were people without a diagnosis of asthma, and "asthma and allergic rhinitis" were those who had both diagnoses. The last 2 groups combined represented a "total rhinitis" group, whereas the "total asthma" group consisted of the "asthma only" plus "asthma and allergic rhinitis" groups.

For each of these diagnostic groups, we estimated physician resources utilization frequencies expressed both as visits per patient and visits per patient-years of observation. The average number of visits per patient was obtained by dividing the total number of relevant visits by the total number of patients affected. Average visits per patient-years of observation were number of total relevant visits divided by the sum

of patient-years of observations, that is, individual patients' intervals from the date of the first diagnosis to the end of the study interval or end of patient's health insurance coverage (due to death or moving out of province), whichever came first.

### Statistical Analyses

To ensure fair year-to-year comparisons of overall provincial prevalence and incidence of physician resources utilization, annual measures were age and sex standardized to the 1991 Manitoba population using the direct method.<sup>13</sup> Least squares regression models evaluated the statistical significance of trends, whereas Poisson regression models with year-diagnosis interaction terms tested if asthma trends differed significantly from allergic rhinitis trends.<sup>14</sup> The values for the prevalence, incidence, and rates of change per year (regression slopes) are given as number of persons per 1,000 population with 95% confidence intervals (CIs).

## RESULTS

Figure 1 shows overall trends for the annual age and sex standardized prevalence and incidence of utilization of physician resources for asthma and allergic rhinitis care. The prevalences of physician resources utilization for asthma and allergic rhinitis were similar in 1985 (17.5 vs 13.9 per 1,000, respectively). Both increased significantly, but much more for asthma than for allergic rhinitis (1.9 [95% CI, 1.7–2.2] vs 0.1 [95% CI, 0.0–0.2] per 1,000 per year,  $P < .001$ ), resulting in a more than 2-fold difference in prevalence by 1998. Asthma care increased the most in 1988 to 92 (average rate, 3.2 per 1,000 per year) and the least in 1993 to 98 (average rate, 0.8 per 1,000 per year). Allergic rhinitis care increased the most from 1985 to 1988 (average rate, 0.8 per 1,000 per year) and the least in 1993 to 1998 (average rate, 0.1 per 1,000 per year).

The utilization incidence of asthma care increased significantly from 1990 to 1998 (0.3 [95% CI, 0.1–0.5] new cases per 1,000 per year,  $P = .01$ ), whereas the utilization incidence of allergic rhinitis care did not change.

Figure 2 shows the physician resources utilization prevalence for asthma and allergic rhinitis in each of the 6 different age groups. Asthma prevalence increased significantly in all groups, with the following average rates of increase in cases per 1,000 population per year in order of age group: 3.9 (95% CI, 3.2–4.6), 3.7 (95% CI, 3.1–4.4), 3.0 (95% CI, 2.5–3.4), 2.4 (95% CI, 2.0–2.9), 1.6 (95% CI, 1.5–1.7), and 0.8 (95% CI, 0.7–0.9) (all  $P < .001$ ). The rate of increase of asthma utilization prevalence was thus inversely related to age, with the largest increases observed in the 2 youngest groups, 0 to 4 years old and 5 to 9 years old. The physician resources utilization prevalence of allergic rhinitis increased significantly only in children ages 0 to 4 years and in adults 55 years and older (increases were 0.2 [95% CI, 0.1–0.4],  $P = .02$ , and 0.1 [95% CI, 0.0–0.2],  $P < .001$ , respectively). In all age groups, asthma care increased significantly more than allergic

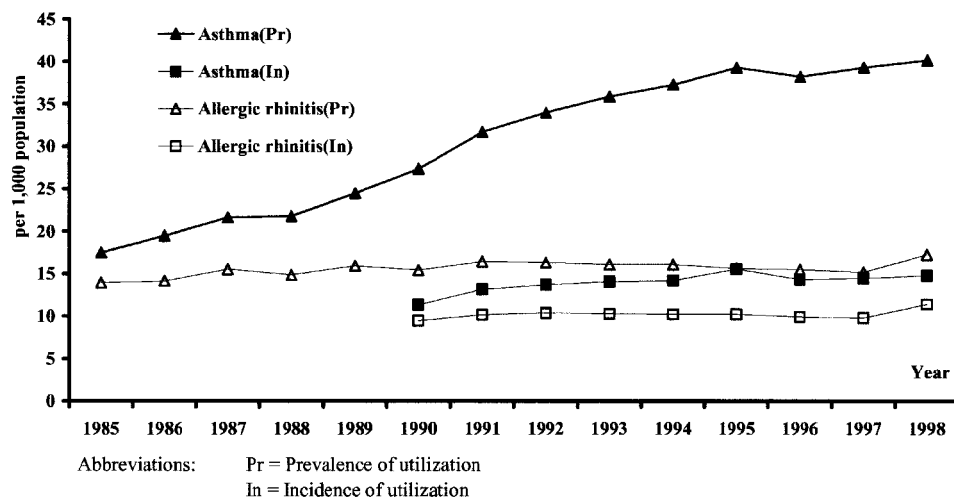


Figure 1. Age- and sex-standardized prevalence and incidence of physician resources utilization for asthma and allergic rhinitis, 1985 to 1998.

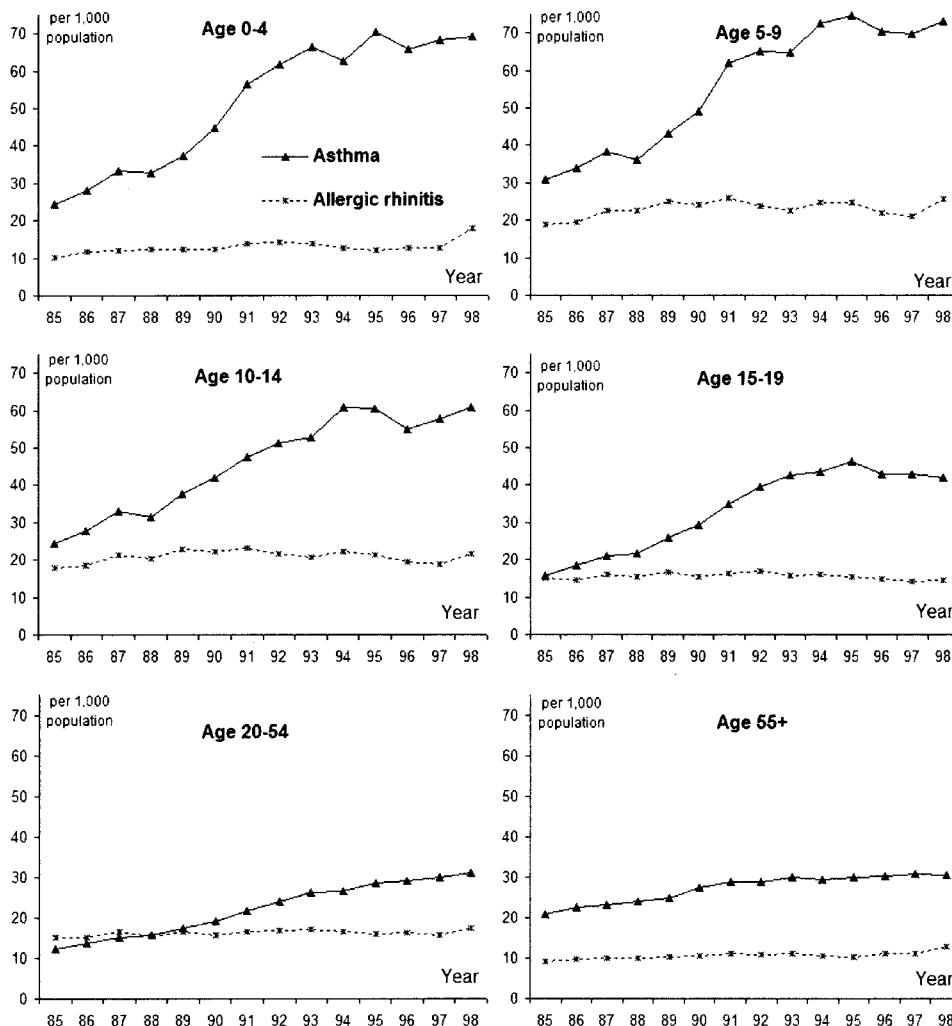


Figure 2. Prevalence of physician resources utilization for asthma and allergic rhinitis by age group, 1985 to 1998.

rhinitis care (all  $P < .001$ ), and the differences between trends for the 2 diagnoses decreased with age.

Incidence of physician resources utilization (not shown) increased significantly only for asthma in those 0 to 4 years old (1.0 [95% CI, 0.4–1.7] per 1,000 per year,  $P = .01$ ) and for both asthma and allergic rhinitis in those 55 years and older. This oldest group showed no difference in physician resources incidence trends between asthma and allergic rhinitis (average rates, 0.2 [95% CI, 0.1–0.3] for both;  $P < .001$ ).

Overall, more than 17% of the provincial residents were seen at least once during the study period for asthma care and 14% were seen for allergic rhinitis care (Table 1). Almost 5% of the population was diagnosed as having both asthma and allergic rhinitis. The diagnosis of asthma was associated with much higher physician resources utilization. Patients with asthma averaged almost 3 times more visits per patient-year than patients with allergic rhinitis. The coexistence of asthma and allergic rhinitis increased utilization of physician resources for each condition (Table 1). Utilization of physician resources (visits per patient and visits per patient-years of observation) did not differ between the sexes in any of the diagnostic groups.

All diagnostic groups showed a decline in utilization of physicians' services per patient with time, whereas the number of people affected increased (Table 2). Visits per patient-year were higher in each period (Table 2) than for the whole

period (Table 1), reflecting increased utilization of physician resources by people soon after diagnosis.

## DISCUSSION

The use of physician diagnosis for studying the disease in population has high specificity but low sensitivity.<sup>15–17</sup> A recent Manitoba study found that the absence of asthma symptoms virtually excluded the probability of having a physician diagnosis of asthma in the database.<sup>12</sup> On the other hand, people with milder symptoms may choose not to seek a physician's services for asthma and even more so for allergic rhinitis, thanks to the availability of over-the-counter medications for the latter. No prescription database existed for the study period, so we could not account for those taking medication but without a visit to a physician for asthma or allergic rhinitis treatment. Thus, our outcomes give conservative estimates of the real prevalence of these diseases in population, and no surveys were available for comparison.

Comparing annual physician resources utilization prevalence of asthma and allergic rhinitis, 2 conditions with different visit frequencies, posed a challenge. Although similar proportions of Manitoba residents were given each diagnostic label during 14 years of the study, the average allergic rhinitis patient was seen only 2 times, whereas the average asthma patient was seen 6 times (Table 1). Of all the patients diagnosed as having allergic rhinitis in 1991, nearly 60% were not seen again for allergic rhinitis in the following 7 years,

Table 1. Number of People With Diagnoses of Asthma and/or Allergic Rhinitis and Their Average Visits, 1985–1998\*

| Diagnostic group             | No. (%) of patients | Visits      |                  |
|------------------------------|---------------------|-------------|------------------|
|                              |                     | Per patient | Per patient-year |
| Total asthma                 |                     |             |                  |
| Male                         | 95,506 (17.1)       | 5.91        | 0.86             |
| Female                       | 101,512 (17.7)      | 5.83        | 0.87             |
| Total                        | 197,018 (17.4)      | 5.87        | 0.86             |
| Total allergic rhinitis      |                     |             |                  |
| Male                         | 71,496 (12.8)       | 2.08        | 0.28             |
| Female                       | 87,783 (15.3)       | 2.12        | 0.29             |
| Total                        | 159,279 (14.0)      | 2.10        | 0.29             |
| Asthma only                  |                     |             |                  |
| Male                         | 72,547 (13.0)       | 5.23        | 0.80             |
| Female                       | 73,639 (12.8)       | 5.19        | 0.81             |
| Total                        | 146,186 (12.9)      | 5.21        | 0.81             |
| Allergic rhinitis only       |                     |             |                  |
| Male                         | 48,537 (8.7)        | 1.89        | 0.27             |
| Female                       | 59,910 (10.4)       | 1.87        | 0.27             |
| Total                        | 108,447 (9.6)       | 1.87        | 0.27             |
| Asthma and allergic rhinitis |                     |             |                  |
| Male                         | 22,959 (4.1)        | 10.6†       | 1.13             |
| Female                       | 27,873 (4.9)        | 10.2‡       | 1.10             |
| Total                        | 50,832 (4.5)        | 10.4§       | 1.11             |

\* In 1991, the population in Manitoba was 560,094 males and 574,179 females.

† Consisted of 8.1 visits for asthma care and 2.5 visits for allergic rhinitis care.

‡ Consisted of 7.5 visits for asthma care and 2.7 visits for allergic rhinitis care.

§ Consisted of 7.8 visits for asthma care and 2.6 visits for allergic rhinitis care.

Table 2. Number of People With Diagnoses of Asthma and/or Allergic Rhinitis and Their Average Visits by Period

| Diagnostic group             | 1985–1988              |                                   | 1989–1993              |                                   | 1994–1998              |                                   |
|------------------------------|------------------------|-----------------------------------|------------------------|-----------------------------------|------------------------|-----------------------------------|
|                              | No. (%)<br>of patients | No. of visits<br>per patient-year | No. (%)<br>of patients | No. of visits<br>per patient-year | No. (%)<br>of patients | No. of visits<br>per patient-year |
| Total asthma                 | 54,917 (1.2)           | 1.66                              | 96,728 (1.7)           | 1.40                              | 123,209 (2.2)          | 1.16                              |
| Total allergic rhinitis      | 51,756 (1.3)           | 0.72                              | 69,811 (1.2)           | 0.58                              | 72,069 (1.3)           | 0.51                              |
| Asthma only                  | 44,796 (0.1)           | 1.59                              | 79,382 (1.4)           | 1.36                              | 104,608 (1.8)          | 1.13                              |
| Allergic rhinitis only       | 41,635 (0.9)           | 0.68                              | 52,465 (0.9)           | 0.55                              | 53,468 (0.9)           | 0.50                              |
| Asthma and allergic rhinitis | 10,121 (0.2)           | 2.43                              | 17,346 (0.3)           | 1.91                              | 18,601 (0.3)           | 1.57                              |

whereas this was true for less than 30% of all the patients with asthma in 1991 (data not shown). Therefore, almost by definition, the annual prevalence of utilization was higher for asthma than for allergic rhinitis.

To overcome these data limitations, we focused primarily on trends comparisons and not on absolute differences between the diagnoses. Although the measure of utilization prevalence probably underestimated the prevalence of allergic rhinitis to a greater degree than was the case for asthma, this should not have particularly affected trend comparisons for the 2 conditions, since utilization frequencies declined with time similarly for asthma and allergic rhinitis (Table 2). The interval analyses also supported the notion of real differences between diagnoses, since the total number of people with asthma diagnoses in each of the 3 periods increased more than the total number of people with the diagnosis of allergic rhinitis (Table 2). Also, the most striking differences between the 2 diagnoses occurred in the youngest age groups, where measures of prevalence and incidence of physician resources utilization are closely related, since most prevalent cases are incident cases (Figs 1 and 2).

In our study, asthma care utilization prevalence increased approximately 130%, with the largest increase in children (Figs 1 and 2). Earlier studies of the same population had already noted this phenomenon,<sup>18,19</sup> and our results are consistent with the reported asthma trends in the United States<sup>15,20</sup> and Canada.<sup>21</sup> A decline in the rate of increase in asthma prevalence (for both symptoms and health care utilization) in the most recent years has been already noted in several studies.<sup>15,21,23</sup>

The average increase in the prevalence of physician resources utilization for allergic rhinitis in our study was similar to the general increase in rates of utilization of physician services in Manitoba during the study period (average increase of 0.1 per 1,000 per year, 1983 to 1987<sup>19</sup>), suggesting that the increase in allergic rhinitis was not “real.” The lack of a significant increase in physician resources utilization incidence for allergic rhinitis also argues against a true increase in the disease, although the largest increase in prevalence of physician resources utilization occurred before we were able to calculate incidence. Although other data regarding allergic rhinitis trends are conflicting, much of the previously published evidence suggests an increase in the incidence and prevalence of allergic rhinitis care in western countries during this time.<sup>1,3–6,22,24</sup>

The observed increase in asthma diagnoses could be due to a true increase in the incidence and prevalence of the disease, diagnostic exchange, or a combination of both phenomena. We believe that the study results support the role of diagnostic exchange in 2 respects: the timing of the increase and the contrast with allergic rhinitis. Asthma care utilization prevalence increased remarkably during 1988 to 1992, and the rate of increase declined sharply thereafter. The incidence of asthma care utilization increased from 1990 to 1995 and actually decreased in later years. These changes were mostly due to a large increase in young children, the age groups for which measures of utilization incidence were most reliable. These findings probably indicate changes in diagnostic criteria first occurring in the mid-1980s. During the 1980s asthma awareness increased substantially among caregivers, partly due to apparent upward trends in asthma mortality rates in some industrialized countries<sup>25</sup> and partly due to improved knowledge, reflected in the new guidelines for the diagnosis and treatment of asthma.<sup>26</sup> It is reasonable to argue that this increased awareness had an impact on diagnostic labeling by physicians.<sup>27</sup> By 1993 diagnostic criteria may have stabilized, that is, diagnostic exchange had decreased and subsequent trends reflected a real increase in the prevalence of asthma symptoms.

Another argument that favors diagnostic exchange as a cause of the increase in asthma care utilization is the significant divergence between asthma and allergic rhinitis trends (for both prevalence and incidence), again occurring mainly in children, and also between 1988 and 1992. Before 1988 and after 1992, the trends in asthma and allergic rhinitis prevalence were more comparable, suggesting that something different was going on in the interim. True change in asthma biology, a striking increase in asthma unaccompanied by change in allergy, seems unlikely during such a brief period. The fact that the largest increases in asthma were seen in children also favors diagnostic exchange. In children, the diagnosis of asthma is often imprecise and based on the presence of wheeze, a nonspecific symptom.<sup>28</sup> The divergence between asthma and atopy in children has been previously reported.<sup>10,24</sup> A recent Danish study also showed that between 1986 and 2001 in children 7 to 17 years old nonatopic asthma increased more (4.2-fold) than atopic asthma (1.4-fold).<sup>9</sup>

Asthma in adolescents (10 to 19 years old) increased less than in younger groups, but the relationship between asthma

and allergic rhinitis trends was similar. Although it is believed that wheezing at this age is usually associated more with markers of atopy than is the case for younger children,<sup>28</sup> our study showed increases in asthma care utilization prevalence and incidence, whereas the physician resources utilization prevalence and incidence for allergic rhinitis for this age group did not change. It is less clear that diagnostic exchange drove the increase in asthma in this group.

The divergence of trends between asthma and allergic rhinitis seen in children was not paralleled by a similar phenomenon in adults, where the increase in asthma prevalence was essentially linear. Although in 20- to 54-year-olds the prevalence of asthma care utilization increased more rapidly than that of allergic rhinitis ( $P < .001$ ), the difference was relatively small and might well have resulted from the greater health care utilization associated with asthma. There were no differences between incidence slopes for asthma and allergic rhinitis in this age group.

For those 55 years and older, asthma and allergic rhinitis trends were virtually parallel for both incidence and prevalence of utilization of health care services. In our study, this was the only adult age group with a significant increase in incidence of health care utilization for both conditions. There are little published data on asthma and allergic rhinitis at these ages. The incidence of allergic disease is believed to be low after the age of 55 years.<sup>29</sup> Enright et al<sup>30</sup> reported 12% prevalence rates for allergic rhinitis among people 60 years and older in 1994, and Upton et al<sup>3</sup> noticed a significant increase in both asthma and allergic rhinitis among adults aged 44 to 54 years from 1976 to 1996, but we are not aware of any reports of the trends of allergic rhinitis concurrently with asthma in people older than 55 years.

## CONCLUSIONS

Trends in utilization of asthma health care services differed significantly from trends in utilization of allergic rhinitis health care services, particularly in the youngest age groups. The divergence of asthma trends from allergic rhinitis trends in children and the bigger increase with time of the diagnostic group "asthma only" compared with "allergic rhinitis only" or to "asthma and allergic rhinitis" also suggest that the relationship of physician-diagnosed asthma with underlying atopy in children may have changed with time. Some of the observed change was probably due to the changes in diagnostic criteria for asthma. Difference in trends for young adults were less pronounced and may have resulted from different health care utilization patterns between asthma and allergic rhinitis, and there was no differences in trends between asthma and allergic rhinitis for adults 55 years and older.

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