

Asthma mortality rate in Swedish children and young adults 1973–88

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To investigate the asthma mortality rate in Sweden for the period 1973–88, we reviewed all death certificates for suspected death from asthma coded as 493 of the *International Classification of Diseases* (ICD)-8 and ICD-9 for the age group 1–24 years. Age-related mortality rates were calculated and compared with the results from a previous Swedish study of 1952–72. To identify factors contributing to death, we assessed hospital records. The mortality rate was 3.46 for the period 1973–88 and 3.31 for the earlier period, a net increase of 5%. This small overall increase includes a minor decrease in deaths for the age group 1–14 years and a rather pronounced increase for 15–24-year-old asthmatic patients. More deaths among “mild” asthmatic patients were found in the higher age group for 1986–8 than 1973–81. In younger children, asthma was more severe, and no difference was found between the two periods of the study. Asthma mortality is increasing in Sweden in adolescents and young adults, and there is a tendency to increasing mortality from less severe asthma not treated with anti-inflammatory drugs.

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Bronchial asthma is the most common chronic disease of childhood and adolescence. Many reports indicate that asthma morbidity and mortality have increased over the last decades in the industrialized countries (4, 5, 7, 8, 11). The increase in mortality rate is mainly due to the deaths of adult asthmatic patients; fatal cases among children are rare. The reason for the increase is still obscure, but factors such as outdoor and indoor pollution, patient compliance problems, and insufficient anti-inflammatory treatment, especially during periods of clinical deterioration, have been cited as possible causes of the increased mortality rate (2, 4, 12, 13).

The aim of this study was to investigate the asthma mortality rate in Sweden for 1973–88 in comparison with the results from a previous Swedish study of 1952–72 (7). Because an increased mortality rate was found among young adults during the last 10 years of the study, a further aim was to elucidate the events preceding the fatal asthma attack.

Material and methods

Death certificates for all suspected deaths from asthma in the age group 1–24 years for 1973–88 were obtained from Statistics of Sweden Data. Death from asthma referred to deaths coded as 493

in the *International Classification of Diseases* (ICD), ICD-8, or ICD-9. Adjacent code numbers 490–496 of ICD-9 and 490–493 of ICD-8 were also checked to ensure that no mistakes had been made on asthma as the main underlying cause of death. If the death certificates were not conclusive, hospital records were assessed to determine the cause of death.

In an attempt to identify factors that may have contributed to the increasing deaths from asthma among young asthmatics, hospital records for all patients, 1–24 years old, who died in Sweden during the periods 1973–5 (17 deaths), 1980–1 (22 deaths), and 1986–8 (35 deaths) were requested. Sixty (81%) of the records were obtained and assessed with regard to sex, age, severity of asthma, ongoing medical treatment, duration of fatal attack, place of death, and possible contributing factors. The following criteria for classification of the asthma condition as severe were used: treatment with oral or inhaled corticosteroids or cromoglycate combined with oral β_2 -agonists or theophyllines, use of oral β_2 -agonists and theophyllines on a regular basis, use of inhaled β_2 -agonists five times a day or more, and admission to hospital for acute asthma problems during the 6 months preceding the final attack. From the crude mortality figures, age-related mortality rates were calculated with data from the Statistical

Yearbooks of Sweden. For statistical comparison between groups, Fisher's exact test was used.

Results

A total of 146 cases, 78 male and 68 female, fulfilling the criteria for death from asthma, was identified for the whole observation period, 1973–88. All were coded as 493, implying that no asthma deaths were found under code numbers 490–492 or 494–496. Seven cases coded as 493 were rejected because asthma was not the primary cause of death. Two had died from intoxication by nonasthma drugs, and five from aspiration or infections secondary to severe brain damage combined with chronic lung problems.

The age-related mortality rate for the whole study group, 1–24 years, was 3.46. In the age group 1–14 years, it rose from 1.51 during the 1970s to 2.10 during the 1980s. The corresponding mortality rates for the age group 15–24 years were 4.29 and 6.97, respectively (Table 1). The numbers of deaths among males and females were almost identical (Table 2), showing only a slight predominance for males (52.7%). This difference was found only up to 14 years of age, after which there was no difference between the sexes.

In the previous Swedish study of 1952–72 (7), the crude mortality figures showed 183 deaths, 97 male and 86 female, and the calculated age-related mortality rate was 3.31. The increase in mortality rate between the two study periods was approximately 5%. This small increase was the net effect of a decrease in deaths among children and a pronounced increase among adolescents and young adults (Table 1; Fig. 1). The mortality rate in the older age

Table 1. Number of deaths from asthma per 1 million in age groups 1–14 and 15–24 years. Data for 1952–72 from reference 7

	1–14 years (<i>n</i> =147)	15–24 years (<i>n</i> =182)
1952–72	3.16	3.53
1973–80	1.51	4.29
1981–8	2.10	6.97

Table 2. Number of deaths from asthma in different age groups and in relation to sex. Data for 1952–72 from reference 7

Age group (years)	1952–72 <i>n</i> =183 (M/F)	1973–88 <i>n</i> =146 (M/F)
1–4	19 (12/7)	9 (5/4)
5–9	36 (19/17)	13 (8/5)
10–14	49 (26/23)	21 (13/8)
15–19	36 (21/15)	49 (24/25)
20–24	43 (19/24)	54 (29/25)

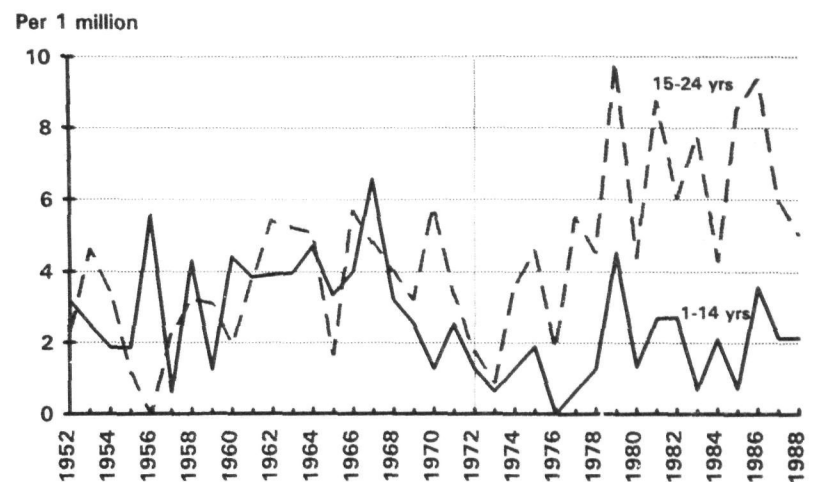


Fig. 1. Deaths from asthma per 1 million for age groups 1–14 years and 15–24 years, in 1952–88. Data from 1952–72 derived from reference 7.

group almost doubled between 1952–72 and 1981–8. The changing pattern was also clearly seen when the average age at death was calculated for each year (Fig. 2).

Sixty-one deaths occurred outside hospital, 25 during transport to hospital, and 60 after admission to hospital. These figures accord well with those found in the earlier Swedish study (7). During the periods 1973–5, 1980–1, and 1986–8, all but one of the deaths in children occurred in cases of severe asthma. On the other hand, 11/37 (29%) deaths among adolescents and young adults caused by asthma occurred in cases regarded as mild (Table 3) (difference between groups, $P < 0.05$). All these deaths in mild asthma occurred during the 1980s and most during 1986–8. None of these “mild” asthma cases seemed to have been treated with anti-inflammatory drugs such as cromoglycate or corticosteroids.

In 7/60 cases, one, four, and two, respectively, in the three periods studied, a near fatal asthma attack had happened before the fatal asthma attack. Death occurred within 3 h after the onset of the final attack in 33% of the asthmatic patients who died in 1973–5, and who had an informative hospital record. The

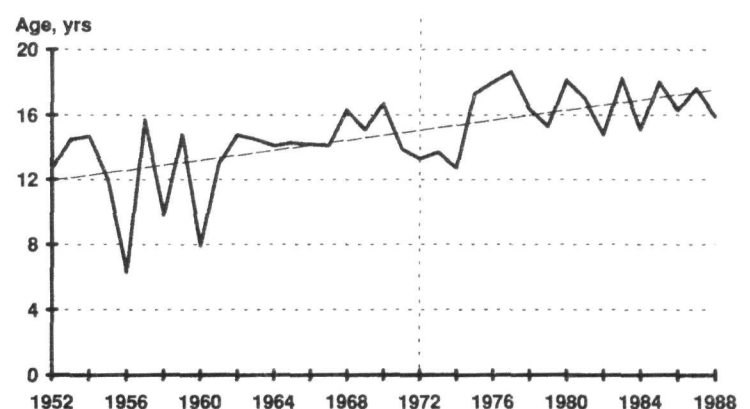


Fig. 2. Trend line and average age at death from asthma in 329 asthmatic patients, 1–24 years old, in 1952–88. Data from 1952–72 derived from reference 7.

Table 3. Estimated severity of asthma in 6 months preceding death. One patient record could not be assessed

	1–14 years		15–24 years	
	Mild	Severe	Mild	Severe
1973–5	0	6	0	5
1980–1	0	6	3	12
1986–8	1	9	8	9

corresponding figure for 1980–1 was 52% and for 1986–8, 68%.

In three cases, ingestion of nuts elicited the fatal asthma attack, and in another four cases, food may have contributed to the fatal reaction. Other factors such as recent exposure to furred pets, infection by common cold, or physical exercise were supposed to have contributed to the fatal outcome in some cases, but to what extent is uncertain.

Discussion

The age group 1–24 years was selected for the study in order to make a direct comparison with a previous Swedish study possible (7). The present study has shown that there was an increase in asthma mortality in the age group 15–24 years in Sweden in 1973–88. The results must be considered to be highly representative of the true asthma mortality in Sweden because an upper age limit of 24 years was imposed. This made it possible to avoid confusion with other pulmonary diseases such as chronic bronchitis and emphysema, and even with heart diseases (11). Children below the age of 1 year were not included because of difficulty in diagnosing asthma in this age group. Furthermore, to avoid diagnostic mistakes, we not only used the ICD code number 493, but we also checked the adjacent code numbers 490–496 for the main underlying cause of death, and if this information was not sufficient, we assessed hospital records to ensure a correct diagnosis. In some studies, the shift from ICD-8 to ICD-9 has been discussed as a contributing factor to the reported increase in the asthma mortality rates. However, this factor has probably not influenced the Swedish figures, because in Sweden ICD-8 was used until 1987, when a revised edition based on ICD-9 was introduced. All definitions of 490–493 are identical in ICD-8 and ICD-9.

There have been many reports of increased mortality from asthma over the last two decades, not only at higher ages but also in the age group 5–34 years (3, 5, 8, 9). The mortality rates for this age group show a marked variation from country to country, with rates from around 2–3 per million in the USA to about 20–30 per million in New Zealand.

In Europe, figures from 3.5 to 8 per million have been published. For the age group 15–24 years, mortality rates are available from only a few studies. In the USA, the rates increased from 3 to 4 per million over the period 1973–82 (5) and in the UK from about 8 to 12.5 per million from 1979 to 1987, but in 1989 the rate had decreased to around 9 per million (1). The mortality rate in Sweden for this age group over the period 1981–8, 6.97 per million, has approached the same level as in the UK.

The cause of the increased mortality rate from asthma in the industrialized world is still under debate, and no single factor has so far been pinpointed as the triggering mechanism. The increase in asthma morbidity parallels the reported increase in asthma deaths and the raised number of hospital admissions for acute asthma (10, 11). This development is surprising and perhaps even embarrassing because the general care of asthma patients has improved and pharmacotherapy today is far more effective than 20–30 years ago, considering the availability of potent topical steroids and other anti-inflammatory drugs as well as effective and selective β_2 -agonists.

One of the most important findings of the present study is not only the increasing mortality rate among 15–24-year-old asthmatic patients over the last decade, but also the fact that more adolescents and young adults with seemingly “mild” asthma and without ongoing anti-inflammatory treatment died from acute asthma attacks. Most of these patients had had severe allergic asthma at younger ages but had improved to such an extent that they no longer consulted an asthma specialist. It is quite probable that most of them still had allergic inflammation in their airways but had become well adapted to their “mild” symptoms and for that reason were undermedicated. Because most of them died at home or while traveling to hospital, it is likely that they had not recognized the early signs that their asthma was deteriorating and therefore did not seek qualified help in time. It is also possible that the life-threatening attack had come very suddenly and it had not been possible to save their lives. This view is supported by the fact that as many as 68% died within 3 h after the onset of the final attack during 1986–8. In a recent survey of asthma deaths in the UK during 1970–85 (6), 11/31 of 1–16-year-old children died within 3 h of the onset of the final asthma attack, and five of these cases had been considered to be under reasonable control. Nine of these rapid deaths occurred in 1980–5, reflecting the same tendency found in the present study.

To obtain more valid and detailed information on the events preceding fatal asthma attacks in children and young adults, we are planning a prospective study using standardized protocols.

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