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The national cost of asthma among school-aged children in the United States

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ABSTRACT

Background: Recent research has quantified the national health care resource use (HCRU) and health care expenditure (HCE) burden associated with adult asthma; however, estimates specific to school-aged children are more than 2 decades old.

Objective: To estimate the national HCRU and HCEs attributable to asthma among school-aged children in the United States.

Methods: This was a cross-sectional retrospective analysis of school-aged children (aged 6–17 years) in the nationally representative 2007–2013 Medical Expenditure Panel Survey. All-cause HCRU and HCEs of school-aged children with asthma were compared with school-aged children without asthma, controlling for sociodemographics and comorbidities. HCRU encounters included emergency department (ED) and outpatient visits, hospitalizations, and prescriptions. Expenditures included total, medical, ED, inpatient, outpatient, and pharmacy. Negative binomial regression analyses were used for HCRU and Heckman selection with logarithmic transformation, and smearing retransformation was used for HCEs.

Results: There were 44,320 school-aged children of whom 5,890 had asthma. Children with asthma incurred a higher rate of all-cause annual ED visits (incidence rate ratio [IRR], 1.5; $P < .001$), hospitalizations (IRR, 1.4; $P < .05$), outpatient visits (IRR, 1.4; $P < .001$), and prescription drugs (IRR, 3.3; $P < .001$) compared with school-aged children without asthma. They incurred US$847 (2015 dollars) more annually in all-cause expenditures ($P < .001$). Private insurance and Medicaid paid the largest share of expenditures. Pharmacy and outpatient costs represented the largest proportion of total expenditures. On the basis of the nationally representative Medical Expenditure Panel Survey sample weights from 2013, the total annual HCEs attributable to asthma for school-aged children in the United States was US$5.92 billion (2015 dollars).

Conclusion: Childhood asthma continues to represent a prevalent and significant clinical and economic burden in the United States. More aggressive treatment and asthma management programs are needed to address this national financial and resource burden.

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Introduction

Asthma is one of the most common chronic disorders among children. It is estimated that 7.1 million children currently have asthma in the United States, and 4.1 million had an attack or episode from uncontrolled asthma in 2011.[1,2] The prevalence is increasing, and children have a higher prevalence than adults.[3] From 2001 to 2011, the prevalence increased by 28% overall (among adults and children). In 2012, asthma prevalence in children younger than 18 years old varied by state and ranged from 6.4% to 13.9%.

Asthma causes a significant clinical and quality-of-life burden in the United States and can have far-reaching consequences on the lives of children with the condition. Asthma has a deleterious effect on school- and work-related productivity and health-related quality of life of children and adults.[4–6] In 2011, a total of 3,345 total deaths were attributed to asthma. It is the third leading cause of hospitalization among children younger than 15 years. In 2010, there were approximately 640,000 emergency department (ED) visits for asthma in those younger than 15 years.[2]

In addition, asthma results in a significant economic burden for children. Understanding the direct cost burden of asthma to children and their families is important from both a clinical and public health or policy perspective. Asthma guidelines emphasize control as the goal of treatment. Successful asthma management requires preventive treatment and follow-up to optimize drug therapy and prevent exacerbations that may be costly. However, many factors influence successful asthma control outside clinical care management. For example, if patients and their families do not have adequate insurance and/or cannot afford the out-of-pocket costs of drug therapy, the best treatment plan may not be successful. Characterizing the direct costs associated with asthma among children can provide insight into important trends about the state of the condition among children in the United States. In addition to understanding the total amount spent on health care for children with asthma, recognizing trends in insurance and payment patterns can help shape policy discussions. Understanding the sources of payments (eg, Medicaid, private insurance, self-pay) provides information on the degree of burden on different payers, including the burden on the child and family (self-pay). Likewise, the proportion of expenditures allocated to emergency or hospital care can reflect the degree of very poorly controlled asthma that could be avoided with better preventive strategies.

Wang et al[7] assessed the national direct cost burden of asthma among children in the United States. They estimated the direct cost attributable to childhood asthma to be US$1 billion (in 2003 dollars) in 1996. More recent studies have been performed in adults[6] or combined populations,[8] but these do not provide estimates specific to children. Although the study by Wang et al[7] provides important insight into the national direct costs of asthma specific to children, it was conducted on data that is more than 20 years old. A contemporary examination to better understand the economic burden of asthma on children in the United States is crucial to inform public health, national health research, and policy decision making, given that treatment and disease patterns have changed markedly in the past 20 years.

Methods

Study Design

This study was a retrospective, cross-sectional analysis of annual health care resource use (HCRU) and health care expenditures (HCEs) for school-aged children in the nationally representative 2007–2013 Medical Expenditure Panel Survey (MEPS). School-aged children (aged 6–17 years) with asthma were compared with school-aged children without asthma to determine the association between asthma and annualized economic outcomes in the United States. In addition, children (aged 6–11 years) and adolescents (aged 12–17 years) with asthma were compared with children and adolescents without asthma to determine whether there were differences across pediatric subgroups.

Data Source and Measurement

The MEPS is a federal survey sponsored by the Agency for Healthcare Research and Quality and is the most comprehensive national data source for medical expenditures associated with US families. MEPS is a nationally representative survey of the US civilian noninstitutionalized population that incorporates survey data from patients and families, medical professionals, insurance providers, and employers to provide a comprehensive portrait of medical resource use, the frequency of use, costs of provided services, how these costs are paid, and the extent and scope of health insurance coverage for US residents. It is an overlapping panel design in which each cohort is followed up for 2 years. Respondents complete the battery of questions in each round (there are 3 rounds per year). The MEPS Household Component contains detailed self-reported information on demographic and socioeconomic characteristics, health conditions, insurance status, smoking status, use and cost of health care services, employment, and missed work days. MEPS collects data on use and expenditures of office- and hospital-based care, home health care, dental services, vision aids, and prescribed medicines. The MEPS Medical Provider Component is a follow-back survey that collects detailed information from a sample of pharmacies and health care professionals used by MEPS respondents. The Medical Provider Component supplements and validates information on medical use, pharmacy events, and expenditures. Further details on MEPS are available at www.meps.ahrq.gov.

Variables of Interest

The main independent variable of interest was the presence of asthma. Two questions in combination with health care use were used to identify the presence of current asthma. These questions were answered by the reference parent or caregiver on behalf of the child. The first question was, “Have you ever been diagnosed with asthma?” A follow-up question was, “Do you still have asthma?” If the response was positive for both questions, the child was considered to have current asthma. School-aged children who responded negatively to still having asthma but who had health care use with *International Classification of Diseases, Ninth Revision* (*ICD-9*) diagnosis code 493 for asthma were also classified as having current asthma. School-aged children who had a positive response to having asthma but a negative response to currently having asthma and no health care use with the *ICD-9* diagnosis code of 493 were excluded from the analysis because of the ambiguity of their asthma status. School-aged children who had a negative response to both questions and no health care use with an *ICD-9* code of 493 were considered to not have asthma and were defined as the comparison group.

Additional characteristics considered important in influencing the association between asthma and outcomes were included in the analyses as covariates. These characteristics included age, sex, race, ethnicity, insurance type, region, family income category, number of chronic conditions (NCC) for child excluding asthma, education of main caregiver, health status of main caregiver (Medical Outcomes Study 12-Item Short Form [SF-12] Mental Component Score [MCS-12] and Physical Component Score [PCS-12]), family members’ mean NCC, and smoking family member. The NCC variable was constructed from all reported chronic *ICD-9* codes to capture comorbidity burden. The total number of