Trends in rates of admission to hospital and death from asthma among children and young adults in Canada during the 1980s

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Objective: To update reports of increases in the rates of admission to hospital and death from asthma among children and young adults in Canada during the 1970s by examining data for the 1980s.
Design: Age-standardized rates were calculated from data for people less than 35 years of age at the time of death from asthma, bronchitis or other respiratory conditions (from 1980 through 1989) and at the time of admission to hospital for treatment of these diseases (from 1980 through 1988). Standardized mortality ratios were calculated with the death rate for Canada as the expected rate.
Setting: Data for all of Canada were examined by sex, age group and province.
Results: In contrast to sharp increases in the rate of death from asthma observed from 1970 through the early 1980s among Canadians less than 35 years of age, the rate showed no net change between 1980 and 1989; on average, there were 58 deaths in this age group annually. During the decade, the rates of death from asthma were three times higher in Saskatchewan and Alberta than in Newfoundland. The national rate of hospital admission/separation for asthma, however, increased greatly, though changes in the rate varied by province. Increases of over 90% were observed in Prince Edward Island and New Brunswick, whereas little overall change occurred in Newfoundland, Manitoba and Saskatchewan. The rate of hospital admission/separation for asthma was highest in Prince Edward Island and lowest in Manitoba and British Columbia. Although the rates of hospital admission/separation for asthma among boys aged less than 15 years of age were consistently 50% higher than those among girls of that age, the rate among people aged 15 through 34 years was twice as high among females as males. A slight decrease in the rates of death from respiratory conditions other than asthma was observed, together with a steady, fairly substantial decline in the rates of hospital admission/separation for these conditions.
Conclusions: Whether there is any relation between increases in rates of admission to hospital for asthma and trends in the rates of death from asthma during the decade will require further study.

Objectif : Actualiser les comptes rendus sur la hausse des taux d'hospitalisation et de décès dus à l'asthme chez les enfants et les jeunes adultes au Canada dans les années 1970, par l'examen des données recueillies pour les années 1980.
Conception : Nous avons calculé les taux normalisés selon l'âge à partir des données sur les personnes qui avaient moins de 35 ans au moment du décès par asthme, bronchite ou autre pathologie respiratoire (de 1980 à 1989) et au moment de l'hospitalisation pour le traitement de ces maladies (de 1980 à 1988). Nous avons calculé les ratios normalisés

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de mortalité, le taux de décès pour le Canada étant le taux prévu.
Cadre : Nous avons examiné les données pour l'ensemble du Canada selon le sexe, le groupe d'âge et la province.
Résultats : Contrairement aux fortes augmentations de taux de décès par asthme observées de 1970 jusqu'au début des années 1980 chez les Canadiens de moins de 35 ans, le taux n'a affiché aucun changement net entre 1980 et 1989; nous avons constaté en moyenne 58 décès par année dans ce groupe d'âge. Au cours de la décennie, les taux de décès dus à l'asthme étaient trois fois plus élevés en Saskatchewan et en Alberta qu'à Terre-Neuve. Le taux national d'hospitalisation/de congé touchant l'asthme a toutefois augmenté considérablement, mais la fluctuation du taux a varié selon la province. Nous avons observé des hausses de plus de 90 % à l'Île-du-Prince-Édouard et au Nouveau-Brunswick et peu de changement global à Terre-Neuve, au Manitoba et en Saskatchewan. Le taux d'hospitalisation/de congé touchant l'asthme était le plus élevé à l'Île-du-Prince-Édouard et le plus faible au Manitoba et en Colombie-Britannique. Bien que les taux d'hospitalisation/de congé pour cette maladie chez les garçons de moins de 15 ans aient été constamment 50 % plus élevés que chez les filles d'âge comparable, le taux chez les personnes de 15 à 34 ans était deux fois plus élevé chez les femmes que chez les hommes. Nous avons observé une légère diminution des taux de décès par maladie respiratoire autre que l'asthme, ainsi qu'un déclin constant et assez prononcé des taux d'hospitalisation/de congé liés à ces pathologies.
Conclusions : La question de savoir s'il y a quelque rapport entre les augmentations des taux d'hospitalisation pour asthme et les tendances dans les taux de décès par asthme au cours de la décennie exigera une étude plus approfondie.

In a previous report[1] we and our colleagues documented sharp increases during the 1970s in the rates of hospital admission/separation and death from asthma in Canada, particularly among children and young adults. Although a new revision of the International Classification of Diseases[2] (ICD) had been adopted during the period of observation, an examination of the death certificates indicated that the increases could not be explained by coding artifact. Substantial increases in the rates of death from asthma in patients aged 5 through 34 years between the mid-1970s and the early 1980s had also been reported from Australia, the United Kingdom, the Netherlands, Sweden, the United States, West Germany and Israel.[3] In New Zealand, where the rate of death from asthma among young people greatly exceeded that in other developed countries, a rapid increase from 1975 to 1979 was followed by a sharp decline from 1982 to 1985.[3] To update our earlier report, we examined information on hospital admission/separation and death from asthma in Canada during the 1980s, focusing on the data for people less than 35 years of age.

In recent years interest in asthma has grown, as the greatly enlarged volume of publications on the subject in both the popular and the medical presses reflects. One result may be an increasing penchant to diagnose other chronic respiratory diseases as asthma. To explore the possibility of such diagnostic drift, we compared trends in hospital admission/separation and death due to chronic and acute bronchitis and other acute inflammations of the respiratory tract, including infection of the upper respiratory tract and tracheitis, with similar trends for patients with asthma.

Methods

We obtained, from the Canadian Centre for Health Information of Statistics Canada, data on hospital admissions/separations and on deaths caused by asthma (ICD-9 code 493) and other respiratory conditions, including chronic and acute bronchitis, emphysema, chronic obstructive airway disease, and acute laryngitis and tracheitis (ICD-9 codes 460 to 466, 490 to 492 and 496) among people less than 35 years of age; data on admissions/separations covered the period 1980 to 1988 and those on deaths 1980 to 1989. The ninth revision of the International Classification of Diseases came into use in 1979 and was in use during the whole study period.

Annual and period hospital admission/separation and mortality rates were calculated and standardized by the direct method, the referent being the age and sex distribution of the 1981 population of Canada. Differences between the age-standardized rate for all of Canada and those for the provinces were tested with the z-test for the calculation of a critical ratio.[4] Trends in mortality rates over time were analysed with the Poisson trend statistic.[5] Standardized mortality ratios were calculated, the expected rate being the death rate for Canada; the Poisson ratio test was applied to test for statistical significance.[5]

Results

From 1980 to 1989 the rate of death attributed to asthma among Canadians under age 35 fluctuated but showed no net change (Table 1) and no trend.

These results contrast with the increase in rate observed from 1970 through the early 1980s, when mortality among Canadians in this age group roughly doubled.[1] An average of 58 people under age 35 died annually during the 1980s; on average, 11 of those deaths occurred among children under the age of 15.

Over the decade, the rate of death from asthma was consistently about twice as high in the group aged 15 through 34 as in those under 15. Within the latter group there was no difference in death rate between the sexes. For the group aged 15 through 34, however, the death rate for males exceeded that for females by one-third to one-half over most of the period of observation.

Table 1: Age-standardized rates of death from asthma per 100 000 population in Canada, 1980 to 1989

Year	Age, yr; rate (and no. of deaths)		
	< 15	15–34	Total
		Males	
1980	0.11 (3)	0.66 (29)	0.45 (32)
1981	0.43 (12)	0.60 (27)	0.54 (39)
1982	0.07 (2)	0.67 (30)	0.44 (32)
1983	0.22 (6)	0.56 (25)	0.43 (31)
1984	0.15 (4)	0.39 (17)	0.29 (21)
1985	0.19 (5)	0.52 (23)	0.39 (28)
1986	0.45 (12)	0.75 (33)	0.63 (45)
1987	0.25 (7)	0.72 (32)	0.54 (39)
1988	0.26 (7)	0.52 (22)	0.42 (29)
1989	0.22 (6)	0.53 (22)	0.41 (28)
		Females	
1980	0.22 (6)	0.39 (17)	0.33 (23)
1981	0.08 (2)	0.43 (19)	0.30 (21)
1982	0.04 (1)	0.52 (23)	0.34 (24)
1983	0.04 (1)	0.71 (31)	0.45 (32)
1984	0.35 (9)	0.75 (32)	0.59 (41)
1985	0.27 (7)	0.45 (19)	0.38 (26)
1986	0.12 (3)	0.39 (17)	0.29 (20)
1987	0.16 (4)	0.46 (19)	0.35 (23)
1988	0.27 (7)	0.49 (21)	0.41 (28)
1989	0.24 (6)	0.38 (16)	0.32 (22)

Death due to asthma for the period 1980 to 1989 varied considerably among the provinces (Table 2). The highest death rates for people under 35, 0.7 per 100 000 population, were observed in Saskatchewan and Alberta. The rate in Newfoundland, 0.2 per 100 000 population, was the lowest.

In contrast to the overall stability in death rates over the decade, the rate of hospital admission/separation due to asthma increased by about 40% from 1980 to 1988; the average annual increase was 4.3%. Increases of 37% and 46% were observed in the people less than 15 and those aged 15 through 34 respectively (Figs. 1 and 2). In 1988 a total of 43 785 hospital admissions/separations were attributed to asthma among Canadians under age 35. The annual rate of hospital admission/separation among children less than 15 years of age was about five times that of people aged 15 through 34 years during the period studied. The average length of stay decreased from about 4.5 days in 1980 to about 3.5 days in 1988 (Fig. 3).

Among children less than 15 years of age, the rate of hospital admission/separation for boys was consistently more than 50% higher than the rate for girls (Fig. 1). In contrast, among people aged 15 through 34 years, the rate of hospital admission/separation was twice as high for females as for males over the same period (Fig. 2).

Over the period 1980 to 1988, the highest rate of hospital admission/separation for asthma among

Table 2: Age-standardized rates of death from asthma per 100 000 population and standardized mortality ratios (SMRs) (in reference to Canada) for people less than 35 years of age in Canada, 1980 to 1989

Province	Rate of death	No. of deaths		SMR
		Observed	Expected	
Newfoundland	0.2*	9	15	0.62
Prince Edward Island	0.4	3	3	1.03
Nova Scotia	0.3	15	20	0.74
New Brunswick	0.4	15	17	0.88
Quebec	0.4	144	152	0.95
Ontario	0.4	201	205	0.98
Manitoba	0.3	16	24	0.66
Saskatchewan	0.7*	37	23	1.62†
Alberta	0.7†	92	59	1.56†
British Columbia	0.3	50	64	0.79
Total	0.4	584	584	1.00

*$p < 0.05$.
†$p < 0.01$.

people under 35 years of age, 552 admissions per 100 000 population, was observed in Prince Edward Island. This rate was more than twice as high as the national rate. The lowest rates were observed in Manitoba and British Columbia.

Great variability among the provinces was also observed in the changes in hospital admission/separation over time (Table 3). Between 1980 and 1988 the greatest increases in the rate of hospital admission/separation for asthma among those under 35 occurred in Prince Edward Island and New Brunswick. Virtually all of the rise in Prince Edward Island was accounted for by an increase of well over 100% among those less than 15 years of age; no change occurred in the older group. In Newfoundland and Saskatchewan the overall rate of hospital admission/separation among people under 35 rose by less than 5%, and in Manitoba it fell. (In Saskatchewan the rate of hospital admission/separation among those aged 15 through 34 rose by about one-third over the period, but because the rate for those less than 15 remained unchanged, the overall increase was 5%.)

The combined rate of death due to chronic and acute bronchitis and other nonasthma respiratory conditions among people under 35 fluctuated little during the first third of the decade, then decreased slightly and remained fairly constant (Table 4). However, hospital admissions/separations attributed to these conditions declined steadily.

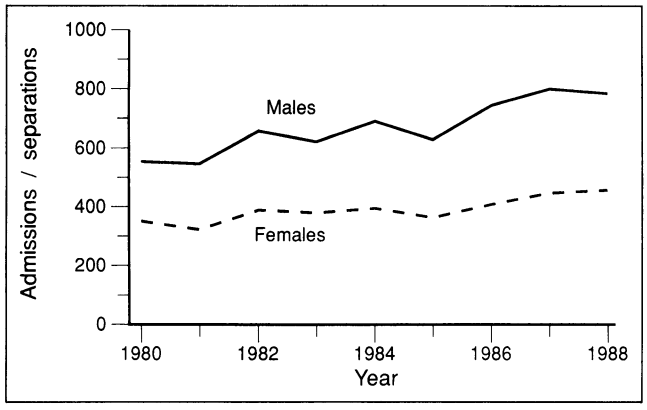

Fig. 1: Rates of hospital admission/separation for asthma per 100 000 population among children less than 15 years of age in Canada between 1980 and 1988.

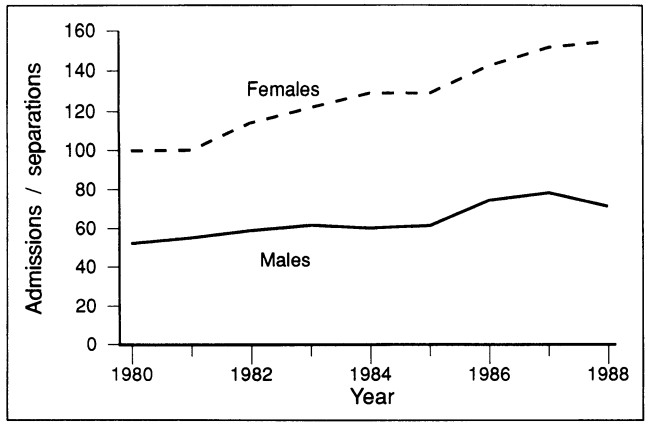

Fig. 2: Rates of hospital admission/separation for asthma per 100 000 population among people 15 through 34 years of age in Canada between 1980 and 1988.

Discussion

In contrast to the increase observed during the 1970s, the rate of death due to asthma among young Canadians appears to have stabilized during the 1980s. However, the rate of hospital admissions/separations rose even more quickly than during the previous decade. Whether there is any relation between continued increases in the rate of hospital admission/separation and the stabilization of death rates during the decade is unknown, though no correspondence is immediately evident.

The higher death rate together with the lower rate of hospital admission/separation among males than among females aged 15 through 34 may suggest that admission to hospital prevents death. No such relation is substantiated by data at the provincial level, however; low death rates in some provinces were not associated with high rates of admission/separation.

It is tempting to speculate that the differences between the sexes in the rates of admission to hospital among people aged 15 through 34 reflect behavioural differences — that is, a greater likelihood that women will seek medical care. Higher rates of admission/separation among women may also reflect greater morbidity, though females appear to be at a somewhat lower risk of death. This finding is consistent with data from England and Wales from the mid-1970s to the mid-1980s that showed higher rates of death from asthma among young males.[6] Data from New Zealand, however, showed a slightly

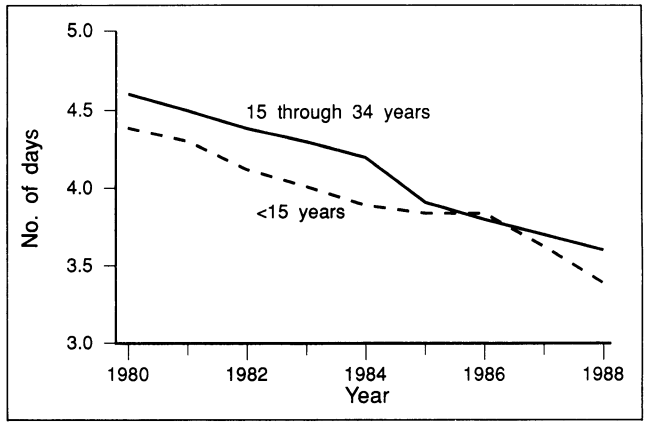

Fig. 3: Average length of stay in hospital for asthma among people less than 35 years of age in Canada between 1980 and 1988.

higher rate of death among females.[7] In the younger group, in which sex-based behavioural differences are less likely to account for differences in rates of hospital admission/separation, the consistently higher rates among boys than among girls probably reflect more asthma-related illness.

The continuing increase in the rates of hospital admission/separation for asthma over time may reflect one or more of several phenomena: a change in diagnostic preference over time, a true increase in the prevalence of the disease, an increase in the severity of the disease or an increase in the tendency of physicians to admit patients to hospital for treatment of acute asthma. Data indicating a reduction in the length of stay in hospital lend support to the last of these possibilities. Because the data reflect only the number of hospital admissions/separations, increases in rates could partially be attributed to more frequent admissions of the same individuals over time, rather than a rising prevalence of asthma. In addition, decreases in the rates of hospital admission/separation for other respiratory conditions during the 1980s suggest that at least some of the rise in admissions for "asthma" may have been due to diagnostic drift. However, evidence from Quebec showing a sharp increase in the number of children treated for asthma during the early 1980s suggests that the prevalence of the disease has increased among children there.[8]

Data from surveys in the United States show that the prevalence of asthma rose by 29% between 1980 and 1987; for those under 20 years of age, the prevalence increased by 42%.[9] In addition, the US rate of hospital admission/separation for asthma in those less than 17 years of age increased by 4.5% annually from 1979 to 1987.[10] It is thus reasonable to surmise that in Canada as well the increases in hospital admission/separation rates observed over the same period may be due to increases in the prevalence of the disease, as well as diagnostic drift and more frequent admission to hospital of the same individuals.

That the highest rates of death from asthma occurred in the Prairie provinces of Saskatchewan and Alberta is particularly intriguing in the light of findings reported recently by O'Hollaren and colleagues.[11] In a case series of young asthmatic patients who had sudden respiratory arrest the investigators found that sensitivity to the outdoor mould *Alternaria*, a common atmospheric mould spore that reaches its greatest abundance in grain-growing areas, was more frequent among the patients than among the controls. However, we observed a lower than expected rate of death in Manitoba, where much more area is devoted to grain than in Alberta; this observation weakens the possible link between mould sensitivity and asthma death, at least at the ecologic level.

The data on deaths due to bronchitis, emphysema and other respiratory conditions suggest that probably not a great deal of diagnostic transfer away

Table 4: Age-standardized rates of death and hospital admission/separation due to acute and chronic respiratory diseases other than asthma* among people less than 35 years of age in Canada, 1980 to 1989

Year	Rate of death	Rate of admission/separation
1980	0.45	525.47
1981	0.41	499.56
1982	0.45	493.99
1983	0.48	501.10
1984	0.30	446.67
1985	0.26	485.05
1986	0.21	454.47
1987	0.29	470.32
1988	0.30	418.88
1989	0.30	Not available

*Includes International Classification of Diseases, 9th revision, codes 460 to 466, 490 to 492 and 496.

Table 3: Age-standardized rates of hospital admission/separation for asthma per 100 000 population in Canada and percent change from 1980 to 1988

	Age group, yr; rate of admission/separation					
	< 15			15–34		
Province	In 1980	In 1988	% change	In 1980	In 1988	% change
Newfoundland	428.29	450.80	+5	95.40	98.41	+3
Prince Edward Island	849.97	1932.15	+127	214.12	216.36	+1
Nova Scotia	723.81	936.76	+29	121.09	147.25	+22
New Brunswick	389.22	782.98	+101	74.06	149.86	+102
Quebec	342.18	581.51	+70	37.60	66.49	+77
Ontario	495.48	665.40	+34	86.40	127.00	+47
Manitoba	389.67	354.87	−9	95.57	88.96	−7
Saskatchewan	666.24	653.52	−2	103.58	137.34	+33
Alberta	489.37	658.77	+35	97.25	143.86	+48
British Columbia	398.87	474.65	+19	85.95	114.10	+33

from those diseases toward asthma as the cause of death occurred over the 1980s. A small decrease in the rate of death from nonasthma respiratory conditions in the latter half of the decade may have accounted for some of the cases attributed to asthma.

The story on asthma in Canada is not yet complete. Lacking data on the prevalence of the disease, we cannot say how many young Canadians are afflicted, assess survival rates or even determine how rates of hospital admission/separation and death relate to rates of asthma in the population. As a first step in addressing some of the questions arising from our data, a national study of the prevalence of the disease should be undertaken.

Factors that might explain regional differences in rates of hospital admission/separation and death also need further investigation. For example, it is interesting but not sufficient to learn that for the past two decades the risk of dying from asthma has been greatest among young Canadians living in the Prairies and lowest among those living in Newfoundland. To explore the reasons for such differences, analytic studies should be designed to examine the relations between risk of asthma and environmental exposure, climatic conditions and pharmacotherapy.

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