Asthma-related medication use among children in the United States

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Background: Asthma is one of the most common chronic conditions in children and has a major impact on health care use and quality of life. The Best Pharmaceuticals for Children Act mandates the federal government to sponsor pediatric studies of drugs approved for use in the United States but lacking evaluation in the pediatric population and lacking interest of commercial sponsors. As input into the drug selection and prioritization process, information is needed on the percentage of children who receive asthma-related medications.

Objective: To estimate the percentage of children who receive asthma-related medications.

Methods: Retrospective analysis of outpatient medical and drug claims from members of commercial health care insurance plans enrolled any time from January 1, 2004, through December 31, 2005. The study population included 4,259,103 children throughout the United States aged birth through 17 years.

Results: Fifteen percent of all children were dispensed an asthma-related medication. Among 218,943 children with an asthma diagnosis, 188,286 (86%) had a dispensed asthma-related medication at any time during the 2-year study period. Among children without any asthma diagnoses, 398,880 (10%) had a dispensed medication. Fifty-nine percent of children with an asthma diagnosis were dispensed an anti-inflammatory medication within 90 days after a claim with a diagnosis of asthma.

Conclusions: Asthma-related medications are dispensed to a large percentage of the pediatric population, including many who do not have claims with asthma diagnoses listed. Data on the pharmacokinetics and safety of these drugs in children are largely unknown and difficult to obtain. Clinical studies that use new tools and approaches are needed to resolve this information gap.

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INTRODUCTION

Asthma is one of the most common chronic conditions in children in the United States and the most prevalent cause of childhood disability.[1] There was a steady increase in asthma prevalence among children 0 to 17 years of age during the 1980s and 1990s in the United States. Recent estimates based on parental reports from the National Health Interview Survey have shown that the prevalence of children with asthma has stabilized at approximately 8% to 9%.[2] Similar patterns have been observed in children worldwide.[3]

Asthma has a major impact on health care use and quality of life.[4] It is the third leading cause of hospitalization of children in the United States.[5] Annually, asthma is related to more than 10 million missed school days, 200,000 hospitalizations, and $400 million spent on direct medical services.[6–8]

Asthma drugs, like most medicines for treating pediatric diseases, have not been adequately studied in children to characterize dosing, efficacy, and safety.[9–12] In 2002, Congress enacted the Best Pharmaceuticals for Children Act (BPCA) to address this issue of insufficient pediatric information in general. The BPCA mandates the National Institutes of Health (NIH) to sponsor pediatric studies of drugs approved for use in the United States but lacking evaluation in the pediatric population if requests by the Food and Drug Administration to the New Drug Application holder are declined.[13] The selection of drugs is based on the frequency of use in the pediatric population, the prevalence and severity of the condition being treated, and the potential for providing a health benefit in the pediatric population. It is not clear how often such drugs are dispensed specifically for asthma diagnoses, at what ages, and whether this varies by region. This study was undertaken to provide input into the prioritization process for federal support of pediatric drug studies by evaluating asthma-related medication use among children in the United States.

METHODS

Estimates of the prevalence of asthma and percentage of children with a dispensed asthma-related medication were derived from administrative claims data for children enrolled in commercial insurance plans. The Ingenix LabRx Database was used. These data include claims for health care utilization

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for members of one insurer's large national managed care plans for an employed, commercially insured population and their dependents with both medical and pharmacy benefit coverage. Thus, the data are derived from outpatient visit claims and do not represent uninsured children. The deidentified database complies with the Health Insurance Portability and Accountability Act of 1996. The Westat institutional review board reviewed and approved the study.

A medical claims file contained information on up to 5 diagnoses recorded with the *International Classification of Diseases, Ninth Revision, Clinical Modification* (*ICD-9-CM*) diagnosis codes. The pharmacy claims file included the National Drug Code and fill date for outpatient prescription medications. Children aged birth through 17 years who were enrolled in the plans at any time from January 1, 2004, through December 31, 2005, were included.

A diagnosis of asthma was defined as an outpatient or ambulatory medical service claim (eg, office visit, urgent care or emergency department visit) with an *ICD-9-CM* code beginning with 493 in any of the 5 available diagnosis fields. Asthma-related drugs included anti-inflammatories (oral inhalation or oral corticosteroids, leukotriene modifiers, or mast cell stabilizers) or bronchodilators (anticholinergics, sympathomimetics, or xanthine derivatives). These drugs are not necessarily used exclusively for the treatment of asthma. However, they will be referred to as asthma-related medications in this report. The combination of fluticasone and salmeterol was classified as an anti-inflammatory, and the combination of albuterol and ipratropium was classified as a sympathomimetic. The use of each drug was analyzed individually. For example, if a child reported using fluticasone, that child was included in the group of children who used fluticasone. If this same child also reported using albuterol, the child was also included in the group of children who used albuterol.

The prevalence of asthma was calculated as the probability of a medical claim containing a diagnosis of asthma within a 12-month period. The probability was computed using time to first asthma diagnosis (based on the first date during the 2004–2005 enrollment period of a submitted asthma claim) for all children in a life table analysis.[14] This approach enables children not continuously enrolled throughout the study period to be included in the calculation. It yields an estimate that is comparable to a 12-month period prevalence typically obtained from a survey (eg, response to the question, "Have you visited a doctor due to asthma during the past 12 months?").

To summarize the total burden of drug use, we calculated the percentage of all children with a dispensed asthma-related medication during a standardized 1-year period using the life table approach described herein. The percentage of children with a dispensed asthma-related medication was also calculated among the subgroup of children with an asthma diagnosis. However, the medical claim does not include information on medications specifically prescribed for the condition, and the pharmacy claims record does not include the indication for use. Therefore, to increase the specificity of the association between the diagnosis and medication, we included only asthma-related medications prescribed within 90 days after a diagnosis of asthma. For rescue medications, the temporal relation between diagnosis and medication use may not be as straightforward or as limited. Therefore, we also calculated the percentage of children with an asthma diagnosis who had an asthma-related medication dispensed at any time during our 2-year study period.

Finally, because children with no claims for asthma-related care during the study period may also be prescribed an asthma-related medication, we calculated the percentage of these children (ie, children presumably without asthma) with a dispensed asthma-related medication during the 2-year study period.

SAS statistical software, version 9 (SAS Institute Inc, Cary, North Carolina), was used for all statistical analyses. Statistical confidence intervals are not presented, since the large samples produced narrow ranges. For example, among children with asthma in our study population, the width of the 95% confidence interval for an estimate of the percentage with a dispensed medication will be approximately 0.4% (ie, the estimate $\pm 0.2\%$). Therefore, even differences of 1 percentage point (eg, 20% vs 21%), which are not clinically important, will be statistically significant at $P < .05$ and should be interpreted cautiously.

RESULTS

A total of 4,259,103 children were enrolled in the insurance plan during at least part of 2004–2005, with slightly more boys enrolled (51.2%) than girls (48.8%). The age distribution by sex is given in Table 1, and the enrollment numbers by geographic area are given in Table 2. Children from all 50 states and the District of Columbia are represented in the study population**.** The age distribution of the study population was similar to that of the US pediatric population (http://www.census.gov/popest/national/asrh/NC-EST2006-sa.html). Proportionately more children were from the Midwest and South than in the US pediatric population (31% vs 22% and 43% vs 36%, respectively). Conversely, fewer children were from the Northeast and West than in the US pediatric population (11% vs 17% and 15% vs 24%, respectively). The mean number of days of enrollment during the 2-year study period was 426 days, and 60% of children were enrolled for at least 12 months.

Table 1. Pediatric Study Population by Age and Sex[a]

Age, y	Male, No.	Female, No.	Total, No. (%)
0–4	717,030	682,694	1,399,724 (32.9)
5–11	822,543	784,373	1,606,916 (37.3)
12–14	366,825	350,801	717,626 (16.8)
15–17	272,409	262,428	534,837 (12.6)
Total	2,178,807	2,080,296	4,259,103 (100.0)

[a] Data are from administrative claims files from a national managed care organization with both medical and pharmacy benefit coverage for commercial insurance plans for calendar years 2004–2005.