

Childhood asthma

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Abstract

Objectives

This article describes trends in the prevalence of asthma among children aged 0 to 14 from 1978/79 to 1994/95, and in hospital separations for asthma from 1974/75 to 1994/95. It also examines factors associated with childhood asthma.

Data sources

Information on asthma among children aged 0 to 11 is from the 1994/95 National Longitudinal Survey of Children and Youth (NLSCY), and among children aged 12 to 14, from the 1994/95 National Population Health Survey (NPHS). Hospital separation data are from the Hospital Morbidity File. Mortality data are from the Canadian Vital Statistics Data Base.

Analytical techniques

Prevalence estimates of asthma were calculated based on a sample of 22,831 children aged 0 to 11 from the NLSCY and 637 children aged 12 to 14 from the NPHS. Logistic regression was used to estimate the odds of asthma among children aged 0 to 11 by selected characteristics.

Main results

The prevalence of childhood asthma and hospital separations rates for asthma have increased sharply. A history of bronchitis and allergies, parental asthma, and residence in the Atlantic provinces and Quebec are associated with higher rates of asthma in children.

Key words

bronchial hyperreactivity, hospital utilization, allergy, bronchitis

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Asthma can be a debilitating and even life-threatening disease. This chronic condition causes recurrent episodes of coughing, wheezing, and breathlessness when airways become inflamed, swell up and tighten (see *What is asthma?*). Exposure to irritants such as smoke, dust, pets and molds can trigger asthma attacks. Quality of life for those who have asthma and for their families can be compromised.^{1,2}

In addition to the personal toll, asthma places a burden on the health care system. The direct and indirect costs of asthma in Canada in 1990 were estimated to range between \$504 and \$648 million.³

A number of international studies have noted rising rates of asthma, particularly among children,⁴⁻⁸ and have suggested that changes in the environment may be contributing to the increases. National health surveys conducted in Canada over the past two decades also reveal a sharp rise in the reported prevalence of childhood asthma. To some extent, Canadian hospital admission data for the same period mirror this increase. However, while hospital separation rates for childhood asthma rose almost every year from 1974 to 1987, they have declined slightly since then.

Methods

Data sources

Data for this article come from the 1994/95 National Longitudinal Survey of Children and Youth (NLSCY),⁹ the 1994/95 National Population Health Survey (NPHS),¹⁰ the Hospital Morbidity File, and the Canadian Vital Statistics Data Base. The NLSCY provides data for children aged 0 to 11, and the NPHS, for children aged 12 to 14. Hospital and mortality data cover the entire 0-to-14 age group. Supplemental historical information on the prevalence of childhood asthma was obtained from the 1978/79 Canada Health Survey¹¹ and the 1983/84 Canadian Health and Disability Survey¹² (see *Definitions*.)

The first cycle of the NLSCY was conducted in 1994/95. The target population was children from newborn to age 11. In each NLSCY household, up to four children were selected at random, and a question was asked to determine who in the household was the person most knowledgeable (PMK) about them. For 91.3% of the selected children, the PMK was the mother (89.9% biological; 1.4% step, adoptive or foster).

The 1994/95 NLSCY resulted in a responding sample of 13,439 households. In these households, 22,831 children were selected to participate in the survey. The overall response rate at the household level was 86%. Response rates for the health outcomes of children and the characteristics of the PMK were 91% or more.

The 1994/95 data on asthma among 12- to 14-year-olds are from the household component of the 1994/95 National Population Health Survey for the 10 provinces—a sample of 27,263 households, 88.7% of which agreed to participate in the survey. After the application of a screening rule (to keep the sample representative),¹⁰ 20,725 households remained in scope. One knowledgeable person in each participating household provided general socio-demographic and health information about each household member. (The data base containing this information is called the General file.) In addition, one randomly selected person in each of the 20,725 participating households was chosen to provide in-depth information about his or her own health. In 18,342 of these households, the selected person was aged 12 or older. The response rate to these in-depth health questions was 96.1% or 17,626 respondents. (The data base pertaining to these respondents is called the Health file.) The NPHS data analysed in this article are from the Health file and refer to the 637 randomly selected children aged 12 to 14 who were in the NPHS sample. In the remaining 2,383 participating households, the randomly selected respondent was younger than age 12. In-depth health information was collected for these children as part of the NLSCY.

The sample size of the 1978/79 Canada Health Survey was 34,993 respondents, 3,704 of whom were aged 0 to 14. One person in each household responded to an interviewer-administered questionnaire on behalf of all household members. The response rate was 86%.

The 1983/84 Canadian Health and Disability Survey used a separate questionnaire for children aged 0 to 14. The sample size was 59,195 children in the 10 provinces. From proxy interviews with a parent or other responsible adult family member, the screening questionnaire identified children with long-term health conditions, which included asthma.

Data on 552,099 hospital stays of children aged 0 to 14 involving asthma were obtained from Statistics Canada's Hospital Morbidity File for fiscal years 1974/75 to 1994/95. The file contains one record for each separation from Canadian general and allied special hospitals in all provinces and territories. This analysis excludes data for the territories.

Data on asthma deaths are from the Canadian Vital Statistics Data Base. The data are adapted from information collected by the provincial and territorial registries of vital statistics.

Analytical techniques

The analysis of the prevalence of asthma focuses on children aged 0 to 11. Where feasible, data for the 12-to-14 age group from the NPHS were combined with NLSCY data to yield estimates for children aged 0 to 14.

All results in this article are based on estimates weighted up to the population level. Logistic regression was used to estimate the odds ratios for asthma among children aged 0 to 11, while controlling for selected independent variables. Sample weights were adjusted so that they average to 1, thereby reducing variance estimate bias, but not accounting for the design effect. Tests with p-values less than .01 (instead of .05) were considered significant to partially account for the larger variance estimates that would have been obtained if full account had been taken of the survey design. Nonetheless, the odds ratios reported in this article should be viewed with caution. Their standard errors, and hence, confidence intervals, may be underestimated.

The World Health Organization's Eighth and Ninth Revisions of the International Classification of Diseases were used to identify asthma in the hospital separation and mortality data.^{13,14} From 1974 to 1978, the Eighth Revision was in effect; from 1979 to 1994, the Ninth Revision was used. In both revisions, the diagnostic category for asthma was 493. Similarly, for mortality, if the underlying cause of death was coded 493, it was considered an asthma death.

This article uses survey data, hospital records, and vital statistics to trace trends in the prevalence of asthma among children (see *Methods, Definitions and Limitations*). The health and lifestyle consequences of asthma for children and factors associated with childhood asthma are also analysed.

Definitions

1994/95 National Longitudinal Survey of Children and Youth

The person most knowledgeable about the child (PMK—usually the mother) answered a series of questions about the child's health and health behaviour. The analysis in this study was confined to the responses of the biological mother or father.

To determine the prevalence of asthma among children, the PMK was asked: "Has he/she ever had asthma that was diagnosed by a health professional?" Recent asthma attacks were determined by the question: "Has he/she had an attack of asthma in the last 12 months?"

The association between asthma and activity restrictions was assessed by: "Does this condition or health problem prevent or limit his/her participation in school, at play or any other activity normal for a child his/her age?"

Chronic conditions were assessed with the question: "Does he/she have any of the following long-term conditions that have been diagnosed by a health professional?" Response categories relevant for this report were: allergies, bronchitis, and emotional, psychological or nervous difficulties.

To determine the overall health of the child, the PMK was asked: "In general, how would you describe his/her health?" Response options were: excellent, very good, good, fair, poor.

The child's general activity level was measured with the question: "In your opinion, how physically active is he/she compared to other children of the same age and sex?" A list of responses was read (much more, moderately more, equally, and much less), only one of which was marked.

The child's use of hospital services was assessed by asking: "In the past 12 months, was the child ever an overnight patient in a hospital?"

To assess the use of health professionals, the PMK was asked: "In the past year, how many times have you seen or talked on the telephone about the child's physical or mental health with: a general practitioner, family physician, pediatrician?"

The health and behaviour of people in the household where the child lives could be expected to affect the child's health status.

Prevalence rising

The prevalence of childhood asthma has risen sharply since the late 1970s. In 1978/79, an estimated 2.5% of children younger than 15 were reported to have asthma. By 1983/84, the percentage had risen only slightly, but in 1994/95, the estimate was 11.2% or 672,000 children (Table 1).

For this reason, questions were asked about the health behaviour and health status of the PMK (and the spouse or partner of that person, if applicable):

"At the present time do you smoke cigarettes daily, occasionally, or not at all?"

"Do you have any of the following long-term conditions that have been diagnosed by a health professional?" Response options relevant for this analysis were: food allergies, other allergies, asthma.

1994/95 National Population Health Survey

The 1994/95 National Population Health Survey asked a series of questions about chronic health problems. "We are interested in 'long-term conditions' that have lasted or are expected to last 6 months or more and that have been diagnosed by a health professional. Do you have ... diagnosed by a health professional?" The response options relevant for this analysis were: food allergies, other allergies, asthma and chronic bronchitis. Respondents who reported that they had been diagnosed with asthma were asked: "Have you had an attack of asthma in the past 12 months?"

The prevalence of smoking was determined with the question: "At the present time do you smoke cigarettes daily, occasionally or not at all?"

1978/79 Canada Health Survey and 1983/84 Canadian Health and Disability Survey

The 1978/79 Canada Health Survey contained a question about the prevalence of chronic disease. The selected household respondent was asked: "Does anyone in the family presently have: ... asthma?" In the 1983/84 Canadian Health and Disability Survey, the children's questionnaire asked: "Which, if any, of these long-term conditions or health problems does ... have?" Asthma was included among the options listed.

Table 1
Selected indicators of asthma among children aged 0 to 14, Canada, excluding territories, 1978/79, 1983/84 and 1994/95

	1978/79	1983/84	1994/95
Population aged 0-14	5,531,000	5,326,000	6,000,000
Number with asthma	141,000	167,000	672,000
% with asthma	2.5	3.1	11.2
Hospital separations for asthma	17,223	27,357	29,073
Per 100,000 population aged 0-14	311	514	488
Per 100,000 population aged 0-14 with asthma	12,215	16,381	4,326
Asthma deaths	16	13	9
Per 100,000 population aged 0-14	0.29	0.24	0.15
Per 100,000 population aged 0-14 with asthma	11.3	7.8	1.3

Data sources: 1978/79 Canada Health Survey, 1983/84 Canadian Health and Disability Survey, 1994/95 National Longitudinal Survey of Children and Youth, 1994/95 National Population Health Survey, Hospital Morbidity File, Canadian Vital Statistics Data Base

Table 2
Prevalence of asthma among children aged 0 to 14, by selected characteristics, Canada excluding territories, 1994/95

	Number	Diagnosed with asthma	Children with asthma who had attack in past year
	'000		%
Total	6,000	11	51
Sex			
Male	3,096	13	50
Female	2,904	9 [†]	51
Age			
0-4	1,960	7 [†]	57 [‡]
5-9	1,931	13	50
10-14	2,108	13	48
Urban/Rural			
Urban	4,894	11	45 [†]
Rural	1,099	11	52
Not stated	7	--	--
Household income			
Lowest/Lower-middle	1,063	13	54 ^{††}
Middle	1,960	10 [§]	51
Upper-middle	1,994	11	50
Highest	911	13	46
Not stated	72	--	--

Data sources: 1994/95 National Longitudinal Survey of Children and Youth (for ages 0 to 11), 1994/95 National Population Health Survey, Health file (for ages 12 to 14)

Note: Because of rounding, detail may not add to total.

[†] Significantly lower than other items in category ($p < 0.01$)

[‡] Significantly higher than ages 10-14 ($p < 0.01$)

[§] Significantly lower than lowest/lower-middle and highest income groups ($p < 0.01$)

^{††} Significantly higher than highest income group

-- Amount too small to be expressed

Throughout the period, asthma was more commonly reported among boys than girls. In 1978/79, 3.4% of boys and 1.6% of girls had asthma. By 1994/95, the figures were higher for both sexes, but the gap persisted: 13% versus 9% (Table 2).

In 1994/95, the percentage of children who have ever been diagnosed with asthma was almost twice as high at ages 5 to 14 (13%) as at ages 0 to 4 (7%). However, among children with asthma, the percentage who had had an attack in the past year was somewhat higher at the youngest ages.

The prevalence of asthma did not differ by urban/rural residence. On the other hand, the percentage of children with asthma who had had an attack in the previous year was significantly higher in rural than in urban areas.

Children in middle-income households had a significantly low prevalence of asthma, compared with those in both lower- and higher-income households. But among children with asthma, those in lower-income households were the most likely to have had a recent attack.

Asthma and health status

Not surprisingly, children with asthma fared less favourably on several measures of health than did other children. According to the NLSCY, 7% of children aged 0 to 11 with asthma were in fair or poor health, compared with just 1% of children who did not have the condition (Table 3).

Children with asthma were also more likely than other children to have an activity limitation: 13% versus 3%. Among those who had experienced an asthma attack in the previous year, the activity limitation rate was 22%.

The general level of physical activity among children with asthma was significantly lower than that of children who did not have asthma. Ten percent of children with asthma were described as "less active"; this applied to 6% of other children.

Children who had been diagnosed with asthma also used more health care services than those without the disease. Children with asthma averaged around six physician or pediatrician consultations in the year before the survey, about double the

number for children without asthma. As well, during that period, 11% of children with asthma had been admitted to hospital; for those who had had an asthma attack, the percentage was 19%. By contrast, just 5% of children who did not have asthma had been hospitalized.

Hospital admissions levelling off

Hospital separations for asthma among children rose from about 14,300 in 1974/75 to 34,600 in 1987/88; however, by 1994/95, they had fallen to 29,100. The trend in the age-standardized hospital separation rate for childhood asthma was similar. Between 1974/75 and 1987/88, the rate rose from 246 to 627 separations per 100,000 children aged 0 to 14. By 1994/95, it had dropped to 489 (see Appendix Tables A and B and *Regional patterns*).

Hospital separation rates based on the number of children with asthma are, of course, much higher. In 1978/79, the rate was 12,215 hospitalizations per 100,000 children who had ever been diagnosed with the disease (Table 1). By 1983/84, the rate had risen to 16,381. Thereafter, the number of children with asthma increased much faster than the number of

asthma hospitalizations. Consequently, the hospital separation rate per 100,000 children with asthma fell to 4,326 in 1994/95.

Since 1974/75, the average time children spend in hospital for asthma has been almost halved. That

What is asthma?

Asthma is a chronic inflammatory disorder of the airways.^{15,16} In susceptible individuals, this inflammation causes recurrent episodes of wheezing, breathlessness, chest tightness and cough, particularly at night and/or in the early morning. Normally, air flows easily through the bronchial tubes, which naturally tighten to keep out very cold air or other harmful substances. But for people with asthma, the lungs also react to even minor irritants.

Asthma attacks vary in frequency and severity. Some people with asthma are generally symptom-free, with occasional mild episodes of shortness of breath. Others cough and wheeze most of the time and have severe attacks after viral infections, exercise or exposure to irritants.

An asthma attack may begin suddenly, or it may come on slowly with gradually worsening symptoms. While many attacks last for only a few minutes, in severe cases, an attack can go on for hours. During an asthma attack, the muscles that control the bronchial tubes tighten and go into a spasm. The airways swell and become inflamed, and the mucus-producing cells that line the bronchial tubes secrete more mucus, which interferes with breathing.

Drug treatments allow most people with asthma to lead relatively normal lives. Such treatments may be immediate to get an attack under control, or continuous, designed to prevent attacks.

Some children with asthma may not suffer from it when they reach late adolescence or adulthood. However, there is evidence that children with moderate to severe asthma are at higher risk for asthma and other respiratory problems in adulthood.¹⁷ Even when the disease has clinically disappeared, the lung function of the patient frequently remains altered, or airway hyper-responsiveness and cough persist. Children with moderate to severe asthma will probably be at risk for its longer-term effects throughout their lives.^{15,18,19}

Although asthma can be life-threatening, mortality from asthma among children declined from 16 deaths in 1978/79 to 9 in 1994/95 (Table 1). Rates fell from 0.29 to 0.15 deaths per 100,000 children aged 0 to 14. Expressed per 100,000 asthmatic children, the rate dropped from 11.3 to 1.3 deaths.

Table 3
Health status and health care utilization of children aged 0 to 11, by asthma status, Canada excluding territories, 1994/95

	Not diagnosed with asthma	Diagnosed with asthma	Asthma attack in past year
			%
Health status			
General health			
Excellent/Very good	91	66	55
Good	8	27	33
Fair/Poor	1†	7	12
Activity limitation	3	13	22
Activity level			
More active	37	37	35
Equally active	57	53	54
Less active	6†	10	12
Health care utilization			
Overnight hospital stay in past year	5†	11	19
Mean number of consultations in past year			
Family physician	2.50†	4.60	5.88
Pediatrician	0.63†	1.44	2.06

Data source: 1994/95 National Longitudinal Survey of Children and Youth

Note: Because of rounding, percentages may not add to 100%.

† Significantly lower than children diagnosed with asthma

year, the average length of stay was 5.55 days; by 1994/95, it was 2.64 days. The decline in the number of hospital separations, as well as in length of stay, could be attributable to a combination of improved treatment of childhood asthma with medications, greater use of ambulatory care services, and the general reduction in hospital admissions for many conditions.²⁰

High separation rates for youngest children and boys

Young children are more likely than older children to be hospitalized for asthma (Chart 1). This may reflect the higher rate of recent attacks reported for children younger than age 5. In 1994/95, asthma was the leading cause of hospitalization of children aged 1 to 4; for older children, it ranked second or third, depending on their sex.

Regional patterns

In 1994/95, the prevalence of childhood asthma was highest in Atlantic Canada and lowest in the Prairies. The percentage of children with asthma who had a recent attack ranged from 43% in Quebec to 59% in British Columbia.

Trends in children's hospital separation rates for asthma have been similar in all regions, with rates rising until the late 1980s or early 1990s and then declining (Appendix Table B). In 1994/95, regional variations in hospital separation rates paralleled the reported prevalence of asthma, with the highest rates in the Atlantic Region and Quebec, and the lowest in British Columbia. This marked a change from the 1970s, when the Prairie Region had the highest hospital separation rates, while Quebec had the lowest.

Several factors should be considered when interpreting regional trends in hospital separation rates for childhood asthma. Differences in rates may reflect differences in the organization of outpatient services, in the availability of hospital beds or in access to primary health care. As well, the severity of asthma within each region's child population may vary.

The tendency toward a higher prevalence of asthma in Atlantic Canada has been noted in a previous study.²¹ The authors speculated that some of the regional differences in asthma rates may be due to variations in exposure to environmental pollution. They also suggested that early migration and settlement patterns may have contributed to a genetic predisposition to asthma in the Atlantic provinces.

Prevalence of asthma among children aged 0 to 14, by region, Canada excluding territories, 1994/95

	Number	Diagnosed with asthma	Children with asthma who had attack in past year
			%
	'000		
Total	6,000	11	51
Atlantic	498	14 [†]	52
Quebec	1,429	12	43 [‡]
Ontario	2,245	11	53
Prairies	1,086	10	51
British Columbia	741	11	59

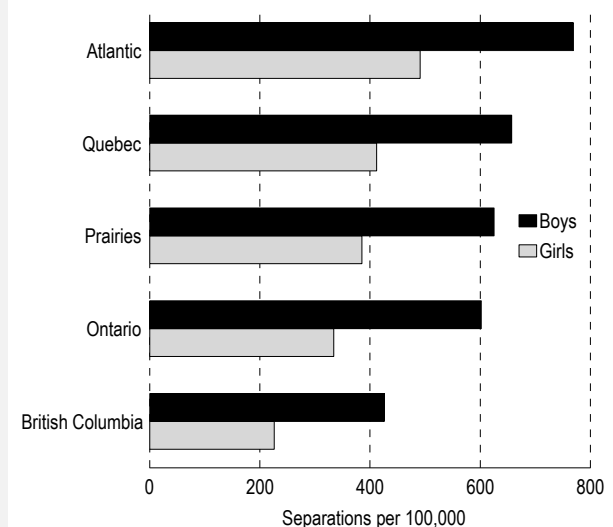
Data sources: 1994/95 National Longitudinal Survey of Children and Youth (for ages 0 to 11), 1994/95 National Population Health Survey, Health file (for ages 12 to 14)

[†] Significantly higher than other regions

[‡] Significantly lower than other regions

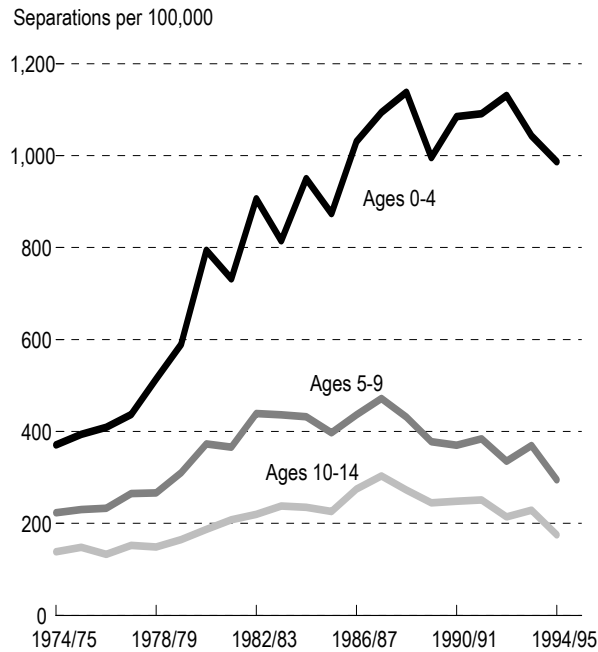
Note: Because of rounding, number does not sum to 6,000,000.

Hospital separation rates for asthma, by sex and region, children aged 0 to 14, Canada excluding territories, 1994/95



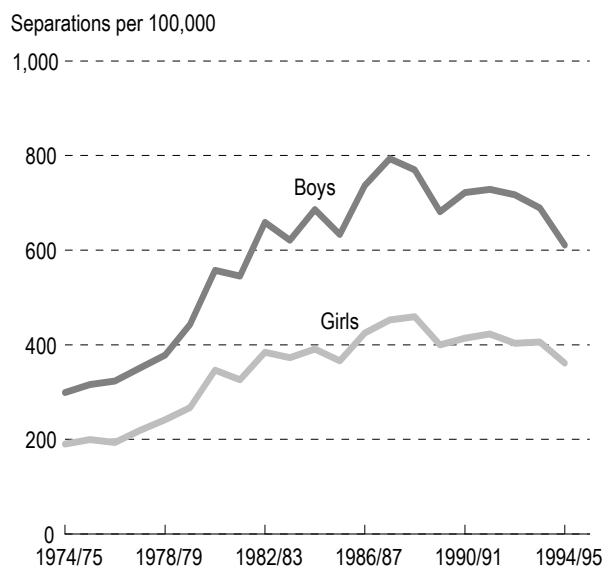
Data source: Hospital Morbidity File

Chart 1
Hospital separation rates for asthma, by age group, children aged 0 to 14, Canada excluding territories, 1974/75 to 1994/95



Data source: Hospital Morbidity File

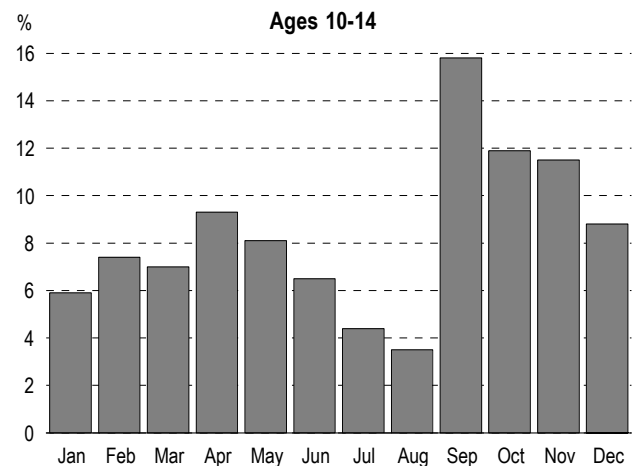
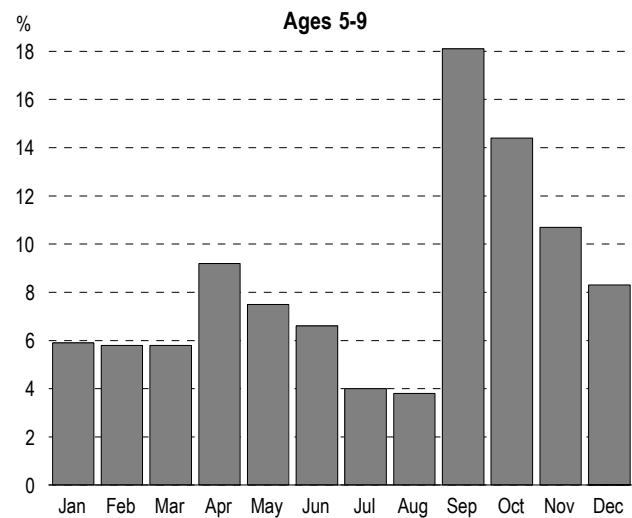
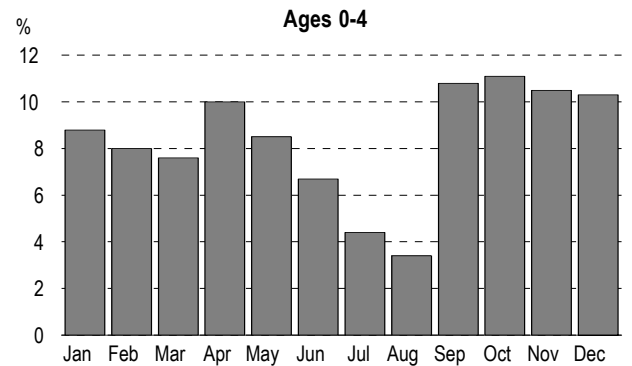
Chart 2
Hospital separation rates for asthma,† by sex, children aged 0 to 14, Canada excluding territories, 1974/75 to 1994/95



Data source: Hospital Morbidity File

† Age-adjusted

Chart 3
Percentage distribution of hospital separations for asthma, by month of hospitalization, children aged 0 to 14, Canada excluding territories, 1994/95



Data source: Hospital Morbidity File

At all ages, boys were more likely than girls to be hospitalized for asthma (Appendix Table A and Chart 2), a trend that has been noted in previous research.²¹⁻²³ The higher hospital separation rate for boys may be attributable to anatomical differences. Boys tend to have narrower airways and increased airway tone, which makes them more susceptible to airflow limitation.¹⁵ These differences typically disappear around age 10, when the airway diameter/length ratio is the same in both sexes. In fact, in recent years, hospital separation rates for asthma among boys and girls aged 10 to 14 were almost the same.

Autumn upturn

The number of hospital separations for asthma rises sharply in September, then declines each month until April when there is another smaller upturn (Chart 3). The percentage of hospital separations that occur in September is much higher for school-age children (ages 5 to 14) than for preschool children. The return to school increases the amount of time children spend indoors and the possibility of exposure to mold and dust mites, both of which have been implicated in childhood asthma.^{24,25} The incidence of viral infections also rises when children go back to school, and there is some indication that respiratory viruses may exacerbate asthma attacks in susceptible children.¹⁵ The elevated hospital separation rates in the spring could reflect exposure to pollen and molds.²⁶

Factors associated with childhood asthma

According to the NLSCY, children aged 0 to 11 with a history of bronchitis or allergies were much more likely to be diagnosed with asthma and to have had a recent attack than were children without these conditions (Table 4). For instance, 49% of children with a history of bronchitis also had asthma, compared with 10% of children who did not have bronchitis.

Children aged 6 to 11 with emotional problems were also more likely to have been diagnosed with asthma and more likely to have experienced an asthma attack in the past year. The direction of

this association, however, is unclear; emotional problems may have stemmed from having asthma rather than being a precursor of it.

A history of asthma in the parents was associated with asthma in children. Fully 28% of children whose biological mother had asthma had also been diagnosed with the disease; the figure was just 10% for children of mothers who did not have the condition. Among children with asthma, 59% of those whose mother was asthmatic had had an attack in the past year, compared with 49% of children

Table 4
Prevalence of asthma among children aged 0 to 11, by health characteristics of children and parents, Canada excluding territories, 1994/95

	Number	Children with asthma who had attack in past year	
		Diagnosed with asthma	
	'000	%	%
Child			
Allergies			
Yes	657	31 [†]	55 [†]
No	3,946	8	48
Bronchitis			
Yes	134	49 [†]	66 [†]
No	4,468	10	49
Emotional problems [‡]			
Yes	38	23 [†]	61
No	2,259	14	47
Parents[§]			
Mother smokes			
Yes	1,374	13	50
No	3,042	10	51
Father smokes			
Yes	1,165	12 [†]	51
No	2,472	9	50
Mother has asthma			
Yes	265	28 [†]	59
No	4,171	10	49
Father has asthma			
Yes	141	19 [†]	64 [†]
No	3,512	10	49
Mother has allergies			
Yes	941	15 [†]	53
No	3,496	10	50
Father has allergies			
Yes	552	12	52
No	3,101	10	50

Data source: 1994/95 National Longitudinal Survey of Children and Youth
Note: Total numbers for each category will not sum to 4,673,000 because of missing data.

[†] Significantly higher than other item in category

[‡] The question on emotional health was asked only for children older than 5.

[§] Biological parents

with asthma whose mother did not have asthma. The pattern was similar if the biological father had asthma.

Table 5
Adjusted odds ratios for asthma among children aged 0 to 11, Canada excluding territories, 1994/95

	Adjusted odds ratio	99% confidence interval
Age		
0-4†	1.00	...
5-9	1.70**	1.48, 1.94
10-11	1.69**	1.43, 2.00
Sex		
Male	1.58**	1.41, 1.79
Female†	1.00	...
Allergies		
Yes	4.64**	4.09, 5.27
No†	1.00	...
Bronchitis		
Yes	6.88**	5.48, 8.65
No†	1.00	...
Parental asthma		
Neither parent asthmatic†	1.00	...
Mother asthmatic	2.78**	2.21, 3.50
Father asthmatic	1.99**	1.48, 2.67
Both parents asthmatic	3.26**	1.03, 10.33
Parental smoking		
Neither parent smokes†	1.00	...
Mother smokes	1.11	0.88, 1.41
Father smokes	1.23*	1.02, 1.48
Both parents smoke	1.01	0.85, 1.20
Region		
Atlantic	1.53**	1.21, 1.94
Quebec	1.26**	1.05, 1.52
Ontario	1.10	0.92, 1.31
Prairies†	1.00	...
British Columbia	0.97	0.77, 1.23
Household income		
Lowest†	1.00	...
Lower-middle	1.29	0.84, 1.99
Middle	1.07	0.70, 1.63
Upper-middle	1.06	0.69, 1.61
Highest	1.09	0.71, 1.69

Data source: 1994/95 National Longitudinal Survey of Children and Youth

Note: The multivariate analysis was based on 22,433 children for whom information was reported on all variables in the model. The multivariate logistic regression was weighted to represent 4,673,000 children aged 0 to 11 in the 10 provinces. Tests with *p*-values less than 0.01 (instead of 0.05) were considered significant to partially account for the larger variance estimates that would have been obtained if full account had been taken of the survey design.

† Reference category for which odds ratio is 1.00

* *p* < 0.05

** *p* < 0.01

... Not applicable

Exposure to cigarette smoke has frequently been associated with the development of asthma in children and with the severity of asthma attacks.²⁷⁻²⁹ Yet the NLSCY indicates only a small increase in the prevalence of asthma among children whose parents smoked. The prevalence of asthma among children whose biological mother smoked was 13%, compared with 10% among children of non-smoking mothers. The corresponding percentages for children whose father smoked were 12% and 9%. As well, the smoking status of the parents was not associated with children having had an attack in the past year.

This does not entirely rule out a link between parental smoking and asthma. Parents of a child with asthma may be less likely to smoke, or they may not be willing to admit that they smoke. As well, the NLSCY does not provide a precise measure of the overall level of exposure to smoke. Factors such as the number of cigarettes smoked, the number of smokers in the household, whether they smoke indoors, and the ventilation of the house, all of which could influence levels of exposure, were not measured.

Significant risk factors

After the effects of other potentially confounding variables are taken into account, having bronchitis and allergies was strongly associated with asthma among children aged 0 to 11 (Table 5). Children with bronchitis had almost seven times the odds, and those with allergies nearly five times the odds, of having been diagnosed with asthma as did children without these conditions. If both biological parents had asthma, the child had about three times the odds of having asthma as did children of parents who did not have asthma. The odds of asthma were slightly elevated among children whose fathers smoked, but this was not the case if the mother or both parents smoked.

Implications

Both survey and hospital statistics show an increase in the prevalence of childhood asthma over the last two decades.^{30,31} Other countries, too, have experienced similar increases.^{4-6,32} It is not clear

whether the changing rates reflect a real increase in the incidence or severity of the disease, or changing perceptions. To some degree, the increase may be influenced by a greater awareness of the illness because of coverage in the mass media.³³

Limitations

The data analyzed in this article are cross-sectional. Consequently, causality cannot be inferred from the relationships observed between the variables.

A major limitation of this analysis is the lack of information on disease severity. Having had an asthma attack in the past year indicates relatively recent problems with the condition, but no data were collected on the severity of the attack(s).

Another limitation is that parents provided information about the health of their children and about their own behaviour. Some parents may have been unwilling to acknowledge harmful behaviour, notably smoking. This may explain the weaker-than-expected association between smoking and asthma among children.

Differences in the prevalence of childhood asthma as measured by various health surveys may be partially attributable to nuances in the wording of questions. Unlike the 1978/79 Canada Health Survey and the 1983/84 Canadian Health and Disability Survey, the definition of asthma used in the 1994/95 NLSCY and NPHS specifies diagnosis by a health professional. Yet despite the more stringent definition, the prevalence of asthma in 1994/95 was much higher than that reported in the earlier surveys.

The figures on hospital separations refer to the number of hospital stays, not the number of patients. A child may be hospitalized more than once during a year because of asthma. When the number of hospital separations in 1994/95 for asthma among children aged 0 to 11 is divided by the NLSCY estimate of the number of asthmatic children, the hospital separation rate is 4%. But according to the NLSCY, 11% of children aged 0 to 11 who had asthma had been admitted to hospital in the previous year. However, the 11% estimate refers to hospitalizations for any reason, whereas the hospital separation data were calculated only for asthma. Since children with asthma tend to have other health problems, it is reasonable to assume that they might be admitted to hospital for a diagnosis other than asthma.

During the 1974/75 to 1994/95 period, the International Classification of Diseases was revised. The classification of asthmatic bronchitis changed from 490 to 493. Assessments of the impact of the revision on Canadian statistics concluded that diagnostic shifts in the classification of asthma accounted for only a small proportion of the increase in rates.³⁴

Part of the increase may be attributable to a change in physicians' diagnosis and management practices since the mid-1970s. They may now be more likely to classify wheezing in a young child as asthma rather than bronchitis, and may be more likely to hospitalize children with asthma-like symptoms. A greater tendency to hospitalize young children may also be associated with research suggesting that treatment can be effective in children younger than age 2.⁷

The high prevalence of asthma among children of parents with asthma shown in the NLSCY supports the argument that heredity is important.³¹ However, it is unlikely that hereditary factors in the general population could account for the sharp upturn in the reported prevalence of asthma or in hospitalization rates since the mid-1970s.

There was little evidence from the NLSCY of higher asthma rates among low-income households. Previous research on the relationship between socioeconomic status and asthma is inconsistent. Some studies have reported higher rates of childhood asthma among higher socioeconomic groups.^{35,36} Others have observed a higher prevalence in lower socioeconomic groups³⁷ or have found no association at all.^{28,38,39}

The results of this analysis show, as have other studies, that asthma is a complex and multifaceted disease. Future cycles of the NLSCY and the NPHS may provide new insights into both the natural history and consequences of the disease. ●

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Appendix

Table A

Number of hospital separations and hospital separation rates for asthma, by sex and age group, children aged 0 to 14, Canada excluding territories, 1974/75 to 1994/95

	Number of hospital separations for asthma				Hospital separation rates for asthma (per 100,000 population)			
	Total	Age group			Total	Age group		
		0-4	5-9	10-14		0-4	5-9	10-14
Boys								
1974/75	8,903	4,240	2,764	1,899	299.3	464.6	270.5	156.3
1975/76	9,272	4,560	2,758	1,954	316.0	501.3	277.8	162.2
1976/77	9,335	4,799	2,793	1,743	323.5	530.4	284.7	148.5
1977/78	10,064	5,022	3,078	1,964	351.0	555.0	318.4	172.2
1978/79	10,688	5,877	3,002	1,809	378.3	647.3	314.0	165.5
1979/80	12,407	6,992	3,517	1,898	443.0	764.3	373.7	181.5
1980/81	15,527	9,285	4,206	2,036	557.4	1,008.1	451.0	201.2
1981/82	15,181	8,807	4,149	2,225	545.1	950.4	449.2	224.0
1982/83	18,410	11,112	4,998	2,300	659.3	1,187.6	542.3	234.0
1983/84	17,419	9,935	5,012	2,472	620.8	1,050.9	544.0	254.2
1984/85	19,324	11,812	5,048	2,464	686.3	1,243.0	543.9	257.5
1985/86	17,809	10,881	4,543	2,385	632.7	1,145.5	486.4	252.7
1986/87	20,680	12,769	5,149	2,762	736.7	1,350.5	546.8	297.3
1987/88	22,456	13,823	5,586	3,047	793.8	1,451.3	585.9	327.3
1988/89	21,975	14,190	5,119	2,666	770.0	1,481.1	528.9	283.8
1989/90	19,731	12,695	4,641	2,395	681.1	1,306.1	472.2	250.6
1990/91	21,244	14,173	4,612	2,459	721.9	1,432.0	464.5	253.8
1991/92	21,647	14,338	4,777	2,532	728.6	1,433.4	478.6	258.2
1992/93	21,578	15,200	4,248	2,130	716.8	1,497.1	423.6	214.6
1993/94	21,030	14,154	4,574	2,302	689.4	1,371.0	454.0	228.6
1994/95	18,458	13,184	3,486	1,788	606.0	1,283.7	345.4	176.0
Girls								
1974/75	5,440	2,367	1,692	1,381	189.9	273.2	173.5	118.9
1975/76	5,667	2,427	1,712	1,528	199.7	281.2	180.8	132.7
1976/77	5,378	2,420	1,662	1,296	193.2	281.6	178.1	115.6
1977/78	6,031	2,697	1,912	1,422	219.1	313.5	208.5	130.6
1978/79	6,535	3,221	1,952	1,362	241.7	373.4	215.7	130.8
1979/80	7,163	3,517	2,170	1,476	267.5	405.2	243.3	148.3
1980/81	9,189	4,964	2,574	1,651	346.1	567.9	291.3	171.6
1981/82	8,670	4,429	2,432	1,809	326.5	502.9	278.1	191.6
1982/83	10,218	5,419	2,897	1,902	384.4	609.8	330.9	204.2
1983/84	9,938	5,072	2,828	2,038	372.6	566.0	322.5	221.3
1984/85	10,445	5,766	2,764	1,915	390.8	640.3	313.3	210.5
1985/86	9,767	5,293	2,685	1,789	365.8	588.0	302.9	198.7
1986/87	11,334	6,244	2,856	2,234	424.9	694.4	320.1	251.3
1987/88	12,192	6,542	3,167	2,483	452.8	719.4	350.8	278.5
1988/89	12,484	7,140	3,005	2,339	459.1	779.2	327.6	260.6
1989/90	11,033	6,238	2,610	2,185	399.8	671.4	279.6	240.0
1990/91	11,607	6,817	2,571	2,219	414.3	721.4	271.7	241.0
1991/92	11,963	6,963	2,726	2,274	423.0	730.7	285.5	243.9
1992/93	11,542	7,202	2,327	2,013	403.3	745.6	242.6	213.3
1993/94	11,755	6,855	2,707	2,193	405.6	698.4	281.0	228.8
1994/95	10,347	6,429	2,264	1,654	357.1	659.1	234.1	170.5

Data source: Hospital Morbidity File

Table B
**Age-standardized hospital separation rates for asthma,
 children aged 0 to 14, by region, Canada excluding territories,
 1974/75 to 1994/95**

	Canada	Atlantic	Quebec	Ontario	Prairies	British Columbia
	(per 100,000 population aged 0-14)					
1974/75	245.9	238.1	176.6	252.9	329.6	241.7
1975/76	259.3	250.8	182.6	268.0	364.5	234.1
1976/77	260.0	277.9	184.6	270.4	340.6	238.1
1977/78	286.7	298.3	209.1	317.7	350.3	232.3
1978/79	311.7	332.3	232.6	331.6	392.4	266.9
1979/80	357.5	458.2	194.2	423.1	426.7	308.4
1980/81	454.5	541.3	343.4	498.5	505.6	396.6
1981/82	438.6	535.4	344.9	511.0	435.4	340.9
1982/83	525.4	651.8	462.3	573.3	532.3	382.8
1983/84	499.9	665.0	455.2	510.8	526.2	369.1
1984/85	542.5	724.0	474.4	581.6	552.2	398.9
1985/86	502.8	643.9	482.1	545.2	509.3	291.8
1986/87	584.8	712.4	551.5	648.1	588.7	361.1
1987/88	627.4	768.7	613.0	670.9	608.7	461.6
1988/89	618.2	824.9	585.4	655.9	591.2	468.5
1989/90	543.8	819.9	497.3	564.1	542.0	388.9
1990/91	571.7	876.1	453.1	621.3	581.0	432.5
1991/92	579.4	835.8	493.1	560.5	680.4	480.3
1992/93	563.9	859.1	506.0	555.8	624.9	416.8
1993/94	550.9	768.5	559.3	518.0	595.5	434.5
1994/95	492.4	618.3	536.4	463.5	430.6	334.4

Data source: Hospital Morbidity File