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HHS Public Access
Author manuscript
J Allergy Clin Immunol Pract. Author manuscript; available in PMC 2020 April 01.

Published in final edited form as:
J Allergy Clin Immunol Pract. 2019 April ; 7(4): 1207–1213.e4. doi:10.1016/j.jaip.2018.10.008.

-Asthma Prevalence Among Medicaid-Enrolled Children

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Abstract

Background: Small-area asthma prevalence measures, which are crucial for targeting interventions, are currently sparsely available for children.

Objective: This study aims to provide measures of in-contact asthma prevalence for the 2012 Medicaid child population, to highlight areas in need of targeted asthma interventions.

Methods: Using the 2012 Medicaid Analytic eXtract (MAX) claims files, we develop two prevalence metrics differentiated by persistent or diagnosed asthma. We develop prevalence measures at the state, county, and census tract levels, with statistical inferences to highlight areas of high-prevalence where intervention should be focused. We compare the measures to asthma prevalence estimates derived from a sample of the child population who have self-reported whether they have been diagnosed with asthma regardless whether in-contact.

Results: 1.98 million (8.1%) and 1.71 million (6.9%) Medicaid-enrolled children are identified with in-contact asthma diagnosis and persistent asthma, respectively. Among 40 states, 17 have lower prevalence estimates for the Medicaid-enrolled children than similar Centers for Disease Control and Prevention (CDC) child asthma self-reported prevalence estimates. High prevalence regions span primarily in the southern Midwest region, from Texas to West Virginia and Illinois to north Florida.

Conclusions: There are large variations in the differences between CDC self-reported estimates for the general population and the in-contact estimates for the Medicaid-enrolled children, highlighting potential asthma misdiagnosis in the Medicaid population in many states. Small area estimates point to areas of high prevalence, consistently throughout the south and southeast.

Keywords

Medicaid claims; small area estimates; pediatric asthma; in-contact prevalence

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The authors have no conflicts of interest nor financial relationships relevant to this article to disclose.

This material has not been published nor is being considered for publication elsewhere.

The research was approved by Centers for Medicare and Medicaid Services (Data Use Agreement #23621) and by the Institutional Review Board of Georgia Tech (protocol #H11287).

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INTRODUCTION

Asthma is the third leading cause of pediatric emergency room (ER) visits resulting in hospitalizations[1]. In 2013, children missed 13.8 million school days due to asthma[2]. The U.S. Centers for Disease Control and Prevention (CDC) has identified pediatric asthma as a priority condition for intervention[3]. While asthma is not preventable, evidence-based healthcare guidelines suggest multi-component, multi-trigger interventions can reduce severe outcomes associated with pediatric asthma[4,5]. To target such interventions, estimates of asthma prevalence are needed.

National and state-level estimates of pediatric asthma prevalence are commonly disseminated by CDC[6], derived from national surveys[7] including the National Health Interview Survey (NHIS)[8] and the Behavioral Risk Factor Surveillance System (BRFSS)[9]. The NHIS CDC estimates provide national-level of lifetime, current, and asthma attack prevalence for children through use of personal household interviews. The BRFSS CDC estimates provide state-level percentages of children whose parents self-report that their child is currently diagnosed with asthma. Both surveys do not provide or contrast self-reported diagnosed prevalence to in-contact prevalence, defined as the percentage of children who are utilizing the healthcare system for asthma treatment. This is particularly of interest for the Medicaid-enrolled children who may be disproportionately under-treated for asthma because of low healthcare access[10,11]. The Medicaid system provides healthcare benefits for more than 36 million children nationally[12], approximately half of the child population, mostly from socio-economically disadvantaged families.

The 2009 Children's Health Insurance Reauthorization Act required the U.S. Department of Health and Human Services to create quality measures for use by State Medicaid Programs. Among these measures, only a measure of adherence to asthma medication is included[13]. Consequently, asthma prevalence measures are disseminated by few state health departments. Notably, while prevalence estimates are commonly available at the state level, small-area prevalence estimates are not commonly available. Geographic granularity for in-contact prevalence can assist in prioritizing asthma management interventions for children diagnosed and undiagnosed. To quantify differences due to geographic location, we define and discuss two prevalence measures to model condition severity at the state, county, and census tract levels. We define in-contact prevalence measures for children with an asthma diagnosis and persistent asthma using a modified Healthcare Effectiveness Data and Information Set (HEDIS) approach to potentially capture intermittent asthma, or when asthma may be diagnosed but not treated. The values and difference among these two measures can give an understanding of regional asthma severity, diagnosis rate, and healthcare utilization for a particular area.

METHODS

Data Sources

We analyzed patient-level claims from the 2012 Medicaid Analytic eXtract (MAX) files obtained from the Centers for Medicare and Medicaid Services (CMS). The research was

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approved by CMS (Data Use Agreement #23621) and by the Institutional Review Board of Georgia Tech (protocol #H11287). All data derived from the MAX files meet a minimum cell size of 11 patients according to the Data Use Agreement; gray areas in the maps of the results did not meet this requirement.

Study Population

Our study includes children age 4 to 17 with at least one month of Medicaid eligibility in 2012 from all states except for Kansas (2011), Rhode Island (2011), Colorado (2010) and Idaho (2010), for which we use earlier years due to data availability. Children under age 4 were excluded since many of these children have other wheezing disorders that mimic asthma and are difficult to diagnose (e.g. viral bronchiolitis)[14,15].

We filter all MAX prescription drug claims to only include National Drug Codes (NDC) for asthma controller and short-term medication[16]. We filter all MAX inpatient and other services claims to only include primary asthma diagnosis, International Classification of Diseases, 9th Revision Clinical Modification (ICD-9-CM) 493.XXX and aggregate all claims to visit level by service date, identifying type of claims by type and place of service. We further classify patients with certain visit types and prescriptions over the entire year into two asthma severity levels.

First, we define children with an *asthma diagnosis* as those who meet at least one of the criteria:

1. At least one physician office visit and another asthma care event (physician office visit, asthma controller medication, or short-term medication); or
2. At least one controller asthma medication; or
3. At least one asthma related ER visit; or
4. At least one asthma related hospitalization.

The HEDIS algorithm provides the definition of patients with persistent asthma specific to asthma controller medications. A modified version of this algorithm allows for the highest sensitivity and specificity for detecting persistent[17]. According to this modified HEDIS definition, children with *persistent asthma* are those who meet at least one of the following criteria:

1. At least three outpatient visits; or
2. At least one asthma controller medication; or
3. At least one ER visit (and a physician office visit, another ER visit, or asthma short-term medication); or
4. At least one hospitalization.

We consider an alteration of the third criterion by restricting to have at least another care event because of potentially misdiagnosis of asthma in ERs[18–20].

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Prevalence Measures

We consider two in-contact prevalence measures to capture differences within a geographical area, which include:

1. *Diagnosis prevalence per-member-year*: The percentage of children diagnosed with asthma among all Medicaid-enrolled children.
2. *Persistent prevalence per-member-year*: The percentage of children with persistent asthma among all Medicaid-enrolled children.

The comparison of these two distinct estimates for asthma prevalence is necessary to assess and compare prevalence; while the diagnosis measure is most comparable to the self-reported CDC measures and has higher specificity, the persistent measure is more sensitive by useing the modified HEDIS algorithm to detect acute asthma conditions. These measures are percentages, taking values between 0 and 100. We will use the term *prevalence* to refer to *in-contact prevalence per-member-year*, unless noted otherwise.

Linking each patient with the MAX person summary file and aggregating by zip code, we derive outcome measures for all states and counties and then estimate them at the census tract level using the U.S. Department of Housing and Urban Development U.S. Postal Service (HUDUSPS) Crosswalk Files[21]. We derived the census tract estimates by taking a weighted average of the zip code prevalence estimates for the zip codes within the area of each census tract, where the weights were specified using the residential population of the zip codes.

We benchmark the prevalence estimates with state-level self-reported diagnosis prevalence for all children provided by the CDC[22] based on the 2010–2014 BRFSS. CDC asthma prevalence measures were estimated based on randomized samples of participants answering questions about their children (e.g. “Has a doctor, nurse or other health professional ever said that the child has asthma? Does the child still have asthma?”). The CDC survey does not consider whether a child is seeking treatment or severity of condition. This comparison between national standards of self-reported diagnosed asthma and Medicaid in-contact asthma gives contextual information concerning national levels of prevalence and characteristics of Medicaid-enrolled children in contrast to the entire child population.

Statistical Analysis

Comparing Measures—We use a Wilcoxon signed-rank test to evaluate whether the medians of the two measures are plausibly similar. The test is applied for the prevalence estimates pooled from all states with significance level of 0.01.

Between-State Analysis—We use a one-way analysis of variance (ANOVA) to evaluate whether the mean of the asthma prevalence is the same in all states and a pairwise Tukey’s Test to identify which of the mean prevalence pairs are different. The test is more conservative in detecting differences between states because of the spatial dependence in the prevalence estimates.

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High-Prevalence Maps—Using existing methods[23,24], we identify census tracts where the difference in asthma prevalence is statistically significantly larger than a high-prevalence threshold, I, which we define using the prevalence third quantile. We consider the prevalence spatial process $Z(s)$ where s is a spatial unit (i.e., census tract). We test whether $Z(s) > I$ for all census tracts by estimating simultaneous confidence bands $[l(s), u(s)]$ for the thresholded expected regression function $E(Z(s)) - I$. Simultaneous confidence bands account for the comparison across multiple locations. We define a high-prevalence community as those spatial units s such that $l(s) > 0$. The results are displayed as point maps, where the points correspond to the centroids of the census tracts of high-prevalence.

RESULTS

Study Population

Across all 50 states and the District of Columbia, approximately 1.98 million children (8.1%) and 1.71 million children (6.9%) have an asthma diagnosis and persistent asthma, respectively. Across all states, the average number of enrollment months per-patient is larger for the population of children with asthma (11.2 months for diagnosed and 11.3 months for persistent) than for all children (9.8 months), with the difference between state average enrollment ranging from 0.41 (MA) to 3.2 (NC) months. The difference in the enrollment months for children with diagnosis versus persistent asthma is not statistically different from zero (p-value>0.1) according to the Mann-Whitney test. Table E1 contains the state-level summary statistics of the study population.

Prevalence Measures

Table 1 presents the state-level prevalence measures for all 50 states and the District of Columbia alongside CDC confidence interval estimates which are available for 40 states and the District of Columbia. Among these states, the prevalence derived using the 2012 MAX data is higher than the upper bound of the CDC self-reported diagnosed and persistent prevalence estimates for six states (AL, LA, NE, TN, TX, WV). For these states, the differences between diagnosis prevalence and the CDC upper bound ranges between 0.7 (WV) and 3.6 (TX). Moreover, the estimates for asthma diagnosis are lower than the CDC lower bound for 17 states (AZ, CA, DC, GA, HI, MI, MS, MT, NC, NH, NJ, NV, OR, PA, UT, WA, WI). For these states, the differences between asthma diagnosis prevalence and the CDC lower bound ranges between 0.1 (AZ) and 6.5 (NV). For the persistent asthma measure, only 7 states (IA, IL, IN, KY, MO, ND, OK) were contained within the CDC confidence interval.

Statistical Analysis

Comparing Prevalence Measures—Figure E1 presents the maps of the differences between the persistent and diagnosis prevalence estimates. Table 1 provides the median and variance of the difference between diagnosis and persistent asthma measures.

Using the Wilcoxon signed-rank test, both measures are significantly different with the p-values at the county and census tract level below .001. By its definition, the diagnosis prevalence measures are always greater or equal to the persistent prevalence measures. The

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ratio between diagnosis and persistent asthma prevalence ranges from 1.019 (WV) to 2.028 (DC) with a median of 1.143.

Between-State Analysis (Census Tract-level)—Figure 1 displays the boxplots for the census tract diagnosis measures by state. Figure E2 provides an equivalent display for the persistent measure. The state-level median of census tract ranges from 2.2% to 15.7% and 1.7% to 14.0% for census tract diagnosis and persistent prevalence respectively. The census tract-level measures vary significantly, from 0.0% (20 census tracts among 13 states) to 46.5% (1 census tract, TX) for the diagnosis prevalence estimate. States containing census tracts above five standard deviations from the mean diagnosis prevalence (26.0%) are AL, GA, KS, LA, MD, NC, NJ, OH, TN, TX, VA, and WV.

Between-State Analysis (County-level)—Figure 2 and Figure E3 (in the Web-Appendix) provide the national county maps for the diagnosis and persistent per-member-year measures, respectively. For enrollment comparison, Figure E4 provides the map of the county-level average enrollment months for the study population and asthma diagnosed children. At the county level, diagnosis prevalence ranges slightly less than the census tract-level, from 0.0% (DC) to 41.7% (TX). States containing counties above three standard deviations from the mean of diagnosis prevalence estimate (20.1%) include AL, GA, KY, LA, MS, OK, TN, TX, and WV.

For both prevalence measures at the census tract level, the state-level means are not equal according to the ANOVA test. Over 85% of the Tukey pairwise comparison p-values are smaller than 0.01.

High-Prevalence Maps—The 3rd quartile of census tract prevalence defines the threshold level (I) as 8.5% and 9.8% for the diagnosis and persistent per-member-year high-prevalence maps.

Figure 3 displays the geographic layout of the high-prevalence. Approximately 23.1% of all census tracts nationwide are high-prevalence census tracts; out of these, both measures identify 77.1%. Both measures agree that high-prevalence is primarily in the southern Midwest region. Small spotted regions exist outside of this range, with the most predominant regions by population being centered on New York City (NY) and Annapolis (MD).

DISCUSSION

The in-contact prevalence measures presented in this study capture multiple aspects of asthma prevalence. The percent of children diagnosed with an asthma condition defined as the per-member-year prevalence in this study is comparable to prevalence estimates provided by CDC, as it does not access severity of condition. We also provide measures for diagnosed and persistent asthma, with only two states (DC and WA) having over 40% more diagnosed than persistent asthma children. Differences between these two measures illustrate not only the severity of the condition but also the level of utilization and quality of care since the definition of persistent asthma implies that an asthma-diagnosed child utilizes the system.

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The national in-contact prevalence in the Medicaid-enrolled child population (6.9% persistent, 8.1% diagnosis) is comparable with national CDC self-reported prevalence asthma estimate of 8.9%[6], but there are differences in estimates at the state level. Generally, it is expected that children from low income households will have a higher prevalence of asthma[25]. Three states (AL, TN, TX) with higher asthma prevalence for the Medicaid population than the CDC are also the states with highest asthma prevalence for the Medicaid population. We identified 17 states with lower diagnosed asthma prevalence in the Medicaid population as compared to the CDC estimates thus pointing to potential under-diagnosis of asthma in the Medicaid child population compared to the general child population.

The asthma prevalence estimates in the Medicaid child population vary widely across the states. Since asthma may be attributed to demographics and geographic variations, including variation caused by environmental triggers such as pollution, pollen level, and weather[26–29], estimates of asthma prevalence between states are expected to vary. However, the differences in both prevalence measures for the Medicaid population are extreme, suggesting disparities in how asthma is treated and diagnosed across states.

The asthma prevalence estimates in the Medicaid child population also vary widely within each state. The state-level diagnosis prevalence varies from 2.5% to 15.9%. At more granular levels, prevalence varies from 0% to 45.2% (county) and 46.5% (census tract). These large disparities are much wider than those estimated by the state-level confidence intervals provided by the CDC. Local environmental asthma triggers or demographics potentially explain the high prevalence communities appearing in clusters around city centers. Other extremely low or high prevalence communities may also reflect over-diagnosis or under-diagnosis of the neighboring communities.

To identify communities with highest prevalence, we employed statistical inference, assuming high prevalence if larger than the 3rd quartile of the prevalence estimates across all communities in the US. This approach highlights an important finding; the overwhelming number of communities identified as having high prevalence are in the South, Southeast, and Midwest. Some Southeast states, including Georgia and North Carolina, are not displaying the highest prevalence but are known to have high asthma prevalence due to environmental triggers (e.g. pollen)[30]. These two states are also among those states with a lower asthma prevalence estimate for the Medicaid child population than the CDC estimates for the general child population, pointing to systematic disparities in asthma diagnosis and consequently in treatment.

On the other hand, western states are not included in the high-prevalence map almost entirely, indicating that asthma is not a prevalent concern for states in this part of the country. For the central and eastern U.S., states show more variations, including communities with high diagnosed asthma or high persistent asthma (but not both). In these states, we also see small clusters of high prevalence. Understanding the triggers of high prevalence in these communities should be a first step before targeting interventions for asthma since these communities behave differently from those in their neighborhood.

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Limitations

One limitation of this study is reliance on claims data. While clinical definitions of intermediate and persistent asthma from organizations such as the National Heart, Lung, and Blood Institute include all patients in and out of treatment, the MAX files only include claims that have been submitted for reimbursement. Therefore, estimates on the healthcare outcomes such as prevalence of a condition may be biased where certain subgroups have difficulty in maintaining Medicaid coverage, lack access to care, or are susceptible to particularly disparate utilization[31]. Moreover, Medicaid MAX files can have data quality issues, especially for states with large populations on managed care[32]. Similarly, in-contact prevalence measures may not accurately represent prevalence for areas where children are enrolled in Medicaid for a fraction of the year, such as if they shift between Medicaid and commercial insurances. We considered children of all ages between 4 and 17 although asthma below age 4 is also of concern. Medicaid-enrolled individuals over the age of 18 and children not enrolled in Medicaid are also a concern but are outside the scope of this study. By studying a maximum of one year of a child's healthcare, prevalence could be underrepresented for patients who sought care over or between multiple years. Finally, the prevalence estimates are for 2012 and although asthma prevalence has historically seen a slow increase[8], the most recent years of Medicaid claims data may provide different estimates, particularly in the context of recent health policies.

Conclusion

This study is the first to provide a comprehensive measurement approach for in-contact asthma prevalence for the Medicaid child population, identifying significant disparities in diagnosis of asthma between and within states. Moreover, this study also provides a heat map of high-prevalence communities, highlighting areas to be targeted for asthma management intervention. These findings can be used by community and public health departments across the country for allocating resources towards improvement in diagnosis and for guiding asthma healthcare and management. We will make the census tract and county level prevalence estimates available upon request for broad dissemination.

Acknowledgments.

The authors are thankful to Matt Sanders and Richard Starr in assisting with data safeguards and the information technology infrastructure. The authors are also thankful to Dr. Jean O'Connor and Francesca Lopez for sharing the list of asthma controller medication used by the Georgia Department of Public Health.

No sources of funding to be reported.

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WEB APPENDIX

Web-Appendix Table E1:

State Level Data Overview for 2012 In-Contact Asthma for Pediatric (Ages 4–17) Medicaid Patients from the Medicaid Analytic eXtract (MAX) claims files

	Total		Asthma Diagnosis			Persistent Asthma		
State	Patients	Enrollment Months	Patients	Enrollment Months	Tract s.d.[3]	Patients	Enrollment Months	Tract s.d.[3]
AL	371,980	3,944,562	59,000	672,505	0.0514	52,670	600,749	0.0511
AK	61,998	637,634	2,955	33,231	0.0143	2,544	28,585	0.0148
AZ	586,578	5,623,301	39,714	435,187	0.0126	28,579	313,847	0.0101
AR	325,375	3,515,403	26,015	298,437	0.022	21,641	248,443	0.0203
CA	3,548,125	30,246,113	164,979	1,898,560	0.0179	140,334	1,615,296	0.0166
CO[1]	315,874	2,510,534	15,346	164,437	0.0143	13,995	150,210	0.0129
CT	219,714	2,398,380	25,684	295,601	0.0199	21,651	249,159	0.0177
DE	76,816	745,595	7,404	83,078	0.0169	6,427	72,043	0.0146
DC	58,776	652,013	2,989	34,834	0.0081	1,476	17,098	0.008
FL	1,368,578	13,790,568	119,429	1,329,391	0.0216	99,561	1,109,379	0.0207
GA	936,771	7,517,959	67,119	727,066	0.0205	58,633	635,583	0.0189
HI	101,758	1,122,129	7,673	89,779	0.0152	6,161	72,167	0.0139
ID[1]	123,108	1,132,902	5,779	62,980	0.0115	5,424	59,147	0.0111
IL	1,235,031	13,216,855	105,631	1,236,131	0.0216	97,105	1,136,230	0.0217
IN	504,872	5,160,772	38,894	443,333	0.0186	34,925	398,055	0.0178
IA	206,012	2,132,149	15,234	171,284	0.0246	13,795	155,075	0.0249
KS[2]	158,881	1,642,409	14,842	166,620	0.0227	13,864	155,898	0.0227
KY	373,981	3,733,076	38,083	429,491	0.031	34,276	386,695	0.0304
LA	528,661	6,000,831	64,196	755,452	0.0347	58,216	685,014	0.0365
ME	95,934	1,010,031	7,343	83,942	0.0183	6,727	76,886	0.0182
MD	402,812	4,392,169	42,645	495,100	0.0221	34,541	401,083	0.0201
MA	438,549	4,185,322	35,935	406,192	0.0197	30,070	339,582	0.0181
MI	784,994	8,112,231	60,121	688,247	0.0184	48,411	553,469	0.0174
MN	303,426	3,092,201	20,661	231,923	0.0173	16,770	188,351	0.0139
MS	336,441	2,900,050	31,883	356,087	0.0253	29,283	327,102	0.0257
MO	441,887	4,416,165	43,224	488,016	0.023	39,749	449,240	0.0228
MT	74,108	595,552	3,518	39,838	0.0172	3,116	35,309	0.0157
NE	128,172	1,322,422	11,494	129,437	0.0234	10,387	116,844	0.0222
NV	161,078	1,551,223	4,004	42,520	0.0193	3,428	36,667	0.0175
NH	74,437	749,657	5,697	62,925	0.0182	4,914	54,194	0.017
NJ	546,954	5,039,411	42,130	484,667	0.0189	32,009	368,103	0.0161
NM	253,183	2,767,055	16,766	193,814	0.014	13,440	155,578	0.0124
NY	1,328,405	14,095,087	119,455	1,370,600	0.0215	93,443	1,072,721	0.0182
NC	821,144	7,509,211	67,713	765,404	0.0176	56,188	634,410	0.0158
ND	34,459	298,945	1,877	20,138	0.021	1,713	18,352	0.0211
OH	860,121	9,498,760	73,215	851,875	0.0236	60,020	698,115	0.0225
OK	387,168	3,910,221	33,373	373,337	0.0222	28,975	324,798	0.0206

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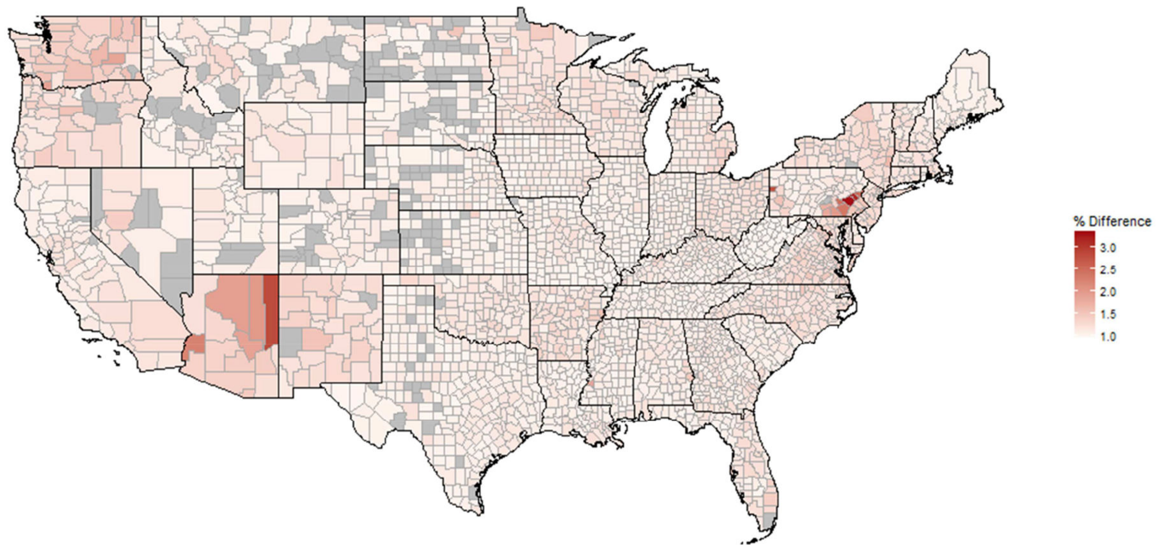
	Total		Asthma Diagnosis			Persistent Asthma		
State	Patients	Enrollment Months	Patients	Enrollment Months	Tract s.d.[3]	Patients	Enrollment Months	Tract s.d.[3]
OR	298,313	2,466,956	11,786	129,156	0.0107	9,563	104,720	0.0102
PA	756,398	7,990,435	24,006	273,361	0.0312	18,343	208,649	0.031
RI[2]	74,043	790,557	7,088	80,081	0.0126	6,491	73,421	0.0128
SC	426,772	4,448,746	38,827	447,582	0.0224	35,856	414,254	0.0223
SD	64,334	643,619	3,832	41,987	0.019	3,598	39,402	0.0186
TN	528,505	5,723,101	67,564	777,886	0.0331	62,689	721,701	0.0334
TX	2,110,497	21,041,905	273,714	3,004,184	0.0353	249,923	2,745,064	0.0354
UT	174,433	1,306,624	6,807	72,691	0.0098	6,559	70,073	0.01
VT	51,590	524,481	3,720	42,200	0.0191	3,162	35,812	0.0166
VA	476,262	4,563,515	42,788	487,357	0.0245	33,519	381,838	0.0233
WA	554,427	5,736,703	21,564	246,681	0.0109	15,233	173,707	0.0091
WV	141,760	1,456,222	14,392	159,898	0.0359	14,115	156,849	0.036
WI	401,467	3,936,453	25,030	285,435	0.0186	21,258	243,255	0.0157
WY	38,508	375,182	2,902	31,435	0.0218	2,644	28,621	0.0213
Total	24673470	242173397	1986040	22491393	0.036	1707414	19336843	0.0342

[1] 2010 data,

[2] 2011 data

[3] Standard deviation for in-contact persistent per-member-year measure for all census tracts with available data



Web Appendix Figure E1: County Level In-Contact Asthma Prevalence Difference from the Medicaid Analytic eXtract (MAX) claims files

Below is the metric difference county heatmap for persistent vs. diagnosis, calculated as the diagnosis per-member-year prevalence divided by the persistent per-member-year prevalence.

[1] Alaska (mean 1.26, 20 counties) and Hawaii (mean 1.22, 4 counties) excluded

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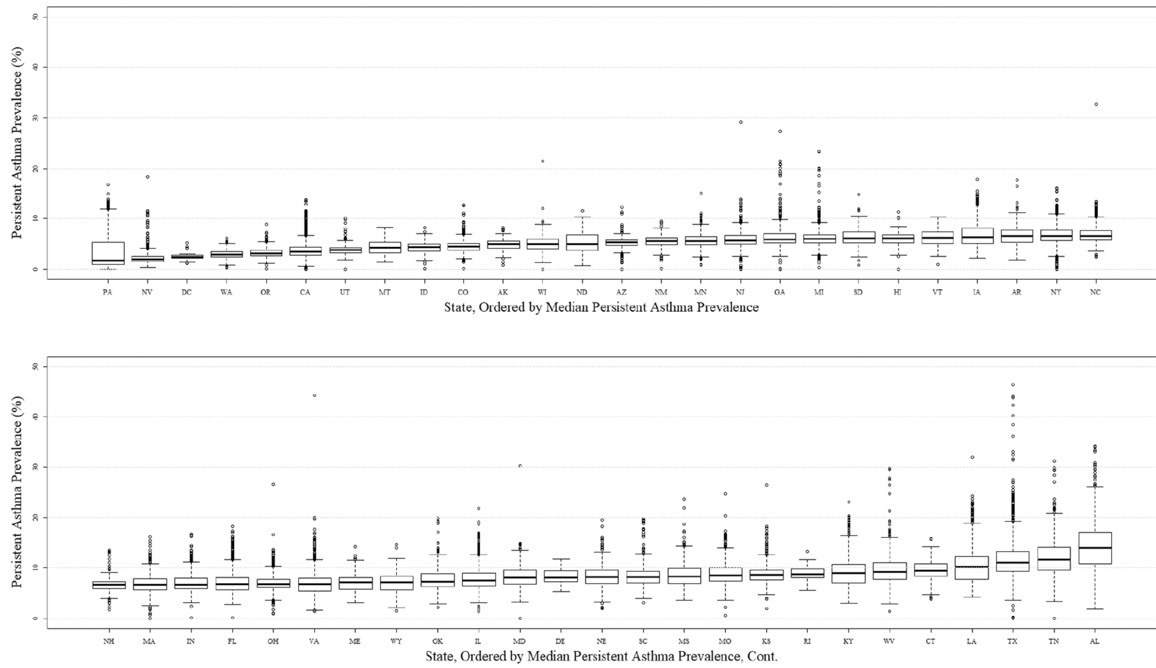
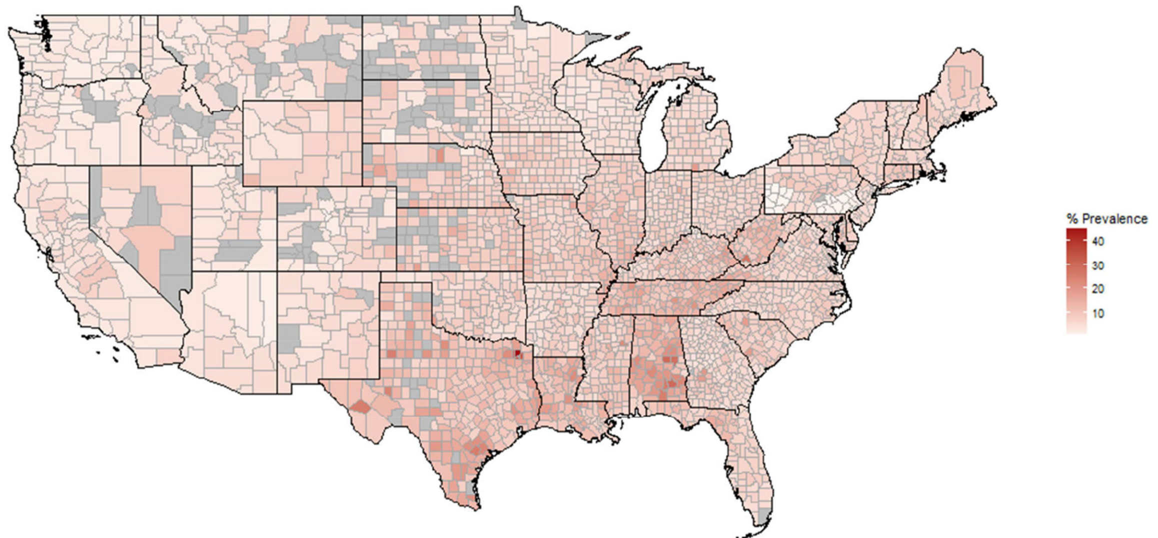


Web Appendix Figure E2: Medicaid Pediatric Persistent Asthma Prevalence Census Tract Box Plots by State

Prevalence per-member-year measures for persistent asthma derived from the 2012 MAX claims files, ordered by median prevalence. Plots use standard quartiles and whiskers bounds.



Web Appendix Figure E3: National County Level In-Contact Persistent Asthma Per-Member-Year

All values in percent of persistent asthma patients out of total patients, ages 4–17, derived from the 2012 MAX claim files. Gray counties represent counties with lower than eleven diagnosis cases.

[1]Alaska (mean 3.1%, 20 counties) and Hawaii (mean 5.9%, 4 counties) excluded

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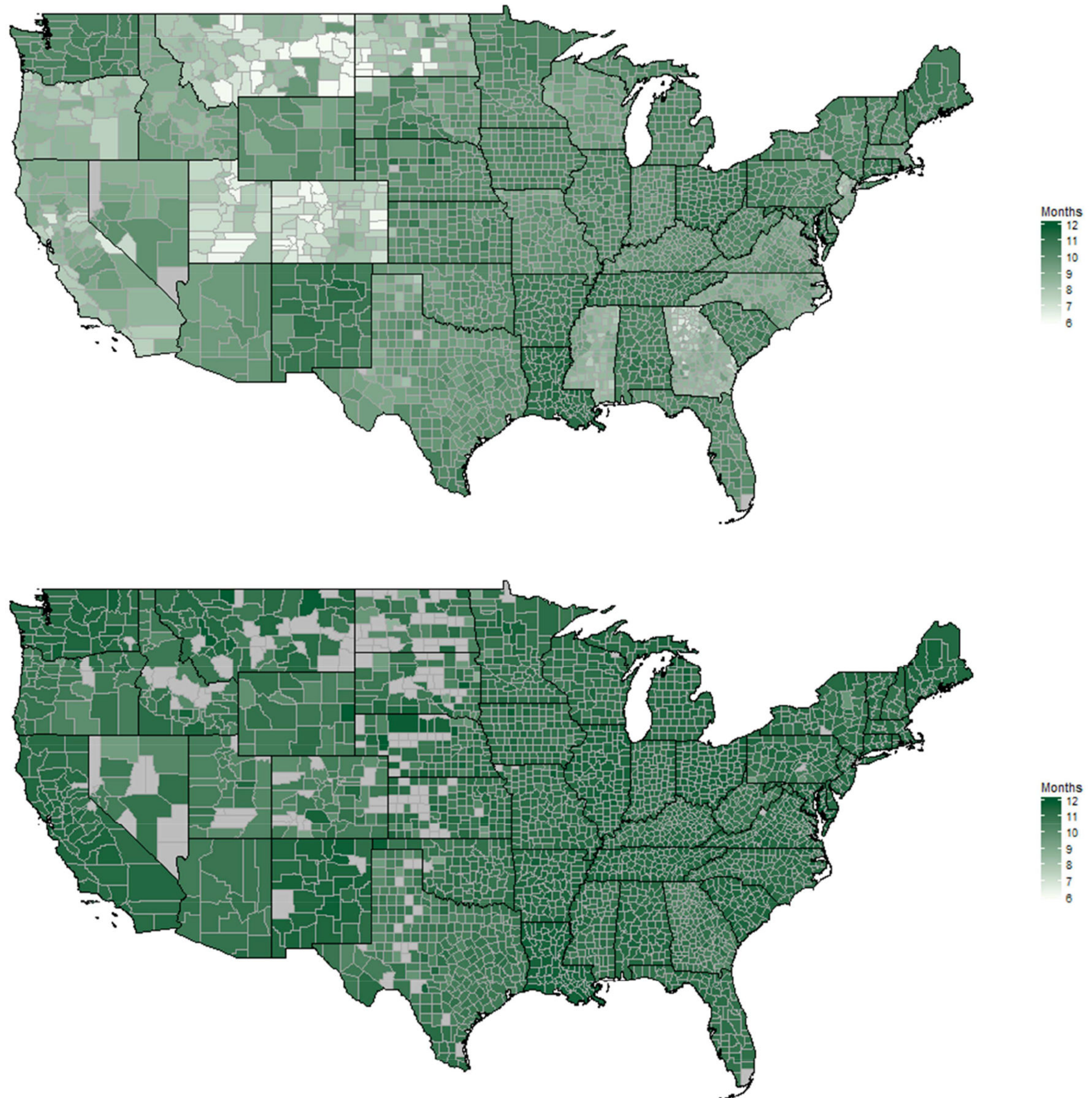

Web Appendix Figure E4: Average County Enrollment Months for children 4–17 from the Medicaid Analytic eXtract (MAX) claims files

All values in average months per year of enrollment for all children (top) and children with an asthma diagnosis (bottom). Gray counties represent counties with less than eleven pediatric patients.

[1]Alaska (mean 10.1 months, 20 counties) and Hawaii (mean 11.0 months, 4 counties) excluded

[2]Counties with average member enrollment less than 6 months (n=33) are lower bounded at 6 months

ABBREVIATIONS

ANOVA	analysis of variance

BRFSS	Behavioral Risk Factor Surveillance System
CDC	Centers for Disease Control and Prevention
CMS	Centers for Medicare and Medicaid Services
ER	emergency room
HEDIS	Healthcare Effectiveness Data and Information Set
HUD-USPS	U.S. Department of Housing and Urban Development U.S. Postal Service
ICD-9-CM	International Classification of Diseases, 9th Revision Clinical Modification
MAX	Medicaid Analytic eXtract
NDC	National Drug Codes
NHIS	National Health Interview Survey

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HIGHLIGHTS

What is already known about this topic?

National and recent self-reported asthma prevalence estimates are available for the general child population and at the state level. Small-area asthma prevalence measures are sparsely available for children.

What does this article add to our knowledge?

This study provides two measures of small-area asthma prevalence for the Medicaid-enrolled children nationally at the state, county, and census tract levels, evaluating differences between and within states highlight areas of high prevalence and utilization.

How does this study impact current management guidelines?

This study's findings, measures, and maps can be used by community and public health departments across the country for identifying high-prevalence areas of at-risk populations to better utilize resources for improvement in diagnosis and for guiding asthma healthcare and management.

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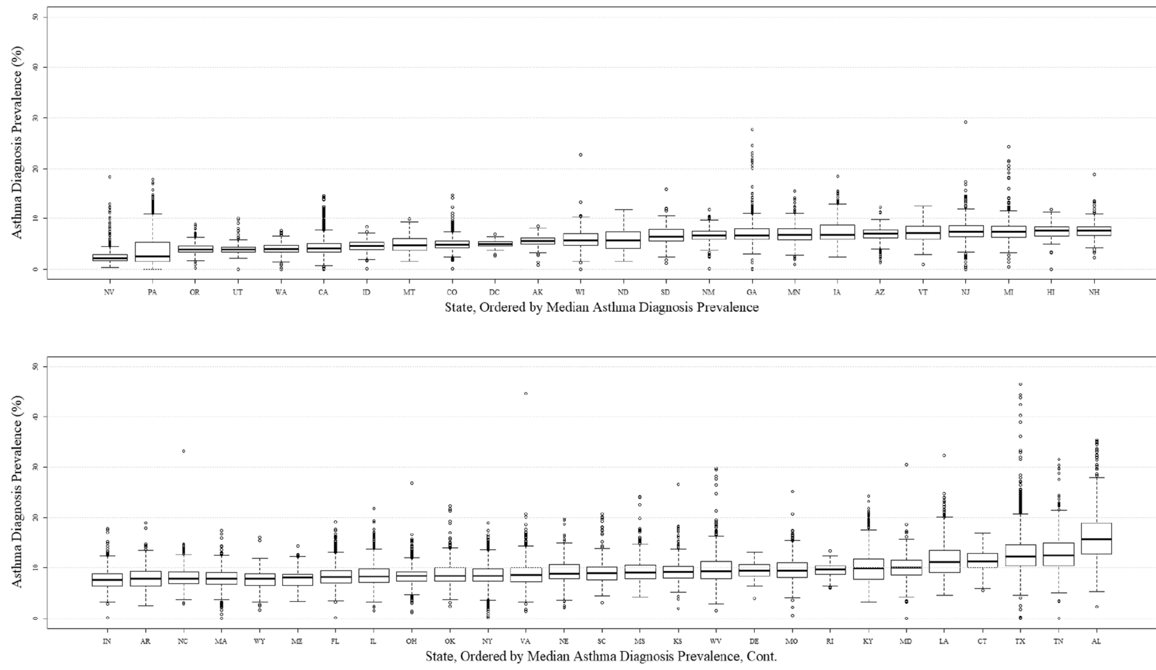

Figure 1: Medicaid Pediatric Asthma Diagnosis Prevalence Census Tract Box Plots by State

Prevalence per-member-year measures for asthma diagnosis derived from the 2012 MAX claims files, ordered by median prevalence. Plots use standard quartiles and whiskers bounds. Boxplots for the persistent measure can be found in Figure E2.

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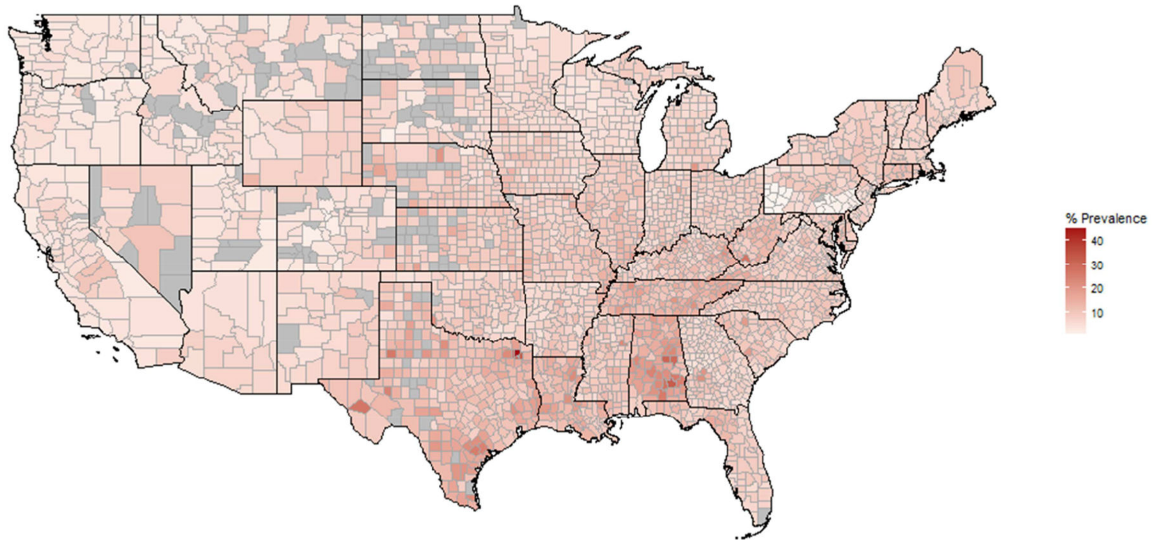

Figure 2: National County Level In-Contact Asthma Diagnosis Per-Member-Year

All values in percent of diagnosis patients out of total patients, ages 4–17, derived from the 2012 MAX claim files. Gray counties represent counties with lower than eleven diagnosis cases.

[1]Alaska (mean 3.8%, 20 counties) and Hawaii (mean 7.3%, 4 counties) excluded

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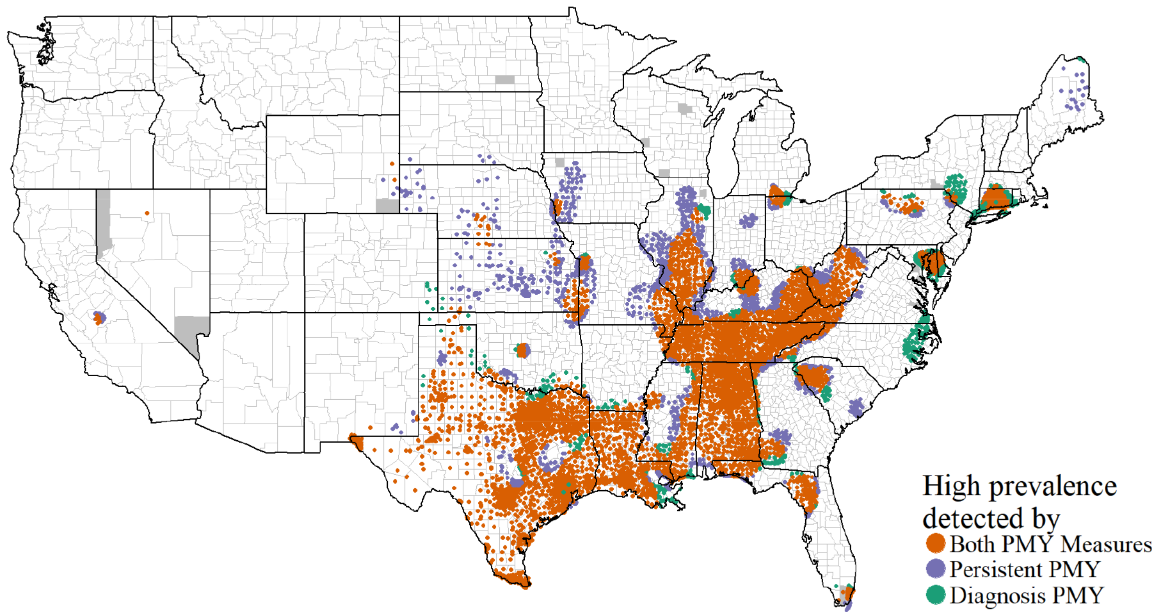

Figure 3: National High-Prevalence Map Using Asthma In-Contact Prevalence Per-Member-Year Measures

Counties without data available are marked in grey. Blue and green points correspond to high prevalence census tracts identified by the persistent and diagnosis per-member year measures respectively, derived from the 2012 MAX claims files. Orange points correspond to census tracts identified by both per-member-year measures. Alaska and Hawaii do not contain high-prevalence census tracts and have been excluded.

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Table 1:

2012 State Level In-Contact Asthma Prevalence for Pediatric (Ages 4–17) Medicaid Patients

This table displays state-wide in-contact asthma prevalence state estimates (EST) and census tract interquartile range (IQR) for diagnosis and persistent cases per-member-year (percentage of members per year) derived from the 2012 MAX claims files. Additionally, it displays the median and variance of the difference the measures using the trimmed (2.5–97.5% quantiles) measures to eliminate outliers and the CDC pediatric asthma confidence intervals[c,d].

	Diag	nosis	Persistent		Difference		
State	**EST**	**IQR**	**EST**	**IQR**	**Median**	**Variance**	**CDC CI**
AK	4.80%	4.9–6.2%	4.10%	4.2–5.5%	0.71%	7.78E-08	
AL	15.90%	12.8–18.9%	14.20%	10.9–17%	1.67%	5.51E-07	9.7 – 13.0%
AR	8.00%	6.5–9.3%	6.70%	5.3–7.7%	1.26%	3.49E-07	
AZ	6.80%	6.2–7.7%	4.90%	4.7–5.7%	1.73%	2.78E-07	6.8 – 10.6%
CA	4.70%	3.3–5.1%	4.00%	2.8–4.3%	0.63%	9.23E-08	7.7 – 10.0%
CO[a]	4.90%	4.2–5.5%	4.40%	3.8–5.1%	0.38%	7.21E-08	
CT	11.70%	10–12.9%	9.90%	8.3–10.9%	1.73%	4.20E-07	10.4 – 14.0%
DC	5.10%	4.6–5.4%	2.50%	2.1–2.7%	2.53%	1.19E-07	10.0 – 19.0%
DE	9.60%	8.4–10.7%	8.40%	7.3–9.4%	1.33%	9.35E-08	
FL	8.70%	7–9.5%	7.30%	5.6–8%	1.34%	4.06E-07	
GA	7.20%	5.9–7.9%	6.30%	5.1–7%	0.80%	1.32E-07	9.0 – 13.0%
HI	7.50%	6.5–8.4%	6.10%	5.2–6.8%	1.48%	1.99E-07	9.5 – 13.2%
IA	7.40%	5.8–8.7%	6.70%	5–8.1%	0.63%	1.81E-07	4.9 – 8.0%[d]
ID[a]	4.70%	3.9–5.3%	4.40%	3.6–5%	0.28%	3.69E-08	
IL	8.60%	7.1 –9.8%	7.90%	6.5–8.9%	0.67%	1.07E-07	7.5 – 11.5%
IN	7.70%	6.5–8.8%	6.90%	5.8–8%	0.70%	1.53E-07	6.8 – 9.4%[d]
KS[b]	9.30%	8–10.3%	8.70%	7.5–9.6%	0.63%	1.46E-07	9.1 – 12.0%
KY	10.20%	7.7–11.7%	9.20%	7–10.7%	0.91%	2.76E-07	8.7 – 11.9%
LA	12.10%	9.1–13.5%	11.00%	7.7–12.2%	1.11%	3.21E-07	6.6 – 9.8%[d]
MA	8.20%	6.8–9.1%	6.90%	5.7–7.8%	1.16%	3.74E-07	7.6 – 11.9%[d]
MD	10.60%	8.6–11.5%	8.60%	6.8–9.5%	1.92%	3.56E-07	8.8 – 12.0%
ME	7.70%	6.5–8.8%	7.00%	5.8–8.1%	0.64%	2.20E-07	7.7 – 11.9%
MI	7.70%	6.4–8.5%	6.20%	5.2–6.8%	1.44%	5.41E-07	8.2 – 10.9%[d]
MN	6.80%	5.8–7.9%	5.50%	4.8–6.4%	1.22%	3.49E-07	
MO	9.80%	8.1–11%	9.00%	7.3–10%	0.83%	2.29E-07	8.2 – 12.3%
MS	9.50%	7.8–10.6%	8.70%	6.9–9.9%	0.69%	2.04E-07	12.2 – 15.9%
MT	4.80%	3.7–6.1%	4.20%	3.2–5.3%	0.55%	2.38E-07	6.0 – 9.7%
NC	8.30%	6.9–9.2%	6.80%	5.7–7.6%	1.27%	2.92E-07	9.3 – 14.1%[d]
ND	5.50%	4.1–7.3%	5.00%	3.7–6.8%	0.44%	1.66E-07	5.0 – 8.3%[d]

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	Diag	nosis	Persistent		Difference		
State	**EST**	**IQR**	**EST**	**IQR**	**Median**	**Variance**	**CDC CI**
NE	9.00%	7.8–10.7%	8.10%	6.9–9.6%	0.79%	2.83E-07	6.0 – 8.0%
NH	7.70%	6.6–8.4%	6.60%	5.9–7.3%	0.99%	2.65E-07	8.7 – 12.5%
NJ	7.70%	6.4–8.6%	5.90%	4.9–6.6%	1.65%	4.49E-07	7.8 – 9.9%
NM	6.60%	5.8–7.4%	5.30%	4.8–6.2%	1.14%	2.24E-07	6.2 – 8.6%
NV	2.50%	1.8–2.9%	2.10%	1.5–2.6%	0.30%	9.68E-08	9.0 – 13.9%
NY	9.00%	7.3–9.8%	7.00%	5.6–7.7%	1.84%	5.16E-07	7.4 – 11.3%
OH	8.50%	7.4–9.2%	7.00%	6.1–7.8%	1.46%	2.53E-07	7.5 – 9.9%
OK	8.60%	7.4–10%	7.50%	6.3–8.8%	1.13%	2.09E-07	7.1 – 10.2%
OR	4.00%	3.3–4.6%	3.20%	2.7–3.7%	0.70%	9.67E-08	5.7 – 9.4%
PA	3.20%	1.5–5.3%	2.40%	0.9–5.3%	0.69%	1.96E-07	9.2 – 11.7%
RI[b]	9.60%	8.8–10.4%	8.80%	8.1–9.8%	0.65%	1.29E-07	9.1 – 13.7%[d]
SC	9.10%	7.6–10.2%	8.40%	7–9.4%	0.66%	1.28E-07	
SD	6.00%	5.5–7.8%	5.60%	5.1–7.4%	0.34%	6.96E-08	
TN	12.80%	10.5–14.9%	11.90%	9.6–14.1%	0.87%	1.75E-07	6.5 – 10.3%
TX	13.00%	10.4–14.5%	11.80%	9.3–13.3%	1.09%	2.48E-07	6.4 – 9.4%
UT	3.90%	3.4–4.3%	3.80%	3.3–4.2%	0.10%	1.47E-08	6.2 – 8.1%
VA	9.00%	7.2–10.1%	7.00%	5.4–7.9%	1.89%	5.34E-07	
VT	7.20%	5.9–8.6%	6.10%	5. 1 –7.4%	1.14%	4.88E-07	6.4 – 10.3%[d]
WA	3.90%	3.3–4.7%	2.80%	2.4–3.4%	1.06%	1.32E-07	5.7 – 7.8%
WI	6.20%	4.7–7%	5.30%	4.1–6%	0.74%	2.01E-07	8.7 – 14.0%
WV	10.20%	7.9–11.3%	10.00%	7.8–11.1%	0.13%	4.92E-08	6.3 – 9.5%
WY	7.50%	6.5–8.9%	6.90%	5.6–8.2%	0.66%	1.15E-07	6.5 – 11.3%
Total	8.00%	5.7–9.8%	6.90%	4.8–8.5%	1.01%	4.91E-07	

[a] 2010 MAX data.

[b] 2011 MAX data.

[c] 95% confidence interval for pediatric (ages 0–17) current asthma prevalence. *Centers for Disease Control and Prevention Behavioral Risk Factor Surveillance System 2012: Child Current Asthma Prevalence Rate (Percent) and Prevalence (Number) by State or Territory*. This confidence interval is influenced by the response rate and size for the self-reported prevalence estimates.

[d] Confidence interval is CDC prevalence estimates within two years of 2012 (2010–2014). Missing confidence intervals indicate data was not available for the state from 2010–2014.