

# Asthma in the United States: Recent Trends and Current Status

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## ABSTRACT

**OBJECTIVE:** To describe the prevalence of and morbidity and mortality from asthma in Americans and the impact of the disease on health resource utilization and costs, define asthma control and characterize the extent to which it is achieved with recommended asthma therapies, discuss patterns of medication use in patients with asthma who are at high risk for morbidity and mortality, characterize health resource utilization and morbidity in patients with difficult-to-treat asthma, and identify the objectives of asthma drug therapy research efforts.

**DATA SOURCES:** This article is based on a presentation given by the author at a symposium entitled "New Frontiers in Asthma Management: Biotechnology for Optimal Therapeutic and Economic Outcomes" at the Academy of Managed Care Pharmacy's 15th Annual Meeting and Showcase in Minneapolis, Minnesota, on April 10, 2003.

**CONCLUSIONS:** The prevalence of asthma and associated costs has increased in the United States. Patients with asthma that is difficult to treat because of frequent or severe exacerbations, inability to avoid asthma triggers, or the need for multiple drug therapies or complex medication regimens are responsible for a disproportionately large share of health resource utilization and costs. Medication use is less than optimal in many patients with asthma who are at high risk for morbidity and mortality, and asthma control is poor in many patients despite the use of recommended drug therapies. Results of the TENOR Study, a large, 3-year, multicenter, observational cohort study, demonstrated that difficult-to-treat asthma is associated with substantial health resource utilization and morbidity. New asthma drug therapies are needed to improve asthma control, patient adherence to the therapeutic regimen, and quality of life and reduce the incidence of asthma exacerbations, health resource utilization, and costs.

**KEYWORDS:** Asthma, Cost, Burden of disease, NAEPP guidelines

Asthma affects 17.7 million American adults, including 10.5 million women and 7.1 million men (i.e., the disease affects women in greater numbers than men).<sup>1</sup> The disease also affects approximately 5 million children in the United States.<sup>2</sup> The prevalence of asthma has more than doubled since 1980, a year when 8.5 million cases were reported.<sup>2</sup> The increase in asthma prevalence over the past 2 decades has been particularly dramatic in children aged 4 years and younger. In this age group, 0.4 million cases were reported in 1980 and 1 million cases were reported in 1998, representing a 250% increase. Although asthma affects many children and young adults, it also affects elderly Americans.<sup>3</sup> However, only about 10% of people with asthma are aged 65 years or older.

## Health Resource Utilization and Mortality

Asthma was responsible for 9.3 million physician office visits in the United States in 2000.<sup>1</sup> The disease results in 500,000 hospitalizations<sup>4</sup> and 5,500 deaths<sup>2</sup> each year in this country. The rates of emergency department visits, hospitalization, and death are 2 to 3 times higher in African Americans than in white Americans.<sup>2</sup> The rate of asthma-related emergency department visits by men and women of all races increased during the 1990s (Figure 1), and the increase in rate between 1994 and 1995 was greater in women than in men.<sup>5</sup> The rate of asthma-related hospitalization began to decrease in the 1990s<sup>5</sup> (Figure 2), possibly because of improved medication use and the availability of treatment guidelines. Reductions in hospitalizations were observed primarily in white Americans, not in young African Americans. Rates of asthma-related hospitalization, emergency department visits, and deaths in African Americans continue to exceed rates in white Americans.<sup>6</sup> Between 1979 and 1995, the mortality rate increased by 132%, from 7.2 to 16.7 per million African Americans. The mortality rate increased from 1.4 to 3.9 per million white Americans, an increase of 179% during the same period.

## Costs

The costs of asthma increased by about 75% between 1985 and 1994, although the estimated cost per patient with asthma decreased during this period.<sup>7</sup> The increase in asthma-related costs was lower in children than in adults.

In 1998, the majority (58%) of the costs of asthma were associated with direct medical expenditures (Figure 3).<sup>8</sup> Indirect costs represented 42% of total asthma-related expenditures, and costs due to lost productivity were the largest component of indirect costs.<sup>8</sup> Expenditures for medications was the largest component (42%) of direct costs, and medications accounted for a larger percentage of direct costs in 1998 than in 1985, when 30% of direct costs were for medications.<sup>7,8</sup>

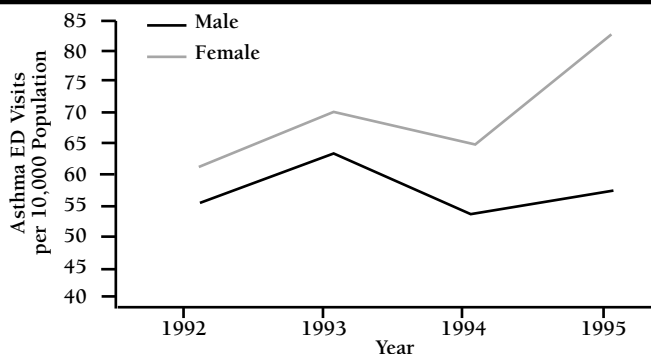
An analysis of national costs and resource utilization data found

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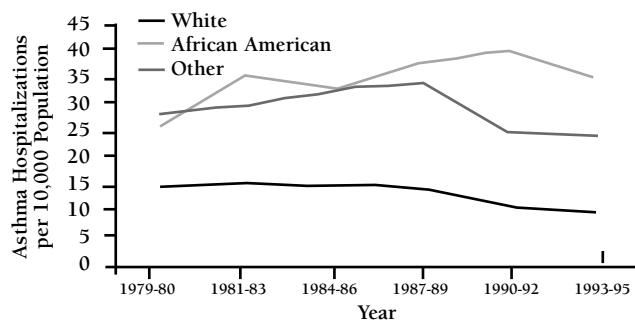
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**FIGURE 1** Trends in Asthma-Related Emergency Department Use



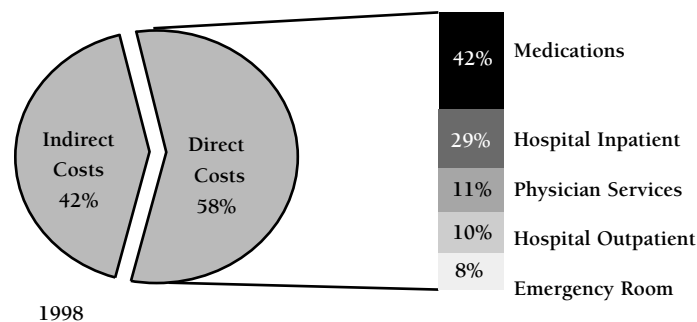
NCHS, National Hospital Discharge Survey, 1999.

**FIGURE 2** Trends in Asthma-Related Hospitalizations



NCHS, National Hospital Discharge Survey, 1999.

**FIGURE 3** Distribution of Asthma Costs in 1998<sup>a</sup>



Weiss KB, Sullivan SD. *J Allergy Clin Immunol* 2001;107:3-8.

that more than 80% of direct costs (e.g., costs for ambulatory care visits, hospital outpatient services and inpatient stays, emergency department visits, physician payments, and medications) were used by 20% of patients.<sup>9</sup> The estimated annual cost per patient for these high-cost patients exceeded \$2,500, although it was only \$140 for other patients. Hospitalization accounted for more than

half of all expenditures.<sup>9</sup> Thus, patients with asthma that is poorly controlled are responsible for a disproportionately large share of costs compared with patients with disease that is well controlled.<sup>9</sup> Interventions to improve asthma control have the potential to reduce costs.

**Asthma Control**

The National Asthma Education and Prevention Program (NAEPP) goals of therapy for achieving asthma control are listed in Table 1.<sup>10</sup> Many patients with moderate persistent or severe persistent asthma do not achieve control despite the use of the combination controller drug therapies recommended by NAEPP.<sup>11</sup> In a study of patients with asthma that was moderate in severity, asthma control was achieved on only about one third of days using an inhaled corticosteroid (ICS) plus a long-acting inhaled beta<sub>2</sub>-agonist.<sup>11</sup> When a short-acting inhaled beta<sub>2</sub>-agonist was added for daytime rescue therapy, control of asthma was achieved on only one half of these days.<sup>11</sup>

**High-Risk Patients**

Characteristics of patients at high risk of asthma-related death who were identified in the National Heart, Lung, and Blood Institute's Global Initiative for Asthma are listed in Table 2.<sup>12</sup> The morbidity and mortality for high-risk patients with severe asthma have not decreased despite the introduction of new asthma drug therapies, including long-acting inhaled beta<sub>2</sub>-agonists, high-dose ICSs, and leukotriene receptor antagonists. This patient population has an 8- to 16-fold greater risk of dying than other patients with asthma and accounts for a disproportionately large share of health care costs.

An analysis of 4,143 adults with moderate or severe asthma who were at high risk for death was conducted using 1997 to 2001 data derived from the Medstat MarketScan Commercial Claims and Encounters Database of 28,506 patients with asthma and claims in 2000 and 2001.<sup>13</sup> This database contains the inpatient, outpatient, and outpatient prescription experience of nearly 3 million employed persons and their dependents, early retirees, and Consolidated Omnibus Budget Reconciliation Act (COBRA) beneficiaries covered under a variety of fee-for-service and capitated health plans.<sup>13</sup> The majority (61%) of the high-risk patients were women, and the mean age was 38 years. Most patients (60%) were covered by a noncapitated insurance plan, and 40% were covered under a capitated plan. Only 0.3% were covered by a Medicare managed care plan. Comorbid allergies and sinusitis were present in more than 40% and nearly 40% of the high-risk patients, respectively.

An analysis of asthma medication use persistence by drug class and controller drugs and treatment adherence to National Heart Lung Blood Institute Guidelines (2002) revealed that the use of ICSs, long-acting inhaled beta<sub>2</sub>-agonists, and leukotriene receptor antagonists was observed on only about 30%, 31%, and 55% of days, respectively. The use of these agents is recommended in NAEPP treatment guidelines.<sup>10</sup> The percentage of patients who

received treatment that was consistent with treatment guidelines was determined using 2 scenarios. In the first scenario, appropriate treatment was defined as use of an ICS for at least 50% of the observed time plus use of a long-acting inhaled beta<sub>2</sub>-agonist, a leukotriene receptor antagonist, or an oral corticosteroid. Only 24% of high-risk patients received appropriate care using this scenario. In the other scenario, appropriate treatment was defined as the use of any controller medication for at least 50% of the exposure time. Forty-two percent of patients received appropriate treatment when this definition was used. Thus, there is considerable room for improvement in medication use in patients with asthma who are at high risk for death.

### The TENOR Study

The Epidemiology and Natural History of Asthma: Outcomes and Treatment Regimens (TENOR) study is an ongoing 3-year, multi-center, observational cohort study designed to ascertain the impact of asthma that is severe or difficult to treat per physician assessment. Health resource utilization, attendance in the workplace and school, asthma symptoms and quality of life, lung function, and medication use and adverse events were reported.<sup>14</sup> The study cohort comprised 4,756 patients recruited from 283 sites, including the managed care setting, health maintenance organizations, private community practices, and academic medical centers. The TENOR registry contains the largest volume of data compiled to date in this patient population. Because the study is observational, asthma medications and other treatments were given as prescribed by patients' own physicians. The data analysis controlled for the influence of confounding variables.

Subjects were included in the TENOR Study if they had severe or difficult-to-treat asthma in the opinion of their physician, had received care from that provider for at least 1 year, were at least 6 years old, and were able to read and understand English. Patients with mild or moderate persistent asthma were eligible if their disease was considered difficult-to-treat. In addition, patients were included in the study only if they had a history of 2 or more unscheduled care visits for asthma or 2 or more courses of oral corticosteroid therapy within the 12 months before screening or a requirement for large daily dosages of ICSs, at least 5 mg/day of oral prednisone, or 3 or more medications for asthma control at the time of screening. Patients with a history of heavy smoking (i.e., more than 30 pack-years), a primary diagnosis of cystic fibrosis, severe cardiovascular disease (New York Heart Association class II or greater), cancer (except nonmelanoma skin cancer and malignancies that had been "clear" for at least 5 years), a severe psychiatric disorder (except anxiety and depression), significant systemic disease with a life expectancy less than 2 or 3 years, or a history of drug abuse were excluded from the study.

Nearly three fourths (73%) of the patients in the TENOR Study registry were adults (aged 18 years or older), 10% were adolescents (aged 13 to 17 years), and 16% were children (aged 6 to 12 years).<sup>15</sup> The majority (71%) of adults were women, but the numbers of male children and adolescents exceeded the numbers of

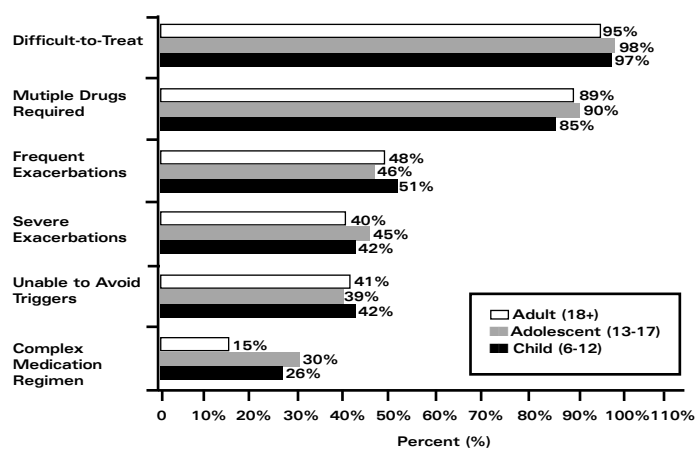
**TABLE 1** National Asthma Education and Prevention Program Goals of Therapy for Asthma Control<sup>10</sup>

- Minimal or no chronic symptoms during the daytime or nighttime
- Minimal or no exacerbations
- No limitations on activities; no school or work missed
- Normal (or near normal) pulmonary function
- Minimal use of short-acting inhaled beta<sub>2</sub>-agonists (less than once per day, less than one canister per month)
- Minimal or no adverse effects from medications

**TABLE 2** Characteristics of Patients With Asthma at High Risk for Death<sup>12</sup>

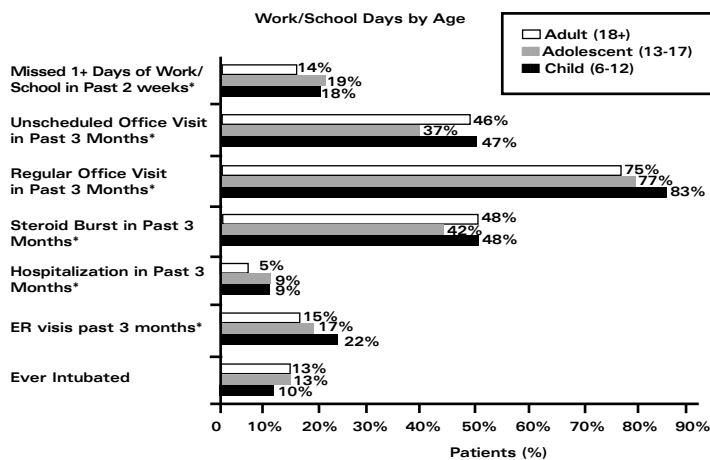
- History of severe exacerbations
- Hospitalization or emergency department visit for asthma within the past year
- Current use of or recent discontinuation of systemic corticosteroids
- History of near-fatal asthma requiring intubation and mechanical ventilation
- Excessive dependence on short-acting inhaled beta<sub>2</sub>-agonists, especially use of more than one canister of albuterol (or equivalent) monthly
- History of serious psychiatric disease, including depression, or psychosocial problems

**FIGURE 4** Physician Assessment of Reasons for Asthma Treatment Difficulty in TENOR Study Patients



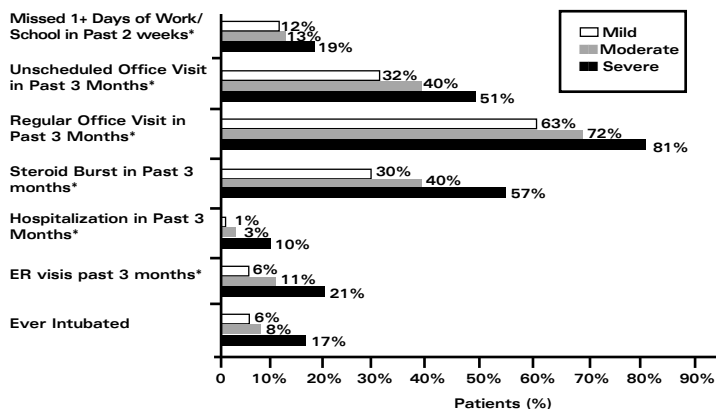
female children and adolescents.<sup>15</sup> The majority of patients had moderate or severe asthma in the judgment of their physician (severity was classified based on overall symptoms, nocturnal symptoms, and forced expiratory volume in 1 second (FEV<sub>1</sub>) in

**FIGURE 5** Health Resource Utilization and Missed Work or School Days by Age in Patients With Difficult-to-Treat Asthma



\*P-value for chi-square test of difference between age groups  $\leq 0.05$ .

**FIGURE 6** Health Resource Utilization and Missed Work or School Days by Asthma Severity in Patients With Difficult-to-Treat Asthma



\*P-value for chi-square test of difference between age groups  $\leq 0.05$ .

regular and unscheduled office visits, emergency department visits, and hospitalizations. Nearly 1 in 5 children and adolescents was absent from school because of asthma for at least 1 day in a 2-week period, reflecting substantial morbidity from difficult-to-treat disease. Adult workplace absenteeism was almost as high as school absenteeism in younger patients.

Health resource utilization and workplace and school absenteeism tended to be higher in patients with severe persistent asthma than in patients with moderate or mild persistent asthma (Figure 6). However, these outcome measures did not vary much by FEV1, demonstrating that FEV1 is a poor predictor of health resource utilization and morbidity in patients with difficult-to-treat asthma.

Almost all (99%) of patients in the TENOR Study received at least 1 controller medication (e.g., ICSs, long-acting inhaled beta<sub>2</sub>-agonists, leukotriene receptor antagonists), 92% of patients received 2 or more controllers, and 56% of patients received 3 or more controllers. The number of controller medications did not substantially affect health resource utilization or workplace or school absenteeism (i.e., adding a second or third controller had little impact). These findings suggest an unmet need in asthma management.

### Addressing Unmet Needs in Asthma Management

Asthma is a chronic inflammatory disease that often has an allergic component. Although ICSs are the mainstay of asthma treatment, patient adherence to such therapy is often poor.<sup>16</sup> Asthma symptoms vary in severity over time, but the dosing of ICSs is not always versatile enough to manage symptoms. Poor adherence to and inadequate dosing of ICSs lead to symptoms, increased use of reliever medications, disruption of activities and sleep, and exacerbations that increase health resource utilization and costs. The challenges for researchers and clinicians are to identify new therapies that will target key elements in the pathogenesis of asthma, effectively control symptoms, offer patients convenience, and adverse-effect profiles that promote adherence to the therapeutic regimen, improve patient health status and quality of life, and reduce the incidence of costly exacerbations.

### Conclusions

Asthma is an increasingly common and costly health problem in the United States. Patients with severe or difficult-to-treat asthma account for the use of more health resources and a larger share of health care costs than do patients with controlled asthma. Many patients at high risk for morbidity and mortality do not receive treatment consistent with asthma guidelines. Asthma control in these patients is often not achieved with the use of recommended asthma drug therapies. New asthma drug therapies that target the allergic component of asthma and have characteristics that promote patient adherence are needed to reduce the incidence of asthma exacerbations, health resource utilization, and costs.

accordance with NAEPP guidelines<sup>10</sup>). About half of the adolescent and adult patients had severe disease, although only 36% of children in the group aged 6 to 12 years had severe disease. In 96% of all patients, the asthma was judged difficult to treat by physicians because of frequent or severe exacerbations, inability to avoid asthma triggers, the need for multiple drug therapies or complex medication regimens, or a combination of these factors (Figure 4).

Health resource utilization data from the TENOR Study (Figure 5) demonstrate that asthma that is severe or difficult to treat consumes a considerable amount of health care resources for

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