



# Asthma Action Plan Receipt among Children with Asthma 2-17 Years of Age, United States, 2002-2013

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**Objective** To examine national trends in the receipt of asthma action plans, an intervention recommended by the National Asthma Education and Prevention Program guidelines.

**Study design** We used data from the sample child component of the National Health Interview Survey from 2002, 2003, 2008, and 2013 to examine the percentage of children 2-17 years of age with asthma ( $n = 3714$ ) that have ever received an asthma action plan. Bivariate and multivariate (with adjustment for sociodemographic characteristics and asthma outcomes consistent with greater disease severity) logistic regressions were conducted to examine trends from 2002 to 2013 and to examine, with 2013 data only, the relationship between having received an asthma action plan and both sociodemographic characteristics and indicators of asthma severity.

**Results** The percentage of children with asthma that had ever received an asthma action plan increased from 41.7% in 2002 to 50.7% in 2013 ( $P < .001$  for trend). In 2013, a greater percentage of non-Hispanic black (58.4%) than non-Hispanic white (47.4%) children ( $P = .028$ ), privately insured (56.2%) vs those with public insurance only (46.3%) ( $P = .016$ ), and users of inhaled preventive asthma medication vs those that did not ( $P < .001$ ) had ever received an asthma action plan. Adjusted results were similar.

**Conclusion** The percentage of US children with asthma that had ever received an asthma action plan increased between 2002 and 2013, although one-half had never received an asthma action plan in 2013. Some sociodemographic and asthma severity measures are related to receipt of an asthma action plan. (*J Pediatr* 2016;171:283-9).

Asthma affects approximately 7 million children in the US and poses a risk of morbidity that ranges from episodic coughing and wheezing to life-threatening events.<sup>1</sup> In 2009-2010, nearly 60% of children with asthma had at least 1 asthma attack, and compared with adults with asthma, children younger than age 18 years of age with asthma had greater rates of visits to their physician's office and the emergency department (ED) for asthma and had similar rates of hospitalizations for asthma.<sup>1</sup> Although prevention of the development of asthma is poorly understood, there are effective means of controlling the symptoms of asthma once it develops, to prevent adverse outcomes.

A central strategy in the management of asthma is symptom monitoring and treatment according to an asthma action plan.<sup>2</sup> The guidelines of the National Asthma Education and Prevention Program (NAEPP) recommend that health care providers develop and provide a written plan for every patient with asthma that includes instructions on asthma trigger avoidance, which medications to take and when to take them, guidance on how to recognize and treat worsening asthma symptoms including adjustment of medications, and when to seek medical care. A written asthma plan not only provides education and information, but it involves the patient directly in self-management.<sup>2</sup> Asthma action plans have been shown to improve asthma-related outcomes<sup>3,4</sup> and are a recognized component of high-quality asthma care.<sup>2,5</sup> Furthermore, Healthy People 2020 Objectives include increasing the proportion of persons with asthma who receive a written asthma action plan.<sup>6</sup>

Nationally representative data on asthma action plan usage seldom have been presented,<sup>7</sup> but previous analyses have suggested that, among adults, the receipt of asthma action plans differs by sociodemographic factors,<sup>7</sup> and, among children, the receipt of asthma action plans may differ by geography.<sup>8</sup> How the receipt of an asthma action plan varies by sociodemographic factors among children is less well studied. Also, to our knowledge, no previous peer-reviewed studies have assessed changes over time in the percentage of children with asthma that have received an asthma action plan.

In this study, we examined trends in the proportion of children that have received an asthma action plan. We also examined associations between receiving an asthma action plan and sociodemographic variables.

ED	Emergency department
FPL	Federal poverty level
NAEPP	National Asthma Education and Prevention Program
NCHS	National Center for Health Statistics
NHIS	National Health Interview Survey
SES	Socioeconomic status

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## Methods

We used data from the sample child component of the National Health Interview Survey (NHIS) from 2002, 2003, 2008, and 2013. These years of the NHIS included a periodic asthma module that included questions about the receipt of asthma action plans. The NHIS is a nationally representative, cross-sectional survey with a complex sample design and is administered by the National Center for Health Statistics (NCHS). Within each participating family, a sample child 0-17 years of age was selected, and health-related information was obtained from in-person interviews with a knowledgeable adult. Data were from in-house NCHS files, which can be accessed in the NCHS research data center. The final, or unconditional, response rates for the NHIS sample child file ranged from 69.0% in 2013 to 81.3% in 2002.<sup>9</sup> Final, or unconditional, response rates take into account both sample child and family-level participation rates.<sup>9</sup> The NHIS data collection was approved by the NCHS Ethics Review Board. No further review was required for this data analysis.

Receipt of an asthma action plan was determined from questions that changed slightly between survey years 2002/2003 and 2008/2013. In 2002/2003, receipt of an asthma action plan was determined by a response of “yes” to the question, “Has a doctor or other health professional EVER given [child’s name] an asthma management plan?” In 2008/2013, the term “asthma action plan” replaced “asthma management plan” (“Has a doctor or other health professional EVER given [child’s name] an asthma action plan?”). These terms have the same meaning and often are used interchangeably.

Covariates explored included age (2-4 years, 5-11 years, 12-17 years), sex, race/ethnicity (non-Hispanic white, non-Hispanic black, non-Hispanic other/multiple race, Puerto Rican, Mexican American, other Hispanic), insurance (any private, public insurance only, uninsured), poverty status, which represents family income as a percentage of the federal poverty level (FPL) (<100%, 100%-<200%, 200%-<400%, ≥400%), and NCHS urban-rural status codes (large central-metro, large fringe-metro [suburbs], medium/small metro, micropolitan/non-core).<sup>10</sup> Detailed definitions for race/ethnicity, insurance, family income, and NCHS urban rural status are provided in the [Appendix](#) (available at [www.jpeds.com](http://www.jpeds.com)).<sup>10-12</sup>

We also included measures of asthma severity. The severity of asthma is an important concept to examine because children affected more adversely by asthma may be more likely to seek care and thus receive an asthma action plan. Asthma severity measures available for all years of data (2002, 2003, 2008, and 2013) included having had an asthma attack in the past 12 months, visit to the ED or urgent care in the past 12 months for asthma, and number of missed school days due to asthma in the past 12 months (0, 1-2, 3-6, ≥7). These were used in analyses of all years of data. In addition, for 2003, 2008, and 2013, additional asthma severity measures

were available for having had an asthma hospitalization visit in the past 12 months and use of preventive asthma medication. Only the 2013 questionnaire, however, contained more detailed responses for frequency of preventive medication use (never, sometimes, every day or almost every day). Therefore, analyses of factors related to receiving an asthma action plan (including asthma severity based on hospitalization and preventive medication use) focused on 2013 data. Preventive asthma medication included both inhaled as well as oral preventive medications and the questions used to identify preventive asthma medication use are provided in the [Appendix](#). These severity measures capture aspects of how severity is measured in the NAEPP asthma guidelines, with measures of impairment (asthma attack in past 12 months, school days missed, preventive asthma medication use) and risk (ED visits and hospitalizations), but the survey recall periods do not match those in the clinical definitions.<sup>2</sup>

## Statistical Analyses

Children <2 years of age were excluded because of difficulty in diagnosing asthma in younger children, when wheezing often is associated with bronchiolitis, or may be a transient rather than chronic condition.<sup>13</sup> For each of the 4 years of data (2002, 2003, 2008, 2013), we estimated the proportion of children with asthma that had received an asthma action plan. Bivariate logistic regression with predictive margins that used receipt of asthma action plan as the dependent variable and survey year as the independent variable was used to identify whether a trend existed across the 4 years (and to estimate the approximate percentage point change per year). Also, we used multivariable logistic regression, adjusting for variables that were consistent across years, to determine whether changes over time in the percentage of children with asthma receiving asthma action plans were related to changes over time in population demographics or severity of asthma. Covariates included in the multivariable logistic regression were as follows: age group, sex, race/ethnicity, insurance status, poverty status, NCHS urban-rural status, having had an asthma attack in the past year, having visited the ED or urgent care in the past year for asthma, and school days missed in the past year due to asthma.

To examine the relationship between both sociodemographic and asthma severity factors and ever having received an asthma action plan, we restricted the analysis to use of the 2013 data only. The NHIS only provides information on whether the child has ever received an asthma action plan and not whether the asthma action plan is current. Hence, although 2013 data provide the most current data available, the analysis nonetheless identifies factors related to having received an asthma action plan at some point in the child’s life. We then conducted both bivariate and multivariable logistic regression by using the dependent variable of reported receipt of an asthma action plan and independent variables of sociodemographic and asthma severity characteristics described above. On the basis of

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