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# Epidemiology of Deaths from Asthma in Pennsylvania, 1978-87

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## Synopsis .....

*Asthma affects an estimated 10 percent of the U.S. population and is the most common chronic disease among children. To determine one component of the public health burden of asthma in Pennsylvania, death certificates were reviewed of*

*persons younger than 35 years who died from asthma during the period 1978-87.*

*Blacks had nearly a sevenfold greater risk of death from asthma than whites. The highest death rates were found among black males and residents of the State's two largest urban areas, Philadelphia County and Allegheny County. A total of 67 percent of asthma deaths occurred outside of the health care system or in a hospital emergency department.*

*Although reasons for excess deaths among black urban residents are not well understood, inadequate access to health care may play a role. Deaths from asthma are uncommon, but they are largely preventable. Intensified public health, preventive, and curative strategies regarding asthma need to be directed to the black urban population.*

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**A**STHMA AFFECTS an estimated 10 percent of the U.S. population and is the most common chronic illness among children (1, 2). Asthma was the first listed diagnosis for 6.5 million ambulatory care visits in 1985 (3) and was responsible for an average of 458,000 hospitalizations annually between 1982 and 1986 (4). There were 4,597 reported deaths from asthma in 1988 (5).

The extent to which the public health impact of asthma in the Commonwealth of Pennsylvania mirrors the national experience is not known. In an effort to describe one component of the public health burden, deaths from asthma for a 10-year period were reviewed.

## Methods

Death certificates for Pennsylvania residents younger than 35 years whose underlying cause of death was coded as asthma were reviewed for the period 1978-87. All deaths in 1978 were selected that were coded as 493.0-493.9 under International Classification of Diseases, 8th Revision (ICD-8) (6); deaths during 1979-87 were coded under International Classification of Diseases, 9th Revision (ICD-9) (7).

The analysis was confined to deaths among

persons younger than 35 years, an age group in which death certificate accuracy in the diagnosis has been shown to be nearly 98 percent (8). Sears and colleagues found that if deaths at all ages were included in the analysis, the accuracy of the death certificate diagnosis of asthma declined to 67 percent.

Death certificates were abstracted for demographic information, including date of birth, date and time of death, sex, race, and residence. For the period 1979-87, information was available as to the decedent's status as inpatient, outpatient, or dead-on-arrival at a hospital. Five deaths of children younger than 2 years were excluded to improve the specificity of the case definition, since the diagnosis of asthma often cannot be made with certainty before that time (9). One was 4 months old, one was 9 months, two were 1 year, and one was 14 months. Five deaths of persons whose death certificates suggested that asthma may have been a contributory cause of death, rather than the cause, were excluded. Examples include narcotic overdose, smoke inhalation, and cancer metastatic to the brain. An asthma death was defined as one that was coded 493.0-493.9 under ICD-8 or ICD-9, if asthma was determined to be the underlying cause of death and the deceased was 2 to 34 years of age.

Pennsylvania population estimates for 1985, enumerated by county, age, sex, and race, were used to calculate rates. Rate ratios were calculated as measures of risk. Data were analyzed using Epi Info, a statistical analysis program designed at the Centers for Disease Control and Prevention for use in epidemiologic field investigations (10).

## Results

A total of 146 deaths from asthma were recorded in the period 1978–87; 136 met the case definition of asthma used in this analysis. Of these, 127 were coded 493.9 and 9 were coded 493.0. The average annual death rate for persons younger than 35 years in Pennsylvania was 2.3 per million population.

The largest annual numbers of asthma deaths were recorded for 1983 (20 deaths) and 1987 (19 deaths); the fewest were recorded for 1979 (7 deaths) and 1981 (7 deaths) (figure). During the 10-year period, the month with the largest number of deaths was July (17 deaths), and the fewest were in August (4 deaths). Slightly more deaths occurred during the periods of March through May (37) and September through November (39).

A total of 33 deaths occurred during the summer period of June through August, and 27 were in the winter period of December through February.

By time of day, the number of asthma deaths peaked during the period from 8 a.m. to noon. When stratified by place of death, virtually all of the periodicity is explained by deaths among non-hospitalized persons.

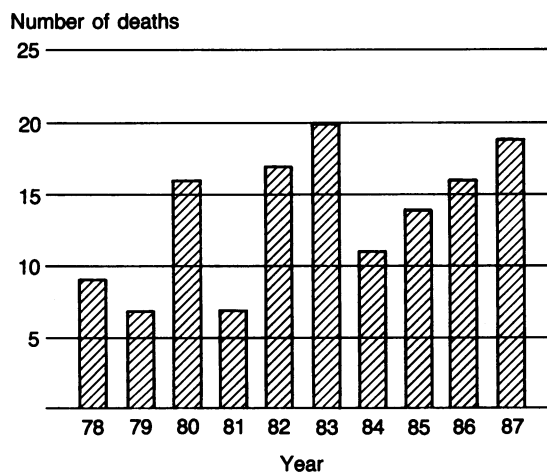
A total of 81 of the deceased (60 percent) were male; the average annual death rate for males younger than 35 years was 2.7 per million, compared with 1.9 for females (a rate ratio of 1.4).

Decedents ranged in age from 3 to 34 years, with a mean of 22 years; 84 percent were 15 to 34 years old (table 1). The risk of death increased sharply for those older than 15 years compared with those younger than 5 years (table 1). Persons 20 to 34 years of age had a nearly fivefold elevated risk of death compared with children ages 2 to 5 years.

A total of 74 (54 percent) deaths occurred among whites; death rates were 1.4 per million per year for whites and 9.1 per million per year for blacks (a rate ratio of 6.5). Black men had the highest death rates from asthma (12 per million per year) and white women had the lowest (1.2 per million per year).

The death rate for black women was 6.6 per

Asthma mortality, Pennsylvania, 1978–87



million per year and for white men was 1.6 per million per year.

Deaths were concentrated in Allegheny County and Philadelphia County. A total of 59 decedents (43 percent) were residents of Philadelphia, an average annual death rate of 7 per million population.

A total of 21 deaths (15 percent) occurred among residents of Allegheny County, an average annual rate of 3 per million population.

The risk of death from asthma in Allegheny County was elevated nearly sevenfold for blacks, compared with whites (table 2). In Philadelphia County, the risk was nearly threefold higher for blacks, compared with whites (table 2).

Of 127 decedents for whom the place of death was recorded, 42 (33 percent) died in a hospital, 27 (21 percent) were dead on arrival at a hospital, and 40 (32 percent) died in a hospital emergency department. An additional 18 (14 percent) were coded as "other" for the place of death, and most often were found dead at home. There were no substantial differences in place of death stratified by age group, sex, race, or county of residence.

## Discussion

During the period 1978–87 in Pennsylvania, urban residents, particularly blacks, were at increased risk of death from asthma. Higher mortality rates in Philadelphia and Allegheny Counties may be explained, in part, by the larger proportions of blacks in the populations of those counties. The risk of death from asthma for whites in Philadelphia was twice that for whites in Allegheny

Table 1. Average annual death rates<sup>1</sup> for asthma, by age group, Pennsylvania, 1978-87

Age group (years)	Number	Percent	Rate <sup>2</sup>	Rate ratio <sup>3</sup>
2-4	4	6	0.8	0.2
5-9	3	2	0.4	0.1
10-14	15	10	1.9	0.6
15-19	25	18	2.7	0.9
20-24	31	23	3.1	1.0
25-29	29	21	2.9	0.9
30-34	29	21	3.1	1.0
Total	136	100	...	...

<sup>1</sup> 1985 population estimates were used to calculate rates.

<sup>2</sup> Per million population.

<sup>3</sup> Age group 30-34 years is referent.

Table 2. Average annual death rates<sup>1</sup> for asthma, by race and residence, Pennsylvania, 1978-87

Residence	Rate <sup>2</sup>	Rate ratio <sup>3</sup>
Pennsylvania:		
White	1.4	1.0
Black	9.1	6.5
Allegheny County:		
White	2.0	1.0
Black	13.0	6.5
Philadelphia County:		
White	4.0	1.0
Black	11.0	2.8

<sup>1</sup> 1985 estimates for the population 2-34 years of age were used to calculate county- and race-specific rates.

<sup>2</sup> Per million population.

<sup>3</sup> White race is referent.

County, however. Other investigators have reported excess asthma deaths in Philadelphia (11) and among black males (1, 12, 13).

The peak time of death (8:00 a.m. to noon) is accounted for primarily by out-of-hospital and emergency department deaths. This finding may reflect severe asthma exacerbations that began the night before, for which medical attention was not sought. Other investigators have found a clustering of deaths at night or in the early morning hours, a finding thought to be related to diurnal variation in airflow limitation or to sleep-related hypoxemia (14, 15).

Although the number of observations was small, more deaths occurred during the fall and spring than during the summer and winter. Other investigators have found that deaths among atopic persons peak in the fall and spring, a finding thought to be related to exposure to seasonal airborne allergens (15).

A total of 67 percent of the asthma deaths occurred either outside the health care system or in a hospital emergency department. Whether some of

these deaths reflect rapidly evolving illness, inadequate access to long-term and ongoing health care, or poor patient compliance is not known. Underuse of theophylline (16), withdrawal of theophylline (17), and overreliance on inhaled bronchodilators (14, 16, 18, 19) have been implicated in fatal asthma. Maladaptive behaviors (16) and depression (16, 20) are thought to increase the risk of death from asthma.

Differences in the prevalence of asthma between blacks and whites (12 percent versus 10 percent for persons of all ages) do not alone explain twofold to threefold elevated death rates from asthma among blacks (1, 13). Wissow found that poverty explained increased rates of hospitalization for asthma among black children compared with white children (21). Weitzman and coworkers found that social and environmental factors accounted for the differences in asthma prevalence between black and white children (22).

Among Baltimore schoolchildren with asthma, twice as many black children as white children were emergency department users, and emergency department users had twice as many hospital admissions for asthma (23). Black Americans often have no source of primary care (24, 25) and often report eschewing medical care for economic reasons (24).

An association between asthma and poverty, excess deaths among urban blacks, and a tendency for deaths to occur outside the health care system or in hospital emergency departments suggest that inadequate access to medical care for asthma as well as discontinuities in care may play a role in increasing the risk of death from asthma. The optimal management of asthma calls for long term ongoing medical care, including medications, medical devices, and physician visits, all of which may be beyond the reach of the uninsured or the underinsured.

Philadelphia had the highest poverty rate of all Pennsylvania counties in 1980, with 20.5 percent of residents living in poverty compared with 10.4 percent for the State (26). Furthermore, in 1985, 22.2 percent of Philadelphia residents were eligible for Medical Assistance (Pennsylvania Medicaid), compared with 9.5 percent in the State overall (personal communication, Linda Mann, State Health Data Center, Pennsylvania Department of Health, May 21, 1992). The proportion of Philadelphia residents with no health insurance is not known.

Several limitations of this death certificate review are noted. First, misclassification of cases may have occurred which, because overall numbers are

small, may have affected the results. The findings reported are consistent with previous findings, however (11-13), suggesting that any effect of misclassification is unlikely to have affected the overall trends in the data. Second, death certificates by themselves provide little detail on the circumstances of death and no information on medication use, gaps in the patient's knowledge, or socioeconomic barriers that may have contributed to death.

Death from asthma is largely preventable. Asthma deaths can be considered sentinel health events, occurrences that justify additional study to determine remediable underlying causes (27). Further investigation, including follow back studies, is necessary to determine to what extent various factors play a role in preventing death from asthma. Among those factors are health insurance coverage, access to primary care, the availability of specialized services (including mental health services), access to medications, and effective patient and family education. Attention needs to be focused especially on black urban residents.

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