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Characteristics of Asthma Visits to Physician Offices in the United States: 2012–2015 National Ambulatory Medical Care Survey

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Abstract

Objective—This report describes asthma visits to offices of nonfederally employed U.S. physicians.

Methods—Asthma visits are defined by the first-listed diagnosis from National Ambulatory Medical Care Survey data. Asthma visit rates among the general population and among persons with asthma (at-risk rates) were estimated. Trends from 2001 through 2016 were assessed. Asthma visit characteristics were assessed for the period 2012–2015 (the diagnostic coding system was changed to the *International Classification of Diseases, 10th Revision, Clinical Modification* in 2016). The consistency of visit characteristics with national asthma guidelines was also assessed.

Results—From 2001 through 2016, population-based asthma visit rates declined from 40.2 to 30.7 visits per 1,000 persons, and at-risk visit rates from 55.5 to 36.7 visits per 100 persons with asthma. During 2012–2015, there was an annual average of 10.2 million asthma visits: 63.5% were by non-Hispanic white persons, 53.8% by female patients, and 32.5% by children under age 15 years. Population and at-risk visit rates were similar across sex and racial and ethnic groups. Children aged 0–4 years had the highest at-risk asthma visit rate. Primary care physicians saw 60.0% of asthma visits. Asthma severity was documented in 34.5% of visits, asthma control in 40.9%, spirometry in 14.9%, and peak flow in 3.3%. Asthma education was provided in 21.4% of asthma visits and asthma action plans in 9.9%. Bronchodilators were the most commonly mentioned medication class (24.9%). A quick-acting relief medication was the most frequently mentioned (albuterol, 16.9%), followed by asthma-control medications (montelukast, 4.7%; fluticasone-salmeterol, 3.7%; and prednisone, 2.7%).

Conclusions—Asthma physician office visit rates declined from 2001 through 2016. During 2012–2015, primary care providers saw nearly two-thirds of asthma visits. Physician adherence to documenting asthma severity or control and providing patient education appeared low. Quick-acting relief medication was the most frequently prescribed medication.

Keywords: pulmonary disease • respiratory disease • chronic conditions • office-based physicians • guideline-based care

Introduction

Asthma is a chronic lung condition with episodic symptoms that can be life-threatening. Its cumulative effects frequently lead to reduced lung function and raise the risk of developing chronic obstructive pulmonary disease, the fourth leading cause of death in the United States (1–3). Asthma is prevalent (8.3% of the U.S. population had asthma in 2016) (4), accounting for 1.8 million emergency department visits in 2016 (5), nearly 340,000 hospitalizations in 2014 (6), and more than 3,500 deaths in 2016 (4). There is no cure for asthma, but effective management strategies exist (7). Most asthma management and patient education occurs in primary care settings (8,9). In 2016, there were 9.8 million asthma visits to physician offices (10). To improve the quality of health care and outcomes of people who have asthma, the National Asthma Education and Prevention Program (NAEPP) issued clinical care guidelines for the diagnosis and management of asthma in 1991 with periodic updates through 2007 (7,11).

A report on detailed nationally representative estimates of asthma visits to physician offices was last released in 1996 using data from a one-time asthma supplement in the 1993–1994 National Ambulatory Medical Care



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Survey (NAMCS). That supplement was designed to determine physician familiarity with and use of the original 1991 NAEPP guidelines.

In 2012, another NAMCS asthma supplement was fielded following the third NAEPP guideline update in 2007. Over the intervening period between these two NAMCS asthma supplemental surveys, primary care for asthma became centered on symptom prevention and disease management, with a focus on controlling underlying inflammation through medication use and avoidance of exposures that exacerbate asthma (12). Consistent assessment and documentation of the control of asthma symptoms and patient education in asthma office visits have also been emphasized (7). Furthermore, ongoing asthma guideline implementation efforts have been made to increase guideline utilization, ranging from local quality improvement efforts (13) to national initiatives (11). In addition to providing updated estimates of asthma health care utilization and visit characteristics, including use of NAEPP guideline recommendations, NAMCS also provides an opportunity to examine trends in asthma office visits.

In this report, asthma visit trends were analyzed from 2001 through 2016. The 2012 NAMCS data were combined with 2013–2015 data to provide adequate sample size to estimate detailed asthma visit characteristics for a more recent period. Visit characteristics related to national guidelines for the diagnosis and management of asthma were assessed (7).

Methods

NAMCS is part of a family of National Health Care Surveys that measure health care utilization. NAMCS is an annual national probability sample survey of nonfederal office-based physicians, conducted by the National Center for Health Statistics (NCHS), Division of Health Care Statistics. NAMCS used a stratified two-stage probability sample design, with physicians selected in the first stage, and patient visits within physician practices selected in the second stage. The NAMCS sampling frame consists of physicians listed in the American Medical

Association and American Osteopathic Association files. The targeted sample includes office-based physicians who are principally engaged in patient care activities. Physicians specializing in anesthesiology, pathology, or radiology and physicians who were over age 85 were excluded.

This report includes visit data from 2001 through 2016, with focus on detailed estimates of asthma visit characteristics for the combined period 2012–2015. In concurrence with a one-time supplement that surveyed office-based physicians about asthma care—the 2012 National Asthma Survey of Physicians (NAS) (14)—additional asthma information was collected in the regular NAMCS. While NAS was fielded only in 2012, asthma-specific data collection in the regular NAMCS continued in subsequent years. In 2012, two other major changes occurred. First, the overall NAMCS sample size was increased to allow state-specific estimates, and asthma specialists (pulmonologists and allergists or immunologists) and primary care physicians (general or family practice, internal medicine, and pediatrics) were oversampled to increase the number of asthma visits sampled. Second, patient visit data were collected with an automated laptop-assisted instrument rather than paper patient record forms (PRFs) (15). U.S. Census Bureau field representatives conducted interviews with physicians or their representatives, determined which visits to sample, and abstracted data from medical charts on patient characteristics, vital signs, reason for visit, continuity of care, diagnoses, procedures, services, medications, and tests. Given the change in the data collection mode and the enlarged sample, a nonresponse bias analysis was undertaken and found no or minimal bias in visit characteristics (16). Weighted response rates for 2012–2015 ranged from 29.6% in 2015 to 40.4% in 2013 (see [Appendix Table](#)).

Definitions of asthma visit and rates

Up to three physician diagnoses associated with the visit were coded and classified according to the *International*

Classification of Diseases, Ninth Revision, Clinical Modification (ICD–9–CM), from 2001 through 2013, and up to five diagnoses beginning in 2014 (17,18). For asthma trends from 2001 through 2016, asthma visits were defined as office visits for which ICD–9–CM codes 493.0–493.9 were listed as the first diagnosis for 2001–2015, and ICD–10–CM code J45 in 2016 (primary diagnosis, or “first listed”). The first-listed diagnosis generally represents the primary diagnosis of the visit and has been used in previous asthma surveillance reports from the Centers for Disease Control and Prevention (CDC) to measure asthma health care use (19–21). For period estimates, 2012–2015 data were combined, and 2016 was not included. In 2016, diagnostic coding changed from ICD–9–CM to the 10th revision (ICD–10–CM). Thus, 2016 was not combined with 2012–2015. The overall impact of the coding scheme change on the primary diagnosis group (e.g., Diseases of the respiratory system) was investigated, and differences between ICD–9–CM and ICD–10–CM were found for first-listed diagnosis for 2% of visits. However, the specific impact on the coding scheme change for asthma visits was not evaluated (22).

Two types of asthma visit rates and 95% confidence intervals were calculated: population-based rates that reflect the visit burden of asthma among the general population, and at-risk rates that reflect the visit burden among the population of persons with asthma. The at-risk rate is of interest because asthma prevalence differs between demographic subgroups: A higher population-based asthma visit rate among a certain group may reflect both higher asthma prevalence as well as higher health care utilization. The at-risk rate accounts for prevalence differences so that only the health care utilization differences between subgroups are measured. CDC asthma surveillance reports have included both measures, and both are included in this report to allow for comparison (20). Population-based rates (visits per 1,000 population) were calculated using population estimates from the U.S. Census Bureau (17). At-risk rates (visits per 100 persons with asthma) were calculated using estimates of the number

of people with current asthma from the National Health Interview Survey (NHIS). Current asthma was defined in NHIS as reporting ever being diagnosed with asthma by a health care professional and still having asthma at the time of the survey (see [Appendix Figure I](#)) (23). Estimated asthma prevalence by age group and sex is shown in [Appendix Figure II](#). At-risk rates were estimated by simulating distributions for the numerator and denominator based on the two survey estimates and corresponding standard errors, assuming both followed a normal distribution. Parametric bootstrapping (with 1 million samples) was then used to estimate the ratios and 95% confidence intervals (24).

Characteristics of asthma visits

Single-year estimates for 2001 through 2016 are presented for asthma visit trends, and estimates for the combined data years 2012–2015 are presented for patient, physician, and visit characteristics. Patient demographics included age, sex, race and ethnicity, and geographic location of visit (U.S. Census region, metropolitan status). Patient race was missing for 25.8%–32.9% of visits, and ethnicity for 25.2%–35.1%, depending on the survey year. Beginning in 2009, NAMCS imputed race (white, black, and other) and ethnicity (Hispanic, not Hispanic) using model-based single imputation. “Other” is a heterogeneous group that included Asian, Native Hawaiian or Other Pacific Islander, American Indian or Alaska Native, mixed race, and other races. Details on imputation are available elsewhere (15). Visits were assessed by physician specialty. Visit characteristics included primary expected source of payment, clinic type, primary provider status, referral status, major reason for visit, and visit disposition.

In addition to the physician’s diagnoses for the visit, the patient’s expressed principal reason for the visit was collected using open-ended text fields, and was coded according to “A Reason for Visit Classification for Ambulatory Care,” defined in the NAMCS public-use data file documentation (15). Up to three reasons

were coded in 2012–2013, and up to five reasons for 2014–2015. Only the principal reason for visit was analyzed for this report.

Additional items were abstracted from medical records, including chronic conditions, asthma severity and control documentation, and services and procedures provided during the visit. Asthma severity is defined as the underlying intensity of the disease and can be determined either by the degree of symptoms in untreated patients, or the level of preventive medication use needed to keep symptoms in check. Severity is categorized as intermittent, mild persistent, moderate persistent, or severe persistent asthma (7,11). Asthma control is defined as the degree to which asthma symptoms are minimized by therapeutic interventions. Control is categorized as well controlled, not well controlled, and very poorly controlled (7,11). Visits for patients with asthma for which the severity or control items were missing were categorized as undocumented severity, undocumented control, or both. Additional items indicate whether spirometry or peak flow was performed at the visit, asthma-specific health education was provided, or an asthma action plan was given to the patient. However, in 2012, data collection for asthma action plan was compromised by a survey instrument problem for part of the year (15). Therefore, estimates for asthma action plan provision were based on 2013–2015 data.

First-listed asthma visits were also categorized by asthma type using ICD–9–CM codes: unspecified, extrinsic (traditionally meaning allergic asthma), intrinsic (nonallergic asthma), chronic obstructive asthma, exercise-induced bronchospasms, and cough variant asthma. Symptom severity is also categorized using this same set of codes, including acute exacerbation and status asthmaticus (potentially life-threatening). For example, ICD–9–CM code 493.01 indicates extrinsic-type asthma with status asthmaticus. The percentage of visits for each asthma type and symptom level was estimated. Note that exercise-induced bronchospasm and cough variant asthma do not have symptom level specified in ICD–9–CM.

Medications

Up to 10 medications prescribed or continued at the visit were listed on the PRF in 2012 and 2013, and up to 30 in 2014 and 2015. To maintain consistency, the first 10 medications were assessed for this analysis. Medications are classified and coded according to a five-digit NCHS classification scheme (17). These could be new or continued medications, including prescription and nonprescription preparations, immunizing agents, and desensitizing agents. The PRF does not determine which drugs were prescribed for the primary diagnosis compared with any concomitant diagnoses, nor does it collect the dosage form, route, or dosing regimen. Generic drug components and therapeutic classifications were classified using Lexicon Plus, a proprietary comprehensive database of Cerner Multum, Inc. that contains all prescription and some nonprescription drug products available in the United States.

Statistical analysis

Estimates of visit counts accounted for the complex sample design. For population-based rates, sampling error was estimated for the number of asthma visits (the numerator). For at-risk rates, sampling error was estimated both for the number of asthma visits (the numerator) and the estimated number of persons with asthma from NHIS (the denominator). NAMCS and NHIS complex survey design variables were used to account for the complex survey design when estimating variance. Selected comparisons were made in a pairwise fashion using two-sided *z* tests at the 0.05 level, with no adjustments made for multiple comparisons. Stated differences in the text were statistically significant unless otherwise noted. No adjustments were made for dependent comparisons (25) between asthma visits and total visits, given that asthma visits represented less than 2% of total visits in 2012–2015. All estimates presented for percentages meet the NCHS standard for presentation of proportions unless noted (26), and estimates for counts and rates that have a relative

standard error (i.e., standard error divided by the estimate) greater than 30% are indicated. Data analyses were performed with SAS version 9.4 (SAS Institute, Cary, N.C.) and SUDAAN version 11.0 (RTI International, Research Triangle Park, N.C.). Trends for 2001–2016 and selected trends by age for 2012–2015 were assessed with Joinpoint software version 4.5.0.1 using annual visit rates (2001–2016) or percentages (2012–2015) and their estimated standard error as described above. Nonlinear trends were assessed with piecewise regression allowing two joinpoints over the analyzed period 2001–2016, and one joinpoint over the age span included in 2012–2015 (27).

Results

Trends in asthma visits to office-based physicians, 2001–2016

From 2001 through 2016, declining trends in rates of first-listed asthma visits among all persons (population-based rates) and first-listed asthma visits among persons with asthma (at-risk rates) were observed (Figure 1). During this period, population-based visit rates for asthma declined from 40.2 to 30.7 visits per 1,000 persons. At-risk asthma visit rates declined from 55.5 to 36.7 visits per 100 persons with asthma. There were no statistically significant nonlinear trends detected for either the population-based rate or at-risk rate despite year-to-year variability in the trends. Note that diagnostic coding for ambulatory visits changed in 2016 from ICD–9–CM to ICD–10–CM, and the comparability

between coding systems for asthma is unknown. No trend was observed in total visit rates for all diagnoses to physician offices from 2001 through 2009, but total visit rates declined from 2009 through 2016 (data not shown).

Patient characteristics of first-listed asthma visits, 2012–2015

During 2012–2015, there was an annual average of 10.2 million first-listed asthma visits made to physician offices, which represented 1.1% of all visits in the United States. Asthma was the 14th most frequently reported morbidity-related, first-listed diagnosis among patients of all ages. Among children aged 0–14 years, first-listed asthma diagnosis was the seventh most frequently reported (data not shown).

Considering the percentage of visits among demographic subgroups, most

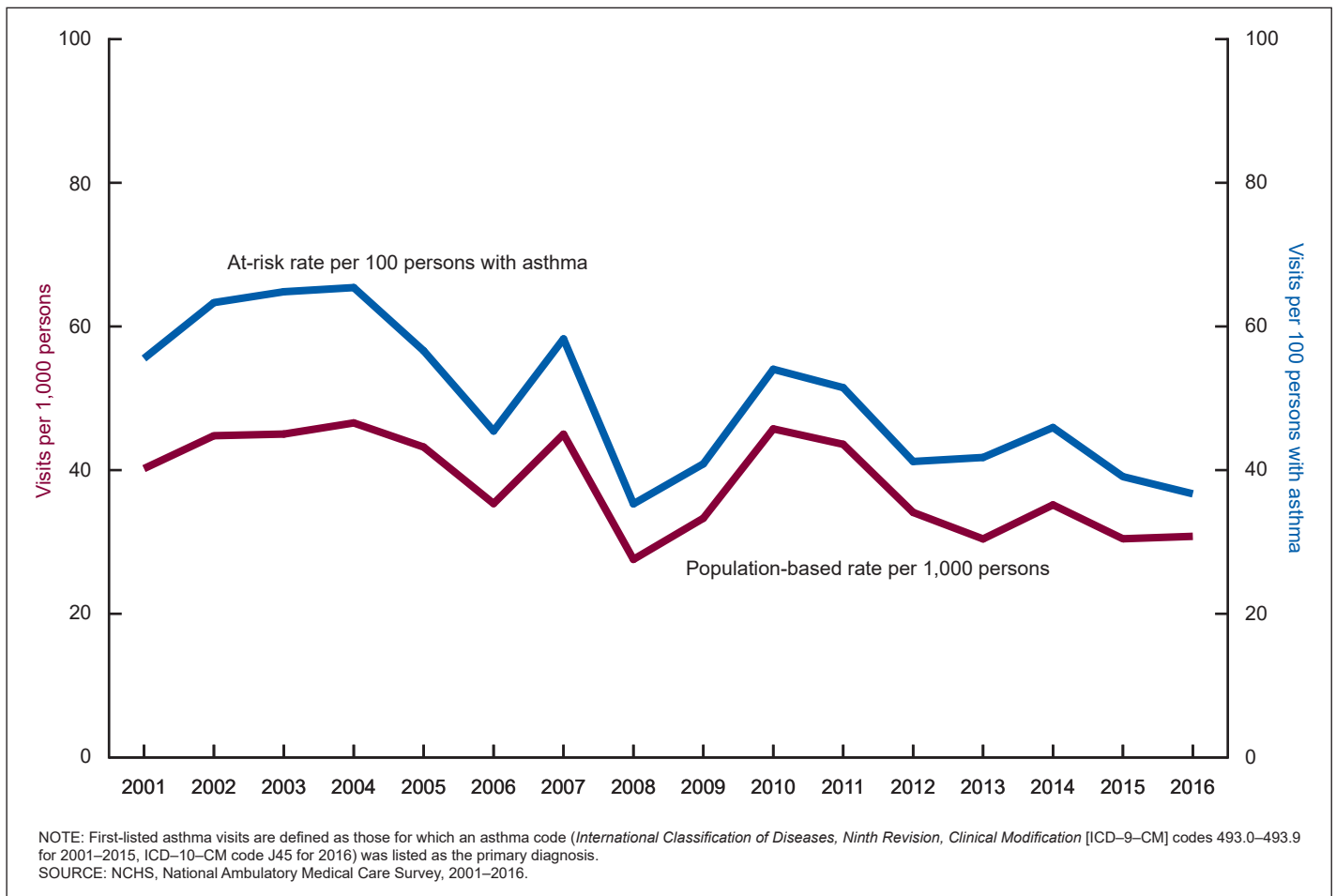


Figure 1. First-listed asthma visit rates among all persons (population based) and among persons with asthma (at risk): United States, 2001–2016

asthma visits were made by non-Hispanic white patients (63.5%) and female patients (53.8%); a plurality of visits was made by children (9.5% among those aged 0–4 years and 23.0% among those aged 5–14 years) (Table 1). Patterns by age group differed by sex. For females, 21.2% of visits occurred among girls aged 0–14 years compared with 69.5% among women aged 25 and over. Among males, 45.5% of visits occurred among boys aged 0–14 years compared with 46.0% among men aged 25 and over. Compared with total visits, a higher percentage of asthma visits occurred among younger ages (Figure 2, Table 1), with 14.0% of total visits occurring among those under age 15 years compared with 32.5% for first-listed asthma visits.

When considering asthma visit rates, both population-based and at-risk asthma visit rates declined from childhood to late adolescence or young adulthood, and then increased among older age groups (Figure 3, Table 1). This pattern was

more pronounced for at-risk rates because the prevalence of asthma in younger children is lower than for older children and adults (4). Neither the observed quadratic trend (decreasing, then increasing rates by age) nor the linear trend by age was statistically significant. However, in pairwise comparison, the pediatric age groups (0–4 and 5–14 years) were significantly higher than all or most older age groups ($p < 0.05$).

Overall, females and males had similar population-based asthma visit rates (34.2 and 30.7 visits per 1,000, respectively) (Table 1). When the higher asthma prevalence among females was accounted for, by using NHIS estimates of the number of U.S. persons with asthma to calculate at-risk rates (see Appendix Figure II) (4), females had lower visit rates than males (38.2 compared with 47.4 per 100 persons with asthma), although the difference was not statistically significant. However, among children aged 0–14 years, boys

had a higher asthma prevalence than girls (Appendix Figure II).

This changing asthma prevalence pattern by sex and age (28) also occurred in the pattern of at-risk rates and population-based rates over the age span (Figure 4). By age group, population-based rates were higher among male children and among female adults aged 45 and over. At-risk asthma visit rates differed between males and females only for children aged 0–4 years.

Population-based and at-risk asthma visit rates were lowest among non-Hispanic persons of other races (Table 1). The population-based visit rate for non-Hispanic black persons was higher than for other groups, but only statistically different from persons of non-Hispanic other race or ethnicity. At-risk visit rates were similar among non-Hispanic white, non-Hispanic black, and Hispanic persons with asthma.

By geographic region, asthma visit rates were higher in the Northeast for

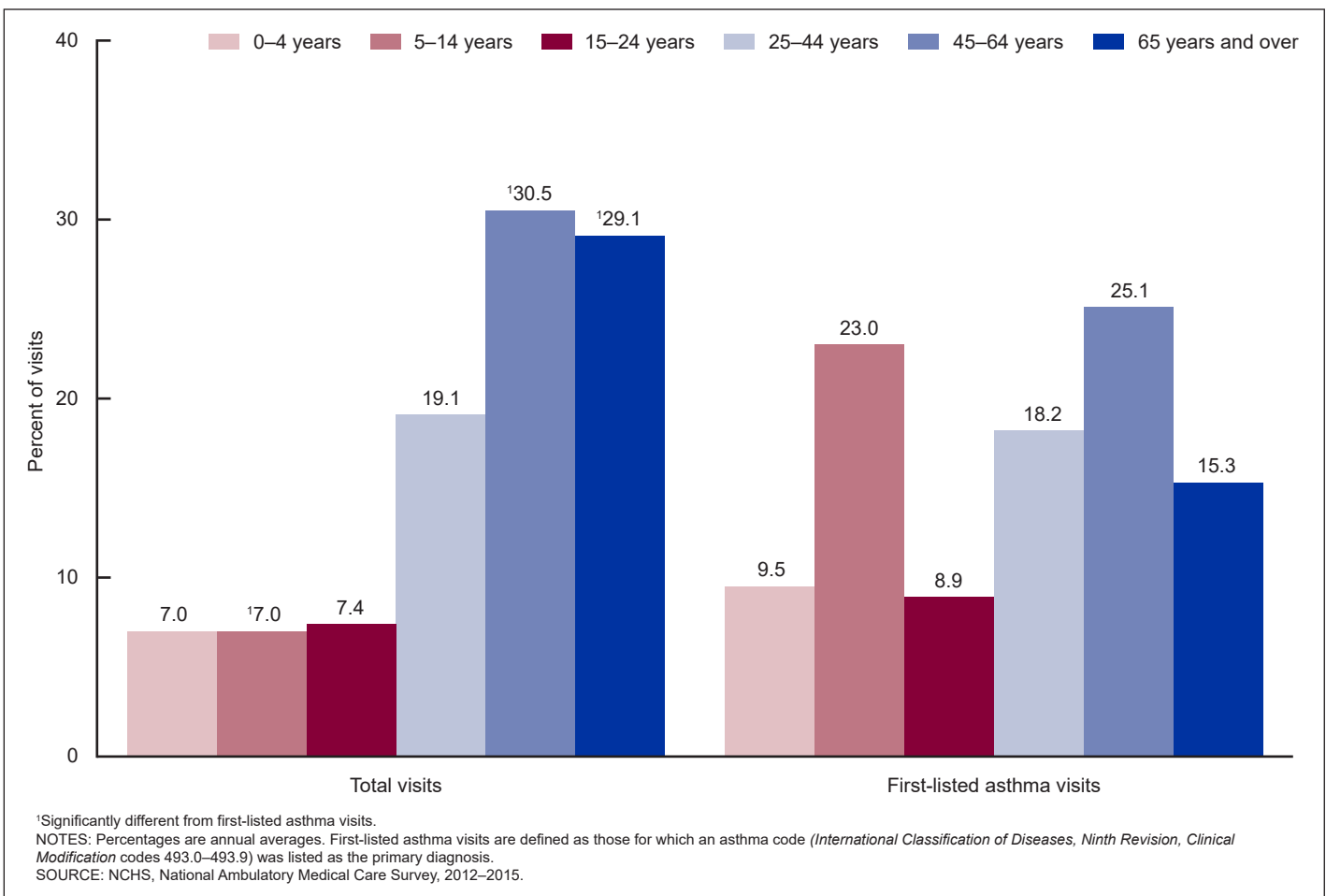


Figure 2. Percentage of physician office visits, by age group for total visits and first-listed asthma visits: United States, 2012–2015

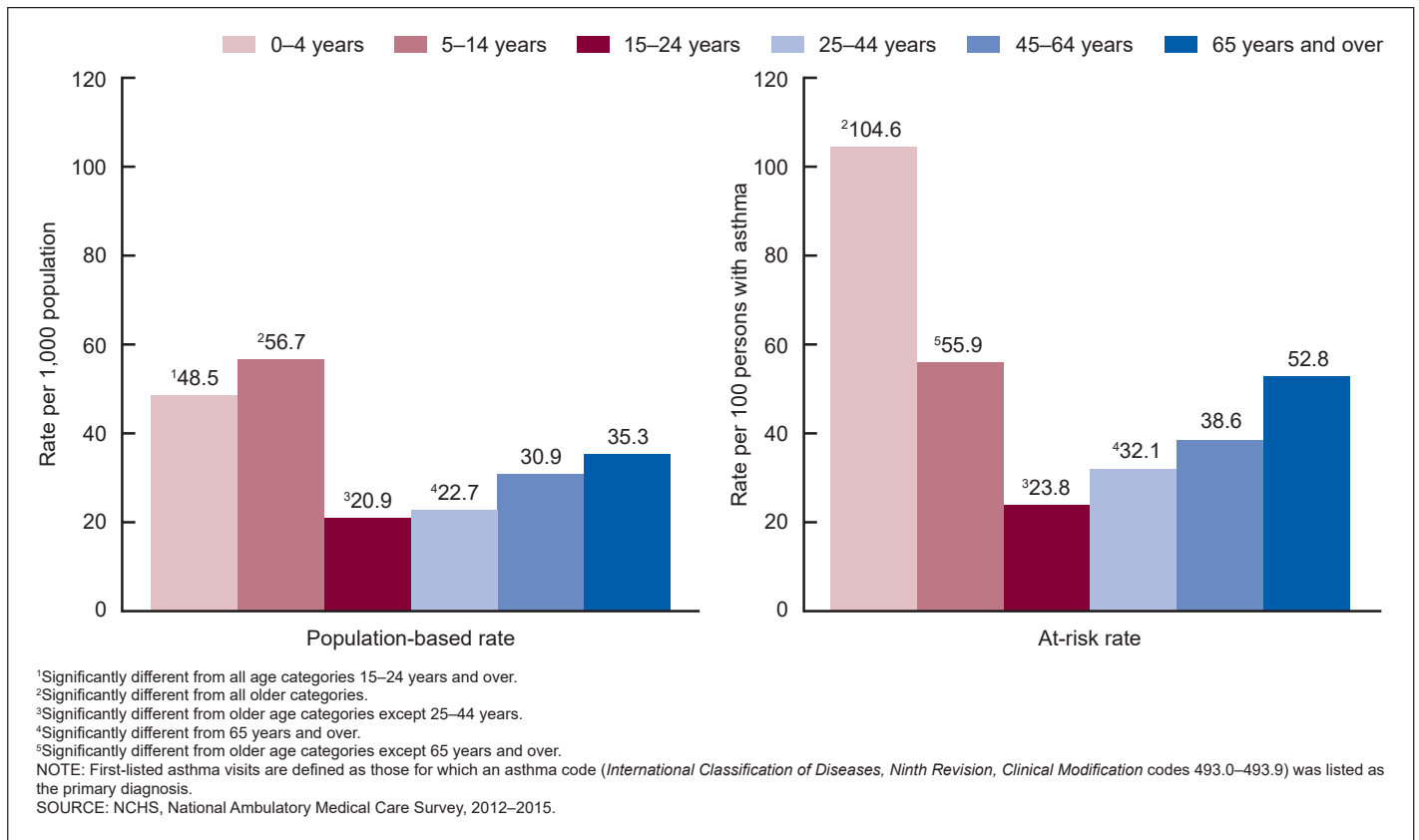


Figure 3. First-listed asthma visit rates, by age group among all persons (population based) and among persons with asthma (at risk): United States, 2012–2015

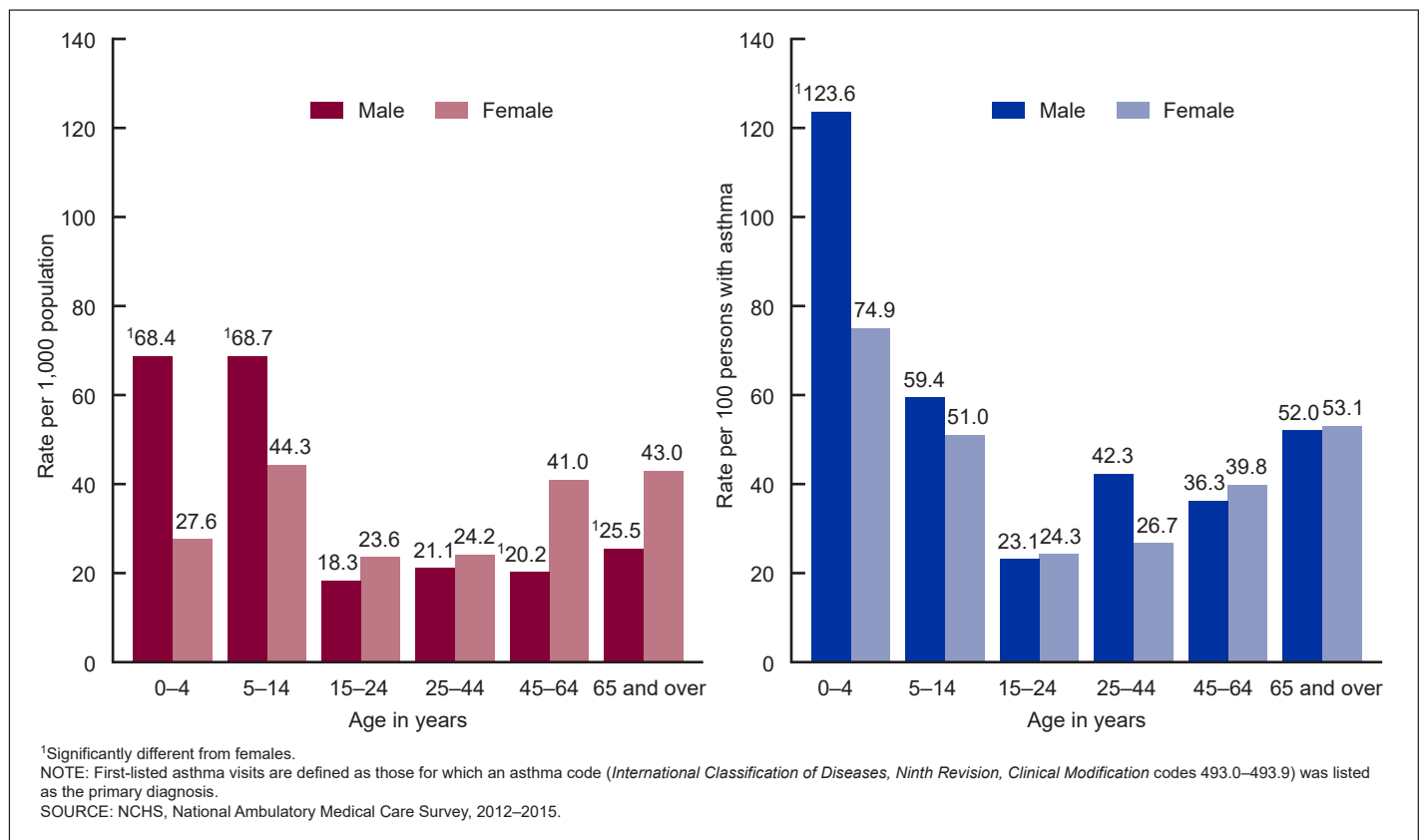


Figure 4. First-listed asthma visits rates, by sex and age group among all persons (population based) and among persons with asthma (at risk): United States, 2012–2015

population-based rates compared with the Midwest and South, and higher for at-risk rates compared with the Midwest (Table 1). Visit rates were similar for other regions. By urbanicity, 93.2% of asthma visits occurred in metropolitan counties, and 6.8% occurred in nonmetropolitan counties. Population-based and at-risk asthma visit rates show a similar pattern of higher rates in metropolitan areas compared with nonmetropolitan areas.

Physician and visit characteristics for asthma office visits, 2012–2015

A higher proportion of asthma visits than total visits were seen by primary care physicians (general or family practice, internal medicine, and pediatrics) (Table 2). This was especially apparent for pediatricians, who saw 22.6% of asthma visits compared with 11.3% of total visits. Most asthma visits among those aged

0–14 years were seen by pediatricians (Figure 5). As age increased, a lower percentage of asthma visits were seen by pediatricians and higher percentages by general or family practice and internal medicine physicians. Changing trends over age were detected for general or family practitioners (increase then decrease) and pediatricians (decrease then plateau), although the slopes of the linear segments making up these changing trends were not significant. Increasing linear trends with age were significant for internal medicine practitioners and pulmonologists, and no trend by age among allergists was observed. The percentage of visits for asthma varied by specialty. Overall, 1.1% of total visits to physician offices were for asthma, and for general or family practice, internal medicine, and pediatrics, the percentages of total visits for asthma were similar to the overall total (1.1%, 1.2%, and 2.2%, respectively). For allergists, 22.7% of all visits were for asthma, and for pulmonologists, 18.7% (data not shown).

A higher percentage of asthma visits occurred with the patient's primary health care provider (53.9%, of which 49.6% were among established patients and 4.3% among new patients) compared with total visits (41.7%, of which 39.0% were among established patients and 2.7% were among new patients) (Figure 6, Table 2). Among total visits, asthma was the eighth most common diagnosis among established patients with visits for chronic problems (1.4% of visits; data not shown). Among visits to physicians other than a patient's primary provider, referrals tended to make up a higher percentage of asthma visits compared with total visits. Visits for chronic routine problems made up 41.8% of first-listed asthma visits (Figure 7, Table 2), a higher percentage than for overall visits (32.0%). Overall, "new problem" was identified as the major reason for 25.9% of asthma visits, and "flare-up of a chronic problem" for 17.2% of asthma visits.

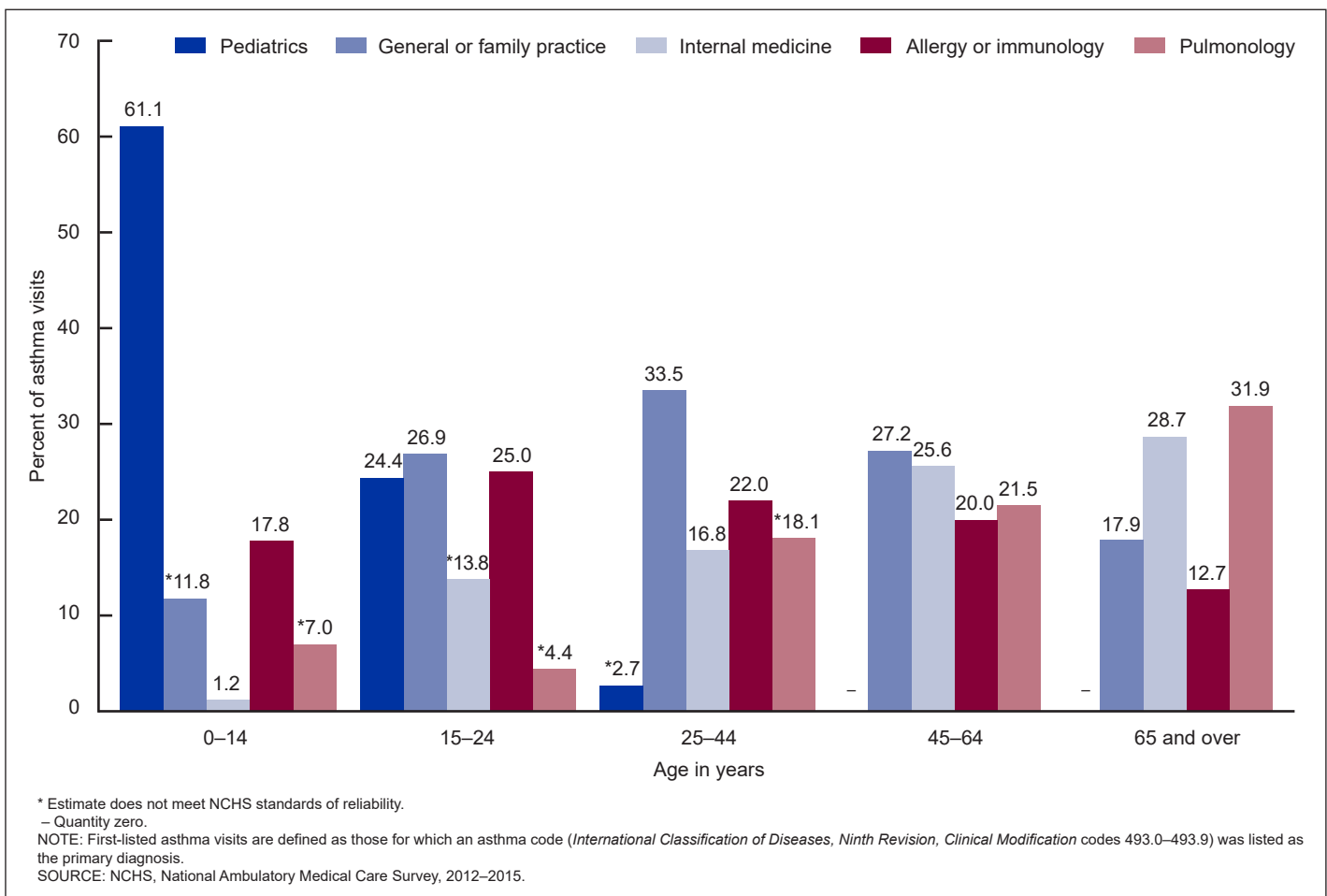


Figure 5. Percentage of first-listed asthma visits, by age group and physician specialty: United States, 2012–2015

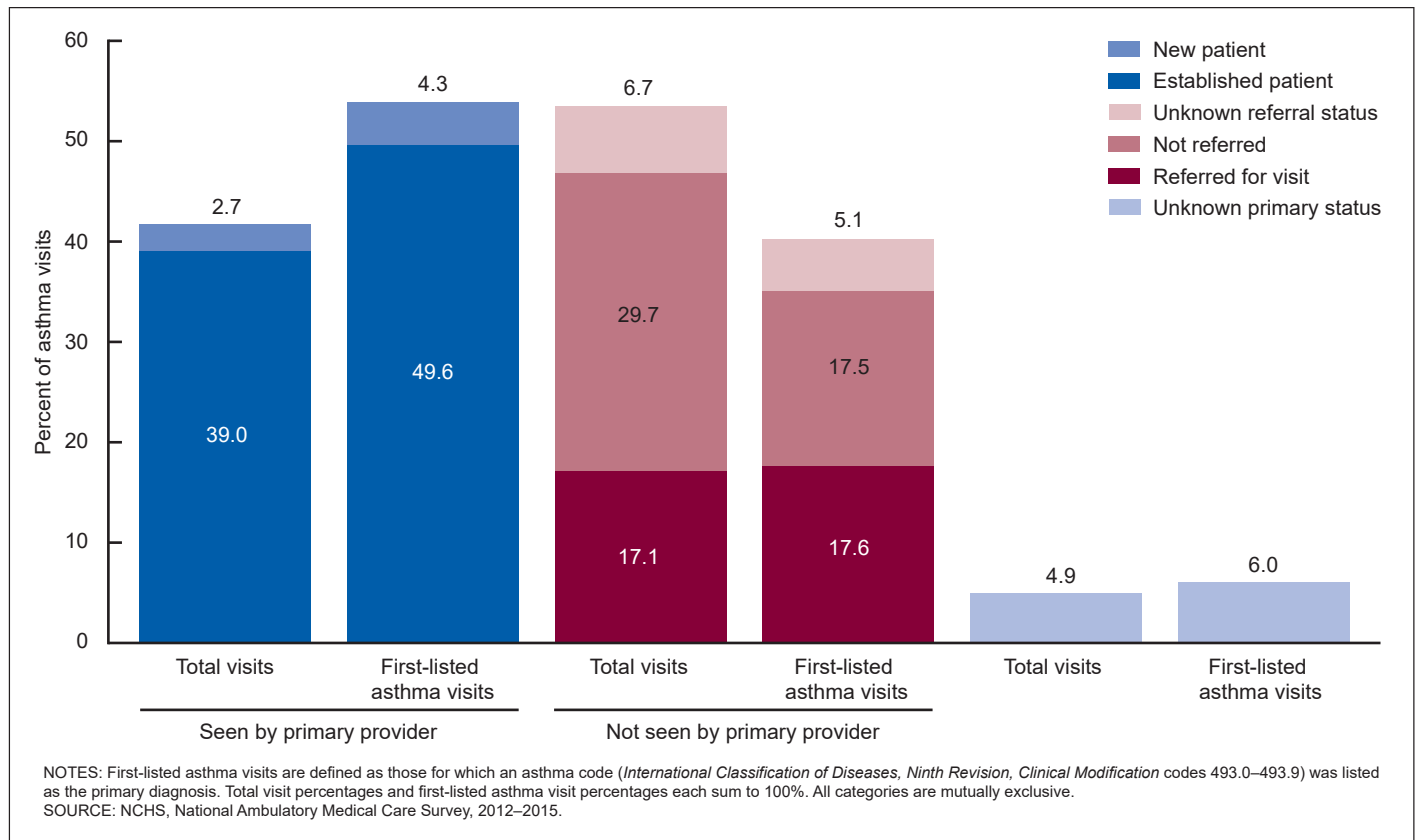


Figure 6. Percentage of physician office visits, by primary provider status and referral status for total and first-listed visits: United States, 2012–2015

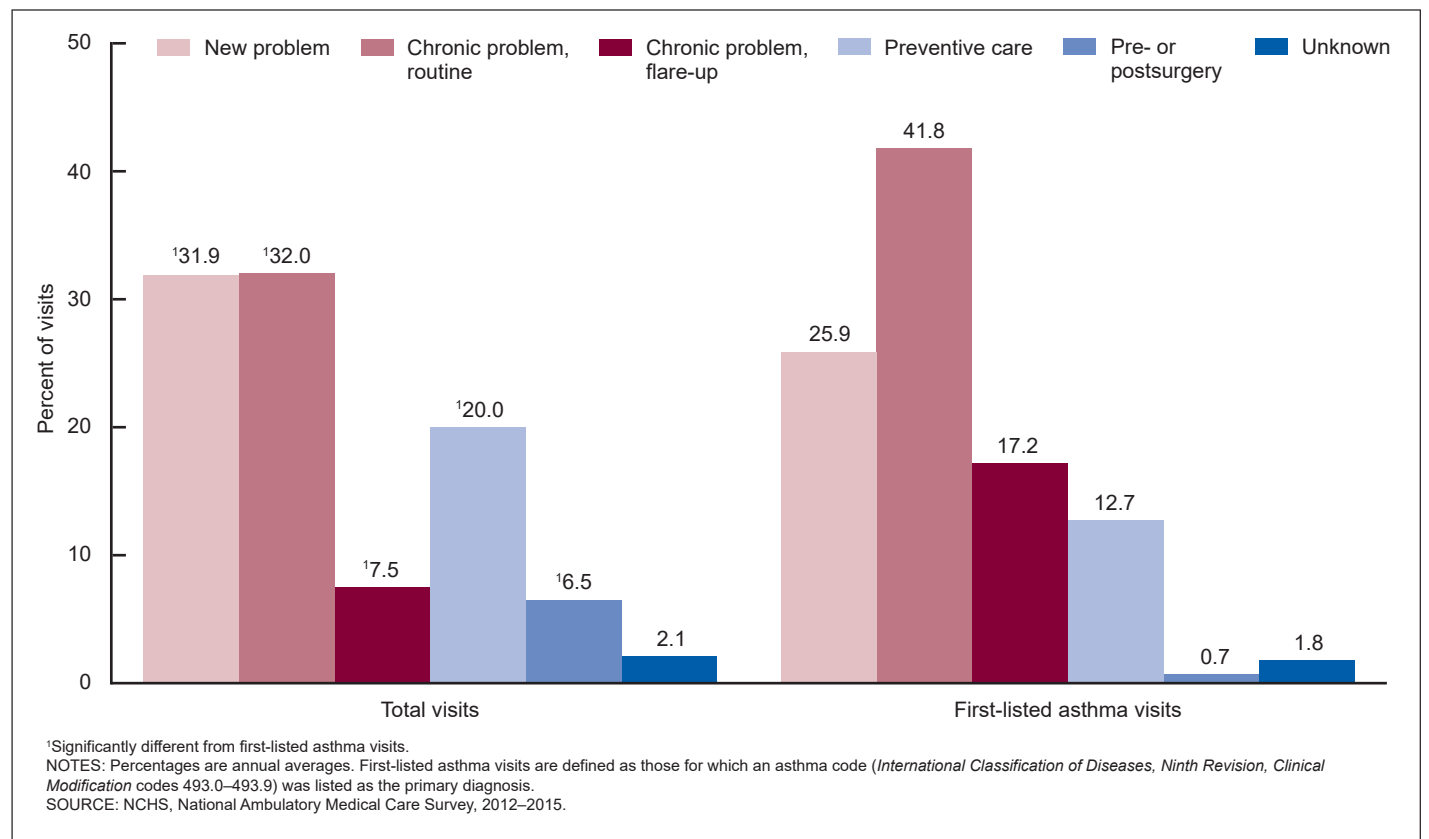


Figure 7. Percentage of physician office visits, by major reason for visit for total visits and first-listed asthma visits, 2012–2015

Private insurance was the largest expected primary source of payment for asthma visits (58.4%) (Table 2). Medicaid or Children’s Health Insurance Program and Medicare payments were similar (17.8% and 14.4%, respectively). The remaining sources of expected payment were “other” (3.0%) and unknown or blank (6.4%). Most asthma visits occurred in private clinics (91.4%), similar to total visits (91.0%). Note that this analysis did not include community health centers or hospital outpatient departments. For most asthma visits, the visit disposition was return visit to the same provider (78.5%; either in a specified or unspecified period of time, or as-needed basis), which was similar for total visits (75.9%). A small percentage of asthma visits resulted in referral or return to the referring physician (3.1%) or to emergency departments or hospitals (0.9%).

Figure 8 shows asthma type and symptom level using ICD–9–CM codes.

The majority of visits were coded as unspecified asthma type with unspecified symptoms level (60.4%). When visits coded as extrinsic, intrinsic, and chronic obstructive asthma are included, 87.0% of asthma visits had an unspecified symptom level. These visits may represent preventive treatment, follow-up visits, and treatment for mild exacerbations. A total of 9.7% of visits were categorized as acute exacerbation (7.3% unspecified type, 2.2% extrinsic type, and less than 0.2% for either intrinsic or chronic obstructive type). Status asthmaticus was coded for 1% of asthma visits, with the highest percentage coming from extrinsic asthma type (0.5%). An additional 1.5% of visits were coded as cough variant type asthma, and 0.9% as exercise-induced bronchospasms (symptom level for these two asthma types are not specified in the ICD–9–CM system, and these estimates are not shown in Figure 8).

Asthma (25.1%), cough (13.8%), and follow-up visit (11.2%) were the

top three reasons expressed by patients for first-listed asthma visits (Table 3). Allergy, allergy medication, and hay fever accounted for 4.4% of principal reasons. Infection-related reasons (nasal congestion, sore throat, upper respiratory infection, and fever) were cited for 6.1% of visits. These reasons closely matched physician diagnoses for asthma visits in the second-listed diagnosis position. Although the most frequent second-listed diagnosis for first-listed asthma visits was blank (36.3%) (i.e., only an asthma diagnosis was indicated), the most frequently used second-listed diagnoses included upper respiratory infection (2.3%), obstructive sleep apnea (2.3%), and cough (2.3%). The next most frequent second-listed diagnoses included essential hypertension (2.1%), sinusitis (2.0%), elevated blood pressure (1.9%), contact dermatitis (1.7%), chronic rhinitis (1.7%), and esophageal reflux (1.5%) (data not shown).

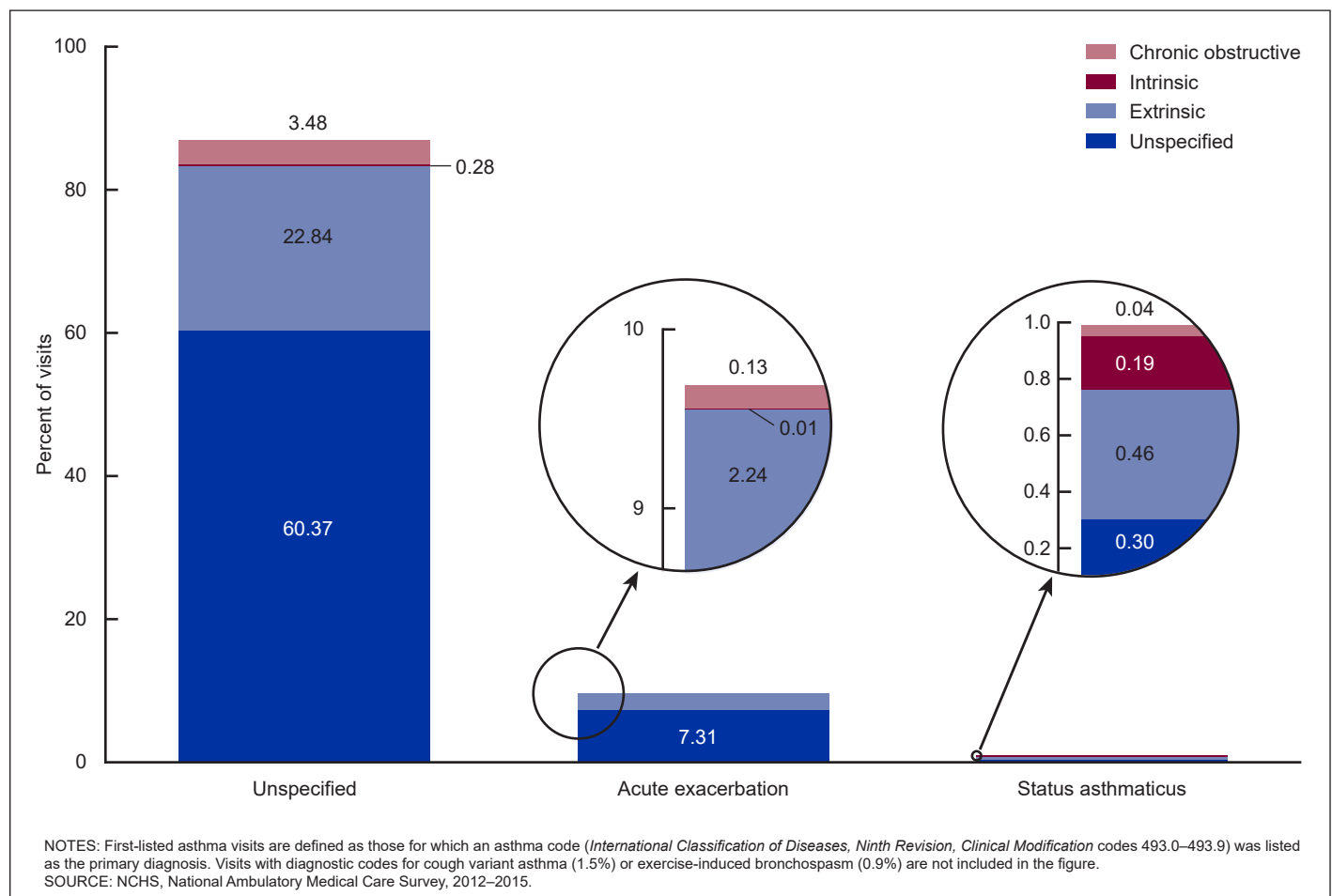


Figure 8. Percentage of asthma visits, by diagnostic code for type of asthma and level of symptoms: United States, 2012–2015

Asthma visits with specified components of asthma care, 2012–2015

The majority of asthma visits had no documentation of asthma severity (65.6%) or control (59.1%) (Table 4). Asthma severity was classified as intermittent for 11.3% of visits, mild persistent for 10.5%, moderate persistent for 10.0%, and severe persistent for 2.7%. Asthma control was classified as well controlled for 29.1% of asthma visits, not well controlled for 10.5%, and very poorly controlled for 1.3%. Spirometry was performed at 14.9% of asthma visits, and peak flow was performed at 3.3% of asthma visits. Asthma-specific education was provided at 21.4% of asthma visits, and asthma action plans were provided at 9.9% of asthma visits. Education about tobacco use and exercise was rarely provided (2.6% and 4.1%, respectively).

Drugs for the respiratory tract accounted for 40.2% of all drug mentions (i.e., a drug that was provided, prescribed, or continued at a visit) for first-listed asthma visits (Table 5). The therapeutic category with the highest percentage was bronchodilators, which accounted for 24.9% of all drug mentions at asthma visits. Adrenergic and anticholinergic bronchodilators (rescue medication) accounted for 19.4% of all drug mentions. Controller medications that are used daily to prevent symptoms from occurring accounted for 13.5% of drug mentions at asthma visits. Albuterol (rescue medication) was the most frequently mentioned generic drug component during asthma visits (16.9%) (Table 6). The next most commonly mentioned generic drug components (montelukast, fluticasone-nasal, fluticasone-salmeterol, and prednisone) were controller medications (15.3%).

Discussion

An analysis of visits to physician offices with a first-listed diagnosis of asthma showed that rates declined from 2001 through 2016 whether considered among the general population or among persons with asthma. Note that NAMCS estimates pertain to number of visits and not to number of patients. In a given

year, a patient could have had more than one asthma office visit. However, changing asthma prevalence trends could still affect observed visit rates. Over the period considered, asthma prevalence increased until 2011, and estimating rates among persons with asthma (at-risk rates) accounts for the possible impact of changes in the size of the population with asthma on visit rates. Assessing recent characteristics of asthma visits during 2012–2015 revealed that compared with overall visit rates, asthma visit rates were higher among persons aged 5–14 years and lower among older age groups, and that children generally have higher asthma visit rates for both population-based and at-risk rates. A higher percentage of asthma visits than total visits occurred among primary care physicians. Nearly 42% of asthma visits to physician offices were for reasons characterized as “chronic routine problems,” with lower percentages due to “new problems” or “flare-ups of chronic problems.” Documentation of asthma severity and control occurred for a minority of asthma visits. Asthma action plans were provided in less than 10% of asthma visits. Similarly, objective monitoring with spirometry and peak flow were documented for less than 15% of visits.

Asthma visit rates were higher among children who have higher asthma prevalence rates compared with adults. High asthma visit rates among very young children may be due to their susceptibility to lower respiratory infection and subsequent airway obstruction due to their smaller airways. Among this age group, wheezing is more likely to be a transient condition that will not persist into later childhood. Thus, an accurate diagnosis of asthma in very young children is more challenging than among older children, and asthma visits among this age group may be capturing nonpersistent wheezing (29). The pattern of higher visit rates among the youngest children is more pronounced among boys aged 0–4 years and is not changed by taking into account asthma prevalence differences by age and sex. Other patterns by demographic characteristics include significantly higher asthma visit rates among older women compared with men. However,

this sex difference among adults over age 45 appears to stem mainly from differences in prevalence because at-risk asthma visit rates are similar between men and women over age 45. This analysis found no statistical difference in visit rates among non-Hispanic white, non-Hispanic black, and Hispanic patients using either population-based or at-risk visit rates. However, at-risk visit rates were lower than population-based visit rates only among non-Hispanic black persons and not among other racial or ethnic categories. This pattern could suggest that ambulatory care may be underutilized among non-Hispanic black asthma patients (20). This hypothesis has been further supported by other research showing higher severity of disease and exacerbations and underlying disease among non-Hispanic black compared with non-Hispanic white patients, but no concordant higher preventive health care utilization among non-Hispanic black patients (30–32). This finding could be further examined in the context of emergency department visits, hospitalizations, and deaths, which are higher among non-Hispanic black patients (33–35).

Asthma visit characteristics also can indicate the extent to which guideline-based care is being provided. Most visits to primary care providers were for established patients. More than 40% of first-listed asthma visits were for management of chronic routine problems, which suggests that this proportion of visits occurs mainly for preventive asthma management. The national guidelines recommend documentation of asthma control, severity, or both at every visit, yet the documentation for most asthma visits did not include this information. Asthma education was also documented at a small percentage of visits, as was objective monitoring of asthma (spirometry and peak flow). These patterns are consistent with the observation that implementation of the guidelines has been suboptimal (36–39). These previous findings match those of the study of physician-reported guideline-based care in the 2012 NAMCS National Asthma Survey of Physicians, which found lower agreement and adherence to asthma guidelines among primary care providers than specialists, and low

adherence for both groups of clinicians for asthma action plans, peak flow monitoring, and spirometry testing (37).

A previous study of ambulatory care visits for asthma in 1993–1994 from NAMCS, conducted soon after the original version of national guidelines was released in 1991, provides a baseline for comparison of asthma visit characteristics, although results may not be directly comparable due to survey and health care system differences over time (19). Over the past 3 decades, there have been significant advances in asthma diagnosis and treatment (7), sustained effort to implement national guidelines for the diagnosis and management of asthma (11), and an increase in asthma prevalence that peaked in 2011. Asthma health care utilization has declined since 1993–1994, when there was an annual average of 11.0 million asthma visits to office-based physicians (1.6% of visits for all primary diagnoses) (19). Since that time, the number of visits has declined to an annual average of 10.2 million asthma visits during the period 2012–2015 (1.1% of visits for all primary diagnoses). The rate per 1,000 population also has declined from 43.0 in 1993–1994 to 32.5 in 2012–2015. The decline in asthma visits preceded the decline in overall visits to physician offices starting in 2009.

Medications provided, prescribed, or continued at asthma visits also shifted between the two periods. During 1993–1994, albuterol was mentioned in 20.9% of visits compared with 16.9% during 2012–2015. Newer controller medications were used for 2012–2015 that were not available for 1993–1994, including montelukast and fluticasone-salmeterol combinations.

Many characteristics of asthma visits have remained relatively stable since 1993–1994 (19). During both periods, the percentages of visits were higher for non-Hispanic white patients, younger children, females, and patients in the Northeast region. Primary care physicians (general or family practice, internal medicine, and pediatrics) saw most of the asthma visits in both periods: 66.7% in 1993–1994 and 60.0% in 2012–2015. Despite the emphasis on objective diagnosis and monitoring of asthma in asthma guidelines, the percentage of

visits where spirometry was ordered or provided did not change: 14.4% in 1993–1994 and 14.9% in 2012–2015.

There are limitations to the analysis that should be considered. Visits for which the asthma severity or control, asthma action plan, asthma education, spirometry, or peak flow checkboxes were unmarked were categorized as visits for which these components were not documented or not performed. It is also possible that documentation of these items was overlooked during abstraction of information from the medical record, which was performed predominantly by U.S. Census Bureau field representatives. While medical or alternate terminology may have obscured some items (management plan, pulmonary function), it is unlikely that medical terminology obscured severity or control documentation. The terms “severity” and “control” are specified in the PRF and match the terms used in asthma treatment guidelines that recommend documentation of asthma severity and control at each asthma visit (7). Additionally, other studies have found similarly low documentation rates of asthma severity (34%) and control (15%) (40,41).

Overall, asthma continues to be a common reason for visits to physician offices, although asthma visit rates have declined from 2001 through 2016. When recent characteristics of first-listed asthma visits were considered, primary care providers saw nearly two-thirds of asthma visits and a higher percentage of asthma visits compared with total visits occurring in the pediatric population. Some asthma management strategies recommended by national asthma guidelines were documented infrequently in first-listed asthma visits, including assessment of asthma severity and control, and provision of asthma action plans, spirometry, and peak flow monitoring. A comparison between 2012–2015 and 1993–1994 asthma visit characteristics shows less evolution in content of asthma visits than may have been expected, given the dissemination of asthma treatment guidelines and the development of clinical tools to facilitate their use.

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Table 1. Selected demographic characteristics of physician office visits for total and first-listed asthma visits: United States, 2012–2015

Characteristic	Total visits		First-listed asthma visits			
	Number (thousands)	Percent	Number (thousands)	Percent	Population-based rate per 1,000 persons (95% confidence interval)	At-risk rate per 100 persons with asthma (95% confidence interval) ¹
Total	931,686	100.0	10,161	100.0	32.5 (28.4, 36.6)	42.0 (36.6, 47.5)
Age (years)						
0–4	64,707	7.0	965	9.5	48.5 (37.1, 59.8)	104.6 (78.7, 132.8)
5–14	65,457	7.0	2,334	23.0	56.7 (46.5, 67.0)	55.9 (45.5, 66.6)
15–24	68,679	7.4	900	8.9	20.9 (16.0, 25.9)	23.8 (18.1, 29.7)
25–44	178,111	19.1	1,851	18.2	22.7 (17.3, 28.1)	32.1 (24.4, 40.0)
45–64	283,978	30.5	2,554	25.1	30.9 (23.8, 38.0)	38.6 (29.7, 47.8)
65 and over	270,754	29.1	1,558	15.3	35.3 (27.9, 42.7)	52.8 (41.4, 64.6)
Sex						
Female	542,159	58.2	5,469	53.8	34.2 (29.3, 39.2)	38.2 (32.6, 44.0)
Male	389,527	41.8	4,692	46.2	30.7 (25.9, 35.6)	47.4 (39.8, 55.1)
Sex and age (years)						
Female						
0–4	30,626	5.7	269	4.9	27.6 (18.8, 36.5)	74.9 (49.4, 105.2)
5–14	30,607	5.7	892	16.3	44.3 (34.6, 54.0)	51.0 (39.4, 63.3)
15–24	43,172	8.0	503	9.2	23.6 (16.4, 30.8)	24.3 (16.8, 32.2)
25–44	120,623	22.3	1,002	18.3	24.2 (18.9, 29.4)	26.7 (20.8, 32.7)
45–64	163,409	30.1	1,746	31.9	41.0 (31.2, 50.9)	39.8 (30.1, 49.7)
65 and over	153,723	28.4	1,058	19.3	43.0 (31.9, 54.2)	53.1 (39.1, 67.8)
Male						
0–4	34,081	8.8	696	14.8	68.4 (48.4, 88.4)	123.6 (85.7, 166.1)
5–14	34,850	9.0	1,442	30.7	68.7 (52.5, 84.8)	59.4 (45.1, 74.2)
15–24	25,508	6.6	397	8.5	18.3 (11.7, 24.9)	23.2 (14.7, 32.0)
25–44	57,488	14.8	849	18.1	21.1 (12.2, 30.1)	42.3 (24.2, 61.0)
45–64	120,569	31.0	808	17.2	20.2 (10.5, 29.8)	36.3 (18.9, 54.2)
65 and over	117,031	30.0	500	10.7	25.5 (18.0, 33.1)	52.0 (36.3, 69.0)
Race and ethnicity ²						
Non-Hispanic white	660,992	71.0	6,447	63.5	33.1 (28.2, 38.0)	42.9 (36.4, 49.5)
Non-Hispanic black	95,518	10.3	1,597	15.7	42.1 (30.5, 53.6)	40.4 (29.2, 52.0)
Non-Hispanic other	53,593	5.8	444	4.4	17.5 (12.2, 22.7)	26.6 (18.4, 35.3)
Hispanic	121,583	13.1	1,672	16.5	30.9 (24.0, 37.8)	47.2 (36.4, 58.4)
Geographic region						
Northeast	190,230	20.4	2,422	23.8	43.8 (34.3, 53.3)	53.0 (41.1, 65.4)
Midwest	173,572	18.6	1,793	17.7	26.9 (20.7, 33.1)	32.3 (24.8, 40.1)
South	348,084	37.4	3,508	34.5	30.0 (23.7, 36.3)	40.4 (31.7, 49.3)
West	219,800	23.6	2,438	24.0	33.1 (22.1, 44.1)	45.1 (30.0, 60.6)
Metropolitan status						
MSA ³	851,264	91.4	9,473	93.2	35.1 (30.5, 39.8)	46.6 (40.2, 53.1)
Non-MSA ³	80,422	8.6	688	6.8	16.1 (10.6, 21.6)	17.7 (11.5, 24.3)

¹Rate is calculated using the annual average estimated population of persons with asthma from the National Health Interview Survey for 2012–2015.

²Persons of Hispanic origin may be of any race.

³MSA is metropolitan statistical area.

NOTES: Numbers may not add to totals because of rounding. Percentages and rates are annual averages. First-listed asthma visits were defined as those for which an asthma code (*International Classification of Diseases, Ninth Revision, Clinical Modification* codes 493.0–493.9) was listed as the primary diagnosis.

SOURCE: NCHS, National Ambulatory Medical Care Survey, 2012–2015.

Table 2. Characteristics of physician office visits for total and first-listed asthma visits: United States, 2012–2015

Characteristic	Total visits		First-listed asthma visits	
	Number (thousands)	Percent	Number (thousands)	Percent
Total	931,686	100.0	10,161	100.0
Physician specialty				
General or family practice	197,294	21.2	2,227	21.9
Internal medicine	127,390	13.7	1,574	15.5
Pediatrics	105,356	11.3	2,292	22.6
Allergy or immunology	8,496	0.9	1,928	19.0
Pulmonology	8,807	0.9	1,648	16.2
Other	484,342	52.0	492	4.8
Expected source of payment				
Private insurance	458,157	49.2	5,933	58.4
Medicare	245,623	26.4	1,467	14.4
Medicaid or CHIP	108,497	11.7	1,812	17.8
Other ¹	69,799	7.5	301	3.0
Unknown or blank	49,611	5.3	648	6.4
Clinic type				
Private	847,717	91.0	9,291	91.4
Urgent care or freestanding clinic	41,164	4.4	542	5.3
Other	42,804	4.6	328	3.2
Primary provider or referral status				
Primary provider				
Established patient	363,096	39.0	5,038	49.6
New patient	24,922	2.7	433	4.3
Not primary provider				
Referred for visit	159,291	17.1	1,785	17.6
Not referred for visit	277,109	29.7	1,776	17.5
Unknown referral status	61,959	6.7	521	5.1
Unknown provider status	45,308	4.9	608	6.0
Major reason for visit				
New problem	297,499	31.9	2,628	25.9
Chronic problem, routine	297,869	32.0	4,245	41.8
Chronic problem, flare-up	69,841	7.5	1,744	17.2
Preventive care ²	186,247	20.0	1,295	12.7
Pre- or postsurgery	60,447	6.5	70	0.7
Unknown	19,782	2.1	180	1.8
Visit disposition				
Refer to another or referring physician	36,363	3.9	313	3.1
Return visit	706,863	75.9	7,981	78.5
Refer to emergency department or hospital	5,355	0.6	86	0.9
Other	164,622	17.7	1,687	16.6
Blank	18,482	2.0	95	0.9

¹Includes workers compensation, self-pay, no charge, and other.

²Includes routine prenatal, well-baby, screening, insurance, and general examinations.

NOTES: Numbers may not add to totals because of rounding. Percentages are annual averages. First-listed asthma visits were defined as those for which an asthma code (*International Classification of Diseases, Ninth Revision, Clinical Modification* codes 493.0–493.9) was listed as the primary diagnosis. CHIP is Children's Health Insurance Program.

SOURCE: NCHS, National Ambulatory Medical Care Survey, 2012–2015.

Table 3. Twenty most frequently mentioned principal reasons for first-listed asthma visits: United States, 2012–2015

Reason for visit	Number (thousands)	Percent
All visits	10,161	100.0
Asthma	2,555	25.1
Cough	1,401	13.8
Follow-up	1,135	11.2
General medical examination	764	7.5
Medical counseling	305	3.0
Medication, other	285	2.8
Wheezing	225	2.2
Shortness of breath	208	2.1
Allergy	206	2.0
Nasal congestion	193	1.9
Sore throat	184	1.8
Allergy medication	172	1.7
Upper respiratory infection	163	1.6
Difficulty breathing	143	1.4
Apnea	140	1.4
Excessive sputum	123	1.2
Test results (including PFTs)	86	0.9
Fever	84	0.8
Hay fever	75	0.7
Chest pain, soreness	70	0.7
All others	1,644	16.2

NOTES: Numbers may not add to totals because of rounding. Percentages are annual averages. First-listed asthma visits were defined as those for which an asthma code (*International Classification of Diseases, Ninth Revision, Clinical Modification* codes 493.0–493.9) was listed as the primary diagnosis. PFT is pulmonary function test.

SOURCE: NCHS, National Ambulatory Medical Care Survey, 2012–2015.

Table 4. Components of guideline-based care among first-listed asthma visits: United States, 2012–2015

Guidelines	Number (thousands)	Percent
Total	10,161	100.0
Asthma severity		
Intermittent	1,143	11.3
Mild persistent	1,062	10.5
Moderate persistent	1,021	10.0
Severe persistent	271	2.7
Not documented	6,665	65.6
Asthma control		
Well controlled	2,960	29.1
Not well controlled	1,067	10.5
Very poorly controlled	127	1.3
Not documented	6,008	59.1
Tests and procedures		
Spirometry	1,518	14.9
Peak flow	336	3.3
Health education		
Asthma education	2,170	21.4
Asthma action plan ¹	744	9.9
Tobacco use or exposure	260	2.6
Exercise	419	4.1

¹Asthma action plan data are available for 2013–2015 only.

NOTES: Numbers may not add to totals because of rounding. First-listed asthma visits were defined as those for which an asthma code (*International Classification of Diseases, Ninth Revision, Clinical Modification* codes 493.0–493.9) was listed as the primary diagnosis.

SOURCE: NCHS, National Ambulatory Medical Care Survey, 2012–2015.

Table 5. Drug mentions at first-listed asthma visits, by therapeutic category: United States, 2012–2015

Therapeutic drug category	Number (thousands)	Percent
All drug mentions	42,683	100.0
Respiratory agents ¹	17,155	40.2
Bronchodilators	10,647	24.9
Adrenergic bronchodilators	7,776	18.2
Bronchodilator combinations	2,234	5.2
Anticholinergic bronchodilators	496	1.2
Methylxanthines	140	0.3
Antihistamines	2,054	4.8
Leukotriene modifiers	1,933	4.5
Antiasthmatic combinations	1,096	2.6
Respiratory inhalant products	577	1.4
Upper respiratory combinations	394	0.9
Antitussives	174	0.4
Other	279	0.7
Topical agent ¹	4,965	11.6
Nasal preparations	3,733	8.7
Nasal steroids	3,410	8.0
Nasal antihistamines and decongestants	270	0.6
Dermatological agents	960	2.2
Topical steroids	613	1.4
Ophthalmic preparations	223	0.5
Other	134	0.3
Hormones ¹	3,686	8.6
Adrenal cortical steroids	2,722	6.4
Sex hormones	463	1.1
Thyroid drugs	438	1.0
Other	63	0.1
Central nervous system agents ¹	3,278	7.7
Cardiovascular agents ¹	2,643	6.2
Anti-infectives ¹	2,575	6.0
Nutritional products ¹	1,709	4.0
Metabolic agents ¹	1,528	3.6
Gastrointestinal agents ¹	1,416	3.3
Immunological agents ¹	1,071	2.5
Psychotherapeutic agents ¹	962	2.3
Other ¹	1,694	4.0

¹Percentages sum to 100.

NOTES: Numbers may not add to totals because of rounding. Additionally, categories are not mutually exclusive; drugs may be included in more than one therapeutic category. Percentages are annual averages. First-listed visits were defined as those for which an asthma code (*International Classification of Diseases, Ninth Revision, Clinical Modification* codes 493.0–493.9) was listed as the primary diagnosis.

SOURCE: NCHS, National Ambulatory Medical Care Survey, 2012–2015.

Table 6. Twenty most frequently occurring generic substances in drug mentions at first-listed asthma visits, by number of occurrences, percentage of drug mentions, and therapeutic classification: United States, 2012–2015

Generic substance	Number (thousands)	Percent	Therapeutic classification
Albuterol	6,855	16.9	Adrenergic bronchodilator
Montelukast	1,914	4.7	Leukotriene modifier
Fluticasone-nasal	1,724	4.2	Nasal steroid
Fluticasone-Salmeterol	1,517	3.7	Bronchodilator combinations
Prednisone	1,098	2.7	Glucocorticoids
Cetirizine	902	2.2	Antihistamines
Beclomethasone nasal	864	2.1	Nasal steroids
Azithromycin	776	1.9	Macrolides
Budesonide nasal-Formoterol	731	1.8	Bronchodilator combinations
Prednisolone	530	1.3	Glucocorticoids
Loratadine	476	1.2	Antihistamines
Mometasone nasal	476	1.2	Nasal steroids
Budesonide	475	1.2	Inhaled corticosteroids
Formoterol-Mometasone	468	1.2	Bronchodilator combinations
Levalbuterol	463	1.1	Adrenergic bronchodilators
Omeprazole	451	1.1	Proton pump inhibitors
Levothyroxine	404	1.0	Thyroid hormones
Epinephrine	387	1.0	Vasopressors, adrenergic bronchodilators, catecholamines
Multivitamin	363	0.9	Vitamin and mineral combinations
Aspirin	362	0.9	Salicylates, platelet aggregation inhibitors
All others	19,399	47.7	Other

NOTES: Numbers may not add to totals because of rounding. Percentages and rates are annual averages. First-listed visits were defined as those for which an asthma code (*International Classification of Diseases, Ninth Revision, Clinical Modification* codes 493.0–493.9) was listed as the primary diagnosis. Antiasthmatic drugs are classified by the pharmacologic class and subclass used by the National Asthma Education Program and “International Consensus Report on Diagnosis and Treatment of Asthma.” Generic substances not used for treating asthma are classified by Lexicon Plus, a proprietary database of Cerner Multum, Inc.

SOURCE: NCHS, National Ambulatory Medical Care Survey, 2012–2015.

Appendix. Supplemental Table and Figures

Table. National Ambulatory Medical Care Survey eligibility and response rates, 2012–2015

Sample and response rate	2012	2013	2014	2015
Total physician sample	15,740	11,212	9,989	8,091
Eligible physician sample	9,574	6,999	6,016	4,910
Responding physicians	3,760	2,879	2,325	1,415
Total patient record forms completed	76,330	54,873	45,710	28,332
Unweighted total visit response rate (percent)	39.3	41.10	38.70	28.80
Weighted total visit response rate (percent)	39.40	40.40	39.00	29.60

NOTES: Respondents are physicians for whom at least one-half of their expected number of patient record forms were completed (full responders); this also includes physicians who saw no patients during their sampled week. Response rate is the number of respondents divided by the number of in-scope physicians.
 SOURCE: NCHS, National Ambulatory Medical Care Survey, 2012–2015.

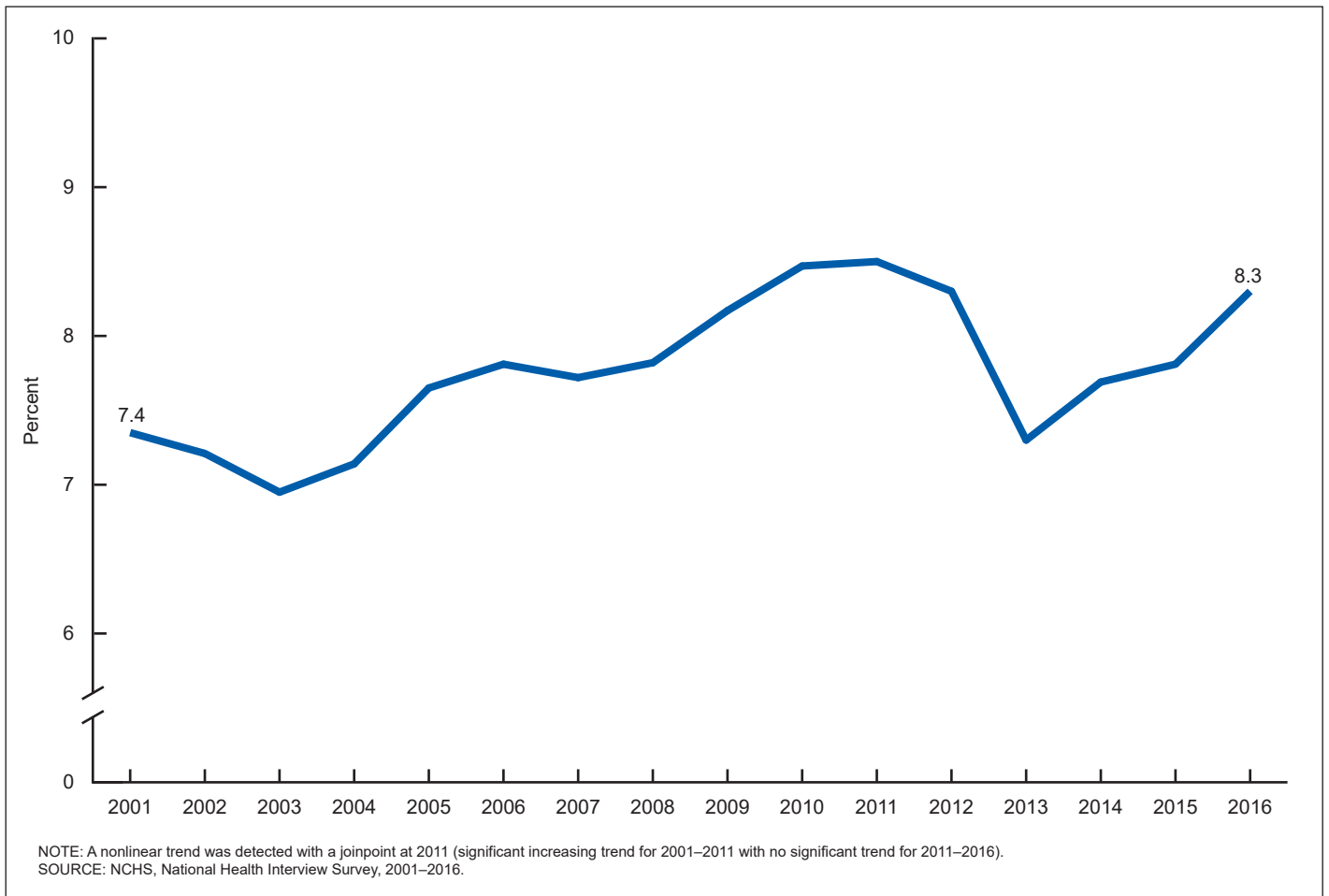


Figure I. Asthma prevalence among all persons: United States, 2001–2016

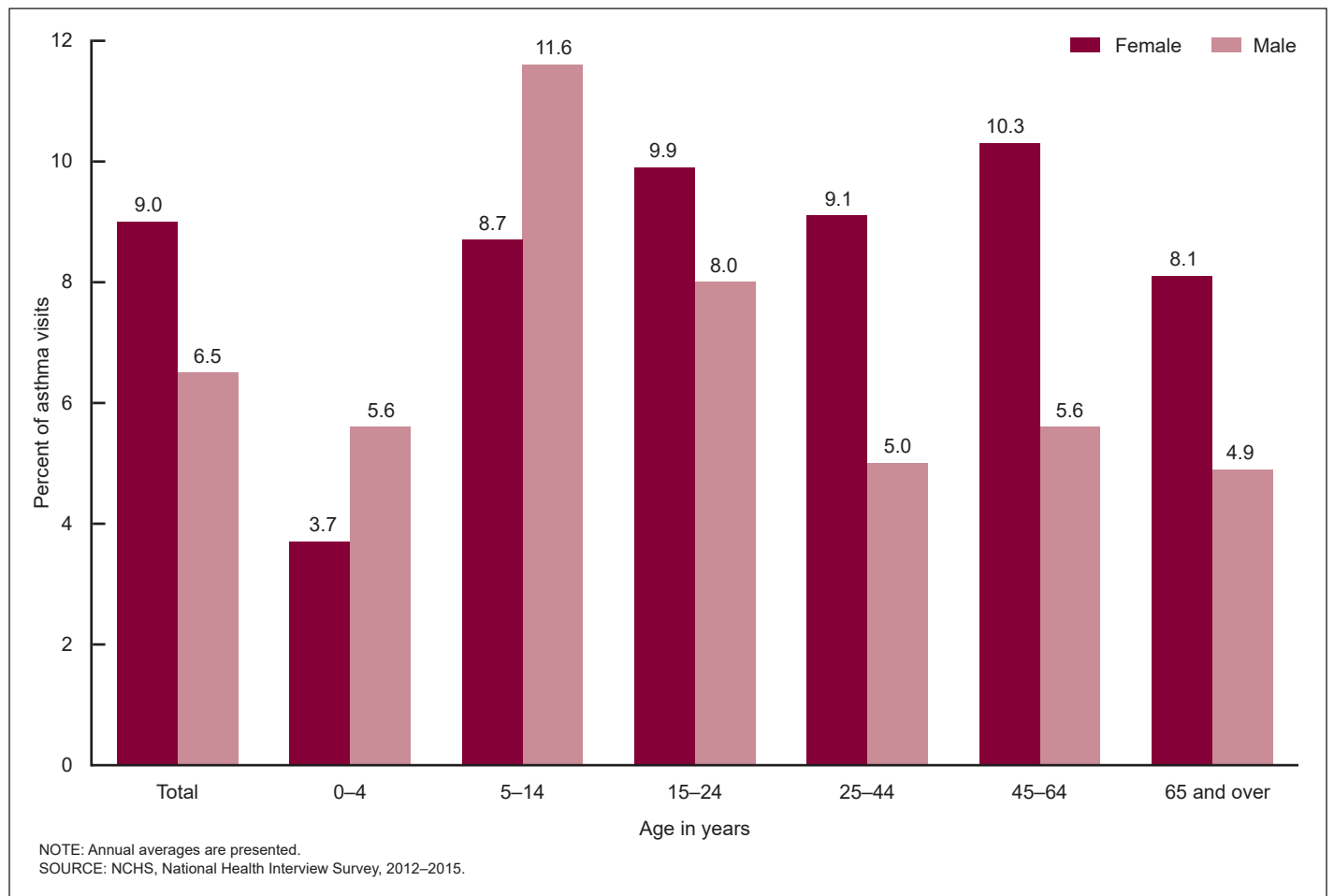


Figure II. Asthma prevalence, by age group and sex: United States, 2012–2015

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