MASSACHUSETTS DEPARTMENT OF PUBLIC HEALTH

Incidence of Asthma among Adults and Children in Massachusetts

INTRODUCTION

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, and chest tightness. Sometimes the symptoms become so severe 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.

26.5M+ people currently had asthma in the United States in 2016

Asthma is a significant public health problem in the United States and in Massachusetts. In 2016 in the United States, over 26.5 million people in America have asthma (1 in 11 Americans), including 8.3% of children and adults.[1] Nationally, the prevalence of asthma has been increasing since 1980 across all age, sex, and racial groups.

The costs associated with asthma are substantial. The American Lung Association estimates that the annual economic cost of asthma from 2002–2007 was $56 billion for both direct and indirect costs combined.[2] Furthermore, in 2008, the Centers for Disease Control and Prevention (CDC) estimated that asthma resulted in 10.5 million missed school days among children ages 5–17 years and nearly 14.2 million missed work days among currently employed adults.[3]

The prevalence of asthma in Massachusetts is among the highest reported for states across the nation. Previously presented findings indicate that asthma prevalence in Massachusetts has increased over time (a companion report describing asthma prevalence in Massachusetts has been posted at: www.mass.gov/asthma-prevention-and-control). Since asthma prevalence is determined by both new onset (incidence) and existing cases, an increase in prevalence does not in itself indicate that the incidence of asthma has increased. Therefore, to better understand whether the proportion of new onset cases of asthma has been increasing over time in Massachusetts, we used information from the Behavioral Risk Factor Surveillance System (BRFSS) and Asthma Call-back Surveys (ACBS) to estimate asthma incidence for adults and children.

This brief will examine at what age survey responders were first told by a doctor they had asthma and time since first asthma diagnosis among adults and children using ACBS. Asthma incidence rates are then calculated separately among adults and children using BRFSS combined with ACBS.

Definitions

Incidence: is defined as the number of newly diagnosed cases of a disease within a specified time period in an at-risk population.

$$\text{INCIDENCE} = \frac{\text{Number of new cases diagnosed with the disease}}{\text{Number of people at-risk* of developing the disease}}$$

**People at-risk are those who had never had a diagnosis of asthma plus those who were diagnosed within the specified time period for the incidence calculation.*

DATA SOURCES

The Behavioral Risk Factor Surveillance System (BRFSS) is a state-based system of health surveys established by the CDC in 1984.

Massachusetts Department of Public Health collects information regarding asthma management through a follow-up survey to the BRFSS, called the Asthma Call-Back Surveys (ACBS). Respondents are asked if they would be willing to be called back for a more in-depth interview regarding their or their child's asthma if in the BRFSS survey they reported that they or their child had lifetime asthma. For more information on the BRFSS or ACBS, see: Appendix and www.cdc.gov/asthma/brfss/default.htm#2010.

The limited sample size of the ACBS for adult and child due to low response rates to BRFSS or ACBS, restricted the subgroup analysis in this section. Similar issues were experienced by other states. Data for multiple years (CY2006–2010) were combined to derive more stable estimates.

TABLE 1. *Adult* Asthma Call-Back Survey Massachusetts Sample Size/ Response, Rates and U.S. Medians 2006-2010

	MASSACHUSETTS		UNITED STATES
YEAR	SAMPLE SIZE	RESPONSE RATE (%)	MEDIAN RESPONSE RATE (%)
2006	378	52.07	69.33
2007	246	51.14	67.49
2008	419	61.25	66.61
2009	317	54.84	65.27
2010	298	55.19	67.06

Data Source: *2006-2010 MA BRFSS Adult Asthma Call-back Survey https://www.cdc.gov/asthma/acbs.htm.*

TABLE 2. *Child* Asthma Call-Back Survey Massachusetts Sample Size/ Response, Rates and U.S. Medians 2006-2010

	MASSACHUSETTS		UNITED STATES
YEAR	SAMPLE SIZE	RESPONSE RATE (%)	MEDIAN RESPONSE RATE (%)
2006	109	59.56	62.77
2007	60	45.46	63.64
2008	96	51.34	61.34
2009	94	61.04	59.22
2010	60	90.91	65.89

Data Source: *2006-2010 MA BRFSS Adult Asthma Call-back Survey https://www.cdc.gov/asthma/acbs.htm.*

AGE OF ASTHMA DIAGNOSIS

Age of first diagnosis of asthma is based on responses to the following question in the ACBS: “How old were you when you were first told by a doctor or other health professional that you had asthma?”

The following figures show the distribution of age at diagnosis among adults or children. Moreover, the age of asthma diagnosis among Massachusetts adults and children with lifetime asthma by sex was examined as well.

Age of Asthma Diagnosis – ADULTS:

FROM 2006 THROUGH 2010:

56.4%

Massachusetts adults were diagnosed as children

From 2006 through 2010, 56.4% of Massachusetts adults with asthma were diagnosed as children (under age 18).

FROM 2006 THROUGH 2010:

32%

More men than women were diagnosed with asthma in childhood

From 2006 through 2010 in Massachusetts, adult males were more likely than females to be diagnosed with asthma during their childhood (under age 18) (75.4% versus 43.4%, respectively but the difference was not statistically significant).

FROM 2006 THROUGH 2010:

32%

More women than men were diagnosed with asthma in adulthood

Adult females were more likely than males to be diagnosed with asthma in adulthood (age 18 years and older) (56.6% vs. 24.6%, respectively but the difference was not statistically significant).

FIGURE 1. Age of Asthma Diagnosis among Massachusetts Adults, 2006–2010

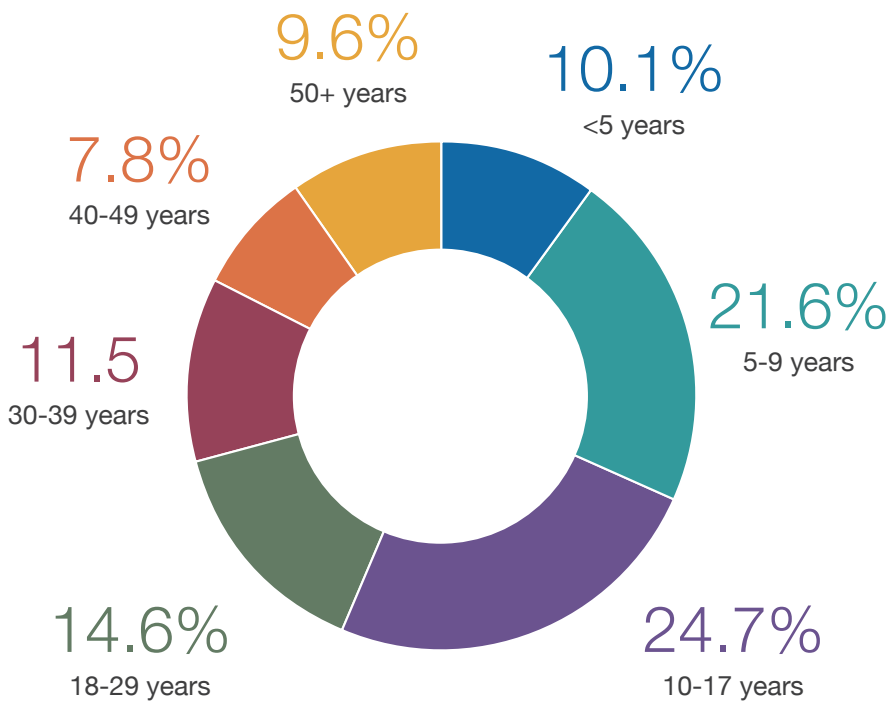

TABLE. Age of Asthma Diagnosis among Massachusetts Adults, 2006-2010

AGE OF ASTHMA (YEARS)	N[1]	%[2]	95% CI[3]
<5		10.1	7.3 – 12.9
5–9		21.6	16.9 – 26.4
10–17		24.7	20.1 – 29.4
18–29		14.6	11.7 – 17.5
30–39		11.5	9.2 – 13.8
40–49		7.8	6.1 – 9.6
50+		9.6	7.7 – 11.5
TOTAL	1,369		

[1] *N is the number of respondents who answered the corresponding question(s).*

[2] *Percent is weighted to population characteristics by sex, age, and race/ethnicity status.*

[3] *95% Confidence Interval.*

Note: *Percentages may not add up to 100 due to rounding.*

Data Source: *2006-2010 MA BRFSS Adult Asthma Call-back Survey*

FIGURE 2. Age of Asthma Diagnosis among Massachusetts Adults with Lifetime Asthma by Sex, 2006- 2010

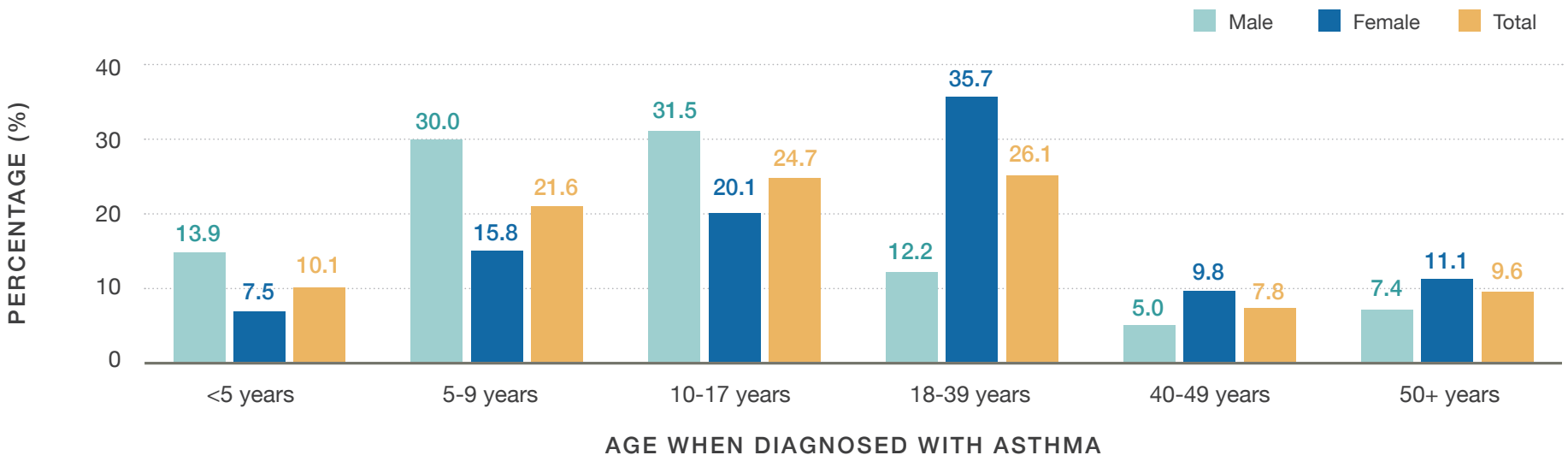

TABLE. Age of Asthma Diagnosis among Massachusetts Adults with Lifetime Asthma by Sex, 2006- 2010

		MALES			FEMALES		
AGE OF ASTHMA DIAGNOSIS (YEARS	N[1]	N[1]	%[2]	95% CI[3]	N[1]	%[2]	95% CI[3]
<5			13.9	8.3 – 19.4		7.5	4.8 – 10.2
5–9			30.0	21.3 – 38.7		15.8	10.7 – 21.0
10–17			31.5	22.6 – 40.3		20.1	15.4 – 24.7
18–39			12.2	8.1 – 16.3		35.7	30.7 – 40.7
40–49			5.0	2.7 – 7.3		9.8	7.3 – 12.2
50+			7.4	4.9 – 10.0		11.1	8.5 – 13.7
TOTAL	1,369	416			953		

[1] *N is the number of respondents who answered the corresponding question(s).*

[2] *Percent is weighted to population characteristics by sex, age, and race/ethnicity status.*

[3] *95% Confidence Interval.*

Data Source: *2006–2010 MA BRFSS Adult Asthma Call-back Survey*

Age of Asthma Diagnosis – CHILDREN

FROM 2006 THROUGH 2010:

66.5%

of children were diagnosed with asthma before age five

From 2006 through 2010, 66.5% of children with asthma were diagnosed before age five.

FROM 2006 THROUGH 2010:

7.5%

More boys than girls were diagnosed with asthma before the age of five

In Massachusetts from 2006 through 2010, a greater proportion of male children were diagnosed with asthma before the age of five compared to female children (71.8% and 64.3%, respectively but the difference was not statistically significant).

FROM 2006 THROUGH 2010:

7.7%

More girls than boys were diagnosed with asthma between the ages of 5–17

Conversely, during this same time, a greater proportion of female children were diagnosed with asthma from 5-17 years of age compared to male children (35.8% and 28.1%, respectively but the difference was not statistically significant) in 2006–2010 in Massachusetts.

FIGURE 3. Age of Asthma Diagnosis among Massachusetts Children, 2006-2010

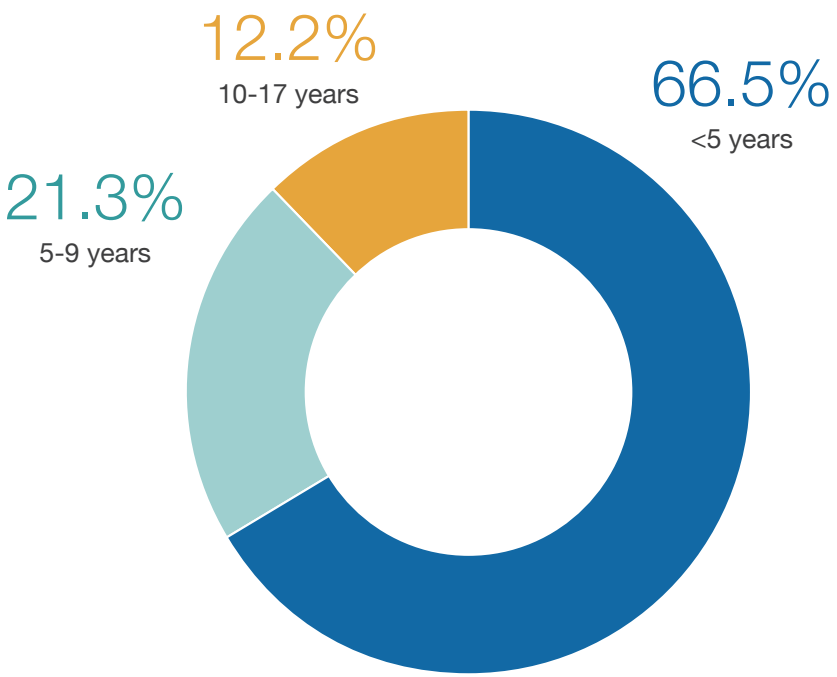

TABLE. Age of Asthma Diagnosis among Massachusetts Children, 2006-2010

AGE OF ASTHMA (YEARS)	N[1]	%[2]	95% CI[3]
<5		66.5	60.0 – 72.9
5–9		21.3	15.9 – 26.7
10–17		12.2	7.8 – 16.6
TOTAL	412		

[1] *N is the number of respondents who answered the corresponding question(s).*

[2] *Percent is weighted to population characteristics by sex, age, and race/ethnicity status.*

[3] *95% Confidence Interval.*

Data Source: *2006-2010 MA BRFSS Child Asthma Call-back Survey*

FIGURE 4. Age of Asthma Diagnosis among Massachusetts Children with Lifetime Asthma by Sex, 2006- 2010

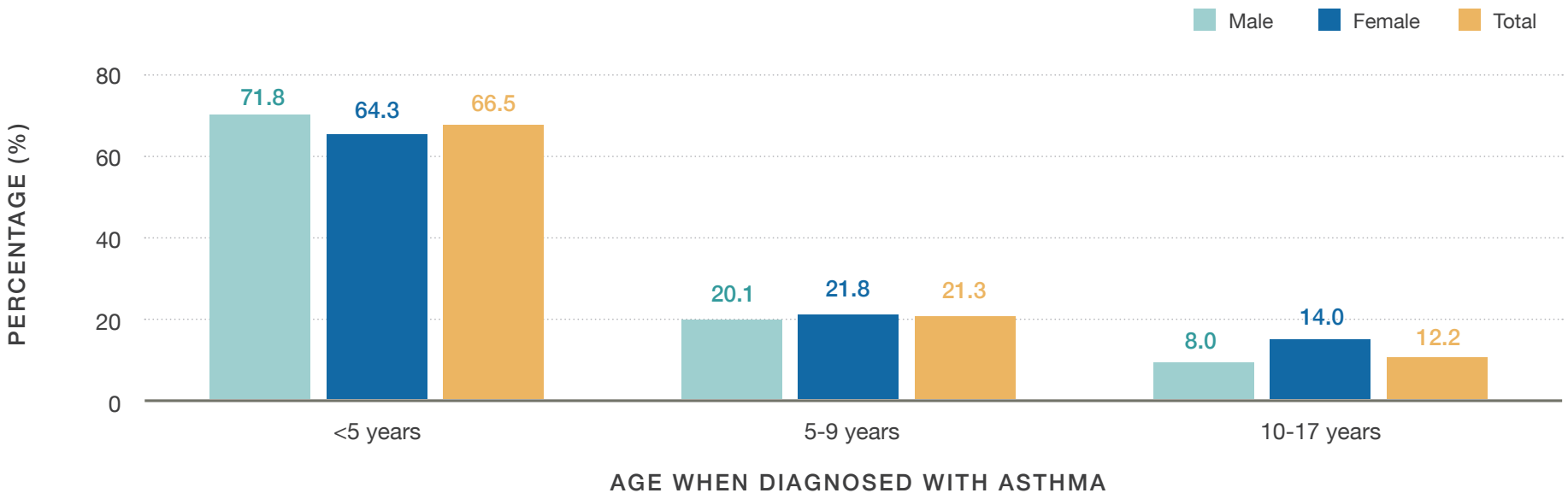

TABLE. Age of Asthma Diagnosis among Massachusetts Children with Lifetime Asthma by Sex, 2006- 2010

		MALES			FEMALES		
AGE OF ASTHMA DIAGNOSIS (YEARS)	N[1]	N[1]	%[2]	95% CI[3]	N[1]	%[2]	95% CI[3]
<5			71.8	59.8 – 83.9		64.3	56.7 – 71.8
5–9			20.1	9.5 – 30.8		21.8	15.6 – 28.0
10–17			8.0	1.0 – 15.1		14.0	8.5 – 19.4
TOTAL	412	105			307		

[1] *N is the number of respondents who answered the corresponding question(s).*

[2] *Percent is weighted to population characteristics by sex, age, and race/ethnicity status.*

[3] *95% Confidence Interval.*

Note: *% may not add up to 100 due to rounding.*

Data Source: *2006–2010 MA BRFSS Child Asthma Call-back Survey*

TIME SINCE ASTHMA DIAGNOSIS

The measure of time since asthma diagnosis is based on responses to the following question in the ACBS: “How long ago was that? Was it... [within the past 12 months, 1-5 years ago, more than 5 years ago]?”

This question follows a question that asks: “How old were you when you were first told by a doctor or other health professional that you had asthma?”

Time Since Asthma Diagnosis – ADULTS

FROM 2006 THROUGH 2010:

1.9%

have been diagnosed with lifetime asthma within the last year

From 2006 through 2010, 1.9% of adults with lifetime asthma were diagnosed within the last year.

FROM 2006 THROUGH 2010:

89.7%

have been diagnosed with lifetime asthma more than five years ago

The majority of Massachusetts adults (89.7%) with lifetime asthma were diagnosed more than five years ago.

FIGURE 5. Time since Asthma Diagnosis among Massachusetts Adults, 2006–2010

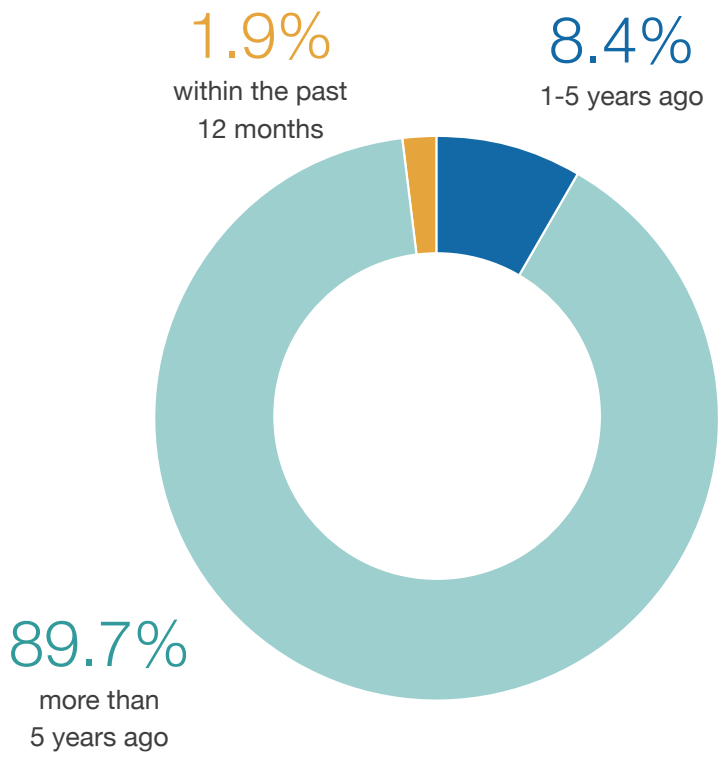

TABLE. Time since Asthma Diagnosis among Massachusetts Adults, 2006–2010

TIME SINCE ASTHMA DIAGNOSIS	N[1]	%[2]	95% CI[3]
Within the past 12 months		1.9	1.2 – 2.7
1–5 years ago		8.4	6.3 – 10.5
More than 5 years ago		89.7	87.5 – 91.9
TOTAL	1,651		

[1] *N is the number of respondents who answered the corresponding question(s).*

[2] *Percent is weighted to population characteristics by sex, age, and race/ethnicity status.*

[3] *95% Confidence Interval.*

Data Source: *2006-2010 MA BRFSS Adult Asthma Call-back Survey*

Time Since Asthma Diagnosis – CHILDREN

FIGURE 6. Time since Asthma Diagnosis among Massachusetts Children, 2006–2010

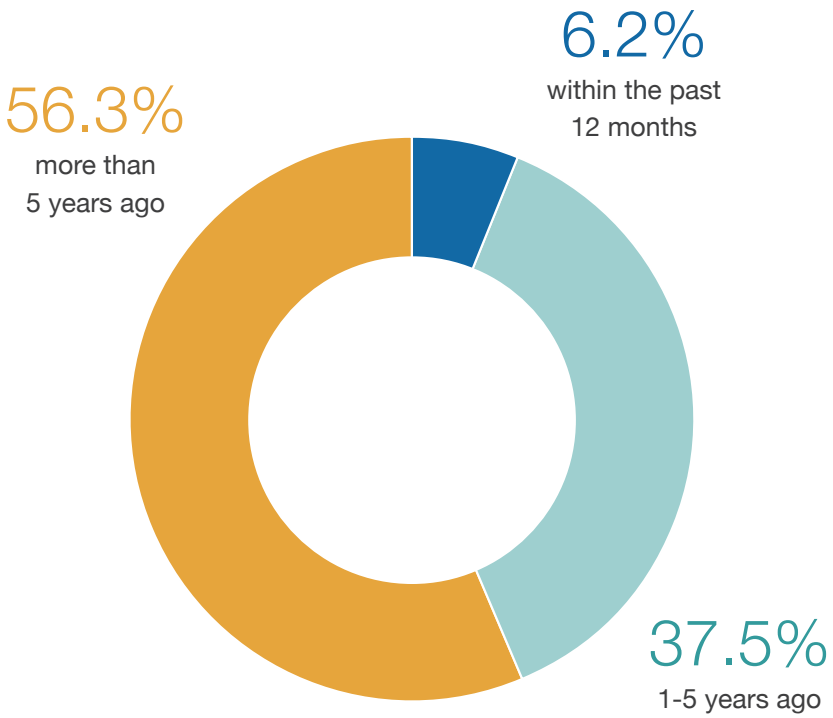

TABLE. Time since Asthma Diagnosis among Massachusetts Children, 2006–2010

TIME SINCE ASTHMA DIAGNOSIS	N[1]	%[2]	95% CI[3]
Within the past 12 months		6.2	2.6 – 9.7
1–5 years ago		37.5	30.3 – 44.6
More than 5 years ago		56.3	49.2 – 63.5
TOTAL	419		

[1] *N is the number of respondents who answered the corresponding question(s).*

[2] *Percent is weighted to population characteristics by sex, age, and race/ethnicity status.*

[3] *95% Confidence Interval.*

Data Source: *2006-2010 MA BRFSS Child Asthma Call-back Survey*

CALCULATED INCIDENCE OF ASTHMA AMONG ADULTS AND CHILDREN

Asthma incidence estimates are important to quantify disease onset rates. Moreover, incidence estimates could reveal whether the number of new asthma cases is increasing and help elucidate asthma risk factors and etiologies. Combined CY2006-2010 datasets were used to calculate the incidence of asthma among adults and children.

FROM 2006 THROUGH 2010:

3.5

adults newly diagnosed with asthma each year per 1,000 at-risk adults

On average, more than 14,000 adults were diagnosed with asthma each year in Massachusetts from 2006 to 2010. This corresponds to an annual incidence rate of 3.5 per 1,000 at-risk adults in Massachusetts from 2006 to 2010. In the US between 2006-2008, the annual incidence rate was 3.8 per 1,000 at-risk adults.

FROM 2006 THROUGH 2010:

15.4

children newly diagnosed with asthma each year per 1,000 at-risk children

On average, more than 11,000 children were diagnosed with asthma each year in Massachusetts from 2006 to 2010. This corresponds to an annual incidence rate of 15.4 per 1,000 at-risk children. In the US between 2006-2008, the annual incidence rate was 12.5 per 1,000 at-risk children.

FROM 2000 THROUGH 2010:

4.4x

higher incidence rate in children than in adults

The asthma incidence rate among children was approximately 4.4 times higher than the rate among adults from 2006 to 2010 in Massachusetts.

TABLE 3. Average Annual Incidence Rate of Asthma among At-Risk Massachusetts Residents, 2006–2010

	AVERAGE NUMBER OF NEW ASTHMA DIAGNOSES EACH YEAR	AVERAGE NUMBER OF PEOPLE AT-RISK OF DEVELOPING ASTHMA EACH YEAR	INCIDENCE RATE*	95% CI[3]
Adults 18 and older	14,914	4,257,246	3.5	2.1 – 4.9
Children <18 years old	11,865	769,374	15.4	6.4 – 24.5
Total (Adults and Children)	26,779	5,026,620	5.3	3.5 – 7.1

Data Source: *CY2006–2010 MA BRFSS Adult and Child Asthma Call-back Surveys*

Frequency estimates are weighted to population characteristics

**Incidence Rate is per 1,000 at-risk MA residents; at-risk residents are those who had never had a diagnosis of asthma plus those who were diagnosed within the last year.*

In Massachusetts from 2006-2010, there was a greater asthma incidence rate among children although there was a greater number of adults with a new asthma diagnosis because there were 5 times as many adults in the at-risk population.

Due to the preponderance of evidence supporting the growing racial disparities in chronic disease incidence, it is important to examine asthma incidence rates stratified by racial/ethnic groups. Unfortunately, from 2006 through 2010 in Massachusetts, the sample size of the ACBS was too small to produce reliable estimates.

APPENDIX

Data Sources

Massachusetts Behavioral Risk Factor Surveillance System

Source: *Health Survey Program, Massachusetts Department of Public Health*

The Behavioral Risk Factor Surveillance System (BRFSS) is a population-based random telephone survey and a commonly accepted source for information on a variety of health topics. The BRFSS collects uniform, state-specific data on preventive health practices and risk behaviors that are linked to chronic disease, injuries, and preventable infectious diseases in the adult and child populations. The BRFSS is the largest telephone health survey in the US, collecting data from more than 400,000 adults each year. The BRFSS is administered to adults ages 18 and above in all 50 states. State results can be compared with national estimates. BRFSS population estimates represent the prevalence of risk factors occurring among individuals living in the community. Up until 2010, the BRFSS was limited to households with landline phones. Individuals who live in institutionalized settings, have cognitive limitations, do not have phone service or have only mobile phone service were unable to participate. In 2011, however, two changes were made to BRFSS in order to ensure its data remains valid and accurately represents its target population of adults ≥18 years of age who do not live in institutional settings. These changes were: Increasing the number of interview calls made to cellular telephone numbers and replacing the "post-stratification" weighting method with a more advanced method called "iterative proportional fitting," also sometimes called "raking". BRFSS is based on self-reported data and as such is subject to the possible bias and errors associated with self-reported data.

The underlying sample size (Sample Size) in the presented tables is the number of people who answered "yes" or "no" to the corresponding questions. The crude proportion (%) in the presented tables is a weighted ratio of those who answered "yes" to the corresponding questions versus all who responded to the question. These percentages are weighted to the total Massachusetts population for the corresponding year in order to reflect both the probability that an individual is selected to participate in the survey and differential participation by sex, age, and race/ethnicity. A detailed description of the weighting process has been published elsewhere. BRFSS survey data and survey questions are in the public domain and may be reproduced without permission.[6, 7]

Definition of Lifetime and Current Asthma among Adults

For adults, lifetime asthma prevalence was defined as the proportion of survey respondents that reported, "yes" to the first question and current asthma prevalence was defined as the proportion of survey respondents that reported, "yes" to the second question.

1. Have you ever been told by a doctor, nurse, or health professional that you had asthma?

2. Do you still have asthma?

Definition of Lifetime and Current Asthma among Children

Since 2005, a random child selection module was added to the national and Massachusetts BRFSS survey. For children under age 18 years, the information is collected from an adult family member, usually a parent, who is knowledgeable about the child's health. Adult BRFSS

respondents are asked how many children under age 18 live in their household; of all respondents reporting one or more children under age 18 living in the household, one child is selected using a computer-generated random selection process. The adult proxy is then asked various questions about the randomly-selected child. The adult proxy is not necessarily the parent or legal guardian of the child. Of the adult proxies reporting childhood data in 2009, 96.4% were a parent or legal guardian, 3.6% were grandparents.

To obtain current asthma prevalence estimates for children, those adult proxies reporting that the randomly-selected child had ever received an asthma diagnosis were then asked if the randomly selected child still has asthma. Starting in 2005, the MA BRFSS survey included two questions on asthma prevalence among children.

1. Has a doctor, nurse, or health professional ever said that the child had asthma?

2. Does the child still have asthma?

For children, lifetime asthma prevalence was defined as the proportion of survey respondents that reported, "yes" to the first question and current asthma prevalence was defined as the proportion of survey respondents that reported, "yes" to the second question.

Massachusetts Asthma Call-back Survey (Adult and Child)
Source: *Health Survey Program, Massachusetts Department of Public Health*

The asthma call-back survey is a standardized questionnaire on asthma developed by the Centers for Disease Control and Prevention, administered on the telephone. The survey examines the health, socioeconomic, behavioral and environmental predictors that relate to better control of asthma. It also is used to characterize the type of care and health care experiences of people with asthma. The data are available in Massachusetts beginning in 2006.

Respondents to the BRFSS who reported that they or the selected child in their household has ever been diagnosed with asthma were asked at the end of the BRFSS interview if they would be willing to participate in a follow-up interview on asthma. Respondents who agreed to participate were called back within two weeks and administered the survey. Adult proxies include parents, legal guardian, grandparents, adult siblings, other relatives or other non-related adults living in the selected child's household. For more information on the call-back methodology, visit the CDC's website.

Topics covered on the ACS include:

- History of asthma symptoms
- Health care utilization
- Asthma education
- Modifications to the environment
- Medications
- Access to care
- School, daycare, and workplace
- Co-morbid conditions
- Complimentary and alternative therapy

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