MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH

Asthma-Related Emergency Department Visits in Massachusetts

2022

BACKGROUND & PURPOSE

Asthma is one of the most common chronic diseases in the United States.[1]

Asthma affects people of all ages and is a significant public health problem, with visits to the Emergency Department (ED) sometimes being necessary in response to asthma attacks. However, asthma is a condition that is largely controllable with appropriate management, and the need for ED visits can be considered preventable, if patients and their families are adequately educated about the disease, have access to high quality health care, and practice appropriate asthma management.[2] Since 2006, the United States Department of Health and Human Service has identified a reduction in ED visits for asthma as a national public health objective.[3] According to a recent national survey, asthma accounts for 1.7 million visits to the emergency department annually, making it one of the top 20 reasons for ED visits.[4] It is important to seek medical care right away if a person or their child has trouble breathing; however, unnecessary trips to the ED can be costly. On average, every asthma-related trip to the ED costs $1,502.[5]

Asthma management is dependent on being able to minimize exposure to asthma triggers in the environment, to understand and take medications as prescribed, and to recognize the signs of asthma and know what to do if asthma gets worse.

Social determinants of health play an important role in asthma outcomes. Exposures and conditions where people live, work, learn or play can affect their asthma. Low levels of environmental pollution, quality living conditions, education and linguistic competency, access to quality medical care and information are necessary to support adequate asthma management. Given that these necessary conditions are not equitably distributed, it is not surprising that there are also dramatic inequities in people's ability to successfully manage their asthma. In fact, although the percent of adults who have ever been told by a health care provider that they have asthma does not differ significantly by race/ethnicity in Massachusetts, there are stark racial/ethnic disparities in asthma-related ED visits and hospitalizations.[6]

WHAT IS ASTHMA?

Asthma is a chronic inflammation of the airways.

Airways become constricted with swelling and excessive mucous production, making it difficult to breathe. Symptoms of asthma are wheezing, coughing, chest tightness, and nighttime or early morning coughing. It can have a significant effect on a person's quality of life. Sometimes the symptoms become so severe that they result in an asthma attack that requires immediate medical treatment. Asthma affects individuals differently, resulting in differing severity, presentation of symptoms, and responsiveness to treatment. When not treated, asthma can cause disability and even death. Asthma control status varies by age, gender, race/ethnicity, and socioeconomic status. Increasing rates of hospital treatment due to asthma may indicate increasing prevalence or severity within the population.

Asthma is largely controllable with appropriate primary and ongoing asthma management. If patients and their families are adequately educated about the disease, and have access to high quality health care, the need for hospitalization can usually be prevented. However, differences in rates of hospitalization for asthma suggest that there is significant room for improvement in caring for the condition.

Content:

The content of this report includes:

1. State-wide trends of asthma-related ED visits and inequities by gender, age, race, and geography.
2. Costs associated with asthma-related ED visits.

In this brief, a statewide data source is used to describe asthma-related ED visits in Massachusetts — the Emergency Department Visits Discharge Database managed by the Center for Health Information and Analysis (CHIA).

The data includes patient demographics, admission and discharge information, diagnostic and procedural coding, provider details, and detailed charge information.
Findings for asthma-related ED visits begin with a time trend using all years of data available. These data are followed by a more detailed examination of trends over time from 2002 onward. Cross sectional findings are based on the most recent data available and in most instances multiple years of data are aggregated to derive more stable estimates where possible.

At-risk based rates for asthma-related ED visits were calculated to assess the rate of ED visits among the Massachusetts population with current asthma.[7]

The Massachusetts Behavioral Risk Factor Surveillance System (BRFSS) from 2007–2018 are used to calculate these at-risk rates, which provide additional understanding of changes over time in different hospital services during a period of increasing prevalence.

This brief also includes data on hospital charges for asthma-related ED visits. In interpreting these findings on charges, readers should be aware of several data considerations. First, the charges for service are not reflective of the actual cost of care, nor are they reflective of what was reimbursed to the hospital by the payer. Second, some of the charges do not include costs associated with the long-term effects of asthma, such as lost time from work and household duties or reduced quality of life. Asthma-related hospitalizations will be reported separately.

Definitions:

Diagnosis Code

The International Classification of Diseases, Tenth Revision, Clinical Modification (ICD-10-CM) is a morbidity classification published by the United States National Center for Health Statistics (NCHS) for classifying diagnoses and reason for visits in all health care settings. The ICD-10-CM is based on the ICD-10, the statistical classification of disease published by the World Health Organization (WHO).The transition from ICD-9-CM to ICD-10-CM occurred on October 1, 2015. The ICD-CM codes for asthma have changed from 493.00 – 493.99 in ICD-9-CM to J45.0–J45.998 in ICD-10-CM. A few codes covered under the ICD-9-CM asthma codes 493.00–493.99 are not covered under asthma's J45 codes in ICD-10-CM. Under ICD-10-CM, co-morbidities are typically coded separately.

ED visits are defined as any visit by a patient who is registered at the ED but the visit does not result in an outpatient observation stay or the inpatient admission of the patient at the reporting facility, and where the only service to a registered patient is triage or screening. An asthma-related ED visit is one where the primary discharge diagnosis ICD-10-CM code J45 is for asthma.

Note: *In tables and figures below, estimates based on ICD-9-CM and ICD-10-CM are separated by a dashed line. Due to the use of the new ICD-CM code, data from 2015 on cannot be aggregated with years prior to 2015 for analysis. Findings are compared to national estimates where possible.*

Data Definitions:

Crude rate

A rate that represents the actual number of events due to asthma per 10,000 residents over a given time period.

Age-adjusted rate

A summary rate (per 10,000 residents) calculated by weighting age-specific event rates for a given year to the 2010 Massachusetts Census population in order to minimize the effect of different age distributions in populations when comparing rates.

Age-specific rate

A rate (per 100 residents) estimated as the number of events due to asthma in a specified age group per total residents within that age group for a particular time period.

At-risk rate

Calculated as the number of events (e.g. ED Visits) due to asthma among adults with current asthma at that time. This rate (per 100 at-risk residents) can be used to determine if the changes over time may be explained by the increase in asthma prevalence.

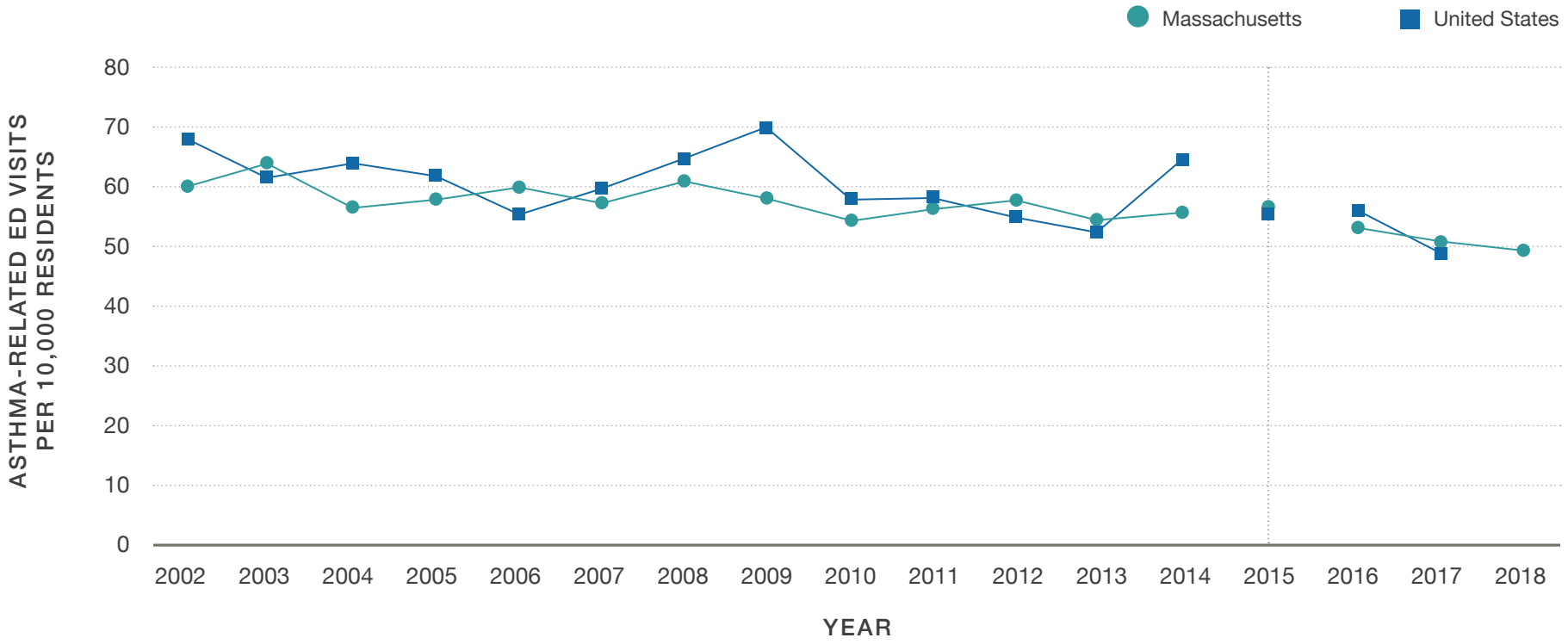
BURDEN IN ASTHMA-RELATED EMERGENCY DEPARTMENT VISITS

Rates of Asthma-Related Emergency Department Visits

The data below is presented for asthma-related ED visits in Massachusetts. ED visit statistics are calculated from the statewide Emergency Department Visits Discharge Database which provides data reported quarterly from hospitals to the Massachusetts Center for Health Information and Analysis. Worth noting, all trend analyses presented in the report did not include data from 2015 and the following years due to ICD code conversion.

As shown in ***Figure 1*** below, the age-adjusted rate of asthma-related ED visits in Massachusetts remained fairly consistent with the national rate. However, statistical significance could not be determined because confidence intervals were not provided for national estimates.

FIGURE 1. Age-Adjusted Rates of Asthma-Related Emergency Department (ED) Visits, Massachusetts and United States Residents, 2002–2018



Data Source: *CY2002–2018 Massachusetts Emergency Department Discharge Database, Massachusetts Center for Health Information and Analysis; CY2007–2018 Massachusetts BRFSS, Massachusetts Department of Public Health;*

US Data: *CY2002–2018 National Ambulatory Medical Care Survey, National Center for Health Statistics, www.cdc.gov/nchs/data/series/sr_03/sr03_035.pdf, https://www.cdc.gov/asthma/national-surveillance-data/healthcare-use.htm#anchor_1554215330246*

FROM 2002 THROUGH 2018, THERE WERE:

over 499k

asthma-related ED visits

From 2002 through 2018, there were over 499,000 asthma-related ED visits among Massachusetts residents. This means that on average, during this time, there were about 96 ED visits for asthma each day in Massachusetts.

FROM 2002 THROUGH 2014:

7.6% decrease

in Massachusetts asthma-related ED visits

In Massachusetts, from 2002 through 2014, the rate of asthma-related ED visits decreased 7.6% from 60.2 to 55.6 ED visits per 10,000 residents (***Figure 2***).

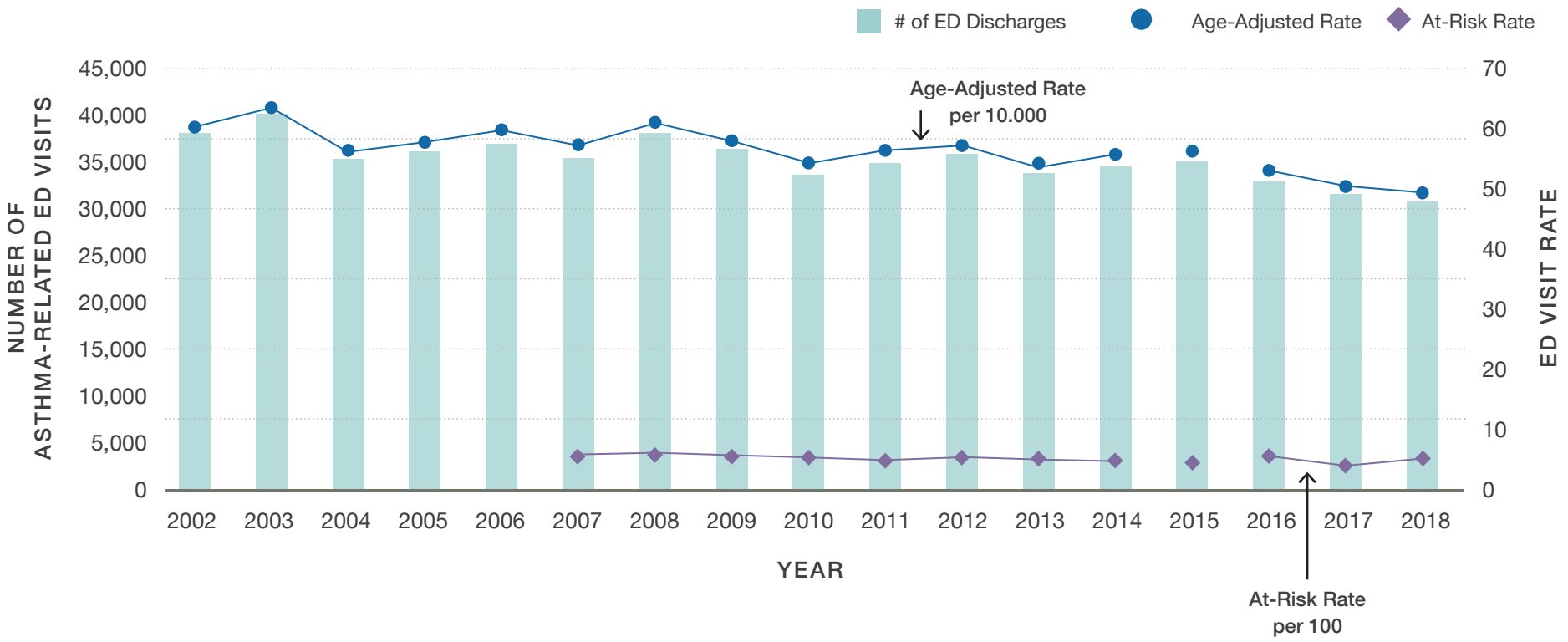
FROM 2007 THROUGH 2014:

57.22

overall at-risk rate in Massachusetts

From 2007 through 2014, the at-risk rate of asthma-related ED visits slightly decreased but it was not significant.

FIGURE 2. Number and Age-Adjusted Rates of Asthma-Related Emergency Department (ED) Visits, Massachusetts Residents, 2002–2018



Data Source: *CY2002–2018 Massachusetts Emergency Department Discharge Database, Massachusetts Center for Health Information and Analysis; CY2007–2018 Massachusetts BRFSS, Massachusetts Department of Public Health;*

US Data: *CY2002–2018 National Ambulatory Medical Care Survey, National Center for Health Statistics, www.cdc.gov/nchs/data/series/sr_03/sr03_035.pdf, https://www.cdc.gov/asthma/national-surveillance-data/healthcare-use.htm#anchor_1554215330246.*

TABLE. Number and Age-Adjusted Rates of Asthma-Related Emergency Department (ED) Visits, Massachusetts Residents, 2002-2018

	MASSACHUSETTS					UNITED STATES
YEAR	NO.	CRUDE RATE[1]	AGE-ADJUSTED RATE[1,2]	95% CI[3]	AT-RISK RATE[4]	AGE-ADJUSTED RATE[1,2]
2002	38,013	59.1	60.2	59.6 – 60.8	NA	67.9
2003	40,155	62.3	63.9	63.2 – 64.5	NA	61.6
2004	35,335	54.9	56.4	55.8 – 57.0	NA	64.0
2005	36,102	56.1	57.7	57.1 – 58.3	NA	61.7
2006	37,021	57.5	59.6	59.0 – 60.3	NA	55.3
2007	35,359	54.8	57.2	56.6 – 57.8	5.6	59.6
2008	37,874	58.3	61.0	60.4 – 61.6	6.2	64.5
2009	36,460	55.3	58.0	57.4 – 58.6	5.4	69.7
2010	33,445	51.1	54.2	53.6 – 54.8	5.1	57.8
2011	34,839	52.9	56.3	55.7 – 56.9	4.9	58.1
2012	35,803	54.7	57.5	56.9 – 58.1	5.1	54.9
2013	33,831	51.7	54.3	53.7 – 54.9	4.8	52.5
2014	34,592	52.8	55.6	55.0 – 56.2	4.5	64.5
2015	35,039	53.5	56.0	55.4 – 56.6	5.0	55.0
2016	32,834	50.1	52.9	52.3 – 53.5	4.8	55.9
2017	31,307	47.8	50.3	49.8 – 50.9	3.8	49.1
2018	30,780	47.0	49.4	48.8 – 49.9	4.8	50.6

Trend Analysis[5] **Slope:[6]** -0.47 **P-Value:[7]** 0.01 **95% CI:[3]** -0.79 – -0.15

[1] *Rate of asthma-related emergency department visits per 10,000 residents.*

[2] *Age-adjusted to United States 2010 population.*

[3] *95% confidence interval.*

[4] *Rate of residents at risk of emergency department visits per 100 residents*

[5] *Trend analysis was performed using 2002–2014 data only due to ICD-9-CM diagnosis code having been changed to ICD-10-CM diagnosis code in October 2015 and after.*

[6] *Slope (slope of the best line of fit calculated using JoinPoint Software) = the average age-adjusted rate increase or decrease per year (e.g. a slope of 1.0 indicates that the age-adjusted rate increased on average one per 10,000 residents per year).*

[7] *P-value < 0.05 is considered statistically significant because it means that there is at most a 5% chance of observing a trend, given that, in reality, rates are stable.*

Data Source: *CY2002–2018 Massachusetts Emergency Department Discharge Database, Massachusetts Center for Health Information and Analysis; CY2007–2018 Massachusetts BRFSS, Massachusetts Department of Public Health;*

US Data: *CY2002–2018 National Ambulatory Medical Care Survey, National Center for Health Statistics, www.cdc.gov/nchs/data/series/sr_03/sr03_035.pdf, https://www.cdc.gov/asthma/national-surveillance-data/healthcare-use.htm#anchor_1554215330246*

Asthma-Related ED Visit Associated Charges

FROM 2002 THROUGH 2018:

$780m+

total charges for asthma-related ED visits in Massachusetts

The combined total charges for asthma-related ED visits in Massachusetts from 2002 through 2018 were over $780 million. This was an average of $45.9 million per year.

FROM 2002 THROUGH 2018:

156% increase

in total charges for asthma-related ED visits

During this time period, the total charges increased 156% from $25.0 million in 2002 to $56.6 million in 2018 (unadjusted for inflation) (***Figure 3***).

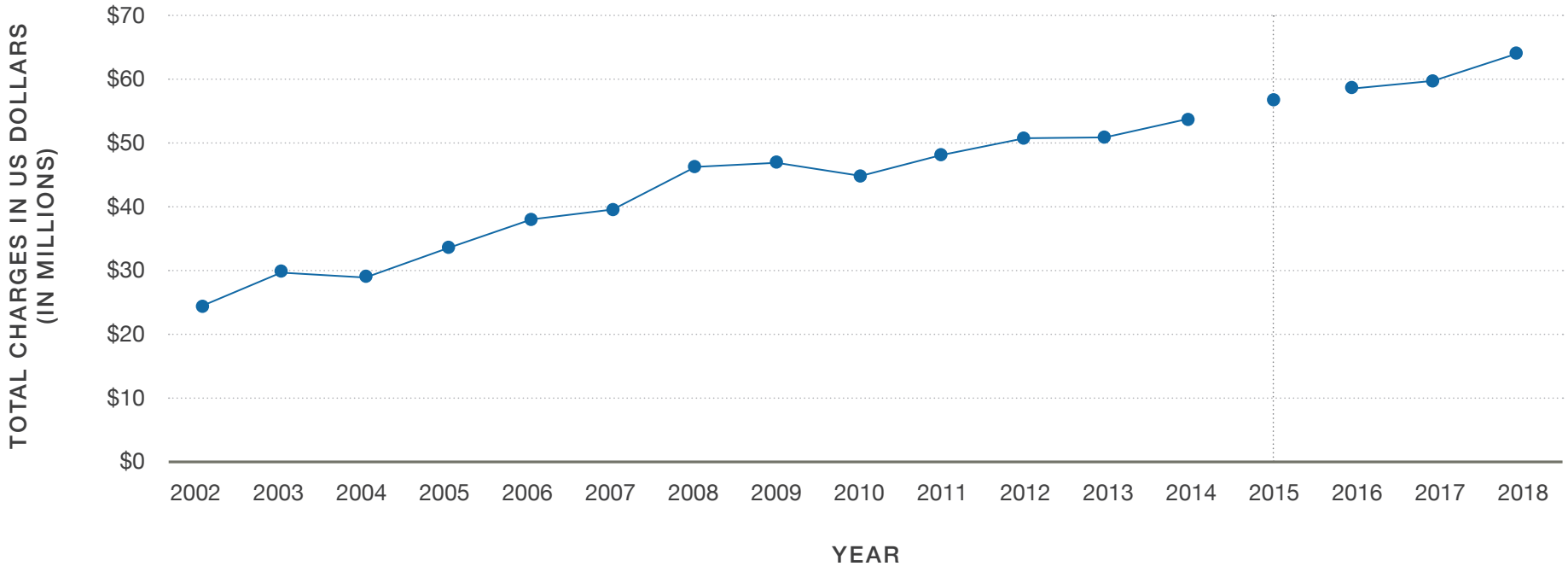
FROM 2002 THROUGH 2018:

200%+

increases for both mean and median charges per asthma-related ED visit

Mean charges per visit increased 219% from $654 in 2002 to $2,085 in 2018. And median charges per visit increased 208% from $553 to $1,702.

FIGURE 3. Total Charges for Asthma-Related Emergency Department (ED) Visits, Massachusetts Residents, 2002–2018



Data Source: *MA Data: CY2002-2018 Massachusetts Emergency Department Discharge Database, Massachusetts Center for Health Information and Analysis.*

TABLE. Total Charges for Asthma-Related Emergency Department (ED) Visits, Massachusetts Residents, 2002-2018

YEAR	TOTAL CHARGES	MEAN CHARGES	MEDIAN CHARGES
2002	$25,032,253	$654	$553
2003	$30,504,730	$760	$659
2004	$29,558,826	$837	$724
2005	$34,037,697	$942	$828
2006	$38,291,327	$1,044	$921
2007	$39,866,884	$1,136	$989
2008	$46,607,167	$1,231	$1,076
2009	$47,262,965	$1,294	$1,128
2010	$44,972,249	$1,345	$1,180
2011	$48,363,941	$1,388	$1,209
2012	$51,371,766	$1,435	$1,252
2013	$51,091,963	$1,510	$1,298
2014	$53,818,533	$1,555	$1,352
2015	$56,667,210	$1,617	$1,358
2016	$58,624,776	$1,785	$1,521
2017	$59,957,814	$1,915	$1,612
2018	$64,174,712	$2,085	$1,702

Trend Analysis[4] **Slope:[1]** 2.35 **P-Value:[4]** 0.01 **95% CI:[3]** 1.99 – 2.71

[1] *Trend analysis was performed using only 2002–2014 data due to ICD-9-CM diagnosis code having been changed to ICD-10-CM diagnosis code in October 2015 and after.*

[2] *Slope (slope of the best line of fit calculated using JoinPoint Software) = the average millions of total charges increase or decrease per year (e.g. a slope of 1.0 indicates that the 1 million of total charges increased on average per year).*

[3] *95% Confidence Interval.*

[4] *P-value < 0.05 is considered statistically significant because it means that there is at most a 5% chance of observing a trend, given that, in reality, total charges are stable.*

Data Source: *MA Data: CY2002–2018 Massachusetts Emergency Department Discharge Database, Massachusetts Center for Health Information and Analysis.*

DISPARITIES IN ASTHMA-RELATED EMERGENCY DEPARTMENT (ED) VISITS

Asthma-Related ED Visit Rates by Race/Ethnicity

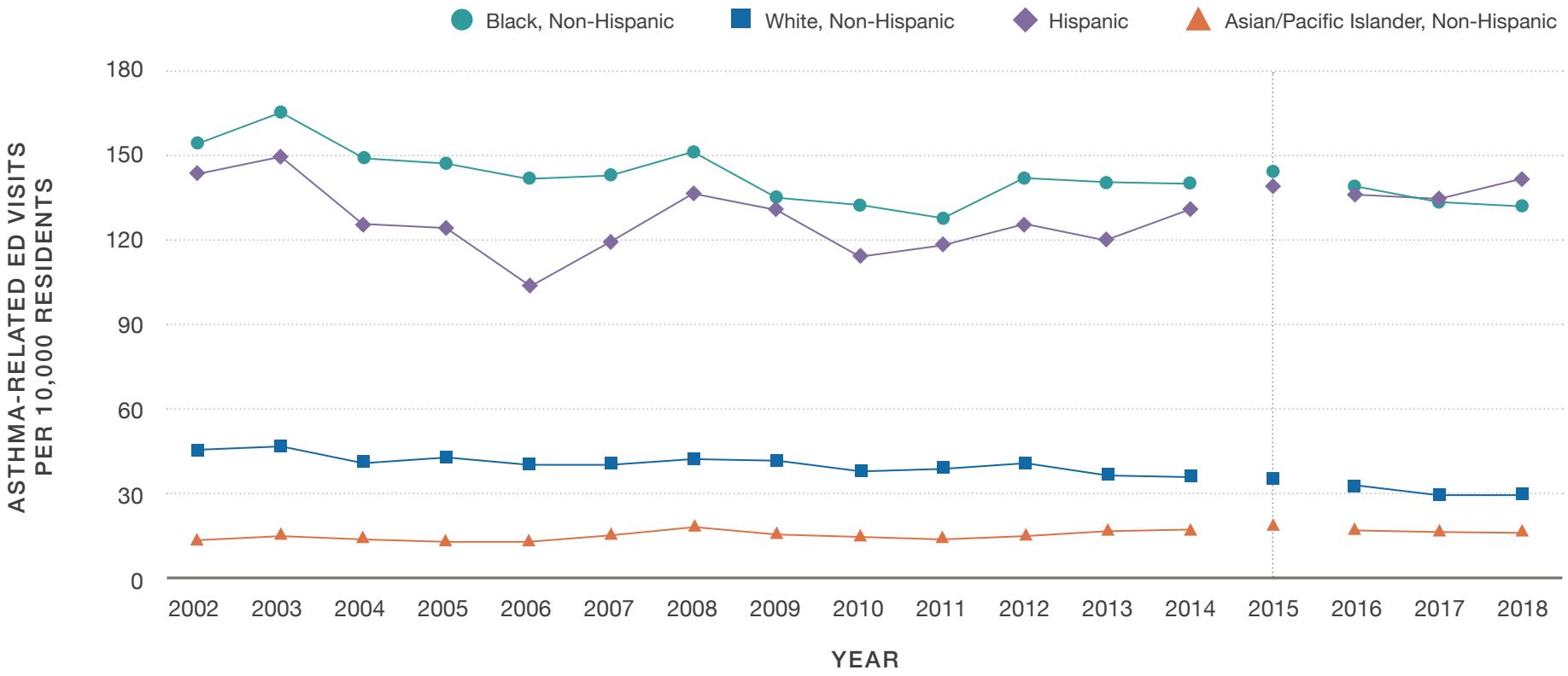
- From 2002 through 2018, Black, Non-Hispanic, and Hispanic residents consistently had substantially higher age-adjusted rates of asthma-related ED visits than those who were White, Non-Hispanic (***Figure 4***).

4.5-4.8x

more asthma-related ED visits for Black, Non-Hispanic and Hispanic than White residents

- For each year examined, except for 2018, the highest rate of asthma-related ED visits was among Black, Non-Hispanic residents.
- During this time, Asian, Non-Hispanic residents including Pacific Islanders consistently had lower age-adjusted rates of asthma-related ED visits than White, Non-Hispanic residents.
- Although the gap between asthma-related ED Visits between Black and Hispanic residents and White and Asian residents continues to persist, statewide across all race/ethnicity categories there has been a statistically significant decrease in asthma-related ED visits as a whole.
- In 2018, relative to the rate among White, Non-Hispanic residents, the age-adjusted rate of asthma-related ED visits were approximately 4.5 times higher among Black, Non-Hispanic residents and 4.8 times higher among Hispanics.

FIGURE 4. Age-Adjusted Rates of Asthma-Related Emergency Department (ED) Visits by Race, Massachusetts Residents, 2002–2018



Data Source: *CY2002–2018 Massachusetts Emergency Department Discharge Database, Massachusetts Center for Health Information and Analysis.*

TABLE. Age-Adjusted Rates of Asthma-Related Emergency Department (ED) Visits by Race, Massachusetts Residents, 2002–2018

	BLACK, NON-HISPANIC				HISPANIC			
YEAR	NO.	CRUDE RATE[1]	AGE-ADJUSTED RATE[1,2]	95% CI[3]	NO.	CRUDE RATE[1]	AGE-ADJUSTED RATE[1,2]	95% CI[3]
2002	6,163	164.3	154.9	151.0 – 158.8	6,864	147.3	144.2	140.3 – 148.1
2003	6,700	176.1	165.8	161.8 – 169.8	7,404	154.0	150.8	146.9 – 154.6
2004	6,050	157.4	149.5	145.7 – 153.3	6,427	130.2	126.2	122.7 – 129.6
2005	6,045	155.5	146.9	143.2 – 150.7	6,656	131.5	125.1	121.8 – 128.4
2006	6,030	150.9	142.3	138.7 – 145.9	5,491	107.5	103.4	100.5 – 106.4
2007	6,019	150.0	143.2	139.6 – 146.9	6,737	127.6	120.5	117.4 – 123.6
2008	6,459	159.6	151.6	147.9 – 155.4	8,196	147.2	137.8	134.6 – 141.0
2009	5,918	141.6	135.2	131.7 – 138.7	8,151	139.8	132.2	129.2 – 135.3
2010	5,681	136.8	132.8	129.3 – 136.3	7,668	122.2	115.5	112.8 – 118.3
2011	5,977	132.5	128.2	125.0 – 131.5	8,162	125.4	119.5	116.7 – 122.2
2012	6,082	146.5	142.4	138.8 – 146.0	8,215	130.9	126.3	123.6 – 129.0
2013	5,974	143.9	140.3	136.8 – 143.9	7,811	124.4	120.5	117.9 – 123.2
2014	6,034	145.3	140.8	137.2 – 144.4	8,503	135.5	132.6	129.8 – 135.4
2015	6,234	150.1	144.8	141.2 – 148.4	8,923	142.2	140.1	137.1 – 142.9
2016	6,008	144.7	139.5	136.0 – 143.0	8,743	139.3	137.4	134.5 – 140.3
2017	5,755	138.6	134.2	130.7 – 137.6	8,505	135.5	135.0	132.1 – 137.9
2018	5,692	137.0	132.8	129.3 – 136.2	8,875	141.4	142.4	139.4 – 145.3
Trend Analysis:[4]	**Slope:[5]** -1.77	**P-Value:[6]** 0.01	**95% CI:[3]** -1.88 – -0.67		**Slope:[5]** -1.10	**P-Value:[6]** 0.25	**95% CI:[3]** -2.90 – 0.70	

[1] *Rate of asthma-related emergency department visits per 10,000 residents.*

[2] *Age-adjusted to United States 2010 population.*

[3] *95% Confidence Interval.*

[4] *Trend analysis was performed using 2002–2014 data only due to ICD-9-CM diagnosis code having been changed to ICD-10-CM diagnosis code in October 2015 and after.*

[5] *Slope slope of the best line of fit calculated using JoinPoint Software) = the average age-adjusted rate increase or decrease per year (e.g. a slope of 1.0 indicates that the age-adjusted rate increased on average one per 10,000 residents per year).*

[6] *P-value < 0.05 is considered statistically significant because it means that there is at most a 5% chance of observing a trend, given that, in reality, rates are stable.*

Data Source: *CY2002–2018 Massachusetts Emergency Department Discharge Database, Massachusetts Center for Health Information and Analysis.*

TABLE. Age-Adjusted Rates of Asthma-Related Emergency Department (ED) Visits by Race, Massachusetts Residents, 2002–2018

	WHITE, NON-HISPANIC				ASIAN/ PACIFIC ISLANDER, NON-HISPANIC			
YEAR	NO.	CRUDE RATE[1]	AGE-ADJUSTED RATE[1,2]	95% CI[3]	NO.	CRUDE RATE[1]	AGE-ADJUSTED RATE[1,2]	95% CI[3]
2002	23,061	43.6	45.7	45.1 – 46.3	398	14.0	13.8	12.4 – 15.3
2003	23,938	45.4	47.9	47.3 – 48.5	476	16.2	16.1	14.6 – 17.6
2004	20,971	40.0	42.3	41.7 – 42.8	424	14.0	14.3	12.9 – 15.8
2005	21,456	41.1	43.4	42.9 – 44.0	426	13.7	14.1	12.7 – 15.5
2006	20,118	38.8	41.3	40.7 – 41.9	436	13.5	13.9	12.5 – 15.3
2007	19,751	38.1	40.8	40.2 – 41.4	513	15.8	16.1	14.6 – 17.5
2008	20,892	40.3	43.4	42.8 – 44.0	619	18.7	19.0	17.5 – 20.6
2009	20,128	38.5	41.9	41.3 – 42.5	581	16.8	16.7	15.3 – 18.1
2010	18,052	35.2	38.6	38.0 – 39.1	518	14.4	14.8	13.5 – 16.1
2011	18,516	36.4	40.0	39.5 – 40.6	562	14.7	15.0	13.7 – 16.2
2012	19,360	37.7	40.8	40.2 – 41.3	572	15.5	15.9	14.6 – 17.2
2013	17,631	34.3	37.2	36.6 – 37.7	635	17.1	17.8	16.4 – 19.2
2014	17,471	34.0	37.0	36.4 – 37.5	623	16.8	17.5	16.2 – 18.9
2015	17,300	33.7	36.2	35.7 – 36.8	687	18.5	19.2	17.8 – 20.7
2016	15,479	30.1	33.0	32.5 – 33.5	617	16.6	17.5	16.1 – 18.9
2017	14,493	28.2	30.6	30.1 – 31.1	616	16.6	17.3	15.9 – 18.6
2018	13,942	27.2	29.5	29.0 – 30.0	646	17.4	18.4	17.0 – 19.8

Trend Analysis:[4] **Slope:**[5] -0.70 **P-Value:**[6] <0.01 **95% CI:**[3] 0.94 – -0.46 **Slope:**[5] 0.23 **P-Value:**[6] 0.05 **95% CI:**[3] 0.03 – 0.43

[1] *Rate of asthma-related emergency department visits per 10,000 residents.*

[2] *Age-adjusted to United States 2010 population.*

[3] *95% Confidence Interval.*

[4] *Trend analysis was performed using 2002–2014 data only due to ICD-9-CM diagnosis code having been changed to ICD-10-CM diagnosis code in October 2015 and after.*

[5] *Slope slope of the best line of fit calculated using JoinPoint Software) = the average age-adjusted rate increase or decrease per year (e.g. a slope of 1.0 indicates that the age-adjusted rate increased on average one per 10,000 residents per year).*

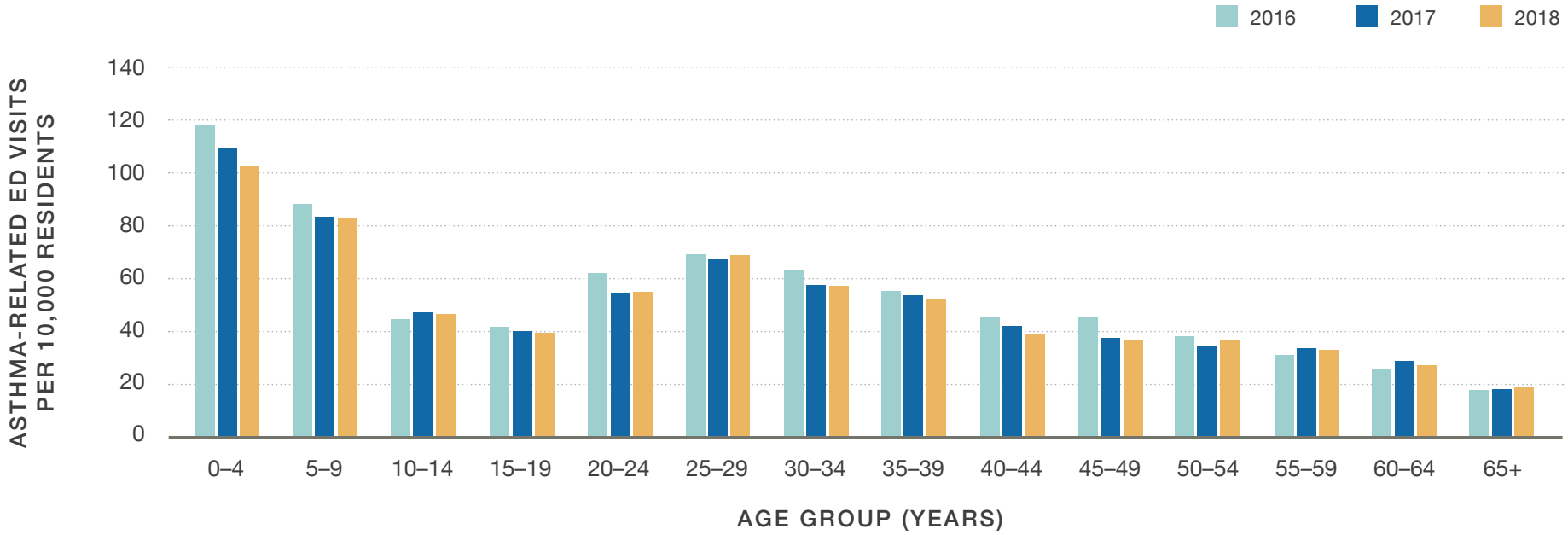
[6] *P-value < 0.05 is considered statistically significant because it means that there is at most a 5% chance of observing a trend, given that, in reality, rates are stable.*

Data Source: *CY2002–2018 Massachusetts Emergency Department Discharge Database, Massachusetts Center for Health Information and Analysis.*

Asthma-Related ED Visit Rates by Age

From 2016 through 2018, among Massachusetts children, the age-specific rates of asthma-related ED visits were consistently highest among those ages 0–4 years old and decreased with increasing age group. Among adults, the rates were highest among young adults ages 25–29. The rates declined with each older adult age group and the lowest rates were among those ages 65 and over. Within each age group except those aged 0–9 years, the rates remained stable from 2016 through 2018 (***Figure 5***).

FIGURE 5. Age-Specific Rates of Asthma-Related Emergency Department (ED) Visits Due to Asthma, Massachusetts Residents, 2016–2018

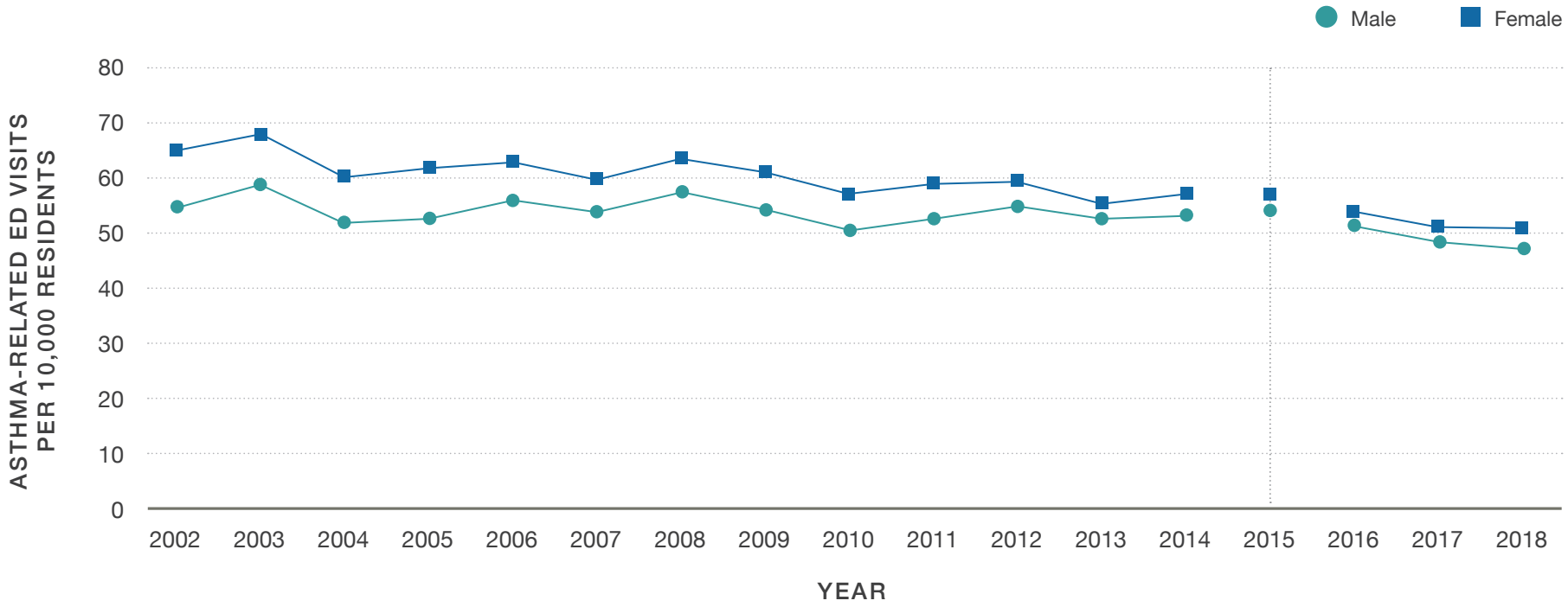


Data Source: *CY2016–2018 Massachusetts Emergency Department Discharge Database, Massachusetts Center for Health Information and Analysis.*

Asthma-Related ED Visit Rates by Sex

From 2002 through 2018, the age-adjusted rate of asthma-related ED visits remained stable among both males and females (***Figure 6***). During the same time period, the age-adjusted rate was consistently higher among females than males.

FIGURE 6. Age-Adjusted Rates of Asthma-Related Emergency Department (ED) Visits by Sex, Massachusetts Residents, 2002–2018



Data Source: *CY2002–2018 Massachusetts Hospitalization Discharge Database, Massachusetts Center for Health Information and Analysis.*

TABLE. Age-Adjusted Rates of Asthma-Related Emergency Department (ED) Visits by Sex, Massachusetts Residents, 2002–2018

	MALES				FEMALES			
YEAR	NO.	CRUDE RATE[1]	AGE-ADJUSTED RATE[1,2]	95% CI[3]	NO.	CRUDE RATE[1]	AGE-ADJUSTED RATE[1,2]	95% CI[3]
2002	16,985	54.7	54.9	54.1 – 55.7	21,027	63.3	65.0	64.1 – 65.8
2003	18,219	58.5	59.1	58.2 – 60.0	21,933	65.9	68.1	67.2 – 69.0
2004	15,942	51.1	51.9	51.1 – 52.7	19,393	58.4	60.3	59.5 – 61.2
2005	16,180	51.8	52.7	51.9 – 53.5	19,921	60.1	62.1	61.3 – 63.0
2006	16,941	54.3	55.9	55.0 – 56.7	20,078	60.5	62.9	62.0 – 63.8
2007	16,290	52.1	54.1	53.3 – 54.9	19,069	57.4	59.9	59.0 – 60.7
2008	17,458	55.4	57.6	56.7 – 58.4	20,415	61.0	64.0	63.1 – 64.9
2009	16,650	52.0	54.3	53.4 – 55.1	19,810	58.5	61.4	60.5 – 62.3
2010	15,147	47.8	50.5	49.7 – 51.4	18,298	54.1	57.3	56.5 – 58.2
2011	15,824	49.6	50.5	52.0 – 53.6	19,015	56.0	57.3	58.3 – 60.0
2012	16,630	52,5	55.0	54.2 – 55.9	19,173	56,7	59.5	58.6 – 60.3
2013	15,908	50.2	52.7	51.9 – 53.5	17,923	53,0	55.5	54.7 – 56.3
2014	16,148	51.0	53.6	52.7 – 54.4	18,444	54,6	57.2	56.3 – 58.0
2015	16,461	52.0	54.4	53.5 – 55.2	18,576	54.9	57.2	56.4 – 58.0
2016	15,491	48.9	51. 5	50.6 – 52.3	17,342	51.2	53.9	53.1 – 54.7
2017	14,706	46.4	48.7	47.9 – 49.5	16,601	49.1	51.5	50.7 – 52.3
2018	14,286	45.1	47.3	46.5 – 48.0	16,494	48.8	51.0	50.2 – 51.8

Trend Analysis[4] **Slope:[5]** 0.004 **P-Value:[6]** 0.25 **95% CI:[3]** -0.01 – 0.002 **Slope:[5]** -0.72 **P-Value:[6]** <0.01 **95% CI:[3]** -1.08 – -0.36

[1] *Rate of asthma-related hospitalizations per 10,000 residents.*

[2] *Age-adjusted to United States 2010 population.*

[3] *95% Confidence Interval.*

[4] *Trend analysis was performed using 2002–2014 data only due to ICD-9-CM diagnosis code changed to ICD-10-CM diagnosis code in October 2015 and after.*

[5] *Slope (slope of the best line of fit calculated using JoinPoint Software) = the average age-adjusted rate increase or decrease per year (e.g. a slope of 1.0 indicates that the age-adjusted rate increased on average one per 10,000 residents per year).*

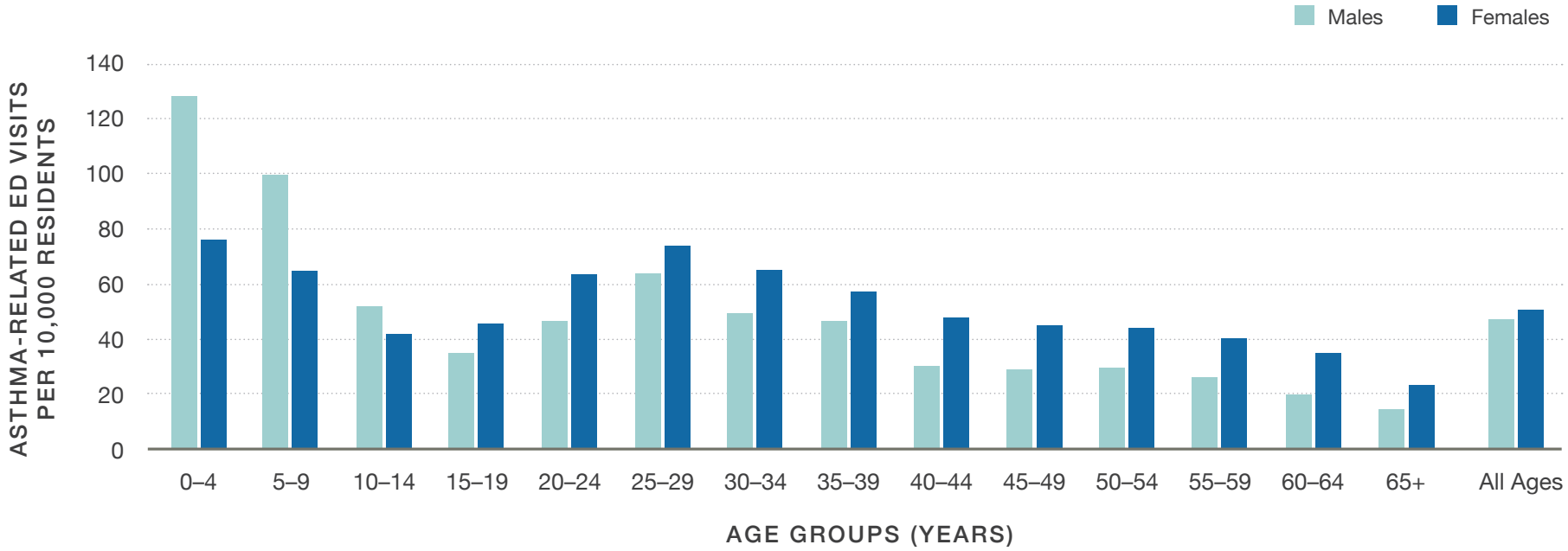
[6] *P-value < 0.05 is considered statistically significant because it means that there is at most a 5% chance of observing a trend, given that, in reality, rates are stable.*

Data Source: *CY2002–2018 Massachusetts Emergency Department Discharge Database, Massachusetts Center for Health Information and Analysis.*

Asthma-Related ED Visit Rates by Age and Sex

- In 2018, Massachusetts females had a higher rate of asthma-related ED visits than males (51.0 vs. 47.3 visits per 10,000, respectively).
- The age-specific rates of asthma-related ED visits varied by sex, with the largest discrepancy in the 0–4 year age group. In this group, as well as the 5–9 and 10–14 year age groups, the rates were higher among males than females (***Figure 7***).
- Starting in the 15–19 year age group and continuing through adulthood, rates of ED visits were consistently higher among females than males.

FIGURE 7. Age-Sex-Specific Rates of Asthma-Related Emergency Department (ED) Visits, Massachusetts Residents, 2018



Data Source: *CY2018 Massachusetts Hospitalization Discharge Database, Massachusetts Center for Health Information and Analysis.*

TABLE. Age-Sex-Specific Rates of Asthma-Related Emergency Department (ED) Visits, Massachusetts Residents, 2018

	MALES			FEMALES		
AGE GROUP	NO.	AGE-SPECIFIC RATE[1]	95% CI[2]	NO.	AGE-SPECIFIC RATE[1]	95% CI[2]
00–04	2,411	128.5	123.4 – 133.7	1,372	76.5	72.4 – 80.5
05–09	1,963	99.9	95.5 – 104.3	1,236	65.4	61.7 – 69.0
10–14	1,078	52.0	48.9 – 55.15	832	42.0	39.1 – 44.8
15–19	809	34.4	32.1 – 36.8	1,030	45.2	42.4 – 48.0
20–24	1,096	46.4	43.7 – 49.1	1,526	63.7	60.5 – 66.9
25–29	1,410	64.6	61.2 – 68.0	1,654	74.1	70.5 – 77.7
30–34	986	49.7	46.6 – 52.8	1,346	65.6	62.1 – 69.1
35–39	953	46.8	43.8 – 49.7	1,235	57.6	54.4 – 60.8
40–44	690	30.2	27.9 – 32.4	1,156	48.1	45.3 – 50.9
45–49	734	29.1	27.0 – 31.2	1,187	45.1	42.5 – 47.6
50–54	717	29.7	27.5 – 31.8	1,121	43.9	41.3 – 46.5
55–59	544	26.1	23.9 – 28.3	902	40.2	37.6 – 42.9
60–64	344	19.5	17.5 – 21.6	676	34.8	32.2 – 37.4
65+	551	14.6	13.4 – 15.9	1,221	23.2	21.9 – 24.5
All Ages	14,286	47.3	46.8 – 48.0	16,494	51.0	50.2 – 51.8

[1] *Rate of asthma-related emergency department visits per 10,000 residents*

[2] *95% Confidence Interval.*

Data Source: *CY2018 Massachusetts Emergency Department Discharge Database, Massachusetts Center for Health Information and Analysis.*

Asthma-related ED Visit Rates by Geography

- Data were not available for 110 Massachusetts cities/towns (depicted in white on ***Map 1***).
- The three-year average annual age-adjusted rates of asthma-related ED visits were not evenly distributed across the state among the 241 cities/towns for which data was available.
- The overall Massachusetts average annual age-adjusted rate in 2016-2018 was 50.9 asthma-related ED visits per 10,000 residents.

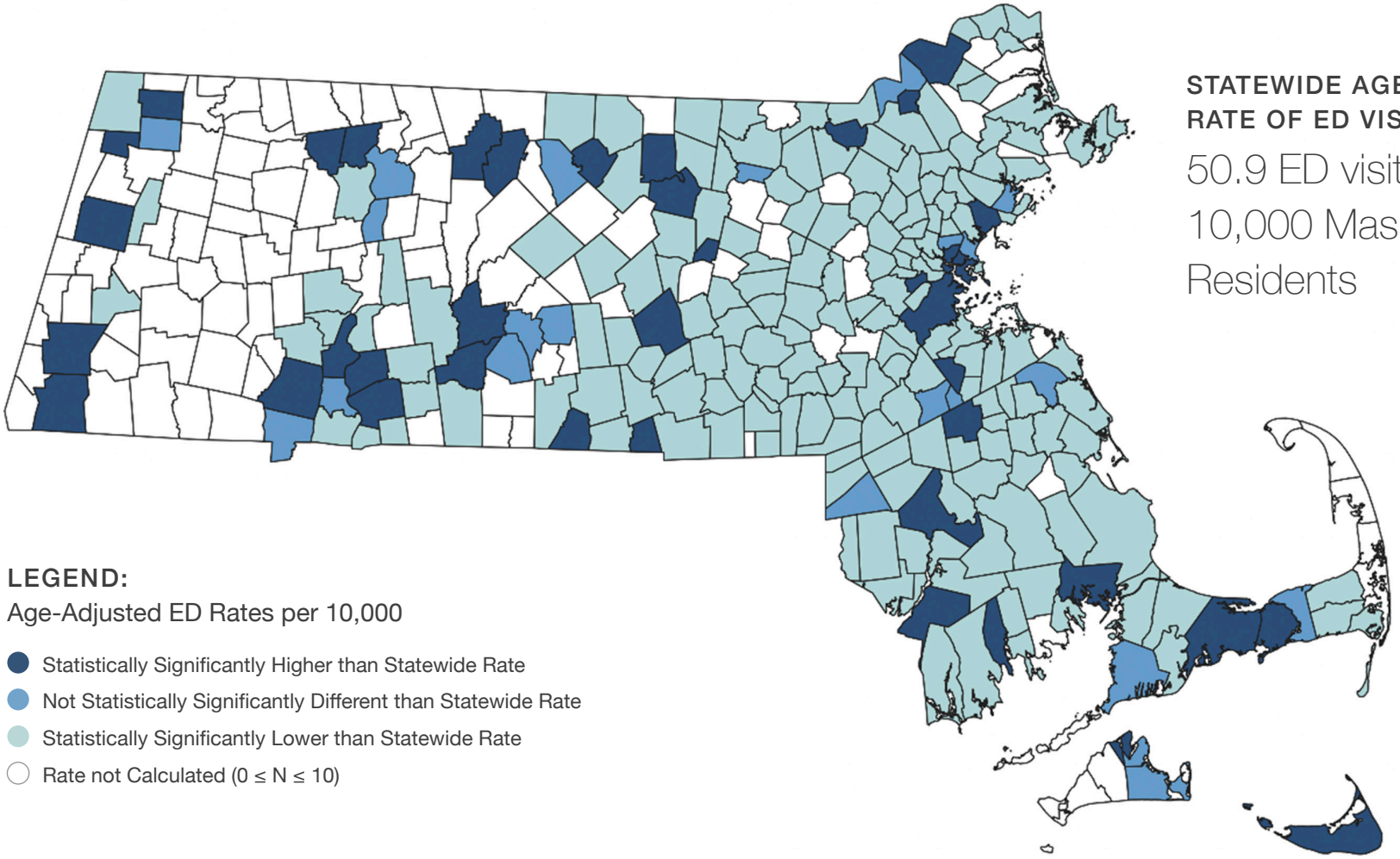
TABLE 1. Top 10 Cities/Towns with the Highest Three-Year Average Annual Age-Adjusted Rate of Asthma-Related Emergency Department (ED) Visits in Massachusetts, 2016–2018

TOWN	2016–2018 TOTAL CASES	AVERAGE ANNUAL AGE-ADJUSTED RATE PER 10,000	95% CI[1]	
Holyoke	2,330	198.09	190.05	206.14
Springfield	7,241	159.50	155.82	163.17
Fall River	3,148	123.16	118.86	127.46
Lawrence	2,784	118.00	113.62	122.39
Brockton	2,786	99.11	95.43	102.79
Southbridge	457	95.64	86.87	104.41
Chicopee	1,434	94.93	90.01	99.84
New Bedford	2,574	93.53	89.92	97.14
Everett	1,015	82.85	77.75	87.95
Boston	13,479	81.02	79.65	82.39

[1] *95% Confidence Interval.*

Data Source: *CY2016–2018 Massachusetts Emergency Department Discharge Database, Massachusetts Center for Health Information and Analysis.*

MAP 1. Three-Year Average Annual Age-Adjusted Rate of Asthma-Related Emergency Department (ED) Visits by City/Town of Residence, Massachusetts, 2016–2018



STATEWIDE AGE-ADJUSTED RATE OF ED VISITS:

50.9 ED visits per 10,000 Massachusetts Residents

LEGEND:

Age-Adjusted ED Rates per 10,000

- Statistically Significantly Higher than Statewide Rate
- Not Statistically Significantly Different than Statewide Rate
- Statistically Significantly Lower than Statewide Rate
- Rate not Calculated (0 ≤ N ≤ 10)

Data Source: *CY2016–2018 Massachusetts Emergency Department Discharge Database, Massachusetts Center for Health Information and Analysis.*

DISPARITIES IN ASTHMA-RELATED EMERGENCY DEPARTMENT VISITS BY POPULATION DEMOGRAPHICS

Asthma-Related ED Visits by Race Distribution:

Black, Non-Hispanic and Hispanic residents accounted for a disproportionate share of the asthma-related visits in Massachusetts (***Figure 8***).

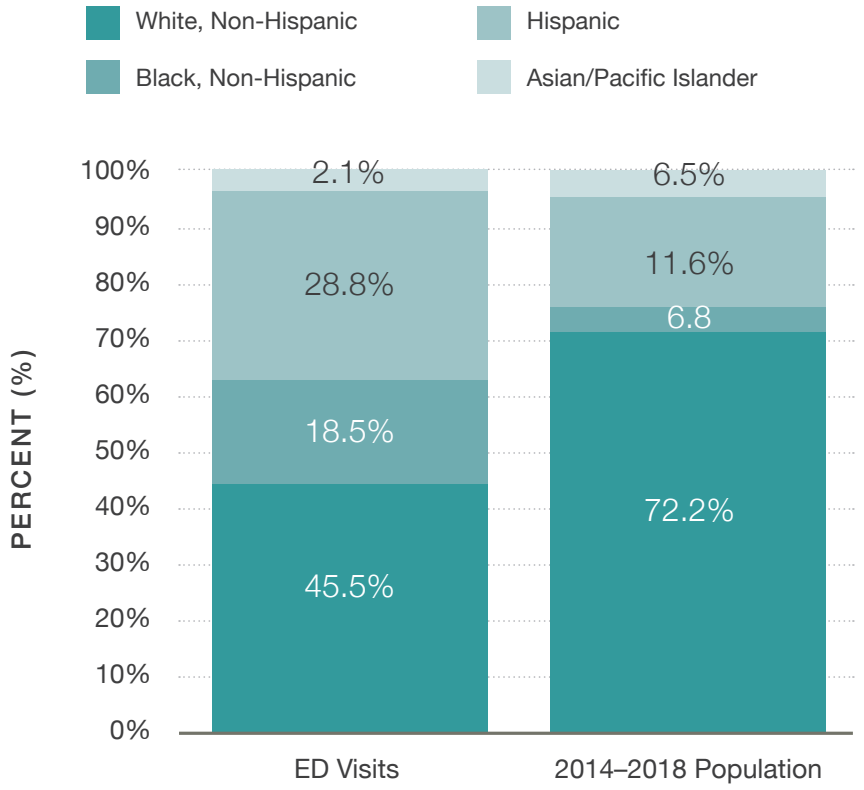
11.6% of the Massachusetts population is comprised of Hispanic residents

6.8% of the Massachusetts population is comprised of Black, Non-Hispanic residents

28.8% of asthma-related ED visits are among Hispanic residents

18.5% of asthma-related ED visits are among Black, Non-Hispanic residents

FIGURE 8. Percent Distribution of Asthma-Related Emergency Department (ED) Visits, by Race/Ethnicity, Massachusetts Residents, 2018



	ED VISITS		2014–2018 POPULATION	
RACE/ ETHNICITY	NO.	%	NO.	%
White, Non-Hispanic	13,942	45.3%	4,930,412	72.2%
Black, Non-Hispanic	5,692	18.5%	463,796	6.8%
Hispanic	8,875	28.8%	789,127	11.6%
Asian/Pacific Islander	646	2.1%	442,034	6.5%
TOTAL	**30,780**		**6,830,193**	

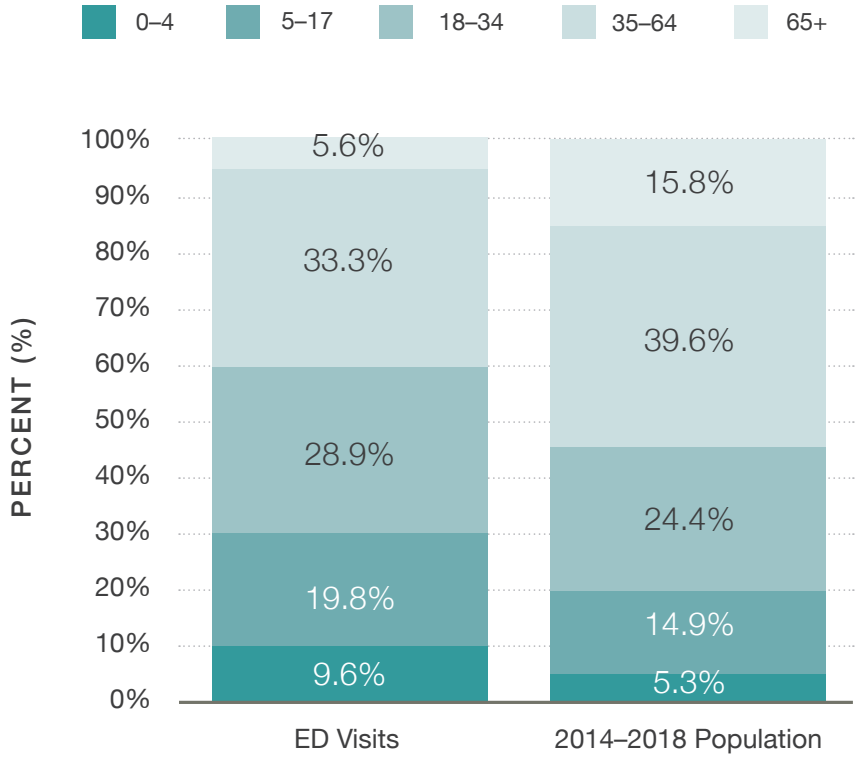
Note: *The numbers may not add up to the total since race/ethnicity was missing for some visits.*

Data Source: *CY2018 Massachusetts Emergency Department Discharge Database, Massachusetts Center for Health Information and Analysis (CHIA); 2014–2018 Population data: https://datacommon.mapc.org/browser/datasets/6.*

Asthma-Related ED Visits by Age Distribution:

In 2018, 58.3% of asthma-related ED visits in Massachusetts occurred among those less than 35 years of age (29.4% for ages 17 years and younger and 28.9% for ages 18–34 years) (***Figure 9***).

FIGURE 9. Percent Distribution of Asthma-Related Emergency Department (ED) Visits, by Age, Massachusetts Residents, 2018



	ED VISITS		2014–2018 POPULATION	
AGE GROUP	NO.	%	NO.	%
0–4	2,958	9.6%	362,681	5.3%
5–17	6,082	19.8%	1,017,216	14.9%
18–34	8,884	28.9%	1,665,134	24.3%
35–64	10,259	33.3%	2,706,929	39.6%
65+	1,723	5.6%	1,078,224	15.8%
TOTAL	**30,780**		**6,830,193**	

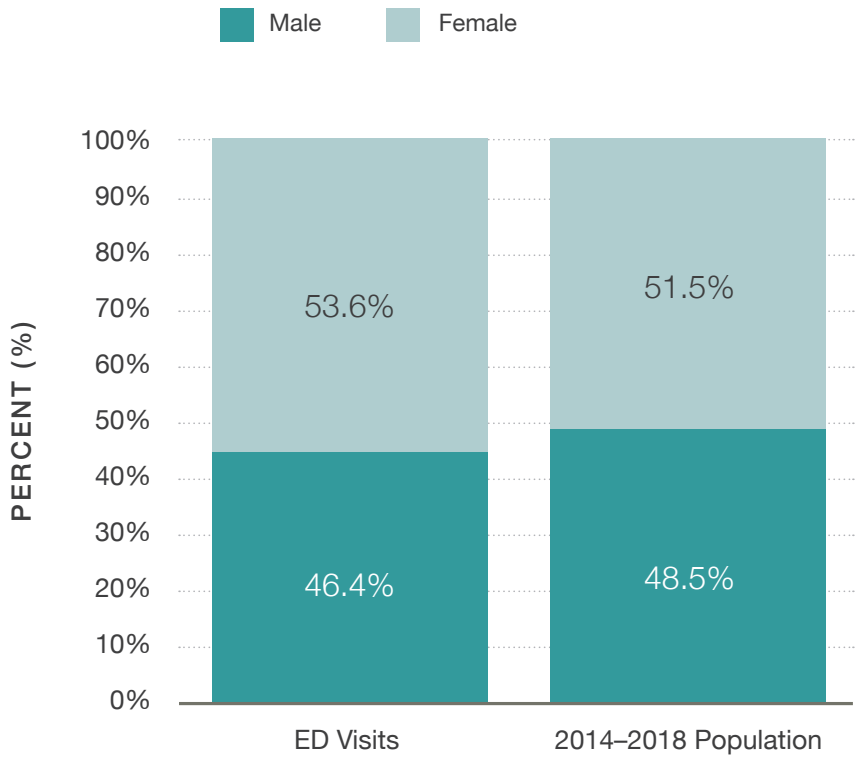
Note: *The numbers may not add up to the total since race/ethnicity was missing for some visits.*

Data Source: *CY2018 Massachusetts Emergency Department Discharge Database, Massachusetts Center for Health Information and Analysis; 2014–2018 Population data: https://datacommon.mapc.org/browser/datasets/363.*

Asthma-Related ED Visits by Sex Distribution:

Females, a group that comprises 51.5% of the Massachusetts population, accounted for a disproportionate share of the asthma-related ED visits in Massachusetts reported in 2018 – 53.6% of ED visits (***Figure 10***).

FIGURE 10. Percent Distribution of Asthma-Related Emergency Department (ED) Visits, Massachusetts Residents by Sex, 2018



	ED VISITS		2014–2018 POPULATION	
SEX	NO.	%	NO.	%
Males	14,286	46.4%	3,313,979	48.5%
Females	16,494	53.6%	3,516,214	51.5%
TOTAL	30,780		6,830,193	

Data Source: *CY2018 Massachusetts Emergency Department Discharge Database, Massachusetts Center for Health Information and Analysis; 2014–2018 Population data: https://datacommon.mapc.org/browser/datasets/363.*

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