

## STATISTICAL BRIEF #341

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### Changes in Children's Use and Expenditures for Asthma Medications, United States, 1997-1998 to 2007-2008

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#### Introduction

Asthma, a chronic respiratory disease, affects persons of all ages but it is more prevalent among children than adults in the U.S. Pharmacotherapy is essential in controlling, preventing and relieving asthma attacks. In recent years, the National Asthma Education and Prevention Program's guidelines for the management of asthma have been updated.<sup>1</sup> The pharmacotherapy section of the guidelines recommends a stepwise approach to long-term asthma management, especially in children, to achieve and maintain asthma control. Given that asthma medications are the most widely used chronic medication in children, it is important to understand how children's use of and expenditures for asthma medications have changed in response to evolving treatment guidelines and the introduction of new drugs.

This Statistical Brief examines changes in asthma medication use and expenditures among children with reported treatment for asthma from 1997-1998 to 2007-2008 using data from the Household Component of the Medical Expenditure Panel Survey (MEPS-HC). We categorized asthma medications into three general classes: controllers, relievers and oral corticosteroids (OCS). Controllers are used to prevent asthma symptoms, by minimizing inflammation and reducing the risk of serious exacerbations. Inhaled corticosteroids (ICS), a type of controller medication, is the preferred first-line therapy and is the cornerstone of asthma therapy for persistent asthma.<sup>1,2,3</sup> Relievers are used to treat moderate or severe asthma attacks by promptly relaxing airway muscles. Oral corticosteroids are used to reduce inflammations that do not respond to inhaler medications.

We present results on the treated prevalence of asthma; the use of controllers, relievers, oral corticosteroids and specific classes of controller medications; and total and out-of-pocket drug expenditures. To increase sample sizes and the precision of our estimates, we pool data from 1997 to 1998 and 2007 to 2008 and present average annual estimates for these time periods. Expenditures for asthma medications for all years are expressed in constant 2008 U.S. dollars. All differences between estimates discussed in the text are statistically significant at the 0.05 level or better.

#### Highlights

- Among children with reported treatment for asthma, the average annual proportion using controller medications nearly doubled from 29.4 percent in 1997-1998 to 58.3 percent in 2007-2008, while the average annual proportion using relievers fell from 43.8 to 30.4 percent; and the average annual proportion using oral corticosteroids declined from 17.1 to 8.7 percent.
- Use increased for several types of controllers: the average annual proportion of children using inhaled corticosteroids rose from 15.5 to 40.3 percent; the average annual proportion using inhaled long acting beta-agonists increased from 3.0 to 13.2 percent; and the average annual proportion using leukotriene receptor antagonists rose from 2.9 to 34.1 percent.
- Average annual total expenditures on all prescribed asthma medications (in constant 2008 dollars) more than quadrupled from \$527 million in 1997-1998 to \$2.5 billion in 2007-2008 and average annual total expenditures on controller medications increased sevenfold from \$280 million to \$2.1 billion.
- Average annual total expenditures for relievers (in constant 2008 dollars) jumped 58.9 percent from \$222 million in 1997-1998 to \$352 million in 2007-2008 while average annual total expenditures for oral corticosteroids fell 68.0 percent from \$25 to \$8 million during the same period.
- Average annual total expenditures (in constant 2008 dollars) for controllers were 6 times the corresponding expenditures for relievers and more than 260 times the corresponding expenditures for oral corticosteroids in 2007-2008.
- Average annual out-of-pocket expenditures per user on all prescribed asthma medications (in constant 2008 dollars) nearly doubled from \$65 in 1997-1998 to \$123 in 2007-2008. Average annual out-of-pocket expenditures per user for controllers were 5 times the corresponding expenditures for relievers and 15 times the corresponding expenditures for oral corticosteroids in 2007-2008.

<sup>1</sup> The National Asthma Education and Prevention Program (NAEPP)—Guidelines for the Diagnosis and Management of Asthma first published in 1997, update in 2002 and more recently in 2007 (Expert Panel Report 3).

<sup>2</sup> O'Connell, E.J. *Optimizing Inhaled Corticosteroid Therapy in Children with Chronic Asthma*. *Pediatric Pulmonology* 2005, 39:74-83.

<sup>3</sup> Wechsler, M. E. *Managing Asthma in Primary Care: Putting New Guideline Recommendations into Context*. *Mayo Clinical Proceedings*. August 2009; 84 (8): 707-717

## Findings

Overall, the average annual proportion of children with reported treatment for asthma in the U.S. increased from 4.7 percent in 1997–1998 to 6.1 percent in 2007–2008. There were increases in the treated prevalence of asthma for children ages 5–11 (5.2 to 7.5 percent) and ages 12–17 (4.0 to 5.7 percent) (figure 1).

The average annual proportion of children with reported treatment for asthma who used controllers to treat their asthma nearly doubled from 29.4 in 1997–1998 to 58.3 percent in 2007–2008. During the same period, the average annual proportion using relievers, but not controllers, fell from 43.8 percent to 30.4 percent and the average annual proportion using oral corticosteroids decreased from 17.1 to 8.7 percent (figure 2).

There were also increases in the use of several specific classes of controller asthma medications during the period of our analysis. The average annual proportion of children with reported treatment for asthma who used inhaled corticosteroids (ICS) increased from 15.5 to 40.3 percent; the average annual proportion using inhaled long acting beta-agonists (LABA) increased from 3.0 to 13.2 percent; and the average annual proportion using leukotriene antagonists (LTRA), rose from 2.9 to 34.1 percent. The use of non-steroidal anti-allergy agents (NSA) declined during the period of our analysis from 15.1 to 0.6 percent (figure 3).

Average annual total expenditures on all prescribed asthma medications by children with reported treatment for asthma more than quadrupled from \$527 million in 1997–1998 to \$2.5 billion in 2007–2008 after adjustment for inflation. During the same period, average annual total expenditures on controller medications increased sevenfold from \$280 million to \$2.1 billion, and average annual total expenditures on relievers jumped 58.9 percent from \$222 to \$352 million. Average annual total expenditures on oral corticosteroids, however, decreased 68.0 percent from \$25 to \$8 million. Average annual total expenditures on controllers were 6 times the corresponding expenditures for relievers and more than 260 times the average annual total expenditures for oral corticosteroids in 2007–2008 (figure 4).

Average annual expenditures per user on all prescribed asthma medications by children with reported treatment for asthma nearly tripled from \$207 in 1997–1998 to \$605 in 2007–2008. During the same period, average annual expenditures per user on asthma controller medications nearly tripled from \$282 to \$796 about 40 times the expenditure per user on oral corticosteroids, which fell 53.9 percent from \$44 to \$20. Average annual expenditures per user on relievers averaged \$112 in 2007–2008, representing 14.1 percent of the average annual expenditure per user on controllers in 2007–2008 (figure 5).

Average annual out-of-pocket expenditures per user on all prescribed asthma medications by children with reported treatment for asthma nearly doubled from \$65 in 1997–1998 to \$123 in 2007–2008. Average annual out-of-pocket expenditures per user on controller asthma medications nearly doubled from \$77 to \$153. During the same period, average annual out-of-pocket expenditures per user on oral corticosteroids asthma medications decreased 52.4 percent from \$21 to \$10. In 2007–2008 average annual out-of-pocket expenditures per user on controllers were 5 times the annual average of \$30 for relievers and 15 times the annual average of \$10 for oral corticosteroids (figure 6).

## Data Source

The estimates presented in this Statistical Brief were derived from the MEPS Full Year Consolidated Data Files, the MEPS Conditions Files and the MEPS Prescribed Medicines Files for 1997, 1998, 2007, and 2008.

## Definitions

### *Children with reported treatment for asthma*

We use the 1997, 1998, 2007, and 2008 MEPS Condition Files and the three-digit ICD-9-CM diagnosis condition variable (ICD9CODX) to construct indicator variables for asthma. We identified children with reported treatment for asthma within the sample by tying the diagnosis code (ICD-9-CM "493") to any reported health services utilization (i.e., home health, inpatient hospital stays, outpatient, office-based, emergency room visits, and prescribed medicines) during the year.

### *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 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 included were primarily comprised of SABAs (inhaled short acting beta agonists), but also included ACB (anticholinergic bronchodilators), SANB (shorting acting non-beta selective agents) and SABA-ACB combinations. Oral corticosteroids included prednisone, dexamethasone, and methylprednisolone and other steroids. For this Brief, "relievers-only" denotes children who, at any time during the year, were using relievers but no controllers to treat their asthma.

### *Utilization*

Indicator variables were created to identify children who used each of the major classes of asthma medications—controllers, relievers, and oral corticosteroids—during the year. For this Brief, "relievers-only" denotes children who used at least one reliever during the year but did not use any controllers to treat their asthma. We also created indicator variables to capture use of subclasses of controller medications and their combinations. For combination drugs, a child was identified as having had each medication comprising the combination therapy. For example, if a child had a combination drug that included both an ICS and an ILABA, then the child was identified as having used each of these types of asthma medications. Utilization estimates are presented as the proportion of children 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 purchase from any source, including payments by individuals and their families and payments by private insurance, Medicaid, Medicare, and other sources types of insurance. For this Brief, all drug expenditures were adjusted to constant 2008 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 1997 expenditures to 1998 dollars and to adjust 2007 expenditures to 2008 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 expenditures to 2008 dollars. All estimates presented are average annual estimates for the 1997-1998 and the 2007-2008 periods.

## About MEPS-HC

MEPS-HC is a nationally representative longitudinal survey that collects detailed information on health care utilization and expenditures, health insurance, and health status, as well as a wide variety of social, demographic, and economic characteristics for the U.S. civilian noninstitutionalized population. It is cosponsored by the Agency for Healthcare Research and Quality and the National Center for Health Statistics.

For more information about MEPS, call the MEPS information coordinator at AHRQ (301-427-1656) or visit the MEPS Web site at <http://www.meps.ahrq.gov/>.

## References

For a detailed description of the MEPS survey design, sample design, and methods used to minimize sources of nonsampling error, see the following publications:

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.pdf](http://www.meps.ahrq.gov/mepsweb/data_files/publications/mr1/mr1.pdf)

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.pdf](http://www.meps.ahrq.gov/mepsweb/data_files/publications/mr2/mr2.pdf)

Cohen, S. Design Strategies and Innovations in the Medical Expenditure Panel Survey. *Medical Care*, July 2003: 41(7) Supplement: III-5-III-12.

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Sarpong, E. M. and Miller, G. E. *Changes in Children's Use and Expenditures of Asthma Medications, United States, 1997-1998 and 2007-2008*. Statistical Brief #341. September 2011. Agency for Healthcare Research and Quality, Rockville, MD. [http://www.meps.ahrq.gov/mepsweb/data\\_files/publications/st341/stat341.pdf](http://www.meps.ahrq.gov/mepsweb/data_files/publications/st341/stat341.pdf)

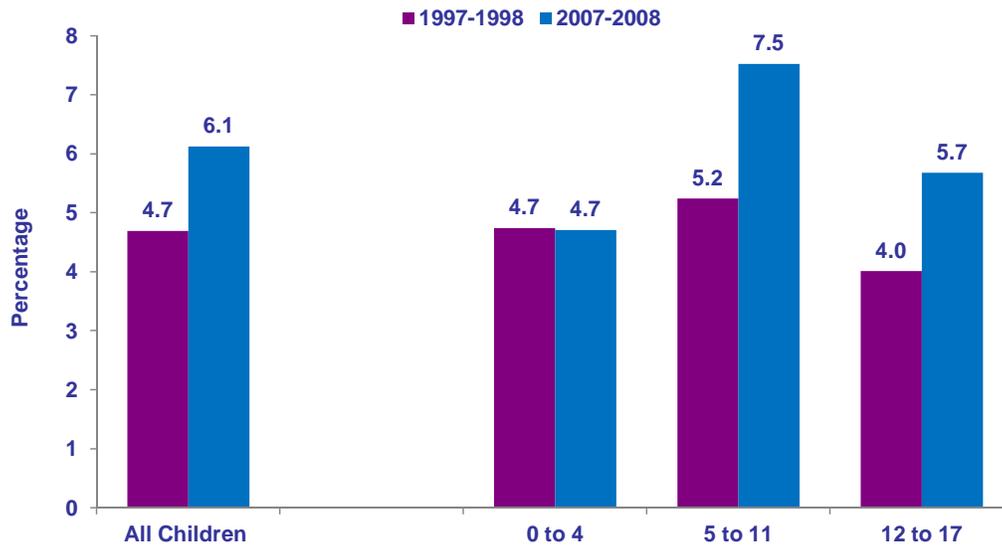
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AHRQ welcomes questions and comments from readers of this publication who are interested in obtaining more information about access, cost, use, financing, and quality of health care in the United States. We also invite you to tell us how you are using this Statistical Brief and other MEPS data and tools and to share suggestions on how MEPS products might be enhanced to further meet your needs. Please e-mail us at [mepsdpd@ahrq.gov](mailto:mepsdpd@ahrq.gov) or send a letter to the address below:

Steven B. Cohen, PhD, Director  
Center for Financing, Access, and Cost Trends  
Agency for Healthcare Research and Quality  
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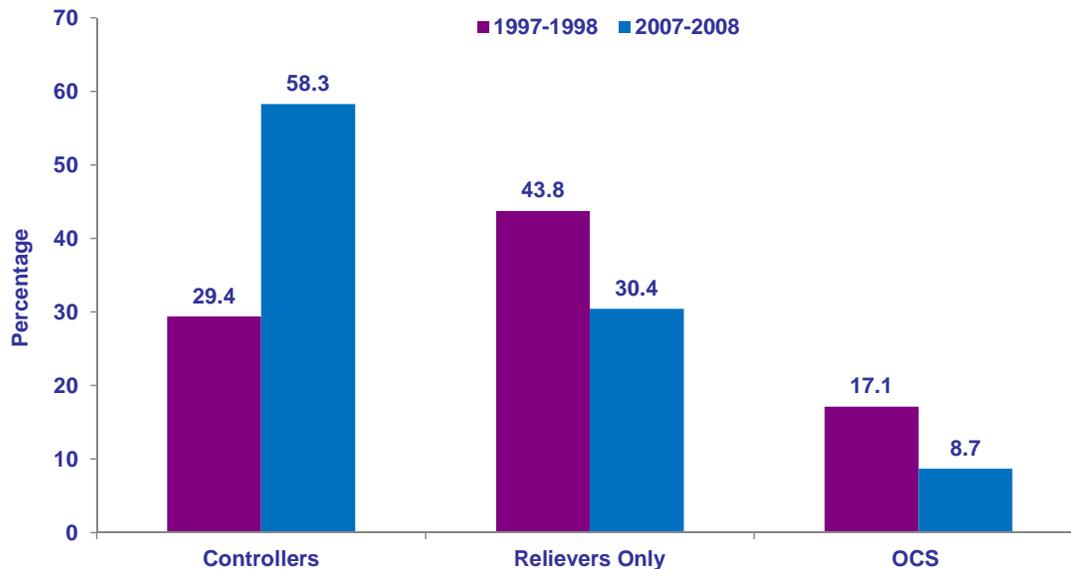
**Figure 1. Percentage of children (<18 years) with reported treatment for asthma by age, 1997–1998 and 2007–2008**



Source: Center for Financing, Access, and Cost Trends, AHRQ, Household Component of the Medical Expenditure Panel Survey, 1997–1998 and 2007–2008



**Figure 2. Percentage of children using major types of asthma medications among children (<18 years) with reported treatment for asthma, 1997–1998 and 2007–2008**

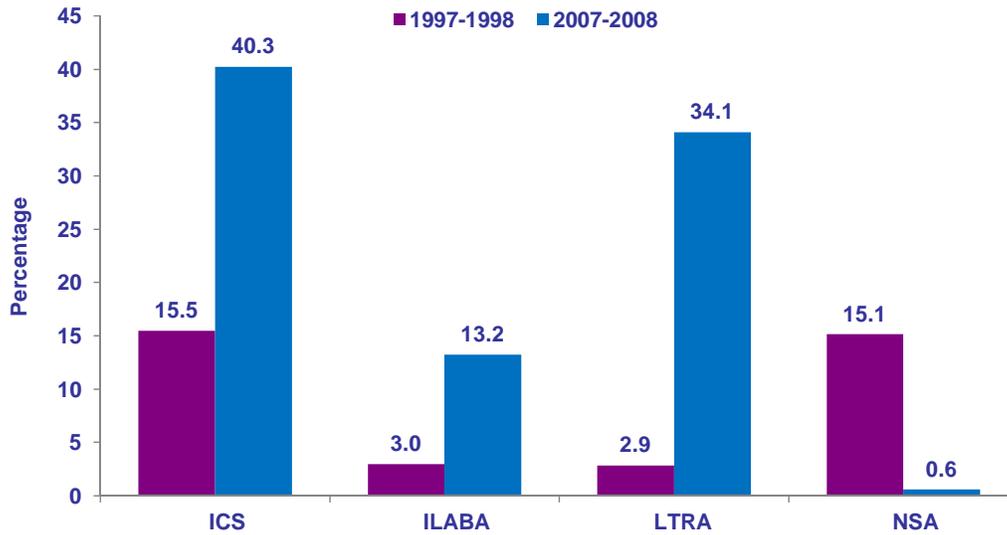


Note: Relievers-only denotes relievers, but no controllers; OCS = oral corticosteroid

Source: Center for Financing, Access, and Cost Trends, AHRQ, Household Component of the Medical Expenditure Panel Survey, 1997–1998 and 2007–2008



**Figure 3. Percentage of children using specific classes of asthma controller medications among children (<18 years) with reported treatment for asthma, 1997–1998 and 2007–2008**

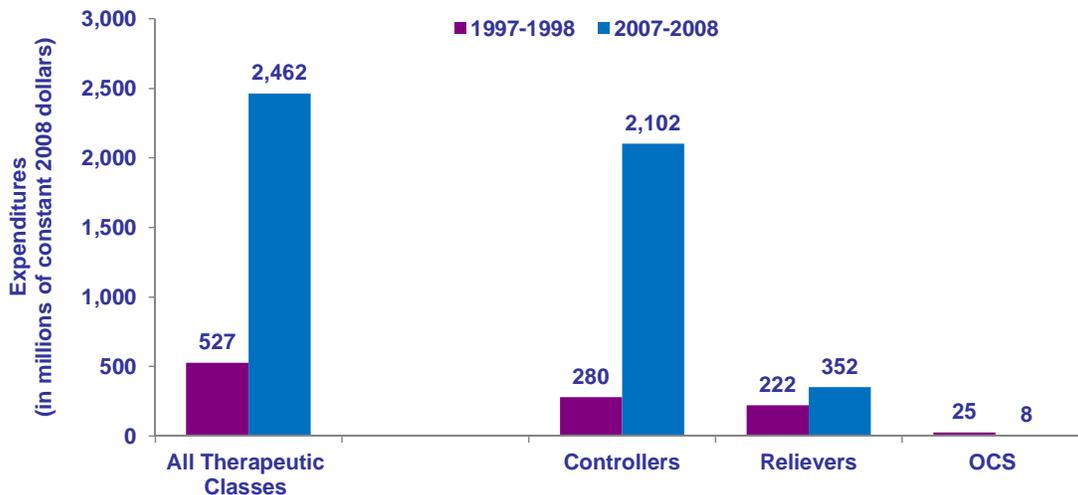


**Note:** ICS = inhaled corticosteroid, ILABA = inhaled long acting beta-agonists, LTRA = leukotriene receptor antagonist and NSA = non-steroidal anti-allergy agents

**Source:** Center for Financing, Access, and Cost Trends, AHRQ, Household Component of the Medical Expenditure Panel Survey, 1997–1998 and 2007–2008



**Figure 4. Average annual total drug expenditures on major types of asthma medications among children (<18 years) with reported treatment for asthma, 1997–1998 and 2007–2008**

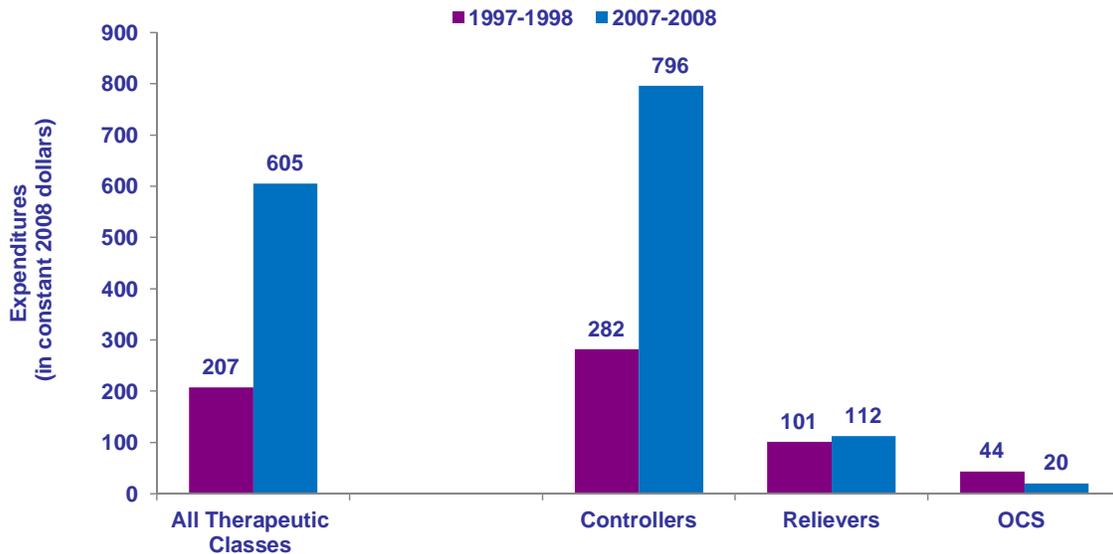


**Note:** OCS = oral corticosteroid

**Source:** Center for Financing, Access, and Cost Trends, AHRQ, Household Component of the Medical Expenditure Panel Survey, 1997–1998 and 2007–2008



**Figure 5. Average annual per user expenditures on major types of asthma medications among children (<18 years) with reported treatment for asthma, 1997–1998 and 2007–2008**

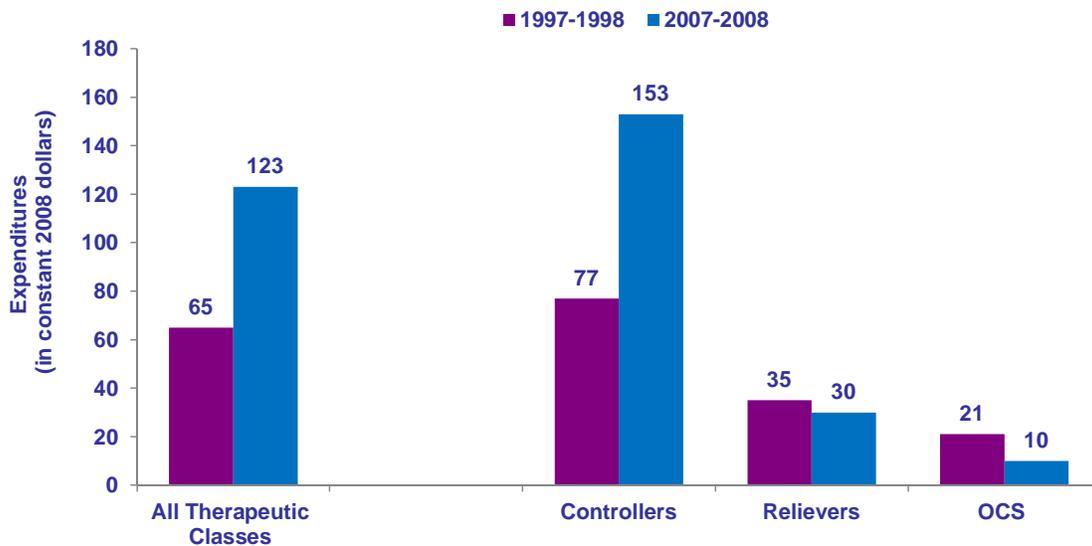


Note: OCS = oral corticosteroid

Source: Center for Financing, Access, and Cost Trends, AHRQ, Household Component of the Medical Expenditure Panel Survey, 1997–1998 and 2007–2008



**Figure 6. Average annual out-of-pocket expenditures per user on major types of asthma medications among children (<18 years) with reported treatment for asthma, 1997–1998 and 2007–2008**



Note: OCS = oral corticosteroid

Source: Center for Financing, Access, and Cost Trends, AHRQ, Household Component of the Medical Expenditure Panel Survey, 1997–1998 and 2007–2008