



Research Findings #33

Trends in the Pharmaceutical Treatment
of Asthma in Adults, 1998 to 2009



ABSTRACT

This report uses nationally representative data from the 1998–2009 Medical Expenditure Panel Survey (MEPS) to examine trends in adult use and expenditures for asthma medications. First, we examine trends in the treated prevalence of asthma among all adults, age 18 and older, in the U.S. civilian noninstitutionalized population. We find that from 1998–1999 to 2008–2009, the total number (proportion) of adults reporting treatment for asthma increased from 5.5 million (2.7 percent) to 10.3 million (4.5 percent). Second, among adults with reported treatment for asthma, we examine trends in the use and expenditures for three major types of medications—controllers, relievers, and oral corticosteroids (OCS). Between 1998–1999 and 2008–2009, the proportion of adults with reported treatment for asthma who used controllers increased from 54.3 to 59.9 percent, while the proportion using any reliever fell from 67.7 to 61.7 percent. In 2008–2009, an estimated 26.1 percent of adults with reported treatment for asthma used “reliever only” and 12.4 percent used OCS. After adjusting all expenditures for inflation, we find that average annual total expenditures for all prescribed asthma medications quadrupled from \$2.5 billion in 1998–1999 to \$10.2 billion in 2008–2009. The \$7.8 billion spent on controllers in 2008–2009 was 4.6 times the average (\$1.7 billion) in 1998–1999. Average annual expenditures on relievers in 2008–2009 (\$2.4 billion) were 3 times the corresponding average (\$.8 billion) in 1998–1999. Annual expenditures for OCS averaged \$.02 billion in 2008–2009. The average annual expenditure per user on all prescribed asthma medications doubled from \$553 in 1998–1999 to \$1,126 in 2008–2009. Average annual out-of-pocket expenditures per user on all prescribed asthma medications averaged \$235 in 2008–2009. In addition to aggregate trends from 1998–1999 to 2008–2009, this report also finds differences in the use of controllers, relievers, “relievers only”, and OCS across several subgroups of adults examined in 2008–2009.

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The estimates in this report are based on the most recent data available at the time the report was written. However, selected elements of MEPS data may be revised on the basis of additional analyses, which could result in slightly different estimates from those shown here. Please check the MEPS Web site for the most current file releases.

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The Medical Expenditure Panel Survey (MEPS)

Background

The Medical Expenditure Panel Survey (MEPS) is conducted to provide nationally representative estimates of health care use, expenditures, sources of payment, and insurance coverage for the U.S. civilian noninstitutionalized population. MEPS is co-sponsored by the Agency for Healthcare Research and Quality (AHRQ) and the National Center for Health Statistics (NCHS).

MEPS comprises three component surveys: the Household Component (HC), Medical Provider Component (MPC), and Insurance Component (IC). Together these surveys yield comprehensive data that provide national estimates of the level and distribution of health care use and expenditures, support health services research, and can be used to assess health care policy implications.

MEPS is the third in a series of national probability surveys conducted by AHRQ on the financing and use of medical care in the United States. The National Medical Care Expenditure Survey (NMCES) was conducted in 1977, the National Medical Expenditure Survey (NMES) in 1987. Beginning in 1996, MEPS continues this series with design enhancements and efficiencies that provide a more current data resource to capture the changing dynamics of the health care delivery and insurance system.

The design efficiencies incorporated into MEPS are in accordance with the Department of Health and Human Services (DHHS) Survey Integration Plan of June 1995, which focused on consolidating DHHS surveys, achieving cost efficiencies, reducing respondent burden, and enhancing analytical capacities. To accommodate these goals, MEPS design features include linkage with the National Health Interview Survey (NHIS), from which the sample for the MEPS-HC is drawn, and thereby enabling enhanced longitudinal data collection.

Household Component

The MEPS-HC, a nationally representative survey of the U.S. civilian noninstitutionalized population, collects medical expenditure data at both the person and household levels. The HC collects detailed data on demographic characteristics, health conditions, health status, use of medical care services, charges and payments, access to care, satisfaction with care, health insurance coverage, income, and employment.

The HC uses an overlapping panel design in which data are collected through a preliminary contact followed by a series of five rounds of interviews over a two-and-a-half year period. Using computer-assisted personal interviewing (CAPI) technology, data on medical expenditures and use for two calendar years are collected from each household. This series of data collection rounds is launched each subsequent year on a new sample of households to provide overlapping panels of survey data and, when combined with other ongoing panels, will provide continuous and current estimates of health care expenditures.

The sampling frame for the MEPS-HC is drawn from respondents to NHIS, conducted by NCHS. NHIS provides a nationally representative sample of the U.S. civilian noninstitutionalized population, with oversampling of Hispanics, blacks, and additionally Asians starting in 2006.

Medical Provider Component

The MEPS-MPC supplements and validates information on medical care events reported in the MEPS-HC by contacting medical providers and pharmacies identified by household respondents. The MPC sample includes all hospitals, hospital physicians, home health agencies, and pharmacies reported in the HC. Also included in the MPC are all office-based physicians:

- Providing care for HC respondents receiving Medicaid.
- Associated with a 75 percent sample of households receiving care through an HMO (health maintenance organization) or managed care plan.
- Associated with a variable sample of the remaining households. Data are collected on medical and financial characteristics of medical and pharmacy events reported by HC respondents, including:
 - Diagnoses coded according to ICD-9 (9th Revision, International Classification of Diseases) and DSMIV (Fourth Edition, Diagnostic and Statistical Manual of Mental Disorders).
 - Physician procedure codes classified by CPT-4 (Current Procedural Terminology, Version 4). Inpatient stay codes classified by DRG (diagnosis related group).
 - Prescriptions coded by national drug code (NDC), medication names, strength, and quantity dispensed.
 - Charges, payments, and the reasons for any difference between charges and payments. The MPC is conducted through telephone interviews and records provided by the medical provider.

Insurance Component

The MEPS-IC collects data on health insurance plans obtained through private and public sector employers. Data obtained in the IC include the number and types of private insurance plans offered, benefits associated with these plans, premiums, contributions by employers and employees, and employer characteristics.

Establishments participating in the MEPS-IC are selected through two sampling frames:

- A Bureau of the Census list frame of private sector business establishments
- The Census of Governments from the U.S. Census Bureau.

Data from these sampling frames are collected to provide annual national and state estimates of the supply of private health insurance available to American workers and to evaluate policy issues pertaining to health insurance. Since 2000, the Bureau of Economic Analysis has used national estimates of employer contributions to group health insurance from the MEPS-IC in the computation of Gross Domestic Product (GDP).

The MEPS-IC is an annual panel survey. Data are collected from the selected organizations through a prescreening telephone interview, a mailed questionnaire, and a telephone follow-up for non-respondents.

Survey Management

MEPS data are collected under the authority of the Public Health Service Act. They are edited and published in accordance with the confidentiality provisions of this act and the Privacy Act. NCHS provides consultation and technical assistance.

As soon as data collection and editing are completed, the MEPS survey data are released to the public in staged releases of summary reports and microdata files. Summary reports and microdata files are available through the Internet on the MEPS Web site:
<http://www.meps.ahrq.gov/>.

For more information, visit the MEPS Web site or e-mail
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Trends in the Pharmaceutical Treatment of Asthma in Adults, 1998 to 2009

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Introduction

The prevalence of asthma, a common and chronic inflammatory disorder of the airways, increased across all ages during the past decade (Zahran, et al., 2011). Studies have found that asthma symptoms, particularly in adults, are associated with worse prognosis, lower remission rates, persistent airflow limitation, and lower lung function levels (Vonk and Boezen, 2006). These have implications for health resource use and expenditures. Indeed, a recent study using the Medical Expenditure Panel Survey (MEPS) found that \$18 billion of national medical expenditure was attributable to asthma, with prescription drugs being the largest contributor for adults with asthma (Sullivan, et al., 2011).

Appropriate prescribed medications are essential for adequate management of asthma. The recently updated pharmacotherapy section of the treatment guidelines from the National Asthma Education and Prevention Program recommend a stepwise approach to asthma management that uses three general types¹ of medications: controllers, relievers, and oral corticosteroids (OCS) (NAEPP-EPR3, 2007). The recommendations call for the use of relievers, as required, to treat intermittent asthma and the use of relievers in conjunction with controllers to treat persistent asthma. Daily anti-inflammatory treatment with an inhaled corticosteroid (ICS), the preferred first-line controller, is the cornerstone of therapy for persistent asthma (O'Connell, 2005; Wechsler, 2009). Use of a reliever more than two days per week, however, generally indicates the need to initiate or intensify treatment with controller asthma medications (NAEPP-EPR3, 2007). OCS is used long-term to treat the most severe asthma symptoms that do not respond to other medications, or severe exacerbations (NAEPP-EPR3, 2007; Wechsler, 2009). The recommendations also contain special consideration for specific subgroups such as older adults, who tend to have co-occurring conditions (e.g., chronic bronchitis-emphysema, cardiac disease, and osteoporosis), susceptible drug-disease interaction (e.g., aspirin and beta-blockers) and may have physical (e.g., arthritis or visual) or cognitive impairments (NAEPP-EPR3, 2007).

A number of studies have examined trends in the use of and expenditure for asthma medications in the U.S. but most of these studies either focus on children (Miller and Sarpong, 2011; Kit et al, 2012), are restricted to specific payer populations such as Medicaid (Chiu et al, 2011), used non-nationally representative administrative claims databases such as PharMetrics and MarketScan (Stempela, et al., 2004; Shenolikar et al., 2011) or are fairly dated (Sullivan, et al., 2011). Given recent changes in recommended treatment guidelines, emergent treatment approaches and the introduction of new therapeutic agents, it is important to understand how the use of and expenditures for asthma medications have changed for adults with asthma. In this report, we examine changes in asthma medication use and expenditures among U.S. adults age 18 and older, with reported treatment for asthma from 1998–1999 to 2008–2009, using nationally representative data from the Household Component and Medical Provider Component of the Medical Expenditure Panel Survey (MEPS-HC, MEPS-MP).

We begin by examining the proportion of adults with reported treatment for asthma in each two-year period from 1998–1999 to 2008–2009. Then, among adults with reported treatment for asthma, we examine several measures of prescribed asthma medications use and also expenditures for overall health care and prescribed asthma medications. First, we examine the percentages of adults who used

¹ These classifications of asthma medication types are functional rather than drug classes per se.

controllers, relievers, and OCS. We examine two measures of reliever use: the percentage of adults with any reliever use and the percentage that used “reliever only” (i.e., relievers but no controller use). We also examine trends for two commonly used subclasses of controller medications: ICS and leukotriene receptor agonists (LTRA). Then we examine aggregate total health care and out-of-pocket expenditures, total expenditures per user and out-of-pocket expenditures per user for all asthma medications and for the three major types of asthma medications.

Additionally, we examine asthma medication use in subgroups of our adult population defined by age, race/ethnicity, sex, education, income, health insurance status, perceived health status, metropolitan statistical area (MSA), and Census region. In our discussion of these results we focus on trends within groups, from 1998–1999 to 2008–2009, in use and expenditures and in differences across groups for use and expenditures only for 2008–2009. We use two-year pooled data from 1998–1999 to 2008–2009 to increase sample sizes and the precision of our estimates, especially for smaller subgroups.

Thus our estimates are presented as average annual estimates for these two time periods. Expenditures for asthma medications for all years are expressed in constant 2009 U.S. dollars. Throughout this report only differences in estimates that are statistically significant at the $p < .05$ are discussed in the text. The Technical Appendix provides details on the sample of adults with reported treatment for asthma and the definitions of measures used in this report.

Findings

Percentage of Adults with Reported Treatment for Asthma

Overall

Table 1 presents trends from 1998–1999 to 2008–2009 in the proportion and total number of adults with reported treatment for asthma overall and by selected comorbidities and smoking status. During the period under review, the total number of adults who were reported to have treatment for asthma almost doubled from an average annual estimated 5.5 million in 1998–1999 to 10.3 million in 2008–2009. This represents an increase of 1.8 percentage points (or 67 percent increase) in the treated prevalence of asthma. The treated prevalence of asthma increased from 2.7 percent of adults in the U.S. civilian noninstitutionalized population in 1998–1999 to 4.5 percent in 2008–2009. Allergens and viral respiratory tract infections are important factors in the development, persistence, and severity of asthma (Guilbert and Denlinger, 2010; NAEPP-EPR3, 2007). Among adults with reported treatment for asthma in 2008–2009, an estimated 39.3 percent also reported treatment for acute respiratory infections, about the same as in 1998–1999. In 2008–2009, an estimated 28.7 percent of adults who reported treatment for asthma also reported treatment for chronic obstructive pulmonary diseases excluding asthma—73 percent higher than in 1998–1999. In 1998–1999 an estimated 16.6 percent of adults with reported treatment for asthma additionally reported treatment for chronic obstructive pulmonary diseases excluding asthma. Exposure to environmental cigarette smoke can potentially cause asthma and is also associated with wheezing (Cunningham, et al., 1996; Sturm, Yeatts, and Loomis, 2004; Mannino and Buist, 2007; NAEPP-EPR3, 2007). In 2008–2009 among adults with reported treatment for asthma, an estimated 20.4 percent were current smokers and an estimated 26.2 percent were either current smokers or lived with another family member who smoked.

By Selected Population Characteristics

The underlying prevalence of asthma differs by demographic and socioeconomic characteristics and by geographic factors including age, race/ethnicity, sex, income, insurance status, perceived health status, metropolitan/nonmetropolitan area, and Census region (Akinbami et al., 2011; Schiller et al., 2011; Bloom et al., 2011). We examine the treated prevalence of asthma in this study. Treated prevalence of asthma may differ across groups of adults both because of differences in the underlying prevalence of the disease and because of differences in access to care, attitudes and beliefs regarding the necessity of medical care, and other factors that may affect medical care use (Kriner et al., 2003; Poureslami et al. 2007). Table 2 presents the percentage and total number of adults with reported treatment for asthma in 1998–1999 and 2008–2009. Results show that the treated prevalence of asthma differs across groups of adults defined by age, race/ethnicity, sex, education, income, health insurance status, perceived health status, and Census region. Treated prevalence of asthma did not differ significantly for metropolitan statistical area status.

Age: In 2008–2009, adults age 65 and older were more likely (6.0 percent) than adults ages 18–44 (3.6 percent) or adults ages 45–64 (4.9 percent) to be treated for asthma. Between 1998–1999 and 2008–2009, the proportion of adults with reported treatment for asthma increased for adults ages 18–44, adults ages 45–64, and adults age 65 and older.

Race/ethnicity: Non-Hispanic whites were more likely (4.8 percent) than Hispanics (3.1 percent) to be treated for asthma in 2008–2009. Also, Non-Hispanic blacks were more likely (4.4 percent) than Hispanics to be treated for asthma. Between 1998–1999 and 2008–2009, the proportion of adults with reported treatment for asthma increased for non-Hispanic whites, non-Hispanic blacks and Hispanics.

Sex: Men were less likely (3.1 percent) than women (5.7 percent) to be treated for asthma. The proportion of adults with reported treatment for asthma increased for both men and women from 1998–1999 to 2008–2009.

Education: In 2008–2009, adults with a high school education (4.5 percent) and adults with at least some college (4.2 percent) were less likely than adults with less than a high school education (5.4 percent) to be treated for asthma. Between 1998–1999 and 2008–2009, the proportion of adults who were treated for asthma increased for adults with less than a high school education, adults with a high school education, and adults with at least some college.

Income: In 2008–2009, adults in poor/near poor families (6.1 percent) and adults in low income families (5.1 percent) were more likely than adults in high income families (3.9 percent) to be treated for asthma. Between 1998–1999 and 2008–2009, the proportion of adults who were treated for asthma increased for adults at all levels of family income: poor/near poor; low income; middle income; high income.

Health insurance status: Among nonelderly adults (ages 18–64) in 2008–2009, adults with public insurance were more than twice as likely (9.5 percent) as adults with private insurance (4.0 percent) to have reported treatment for asthma. In 2008–2009, uninsured nonelderly adults were half as likely (2.0 percent) as adults with private insurance to be treated for asthma. Among nonelderly adults, the proportion with reported treatment for asthma increased during the period from 1998–1999 to 2008–2009 for adults with private insurance and adults with public insurance. Among elderly adults (age 65 and older) in 2008–2009, adults with Medicare and other public insurance were more likely (9.4 percent) than adults with Medicare only insurance (4.7 percent) or adults with Medicare and private insurance (6.3 percent) to be treated for asthma. Between 1998–1999 and 2008–2009, the proportion of elderly adults

age 65 and older with reported treatment for asthma increased for adults with Medicare only insurance, adults with Medicare and private insurance, and adults with Medicare and other public insurance.

Perceived health status: In 2008–2009, adults in fair/poor health (9.4 percent) were about 3 times as likely as adults in excellent/very good/good health (3.0 percent) to have reported treatment for asthma. Between 1998–1999 and 2008–2009 the proportion of adults with reported treatment for asthma increased for those in excellent/very good/good health and those in fair/poor health.

Metropolitan statistical area (MSA): Between 1998–1999 and 2008–2009, the percentage of adults with reported treatment for asthma increased by 1.7 percentage points (2.7 to 4.4 percent) for those living in MSAs and by 2.2 percentage points (2.9 to 5.1 percent) for those not living in MSAs.

Census region: In 2008–2009, adults living in the Northeast region were more likely (5.4 percent) than adults living in the South (4.0 percent) to have reported treatment for asthma. Between 1998–1999 and 2008–2009, the proportion of adults with reported treatment for asthma increased for those living in the Northeast, Midwest, South, and West.

Percentage of Adults Using Major Classes of Asthma Medications: Controllers, Relievers, and Oral Corticosteroids

Overall

Changes in asthma medication use and expenditures, like other chronic disease medications, tend to be driven by factors such as treatment guidelines, health policy, health systems dynamics and prescribing patterns, pharmaceutical marketing or advertising and patients' behavior regarding medication adherence. In this section, we examine changes in the use of the three major types of asthma medications: controllers are used in preventing asthma symptoms by minimizing inflammation; relievers are used in providing prompt relief of symptoms by relaxing airway muscles; and OCS are generally used in the long term treatment of the most severe cases of asthma and also in the treatment severe asthma exacerbations. Controllers do not usually provide quick relief of symptoms and relievers do not address the underlying inflammation nor control symptoms.

Table 3 presents overall trends from 1998–1999 to 2008–2009 in the proportion of adults with reported treatment for asthma who used each of these major types of asthma medications. The primary measures of use presented are the percentages of adults with reported treatment for asthma who used any controllers, any relievers, “relievers only” (i.e., any relievers but no controllers) and any OCS. Results show that the proportion of adults with reported treatment for asthma who used controller medications, the recommended treatment for persistent asthma, rose from 54.3 percent in 1998–1999 to 59.9 percent in 2008–2009. In contrast, the use of relievers declined from 67.7 percent in 1998–1999 to 61.7 percent in 2008–2009. The proportion of adults with reported treatment for asthma who used “reliever only” and OCS did not change significantly during the period. About a quarter of adults with reported treatment for asthma used “reliever only” in both 1998–1999 (26.8 percent) and 2008–2009 (26.1 percent). Also, 13.7 percent of adults with reported treatment for asthma used OCS in 1998–1999 and 12.4 percent used OCS in 2008–2009.

Results also indicate changing patterns of use for two classes of controllers. In both 1998–1999 and 2008–2009, controller use by U.S. adults with reported treatment for asthma almost entirely comprised two subclasses: ICS and LTRA. Daily anti-inflammatory treatment with an ICS is the cornerstone of therapy for all patients with persistent asthma. Adults with mild to severe persistent asthma may be treated with varying doses of ICS and may be stepped-up by increasing the ICS dose and/or by adjunctive

therapy such as LTRA. The later have both anti-inflammatory and bronchodilating effects (Wechsler, 2009). Among adults with reported treatment for asthma, the percentage using ICS increased from 39.9 percent in 1998–1999 to 51.2 percent in 2008–2009, and the proportion using LTRA increased from 12.4 to 20.4 percent.

By Selected Population Characteristics

Table 4 presents the percentage of adults with reported treatment for asthma who used the three different types of asthma medications in 1998–1999 and 2008–2009 by selected population characteristics.

Controllers

Daily anti-inflammatory treatment with controller medications is the recommended treatment for all patients with persistent asthma. We find that among adults with reported treatment for asthma, the proportion using controllers increased significantly from 1998–1999 to 2008–2009. The use of controllers increased during this period for some subgroups of adults examined. We also find differences in controller use in 2008–2009, across subgroups of adults defined by age, race/ethnicity, education, income, health insurance status, and Census region.

Age: In 2008–2009, adults ages 18–44 were less likely (48.1 percent) than adults ages 45–64 (65.4 percent) or adults age 65 and older (70.3 percent), to have used at least one controller during the year.

Race/ethnicity: Among adults with reported treatment for asthma, non-Hispanic whites were more likely (64.6 percent) than non-Hispanic blacks (50.4 percent), Hispanics (41.4 percent), or other non-Hispanics (49.5 percent) to have used at least one controller in 2008–2009.

Sex: While there was no significant difference between men and women in the use of controllers in 2008–2009, the proportion of women who used at least one controller increased by 6.5 percentage points from 55.3 percent in 1998–1999 to 61.8 percent in 2008–2009.

Education: In 2008–2009, adults with less than high school education were less likely (52.6 percent) than adults with at least some college education (63.4 percent) to have used at least one controller during the year.

Income: In 2008–2009, adults in high income families were more likely (67.5 percent) than adults in poor/near poor income families (51.0 percent), adults in low income families (56.8 percent) and adults in middle income families (58.9 percent) to have used at least one controller during the year. The proportion of adults with high income who used controllers increased from 1998–1999 to 2008–2009.

Health insurance status: Among nonelderly adults with reported treatment for asthma, those with private insurance were more likely (63.5 percent) than adults with public insurance (46.9 percent) or uninsured adults (30.9 percent) to have used at least one controller in 2008–2009. The proportion of nonelderly adults with any private insurance who used controllers increased from 1998–1999 to 2008–2009.

Perceived health status: There were no significant differences in the use of controllers by perceived health status in 2008–2009. During the period 1998–1999 to 2008–2009, the proportion of adults with reported treatment for asthma increased for those in excellent/very good/good health.

Census region: In 2008–2009, adults living in the West were less likely (55.0 percent) to use controllers than adults living in the Northeast (65.4 percent).

Relievers

Most of the reliever use consisted of short-acting beta antagonists (SABAs). SABAs are bronchodilators and are the treatment of choice for relief of acute asthma symptoms. We report on the percentage of adults with any reliever use during the year, and also report on the percentage of adults who used “reliever only” (use of relievers but had no controllers during the year). Use of “reliever only” may be an appropriate treatment for intermittent asthma but is a marker for poor control in patients with persistent asthma.

Any Reliever Use

Among adults with reported treatment for asthma, the proportion using at least one reliever decreased from 67.7 percent in 1998–1999 to 61.7 percent in 2008–2009. Statistically significant differences in the use of relievers during this period are found for some subgroups of adults examined. We also found statistically significant differences in the use of relievers in 2008–2009 across subgroups of adults defined by age, education, income, health insurance status, perceived health status, and Census region.

Age: In 2008–2009, adults age 65 and older were less likely (54.6 percent) than adults ages 18–44 (65.2 percent) or adults ages 45–64 (62.6 percent), to use any reliever to treat their asthma. During the period 1998–1999 to 2008–2009, the proportion of adults age 65 and older who used any reliever decreased from 72.6 percent to 54.6 percent.

Race/ethnicity: There were no significant differences by race/ethnicity in the use of any relievers in 2008–2009. The proportion of non-Hispanic whites who used any reliever decreased from 71.3 percent in 1998–1999 to 61.2 percent in 2008–2009.

Sex: In 2008–2009 there were no significant difference in the use of at least one reliever among men and women. During the period from 1998–1999 to 2008–2009, the proportion of women who used at least one reliever decreased from 67.4 percent to 60.1 percent.

Education: In 2008–2009, adults with at least some college education were less likely (56.5 percent) than adults with less than high school education (68.6 percent) or adults with high school education (65.3 percent) to use any reliever. The proportion of adults with at least some college education who used any reliever fell from 65.0 percent in 1998–1999 to 56.5 percent in 2008–2009.

Income: In 2008–2009, adults in high income families were less likely (53.6 percent) than adults in poor/near poor income families (65.8 percent), adults in low income families (73.3 percent) or adults in middle income families (62.3 percent) to use any reliever during the year.

Health insurance status: Among nonelderly adults with reported treatment for asthma, uninsured adults were more likely (73.0 percent) than adults with private insurance (61.0 percent) to use any reliever in 2008–2009. Adults with public insurance were also more likely (68.9 percent) than adults with private insurance (61.0 percent) to use any reliever in 2008–2009.

Perceived health status: Among adults with reported treatment for asthma, adults in fair/poor health were more likely (65.9 percent) than adults in excellent/very good/good health (58.1 percent) to use any

reliever in 2008–2009. The proportion of adults in fair/poor health who used any reliever declined from 73.1 percent 1998–1999 to 65.9 percent in 2008–2009.

Metropolitan statistical area (MSA): While there was no significant difference in the use of any reliever between adults living in MSAs versus non-MSAs in 2008–2009, the use of any reliever decreased for adults living in MSAs from 66.4 percent in 1998–1999 to 60.7 percent in 2008–2009.

Census region: In 2008–2009, there were no significant differences in the use of any reliever across Census regions. The proportion of adults living in the South, who used any reliever decreased from 66.7 percent in 1998–1999 to 57.3 percent in 2008–2009.

Use of “Reliever Only”

Overall and within any subgroup, results did not show a statistically significant change between 1998–1999 and 2008–2009 in “reliever only” use; about a quarter of adults with reported treatment for asthma used “reliever only” during the year in both time periods (26.8 percent and 26.1 percent, respectively). Results showed differences in “reliever only” use in 2008–2009, across subgroups of adults defined by age, race/ethnicity, sex, education, income, and health insurance status.

Age: Adults age 65 and older were less likely (15.1 percent) than adults, ages 18–44 (36.3 percent) or adults ages 45–64 (22.3 percent) to use “reliever only” to treat their asthma in 2008–2009.

Race/ethnicity: Among adults with reported treatment for asthma, non-Hispanic whites were less likely (23.7 percent) than Hispanics (36.6 percent) to use “reliever only” in 2008–2009.

Sex: Among adults with reported treatment for asthma, men were more likely (29.9 percent) than women (24.1 percent) to use “reliever only” during 2008–2009.

Education: During the period 2008–2009, adults with at least some college education were less likely (23.2 percent) than adults with less than high school education (29.9 percent) to use “reliever only”.

Income: Adults with high income were less likely (21.2 percent) than adults in poor/near poor income families (29.8 percent) or adults in low income families (30.7 percent) to use “reliever only” during 2008–2009.

Health insurance status: Among nonelderly adults with reported treatment for asthma, uninsured adults were more likely (47.8 percent) than adults with private insurance (25.3 percent) or adults with public insurance (33.9 percent) to use “reliever only” in 2008–2009.

Oral Corticosteroids

Oral systemic corticosteroids (OCS) are primarily used to treat patients who have severe persistent asthma (NAEPP-EPR3, 2007). Short courses of OCS are also used to help patients gain prompt control of their asthma. The use of OCS more than twice per year suggests poorly controlled asthma (Wechsler, 2009). Overall the proportion of adults with reported treatment for asthma who used OCS did not change significantly between 1998–1999 and 2008–2009. We found differences in OCS use across subgroups of adults defined by age and Census regions in 2008–2009.

Age: Adults ages 45–64 were more likely (14.7 percent) to use OCS than adults 65 and older (10.1 percent).

Education: While there was no significant difference in the use of OCS within educational categories in 2008–2009, the proportion of adults with a high school education who used OCS decreased from 18.7 percent in 1998–1999 to 11.8 percent in 2008–2009.

Census region: Adults with reported treatment for asthma who lived in the West were less likely (8.8 percent) to use OCS medications than adults living in the Northeast (16.0 percent) in 2008–2009.

Average Annual Expenditures for Adults' Health Care and Asthma Medications

Table 5 presents trends from 1998–1999 to 2008–2009 in aggregate total expenditures, total expenditures per user, and out-of-pocket expenditures per user for all asthma medications and for the three major types of asthma medications: controllers, relievers, and OCS. All expenditures were adjusted to constant 2009 U.S. dollars in a two-step process. First, to produce two-year pooled expenditure data for the beginning and ending point of our study period, we used the Consumer Price Index (CPI) for prescription drugs to adjust 1998 expenditures to 1999 dollars and to adjust 2008 expenditures to 2009 dollars. Next, to adjust for general inflation between the beginning and ending point of our study, we used the all item CPI for all urban consumers (CPI-U), to adjust the pooled 1998–1999 expenditures to 2009 dollars.

Total and Out-of-Pocket Health Care Expenditures

Average annual total health care expenditures for persons with reported treatment of asthma in 2008–2009 (\$104.6 billion) were almost four times the average annual total health care expenditures in 1998–1999 (\$27.8 billion), after adjustment for inflation. Average annual total out-of-pocket health care expenditures in 2008–2009 (\$14.3 billion) were just over three times the average annual total out-of-pocket health care expenditures in 1998–1999 (\$4.5 billion).

Total Drugs Expenditures

Average annual total expenditures for all prescribed asthma medications for adults with reported treatment for asthma quadrupled from \$2.5 billion in 1998–1999 to \$10.2 billion in 2008–2009, after adjustment for inflation. The \$7.8 billion in average annual total expenditures spent on controllers in 2008–2009 was 4.6 times the annual average (\$1.7 billion) in 1998–1999. Average annual total expenditures on relievers in 2008–2009 (\$2.4 billion) were three times the average annual total expenditure (\$.8 billion) in 1998–1999. Average annual total expenditures for OCS did not change significantly from 1998–1999 (\$.03 billion) to 2008–2009 (\$.02 billion). In 2008–2009, controllers accounted for 76.4 percent and relievers accounted for 23.4 percent of all spending on asthma medications for adults.

Total Drugs Expenditures per User

The average annual expenditure per user on all prescribed asthma medications for adults with reported treatment for asthma doubled from \$553 in 1998–1999 to \$1,126 in 2008–2009. Average annual expenditures per user for controller medications in 2008–2009 (\$1,258) were 2.2 times the average annual expenditures per user for controller medications in 1998–1999 (\$569). Similarly average annual expenditures per user for reliever medications in 2008–2009 (\$373) were 1.8 times the average annual expenditures per user for reliever medications in 1998–1999 (\$212). In 2008–2009, average annual expenditure per user for controllers (\$1,258) was 3.4 times the average for relievers (\$373).

Total Out-of-Pocket Drugs Expenditures per User

The average annual out-of-pocket expenditures per user for adults in 2008–2009 on all prescribed asthma medications (\$235), for controllers (\$239), and for relievers (\$99) were not statistically significantly different from the corresponding amounts in 1998–1999: \$227 for all prescribed asthma medications; \$238 for controllers; and \$82 for relievers. The average annual out-of-pocket expenditures per user for adults on OCS medications decreased from \$23 in 1998–1999 to \$10 in 2008–2009.

Summary and Conclusions

Trends in adult asthma medication use and expenditures, and differences within and across groups in the use of recommended medications are interesting because they help inform the public and health policy makers on evolving patterns of over- and under-use of asthma medication types. They also help shed light on the expenditures associated with the use of asthma medications, particularly, as new therapeutic agents for asthma become available and as evidence-based guidelines are updated. This report uses nationally representative data from the MEPS to examine trends in the use and expenditures of asthma medications from 1998–1999 through 2008–2009.

We first examined trends in the treated prevalence of asthma among all adults age 18 and older, in the U.S. civilian noninstitutionalized population. The total number of adults with reported treatment for asthma almost doubled, and the proportion of adults with reported treatment for asthma increased significantly between 1998–1999 and 2008–2009. Increases in the treated prevalence of asthma occurred in all subgroups of adults we examined, with the exception of other non-Hispanics adults and uninsured nonelderly adults. In 2008–2009, the following subgroups of adults were more likely to be treated for asthma compared to others: those age 65 and older; non-Hispanic whites and non-Hispanic blacks; women; those with less than a high school education; poor/near poor and low income families; nonelderly adults with public insurance; elderly adults with Medicare and other public insurance; those in reported fair/poor health; and those living in the Northeast. Differences in the treated prevalence of asthma may suggest differential underlying prevalence of asthma, differential access to health care, or perhaps differences in other factors related to the use of health services.

Next, we examined trends in asthma medication use among adults with reported treatment for asthma. The overall results show that the proportion of adults with reported treatment for asthma who used controller medications increased, but the proportion using relievers fell during the period. The results also show that there were no significant changes in the proportion of adults who used “reliever only” or OCS during the period. There were important differences in the use of asthma medications across subgroups of adults examined. Among adults with reported treatment for asthma, those ages 18–44, Hispanics, with less than a high school education, in poor/near poor or low income families, and nonelderly with public insurance or uninsured nonelderly adults were less likely than others to use controllers and more likely to use “reliever only” in treating their asthma.

Finally, we examined changes in health care and asthma medication expenditures for adults with reported treatment for asthma. During the period 1998–1999 to 2008–2009, the total population with treatment for asthma almost doubled from 5.5 million to 10.3 million, while the average annual total health care expenditures for this population in 2008–2009 (\$104.6 billion) was almost 4 times the corresponding expenditures in 1998–1999 after adjusting for inflation (\$27.8 billion). During the same period, average annual total expenditures on all prescribed asthma medications quadrupled from \$2.5 billion in 1998–1999 to \$10.2 billion in 2008–2009. Average annual total drug expenditures for controllers more than quadrupled from \$1.7 billion in 1998–1999 to \$7.8 billion in 2008–2009. Average annual total drug expenditures for relievers after adjusting for inflation tripled from \$0.8 billion in 1998–1999 to \$2.4 billion in 2008–2009 but average annual total drug expenditures for OCS did not change significantly during this period. While the average annual expenditures per user more than doubled for controllers and almost doubled for relievers, the average annual out-of-pocket expenditures per user for controllers and relievers did not change significantly during the period. Average annual expenditures per user and average annual out-of-pocket expenditures per user for OCS also did not change significantly during the period.

References

- Akinbami L. J., Moorman J. E., Liu X. *Asthma Prevalence, Health Care Use, and Mortality: United States, 2005–2009*. National Health Statistics Reports; No. 32. Hyattsville, MD: National Center for Health Statistics. January 2011.
- Bloom B., Cohen R. A., Freeman G. *Summary health statistics for U.S. children: National Health Interview Survey, 2010*. National Center for Health Statistics. Vital Health Statistics 2011; 10(250).
- Centers for Disease Control and Prevention, National Center for Health Statistics. Table 2-1 Lifetime Asthma Prevalence Percents by Age, United States: *National Health Interview Survey (NHIS) Data, 2007*. <http://www.cdc.gov/asthma/nhis/07/table2-1.htm>. (Accessed July 17, 2012.)
- Chiu, S-F., Kelton C. M. L., Guo J. J., Wigle P. R., Lin A. C., Szeinbach S. L. Utilization, Spending, and Price Trends for Short- and Long-Acting Beta-Agonists and Inhaled Corticosteroids in the Medicaid Program, 1991-2010. *American Health and Drug Benefits*. 2011; 4(3): 140-149.
- Cohen J. *Design and Methods of the Medical Expenditure Panel Survey Household Component*. MEPS Methodology Report No. 1. AHCPR Pub. No. 97-0026. Rockville, MD: Agency for Health Care Policy and Research, 1997.
http://www.meps.ahrq.gov/mepsweb/data_files/publications/mr1/mr1.shtml (Accessed July 17, 2012.)
- Cohen S. *Sample Design of the 1996 Medical Expenditure Panel Survey Household Component*. MEPS Methodology Report No. 2. AHCPR Pub. No. 97-0027. Rockville, MD: Agency for Health Care Policy and Research, 1997.
http://www.meps.ahrq.gov/mepsweb/data_files/publications/mr2/mr2.shtml (Accessed July 17, 2012.)
- Cohen S. Design Strategies and Innovations in the Medical Expenditure Panel Survey. *Medical Care*, July 2003; 41(7) Supplement: III-5–III-12.
- Cunningham J., O'Connor G. T., Dockery D. W., Speizer F. E. Environmental tobacco smoke, wheezing, and asthma in children in 24 communities. *American Journal of Respiratory and Critical Care Medicine*. 1996 Jan; 153(1): 218-24.
- Guilbert T. W., Denlinger L. C. Role of infection in the development and exacerbation of asthma. *Expert Review of Respiratory Medicine*. 2010; 4: 71-83.
- Kit B. K., Simon A. E., Ogden C. L., Akinbami L. J. Trends in preventive asthma medication use among children and adolescents, 1988-2008. *Pediatrics*. January 2012; 129(1): 62-69.
- Kriner P., Bernal Y., Binggeli A., Ornelas I. Attitudes, Beliefs, and Practices Regarding Asthma Care Among Providers and Adult Asthmatics in Imperial County. *Californian Journal of Health Promotion*. 2003; 1(2): 88-100.
- Mannino D. M., Buist A. S. Global burden of COPD: risk factors, prevalence, and future trends. *Lancet*. 2007; 370: 765-773.

Miller G. E., Sarpong E. M. *Trends in the Pharmaceutical Treatment of Children's Asthma, 1997 to 2008*. Research Findings No. 31. September 2011. Agency for Healthcare Research and Quality, Rockville, MD. http://meps.ahrq.gov/mepsweb/data_files/publications/rf31/rf31.pdf (Accessed July 17, 2012.)

National Asthma Education and Prevention Program. *Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma: Full Report 2007*. Bethesda, MD: National Institutes of Health, U.S. Department of Health and Human Services, National Heart, Lung, and Blood Institute; 2007. <http://www.nhlbi.nih.gov/guidelines/asthma/asthgdln.pdf> (Accessed July 17, 2012.)

National Heart, Lung, and Blood Institute. *Morbidity & mortality: 2007 chart book on cardiovascular, lung, and blood diseases*. <http://www.nhlbi.nih.gov/resources/docs/07-chtbk.pdf>. (Accessed July 17, 2012.)

Poureslami I. M., Rootman I., Balka E., Devarakonda R., Hatch J., Fitzgerald J. M. *A Systematic Review of Asthma and Health Literacy: A Cultural-Ethnic Perspective in Canada*. *Medscape General Medicine*. 2007; 9(3): 40.

Schiller J. S., Lucas J. W., Ward B. W., Perogoy J. A. *Summary Health Statistics for U.S. Adults: National Health Interview Survey, 2010*. National Center for Health Statistics. *Vital Health Statistics*. 2012; 10(252).

Shenolikar R., Song X., Anderson J. A., Chu B. C., Cantrell C. R. Costs of asthma among U.S. working adults. *American Journal of Managed Care*. June 2011; 17(6): 409-416.

Stempela D., Fuhlbrigge A. L., McLaughlin T., Pendergraft T. B., Stanford R. Three Year Examination of Trends in Asthma-Related Utilization Demonstrate Significant Variation in Resource Consumption. *Journal of Allergy and Clinical Immunology*, Volume 113, Issue 2, Supplement, February 2004; 113(2): S252-S253.

Sturm J. J., Yeatts K., Loomis D. Effects of Tobacco Smoke Exposure on Asthma Prevalence and Medical Care Use in North Carolina Middle School Children. *American Journal of Public Health*. 2004; 94(2): 308-313.

Sullivan P. W., Ghushchyan V. H., Slejko J. F., Belozeroff V., Globe D. R., Lin S-L. The burden of adult asthma in the United States: evidence from the Medical Expenditure Panel Survey. *Journal of Allergy and Clinical Immunology*. 2011; 127: 363-369.

Vonk J. M., Boezen H. M. Predicting adult asthma in childhood. *Current Opinion in Pulmonary Medicine*. 2006; 12: 42-47.

Wechsler M. E. *Managing Asthma in Primary Care: Putting New Guideline Recommendations Into Context*. *Mayo Clinical Proceedings*. August 2009; 84(8): 707-717.

Zahran H. S., Bailey, C., Garbe P. *Vital Signs: Asthma Prevalence, Disease Characteristics, and Self-Management Education—United States, 2001–2009*. Division of Environmental Hazards and Health Effects, National Center for Environmental Health, Centers for Disease Control and Prevention. *Journal of the American Medical Association*. 2011; 305(24): 2514-2516.

Table 1. Percentage and total number of adults with reported treatment for asthma, selected comorbid conditions and smoking status, 1998–1999 to 2008–2009

	1998–1999	2000–2001	2002–2003	2004–2005	2006–2007	2008–2009
Total population (millions)	202.4	208.6	216.5	221.5	226.3	231.0
Adults with reported treatment for asthma						
Number in millions	5.5	6.6	7.5	7.7	8.5	10.3
Percentage	2.7	3.2	3.5	3.5	3.8	4.5
Among adults with reported treatment for asthma, percentage with reported ¹ :						
Diabetes	9.4	9.8	12.1	12.5	14.8	15.5
Selected mental disorders	14.2	16.4	24.5	25.6	24.7	27.9
Major cardiovascular diseases	30.7	34.7	35.6	37.0	40.7	44.7
Diseases of heart	12.6	13.8	12.6	13.3	15.6	18.3
Hypertension	24.0	27.8	28.7	30.2	34.8	39.5
Acute respiratory infections	39.4	39.9	47.3	47.6	42.8	39.3
Acute respiratory infections (excl. pneumonia and influenza)	34.0	34.7	42.1	43.4	39.4	35.6
Chronic obstructive pulmonary diseases (excluding asthma)	16.6	15.2	15.4	15.0	18.9	28.7
Current smoker ²		20.4	19.1	19.8	17.1	20.4
Family with current smoker ²		27.7	24.8	26.4	22.4	26.2

Source: Center for Financing, Access, and Cost Trends, Agency for Healthcare Research and Quality, Medical Expenditure Panel Survey, 1998 to 2009

¹ Please see Technical appendix for more information on comorbid conditions and smoking status.

² Data on whether respondents currently smoke were first collected in 2000.

Table 2. Percentage and total number of adults with reported treatment for asthma, by selected population characteristics, 1998–1999 to 2008–2009

	1998–1999			2008–2009		
	Total population (in millions)	Total with reported treatment for asthma (in millions)	Percentage with reported treatment for asthma	Total population (in millions)	Total with reported treatment for asthma (in millions)	Percentage with reported treatment for asthma
Total	202.4	5.5	2.7	231.0	10.3	4.5
Age in years						
18 to 44	108.9	2.7	2.5	111.1	4.0	3.6
45 to 64	59.1	1.8	3.1	79.9	3.9	4.9
65 and older	34.5	1.0	2.8	40.0	2.4	6.0
Race/ethnicity ¹						
White	150.3	4.1	2.7	157.6	7.5	4.8
Black	23.3	0.8	3.3	26.5	1.2	4.4
Hispanic	20.9	0.5	2.3	31.7	1.0	3.1
Other	7.9	0.2	2.7	15.2	0.6	4.2
Sex						
Male	96.9	1.9	2.0	111.9	3.5	3.1
Female	105.6	3.6	3.4	119.1	6.8	5.7
Education						
Less than high school	40.3	1.3	3.3	40.3	2.2	5.4
High school	67.7	1.7	2.5	71.9	3.2	4.5
At least some college	93.2	2.4	2.6	117.0	4.9	4.2
Income						
Poor/near poor	28.5	1.2	4.2	37.4	2.3	6.1
Low income	26.4	0.7	2.6	31.1	1.6	5.1
Middle income	63.8	1.5	2.4	70.2	2.8	4.0
High income	83.7	2.1	2.5	92.3	3.6	3.9
Health insurance status						
Less than 65						
Any private	130.3	3.4	2.6	135.9	5.4	4.0
Public only	13.0	0.7	5.0	19.1	1.8	9.5
Uninsured	24.6	0.5	2.1	35.9	0.7	2.0
65 and older						
Medicare only	10.5	0.3	2.4	15.4	0.7	4.7
Medicare and private	19.5	0.5	2.7	20.0	1.3	6.3
Medicare and other public	4.0	0.2	4.3	4.1	0.4	9.4
Perceived health status						
Excellent/very good/good	159.5	3.0	1.9	178.0	5.4	3.0
Fair/poor	42.3	2.5	5.9	52.5	4.9	9.4
Metropolitan statistical area (MSA)						
MSA	161.2	4.4	2.7	191.8	8.4	4.4
Non-MSA	38.7	1.1	2.9	36.5	1.8	5.1
Census region						
Northeast	39.2	1.1	2.9	42.5	2.3	5.4
Midwest	46.4	1.4	3.1	50.6	2.3	4.5
South	72.0	1.8	2.5	84.4	3.3	4.0
West	44.9	1.1	2.5	53.4	2.4	4.5

Source: Center for Financing, Access, and Cost Trends, Agency for Healthcare Research and Quality, Medical Expenditure Panel Survey, 1998, 1999, 2008, and 2009

¹ The Hispanic grouping can include adults of any race, so the race categories of black, white, and ‘other’ exclude Hispanics. In all data years, the ‘other’ category includes adults with single races other than white and black. In 2008–2009 the ‘other’ category also includes adults with multiple races. MEPS respondents were first able to identify household members as belonging to multiple race groups in 2002.

Table 3. Percentage of adults using controllers, relievers and oral corticosteroids, among adults with reported treatment for asthma, 1998–1999 to 2008–2009

	1998–1999	2000–2001	2002–2003	2004–2005	2006–2007	2008–2009
Population with reported treatment for asthma (millions)	5.5	6.6	7.5	7.7	8.5	10.3
Among adults reported treatment for asthma, percentage using:						
Controller ¹	54.3	58.1	62.5	69.2	64.6	59.9
ICS	39.9	44.0	49.0	57.8	53.8	51.2
LTRA	12.4	17.2	21.7	27.0	26.0	20.4
Reliever ²						
Any reliever	67.7	67.5	66.9	65.2	66.3	61.7
“Reliever only” ³	26.8	27.8	26.6	21.9	25.3	26.1
OCS ⁴	13.7	15.4	12.6	12.5	11.2	12.4

Source: Center for Financing, Access, and Cost Trends, Agency for Healthcare Research and Quality, Medical Expenditure Panel Survey, 1998 to 2009

¹ Controllers denotes the use of any controller—include ICS (inhaled corticosteroids), LABA (inhaled long acting beta-agonists), LTRA (leukotriene receptor antagonists), NSA (non-steroidal anti-allergy agents), MXS (methylxanthines) and LABA (oral long acting beta-agonists).

² Relievers denotes the use of any reliever—include SABA (inhaled short acting beta agonists), ACB (anti-cholinergic bronchodilators) and SANB (shorting acting non-beta selective agents).

³ “Relievers only” indicates reliever use but no controller use.

⁴ OCS (oral corticosteroids) denotes the use of any OCS—includes prednisone, dexamethasone, methylprednisolone and other steroids.

Table 4. Percentage of adults using controllers, relievers and oral corticosteroids, among adults with reported treatment for asthma, by selected population characteristics, 1998–1999 to 2008–2009

	Controller ¹		Reliever ²		“Reliever only” ³		OCS ⁴	
	1998–1999	2008–2009	1998–1999	2008–2009	1998–1999	2008–2009	1998–1999	2008–2009
Total	54.3	59.9	67.7	61.7	26.8	26.1	13.7	12.4
Age in years								
18 to 44	43.9	48.1	64.4	65.2	33.1	36.3	13.8	11.4
45 to 64	64.4	65.4	70.1	62.6	21.5	22.3	14.2	14.7
65 and older	64.4	70.3	72.6	54.6	19.0	15.1	12.9	10.1
Race/ethnicity ⁵								
White	58.2	64.6	71.3	61.2	26.8	23.7	13.9	12.3
Black	46.6	50.4	57.4	61.8	23.3	29.1	13.8	13.5
Hispanic	37.3	41.4	64.1	65.1	34.3	36.6	13.9	14.2
Other	a	49.5	a	62.7	a	32.4	a	9.0
Sex								
Male	52.5	56.1	68.5	65.0	25.7	29.9	12.9	12.5
Female	55.3	61.8	67.4	60.1	27.3	24.1	14.2	12.4
Education								
Less than high school	52.7	52.6	67.5	68.6	26.6	29.9	11.7	11.9
High school	53.1	59.6	71.5	65.3	30.5	28.0	18.7	11.8
At least some college	55.9	63.4	65.0	56.5	24.3	23.2	10.9	13.1
Income								
Poor/near poor	51.9	51.0	72.6	65.8	30.3	29.8	9.4	10.7
Low income	50.6	56.8	73.9	73.3	31.6	30.7	18.8	10.7
Middle income	55.3	58.9	69.7	62.3	25.6	26.7	15.0	11.8
High income	56.2	67.5	61.4	53.6	24.0	21.2	13.7	14.6
Health insurance status								
Less than 65								
Any private	56.0	63.5	65.5	61.0	26.3	25.3	13.4	13.1
Public only	50.6	46.9	77.3	68.9	32.2	33.9	17.2	11.0
Uninsured	a	30.9	a	73.0	a	47.8	a	18.7
65 and older								
Medicare only	a	70.8	a	55.4	a	12.6	a	9.2
Medicare and private	a	70.0	a	55.5	a	17.9	a	9.3
Medicare and other public	a	70.8	a	50.6	a	10.0	a	13.3
Perceived health status								
Excellent/very good/good	53.0	60.5	63.2	58.1	25.0	26.0	10.1	10.7
Fair/poor	56.2	59.4	73.1	65.9	28.7	26.2	18.3	14.3
Metropolitan statistical area (MSA)								
MSA	55.0	59.7	66.4	60.7	25.2	26.6	13.6	13.0
Non-MSA	54.1	61.7	75.0	67.5	33.1	23.7	14.6	10.2
Census region								
Northeast	54.0	65.4	65.2	65.3	26.1	23.5	13.9	16.0
Midwest	52.7	60.1	69.8	63.0	31.7	28.1	15.1	13.0
South	55.0	59.3	66.7	57.3	24.6	24.0	12.5	12.1
West	55.7	55.0	69.2	63.3	24.6	29.4	13.8	8.8

Source: Center for Financing, Access, and Cost Trends, Agency for Healthcare Research and Quality, Medical Expenditure Panel Survey, 1998, 1999, 2008, and 2009.

^a Insufficient sample; fewer than 100 cases in denominator.

¹ Controllers denotes the use of any controller—include ICS (inhaled corticosteroids), ILABA (inhaled long acting beta-agonists), LTRA (leukotriene receptor antagonists), NSA (non-steroidal anti-allergy agents), MXS (methylxanthines) and OLABA (oral long acting beta-agonists).

² Relievers denotes the use of any reliever—include SABA (inhaled short acting beta agonists), ACB (anti-cholinergic bronchodilators) and SANB (shorting acting non-beta selective agents).

³ “Relievers only” indicates reliever use with no controller use.

⁴ OCS (oral corticosteroids) denotes the use of any OCS—includes prednisone, dexamethasone, methylprednisolone and other steroids.

⁵ The Hispanic grouping can include adults of any race, so the race categories of black, white, and 'other' exclude Hispanics. In all data years, the 'other' category includes adults with single races other than white and black. In 2008–2009 the 'other' category also includes adults with multiple races. MEPS respondents were first able to identify household members as belonging to multiple race groups in 2002.

Table 5. Average annual expenditures (in 2008 U.S. dollars) for health care and asthma medications, among adults with reported treatment for asthma, 1998–1999 to 2008–2009

	1998–1999	2008–2009
Population with reported treatment for asthma (millions)	5.5	10.3
Total health care expenditures (millions of dollars)	\$27,785	\$104,563
Total out-of-pocket health care expenditures(millions of dollars)	4,535	14,262
Total drugs expenditures (millions of dollars)		
All therapeutic classes	\$2,528	\$10,154
Controller ¹	1,706	7,758
Reliever ²	793	2,375
OCS ³	30	21
Total expenditures per user		
All therapeutic classes	\$553	\$1,126
Controller ¹	569	1,258
Reliever ²	212	373
OCS ³	39	17
Out-of-pocket expenditures per user		
All therapeutic classes	\$227	\$235
Controller ¹	238	239
Reliever ²	82	99
OCS ³	23	10

Source: Center for Financing, Access, and Cost Trends, Agency for Healthcare Research and Quality, Medical Expenditure Panel Survey, 1998, 1999, 2008, and 2009

¹ Controllers denotes the use of any controller—include ICS (inhaled corticosteroids), LABA (inhaled long acting beta-agonists), LTRA (leukotriene receptor antagonists), NSA (non-steroidal anti-allergy agents), MXS (methylxanthines) and LABA (oral long acting beta-agonists).

² Relievers denotes the use of any reliever— include SABA (inhaled short acting beta agonists), ACB (anti-cholinergic bronchodilators) and SANB (shorting acting non-beta selective agents).

³ OCS (oral corticosteroids) denotes the use of any OCS—includes prednisone, dexamethasone, methylprednisolone and other steroids.

Technical Appendix

The data used in this report were obtained from interviews conducted as part of the Household Component supplemented by the Medical Provider Component of the Medical Expenditure Panel Survey (MEPS) for 1998–2009. MEPS is an ongoing, annual survey of the U.S. civilian noninstitutionalized population. MEPS collects detailed information on health care use and expenditures (including sources of payment); health insurance; and health status, access, and quality. It also collects detailed demographic and economic information on the persons and households surveyed. The MEPS-MPC supplements and validates expenses and payment information on medical care events reported in the MEPS-HC. More information about MEPS can be found at <http://www.meps.ahrq.gov>. For a detailed description of the survey and its methodology, also see J. Cohen (1997) and S. Cohen (1997, 2003).

Definitions

Adults with reported treatment for asthma and comorbid conditions: We use the 1998 through 2009 MEPS Condition Files and the three-digit ICD-9-CM diagnosis condition variable (ICD9CODX) to construct indicator variables for specified conditions. We identified adults, age 18 and older, with reported treatment for asthma and comorbid conditions within the sample by tying the diagnosis code for each condition associated with any reported health services utilization (i.e., home health, inpatient hospital stays, outpatient, office-based, emergency room visits, and prescribed medicines) during the year. The prevalence of all selected comorbid conditions were higher among adults who reported treatment for asthma than among adults who did not reported treatment for asthma. Conditions in this report were defined using the following 3 digit ICD-9-CM codes:

<u>Conditions</u>	<u>ICD-9-CM Diagnosis</u>
Asthma	493
Diabetes	249, 250
Mental Illness (other neurotic, personality, and nonpsychotic disorders)	300-302, 305-316
Major cardiovascular diseases	390-448
Diseases of Heart	390-398, 402, 404-429
Hypertension	401-405
Acute respiratory infections and other diseases of the upper respiratory tract	460-466, 470-478, 480-488
Acute respiratory infections and other diseases of the upper respiratory tract (excluding pneumonia and influenza)	460-466, 470-478
Chronic obstructive pulmonary diseases and allied conditions (excluding asthma)	490-492, 494-496

Current smoker: Smoking behavior of each adult was determined based on a question on current smoking status in the MEPS Self-Administered Questionnaire (SAQ). The SAQ smoking question was first asked of MEPS respondents in the 2000 data.

Smoker in the family: For each adult, the smoking behavior of all co-residing, adult family members was determined based on a question on current smoking status in the MEPS Self-Administered Questionnaire (SAQ). Families were defined using health insurance eligibility units (HIEUs). HIEUs include adults, their spouses, and their unmarried natural/adoptive children under age 18 and children under age 24 who are full-time students.

Asthma medications: Each drug that was listed as purchased or otherwise obtained in the MEPS Prescribed Medicines (PMED) Files was linked to the Multum Lexicon database, a product of Cerner Multum, Inc. We used the Multum drug name variable which gives the active ingredient(s) in each drug to identify three general types of asthma medications: controllers, relievers and oral corticosteroids. Controller medications included ICS (inhaled corticosteroids), ILABA (inhaled long acting beta-agonists), OLABA (oral long acting beta-agonists), LTRA (leukotriene receptor antagonists), MXS (methylxanthines), NSA (non-steroidal anti-allergy agents), and ICS-ILABA combinations. Relievers were primarily comprised of SABA (inhaled short acting beta agonists), but also included ACB (anti-cholinergic bronchodilators), SANB (short acting non-beta selective agents) and SABA-ACB combinations. Oral corticosteroids included prednisone, dexamethasone, methylprednisolone and other steroids.

Utilization: Indicator variables were created to identify adults who received each of the major classes of asthma medications—controllers, relievers and oral corticosteroids. For this report, “relievers-only” denotes adults who, at any time during the year, were using relievers but no controllers to treat their asthma. We also created indicator variables to capture use of subclasses of controller medications and their combinations. For combination drugs, an adult was identified as having had each medication comprising the combination therapy. For example, if an adult had a combination drug that included both an ICS and an ILABA, then the adult was identified as having used each of these types of asthma medications. Utilization estimates are presented as the proportion of adults using each of the three general types of asthma medications, and each specific class of asthma controller medication during the year.

Expenditures: Expenditures include all amounts paid for each drug purchased from any source including payments by individuals and their families and payments by private insurance, Medicaid, Medicare, and other sources of insurance. For this report, all drug expenditures were adjusted to constant 2009 U.S. dollars in a two-step process. First, to produce two-year pooled drug expenditure data for the beginning and ending point of our study period, we used the Consumer Price Index (CPI) for prescription drugs to adjust 1998 expenditures to 1999 dollars and to adjust 2008 expenditures to 2009 dollars. Next, to adjust for general inflation between the beginning and ending point of our study, we used the all item CPI for all urban consumers (CPI-U), to adjust the pooled 1999 expenditures to 2009 dollars.

Age: In this report, age is the last reported age in each year for each adult age 18 and older, in the sampled households.

Race/ethnicity: Classification by race and ethnicity in this report was based on the following four race/ethnicity groups: Hispanic; black single race non-Hispanic; white single race non-Hispanic; and other races non-Hispanic. Classification by race and ethnicity is based on information provided by the household respondent for each household member. First, respondents were asked if the person’s main ethnic background was Puerto Rican, Cuban/Cuban American, Dominican, Mexican, Mexican American, Central or South American, other Latin American, or other Hispanic/Latino. All persons whose main ethnic background was reported as one of these Hispanic groups, regardless of racial background, were classified as Hispanic. All other persons were classified as non-Hispanic according to their reported race. From 1998 to 2001, the respondent was asked if each person’s race was best described as American Indian; Aleut, Eskimo; Asian or Pacific Islander, black, white, or other. Beginning in 2002, the respondent was able to describe each person’s race by specifying any number of races that applied (i.e., multiracial). The other races non-Hispanic includes non-Hispanic adults with single races other than white and black as well as adults with multiple races.

Education: All adults (those age 18 and older) were assigned the number of years of education completed and reported when they first entered MEPS. The following education categories were based on highest grade of regular school completed: “less than high school” for less than 12 years, “high school” for 12 years; and “at least some college” for more than 12 years.

Income: In MEPS, personal income from all members within a household in a family (CPS definition of family) is summed to create family income. Potential sources of income include annual earnings from wages, salaries, bonuses, tips, and commissions; business and farm gains and losses; unemployment and Workers’ Compensation payments; interest and dividends; alimony, child support, and other private cash transfers; private pensions; individual retirement account (IRA) withdrawals; Social Security and Department of Veterans Affairs payments; Supplemental Security Income and cash welfare payments from public assistance, TANF (Temporary Assistance for Needy Families; formerly known as Aid to Families with Dependent Children, or AFDC); gains or losses from estates, trusts, partnerships, S corporations, rent, and royalties; and a small amount of “other” income. In this report, poverty status is the ratio of the family’s income to the Federal poverty thresholds, which control for the size of the family and the age of the head of the family. The following classification of poverty status was used:

Poor/near poor income: adults in families with income less than 125 percent of the Federal poverty line, including those who reported negative income.

Low income: adults in families with income from 125 percent to less than 200 percent of the Federal poverty line.

Middle income: adults in families with income from 200 percent to less than 400 percent of the Federal poverty line.

High income: adults in families with income greater than or equal to 400 percent of the Federal poverty line.

Health insurance status:

Individuals 18 to 64 years of age were classified in the following three insurance categories based on household responses to health insurance status questions:

- *Any private health insurance:* Individuals who, at any time during the year, had insurance that provides coverage for hospital and physician care (other than Medicare, Medicaid, or other public hospital/physician coverage) were classified as having private insurance. Coverage by TRICARE (Armed Forces–related coverage) was also included as private health insurance. Insurance that provides coverage for a single service only, such as dental or vision coverage, was not included.
- *Public coverage only:* Individuals were considered to have public coverage only if they met both of the following criteria: 1) they were not covered by private insurance at any time during the year, and 2) they were covered by one of the following public programs at any point during the year: Medicare, Medicaid, or other public hospital/physician coverage.
- *Uninsured:* The uninsured were defined as people not covered by private hospital/physician insurance, Medicare, TRICARE, Medicaid, or other public hospital/physician programs at any time during the entire year or period of eligibility for the survey.

For individuals 65 and older, the following insurance categories were used:

- *Medicare plus private (including TRICARE)*: Individuals who at any time during the year were covered by TRICARE or a supplemental private insurance policy in addition to Medicare.
- *Medicare plus other public coverage*: Individuals were considered to have Medicare plus other public coverage if they were covered by Medicare and met both of the following criteria: 1) they were not covered by TRICARE or a supplemental private policy at any time during the year, and 2) they were covered by one of the following public programs other than Medicare at any point during the year: Medicaid; or other public hospital/physician coverage.
- *Medicare only*: This group includes adults who had Medicare fee-for-service coverage or who were enrolled in Medicare HMOs and did not report any private or public supplemental insurance coverage.
- A very small number of persons age 65 and older did not report Medicare coverage. This category is not shown in the table but is included in the total.

Perceived health status: During each round of interviewing, the household respondent was asked to rate the health of each person in the family according to the following categories: excellent, very good, good, fair, or poor. For this report, the highest ranking response category reported for the year was used and then collapsed into the following two categories: "excellent," "very good," and "good"; and, "fair" and "poor."

Metropolitan statistical area (MSA): During each round adults were identified as residing either inside or outside an MSA reflecting the most recent definitions of metropolitan areas established by the Office of Management and Budget (OMB), including the most recent updates. These updates are based on the application of the 2000 Standards for Defining Metropolitan Statistical Areas of OMB to Census Bureau population estimates for July 1, 2004 and July 1, 2005. For MEPS data releases prior to 2004 the MSA was classified in compliance with the definition of metropolitan statistical areas based on application of OMB standards to Census 1990 data. In this report the end of year variable is used.

Census region: During each round adults were classified as living in one of the following four regions as defined by the U.S. Census Bureau. In this report, the last reported census region in each year is used.

Northeast: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, and Pennsylvania.

Midwest: Ohio, Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, South Dakota, North Dakota, Nebraska, and Kansas.

South: Delaware, Maryland, District of Columbia, Virginia, West Virginia, North Carolina, South Carolina, Georgia, Florida, Kentucky, Tennessee, Alabama, Mississippi, Arkansas, Louisiana, Oklahoma, and Texas.

West: Montana, Idaho, Wyoming, Colorado, New Mexico, Arizona, Utah, Nevada, Washington, Oregon, California, Alaska, and Hawaii.

Rounding

Because of rounding and some missing data, some of the subpopulation estimates presented in the tables will not sum exactly to the overall population total. Standard errors are presented in tables A–E.

Standard Error Tables

Table A. Standard errors for percentage and total number of adults with reported treatment for asthma, selected comorbid conditions and smoking status, 1998–1999 to 2008–2009

	1998–1999	2000–2001	2002–2003	2004–2005	2006–2007	2008–2009
Total population (millions)	7.8	12.5	5.3	6.4	5.3	4.2
Adults with reported treatment for asthma						
Number in millions	0.3	0.4	0.3	0.3	0.4	0.4
Percentage	0.1	0.1	0.1	0.1	0.1	0.1
Among adults with reported treatment for asthma, percentage with reported ¹ :						
Diabetes	1.2	1.0	0.9	1.2	1.3	1.1
Selected mental disorders	1.5	1.2	1.3	1.5	1.5	1.6
Major cardiovascular diseases	1.9	1.8	1.5	1.5	1.6	1.7
Diseases of heart	1.5	1.3	1.0	1.1	1.2	1.3
Hypertension	1.7	1.8	1.5	1.4	1.7	1.7
Acute respiratory infections	1.9	1.5	1.5	1.6	1.7	1.6
Acute respiratory infections (excl. pneumonia and influenza)	1.8	1.5	1.5	1.6	1.8	1.5
Chronic obstructive pulmonary diseases (excluding asthma)	1.7	1.3	1.2	1.3	1.2	1.4
Current smoker ²		1.4	1.3	1.5	1.1	1.3
Family with current smoker ²		1.7	1.4	1.8	1.2	1.4

Source: Center for Financing, Access, and Cost Trends, Agency for Healthcare Research and Quality, Medical Expenditure Panel Survey, 1998 to 2009

¹Please see Technical appendix for more information on comorbid conditions and smoking status.

²Data on whether respondents currently smoke were first collected in 2000.

Table B. Standard errors for percentage and total number of adults with reported treatment for asthma, by selected population characteristics, 1998–1999 to 2008–2009

	1998–1999			2008–2009		
	Total population (in millions)	Total with reported treatment for asthma (in millions)	Percentage with reported treatment for asthma	Total population (in millions)	Total with reported treatment for asthma (in millions)	Percentage with reported treatment for asthma
Total	7.8	0.3	0.1	4.2	0.4	0.1
Age in years						
18 to 44	4.4	0.2	0.2	2.3	0.2	0.2
45 to 64	2.5	0.2	0.2	1.7	0.2	0.2
65 and older	1.5	0.1	0.3	1.2	0.2	0.4
Race/ethnicity ¹						
White	6.5	0.3	0.1	3.5	0.3	0.2
Black	1.5	0.1	0.4	1.3	0.1	0.3
Hispanic	1.5	0.1	0.3	1.7	0.1	0.3
Other	0.9	0.1	0.7	1.0	0.1	0.6
Sex						
Male	3.9	0.2	0.1	2.1	0.2	0.2
Female	3.9	0.2	0.2	2.2	0.3	0.2
Education						
Less than high school	1.8	0.1	0.2	1.1	0.1	0.3
High school	2.6	0.2	0.2	1.6	0.2	0.3
At least some college	4.2	0.2	0.2	2.5	0.2	0.2
Income						
Poor/near poor	1.3	0.1	0.3	1.0	0.1	0.3
Low income	1.1	0.1	0.3	0.9	0.1	0.3
Middle income	2.7	0.1	0.2	1.6	0.2	0.2
High income	3.8	0.2	0.2	2.4	0.2	0.2
Health insurance status						
Less than 65						
Any private	5.6	0.3	0.2	2.8	0.3	0.2
Public only	0.7	0.1	0.5	0.7	0.1	0.6
Uninsured	1.2	0.1	0.3	1.2	0.1	0.2
65 and older						
Medicare only	0.5	0.1	0.5	0.6	0.1	0.5
Medicare and private	1.0	0.1	0.4	0.8	0.1	0.6
Medicare and other public	0.3	0.0	0.9	0.2	0.0	1.1
Perceived health status						
Excellent/very good/good	6.5	0.2	0.1	3.4	0.3	0.1
Fair/poor	1.6	0.2	0.4	1.2	0.2	0.4
Metropolitan statistical area (MSA)						
MSA	7.3	0.3	0.1	4.2	0.3	0.1
Non-MSA	2.3	0.1	0.2	2.5	0.2	0.4
Census region						
Northeast	2.7	0.1	0.3	1.7	0.2	0.3
Midwest	2.8	0.2	0.3	1.6	0.2	0.3
South	4.5	0.2	0.2	2.3	0.2	0.2
West	4.8	0.2	0.2	1.8	0.2	0.3

Source: Center for Financing, Access, and Cost Trends, Agency for Healthcare Research and Quality, Medical Expenditure Panel Survey, 1998, 1999, 2008, and 2009

¹The Hispanic grouping can include adults of any race, so the race categories of black, white, and ‘other’ exclude Hispanics. In all data years, the ‘other’ category includes adults with single races other than white and black. In 2008–2009 the ‘other’ category also includes adults with multiple races. MEPS respondents were first able to identify household members as belonging to multiple race groups in 2002.

Table C. Standard errors for percentage of adults using controllers, relievers and oral corticosteroids, among adults with reported treatment for asthma, 1998–1999 to 2008–2009

	1998–1999	2000–2001	2002–2003	2004–2005	2006–2007	2008–2009
Population with reported treatment for asthma (millions)	0.3	0.4	0.3	0.3	0.4	0.4
Among adults reported treatment for asthma, percentage using:						
Controller ¹	2.2	1.7	1.4	1.4	1.5	1.6
ICS	2.2	1.6	1.6	1.7	1.7	1.7
LTRA	1.5	1.3	1.2	1.5	1.5	1.3
Reliever ²						
Any reliever	2.0	1.6	1.5	1.8	1.5	1.5
“Reliever only” ³	1.9	1.4	1.4	1.5	1.4	1.4
OCS ⁴	1.4	1.2	1.1	1.2	0.9	1.0

Source: Center for Financing, Access, and Cost Trends, Agency for Healthcare Research and Quality, Medical Expenditure Panel Survey, 1998 to 2009

¹ Controllers denotes the use of any controller—include ICS (inhaled corticosteroids), LABA (inhaled long acting beta-agonists), LTRA (leukotriene receptor antagonists), NSA (non-steroidal anti-allergy agents), MXS (methylxanthines) and LABA (oral long acting beta-agonists).

² Relievers denotes the use of any reliever—include SABA (inhaled short acting beta agonists), ACB (anti-cholinergic bronchodilators) and SANB (shorting acting non-beta selective agents).

³ “Relievers only” indicates reliever use but no controller use.

⁴ OCS (oral corticosteroids) denotes the use of any OCS—includes prednisone, dexamethasone, methylprednisolone, and other steroids.

Table D. Standard errors for percentage of adults using controllers, relievers and oral corticosteroids, among adults with reported treatment for asthma, by selected population characteristics, 1998–1999 to 2008–2009

	Controller ¹		Reliever ²		“Reliever only” ³		OCS ⁴	
	1998–1999	2008–2009	1998–1999	2008–2009	1998–1999	2008–2009	1998–1999	2008–2009
Total	2.2	1.6	2.0	1.5	1.9	1.4	1.4	1.0
Age in years								
18 to 44	3.2	2.7	2.8	2.4	2.8	2.4	2.1	1.9
45 to 64	3.3	2.2	3.0	2.5	2.8	1.9	2.3	1.6
65 and older	5.1	3.0	4.0	2.8	4.9	2.1	2.5	1.7
Race/ethnicity ⁵								
White	2.8	1.9	2.3	1.8	2.4	1.5	1.7	1.1
Black	4.6	3.0	5.1	2.9	4.4	2.8	3.7	1.8
Hispanic	5.5	3.6	4.6	3.2	4.7	3.4	3.2	2.7
Other	a	6.3	a	5.1	a	5.8	a	2.8
Sex								
Male	3.9	2.5	3.2	2.2	3.3	2.2	2.4	1.9
Female	2.6	1.9	2.6	1.9	2.2	1.6	1.8	1.1
Education								
Less than high school	3.8	3.2	3.5	2.3	3.0	2.8	2.3	2.7
High school	3.6	2.8	3.9	2.5	3.5	2.5	3.0	1.6
At least some college	3.4	2.2	3.1	2.5	2.5	1.9	1.8	1.4
Income								
Poor/near poor	3.5	2.9	3.4	2.3	3.5	2.4	2.6	1.6
Low income	5.0	3.5	5.0	2.8	5.0	3.0	4.5	2.0
Middle income	3.9	2.9	3.4	2.6	2.8	2.4	2.5	1.7
High income	3.5	2.5	3.4	2.8	2.9	2.2	2.4	1.9
Health insurance status								
Less than 65								
Any private	2.9	2.1	2.7	2.0	2.4	1.9	2.0	1.6
Public only	4.8	3.0	4.2	2.8	4.3	2.8	4.3	1.8
Uninsured	a	5.3	a	4.5	a	5.6	a	3.9
65 and older								
Medicare only	a	4.7	a	5.6	a	3.5	a	2.6
Medicare and private	a	4.3	a	4.0	a	3.3	a	2.6
Medicare and other public	a	5.3	a	5.7	a	3.2	a	3.6
Perceived health status								
Excellent/very good/good	3.2	2.0	2.7	2.0	2.5	1.8	1.7	1.3
Fair/poor	3.0	2.2	2.5	1.8	2.5	1.8	2.3	1.4
Metropolitan statistical area (MSA)								
MSA	2.5	1.8	2.2	1.7	2.0	1.6	1.6	1.1
Non-MSA	4.4	3.6	4.3	3.2	4.4	2.7	2.7	2.1
Census region								
Northeast	5.2	3.5	4.4	3.5	4.3	3.4	3.1	2.7
Midwest	4.5	2.8	4.3	2.7	4.3	2.3	2.8	1.8
South	3.0	2.6	3.5	2.5	2.6	2.1	2.4	1.6
West	6.0	3.4	3.8	3.0	3.5	2.7	2.8	1.5

Source: Center for Financing, Access, and Cost Trends, Agency for Healthcare Research and Quality, Medical Expenditure Panel Survey, 1998, 1999, 2008, and 2009

^a Insufficient sample; fewer than 100 cases in denominator.

¹ Controllers denotes the use of any controller—include ICS (inhaled corticosteroids), LABA (inhaled long acting beta-agonists), LTRA (leukotriene receptor antagonists), NSA (non-steroidal anti-allergy agents), MXS (methylxanthines) and OLABA (oral long acting beta-agonists).

² Relievers denotes the use of any reliever—include SABA (inhaled short acting beta agonists), ACB (anti-cholinergic bronchodilators) and SANB (shorting acting non-beta selective agents).

³ “Relievers only” indicates reliever use with no controller use.

⁴ OCS (oral corticosteroids) denotes the use of any OCS—includes prednisone, dexamethasone, methylprednisolone and other steroids.

⁵ The Hispanic grouping can include adults of any race, so the race categories of black, white, and 'other' exclude Hispanics. In all data years, the 'other' category includes adults with single races other than white and black. In 2008–2009 the 'other' category also includes adults with multiple races. MEPS respondents were first able to identify household members as belonging to multiple race groups in 2002.

Table E. Standard errors for average annual expenditures (in 2009 U.S. dollars) for health care and asthma medications, among adults with reported treatment for asthma, 1998–1999 to 2008–2009

	1998–1999	2008–2009
Population with reported treatment for asthma (millions)	0.3	0.4
Total health care expenditures (millions of dollars)	\$2,239	\$6,926
Total out-of-pocket health care expenditures (millions of dollars)	370	1,030
Total drugs expenditures (millions of dollars)		
All therapeutic classes	\$237	\$628
Controller ¹	181	505
Reliever ²	72	208
OCS ³	5	3
Total expenditures per user		
All therapeutic classes	\$40	\$52
Controller ¹	41	51
Reliever ²	15	27
OCS ³	6	2
Out-of-pocket expenditures per user		
All therapeutic classes	\$21	\$15
Controller ¹	25	17
Reliever ²	6	7
OCS ³	4	1

Source: Center for Financing, Access, and Cost Trends, Agency for Healthcare Research and Quality, Medical Expenditure Panel Survey, 1998, 1999, 2008, and 2009

¹ Controllers denotes the use of any controller—include ICS (inhaled corticosteroids), LABA (inhaled long acting beta-agonists), LTRA (leukotriene receptor antagonists), NSA (non-steroidal anti-allergy agents), MXS (methylxanthines) and LABA (oral long acting beta-agonists).

² Relievers denotes the use of any reliever—include SABA (inhaled short acting beta agonists), ACB (anti-cholinergic bronchodilators) and SANB (shorting acting non-beta selective agents).

³ OCS (oral corticosteroids) denotes the use of any OCS—includes prednisone, dexamethasone, methylprednisolone and other steroids.