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Surveillance for Asthma — United States, 1960–1995

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Contents

Reports Published in *CDC Surveillance Summaries* Since January 1, 1985 ii
Introduction 2
Methods 2
Results 5
Discussion 6
References 10
State and Territorial Epidemiologists and Laboratory Directors ..... inside back cover

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Reports Published in *CDC Surveillance Summaries* Since January 1, 1985

Subject	Responsible CIO/Agency*	Most Recent Report
Abortion	NCCDPHP	1997; Vol. 46, No. SS-4
AIDS/HIV		
Distribution by Racial/Ethnic Group	NCID	1988; Vol. 37, No. SS-3
Among Black & Hispanic Children & Women of Childbearing Age	NCEHIC	1990; Vol. 39, No. SS-3
Asthma	NCEH	1998; Vol. 47, No. SS-1
Behavioral Risk Factors	NCCDPHP	1997; Vol. 46, No. SS-3
Birth Defects		
B.D. Monitoring Program (see also Malformations)	NCEH	1993; Vol. 42, No. SS-1
Contribution of B.D. to Infant Mortality Among Minority Groups	NCEHIC	1990; Vol. 39, No. SS-3
Breast & Cervical Cancer	NCCDPHP	1992; Vol. 41, No. SS-2
Campylobacter	NCID	1988; Vol. 37, No. SS-2
Chancroid	NCPS	1992; Vol. 41, No. SS-3
Chlamydia	NCPS	1993; Vol. 42, No. SS-3
Cholera	NCID	1992; Vol. 41, No. SS-1
Chronic Fatigue Syndrome	NCID	1997; Vol. 46, No. SS-2
Congenital Malformations, Minority Groups	NCEHIC	1988; Vol. 37, No. SS-3
Contraception Practices	NCCDPHP	1992; Vol. 41, No. SS-4
Cytomegalovirus Disease, Congenital	NCID	1992; Vol. 41, No. SS-2
Dengue	NCID	1994; Vol. 43, No. SS-2
Dental Caries & Periodontal Disease Among Mexican-American Children	NCPS	1988; Vol. 37, No. SS-3
Developmental Disabilities	NCEH	1996; Vol. 45, No. SS-2
Diabetes Mellitus	NCCDPHP	1993; Vol. 42, No. SS-2
Dracunculiasis	NCID	1992; Vol. 41, No. SS-1
Ectopic Pregnancy	NCCDPHP	1993; Vol. 42, No. SS-6
Elderly, Hospitalizations Among	NCCDPHP	1991; Vol. 40, No. SS-1
Endometrial & Ovarian Cancers	EPO, NCCDPHP	1986; Vol. 35, No. 2SS
Escherichia coli O157	NCID	1991; Vol. 40, No. SS-1
Evacuation Camps	EPO	1992; Vol. 41, No. SS-4
Family Planning Services at Title X Clinics	NCCDPHP	1995; Vol. 44, No. SS-2
Foodborne Disease	NCID	1996; Vol. 45, No. SS-5
Gonorrhea & Syphilis, Teenagers	NCPS	1993; Vol. 42, No. SS-3
Hazardous Substances Emergency Events	ATSDR	1994; Vol. 43, No. SS-2
Health Surveillance Systems	IHPO	1992; Vol. 41, No. SS-4
Hepatitis	NCID	1985; Vol. 34, No. 1SS
Homicide	NCEHIC	1992; Vol. 41, No. SS-3
Homicides, Black Males	NCEHIC	1988; Vol. 37, No. SS-1
Hysterectomy	NCCDPHP	1997; Vol. 46, No. SS-4
Infant Mortality (see also National Infant Mortality; Birth Defects; Postneonatal Mortality)	NCEHIC	1990; Vol. 39, No. SS-3
Influenza	NCID	1997; Vol. 46, No. SS-1
Injury		
Death Rates, Blacks & Whites	NCEHIC	1988; Vol. 37, No. SS-3
Drownings	NCEHIC	1988; Vol. 37, No. SS-1
Falls, Deaths	NCEHIC	1988; Vol. 37, No. SS-1
Firearm-Related Deaths, Unintentional	NCEHIC	1988; Vol. 37, No. SS-1

*Abbreviations

ATSDR	Agency for Toxic Substances and Disease Registry
CIO	Centers/Institute/Offices
EPO	Epidemiology Program Office
IHPO	International Health Program Office
NCCDPHP	National Center for Chronic Disease Prevention and Health Promotion
NCEH	National Center for Environmental Health
NCEHIC	National Center for Environmental Health and Injury Control
NCID	National Center for Infectious Diseases
NCIPC	National Center for Injury Prevention and Control
NCPS	National Center for Prevention Services
NIOSH	National Institute for Occupational Safety and Health

Reports Published in *CDC Surveillance Summaries* Since January 1, 1985 — Continued

Subject	Responsible CIO/Agency*	Most Recent Report
Head & Neck	NCIPC	1993; Vol. 42, No. SS-5
In Developing Countries	NCEHIC	1992; Vol. 41, No. SS-1
In the Home, Persons <15 Years of Age	NCEHIC	1988; Vol. 37, No. SS-1
Motor Vehicle-Related Deaths	NCEHIC	1988; Vol. 37, No. SS-1
Objectives of Injury Control, State & Local	NCEHIC	1988; Vol. 37, No. SS-1
Objectives of Injury Control, National	NCEHIC	1988; Vol. 37, No. SS-1
Residential Fires, Deaths	NCEHIC	1988; Vol. 37, No. SS-1
Tap Water Scalds	NCEHIC	1988; Vol. 37, No. SS-1
Lead Poisoning, Childhood	NCEHIC	1990; Vol. 39, No. SS-4
Low Birth Weight	NCCDPHP	1990; Vol. 39, No. SS-3
Malaria	NCID	1997; Vol. 46, No. SS-2
Measles	NCPS	1992; Vol. 41, No. SS-6
Meningococcal Disease	NCID	1993; Vol. 42, No. SS-2
Mining	NIOSH	1986; Vol. 35, No. 2SS
Mumps	NIP	1995; Vol. 44, No. SS-3
National Infant Mortality (see also Infant Mortality; Birth Defects)	NCCDPHP	1989; Vol. 38, No. SS-3
Neisseria gonorrhoeae, Antimicrobial Resistance in	NCPS	1993; Vol. 42, No. SS-3
Neural Tube Defects	NCEH	1995; Vol. 44, No. SS-4
Nosocomial Infection	NCID	1986; Vol. 35, No. 1SS
Occupational Injuries/Disease		
Asthma	NIOSH	1994; Vol. 43, No. SS-1
Hazards, Occupational	NIOSH	1985; Vol. 34, No. 2SS
In Meatpacking Industry	NIOSH	1985; Vol. 34, No. 1SS
Silicosis	NIOSH	1993; Vol. 42, No. SS-5
State Activities	NIOSH	1987; Vol. 36, No. SS-2
Parasites, Intestinal	NCID	1991; Vol. 40, No. SS-4
Pediatric Nutrition	NCCDPHP	1992; Vol. 41, No. SS-7
Pertussis	NCPS	1992; Vol. 41, No. SS-8
Plague	NCID	1985; Vol. 34, No. 2SS
Plague, American Indians	NCID	1988; Vol. 37, No. SS-3
Poliomyelitis	NCPS	1992; Vol. 41, No. SS-1
Postneonatal Mortality	NCCDPHP	1991; Vol. 40, No. SS-2
Pregnancy Nutrition	NCCDPHP	1992; Vol. 41, No. SS-7
Pregnancy-Related Mortality	NCCDPHP	1997; Vol. 46, No. SS-4
Pregnancy, Teenage	NCCDPHP	1993; Vol. 42, No. SS-6
Rabies	NCID	1989; Vol. 38, No. SS-1
Racial/Ethnic Minority Groups	Various	1990; Vol. 39, No. SS-3
Respiratory Disease	NCEHIC	1992; Vol. 41, No. SS-4
Rotavirus	NCID	1992; Vol. 41, No. SS-3
Salmonella	NCID	1988; Vol. 37, No. SS-2
Sexually Transmitted Diseases in Italy	NCPS	1992; Vol. 41, No. SS-1
Silicosis		1997; Vol. 46, No. SS-1
Smoking	NCCDPHP	1990; Vol. 39, No. SS-3
Smoking-Attributable Mortality	NCCDPHP	1994; Vol. 43, No. SS-1
Tobacco Control Laws, State	NCCDPHP	1995; Vol. 44, No. SS-6
Tobacco-Use Behaviors	NCCDPHP	1994; Vol. 43, No. SS-3
Spina Bifida	NCEH	1996; Vol. 45, No. SS-2
Streptococcal Disease (Group B)	NCID	1992; Vol. 41, No. SS-6
Sudden Unexplained Death Syndrome Among Southeast Asian Refugees	NCEHIC, NCPS	1987; Vol. 36, No. 1SS
Suicides, Persons 15–24 Years of Age	NCEHIC	1988; Vol. 37, No. SS-1
Syphilis, Congenital	NCPS	1993; Vol. 42, No. SS-6
Syphilis, Primary & Secondary	NCPS	1993; Vol. 42, No. SS-3
Tetanus	NIP	1997; Vol. 46, No. SS-2
Trichinosis	NCID	1991; Vol. 40, No. SS-3
Tuberculosis	NCPS	1991; Vol. 40, No. SS-3
Waterborne Disease Outbreaks	NCID	1996; Vol. 45, No. SS-1
Years of Potential Life Lost	EPO	1992; Vol. 41, No. SS-6
Youth Risk Behaviors	NCCDPHP	1996; Vol. 45, No. SS-4
Youth Risk Behaviors, College Students	NCCDPHP	1997; Vol. 46, No. SS-6

Surveillance for Asthma — United States, 1960–1995

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Abstract

Problem/Condition: Asthma is one of the most common chronic diseases in the United States, and it has increased in importance during the preceding 20 years. Despite its importance, no comprehensive surveillance system has been established that measures asthma trends at the state or local level.

Reporting Period: This report summarizes and reviews national data for specific endpoints: self-reported asthma prevalence (1980–1994), asthma office visits (1975–1995), asthma emergency room visits (1992–1995), asthma hospitalizations (1979–1994), and asthma deaths (1960–1995).

Description of System: The National Center for Health Statistics (NCHS) annually conducts the National Health Interview Survey, which asks about self-reported asthma in a subset of the sample. NCHS collects physician office visit data with the National Ambulatory Medical Care Survey, emergency room visit data with the National Hospital Ambulatory Medical Care Survey, and hospitalization data with the National Hospital Discharge Survey. NCHS also collects mortality data annually from each state and produces computerized files from these data. We used these datasets to determine self-reported asthma prevalence, asthma office visits, asthma emergency room visits, asthma hospitalizations, and asthma deaths nationwide and in four geographic regions of the United States (i.e., Northeast, Midwest, South, and West).

Results: We found an increase in self-reported asthma prevalence rates and asthma death rates in recent years both nationally and regionally. Asthma hospitalization rates have increased in some regions and decreased in others. At the state level, only death data are available for asthma; death rates varied substantially among states within the same region.

Interpretation: Both asthma prevalence rates and asthma death rates are increasing nationally. Available surveillance information are inadequate for fully assessing asthma trends at the state or local level. Implementation of better state and local sur-

veillance can increase understanding of this disease and contribute to more effective treatment and prevention strategies.

INTRODUCTION

Asthma is a chronic inflammatory disorder of the airways characterized by variable airflow obstruction and airway hyperresponsiveness in which prominent clinical manifestations include wheezing and shortness of breath (*1*). It is a multifactorial disease that has been associated with familial, infectious, allergenic, socioeconomic, psychosocial, and environmental factors (*2,3*). Asthma morbidity and mortality are largely preventable with improved patient education regarding the factors associated with asthma and medical management (*1,4*). Surveillance information on asthma, with the exception of mortality data, are not available at the state or local level. Such information is needed to identify high-risk populations and to design and evaluate interventions aimed at preventing the development or exacerbation of this disease. This report summarizes and reviews national data for self-reported asthma prevalence (1980–1994), asthma office visits (1975–1995), asthma emergency room visits (1992–1995), asthma hospitalizations (1979–1994), and asthma deaths (1960–1995). In addition, this report describes several asthma surveillance programs at the state and local levels that may be useful to other states that are developing asthma surveillance systems.

METHODS

We used existing databases to evaluate self-reported asthma prevalence, asthma office visits, asthma emergency room visits, asthma hospitalizations, and asthma mortality. At the state level, only asthma mortality data are reported; the other endpoints are available only at regional and national levels. The four regions* (Figure 1) represent standardized geographical divisions defined by the U.S. Bureau of the Census. We used data from the 1960, 1970, 1980, and 1990 censuses and the 1996 intercensal estimate to calculate denominators for office visit rates, emergency room visit rates, hospitalization rates, and death rates. We stratified each censal dataset by region, sex, race (white, black, and other), and age group (i.e., 0–4 years, 5–14 years, 15–34 years, 35–64 years, and ≥65 years). The 1960 census reported only whites and nonwhites; therefore, we used the 1970 region-, sex-, and age-specific proportions between black and other nonwhite populations and applied this proportion to the 1960 region-, sex-, and age-specific population of nonwhites. We used linear interpolation to estimate the population for years in which there was neither census data nor the intercensal estimate. We used the civilian, noninstitutionalized population of the United States as our denominator for prevalence rates.

* *Northeast*=Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; *Midwest*=Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South*=Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; and *West*=Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

The diagnosis of asthma is less reliable among persons aged <5 years and those aged >35 years (*5*) compared with persons aged 5–34 years. Persons in these same age groups, however, are the ones most likely to be adversely affected by asthma (*6,7*). The figures in this summary depict the asthma endpoints, by region, both among the overall population and among persons aged 5–34 years.

For most datasets, we grouped the data into 3-year groups. We also race-, sex-, and age-adjusted our estimates to the 1970 U.S. population, using the five age groups (i.e., 0–4 years, 5–14 years, 15–34 years, 35–64 years, and ≥65 years). We used 1970 as a reference population because we had complete race, sex, and age data available from the 1970 census. All analyses were done using SAS (SAS Institute, Cary, NC) and SUDAAN (RTI, Chapel Hill, NC). We used the procedure REG in SAS to determine whether the trends over time in asthma prevalence rates, asthma office visit rates, asthma emergency room visit rates, asthma hospitalization rates, and asthma death rates were significant. We used two-tailed t tests to compare asthma hospitalization rates and asthma emergency room visit rates between regions, racial groups, age groups, and males and females in a single year or group of years. Using the Bonferroni adjustment for multiple comparisons in up to five groups, we considered a p value of 0.05 as significant.

Self-Reported Prevalence

The National Health Interview Survey (NHIS) is conducted annually among a probability sample of the civilian, noninstitutionalized population of the United States by the National Center for Health Statistics (NCHS) (*8*). The NHIS questionnaire asks participants about their own present health status and that of other persons in their families, including whether they have had any recent illnesses. Each year, one sixth of the sample (approximately 20,000 of 120,000 persons) are asked whether they have had any one of 17 chronic respiratory diseases, including asthma, during the preceding 12 months. We used this subset of NHIS to determine the prevalence of self-reported asthma, using NHIS weights to determine national estimates of the population affected. Information on chronic conditions is collected on NHIS core questionnaire in which questions are asked about all family members. Although all members of the family are invited to participate in the interview, in many cases, a single respondent provides information for other family members. Thus, for adults, information on asthma may not have been reported by subjects themselves; for children, all information would have been provided by an adult responding for the family. We used SUDAAN (RTI, Research Triangle Park, NC) to determine the relative standard errors (RSEs) of the estimates and to indicate which estimates were reliable (i.e., RSE <30%, which is equivalent to a relative confidence interval <59%).

Office Visits

Ambulatory medical care is the predominant means of providing health-care services in the United States. Since 1975, NCHS has administered the National Ambulatory Medical Care Survey (NAMCS), collecting information on ambulatory patient visits to physicians' offices (*9*). Of the 3,507 physicians included in the 1975 NAMCS sample, 2,081 actually participated in the survey. Approximately 2,000 physicians participated in the survey in subsequent years that the survey was administered (i.e.,

1980, 1981, 1985, and 1989–1995). For each year, 30,000–60,000 patient encounters were included in the database. We identified visits for which asthma (*International Classification of Diseases, Ninth Revision, Clinical Modification* [ICD-9-CM], code 493) was the first-listed diagnosis. Sample weights were used to obtain national estimates of annual office visits for asthma. We used the RSEs, which are listed with the database documentation, to indicate which estimates were reliable (i.e., RSE <30%).

Emergency Room Visits

Since 1992, information on visits to hospital emergency and outpatient departments has been collected annually by NCHS in the National Hospital Ambulatory Medical Care Survey (NHAMCS) (*10*). For this analysis, we included only the emergency room database. For each year, records from 25,000 to 45,000 emergency room visits were included in the survey. We identified emergency room records for which asthma (ICD-9-CM-493) was listed as the first diagnosis. We used the survey weights to obtain national estimates of emergency room visits for asthma. We used the RSEs to indicate which estimates were reliable (i.e., RSE <30%).

Hospitalizations

To investigate national trends in hospitalizations attributable to asthma in the United States during 1979–1994, we analyzed hospitalization data from the National Hospital Discharge Survey (NHDS) (*11*), which is conducted annually by NCHS. These data were obtained from a sample of inpatient records from a national sample of nonfederal general and short-stay specialty hospitals in the United States. Hospitalizations considered attributable to asthma were those with ICD-9-CM-493 listed as the primary discharge diagnosis. Data on race were missing for 5%–20% of the sample in any given year (*12*); we excluded these subjects from the race-specific rate calculations but included them in all of the other rate calculations. Thus, the race-specific, age-adjusted rates underestimate the true hospitalization rates. We used the RSEs to indicate which estimates were reliable (i.e., RSE <30%). The survey was redesigned in 1988; our trend analysis was done on data during 1988–1994 (*13*).

Mortality

We reviewed the Underlying Cause of Death dataset from NCHS (*14*) for 1960 through 1995 to identify all deaths in which asthma was selected as the underlying cause of death. During this period, three different ICD classifications were used to indicate a diagnosis of asthma: ICD-7 (code 241, 1960–1967), *International Classification of Diseases, Eighth Revision* (*Adapted*) (ICDA-8) (code 493, 1968–1978), and ICD-9 (code 493, 1979–1995). The comparability ratio for asthma (ICD-9/ICDA-8) is 1.35, indicating that approximately 35% more deaths would be attributed to asthma as the underlying cause of death under ICD-9 as compared with ICDA-8 (*15*). Part of this change was related to classifying "asthmatic bronchitis" as "bronchitis" in ICDA-8 but as "asthma" in ICD-9 (*16*). The comparability ratio for asthma (ICDA-8/ICD-7) is 0.70, indicating that approximately 30% fewer deaths would have been assigned to asthma under ICDA-8 compared with ICD-7 (*17*).

For 1960 and 1961 mortality data, race was classified as white and nonwhite. For these years, we estimated the number of blacks and persons of other races within the nonwhite stratum (by state, race, and age) by using the proportion of blacks and persons of other races in that same stratum during 1962–1963. We used a similar technique to estimate the number of deaths among blacks and whites in New Jersey for 1962 and 1963, as no race data were available for that state for those years. In addition to the regional analysis, we did a state-by-state analysis of death rates among blacks and whites within 6-year periods. Among blacks, we restricted our analysis to states in which two or more asthma deaths occurred annually over the 6-year period, corresponding to an RSE of <30%. Our trend analysis was limited to data during 1979–1995.

RESULTS

During the preceding 15 years, prevalence and death rates for asthma have increased both nationally and regionally. Regional differences were apparent for some endpoints (e.g., hospitalization rates and emergency room visit rates) but not for others (e.g., prevalence rates).

Self-Reported Prevalence

The self-reported prevalence rate for asthma increased 75% from 1980 to 1994; by 1993–1994, an estimated 13.7 million persons reported asthma during the preceding 12 months (Table 1). This increasing trend in rates was evident among all race strata, both sexes, and all age groups ($p<0.05$ for all). The most substantial increase occurred among children aged 0–4 years (160%, from 22.2 per 1,000 to 57.8 per 1,000; $p<0.05$) and persons aged 5–14 years (74%, from 42.8 per 1,000 to 74.4 per 1,000; $p<0.05$) (Table 2). During 1993–1994 the self-reported prevalence rate for asthma was slightly higher among persons aged ≤14 years than among persons aged ≥15 years. The increasing trend in asthma prevalence rates during 1980–1994 was evident and significant ($p<0.05$) in every region of the United States, with the prevalence patterns in the overall population similar to those among persons aged 5–34 years (Figures 2 and 3). During 1993–1994, asthma prevalence rates were similar in all four regions of the country.

Office Visits

From 1975 to 1993–1995, the estimated annual number of office visits for asthma more than doubled, from 4.6 million to 10.4 million (Table 3). Repeat visits could not be separated out in the data; therefore, the number of persons affected cannot be determined. Increasing rates were evident among all race strata, both sexes, and all age groups (Table 4). Estimated regional rates for asthma office visits also increased, but not uniformly (Figures 4 and 5). During 1993–1995, the rate for office visits for asthma was lowest among persons aged 15–34 years ($p<0.05$) (Table 4). We did not report on hospital outpatient visits for asthma, which comprise <10% of total visits for asthma (*18*), and for which data were only available for 1992–1995.

Emergency Room Visits

Data for emergency room visits are available for 1992–1995. Over this period, the national rate of emergency room visits for asthma did not change significantly ($p<0.05$). In 1995, there were an estimated >1.8 million emergency room visits for asthma (Table 5). Blacks had consistently higher rates for emergency room visits than whites ($p<0.05$), and rates decreased as age strata increased (Table 6). In 1995, the Northeast had higher rates than the South and West, both among the entire population and among persons aged 5–34 years ($p<0.05$) (Figures 6 and 7). For each year, the rate for emergency room visits for asthma decreased with increasing age (Table 6).

Hospitalizations

Between 1979–1980 and 1993–1994, the estimated national number of asthma-related hospitalizations increased from 386,000 to 466,000 (Table 7), whereas the national asthma hospitalization rate was not significantly changed ($p>0.05$; Table 8). During this period, hospitalization rates for asthma were consistently higher among blacks than they were among whites ($p<0.05$) (Table 8). During 1988–1994, asthma hospitalization rates increased in the Northeast but decreased in the Midwest and West ($p<0.05$). By 1993–1994, age-adjusted asthma hospitalization rates were higher among persons residing in the Northeast than they were among those residing in the West ($p<0.05$) (Figure 8). A similar pattern was exhibited in the rates among persons aged 5–34 years (Figure 9). In every grouping of years, asthma hospitalization rates were highest among persons aged 0–4 years, lowest among persons aged 15–34 years, and intermediate among persons aged ≥35 years (Table 8).

Mortality

Overall rates of death with asthma as the underlying cause decreased from 1960–1962 through 1975–1977, and gradually increased again in all race, sex, and age strata. (Tables 9 and 10). Blacks had consistently higher death rates than whites. Death rates were consistently higher in older age strata. In most race-, sex-, and age-strata, death rates were lower during 1968–1978, when the ICDA-8 coding system was being used, than in other years.

Changes in ICD codes also may have affected death rates by region (Figures 10 and 11). We found a difference in the regional death rates for the entire population when compared with the death rates among persons aged 5–34 years; the West had the highest death rates in the overall population, whereas the Northeast and Midwest had the highest rates among persons aged 5–34 years.

Death rates also varied among states within regions among both whites (Table 11) and among blacks (Table 12).

DISCUSSION

This report describes several trends, raises questions, and highlights the need for improved surveillance of asthma and other chronic respiratory diseases. The overall picture of asthma is changing. National statistics indicate that asthma prevalence and mortality have increased in recent years, despite numerous advancements in the diag-

nosis and treatment of asthma. The reasons for these increases are not clear (*2*). The data cannot be used to differentiate between a true increase in asthma versus an increase in the diagnosis of asthma by physicians (*19*).

Asthma-related deaths varied substantially by age group. Although asthma prevalence was lowest for persons aged ≥35 years, this group accounted for >85% of the asthma mortality. This may reflect an overlap in diagnosis of asthma with chronic obstructive pulmonary disease (COPD), an overlap most likely to occur among older persons. Clinically, the key difference between these conditions is that decreases in airway function are reversible in asthma, but not in COPD. However, persons with longstanding asthma, especially if inadequately treated, can develop irreversible changes in lung function (*20*). Conversely, many persons with COPD can improve their lung function with interventions such as smoking cessation or medication (*21*). Trends in overall asthma mortality through the 1960s and 1970s may have been affected by both changes in clinical diagnosis and changes in the ICD coding system (*16*). At the state level, only mortality data are available for asthma. Age-adjusted death rates for asthma during 1990–1995 varied substantially from state to state, even among states in the same region (Tables 11 and 12).

We have used several measures of asthma morbidity: self-reported prevalence, office visits, emergency room visits, and hospitalizations. The overall national increase in the prevalence of asthma, which has been previously reported, occurred in all regions of the United States. We observed different trends, however, in hospitalization rates. In 1979, the four regions had similar hospitalization rates, both for the overall population and for persons aged 5–34 years. By 1994, overall rates in the Northeast were more than twice the rates in the West; among persons aged 5–34 years, the difference was more than threefold (Figures 8 and 9). The possible reasons for these differences include differences among the regions in asthma severity (*22*), asthma treatment (*23*), physician diagnosis (*22*), access to health care (*24,18*), climatic and home heating factors (*25*), or exposure to air pollutants (*26,27*). Caution should be exercised in interpreting trends over time, in that methods of data collection, disease coding, and disease recognition have changed over the years (*13,16*).

The summary differences in asthma morbidity outcomes among regions raise the question of whether rates within the regions are also heterogeneous. The previously described state-to-state differences in death rates suggest that morbidity may also differ within regions and highlight the need for asthma surveillance data at the state and local level.

A 1996 survey by the Council of State and Territorial Epidemiologists and CDC revealed an interest in establishing asthma surveillance systems among states and territories that do not have programs (*28*). Of the 43 state respondents who did not have an asthma-control program, 37 (86%) were interested in establishing such programs. Respondents cited funding and manpower limitations as the main reasons for not having an asthma-control program. Forty-two states had hospital discharge data available for characterizing asthma, but only 14 (33%) had used the data to examine asthma morbidity. In some states, legislative restraints and incompatible data formats contributed to an inability to use the data (*28*).

Several states have used existing data or have initiated other approaches to examine asthma morbidity. Wisconsin analyzed billing data from hospital emergency rooms to develop a low-cost surveillance system for asthma. The main data source

came from billing data for emergency room visits for 1990–1994 from Children's Hospital of Wisconsin in Milwaukee. Data collected included demographic information, date of visit, diagnosis, and length of stay (if the patient was hospitalized). Patients aged <19 years who had a diagnosis of asthma (ICD-9-CM-493), acute pharyngitis (ICD-9-CM-462), upper respiratory infections (ICD-9-CM-465), or acute bronchitis or bronchiolitis (ICD-9-CM-466) were included (*29,30*). Results from this study revealed that 20% of the children in the study accounted for 50% of the total number of emergency room visits, and 8% of these children accounted for 38% of all hospital admissions. Researchers also found that asthma admissions increased when sulfur dioxide levels in ambient air increased (*29,30*).

The Michigan Department of Community Health has examined hospital data from the Michigan Inpatient Discharge Database for 1989–1993 for children aged <15 years with a primary diagnosis of asthma (ICD-9-CM-493) (*31*). Results indicated that the rate for asthma hospitalizations was higher for boys than for girls (43 per 10,000 versus 25 per 10,000) and that the rate for blacks was higher than for whites (81.3 per 10,000 versus 25.6 per 10,000). The data also demonstrated local differences, with three groups of counties in the southeast, southwest, and eastern parts of Michigan having higher hospitalization rates for asthma than the rest of the state (*31*).

Other potential sources of asthma surveillance include billing data from Medicaid and Medicare and data from managed-care organizations. In 1995, Arizona had a higher asthma death rate than the overall U.S. population (2.8 versus 2.1 per 100,000), with particularly high rates in Maricopa County, in which the city of Phoenix is located. Billing data and managed-care data from Maricopa County demonstrated high hospital discharge rates, particularly among blacks and Hispanics (*32*).

The Behavioral Risk Factor Surveillance System (BRFSS) is an ongoing random-digit–dialed telephone survey in which 45 states participate. The purpose of the survey is to ascertain the prevalence of behaviors and practices related to certain risk factors (e.g., cigarette smoking) associated with the leading causes of death in the United States. The system has core questions (e.g., about diabetes and tobacco use), which all state participants are required to ask and standardized modules (e.g., about health-care utilization and weight control), which are optional. States may also include additional health questions as part of the survey, although these questions are not nationally standardized. Since 1996, New Hampshire, New York, and Oregon have included additional questions about asthma, and in 1997, Washington added questions about asthma. Respondents from all four states were asked if a doctor or other health professional had told them that they had asthma. New Hampshire, New York, and Oregon had questions on medication usage. New Hampshire and Washington included questions regarding children in the household with asthma, whereas New York and Oregon included a question on emergency room and urgent-care visits.

Oregon and New Hampshire have analyzed BRFSS data on asthma-specific questions. The American Lung Association of Oregon assisted in analyzing data for Oregon. These data, which are specific to adults, indicated that 6.6% of the 1995 respondents (n=2,371) and 7.4% of the 1996 respondents (n=2,932) reported active asthma (i.e., positive responses for wheezing during the preceding year and ever being told by a health provider that they had asthma). Nine percent of the respondents who had been told that they had asthma reported receiving emergency care for asthma during the year preceding the survey (*33*). Data from New Hampshire re-

vealed that 11% of the respondents (n=1,502) reported that they had been told that they had asthma. Of those with asthma (n=166), 19.9% of the males and 44.6% of the females had used medication. Almost 10% of the respondents reported that they had a child with asthma (L. Powers, New Hampshire Department of Health and Human Services, personal communication, 1997).

Asthma surveillance data collected by states have many uses. Researchers in Wisconsin have demonstrated that asthma surveillance data can be used to investigate correlations between environmental events and asthma morbidity. States are also using data to develop prevention strategies. In Michigan, prevention strategies have been implemented in areas with elevated hospital discharge rates for asthma. In southeast Michigan, an area where hospitalization rates for asthma are high, asthma has been made a health priority in a seven-county area. One county health department has organized an advisory committee to develop strategies for prevention (K. Wilcox, Michigan Department of Health, personal communication, 1997). The experience in Arizona highlights the importance of partnerships between the public and private sectors in collecting and analyzing surveillance data. Nationwide, CDC can help states identify potential partners in collecting surveillance data and also can help promote collaborative efforts.

One component of a proposed national strategy for asthma control and surveillance is to support the development of state-based asthma surveillance systems, using existing databases. As indicated by the state systems highlighted in this report, developing state-based surveillance systems for asthma will likely require the use of several sources of data. These data sources should be easily accessible and not costly. Some surveillance data that already exist include hospital discharge data, billing and insurance data, and managed-care data (*34*). Hospital discharge data and the billing and insurance data (e.g., Medicare and Medicaid) would probably be the most accessible and least costly data sources in many states. Because managed-care organizations are private entities, use of their data may require the development of specific collaborative projects (*32*). Potential national activities to promote the development of state surveillance systems include providing technical assistance on the design and implementation of systems and developing standardized data elements and case definitions for use by states. National activities can also encourage states to share information on data collection and analysis and on the development and assessment of control measures.

A second component of a proposed national strategy for asthma control and surveillance is to develop new databases that can provide estimates of morbidity at the state level. One approach that may meet these criteria is the BRFSS, which, in its present form, can obtain data reliable for adults but not for children. The use of an asthma module with randomly selected households can permit researchers to estimate asthma rates among adults. Another potential new source of data is the State and Local Integrated Telephone Survey, which is being piloted by NCHS and is modeled after NHIS. It could be used to obtain data on both persons with diagnosed asthma and persons with asthma symptoms (e.g., coughing or wheezing) but no diagnosis.

This report presents data on asthma morbidity and mortality and highlights the need for better state and local surveillance of asthma outcomes. Collecting local asthma data can aid in assessing the etiology of asthma and in evaluating prevention strategies. State-specific data can help public health officials direct preven-

tion efforts and allocate resources. Finally, asthma surveillance systems can provide an opportunity for health departments to develop partnerships with voluntary associations, managed-care organizations, and other groups to better understand, prevent, and treat a growing and expensive health problem that affects both children and adults (*4*).

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TABLE 1. Estimated average annual number of persons with self-reported asthma during the preceding 12 months, by race, sex, and age group — United States, National Health Interview Survey, 1980–1994*

Category	1980	1981–1983	1984–1986	1987–1989	1990–1992	1993–1994
Race						
White	5,790,000	6,560,000	7,430,000	8,270,000	9,110,000	10,700,000
Black	880,000	1,020,000	1,030,000	1,510,000	1,590,000	1,880,000
Other	100,000†	180,000†	320,000†	280,000†	380,000	540,000
Sex						
Male	3,350,000	3,730,000	4,080,000	4,910,000	5,260,000	6,150,000
Female	3,410,000	4,110,000	4,680,000	5,290,000	6,060,000	7,400,000
Age group (yrs)						
0– 4	360,000	550,000	600,000	620,000	870,000	1,280,000
5–14	1,520,000	1,560,000	1,790,000	2,130,000	2,360,000	2,790,000
15–34	2,160,000	2,410,000	2,810,000	3,210,000	3,320,000	4,050,000
35–64	1,960,000	2,410,000	2,460,000	2,980,000	3,630,000	4,090,000
≥65	770,000	920,000	1,100,000	1,260,000	1,150,000	1,480,000
Total§	**6,770,000**	**7,850,000**	**8,760,000**	**10,200,000**	**11,330,000**	**13,690,000**

*All relative standard errors are <30% (i.e., relative confidence interval <59%) unless otherwise indicated.
†Relative standard error of the estimate is 30%–50%; the estimate is unreliable.
§Numbers for each variable may not add up to total because of rounding error.

TABLE 2. Estimated average annual rate* of self-reported asthma during the preceding 12 months, by race, sex, and age group — United States, National Health Interview Survey, 1980–1994†

Category	1980	1981–1983	1984–1986	1987–1989	1990–1992	1993–1994
Race§						
White	30.4	33.9	37.7	41.1	44.7	50.8
Black	34.0	38.0	36.4	51.7	52.2	57.8
Other	22.5¶	31.7¶	28.2¶	32.7¶	39.7	48.6
Sex§						
Male	32.0	34.3	36.8	43.0	45.3	51.1
Female	29.2	34.7	38.4	42.3	47.5	56.2
Age group (yrs)						
0– 4	22.2	32.6	34.3	33.9	46.1	57.8
5–14	42.8	44.7	51.1	60.7	65.9	74.4
15–34	27.7	30.2	35.1	40.1	41.7	51.8
35–64	28.1	33.1	32.0	36.8	42.3	44.6
≥65	30.7	34.4	38.9	42.1	36.4	44.6
Total§	**30.7**	**34.6**	**37.6**	**42.9**	**46.6**	**53.8**

*Per 1,000 population.
†All relative standard errors are <30% (i.e., relative confidence interval <59%) unless otherwise indicated.
§Age-adjusted to the 1970 U.S. population.
¶Relative standard error of the estimate is 30%–50%; the estimate is unreliable.

TABLE 3. Estimated average number of office visits for asthma as the first-listed diagnosis, by race, sex, and age group — United States, National Ambulatory Medical Care Survey, 1975–1995*

Category	1975	1980–1981	1985	1989	1990–1992	1993–1995
Race						
White	4,084,000	4,804,000	5,663,000	5,471,000	6,980,000	8,316,000
Black	463,000†	584,000†	702,000	893,000	1,196,000	1,373,000
Other	§	§	§	§	290,000	686,000
Sex						
Male	2,173,000	2,643,000	2,972,000	2,458,000	3,695,000	4,252,000
Female	2,460,000	2,830,000	3,531,000	4,364,000	4,866,000	6,122,000
Age group (yrs)						
0– 4	429,000†	517,000†	556,000	626,000†	950,000	1,024,000
5–14	867,000	1,629,000	1,520,000	975,000	1,821,000	2,004,000
15–34	1,009,000	1,140,000	1,206,000	1,580,000	1,984,000	1,876,000
35–64	1,743,000	1,506,000	2,275,000	2,684,000	2,617,000	3,982,000
≥65	584,000	680,000	945,000	957,000	1,187,000	1,488,000
Total¶	**4,632,000**	**5,472,000**	**6,502,000**	**6,822,000**	**8,559,000**	**10,374,000**

*All relative standard errors are <30% (i.e., relative confidence interval <59%) unless otherwise indicated.
†Relative standard error of the estimate is 30%–50%; the estimate is unreliable.
§Relative standard error of the estimate exceeds 50%.
¶Numbers for each variable may not add up to total because of rounding error and missing race for 1989 and 1990–1992.

TABLE 4. Estimated average rates* of office visits for asthma as the first-listed diagnosis, by race, sex, and age group — United States, National Ambulatory Medical Care Survey, 1975–1995†

Category	1975	1980–1981	1985	1989	1990–1992	1993–1995
Race§						
White	22.2	26.2	29.3	26.2	34.6	39.6
Black	19.7¶	22.4¶	26.8	29.9	39.5	43.8
Other	**	**	**	**	17.3	34.1
Sex§						
Male	21.1	25.8	27.3	21.0	31.2	33.9
Female	21.5	23.7	28.3	32.7	36.7	43.6
Age group (yrs)						
0– 4	25.3¶	30.4¶	30.7	32.7¶	48.2	50.3
5–14	22.5	45.6	42.6	27.0	49.3	51.5
15–34	14.1	13.9	14.6	19.0	23.9	22.8
35–64	25.4	20.7	28.8	31.7	29.5	41.7
≥65	25.3	25.8	33.0	30.9	37.0	44.0
Total§	**21.4**	**25.0**	**27.9**	**27.0**	**34.1**	**39.0**

*Per 1,000 population.
†All relative standard errors are <30% (i.e, relative confidence interval <59%) unless otherwise indicated.
§Age-adjusted to the 1970 U.S. population.
¶Relative standard error of the estimate is 30%–50%; the estimate is unreliable.
**Relative standard error of the estimate exceeds 50%.

TABLE 5. Estimated annual number of emergency room visits for asthma as the first-listed diagnosis, by race, sex, and age group — United States, National Hospital Ambulatory Medical Care Survey, 1992–1995*

Category	1992	1993	1994	1995
Race				
White	925,000	1,000,000	927,000	1,018,000
Black	488,000	642,000	635,000	775,000
Other	54,000†	43,000†	45,000†	73,000†
Sex				
Male	667,000	766,000	735,000	725,000
Female	800,000	920,000	872,000	1,140,000
Age group (yrs)				
0– 4	288,000	334,000	298,000	248,000
5–14	291,000	317,000	313,000	322,000
15–34	438,000	488,000	517,000	566,000
35–64	361,000	473,000	400,000	630,000
≥65	89,000	74,000	79,000	101,000
Total§	**1,467,000**	**1,686,000**	**1,607,000**	**1,867,000**

*All relative standard errors are <30% (i.e., relative confidence interval <59%) unless otherwise indicated.
†Relative standard error of the estimate is 30%–50%; the estimate is unreliable.
§Numbers for each variable may not add up to total because of rounding error.

TABLE 6. Estimated annual rate* of emergency room visits for asthma as the first-listed diagnosis, by race, sex, and age group — United States, National Hospital Ambulatory Medical Care Survey, 1992–1995†

Category	1992	1993	1994	1995
Race§				
White	46.8	50.3	46.1	48.8
Black	151.9	197.4	191.2	228.9
Other	28.6¶	23.7¶	21.9¶	33.1¶
Sex§				
Male	55.5	62.6	53.4	57.8
Female	61.4	69.7	65.9	82.3
Age group (yrs)				
0– 4	143.5	164.3	145.5	120.7
5–14	77.1	82.8	80.3	81.3
15–34	52.9	59.0	62.8	69.2
35–64	39.6	50.7	41.8	64.4
≥65	27.7	22.6	23.5	29.5
Total§	**58.8**	**66.6**	**62.9**	**70.7**

*Per 10,000 population.
†All relative standard errors are <30% (i.e., relative confidence interval <59%) unless otherwise indicated.
§Age-adjusted to the 1970 U.S. population.
¶Relative standard error of the estimate is 30%–50%; the estimate is unreliable.

TABLE 7. Estimated average number of hospitalizations for asthma as the first-listed diagnosis, by race, sex, and age group — United States, National Hospital Discharge Survey, 1979–1994*

Category	1979–1980	1981–1983	1984–1986	1987–1989	1990–1992	1993–1994
Race						
White	271,000	317,000	322,000	296,000	254,000	240,000
Black	67,000	94,000	94,000	111,000	124,000	115,000
Other	12,000	17,000	23,000	27,000	23,000	26,000
Missing†	35,000	23,000	40,000	42,000	83,000	85,000
Sex						
Male	167,000	193,000	204,000	205,000	206,000	191,000
Female	219,000	259,000	275,000	271,000	277,000	275,000
Age group (yrs)						
0– 4	56,000	72,000	85,000	95,000	111,000	97,000
5–14	56,000	66,000	66,000	65,000	73,000	67,000
15–34	68,000	75,000	75,000	76,000	74,000	78,000
35–64	127,000	148,000	146,000	135,000	132,000	139,000
≥65	79,000	90,000	106,000	105,000	94,000	85,000
Total§	**386,000**	**451,000**	**478,000**	**476,000**	**484,000**	**466,000**

*All relative standard errors are <30% (i.e., relative confidence interval <59%).
†Race data was not collected by some hospitals in the survey.
§Numbers for each variable may not add up to total because of rounding error.

TABLE 8. Estimated average rates* of hospitalizations for asthma as the first-listed diagnosis, by race, sex, and age group — United States, National Hospital Discharge Survey, 1979–1994†

Category	1979–1980	1981–1983	1984–1986	1987–1989	1990–1992	1993–1994
Race§						
White	14.2	16.2	15.9	14.1	11.9	10.9
Black	26.0	34.8	33.2	38.1	40.1	35.5
Other	28.2	30.6	32.7	33.6	24.4	23.0
Sex§						
Male	16.3	18.4	18.7	18.3	18.0	15.9
Female	18.7	21.4	21.8	21.0	20.8	20.0
Age group (yrs)						
0– 4	34.3	42.8	48.5	52.2	58.3	49.7
5–14	15.9	19.2	18.9	18.7	20.6	18.0
15–34	8.7	9.5	9.5	9.5	9.3	10.0
35–64	18.2	20.3	19.0	16.7	15.4	15.2
≥65	31.5	33.6	37.5	35.2	29.7	25.6
Total§	**17.6**	**20.0**	**20.5**	**19.8**	**19.7**	**18.1**

*Per 10,000 population.
†All relative standard errors are <30% (i.e., relative confidence interval <59%).
§Age-adjusted to the 1970 U.S. population.

TABLE 9. Average number of deaths with asthma as the underlying cause of death diagnosis, by race, sex, and age group — United States, Underlying Cause of Death dataset, 1960–1995*

Category	1960–1962†	1963–1965	1966–1967	1968–1971†	1972–1974	1975–1978	1979–1980†	1981–1983	1984–1986	1987–1989	1990–1992	1993–1995
Race												
White	4,342	3,928	3,499	1,786	1,588	1,466	2,193	2,542	2,947	3,520	3,800	4,084
Black	682	701	688	560	428	377	514	652	769	972	1,022	1,182
Other	43	44	45	36	22	28	38	62	84	116	141	165
Sex												
Male	3,226	2,806	2,392	1,052	879	782	1,213	1,352	1,534	1,800	1,894	2,036
Female	1,841	1,867	1,839	1,330	1,159	1,089	1,532	1,904	2,266	2,809	3,069	3,394
Age group (yrs)												
0– 4	86	77	62	52	32	22	27	27	28	28	40	34
5–14	77	89	100	76	50	39	53	76	91	103	108	136
15–34	272	272	274	256	197	176	223	309	331	392	420	489
35–64	2,239	2,102	1,947	1,130	920	745	962	1,164	1,305	1,541	1,588	1,798
≥65	2,393	2,134	1,848	868	840	888	1,481	1,679	2,045	2,545	2,807	2,972
Total§	**5,067**	**4,674**	**4,231**	**2,382**	**2,039**	**1,870**	**2,745**	**3,255**	**3,800**	**4,609**	**4,963**	**5,429**

* All relative standard errors are <30%, (i.e., relative confidence interval <59%).
† *International Classification of Diseases* (ICD), *Seventh Revision*: 1960–1967; *ICD, Eighth Revision (Adapted)*: 1968–1978; and *ICD, Ninth Revision*: 1979–1995.
§ Numbers for each variable may not add up to total because of rounding error.

TABLE 10. Rates* of death with asthma as the underlying cause of death diagnosis, by race, sex, and age group — United States, Underlying Cause of Death dataset, 1960–1995†

Category	1960–1962§	1963–1965	1966–1967	1968–1971§	1972–1974	1975–1978	1979–1980§	1981–1983	1984–1986	1987–1989	1990–1992	1993–1995
Race¶												
White	26.6	23.1	20.0	9.8	8.3	7.2	10.2	11.4	12.5	14.2	14.6	15.1
Black	42.0	40.8	38.0	28.4	20.7	17.3	22.2	26.7	30.0	36.1	35.6	38.5
Other	25.7	23.0	22.3	15.3	8.1	8.4	10.3	13.6	15.3	17.6	18.7	17.7
Sex¶												
Male	38.6	32.6	27.0	11.4	9.1	7.7	11.5	12.2	13.2	14.7	14.8	15.1
Female	19.5	18.7	17.7	12.3	10.0	8.8	11.6	13.8	15.5	18.2	18.9	20.0
Age group (yrs)												
0– 4	4.3	4.0	3.4	3.0	1.9	1.3	1.6	1.6	1.6	1.5	2.1	1.8
5–14	2.1	2.4	2.6	1.8	1.3	1.1	1.5	2.2	2.6	2.9	3.0	3.7
15–34	5.6	5.2	4.9	4.3	3.0	2.4	2.8	3.9	4.1	4.9	5.3	6.3
35–64	36.9	33.9	30.8	17.5	13.8	10.9	13.8	16.0	17.0	19.0	18.5	19.6
≥65	141.5	118.8	98.1	43.6	38.7	37.6	58.6	63.0	72.3	85.0	89.0	89.8
Total¶	**28.2**	**24.9**	**21.8**	**11.8**	**9.5**	**8.2**	**11.5**	**13.1**	**14.4**	**16.6**	**17.1**	**17.9**

* Per 1,000,000 population.
† All relative standard errors are <30% (i.e., relative confidence interval <59%).
§ *International Classification of Diseases* (ICD), *Seventh Revision*: 1960–1967; *ICD, Eighth Revision (Adapted)*: 1968–1978; *ICD, Ninth Revision*: 1979–1995.
¶ Age-adjusted to the 1970 U.S. population.

TABLE 11. Rates* of deaths for asthma as the underlying cause of death among whites, by year, region, and state — United States, Underlying Cause of Death dataset, 1960–1995

Region/State	1960–1965†	1966–1971§	1972–1977†	1978–1983§	1984–1989†	1990–1995
Northeast						
Connecticut	16.4	—	6.7	—	10.9	10.2
Maine	35.0	—	10.2	—	15.7	13.0
Massachusetts	25.3	—	8.1	—	14.7	14.1
New Hampshire	35.8	—	8.9	—	13.4	12.4
New Jersey¶	17.5	—	4.5	—	9.4	11.3
New York	19.8	—	8.4	—	16.7	17.0
Pennsylvania	22.5	—	6.9	—	10.0	11.6
Rhode Island	28.0	—	6.1	—	8.6	9.5
Vermont	27.1	—	9.9	—	11.9	14.7
Midwest						
Illinois	21.5	—	7.0	—	11.8	14.5
Indiana	26.9	—	6.9	—	12.3	14.4
Iowa	29.6	—	6.8	—	14.9	16.6
Kansas	26.9	—	8.7	—	13.7	14.8
Michigan	30.6	—	9.1	—	12.5	14.1
Minnesota	26.0	—	8.1	—	15.7	18.1
Missouri	27.8	—	6.9	—	9.0	12.7
Nebraska	36.2	—	9.1	—	20.6	23.0
North Dakota	33.0	—	10.7	—	19.5	20.0
Ohio	22.8	—	6.3	—	11.2	11.7
South Dakota	33.6	—	6.6	—	16.3	18.3
Wisconsin	23.3	—	7.8	—	14.0	14.9
South						
Alabama	20.4	—	7.0	—	9.3	10.1
Arkansas	18.4	—	5.6	—	9.5	15.3
Delaware	22.8	—	4.2	—	7.7	12.7
District of Columbia	20.2	—	7.3	—	13.0	12.1
Florida	22.5	—	6.6	—	9.8	11.5
Georgia	21.1	—	6.9	—	11.8	13.3
Kentucky	34.6	—	11.5	—	13.9	14.1
Louisiana	22.9	—	7.3	—	12.0	15.3
Maryland	18.8	—	6.2	—	9.4	11.1
Mississippi	19.8	—	5.6	—	10.3	11.1
North Carolina	24.0	—	8.7	—	14.1	16.4
Oklahoma	31.1	—	7.3	—	13.6	16.0
South Carolina	18.6	—	7.4	—	12.6	14.1
Tennessee	24.3	—	7.5	—	10.3	14.2
Texas	21.5	—	6.9	—	11.3	15.4
Virginia	22.4	—	7.5	—	15.4	16.3
West Virginia	33.6	—	11.4	—	14.1	15.4
West						
Alaska	25.8	—	9.4	—	11.6	5.3
Arizona	89.4	—	15.3	—	23.5	20.4
California	24.8	—	7.8	—	15.8	17.0
Colorado	29.9	—	10.6	—	23.2	21.3
Hawaii	27.3	—	11.5	—	14.9	23.3
Idaho	34.2	—	9.7	—	19.4	16.9
Montana	34.0	—	10.1	—	21.8	22.4
Nevada	36.9	—	10.2	—	14.1	15.8
New Mexico	43.1	—	12.4	—	22.9	22.9
Oregon	31.3	—	10.0	—	20.4	21.5
Utah	23.9	—	10.3	—	18.0	18.8
Washington	28.4	—	9.7	—	16.2	18.2
Wyoming	34.5	—	7.9	—	14.3	17.2

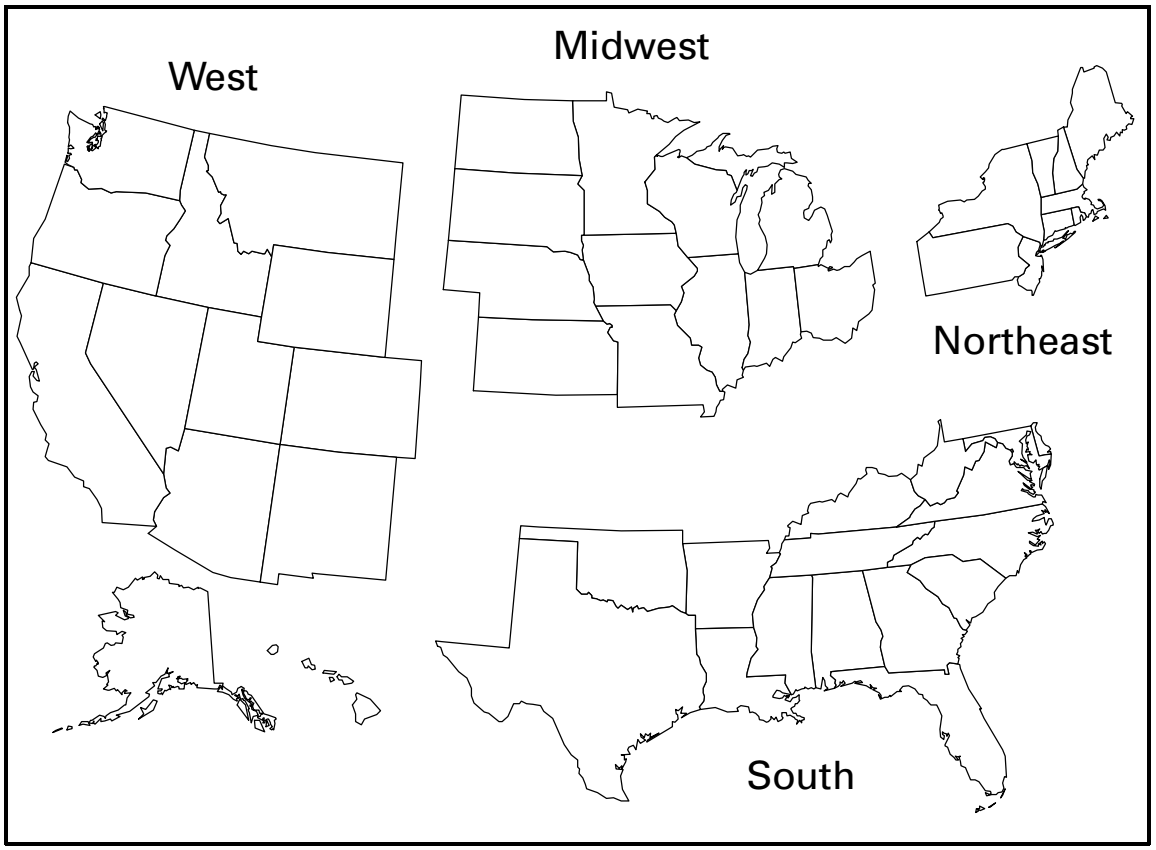
*Per 1,000,000 population, age-adjusted to the U.S. 1970 population.
†*International Classification of Diseases* (ICD), *Seventh Revision*: 1960–1967; *ICD, Eighth Revision (Adapted)*: 1968–1978; *ICD, Ninth Revision*: 1979–1995.
§Rates are not reported for these year groupings because they cross ICD classifications.
¶For 1962 and 1963, the number of deaths among whites was estimated.

TABLE 12. Rates* of deaths for asthma as the underlying cause of death among blacks, by year, region, and state† — United States, Underlying Cause of Death dataset, 1960–1995

Region/State	1960–1965§**	1966–1971¶	1972–1977**	1978–1983¶	1984–1989**	1990–1995
Northeast						
Connecticut	39.5	—	16.1	—	26.0	30.1
Massachusetts	52.9	—	33.8	—	32.2	36.4
New Jersey††	34.4	—	16.1	—	29.1	36.1
New York	46.9	—	24.7	—	45.8	49.0
Pennsylvania	34.3	—	15.1	—	27.9	34.0
Midwest						
Illinois	28.0	—	21.0	—	45.4	60.8
Indiana	46.8	—	12.0	—	29.8	30.2
Kansas	56.4	—	20.9	—	42.5	23.2
Michigan	46.6	—	18.0	—	32.1	38.5
Missouri	53.7	—	20.8	—	31.3	41.1
Ohio	48.7	—	15.9	—	31.5	32.2
Wisconsin	44.6	—	17.1	—	29.5	48.5
South						
Alabama	31.1	—	19.8	—	26.0	26.5
Arkansas	33.8	—	7.9	—	30.1	45.0
Delaware	11.9	—	21.1	—	30.8	19.2
District of Columbia	51.7	—	18.8	—	34.3	44.9
Florida	58.6	—	25.5	—	28.5	30.4
Georgia	39.3	—	19.3	—	36.5	30.9
Kentucky	44.3	—	23.2	—	20.0	32.8
Louisiana	47.0	—	21.0	—	32.9	35.0
Maryland	45.3	—	17.3	—	23.5	25.6
Mississippi	30.8	—	13.1	—	27.6	32.2
North Carolina	32.2	—	20.7	—	30.2	31.7
Oklahoma	61.8	—	12.4	—	26.6	29.4
South Carolina	20.6	—	14.1	—	30.7	31.0
Tennessee	49.6	—	20.2	—	29.6	32.8
Texas	39.9	—	14.8	—	25.1	32.9
Virginia	42.4	—	22.6	—	26.4	36.7
West Virginia	46.2	—	24.8	—	12.0	26.3
West						
Arizona	104.1	—	20.4	—	39.4	40.6
California	40.3	—	18.1	—	37.9	36.6
Colorado	84.7	—	17.2	—	58.8	50.6
Washington	34.6	—	13.9	—	34.0	42.0

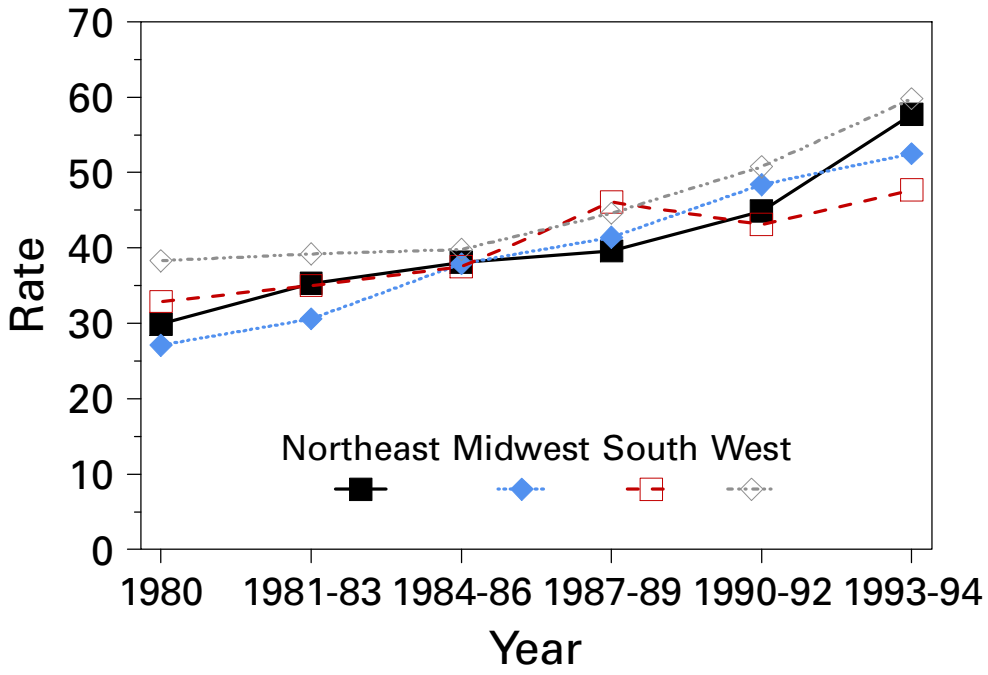
*Per 1,000,000 population, age-adjusted to the 1970 U.S. population.
†Includes only data from states in which two or more asthma deaths occurred among blacks annually.
§For 1960 and 1961, the number of deaths among blacks was estimated for all states.
¶Rates are not reported for these year groupings because they cross ICD classifications.
**_International Classification of Diseases (ICD), Seventh Revision_: 1960–1967; _ICD, Eighth Revision (Adapted)_: 1968–1978; _ICD, Ninth Revision_: 1979–1995.
††For 1962 and 1963, the number of deaths among blacks was estimated.

FIGURE 1. Geographic regions — United States*



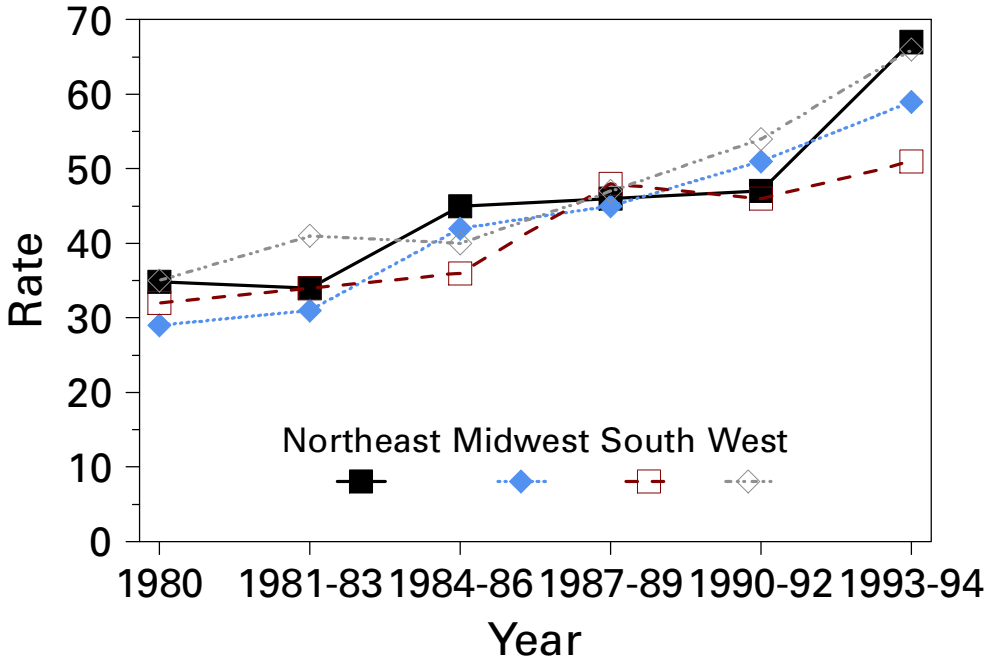
* *Northeast*=Connecticut, Maine, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont; *Midwest*=Illinois, Indiana, Iowa, Kansas, Michigan, Minnesota, Missouri, Nebraska, North Dakota, Ohio, South Dakota, and Wisconsin; *South*=Alabama, Arkansas, Delaware, District of Columbia, Florida, Georgia, Kentucky, Louisiana, Maryland, Mississippi, North Carolina, Oklahoma, South Carolina, Tennessee, Texas, Virginia, and West Virginia; and *West*=Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming.

FIGURE 2. Estimated average prevalence rate* of self-reported asthma, by region and year — United States, National Health Interview Survey, 1980–1994



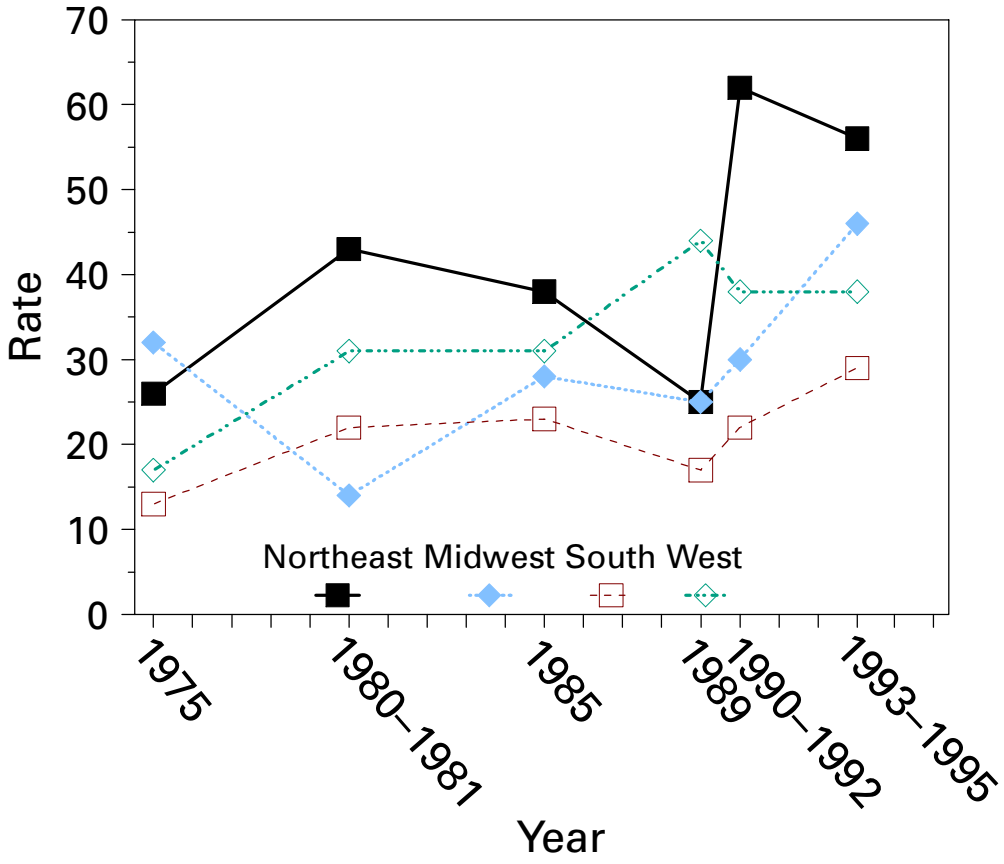
*Per 1,000 population. Race-, sex-, and age-adjusted to the 1970 U.S. population.

FIGURE 3. Estimated average prevalence rates* of self-reported asthma for persons aged 5–34 years, by region and year — United States, National Health Interview Survey, 1980–1994



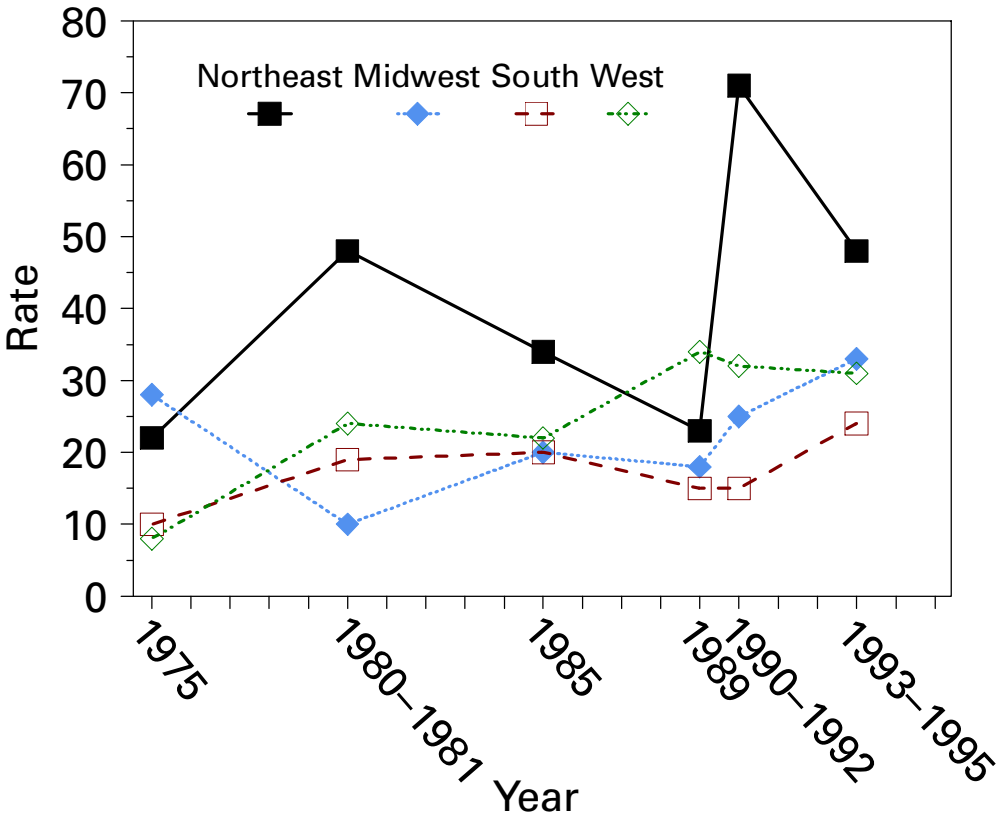
*Per 1,000 population.

FIGURE 4. Estimated average rates* of office visits for asthma as the first-listed diagnosis, by region and year — United States, National Ambulatory Medical Care Survey, 1975–1995†



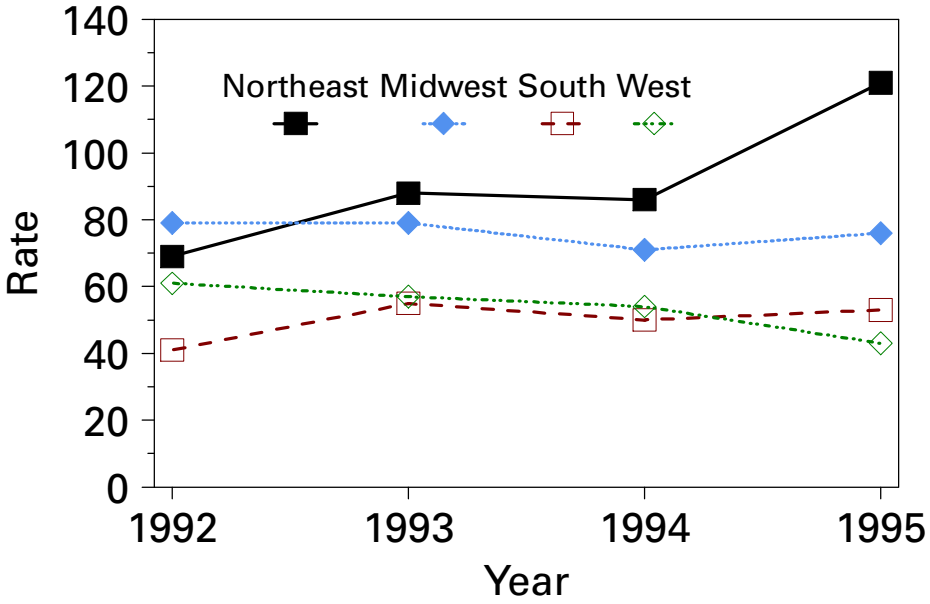
*Per 1,000 population. Race-, sex-, and age-adjusted to the 1970 U.S. population.
†Estimated average rates of office visits for 1975, 1985, and 1989, when only 1 year of data were available for analysis, are less stable average rates than rates for the other years (1980–1981, 1990–1992, and 1993–1995).

FIGURE 5. Estimated average rates* of office visits for asthma as the first-listed diagnosis among persons aged 5–34 years, by region and year — United States, National Ambulatory Medical Care Survey, 1975–1995†



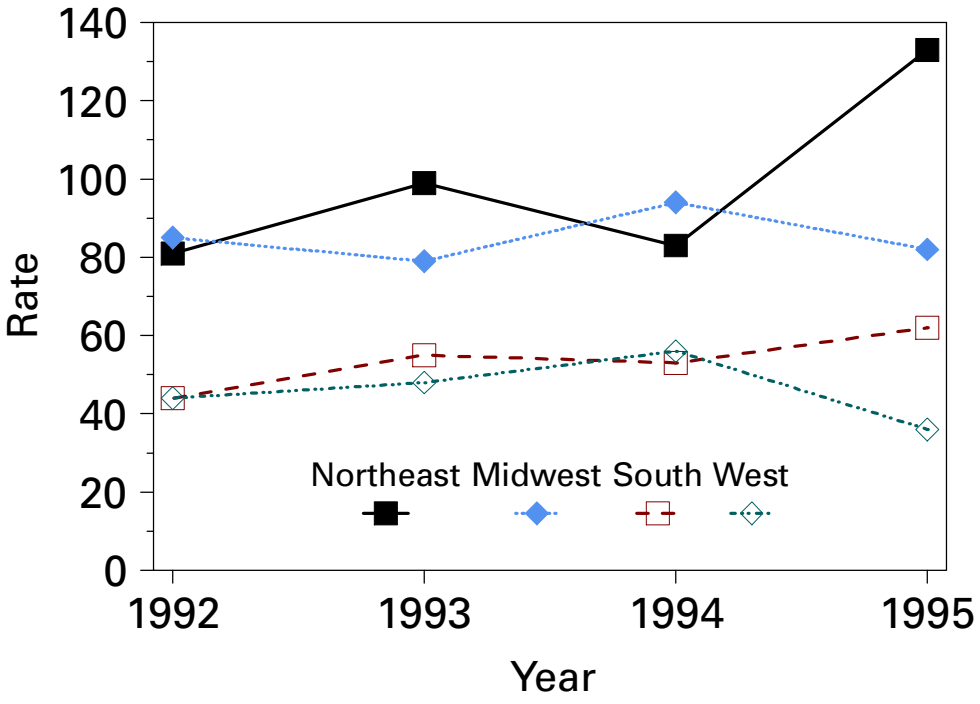
*Per 1,000 population.
†Estimated average rates of office visits for 1975, 1985, and 1989, when only 1 year of data were available for analysis, are less stable average rates than the other years (1980–1981, 1990–1992, and 1993–1995).

FIGURE 6. Estimated average rates* of emergency room visits for asthma as the first-listed diagnosis, by region and year — United States, National Hospital Ambulatory Medical Care Survey, 1992–1995



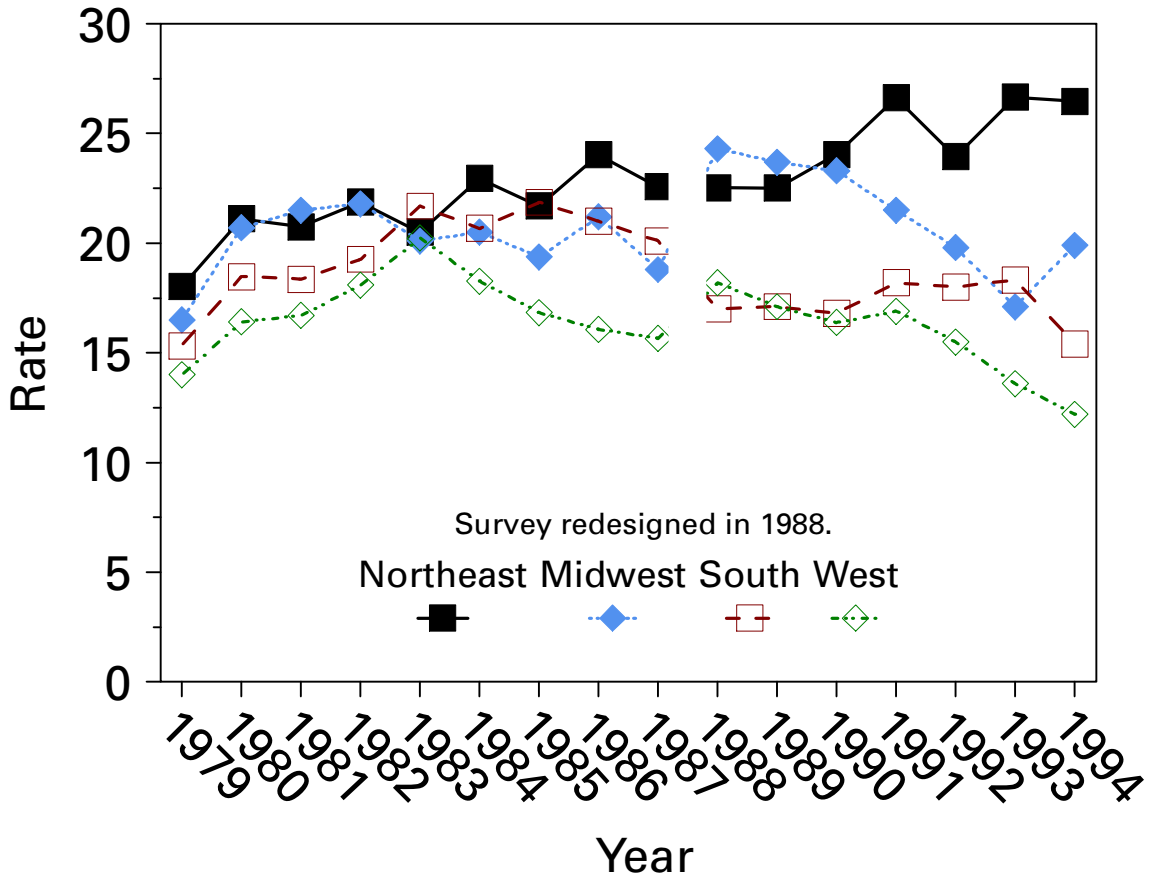
*Per 10,000 population. Race-, sex-, and age-adjusted to the 1970 U.S. population.

FIGURE 7. Estimated average rates* of emergency room visits for asthma as the first-listed diagnosis among persons aged 5–34 years, by region and year — United States, National Hospital Ambulatory Care Survey, 1992–1995



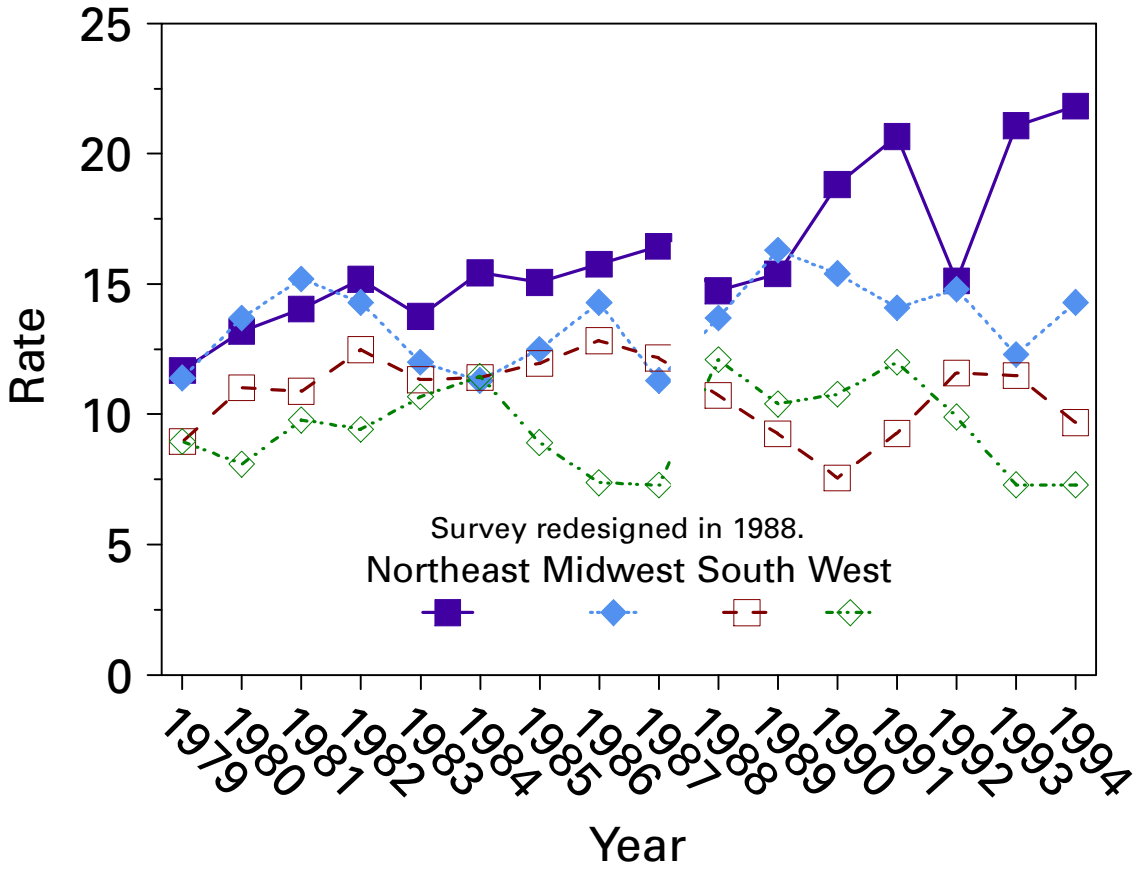
*Per 10,000 population.

FIGURE 8. Estimated average rates* of hospital discharge for asthma as the first-listed diagnosis, by region and year — United States, National Hospital Discharge Survey, 1979–1994



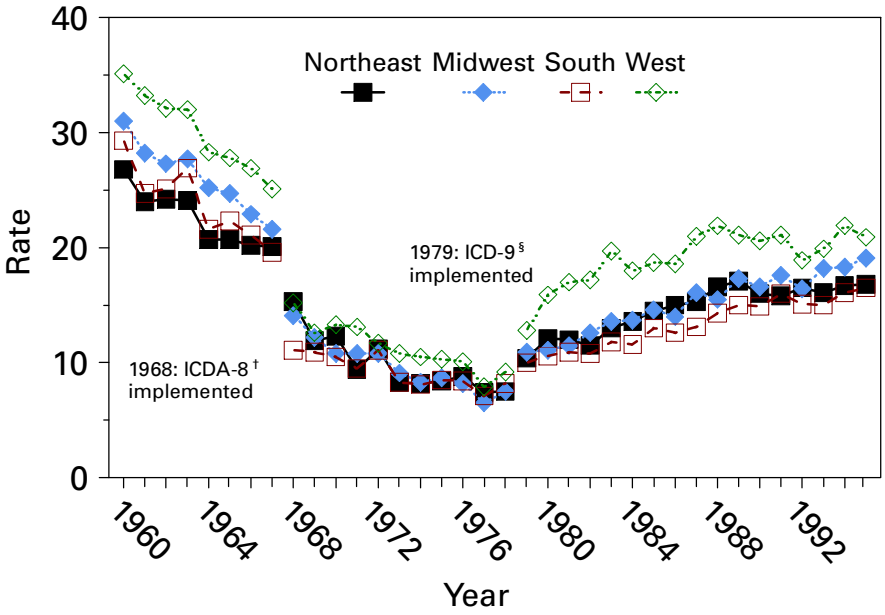
*Per 10,000 population, age-adjusted to the 1970 U.S. population.

FIGURE 9. Estimated average rates* of hospital discharge for asthma as the first-listed diagnosis, among persons aged 5–34 years, by region and year — United States, National Hospital Discharge Survey, 1979–1994



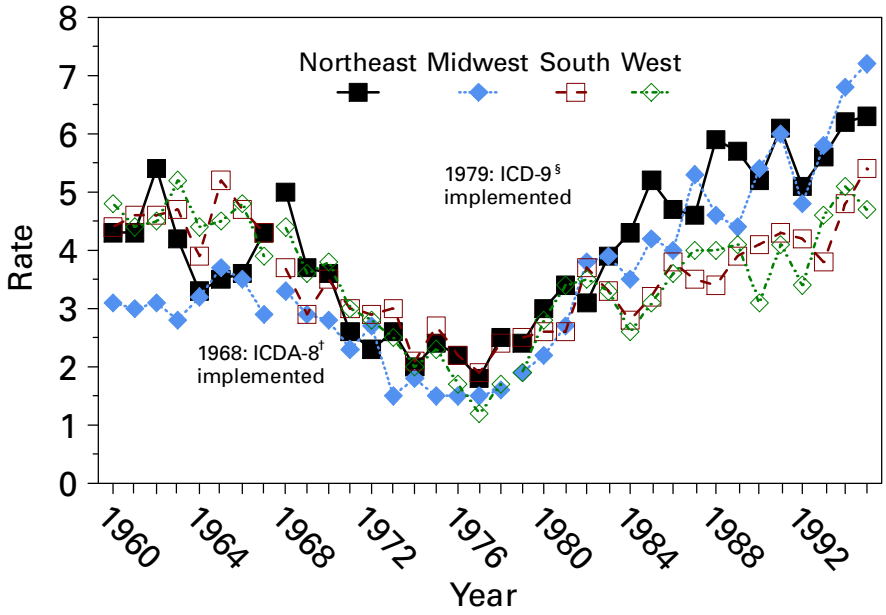
*Per 10,000 population.

FIGURE 10. Rates* of deaths for asthma as the underlying cause of death, by region and year — United States, Underlying Cause of Death dataset, 1960–1995



*Per 1,000,000 population. Race-, sex-, and age-adjusted to the 1970 U.S. population.
†*International Classification of Disease, Eighth Revision (Adapted).*
§*International Classification of Diseases, Ninth Revision.*

FIGURE 11. Rates* of deaths for asthma as the underlying cause of death, among persons aged 5–34 years, by region and year — United States, Underlying Cause of Death dataset, 1960–1995



*Per 1,000,000 population.
†*International Classification of Disease, Eighth Revision (Adapted).*
§*International Classification of Diseases, Ninth Revision.*

State and Territorial Epidemiologists and Laboratory Directors

State and Territorial Epidemiologists and Laboratory Directors are acknowledged for their contributions to *CDC Surveillance Summaries*. The epidemiologists listed below were in the positions shown as of March 1998, and the laboratory directors listed below were in the positions shown as of March 1998.

State/Territory	Epidemiologist	Laboratory Director
Alabama	John P. Lofgren, MD	William J. Callan, PhD
Alaska	John P. Middaugh, MD	Gregory V. Hayes, DrPH
Arizona	Robert W. England, Jr, MD, MPH	Barbara J. Erickson, PhD
Arkansas	Thomas C. McChesney, DVM	Michael G. Foreman
California	Stephen H. Waterman, MD, MPH	Paul Kimsey, PhD
Colorado	Richard E. Hoffman, MD, MPH	Ronald L. Cada, DrPH
Connecticut	James L. Hadler, MD, MPH	Sanders F. Hawkins, PhD
Delaware	A. LeRoy Hathcock, PhD	Roy J. Almeida, DrPH
District of Columbia	Martin E. Levy, MD, MPH	James B. Thomas, ScD
Florida	Richard S. Hopkins, MD, MSPH	E. Charles Hartwig, ScD
Georgia	Kathleen E. Toomey, MD, MPH	Elizabeth A. Franko, DrPH
Hawaii	Paul Effler, MD, MPH	Vernon K. Miyamoto, PhD
Idaho	Christine G. Hahn, MD	Richard H. Hudson, PhD
Illinois	Byron J. Francis, MD, MPH	David F. Carpenter, PhD
Indiana	Gregory K. Steele, DrPH, MPH	David E. Nauth
Iowa	M. Patricia Quinlisk, MD, MPH	Mary J. R. Gilchrist, PhD
Kansas	Gianfranco Pezzino, MD, MPH	Roger H. Carlson, PhD
Kentucky	Clarkson T. Palmer, MD, MPH (Acting)	Thomas E. Maxson, DrPH
Louisiana	Louise McFarland, DrPH	Henry B. Bradford, Jr, PhD
Maine	Kathleen F. Gensheimer, MD, MPH	John A. Krueger
Maryland	Diane M. Dwyer, MD, MPH	J. Mehsen Joseph, PhD
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Mississippi	Mary Currier, MD, MPH	Joe O. Graves, PhD
Missouri	H. Denny Donnell, Jr, MD, MPH	Eric C. Blank, DrPH
Montana	Todd A. Damrow, PhD, MPH	Paul Lamphier
Nebraska	Thomas J. Safranek, MD	Steve Hinrichs, MD
Nevada	Randall L. Todd, DrPH	L.D. Brown, MD, MPH
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New Jersey	Herman Ellis, MD	Thomas J. Domenico, PhD
New Mexico	C. Mack Sewell, DrPH, MS	David E. Mills, PhD
New York City	Benjamin A. Mojica, MD, MPH	Alex Ramon, MD, MPH
New York State	Perry F. Smith, MD	Ann Willey, PhD
North Carolina	J. Newton MacCormack, MD, MPH	Lou F. Turner, DrPH
North Dakota	Larry A. Shireley, MS, MPH	James D. Anders, PhD
Ohio	Thomas J. Halpin, MD, MPH	Leona Ayers, MD
Oklahoma	J. Michael Crutcher, MD, MPH	Garry L. McKee, PhD
Oregon	David W. Fleming, MD	Michael R. Skeels, PhD, MPH
Pennsylvania	James T. Rankin, Jr, DVM, PhD, MPH	Bruce Kleger, DrPH
Rhode Island	Utpala Bandyopadhyay, MD, MPH	Walter S. Combs, PhD
South Carolina	James J. Gibson, MD, MPH	Harold Dowda, PhD
South Dakota	Susan E. Lance, DVM, PhD, MPH	Michael Smith
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Vermont	Peter D. Galbraith, DMD, MPH	Burton W. Wilcke, Jr, PhD
Virginia	Suzanne R. Jenkins, VMD, MPH	James L. Pearson, DrPH
Washington	Paul A. Stehr-Green, DrPH, MPH	Jon M. Counts, DrPH
West Virginia	Loretta E. Haddy, MA, MS	Frank W. Lambert, Jr, DrPH
Wisconsin	Jeffrey P. Davis, MD	Ronald H. Laessig, PhD
Wyoming	Gayle L. Miller, DVM, MPH	Carl Blank, DrPH
American Samoa	Edgar C. Reid, MO, MPH	Edgar C. Reid, MO, MPH
Federated States of Micronesia	Jean-Paul Chaine	—
Guam	Robert L. Haddock, DVM, MPH	Florencia Nocon (Acting)
Marshall Islands	Tom D. Kijiner	—
Northern Mariana Islands	Jose L. Chong, MD	Isamu J. Abraham, DrPH
Palau	Jill McCready, MS, MPH	—
Puerto Rico	Carmen C. Deseda, MD, MPH	José Luis Miranda Arroyo, MD
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