

Trends in Asthma Mortality among African Americans and Whites in Chicago, 1968 through 1991

ABSTRACT

Death certificate data were used to examine asthma mortality among African Americans and Whites aged 5 through 34 years in Chicago from 1968 through 1991. African Americans experienced consistently higher asthma mortality throughout the period. Asthma mortality remained stable among Whites from 1968 through 1991 but increased by 337% among African Americans from 1976 through 1991 ($P < .001$). The increase was greatest among 20-through 34-year-olds. Between 1979 and 1991, outpatient and emergency department deaths increased significantly, while the proportion of dead-on-arrival cases remained stable at 51%. This shift to non-inpatient deaths suggests that lack of access to health care may play a role in increasing asthma mortality. (*Am J Public Health*. 1994;84:1830-1833)

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Introduction

From 1982 through 1986, asthma mortality among 5- through 34-year-olds in the United States increased by 6.2% annually.¹ High mortality rates relative to the rest of the country²⁻⁴ and a greater increase in mortality (10.2% annually) were noted for New York City and Chicago (Cook County, Illinois) during the same period.⁴

Although concomitant increases in asthma prevalence and hospitalization were reported throughout the 1980s,^{5,6} the very rapid increase in mortality suggests that other factors may be involved. Limited health care access,⁷ a lack of recognition of asthma severity by patient or physician,⁸ psychosocial dysfunction of patient and family,⁹ and overuse or inappropriate use of asthma medication leading to toxicity or delays in accessing appropriate medical treatment¹⁰ have been identified as possible contributing factors.

This study of asthma mortality in Chicago from 1968 through 1991 was undertaken to extend previous research examining characteristics of asthma deaths in Chicago.²

Methods

Death certificate data for all 5-through 34-year-old residents of Chicago with asthma as the underlying cause of death from 1968 through 1991 were collected from the Illinois Department of Public Health. The Eighth Revision of the *International Classification of Diseases* (ICD), used from 1968 through 1978, was replaced by the Ninth Revision in 1979. According to National Center for Health Statistics reports, 96% of deaths coded for asthma using ICD-8 were also coded for asthma using ICD-9.¹¹

Demographic information used in this study included sex, race (White or African American), age at death, hospital status at death (inpatient, emergency department patient or outpatient, dead on arrival [DOA], other), and secondary causes of death. Hospital status was

recorded on death certificates from 1979 through 1991. Four persons of Chinese origin were excluded because the small number precluded detailed analysis.

Statistical analysis included chi-square comparisons of hospital status by race, sex, age, and combinations of these variables. Trends in the proportion of patients who were DOA, who died in the emergency department or as outpatients, or who died as hospital inpatients from 1979 through 1991 were examined with linear regression for the complete Chicago population as well as for race- and age-specific groups.

Age-, sex-, and race-specific populations for 5- through 34-year-olds in Chicago were obtained from the City of Chicago Department of Planning. Yearly asthma mortality rates were calculated and adjusted to the 1980 US population.¹² Separate analyses of trends in mortality were performed by linear regression for the periods 1968 to 1976 and 1976 through 1991, which exhibited distinctly different temporal patterns.

Results

From 1968 through 1991, asthma was listed as the underlying cause of death for 344 Chicago residents aged 5 through 34 years, including 4 Chinese persons who were excluded from the analysis. The number of deaths per year ranged from 2 through 27 overall, from 0 through 6 for Whites, and from 1 through 24 for African Americans. Of the 340 deaths examined,

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This paper was accepted March 30, 1994.

292 (85.9%) were among African Americans, a proportion that did not vary significantly over time. Proportions of deaths by sex (50.3% of deaths occurred among females) did not differ by race ($\chi^2 = 0.04$, $P = .84$) or age group ($\chi^2 = 0.01$, $P = .96$). The death certificates of 2 Whites listed Mexico as the country of citizenship, and 11 deaths occurred among Whites who had been born in Mexico, Puerto Rico, or "other Spanish" countries. These persons were considered Whites in this analysis.

No significant differences in hospital status by sex, race, or age group were detected (Table 1). There were higher proportions of DOA cases among 20-through 34-year-olds than among 5-through 19-year-olds (54% vs 44%) and higher proportions of inpatient deaths among females than among males (24% vs 14%), but these differences were not significant. Autopsies were performed on 62% of deaths, including 78% of DOA cases from 1979 through 1991.

Cardiac dysrhythmias were the most commonly cited accompanying causes of death, occurring in 36 (11%) of the cases. For 11 deaths, medicinal or recreational drug poisoning was listed as an accompanying cause; all of these deaths occurred among African-American persons aged 20 through 34 years. Ten of the 11 drug poisoning deaths occurred between 1980 and 1991, representing 7% of deaths among 20- through 34-year-old African Americans during that period. No differences in hospital status were found between cardiac dysrhythmias or drug poisonings and other deaths.

All measures of asthma mortality among 5- through 34-year-olds declined insignificantly from 1968 to 1976 in Chicago. Overall asthma mortality declined at a rate of 0.024 deaths per 100 000 persons annually ($F = 1.16$, $P > .05$). The decline was greater among African Americans than among Whites (0.063 vs 0.017 deaths per 100 000 persons annually) but remained insignificant within race groups, as did the decreases among age-specific groups (5 through 19 years, 20 through 34 years) within races.

From 1976 through 1991, overall asthma mortality increased significantly, at a rate of 0.039 deaths per 100 000 persons annually (Table 2). Asthma mortality rates among Whites ranged from 0 deaths in 1971, 1973, 1978, and 1989 to 1.33 deaths per 100 000 persons in 1985, with no significant trends during this period.

TABLE 1—Hospital Status, by Race, Age Group, and Sex, 1979 through 1991^a

	Dead on Arrival		Emergency Department/Outpatient		Inpatient		Other		P
	No.	%	No.	%	No.	%	No.	%	
Race									
African American	111	52	59	27	40	19	5	2	.19
White	15	48	7	23	6	19	3	4	
Age group									
5–19 y	31	44	21	30	17	24	1	1	.27
20–34 y	95	54	45	26	29	16	7	4	
Sex									
Female	64	52	28	23	29	24	2	2	.08
Male	62	50	38	31	17	14	6	5	

^aHospital status data were not recorded on death certificates from 1968 through 1978.

TABLE 2—Linear Regression: Annual Increases in Asthma Mortality Rates^a among Persons Aged 5 through 34 Years, Chicago, 1976 through 1991

	Annual Increase ^a	SE	P
Citywide	0.039	0.021	NS
Whites			
5–19 y	0.019	0.031	NS
20–34 y	0.021	0.032	NS
Overall	0.020	0.023	NS
African Americans			
5–19 y	0.076	0.029	< .03
20–34 y	0.261	0.057	< .001
Overall	0.170	0.031	< .001
African-American males			
5–19 y	0.051	0.047	NS
20–34 y	0.237	0.093	< .03
Overall	0.146	0.058	< .03
African-American females			
5–19 y	0.102	0.060	NS
20–34 y	0.285	0.078	< .003
Overall	0.195	0.044	< .001

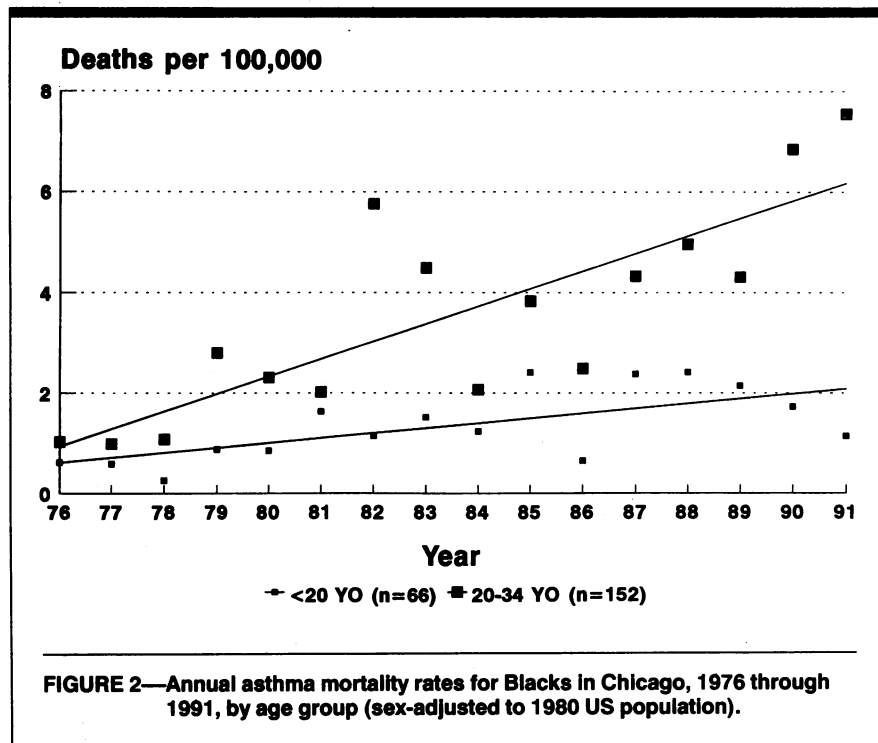
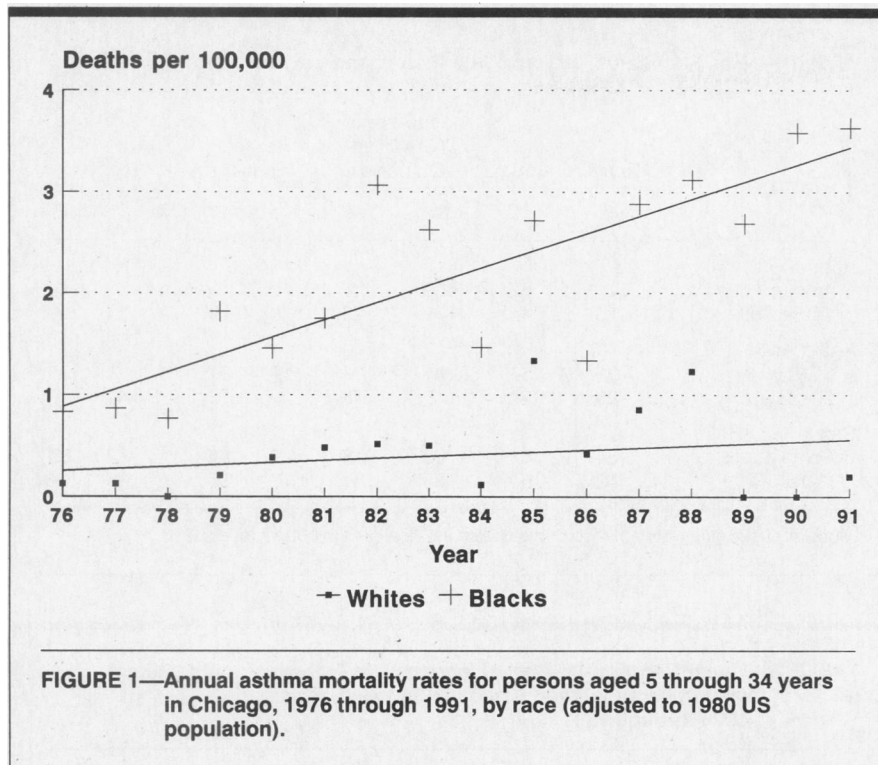
Note. NS = not significant.

^aDeaths per 100 000 population.

Asthma mortality among African Americans increased from a nadir of 0.77 to 0.86 deaths per 100 000 persons between 1976 and 1978 to a peak of 3.63 deaths per 100 000 persons in 1991 (Figure 1). The increase from 1976 to 1991 (0.83 to 3.63 deaths per 100 000 persons) was 337% over a 15-year period, or 22.5% annually. This significant increase (0.170 deaths per 100 000 persons per year) occurred among both males and females, regardless of age classification. Age-specific increases were significant among 5- through 19-year-old and 20- through 34-year-old African Americans (Figure 2)

but were approximately 3.5-fold greater in the older age group (Table 2). Examination of data from 1979 through 1991, during which only ICD-9 codes were used, did not significantly alter the magnitude of any regression estimates calculated above.

Annual changes in hospital status were examined for 1979 through 1991, the years for which such data were collected. Among persons aged 5 through 19 years, a significant overall increase in the proportion of patients dying in emergency departments or outpatient clinics (2.4% annually, $P < .01$) was seen (from 1979



through 1991), but this increase was nonsignificant within race groups. Among persons aged 20 through 34 years, there was a significant annual increase in the proportion of deaths occurring in emergency departments and outpatient clinics overall (3.3%, $P < .004$) as well as for African Americans (2.8%, $P < .006$) and

Whites (4.1%, $P < .02$) as groups. No other significant changes in hospital status occurred over time among 20- through 34-year-old Whites, but a significant decrease occurred during this period in the proportion of African-American 20-through 34-year-olds who died as inpatients (1.3% annually, $P < .05$).

Discussion

Asthma mortality trends among African Americans in Chicago are similar to those seen internationally,^{13,14} and overall decreases in asthma mortality observed from 1968 through 1976 were consistent with national trends for that period.¹ The disproportionate increases among African-American adults aged 20 through 34 years in Chicago, however, have not been previously reported, although several authors have noted increasing mortality from asthma among children in the United States.^{1,15} In 1990 and 1991, asthma mortality rates in Chicago were 3.58 to 3.63 and 0.00 to 0.20 per 100 000 persons among African Americans and Whites, respectively, resulting in African American:White mortality rate ratios far in excess of the two- to four-fold increases seen in previous studies.^{2,3,16} The fact that 13 deaths were among persons recorded as White but for whom other information indicated Hispanic origin suggests that racial differences in asthma mortality may be even larger than reported here.

We have previously shown that mortality from asthma is inversely correlated with measures of income and that African Americans, in general, suffer worse socioeconomic conditions than Whites in Chicago.² An inverse association between socioeconomic status and asthma mortality has also been reported in New York City.³

Trends in asthma mortality can reflect trends in prevalence, severity of disease, treatment, or access to and utilization of health services. Previous studies indicate that asthma prevalence and incidence increased during the 1980s.^{5,17,18} Factors that may be contributing to higher prevalence or greater severity of disease include increased survival of low-birthweight children, who are at higher risk for development of asthma, and increased exposure to environmental allergens and irritants. The magnitude of the increases in prevalence was much less striking than that noted here for asthma mortality, particularly among 20- through 34-year-old African Americans, suggesting that characteristics affecting severity of disease, treatment, or health care access may be etiologically related to death from asthma.

Among Michigan residents younger than 45 years, the number of prescription asthma medications and prescribed metered dose inhalers per person increased significantly faster among Medicaid recipients than among the non-Medicaid popu-

lation annually from 1981 through 1985.¹⁹ Previous studies have suggested that inhaled bronchodilator medications may increase the risk of asthma mortality²⁰ or morbidity²¹ and that tolerance to beta-agonists may develop over time among persons with mild asthma.^{22,23} It is not clear, however, why use of beta-agonists would differentially affect 20- through 34-year-old African Americans, unless improper instruction for, use of, and/or compliance with the medication interacts with other factors, such as poverty or lack of access to health care.

Interpretation of accompanying causes of death in this study is limited by the use of three-digit ICD codes, which prevent the identification of specific drugs listed as contributing to the deaths of 11 African-American 20- through 34-year-olds. It is notable that the use of beta-agonists,²⁴ as well as crack cocaine,²⁵ aspirin,²⁶ and other drugs,²⁷ has been postulated in death from asthma. Identification of asthma as a cause of death in this study was limited to primary diagnosis in persons aged 5 through 34 years to minimize misclassification.^{28,29}

Lack of access to health care has been proposed as a contributor to the increase in mortality from asthma.^{2,3,16} From 1979 through 1987, 48.6% of White and 46.7% of African-American asthma deaths occurred in hospital nationally,¹ whereas in this Chicago study only 19.4% and 18.6% of asthma deaths among Whites and African Americans, respectively, were recorded as inpatient deaths. Half of the uninsured in Chicago are between the ages of 18 and 34,³⁰ and uninsured persons and Medicaid recipients may be at higher risk for substandard care in hospitals and emergency departments.³¹ Among 20- through 34-year-old African Americans in Chicago, for whom asthma mortality is increasing most rapidly, the proportion of inpatient deaths declined, while emergency department and outpatient clinic deaths significantly increased and DOA cases remained stable at a high rate (51%), suggesting that access to care is an issue in increasing asthma mortality in Chicago.

More detailed information on asthma deaths in Chicago is necessary to explore further the possible influence of specific factors on increasing asthma mortality, particularly differences in health care access between race- and income-specific groups, the contribution of low-birth-weight survivors, and recreational and medicinal drug use. Although the development of effective therapies for the treat-

ment of asthma may be considered a medical success story, death from asthma continues to be a preventable tragedy in which social, cultural, and economic conditions conspire to undermine the best clinical efforts. □

Acknowledgments

This research was supported in part by the Educational Resource Center of the University of Illinois Occupational Health and Safety Center (NIOSH grant T15 OH07104) and the Asthmatic Children's Aid Foundation.

We would like to thank Mr Mark Peters of the Illinois Department of Public Health, Division of Vital Statistics, for his gracious cooperation in providing mortality data, and Dr Patricia Kelleher for her efforts and thoughtful comments in reviewing the manuscript.

References

- Weiss KB, Wagener DK. Changing patterns of asthma mortality: identifying target populations at high risk. *JAMA*. 1990; 264:1683-1687.
- Marder D, Targonski P, Orris P, Persky V, Addington W. Effect of racial and socioeconomic factors on asthma mortality in Chicago. *Chest*. 1992;101(suppl):426S-429S.
- Carr W, Zeitel L, Weiss K. Variations in asthma hospitalizations and deaths in New York City. *Am J Public Health*. 1992;82:59-65.
- Weiss KB, Wagener DK. Geographic variations in US asthma mortality: small-area analyses of excess mortality, 1981-1985. *Am J Epidemiol*. 1990;132(suppl 1):S107-S115.
- Centers for Disease Control. Asthma—United States, 1980-1987. *MMWR*. 1990;39: 493-497.
- Weiss KB. Seasonal trends in US asthma hospitalizations and mortality. *JAMA*. 1990; 263:2323-2328.
- McFadden ER Jr, Gilbert IA. Asthma. *N Engl J Med*. 1992;327:1928-1937.
- Johnson AJ, Nunn AJ, Somner AR, Stableforth DE, Stewart CJ. Circumstances of death from asthma. *BMJ*. 1984;288:1870-1872.
- Birkhead G, Attaway NJ, Strunk RC, Townsend MC, Teutsch S. Investigation of a cluster of deaths of adolescents from asthma: evidence implicating inadequate treatment and poor patient adherence with medications. *J Allergy Clin Immunol*. 1989; 84:484-491.
- Sly RM. Mortality from asthma. *N Engl Reg Allergy Proc*. 1986;60:433-443.
- Duggar DB, Lewis WF. Comparability of diagnostic data coded by the 8th and 9th International Classification of Diseases. *Vital Health Stat [2]*. 1987; no. 104. DHHS publication PHS 87-1378.
- Statistical Abstract of the United States: 1983 (103rd Printing)*. Washington, DC: US Dept of Commerce, Bureau of the Census; 1983.
- Sears MR. Worldwide trends in asthma mortality. *Bull Int Union Tuberc Lung Dis*. 1991;66:79-83.
- Benatar SR, Ainslie GM. Deaths from asthma in Cape Town, 1980-1982. *S Afr Med J*. 1986;69:669-671.
- Sly RM. Mortality from asthma, 1979-1984. *J Allergy Clin Immunol*. 1988;82:705-717.
- Schwartz E, Kofie VY, Rivo M, Tuckson RV. Black/White comparisons of deaths preventable by medical intervention: United States and the District of Columbia, 1980-1986. *Int J Epidemiol*. 1990;19:591-598.
- Weitzman M, Gortmaker SL, Sobol A, Perrin JM. Recent trends in the prevalence and severity of childhood asthma. *JAMA*. 1992;268:2673-2677.
- Yunginger JW, Reed CE, O'Connell EJ, Melton LJ III, O'Fallon WM, Silverstein MD. A community-based study of the epidemiology of asthma: incidence rates, 1964-1983. *Am Rev Respir Dis*. 1992;146: 888-894.
- Gerstman BB, Bosco LA, Tomita DK, Gross TP, Shaw MM. Prevalence and treatment of asthma in the Michigan Medicaid patient population younger than 45 years, 1980-1986. *J Allergy Clin Immunol*. 1989;83:1032-1039.
- Spitzer WO, Suissa S, Ernst P, et al. The use of beta-agonists and the risk of death and near death from asthma. *N Engl J Med*. 1992;326:501-506.
- Sears MR, Taylor DR, Print CG, et al. Regular inhaled beta-agonist treatment in bronchial asthma. *Lancet*. 1990;336:1391-1396.
- Cheung D, Timmers MC, Zwinderman AH, Bel EH, Dijkman JH, Sterk PJ. Long-term effects of a long-acting beta₂-adrenoceptor agonist, salmeterol, on airway hyperresponsiveness in patients with mild asthma. *N Engl J Med*. 1992;327:1198-1203.
- O'Connor BJ, Aikman SL, Barnes PJ. Tolerance to the nonbronchodilator effects of inhaled beta₂-agonists in asthma. *N Engl J Med*. 1992;327:1204-1208.
- Pearce N, Crane J, Burgess C, Jackson R, Beasley R. Beta-agonists and asthma mortality: deja vu. *Clin Exp Allergy*. 1991;21:401-410.
- Rao AN, Polos PG, Walther FA. Crack abuse and asthma: a fatal combination. *NY State J Med*. 1990;90:511-512.
- Tan Y, Collins-Williams C. Aspirin-induced asthma in children. *Ann Allergy*. 1982;48:1-5.
- Hunt LW, Rosenow EC III. Asthma-producing drugs. *Ann Allergy*. 1992;68:453-462.
- Sears MR, Rea HH, deBoer G, et al. Accuracy of certification of deaths due to asthma: a national study. *Am J Epidemiol*. 1986;124:1004-1011.
- Barger LW, Vollmer WM, Felt RW, et al. Further investigations into the recent increase in asthma death rates: a review of 41 deaths in Oregon in 1982. *Ann Allergy*. 1988;60:31-39.
- Chicago and Cook County Health Care Action Plan: Report of the Chicago and Cook County Health Care Summit. Vol 2: Appendices*. Chicago, Ill: Illinois Department of Public Health; 1990.
- Burstin HR, Lipsitz SR, Brennan TA. Socioeconomic status and risk for substandard medical care. *JAMA*. 1992;268:2383-2387.